



**UNDP/GEF PROJECT ENTITLED “REDUCING ENVIRONMENTAL STRESS IN THE
YELLOW SEA LARGE MARINE ECOSYSTEM”**

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Conceptual Procedure for SAP Preparation

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Having completed the Transboundary Diagnostic Analysis (TDA), the UNDP/GEF Yellow Sea Project will develop a regional Strategic Action Programme (SAP) and the National Strategic Action Plans from 2007 through 2008. The SAP is a document that identifies policy, legal and institutional reforms, and environmental interventions to address transboundary environmental issues in the Yellow Sea. The SAP describes actions to solve major problems that the TDA identifies through its causal chain analysis.

For the SAP of the Yellow Sea Project, it is proposed to use the central theme of “Carrying Capacity of Ecosystem (CCE)” to link all Project Components—Biodiversity, Ecosystem, Fisheries, Investment, and Pollution. The goal of the SAP for the Yellow Sea Project is to prepare management interventions to maintain and/or improve the Carrying Capacity of the Yellow Sea Ecosystem in order to ensure the continued provision of ecosystem services. These interventions will address environmental problems identified by the causal chain analysis of TDA. As the environmental problems are closely interlinked and interacted each others, the interventions will tackle them in a comprehensive manner, but not individually, as this will not achieve the primary objective, that of maintaining/improving the CCE.

As an initial step in the development of a Yellow Sea SAP, the Project convened an SAP Consultation Meeting (Jinghong, China, 6-8 February 2007). The Meeting of regional experts from relevant fields discussed in detail a process and a framework for preparing the SAP, as well as formulating a set of guidelines for subsequent work.

This Paper was prepared for the discussion at the consultation meeting, and revised based on the comments and recommendations of the Meeting. The document will be circulated for the Project Steering Committee (PSC) to review and approve. This document will outline the basic structure for the preparation of the SAP, specifically:

- Objectives of SAP for the Yellow Sea Project;
- Carrying Capacity of Ecosystem: Central Theme of the SAP;
- Ecosystem Services of the Yellow Sea;
- Framework of SAP Preparation;
- Procedure for SAP Preparation;
- SAP preparation mechanism; and
- SAP Preparation Schedule.

1. Objectives of SAP for the Yellow Sea Project

The SAP for the Yellow Sea Project aims to prepare management actions to maintain and/or improve the Carrying Capacity of Ecosystem in the Yellow Sea to ensure continued provision of Ecosystem Services; as a result, the Project would achieve the following objectives comprehensively:

- Protection of marine and coastal environments in the Yellow Sea;
- Sustainable use of marine and coastal resources in the Yellow Sea; and
- Upgrading national capacity in protection of marine environment.

For the definitions of the Carrying Capacity of Ecosystem as well as the Ecosystem Services, see Sections 2 and 3, respectively.

2. Carrying Capacity of Ecosystem: Central Theme of the SAP

The TDA, conducted in 2005-2006, identified five major environmental problems in the Yellow Sea:

- Marine environment pollution;
- Marine and coastal habitat modification;
- Change in ecosystem structures and functions;
- Unsustainable fisheries; and
- Unsustainable mariculture practices.

These problems adversely affect the “Carrying Capacity of Ecosystem” in the Yellow Sea (Figure 1). We define “Carrying Capacity of Ecosystem” as the ability to sustain the provisioning, regulating/supporting and cultural services in the Yellow Sea (adapted from Olsen et al. 2006). We use the maintenance of CCE as a management concept to identify management actions in the Yellow Sea based on the causes described in the causal chain analysis prepared during the TDA process.

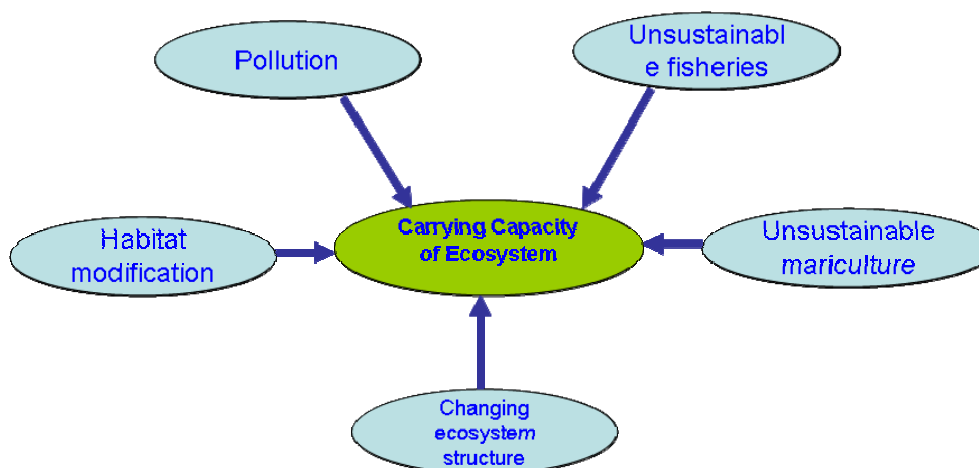


Figure 1. Central theme of the SAP for the Yellow Sea Project

The problems are often linked. For example, unsustainable mariculture practices might result in pollution problems (through eutrophication and localised benthic enrichment) and changes in ecosystem structure (as a result of habitat modification due to increased sedimentation rates caused by changes in water movement). As a consequence of these changes, fisheries yields will be impacted. Habitat modification through e.g., pollutants or land reclamation might change the ecosystem structure by adversely affecting primary production, spawning sites, nursing grounds, and/or nitrogen absorption capacity by the ecosystem. All those negative impacts of the environmental problems could eventually diminish the ability of the Yellow Sea ecosystem to provide its services.

Based on past experiences in managing marine environment and sustainable use of coastal and marine resources, it is very difficult, if not impossible, to manage the marine environment according to the Project Components individually, i.e., Biodiversity, Ecosystem, Fisheries, and Pollution. Addressing all the impacts from these Components will be critical for the success of management actions. For instance, protection of coastal wetlands will not simply imply the protection of the habitats for migratory birds. It would not work if the management actions only focus on wetlands themselves because the impacts from pollution, fishing activities, changes in productivity, and development contribute to the degradation and/or modification of coastal wetlands.

Therefore, it is critical to identify an appropriate linkage between the Project Components, which can provide effective central concept for preparing the SAP. We propose Carrying Capacity of the Ecosystem to be used as the central linkage in the management structure. Previously, the Regional Working Group (RWG) for Pollution Component discussed the issue of regional targets for pollution management, and indicated that the level to control nutrients in the marine environment will depend on the requirements of productivity in the Yellow Sea ecosystem. Therefore, it would be reasonable to use Carrying Capacity of Ecosystem as a linkage between the Ecosystem Component and the Pollution Component.

3. Ecosystem Services of the Yellow Sea

For the purposes of the Yellow Sea Project’s SAP development, the services that the Yellow Sea ecosystem provides, hereinafter called “Ecosystem Services,” mainly consist of the following (Figure 2):

- Provisioning services;
- Supporting/regulating services; and
- Cultural services.

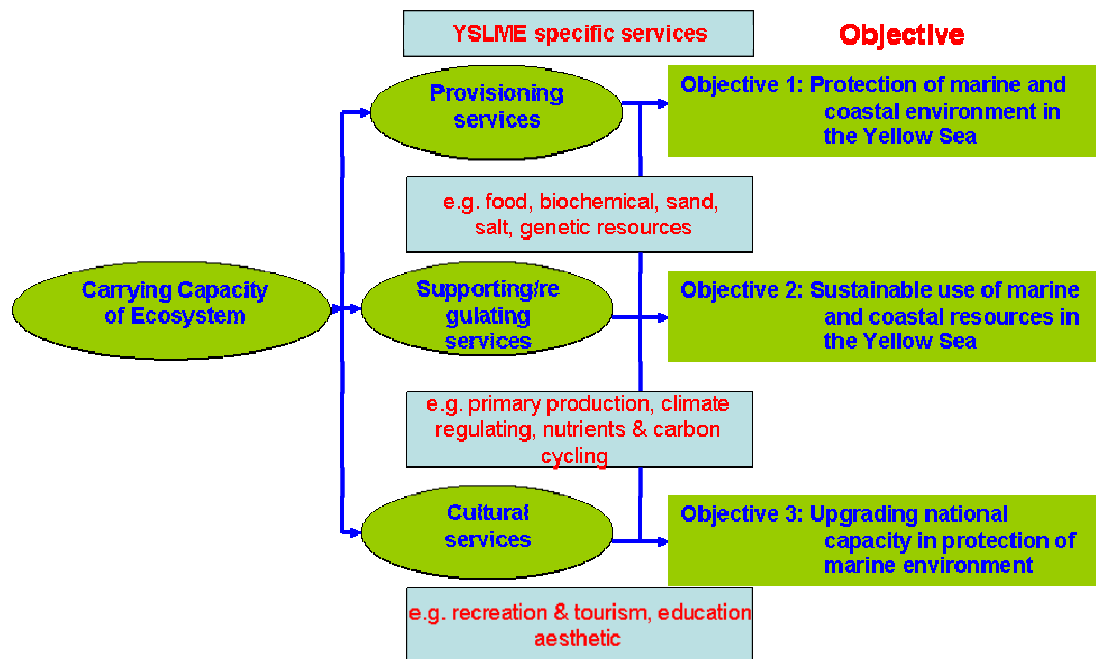


Figure 2. Ecosystem services provided by the Yellow Sea

Provisioning services are the products obtained from ecosystems. Those services in the Yellow Sea include food, biochemical, sand, salt, and genetic resources. Supporting and regulating services in the Yellow Sea are those that are necessary for providing the two categories of services—provisioning and cultural services—including *inter alia* primary production, climate regulation, and nutrient and carbon cycling. Cultural services are the ones that people obtain from ecosystems through spiritual enrichment, cognitive development, and recreational and aesthetic experiences. The Yellow Sea provides opportunities for tourism and education. The classification of Ecosystem Services is adapted from the Millennium Ecosystem Assessment (2003).

To address the environmental problems in the Yellow Sea, it is important to act comprehensively, not individually due to the interlinkages between the environmental problems as well as the Project Components as illustrated above in the previous section.

As a result of the intervention, the SAP is expected to contribute to the objectives described in Section 1: protection of and sustainable use of marine and coastal resources in the Yellow Sea, and upgraded national capacity in protecting the marine environment.

4. Framework of SAP Preparation

There are four main parts to the SAP development (Figure 3):

- (1) Identification of the central linkage of protection and/or improvement of the Carrying Capacity of Ecosystem in the Yellow Sea through securing and/or improving its ability to provide Ecosystem Services;
- (2) Identification and prioritisation of environmental problems in the Yellow Sea;
- (3) Application of Causal Chain Analysis; and
- (4) Creation, prioritisation, and implementation of management interventions.

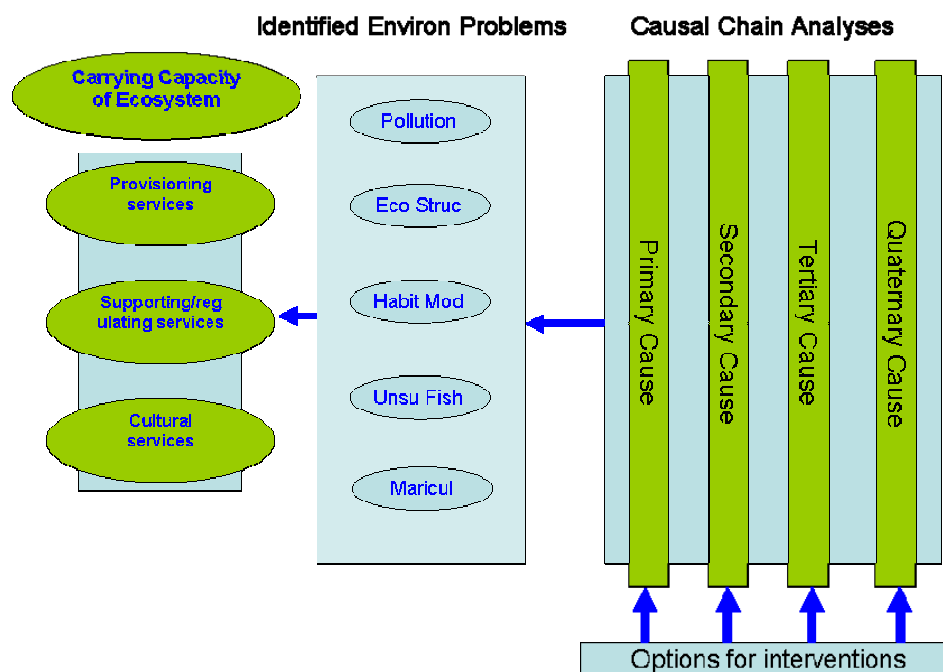


Figure 3. Four main parts of the SAP development

These result in the SAP identifying options for intervention i.e. harmonisations of the policies and legislations, institutional reforms, and environmental investments. The SAP should also prioritise conservation activities or interventions to protect and improve the Carrying Capacity of Ecosystem in the Yellow Sea.

Note that the TDA process has already completed part 2 and provided the causal chain analysis for part 3. Having conducted the Causal Chain Analysis, the TDA as well as other national and regional studies identified environmental problems in order of priority. Those priority problems are, as mentioned above, marine environment pollution, marine and coastal habitats modification, changes in ecosystem structures and functions, unsustainable fisheries, and unsustainable mariculture. The TDA then assessed the causes of the

problems hierarchically “from the immediate to the proximal causes as high a level of hierarchy as possible, extending up to the policy level wherever feasible” (TDA 2006, p. 4).

The impacts of the management interventions may take time to take effect and there may be a need to review and adjust the levels of those interventions, based on the required outcomes. It is therefore suggested that the duration of SAP should be until 2020.

5. Procedure for SAP Preparation

In order to identify the appropriate levels of management interventions (Part 4 of the SAP Framework) it is necessary to:

- (1) Identify the procedure to determine the regional Ecosystem Quality Objectives (EcoQOs)

Given the central linkage of CCE and the need to set the extent of management interventions, the next important step for the SAP preparation is to identify the regional EcoQOs. Note that EcoQOs are referred to as “regional targets” for management in some documents. This document uses EcoQOs and regional targets interchangeably.

Early on in the SAP development, there is a need to work out a procedure to identify the EcoQOs for the SAP.

Figure 4 shows the nitrogen enrichment problem as an example (for details of this example, see Box 1). In this example, the regional target for nitrogen concentration is established so that the level allows the Yellow Sea ecosystem to continue to provide its supporting and regulating services. However, it is necessary to have a clear understanding of how interlinking problems in the Yellow Sea will affect the level at which the EcoQOs are set.

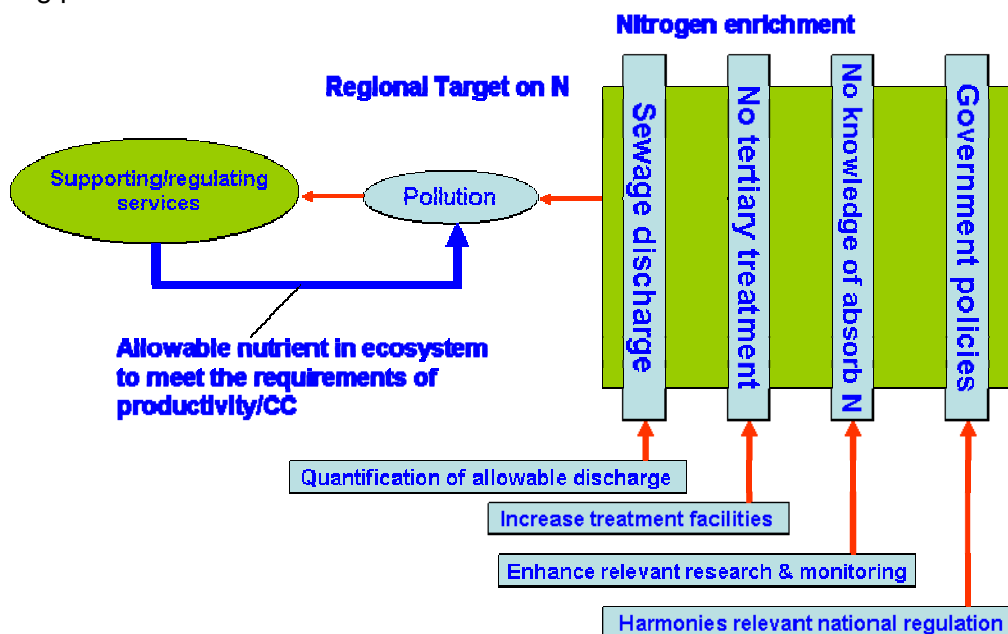


Figure 4. EcoQO identification process

Box 1. SAP Process Illustrated with an Example of a Pollution Problem

The SAP will list a set of management interventions according to priority in order to address major environmental problems identified by the TDA. For example, suppose that there are four hierarchically-organised causes of a pollution problem—nitrogen enrichment—as shown in Table 1.

Table 1. Causes of pollution problem – Nitrogen enrichment

Level of causes	Causes
Primary cause	Sewage discharge
Secondary cause	No tertiary treatment
Tertiary cause	No knowledge of Nitrogen absorption capacity by ecosystem
Root cause	Inadequate government policies

Suppose also that the sewage discharge, the primary cause, contributes to the pollution problems in the Yellow Sea, adversely affecting its supporting and regulating services. To mitigate those problems, the SAP would establish Ecosystem Quality Objectives (EcoQOs) on the nitrogen level in the concerned ecosystem so that it could provide the necessary supporting and regulating services. Subsequently, the SAP would create possible options for intervention to lessen the nitrogen enrichment. Table 2 shows examples of such options.

Table 2. Possible options for intervention

Causes	Interventions
Sewage discharge	Quantification of allowable discharge
No tertiary treatment	Increase treatment facilities
No knowledge of nitrogen absorption	Enhancement of relevant research and monitoring activities
Inadequate government policies	Harmonisation of relevant national regulations

Table 3 shows potential EcoQOs according to the three categories of the Ecosystem Services that the Yellow Sea ecosystem provides.

Table 3. Possible EcoQOs for Ecosystem Services in the Yellow Sea

Ecosystem Services	EcoQOs
Provisioning services	Maximum sustainable fisheries yield (MSY), sustainable production of mariculture, genetic resources
Supporting/regulating services	Allowable pollutant levels, productivity (diagnoses of changes), maintaining marine and coastal habitats
Cultural services	Sustained recreation and tourism

The SAP should define each EcoQC as specifically as possible to be used as the regional target.

There are three possible steps to identify the EcoQOs: (i) retrospective approach, (ii) theoretical approach, and (iii) comparative analysis approach. Each approach, shown in Table 4, contains a series of tasks to identify the EcoQOs.

Table 4. Methodologies for EcoQOs identification

Methodology	Task
Retrospective approach	Review historical data
	Check historical trends
	Identify current situation
	Review current political situation
	Identify critical habitats
Theoretical approach	Modelling
	Best Management Practices
	Maximum sustainable fisheries yield (MSY)
Comparative analysis approach	Comparative analysis with other LME's, international projects
	Consideration of different requirements between central and local govt.

(2) Identify the mechanisms to determine the EcoQOs

Having identified a methodology to determine the EcoQOs, it is also important to find an appropriate mechanism to discuss and agree on the EcoQOs. Currently, the Project is structured according to the “Components.” This structure was useful and effective for the TDA process. However, as we are facing the issue of cross components, the current project structure may not be as effective as for the TDA process. So now we need to agree on EcoQOs based on the central linkage of “Carrying Capacity of Ecosystem” that incorporates the cross component issues. It might be necessary to modify both the roles of the RWGs and the way RWG meetings are organised. For further discussion on this issue, see Section 6 “SAP Preparation Mechanism” in this document.

(3) Calculate the Carrying Capacity of Ecosystem

There is a need to identify how the Carrying Capacity of Ecosystem should be calculated. Currently most Carrying Capacity models use primary productivity as the central theme, however we need to consider how to quantitatively describe the provisioning, supporting/regulating, and cultural services that the Yellow Sea provides.

(4) Identify management interventions

With clearly defined regional targets for management, the necessary management interventions need to be identified based on the Causal Chain Analysis, and on geographic, social, and political conditions. Management actions should include harmonisation of legislation, institutional reforms, financial sustainability, human resource development, and regional co-operation. Technical interventions should also be considered to address specific problems identified in the TDA.

(5) Perform feasibility studies on the various options of management interventions

Studies will be conducted to test the feasibility of possible management interventions from the perspective of:

- Technical feasibility;
- Cost-benefit analysis; and
- Political and social acceptance.

The feasibility studies would then prioritise the interventions. Demonstration projects would be implemented to show the effectiveness of the proposed management actions before they are adopted on a widespread basis.

(6) Identify regional and national mechanisms to implement the management interventions

The mechanism to implement the agreed management actions will be very critical in ensuring success of the SAP. The SAP should:

- Clearly define the period of management actions;
- Clearly define regional targets for management;
- Describe management interventions to address the identified environmental problems and associated causes; and
- Clearly define feasibilities and benefits of the management interventions.

(7) Endorse the SAP

The SAP will describe a mechanism for SAP endorsement, specifying not only how and when the draft SAP should be presented for the participating governments to review and endorse, but also who should be involved in that endorsement process. An explicit consultation process with the government entities as well as other relevant stakeholders should be established in the SAP.

Figure 5 summarises the above procedure as well as other relevant work for preparing the SAP. Other preparatory work includes the following:

- Cost-benefit analysis;
- Regional governance analysis;
- Analysis on relationship between local and national governments; and
- Critical habitat verification.

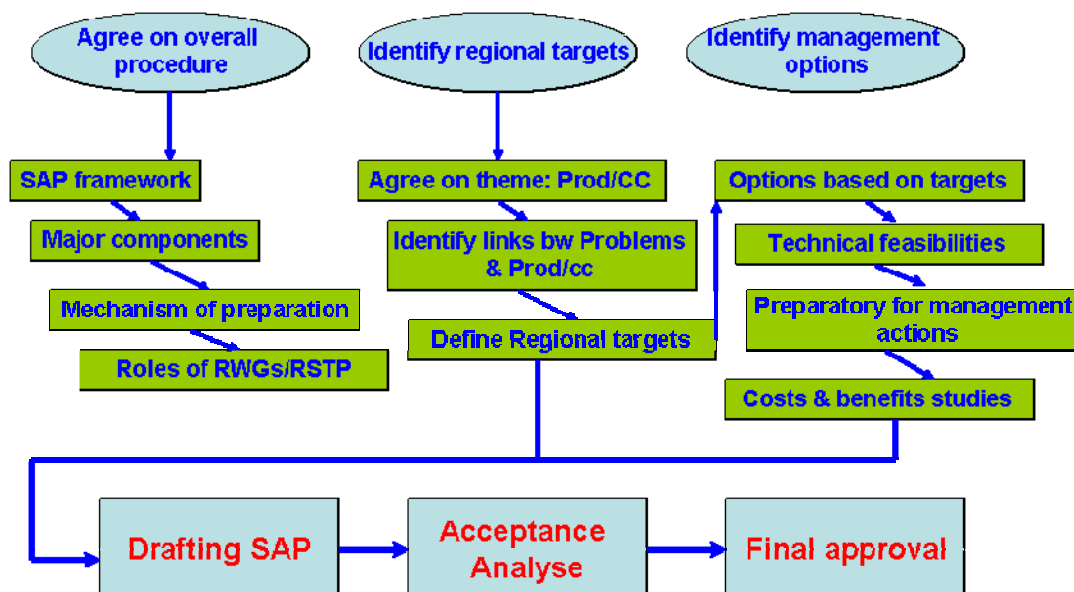


Figure 5. SAP preparation process

6. SAP Preparation Mechanism

An Ad-hoc Working Group that is responsible for the SAP preparation will be established under the Regional Scientific and Technical Panel (RSTP). According to the Terms of Reference (TOR), the RSTP has a role to “prepare scientifically and environmentally sound TDA and SAP.” The Ad-hoc Working Group will consist of 11 members with expertise in both natural science and social science. Table 5 shows the expertise required for the Group activities with the number of experts.

Table 5. Personnel composition of Ad-hoc Working Group

Expert	Number of experts
Natural scientists:	
Biodiversity	2
Ecosystem	2
Fisheries	2
Pollution	2
Economist	1
Legal expert	1
Project Manager	1
Total	11

The Ad-hoc Working Group will be guided by the Project Manager from the Project Management Office (PMO).

The first Ad-hoc Working Group meeting will be organised in the first half of April, 2007. The objective of this meeting is to identify the EcoQOs. The participants will use the retrospective approach as described in Section 5 (Table 4) in this document, reviewing historical data and trends, identifying the current situation of the Yellow Sea ecosystem, and reviewing the current political situation. The participants will also discuss whether alternative and/or supplementary approaches, i.e., the theoretical approach and the comparative analysis approach, are necessary for the EcoQO identification.

Prior to the first meeting, the Project will contract experts who may also be members of the Ad-hoc Group to provide the first Ad-hoc Working Group meeting with information to identify the EcoQOs. The contracted work, requiring approximately five person-days, should be carried out in March, 2007. A possible TOR for the work might include the following:

- Review historical data and trends of the Yellow Sea ecosystem;
- Identify the current situation of the Yellow Sea ecosystem;
- Review the current political situation in the countries bordering the Yellow Sea;
- Present the results of the above analyses which should include various options for EcoQOs for each variable (as highlighted by the HAB example in the SAP consultation meeting where an experts suggested that a 30% cut in N concentration in seawater would virtually eliminate HAB events, whereas a 50% cut in N concentration would restore the original diatom/dinoflagellate ratio) to the first Ad-hoc Working Group meeting; and
- Conduct further analysis, if necessary, and provide the Ad-hoc Working Group with the results based on the comments and suggestions provided during the first meeting.

The second Ad-hoc Working Group meeting will be organised in August, 2007. The objective of this second meeting is to:

- Review additional data and information collected after the first meeting;
- Finalise and agree on the EcoQOs;
- Discuss and agree on how to calculate the Carrying Capacity of Ecosystem; and

- Identify management actions to achieve the EcoQOs.

Participants in the second meeting will be determined after the first meeting according to needs. Inviting those who have expertise in local governments and NGOs—both are important stakeholders—might be necessary to incorporate their views and opinions in the SAP development.

It is preferable to organise several Regional Working Groups (RWG) meetings at the same time, which are currently scheduled separately, for the effective and efficient preparation of the SAP. The RWG meetings might be organised in conjunction with the Ad-hoc Working Group. The necessity as well as the timing of the RWG meetings will be considered after the first Ad-hoc Working Group meeting.

An SAP drafting group will consist of three/four members. The specific number of members will be decided through consultation at the Ad-hoc Working Group meetings. The drafting team might be drawn from within the Ad-hoc Working Group.

7. SAP Preparation Schedule

Task	Deadline	Responsibility
Finalise the Concept Paper	February, 2007	PMO
Contract with experts for basic data preparation (e.g., historical data review)	March, 2007	Regional experts/PMO
Start other relevant preparatory work (e.g., cost-benefit analysis, regional governance analysis, critical habitat verification)	March – July, 2007	Consultants/PMO
First Ad-hoc Working Group meeting	April, 2007	Ad-hoc Working Group/PMO
Second Ad-hoc Working Group meeting	August, 2007	Ad-hoc Working Group/PMO
Feasibility studies (technical, socio-economic, political)	August – December, 2007	Consultants/PMO
Start drafting Regional SAP	December, 2007 – Middle of 2008	SAP Drafting Group
Final Regional SAP	Middle of 2008	SAP Drafting Group
Endorse Regional SAP/National Yellow Sea Action Plans (NYSAP)	End of 2008	RSTP/PSC

References

- Millennium Ecosystem Assessment. (2003). Ecosystems and human well-being: A framework for assessment. Washington, DC: Island Press.
- UNDP/GEF Project "Reducing Environmental Stress in the Yellow Sea Large Marine Ecosystem." (2006). Transboundary Diagnostic Analysis.

Appendix

Productivity Module "focuses on oceanic variability and its effect on the production of phytoplankton and zooplankton that are at the base of the ocean food chain; it is concerned with the carrying capacity of ecosystems and their ability to sustain fishery and other living resources" (Olsen, et al., 2006).

Source: Olsen, S.B., J.G. Sutinen, Juda, L., Hennessey, T.M., & Grigalunas, T.A., 2006. A Handbook on Governance and Socioeconomics of Large Marine Ecosystems. Univ. of Rhodes Island, 94 p.