



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

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for the UNDP/GEF Yellow Sea Project**
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**REPORT FROM CHAIRPERSON OF
THE ECOSYSTEM REGIONAL WORKING GROUP (RWGE)**

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1. Introduction

After TDA had been completed, RWG-E's (Ecosystem Regional Working Group) remaining tasks would be assisting the preparation of SAP and demonstration projects. In addition to these, conducting surveys and developing techniques to obtain updated information on the ecosystem status are important tasks of RWG-E. Such include CPR (Continuous Plankton Recorder) surveys and Ocean Color Algorithm Development. Here, RWG-E's efforts in 2007 and future plans are briefly described. Also some recommendations are made to RSTP and PSC.

2. Past Activities

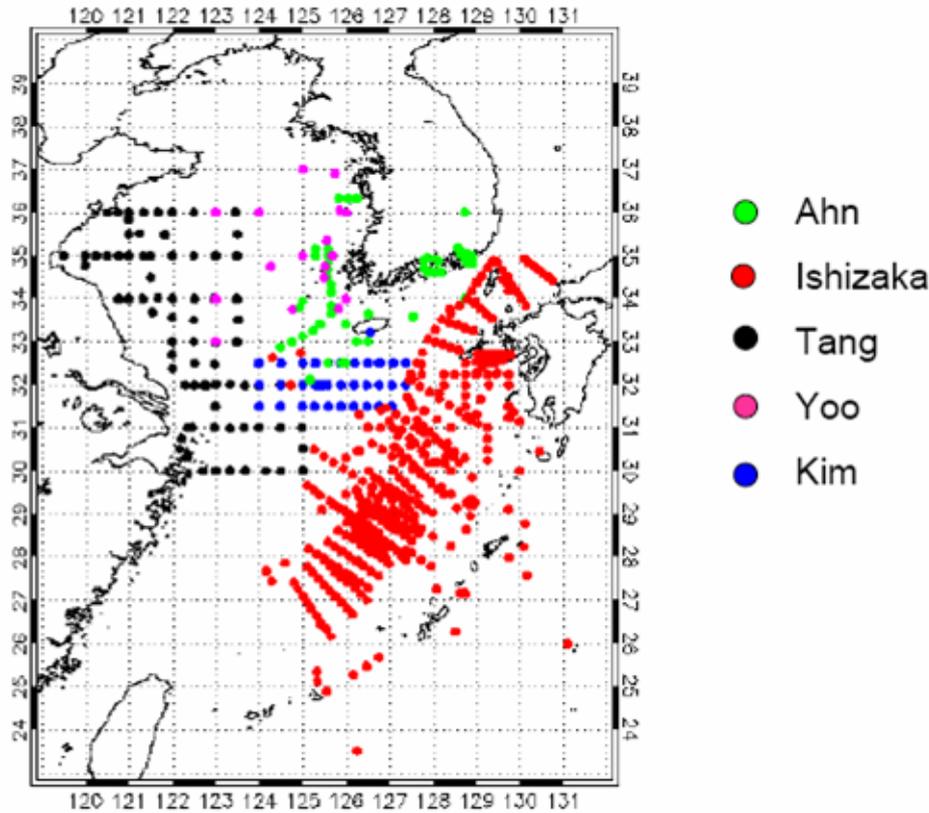
2.1. CPR survey

FIO conducted Nv-shuttle surveys in April 2007. The purpose of the survey was to demonstrate the utility of underwater towed body in making continuous observation revealing small scale structure in temperature, salinity, DO, pH, fluorescence, and phytoplankton & zooplankton abundance. FIO data clearly indicated that different structure existed across 124E in biological as well as hydrographical features. While the surveys successfully demonstrated the use of CPR, the survey covered only small segments to reveal more meaningful scientific information. During RWG-E discussion, consensus was that surveying several times a year in specific seasons and/or areas of scientific meaning is necessary for this to be useful. To demonstrate the usefulness of CPR fully, a better planned survey should be conducted with specific scientific questions.

2.2. Regional Ocean Color Algorithm Development

One of the obstacles in assessment of the status of the Yellow Sea ecosystem is lack of proper estimates of primary productivity in basin-scale. Primary productivity (PP) is one of the fundamental ecosystem properties concerning provisioning, and supporting/regulating services. Satellite observation has been established as a world-wide monitoring method of primary productivity. However, applying satellite observation to the Yellow Sea ecosystem is limited due to technical problems. To resolve the uncertainty in the base property of the food web, we have to resort to satellite technology, but for this, two problems have to be solved: 1) retrieval of chlorophyll-a from satellite data; and 2) estimation of depth-integrated daily primary production given the data of surface chlorophyll-a, PAR, turbidity, SST, etc. In this context, there is a need for two activities on developing an algorithm for chlorophyll retrieval and also for primary production.

To solve the first of the two problems, YSLME is sponsoring a China-Japan-Korea cooperative research on developing ocean color algorithm. This study group, called YOC (Yellow Sea Ocean Color), consists of six scientists who contributed bio-optic data covering the Yellow Sea and East China Sea. Two workshops were held, one in June and one in September 2007. Progresses have been made in setting up a common database, identifying missing data, and methods of analysis. The database is remarkably good in coverage and amount as the following map indicates.



The data coverage of YOC ocean color database

2.3. First Yellow Sea Regional Science Conference

RWG-E contributed nine papers to the conference. From the conference, some of the new findings and questions were raised. Among these the topics relevant to RWG-E group are:

- Is the Cold Water Mass shrinking and warming? Then how will the ecosystem be affected by the changes in the water mass, benthic communities in particular?
- How the climate change will affect the circulation pattern, upwelling & downwelling, and stratification strength?
- How Yellow Sea Warm Current will change?
- Test the hypotheses on the structural changes and energy flows in the lower trophic level ecosystem.
- Monitor the distribution and population dynamics of Jellyfish in YS and their migration to the East Sea/Japan Sea.
- Identify controlling factors of food web interaction
- Conduct and continue intercomparison and harmonize methodologies
- Ship Monitoring with more frequent samplings rather than annual broad-scale sampling
- Expand monitoring network with new platforms such as ferries
- On-going development of ocean color algorithm will enhance the utility of satellite data.

Some of these questions and issues need to be incorporated into SAP.

3. Preparatory Works for SAP

3.1. Clarification of the regional targets

The viewpoint of RWG-E is rather different from others in relation with SAP. Unlike other working groups who deal with provisioning, regulating, or cultural services, RWG-E's interests are more or less confined to supporting services. The implication is that RWG-E is more concerned with management actions of indirect nature. Consequently, it is not straightforward to relate the issues in terms of SAP.

There are two regional targets from Ecosystem working group and each of these targets are reviewed whether they are relevant and precisely defined. The two targets are: 1) assessment and prediction of ecosystem status; 2) reducing the frequency of HAB outbreaks. Previous description of the first target, after reviewing several suggestions, has been re-worded as, "better understanding and prediction of ecosystem changes for adaptive management." The target on HABs also came under some discussion as to how to justify and clarify it. After extensive discussion, it was agreed to revise the target to, "< 5 events (late 1980s condition) (HAB includes high biomass algal bloom)."

3.2. Finalization of management actions

RWG-E also reviewed the management action table produced during the 2nd SAP Ad-hoc Working Group Meeting, provided additional input to finalize the table, and reworded some of the actions to make them clearer to all readers. There was some discussion on assessing and monitoring the impacts of climate change, the institutional limitations related to this action, and HABs. In the same token, technical feasibility of each of the management actions were reviewed and re-worded. The management table has been completed.

4. Suggestions for potential demonstration activities.

Potential demonstration projects were discussed based on the selection criteria prepared at the Ad-hoc SAP meeting. After group deliberations, following three projects were selected as potential demonstration projects.

4.1. Monitor jellyfish bloom (Priority 1)

Motivation:

Recent outbreaks of jelly fish in the Northwestern Pacific is truly a transboundary problem in that reproduction occurs in the Yellow Sea or East China Sea and medusa spread out to the East Sea. An international co-operation is required for proper monitoring and mitigation of jellyfish blooms.

Methods:

- summer co-operative cruise + additional monitoring
- ship of opportunities

Expected outputs:

- Origination, composition, propagation, transport route of jellyfish bloom
- Reviews of and recommendations for monitoring methodology

4.2. Impacts of climate change on ecosystem (Priority 2)

Motivation:

There are many signs of global changes in regional scales. Certainly these changes will continue in the coming decades and interacts with anthropogenic influences. Therefore, the Yellow Sea ecosystem is anticipated to undergo severe changes in the future. Without understanding and predicting the future changes, it will be difficult, if not impossible, to properly manage the Yellow Sea ecosystem.

Methods:

- 2 co-operative cruises + additional monitoring
- Retrospective analysis (historical information)
- Remote sensing
- modeling

Expected outputs:

- Signal of climate change in Cold Water Mass (volume of water mass, intensity of stratification, range and average temperature)
- Signal of climate change from plankton and benthos communities

4.3. Impact of N:P:Si ratio change on ecosystem (Priority 3)

Motivation:

Of the changes reported in the past decades, nutrient ratio change in the basin is best documented and verified. However, the subsequent changes in the ecosystem are not verified well. Further monitoring of a long-term trend in the nutrient ratio and its consequences in the lower trophic level ecosystem should be studied.

Methods:

- 36 latitude
- 2 co-operative cruises + additional monitoring
- Measure nutrients, plankton (community structure and productivity)

Expected outputs:

- To assess the current status of long-term trend reported by Lin et al. (2005)
- To assess impact on ecosystem at lower trophic levels

5. Major Difficulties and Problems Encountered

As mentioned above, RWG-E's main task is to make proper assessment and prediction of the ecosystem status. We have been frustrated by delay of basin-scale surveys. Since 1992 there has been no basin-scale survey and assessment. And we do not have clear picture on the current state of the Yellow Sea ecosystem. As of now, we expect co-operative cruises to happen in 2008. Although delayed, the cruises will provide important information on the current status of the Yellow Sea ecosystem.

One of the problems in preparing for the cruises is lack of proper budget for benthos survey. When the second stage of the YSLME was planned, benthos surveys did not receive much attention and appropriate budget was not allocated. However, there are some reasons to believe that benthos surveys are crucial in understanding the changes in the Yellow Sea ecosystem. First, historical data collection indicates that for the past two decades, benthos biomass has been steadily increased and mostly polychaetes, in particular. This is consistent with eutrophication trend observed in the pelagic ecosystems. The trend in the

benthic communities has to be confirmed. Second, recent hydrological surveys showed that the temperature in the Cold Water Mass has been increasing. With continuing warming in the Cold Water Mass, a substantial change in the benthic community is anticipated. For better scientific surveys to be made, additional budget allocation for benthic surveys is desirable.

6. Work Plan for 2008

6.1. Writing of the guidelines of ecosystem monitoring SAP

There was no applicant for the consultant position to write the guidelines of ecosystem monitoring in 2006. We found out that some of the potential consultants for this work were not aware of the announcement of the work. We agreed to make a new announcement and also make sure the candidates be notified of this new opportunity. The announcement has been made as of November 2007.

6.2. Co-operative cruises

The fundamental role of RWG-E is to provide relevant scientific information for adaptive management. Such includes the current status and future projection of the Yellow Sea ecosystem. This is important for management in the face of many forcing factors such as global warming. Although we have collected historical data for the past decades, our current knowledge falls short of making comprehensive and definite assessment on the state of the Yellow Sea ecosystem. In this regard, a basin-scale ecosystem survey is crucial in laying a baseline in ecosystem assessment. At this point, we expect two co-operative cruises will happen, one in Jan and one in Aug 2008. Particularly, benthos surveys will provide important clue to the ecosystem change in the Cold Water Mass (central region) of the Yellow Sea.

6.3. YOC workshop

As mentioned in 2.2, an ocean color algorithm development activity has been going on since Feb 2007. Through two workshops, a common bio-optic database has been set up and preliminary analysis has been made. The third workshop will be held in Jan 2008 where the first cut of regional chlorophyll algorithm will be made. Although FIO scientists are not involved at this stage, one scientist will be invited as an observer to the third workshop. The third workshop will issue an assessment and recommendation on a regional ocean color algorithm. However, this should be considered as a beginning of continuing efforts for better algorithm. This activity should be supported in the future. As FIO is conducting bio-optical surveys in the Yellow Sea, we hope they will participate in the future activity.

6.4. Primary productivity estimation

Primary productivity of the Yellow Sea is important in two respects: 1) Potential biological production, and 2) water quality issues. Among many approaches to estimate potential food production, assessment and monitoring of primary productivity is crucial as they provide information of energy input at the basis of the food web. This knowledge is important in the face of changing climate in that variability in climate forcing and its effects on the ecosystem as a whole should be estimated from the basis of the food web. The processes and factors of primary production will also be used as a guideline for water quality management in relation with nutrient budget and control. With the advent of remote sensing technology, we have better assessment methods of basin-scale primary production or long-term changes in the primary productivity in the Yellow Sea. However, there are still serious uncertainties in

these results. First, the chlorophyll algorithm used is based on an empirical algorithm and not validated at all. Second, our understanding is still limited in turbid regions (tidally mixed areas of the YS) due to significant lack of field data and poorly-validated remote sensing algorithms for chlorophyll retrieval and photosynthesis parameters. YOC activity mentioned above will provide some breakthrough of the chlorophyll algorithm development. Using the chlorophyll algorithm and new measurements of photosynthesis parameter in turbid waters, an improved estimation of primary productivity of the Yellow Sea will be made in 2008. Expected outputs include:

- Monthly maps of primary production of the whole Yellow Sea
- Annual map of primary production (at 9 km resolution)
- Interannual variability of primary production of the Yellow Sea

6.5. Budgetary issues

As already mentioned in section 5, additional allocation of budget is needed for benthic surveys. However, itemized details of required budget can be determined during the Cruise-preparing technical meeting scheduled for Nov 22-23. The budget details as determined in the meeting will be reported to RSTP.

7. Recommendations to RSTP and PSC

- I. We ask additional budget allocation for successful benthos surveys in co-operative cruises (see Section 5). The exact details will be reported based on the discussion of Pre-cruise Technical meeting in Nov 22-23.
- II. Although we are expecting new ocean color algorithms from the final YOC workshop in Jan 2008, algorithm development should be continuously supported in the future. This is important as more remote sensing developments are being made. This activity will be one of the major technical developments from YSLME. The outputs can be used in other coastal seas of the Northwestern Pacific such as the East China Sea. Annual workshops where scientists from the region can discuss algorithm development/validation can be supported by YSLME.

Annex I. Ecosystem Component's Management Actions Table

Problems identified in CCA	"Problem Issue"	Regional target (2020)	General action	Ideal Management Action			Analysis of Planned & On-going Management Actions			Feasible Management Actions by 2020			Tech. Feasibility	Remark	Demo acts
				Technical	Institutional	Legislative	Technical	Institutional	Legislative	Technical	Institutional	Legislative			
Ecosystem changes (lower trophic level and benthos)		better understanding and prediction of ecosystem changes for adaptive management	Assess and monitor the impact of N/P/Si ratio change	harmonise monitoring methodologies and assess impacts	Establish cross-basin monitoring network & implement monitoring activities	develop a regional protocol for marine survey & monitoring; develop regional framework to incorporate the assessment into management policy	countries have different sampling methods and timing; regular surveys only cover limited area; not designed to reveal basin-scale changes; limited assessments	no cross-basin monitoring network due to lack of coordination among different agencies	non-harmonised existing national protocol between countries for marine survey & monitoring	harmonise monitoring methodologies and assessment of impacts	Establish cross-basin monitoring network & implement monitoring activities	harmonise national protocol for marine survey & monitoring; develop regional framework to incorporate the assessment into management policy	4	existing national monitoring networks	3

Problems identified in CCA	"Problem Issue"	Regional target (2020)	General action	Ideal Management Action			Analysis of Planned & On-going Management Actions			Feasible Management Actions by 2020			Tech. Feasibility	Remark	Demo acts
				Technical	Institutional	Legislative	Technical	Institutional	Legislative	Technical	Institutional	Legislative			
			Assess and monitor the impact of climate change	develop and/ or harmonise monitoring methodologies and assess impacts	Establish basin-scale monitoring network & implement monitoring activities	develop a regional protocol for marine survey & monitoring; develop regional framework to incorporate the assessment into management policy	ditto	no basin-scale monitoring network due to lack of co-ordination among different agencies; insufficient national programmes to train and support taxonomists	non-harmonised existing national protocol between countries for marine survey & monitoring; no regional protocol exists	develop and/ or harmonise monitoring methodologies and assessment of impacts	Establish basin-scale monitoring network & implement monitoring activities; convince relevant government agencies to increase investment on taxonomical research	harmonise national protocol for marine survey & monitoring; develop regional framework to incorporate the assessment into management policy	3	national monitoring network exists, but limited geographical scope & variables	2

Problems identified in CCA	"Problem Issue"	Regional target (2020)	General action	Ideal Management Action			Analysis of Planned & On-going Management Actions			Feasible Management Actions by 2020			Tech. Feasibility	Remark	Demo acts
				Technical	Institutional	Legislative	Technical	Institutional	Legislative	Technical	Institutional	Legislative			
			Predict ecosystem change in the long run	develop comprehensive models to predict ecosystem change and its impact on fisheries	establish regional science committee to co-ordinate modelling activities	develop framework to incorporate the prediction into management policy; develop regional framework to incorporate the assessment into management policy	no comprehensive, co-ordinated modelling	no regional body to co-ordinate modelling activities	no existing framework to incorporate prediction into management policy	develop comprehensive models to predict ecosystem change and its impact on fisheries	establish regional science committee to co-ordinate modelling activities	develop framework to incorporate the prediction into management policy	4	basic modelling technology exist	
			Monitor the trans-boundary impact of jellyfish blooms	develop nat'l and reg'l monitoring methodologies	Establish international monitoring network	not relevant	no common monitoring methodologies	no international monitoring network	not relevant	develop nat'l and reg'l monitoring methodologies	Establish international monitoring network	not relevant	4	Kor - has monitoring programmes; CHN - increasing damage; int'l interest is high	1

Problems identified in CCA	"Problem Issue"	Regional target (2020)	General action	Ideal Management Action			Analysis of Planned & On-going Management Actions			Feasible Management Actions by 2020			Tech. Feasibility	Remark	Demo acts
				Technical	Institutional	Legislative	Technical	Institutional	Legislative	Technical	Institutional	Legislative			
			Monitor HAB occurrences	improve capability in HAB monitoring, prediction and mitigation	establish regional HAB committee to co-ordinate assessment activities	develop regional framework to incorporate the assessment into management policy	monitoring programmes only at national level and scattered among responsible agencies	no regional HAB committee	no existing regional framework to incorporate assessment into management policy	improve capability in HAB monitoring and mitigation	establish regional HAB committee to co-ordinate assessment activities	develop regional framework to incorporate the assessment into management policy	4	on-going monitoring network; serious trans-boundary issue	
			establish Yellow Sea ecosystem database	Refer to RWG-I	Refer to RWG-I	Refer to RWG-I	Refer to RWG-I	Refer to RWG-I	Refer to RWG-I	Refer to RWG-I	Refer to RWG-I	Refer to RWG-I	4	DB under construction	
Increased frequency of HABs	See Nitrogen enrichment and eutrophication	< 5 events (late 1980s condition) (HAB includes high biomass algal bloom)	See Nitrogen enrichment and eutrophication	See Nitrogen enrichment and eutrophication	See Nitrogen enrichment and eutrophication	See Nitrogen enrichment and eutrophication	See Nitrogen enrichment and eutrophication	See Nitrogen enrichment and eutrophication	See Nitrogen enrichment and eutrophication	See Nitrogen enrichment and eutrophication	See Nitrogen enrichment and eutrophication	See Nitrogen enrichment and eutrophication	Refer RWG-P	Refer RWG-P	

Annex II. ECOSYSTEM COMPONENT'S WORKPLAN FOR 2008

Activity	Action	Timeline / Deadline
<u>CPR 2</u>	survey with co-operative cruises	Jan. and July/Aug. 2008
<u>Co-operative cruises</u>	technical planning meeting	Nov/Dec. 2007
	cruises	Jan. and July/Aug. 2008
<u>OC</u>	support participation of expert from FIO to participate in OC-3 Meeting	Jan. 2008
<u>Primary productivity estimation</u>	move from 2007 to 2008	All -08
<u>Guidelines on ecosystem monitoring</u>	PMO advertise and solicit proposals	Oct - Nov. 07
	drafting guidelines	Dec. 07 - Mar. 08
<u>SAP Finalisation</u>		
Feasibility Studies (political and social acceptance)		Sept - Dec. 2007
SAP drafting	Drafting Group to liaise through e-mail and 3 working meetings	Jan. to May 2008
SAP review by RSTP and PSC	Special RSTP/PSC	Apr-08
SAP approval	govts	Jun-08
Demo Activities	Demo site implementation	Sept. 2008 to Dec. 2009
<u>NYSAP</u>		
drafting NYSAP	NPC and national members	2008
govt approval of NYSAP	govt	late 2008
<u>5th RWG-E Meeting</u>	PMO will arrange	23-25 Sept.