

YSLME SAP

(6th Draft)

Updated as of October 14 by RWGs of YSLME Phase II Projects

Table of Contents

Acknowledgement	iv
Executive Summary	v
1 Introduction	1
1.1 An Updated SAP for the YSLME	1
1.2 A Vision and Mission for the Future of the YSLME	1
1.3 The Purpose, Scope, and Approach of the SAP	2
2 The Technical Basis for the YSLME SAP.....	2
2.1 Socioeconomic and Environmental Contexts	2
2.2 Priority Transboundary Problems.....	3
2.2.1 Overfishing and Unsustainable Mariculture	4
2.2.2 Pollution.....	4
2.2.3 Ecosystem Changes.....	5
2.2.4 Biodiversity Loss.....	5
2.3 Formulating Solution Strategies.....	5
3 Strategic Actions for the YSLME.....	6
3.1 Goal 1: Ensure Sustainable Fisheries and Aquaculture.....	7
3.1.1 Target 1: Create and Maintain a Sustainable Capture Fishery	7
3.1.2 Target 2: Develop a Sustainable and Economically Robust Mariculture Industry.....	8
3.1.3 Target 3: Build Social Safeguards into Development of a Sustainable Marine Food Supply	8
3.2 Goal 2: Protect the Marine Environment	9
3.2.1 Target 4: Reduce Discharges of Contaminants including Nutrients	9
3.2.2 Target 5: Reduce Exposure to Pathogens and Emerging Contaminants in the Marine Environment.....	10
3.2.3 Target 6: Control and Manage Marine Litter and Microplastics.....	10
3.3 Goal 3: Improve Ecosystem Resilience	11
3.3.1 Target 7: Assess and Adapt to Long Term Changes in the Marine Ecosystem	11
3.3.2 Target 8: Conserve and Improve Biodiversity and Habitats	12
3.3.3 Target 9: Prevent and Reduce Marine Disasters	12
3.3.4 Target 10: Control and Prevent Invasive Species.....	13
4 Enabling Conditions for the YSLME SAP.....	14
4.1 Formulate and Implement Laws and Regulations	14
4.1.1 Coordinated Implementation of International Conventions	14
4.1.2 Develop Regional Guidelines	15
4.1.3 Transform International Conventions and Agreements into Domestic Laws.....	15

YSLME SAP
Draft October 14, 2020

4.2	Improve Regional Governance Mechanisms	15
4.2.1	Perfect Regional Governance Mechanisms	15
4.2.2	Enhance Governance Capacity.....	16
4.2.3	Strengthen Public Participation	16
4.3	Mainstream Gender in Management Actions	16
4.4	Incorporate Public Awareness and Education as Drivers of Success.....	16
5	Monitoring and Evaluation	17
5.1	Monitoring and Evaluation Indicators	17
5.2	Monitoring and Evaluation Mechanisms	18
6	References	18

Acknowledgement

The update of the YSLME Strategic Action Programme (SAP) was supported by the UNDP/ GEF YSLME Phase II Project and the Governments of PR China and RO Korea under the overall coordination of the Project Management Office led by the Project Manager, Yinfeng Guo, and Environmental Economist, Sangjin Lee, with technical assistance of Professor Paul Gremillion from Northern Arizona University, United States of America. The process of updating the SAP builds on work to update the TDA, with significant consultations by the National Working Groups (NWGs) of PR China and RO Korea. NWGs developed documents prioritizing national goals, targets, and management actions. Ming Yu of Ocean University of China drafted the legal and institutional safeguards in Section 4 and Jing Wang of Global Environment Institute of PR China contributed to integrating nature-based solutions in the SAP. All these were combined into this regional SAP document, which was edited and consolidated by Professor Paul Gremillion and reviewed by the NWGs.

Special thanks are extended to these colleagues for professionally leading the national review of the NSAP and updated TDA report: Bin Wang, Director General of Department of Marine Strategic Planning and Economy of the Ministry of Natural Resources of PR China; Zhifeng Zhang, Deputy Director General of National Marine Environmental Monitoring Center (NMEMC) of the Ministry of Ecology and Environment of PR China; Jae Ryoung Oh, National Coordinator of the YSLME Phase II Project of RO Korea and Adviser of Korea Institute of Ocean Science and Technology (KIOST) and Hyun Hee Ju, Principal Research Specialist of Ocean Policy Institute, KIOST of RO Korea.

Contributions from below experts are acknowledged in the TDA review and SAP update: **PR China** (in alphabetical order): Xiping Chen; Min Fan; Jinghui Fang; Jianguang Fang; Jiangchun Guan; Hao Guo; Chuan Jia; Xianshi Jin; Yue Jin, Shenghao Liu; Ping Qi; Fangyuan Qu; Xiujuan Shan; Heyun Xu; Juying Wang; Lijun Wang; Shouqiang Wang; Xiaocheng Wang; Yan Wang; Quan Wen; Shanshan Wu; Fan Yang; Ziwei Yao; Dan Yi; Limin Yu; Ting Zhang; Weiwei Zhang; Zhaohui Zhang; Zhendong Zhang; Linlin Zhao; and **RO Korea** (in alphabetical order): Joon Young Chang; Junghee Cho; Keun-Hyung Choi; Sun Wook Hong; Yang Jae Im; Se-Jong Ju; Jung Hoon Kang; Chang Soo Kim; Hyung Chul Kim; Hyung Won Kim; Kyung Shin Kim; Bong Oh Kwon; Hyun Jeong Lim; Gyung Soo Park; Mi-seon Park; and Wonduk Yoon.

The Project Management Office appreciates the enthusiastic support of Jose Padilla, Regional Technical Adviser of UNDP Regional Hub for Asia and Pacific, Chaode Ma, Program Director of UNDP China and Katrin Lichtenberg, Vienna Representative and Head of Programme of WEC, UNOPS. Warm thanks are also extended to Jayeon Kim, Jeenho Mok and Zhengguang Zhu for assisting in coordinating the TDA and SAP update, and Jae Ryoung Oh, Bin Wang and John Castillo for editorial and design/layout assistance.

Executive Summary

The Strategic Action Programme (SAP) is a policy document negotiated by the governments of the People's Republic of China (PR China) and the Republic of Korea (RO Korea) in responding to the transboundary marine environmental challenges in the Yellow Sea and achieving the vision and mission of the YSLME regional mechanism. The TDA was completed in July 2020 and is the primary source of scientific and technical information for the recommended strategic actions presented. This document provides the 3 goals, 10 targets and enabling measures to anticipate the continued management of the YSLME for the decade ahead:

Goal 1: Ensure Sustainable Fisheries and Aquaculture

1. Create and Maintain a Sustainable Capture Fishery
2. Develop a Sustainable and Economically Robust Mariculture Industry
3. Build Social Safeguards into Development of a Sustainable Marine Food Supply

Goal 2: Protect the Marine Environment

4. Reduce Discharges of Nutrients and Contaminants
5. Reduce Exposure to Pathogens and Emerging Contaminants in the Marine Environment
6. Control and Manage Marine Litter and Microplastics

Goal 3: Improve Ecosystem Resilience

7. Assess and Adapt to Long Term Changes in the Marine Ecosystem
8. Conserve and Improve Biodiversity and Habitats
9. Prevent and Reduce Marine Disasters
10. Control and Prevent Invasive Species

In addition to the goals and targets, this document also illustrates 26 management actions to achieve the targets agreed by both countries. Specific performance indicators to monitor and evaluate the proposed strategic actions under each goal are also outlined.

The SAP represents a significant step toward the protection, conservation, and restoration of the ecosystem health, natural resources and environment of the YSLME as enshrined in the vision. The SAP will support the future development of National Strategic Action Plans (NSAPs) of both PR China and RO Korea, to further strengthen regional cooperation and relevant institutions.

1 Introduction

In 2014, The Yellow Sea Large Marine Ecosystem (YSLME) Phase II Project of the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF) was implemented to support the efforts of the People's Republic of China (PR China) and the Republic of Korea (RO Korea) in addressing the transboundary marine environmental challenges. The goal of the project was to achieve adaptive ecosystem-based management of the YSLME by fostering long-term sustainable institutional, policy, and financial arrangements in accordance with the YSLME Strategic Action Programme (SAP). The YSLME Phase II project closes in 2020. This document provides an updated SAP to anticipate the continued management of the YSLME for the decade ahead.

1.1 An Updated SAP for the YSLME

The first YSLME SAP was developed in the YSLME Phase I project and endorsed in November 2009. The management actions were intended to plan for the period 2010 to 2020. The YSLME Phase II project used the 2009 SAP document as an overarching framework for PR China and RO Korea to develop national strategic action plan (NSAPs). Implementation of NSAPs was made possible by the Phase II projects and funding leveraged by the project through 20120

As the YSLME Phase II project drew to a close in 2020, updates to the YSLME Transboundary Diagnostic Analysis (TDA) and SAP were conducted. These updates drew upon new knowledge, insights, and perspectives gained through the YSLME Phase II project and new approaches developed by the international community.

A key element of the TDA update was to conduct a new causal chain analysis (CCA). Causal chains provide linkages that connect the primary environmental problems in the Yellow Sea with their immediate, underlying, and root causes. This causal analysis is useful in connecting the technical information gathered in the TDA process with the more policy-oriented strategies for addressing environmental problems outlined in the SAP.

1.2 A Vision and Mission for the Future of the YSLME

The Vision and Mission for the YSLME have changed little since they were established during the YSLME Phase II project. The changes that were made reflect progress made in the Phase II project, a better understanding of the ecosystem itself, and advances in the practice of ecosystem management.

Vision

Our vision is to protect, conserve, and restore the ecosystem health, natural resources, and environment of the Yellow Sea to secure a safe and reliable source of food, recreation, livelihoods and resilience to climate change; to support sustainable growth; and to protect human health, while also meeting the aspirations of all generations into the future.

Mission

Our mission is to bring all stakeholders together at local, national, regional and global levels to ensure that human impacts remain within natural ecosystem carrying capacity while building ecosystem and societal resilience, reducing environmental threats from anthropogenic activities, recovery of fishery resources, and protecting biodiversity and habitats through overall ecosystem-based management and implemented as appropriate through nature-based solutions of the Yellow Sea.

1.3 The Purpose, Scope, and Approach of the SAP

The purpose of this updated SAP is to establish priorities and regional goals to realize the vision for the YSLME: The protection, conservation, and restoration of the YSLME ecosystem. The scope for this updated SAP is to present a ten-year regional plan to work toward achieving the mission and vision for the YSLME. This SAP will form the basis for joint bilateral, or harmonized national activities, and provides the basis for the development of updated NSAPs.

2 The Technical Basis for the YSLME SAP

2.1 Socioeconomic and Environmental Contexts

The YSLME project area (Figure 1) is located between the Chinese continent and the Korean Peninsula (31°40'–39°50'N and 119°10'–126°50'E). It faces to the west the Shandong Peninsula and the North Jiangsu Plain, borders on the east with the Jeju Island of RO Korea, and end in the north at the Liaodong Peninsula. Three nations — the People's Republic of China (PR China), the Republic of Korea (RO Korea) and the Democratic People's Republic of Korea (DPRK) — are located along the coasts of the Yellow Sea. The sea area is 380,000 km², with a mean depth of 44 meters. As a shallow and semi-enclosed sea, the Yellow Sea possesses typical characteristics of a large marine ecosystem (LME): large area, distinct bathymetry, hydrography, productivity, and tropically linked populations.



Figure 1. Boundaries of the YSLME Project Area.

Biota in the YSLME belongs to the East Asian sub-region of the North Pacific Region. The biological community is dominated by temperate species, while some tropic species appear in the southeast part of the Yellow Sea. It supports rich marine living resources, and is recognized as an important regional fishery ground. A total of 113 families and 321 fish species have been recorded in the Yellow Sea. It is estimated that over 50 million migratory waterbirds use the region during their migration, representing around 40 percent of all migratory shorebirds using East Asian-Australasian Flyway.

The YSLME also plays an important role in marine transportation with several important port cities along its coastline. Coastal cities of the YSLME include the Chinese cities of Lianyungang, Yancheng, Nantong, Rizhao, Qingdao, Yantai, Weihai, Dalian, and ROK's city of Incheon, Gyeonggi Province, Chungnam Province, Jeonbuk Province; Jeonnam Province; and DPRK cities of Sinuiju and Nampo.

Along the coast of YSLME, there are three provinces in PR China — Liaoning in the north, Shandong and Jiangsu provinces in the south. In 2016, the total population of this region was about 218 million, accounting for 15.8 percent of the total population of China. About 50 million people live in the coastal cities and counties of the Yellow Sea, of which 0.79 million people are fishers. In 2016, the marine GDP of the coastal regions of the Yellow Sea was CNY 2.54 trillion, which was 3.4 percent of China's GDP and 36 percent of China's marine GDP. The Yellow Sea fishery in RO Korea is comparably important. Between 2012 and 2016, the RO Korean waters of the Yellow Sea yielded an annual average of 125,000 tonnes of commercially important seafood 12% of the domestic commercial catch for RO Korea (Zhang et al., 2019).

The coastal regions of the Yellow Sea are well developed in industry and aquaculture. Of the over 100 harbors in the three provinces, Qingdao Harbor is the second largest harbor in terms of load, and third largest in container transportation in China and 15th in the world. Incheon Port, representative port of ROK, has an impact on the regional economy of 33.%. The total areas in the western side of the RO Korea however, are 9,345 km² (9.3% of the total areas of the RO Korea) with a population of 17 million, accounting for 32.6%. Due to geographical characteristics along the coast of Yellow Sea, a total area of mudflats is 1,349 km², accounting for 54 percent and designated as areas for environmental conservation. Along with 3,115 km of coastal line, three provinces and a city are located Gyeonggi Province, Chungnam Province, Jeonbuk Province, Jeonnam Province and Incheon city. The GDP of these coastal regions accounts for 37.6 percent of the RO Korea.

The YSLME and its three bordering countries located along its coast are experiencing resource pressures and the accumulated impacts of anthropogenic activities and global environmental change. This document, the YSLME SAP, represents collective responses to the persistent and emerging transboundary environmental problems. It also provides a cooperation framework for restoring the ecosystem carrying capacity by the year 2030 through a combination of improvements brought about from implementation of agreed nature-based solutions, enabled by strengthened legal framework, regional collaboration, national capacity and improved awareness and participation of the general public.

2.2 Priority Transboundary Problems

In the TDA 2020 updated during the YSLME Phase II project, transboundary environmental issues and causal chains identified during the first phase of the YSLME Project were validated and updated. Emerging issues were also captured. Four key areas of concern, along with emerging problems, are described as below.

2.2.1 Overfishing and Unsustainable Mariculture

There is an observed decline in landings of commercially important species, increase in landings of low-value species, and changes in dominant species. The situation is improving over the past decade following efforts to restore the fisheries. These included restocking and strategies to reduce fishing pressure, such as buy-back programs for fishing vessels, closure of fishing in area and time, and marine ranching. Compared with the CCA from the 2007 TDA, concerns regarding overfishing have decreased, but vigilance is still necessary for recovery of the capture fishery, particularly commercial species. Over-exploitation of target fish species, over-capacity of fishing fleets, and inadequacy of monitoring and enforcement remain key causes for unsustainable fishing practices in the Yellow Sea.

Key vulnerabilities in mariculture are farming practices exceeding the area's carrying capacity, use of drugs, and negative environmental consequences of releases of nutrients, bacterial, viral, and fecal matter and feed residues from aquaculture. Insufficient knowledge of the carrying capacity of mariculture and lack of mechanisms to internalize environmental consequences are the key causes to unsustainable mariculture. Climate change is also a known cause to disturbances in mariculture.

2.2.2 Pollution

Impacts from pollution range from biological, physical, and chemical impacts that affect water quality, patterns, abundance, and quality of products from fisheries and overall health of marine habitats. All these impacts have negative effects on tourism, fisheries, public health, and biodiversity. Climate change can further exacerbate the impacts of pollution, through changes in runoff patterns, and deteriorate the ecosystem health, which may in turn result in reduced resilience of ecosystem towards contaminants.

Impacts of pollution are typically more evident along the coastal zone. Pollution problems in the Yellow Sea can be linked to a diversity of both land-based and marine sources and activities. Major pollution streams that are affecting the Yellow Sea environment are nutrient, contaminants and marine litter including microplastics. Progress in decreasing marine litter has focused on reducing the amount of litter generated, strengthening capacities to collect and treat marine litter, and developing information management systems for litter.

As an emerging pollutant, microplastics in the marine environment are of increasing concern. There is a lack of systematic research on the origin, flux into the sea, transmission path, and ecological impact of marine microplastics in the Yellow Sea.

The TDA update (UNDP 2020) confirmed that the issues and primary concerns identified in the 2007 TDA still exist, including eutrophication and harmful algae blooms (HABs), but with trends of improving conditions. Fundamental problems carried over from the 2007 CCA consisted of nitrogen enrichment, fecal contamination, heavy metal and organic contaminants, and marine litter. Root causes included economic development, population growth, and limited influence of environmental constituencies on government policies.

The 2019 CCA exercises also identified several emerging issues, showing the trends of increase in atmospheric particulate matter, marine plastics affecting all trophic levels of the ecosystem, human health risks associated with pathogens in public waters, and contaminants of emerging concern. Root causes included limited or inadequate regulatory mechanisms and limited influence of environmental constituencies on the development of governmental policies.

2.2.3 Ecosystem Changes

In the Yellow Sea, the main problems addressed are eutrophication, resulting in HABs and jellyfish blooms, and overall changes in ecosystem structure. Climate change impacts affect many trophic levels and alter the overall ecosystem structure. The Yellow Sea is also highly vulnerable to the potential negative effects of ocean acidification, and should be considered as a priority region for further research on ocean acidification and its synergistic effects on marine mammals and ecosystem structures.

The 2019 CCA exercises also identified drifting macroalgae *Ulva* and *Sargassum* as an emerging issue with evidenced direct impact on mariculture farming in north Jiangsu and south Shandong coasts and tourism on Jeju Island and Qingdao city. Various environmental factors, such as seawater temperature, light availability, water circulation and nutrients, could regulate or influence the blooming dynamics.

The 2019 CCA exercise for ecosystem impacts confirmed that the primary issues consisted of changes in biomass, changes in both water column and benthic species composition, toxic algae blooms, spread of cordgrass and loss of benthic habitat in coastal areas. Trends for most of these sources were determined to be toward worsening conditions. It is confirmed that the root causes include climate change and economic development without adequate consideration of marine environmental consequences.

2.2.4 Biodiversity Loss

Biodiversity has been threatened in the YS through the destruction or degradation of habitats and also through the introduction of invasive alien species. Habitat degradation is a severe problem across the YSLME, with marine and coastal habitats being physically, chemically, and biologically impacted by marine and land-based causes, including coastal development. Introduction of invasive alien species and non-native wetland plants, notably spartina (*S. alterniflora*), has resulted in the loss of abundance and diversity of native species in the Yellow Sea. Alterations in habitats for the spotted seal and critical vulnerability of migratory waterbirds due to a lack of marine protected areas (MPAs) were observed. Development of a regional MPA network is an effective way to protect biodiversity and respond to climate change, even if the MPA network remains far from completion at present. Many important wetlands that constitute the stopovers for these birds are irreplaceable, and coastal development and marine engineering encroach many intertidal zones, especially the high-tide zone. Shorebirds' main foraging areas are concentrated in the mid-tide and low-tide zones and protecting these mudflat ecosystems is essential to their wellbeing.

While the ecosystems CCA showed trends of decreasing conditions, most of the fundamental problems related to biodiversity showed improving trends. The main fundamental problems for biodiversity include changes in community structure, habitat loss and modification, declines in anadromous and catadromous fisheries, and declines in threatened and endangered species, including birds, sea turtles, and marine mammals. From these findings, the key causes include increased demands for coastal lands and seafood, increased damming of rivers, degradation and fragmentation of habitats, destruction of coastal habitats, bycatch and accidental injuries, and overexploitation.

2.3 Formulating Solution Strategies

The concept of ecosystem carrying capacity and ecosystem services formed the conceptual basis for the 2009 SAP, with four separate service types (Provisioning, Regulating, Cultural, and Supporting) addressing the 11 targets identified in the SAP. An important advantage of applying the concepts of ecosystem carrying capacity and ecosystem services in the YSLME Phase II project was the recognition

of the value that stable, resilient ecosystems can provide, both for the sustainability of the ecosystems and for the human livelihoods themselves.

The next phase in managing the YSLME can build on the success of these approaches by

- Retaining the orientation toward the ecosystem services
- Incorporating integrated ecosystem management approaches
- Applying concepts in nature-based solutions

Integrated ecosystem management applies a systemic-thinking approach, which recognizes the connectivity of ecosystems. For example, planning for Marine Protected Areas (MPAs) and establishing a regional MPA network should consider the importance of providing corridors for the safe movement of the marine organisms being protected. Therefore, planning for MPA networks, rather than considering MPAs to be isolated patches, results in more effective protection for marine organisms.

Integrated ecosystem management concepts can be implemented through nature-based solutions (NbS). In broad terms, NbS are strategies to be with the help of natural or engineered ecosystems in managing the effects of human disturbance, while also performing their natural functions as stable, resilient ecosystems. One example is the use of constructed wetlands to sequester human-caused nutrient loads, while also serving as coastal protection barriers against waves, and serving as nursery habitats for migratory birds. The NbS approach augments ecosystem services approach and permits broader, systemic approaches in ecosystem management.

Through this systemic approach to managing the YSLME, the original ecosystem services around which the YSLME Phase II project were organized can be re-oriented into the following three goals:

Goal 1: Ensure Sustainable Fisheries and Aquaculture: Ensure that capture fisheries and marine land-based aquaculture are conducted sustainably and in ways that protect livelihoods.

Goal 2: Protect the Marine Environment: Control releases of pollutants and pathogens, and prevent ecosystem imbalances that result in unhealthy conditions.

Goal 3: Improve Ecosystem Resilience: Bring ecosystems into a sustainable balance that enables ecosystem services to be delivered, while also providing resilience against human disturbances and the effects of climate change.

These goals form the conceptual basis around which strategic actions can be developed and implemented for the YSLME.

3 Strategic Actions for the YSLME

The 2020 TDA update, and particularly the re-examination of causal chains, provided insights that enabled the mission for the YSLME over the next decade to be realized through three goals: ensure sustainable fisheries and aquaculture, protect the marine environment, and improve ecosystem resilience. These goals are articulated through a set of ten targets, which in turn are implemented at the regional scale through 26 management actions. These management actions may be undertaken through bilateral cooperation or by each country independently at the national level. As with the YSLME Phase II project, national SAPs will be developed to more closely address national priorities and capabilities to meet the three goals for the YSLME over the next decade.

3.1 Goal 1: Ensure Sustainable Fisheries and Aquaculture

Marine fisheries and mariculture are important sources of food and protein for human life. Commercial fish species also play an important role in the marine ecosystem. For instance, they feed on, and are part of the diet of other marine organisms in the food web. Therefore, the sustainable development of fisheries is not a management issue confined to the fishery industry, but also involves the ecosystem it is in, thereby influencing the stability of the ecosystem. Integrated ecosystem approaches can more effectively protect and conserve marine fisheries resources, manage marine economic species (especially fish), and enhance the sustainable food supply of the Yellow Sea ecosystem.

3.1.1 Target 1: Create and Maintain a Sustainable Capture Fishery

The management and regulation of fishery activities are necessary for the maintenance of sustainable capture fishery within the limit of not exceeding the capacity of marine ecosystem in the YSLME. Establishing a sustainable capture fishery in the YSLME requires imposing reaffirmed limits on the timing, location, and intensity of fishing activities. For sustainable capture fisheries, conservation of spawning and breeding grounds based on adaptive management is also required.

Management Action 1.1: Improve the management system for fishery conservation areas

The management system for conservation of spawning and nursery grounds of key economic species will be improved. Promote the systematic construction of marine ranching based on regional management. The construction of marine ranching focuses on the restoration of habitat, the enhancement of natural prey, the restoration of seagrass bed and seaweed farm. Pay attention to the research on stock enhancement, artificial reefs, impact of marine ranching on ecosystem and conservation effect evaluation. Designation of protected areas and development of stock enhancement technologies should be encouraged to conserve and increase marine living resources and sustain their environment.

Management Action 1.2: Reduce fishing activity

Fishing activity will be reduced through a variety of coordinated efforts. These include reduction of the total numbers, tonnage, and power of motored fishing vessels, strict supervision of fishery law enforcement and continuation of implementation of vessel buy-back programs with particular emphasis on vessels with excessive capacity.

Management Action 1.3: Establish certification for responsible capture fishery practices

Sustainable practices in marine fisheries will be encouraged through certification of responsible capture fishery practices. These practices will be the foundation for making the marine ecosystem healthy and robust. Fisheries management system can be improved by rationally allocating catch proportion for each fishing ground according to existing biomass and catch data. Various steps and measures should be taken to achieve eco-friendly fishing.

Management Action 1.4: Implement sustainable dynamic fisheries management

Effective and adaptive management of capture fisheries benefits from a comprehensive management approach that considers the ecosystem as a whole. Sustainable dynamic fisheries management approaches can be used. Specific actions are needed to carry out scientific fishery survey and assessment on a regular basis, determine the population dynamics, distribution and habitat of fishery species, grasp the spawning distribution of main economic species, comprehensively evaluate the

capacity of recruitment of fishery resources, and provide scientific basis for formulating and adjusting fishery resources conservation and management measures.

3.1.2 Target 2: Develop a Sustainable and Economically Robust Mariculture Industry

Mariculture has the potential to support socio-economic growth in the Yellow Sea region and to address global demand for seafood. Sustainable mariculture requires adopting ecologically sound practices and deliberate attention to minimizing eutrophication and use of fishmeal, and rigorous monitoring at a regional scale.

Management Action 2.1 Adopt ecological aquaculture models

It is necessary to adopt ecological aquaculture modes such as the Integrated Multi-trophic Aquaculture (IMTA). In order to enhance the effectiveness of the application of the ecological mariculture model, it is necessary to reduce the emission of nutrients and organic particles discharged from land and sea-based aquaculture. There is also a need to assess the aquaculture support capacity of the Yellow Sea through the application of eco-friendly aquaculture models.

Management Action 2.2: Reduce impacts of nutrients, pathogens, residual feeds, and antibiotics in mariculture

Effective measures such as ecological aquaculture mode, high-quality seed, medication management practices should be taken to reduce the impacts of nutrients, bacteria, viruses, feces, residual feeds, and antibiotics on the environment in mariculture in the Yellow Sea. Similarly, discharges of dissolved nutrients and organic particles from mariculture in coastal waters should be reduced.

Management Action 2.3: Establish certification for responsible mariculture practices

Sustainable practices in land-based and inshore mariculture will be encouraged through certification of responsible aquaculture practices. To establish a certification for responsible mariculture system, tracking and managing systems from the process of mariculture to the final production and supply stage would be required.

3.1.3 Target 3: Build Social Safeguards into Development of a Sustainable Marine Food Supply

The commercial seafood sector is a powerful economic driver in the Yellow Sea region. Reductions in capture fisheries through reducing capture fisheries outputs and vessel buy-back programs can be offset to some extent by growth in eco-friendly mariculture, but these changes affect livelihoods. An essential requirement for the maintenance of food supply in the Yellow Sea is the establishment of a social safeguard system that includes both management measures and ecological protection for the Yellow Sea.

Management Action 3.1: Create investment incentives for sustainable fishing and aquaculture practices

Sustainable fishing and aquaculture practices can be mandated through regulatory means. Various support including technical support and investment for the implementation of the eco-friendly food supply system (alternating catching) such as eco-friendly mariculture and marine ranching should be provided.

Management Action 3.2: Retrain traditional fishermen for alternative livelihoods

Implementing reductions in fishing pressure through the reduction in vessel numbers and restricting areas and seasons for fishing results in an increase in the number of laid-off workers in that industry. In order to overcome this problem, various supports are needed for traditional fishermen and industry.

There is a need to provide various supports for capture fisheries, particularly traditional fisheries area. It is essential to improve competitiveness of these workers, and encourage them to engage in alternative jobs and other related industries based on labor market demand and the need for development of responsible fishing and aquaculture.

3.2 Goal 2: Protect the Marine Environment

The 2020 TDA for the YSLME (UNDP 2020) identified seven priority transboundary problems in the YSLME. Of these, two directly address threats to the marine environment: pollution and contaminants. The TDA further identified the potential threats of newly emerging contaminants, microplastics and marine litter. Three targets address these concerns through the reduction of nutrient loading to the YSLME, reducing the threat of pathogens and emerging contaminants, and control and management of marine litter and microplastics.

3.2.1 Target 4: Reduce Discharges of Contaminants including Nutrients

Pollutants including nutrients enter the Yellow Sea from point and non-point terrestrial sources, from the atmosphere, and from ships and harbors. It is necessary to control the release of contaminants including nutrients from watersheds and maritime activities into the Yellow Sea to protect human health and prevent adverse ecosystem alterations.

Management Action 4.1: Reduce the impact of contaminants including nutrient pollution from land-based activities (including point and non-point sources)

The continuation of the strict control of contaminants including nutrient loading from point sources is encouraged. The routine monitoring of major input sources and loads should be enhanced with the exchange of data and information at a regional level. The hot spot control should be conducted with the calculation of loads in hot spot areas. Nonpoint source pollution results from many diffuse sources, such as land runoff, precipitation, atmospheric deposition, drainage, seepage, or hydrological modification (rainfall and snowmelt). In spite of the difficulties in the control of nonpoint source pollution because of its daily discharge from many different activities, it is necessary to implement nonpoint source pollution control measures to achieve load reductions and incremental progress toward watershed improvement. Water runoff from agriculture activities could become a source of high nitrogen and phosphorus due to fertilizer use. So proper management measures need to be taken to reduce fertilizer usage and increase the efficiency.

Management Action 4.2: Strengthen the prevention and control of pollution from maritime activities

The Yellow Sea is also directly and indirectly exposed to the pollutants from various maritime activities including maritime trade, fishery, and marine transportation. Therefore, it is equally important to prevent various pollutions possibly originating from maritime activities in the Yellow Sea, and manage sources of the pollutants. Both countries need to strengthen management systems to prevent or mitigate pollution from maritime activities. Control and prevention measures include treating pollution from vessels by operating port reception facilities, promoting the use of clean fuels, and enforcing stricter discharge requirements and limits. It is also important to develop emergency response capabilities for pollution accidents. It is also recommended to continuously implement IMO Conventions such as MARPOL (Port Reception Facilities, Global Sulfur Cap-2020, etc.) and OPRC-HNS protocol.

3.2.2 Target 5: Reduce Exposure to Pathogens and Emerging Contaminants in the Marine Environment

Pathogens present a hazard to humans recreating in infected waters or beach sands when an infective dose colonizes a suitable growth site in the body and leads to disease. Consumption of contaminated shellfish also exposes humans to marine pathogens. In addition to those internationally regulated contaminants, other “new”, largely unmonitored chemicals have been recently identified as “emerging pollutants”: substances that have the potential to enter the environment and cause adverse ecological and human health effects, but are still largely unregulated and whose fate and potential effects are poorly understood.

Management Action 5.1: Develop monitoring and early warning systems for pathogens in public waters (beaches)

Risks to humans from pathogenic organisms are higher in areas with large population densities or with a significant tourism. Monitoring, early warning, and response programmes can prevent or minimize human health impacts. More attention should be paid to the monitoring of beaches and coastal tourist resorts in summer. When there is a risk of endangering the health of tourists, government (or the tourism authorities) need to take appropriate management actions.

Management Action 5.2: Implement regional monitoring of newly emerging

Emerging contaminants have the potential to degrade marine waters and cause serious damage to organisms and biological processes. These substances include hormones, current-use pesticides, new flame retardants, pharmaceuticals and personal care products (PPCPs), biocides, among others. The standard operating procedures (SOPs) of these substances should be established and inter-laboratory comparison should be conducted to guarantee the quality of the data. A regional monitoring program and data sharing mechanism are necessary to detect emerging contaminants in the Yellow Sea. These data can be used to predict the potential risk presented to the marine biota and human health.

3.2.3 Target 6: Control and Manage Marine Litter and Microplastics

Marine litters and microplastics pollution is a complex transboundary environmental issue which has biological, social and economic implications. There is an imperative need to establish and strengthen collaborations and partnerships between public and private institutions, locally and internationally. Monitoring systems for marine litters and microplastics movement paths at the regional sea level, where they are generated, and the amount of generation should be provided.

Management Action 6.1: Improve the management of domestic and agricultural solid waste

Marine pollution caused by solid wastes threatens the habitat of marine life and navigation safety, and may cause negative impacts to fisheries and marine biota. Management of the sources of marine litters at sea or coast should be strengthened. The activities to cut off domestic and agricultural solid wastes from human habitation should be strengthened. It is necessary to establish a mechanism for coordination among the government, communities, enterprises and residents; carry out solid waste classification and recycling; and promote the reduction, recycling and harmless disposal of solid waste.

Management Action 6.2: Proper management (recycling/reuse/disposal) of used fishing nets and gear and alternatives for disposable plastics

Ghost fishing by lost or abandoned fishing gear, also called derelict fishing gear (DFG), has been a critical issue in the YSLME and other marine ecosystems. Efforts have to be made to solve ghost fishing problems in the Yellow Sea. A wide range of disposable plastic products also pollutes the Yellow Sea. Measures to control the release of these products need to be implemented in both countries.

Expanded polystyrene (EPS) buoys are one of the major sources of marine litter and microplastics in the Yellow Sea. It is necessary to replace EPS buoys with environment friendly buoys to reduce pollution.

Management Action 6.3: Regional monitoring of marine litter and microplastics

Monitoring systems for sources, distribution, magnitude and dynamics of marine litters including microplastics at the regional sea level should be established. There is a urgent need to establish and strengthen collaborations and partnerships between various sectors and industries, locally and internationally, to trace marine litter and microplastics from product value chain. In combination with existing monitoring and beach cleanup activities, the public collects marine litters and data to protect marine environment. The focus on the public survey is designed to complement the collection of official marine litter data by national authorities and fill data gaps.

Management Action 6.4: Organize public awareness and cleanup campaigns for public beaches

Public awareness, education, outreach, and beach cleanup participation are effective ways to address marine litter. Development and implementation of public awareness and education programs, especially for Yellow Sea users such as NGOs, fishermen and citizens are recommended. Beach cleanup activities often have multiple aims including removal of litter, monitoring of litter abundance and composition, and raising awareness of marine litter issues. As various data collection methods are being used, it is necessary to standardize methods for inter-comparison and to establish a regional open-access database.

3.3 Goal 3: Improve Ecosystem Resilience

Stable and diverse ecosystems have the capacity to withstand damage and recover from adverse conditions. Targets to address the goal of improving ecosystem resilience include improving ecosystem structure, protecting biodiversity and habitats taking into account biophysical connectivity, preventing or reducing bloom events (or mass occurrence), controlling invasive species, and adaptation to climate change.

3.3.1 Target 7: Assess and Adapt to Long Term Changes in the Marine Ecosystem

An ecosystem in balance can provide services for human and self-sustaining needs. Integrated management of ecosystem structures can result in shifts that increase populations of more economically desirable fish species at the top of the food web, and can reduce the occurrence of HABs and jellyfish blooms toward the bottom of the food web. Understanding ecosystem status and responses requires investments in regional-scale monitoring, assessment, and analysis of ecosystem dynamics.

Management Action 7.1: Monitor and assess long term changes in the marine ecosystem

In the last decades, there have been many observed impacts of long-term ecosystem changes in penology, species composition, production and trophic structures at a regional scale caused by increase in sea surface temperature and acidification. There is still uncertainty of impacts on marine ecosystem in the YSLME. For better management of the Yellow Sea ecosystem, monitoring and assessment of the ecosystem status in a regional scale focusing on climate impacts is necessary. This should be implemented not only at the national level, but also at the bilateral cooperation framework. Adaptive management strategies for the Yellow Sea should be developed after assessing the impact of climate change on the structure and functions of the YSLME.

Management Action 7.2: Develop regional guidelines for ecosystem management under predicted climate change scenarios

The impacts of climate change on the YSLME are diverse and can affect all trophic levels in the ecosystem. It is necessary to focus on the long-term monitoring and modelling to identify the trends and responses of ecosystem by climate changes and also to develop effective and timely adapted regional guidelines. Modeling studies driven by regional monitoring data can be undertaken to enable prediction of responses of various organisms to climate change. These modeling efforts can also evaluate the impact of climate change on ecosystem structure and functions of the Yellow Sea. These efforts will form the basis for adaptive and preventive ecosystem management strategies for the Yellow Sea.

3.3.2 Target 8: Conserve and Improve Biodiversity and Habitats

Protecting biodiversity means creating healthy habitats and corridors to preserve the wellbeing of threatened and endangered marine mammals and migratory birds. The work done to conserve, protect, and preserve these habitats also improves the resilience of the ecosystem and provides protection against disturbances. Conservation and improvement of biodiversity and habitats is essential to maintain and improve the community structure, species distribution and genetic diversity of endangered and endemic species.

Management Action 8.1: Strengthen MPA networks for endangered migratory mammals and shorebirds

Inter-linkage of MPAs is important to ensure that migration routes and genetic exchanges are maintained. Regional MPA networks in the YSLME were established during the YSLME Phase II Project and in order to improve effectiveness of these MPAs/reserves, enforcement should be strengthened and management strategies should be improved through periodic assessments. . Activities to implement these measures include studying the migratory route of endangered species, identifying conservation gaps for endangered species and proposing new MPAs, conducting regular assessment, and building a platform for sharing information and strengthening cooperation to conserve the endangered migratory species in the Yellow Sea.

Management Action 8.2: Strengthen protection and restoration of coastal wetlands, spawning grounds, and migratory routes.

Intertidal wetlands play a vital role in the provision of supporting services such as nutrient absorption, carbon sequestration, sediment deposition, shore line stability, and as habitat for many commercially important fish and shellfish species as well as birds and other animals. A reasonable restoration plan should be established/implemented for the wetlands that have lost their function due to coastal reclamation and habitat changes. Specific activities include: comprehensive investigation of coastal wetland plants, benthic organisms, birds and other resources in the Yellow Sea region, identifying conservation gaps for coastal wetland, spawning ground, and migratory routes, and restoring the impacted coastal wetlands and spawning grounds followed by the joint survey for migratory species to assess the effectiveness of the restoration.

3.3.3 Target 9: Prevent and Reduce Marine Disasters

Marine disasters bring serious impact on the life and property security in coastal zones. The nature-based solutions can enhance the disaster prevention and mitigation functions of marine ecosystems, maintain economic and social activities in coastal zones more economically and effectively, and reduce the losses caused by natural disasters. In the Yellow Sea region, among the marine disasters, biological disasters like red tide, macroalgae blooms, and Jellyfish bloom need more attention. The regional

capacity for disaster response can be improved through the capacity building for early warning and monitoring. The ecological restoration along with construction of disaster prevention and reduction facilities will contribute to the mitigation of the loss caused by marine disasters.

Management Action 9.1: Improve early warning, monitoring, and assessment capabilities for harmful organism blooms

Cooperative research on harmful organism blooms should be conducted, and remediation measures should be implemented which consider principles of ecosystem structure, nutrient dynamics, ocean currents and other factors that influence the occurrence and development of harmful organism blooms. A cooperation mechanism for harmful organism blooms should be established in the Yellow Sea region to carry out inter-country coordination and joint monitoring and early warning.

Management Action 9.2: Prevent the occurrence of macroalgae blooms through ecosystem management

Adaptive management measures should be adopted in order to reduce the nutrient base of macroalgae blooms. Various activities should be taken to reduce the degree of eutrophication in the coastal area. It is important to advocate nature-based marine projects, control the scale of artificial marine structures, and reduce the suitable area for aggregation of jellyfish hydranth.

Management Action 9.3: Establish the marine disaster reduction system based on natural ecosystems for the Yellow Sea coastal zones

To respond to marine hazard risks of storms, tsunamis and floods, it is necessary to establish a marine disaster reduction system, considering carrying capacity of ecosystems in the Yellow Sea coastal area. Precautionary actions should also be taken to reduce the impact of marine hazards. Appropriate measures include investigation and assessment on marine hazard mitigation by the ecosystems in the Yellow Sea and quantitative analysis and evaluation on the disaster reduction effects of the ecosystems. Ecosystem protection and restoration projects should be carried out, to enhance the resilience of the coast to mitigating marine disasters. In addition, comprehensive coastal protection systems combined with traditional coastal engineering and natural ecosystem should be put in place, in order to enhance both the environmental protection and marine disaster reducing capacity of the Yellow Sea.

3.3.4 Target 10: Control and Prevent Invasive Species

The introduction of non-native species through various pathways is a growing international problem that can reduce the productivity of native species in the existing ecosystem and possibly change the function and structure of ecosystem. At a minimum, invasive species can displace native species. However, invasive species have the real threat of causing significant damage to marine and shoreline ecosystems. Surveillance and control programs are necessary to prevent the introduction of invasive species through accidental releases.

Management Action 10.1: Promote mechanisms for the management and control of alien invasive species

It is important to establish the mechanism for management and control of alien invasive species in the Yellow Sea region with the cooperation of multiple agencies and the public. A data base on invasive species in the coastal zone of the Yellow Sea should be established, and activities should be carried out the activities to prevent the introduction of harmful invasive species, to remove introduced ones, and to restore the endemic species.

Management Action 10.2: Implement the International Convention for the Control and Management of Ships' Ballast Water and Sediment

Improved control and monitoring of ballast water discharge is constantly needed following the International Convention for the Control and Management of Ships' Ballast Water and Sediments. In accordance with the Convention, there is an ongoing need for improved control and monitoring of ballast water discharges. It is necessary to strictly implement the Convention, compile the convention implementation report, and exchange management experience. Various forms of publicity activities can also be carried out to raise public awareness on the dangers (or negative effects) of invasive species and the need to implement international covenants.

4 Enabling Conditions for the YSLME SAP

Effective management of the YSLME will require implementation of the management actions described in the previous section which requires establishing, modifying, or improving certain frameworks and practices. These include legal and institutional frameworks, mainstreaming gender into management actions, and incorporating public awareness and participation widely across YSLME management activities.

4.1 Formulate and Implement Laws and Regulations

The formulation and implementation of laws and regulations and the construction of a regional governance framework can facilitate the establishment of institutions and mechanisms to enable the success of management actions. Over recent decades, more and more countries have come to realize that holistic action is necessary to protect marine environment and resources. Starting as early as the 1960s, the international community began to formulate international and regional conventions, treaties, agreements, protocols, guidelines, and other legal documents addressing the protection of marine environment and resources. PR China and the RO Korea, have actively signed and ratified the major conventions, agreements, and protocols in due course, and have continued to refine the development and implementation of relevant international laws and legal documents. Given the relevance and transboundary nature of marine environmental issues, strengthening the implementation of international conventions and legal documents at the regional level under the cooperation between the two countries will promote the development of regional marine environmental governance and the resolution of regional marine environmental issues.

4.1.1 Coordinated Implementation of International Conventions

Marine environmental issues and resource scarcity are intricately interlinked with each other. Therefore, response measures under international conventions require full consideration of different facets of environmental, economic, and social dimensions in addressing wetland degradation, biodiversity loss, depletion of fishery resources, and climate change impact. Coordinated implementation of international conventions within the region can enable measures to address one issue under one convention to have multiplier effects to resolve environmental issues under another or other conventions due to the interconnectedness of marine ecosystems. Such coordination can be realized through a regional governance mechanism with a mutually acceptable policy and cooperation framework, i.e. the regional mechanism to coordinate the implementation and monitoring of YSLME SAP. The countries bordering the Yellow Sea embed such a cross-domain mechanism for the coordinated implementation of international conventions whereby information sharing, development of regional strategies for the coordinated implementation of international conventions, access to and optimized use of information and resources, improved compliance of international conventions can be maximized.

4.1.2 Develop Regional Guidelines

The *United Nations Convention on the Law of the Sea* (UNCLOS) can be more effectively implemented through regional cooperation to formulate and elaborate international rules, standards, proposed actions, and measures. The two countries need to promote the formulation of technical standards, regional guidelines, or joint management plans within the framework of YSLME regional mechanism in fulfilling their respective responsibilities under international conventions and agreements collaboratively and effectively.

4.1.3 Transform International Conventions and Agreements into Domestic Laws

Under the legal context of some countries, international conventions need to be implemented through domestic laws. In the past decades, PR China and RO Korea have respectively established a relatively complete framework of marine-related laws and systems to fulfill their obligations under the international conventions. Within the emerging areas where gaps exist, further efforts need to be taken to transform the obligations under international conventions through national legal processes.

4.2 Improve Regional Governance Mechanisms

An effective regional governance mechanism plays a decisive role in sustainable, stable, and efficient regional governance. While there are existing multilateral and bilateral governance mechanisms within the Yellow Sea region, the YSLME Phase II project distinguishes itself in applying science-based and adaptive management of the YSLME using integrated ecosystem management approaches and nature-based solutions at LME level. The interim regional governance mechanism and subsidiary bodies will provide practical experiences in agreeing to a flexible and innovative mechanism to coordinate the implementation of the YSLME SAP. There are continued interests and need for the YSLME regional mechanism to maintain coordination and cooperation with other multilateral governance mechanisms in the region: the Action Plan for the Protection, Management and Development of the Marine and Coastal Environment of the Northwest Pacific Region (NOWPAP), the UNESCO/IOC Sub-Commission for the Western Pacific (WESTPAC) and the Partnerships in Environmental Management for the Seas of East Asia (PEMSEA). Coordination and cooperation can be fostered between the YSLME and existing bilateral mechanisms in the implementation of the SAP objectives, including the *China-ROK Environmental Protection Agreement* and its China-ROK Joint Commission on Environmental Protection and the China-ROK Marine Science and Technology Cooperation Agreement and its China-ROK Joint Committee on Ocean Research.

4.2.1 Perfect Regional Governance Mechanisms

With the completion of the second phase of the YSLME project and the increasing demand of coastal states in the Yellow Sea region for continuous cooperation in the protection of marine environment and resources, it is of great significance to establish a long-term and effective regional governance mechanism. This mechanism should be a non-legally binding, cooperation-oriented, and flexible in operation. It should be state-led, sustainably funded and distinct from the existing cooperation mechanisms in the Northeast Asia. The main functions of this mechanism include:

- Promoting the coordination and implementation of policies and laws relating to the protection and management of the regional marine environment and resources;
- Promoting the development of scientific research activities relating to the protection of regional marine environment and resources;

- Promoting the collection, exchange, sharing and analysis of relevant data and information, including the data and information on marine organisms, environment, and sustainable ocean development; and
- Promoting capacity building, trainings and stakeholder participation relating to regional governance.

-A Post-YSLME mechanism participated by various stakeholders with the mechanism playing the central coordinating roles should be established as agreed by the both countries.

4.2.2 Enhance Governance Capacity

National and local governments are the main players in implementing the SAP. At the national level, the regional governance framework should provide a platform for communication and coordination among national government departments, and facilitate the government to improve capacities in prior informed decision-making, macro-planning, as well as execution of laws and policies. At the local level, the regional governance framework should enhance local governments' understanding of integrated ecosystem approaches and nature-based solutions through dialogues, trainings, and demonstration projects, so as to achieve local implementation of laws, policies, and measures.

4.2.3 Strengthen Public Participation

A regional marine governance framework should be able to provide non-for-profit organizations, communities and private sectors with a comprehensive participatory governance approach and platform. Non-for-profit organizations should be encouraged to help the public understand important environmental issues through awareness raising, education and policy publicity. These organizations can then guide community residents to participate in demonstration projects for marine environmental protection and resource management. These efforts can become more comprehensive and effective if private sectors can be motivated to support marine environmental protection and resource management practices.

4.3 Mainstream Gender in Management Actions

The concept and practice of gender equality, which is at the core of UN-supported projects, will also be adopted in the implementation of the YSLME SAP. In line with the UN Sustainable Development Goal 5 - *Achieve gender equality and empower all women and girls*¹, available tools will be considered and used to put this principle into practice by integrating actionable tasks in the SAP and measurable outcomes in monitoring and evaluation plans.

4.4 Incorporate Public Awareness and Education as Drivers of Success

Public awareness of environmental and resource protection is an essential component for ensuring sustainable use of the YSLME. The development and implementation of environmental awareness and education programs, especially for Yellow Sea users such as NGOs, fishermen and citizens, is recommended. Public awareness efforts need to be mainstreamed across all targets. Examples of public awareness efforts include:

Developing Educational Materials: A systematic outreach program for public awareness and education is necessary. Components may include activities, social media outreach campaigns, classroom visits and demonstrations, and hosted exhibits at public events. These should be

¹ <https://www.un.org/sustainabledevelopment/gender-equality/>

developed through collaboration between experts and stakeholders. Education on the ethics and guidelines for users of the Yellow Sea should be included.

Engaging the Public in Management Actions: Public education programs can be linked with management actions by including participatory activities in the educational outreach planning. As an example, education programs on litter reduction can be combined with beach cleanup activities, or encouraging civic groups to adopt public beaches or other locations as cleanup sites. Another example can be citizen or crowdsourced monitoring. Public engagement helps build public support of SAP programs and the sustainability of the YSLME regional mechanism.

Promoting Public Awareness of the Benefits of Integrated Ecosystem Management and Nature-based Solution: The benefits of biodiversity preservation in terms of increased productivity from fisheries and mariculture, and the ability of the ecosystem to adapt to change and continue providing the vital ecosystem services is not generally appreciated by the general public. To raise support for conservation measures, increased public awareness of both the benefits of biodiversity preservation and the conservation regulations are required.

Enhancing Participation of Local Governments and Non-for-profit Organizations: Non-for-profit organizations play important roles in engaging the public's protection of the marine environment and coastal local governments are most responsible for direct pollution of the Yellow Sea. Their participation in YSLME programs can increase the chances of success for all targets and management actions in the SAP.

5 Monitoring and Evaluation

Progress in the implementation of the next phase of SAP will undergo ongoing qualitative and quantitative evaluation. These data will inform decision makers of the progress and performance for adaptive management of the Yellow Sea. In doing so, process and performance indicators in the TDA and assessing the YSLME SAP implementation and agreed methodologies during the YSLME Phase II Project will be used for the countries to apply a consistent monitoring framework over time in the use of science-based adaptive management of the YSLME.

5.1 Monitoring and Evaluation Indicators

Monitoring the implementation of the YSLME SAP will involve quantitative and qualitative assessment of the effectiveness of project activities. Indicators should be “SMART” (GEF, 2013):

Specific
Measurable
Achievable and Attributable
Relevant and Realistic
Time-bound, Timely, Trackable, and Targeted

GEF co-funded projects typically use some combination of the following three indicator types (GEF, 2013):

Process Indicators: Focus on the outputs that are likely to lead toward a desirable outcome

Stress Reduction Indicators: Relate to project objectives or outcomes

Environmental Status Indicators: Goal oriented and focus on improvements in ecosystem quality

Of these indicators, Process Indicators are the easiest to track and measure, but have the lowest information value in terms of the impact of a management action on ecosystem improvement. Environmental Status Indicators have the highest information content, but are difficult to measure, both because of logistics and time scales involved. Annex 1 provides an initial listing of performance indicators for the management actions identified in this document.

5.2 Monitoring and Evaluation Mechanisms

Methodologies in monitoring the progress and performance of the implementation of management actions will be agreed upon by corresponding regional working groups (RWGs), with the participation of non-for-profit organizations, the business community, and academia. Each RWG will determine the baseline using the TDA 2020 as the key source of reference. Targets for 2030 will be also discussed and agreed upon by stakeholders, and endorsed by the decision-making body of the YSLME coordination mechanism. A comprehensive mid-term and terminal assessment of the effectiveness and impact of the YSLME SAP 2030 will be conducted and coordinated by the respective RWGs. Based on the observed progress towards the 2030 targets, adaptive management measures can be developed and incorporated into the YSLME SAP 2030 to ensure the overall achievement of the YSLME goals.

6 References

C-NSAP: UNDP/GEF (China-National Strategic Action Plan: United Nations Development Programme/Global Environment Facility). 2019. Status Report of the Implementation of the National Strategic Action Plan (NSAP) for the Yellow Sea Large Marine Ecosystem of the People's Republic of China. United Nations Development Programme/Global Environment Facility.

GEF. (2013, March 21). GEF Transboundary Diagnostic Analysis / Strategic Action Programme Manual. Volume 2: TDA/SAP 'How to' Guide. Retrieved May 24, 2020 from IW-Learn website: <https://iwlearn.net/manuals/tda-sap-methodology>.

GEF. (2016, March 24). Gender. Retrieved May 24, 2020, from Global Environment Facility website: <https://www.thegef.org/topics/gender>.

GEF. (2018, June 1). Guidance to Advance Gender Equality in GEF Projects and Programs. Retrieved May 24, 2020, from Global Environment Facility website: <https://www.thegef.org/council-meeting-documents/guidance-advance-gender-equality-gef-projects-and-programs>.

K-NSAP: UNDP/GEF (RO Korea-National Strategic Action Plan: United Nations Development Programme/Global Environment Facility). 2019. An Analytical Study on the Implementation of the National Strategic Action Program (NSAP) for the Yellow Sea Large Marine Ecosystem of the Republic of Korea. United Nations Development Programme/Global Environment Facility.

UNDP 2020. Transboundary Diagnostic Analysis for the Yellow Sea Large Marine Ecosystem (2020).

UNDP/GEF Yellow Sea Large Marine Ecosystem (YSLME) Phase II Project, Incheon, RO Korea. pp 75.

UNDP/GEF 2007. UNDP/GEF Project: Reducing Environmental Stress in the Yellow Sea Large Marine Ecosystem. Transboundary Diagnostic Analysis. 98 pages.

YSLME SAP
Draft October 14, 2020

UNDP/GEF 2009. UNDP/GEF Project: Reducing Environmental Stress in the Yellow Sea Large Marine Ecosystem. Strategic Action Programme. 56 pages.

Zhang, C., Seo, Y, Kang, H, and Lim, J, 2019. Exploitable carrying capacity and potential biomass yield of sectors in the East China Sea, Yellow Sea, and East Sea / Sea of Japan large marine ecosystems. Deep-Sea Research Part II, 163(2019):16-28. <https://doi.org/10.1016/j.dsr2.2018.11.016>