UNDP/GEF/YS/RWG-B.4/5
Date: 24 August 2007
English only

Fourth Meeting of the Regional Working Group
for the Biodiversity Component
Seogwipo, Republic of Korea, 17 -19 September 2007

2007 Completed and On-going Activities Of the Biodiversity Component

1. In addition to the Genepool Workshop and Biodiversity Advisor and Coastal Survey, in 2006, the Biodiversity Component considered implementing other activities, some of which are still pending. These activities are described below.

Agenda 5.1
Genepool & Genetic Diversity

2. RWG-B members are invited to review the discussion document and suggest if any specific actions that are required to protect genetic diversity in the Yellow Sea. Or can genetic diversity be protected by the same measures proposed for Biodiversity in general?
3. The discussion document from the Genepool Workshop is listed in **Annex 1.**

Agenda 5.2 & 5.3
Biodiversity Advisor & Coastal Survey

4. Since the inception of the Project, Biodiversity advisor has been part of the project budget. In 2007 the budget for Biodiversity advisor was used to aid us identifying areas of high biodiversity through the conception of a plan to survey the coastal biodiversity.

5. RWG-B members are invited to review/comment on the TOR/proposals (**Annex 2**).

6. The RWG-B members need to discuss and recommend in the role that the future Biodiversity Advisor should play. PMO suggests that the Advisor play a part in the initialisation and monitoring of the demonstration activities.

Agenda 5.4.
Regional Science conference

7. RWG-B members are informed of the First Regional Yellow Sea Science Conference held in Hangzhou 14 -16 August.

Agenda 5.5.
WWF YSESP project

8. RWG-B members will be informed of the new YSESP project and possible compatibility and synergy with the YSLME project

Annex 1
Genepool outputs
Biodiversity Discussion and agreements

The talks presented on 14 May were briefly reviewed. An overview of the Yellow Sea Large Marine Ecosystem project was presented that included achievements so far including the National Data and Information reports on the 5 project components Biodiversity, Fisheries & Mariculture, Ecosystem, Pollution and Governance Analysis and their Regional Synthesis. These fed into the Transboundary Diagnostic Analysis which highlighted the major problems environmental problems in the Yellow Sea and the presented causes of those problems in a Causal Chain Analysis. At present the Strategic Action Plan (SAP) being developed, in which the Ecosystem Quality Objectives or Regional targets are identified. These targets include discharge levels and water quality goals for pollution; a Total Allowable Catch set at less than the Maximum Sustainable Yield for fisheries; Best Management Practice and Polyculture for Mariculture; No further land reclamation other than that already planned for Biodiversity; Diatom dominated phytoplankton community for Ecosystem. The next phase for the SAP is the identification of management action plans that will result in the achievement of the Ecosystem Quality Objectives.

Some ideas from Conservation Biology- Applied Ecology from a lecture by Dr Charles Krebb were used to highlight some of the problems facing the identification of regional targets in the Biodiversity Component.

1) How to protect biodiversity? Which aspect is more important species richness, species composition, vulnerable species, structural species or keystone species?
2) How do you protect genetic diversity (no. of distinct alleles) and genetic variance (homologous to heterozygosity)?
3) How do you select which habitat is important for biodiversity preservation?
4) How do you ensure adequate gene-flow between preserved habitats, especially for less mobile land based animals/mammals/insects?

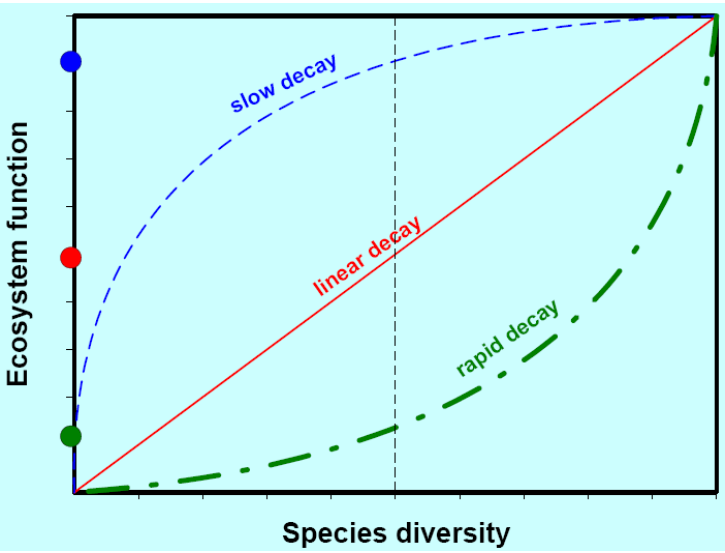

Figure 1: Theoretical decline in ecosystem function with species loss.

Reductions in biodiversity, both on a species level and genetic level result in a decline in ecosystem function, but what is the relationship? How much redundancy is built into the

system in terms of the number of species and amount of genetic diversity that can be lost without significant loss of ecosystem function? Figure 1 shows the possible relationships between the rate of decline in ecosystem function and the number of species removed. The non-linear rates of decay suggest some species may be more important in maintaining ecosystem function than others eg keystone or structural species. However most policy is made only considering a linear relationship between ecosystem function and species diversity, which may be an unreliable predictor.

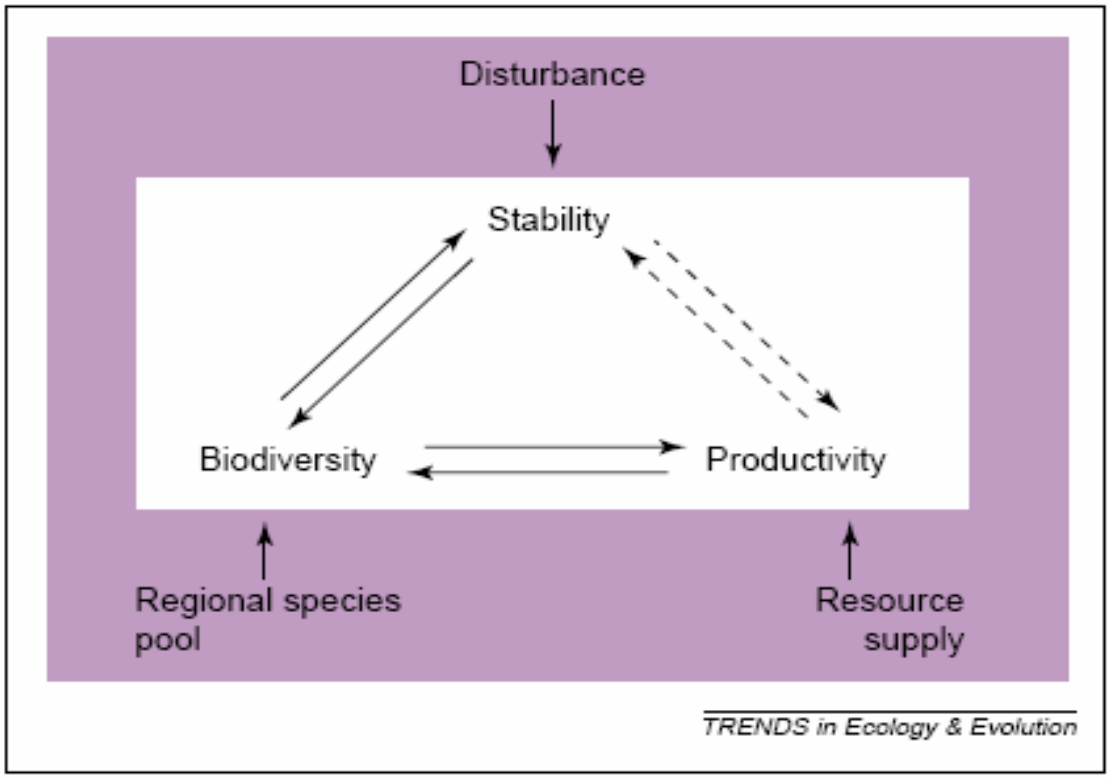

Figure 2: Relationship between biodiversity, stability and productivity hypothesised by Worm and Duffy (2003)

Communities with high levels of biodiversity in terms of composition and species richness frequently show greater stability (in terms of biomass) when exposed to environmental change or disturbance (Worm and Duffy 2003). Highly disturbed environments often show low species diversity, while stable environments show high diversity. These relationships are shown in Fig.2. Loss of biodiversity can also impact on productivity of a system, for example structural species such as mangroves or seagrass could have serious consequences for dependant organisms and a consequent loss in productivity (Worm and Duffy 2003). In contrast, other reports suggest that while generally biodiversity does increase stability, certain functional groups or the inclusion of particular species can have much more of an impact on stability than others (McCann 2000),

Food webs consist of interactions between many species, with an interaction defined as the relationship between predator and prey. But are strong interactors or keystone species more important? Models suggest that weak interactors dampen oscillations between predator and

prey and reduce extinction rates. Moreover analysis of food webs and experiments have shown variable, but frequently strong effects of week interactors (Worm and Duffy 2003). Complexity within the system in terms of the number of energetic pathways in the food web is also related to stability (McCann 2000). These authors conclude that any loss of biodiversity could have serious consequences resulting in the reorganisation of the ecosystem through trophic cascades or a rapid shift to an undesirable stable state (McCann 2000, Worm and Duffy 2003). There are many examples of regime shifts in the marine system, such as that from fish to jellyfish dominated systems, and in the North Atlantic from cod to Atlantic herring (Bakun and Weeks 2006).

Another hypothesis suggests that simplified systems are more vulnerable to invasion from exotic species (McCann 2000).

Genetic diversity discussion

1) So why protect genetic diversity? One of the most important reasons is to preserve future evolutionary potential, which may be especially important given the impacts from both climate change and pollution. Genetic diversity also increased a species' resistance to disease. Moreover, it has been demonstrated that local ecotypes exist that are better adapted to local conditions and more productive in that specific environment, compared with the same species from outside the area (Joshi et al. 2001). Therefore loss of localised ecotypes would reduce the productivity of the system.

2) Are there any specific threats to genetic diversity? It was agreed that most threats come from aquaculture, specifically from selective breeding programs and the small initial number of brood stock used for breeding programs. Escapees from cultured species, such as the olive flounder and black rock fish and culture molluscs, may well have an impact on genetic diversity of wild stocks if there are enough escapees and sufficient interbreeding between the escapees and the wild stock. Restocking programs are another source of genetic degradation, due to the interbreeding of cultured individuals of low genetic diversity and the wild stock. Other threats come from the same sources that impact species diversity including; pollution, reclamation, introduction of exotic species/ecotypes and over-fishing/over-exploitation.

3) Are there any specific genetic diversity hotspots in the Yellow Sea? South west of Jeju Island and Hong Do in the SW of the Republic of Korea were suggestions, these are also known to be areas of high species richness.

4) In terms of preserving genetic diversity, are there any specific measures that need to be taken? Or will the management actions required to preserve species diversity also cover the needs of genetic diversity? There was general agreement amongst participants, that for the purpose of the YSLME project, the actions needed to preserve species diversity would also conserve genetic diversity and therefore could the both genetic and species diversity be considered the same. The only exceptions being, those raised in point 2.

5) Is there a method of observing the degradation in the Yellow Sea? Heterozygosity was suggested as a measure that could be used to observe declines in genetic diversity. (*Heterozygosity = The presence of different alleles (forms of a given gene)*

at a particular gene locus. Heterozygosity provides a measure of the genetic variation, either in a population (the frequency of individuals heterozygous at a particular locus), or in an individual (the proportion of gene). However, at present there was not enough historical data for almost all of the species with in the Yellow Sea. Moreover, it was agreed that although this method was very important, to obtain such data would be expensive and require long term monitoring. However, Dr Linsheng Song suggested that there maybe enough data to permit an examination of genetic decay in *Fenneropenaeus chinensis* stocks, as this species was subject to an extensive restocking campaign.

6) Lastly the need for a genetic database or germplasm bank specifically for the Yellow Sea was raised. In light of the large number of genetic databases that already existed in various institutions mentioned in the talks it was agreed that another data base was not needed. However, it was felt that although websites existed, such IUCN, that had links to a number of genetic databases, most of the local databases were not included in these lists.

   Dr Linsheng Song agreed that he would be responsible for collecting the web addresses of all Chinese databases containing genetic information relevant to the Yellow Sea. For private databases and those not available to the public, only the contact details of the person in charge of the database would be provided.

   Dr Tae-Jin Choi reported that he was already compiling a report for the Korean government that would include a list of databases and he would forward this list to YSLME project management office (PMO) by the end of June.

   It was agreed that PMO would compile the complete list and make a webpage including all the links and contact details. This page would be distributed to other institutions for them to uploaded onto their websites

   A germplasm bank already existed in China and one was in the planning stages in the R. of Korea.

References

Bakun, A., and S. J. Weeks. 2006. Adverse feedback sequences in exploited marine systems: are deliberate interruptive actions warranted? Fish and Fisheries. **7**:316-333.

Joshi, J., B. Schmid, M. C. Caldeira, P. G. Dimitrakopoulos, J. Good, R. Harris, A. Hector, K. Huss-Danell, A. Jumpponen, A. Minns, C. P. H. Mulder, J. S. Pereira, A. Prinz, M. Scherer-Lorenzen, A. S. D. Siamantziouras, A. C. Terry, A. Y. Troumbis, and J. H. Lawton. 2001. Local adaptation enhances performance of common plant species. Ecology Letters. **4**:536-544.

McCann, K. S. 2000. The diversity-stability debate. Nature. **405**:228-233.

Worm, B., and J. E. Duffy. 2003. Biodiversity, productivity and stability in real food webs. Trends in Ecology & Evolution. **18**:628-632.

Annex 2

Terms of Reference

Project:	UNDP/GEF Yellow Sea Large Marine (YSLME) Ecosystem Project
RAS/00/G31	Reducing Environmental Stress in the Yellow Sea Large Marine Ecosystem
Objective:	2 - Biodiversity Component
Sub-Objective:	B – Biodiversity Advisor
TOR Code:	TORO2B1702Bioad
Contract Code:	CONO2B1702Bioad _[ROK and PRC]
Description:	*Biodiversity advisor to develop a protocol and perform a rapid assessment of species diversity in coastal areas within Yellow Sea Large Marine Ecosystem*

BACKGROUND

In the approved Implementation Plan of the UNDP/GEF Yellow Sea Project, "Reducing Environmental Stress in the Yellow Sea Large Marine Ecosystem (YSLME)," one of the activities of the Biodiversity Component is to identify critical habitats for biodiversity conservation. Two of these habitats will be selected as sites where the effectiveness of management actions identified in the YSLME Strategic Action Plan can be demonstrated.

The national data and information reports and the regional synthesis indicate that biodiversity conservation is not well understood. The concept of biodiversity and its importance remains hard to grasp and is difficult to articulate. These reports have successfully identified many of the problems facing the different components of biodiversity (habitats, species diversity, vulnerable species, and genetic diversity) such as over exploitation, pollution and land reclamation. However, there is a need to now emphasise the importance of biodiversity and use current ecological theories on population, community or landscape dynamics to help explain what may be happening to biodiversity in the Yellow Sea and to predict what the consequences of this decline in biodiversity maybe in terms of the loss of ecosystem services.

The Yellow Sea Project commissioned Biodiversity National Data and Information Reports suggest there are there is a lack of spatial information on species diversity and density. Loss of some important habitats have gone almost unreported such as the dramatic decline in one of the most critical sub-tidal habitats, that of the sub-tidal eelgrass (*Zostera marina*), which has almost disappeared along the Chinese coast since the 1970's (Tang and Fang 2002). This is a major loss as *Zostera* spp. is considered an important nursery habitat for fish and crustaceans (Polte et al. 2005, Joseph et al. 2006, Polte and Asmus 2006).

The objective of this task is to identify the critical areas for biodiversity conservation in the Yellow Sea in order to facilitate the selection of two of these sites to demonstrate the effectiveness of the YSLME Strategic Action Programme (SAP) management actions. The consultant should review data from the national reports, YSEPP report and scientific literature to identify gaps and then develop an efficient sampling design for a rapid coastal survey. Ideally the survey should be combined with predictive spatial modelling of communities to fill the data gaps to help in the identification of critical habitats. For the predictive modelling, the study area is divided into a grid of many thousands/millions of cells, depending on the resolution required. Two types of data are required for this predictive spatial modelling: (a) biological survey or collection data scattered over the modelled area,

and (b) remotely derived environmental predictors covering the entire grid. Extrapolations using the relationship of communities with certain physical parameters are used to predict which communities are expected in what areas. These can then be re-sampled to ensure accuracy. However if cost are prohibitive, then other survey methods may be considered such as those that use indicator species or structural species.

The consultant should also formulate better ecosystem quality objectives and management actions for the Yellow Sea for example landscape management of the coastal environment. How these habitats should be managed and sustainably developed to improve their biodiversity friendliness (for example water levels in aquaculture ponds, the way reed beds are cut to improve the feeding and shelter for birds).

The immediate objectives of this task are to

a) Produce a report highlighting the importance of biodiversity, combining currently accepted ecological theories of population, community and landscape dynamics with conservation biology with examples to demonstrate this, and the implications for ignoring biodiversity loss.

b) Review the data from the national reports and current literature to determine the gaps in information needed to identify areas critical to biodiversity preservation and what data are required to provide the necessary scientific and spatial justification for the protection of these areas.

c) Develop a rapid sampling scheme that that can be combined with predictive modelling to provide the necessary evidence to identify areas of biodiversity importance.

d) Organise the survey on Yellow Sea inter-tidal and shallow sub-tidal habitats, analyse the data.

e) Produce a map of areas critical to Yellow Sea biodiversity with a report justifying the selection and identifying possible ecological targets and management actions required to safeguard biodiversity. The report that will help in the selection of the YSESP and YSLME demonstration sites.

f) The data generated will be open to the public and available through the YSLME GIS database.

Geographic Scope: The Yellow Sea Large Marine Ecosystem is defined in this Project Document as the body of water delineated at the south, by a line connecting the north bank of the mouth of the Chang Jiang (Yangtze River) to the south side of Cheju Island; at the east, by a line connecting Cheju Island to Jindo Island along the coast of the ROK; and to the north, a line connecting Dalian to Penglai (on the Shandong Peninsula).

DESCRIPTION OF REQUIRED SERVICES

Two competent incumbents [1], selected through the required United Nations bidding procedure, will be contracted to develop and perform a survey of Yellow Sea biodiversity in order to produce a map of areas critical to Yellow Sea biodiversity with a report justifying the selection and identifying possible ecological targets and management actions required to safeguard biodiversity. These critical areas will become part of the YSLME Project Strategic Action Programme (SAP) and National Yellow Sea Action Plans (NYSAP). Moreover two

[1] The name of institution or person coordinating the activity (one for China and one for R. Korea).

will be selected to demonstrate the effectiveness of the Management Actions identified in the SAP. The incumbent(s) shall carry out the following activities:

Analyse the available data to identify the data needs of the survey, and review the current techniques/methodologies used in rapid biodiversity survey techniques. The summary should describe:

a. A review of the Yellow Sea Biodiversity data to identify gaps and help focus the survey
b. A brief description of the techniques/methodologies used to survey biodiversity.
c. The benefits, drawbacks and difficulties of the selected method along with a comprehensive explanation of the method.
d. The types of data and information collected by the survey.

Perform the Survey:

a. Organise the survey teams.
b. Manage the data collection in a centralized data base
c. Analyse the data collected

Prepare final report that includes the critical areas for biodiversity conservation:

a. Produce a map of Yellow Sea biodiversity that identifies critical areas (< 10% of the total coastline);
b. The report should specify why these areas where selected;
c. The report should include recommendations for regional targets and the management actions that are needed to meet those targets;

Present the report and model to the PMO for review.

Based on the comments of the PMO, revise the manuscript for final acceptance by PMO.

Qualifications:
The incumbent selected to carry out this task should have the following qualifications:

- At least 10 years experience in the field of biodiversity assessment, most preferable in the Yellow Sea.
- An extensive knowledge of contemporary biodiversity survey methods and the analysis of relevant data and information.
- Ability to access necessary data and information through the databases, information centres, and other relevant institutions.
- Have the appropriate academic qualifications, available time to undertake the task.
- Financial accountability with a professional financial management system.

EXPECTED OUTPUTS

The final product (report) should be a set of reports as listed below:

i. A comprehensive review on the current techniques used in Biodiversity assessment, comparison of methodologies and rationale for the selection of the chosen method. The review of the currently available data should be presented as a guide as to what the survey should cover.

ii. The report should be structured like that of peer-reviewed review article and all sources of information and data should be cited in the text. Literature citations in the text should indicate the author's surname with the year of publication in parentheses, e.g. Carlin (1992); Brooks and Carlin (1992). If there are more than two authors, only the first should be named, followed by "et al." References at the end of the paper should include all in text citations and be listed in alphabetical order by the first author's name. If there is more than one work by the same author or team of authors in the same year, a, b, etc. is added to the year both in the text and in the list of reference

   Name(s) and initial(s) of all authors; year; full title of article or report; journal title or oraganisation; volume number; first and last page numbers
   Example:
   Glassom D, Zakai D, Chadwick-Furman NE (2004) Coral recruitment: a spatio-temporal analysis along the coastline of Eilat, northern Red Sea. Marine Biology 144: 641-651

iii. The final report should be structured as a scientific report with introduction, methods, results and discussion. The results should detail the survey findings and include a biodiversity map for the Yellow Sea. A CD containing the raw data collected in the survey should also be submitted.

iv. Project progress reports and financial report as described in the Section on Monitoring/Progress Control and shown in Appendix 2.

All documents must be written in English (and in Chinese and Korean if possible) and provided in both print and electronic form. Three printed copies of each report and one electronic copy will be submitted to the Yellow Sea Project Management Office (PMO) on the due date, and at least three weeks in advance of the RWG Meeting at which it will be reviewed. The contracted institution(s) should then incorporate the comments from the RWG Meeting(s) into the final report(s).

SUGGESTED FINAL REPORT TABLE OF CONTENTS

I. Abstract

II. Introduction of the various methodologies and rationale for selecting the chosen method. Outline of the survey area and available data and aims of the survey.

III. Methods

IV. Results, analysis and presentation of the survey data, to include visual representations of the density of species, indicator species, endangered species, and endemic species

V. Discussion to include arguments for the ecological targets for 2020, and management actions, within the context of what other government/agencies have done

VI. Summary and Recommendations

VII. List of References

Annex containing:

- CD of raw survey data
- Progress and Financial Summary Reports

DELIVERABLES AND DEADLINES

The commissioned assignment will be carried out from (*) through (*), according to the following schedule:

Task	**Deadline**
Proposal detailing methodology and deliverables	31 Aug 2007
Contract signature	7 Sept 2007
Report on the current techniques used to assess biodiversity and review on the gaps in biodiversity knowledge and rational and selection of method	30 Sept 2007
Survey	1-31 Oct 2007
Progress report and interim financial statement submitted to PMO/UNOPS	30 Nov 2007
Final Report and Final financial statement submitted to PMO/(UNOPS	30 Dec 2007

MONITORING/PROGRESS CONTROL

The PMO will assume overall supervision and co-ordination of this task. Programmatic guidance should be sought from the Project Manager, Mr. Yihang Jiang (yihang@yslme.org), copied to Mr. Mark Walton (mark@yslme.org) at the Yellow Sea PMO. All deliverables should be submitted to Mr. Mark Walton. The format of the progress, final and financial reports should follow the templates included in Appendix 2 and the schedule as above.

BREAKDOWN OF COSTS (USD)

Please attach your detailed bid for the above contract using the format below. There may be travel costs associated with this task, as outlined in the budget below. Travel costs associated with the missions should be included in the fees below. [Name of institution(s)] will make its own travel arrangements unless otherwise agreed in advance with the PMO.

Item	**Unit Cost (USD)**	**# of Units**	**Total Cost (USD)**
TOTAL AMOUNT REQUESTED			