



Marine and Coastal Biodiversity Strategy  
for the South Asian Seas Region:  
Living in Harmony with our Oceans and Coasts



# Marine and Coastal Biodiversity Strategy for the South Asian Seas Region: Living in Harmony with our Oceans and Coasts

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## Preface

South Asia's marine and coastal ecosystems are of paramount importance for the social and economic wellbeing of the region, with activities such as fishing, shrimp farming, tourism and shipping contributing to income, food security and the livelihoods of millions of people, many of which are poor. Yet, despite their immense importance, these ecosystems are being rapidly degraded, due to unsustainable development, overpopulation of coastal areas, overexploitation of resources, land-based pollution and habitat modification and destruction. Climate change is exacerbating these negative impacts. An urgent regional response is needed to restore and maintain healthy coastal and marine habitats and species, ensuring coastal protection and the provision of ecosystem services.

Of all the initiatives that have been launched at national and international levels with the aim of addressing these issues, the most relevant for our region is the South Asian Seas Action Plan (SASAP), which was developed under the umbrella of the UNEP Regional Seas Programme and adopted in 1995 by the five South Asian maritime countries, Bangladesh, India, Maldives, Pakistan and Sri Lanka. The objective of SASAP is to protect and manage the marine environment and related coastal ecosystems of the South Asian Seas (SAS) region, through the promotion of sustainable development. The SASAP emphasizes the need for establishing a regional cooperative network of activities concerning concrete subjects of mutual interest for the whole region.

It is within the spirit of cooperation and commitment that this document, the **Regional Marine and Coastal Biodiversity Strategy (MCBS) for the South Asian Seas Region**, has been framed. The aim of the MCBS is to address the issues threatening marine biodiversity, by supporting the achievement of the Aichi Biodiversity Targets, which are also reflected in SDG's 2030 targets related to marine and coastal habitats, through strengthening implementation of and coherence of actions under National Biodiversity Strategies and Action Plans (NBSAP) for 2011-2030 period. The development of the MCBS was approved by the 5<sup>th</sup> Inter-governmental Meeting of Ministers of the South Asian Seas Programme (5IMM-SASP). This First Order Draft (FOD) of the Regional Marine and Coastal Biodiversity Strategy provided initial identification of Regional Targets and Action Plans for the SAS region, prepared based on thematic Desk Review Studies conducted during 2013/2014 and the Regional Technical Workshop held in Colombo in July 2014. This document was then shared amongst the workshop participants for comments and the amended document was re-circulated for further enhancement and revised accordingly with necessary inputs received from the Member States. Review of the report finally vetted by the SAS Member States during the Consultative Workshop held in Malé, Maldives, from 12-13 September 2018.

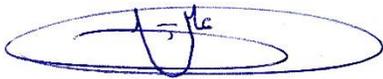
The 6<sup>th</sup> Inter-Governmental Meeting of Ministers of the South Asian Seas Programme (6IMM-SASP) endorsed the Regional Marine and Coastal Biodiversity Strategy on 6<sup>th</sup> November 2020 for necessary implementation by the SAS member countries. This strategic document is divided into three main sections:

**Part I, A Common Vision for the Marine and Coastal Biodiversity of the SAS Region**, introduces the SAS region, presenting the Vision and Mission of the Strategy, and the Rationale for the Regional Strategy.

**Part II, Marine and Coastal Biodiversity in South Asian Seas; Status, Trends and Threats** provides background information on each of the six thematic areas of the Strategy, including key conclusions and recommendations related to the Aichi Targets that are relevant to marine and coastal biodiversity.

**Part III, The Way Forward**, provides the Framework for Action of the Strategy, including the main Regional, Aichi Targets reflected in SDGs 2030, Action Plan, Communication and Monitoring and Evaluation Strategies, Financing and Partnership possibilities.

With the adoption of this Strategy, SASP member countries are expected to facilitate its implementation at the national level. I hope and wish that, with the implementation of this strategy, our healthy coastal and marine habitats and species will be restored and maintained, and the coastal protection and the provision of ecosystem services are ensured.



**Dr. Abas Basir**  
**Director General**  
**South Asia Co-operative Environment Programme**

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On behalf of South Asia Co-operative Environment Programme (SACEP), I would like to appreciate the support extended by the member countries of the South Asian Seas Programme (SASP) and information sharing for preparation of the Regional Marine and Coastal Biodiversity Strategy for South Asian Seas (SAS) Region. The financial support provided by UNEP and BOBLME Project is highly appreciated.

The contributions made by the presenters at the workshops, held in July 2014 and September 2018 are gratefully acknowledged. In particular, we are thankful for the active participation of the representatives of SACEP maritime member countries: Bangladesh, India, Maldives, Pakistan and Sri Lanka. We thank Dr. Indumathie Hewawasam, Marine Policy Specialist, who was fundamental in facilitating the workshop and preparing the First Order Draft of the Strategy. We also thank representatives of regional organizations, including Mr. Wenxi Zhu, Head, Regional Office for the Western Pacific (WESTPAC), UNESCO; Dr. Yugraj Singh Yadava, Director, BOBP-IGO; Mr. Arjan Rajasuriya, Project Manager, Marine & Coastal Thematic Area, IUCN, Sri Lanka; Ms. Cristi Marie Nazawa, Regional Director, Bird Life International (Asia); Mr. Douglas Hykle, Coordinator/Senior CMS Advisor, IOSEA Marine Turtle MoU Secretariat; Dr. Somboon Siriraksophon, Policy and Programme Coordinator, SEAFDEC Secretariat, Bangkok, Thailand; Dr. Somkiat Khokiattiwong, BOBLME NSC, Thailand; CBD and CITES Secretariats; Mr. Ibrahim Naeem, Director/SAARC CZMC; Ms. Ramya Rajagopalan, International Collective in Support of Fishworkers; Dr. Sevvandi Jayakody, Senior Lecturer, Department of Aquaculture & Fisheries, Wayamba University of Sri Lanka and Ms. Anouk Illangakoon, Researcher on Marine Mammals.

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I hope and wish this Regional Marine and Coastal Biodiversity Strategy report will go a long way in protecting, as well as resorting the marine and coastal environment of the SAS region harmonically.



**Dr. Abas Basir**  
**Director General**  
**South Asia Co-operative Environment Programme**

## Acronyms

APFIC	Asia-Pacific Fishery Commission
BOBLME	Bay of Bengal Large Marine Ecosystem
CBD	Convention on Biodiversity
CCRF	FAO Code of Conduct for Responsible Fisheries
CEPF	Critical Ecosystem Partnership Fund
CFA	Conservation Finance Alliance
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on the Conservation of Migratory Species of Wild Animals
CTF	Conservation Trust Fund
DIF	Draft Implementation Framework
EAF	Ecosystem approach to Fisheries
ECA	Ecological Critical areas
EEAFM	Ecosystem approach to fisheries management
FAO	Food and Agriculture Organization
FCPF	Forest Carbon Partnership Facility
FOD	First Order Draft
GCRMN	Global Coral Reef Monitoring Network
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GOI	Government of India
IAS	Invasive Alien Species
IBA	Important Bird Area
ICCA	Indigenous and Community Conserved Areas
ICM	Integrated Coastal Management
IGO	Intergovernmental Organization
IOSEA	Indian Ocean and South East Asia
ITFPA	International Trust Fund for Protected Areas
IUCN	International Union for Conservation of Nature
IUU	Illegal, Unreported, and Unregulated fishing
KBA	Key Biodiversity Areas
MAR	MesoAmerican Reef Fund
MCPA	Marine and Coastal Protected Area
MCS	Monitoring, Control and Surveillance
MEE	Management Effectiveness Evaluation
METT	Management Effectiveness Tracking Tool
MMAP	Global Plan of Action for the Conservation, Management and Utilization of Marine Mammals
MOEFCC	Ministry of Environment, Forest and Climate Change
MOU	Memorandum of Understanding
MPA	Marine Protected Area
M&E	Monitoring and Evaluation
NBSAP	National Biodiversity Strategies and Action Plan
NGO	Non-governmental Organization
RAMSAR	The Convention on Wetlands of International Importance, called the Ramsar Convention
REDD	Reducing Emissions from Deforestation and Forest Degradation

CBD	Convention on Biological Diversity
ECA	Ecologically Critical Area
NBSAP	National Biodiversity Strategy and Action Plan
SACRTF	South Asia Coral Reef Task Force
SAP	Strategic Action Plan
SAS	South Asian Seas
SASAP	South Asian Seas Action Plan
SIDS	Small Island Developing states
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WDCS	Whales and Dolphins Conservation Society
WESTPAC	Western Pacific
WWF	Worldwide Fund for Nature

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## Executive Summary

The South Asian Seas (SAS) region's 12,000 km long coastline and the large marine area harbors some of the most extensive and diverse tropical marine ecosystems in the world. The five maritime countries in the SAS region, Bangladesh, India, Maldives, Pakistan and Sri Lanka, host rich biodiversity in coastal and marine ecosystems, including mangroves, coastal wetlands, seagrass meadows, coral reefs and sand dunes. However, these ecosystems are facing serious threats, due to marine pollution, coastal development, unsustainable use of ecosystem services, among other issues including climate change. While there are a number of national, regional and international instruments for addressing these challenges, the underlying drivers (e.g. increasing coastal population density and urbanization, increasing per capita consumption, lack of awareness across all levels of society, low per capita GDP, widespread poverty, etc.), pose serious obstacles towards achieving desirable results sustaining coastal and marine ecosystems and their biodiversity. In order to effectively address the magnitude of these issues, a regional approach to coordinate national interventions is urgently required.

In response to this need, the South Asia Co-operative Environment Programme (SACEP), which acts as the Secretariat for the South Asian Seas Programme, in collaboration with the United Nations Environment Programme (UNEP), the five SAS countries and other partners, are developing a Regional Marine and Coastal Biodiversity Strategy (MCBS) for the South Asian Seas Region. The development of the MCBS was approved by the 5<sup>th</sup> Inter-Ministerial Meeting of the South Asian Seas Programme held in Islamabad, Pakistan, on 5<sup>th</sup> December 2013, and is in line with the Strategic Action Plan for Biodiversity adopted in October 2010 by the Conference of the Parties to the Convention on Biological Diversity (CBD). **Part I** of this document, **A Common Vision for the Marine and Coastal Biodiversity of the South Asian Seas Region**, provides background information and the Rationale for the MCBS.

The aim of the MCBS is to provide a framework for coordination and collaboration between countries' National Biodiversity Strategic Action Plans (NBSAPs), enhancing national and regional interventions for the achievement of the Aichi Biodiversity targets, particularly those addressing coastal and marine issues relevant to the region.

The initial step in the process was the development of thematic studies based on desk reviews to identify issues, gaps and needs, and other relevant ongoing national and regional processes. These thematic studies were carried out focusing on clusters of relevant Aichi targets as well as SDG-14 vision for 2030:

- Ensuring Ecosystem Services and Wellbeing (Aichi Target 1,2, 5,10,14, and 15)
- Prevention of Species Extinction (Aichi Target 12);
- Control of Alien Invasive Species (Aichi Target 9)
- Sustainable Fisheries and Aquaculture (Aichi Target 6 and 7)
- Prevention of Marine Pollution (Aichi Target 10 and 11)
- Effective and Equitable Governance of Marine and Coastal Protected Areas (Aichi Target 11).

The findings of these studies provided the basis for a Zero Draft of the Regional MCBS, and are presented as **Part II** of this document, **Marine and Coastal Biodiversity in South Asian Seas; Status, Trends and Threats**. The conclusions of these studies were presented for discussion at the consultative workshop held in Colombo during July 2014 and in Maldives during September 2018. The workshop, which involved a wide range of regional and national stakeholders, identified preliminary regional targets, goals and visions for the region, with recommendations for specific actions constituting the core of the strategy.

**Part III** of this document, **The Way Forward**, provides a summary of the findings and agreements reached during the Colombo Workshop. The Vision of the MCBS agreed during the workshop was *“South Asian Seas countries share healthy marine and coastal ecosystems rich in biodiversity that will continue to provide ecosystem services for the wellbeing of the people, and social and economic development of the region”*. It was agreed that the Regional MCBS should draw on and promote application of an Ecosystem Approach for the design and implementation of the MCBS initiatives in the region. Other guiding principles underpinning the strategy include: Maintaining Healthy and Resilient Ecosystems, Government commitment at every level, Maintaining Healthy and Resilient Ecosystems, Recognition of the economic, social and cultural values of marine and coastal ecosystems, Adaptive management and learning by doing, Precautionary approach and risk analysis, Participatory and Inclusive, Commitment to Human Rights and Gender Equality and Building and Strengthening Partnerships.

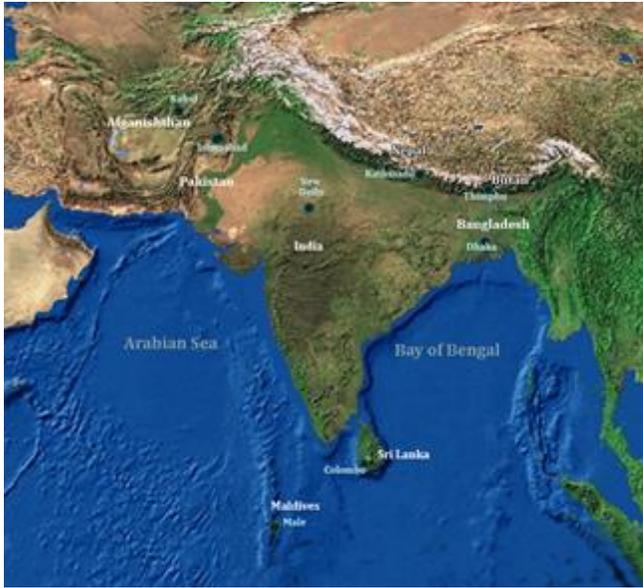
The MCBS has been developed around **six Regional Targets** (one for each thematic study), which are based on **Six main Goals** for the conservation of biodiversity and sustainable use of marine and coastal ecosystems in the SAS region. A set of **Regional Actions** are being proposed for each sub-target, along with **Performance Indicators** to measure progress, in addition to **potential Partnerships** that will support the implementation of the MCBS.

## **PART I: A Common Vision for the Marine and Coastal Biodiversity of the South Asian Seas Region**

### **Introduction to the South Asian Seas Region**

The South Asian Seas (SAS) Region is comprised of the Northern Indian Ocean and incorporates the marine and coastal environments, including the Exclusive Economic Zones (EEZ), of Bangladesh, India, Maldives, Pakistan and Sri Lanka. The marine environment is physically divided by the Indian subcontinent into three distinctive areas: two large marine ecosystems - the Arabian Sea in the west and the Bay of Bengal in the east; and a large area of the open Indian Ocean to the south of India and Sri Lanka (Fig 1). The estimated land cover of the five countries is around 4.3 million km<sup>2</sup>, of which India constitutes about 75 percent (being the seventh largest country in the world). The combined Exclusive Economic Zone (EEZ) of the five countries accounts for 3.7 million km<sup>2</sup>, and the declaration of 200 nautical miles EEZ have led to 300-fold increase in the jurisdictional area of Maldives, while Sri Lanka's EEZ is more than seven times larger than its terrestrial area (Table 1.1).

The oceanic conditions of the region are dominated by the monsoons, evaporation and high runoff from the rivers entering the coastal areas. Shallow accreting coastlines, with deltas and coastal lagoons, dominate in Bangladesh, parts of India, Pakistan and Sri Lanka, while the Maldives and the island chains belonging to India (Lakshwadweep, Andamans and Nicobars) are archipelagic. The coastline of Bangladesh is particularly low-lying, and is unique in the region in that the influence of the sea is felt for a long distance inland. The Maldives and Laccadives are composed entirely of atolls, with reefs and sandy islands, and form the Laccadive-Chagos chain that extends southward from India to the central Indian Ocean (Brown, 1997, Wells *et al*, 1995 and Pernetta 1993).



**Figure 1: The South Asian Seas Region**

The SAS coastline, together with an extensive system of river deltas, estuaries and open ocean waters, supports some of the richest concentrations of biodiversity in the world, with coastal and marine ecosystems such as mangroves, coastal wetlands, seagrass meadows, coral reefs and sand dunes. These ecosystems support the livelihoods and food security of millions of people and protect the scarce land resources from being depleted by storm surges, tsunamis and cyclones. Further economically valuable non-living resources like petroleum, natural gases and minerals are found within the EEZs of the countries and presently only few of these resources

are being commercially exploited. These waters are also habitat of healthy remaining populations of many globally threatened species such as whales and sea turtles.

However, the five maritime countries of South Asia also share problems of increasing population pressures and resultant increasing demands on the coastal and marine resources, at a level which is almost unprecedented elsewhere in the world. The limited land area holds a population of over 1.6 billion people of which around 30% lives in poverty (Table 1.1), and alongside these coastal resources are some of the most densely populated cities in the world (Karachi, Bombay, Madras, Calcutta and Dhaka).

The main drivers of environmental damage have been identified to be: land-based sources of pollution, including those derived from agriculture and urban activities, sea-based pollution, especially from oil and chemical spills, overfishing and unsustainable fishing, physical alteration and destruction of coastal habitats, infrastructure development, climate change and associated sea level rise and disasters (UNEP, 2010, BOBLME, 2014). A recently published report by the Asian Development Bank (ADB) stated that the changes in climatic events have significant impacts on coastal and marine resources in South Asia region through the alteration of ocean circulation, coral reef ecosystems, ocean and estuarine salinity, fisheries, and recreation and tourism activities. The effects also include dryland and wetland losses, which impose both physical and economic risks on coastal communities (Ahmed and Suphachalasai , 2014). The region needs to tackle all of these above issues, and it is in urgent need of Ecosystem Approaches that promote economic development while maintaining healthy marine and coastal environments, in a context of uncertainty due to climate change. Urgent actions are now required to restore fisheries that have collapsed, avoid continued fishing stocks which are already fully utilized, and to minimize the biological loss of other coastal and marine habitats. Managing and mitigating the threats to these resources cannot be adequately addressed unless governments and stakeholders collaborate and coordinate. In addition, most of these issues, like shared fish stocks and trans-boundary pollution, require regional decision-making for adequate planning of interventions, and so do the protection of shared ecosystems and migratory species.

Table 1.1: The South Asian Seas Region in numbers

	Bangladesh	India	Maldives	Pakistan	Sri Lanka	Total
<sup>1</sup> Surface Land Area (000 km <sup>2</sup> )	143.998	3,287.3	0.30	796.1	65.61	<b>4,293.3</b>
<sup>2</sup> Claimed Exclusive Economic Zone Area (000 km <sup>2</sup> )	39.9	2,103.4	870.6	201.5	500.7	<b>3,716.2</b>
<sup>3</sup> Length of Coastline (km)	714	7,517	644	1,046	1,620	<b>11,541</b>
<sup>4</sup> Total population 2013(millions)		1,252.1	0.3	182.1	21.3	<b>1,612.4</b>
Total population 2030 (millions)	156.6 185.1	1,476.1	0.4	231.7	23.3	<b>1,916.6</b>
<sup>2</sup> Percentage of Population within 100 km from the coast	54.8	26.3	100	9.1	100	<b>27</b>
<sup>4</sup> UNDP Human Development Index Rank 2013	142	135	103	146	73	
<sup>4</sup> Population below US\$ 1.25 per day (%) (2002 -12)	43.25	32.68	1.48	21.04	-	

Sources : <sup>1</sup> CIA, 2014 ; <sup>2</sup>Burke et al, 2001 ; <sup>3</sup> CBD National Reports ; <sup>4</sup>UNDP, 2014;

## Rationale for a Regional Strategy

As seen above, the SAS region faces many environmental challenges resulting from inadequate management and other human induced impacts. As the region expands economically to cater for an increasing population, the limited resource base in SAS countries are being increasingly pressurized and some habitats and species are already threatened with total destruction or disappearance. In order to address this, the SAS governments are developing their policy, legislative and institutional capabilities, moving towards a more sustainable utilization of their coastal and marine resources.

One of the most relevant instruments at the sub-regional level is the South Asian Seas Action Plan (SASAP), developed under the umbrella of UNEP – Regional Seas Programme. Adopted in 1995 by the five maritime countries, the objective of the SASAP is to protect and manage the marine environment and related coastal ecosystems of the region through the promotion of sustainable use of the resources. This objective is achieved by:

- Establishing and enhancing consultations and technical co-operation among region States
- Emphasizing the economic and social importance of the resources of the marine and coastal environment; and
- Establishing a regional co-operative network of activities concerning concrete subjects/projects of mutual interest for the whole region

The Action Plan identified four priority areas where activities need to be developed and implemented: Integrated Coastal Zone Management; Development and Implementation of National and Regional Oil and Chemical Spill Contingency Planning; Human Resources Development through Strengthening Regional Centers of Excellence; and Protection of the Marine Environment from Land-based Activities (SACEP, 1995). Although not yet *per se* a Regional Convention, SASAP follows existing global environmental and maritime international instruments, and considers the Law of the Sea as its umbrella convention.

Other relevant strategic instruments which provide the rationale for the Regional Marine and Coastal Biodiversity Strategy for SAS region include:

- **the Convention on Biological Diversity (CBD)** to which all SAS nations are party to, urges regional organizations to consider the development or updating of regional biodiversity strategies, as appropriate, including agreeing on regional targets, as a means of complementing and supporting national actions and of contributing to the implementation of the Strategic Plan for Biodiversity 2011-2030<sup>1</sup>:
  - In decision X/2, the tenth meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD), held in October 2010 at Nagoya adopted a revised and updated Strategic Plan for Biodiversity, including reflected Aichi Biodiversity Targets<sup>1</sup>, <sup>2</sup>Sustainable Development Goals SDG's and targets of the 2030 agenda, and agreed to translate this overarching international framework into national biodiversity strategies and action plans. It was also recommended that Parties and other Governments, with the support of intergovernmental and other organizations, as appropriate, shall implement the Strategic Plan and promote the generation and use of scientific information, develop methodologies and initiatives to monitor status and trends of biodiversity and ecosystem services, share data, develop indicators and measures, and undertake regular and timely assessments. In this regard National and or regional Biodiversity Strategies and Action Plans (NBSAPs) can be considered the principal instruments for implementing the CBD.
  - Further under decision X/29, the 10<sup>th</sup> COP urged Parties and other Governments to achieve long-term conservation, management and sustainable use of marine resources and coastal habitats, and to effectively manage marine protected areas, in accordance with international law, including the United Nations Convention on the Law of the Sea, in order to safeguard marine and coastal biodiversity and marine ecosystem services, and sustainable livelihoods, and to adapt to climate change, through appropriate application of the precautionary approach and ecosystem approaches, including the use of available tools such as integrated river basin and integrated coastal zone management, marine spatial planning, and impact assessments.
  - At the recently concluded COP 11, yet again SAS Government affirmed the importance of implementing the Strategic Plan for Biodiversity achieving the appropriate Aichi Biodiversity Targets and SDG's 2030 targets and agendas. Further they recognized the potential for enhanced cooperation at the regional and sub-regional levels among developing countries (South-South cooperation) and between developed and developing countries (North-South and triangular cooperation), consistent with the Convention, and, it was noted the potential role of national, regional and international organizations and the private sector in facilitating technical and scientific cooperation.
- **UNEP's Regional Seas Program (RSP)**, to which the South Asia Programme is a partner, urges members, through the Regional Seas Strategic Directions (2013-2016) to effectively apply an

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<sup>1</sup> The Aichi Biodiversity Targets are 20 goals that were incorporated in the Convention on Biological Diversity (CBD) - Strategic Plan for Biodiversity 2011–2020, for providing a framework for action by all stakeholders to preserve biodiversity and enhance its benefits for the people. Find more here: <http://www.cbd.int/sp/targets/>. <sup>2</sup> The 2030 Agenda for Sustainable Development, agreed by the 193 States Members of the United Nations, sets out an ambitious framework of universal and indivisible goals and targets to address a range of global societal challenges. Biodiversity and ecosystems feature prominently across many of the Sustainable Development Goals (SDGs) and associated targets. Find more here: <https://www.cbd.int/development/doc/biodiversity-2030-agenda-technical-note-en.pdf>.

Ecosystem Approach in the management of the marine and coastal environment, contribute to the implementation of the Manila Declaration of the Global Programme of Action for the Protection of the Marine Environment from land Based Activities (GPA), in particular the partnerships on wastewater management, nutrients and marine litter, strengthen capacities at the regional and national levels on marine and coastal governance, support the provision of tools to decouple economic growth from environmental pressures in the marine and coastal environment by promoting resource efficiency and productivity, strengthen coordination and build capacity to improve global knowledge and trends on the status of the marine environment, and strengthen collaboration mechanisms with relevant Multilateral Environmental Agreements, UN Agencies and International Financial Institutions.

- **UNEP Marine and Coastal Strategy (2009)** emphasized four guiding objectives: land-ocean connections; ecosystems for humanity; reconciling use and conservation; and vulnerable people and places.
- **The Bay of Bengal Large Marine Ecosystem (BOBLME) Strategic Action Plan (SAP) (2014)** emphasizes the importance of healthy ecosystems for food security and economic development, and identified areas for regional action to address the pressure on marine resources. The SAP will provide a coordination mechanism for engagement of the member countries, underpinning sustainable economic development, and showing commitment to action by meeting global expectations, realizing that doing nothing is not an option. All of the SAS nations, except Pakistan, are members of the BOBLME project, and both processes should work in cooperation to achieve their expected outcomes, avoiding replication, and building synergies.
- The outcome document of **the RIO+20 titled “The Future we want”** recognizes that oceans, seas and coastal areas form an integrated and essential component of the Earth’s ecosystem and are critical to sustaining it. Further, it stated commitment to protect and restore the health, productivity and resilience of oceans and marine ecosystems, and to maintain their biodiversity, enabling their conservation and sustainable use for present and future generations, and to effectively apply an ecosystem approach and the precautionary approach for the management, in accordance with international law, of activities having an impact on the marine environment, to deliver on all three dimensions of sustainable development.

## Background and Process for Developing the Strategy

In line with the Strategic Plan for Biodiversity of the CBD, SACEP and UNEP jointly initiated a process in 2013 to develop a Regional Marine and Coastal Biodiversity Strategy for the South Asian Seas Region, with the objective of supporting South Asian countries in achieving Aichi Biodiversity targets and SDG’s for the 2011-2030 period. Acknowledging that all of the linkages between SDGs and Aichi Biodiversity Targets (see above) are relevant for the success of the Regional Marine and Coastal Biodiversity Strategy, the focus of the Strategy is to bring a regional perspective to the targets which are more relevant to marine and coastal biodiversity. These are Targets 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 14, 15, 17 and 19.

The **Marine and Coastal Biodiversity Strategy (MCBS) for South Asia Seas region** is being formulated as a part and parcel of the ongoing process of preparing National Biodiversity Strategies and Action Plans (NBSAPs) as well as other regional and global initiatives targeting the five maritime countries of South Asia: Bangladesh, India, Maldives, Pakistan and Sri Lanka. This process received support through the endorsement by the SAS countries at the 5th Inter-Ministerial Meeting of the South Asian Seas Programme (5 IMM-SASP) held in Islamabad, Pakistan on 5th December 2013.

As a first step in the Strategy development process, a desk review was undertaken to prepare a knowledge base, identify gaps and needs, document relevant national and regional processes and identify how the proposed strategy can complement the NBSAPs process with respect to achieving the Aichi targets relevant to marine and coastal biodiversity conservation. For the desk review purpose, the Aichi targets were grouped in to six distinctive thematic areas as indicated in Table 3.1. A summary of the findings of the Background Documents are presented in Part II of this document.

Table 3.1: Thematic areas of the Marine and Costal Biodiversity Strategy

Thematic Area	Aichi Biodiversity Targets	Main Issues Addressed
1. Ensuring Ecosystem Services and Wellbeing		Extent and distribution of major habitats, ecosystem services provided by them and their importance to human wellbeing; their major causes of habitat destruction and ongoing national, regional and global process addressing these issues
2. Prevention of Species Extinction		List of currently threatened species and their distribution; major threats faced and the conservation action taken to safeguard them;
3. Control of Alien Invasive Species		The existing alien invasive species, their pathways of introduction and the harm they do; the existing programmes to address the issue
4. Sustainable Fisheries and Aquaculture		Types and extent of fishery, invertebrates and aquatic plants harvested and the techniques used to harvest them; Opportunities and constraints for mitigating overexploitation of the resources
5. Prevention of Marine Pollution		What are the main type pollution and how they affect coastal and marine systems; the actions that are in place to address the problem
6. Effective and Equitable Governance of Marine and Coastal Protected Areas		The current extent of Marine and coastal protected areas and how effective they are in protecting species and habitats; The areas of importance for biodiversity and ecosystem services that are not currently protected and the opportunities and constraints to expanding protected areas

Additionally, there are two Aichi targets that are considered cross-cutting and necessary for the implementation of the Strategy are also covered within the Framework for regional action. These are Target 3 and Target 20:

- **Target 3:** By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, considering national socio-economic conditions.
- **Target 20:** By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Marine and Coastal Biodiversity will increase to a level 30% higher than the current level. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.

With regards to the SDG 14, Classification of SDG Indicators and Custodian Agencies. UN Environment has been identified by the IAEG-SDGs as custodian agency for 26 SDG indicators, of which three (14.1.1, 14.2.1, and 14.5.1) are related to SDG 14 (UN ECOSOC, 2017c).

Based on the findings of the desk reviews on each thematic area, a Zero Draft of the MCBS was prepared by a leading consultant. A three-day regional workshop was then held from 8-10th July 2014, where 52 representatives from the South Asian Seas' countries and partner organizations working on marine and coastal biodiversity issues. Participants agreed on practical targets for the region based on current status, threats and policy and institutional measures already in place and the potential to implement within a reasonable time frame, suggested indicators to monitor the targets; and regional actions to be included in the Regional Marine and Coastal Biodiversity Strategy. The workshop findings enabled the preparation of a First Order Draft of the MCBS; including Regional Targets, Implementation and Monitoring Framework, in addition to potential partnerships, coordination and communication mechanisms among the partners, legislative or institutional reforms required and financial mechanisms to support implementation. These outputs will be finalized pursuant to a consultation period, and will then be concluded at a second regional workshop held on 12-13<sup>th</sup> September ,2018 and will be presented for endorsement at the 6th Inter-ministerial meeting. The Strategy will ultimately promote an Ecosystem Approach for protecting marine and coastal biodiversity and safeguarding ecosystem services, promoting inter-sectoral coordination and exploring impacts of economically important activities (e.g. fisheries and tourism) on the region's marine and coastal habitats and resources. The Strategy should be used as a framework for coordination and collaboration of the different initiatives taking place in the SAS region, avoiding duplication of efforts and wherever possible, focusing on amplifying the positive effects of ongoing interventions.

#### **Expected timeline:**

- First Order Draft - Open for comments: 30 January 2015
- Second Workshop for discussion: September 2018
- Final Version of the Strategy: October 2018
- Presented for Endorsement: IMM 2019
- Entry into force: 2019

## **Part II: Marine and Coastal Biodiversity in South Asian Seas; Status, Trends and Threats**

According to the Convention on Biological Diversity (CBD), *biodiversity* is the variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part. This includes diversity within species, between species and of ecosystems. The Convention also notes:

*“Oceans cover 70% of the planet’s surface area, and marine and coastal environments contain diverse habitats that support an abundance of marine life. Life in our seas produces a third of the oxygen that we breathe, offers a valuable*

Bangladesh has achieved its sovereign rights over 1,18,813 square kilometer maritime area after resolution of the dispute settled by ITLOS with the neighboring countries of Myanmar and India in 2012 and in 2014 respectively. Being directed by the Honorable Prime Minister of Bangladesh relevant ministries have formulated a Blue Economy Action Plan which are being implemented, to harness economic development ensuring sustainable use of marine resources.

Unlike other organizations, Department of Environment has formulated blue economy action plan which are being implemented to conserve marine ecosystem, control sea pollution, ensure environment friendly management and harvesting of marine resources, mainstreaming marine and coastal biodiversity conservation and management activities. Department of Environment has been working with other relevant organizations to implement the action plan in an integrated manner.

The action plan comprises some important activities with a view to develop climate resilient and biodiversity rich sustainable coastal and marine ecosystem. These are:

1. Mainstreaming marine biodiversity conservation and management activities
2. Capacity development of Department of Environment officials for management of coastal and marine resources
3. Preparation of a combined database of coastal and marine biodiversity takes care of climate change
4. Assessment of strategic environmental impacts of coastal and marine resource extraction and its management
5. Ensuring biodiversity conservation and management of coastal and marine ecosystem
6. Controlling marine pollution and conserve its habitat by implementing relevant international convention and protocols
7. Strengthening regulatory system to control marine pollution
8. Monitoring impacts of various point sources for marine pollution.
9. Monitoring impact of climate change on marine habitat

Now, the following projects are prepared to implement some of the above activities of Blue Economy Action Plan for Department of Environment under Ministry of Environment, Forest and Climate Change:

- a. Assessment of Coastal and Marine Biodiversity Resources and Ecosystems to Implement the Blue Economy Action Plan and
- b. Monitoring of Marine Water Pollution: Estuaries and Offshore Areas of the Bay of Bengal

This tremendous wealth of biodiversity and ecosystem services provided by coastal and marine systems are not infinite. According to the Millennium Ecosystem Assessment, the world's oceans and coasts are highly threatened and subject to rapid environmental change. Human activities are greatly threatening

the seas and coasts through overfishing, destructive fishing practices, pollution and waste disposal, agricultural runoff, invasive alien species, and habitat destruction due to uncontrolled development. Global climate change will exacerbate these problems. Sea levels will rise, water temperature will increase, oceans will acidify, and there will be more storms and natural disasters.

Major root causes underlying these issues include population growth and changing demographics, increased production to meet increasing demand for exports, a growing and diversifying industrial sector, undervaluing environmental “goods and services” provided by the coastal and near-shore marine ecosystems, weak and/or inappropriate policies and strategies, lack of capacity and incentives to enforce regulatory frameworks, inadequate education and awareness of the values of marine and coastal resources, insufficient budgetary commitments, lack of community stakeholder consultation and empowerment and widespread poverty in coastal areas in many countries in the region (BOBLME, 2012).

While countries recognize these issues and their negative impacts on the livelihoods of its people, they are challenged to address the underlying causal factors, even though they have demonstrated significant levels of commitment to address many of the aforementioned problems, both in terms of national actions as well as through their participation in a number of international conventions that address these issues. Annex 1 outlines the international obligations of the SAS countries, and Annex 2 describes the main organizations working on the conservation of coastal and marine ecosystems. Countries also require regional action to support national interventions, especially for resources that, due to their trans-boundary nature, need to be managed regionally.

The following sections provide an account on above issues from the findings of desk reviews undertaken on the six main thematic areas of the Coastal and Marine Biodiversity Strategy.

## 1. Ensuring Ecosystem Services and Human Wellbeing

### **Box 1: Global Importance of Coastal and Marine Ecosystems in SAS**

- 6.8% of the global mangrove forests
- 6% of the global coral reefs
- Two of the world largest estuaries (the Ganges and the Indus)
- Six of the Global 200 Ecosystems (Sudarbans, Indus delta, Rann of Kutch Flooded Grasslands, Maldives, Chagos, Lakshadweep Atolls, Arabian sea and the Andaman sea)

Marine and coastal ecosystems provide supporting services in the form of a wide range of habitats. Estuaries, mangroves, lagoons, and seagrasses, serve as nurseries for both inshore and offshore fish and other species, many of which are commercially significant. Other habitats such as beaches, dunes, saltmarshes, estuaries, and mudflats are important during the life cycles of fish, shellfish, and migratory birds. Marine and coastal ecosystems also play important roles due to photosynthesis and productivity through primary production by phytoplankton, and mixing nutrients from upstream and tidal sources, with estuaries being one of the most fertile coastal environments (UNEP, 2006). In the aftermath of the devastation caused by the Indian Ocean

tsunami in 2004, awareness that there is an inextricable link between the status of coastal ecosystems and the vulnerability of coastal inhabitants to natural disasters was brought forcefully to the forefront,

bringing to light the direct correlation between the health of coastal ecosystems and the degree of shoreline protection provided (Kallesøe *et al*, 2008).

The following section provides baseline information on the status of the marine and coastal habitats and strategies that are being adopted by South Asian countries through national and regional processes to address the Aichi targets reflected in SDG,2030 targets.

### **1.1. Overview of the Current Status of marine and coastal ecosystems and their importance to human well-being in South Asia**

The major marine and coastal habitats in the region are mangroves, coral reefs, seagrass meadows, coastal wetlands including estuaries and lagoons, sandy beaches and sand dunes (Refer Box 1). The distribution of these habitats varies throughout South Asia with the largest contiguous mangroves in the world between India and Bangladesh, while Maldives Archipelago accounts for the seventh largest coral reef area in the world.

#### **Mangroves**

Mangrove ecosystems are rich in biodiversity and harbor a number of species that are globally threatened, such as the Bengal Tiger, the Estuarine Crocodile and the Genetic Dolphin, among others. The services provided by mangroves are far reaching and include: economic benefits from the contribution to fisheries, being nursery grounds for many species of finfish and shell fish; ecological benefits through the release of large amounts of nutrients that support the productivity in coastal lagoons and nearshore waters, protection of shorelines from storm surges and trapping sediment and increasing land area; provision of timber, fuel wood, mangrove poles for constructing fish traps, construction of fishing huts, building of boats and fence posts and fodder for livestock, non-timber forest products including traditional medicines; and producing honey and wax from bees. Mangrove forests are considered globally rare, despite being present in 123 tropical and sub-tropical nations and territories, because they only cover an area of only around 152,000 km<sup>2</sup>; this is less than 1% of all tropical forests worldwide, and less than 0.4% of the total global forest (Van Lavieren *et al*, 2012). South Asia is home to 6.8% of the global mangroves, with 10, 344 ha, which are distributed discontinuously. Through Pakistan and north-west India the mangrove trees are stunted and the diversity is low due to harsh arid conditions. The Indus River delta is also ranked fifth largest semi-arid mangrove area in the world (Farooqui, 2014). Further south, conditions become more humid and there is more reliable riverine inputs, although mangroves remain mostly restricted to protected lagoons. Deltaic mangroves become important along India's east coast and Bangladesh, where the Sundarbans form one of the world's largest contiguous mangrove forest, covering an area of 6,500 km<sup>2</sup> and extending 85 km inland South Asia, together with South East Asia, is considered a global mangrove biodiversity hotspot, due to the elevated number species in comparison with other parts of the world. Overall, 38 mangrove species have been recorded in the region, with diversity increasing towards the east. The northern Bay of Bengal and Sundarbans form an important part of the Indo–Andaman biogeographic province, with several regional endemic species (ITTO *Tropical Forest Update*, 2012; Spalding *et al*, 2010).

The original area occupied by mangroves in South Asia has declined markedly over the past decades with estimated reductions of 85% for India, 78% from Pakistan and 73% reduction in the Bangladesh (*Values of 1996, in Macintosh and Ashton 2002*). In Sri Lanka, there has been about a 50 percent reduction of the mangrove cover between 1986 and 2002 (*Joseph, 2003*).

### **Main threats to mangroves in South Asia**

In SAS countries, except Maldives, threats to mangroves include the rapid expansion of the shrimp aquaculture industry (such as the destruction of Chakoria mangroves of Bangladesh), reduced fresh water and sediment inputs due to upstream activities and especially damming of major rivers and irrigation for agriculture. Damage from storms, cyclones and sea level rise are likely to increase with climate change. Climate change related alterations of ocean circulation patterns could affect mangrove tree distribution and the genetic structure of mangrove populations. The impact on the community structure of the mangrove population may have further impact on biodiversity, with economic implications in view of the importance of mangrove forests to commercial fisheries in certain coastal areas (*Ahmed and Suphachalasai, 2014*). A study conducted in the Indus delta of Pakistan showed that rapidly escalating mangrove loss has seriously jeopardized the livelihoods of more than 135,000 people who rely on mangrove resources for their livelihood (*Ifthikhar, 2002*). Even small areas of mangroves need to be conserved and managed as these habitats are critically important as nursery grounds for fish and other marine organisms and many livelihood and commercial fishery activities are dependent on the productivity of these habitats.

Series of conservation measures have been initiated by the countries. For example, Bangladesh has the world's largest areas of new mangrove plantations, and significant areas have also been planted in Pakistan and India. Many remaining mangrove areas are in protected areas. In India, mangroves have been listed as 'ecologically sensitive areas' under the Coastal Regulation Zone notifications of India Annex 3.

### **Coral Reefs**

Found only in tropical ocean waters, warm water coral reefs cover less than 0.2 percent of the ocean floor. Over six percent of the world's coral reef area is found in South Asia, which includes some of the most diverse, extensive and least disturbed reef areas in the Indian Ocean. Distribution of coral reefs is a mirror image of that of mangroves; while the major mangrove areas are recorded from the north, the most extensive and diverse reefs are found in the south (*Wells et al, 1995*). A study conducted by Roberts *et al* (2002), identified the Northern Indian Ocean, as one of the ten centers of coral biodiversity hotspots with high endemism. The atolls of the Maldive ridge (including Laskahdweep and Chagos) are the most extensive coral reef system (8, 929 km<sup>2</sup>) in the Indian Ocean and the largest atoll system in the world. This atoll system together with Sri Lanka has been collectively identified as one of the ten global priority areas for coral reef conservation. The South Asian Seas coral reefs also provide a critical link between the Southeast Asian and the western Indian Ocean coral reefs species. All three major reef types (atoll, fringing and barrier) are represented in the region to varying degrees (*Spalding et al, 2001*).

There are extensive reefs around the Andaman and Nicobar Islands as well as in the Gulf of Mannar between India and Sri Lanka. Coral reef growth is inhibited in the North-east coast of India, the entire coastline of Bangladesh and Pakistan due to freshwater and sediment inputs from larger rivers such as Ganga, Indus, Krishna and Godavari. There are four major coral reef areas in India in the Gulf of Mannar, Gulf of Kachchh, in the Malvan coastal waters between Mumbai and Goa, Lakshadweep and Andaman and Nicobar Islands (5,790 km<sup>2</sup>). Sri Lanka has many fringing coral reefs and several offshore coral reefs in the Gulf of Mannar. In Pakistan, sparse coral growth can be found around Astola Island and in the coastal waters of the Jiwani coast. Bangladesh has coral reefs only around St. Martin's island (*Spalding et al., 2001; Wilkinson, 2008; Rajasuriya et al, 2004; Rajasuriya et al, 1998*).

More than 250 reef building coral species have been recorded from the region (See Table 2.1), with the most common coral genera being *Acropora*, *Montipora* and *Porites* (*Spalding et al, 2001*). A study conducted in Andaman and Nicobar islands of India indicated that the coral reef diversity in the region might increase up to 400 species (*Venkataraman, 2003*). Among the deep water (Ahermatypic) corals, 227 species belonging to 71 genera and 12 families have been reported from the Indian Ocean region. Although 44 species of deep-water corals have been identified from India, so far very little attention have been paid to address the knowledge gap in deep-water corals of the region (MoEFCC/Gol, 2005).

Table 2.1: Status of Coral reef of South-Asia

	Reef Area (km <sup>2</sup> ) <sup>1</sup>	No of hard coral sps	No. of reef fish species	Reefs at risk (%) <sup>1</sup>	% of Reefs now dead <sup>3</sup>
<b>Bangladesh</b>	<50	52 (25 living) <sup>2</sup>	86 <sup>2</sup>	100	50
<b>India</b>	5,790	262 <sup>3</sup>	1,087 <sup>3</sup>	61	25
<b>Maldives</b>	8,920	250 <sup>3</sup>	1,200 <sup>3</sup>	11	55
<b>Pakistan</b>	< 50	na	na	na	na
<b>Sri Lanka</b>	680	190 <sup>3</sup>	350	86	35

Sources: Spalding et al, 2001<sup>1</sup>; Uddin, 2004<sup>2</sup>; Rajasuriya et al, 2004<sup>3</sup>

Reef resources provide the base for tourism and fishery, which are important economic sectors of the countries. In Maldives, the number of annual tourist arrivals in certain months exceeds the total local population, and tourism continues to be the largest economic activity and the main source of foreign exchange earnings contributing 28% of the countries' GDP (MoTAC/GoM, 2013). Intact coral reefs and sand-stone reefs in Sri Lanka also have contributed to reduce the force and energy of the Tsunami waves, since a severe damage to inland areas is visible in areas such as Oruwella, where the near-shore coral reefs has been severely destroyed by mining and bottom-set netting over the past decade (IUCN, 2005).

Table 2.2: Globally recognized coral reef areas of the region

<b>Coral Reef system</b>	<b>Global Significance</b>	<b>Biodiversity value</b>
▪ Gulf of Mannar, India	UNESCO- MAB & WHS area	Ninety-four scleractinian coral species belonging to 37 genera.
• Maldives, Chagos and Lakshadweep Atolls, and Sri Lanka	WWF Global 200 Ecosystems UNESCO MAB (Baa Atoll)	Over 250 coral reef species, act as a stepping stone for coral larvae transport from eastern to western Indian Ocean
• Andaman Sea (including Andaman & Nicobar islands of India)	WWF Global 200 Ecosystem UNESCO – MAB (Great Nicobar)	Extensive fringing reefs exist here, as well as a 320 kilometers-long barrier reef on the west coast. Much of the wildlife on these islands is endemic.

### Threats to Coral reefs in South Asia

Coral reefs are threatened by a number of factors including: climate change related coral bleaching; sedimentation; diseases; overharvesting of resources including fish for food and ornamental fish; use of destructive fishing methods such as trawling and dynamiting, pollution and coastal development. Coral reefs in the Indian Ocean were seriously damaged due to the unprecedented bleaching event in 1998 from which many reefs have not recovered to their pre-bleaching status. South Asian reefs also suffered damage from the 2004 tsunami in the Indian Ocean, including from ... and .... Andaman & Nicobar Islands lost some fringing reefs due to upliftment or subsidence (*Keating and Helsley, 2005, Obura et al., 2008; Wilkinson et al., 2006 and Wilkinson 2008*).

### Sea grass beds and seaweeds

Extensive seagrass beds are found in southern India and in the many estuaries of Sri Lanka. They cover an area greater than that of mangroves and coral reefs combined, making the largest contribution to primary productivity in coastal waters. In India the major areas are in the Gulf of Mannar, Lakshadweep group of islands, Andaman and Nicobar group of islands and along the West Coast. Distribution is up to a depth of 15 m. The highest species diversity is found in the shallow sandy marine areas (Green and Short, 2003). India is bestowed with 15 species of seagrasses belonging to six genera (MoFE/GoI, 2014). About 120 species of seaweeds have been recorded from India (Venkataraman, 2003). Information on seagrass meadows in Bangladesh is scanty. They are found mainly in the eastern coast of Bangladesh and five species of seagrasses have been recorded from the Bakkhali River Estuary area (Abu Hena and Khan, 2009). Five species of seagrasses as well as 285 species marine algae have been recorded from Maldives (MoHE-GoM, 2010). There is little information on the extent and diversity of seagrasses and seaweeds in Pakistan, although there are records of the presence of Green Turtles, which feed on seagrasses. In Sri Lanka, the sea grass beds from Puttalam lagoon to Jaffna lagoon are extensive and are important feeding grounds for dugongs as well as commercially important species of fish, crab, prawns and polychaete worms (CCD, 2006).

Threats to seagrasses vary in each country. The most extensive damage is caused by trawling for shrimps and bottom dwelling fishes. Extensive trawling in the Gulf of Mannar region is causing large scale damage to seagrass meadows and also threatens the survival of the Dugong dugon both in India and in Sri Lanka.

Illegal trawling by Indian fishermen in Sri Lankan waters in the Gulf of Mannar, Palk Bay and Palk Strait are causing much damage to seagrass meadows. Seagrasses are also damaged due to pollution, and high sedimentation especially in Bangladesh where high sedimentation and coastal pollution are major problems. Similar problems are found in the Gulf of Kachchh. Further damage is caused by cutting access channels through seagrass meadows and by boat propellers.

Seagrasses in the lower inter-tidal areas and around a number of islands in the Gulf of Kachchh have declined. *Halophila decipiens*, which has been a common species in the west coast until recently, has disappeared (Green and Short, 2003). Overexploitation of fauna such as sea cucumber, shrimp and sea urchins alter the balance of the seagrass ecosystem. In many areas these species have declined due to heavy exploitation. A study conducted in Sri Lanka revealed that all the high value sea cucumbers have been totally overexploited (Long *et al.*, 2010).

### ***Deltas Estuaries and Lagoons***

Almost all of Bangladesh lies in the active delta of three of the world's major rivers: Ganga, Brahmaputra and Meghna (GBM system). The major part of the Gangetic floodplain is located in India. The high sediment load carried by the rivers has led to the continuous formation of new islands off the coast of Bangladesh, which the government is reclaiming by planting mangroves. Other major rivers with deltas on the eastern Indian coast include those formed by the Mahanadi, Godavari-Krishna, Kaveri and Tambraparani rivers. The Indus flows through most of Pakistan and fall into the Arabian Sea. The Mahaveli is the largest river in Sri Lanka. The Maldives does not have any rivers (Rajagopalan & Lakshmi, 2003). There are 17 major lagoons within the coastline of India, while the Pulicat and Chilika are noteworthy estuaries rich in biodiversity (Venkataraman, 2003). In Sri Lanka the total area of estuaries and lagoons has been estimated at 158,017 ha and there are 45 estuaries belonging to two types: basin estuaries where river discharges into relatively shallow basins, which in turn open into the sea (Puttalam, Negambo and Jaffna); and riverine estuaries, where river discharge into the sea by way of relatively narrow channels (Kaluganga, Kelani Ganga estuaries). Around 40 true coastal lagoons are recorded mainly from southern, southeastern and eastern coasts. Sand barrier formations has transformed some basin estuaries into lagoons (Koggala Lagoon) and in some cases (Batticaloa, Kokkilai Lagoons) seasonally formed sand barriers result in temporary lagoons with restricted connection to the open sea (CCD, 2006).

The health and the biological diversity of the estuarine and lagoon ecosystems are deteriorating daily due anthropogenic interventions including dumping of solid waste and the release of untreated sewage and industrial effluents (Venkataraman, 2003). In countries such as Sri Lanka sand mining in major rivers, especially closer to river mouths has reduced the amount of sand, which would otherwise be available to replenish sand lost during storm events. This has resulted in large-scale coastal erosion in the south and west coasts of the country. As described above, the mangrove forests of the Indus delta in Pakistan show a dramatic decline and it has reduced from 2,600 square kilometers in the late 1970s to 1,300 square kilometers in the mid-1990s, mainly due to water diversion in the upstream of the river. About three-quarters of the water entering the Indus basin is now diverted and only a quarter reaches the delta and the Arabian Sea (Iftikhar, 2002).

### **Beaches, Sand-dunes and cliffs**

Bangladesh is notable for its 145 km stretch of beach from Cox Bazar to the tip of Teknaf Peninsula (Pernetta 1993b), and in Maldives there are numerous sandy beaches on the islands of the atoll chains. Sri Lanka has about 11,800 ha of beaches and spits extending over 300 km of coast, and sand dunes covering an area of 7,606 ha (Pernetta 1993c). Various forms of rocky shores dominate both the east and west coast of India. Coastal cliffs are the most observed characteristic geomorphic feature along the Indian coastline. Sand dunes in India support diverse flora and are categorized as ecologically sensitive areas under the Coastal Regulation Zone notification of 1991. There are around 148 species of sand dune vegetation reported from the east and west coasts of India. The dominant species are, *Spinifex littoreus*, *Hydrophylax meristima*, *Ipomea pescaprae*, and *Asparagus dumosus* (Apte, 2013; and Untawale, et al, 2000).

In Pakistan, the most important beach is situated southwest of Karachi, which stretches for 20kms. The mainland coast of India has beaches along 55 percent of its length while in Sri Lanka beaches are found along 75-90 percent of the coast, where majority are sandy barrier beaches backed by lagoons and wetlands. Dunes are also an important feature in Sri Lanka with extensive dune system on the west and south east coasts. Mature and intact sand dunes (i.e., old and broad dunes covered with scrubland vegetation) occurring in the Rakewa, Usangoda and Kalamatiya area have functioned as an effective barrier against the December 2004 Tsunami waves, thereby protecting inland ecosystems and human settlements (IUCN, 2005). The atoll islands of Maldives and Laccadives are bordered by sandy beaches derived from the coral reef surrounding them. Island beaches are highly dynamic and sand migrates around the island in response to the reversing monsoonal influence (Brown, 1997).

After the December 2004 tsunami that hit the southeast coast of India, there has been recognition among the coastal communities living adjacent to coastal sand dunes about the value of sand dunes in not only protecting the hinterland and coastal hamlets, but also their role in preventing saltwater intrusion as a result of inundation by large waves. There is also better recognition of their cultural, social and ecological significance. Further sandy beaches and sand dunes are important turtle nesting grounds. In spite of all this, sand dunes have not enjoyed the kind of attention or popularity that is given to other coastal ecosystems like mangroves (Namboothri et al, 2007). Human settlement is increasing on lands near sandy shores. Issues such as flattening of sand dunes and sand mining have severe consequences on shore erosion. Sandy shores are widely used for recreational purposes. The threat to sandy shores is further aggravated because they are relatively poorly understood. In 2004, an extent of 1,214 km of the 5,422 km Indian coastline was reported to be affected by sea erosion (Apte, 2013).

### **1.2. Ongoing Initiatives for the Protection of Marine and Coastal Ecosystems**

Protection of Biodiversity has a long tradition in the history of South Asia, as natural resources are closely linked to many religious beliefs and cultural traditions. The 'modern' conservation in the region stems mainly from the establishment of forest reserves in the 19th and early 20th centuries to safeguard timber, soil and water resources (IUCN, 1992). At National level there are numerous government agencies and other stakeholders including NGOs, and community itself who are responsible for protecting the habitats and the ecosystem services they provide (Annexes 2 and 3).

These legislations mainly protect the ecosystems through establishing Protected Areas, and this aspect will be discussed in length on Section 2.5, which will address Aichi Target 11 on Protected Areas.

The regional and international initiatives for major coastal habitats protection are given in Annex 1. Few are ongoing projects that will depend on continuous donor funding for long-term survival (e.g. Mangroves for the Future, BoB LME project etc). Some are intergovernmental processes that depend on member governments for funding and policy directives. Conventions such as Ramsar, UNESCO- MAB and UNESCO –WH assist in protecting and obtaining international attention through increased donor funding and technical assistance. Further Global Environmental Facility (GEF) and other bilateral donors such as the Government of Netherlands have been assisting the countries to safeguard and sustainably utilize the resources in these important ecosystems.

### 1.3. Conclusions and Recommendations

Sensitive marine and coastal habitats are widespread in South Asia. The most extensive mangrove areas are found in India, Bangladesh and Pakistan mainly around the large rivers and coastal Lagoons. The main coral reefs are in the Maldives Archipelago, in four locations in India (Lakshadweep, Gulf of Mannar, Gulf of Kachchh and Andaman and Nicobar group of Islands) and Sri Lanka. The major seagrass areas are in the Gulf of Mannar and Palk Bay, Bangladesh, Gulf of Kachchh and Indus Delta area and Andaman and Nicobar Islands. Although conservation efforts have been carried out by respective governments and non-governmental organizations with the support of international organizations, most of these habitats continue to degrade due to various reasons listed in this report. Several common problems impede proper conservation and management efforts. The main issues are:

- Overlapping responsibilities within government departments: often different departments are responsible for the same resource/ecosystem, creating another layer of difficulty in decision-making and confusion
- Slow or ineffective implementation of plans and regulations: Laws and plans for protection of certain habitats are existing, but they are not being implemented due to lack of resources and lack of enforcement and monitoring
- Ineffective laws: not responding to the specific needs of the people and the protection of coastal and marine ecosystem
- Lack of political will: even when the laws are adequate, they may not be implemented due to slow processes and absence of “champions” or leaders.
- Corruption: hindering the implementation of well-intended initiatives.
- Lack of skills and/or resources (human, technological and financial): which also limits the implementation of plans and other interventions
- Poverty among coastal communities: when people are struggling with day to day survival, it is more difficult to discuss topics related to environmental conservation
- Lack of awareness: coastal communities, private and public sector often lack awareness on the services that ecosystem provide
- Lack of ownership and open access regimes: conflicts can arise when it is not clear who has access and ownership of resources, and who is in charge of protection of coastal and marine ecosystems

Every country in South Asia has developed several policies and conservation plans for the protection and sustainable use of marine and coastal resources. However, some legislations, laws and regulations, remain inadequate, or poorly implemented, often due to political interference. Despite these policies and management plans the habitats continue to degrade and their resources are being overexploited. There is also little control over shared stocks of fish and other marine organisms (see section 4, Sustainable Fisheries and Aquaculture for SAS).

To address these issues, it is recommended that SAS region focuses on:

- Improve legislations and their implementation
- Harmonize policies on environmental management among neighboring countries
- Establish quotas for harvesting living resources, especially on migratory and highly threatened species
- Establish marine protected areas, fish *refugia* and form networks with corridors among neighboring habitats
- Develop capacity in governance
- Address issues such as land-based pollution including agricultural runoff, sewage discharge and industrial waste.
- Improve and use existing instruments such as Environmental Impact Assessment Process, Environmental Protection license process to mitigate the impact of the industry
- Create awareness among governments, private sector and coastal communities on the use of agrochemicals and other pollutants and their effect on marine and coastal ecosystems
- Reactivate regional bodies such as the South Asia Coral Reef Task Force (SACRTF) to improve conservation and management of sensitive habitats.
- Incentives and restructuring subsidy systems.
- Broadening collaboration with and responsibility of the private sector

## 2. Preventing Species Extinction – Dimming the Red Light

Aichi Biodiversity Target 12 recommends that by 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained by undertaking following actions:

- **Preventing extinction** – Preventing further extinction entails that those species which are currently threatened do not move into the extinct category.
- **Improving the conservation status of threatened species** - An improvement in conservation status would entail a species increasing in population to a point where it moves into a lower threat status. Using the IUCN criteria a species would no longer be considered as threatened once it moved into the near threatened category.

### Box 2: Globally Threatened Species in SAS region

- SAS region is critical to the recovery of the endangered north Indian Ocean blue whales
- Considerable number Irrawaddy Dolphins are found in the estuarine waters of Bangladesh and the Chilika Lagoon of India
- One of the largest remaining population of Bengal Tigers are found in Sundarbans mangroves, spanning between Bangladesh and India
- Almost half of the world's threatened sea turtle populations are found in the northern Indian Ocean and the largest rookery of olive ridley turtles are found in Orissa, India
- Migratory Waders including Spoon bill Sand pipers feed in the coastal wetlands, especially in Sonadia Island of Bangladesh
- 3 Protected Areas in Andaman and Nicobar islands have been identified under Alliance for Zero Extinction, for the protection of endemic shrews and the Narcodam Hornbill

### 2.1. Species of Conservation Concern and the major threats for their survival

Within the Northern Indian Ocean, no systematic assessment of the Coastal and Marine Biodiversity has been carried out so far and there is considerable data and information gap both in spatial and temporal coverage. Reports of major regional/national programmes contain only group/taxa details and not the species details. On a regional scale, there is lack of clarity on the coastal and marine biodiversity as the formats adopted by various groups/authors, the number of species reported under each taxonomic group and the total number of species reported show considerable variation and inconsistency (MES/GOI, 2014).

Yet the available information indicates that South Asian Seas region is rich in species diversity. For example, more than 15,000 marine species have been recorded from India alone (MoE/GOI, 2014). Published literature indicates that the region is important for the survival of around 100 globally threaded species (i.e. species included in the IUCN Red List of threatened species- critically endangered, endangered and vulnerable, the CITIES and CMS Appendices). Table 2.3 provides a summary of globally threatened species found in coastal and marine habitats of South Asia, while Annex 4 gives a comprehensive list of species.

Table 2.3: A summary of Species of global concern, recorded from Coastal and marine habits of South Asia

	Total No of species	No. of Species of Conservation concern		
		IUCN Red List (Thretned Categories-CR, EN, VU)	CITES Appendices	CMS Appendices
<b>Mammals</b>				
- Cetaceans	31	09	26	10
- Sirenia	01	01	01	01
- Other		07	04	01
<b>Waders &amp; Sea birds</b>		32	17	
<b>Reptiles</b>				
- Marine turtles	05	05	05	05
- Sea snakes		02	02	
- Salt water Crocodiles				
- Other				
<b>Fishes</b>		26	18	03
<b>Invertebrates</b>				
- Coral		78	88	
- Mollusks		07	04	
- Other				
<b>Plants</b>				
- Mangroves		02		

### **Mammals**

Most marine mammals in the region, such as whales, dolphins, porpoises and dugongs, are trans-boundary species. Terrestrial species such as the endangered Bengal tiger, the Leopard and Asiatic elephant are also encountered from forested areas within the coastal zone.

**Cetaceans** (Whales, Porpoises and Dolphins) - The SAS region is rich in Cetacean diversity with 31 species, accounting for one thirds of the recorded cetaceans worldwide. Of these, nine species are globally threatened (Refer Annex 4) and most are listed as Data while national species assessments have not been done for the majority of species. The Cetaceans vary in size from the largest blue whale to the very small finless porpoise.

### Box 3 - Irrawaddy Dolphin population in Bangladesh

As recently as in 2009, nearly 6,000 Irrawaddy Dolphins were found living in freshwater regions of Sundarbans mangrove forest and the adjacent waters of the Bay of Bengal. This discovery gives a great hope for the survival of this threatened species and conservation of this habitat needs to be prioritized, as previously, the largest known populations of the dolphin had numbered in the low hundreds. However, the newly discovered population is already threatened by climate change and fishing nets.

The Government of Bangladesh declared three new Wildlife Sanctuaries to help protect this species as well as the threatened Ganges River Dolphin. These Sanctuaries safeguard 19.4 miles of channels with a total area of 4.1 square miles.

Source: MOEFCC/GOB, 2010 and <http://www.wcs.org/news-and-features-main/helping-dolphins-stay-afloat.aspx>

The region is critical to the recovery of the endangered north Indian Ocean blue whales, as a migratory as well as resident population's occurs in Sri Lanka, India and Maldives. The Irrawaddy dolphin, which is endemic to the North-eastern Indian Ocean, has distinct estuarine and coastal populations in Bangladesh (See Box 3) and in the Chilka lake of India where 138 individuals were recorded recently. Additionally, two freshwater dolphin species, the Ganges and the Indus dolphins inhabits the largest river systems of South Asia including their estuarine zones (Anderson *et al*, 2012, Hyot, 2011; Mohanty and Otta, 2008; de Boer *et al*, 2003; Ballance, 2001).

**Sirenia (Dugongs)** - The dugong (*Dugong dugon*) is listed as vulnerable to extinction at a global scale. The species is listed in CITES Appendix I and CMS Appendix II. The dugong has a large range that spans some 48 countries and territories including India and Sri Lanka (Marsh, 2008). Most sightings of dugongs in Bangladesh were reported as accidental capture or anecdotes from fishermen (Shah-e-Alam, 2011). Dugongs are believed to be extinct in the Maldives, but are reportedly sighted in the Gulf of Mannar and Palk Bay, followed by the Andaman and Nicobar Islands (Sivakumar & Nair, 2013).

The main **threats** to cetaceans and dugongs include: Stranding due to shipping, naval exercises etc. (especially the larger species), water pollution (mainly affect estuarine and near shore species) and marine debris and discarded or lost and floating fishing gear, noise pollution from military and seismic sonar, damming of rivers, haphazardly developed tourism (especially in whale and dolphin watching) and global climate change. Small cetaceans are primarily threatened due to fisheries related mortality with large numbers being taken as accidental by-catch throughout the region.

**Tigers** - The Sundarbans mangrove forest is the home of some 100 endangered Bengal tiger (*Panthera tigris*), possibly one of the biggest remaining tiger populations on the globe (Neumann-Denzau and Denzau H, 2010).

### **Waders and Sea birds**

The coastal wetlands in South Asia form an important feeding, nesting and wintering grounds for large number of waders. Sandy beaches, intertidal mud flats, and rocky outcrops are important as foraging sites, while the mangroves serve as breeding ground for species such as egrets, herons, storks, warblers and raptors. South Asia belongs to the Central Asian-Indian flyway of the Asia Pacific region covering large

intra-continental territories of Eurasia between the Arctic and the Indian Ocean. This flyway is important for migratory waders, with arctic-breeding species travelling from northern and central Siberia to winter in South Asia, principally along the coast of Bangladesh, east coast of India (e.g. Great Knot- Refer Annex 4), Sri Lanka. A significant population for the Spoonbilled sandpiper, one of the, if not the most, threatened migratory waterbird in the world, winters in the huge inter-tidal areas of the coast of Bangladesh.

Annex 5 and 7 outlines important bird areas (IBAs) in the region, where high concentrations of species of global significance are encountered. According to the Bird life International Red Data Book, the following three coastal habitats occupy some of the largest wader concentrations in the region: Indus delta and Run of Kutch; South India and Sri Lanka (Pulicat and Chilika Lakes and Point Calimere of India; Bundala and Yala National Parks of Sri Lanka); and Bay of Bengal coast, mainly the Sundarbans). The intertidal mud and sand flats of the Ganges-Brahmaputra-Meghna delta IBA support the largest known concentrations of Spotted Greenshank, Spoon-billed Sandpiper and Indian Skimmer in the world.

The seabirds of the region are poorly known and do not appear to be abundant in the region, yet considerable populations are found in the following locations:

- The Sundarbans are an important staging and wintering area for gulls and terns,
- the islets of Adam's Bridge, off Sri Lanka have some seabird colonies .
- Pitti islands of Lakshadweep, three pelagic species are of significance; Sooty tern , Noddy Tern and Large crested Tern
- Haa Alifu Atoll of Maldives, supports a large seasonal concentration of Lesser Noddy

Most of the water birds inhabiting the coastal wetlands of South Asia are decking, although information on status and trends is generally poor. In most countries there has been little previous investment in conservation and low involvement of local stakeholders in the sustainable management of wetlands. For example, along India's east coast, many important wader habitats have been severely degraded by a range of threats including the depletion of groundwater, saltwater intrusion, intensive species, illegal hunting and the extension of salt-based industries. At the Point Calimere Wildlife Sanctuary, ringing and census data show that there has been a dramatic decline in many species of waders since the 1980s. Populations of the two most common sandpipers, the Little Stint and Curlew Sandpiper, have decreased by over 70%, and once numerous species such as Pied Avocets and Black-winged Stilts are now scarce. For Sea birds the main reason for mortality is due to long-line fisheries and gill-nets (BirdLife International, 2005 and Chan *et al*, 2004).

### **Reptiles**

The reptilian population that the coastal and marine habitat of South Asia harbours around 26 species of sea snakes (MoEFCC/GOI, 2014), five species of sea turtles and several globally threatened terrestrial turtles and terrapins (MoEFCC/GOB, 2010; CCD/GOP, 2014).

**Marine Turtles** - Out of the seven species of marine turtles recorded worldwide, five species are found from the coastal waters of South Asia and at least four of them have significant nesting grounds within

the regions beaches (Refer Annex 6). On a global scale these turtles are listed in the IUCN Red list of Threatened Species (*IUCN Red List, 2014*) as Critically Endangered (Hawksbill), Endangered (Loggerhead and Green turtle), and Vulnerable (Olive ridley and Leatherback). Green turtle nesting sites are the most widely distributed within the region, while the only reported recent loggerhead nesting sites are from Sri Lanka (*Shankar, 2004*). In the late 1970's and up to early 1980's, there were several reports of Loggerheads nesting on the Andaman and Nicobar islands. However there is absolutely no evidence of this species nesting in the Islands now (*Andrews, 2000*).

The single largest breeding ground of olive ridley is found in Orissa on the east coast of India, where mass breeding occurs in three nesting beaches; Gahirmatha, Deviriver mouth and Rushikulya. The nesting at Gahirmata at the mouth of the river Maipura near Dhamra, is the largest sea turtle rookery in the world with 100,000 to 500,000 turtles nesting there each year (MoEFCC/Gol, 2005).

According to a study conducted in 2011, almost half (45%) of the world's threatened sea turtle populations are found in the northern Indian Ocean. Threatened populations of Loggerheads and Olive Ridley Turtles are found in waters and on nesting beaches within EEZs of countries such as India, Sri Lanka and Bangladesh (*Wallace et al, 2011*). All sea turtles have declined in recent times, and until 1980s the major threats for turtle conservation were trade, and egg and meat consumption by humans. Presently, the threats to their survival are more indirect, such as development activities along the coast, pollution of coastal waters, and incidental capture in fishing nets (Table 2.4).

**Table 2.4: Major threats to the survival of marine turtles in South Asia**

Country	Major Threats
Bangladesh	Obstruction by fishing trawlers and fishing nets, poaching of eggs and loss of nesting beaches due to erosion and construction, man-made barriers
India	Heavy trawling related mortality, Incidental catching during fishing, Sand mining at Kerala and Andaman-Nicobar islands, Loss of habitat due to tourism development, Predation by tigers and dogs, Meet consumption and egg poaching by humans; natural disasters (Tsunami, cyclones)
Maldives	Trade of turtle shells and eggs, infrastructure development for tourism.
Pakistan	Oil spills, Shrimp trawling, predation by wild-animals
Sri Lanka	Improper hatchery practices, Coastal developments; Exploitation by humans for eggs and meat, and Incidental by-catch.

### **Fish species**

The fish population in the Indian Ocean is extremely diverse with 2,546 species of fish belonging to 969 genera, 254 families and 40 orders. Over 1,200 species of fish have been recorded from the reefs and surrounding ocean of the Maldives alone (*Wells et al, 1995*). Around 1,000 species of marine fish have been recorded in Pakistan's coastal waters; however, no analysis of their population status and distributional range is available (Climate Change Division/GoP, 2014). Around 475 fish species have been recorded from the marine waters of Bangladesh (MEF/GoB, 2010). 2,546 marine fish species have been recorded from India (MoFE/Gol, 2014).

As indicated in Annex 4, a considerable number of marine fish species recorded from the South Asian Seas are globally threatened. Given below are two examples, where the fish are threatened either as a by-catch in commercial tuna fishery (Sharks) or due to direct exploitation (Humphead Wrasse).

**Sharks** - Most sharks are long-living species that grow slowly, mature late, and have low reproduction rates. These biological factors make sharks particularly vulnerable to overfishing. Globally around 17% of sharks and their relatives are threatened, an additional 13% are considered Near Threatened, and a high proportion (47%) are Data Deficient. In the South Asian Seas region some of the globally threatened species encountered are Whale sharks, Great Oceanic white tip, Scalloped hammerhead and Great hammerhead shark. However, India, Pakistan and Sri Lanka are within the 15 top shark-fishing nations.

**Humphead Wrasse** is widely distributed in coral reefs and inshore habitats throughout the tropical Indo-Pacific. It is particularly heavily exploited at the centre of its range in South-eastern Asia, due to the live reef fish trade. Fishery-dependent and trade-related data suggests overall declines of at least 50% over the last 30 years, which has qualified this fish for an Endangered listing (Red list, 2014).

The impact of fishery on marine biodiversity will be further discussed in Section 4 (Sustainable Fisheries and Aquaculture for the SAS region).

### **Invertebrates**

**Reef Building Corals** - Over one-quarter (27%) of the world's 845 species of reef-building corals have been listed as threatened, an additional 20% are considered Near Threatened, and 17% are Data Deficient (IUCN Red List of Marine Species, 2008) (see Section 1.1. for more details).

### **Plant species**

**Mangroves** – As indicated by Polidoro et al, 2010, eleven of the 70 mangrove species (16%) are at elevated threat of extinction. Particular areas of geographical concern include the Atlantic and Pacific coasts of Central America, where as many as 40% of mangroves species are threatened with extinction. *Sonneratia griffithii*, which is critically endangered is found in India, Bangladesh and Southeast Asia, where 80 percent of all mangrove area has been lost over the past 60 years (see Section 1.1 for more details)

## **2.2. Opportunities and constraints in preventing species extinction**

At National levels, marine species have varying degree of legal protection in all five countries but enforcement of these legal provisions are not as effective as they should ideally be for various reasons. Listing Species in Appendices of fishery and wildlife legislation as well as declaration of protected areas are two main actions undertaken by national governments.

Yet a major drawback to national conservation efforts in all countries of the region is a lack of knowledge and scientific data upon which conservation strategies and measures can be designed effectively. Studies being conducted are either opportunistic or mostly small research initiatives lead by individual researchers, NGO's or Universities, under externally funded projects, which are sporadic and do not yield the kind of long-term data that can inform conservation or management. As a result of the lack of research

in the region there are large gaps in knowledge and for most species: population estimates or trends, distribution and movement patterns, and human-marine mammal interactions are not monitored.

At the regional and international levels there are several initiatives for the protection of the species as described below:

- The waters of all SASP countries are within the **Indian Ocean Whale Sanctuary**, declared by the International Whaling Commission in 1979. However the provisions of this Sanctuary only apply to large whale stocks that were once commercially exploited and small cetaceans are not taken into consideration.
- Under the auspicious of the **Convention on Migratory Species** there are 3 Memorandums of Understanding (MoUs) targeting marine species: Marine Turtles, Dugong, and Marine Sharks (Refer Annex 1).
- **CITES listing**– for example 18 shark and ray species have been listed in Appendix 11 and from September 2014 there will be trade regulations for importing and re-exporting the species – many of them are found in the SASP region (Refer Annex 4).
- **BirdLife International** initiatives such as Important Bird Areas (IBAs) programme
- Listing wetlands important for wader population under **Ramsar Convention**.
- Numerous resolutions adopted by **FAO, IOTC and BOB-IGO** with regard to safeguard the commercially important fish species

### 2.3. Conclusions and Recommendations

The most important cetaceans that need priority conservation measures within the region are: Blue whales, Pacific humpbacked dolphins, Irrawaddy dolphin, and the Dugong. Collaboration between countries in relation to conservation and research is important because:

- The habitat and range of many species is not confined to the waters of a single country.
- For certain shared populations standardization of conservation activities through co-operation and collaboration between countries is crucial if the population is to be viable in the long term (MoU Dugong).
- Collaboration can facilitate maximization of scarce resources for marine mammal research which is costly and difficult for individual developing countries to carry out on their own.

Policy statements of most countries in the region recognize cross-cutting issues between different uses of coastal and marine ecosystems, such as the fisheries sector, marine transport, coastal tourism, municipal development and offshore minerals exploitation. All South Asian nations have expressed their commitment to sustainable harvesting of marine and coastal resources and to conserving biodiversity. However, the implementation of these policies is varied and differ in effectiveness. The reasons include overlapping jurisdictions, conflicting mandates, inadequate coordination, socio-economic and poverty issues and capacity constraints.

The specific recommendations for the region include:

- Improve knowledge base through joint research, collaborative assessments and long-term monitoring
- Strengthen taxonomic capacity and formulate standard format for data collection and analysis;

- Identify migratory routes of species as well as resident and transboundary stocks
- Assess upwellings and salinity changes, and impact of climate change
- Coordinate research
- Harmonize legislation protecting marine species at national and regional level;
- Train enforcement staff of different agencies;
- Develop MPAs to cover Migratory routes
- Promote collaboration between different stakeholders
- Regularly update IUCN Red List assessments at national level, or develop a regional level Red list
- Introduce eco-labelling and certification systems for sustainable fishery
- Secure funding

### 3. Combating Marine and Coastal Invasive Alien Species

The Aichi Target 9 establishes that by 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated and measures are in place to manage pathways to prevent their introduction and establishment.

#### 3.1. Main Entry Pathways of Marine and Coastal Invasive Species (IAS) in SAS

**Invasive Alien Species (IAS)** are those introduced (accidentally or intentionally) species, which out-compete native species and cause economic and ecological damage by spreading in natural ecosystems (IUCN, 2009). Main transmission pathways for IAS in coastal and marine ecosystems are due to ship ballast water, aquaculture, aquarium and ornamental trade, and other land based IAS that reach the coast and marine environments.

**Ship ballast water** is the largest vector of transfer of IAS. It is estimated that at any given moment worldwide, between 7 000 and 10 000 different species are being transported between bio-geographic regions in ballast tanks alone (*Bax et al, 2003, IUCN, 2009*). The increase in transoceanic trade through SAS region's ports is an area of concern. For example, in India, nearly five thousand ships call annually at Mumbai Port, collectively discharging approximately two million tons of ballast water (Puthucherril, 2008). Ballast water is capable for transporting viral and bacterial pathogens (e.g. cholera), as well as resistant cysts of toxic dinoflagellates that could lead to harmful algal blooms and shellfish poisoning (*Bax et al, 2003*). Another important transfer of IAS in ships is through hull fouling, which is the attachment to the hull of ship certain organisms, such as mussels, sponges, algae, etc., and there is a risk that these alien organisms will spread and establishing themselves in new ports and bioregions. The recent use of metal hulls and anti-fouling paints and faster ship speeds have contributed to less hull fouling, although shipping has increased and therefore the problem of hull fouling remains relevant.

**Aquaculture is a main economic activity in the region and the introduction of** alien species through this industry is also an area of concern. In the Asian context, around 50 species of finfish that are alien to one nation or the other are being cultured (de Silva et al. 2006), including species that are farmed in accordance with national laws and regulations as well as those that are illegally introduced. India, the second largest aquaculture producer in the world (FAO, 2012), has a thriving industry focusing on various cyprinids, freshwater prawn and marine shrimp. 40% of the national production it is achieved through the culture of alien cyprinids, notably the common carp and different species of Chinese carps (de Silva et al. 2006). Unregulated introduction and illegal farming of several new exotic species also occurs in the region,

with several of these species being listed as potential pests, and capable of negatively impacting the native aquatic biodiversity (see Box 4).

A related sector, the **aquarium and ornamental industry**, is another area of concern, as IAS traded are usually healthy adults, which make them a bigger threat of invasion if released to the wild (Padilla & Williams, 2004).

#### **Box 4 - Introduction of American White Shrimp – Lessons Learned**

The white leg shrimp (*Litopenaeus vannamei*), formerly known as *Penaeus vannamei* has spread from Taiwan in 1995 to almost all Asian shrimp farming countries. In India, it was introduced clandestinely during 2001 in the states of Tamil Nadu and Andhra Pradesh under the belief that it out performs *P. monodon* on all aspects of aquaculture. The rapid growth in the farms of this species has had its set-back. Despite the rapid expansion of farming of *L. vannamei*, farmers have suffered significant economic losses due to various viral diseases. It is suspected that the Taura Syndrome virus and infectious Hypodermal and Hepatopoeitic Necrosis virus, exotic viral pathogens invaded the Indian shrimp farms through *L. vannamei*. Various possible problems include its impact on the wild and indigenous stocks, potential to act as carriers of diseases, biodiversity issues, etc., remains to be studied. The consequences of introduction of *L. vannamei* point to the importance of precautionary approach that should be taken before introductions are allowed.

Source: Ministry of Environment and Forest /Government of India (2010): Achieving 2010 Biodiversity Target: India's Contributions.

Further numerous **land invasive** are affecting the coastal and nearshore ecosystems of the region. Species such as Prickly Pear (*Opuntia dillenii*) and Mesquite (*Prosopis juliflora*) are spreading in sand dunes and beaches and destroying natural vegetation. In southern Sri Lanka, *O. dillenii* has spread in sand dunes and beaches after the tsunami preventing the regeneration of natural vegetation such as Spinifex (Bambaradeniya *et al.*, 2006).

The Bangladesh portion of the Sundarban mangrove is also threaded by spread of invasive plant species such as *Derris trifoliata*, *Eichhornia crassipes* and *Eupetorium odoratum*. *D. trifoliata*, a climber, poses a threat to many regenerating tree seedlings owing to its aggressive twining and strangulating habit. This species is widely distributed throughout the mangrove forest irrespective of local ecological and environmental conditions. The dense populations of *Derris trifoliata* form a cover over the seedlings and saplings of *Heritiera fomes*, *Excoecaria agallocha*, *Sonneratia apetala*, among others (Biswas, 2007).

IAS can lead to the loss of native biodiversity due to: preying upon native species, competition for habitat, transmission of parasites and diseases, genetic dilution due to hybridization, changes to ecosystem function and nutrient cycles and decreased water quality. Many of these impacts would have economic impacts, by interfering with biological resources that support fishing and mariculture, disrupt tourism; damage infrastructure, and other costs related to clean up, control, treatment and quarantine measures.

### **3.2. Current Status and Recommended Actions for Mitigate the Threats of IAS**

The present IAS status and recommendations to mitigate the threats posed by them are provided in the Annex 8. In general, countries have inadequate legislations or policies to deal with IAS, quarantine

measures are also weak, and there are insufficient scientific information to address prevention and control of IAS.

### Regional actions

The Regional South Asian Seas Programme, through SACEP coordination, is currently working for the creation of a Ballast Water task force and a Regional Strategy for Ballast Water Management Strategy.

Other relevant international instruments that support the management of IAS in coastal and marine environments include:

- For **Aquaculture**, the Convention on Biological Diversity and the Food and Agriculture Organisation (FAO) Code of Conduct for Responsible Fisheries (CCRF), discourages the use of invasive alien species in aquaculture (including mariculture) and calls for accurate assessments of the risks of using alien species. The International Council for the Exploration of the Sea's Code of Practice on the Introduction and Transfer of Marine Organisms is one of the most comprehensive instruments to help in the responsible use of introduced species but is only voluntary (IUCN, 2009).
- For **Ballast water**, the International Convention for the Control and Management of Ships Ballast Water and Sediments (BWC) was adopted by the International Maritime Organization (IMO) in 2004, but has only been ratified by Maldives from the SAS countries. The Convention will enter into force 12 months after it has been ratified by 30 states representing 35 percent of the world's merchant shipping tonnage. In addition, the IMO has also developed several Ballast Water management guidelines<sup>2</sup> to support the implementation of the IMO Convention. Additionally, hull fouling is often treated with harmful substances, such as anti-fouling paints to prevent marine life to attach itself to the hull of ships. In order to reduce these impacts, the IMO adopted the International Convention on the Control of Harmful Anti-fouling Systems on Ships in 2001, which entered into force in 2008, and which sets the standard of what type of substances are banned for use for hull anti-fouling.
- The Global Ballast Water Management Program is an effort of the IMO, the United Nations Development Program (UNDP), and the shipping industry to assist less industrialized countries to tackle the ballast water problem.

While ballast water and aquaculture are encouragingly starting to being addressed, it is necessary to understand what are the other vectors and transmission pathways responsible for distributing invasive alien marine species in the South Asia region, and more needs to be done at national, regional and global levels to understand and address these issues.

### 3.3. Conclusions and Recommendations

While prevention is cheaper and safer option, it requires full commitment of countries. The management of threats is only possible if taken care at the global and regional levels, not only because of the global nature of the IAS problem, but because the development of national initiatives without international consensus will also complicate international trade (Bax *et al*, 2003).

Measures to address control and eradication needs on Invasive Species include:

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<sup>2</sup> <http://globallast.imo.org/index.asp?page=resolution.htm&menu=true>

- Create an Early Warning of International Outbreak of Marine Invasive Species, with a regional framework to manage the risks and the responses (Bax et al, 2003).
- Develop an IAS Expert Working Group to address the scope of the IAS problem on marine and coastal biodiversity in SAS, identifying the specific pathways and risks in the region.
- Carry out a capacity building assessment needs in SAS countries, and develop a capacity building plan for the SAS region.
- Urge all SAS countries to ratify the IMO - Convention for the Control and Management of Ships Ballast Water and Sediments.
- Support countries to establish national and regional standards and procedures for the management and control of ships' ballast water and sediments
- Promote a shift in from developing organizations to direct their investment in the use of native species for aquaculture purposes, either as primary species for human consumption, or as food products for aquaculture species growth (Hewitt, Campbell, & Gollasch, 2006)
- Evaluate the short-term benefits to society against the consequences of short and long-term impacts, through a clear, transparent and participatory decision-making process, based on scientific evidence and a precautionary approach.
- Conduct risk assessments previous to the introduction of new aquaculture species and aquarium species
- Collaborate with the aquarium trade industry, for the certification of stocks, and preventing species being released.

#### **4. Sustainable Fisheries and Aquaculture for the SAS region**

The Aichi Target 6 aims for fisheries to be managed sustainably, legally and applying ecosystem based approaches, avoiding overfishing and ensuring that recovery plans are in place by 2020. Additionally, the Aichi Target 7 aims for aquaculture to be managed sustainably and ensuring the conservation of Biodiversity by 2020.

##### **4.1. Main fisheries and aquaculture impacts on marine and coastal biodiversity**

###### ***Fisheries***

The SAS region is rich in both marine and inland fishery, and for Bangladesh and India inland fishery production is higher than marine fishery production (FAO, 2008). Marine fisheries make a modest contribution to the GDP of the bordering countries, with the exception of the Maldives, where this sector contributes 11% to GDP and 74% of the country's export commodities. Primary export commodities are shrimp and tuna, which make a significant contribution to national foreign exchange earnings. For example, in Bangladesh, fisheries account for more than 11% of annual export earnings. Rapid development of aquaculture, mainly of shrimp, in the extensive coastal and brackish-water areas has made a significant contribution to the growth of national export earnings (FAO 2005). However, as fisheries production increases, the sector represents one of the biggest threats to marine biodiversity, and to its own existence, as fisheries require of healthy ecosystems to thrive. The growing demand of fish in local markets, due largely to the growing awareness on the nutritive value of fish, has been coupled with improvements in fisheries technology, bigger and better vessels, better fish finding and geo-position equipment, communication systems and storage facilities, aspects that are having an important impact in marine fisheries production (Aswathy, 2011; Dineshababu, 2013).

Marine fishery catch trends have been oscillating within SAS countries, with increases in production in some countries, such as Bangladesh, India, and Sri Lanka (due to the end of fishing restrictions imposed during the civil war from the north and east of the country) and decreases in others, such as Pakistan and the tuna fisheries in Maldives. According to FAO analysis, the Southern Bluefin Tuna stocks are depleted, while species such as Croakers and drums Ponyfish and Giant Prawn are being over-exploited in the region. The below table (Table 2.5) provides an overview of the trends in catch assessment<sup>3</sup> by countries.

Country/ area	Time period	Large demersal	Small demersal	Large pelagic	Small pelagic	Anchovy/sardine	Trash fish/ Low-value fish	Surimi species	Shark/ rays	Squids/ cuttlefish	Crustaceans
Bangladesh	1999 to 2009	+	+	o	+	nd	-	o	-	+	+
India	1995 to 2009	+	o	+	o	+	+	+	+	-	-
Maldives	2004 to 2010	+	+	-	+	nd	nd	nd	-	nd	nd
Sri Lanka	2000 to 2009	+		+		o		nd	-	nd	+

**Table 1.5 - Trends in catch composition in the SAS countries (based on APFIC, 2012, excludes Pakistan). Notes:** different groupings were assessed in terms of their relative occurrence in the catch (percent): increased (+); decrease (-) or were stable (o) over a specific time period, nd denotes no data available

The Trans-boundary Diagnostic Analysis carried out by the Bay of Bengal Large Marine Ecosystem (BOBLME) project during 2012, identified the main trans-boundary issues relevant to the overexploitation of marine living resource in the Bay of Bengal to be<sup>4</sup>:

- Decline in overall availability of fish resources
- Changes in species composition of catches.
- High proportion of juvenile fish in the catch
- Changes in marine biodiversity, especially through loss of vulnerable and endangered species.

<sup>3</sup> Adapted from APFIC 2012. No information available for Pakistan (Arabian Sea).

<sup>4</sup> The analysis includes Bay of Bengal area, which are SACEP maritime countries (except Pakistan)

These issues are mainly due to **overfishing** (including by-catch and discards), **unsustainable and destructive fishing practices** that modify or destruct habitats, and **illegal, unreported and unregulated (IUU) fishing** that seriously undermines the sustainability of fisheries management efforts (FAO & UNEP, 2010).

The impacts of **overfishing** on marine biodiversity include: the modification of community structure (e.g. trophic structure), the reduction in species richness or other taxonomic diversity indices, and risk of the impacted species populations becoming threatened, endangered, or even locally extinct. The impact of overfishing on the ecosystem may be direct or indirect, but it becomes more acute with the increase of fishing pressure, unreported by-catch and discards and IUU fishing.

Other issues and processes occurring in the region that are (or will in the near future) promoting unsustainable practices include:

- **Trawl fishing** remains a cause of great concern for the conservation of marine biodiversity, due to the lack of selectivity and elevated by-catch (incidental capture of non-target species that is retained), the destruction of vulnerable ecosystems such as coral reefs and other disturbances of the seafloor and benthic communities (Hiddink et al, 2006, Biju Kumar & Deepthi, 2006). The trawl fishery is multispecies, although their main target is shrimp and other high-value species. Large portion of the by-catch is brought back to landing centers to be later used for fishmeal and animal feed. The percentage of discards may be around 3 % Up to 800 species are taken by the trawls, indicating an urgent need to regulate trawl fisheries (Vivekenandan, 2013).
- **Dynamite/blast fishing** is an example of “destructive fishing”. Explosives are used to kill fish for easy collection, with tremendous negative effects on marine ecosystems such as coral reefs, as well as other vulnerable species linked to that ecosystem. Although not reported in South Asia, there is evidence that it exists (Arjan Rajasuriya, personal observation,). Another very harmful practice is the use of cyanide fishing, which is used to stun the fish and capture it alive, but with very negative impacts to the habitat and other marine vulnerable species in the surrounding area.
- **Unaccounted Mortality** is one of the main issues that undermine fisheries management due to: misreporting, discarding (if the related deaths are not accounted for), escaping (e.g. encountering the gear but not being retained by it), dropping out during hauling, and ghost fishing.
- **IUU Fishing** compromises existing efforts to improve fisheries management, adding to the uncertainty in decision making regarding the sustainable level of exploitation of fish stocks. IUU

#### Box 5 – Increase in Fleet Size

India, which contributes to 63,7 % to the fisheries production in SAS countries, has seen an increase in fleet size, with the consequent increases in yield, employment and exports, but also leading to excessive fishing pressure. The target of juvenile species is seen as a clear indication of overfishing in the region (Dineshbabu, 2013).



Figure 2 – Impact of blast fishing

fishing is likely to ignore any specific regulations implemented to protect vulnerable species or habitats, or any type of measures to protect biodiversity, it may also be focused on high value species that are also highly vulnerable to fishing, and where risk of extinction may be of greatest concern, and could compromise measures for biodiversity conservation in legal, reported and regulated fisheries (FAO & UNEP, 2010).

- **Fisheries subsidies** role maintaining or promoting the over-exploitation of fisheries resources needs to be better understood, specifically by looking at how they shape unsustainable practices in the marine capture fisheries sector.
- **Increased market demand for low value/trash-fish**, specially directed for fishmeal, particularly for those countries where the demand of fishmeal for aquaculture is increasing.
- **Increased production of surimi in the region**, which requires high amounts of raw material that comes from demersal species.

The negative impacts of these issues are expected to worsen due to climate change. Further the loss of spawning and nursery areas of some commercial species due to the degradation of coastal habitats such as mangroves, or the loss or destruction of migratory paths are also affecting the fishery resources of SAS. For example, anadromous species such as Hilsa shad, which lives in the sea most of its life but migrates inland through rivers for spawning, are vulnerable to river basin changes, such as barrage development. The closure of the Kumar River under the Ganges-Kobadak Project, cut off the Hilsa migration route and, as a consequence, the Hilsa fishery in Bangladesh and India was severely affected (Ara-Mome, 2007).

### **Aquaculture**

South Asia's total aquaculture production amounted to 6,138,043 tonnes, equating to just under 8 percent of the total world aquaculture production. The growth rate was 9 percent/year in terms of volume and 13 percent/year in terms of value between 2000 and 2010 (APFIC, 2012). The sector contributes to food security for millions of people, ensuring fish provision against a backdrop of declining wild fish stocks. In Bangladesh alone, more than 0.70 million people are employed in the farmed shrimp sector.

The mainstay of the South Asia subregion has been production of freshwater fish, especially the omnivorous and herbivorous Indian carps. This increase is probably not heavily dependent on marine sources of feed, which may represent a real contribution in terms of food security (APFIC, 2012). Other relevant species produced include lower value species, such as aquatic plants and mollusks, and other high value species such as marine finfish, and crustaceans. Aquatic plants had the strongest increase, of 43 percent/year between 2001 and 2010 although the production remained low at just 18 018 tonnes (FAO, 2010). The culture of mollusks also increased rapidly by 28 percent/year between 2000 and 2010 with a production of 4 242 tonnes. Most mollusk production in the region is of green mussel (*Perna viridis*) and Indian backwater oyster (*Crassostrea madrasensis*), and are both mainly produced in India. Marine finfish increased at a 14 percent/year between 2000 and 2010, however, production again remained small, at just 102 245 tonnes in 2010. The main group cultured in the region is crustaceans, with a slower growth rate of just 2 percent/year between 2000 and 2010, and a production of 226 727 tonnes in 2010. Main crustacean species produced are the giant tiger prawn (*Penaeus monodon*), mostly from India and Bangladesh.

Some of the negative impacts of the aquaculture sector include:

- the loss of large amounts of wild larvae
- physical degradation of coastal habitats, such as the conversion of mangrove forest and the destruction of wetlands, land subsidence and the salinization of ground and surface water
- discharge of suspended solids and enrichment of nutrients accompanying the aquaculture operations
- changes in benthic communities and the eutrophication of coastal wetlands
- risk of transmission of diseases from aquaculture species to wild stocks
- introduction of non-native species into the natural ecosystem that can lead to displacement or competition with indigenous species (see section on Alien Invasive Species)

These negative impacts could be minimized by applying sustainable practices that do not add pressure over wild stocks or over coastal and marine biodiversity.

#### **4.2. Existing Strategic Actions - Policy, Legislative and Institutional Responses to Issues in the Fisheries and Aquaculture Sector in the South Asian Seas (SAS)**

##### ***Fisheries***

There is a considerable verbal and written support by countries towards sustainable fisheries management, with increased reference to “good” fisheries management initiatives, such as the Declaration of Fisheries Management Areas (Sri Lanka), Fleet Reduction targets in line with capacity limits (India), Marine and freshwater protected areas/no take-zones (Bangladesh), and Gear Restrictions (India). Additionally, National Action Plans on Sharks are being developed, with ongoing discussions of developing a regional plan for Bay of Bengal region. Despite the good intentions, however, many of the plans are not fully adopted by national authorities, and implementation is still weak in the SAS countries. Annex 1 outlines existing policy and management measures for the SAS region.

A policy analysis carried out by BOBLME (2012), which looked into capture fisheries, the marine environment and integrated coastal management, concluded that the majority of countries are determined to increase marine capture fisheries despite doubts over the availability of fish. All countries emphasized the need to expand their national fleets offshore, mainly due to fully exploited inshore fisheries (as a way to reducing conflict), but also towards supporting the national fishery industry to generate employment, ancillary industries and providing food security (Huntington, Tim & Graeme Macfadyeb, 2012).

The analysis also identified:

- the need for greater emphasis of catch certification and traceability for capture fisheries as well as aquaculture, both for domestic as well as regional and international markets
- reduction of tariff barriers requires much greater policy attention
- the need for balancing increase in exports with food security and environmental needs
- capacity development needs
- insufficient budget for MCS as major issues for successful policy implementation
- challenges to incorporate elements of the FAO Code of Conduct for Responsible Fishing (CCRF)
- increasing mention of EAF, but little implementation
- a need for greater regional cooperation in adopting EAF and updating policies.

### **International Agreements to promote Sustainable Fisheries and Regional Responses**

A number of international instruments have been formulated to address the issues of responsible fishing and sustainable management of fish stocks (see Annex 1 for more details).

At the global level, two important instruments are the **Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels** (the 1993 FAO Compliance Agreement) which none of the SAS countries are party to, and the **Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 1982** (UNCLOS), which has been ratified by all five SAS members.

Relating to the **Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks** (the 1995 UN Fish Stocks Agreement), which have been ratified by Maldives and Sri Lanka. India has acceded this international agreement while Bangladesh and Pakistan are signatory (Refer Annex 1).

The **Convention on Biological Diversity (CBD)** entered into force on 29 December 1993, and is a strong commitment of the international community to sustainable development and the conservation of biodiversity, which has been ratified by all five SAS members.

The **UN Food and Agriculture Organization Code of Conduct for Responsible Fisheries (CCRF)** came to force in 1995, to ensure the benefits of fisheries for future generations by encouraging responsible fishing practices.

The **FAO 2009 Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated (IUU)** fishing, which lays out in detail the commitments and obligations that port states have relating to the use of their ports by fishing vessels and the vessels which service the fishery, has not yet entered into force but has been open for signing since 2009 and five countries in the region have already signed or acceded to the agreement (only Sri Lanka from South Asian Seas countries, APFIC 2012).

With the exception of Pakistan, which is located in the Arabian seas, the other four SAS countries were also Party to the agreement making the **Bay of Bengal Programme Intergovernmental Organization (BOBPIGO, 2010)**.

India, Maldives, Pakistan and Sri Lanka are also members to the **Indian Ocean Tuna Commission (IOTC)**, which aim is to promote the conservation and optimum utilization of tuna stocks in the Indian Ocean. In 1979, the International Whaling Commission declared the **Indian Ocean a Whale Sanctuary**, prohibiting commercial whaling in the whole of the Indian Ocean.

All South Asian Seas countries are also signatories to the **Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)**, with the recent inclusion of Maldives. The Convention has included 18 species of sharks and Mantra rays in Appendix II to ensure sustainability in their stocks.

## Improving Fisheries Management through an Ecosystem Approach

The Ecosystem Approach to Fisheries (EAF) strives to balance diverse societal objectives, by taking into account the knowledge and uncertainties about biotic, abiotic and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries (FAO 2003). EAF aims to implement sustainable development concepts into fisheries management by addressing human and ecological well-being. The Bay of Bengal Large Marine Ecosystem Project Regional Fisheries Management Advisory Committee has provided an excellent example of advice on the major issues facing the regional fisheries for hilsa shad and Indian mackerel using the EAF. In Annex 9 there is an overview of the findings of the working group that could be used as example for other stocks. The EAF explicitly encourages the participation of all the relevant stakeholders in order to translate high level policy goals into day-to-day management activities.

### Voluntary certification schemes for capture fisheries

Due to greater consumer awareness, voluntary certification schemes are on the rise. Despite their focus on sustainability, which has the potential to improve fishery management, the development and use of these types of schemes has certain challenges, such as UNEP has identified (UNEP, 2013):

- the need of reliable data availability
- risk of distortions to local markets and livelihoods due to an increase on exports
- high certification related costs, which may hinder the capacity of small enterprisers to achieve certification.

The only example of certification in the SAS countries is the Marine Stewardship Council (MSC) Certification to Maldives pole-and-line skipjack tuna, which obtained certification in 2012.

### By-catch management

Improving fisheries management would also require scientific studies of the ecosystem to which the by-catch species belongs, contributing to the knowledge of the state of non-target populations species linked to the fishery, whether they are increasing, decreasing, remaining stable or whether they are in danger of extinction. It is recommended that by-catch management plans should be developed for each fishery, with the use of more selective fishing gear, and changes in fishing areas and seasons, including conservation management measures to protect most vulnerable and threatened species.

### Aquaculture

Some SAS countries have specific regulations to manage aquaculture specifically in coastal areas, promoting sustainable aquaculture without causing damage to coastal ecosystems (e.g. Coastal Aquaculture Authority Act, 2005, Government of India). Due to greater consumer awareness on the impacts of aquaculture, there has been a rise of voluntary schemes for sustainable aquaculture development. The 2011 FAO Technical Guidelines on Aquaculture Certification set the minimum criteria for developing aquaculture certification standards, and should be followed by SAS countries to improve the sustainability of their aquaculture operations.

### 4.3. Conclusions and Recommendations

Interventions should be designed and implemented with a holistic approach, taking into consideration not only fisheries concerns but also habitat and biodiversity concerns, as well as socioeconomic impacts. Some of the areas that require attention in the South Asian Seas region include:

- Improving cooperation in areas of fisheries and aquaculture, particularly in the management of trans-boundary stocks,
- Support South Asian countries in the implementation of the Code of Conduct for Responsible Fisheries (CCRF),
- Improve fisheries and aquaculture management, incorporating EAF and EAA principles and guidelines,
- Combat IUU fishing, with clear measures on how to address the issue at the regional and national levels, and an effective Monitoring, Surveillance and Control (MSC) system
- Identify and protect vulnerable habitats and species, including spawning and nursery grounds,
- Prevent habitat degradation, by prohibiting destructive fishing methods in ecologically sensitive habitats, etc.,
- Ensure the maintenance of genetic diversity and the integrity of aquatic communities, through responsible and sustainable aquaculture,
- Improve stakeholder involvement, through co-management mechanisms,
- Implement measures that minimize by-catch, waste and discard,
- Control the impact from fishing gear on habitats.
- Improve aquaculture systems, increasing the sustainable use of natural resources (land, water, wild fry, etc.) and reducing unsustainable fishmeal production,
- Introduce risk analysis and risk management measures when introducing species for aquaculture, to reduce environmental impacts, and the spread of diseases and pathogens.

## 5. Clean and productive waters: Prevention of Marine Pollution, especially through Excessive Nutrients

Rapid economic development and population growth, much of it along the world's coasts, plus increasing agriculture and livestock production and processing, have placed huge environmental pressures on coastal ecosystems from direct resource use and the rising influx of nutrients and other pollutants from the land and atmosphere. Nutrients, such as Nitrogen (N), are a key part of delivering food security and sustainable development. But excess use and inefficient practices lead to nutrient over-enrichment of water, sediment and soil causing eutrophication, algal blooms, species composition changes and ultimate habitat change in coastal areas. In addition changes in chemical properties like PH, and ion exchange in soil contribute to soil acidification, groundwater pollution in affected areas. These directly impact the marine and coastal ecosystem services and livelihoods they support. To mitigate these above issues, the Aichi Target 8 recommends that "by 2020, pollution, including from excess nutrients, should be brought to levels that are not detrimental to ecosystem function and biodiversity". Presently this chapter only discusses pollution due to excess nutrient loading, yet the possibility of adding oil spills and marine debris to this section is under consideration.

## 5.1. Main Sources of Nutrient loading and their negative effects

### Box 6 – Main Facts on Marine Pollution in SAS

- The world's largest natural hypoxic zone develops seasonally over the Western Indian continental shelf which appears to have intensified in recent years most likely because of enhanced nitrogen loading
- South Asia is the second largest fertilizer consuming region in the world with consequent pollution especially related to fertilizer overuse.
- Large urban centers within the coast line are without adequate sewage treatment facilities, and in many instances raw sewage are directly disposed to the marine environment

The majority of the anthropogenic activities are conducted in the coastal zones or within the river catchments that releases to coastal zones. The consequence of these activities (agriculture or industrial activity, transport and commerce, power generation or urban developments) results in an inevitable release of pollutants (Fig. 5.1). Over the last 20 years, considerable data and expertise in understanding and addressing the various sectoral drivers, pressures, sources, impacts and response to nutrient enrichment and consequential eutrophication have been gathered. Model studies indicate that globally, roughly equal amounts of reactive Nitrogen reaches the oceans from fertilizer, manure and atmospheric deposition with smaller fractions from sewage (Setzinger *et al.*, 2010). For the countries of the south Asian Seas region, fertilizer input is the most important contributor to nutrient pollution, although marginal differences may be observed in the context of a specific country. For example, in the case of Maldives, where agriculture plays a minor role in the economy, sewage is the major contributor (SACEP, 2014).

Signs of degradation of aquatic, estuarine, coastal and marine ecosystems due to nutrient loading are evident at various locations in South Asia, with several reports on eutrophic zones due to excessive growth of algae and fish kills due to hypoxia. Estuarine and coastal systems in South Asia are N-limited and N loading through upwelling, sediment transport and sediment release can trigger algal blooms and eutrophication (SACEP, 2014). For example, Nitrogen limitation has been reported from Mandovi-Zuari and Cochin estuaries on the west coast and Godavari and Hoogly estuaries on the east coast of India. Martin *et al.*, (2011) report that anthropogenic nutrient loading (a six-fold increase in nutrient and chlorophyll levels during the last few decades) have caused a change in the benthic diversity of the Cochin estuary followed by an invasion of opportunistic polychaetes. In the Kodungallur-Azhikode estuary (Kerala, west coast), the major source of nutrients was associated with river discharge during the south-west monsoon (Jayachandran *et al.*, 2012).

A few of these issues are also trans-boundary issues, like discharge of untreated/partially treated sewage, and sewage and organic discharges from the Ganges-Brahmaputra-Meghna River (BOBLME-TDA, 2012). Moreover, high nutrient discharges from rivers could intensify large-scale hypoxia, and a few hypoxic zones are already identified in the South Asian Seas. The world's largest natural hypoxic zone develops seasonally over the Western Indian continental shelf which appears to have intensified in recent years most likely because of enhanced nitrogen loading through runoff and atmospheric deposition (Naqvi *et al.*, 2000, 2009). Increasing reports on the number and frequency of algal blooms along the coast and

concerns of development of hypoxic zones makes it imperative for efficient nutrient management in South Asian Seas countries, especially because more than 90 per cent of fisheries depend in one way or another on estuarine and near-shore habitats which are increasingly being impacted by nutrient over-enrichment of coastal waters.

While nutrients are chemicals essential for the growth of organisms, nutrient pollution refers to the contamination by excess inputs of nitrogen and phosphorus into aquatic systems. This nutrient enrichment, eutrophication, initially stimulate growth of phytoplankton, microalgae and macroalgae, which in turn can lead to other impacts such as:

- Loss of subaquatic vegetation as excessive phytoplankton, microalgae, and macroalgae growth reduce light penetration.
- Change in species composition and biomass of the benthic (bottom-dwelling) aquatic community, eventually leading to reduced species diversity and the dominance of gelatinous organisms such as jellyfish.
- Coral reef damage as increased nutrient levels favor algae growth over coral larvae. Coral growth is inhibited because the algae outcompetes coral larvae for available surfaces to grow.
- A shift in phytoplankton species composition, creating favorable conditions for the development of nuisance, toxic, or otherwise harmful algal blooms.
- Low dissolved oxygen and formation of hypoxic or “dead” zones (oxygen-depleted waters), which in turn can lead to ecosystem collapse due to mass fish kills.

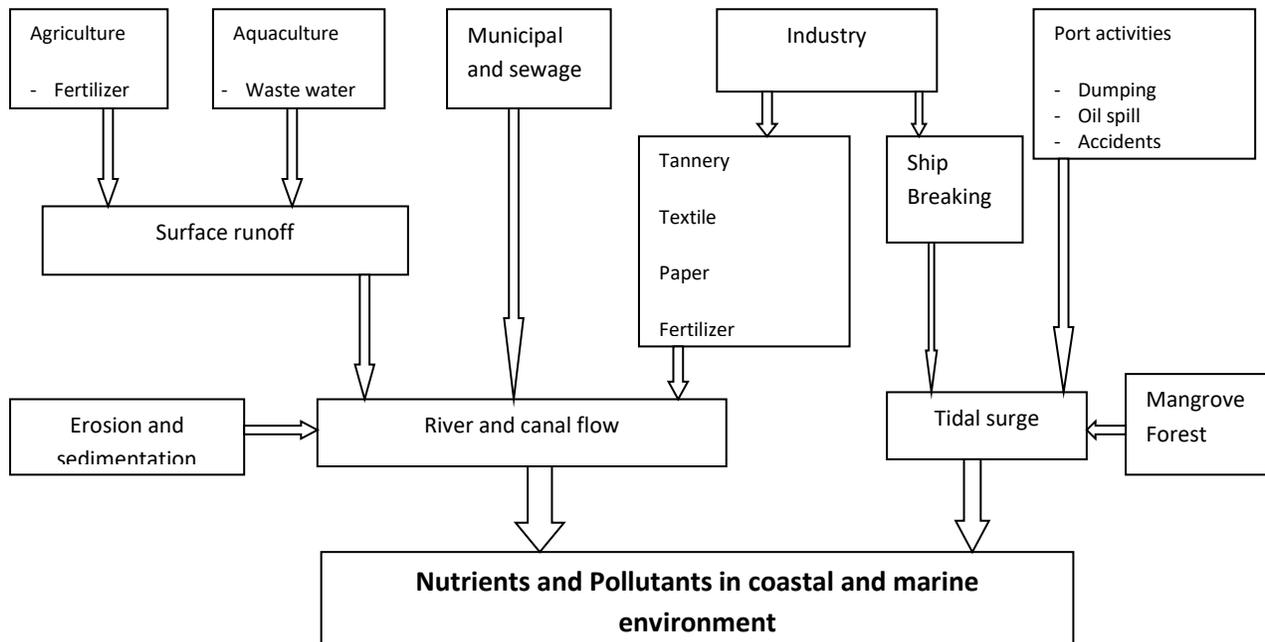


Figure 3 - Pathways of entering nutrients and pollutants in coastal and marine environment

The following section provides a summary of the main pollution pathways to coastal and marine ecosystems.

### *Agriculture*

Agriculture remains the major livelihood in SAS nations. However, fertilizer input continues to be the most important contributor to nutrient pollution, although marginal differences may be observed in the specific context of each country. While the world demand for total fertilizer nutrients is estimated to grow at 2.0 per cent per annum from 2011 to 2015, Asia is the largest consumer of fertilizer in the world. Total fertilizer nutrient consumption in Asia is 60 per cent of the world total, and South Asia is the second largest fertilizer consuming region in the world (FAO, 2011) with consequent pollution especially related to fertilizer overuse.

### *Aquaculture*

Fisheries and aquaculture are practiced to a great extent in south Asian countries and the produce serves as one of the major source of protein to ensure food security as well as income through export, and a source of livelihoods. However, it also comes at a cost. For example, shrimp aquaculture demands the use of a variety of chemicals apart from artificial feed to achieve higher production. Chemicals used in shrimp culture include disinfectants, water and soil treatment compounds, algaecides and pesticides, plankton growth inducers (fertilizers and minerals) and feed additives. Highly polluted effluents from shrimp farms that are discharged into the coastal waters leads to eutrophication of the receiving waters. BOBLME (2013) revealed that much of the coastal pollution in the Northwestern Province of Sri Lanka has been attributed to ad hoc development of aquaculture leading to the discharge of high amounts of effluents from shrimp ponds. This has already caused considerable pollution in the Dutch Canal (in the west) and the surrounding coastal areas.

### *Domestic sewage*

Domestic sewage includes household waste liquid from kitchen, washing, bathing and toilets. Untreated sewage contains water, nutrients (nitrogen and phosphorus), solids, pathogens, chemicals including detergents, oils and greases and heavy metals, among other constituents. In most countries, except for the large cities and towns, wastewater generated from homes is usually let untreated into the nearest water body. In Bangladesh, only a third of Dhaka city has wastewater collection and treatment facility while another third uses septic tanks. Most of the untreated or inadequately treated wastewater directly or indirectly reaches the river systems and finally reaches the bay through different canals, drains and estuaries (DFID, 2005). Similarly the mega coastal cities in India such as Chennai and Mumabai generate large amounts of wastewater, of which about half is not treated before discharge. The wastewater from metros cities located on the coast is mostly disposed into creeks, canals or backwaters. It is estimated that 0.6 million tonnes of nitrogen and 0.1 million tonnes of phosphorus reach the coastal waters annually (CPCB, 2009).

Disposal of untreated sewage and food waste are believed to be major contributors to the nutrient influx to the marine environment in Maldives. This is evident from the growth of seagrass beds in the vicinity of islands following inhabitation or increased population in the islands. There are neither existing guidelines nor a framework for monitoring and assessment of nutrient levels in the marine environment (BOBLME, 2010). In Pakistan, it is estimated that approximately 362 million gallons per day (MGD) of sewage is generated in Karachi and adjacent areas from domestic and industrial sources. Approximately, 60 % are industrial effluents and 40% domestic discharges. The industrial waste-water and sewage are discharged

into the two seasonal rivers: the Lyari River and the Malir River of Karachi. These rivers act as main open sewers for liquid waste disposal from the city. The Lyari and Malir Rivers are thus contributing about 59% and 25% of the total pollution load of Karachi City respectively, while 15% of the pollution load is directly discharged into the adjacent open seacoast or discharged via Gizri, Korangi and Gharo Creek (Amjad and Rizvi, 2000).

Colombo is one of the few cities in Sri Lanka with an installed sewerage system, yet its capacity is inadequate to cater for the entire Colombo city as it is about 100 years old, and needs frequent repair. Another problem is the illegal sewage connections to sewerage lines and unauthorized connections to storm water drainage systems and combined sewers, leading to pollution of coastal water bodies such as the Beira Lake. Tourism expansion in southwest and southern areas of Sri Lanka has led to water quality degradation as well as visual pollution on beaches and near shore waters. The development of squatter settlements connected with tourism development is another cause for concern as it contributes to fecal pollution, being not only a health issue, but also poses a severe threat to recreational activities such as contact sports in coastal waters (CZMP, 2006). The high BOD and COD levels found during the one-year study conducted by the University of Moratuwa in the coastal waters coincided with areas where tourism is predominant – Marawila, Mount Lavinia, Wadduwa and Beruwala showed high levels during the northeast monsoon as tourist season falls in the months of December and January (Jayaweera, 2003).

#### *Industrial actions*

Several industrial operations release effluents into the coastal areas. There are more than 8,542 industrial establishments along the coastal zone of Bangladesh that deals with jute, paper and pulp, textiles, fertilizers, rubber and plastic, tannery, food and beverages, sugar, pharmaceuticals, tobacco, distilleries, cement clinker, ship breaking etc. The textile industries discharge waste water of 40,000 m<sup>3</sup>/day and pollution load of these industries is 26,000 kg/day. A rough estimation of Polychlorinated Biphenyls (PCBs) released from Ship breaking yards at Sitakunda, Chittagong at 22.5 tons per year (Islam, 2004).

Approximately 95% India's trade by volume and 70% by value is moved through maritime transport. There are eight major ports on the Bay of Bengal coast and fifty three minor ports of particular concern is the potential for serious damage to livelihoods dependent on marine and coastal livelihoods in the event of major marine accidents such as oil or chemical spills from tankers (Gol, 2009). Major industries and mining activities situated within the coastal areas of India include textile industries, tanneries, paper and pulp mills, breweries, chemical factories, cement factories, sugar refineries, food processing industries (e.g. fish factories and slaughterhouses), fertilizer factories, oil refineries, and oil and gas exploration (an emerging activity). These contribute to transboundary marine pollution problems through inappropriate disposal of liquid wastewater, solid waste or atmospheric emissions.

In Pakistan, Karachi is not only has the largest port in the country but it is also the industrial hub of the and the main source of pollution in the coastal waters of Sindh. There are currently over 6000 big and small registered industrial units operating in Karachi. These industrial units are located in Sindh Industrial Trading Estate (SITE), Landhi, Korangi, Malir and the Port Qasim Authority area).

Industries that contribute most toward coastal water pollution in Sri Lanka are those dealing with textiles, paper, tanning, metal finishing and engineering, paints, chemicals, cement, food and beverages and distilleries. Small Industries that deal with coconut fiber retting also have highly localized impacts on water pollution. Most industries are not yet equipped with the basic infrastructure for waste treatment, while others are constrained in the use of available waste treatment facilities due to the high costs involved (CZMP. 2006).

## **5.2. Existing strategic actions (national and regional levels)**

At national level, all SAS countries have enacted numerous legislation and policy on agriculture, waste management, aquaculture, fertilizer and agrochemicals to address this issue, yet the implementation is weak as well as the nutrient loading issue is not address holistically, but on piece meal level. The countries are also party to various international treaties and are in agreement on implementing the international standards of coastal water management:

- GPA, adopted in 1995, is a voluntary, action-oriented, intergovernmental programme led by UNEP, to prevent the degradation of the marine environment from land-based activities
- The Global Partnership on Nutrient Management (GPNM) -a multi stakeholders global partnership for strategic advocacy and co-operation at the global and regional levels to build consensus in promoting nutrient use efficiency and work with stakeholders to develop guidance, strategies or policies on sustainable use of nutrients
- Land Ocean Interactions in the Coastal Zone (South Asia node)
- BOBLME project
- SACEP/SASP activities
- SARRC Coastal Zone Management Center

## **5.3 Conclusion and Recommendations**

There are clear overall indications of the effects of nutrient pollution throughout South Asia and a few of them are transboundary nature. Signs of degradation of aquatic, estuarine, coastal and marine ecosystems due to nutrient loading are evident at various locations in South Asia, as seen on eutrophic zones due to excessive growth of algae and fish kills due to hypoxia. Estuarine and coastal systems in the region are Nitrogen limited and Nitrogen loading can trigger algal blooms and eutrophication. Some of the estuaries, especially along the Indian east coast, are Phosphorus limited and are adversely affected by Phosphorus loading. The Western side of the Indian peninsula is already prone to seasonal development of natural hypoxic zones, whereas the East coast is relatively less prone to hypoxia. However, the most crucial factors of governance that contribute to nutrient pollution across the region are inadequate emphasis on nutrient use efficiencies and environmental standards in agriculture, poor sewage management and inadequate understanding that nutrients which are essential for food production, can be cause of pollution when released to the natural environment. The situation merits strong national and regional interventions, with a thorough assessment to understand the extent and scale of the problem, as well as to define remedial actions that could be pursued at various levels.

The available information on nutrient losses from various human activities and their accumulation in the coastal zones of South Asia is very limited. This calls for detailed studies with actual long term

measurements and simulation of nutrient pollution from source to sink (land to sea) for informed decision-making. Some of the recommendations identified for the region are:

- Systematic studies should be initiated to quantify the sources, flows, fate and extent of current industrial, agricultural and municipal effluents and the nutrients they contribute to water bodies and their impacts on aquatic life, fishing as well as human health.
- Methodologies and mechanisms should be developed for collection and sharing of data on the nutrient pollution status in different coastal regions of South Asia.
- Sustained efforts are needed for increasing nutrient use efficiency, land and water productivity to improve agricultural productivity, sanitation and reduce pollution.
- Land-based pollution should be minimized through integrated land use planning and land zoning for recycling of waste materials.
- The nutrient load in the estuarine and brackish water fisheries and its impacts on fish catch, landing, species composition and seasonality, ecosystem productivity and human health need to be assessed to limit adverse impacts.
- Pollution from ships and other transport systems as well as ship breaking industry should be tightly regulated through rigorous environmental impact assessment
- Innovative new policies to combine the social benefits of eradicating open defecation with technologies (such as composting toilets or treatment plants) for recycling human wastes as fertilizers, along with awareness programmes to highlight the health hazards of untreated use of human excreta (or sewage contaminated with them) for crop production
- There is a strong need for a South Asian level intergovernmental working group/task force for coordinated sustainable nutrient management and protection of the region's coastal and marine environment, with governmental and civil society representatives from the above national bodies. This may work within, or coordinate with the existing intergovernmental processes, including the UNEP-GPA, SAARC, SACEP the BOBLME project, etc. and build on them for stronger regional cooperation on nutrient management.
- Revisiting the existing regulations for nutrient pollution management in S. Asia and updating the national policies, regulation and action plans to accommodate the new challenges. Concurrent infrastructure development for rapid analysis of data and data sharing.

## **6. Ecologically representative and Effectively Managed MCP Network - Protecting biodiversity today for our future wellbeing**

Aichi Target 11 requests countries that by 2020, at least 17 per cent of terrestrial and inland water areas and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effective and equitable management, are ecologically representative and there are well-connected systems of protected areas and other effective area-based conservation measures, integrated into the wider landscape and seascape.

Protected Area (PA) within the coastal and marine environment can have many definitions and can take many different forms around the world. For the purpose of the Regional Marine and Coastal Biodiversity Strategy (MCBS), the CBD definition is used, which describes a Marine and Coastal Protected Area (MCPA) as “an area within or adjacent to the marine environment, together with its overlying waters and associated flora, fauna and historical and cultural features, which has been reserved by legislation or other effective means, including customs, with the effect that its marine and/or coastal biodiversity

#### Box 7 - Prominent Categories of MPAs

- Fully Protected no take zones
- Multiple use (balance between biodiversity conservation and human utilization of resources)
- Areas protected under Multilateral initiatives – UNESCO MAB, World Heritage, Ramsar
- Shared MPAs - between two or more nations
  - o Trans-boundary (within the jurisdiction of two or more countries)
  - o High seas PAs (areas beyond national jurisdictions)

enjoys a high level of protection than its surroundings”<sup>5</sup>. In the context of the Regional MCBS , it is also necessary to include “indigenous and community conserved areas,” or ICCAs, which are defined as “natural and/or modified ecosystems containing significant biodiversity values , ecological services and cultural values, voluntarily conserved by Indigenous peoples and local communities, both sedentary and mobile, through customary laws or other effective means” (ICCA Forum, 2012).

### 6.1 Main MPA areas in SAS, Levels of protection and Challenges in Enforcement

The overall legal framework for biodiversity protection and PA establishment in Bangladesh, India, Maldives and Sri Lanka is centered on a main national legislation, while Pakistan has enacted several state laws (Annex 10). Yet, owing to the sectoral nature of the administrative systems for biodiversity conservation on coastal and marine ecosystems, several other laws also supplement the main legislation in identification and establishment of MCPAs. These sectorial legislations vary in the degree to which their provisions support the conservation of species and habitats depending on the primary objectives of each sector. Of relevance to PA in SAS countries:

- A total of 21 PAs ( 7 national parks, 12 wildlife sanctuaries, 1 marine PA and 1 special biodiversity conservation area) have been declared as Protected Area (PA) by the Government of Bangladesh since 2010 after the submission of the Fourth National Report on the CBD. The total area of newly added forest PA is 33,915,31 hectares. All 38 of forest PAs now cover about 10.55% of total forest area which is 1.8% of the total area of the country. Besides, two Marine Protected Areas (MPAs) of Swatch of No-ground in the Bay of Bengal, declared under Bangladesh Wildlife (Conservation and Security) Act, 2012, and Middle and South Patches of the Bay of Bengal, declared under the Marine Fisheries Ordinances 1983, together comprise 241,600 hectares (2936 sq km) constituting 2.05% of the total marine area of 11,881,300 hectares (1,18,813 sq km) of Bangladesh. Bangladesh has also declared 13 wetland areas of biodiversity importance as ECAs under Bangladesh Environment Conservation Act, 1995. The total area of ECAs managed by Department of Environment is 3,84,529 hector or about 2.60% of the total country. Among them, the four

<sup>5</sup> <http://www.wcmc.io/areas/46>

biodiversity important areas in coastal region are Cox’s Bazar-Teknaf Peninsula ECA (20,373 hectares), ECA the Sundarban (10 km wide landward strip of land outside the Sundarban PA) ECA(2,92,926 hectares), St. Martins Island ECA (1,214 hectare), and Sonadia Island ECA (10,298 hector) (Source: Biodiversity National Assessment 2015).

- In **India**, presently there are 690 PAs covering 1, 66,851 km or 5.07% of the country's geographical area under the Wildlife Protection Act 1972. The 23 MPAs of peninsula India covers about 6158 km<sup>2</sup>, which is 3.85% of the total PA coverage. Further there are 105 PAs in the Andaman and Nicobar Islands, about 100 include marine areas. These MPAs cover more than 30% of the terrestrial area of the islands and protect more than 40% of the coastal habitat. In the Lakshadweep group of islands, Pitti Island (0.01 km<sup>2</sup>) is the only island having the status of an MPA. Additionally, coastal Regulation Zone Notification, 1991 declares coastal stretches of sea bays, estuaries, creeks, rivers and back waters which are influenced by tidal action up to 500 m from high tide line and intertidal zone, as the Coastal Regulation Zone (MoEFCC/GOI, 2014)
- The **Maldives** does not have any specific legislation for biodiversity conservation per se, but the existing Environment Protection and Preservation Act (Law No 4/93) incorporates provisions for PAs. Present PA system includes a network of 27 dive sites, in which only diving and bait fishing are allowed; 3 Protected Mangrove areas; and 4 protected islands. Maldives has pledged to become the first nation where the entire country and its Exclusive Economic Zone will be a UNESCO Biosphere Reserve by 2017. The entirety of Baa Atoll was declared a UNESCO World Biosphere Reserve in June 2011 (MEE/GoM, 2012).
- In **Pakistan** the PA system covers an area of 109,969 km<sup>2</sup> or 13.65 % of the area of Pakistan. 114 PAs cover 12% of the area of the country. No exclusive Marine PAs have been established. Hingol NP and three Wildlife Sanctuaries contain coastal elements such as mangroves, estuarine environment and salt marshes. There is neither a national biodiversity policy nor legal framework for mainstreaming biodiversity in the planning and development process. At least nine sites have been identified as potential MPAs including the Indus delta, Astola Island and Miani Hor (Sonmjani Bay) (CCD/GOP, 2014 and 2012).
- In **Sri Lanka**, the total Protected Area coverage at 2010 is around 1.84 million ha representing about 28% of the total land area of the country. Wildlife and the Forest Departments manage the majority of these. Additionally, 8 Environmental Protection Areas (EPAs) have been gazette by the

**Box 8 – Main facts on MPAs in SAS**

- SAS is lagging behind in protecting Marine environment and presently less than 0.5% of the EEZ is protected
- Most MCPAs are contained in near-shore habitats such as mangroves or coral reefs
- Other than the Indian Ocean whale Sanctuary, there are no shared MPAs in the region to protect trans-boundary species or habitats
- Cooperation and coordination between biodiversity and fishery sectors in PA establishment is limited, despite being recognized by legislation

CEA under the National Environmental Act of 1980. The majority of these PAs are terrestrial, while 7 National Parks, 25 sanctuaries and 1 SNR contain coastal and marine elements. Further 15 mangrove areas are designated as Conservation Forests. The Coast conservation Act (CCA) amendment No 49 of 2011 also paves the way for more positive coastal zone management. It has provisions to declare: affected areas where no development, dumping of waste or damaging activity can be carried out, beach parks for preservation of scenic beauty and biodiversity, and conservation areas for the protection of the coastal and aquatic eco-systems, where no development activity will be permitted. Several near shore areas (mainly lagoons and estuaries) have also been gazette as Fishery Management Areas under the Fisheries and Aquatic Resources Act (MoERE/GoSL, 2014).

## 6.2 Regional and Global Initiatives

A number of regional and global initiatives are taking/will take place of relevance to marine and coastal protected areas, such as:

- The South Asian Seas Action Plan (SASP) emphasizes the importance of co-operation between the member states for the establishment and management of national protected coastal and marine habitats, and aims the establishment of a regional network of protected areas, through joint activities to protect coastal ecosystems and wildlife and through the training of technical and managerial personnel for the conservation of wildlife and habitats.
- As part of the CBD work on Protected Areas and Ecologically or Biologically Significant Areas, for the marine environment, a workshop for the Bay of Bengal region will be held in March 2015.
- The CMS Indian Ocean – South-East Asia Marine Turtle Memorandum of Understanding (IOSEA) Marine Turtle Site Network is awaiting the nomination of sites by the SAS countries.
- No sites have been designated by the IMO as Particularly Sensitive Sea Area (PSSA). A PSSA<sup>6</sup> is an area that needs special protection through action by IMO because of its significance for recognized ecological or socio-economic or scientific reasons and which may be vulnerable to damage by international maritime activities.
- The BOBLME project has taken action for collaborative critical habitat management (e.g. Gulf of Mannar between India and Sri Lanka).
- The SAS region falls within the Indian Ocean Whale Sanctuary established by Indian Whaling Commission.
- There are 19 Ramsar sites with coastal and marine elements within the region. Annex 1 provides biologically significant ecosystems designated under international process such as Conventions.

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<sup>6</sup> <http://www.imo.org/OurWork/Environment/PollutionPrevention/PSSAs/Pages/Default.aspx>

### 6.3 Conclusions and Recommendations

The number of MCPAs has increased over the years to provide protection for coastal and marine ecosystems, especially near-shore habitats such as coral reefs, mangroves, estuaries, lagoons and beaches. Many are part of terrestrial PAs, but the protection of open waters remains comparatively very low. A more detailed analysis is necessary to determine whether the existing MCPAs are effectively conserving a representative range of habitats and ecosystem types, as well as species that need urgent conservation (e.g. turtles, sharks, etc.).

Despite this increase on the numbers of MCPAs in the region, there are some existing issues regarding their management:

- Lack of coordination: Different categories of PAs established under same law or several laws can be found within larger continuous habitats - e.g. Indian Sundarbans contain a NP, three wildlife sanctuaries and a Tiger Reserve coming under same legislation and agency Negambo estuary in Sri Lanka 4 categories of PAs declared under four legal enactments coming under different agencies
- Most of the MCPAs are small in extent, and as such, may not sufficiently protect species with wide habitat ranges or those reliant upon dispersal reproductive strategies
- Conservation in the region has been focused on terrestrial issues and there is comparatively much less expertise in marine resource management, especially in protecting fishery resources and migratory species. Although Legislation specifically for establishing protected areas in the marine environment is somewhat developed, but not being utilized.
- Majority of South Asia's PAs pay insufficient attention to ecological criteria and the requirements of communities - mobilization of local communities as well as private sector including dive and tour operators and hoteliers is a must

Therefore, the development of effective national MPA (and other special conservation systems set seasonal or other type of restrictions) would require: (a) clarity in institutional mandates within agencies which have responsibilities for MCPAs; (b) development of strong coordination mechanisms within agencies with responsibilities relevant to the marine environment; (c) coordination between fishery and biodiversity sectors; (d) greater attention to ecological criteria and the requirements of communities; (e) mobilization of local communities as well as private sector including dive and tour operators and hoteliers; (f) PAs be re-categorized on the basis of ecosystem services they provide; and (g) PA valuation studies be carried out.

Further collaboration between national, regional (BOB-IGO, SEAFDEC, SAARC CZMC, etc.) and Global partners such as UNEP, CBD (EBSA) and FAO in identifying, establishing and monitoring PAs within the Open Oceans and high seas - especially with regard to protecting migratory species.

Some regional interventions for consideration could include:

- Look beyond national jurisdictions and adopt regional approaches for managing shared resources – Transboundary and High Seas MPAs (e.g. The Chagos – Maldivian and Lakshadweep archipelago; Seasonal marshes, mudflats and brackish water lagoons of Runn of Kutch Gulf of Mannar and Palk Bay: Sundarban mangroves)
- Update the existing protected area database of UNEP-WCMC and develop a mirror site for the SACEP website as well as linking with the existing national websites
- Development of a regional capacity development programme to assist national partners that will include site networking and lessons sharing facilities.

## **PART III: The Way Forward - Framework for Action in addressing the Aichi targets and SDGs within the context of the South Asian Seas Region**

### **Vision, Regional Targets and the Implementation Framework for the Marine and Coastal Biodiversity Strategy for SAS region**

#### **SAS Vision Statement up to 2030**

*“South Asian Seas countries share healthy marine and coastal ecosystems rich in biodiversity that will continue to provide ecosystem services for the wellbeing of the people, and the social and economic development of the region”* (Colombo Workshop Outcome, 2014 and Maldives Workshop outcome,2018).

To this end the purpose of the Marine and Coastal Biodiversity Strategy (MCBS) is to provide a framework for cooperation and collaboration amongst the five maritime countries of South Asia and other stakeholders, for the application of Ecosystem Approaches in managing coastal and marine resources, that will ensure the conservation of biodiversity and safeguard ecosystem services for the wellbeing and poverty reduction of the people of South Asia.

This strategy is underpinned by the following guiding principles:

- The use of the Ecosystem Approach
- Government commitment at every level
- Maintaining Healthy and Resilient Ecosystems
- Recognition of the economic, social and cultural values of marine and coastal ecosystems
- Adaptive management and learning by doing
- Precautionary approach and risk analysis
- Participatory and Inclusive
- Commitment to Human Rights and Gender Equality
- Building and Strengthening Partnerships (not reinventing the wheel but collaborate and cooperate with existing initiatives and programmes)

## Regional Targets

### 1. Ensuring Ecosystem Services and Wellbeing

**GOAL 1:** Ensure the provision of ecosystem services of the coastal and marine habitats for the wellbeing of coastal communities in SAS region (Aichi Targets 5, 10, 14 & 15).

**Desired Outcome:** The health of ecosystems and livelihoods of coastal communities has improved as a result of protection, restoration and sustainable use of marine and coastal ecosystems services.

**Target 1:** By 2030, at least 10 % of coastal habitats have been restored to pre-degraded status: **mangroves** loss halted by 2020 and mangrove area increasing by 2030, there is no net of **coral reef or seagrass** by 2030, through a reduction of the key anthropogenic pressures that erode the resilience of coral reefs, seagrass and mangroves.

#### Actions under Target 1

- 1.1. Plan and implement scientifically sound restoration programs for degraded coastal and marine ecosystems (mangroves, coral reefs, seagrasses, lagoons and estuaries)
- 1.2. Increase equitable participation of coastal communities in managing the resource base through formal co-management mechanisms.
- 1.3. Build capacity among stakeholders for co-management, the ecosystem approach, natural resource governance, participatory management and monitoring, etc.
- 1.4. Develop and implement models for Benefit Sharing in marine management based on Ecosystem Service assessment and valuation, and build related capacity.
- 1.5. Establish a mechanism for enhanced regional collaboration in shared natural marine and coastal biodiversity management under SACEP.
- 1.6. Revitalize the South Asia Coral Reef Task Force and National Task Forces.
- 1.7. Create a regional database with updated information (national, regional and global level) of the status and trends of coastal and marine ecosystems.
- 1.8. Identify the main drivers causing mangroves, coral and seagrass loss, and develop specific actions to address them.
- 1.9. Enhance the capacity of SAS countries to develop and implement marine spatial planning and integrated coastal management.

### 2. Prevention of Species Extinction

**GOAL 2: Globally threatened Marine and Coastal species (such as turtles, marine mammals, sharks, migratory shorebirds, seabirds, coral, sponges, mollusks, mangroves and seagrasses species) are protected and without risk of extinction within the SAS Region (Aichi Target reflected in SDG's 2030)**

**Desired Outcome:** No extinctions of and reduced extinction risk among endangered marine and coastal species within the SAS region.

**Target 2:** By 2030, all critically endangered and endangered species and the ecosystems they inhabit have been identified, including extent and status and there is improvement in or no further deterioration of their conservation status as a result of measures for their protection.

#### **Actions under Target 2**

- 2.1. Conduct surveys of critically endangered and endangered species, their distribution and threats to identify conservation measures needed.
- 2.2. Develop comprehensive recovery or management plans for priority species and Implement main conservation measures identified in the management/recovery plans.
- 2.3. Form national and regional committees to promote inter-agency dialogue for specific species as needed.
- 2.4. Establish principles and standards for tourism and other economic activities that use or affect endangered species.
- 2.5. Establish collaborative long-term monitoring programmes for transboundary species.
- 2.6. Build capacity on taxonomy, endangered species legislation, eco-tourism development etc.

### **3. Control of Alien Invasive Species**

#### **GOAL 3: Marine Invasive Alien Species do not pose a threat to the native biota of the SAS Region**

**Desired Outcome:** The risk of introduction of marine and coastal IAS to South Asia is mitigated through management measures and safeguards, and alien species already introduced are controlled so as to prevent invasion.

**Target 3:** By 2030, Marine and coastal IAS risks in SAS are identified, knowledge on control of transmission pathways is improved and countries adopt regionally coherent policies and practices for marine IAS prevention and control

#### **Actions under Target 3**

- 3.1. Ensure access to information on IAS, including establishment of regional data and information sharing mechanism and where possible drawing on and further developing existing databases such as GISD
- 3.2. Regional IAS risk assessment including identification of pathways for introduction and spread in the region.
- 3.3. Establish of a Regional collaborative mechanism on IAS, such as an Expert Task Force established under SACEP and in collaboration with relevant agencies such as IMO
- 3.4. Establish regionally coherent approaches/guidelines for e.g. risk screening for commercial use of non-native species (in aquaculture) and reducing risk of spread through marine species trade and tourism.
- 3.5. Raise awareness about IAS among the general public as well as policy makers
- 3.6. Ratification of the Ballast Water Convention by SAS countries and implementation of its provisions

## 4. Sustainable Fisheries and Aquaculture

### **GOAL 4: Sustainable Fisheries and Aquaculture in SAS region underpin food security and economic development**

**Desired Outcome:** Fisheries and aquaculture in the South Asian Region are managed so as to support livelihoods and food security of coastal people as well as economic development, without compromising ecological integrity and inter-generational equity.

**Target 4:** By 2030, all fisheries and aquaculture activities are developed and managed using an ecosystem approach and guided by a management plan, and by 2020 there are specific measures in place in each fishery to avoid by-catch, particularly of endangered and vulnerable species and plans are in place for recovery of depleted species.

#### **Actions under target 4**

- 4.1. Improve catch reporting and fisheries statistics, as well as environmental assessment of the effects of fishing.
- 4.2. Combat illegal unreported and unregulated (IUU) fishing, with clear measures on how to address this issue at the regional and national levels.
- 4.3. Implement measures that minimize by-catch, waste and discard.
- 4.4. Control/Minimize the impact of fishing gear on habitats, especially critical habitats, and endangered.
- 4.5. Develop regional protocols on Monitoring Control and Surveillance (MCS).
- 4.6. Prepare recovery plans for all depleted species (with special focus on trans-boundary species).
- 4.7. Promote and build capacity for application of an ecosystem approach in fishery resource management.
- 4.8. Drawing on global efforts where possible, develop regional guidelines on use of an ecosystem approach in aquaculture (including waste management and fish feed).
- 4.9. Drawing on global efforts where possible, develop regional standards for sustainability certification of fishery and aquaculture products.
- 4.10. Identify specific needs and develop and implement specific measures to limit by-catch of endangered and vulnerable species

## 5. Prevention of Marine Pollution

### **GOAL 5: Marine Pollution, especially nutrient loading, is brought to sustainable levels in the SAS region**

**Desired Outcome:** Pollution loading from land and sea, and in particular nutrient loading, is brought to a level that does not degrade coastal ecosystems, threaten biodiversity, contribute to anoxia, or otherwise exacerbate ecosystem vulnerability to climate change and ocean acidification.

**Target 5:** By 2030, nutrient use efficiency in agriculture is increased by 20%, and marine pollution from municipal wastewater and vessels is reduced to an appropriate level

#### **Actions under target 5:**

- 5.1. Update National Plans of Actions under GPA
- 5.2. Enhance the nutrient efficiency and recovery in agriculture, livestock, poultry and aquaculture sectors:

- 5.2.1 Improve treatment of sewage including enhancing nutrient recovery, through development of municipal secondary and tertiary treatment as well as other methods appropriate in rural areas.
- 5.2.2 Promote efficient solid waste management practices.
- 5.2.3 Develop and implement a marine litter action plan and adequate policy implementations for South Asia Seas region.
- 5.2.4 Develop and implement marine water quality standards for SA seas.
- 5.2.5 Improve disposal facilities for oils and other waste in major and minor sea ports/harbors and fish landing sites.

## 6. Effective and Equitable Governance of Marine and Coastal Protected Areas

**GOAL 6:** Marine and Coastal Protected Areas in South Asia effectively conserve biodiversity and generate ecosystem service benefits to stakeholders.

**Desired Outcome:** Marine and Coastal Protected Areas in South Asia form an ecologically connected network of well managed sites with the participation of all stakeholders including indigenous and local communities, and support ecosystem service provision of the marine and coastal environment also beyond protected area sites,

**Target 6:** By 2030, countries have put in place measures for effective and equitable management of PAs and establish transboundary protected areas, including management plans and periodic assessment of management effectiveness for all protected areas and other area-based conservation measures, and at least 10 % of coastal habitats have been incorporated in newly established protected areas through a participatory approach.

### Actions toward target 6

- 6.1 Establish regional standards/practices for assessing and enhancing management effectiveness of existing MCPAs, drawing on existing international, regional and national tools and measures.
- 6.2 Identify vulnerable habitats and species (with particular attention to trans-boundary ecosystems) and develop area-based management measures for their protection.
- 6.3 Establish a regional institutional network mechanism for and the creation of a Regional Network of MPAs and Protection of Trans-boundary and migratory species, based on past regional efforts under SACEP/SAS.
- 6.4 Promote legislative and institutional reform to secure MCPA effectiveness and impact and guaranteeing equitable benefit sharing among stakeholders.
- 6.5 Organize exposure and exchange programs to learn from countries within the South Asian region, and also from other regions, to learn about effective management and governance measures.

### Regional Cross-cutting Actions

A number of priority actions cut across all Regional Goals and Targets and are critical to their achievement. This includes the following:

#### Governance and Participation:

- Develop equitable benefit sharing measures, with the local communities and other stakeholders, for benefits arising from conservation and protection measures.

- Ensure full and effective participation of indigenous/local communities, regarding their rights and recognition of their responsibilities, particularly during the management of existing PAs, and the establishment and management of new PAs.
- Ensure recognition of tenure rights of local communities and recognition and inclusion of traditional knowledge.

#### **Incentive Mechanisms**

- The use of incentives for each regional target should consider cultural and traditional aspects, avoiding or replacing perverse incentives.
- Promote subsidies that reward and encourage sustainable 'green economy' practices

#### **Capacity Building and Training**

- Develop capacity building and training programmes for all relevant decision makers and stakeholders, at regional, national and local levels

#### **Information Exchange and Public Awareness**

- Organize exposure and exchange programs to learn from countries within the South Asian region, and also from other regions (e.g. thematic areas of effective management, natural resource governance, financial mechanisms for the protection of biodiversity, etc.)

## **Enabling the Implementation of the Marine and Coastal Biodiversity Strategy**

### **SACEP's role implementing the Strategy and coordinating regional collaboration**

SACEP was created to fulfill a Vision based on the following assumptions:

- Recognition of environmental degradation caused by factors like poverty, over population, over consumption and wasteful production threatening economic development and human survival;
- Integration of environment and development as essential prerequisites to Sustainable Development, and
- Importance of co-operative action in the South Asian region where many ecological and development problems transcend national and administrative boundaries.

**The Mission of SACEP** is "to promote regional co-operation in South Asia in the field of environment, both natural and human in the context of sustainable development and on issues of economic and social development which also impinge on the environment and vice versa; to support conservation and management of natural resources of the region and to work closely with all national, regional, and international institutions, governmental and non-governmental, as well as experts and groups engaged in such co-operation and conservation efforts".

Based on this and being the Secretariat for the South Asian Seas Programme, SACEP should be the agency to lead and coordinate the implementation and promotion of the Strategy, including cross-cutting interventions, and make it operative. This does not mean that SACEP should be in charge of implementing each one of the actions, but rather, SACEP should be in charge of coordinating and collaborating with regional partners, including government departments, financiers, and research institutions with member countries. Leadership for monitoring, reporting, resource mobilization and capacity building can rest with SACEP.

## Communicating the strategy

A comprehensive communication strategy should be developed with the following goals:

- to raise the visibility and understanding of priority actions of the Marine and Coastal Biodiversity Strategy;
- to secure high-level political support from national leaders and international partners, to promote appropriate principles and tools that can be incorporated into national management frameworks,
- to build the communications capacity within national partners to conduct effective outreach,
- to establish branding guidelines,
- to establish a protocol for the flow of information to and from the Regional Secretariat, the NBSAP secretariats, Technical Working Groups, Council of Ministers, and other stakeholders.

Communication is a critical component for the success of the implementation of the strategy, and should focus reaching not only the obvious institutions participating in marine and coastal governance, but also other not so evident such as the Ministries of Finance and Economic Planning.

The communication strategy can also assist SACEP in raising its visibility at the regional and national level and among domestic and international partners. Such a strategy is vital to achieving the overarching objectives in the Implementation Framework, and could be a part of an overall communication strategy for SACEP.

Engaging broad partnership/stakeholder outreach and coordination is also essential for successful implementation of the strategy. Efforts need to be made early on, to engage relevant stakeholders to achieve the strategic goals and targets. Similarly increasing public awareness of the national, regional and global importance of the strategy needs to be started early on. Outreach actions should clearly delineate international, regional, national and local economic and social benefits. Specific target audiences both within the SACEP as well as external audiences and partners ranging from local governments and community groups, to international development partners and scientific organizations need to be identified. Given that the strategy needs to reach varied audiences the outreach materials need to be developed accordingly and in the different national languages as well as in English. An initial assessment needs to be carried out to: identify objectives, target audiences, and key messages to be conveyed, identify specific outreach products and tools to be incorporated into a broader communications program, examine the potential to establish the communication strategy as a regional forum, develop a Work Plan and a Staffing and Management Plan for the first year (lessons learned during the first years will help refine and strengthen the plans for the outer years), identify national, regional and international partners to support the delivery of the communication program, identify supportive operationalization and institutionalization structures including the media, radio and TV, and assess how the information flow will be channeled between SACEP membership and outside agencies, Partners, and stakeholders.

## Conservation Finance: Options for financing Strategy implementation

The sustainability of the Marine and Coastal Biodiversity Strategy will also be dependent on other additional considerations, such as the availability of funds to implement activities and carry out assessments, and partnerships created, contributing in different ways, for example, changing industry

practices. National governments and other institutions will have to commit funds and incorporate the agreed plans into their national budgets. For other regional activities requiring extra-budgetary support, a number of financial instruments can be considered. Below is a list of possibilities:

- The **Global Environment Facility, GEF**, in its evaluation of conservation trust funds emphasizes four essential conditions: a commitment of at least 10-15 years; active government support for a public-private sector mechanism outside direct government control; a critical mass of people from diverse sectors of society working together to achieve biodiversity conservation and sustainable development; and legal and financial practices and institutions that are supportive and in which people have confidence. Other conditions noted by GEF include: the initial capitalization, together with other resources available on a recurrent basis, should allow a meaningful program, keeping operating costs within a range of 20-25%; a strong Executive Director; strong stakeholder involvement and financial and administrative discipline.
- The **Forest Carbon Partnership Facility (FCPF)** launched the Carbon Fund in 2011. It provides performance-based payments to countries that have made significant progress in their REDD+ (Reducing Emissions from Deforestation and Forest Degradation) endeavors. Mangrove forests are eligible to apply to this Fund. The FCPF is a global partnership of governments, businesses, civil society, and Indigenous Peoples to combat deforestation and forest degradation, promote forest carbon stock conservation, and the sustainable management of forests.
- The **Conservation Finance Alliance (CFA)** discusses a new type of environmental asset targeting the conservation of Protected Areas: Park Bonds which are defined as a fixed income product that offers investors the opportunity to participate in the financing of conservation projects through the capitalization of an International Trust Fund. Interest will be distributed to bond holders and identified beneficiaries. These Bonds could be issued by an International Trust Fund for Protected Areas (ITFPA), either hosted by a Multilateral Development Agency such as the World Bank or the Global Environment Facility.
- The **Conservation Trust Funds (CTF)** are mechanisms for releasing funding on a regular basis that could be used to support the implementation of the Marine and Coastal Biodiversity Strategy. These funds are becoming increasingly popular but their establishment requires technical expertise and institutional commitment. The establishment of CTFs require a group of diverse stakeholders with a common vision, a demand for funds from capable implementing organizations, the existence or possibility of quickly establishing a basic legal and financial framework, government buy-in and take into account the relevant political, legal and governance contexts, and linkage to existing regional or national environmental strategies or PA management plans, a consultative process, the identification of a diverse sources of finance, and ensure the mobilization of sufficient resources and protect against over-reliance on a single source of funding.
- Other potential sources of funds include: **the Asian Development Bank, the World Bank** and other bilateral donors such as **DFID, CIDA, USAID, GIZ and SIDA**.
- Lessons can be learned from other regions, such as the **Mesoamerican Reef Fund**, which was created in 2004 to help support financing of the conservation and sustainable use of the marine and coastal ecosystems of the Mesoamerica Reef, an ecoregion shared by four countries (Mexico, Belize, Guatemala and Honduras).

- Green Climate Fund (GCF), created to support the efforts of developing countries to respond to the challenge of climate change. It seeks to promote a paradigm shift to low-emission and climate-resilient development, considering the needs of nations that are particularly vulnerable to climate change impacts. It aims to deliver equal amounts of funding to mitigation and adaptation, while being guided by the Convention's principles and provisions.

When the Paris Agreement was reached in 2015, the Green Climate Fund was given an important role in serving the agreement and supporting the goal of keeping climate change well below 2 degrees Celsius. Responding to the climate challenge requires collective action from all countries, including by both public and private sectors. Among these concerted efforts, advanced economies have agreed to jointly mobilize significant financial resources. Coming from a variety of sources, these resources address the pressing mitigation and adaptation needs of developing countries.

### Partnerships

Implementing the strategy successfully will require of sound partnerships with collaborating agencies. They may include multilateral and bilateral agencies, MFF, BOBLME, IOTC, SAARC, IGOs, UN agencies, government agencies, private sector agencies, NGOs and community organizations. The Strategy should rely on the work of these other partner organizations (e.g. those named in Annex 1), as they shall be instrumental for implementing the Strategy.

### Monitoring and Evaluation (M&E)

An appropriate system for **Monitoring and Evaluation (M&E)** needs to be established, not only to make sure that the interventions towards achieving the targets are on track, but also for capturing and sharing lessons.

In order to efficiently monitor the progress of the Marine and Coastal Biodiversity Strategy for South Asia, a systematic monitoring strategy with useful and measurable indicators need to be developed. The monitoring action plan needs to take into account:

- Changes in the direction towards achieving the regional targets, such as:
  - o Changes in population density, including migration patterns
  - o Changes in the levels and frequency of threats
  - o Improvements in management and effectiveness
  - o Improvements in enforcement and compliance of laws and regulations
- Progress towards the defined biodiversity outcomes, including measurement of environmental indicators
- Clearly defined roles and expected deliverables of local, national, regional and international partners
- New models and tools developed
- Creation or strengthening of partnership with civil society organizations, government organizations, private sector and other relevant institutions.

The implementation and monitoring framework will be further developed in detail during the second workshop. The monitoring strategy will have to keep track of the progress of the regional actions, and be reported to member nations, bilateral and multilateral partners and to the CBD Secretariat.

## Implementation and Monitoring Framework

Table 3.1 Implementation and Monitoring framework

<b>1. Ensuring Ecosystem Services and Wellbeing</b>				
<p><b>GOAL 1:</b> Ensure the provision of ecosystem services of the coastal and marine habitats for the wellbeing of coastal communities in SAS region (Aichi Targets 5, 10, 14 &amp; 15).</p> <p><b>Desired Outcome:</b> The health of ecosystems and livelihoods of coastal communities has improved as a result of protection, restoration and sustainable use of marine and coastal ecosystems services.</p> <p><b>Target 1:</b> By 2030, at least 10 % of coastal habitats have been restored to pre-degraded status: <b>mangroves</b> loss is halted by 2020 and mangrove area increasing by 2030, there is no net of <b>coral reef or seagrass</b> by 2020, and there is a reduction of the key anthropogenic pressures that erode the resilience of coral reefs, seagrass and mangroves.</p>				
<b>Sub-Targets</b>	<b>Activities</b>	<b>Indicator/s</b>	<b>Partners</b>	<b>Time Frame/Possible funding sources</b>
1.1 Plan and implement scientifically sound restoration programs for degraded coastal and marine ecosystems (mangroves, coral reefs, seagrasses, lagoons and estuaries)	Extent recovered/replanted	Percentage of Changes in specific ecosystems,  No: of initiatives	National (MoE, FD, DW, Research institutions, NGO/CBOs)  International (SACE/SASP, SAARC-CZMC, Mangrove for the Future; IUCN, WWF, UNEP, RAMSAR, UNESCO-MAB; UNESCO-WH; Coral Reef Initiative, Global Coral Reef Monitoring Framework)	Monitoring every 3 years  Funding sources (to be discussed at the next WS)  GEF - Biodiversity
1.2 Increase equitable participation of coastal communities in managing the resource base through formal co-management mechanisms.	No of co-management/ community based mechanisms created and functioning for the sustainable management of coastal and marine resources. Awareness programmes developed on the importance of conservation of coastal and marine resources.  Sustainable livelihood options provided.	Governance effectiveness in coastal areas.		Monitoring every 2 years  GEF - Biodiversity

<p>1.3. Build capacity among stakeholders for co-management, the ecosystem approach, natural resource governance, participatory management and monitoring, etc.</p>	<p>Capacity assessment programs.  Monitoring mechanisms established.</p>	<p>No of training/workshops</p>		<p>Monitoring every 2 years  GEF - Biodiversity</p>
<p>1.4. Develop and implement models for Benefit Sharing in marine management based on Ecosystem Service assessment and valuation, and build related capacity.</p>	<p>Implementation of the Nagoya Protocol  Development of legal frameworks at national level for Access and Benefit Sharing(ABS)  Development of models for appropriate ecosystems  Conducting programs and capacity Development on ABS</p>	<p>No: of legal frameworks Established under the Nagoya Protocol  Organization of related programmes  Percentage of trainees aware on ABS</p>	<p>UNEP – TEEB  Nagoya Protocol Implementation Fund</p>	<p>UNEP - TEEB</p>
<p>1.5 Establish a mechanism for enhanced regional collaboration in shared natural marine and coastal biodiversity management under SACEP.</p>	<p>Conducting regular meeting/scientific forum /Joint working group</p>	<p>No of initiatives conducted (e.g. Re-activation of the South Asia Coral Reef Task Force)  No: of activities carried out among countries</p>		<p>Monitoring every 2 years  GEF - Biodiversity</p>
<p>1.6 Revitalize the South Asia Coral Reef Task Force (SACR) and national Task Forces.</p>	<p>Implementation of Action Plans</p>	<p>No of meetings held by the SACR Task Force and other national task forces a year</p>	<p>Task force members</p>	<p>Monitoring every 2 years</p>

1.7 Create a regional database with updated information of the status and trends of coastal and marine ecosystems (mangroves, coral reefs, seagrasses, lagoons and estuaries).	Database development  Regular updating of data base	No of data entry in the database  No of users of the database		
1.8 Identify the main drivers causing seagrass loss, and develop specific actions to address them.	Conducting Seagrass studies  Developing seagrass management action plan	No of publications on the seagrass of South Asia		Monitoring every 2 years
1.9 Enhance the capacity of SAS countries to develop and implement marine spatial planning (MSP) and integrated coastal zone management (ICZM).	Conducting capacity building activities and trainings on MSP and ICZM  Developing national ICZM plans	Number of MSP and ICZM trainings held  No of countries with a National ICZM plans	UNEP, Environment and Coastal Departments	Every 5 years

**2.Prevention of Species Extinction**

**GOAL 2: Globally threatened Marine and Coastal species (such as turtles, marine mammals, sharks, migratory shorebirds, seabirds, coral, sponges, mollusks, mangroves and seagrasses species) are protected and without risk of extinction within the SAS Region (Aichi Target 12)**

**Desired Outcome:** No extinctions of and reduced extinction risk among endangered marine and coastal species within the SAS region.

**Target 2:** By 2030, all critically endangered and endangered species and the ecosystems they inhabit have been identified, including extent and status and there is improvement in [no further deterioration of] their conservation status as a result of measures for their protection.

Sub-Tragets	Activity	Indicator/s	Partners	Time Frame/Possible funding sources
2.1 Conduct surveys of critically endangered and endangered species, their distribution and threats to identify conservation measures needed.	<p>Conducting national and regional level surveys</p> <p>Establishing measures and legal frameworks for conservation of threatened species established at national level</p>	<p>No of IUCN Redlist species (the status of their vulnerability in the IUCN database)</p> <p>No of scientific articles published about the species of South Asia region</p>	<p>National (MoE, Research Institutions, NGO/CBOs)</p> <p>International (CMS - IOSEA Marine Turtle, MoU on Dugongs and Sharks ; IOTC, BOB-IGO, BirdLife International; IUCN, WWF, CITES)</p>	
2.2. Develop comprehensive recovery or management plans for priority species and Implement main conservation measures identified in the management/recovery plans.	<p>Developing conservation plans and recovery plans</p> <p>Establishing legal framework for management of priority species</p>	<p>No of management/recovery plans developed/</p> <p>No of legal frameworks established</p>		<p>Monitoring every 3 years</p> <p>GEF Biodiversity/International Waters</p>
2.3. Form national and regional committees to promote inter-agency dialogue for specific species as needed.	<p>Establishing regional committee</p> <p>Conducting the meetings / regional dialogues</p>	<p>No of task force/ or other mechanisms established</p> <p>No of meetings held</p>		<p>Monitoring every 2 years</p> <p>SACEP to implement</p>

<p>2.4. Establish principles and standards for tourism and other economic activities that use or affect endangered species.</p>	<p>Developing national / regional level guidelines on eco-friendly tourism/ agriculture and fisheries</p> <p>Information exchange on good practices and success stories</p>	<p>No of guidelines established</p> <p>No of eco-friendly certifications received on tourism/ fisheries/ agriculture</p>		<p>Monitoring every 3 years</p> <p>BOBLME SAP</p>
<p>2.5. Establish collaborative long-term monitoring programmes for transboundary species.</p>	<p>Conducting studies on the stocks of transboundary and migratory species</p>	<p>No of studies conducted</p> <p>The status of stocks of transboundary species</p>		
<p>2.6. Build capacity on taxonomy, scientific measures on conservation, endangered species legislation, eco-tourism development etc.</p>	<p>Training held on taxonomy and legislation and scientific measures on conservation</p>	<p>No of workshops and public training</p> <p>No: of trainees aware on taxonomy/legislation/ecotourism</p>		

**3. Control of Alien Invasive Species**

**GOAL 3: Marine Invasive Alien Species (IAS) do not pose a threat to the native biota of the SAS Region**  
**Desired Outcome:** The risk of introduction of marine and coastal IAS to South Asia is mitigated through management measures and safeguards, and alien species already introduced are controlled so as to prevent invasion.  
**Target 3:** By 2030, Marine and coastal IAS risks in SAS are identified, knowledge on control of transmission pathways is improved and countries adopt regionally coherent policies and practices for marine IAS prevention and control

<b>Sub-targets</b>	<b>Activity</b>	<b>Indicator/s</b>	<b>Partners</b>	<b>Time Frame/Possible funding sources</b>
3.1. Ensure access to information on IAS, including establishment of regional data and information sharing mechanism and where possible drawing on and further developing existing databases such as GISD	Developing regional database on IAS	No of data entry in the database  No of users of the database  Biological species database  No. of IAS recorded	SACEP to facilitate	1 year after approval  Global Invasive Species Database.
3.2. Regional IAS risk assessment including identification of pathways for introduction and spread in the region.	Training on IAS Risk Assessment  Identification of regional pathways (hotspots) for IAS  Information sharing on success stories of IAS management	No of trainings held  No of regional risk assessments conducted  No of regional pathways (hotspots)  No of information exchange conducted / no of tools for information exchange	National: National maritime authorities. Research and tech. groups  International: SACEP-SASP; UNESCO- IOC; IMO; IUCN	Start now and have it ready by 2030
3.3. Establishment of a Regional collaborative mechanism on IAS, such as an Expert Task Force established under SACEP and in collaboration with relevant agencies such as IMO	Establish a regional Expert Task Force on IAS	Task Force in place		Every 2 years

<p>3.4. Establish regionally coherent approaches/guidelines for e.g. risk screening for commercial use of non-native species (in aquaculture) and reducing risk of spread through marine species trade and tourism.</p>	<p>Establishing regional approaches and guidelines</p>	<p>No of countries which become party to new initiatives following the approaches</p> <p>No. of guidelines published</p> <p>Number of policies that make reference to IAS (including risk analysis, prevention, control, and quarantine measures on introduced species for aquaculture).</p>		<p>Every year</p>
<p>3.5. Raise awareness about IAS among the general public as well as policy makers</p>	<p>Survey to assess the understanding of IAS</p> <p>Conduct awareness campaigns about IAS for general public, for policy makers</p> <p>Conduct a post survey on the effectiveness of the awareness programs</p>	<p>No of surveys and level of understanding</p> <p>No of media awareness programs broadcast/published</p> <p>Survey results/articles published and the changes in the level of understanding</p>	<p>SACEP to facilitate</p>	<p>Every 2 years</p> <p>IMO and FAO</p>

3.6. Ratification of the Ballast Water Convention by SAS countries and implementation of its provisions	Conduct regional policy dialogues to assist ratification process  Ratification of the Ballast Water Convention	Status of ratification  Biological species database  No. of IAS recorded		IMO
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**4.Sustainable Fisheries and Aquaculture**

**GOAL 4: Sustainable Fisheries and Aquaculture in SAS region underpin food security and economic development**

**Desired Outcome:** Fisheries and aquaculture in the South Asian Region are managed so as to support livelihoods and food security of coastal people as well as economic development, without compromising ecological integrity and inter-generational equity.

**Target 4:** By 2030, all fisheries and aquaculture activities are developed and managed using an ecosystem approach and guided by a management plan, and by 2030 there are specific measures in place in each fishery to avoid by-catch, particularly of endangered and vulnerable species.

Sub-targets	Activity	Indicator/s	Partners	Time Frame/Possible funding sources
4.1. Improve catch reporting and fisheries statistics, as well as environmental assessment of the effects of fishing.	Establish mechanisms and collaboration for catch reporting and fisheries statistics	Trends of catch per unit effort (CPUE), and Maximum Sustainable Yield (MSY)	National: Environment/Fisheries Ministries and Departments; Research institution and academia  International: BOBP-IGO; IOTC, FAO; UNESCO-IOC	Every 2 years  BOBLME SAP
4.2. Combat illegal unreported and unregulated (IUU) fishing, with clear measures on how to address this issue at the regional and national levels	Develop National Plan of Action to combat IUU in line with International Plan of Action adopted by FAO	No. of national regulations and strategic plans to address IUU	BOBLME SAP	Every 2 years

4.3. Implement measures that minimize by-catch, waste and discard.	Develop a fishery code of conduct	No of regulations and practices that are incorporated to reduce by-catch, waste and discard		Every 3 years FAO, BOBLME SAP Partnerships with private sector and certification schemes
4.4. Control/Minimize the impact of fishing gear on habitats, especially critical habitats, and endangered.	Demarcation of critical habitats (core zones, buffer zones and utilization zones)	No of regulations on fishing	FAO, BOBP-IGO, Departments of Fisheries	Every 2 years Partnerships with private sector and certification schemes
4.5. Develop regional protocols on Monitoring Control and Surveillance (MCS).	Design and approval of regional protocol	No and type of instruments created	FAO, BOBP-IGO, Departments of Fisheries	Every 5 years FAO, IMO, Port State Measures
4.6. Prepare recovery plans for all depleted species (with special focus on trans-boundary species).	Preparation of recovery plans	No of recovery plans for targeted species	Departments of Fisheries	Every 3 years BOBLME SAP
4.7. Promote and build capacity for application of an ecosystem approach in fishery resource management.	Conduct capacity building programme on ecosystem approaches in fisheries resource assessment and management	No. of capacity building programs conducted for fisheries resource assessment and management	FAO, BOBLME SAP, BOBP-IGO	Every 3 years BOBLME SAP GEF International Waters

	Development of EA management plans for SAS countries	Number of transboundary and national stocks that have EA management plans		
4.8. Drawing on global efforts where possible, develop regional guidelines on use of an ecosystem approach in aquaculture (including waste management and fish feed).	Develop regional guidelines for sustainable aquaculture certification  Development of regulations and guidelines on waste management in aquaculture and fish feed and anti-biotics	No. of countries that utilize aquaculture certification.  No. of regulations in place	FAO, BOBLME SAP, BOBP-IGO	2 years from approval  FAO, Partnerships with private sector and certification schemes
4.9. Drawing on global efforts where possible, develop regional standards for sustainability certification of fishery and aquaculture products.	Develop a criteria for Regional Certification Standards for sustainable fishery and aquaculture	Green protocol criteria for sustainable fishery and aquaculture in place	FAO, BOBLME, UNEP  Partnerships with private sector	Follow up in every two years
4.10. Identify specific needs and develop and implement specific measures to limit by-catch of endangered and vulnerable species.	Identification and development of specific measures to limit by-catch of endangered and vulnerable species  Implementation of those measures in collaboration with other international bodies	Trends in fisheries certified by the Marine Stewardship Council  Proportion of fish stocks within biologically sustainable levels (reflected Aichi Targets in SDG's)	FAO, BOBLME, Fisheries sector, UNEP, CMS	Every 3 years follow up

## 5. Prevention of Marine Pollution

**GOAL 5: Marine Pollution, especially nutrient loading, is brought to sustainable levels in the SAS region**

**Desired Outcome:** Pollution loading from land and sea, and in particular nutrient loading, is brought to a level that does not degrade coastal ecosystems, threaten biodiversity, contribute to anoxia, or otherwise exacerbate ecosystem vulnerability to climate change and ocean acidification.

**Target 5:** By 2030, nutrient use efficiency in agriculture is increased by 20%, and marine pollution from municipal wastewater and vessels is reduced by

Sub-targets	Activity	Indicator/s	Partners	Time Frame and possible funding sources
5.1. Update National Plans of Actions under GPA	Develop and update national plans of Action under GPA	Healthy ecosystem monitoring as per Aichi targets, reflected also in SDG's indicators.		
5.2. Enhance the nutrient efficiency and recovery in agriculture, livestock, poultry and aquaculture sectors.	Development of remedial measures for nutrient recovery and nutrients efficiency.	Monitoring the appropriate Water Quality parameters as per reflected Aichi Targets in SDG's.	Government  SACEP-SASP; UNEP-GPA, GPNM; LOICZ – South Asia Node;	2 years  UNEP-GPA  GEF
5.3. Improve treatment of sewage including enhancing nutrient recovery, through development of municipal secondary and tertiary treatment as well as other methods appropriate in rural areas	Establishment of sewage treatment plants at the national levels  Minimization of sewage	Ecosystem health status  Physiochemical parameters of nearshore waters (necessary ecosystem healthy indicator microbial communities, BOD, DO, & COD)		3 years  Large coastal cities

<p>5.4. Promote efficient solid waste management practices.</p>	<p>Development of efficient solid waste management plans and rules at the country level</p> <p>Identify targets to reduce mismanaged solid wastes (especially in coastal cities)</p>	<p>Number of Marine Litter Management Plans, policies and rules etc. in place.</p>		<p>3 years</p> <p>Large coastal cities</p>
<p>5.5. Develop and implement marine water quality standards for South Asian seas.</p>	<p>Developing national and regional sea water quality standards</p>	<p>No of regulations and standards that affect effluent water standards in the region reflected Aichi Targets in SDG's and other conventions ratification to this effect (nutrient levels in effluent discharged, No of sewers established, No of septic tanks in non-urban areas, etc.)</p>	<p>UNEP, SACEP;</p>	<p>3 years</p> <p>UNEP-GPA</p>
<p>5.6. Improve disposal facilities for oils and other waste in major and minor sea ports/harbors and fish landing sites.</p>	<p>Development of guidelines on the environmentally sustainable disposal mechanism and implementation of them</p> <p>Develop facilities for collecting and recovery of oil and related wastes</p>	<p>Number of facilities for collecting and recovering oil and related wastes, Oil levels in main ports, solid waste management measures in place.</p>	<p>IMO</p>	<p>3 years</p> <p>UNEP-GPA</p> <p>IMO</p> <p>GEF</p>

## 6. Effective and Equitable Governance of Marine and Coastal Protected Areas

**GOAL 6:** Marine and Coastal Protected Areas (MCPAs) in South Asia effectively conserve biodiversity and generate ecosystem service benefits to stakeholders.

**Desired Outcome:** Marine and Coastal Protected Areas in South Asia form an ecologically connected network of well managed sites with the participation of all stakeholders including indigenous and local communities, and support ecosystem service provision of the marine and coastal environment also beyond protected area sites,

**Target 6:** By 2030, countries have put in place measures for effective and equitable management of PAs, including management plans and periodic assessment of management effectiveness for all protected areas and other area-based conservation measures, and at least 10 % of coastal habitats have been incorporated in newly established protected areas through a participatory approach.

Sub-targets	Activity	Indicator/s	Partners	Time Frame and possible funding sources
Identify the percentage of coastal (and marine) ecosystems already covered by MCPAs	Establishing protected areas and transboundary protected areas within the SAS region	Area covered	UNEP, IUCN, SACEP	Every 5 years
6.2. Establish regional standards/practices for assessing and enhancing management effectiveness of existing MCPAs, drawing on existing international, regional and national tools and measures	Developing tools for measuring effective management	Tools in place Trends in extent of MCPAs		

<p>6.3. Identify vulnerable habitats and species (with particular attention to trans-boundary ecosystems) and develop area-based management measures for their protection.</p>	<p>Identification of vulnerable habitats and species</p> <p>Identification of area-based management measures</p>	<p>Gap analysis</p>	<p>SACEP, IUCN, UNEP, BOBLME SAP, CITES, CBD</p>	<p>3 years</p> <p>GEF Biodiversity and International Waters</p>
<p>6.4. Establish a regional institutional network mechanism for and the creation of a Regional Network of MPAs and Protection of Trans-boundary and migratory species, based on past regional efforts under SACEP/SAS</p>	<p>Identification of routes and pathways of transboundary and migratory species</p> <p>Establish measures to protect the pathways and routes and management plan for conservation of habitats</p> <p>Establishment of regional institutional mechanism for the creation of MPAs</p>	<p>MoU signed, Existence of the Regional Network. Coverage of Key Biodiversity Areas, Management Effectiveness (including reflected Aichi Targets in SDG's for equitable management)</p>		<p>5 years</p> <p>GEF Biodiversity and International Waters</p>
<p>6.5. Promote legislative and institutional reform to secure MCPA effectiveness and impact.</p>	<p>Development of a regional action plan to secure the MCPA effectiveness</p>	<p>Regional action plan in place</p> <p>No of legislations and plans enacted</p> <p>Governance effectiveness and MoU drafted and operative</p>		<p>Monitoring every 2 years</p>

<p>6.6. Organize exposure and exchange programs to learn from countries within the South Asian region, and also from other regions, to learn about effective management and governance measures.</p>	<p>Conduct regional learning and exchange programmes among SAS countries</p> <p>And sharing of success stories and good experiences</p>	<p>No of training and exchange programs carried out</p> <p>No of success stories and case studies published</p> <p>Regional Ocean governance.</p>	<p>UNESCO - IOC</p>	
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## ANNEXES

### Annex 1: The international obligations of the SAS countries (National level participation of Conventions, Initiatives and other process - as of 10<sup>th</sup> September 2018)

	Bangladesh	India	Maldives	Pakistan	Sri Lanka
<b>• Conventions</b>					
Convention on Biological Diversity (CBD)	03/05/1994	18/02/1994r	09/11/1992r	26/07/1994r	23/03/1994r
Cartagena Protocol on Biosafety	05/05/2004r	11/09/2003r	11/09/2003a	31/05/2009r	26/07/2004r
Nagoya Protocol on Access & Benefit sharing (NIF)	06/09/2011s	09/10/2012r			
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	20/11/1981r	20/07/1976r	12/12/2012a	20/04/1976a	04/05/1979a
Convention on Migratory Species (CMS)	1/12/2005	1/11/1983		1/12/1987	01/.09/1990
MoU on IOSEA Marine turtles	23.10.2003	01.05.2007	26.04.2010	12.07.2004	23.06.2001
MoU Dugong	19.02.2013	28.05.2008	rs	rs	31.01.2012
MoU Marine Sharks	rs	rs	rs	rs	rs
Central Asian Flyway	rs	rs	rs	rs	rs
The International Treaty on Plant Genetic Resources for Food And Agriculture (IPGRA)	14/11/2003r	10/06/2002r	02/03/2006a	02/09/2003a	
Ramsar Convention on Wetlands	21/09/1992	01/02/1982		23/11/1976	15/10/1990
UNESCO – World Heritage Convention (WHC)	03/08/198a	14/11/1977r	22/05/1986a	23/07/1976r	06/06/1980a

UN Convention on the Law of the Sea (UNCLOS)	27/07/2001r	29/06/1995r	07/09/2000r	26/02/1997r	19/07/1994r
Agreement on Part XI	27/07/2000	29/06/1995	07/09/2000	26/02/1997	28/07/1995
UN Fish Stocks Agreement	05/11/2012r	19/08/200a	30/12/1998r	15/02/1996s	24/10/1996r
IMO Environmental Related Conventions					
MARPOL 73/78	party	party	party	party	party
OPRC Convention	party	party			
Ballast Water Management Convention -NIF			party		
<b>• Other Initiatives, Programmes, projects</b>					
Millennium Development Goals	party	party	party	party	party
RIO+20 – The Future We Want	party	party	party	party	party
UNEP – Global Programme of Action For the Protection from Land Based Activities	party	party	party	party	party
SACEP/South Asian Seas Action Plan	party	party	party	party	party
SAARC – Coastal Zone Management Center	party	party	party	party	party
Bay of Bengal Large Marine Ecosystem Project	party	party	party	party	Not a party
Mangrove for the Future Initiative	party	party	party	party	party
Global Environmental Facility	party	party	party	party	party
UNESCO – Man and Biosphere Programme					
Indian Ocean Tuna Commission and its various Resolutions on Fisheries		party	party	party	party
BirdLife International – Asia (NGO partners)	party	party			Party
Land Ocean Interaction in the Coastal Zone – South Asia node					
International Coral Reef Initiative					
Wetland International					

NIF – Not in Force; r- Ratification; s – signatory; rs – Range State

## Annex 2: Government and international organizations in SA supporting conservation, management and sustainable use of marine and coastal resources

Countries	Department of Environment	Roles of the organizations
<b>Bangladesh</b>	Ministry of Environment and Forests	Conservation and management of natural environment including mangroves, wetlands, sea grass meadows and coral reefs
	Forest Department	Conservation and management of mangroves, wetlands.
	Water Resources Planning Organization	Integrated Coastal Zone Management
	IUCN – Bangladesh	Education, contributions to national efforts in conservation of living resources.

<b>India</b>	Ministry of Environment and Forests	Conservation and management of natural environment including mangroves, wetlands, sea grass meadows and coral reefs
	Forest Department	Conservation and management of mangroves, wetlands.
	Department of Animal Husbandry Dairying & Fisheries (DADF)	
	Ministry of Earth Sciences (Centre for Marine Living Resources and Ecology Integrated Coastal and Marine Area Management Project Directorate; The National Institute of Ocean Technology; ESSO - Indian National Centre for Ocean Information Services)	Promoting research and education on marine living resources. Reporting possible conservation & restoration measures. Dissemination of information and services for sustainable exploitation and management.
	IUCN – India	Education, contributions to national efforts in conservation of living resources..
<b>Maldives</b>	Ministry of Environment and Energy	Coordination of matters related to the environment
	Environment Protection Agency	Conservation and management of resources and a regulatory body responsible for IEE and EIA approvals
	Ministry of Fisheries and Agriculture	management of fisheries
	Marine Research Center	Responsible for coral reef monitoring, fisheries research and monitoring of sensitive habitats.
	IUCN - Maldives	supporting environmental conservation and addressing development challenges. Project Regeneration is aimed at enhancing resilience of social-ecological coral reef systems. This initiative is supported by USAID.
<b>Pakistan</b>	Climate Change Division	Coordination of matters related to the environment.
	Pakistan Environmental Protection Agency	Overall responsibility in the management of the environment including coastal and marine
	IUCN - Pakistan	Education, contributions to national efforts in conservation of living resources.
	WWF- Pakistan	
<b>Sri Lanka</b>	Ministry of Mahaweli Development and Environment	Coordination of matters related to the environment
	Ministry of Fisheries and Aquatic Resources	Management of fishery resources
	Department of wildlife Conservation	Management of all kind Protected Areas (terrestrial and Marine), conservation of species, habitat and there ecosystems.
	Forest Department	Conservation of mangroves
	Central Environmental Authority	Mainly a regulatory body for granting IEE and EIA approvals. Also responsible for setting up environmental quality standards and safeguarding the environment.
	Department of Coast Conservation and Coastal Resources Management	In charge of the coastal zone and is also a regulatory authority entrusted with granting approvals for IEE and EIA within the coastal zone.

	Marine Environment Protection Authority	Responsible for controlling marine pollution from land based sources and from ships including control of invasive alien species.
	National Aquatic Resources Research and Development Agency	Responsible for research and monitoring of sensitive marine ecosystems and species. Also responsible for fisheries data collection and determining maximum sustainable yields of marine resources and monitoring water quality.
	IUCN –Sri Lanka	Education, contributions to national efforts in conservation of living resources.

### Annex 3: National Legal framework for coastal and marine biodiversity conservation

	Main legislation	Sectoral Frameworks		
		Forestry	Fisheries	Environment related others
<b>Bangladesh</b>	Bangladesh Environment Conservation Act, 1995 (Amendment 2010)	Forestry Act, 1927; Forest (Amendment) Ordinance, 1989	Marine Fisheries Ordinance, 1983; Marine Fisheries Rules, 1983	Environment Protection Act, 1995. Bangladesh Biological Diversity Act 2017, Ecologically Critical Areas Management Rules 2016, and Blue Economy Action Plan respectively
<b>India</b>	Wildlife Protection Act of 1972:	Forest Act, 1927, Forest(Conservation) Act, 1980	Indian Fisheries Act, 1897; Marine Fishing Regulation Act, 1978; State Fisheries Acts	Biological Diversity Act, 2002; Environment Protection Act, 1995; Coastal Regulation Zone Notification, 1991; Maritime Zones Act, 1976
<b>Maldives</b>	Environmental Protection and Preservation Act of 1993		Fisheries Law of 1987	
<b>Pakistan</b>	Balochistan Wildlife (Protection, Preservation, Conservation and Management) Act (1974); Sindh Wildlife Protection Ordinance (1972, amended 1993)	Forest Act 1927	The Pakistan Fisheries Ordinance, 1961	Environmental Protection Act, 1997
<b>Sri Lanka</b>	Flora and Fauna Protection Ordinance, 1937 .	Forest Conservation Ordinance, 2009	Fisheries and Aquatic Resources Act	Coast Conservation Act 1981

		National Heritage and Wilderness Act 1988	the No. 2 of 1996  Fisheries & Aquatic Resources (Amendment) Act, No.35 of 2013	National Environment Act, 1981  Maritime Zones Act, 1976  Prevention and Control of Invasive Alien Species act (on the process of formulation under the department of legal draftsmen)
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Sources: MoFE/GgoB, 2005; Rajagopalan and Lakshmi, 2003;

#### Annex 4: Species of Conservation Concern Recorded from the Coastal and Marine Ecosystems of South Asia

Common English Name	Scientific Name	Global Conservation Status	
		IUCN Red listing	CITES and CMS Appendices
<b>• Mammals</b>			
Sei Whale	<i>Balaenoptera borealis</i>	EN	CITES A 1/CMS A 1
Blue Whale	<i>Balaenoptera musculus</i>	EN	CITES A 1/CMS A 1
Fin Whale	<i>Balaenoptera physalus</i>	EN	CITES A 1/CMS A 1
Sperm whale	<i>Physeter macrocephalus</i>	VU	CITES A 1/CMS A 1
Hump whale (Arabian sea pop)	<i>Megaptera novaeangliae</i>	EN	CITES A 1/CMS A 1
Indo –Pacific Finless Porpoise	<i>Neophocaena phocaenoides ssp. asiaeorientalis</i>	VU	CITES A 1
Ganges River Dolphin	<i>Platanista gangetica</i>	EN	CITES A 1/CMS A. 11
Indus Blind Dolphin	<i>Platanista gangetica</i>	EN	CITES A 1
Irrawaddy Dolphin	<i>Orcaella brevirostris</i>	VU	CITES A 1
Indo-pacific Humpbacked Dolphin	<i>Sousa chinensis</i>	NT	CITES A. 1
Short-finned Pilot Whale	<i>Globicephala macrorhynchus</i>	DD	CITES A. 11
Melon-headed Whale	<i>Peponocephala electra</i>	LC	CITES A. 11
Bridled Dolphin	<i>Stenella attenuata</i>	LR/cd	CITES A 11/CMS A 11
Spinner/Long-beaked Dolphin	<i>Stenella longirostris</i>	DD	CITES A 11/CMS A. 11
Rough-toothed Dolphin	<i>Steno bredanensis</i>	DD	CITES A 11/CMS A 1
Southern Right Whale	<i>Eubalaena australis</i>	LC	CITES A 1/CMS A 1
Minke Whale	<i>Balaenoptera acutorostrata</i>	LC	CITES A 1/CMS A 1
Bryde's Whale	<i>Balaenoptera edeni</i>	DD	CITIES A I/CMS AII
Pygmy sperm whale	<i>Kogia breviceps</i>	DD	CITIES A II
Dwarf sperm whale	<i>Kogia sima</i>	DD	CITIES A II
Killer Whale	<i>Orcinus orca</i>	DD	CITES A II/CMS A I & II
False Killer Whale	<i>Pseudorca crassidens</i>	DD	CITES A II
Pygmy Killer Whale	<i>Feresa attenuata</i>	DD	CITES A II
Melon-headed whale	<i>Peponocephala electra</i>	LC	CITES A II
Risso's Dolphin	<i>Grampus griseus</i>	LC	CITES A II

Fraser's dolphin	<i>Lagenodelphis hosei</i>	LC	CITES A II
Dugong	<i>Dugong dugon</i>	VU	CITES A 1/CMS A1
Bengal tiger	<i>Panthera tigris tigris</i>	EN	CITES A 1
Asian Elephant	<i>Elephas maximus</i>	EN	CITES A 1
Indian Wild Ass	<i>Equus hemionus ssp. Khur</i>	VU	CITES A 1 & 11/CMS A 11
Leopard	<i>Panthera pardus</i>	EN	CITES A 1
Indian Smooth-Coated Otter	<i>Lutrogale perspicillata</i>	VU	CITES A 11
Fishing Cat	<i>Prionailurus viverrinus</i>	EN	
Oriental Small-clawed Otter	<i>Aonyx cineria</i>	VU	
<b>• Waders and Sea birds</b>			
Christmas island Frigatebird	<i>Fregata andrewsi</i>	CR	CITES A 1
Red-Breasted Goose	<i>Branta ruficollis</i>	VU	CITES A 11/CMS A 1 & 11
Oriental White Stork	<i>Ciconia boyciana</i>	EN	CITES A 1/CMS A.1
Spotted Greenshank	<i>Tringa guttifer</i>	EN	CITES A 1/CMS A 1& 11
Spoon billed sand piper	<i>Eurynorhynchus pygmeus</i>	CR	CMS A 1& 11
Christmas island Frigatebird	<i>Fregata andrewsi</i>	CR	CITES A 1
Masked Finfoot	<i>Heliopais personata</i>	EN	
Lesser Adjacent	<i>Leptoptilos javanicus</i>	VU	
Hooded Crane	<i>Grus monacha</i>	VU	CITES A 1/CMS A 1 & 11
Dalmatian Pelican	<i>Pelecanus crispus</i>	VU	CITES A 1/CMS A 1 & 11
Indian Skimmer	<i>Rynchops albicollis</i>	VU	
Greater Adjutant	<i>Leptoptilos dubius</i>	EN	
Lesser Adjutant	<i>Leptoptilos javanicus</i>	VU	
Great Knot	<i>Calidris tenuirostris</i>	VU	

<b>• Reptiles</b>			
Saltwater crocodile	<i>Crocodylus porosus</i>	LR/lc	
Mugger crocodile	<i>Crocodylus palustris</i>	VU	CITES App.1& 11
Olive Ridley Turtle	<i>Lepidochelys olivacea</i>	VU	CITES App. 1
Leather back Turtle	<i>Dermodochelys coriacea</i>	CR	CITES App. 1 & 11/CMS APP. 1 & 11
Hawksbill Turtle	<i>Eretmochelys imbricata</i>	CR	CITES App. 1 & 11/CMS APP. 1 & 11
Green Turtle	<i>Chelonia mydas</i>	EN	CITES App. 1/CMS App. 1& 11
Logger head Turtle	<i>Caretta caretta</i>	EN	CITES App. 1 & 11/CMS APP. 1 & 11
Batagur terrapin	<i>Batagur baska</i>	CR	CITES App. 1 & 11/CMS APP. 1 & 11
Indian tent turtle	<i>Kachuga tecta</i>		
Asian Giant (Frog-faced) turtle	<i>Pelochelys cantorii</i>	EN	
Softshell Turtle	<i>Lissemys punctata</i>		
Indian soft shelled turtle	<i>Aspideretes gangeticus</i>		
Peacock marked soft shelled turtle	<i>Aspideretes hurum</i>		
Common Indian monitor			
Yellow monitor	<i>Varanus bengalensis</i>		

Water monitor	<i>Varanus flavescens</i>		
Indian rock python	<i>Varanus salvator</i>		
Asiatic (Indian) Rock Python	<i>Python molurus</i>	NT	
<b>• Fish</b>			
Humphead /Napoleon wrasse	<i>Rhincodon typus</i>	VU	
Giant Grouper	<i>Cheilinus undulates</i>	EN	
Banded Eagle Ray	<i>Epinephelu lanceolatus</i>	VU	CITES App. II
Largetooth Sawfish	<i>Pristis pristis</i>	CR	CITES App. II
Largetooth Sawfish	<i>Pristis microdon</i>	CR	CITES App. II
Knifetooth Sawfish	<i>Aetomylaeus nichofii</i>	VU	CITES App. II
Grey Nurse Shark	<i>Anoxypristis cuspidate</i>	EN	
Pondicherry Shark	<i>Carcharias taurus</i>	EN	
Queen Triggerfish	<i>Carcharhinus hemiodon</i>	CR	
Whale Shark	<i>Rhincodon typus</i>	VU	CITES App 11
Great Oceanic white tip	<i>Carcharinus longimanus</i>	VU	CITES App 11
Great hammerhead shark	<i>Sphyrna mokarran</i>	EN	CITES App 11
Smooth hammerhead shark	<i>Sphyrna zygaena</i>	VU	CITES App 11
Scalloped hammerhead	<i>Sphyrna lewini</i>	En	CITES App 11
Great White shark	<i>Carcharodon carcharias</i>	VU	CITES App 11
Ganges shark	<i>Balistes vetula</i>	VU	
Fossil Shark	<i>Glyphis gangeticus</i>	CR	
Triggertail Seahorse	<i>Hemipristis elongates</i>	VU	
Common Seahorse	<i>Hippocampus comes</i>	VU	
Headhodge Seahorse	<i>Hippocampus kuda</i>	VU	
Devil Fish	<i>Hippocampus spinosissimus</i>	VU	
Tawny Nurse Shark	<i>Mobula mobular</i>	VU	
Sharptooth Lemon Shark	<i>Nebrius ferrugineus</i>	VU	
Freshwater Sawfish	<i>Negaprion acutidens</i>	VU	
Shark Ray	<i>Pristis zijsron</i>	EN	
Common Shovelnose Ray	<i>Rhina ancylostoma</i>	VU	
Whitespot Giant Guitarfish	<i>Rhinobatos typus</i>	VU	
Smoothnose Wedgefish	<i>Rhynchobatus djiddensis</i>	VU	
Leopard Shark	<i>Rhynchobatus laevis</i>	VU	
Bigeye Tuna	<i>Stegostoma fasciatum</i>	VU	
Porcupine Ray	<i>Thunnus obesus</i>	VU	
Whitecheek Shark	<i>Urogymnus asperrimus</i>	VU	
	<i>Carcharhinus dussumieri</i>	NT	
<b>• Invertebrates</b>			
Giant clam	<i>Tridacna squamosa</i>		
Black coral	<i>Antipatharia</i>		
True stoney corals	Family: Acroporidae, Astrocoeniidae, Pocilloporidae		
	<i>Alveopora fenestrata</i>	VU	
	<i>Catalaphyllia jardinei</i>	VU	
	<i>Acanthastrea brevis</i>	VU	

	<i>Physogyra lichtensteini</i>	VU	
	<i>Pectinia alcornis</i>	VU	
	<i>Acropora hemprichii</i>	VU	

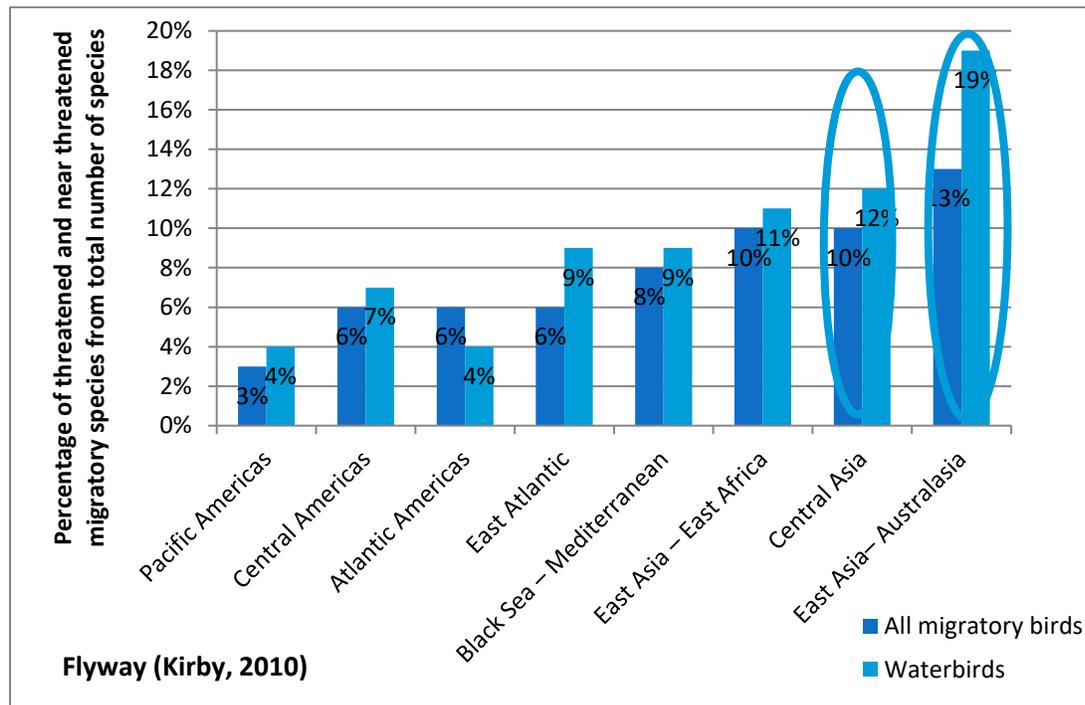
References: <http://www.iucnredlist.org/>

### Annex 5a: Important Bird Areas (IBAs) located within the coastal zone

Total IBAs	IBAs located near to the coastline	Threatened bird species recorded
<b>• Bangladesh</b>		
19	05 (Ganges- Brahmaputra-Meghna delta;	<i>Pelecanus philipensis, Leptoptilos javanicus, Leptoptilos dubius, Haliaeetus leucoryphus, Haliopasis personata, Eurynorhynchus pygmeus, Tringa guttifer, Rynchops albicollis, Tringa guttifer</i>
465	50	<i>Gyps bengalensis, Gyps indicus, Pelicanus crispus, Pelecanus philipensis, Aquila clanga, Aquila heliaca, Falco naumanni, Grus antigone, Rynchops albicollis, Parus nuchalis, Saxicola marorhyncha, Tringa guttifer</i>
01	01	<i>Anous tenuirostris</i>
55	03	<i>Pelicanus crispus,</i>
70	13	<i>Pelecanus philipensis, Leptoptilos javanicus</i>

Ref: Bird life International, 2003

### Annex 5b: Percentage of Threatened Migratory birds by region



Migratory birds know no political borders, and they are a shared resource among the different countries they migrate to during their life time. No action in one country alone can save these migratory birds. It is a group of birds that need joint action among countries and their peoples. It is a group of birds that need regional action for conservation in its breeding, wintering and lay over sites along its flyways. Of the nine flyways of the world, the Central Asian and the East Asia and Australasian Flyways which straddle the different South Asian Countries has the most number of globally threatened birds. This reflects a challenge and an opportunity that can be addressed together by the people of South Asia. A jointly developed and implemented programme on flyways and migratory birds conservation would be helpful to bring ordinary people together and also government institutions as well. The promotion of citizen science to monitor birds along the flyway will encourage ordinary people, students, birdwatchers and local communities to contribute to this programme across the region. A good example of this citizen science is what the Indian Bird Conservation Network (IBCN) does. It be an opportunity for governments, international organisations, corporations and other stakeholders to work together considering their own contexts and capacities. These organizations and other people can participate in flyway wide events such as the “Welcome to the Birds” events that reaches out to people from all walks of life and help make people aware of migratory birds and their flyways. “Migrant watch” in Sri Lanka is an example of a series of events that promotes migratory birds and flyways. Such a programme is ideal to promote network among people. This can also be a way of generating data from a regular and sustained source which will be important for tracking and assessing the impact of conservation actions

#### Annex 6: Recorded nesting and feeding habitats of the Marine Turtles

Recorded nesting and feeding habitats				
Bangladesh	India	Maldives	Pakistan	Sri Lanka
<b>1.Green turtle (<i>Chelonia mydas</i>)</b>				
St. Martin’s Island	Malvan in Maharashtra; Gulf of Kutch; Few islands in Lakshadweep and Andaman & Nicobar	Mulhadhoo, Kunfunadhoo, Maadhoo, Gaadhoo	Hawkes Bay and Sandspit in Karachi, Astola Island in southern Balochistan	Southern and eastern coast of Sri Lanka specially from induruwa to Nilaweli
<b>2.Hawksbill (<i>Eretmochelys imbricata</i>)</b>				
St. Martin’s Island (rare)	Andamans (particularly South Reef and North Brother in Andaman) and Nicobar islands and Lakshadweep atolls	Several islands in the Maldives (Vaadhoo, Baa atolls)		All the southern coastal areas of Sri Lanka
<b>3.Olive Ridley (<i>Lepidochelys olivacea</i>)</b>				
Sundarbans, St. Martin’s Island, Sonadia and Maheskhali island of Cox Bazar	Orissa, Gujarat (Gulf of Kutch and Gulf of Khambhat), Maharashtra (Gorai, Kihim, Manowrie, Versova and the beach between Ambolgad and Vetye), Goa, Kozhikode district in Kerala.		The beaches of Hawkes Bay and Sandspit in Karachi	All the coastal areas of Sri Lanka

	Sporadic nesting in Tamil Nadu, Andhra Pradesh, and in Sundarbans.			
<b>4. Leatherback (<i>Dermochelys coriacea</i>)</b>				
	Andaman & Nicobar and Lakshadweep islands.		The beaches of Hawkes Bay and Sandspit in Karachi	All the southern coastal areas of Sri Lanka. Specially Induruwa, Kosgoda, Mavela, Usangoda, Amabalantota, Bundala, Kahandamodara
<b>5. Loggerhead (<i>Caretta caretta</i>)</b>				
	Sighted along the East Coast of India and Andaman & Nicobar Islands, but nesting has not been reported.			Bundala; Rekawa; Welipatanwila Balapitiya

## Annex 7: Existing Policy and Strategic Actions at the National Level

Bangladesh	National Fisheries Policy of 1998 focused on the enhancement of the fisheries production, poverty alleviation, the provision of livelihoods and employment, food security, economic growth through exports, and maintaining healthy ecosystems. The 2006 Marine Fisheries Sector Sub-strategy aimed to: (a) improve support to capture fisheries; (b) prevent biodiversity losses; (c) promote sustainable aquaculture; (d) improve stakeholder involvement through co-management approaches; (e) increase partnerships with NGOs and the private sector. The government banned shrimp fry catchers along the coastal belt as a measure to preserve biodiversity.
India	States are responsible for the control and regulation of fishing activities within territorial waters, whereas the Union is responsible for areas beyond the territorial waters. The Central Government acts as a facilitator and coordinator responsible for policy formulation, fishery research and channeling funding support to the States/UT.  India is currently under its XII Five Year Plan: 2012-2017 for the Development and Management of Fisheries and Aquaculture (Government of India, 2011), which emphasizes: (a) <i>socio-economic upliftment of the fishery community and provides long-lasting benefits to build-up their resilience and improve their safety nets</i> ; (b) improving the information base for better decision-making on policy needs; (c) a sound MCS system. The dual goals of “ <i>enhancing production of fish on an environmentally sustainable and socially equitable basis</i> ”, and “ <i>augmenting export of fish and fish products</i> ” present a challenge in implementation.

Maldives	<p>Fisheries policies aim to: (a) diversify fisheries; (b) reduce stress on reef fisheries, which support most of the current fishing activities' (c) develop the longline fishery; (d) promote multi-day fishing vessels. There are several incentives for the development of the fishing industry and expansion into offshore waters, such as: (i) long-term lease of multi-day fishing vessels; (ii) a temporary fuel subsidy programme; (iii) construction of longline fishing vessels; (iv) training of master fishers; (v) expanded fishing zones exclusive to Maldivian fishers; (vi) formulation of a guideline for safer and stable fishing vessels that can operate further away from shore. Maldives recently placed a complete ban on shark fishing in 2010. However, the recent development and expansion of the longline fishing for tuna, may increase impacts on shark by-catch. A national plan of action on shark is under development.</p>
Pakistan	<p>Fisheries is a highly important economic activity along the coastal villages and towns in Pakistan, being the sole source of employment and income in some villages (FAO country profile, 2009). Commercial shrimp trawling is highly important, and is mainly directed for exports, followed by tuna fishing carried out by artisanal boats. Joint ventures started in 1979, but were stopped due to conflicts with local fishers. There is only limited potential for tuna and other tuna-like fish in the Pakistan EEZ. The demersal resources also show signs of being fully fished and only a limited expansion may be possible. The major portion that is available is off the Balochistan coast where the continental shelf extends less than 35 nm offshore. Most fishing is done by small-scale artisanal boats. Lack of modern facilities, limited size of boats (only 4-5 large vessels), poor post-harvest technology, unfriendly gears are constraints for the development of the sector.</p>
Sri Lanka	<p>In Sri Lanka, with the overall guidance of the Ministry of Mahaweli Development and Environment and the Ministry of Sustainable Development, Wildlife and Rural Development, the Department of Wildlife Conservation and the Forest Department are the main organizations mandate to conserve the Biodiversity in Sri Lanka, together ,these two departments have declared about 26% of terrestrial land as protected area and 0.3% of marine area at present. National Biodiversity Strategic Action Plan 2016-2022 (NBSAP) is the main policy instrument for guiding Sri Lanka for the conservation on biodiversity and sustainable development and sharing its benefits.</p> <p>The Ministry of Fisheries and Aquatic Resources has formulated a 10 year fisheries development plan for implementation during the period 2007-2016 based on the national fisheries and aquatic resources policy objectives. The plan envisages the increase in the total production of fish in sustainable manner. Although coastal fisheries will continue to make a considerable contribution to total fish production, they have serious limits to further expansion due to resource constraints. Therefore, the major contributions to the increase in production are expected from inland fisheries and aquaculture, complemented with the high seas and offshore fisheries production. With regards to the offshore fishing policy the government is providing incentives to improve the facilities in the boats to preserve the catch and to minimize the post-harvest losses.</p>

## Annex 8: IAS Current Status in SAS nations and Recommended Actions for Mitigation

Country	Current Status	Recommended Measures
<b>Bangladesh</b>	<p>a) Alien species found to be productive elsewhere, having potential to bring economic benefits were introduced</p> <p>b) fish species capable of producing a higher biomass in a shorter period than native species were introduced (e.g. <i>Oreochromis mossambicus</i> and <i>Oreochromis niloticus</i>)</p> <p>c) Weak Quarantine measures,</p> <p>d) inadequate scientific information</p>	<p>(a) inventory and identification of IAS; (b) description of the natural habitat of each alien species; (c) Mechanisms by which they propagate; (d) clear quarantine regulations; (e) international co-operation in information exchange; (f) prior clearance for species of economic and/or aesthetic importance before introduction to a country; (h) standardized procedures for introduction and monitoring; (i) political commitment through enactment of proper legal instruments.</p>
<b>India</b>	<p>While there are several legislative enactments which reference IAS, there is no exclusive legislation or policy to address IAS, and no system regulating species entering the country. Quarantine measures are weak. There is no national data base on IAS.</p> <p>Some states such as West Bengal and Tamil Nadu have adopted legislative and administrative measures for eradicating and preventing further invasion of the most noxious weed species and exotic fish carnivores (such as the Big Head Carp) replacing native species (MOEFCC, 2014)</p>	<p>Under the National Biodiversity Action Plan: (a) Regulation of introduction of IAS and their management; (b) develop a unified national system for regulation of all species entering the country; (c) rigorous quarantine checks. (d) develop a national database on IAS reported in India; (e) appropriate early warning and awareness system in response to new sightings of IAS; (f) priority funding to basic research on managing IAS; (g) promote regional cooperation in adoption of uniform quarantine measures and containment of invasive exotics.</p>
<b>Maldives</b>	<p>Follows cautious policy due to the fragile ecosystems on which economy is based. Management measures include: (a) formulate quarantine and other regulations to control IAS import; (b) adopt risk assessment techniques for identification, entry, establishment and control of potentially harmful species; Ballast water Management convention has been signed</p>	<p>(a) Establish quarantine facilities at points of entry of potentially harmful alien species; and (b) conservation of local biological diversity when transferring species from one locality to another within the country</p>
<b>Pakistan</b>	<p>(a) Need conservation projects aimed at conserving and restoring biodiversity, habitats and ecosystems that are threatened by IAS; (b) facilitate close coordination and collaboration between quarantine and plant protection departments; (c) prepare a black list of IAS in Pakistan; (d) inadequate education and awareness in the management of IAS;</p>	<p>(a) commission a technical review of IAS occurrence; (b) enhance local expertise for managing IAS, and train staff in the preparation of contingency plans; (c) strengthen and build capacity of the quarantine department for identification of IAS in the country due to increasing trade and travel; (d) initiate research to investigate the impacts of IAS on biodiversity,</p>

		tourism, agriculture, livestock production; (i) develop legislation to discourage introduction of IAS and encompass linkages between animal, plant and bio-safety issues.
<b>Sri Lanka</b>	Threat from IAS to local species, particularly in agriculture, was recognized. Relevant legislation includes (i) Water Hyacinth Ordinance; (ii) Plant Protection Ordinance; and (iii) Fauna and Flora Protection ordinance of 1937 and amendments. These restrict the introduction of weeds, pests and diseases harmful to indigenous plants and restrict the movement of flora and fauna. While the Acts provide the support to act against the introduction of IAS, their scope is limited.	<ul style="list-style-type: none"> <li>-Develop an appropriate legislative framework for effective prevention and subsequent control of IAS.</li> <li>-Strategic approach that encompasses prevention, eradication, control and containment is needed.</li> <li>-Sound management strategies based on ecological principles</li> <li>-co-ordination between line agencies</li> <li>-human resource development. Prevention is the cheapest and most preferred option</li> </ul>

Source: GISP, 2003, Government of India, 2014.

#### Annex 9: Hilsa shad and Indian Mackerel - Ecosystem-based fisheries issues in the Bay of Bengal

(Source APFIC, 2012)

Biological status of hilsa (regional stock)	According to the latest stock assessment by the BOBLME hilsa working group, the regional hilsa stock is overfished. Widespread use of small mesh gillnets is leading to a large number of juveniles being caught, especially in riverine areas.
What impact is the fishery having on the environment?	There are no major impacts on the seabed or water column
What impact is the fishery having on endangered and threatened species?	The fishery also catches turtles, sharks and cetacean, but exact numbers are unknown. Sea turtles are considered to be a threatened species.
What impact is the fishery having on other species?	Small mesh fisheries have an adverse impact on aquatic biodiversity in rivers and floodplains.
What external factors threaten the fishery?	Loss of the riverine habitats through siltation and water diversion, pollution. Water quality in both India and Bangladesh is typically poor.

Socio-economic issues	
Contribution of the fishery to livelihoods	<p>The hilsa fisheries play a critical role in the generation of employment and income. In Bangladesh, over 500 000 fishers are involved in catching hilsa and over 2 000 000 people are indirectly involved in the distribution and sale of hilsa., processing and export.</p> <p>The socio-economic status of most hilsa fishers can be categorized as socioeconomically disadvantaged in terms of access to services (education, health, banking, electricity, piped water), and income. However, given the relatively high value of hilsa as a result of strong local demand, the hilsa fishery may provide higher daily incomes compared to fisheries for other species.</p>
Economic value of hilsa fisheries	Hilsa catches in Bangladesh are valued at about Tk. 90 billion/US\$1.3 billion. Accurate estimates of landed values are problematic to obtain given complex relationships between money lenders and fishers that distort prices paid to fishers, but are thought to be about Tk. 45-60 billion/US\$640 to US\$850 million.
Governance issues	
Current management	There is no coordinated regional management of the hilsa stock. Bangladesh has a hilsa fisheries action management plan.
Implementation of an ecosystem approach to fisheries management (EAFM)	BOBP-IGO provides training in the Code of Conduct for Responsible Fisheries (the basis of EAFM).
Data and information	There are no integrated data management of collection activities for hilsa.
Legal tools and compliance	Legal tool exist, but few actions are directed at hilsa and enforcement of management measures is difficult.
MPAS	Bangladesh has about 1 394 km <sup>2</sup> of MPA (about 0.05 percent of the EEZ); India has 12 276 km <sup>2</sup> (about 0.5 percent of the EEZ); Myanmar has 341 km <sup>2</sup> (about 0.01 percent of the EEZ). Degree to which these MPAs contribute to the protection of the stock is not known.
Institutional structure	The links between the main agencies that need to be involved in hilsa management (fisheries and environment) are weak. Agencies that manage these areas in each country also need to be involved.

## Annex 10: Legal framework PA establishment in the region

	Overall Legal Framework	Sectoral Enactments		
		Forestry	Fisheries	Other
<b>Bangladesh</b>	Bangladesh Wildlife Preservation (Amendment) Act, 1974	Forestry Act, 1927; Forest (Amendment) Ordinance, 1989	Marine Fisheries Ordinance, 1983	Environment Protection Act, 1995;
<b>India</b>	Wildlife Protection Act of 1972	Forest Act, 1927, Forest (Conservation) Act, 1980	Indian Fisheries Act, 1897	Environment Protection Act, Coastal Regulation Z one notification, 2011; Biological Diversity Act, 2002 (State Governments)
<b>Maldives</b>	Environmental Protection and Preservation Act of 1993	-	Fisheries Law of 1987 (Law No: 5/87)	-
<b>Pakistan</b>	Balochistan Wildlife (Protection, Preservation, Conservation and Management) Act (1974); Sindh Wildlife Protection Ordinance (1972, amended 1993)	Forest Act 1927	The Pakistan Fisheries Ordinance, 1961	Environmental Protection Act, 1997
<b>Sri Lanka</b>	Fauna and Flora Protection Ordinance, 1937 and its periodic amendments	The Forest Conservation Ordinance	Fisheries and Aquatic Resources Act the No. 2 of 1996	Coast Conservation Act enacted in 1981  National Environment Act  National Heritage & Wilderness Act.

## Annex 11: Marine Protected Areas - Actions at National Level

### Update on Marine Protected Areas – National Level

#### Bangladesh

- Biodiversity Act 2011 and the formation of Ecosystem Critical Areas (ECA)
- Four marine reserves have been set up under ECA and are areas important to conserve hilsa fisheries
- Identification of key areas that should be protected include Elephant Point (shrimp breeding), Meghna estuary (hilsa breeding), Swatch Of No Ground (shrimps & dolphins), marine areas in Chakaria Sundarbans & Sundarbans (mangrove habitat; nursery grounds)
- Government plans to extend the mandate of the Coast Guard and Navy to help with enforcement efforts in fisheries management

#### India

- Critically Vulnerable Coastal Areas include Sundarbans, Chilika, Bhitarkanika, Gulf of Mannar, all under Coastal Regulation Zone Notification (2011)
- Society for Integrated Coastal Management (SICOM) has been formed to implement ICZM in two sites in environmentally sensitive areas (World Bank Project)
- Several regional initiatives are underway including India-Bangladesh joint research initiative (on hilsa) and India-Sri Lanka joint working committee on fisheries
- Under GEF/UNDP project, India is implemented work in Gulf of Mannar (finalized in 2012), and planning work for mainstreaming coastal and marine biodiversity into production sectors East Godavari

#### Maldives

- Baa Atoll was declared a UNESCO biosphere reserve in June 2011
- Six new protected areas (Mendhoo, Goedhoo Korau, Maahuruvalhi Faru, Bathalaa, Mathifaru Huraa, and ship wreck near Fulhadhoo) are established in Baa Atoll
- The boundaries for two existing MPAs (Hanifaru Bay and Dhigli Giri) were extended

#### Sri Lanka

- MPAs such as Hikkaduwa Marine National Park, Pigeon Island National Park, Adam's Bridge Marine National park, Delft National Park, Chundikulam National Park, Vidathalthiu Nature Reserve, Vankalei Sanctuary, Bar Reef sanctuary at Kalpitiya, Unawatuna Sanctuary, and Pareithiu sanctuary,
- Responsible ministries and agencies are Ministry of Mahaweli Development and Environment, Dept. of Wildlife Conservation under the Ministry of Sustainable Development Wildlife and Rural Development. Dept. of Fisheries under Ministry of Fisheries and Aquatic Resources, Coast Conservation Department under Ministry of Defense
- Further actions should include awareness about MPA for the community and financial assistance for park management

BOBLME (2012) Report of the Marine Protected Areas Working Group, 1-2 February, 2012, Bangkok, Thailand.  
BOBLME-2012-Ecology-07

## REFERENCES

1. Ahmed, M. and Suphachalasai S, 2014. Assessing the costs of climate change and adaptation in South Asia. Mandaluyong City, Philippines: Asian Development Bank, 2014  
<http://www.adb.org/sites/default/files/pub/2014/assessing-costs-climate-change-and-adaptation-south-asia.pdf>
2. Abu Hena, M.K., Short, F.T. Sharifuzzaman, S.M., Hasan, M., Rezowan, M and Ali, M., 2007. Salt Marsh and Seagrass Communities of Bakkhali Estuary, Cox's Bazar, Bangladesh. *Estuarine Coastal and Shelf Science*, 75 (2007) 72-78. <http://www.deepdyve.com/lp/elsevier/salt-marsh-and-seagrass-communities-of-bakkhali-estuary-cox-s-bazar-i0H2jEcko5>. accessed 18-5-2014
3. American Museum of Natural History. Center for Biodiversity and Conservation. Why is Biodiversity Important? <http://www.amnh.org/our-research/center-for-biodiversity-conservation/about/what-is-biodiversity>
4. Amjad, S. and Rizvi S.H N., 2000. Pakistan National Programme of Action under the Global Programme of Action for the protection of marine environment from land based activities. Ministry of Environment & Local Government/National Institute of Oceanography. Karachi.
5. Anderson Charles., Branch Trevor A., Alagiyawadu Anoma., Baldwin Robert., and Marsac Francis, 2012. Seasonal distribution, movements and taxonomic status of blue whales (*Balaenoptera musculus*) in the northern Indian Ocean. *CETACEAN RES. MANAGE.*12(2): 203–218, 2012 [http://hal-sde.archives-ouvertes.fr/docs/00/77/73/13/PDF/Anderson\\_et\\_al\\_JCRM2012.pdf](http://hal-sde.archives-ouvertes.fr/docs/00/77/73/13/PDF/Anderson_et_al_JCRM2012.pdf)
6. Andrews H. V., 2000. Current marine turtle situation in the Andaman and Nicobar Islands - An urgent need for conservation action. *Kachhapa News Letter*, October 2000.
7. APFIC, 2012. Funge-Smith, S., Briggs, M. & Miao, W. (2012). Regional overview of fisheries and aquaculture in Asia and the Pacific 2012. Asia-Pacific Fishery Commission, FAO Regional Office for Asia and the Pacific. RAP Publication 2012/26. 139 pp.
8. Apte Deepak, 2013. The Plight of the Neglected Coastal and Marine Ecosystems of India. *HORN BIL*, July-September, 2013  
<http://deepakapte.com/attachments/article/103/Neglected%20Coastal%20and%20Marine%20Ecosystems%20of%20India.pdf>
9. APFIC, 2012. Funge-Smith, S., Briggs, M. & Miao, W. (2012). Regional overview of fisheries and aquaculture in Asia and the Pacific 2012. Asia-Pacific Fishery Commission, FAO Regional Office for Asia and the Pacific. RAP Publication 2012/26. 139 pp.
10. Aswathy, N and Sathiadhas, R and Narayanakumar, R and Shyam, S Salim, 2012. Marketing and utilization of marine by catch: Problems and prospects. *Journal of Fisheries Economics and Development* , 12 (2). pp. 1-8.
11. Ballance L.T.R; Anderson C; Pitman R. L; Stafford K.; Shaan A.; Waheed Z. and Brownell R. L., 2001. Cetacean sightings around the Republic of the Maldives, April 1998. *J. CETACEAN RES. MANAGE.* 3(2): 213–218, 2001
12. Bangladesh Forest Department -<http://www.bforest.gov.bd/index.php/forest-category/mangrove-forests>. Downloaded on 12/08/2014
13. Bax, N., Williamson, A., Aguero, M., Gonzalez., Geeves, W., 2003. Marine invasive species: a threat to global biodiversity. *Marine Policy*, 27: 313-323.
14. Bladon, A. Essam, Y. M, and E. J. Milner-Gulland, 2014. International Institute for Environmental and Development (IIED). A Review of Conservation Trust Funds for Sustainable Marine Resources Management: Conditions for Success, IIED, UK 2014.
15. Biju Kumar, A., and Deepthi G.R., 2006. Trawling and by-catch: Implications on marine ecosystem. *Current Science*, Vol. 90, No7.
16. BirdLife International., 2005. Important Bird Areas and potential Ramsar Sites in Asia. Cambridge, UK: BirdLife International.
17. BirdLife International. Fact sheet on Central Asian Flyway  
[http://www.birdlife.org/datazone/userfiles/file/sowb/flyways/7\\_Central\\_Asia\\_Factsheet.pdf](http://www.birdlife.org/datazone/userfiles/file/sowb/flyways/7_Central_Asia_Factsheet.pdf)

18. Biswas S. R., Choudhury J.K., Nishat A., Rahman M.R., 2007. Do invasive plants threaten the Sundarbans mangrove forest of Bangladesh? *Forest Ecology and Management* 245 (2007) 1–9
19. BOBLME, 2014. Strategic Action Programme. Bay of Bengal Large Marine Ecosystem Project. 52 pp. In press
20. BOBLME, 2013. Country report on pollution - Sri Lanka BOBLME-2011-Ecology-14
21. BOBLME., 2012. Fisheries, Marine Environment and Integrated Coastal Management Policy Processes, Content and Implement in the BOBLME Countries. Governance-03.  
<http://www.boblme.org/documentRepository/BOBLME-2012-Governance-03.pdf>
22. BOBLME, 2012a. Transboundary Diagnostic Analysis, Volume 1: Issues, Proximate and Root Causes. Bay of Bengal Large Marine Ecosystem project.
23. BOBLME, 2012b. Transboundary Diagnostic Analysis, Volume 2: Background and Environmental Assessment
24. BOBLME, 2010. Coastal pollution loading and water quality criteria – Maldives. BOBLME-2010-Ecology-06.
25. Borisy, Gary. Woods Hole Marine Biological Laboratory, Woods Hole, MA, USA on Oceans Day, Copenhagen, December 14, 2009.
26. Brown B.E., 1997. Integrated Coastal Management: South Asia. Department of Marine Sciences and Coastal Management, University of Newcastle, Newcastle, UK
27. Burke L., Kura Y., Kassem K., Revenga C., Spalding M., and Mc Allister D., 2001. Pilot Analysis of Global Ecosystems: Coastal Ecosystems. World Resources Institute [http://pdf.wri.org/page\\_coastal.pdf](http://pdf.wri.org/page_coastal.pdf)
28. CCD, 2006. Revised Coastal Zone Management Plan, Sri Lanka. Coast Conservation Department and the Ministry of Fisheries and Aquatic Resources Development, Sri Lanka.
29. CIA, 2014. World Fact book - [https://www.cia.gov/library/publications/the-world-factbook/wfbExt/region\\_sas.html](https://www.cia.gov/library/publications/the-world-factbook/wfbExt/region_sas.html)
30. Chan, S., Crosby, M. J., Islam M. Z. and Tordoff, A. W., 2004. Important Bird Areas in Asia: Key Sites for Conservation. BirdLife International. <http://www.birdlife.org/datazone/info/ibasasia>
31. Climate Change Division/GoP. 2014. Fifth National Report. Progress on CBD Strategic Plan 2010-2020 and Aichi Biodiversity Targets. <http://www.cbd.int/doc/world/pk/pk-nr-05-en.pdf>
32. Center for Marine Biodiversity. What is Marine Biodiversity. Centre for Marine Biodiversity
33. Bedford Institute of Oceanography, Canada <http://www.marinebiodiversity.ca/cmb/education/what-is-marine-biodiversity>
34. Conservation Finance Alliance, 2014. Park Bonds: A new mechanism to secure the long-term financing of Protected Area networks by Benjamin Landreau, May, 2014  
<http://conservationfinance.org/news.php?id=246>
35. Convention on Biodiversity, Strategic Plan for Biodiversity 2011-2020, paragraph 5 of decision X/2.  
<http://www.cbd.int/nbsap/related-info/region-bsap/>
36. Convention on Biodiversity XI Conference of Parties. 2012. Hyderabad, India. Press Brief on Marine and Coastal Biodiversity. <http://www.cbd.int/cop/cop-11/doc/cop-11-media-press-brief-marine.pdf>
37. Coral Triangle Initiative On Coral Reefs, Fisheries And Food Security (Cti-Cff). Regional Plan of Action, May, 2009.  
[http://www.coraltriangleinitiative.org/sites/default/files/resources/CTI%20Regional%20Plan%20of%20Action\\_June%2023%202009.pdf](http://www.coraltriangleinitiative.org/sites/default/files/resources/CTI%20Regional%20Plan%20of%20Action_June%2023%202009.pdf)
38. CPCB. 2009. Status of water supply, wastewater generation and treatment in Class-I cities & Class-II towns of India. Control of Urban Pollution Series: CUPS/ 70 / 2009 – 10
39. DFID, 2005. Decentralised domestic wastewater and faecal sludge management in Bangladesh. An output from a DFID funded research project (ENG KaR 8056)
40. de Boer M.N., Baldwin R., Burton C.L.K., Eyre E.L., Jenner K.C.S, Jenner M-N.M., Keith S.G., McCabe K.A., Parsons E.C.M., Peddemors V.M., Rosenbaum H.C., Rudolph P. and Simmonds M. P., 2003. Cetaceans in the Indian Ocean Sanctuary: A Review: A WDCS Science report.
41. Dineshababu, A.P, 2013. The trawl fishery of the Eastern Arabian Sea, presented at the APFIC Regional Expert Workshop on Tropical Trawl Fishery Management, 30th September 4th October 2013, Phuket, Thailand
42. de Silva, S.S., N.W. Abery & T.T.T. Nguyen, 2006. An evaluation of the role and impacts of alien finfish in Asian inland aquaculture. *Aquaculture Research* 37: 1–17

43. FAO, 2012. The State of Fisheries and Aquaculture. FAO Fisheries and Aquaculture Department. Food and Agriculture Organization of the United Nations, Rome, 2012
44. FAO, 2011. Current world fertilizer trends and outlook to 2015. Food and Agriculture Organization of the United Nations, Rome, 2011
45. FAO, 2009. The State of World Fisheries and Aquaculture 2008. FAO Fisheries and Aquaculture Department. <ftp://ftp.fao.org/docrep/fao/011/i0250e/i0250e.pdf>
46. FAO, 2007. The world's mangroves 1980-2005: A thematic study prepared in the framework of the global forest resources assessment 2005. FAO Forestry Paper 153. FAO, Rome, Italy. <ftp://ftp.fao.org/docrep/fao/010/ai444e/ai444e00.pdf>
47. FAO UNEP, 2010. Report of the FAO/UNEP Expert Meeting on Impacts of Destructive Fishing Practices, Unsustainable Fishing, and Illegal, Unreported and Unregulated (IUU) Fishing on Marine Biodiversity and Habitats. Rome, 23–25 September 2009. FAO Fisheries and Aquaculture Report. No. 932. Rome, FAO. 2010. 32p
48. FAO, 2005. Review of the state of world marine fishery resources. Food and Agricultural Organization of the United Nations. <ftp://ftp.fao.org/docrep/fao/007/y5852e/Y5852E00.pdf>
49. Farooqui, Z. 2014. Mangroves of Keti-Bunder, Indus Delta; A present Status. European Scientific Journal May 2014 /SPECIAL/ edition ISSN: 1857 – 7881 (Print) e - ISSN 1857- 7431. Retrieved 2 Dec 2014 - <http://eujournal.org/index.php/esj/article/view/3255>
50. Forest Survey of India, 2013. India State of Forest Report 2013. [http://fsi.nic.in/details.php?pgID=mn\\_93](http://fsi.nic.in/details.php?pgID=mn_93)
51. Green, E.P., and Short, F.T., 2003. World Atlas of Seagrasses. Prepared by the UNEP World Conservation Monitoring Centre. University of California Press, Berkeley, USA.
52. Hiddink J.G., Jennings S. and Kaiser M.J., 2006. Indicators of the ecological impact of bottom-trawl disturbance on seabed communities. *Ecosystems* 9 1190-1199.
53. Hoyt, Erich, 2011. Marine Protected Areas for Whales, Dolphins and Porpoises. A World Handbook for Cetacean Habitat Conservation and Planning
54. Ilangakoon A., 2012. Dugong Conservation a Critical Issue in Sri Lanka. [http://repository.kulib.kyoto-u.ac.jp/dspace/bitstream/2433/154046/1/11thseastar\\_29.pdf](http://repository.kulib.kyoto-u.ac.jp/dspace/bitstream/2433/154046/1/11thseastar_29.pdf)
55. Ilangakoon, A., 2006. Taxonomy and current status of marine mammals in Sri Lanka. pp.302–08. In: Bambaradeniya, C.N.B. (eds). The Fauna in Sri Lanka: Status of Taxonomy, Research and Conservation. IUCN, Sri Lanka Country Office, Colombo. 308pp.
56. IUCN Red List of Threatened Species. Version 2013.2. <[www.iucnredlist.org](http://www.iucnredlist.org)>. Downloaded on 08 May 2014.
57. IUCN, 2012. Bangladesh establishes three New Wildlife Sanctuaries. <http://www.iucn-csg.org/index.php/2012/03/01/three-new-wildlife-sanctuaries-for-ganges-river-and-irrawaddy-dolphins-declared-by-the-government-of-bangladesh/>).
58. IUCN, 2009. Marine Menace. Alien invasive species in the marine environment
59. IUCN, CORDIO and ICRAN, 2008. Managing Marine and Coastal Protected Areas: A toolkit for South Asia.
60. IUCN, 2005. A Report on the Terrestrial Assessment of Tsunami Impacts on the Coastal Environment in Rekawa, Ussangoda And Kalametiya (Ruk) Area of Southern Sri Lanka.
61. Iftikhar, U., 2002. Valuing the economic costs of environmental degradation due to sea intrusion in the Indus Delta', in IUCN, Sea Intrusion in the Coastal and Riverine Tracts of the Indus Delta - A Case Study IUCN - The World Conservation Union Pakistan Country Office, Karachi. <http://www.cbd.int/financial/values/pakistan-valueindus.pdf>
62. ITTO Tropical Forest Update, 2012. Mapping mangroves. Special edition summarizing the findings of the 2010 World Atlas of Mangroves A newsletter from the International Tropical Timber Organization to promote the conservation and sustainable development of tropical forests.
63. Jayachandran, P.R., Bijoy Nandan, S. and Sreedevi, O.K., 2012. Water quality variation and nutrient characteristics of Kodungallur-Azhikode Estuary, Kerala, India. *Indian J. Geo-Marine Sciences*. 41: 180-187
64. Joseph L., 2003. National Report of Sri Lanka on the Formulation of a Transboundary Diagnostic Analysis and Strategic Action Plan for the Bay of Bengal Large Marine Ecosystem Programme. [http://www.fao.org/fi/boblme/website/nat\\_rep/Nat\\_Sri%20Lanka.PDF](http://www.fao.org/fi/boblme/website/nat_rep/Nat_Sri%20Lanka.PDF)

65. Jayaweera, M.W., 2003. Quoted by Joseph, L., 2003. National Report of Sri Lanka on the Formulation of a Transboundary Diagnostic Analysis and Strategic Action Plan for the Bay of Bengal Large Marine Ecosystem Programme. BOBLME Report, 114pp
66. Kiani, M.S., Iqbal, P. & Siddiqui, J.A. 2011. First confirmation of occurrence of the pan-tropical spotted dolphin, *Stenella attenuate*, in Pakistani waters through a mass stranding event. *Mar. Biodivers. Rec.* 4(e60): 1-3 <http://iwc.int/private/downloads/3fz57t5mrso44g8gg4sc8kooo/SC-64-E2-Final.pdf>
67. Kirby, J. (2010). Review 2: Review of Current Knowledge of Bird Flyways, Principle Knowledge Gaps and Conservation Priorities., CMS Scientific Council: Flyway Working Group Reviews.
68. Kallesøe, M. F., Bambaradeniya, C. N. B., Iftikhar, U. A., Ranasinghe, T. and S. Miththapala, 2008. Linking Coastal Ecosystems and Human Well-Being: Learning from conceptual frameworks and empirical results. Colombo: Ecosystems and Livelihoods Group, Asia, IUCN. viii + 49 pp.
69. Khan N. A., 2001. Regional Study on Forest Policy and Institutional Reform Final Report of the Bangladesh Case Study. Asian Development Bank <http://adb.org/documents/events/2001/forestpolicy/banfinalreport.pdf>
70. Keating, B. H., and C. Helsley, 2005. 2004 Indian Ocean Tsunami on the Maldives Islands: Initial Observations. *Science of Tsunami Hazards* 23: 19-69.
71. Giri, C., Zhu, Z., Tieszen, L.L., Singh, A., Gillette, S., Kelmelis, J.A., 2008. Mangrove forest distributions and dynamics (1975–2005) of the tsunami-affected region of Asia†. *Journal of Biogeography* 35, 519–528.
72. Long, B. G., C. Amarasiri, A. Rajasuriya, D. C. T. Dissanayake, U. S. P. K. Liyanage, R. P. P. K. Jayasinghe, A. A. S. H. Athukoorala, K. M. B. C. Karunathileke, H. S. G. Fernando, and W. V. A. T. D. Fernando, 2010. SRI LANKA FISHERIES ATLAS - VOLUME 1 - Status of Resources, fisheries management initiatives on sea cucumber, chank, lobster, shrimp and marine aquarium fish in the northwest, south and east coast of Sri Lanka. National Aquatic Resources Research and Development, Colombo 15, Sri Lanka.
73. Marsh, H. 2008. Dugong dugon. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. <[www.iucnredlist.org](http://www.iucnredlist.org)>. Downloaded on 08 May 2014.
74. Marsh Helene., Penrose H., Erose C., Hugues J, 2002. Dugong Status Report and Action Plans for Countries and Territories. UNEP/DEWA/RS.02-1 - <http://www.unep.org/NairobiConvention/docs/dugong.pdf>
75. Macintosh D. J. and Ashton E. C. 2002. A Review of Mangrove Biodiversity Conservation and Management. [http://www.biology.au.dk/cenTER/MCB\\_Files/2002\\_Review\\_WB\\_MCB\\_Final.pdf](http://www.biology.au.dk/cenTER/MCB_Files/2002_Review_WB_MCB_Final.pdf)
76. Martin, G.D., Nisha, P.A., Balachandran, K.K., Madhu, N.V., Nair, M., Shaiju, P., Joseph, T., Srinivas, K. and Gupta, G.V.M., 2011. Eutrophication induced changes in benthic community structure of a flow-restricted tropical estuary (Cochin backwaters), India. *Environ. Monit. Assess.* 176: 427-438
77. MEE/GOM, 2012. Maldives as a Biosphere Reserve. An Implementation Plan 2013-2017 <http://www.cbd.int/doc/world/mv/mv-biosphere-reserve-en.pdf>
78. MOEFCC/GOI, 2014. India's Fifth National Report to the Convention on Biological Diversity. <http://www.cbd.int/doc/world/in/in-nr-05-en.pdf>  
MERE/GOSL, 2014. Sri Lanka's Fifth National Report to the Convention on Biological Diversity <http://www.cbd.int/doc/world/lk/lk-nr-05-en.pdf>
79. MoHE/ GoM, 2010. Fourth National Report to the Convention on Biological Diversity, Ministry of Housing and Environment Maldives.
80. MOEFCC/GOB, 2010. Fourth National Report to the Convention on Biological Diversity <http://www.cbd.int/doc/world/bd/bd-nr-04-p1-en.pdf>
81. MoE/ GoP, 2000. Biodiversity Action Plan for Pakistan. Government of Pakistan, WWF and IUCN
82. MoTAC/GoM, 2013. Tourism Year Book 2013. Ministry of Tourism, Arts and Culture. Republic of Maldives [http://www.tourism.gov.mv/pubs/Yearbook\\_2013.pdf](http://www.tourism.gov.mv/pubs/Yearbook_2013.pdf)
83. Ministry of Earth Sciences/GOI, 2014. National Report for the Workshop, under the Auspices of the United Nations, in Support of the Regular Process for Global Reporting and Assessment of the State of the Marine Environment, Including Socio-economic Aspects 27-28 January 2014 Chennai, India. Organized by the National Institute of Oceanography
84. Mohanty P.K., and Otta, S.N., 2008. Dolphins of Chilika. *Chilika Review* –June 2008. <http://orissa.gov.in/e-magazine/Orissareview/2008/June-2008/engpdf/Pages21-26.pdf>

85. MoEFCC/GoI, 2005. Report of the Committee Chaired by Prof. M.S. Swaminathan to Review the Coastal Regulation Zone Notification, 1991. Ministry of Environment & Forests, New Delhi.  
[http://envfor.nic.in/mef/crz\\_report.doc](http://envfor.nic.in/mef/crz_report.doc)
86. Namboothri, N., D. Subramanian, A. Sridhar, S. Rodriguez, M. Menon, and K. Shanker. 2008.
87. Policy Brief: Sand Dunes. UNDP/UNTRIS, Chennai and ATREE, Bangalore, India, 12 p  
[http://www.seaturtlesofindia.org/downloads/Policy%20Brief\\_Sand%20dunes.pdf](http://www.seaturtlesofindia.org/downloads/Policy%20Brief_Sand%20dunes.pdf)
88. Naqvi, S.W.A., Jayakumar, D.A., Narvekar, P.V., Naik, H., Sarma, V.V.S.S., D'Souza, W., Joseph, S. and George, M. D., 2000. Increased marine production of N<sub>2</sub>O due to intensifying anoxia on the Indian continental shelf, *Nature*, 408, 346–349.
89. Naqvi, S.W.A., Naik, H., Jayakumar, D.A., Pratihary, A., Narvekar, G., Kurian, S., Agnihotri, R., Shailaja, M.S. and Narvekar, P.V., 2009. Seasonal anoxia over the western Indian continental shelf. In *Indian Ocean: Biogeochemical Processes and Ecological Variability*. Wiggert, J.D., Hood, R R., Naqvi, S.W.A., Brink, K.H. and Smith, S.L. (Eds.) *Geophys. Monogr. Ser.*, 185, American Geophysical Union, Washington, D.C., pp. 333–345, 2009.
90. Nelleman et al., 2011. Blue Carbon Policy Options Assessment. The Linden Trust for
91. Neumann-Denzau G and Denzau H., 2010. Examining the Extent of Human-Tiger Conflict in the Sundarbans Forest, Bangladesh. *Tigerpaper*. Vol 37 No.2 April-June 2010
92. Obura, D.O., Tamelander, J., & Linden, O. (eds.), 2008. Ten years after bleaching – facing the consequences of climate change in the Indian Ocean. *CORDIO Status report 2008*. *CORDIO (Coastal Oceans Research and Development in the Indian Ocean)/Sida – SAREC*. Mombasa.  
<http://www.cordioea.org>. 489 pp.
93. Pernetta JC, 1993. Marine Protected Area needs in South Asian Seas Region. Volume 2: India. A Marine Conservation and Development Report, IUCN, Gland, Switzerland
94. Pernetta JC, 1993. Marine Protected Area needs in South Asian Seas Region. Volume 1: Bangladesh. A Marine Conservation and Development Report, IUCN, Gland, Switzerland.
95. Pernetta JC, 1993b. Marine Protected Area needs in South Asian Seas Region. Volume 5: Sri Lanka. A Marine Conservation and Development Report, IUCN, Gland, Switzerland.
96. Puthucherril T.G., 2008. Ballast Waters and Aquatic Invasive Species: A Model for India. *Colo. J. Int'l Env'tl. L. & Poliy*. Vol. 19:3
97. Polidoro BA, Carpenter KE, Collins L, Duke NC, Ellison AM, et al., 2010. The Loss of Species: Mangrove Extinction Risk and Geographic Areas of Global Concern. *PLoS ONE* 5(4): e10095.  
doi:10.1371/journal.pone.0010095
98. Rajagopalan R & Lakshmi Ahana, 2003. A Comparative Review of Coastal Legislation in South Asia. *UNEP Global Programme of Action (GPA) for the Protection of marine environment from land-based activities and the Indian Institute of Oceanography*  
[http://www.gpa.unep.org/documents/PADH/Legislation\\_Study\\_FINAL\\_Report\\_2003.pdf](http://www.gpa.unep.org/documents/PADH/Legislation_Study_FINAL_Report_2003.pdf)
99. Rajasuriya A., Zahir H., Venkataraman K, Islam Z., and Tamelander J., 2004. Status of Coral Reefs in South Asia: Bangladesh, Chagos, India, Maldives and Sri Lanka. In Clive Wilkinson (eds): *Status of the Coral Reefs of the World: 2004*. Volume 1. pp. 213-234
100. Rajasuriya A., Maniku M.H., Subramanian BR and Rubens J. 1998. South Asia: A Review of the progress in implementation of management actions for the conservation and sustainable development of coral reef ecosystems in South Asia. *Proceedings of the International Tropical Marine Ecosystem Management Symposium, 1998, Townswell, Australia*. Pp 86-116
101. Roberts C. M., McClean C. J., Veron J. E. N., Hawkins J. P., Allen G. R., McAllister D. E., Mittermeier C. G., Schueler F. W., Spalding M., Wells F., Vynne C., Werner T. B., 2002. Marine Biodiversity Hotspots and Conservation Priorities for Tropical Reefs, *Science* 295: 1280-1284
102. SACEP, 2014. Nutrient Loading and Eutrophication of Coastal waters of the South Asia Seas– A Scoping study. Final draft
103. SACEP, 1995. The South Asian Seas Action Plan. <http://www.sacep.org/pdf/SAS%20Action%20Plan.pdf>.  
Downloaded on 5/8/2014
104. Sattar S.A., Anderson R.C. and Adam M.S. (compilers), 2009. Report of the Indian Ocean Cetacean Symposium 2009, held at Paradise Island Resort and Spa, Maldives, 18-20 July 2009. *Marine Research*

- Centre, Maldives. 46 pp. Revised edition 2012. [www.mrc.gov.mv](http://www.mrc.gov.mv)  
<http://www.boblme.org/documentRepository/2009%20Indian-Ocean-Cetacean-Symposium-Report.pdf>
105. Shanker K., 2004. Marine turtle status and conservation in the Indian Ocean. Papers Presented at the Expert Consultation on Interactions Between Sea Turtles and Fisheries Within an Ecosystem Context Rome, 9-12 March 2004.  
[http://www.fao.org/documents/show\\_cdr.asp?url\\_file=/docrep/007/y5750e/y5750e06.htm](http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/007/y5750e/y5750e06.htm)
106. Seitzinger, S. P., et al., 2010. Global river nutrient export: A scenario analysis of past and future trends, *Global Biogeochem. Cycles*
107. Spalding Mark., Kainuma Mami and Collins Lorna, 2010. *World Atlas of Mangroves*.
108. Spalding M.D; Ravilous C., and Green E.P., 2001. *World Atlas of Coral Reefs*. UNEP - World Conservation and Monitoring Centre. PP 212 - 225
109. Survey Department, 2007. *National Atlas of Sri Lanka*. Second Edition
110. Selig et al, 2014. *Global Priorities for Marine Biodiversity Conservation*.
111. Shah-e-Alam Mohamed, 2011. Country Report- Overview of the population status, conservation and management of Dugong and their habitats in Bangladesh.  
<http://www.cms.int/sharks/sites/default/files/document/Bangladesh%20Jun%202011.pdf>
112. Sivakumar, K. and Nair, A., 2013: Dugong Distribution, Habitat and Risks Due to Fisheries and Other Anthropogenic Activities in India. Wildlife Institute of India –Technical Report. 74 pp.  
[http://www.wii.gov.in/images/images/documents/rr\\_ass\\_dugong\\_dist\\_2013.pdf](http://www.wii.gov.in/images/images/documents/rr_ass_dugong_dist_2013.pdf)
113. Smith, B.D. & Braulik, G.T., 2012. *Platanista gangetica*. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. <[www.iucnredlist.org](http://www.iucnredlist.org)>. Downloaded on 08 May 2014.
114. Steiner, A., 2014. "Bringing the Green Economy to the Blue World: Healthy Oceans are a Lifeline for Sustainable Living and Robust Economies" *The Economist*, February, 2014
115. Uddin A. M. K., 2004. Areas with Special Status in the Coastal Zone. Working Paper WP030. Program Development Office for Integrated Coastal Zone Management Plan (PDO-ICZMP)
116. UNDP, 2014. Human Development Report 2014. Sustaining Human Progress: Reducing Vulnerabilities and Building Resilience - <http://hdr.undp.org/sites/default/files/hdr14-report-en-1.pdf>
117. UNEP, 2010. State of Biodiversity in Asia and the Pacific. Division of Environmental Law and Conventions. Nairobi, Kenya
118. UNEP, 2006. Marine and coastal ecosystems and human well-being: A synthesis report based on the findings of the Millennium Ecosystem Assessment. UNEP. 76pp  
[http://www.unep.org/pdf/Completev6\\_LR.pdf](http://www.unep.org/pdf/Completev6_LR.pdf)
119. UN ECOSOC (2017c). Fifth Meeting of the Inter-Agency and Expert Group on the Sustainable Development Goal Indicators 30 – 31 March 2017. Tier Classification for Global SDG Indicators. Available at <https://unstats.un.org/sdgs/meetings/iaeg-sdgs-meeting-05/>
120. US Agency for International Development (USAID), 2012. Tetra Tech ARD Inc, Summary Report: Regional Exchange on Designing and Supporting National and Regional MPA Systems in the Coral Triangle Denpasar, Indonesia March 26-30, 2012 US CTI Support Program Document No. 06B-USCTI-12
121. Van Lavieren, H., Spalding, M., Alongi, D., Kainuma, M., Clüsener-Godt, M., and Adeel, Z. 2012. Securing the Future of Mangroves. A Policy Brief. UNU-INWEH, UNESCO-MAB with ISME, ITTO, FAO, UNEP-WCMC and TNC. 53 pp.
122. Vivekenandan, E., 2013. The trawl Fisheries of the western Bay of Bengal, presented at the APFIC Regional Expert Workshop on Tropical Trawl Fishery Management, 30th September - 4th October 2013, Phuket, Thailand
123. Venkataraman K., 2003: Marine Ecosystems of India. In K Venkataraman (eds) *Natural Aquatic Ecosystems of India*. Thematic Biodiversity Strategy and Action Plan. The National Biodiversity Strategy Action Plan, India. 57-140
124. Wabnitz, C., Taylor, M., Green, E., Razak, T., 2003. *From Ocean to Aquarium*. UNEP-WCMC, Cambridge, UK  
<https://portals.iucn.org/library/efiles/edocs/Bios-Cons-Wil-Util-023.pdf>
125. Wafar, Mohideen; Venkataraman, Krishnamurthy; Ingole, Baban; Khan, Syed Ajmal; LokaBharathi Ponnappakkam, 2011. State of Knowledge of Coastal and Marine Biodiversity of Indian Ocean Countries. <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0014613#pone-0014613-g004>

126. Wallace BP, DiMatteo AD, Bolten AB, Chaloupka MY, Hutchinson BJ, et al., 2011. Global Conservation Priorities for Marine Turtles. PLoS ONE 6(9): e24510. doi:10.1371/journal.pone.0024510
127. Wells S., Dwivedi S. N., Singh S., Ivan R. , 1995: Marine Region 10: Central Indian Ocean. In A Global Representative System of Marine Protected Areas: Volume III- Central Indian Ocean, Arabian Seas, East Africa and East Asian Seas <http://www.deh.gov.au/coasts/mpa/nrsmpa/global/volume3/chapter10.html>
128. Wilkinson, C, 2008. Status of Coral Reefs of the World: 2008. Global Coral Reef Monitoring Network and Reef and Rainforest Research Centre. Townsville, Australia.
129. Wilkinson, C., Souter, D. and Goldberg, J. (eds), 2006. Status of Coral Reefs in Tsunami Affected Countries: 2005. Australian Institute of Marine Science, pp. 154
130. World Resource Institute, 2014. Eutrophic and Hypoxic Areas in Asia [http://www.wri.org/sites/default/files/asia\\_20dec2010.jpg](http://www.wri.org/sites/default/files/asia_20dec2010.jpg) - downloaded on 20th August 2014
131. Wilson, E.O. "Biophilia", 1984 p 121 [EO Wilson quote from his memoir, "Biophilia" (Cambridge: Harvard University Press, 1984, p. 121)]
132. WIOMSA Webpage Managing Marine Protected Areas: A TOOLKIT for the Western Indian Ocean. Retrieved September 2014 [http://wiomsa.org/mpatoolkit/Themesheets/E4\\_Environmental\\_trust\\_funds.pdf](http://wiomsa.org/mpatoolkit/Themesheets/E4_Environmental_trust_funds.pdf)
133. World Resources Institute, 2005. Millennium Ecosystem Assessment, Ecosystems and Human Well-being: Biodiversity Synthesis. Washington, DC
134. WWF Webpage - What are the major reasons why we are losing so much biodiversity, Retrieved September 2014 [http://wwf.panda.org/about\\_our\\_earth/biodiversity/threatsto\\_biodiversity/](http://wwf.panda.org/about_our_earth/biodiversity/threatsto_biodiversity/)
135. WWF, 2014. Conservation Finance. <https://www.worldwildlife.org/initiatives/conservation-finance>