



Implementing the Strategic Action Programme for the Yellow Sea Large Marine Ecosystem:
Restoring Ecosystem Goods and Services and Consolidation of a Long-term Regional
Environmental Governance Framework (UNDP/GEF YSLME Phase II Project)

Proceedings of the 1st Meeting of the Regional Working Group on Fish Stocks (RWG-F) of the UNDP/GEF YSLME Phase II Project

Bunea Vista Peninsula Hotel, Yantai, PR China
17-18 October 2017

Cover photo: From 2017 on, the Swimming Crab (*Portunus trituberculatus*) is under total allowable catch (TAC) and quota management in both PR China (Zhejiang Province) and RO Korea. One population of the species spends winter time in the bottom in the deep waters of Yellow Sea and migrates to the west coast of Korea and east coast of PR China (Jiangsu, Shandong and Liaoning provinces) for spawning from April to September each year (Yeon et al., 1992; Yeon, 1997).

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Table of Contents

1. Opening of the Meeting	4
2. Organization of the meeting	5
3. Review and refine documents approved at the 1st Meeting of Interim YSLME Commission Council	5
4. Session 1: Review of the implementation of activities related with Objective 1: to assess the progress of SAP target 1 implementation and make recommendations on targets and actions in the updated SAP	6
5. Session 2: Review of the implementation of activities related with Objective 2: to enhance capacity of national and local governments in monitoring and assessment of fish stocks, and effectiveness of licensing, closure and restocking management	10
6. Session 3: Selection of demonstration sites	11
7. Session 4: knowledge management	12
8. Session 5: Collaboration with other partners	12
9. Agenda of next RWG meeting	12
10. Other Business	13
11. Wrap-up and closure of the meeting	13
Annex 1: List of Participants	15
Annex 2: Program of the 1st Meeting of the RWG-F	17
Annex 3: Terms of Reference of activities in Component 2 in relation to mandate of RWG-F in UNDP/GEF YSLME Phase II Project (revised)	20
Annex 4: Presentation of Xiujian Shan on Joint regional stock assessment methodology	26

PROCEEDINGS OF THE MEETING

I. Opening of the Meeting

1. The 1st Meeting of the Regional Working Group on Fish Stocks (RWG-F) of the UNDP/GEF YSLME Phase II Project was held in Bunea Vista Peninsula Hotel, Yantai, on October 17-18, 2017. National Coordinators (NCs) from ROK, members of the RWG-F from ROK, members of National Working Group on Fish Stocks from PR China, representatives from Ministry of Agriculture of PR China, members of the Oceanic and Fishery Department of Shandong province, Korea Marine Environment Management Corporation (KOEM) and staff of PMO participated in the meeting.
2. Mr. Yinfeng GUO, Chief Technical Adviser of the Project opened the meeting and welcomed all participants to Yantai, PR China. He introduced briefly the background of the project, the processes of TDA and SAP addressing key issues under the mandate of the RWG-F, as well as roles of RWG-F as directed by the first meeting of the Interim Commission Council (ICC). He reminded the participants of the slower than expected implementation of the project and underscored the urgency of full implementation of the project with cooperation of both countries.
3. Mr. Xianshi JIN, Director General of YSFRI and the Chair of NWG-F in PR China, welcomed all participants and expected the second phase of the Project to be as successful as in the first phase through enhanced cooperation. He welcomed Mr. Qingchun JIANG and Ms. Rui GUO for their attending this meeting to support YSLME Project.
4. Mr. Junhee CHO, the Chair of NWG-F in ROK, delivered welcome remarks. On the behalf of ROK Government, he thanked all the participants for attending the RWG-F meeting.
5. Ms. Rui GUO from Bureau of Fisheries, Ministry of Agriculture, welcomed all the guests from ROK to visit PR China and to enjoy the good season in Yantai. She hoped all the participants would enjoy the food in Yantai City and wished both sides could have satisfactory results in regional cooperation. Also, she informed all the participants that Ministry of Agriculture would do its best to support the project. She wished all the guests from ROK have a pleasant journey in PR China.
6. Mr. Qingchun JIANG, Deputy Director General of Oceanic and Fishery Department of Shandong Province, welcomed all the participants and recalled the good collaboration between Shandong Province and Ministry of Oceans and Fisheries of ROK. He underscored the importance of protecting fish spawning and nursery grounds in the Yellow Sea and roles of Shandong Province in replenishing the fish stocks through conservation and protection of these areas.
7. The participants then went through a round of self-introduction of their names, organizations and expertise related to the mandate of the RWG-F.
8. The list of participants is attached to this report as Annex I.

2. Organization of the meeting

2.1. Election of Chair and designation of rapporteurs

9. Mr. GUO invited the representatives of PR China and ROK to nominate the Chair of the meeting. Considering the fact that Chairs and Vice Chairs of all RWGs have not been nominated, the meeting suggested Mr. JIN, Director General of YSFYI to serve as the interim Chair and designated the secretariat as rapporteur.
10. Mr. JIN, the Chair reiterated the significance of prompt implementation of activities considering delayed start-up of the 2nd phase of the project. He recalled the first phase of YSLME in 1995 when he acted as chairperson of RGW-F and the fact that very few people still work for the second phase of YSLME. In this regard, he suggested more young scientists be involved in implementing this project and shoulder the responsibilities.

2.2. Adoption of agenda

11. Mr. GUO introduced the meeting agenda. He explained that the meeting will address the following issues: 1) to seek consensus over the TORs and workplans of the RWG-F. In this meeting, it is expected to have discussion to revise and refine work plans as well as TORs of RWG-F if necessary; 2) to respond to the decisions of the interim Commission Council to expedite the implementation of the project with review of TORs of key activities related with mandate of the RWG-F as a standard procedure of UNOPS and UNDP in mobilizing expertise to implement project activities; 3) to identify demonstration sites and agree on interventions at local levels to catalyse active participation of local stakeholders in the near future; 4) knowledge management and capacity development; 5) agenda for next meeting.
12. The meeting adopted the agenda as it is.

3. Review and refine documents approved at the 1st Meeting of Interim YSLME Commission Council

3.1. Project overview and outcomes and activities related to the mandate of RWG-F

13. Mr. GUO introduced project outcomes, targets, activities and budget for activities in 2017. In his presentation, outcomes of components 2 and 4 in relation to fish stocks were elaborated. Also, in line with activities that RWG-F is supposed to implement, management measures at regional level were introduced together with activities to be implemented in 2017.
14. After PMO's presentation, the floor was open for general comments and suggestions. Mr. OH introduced current relevant situations of ROK in project implementation by highlighting two points: 1) the budget in 2017 is limited but ROK would make efforts to secure more funding; 2) ROK can implement the activities after this meeting and internal discussion within MOF.
15. In response to the updates from ROK, Mr. GUO appreciated ROK of the update on financial situations. Mr. GUO informed all the participants that PMO will prepare the meeting proceedings in the coming weeks and wished to get feedbacks in another two weeks to get confirmation from both sides.
16. Participants endorsed the outcomes, target and activities as presented.

3.2. Terms of reference of RWGs and Chairs/Vice Chairs, and TORs of RWG-F; and RWG-F work plans (2017-2019)

17. Upon the request of the Chair, PMO introduced TORs of RWGs and Chairs/Vice Chairs with focus on TORs of RWG-F. After presentation, PMO emphasized that at the ICC-1 the TOR of RWGs and 3-year work plans were approved under the condition of possible revision by RWG members.
18. Due to time constraints in implementation of project activities, representatives of both countries raised the concern over practicality of full implementation of planned activities in 2017. Mr. CHO from ROK suggested that activities planned in 2017 be extended to 2018 if unable to be completed in 2017. The Chair concluded that PMO should reconsider the timeline of implementing some of activities and suggested that the extension be made taking a practical approach. Regarding the workplan for activities that the Chair requested, PMO will review the timeline of activities in consultation with the project team.
19. Mr. GUO mentioned three years already passed after GEF's approval of the project and that PMO would prepare a proposal for project extension for review by ICC in the first quarter of next year. Mr. GUO explained that based on current progress the project would best be extended hopefully to end of 2020. PMO hoped that the project would update the TDA and SAP in line with changes the context for implementation of the SAP in both countries. PMO will invite an initial discussion of the proposal for extension at the 1st meeting of the RWG-G before review and approval by the ICC.
20. Mr. CHO from ROK commented that even though the project extension may not be a problem, financial issues must be solved in ROK. Mr. Yinfeng GUO echoed the concern of Mr. CHO.

4. Session 1: Review of the implementation of activities related with Objective 1: to assess the progress of SAP target 1 implementation and make recommendations on targets and actions in the updated SAP

Introduction of stock assessment methodologies in the two countries and explore ways and means to develop the harmonized methodologies

21. Mr. CHO suggested that in conducting regional stock assessment in both countries the first thing is to define some special species. Because stock assessment is very species-dependent and consequently methodologies vary from species to species. He suggested RWG-F to define species in particular migratory species such as mackerel. He suggested that RWG-F should narrow the scope for joint stock assessment.
22. Mr. Myoungcho SOHN from ROK highlighted importance of data sharing. He mentioned that we usually use destination method in the evaluation of the fish stock. Dr. SOHN also mentioned the method can be easily harmonized, the difficult part is data sharing between PR China and RO Korea, in particular catch data sharing.
23. Mr. JIN from YSFYI mentioned the activities are mostly focused on methodologies. Both sides can conduct these activities independently. He mentioned that scientists could focus on species. He also suggested that both countries update report. The way each country measure stock is different and consequently results are different which renders data comparison difficult. Under this circumstance, he reiterated the importance of methodology.

24. Mr. JIN pointed out data sharing was not included in this activity and therefore data sharing should not be discussed in this phase. In the first phrase reports were published using the methodologies. New measures should be included, such as artificial reef assessment.
25. Mr. CHO from ROK commented that he agreed that data sharing is not much related to activity 1. But he reminded that this issue was related to activity 4 and under this activity, the most important issue is data sharing. But for conducting the joint stock assessment both countries have to define methodologies and species. In that case, activity 1 and 4 are closely related. In 2018 and 2019 both countries have to conduct a joint stock assessment based on the timetable. Mr. JIN suggested that the meeting group could review the activity one by one.
26. Mr. GUO mentioned the hard copy for methodologies was already published in the first phrase and it was the time to revise/update and then agree on it. And immediately after session 1, PMO preferred to invite experts from both countries to present the methodologies. Afterwards members of RWG-F could review, agree or continue to work on it. After the activity 1, members of RWG-F can review activity 4 in the next session.
27. Mr. GUO pointed out that in the workplan for the RWG-F, activity 4 is very relevant. One of the three deliverables is updated TDA and SAP, which means both countries have to agree on methodologies and then apply them to selected species and further to compare the results. In the discussion, he observed that members of RWG-F need to revise activity 4. For example, while line 21 of RWG-F workplan is on conduct of joint stock assessments yet this is the only paragraph where joint stock assessment is referred to. However, The Project does not have the budget to conduct the joint assessment. In this regard, he suggested that in next workshop scientists from two countries instead present the results of stock assessment using agreed methodologies in activity 1 of workplan of RWG-F.
28. Mr. CHO agreed that it is impossible to conduct stock assessment in the field due to the budget constraint. He suggested to have a discussion about stock assessment using the existing data or information from scientists from both countries.
29. Mr. JIN suggested in the second phrase the most important thing is implementation and demonstration. He suggested RWG-F members use existing data or information to do the comparing work.
30. Mr. CHO suggested that RWG-F hold workshops for further discussion on the conduct of joint stock assessment and analysis of data on selected species.
31. Ms. SHAN, member of the NWG-F in PR China, introduced the joint regional stock assessment methodology, a deliverable of the 1st phase of the project for team members to review of its continued relevance for application in the Project. Following the presentation of the methodologies, Ms. SHAN also highlighted some issues in its application and recommendations for enhancing its application in the context of YSLME.
32. Mr. CHO from ROK suggested Mr. SUH making a short comment regarding Ms. SHAN's presentation. Mr. SUH from ROK pointed out four types of assessment methods have been conducted, but the result is not used in assessment the fish stock but only as reference value. Both models are fine for use in the project. Models and data types can be discussed for future cooperation. Mr. SOHN from ROK reiterated the need to select target species to apply these stock assessment methodologies.
33. Mr. GUO suggested the target species need to be agreed before application of the methodologies. He pointed out during the 2nd phrase the project will not conduct stock assessment but emphasized that both countries should agree on methodologies first and compare results using these methodologies during the workshop.

34. Mr. LEE from ROK requested a clarification on the date of the workshop and the possibility to invite an international consultant to the workshop. Mr. Yinfeng GUO responded that PMO will check and allocate budget if there is a need.
35. This session reviewed a total 4 TORs of the project activities to be implemented in 2017. Activities and discussion results are highlighted in the following paragraphs.

Activity 3 of Output 2.1.1: Assessment of the effectiveness of license system and recommendations for improvement of license system

36. After presentation from PMO, Mr. CHO from ROK raised 3 questions: 1) How to collect data of the existing relevant technical files in ROK? 2) The budget for this activity is \$36,000. However, the working period is until 2019, so a time gap remains. 3) Have the demonstration sites have been decided already?
37. Mr. GUO explained that regional activities have been added into the Project Cooperation Agreement to be signed between UNOPS and YSFRI.
38. Mr. CHO from RO Korea inquired whether the fishery license system focus on just general license system or specific species license system in Yellow Sea both RO Korea and China. Ms. SHAN responded that it is the general license system including fisheries, fishery vessels and finishing in Yellow Sea area.
39. Mr. CHO suggested the license system not only focus on general license system and pointed out that in that case it will be not effective. Therefore, ROK recommended that the scope of license system should be narrowed down.
40. The Chair concluded that in this activity should review the following issues:
 - Part 1: general licensing system
 - Part 2: gears, waters and species
 - Part 3: comparing licensing system from both countries
 - Part 4: comparing the common used licensing system
 - Part 4: summary and recommendations for licensing system
41. Mr. LEE raised the question of how ROK can contribute to the licensing system? The Chair suggested that all the results can be compared during the workshop. From Mr. JIN's perspective, during the second phase of YSLME, the result would be presented at workshops, including results from demonstration sites and study trips.
42. Ms. CHAE of ROK raised the question that if both countries need to present results of work for comparison, would it be possible to engage international consultants or national experts from each country. She further inquired of the work mechanism for comparison when an activity is subcontracted to YSFRI.
43. The Chair suggested each country collect the existing relevant technical files. Mr. GUO explained the principals of the GEF project to all the participants. For this activity, it is good for both countries to share the experiences rather than hire an international consultant. Another point for demo site selection, it will be useful to decide a sizable area which will be effective to show the licensing system progress.
44. The Chair concluded that all the activities should be implemented by both countries and requested to delete the reference to PR China and that both countries implement this activity.

45. Mr. GUO informed all the participants that the project will support two workshops for this activity. One in PR China and one in ROK.
46. Mr. CHO from ROK raised the question of how ROK would contribute to this project, in workshops for example? In response to concerns from ROK, Mr. GUO suggested ROK present the implementation of the licensing system from ROK's perspective.
47. The Chair concluded that all the activities should be implemented by both countries and requested PMO to delete the reference to PR China only as both countries need to do implement this activity.

Activity 4 of Output 2.2.1: Technical assistance to improve techniques of replanting seagrass and macroalgae

48. After presentation by PMO, Mr. CHO from ROK suggested lots of work should be done in limited time such as laboratory work. Also, he pointed out only 30,000 dollars would not be enough to cover all the work for this activity. There is budget constraint for this activity.
49. Mr. SUH suggested experts do study visits to ROK Fishery Resources Agency and learn the experiences from ROK side.
50. The Chair concluded that laboratory visit or site visit could be combined with workshops or RWG-F meetings.
51. Mr. OH sought clarification on the major problems for transplanting sea grass in the field. Ms. Yaping GAO from YSFRI explained the low rate of survival of sea grass is the key issue. Mr. GUO supported the project and emphasized that the add value for this GEF intervention should be highlighted in the transplantation of seagrass.

Activity 9 of Output 2.2.1: Monitoring of the implementation of results of three demo sites

52. After presentation by PMO, Mr. CHO from ROK requested clarifications on the considerations in selecting three demo sites. The Chair clarified that each country should have three demo sites according to the project document. The total number of demo sites is six. Mr. OH from ROK mentioned if PR China can provide three demo sites and the selection criteria, ROK can also provide 3 demo sites.
53. With regard to the possible integration of project implementation monitoring into workshop design asked by Mr. CHO, Mr. GUO explained that there is budget allocation for organizing workshop under the activity 8: International experience sharing on science-based fishery management. Specifically, experiences of restocking such as artificial reefs, habitat enhancement and other technologies or management practices in demonstration sites can be shared at workshops. In addition, Mr. GUO underscored the need for agreed generic or site-specific indicators for demonstration sites, including socioeconomic and governance indicators.
54. Mr. CHO from ROK suggested PMO to prepare the workshop plan and discuss this issue by email.

Activity 2 of Output 2.1.1: Assessment of socio-economic implications of fishing vessel buy-back scheme and prepare policy recommendation

55. The Chair pointed out the baseline level of fishing vessels referred to in the background section of the TOR should be updated as the total number for the fishing boats in PR China is around 200,000 rather than 1.2 million. Both sides agreed that 30% should be reduced to 10% in terms of reduction in number of fishing vessels during the project. Also, both sides agreed to delete the following sentences: during the project cycle in line with the 2020 target of 30% reduction.

56. Regarding the consolidation of reports from both sides mentioned by Mr. CHO from ROK, Mr. GUO explained that GEF will request the annual report for the project implementation progress. It is useful that the two countries can report the progress including in reduction of fishing boats.
57. Mr. LEE suggested that the names of three west provinces from ROK also be mentioned.
58. In this Session, Ms. SHAN from YSFRI delivered a presentation on the plan of the regional workshop. Ms. CHAE from ROK sought a clarification on budget allocation to the workshop.
59. Mr. GUO explained that every year PMO will support at least one workshop in fish stocks. PMO will support 2 workshops on licensing system effectiveness, and in total PMO will support 8 workshops in fish stocks during the project. The total budget for 8 workshops is around 50,000 dollars.
60. Mr. OH and Mr. JIN suggested that RWG-F have a discussion on how to manage the workshops. Mr. GUO agreed to prepare a plan for workshops for discussion at the meeting.
61. Mr. JIN suggested that all the workshops and RWG meetings be held near the demonstration sites.

5. Session 2: Review of the implementation of activities related with Objective 2: to enhance capacity of national and local governments in monitoring and assessment of fish stocks, and effectiveness of licensing, closure and restocking management

62. This session will focus on the following issues:
 - Capacity need and determination of venue and resource persons, and key elements of a training program of stock assessment
 - Training modules on stock assessment
 - Training courses on fish restocking
63. The Chair requested PMO to introduce the purposes of session 2. Mr. GUO informed the Meeting that in the project document two types of workshops will be organized by PMO, one on stock assessment and the other on fish restocking. Taking advantage of the RWG-F, PMO wished to get feedback from members on the needs, collaborators, lecturers, and time and venue of these workshops.
64. Ms. SHAN from YSFRI briefly introduced the concept of a training course on stock assessment. Ms. Shan suggested the stock assessment training course be held in Qingdao with support from YSFRI and PMO. Ms. Shan also confirmed that YSFRI would invite experts from RO Korea to participate to give lectures. The Chair affirmed that both countries should attend the training course.
65. Ms. CHAE inquired of the name of organizer of the workshop and budget allocation from the Project. Mr. GUO clarified that two training workshops are planned by PMO, one in 2017 and another in 2018. Due to the time constraints, PMO is unable to organize the planned workshop in 2017, but confirmed to organize at least one training on stock assessment in 2018. Mr. GUO also informed that Meeting that the budget for each training course is around 10,000 US dollars to cover rental of venue, travel, food and accommodation for lecturers. He highlighted that participants should cover travel and accommodation during the training.
66. Ms. SHAN suggested the training to last for at least one week, to include the development of stock assessment, the

conceptualization, and methods to build the model among others.

67. Ms. CHO suggested to combine the two training courses into one. He also reminded that few people in RO Korea are interested in stock assessment and that one week training is too long for young scientists from RO Korea. Also, he advised that young scientists can be incentivised to participate if a certificate can be awarded by the project upon completion of the program. Mr. GUO confirmed that young scientists can get certificates from the training course.
68. On the design of the trainings and workshops on stock assessment, Mr. GUO reminded the meeting of the following four steps to take:
 - Agreement on methodologies;
 - Training of team members in application of methodologies;
 - Conduct of stock assessment using co-financing by PR China and RO Korea; and
 - Present and compare results at the workshops.
69. Mr. CHO from ROK responded that the Korean team will revise the training program and send it to PMO by email.
70. Mr. GUO emphasized the need for use of standard training modules in the training which can be adapted or developed based on the needs from both sides with assistance of resource persons with hands-on skills. Needs, project requirements and subsequent comparison of assessment results are the key consideration of the training modules.
71. Mr. LEE suggested PMO to develop the training program and send to both sides. Mr. GUO agreed to take the suggestion and reminded that budget can be adjusted in accordance with the needs from both countries within the available resources in the project.
72. On the training course on fish restocking including artificial reef and habitat enhancement, Mr. CHO from ROK informed the PMO that RO Korea wishes to organize the training on restocking. PMO confirmed to make available budget from the Project for this training.
73. After discussion on time, venue and host of the two training courses, the meeting concluded that PMO will hold the stock assessment training in September, 2018, in PR China and restocking training in Tongyoung in April, 2018 in RO Korea.
74. Mr. OH and Mr. JIN suggested that RWG-F have a discussion on how to manage the workshops. In response to the concerns from both sides, Mr. GUO agreed to strategize the scheduling of workshops. Mr. JIN further reiterated that all workshops and RWG meetings should be combined with visit to demo sites of the Project.

6. Session 3: Selection of demonstration sites

75. In this session, it is expected that demonstration sites from PR China and RO Korea would be introduced in line with the principle that each country would have equal number of demonstration sites for exchange of experiences and cross-site learning facilitated by the PMO. RWG members would review local contexts and GEF support to demonstration sites. Mr. GUO suggested the demonstration sites be related to the following three subjects in accordance with the Project Document and latest development in the two countries:
 - artificial reef
 - habitat enhancement
 - marine ranching
76. After some discussions, demonstration sites have been narrowed down to three places in China: 1) Dalian; 2) Weihai;

and 3) Yantai. The Chair concluded that each country will select 3 demo sites related with artificial reef, habitat enhancement and sea ranching, and then send the list of sites to PMO by email.

77. Mr. GUO requested both countries to prepare baseline reports of demonstration sites as earlier as possible.

7. Session 4: knowledge management

78. In this session, the members discussed the capacity need, good practices and elements and arrangement for development of the following training modules: 1) ecosystem carrying capacity - fish restocking; and 2) social safeguards in fishing vessel buy-back scheme.
79. About organization in preparation of training modules, the PMO suggested to establish a group of 5-6 experts from both countries to develop each training manual. In response to questions raised by Mr. CHO from RO Korea, Mr. GUO mentioned the training module would ideally be prepared by experts from both PR China and RO Korea with support in the amount of 10,000 US dollars for each manual. The Chair further suggested that two experts from each country work together for each training manual. Mr. GUO also suggested that both sides start the work from now. PMO would share a template of a training module to both sides by email.
80. Mr. CHO informed the Meeting that RO Korea would select right persons to write the training modules and send the name list to the PMO.

8. Session 5: Collaboration with other partners

81. In this session, the meeting explored the opportunities for YSLME Project to develop partnership with existing initiatives including identification of joint collaborative activities with other regional ocean governance mechanisms, such as West and Central Pacific Fishery Commission, UNEP/GEF South China Sea Project, PICES, etc.
82. Mr. LEE from ROK suggested to have cooperation with FAO on gear selection, IUU, etc. The Chair suggested PMO prepare and design the program of collaboration for discussion in PICES science boarding meeting. Mr. CHO suggested PMO to present the YSLME Project at the PICES meeting for information sharing.

9. Agenda of next RWG meeting

83. The Chair was pleased to note that both countries agreed that the next RWG meeting would be held in Jeju Island, RO Korea, in the second week of October. He confirmed that PMO will draft the meeting program, adjust the schedule, and share program with RWG-F members in consultation with the two Chairs of NWG-F.

10. Other Business

84. After discussion, PR China and RO Korea agreed with following arrangement of workshops related to recovery of fish stocks relevant to the mandate of the RWG-F, with indication of title, month and year, host, and indicative budget:

No.	Title	2018	2019	2020
1	Enhancing effectiveness of fishery license system	\$10,200 September YSFRI		
2	Regional workshop on fishing vessel buy-back scheme and income generation from ecotourism and recreational fisheries		\$19,400 +\$10,200 KMI	
3	Regional networking and harmonization of stock assessment	\$12,000 NIFS April/Tongyoung	\$12,000 YSFRI	
4	International workshop on science-based fishery management			\$18,500 +\$10,700 +\$15,000 Dalian/Qingdao
5		\$108,000, inclusive of travel, venue and producing proceedings		

85. Regarding activity 1 of output 2.1.2: identify possible compensation schemes and alternative livelihoods in demonstration sites and activity 2 of output 2.1.2: design and test microfinance and tax rebate for alternative livelihoods for demonstration sites, PMO suggested two options to implement the activities. One option is to identify a consultant to design after field visit to demonstration sites; and another is for PMO to issue a subcontract to companies to help design the program of the alternative livelihoods. Ms. CHAE from Korea suggested to start this activity in 2018 rather than 2017. Mr. GUO confirmed that PMO will prepare the TORs and circulate the TORs to participants from the two countries for review and comments.
86. Mr. GUO suggested to review the activity 5 of output 2.2.1: joint study of fish behaviour/gear selectivity. Mr. Yinfeng GUO informed that the project would support two scientists from each country for a 10-day joint study and suggested to implement this activity in 2018 and 2019. The Chair concluded that both sides to undergo internal consultation and inform PMO together with the name list for PMO to organize the joint study in 2018.

11. Wrap-up and closure of the meeting

87. The Chair highlighted the productivity of the meeting which would enable PMO to proceed with the implementation of those activities. The Chair made it clear that the TORs will be consolidated, combined, and revised as discussed for sharing with RWG members within a week. He also requested feedback from RWG members to the revised TORs and meeting proceedings within a week.

88. While expressing thanks to the participants for showing open-minded and co-operative attitudes, Mr. CHO from RO Korea was pleased that the meeting successfully went over the all program in the meeting agenda. On behalf of the delegation, he also expressed sincere thanks to YSFRI for the hospitality. He also highly appreciated the leadership of the Chair and hard work of PMO and believed next meeting will produce even better results for the future.
89. The Chair thanked all the participants and declared the closure of the meeting.



Annex 1. List of Participants

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Annex 2. Program of the 1st Meeting of the RWG-F

Background

The Terms of Reference and workplan of the Regional Working Group on Fish Stocks for 2017-2019 and the Project Workplan for 2017 were approved by the first meeting of the Interim Commission Council in last July, 2017. In accordance to the decisions of the 1st meeting of the Interim Commission Council (ICC-1), implementation of these workplans need to consider the following factors:

- significant delay of the second phase of the Project and delayed establishment of the RWGs and the urgency of implementation of activities immediately;
- review of TOR and planned activities carefully by RWG members who have not participated in the first meeting of the MSTP; and
- maximizing cooperation and coordination among of RWGs;

In line with decisions of the ICC-1 and approved documents, the 1st meeting of the RWG-F will be held in Yantai of PR China on October 17-18, 2017. The meeting will be organized by the Interim Commission Secretariat in collaboration with Yellow Sea Fisheries Research Institute of Chinese Academy of Fishery Sciences (YSFRI/CAFS).

Objectives and Outcomes of the meeting

The 1st meeting of the RWG-F is expected to achieve the following objectives:

- To review and refine the TOR of RWG-F and workplan for 2017-2019 as necessary and agree on the work arrangement among RWG members in implementation of the activities of RWG workplan (2017-2019);
- To discuss and finalize on the draft program and speakers of a regional workshop related with joint assessment of improved fishery management effectiveness, as well as the harmonized stock assessment methodologies;
- To review and agree on the TORs of the regional activities under purview of the RWG-F to enable expedited implementation of project activities in 2017;

It is expected that the workshop could provide the following tangible outcomes:

- 1) Revised TOR and workplan activities proposed in the 3-year workplan and agreed work arrangement among RWG-F members;
- 2) Revised program of regional workshop on joint assessment of fishery management effectiveness and the harmonized stock assessment methodologies and speakers identified and budget allocated;
- 3) Cleared TORs of project regional activities and activities with inputs;
- 4) Identification of demonstration sites and consensus on interventions;
- 5) Agenda of next RWG meeting
- 6) Consensus on training modules to prepare and key elements;
- 7) Joint activities with identified organizations

Participants

Members of the RWG designated by PR China and ROK YSFRI/CAFS, PR China, NIFS/MOF, ROK, CTA/Manager, Environment Officer, etc.

PROGRAM

17 October (Tuesday)

08:30~09:00	Registration for participants
09:00~09:20	Opening of the meeting <ul style="list-style-type: none">• Welcome addresses• Introduction of the members and participants
09:20~09:30	Organization of the meeting <ul style="list-style-type: none">• Election of Chairs and designation of rapporteurs• Adoption of agenda
09:30~10:30	Review and refine the following documents approved by the Interim YSLME Commission: <ul style="list-style-type: none">• Terms of Reference of RWGs and Chairs/Vice Chairs;• TOR of RWG-F;• RWG-Fworkplan (2017-2019)
10:30~10:45	Coffee break
10:45~12:00	Review workplan for 2017 and activities, and work arrangement among RWG-F members
12:00~13:30	Lunch and Break
13:30~15:30	Session 1: Review of the implementation of activities related with Objective 1: to assess the progress of SAP Target 1 implementation and make recommendations on targets and actions in the updated SAP <ul style="list-style-type: none">• Introduction of stock assessment methodologies in the two countries and explore ways and means to develop the harmonized methodologies;• review of the TOR of Activity 2 of Output 2.1.1: assessment of socio-economic implications of fishing vessel buy-back scheme and prepare policy recommendation;• review the terms of references of Activity 3 of output 2.1.1: assessment of the effectiveness of license system and recommendations for improvement of license system;• review of TOR for Activity 9 of Output 2.2.1: monitoring of the implementation of results of three demo sites;• review of TOR of Activity 4 of Output 2.2.1: technical assistance to improve techniques of replanting seagrass and macroalgae
15:30~15:45	Coffee Break
15:45~18:00	<ul style="list-style-type: none">• Discussion of the draft program of a regional workshop on joint assessment of fishery management effectiveness (meeting document) (It is expected that the meeting will discuss and agree on the refined outcomes, speakers, Chair-co-chairs of each session, speakers from ROK and PR China and other organizations under each session, and facilitators of break-out group discussions if any, and field visit program if any)

18 October (Wednesday)

09:00~10:30	<p>Session 2: Review of the implementation of activities related with Objective 2: to enhance capacity of national and local governments in monitoring and assessment of fish stocks, and effectiveness of licensing, closure and restocking management</p> <ul style="list-style-type: none">• discussion on capacity need, and determination of venue and resource persons, and key elements of a training program of stock assessment;• discussion on the preparation of training modules on stock assessment;• discussion on training courses on fish restocking
10:30~10:45	Coffee Break
10:45~12:00	Continuation of Session 2
12:00~13:30	Lunch Break
13:30~15:30	<p>Session 3: Selection of demonstration sites</p> <p>Demonstration sites from PR China and ROK will also be introduced in line with the principle that each country will have equal number of demonstration sites for exchange of experiences and cross-site learning in the project.</p> <p>In this session, RWG members will review local contexts and GEF support to demonstration sites. Representatives from local governments of China and ROK can also be invited to participate to present the proposals for support by the project.</p>
15:30~15:45	Coffee break
15:45~16:30	<p>Session 4: knowledge management</p> <p>In this session, the members will discuss the capacity needs, good practices and elements of a training modules and arrangement to prepare the following training modules:</p> <ul style="list-style-type: none">• Ecosystem carrying capacity - fish restocking; and• Social safeguards in fishing vessel buy-back scheme
16:30~17:00	<p>Session 5: collaboration with other partners</p> <p>In this session, the collaborating partners will be invited to discuss existing similar initiatives with YSLME Project and identification of joint collaborative activities with other regional ocean governance mechanisms, such as West and Central Pacific Fishery Commission, UNEP/GEF South China Sea Project, PICES, etc.</p>
17:00~17:20	Agenda of next RWG meeting
17:20~17:40	Other business
17:40~18:00	Wrap-up and closure of the Meeting

Annex 3. Terms of Reference of activities in Component 2 in relation to mandate of RWG-F in UNDP/GEF YSLME Phase II Project (revised)

Assessing effectiveness of fisheries license system

Activity 3 of Output 2.1.1 (REV)

Establish the regional methodology to assess effectiveness of license system and provide the recommendations for improvement of licensing system: legal and policy adequacy, institutional capacity, individual capacity, availability of capacity, fish landings.

Estimated start of work: Mid-October 2017–June 30, 2019

Background and Justification

License system has been conducted in the YS since the 1980s, it still plays an important role in fishery management by controlling the fishing intensity of target species, including the limit of fishing patterns, fishing gears, the number of fishing vessels and so on. The license system evolves in the license of fishing waters, the license of fishing time, the license of fishing species, the license of fishing gears. The licenses of fishing waters and fishing time are similar as fishing moratorium, all the species can be protected in the target waters and specific time. The licenses of fishing gears and fishing species, with obvious selectivity, mainly focus to protect the target species. Overall, the license system reduces the number of fishing vessels and gears by common-of-piscary right, then reaches the goal of TAC limit. The license system is easily to be conducted, but the effectiveness of license system is not well addressed until now. So, this subcontractor will assess the effectiveness of license system, and give some recommendations to improve the license system in line with the targets of the YSLME Strategic Action Programme.

Objectives

The objective is to assess the effectiveness of the license system, including legal and policy adequacy, institutional capacity, individual capacity, availability of capacity, fish landings changes; based on the results, provide some recommendations for improvement of licensing system.

Expected Outputs

The activity is expected to deliver the following results:

1. Methodologies and workplan to assess the effectiveness of license system;
2. An assessment report with recommendation for improvement of licensing system

Activities

Under supervision of the Chief Technical Advisor and technical guidance of RWG-F in close collaboration with the local project team, the subcontractor will:

- Each country collects the existing relevant technical files;
- Summarize and review the existing methodology to assess effectiveness of license system including reviewing the general licensing system;
- Identify the indicators to assess the license of fishing gears, fishing waters, fishing time, and fishing target species;
- Compare the similarities and differences of the license system between PR China and ROK, and the potential capacity of harmonizing them on the regional level.
- Analyze their advantages and disadvantages, the problems, the potential technical and administration needs, give some recommendations to improve license system. According to the analysis, propose recommendations and implementation plan for improvement of licensing system.

- Further to assess the legal and policy adequacy, institutional capacity, individual capacity, availability of capacity
- To participate relevant workshops or training course conducted by the Project Management Office (PMO).
- Prepare the draft report on regional license system, and submit it for consultation and review by members of the RWG-F of the YSLME Phase II Project.

Inputs

UNDP/GEF YSLME Phase II PMO will provide the background information and documents, and will be responsible for providing logistics support to facilitate travel to project sites and meeting with relevant stakeholders, including access to information and data about the project sites.

Timing

The subcontractor will begin in mid-October 2017 and complete in June 30, 2019.

Reporting

The subcontractor will produce the following reports within the specified timeframe:

1. By February 10, 2018, submit the assessment methodologies and workplan;
2. By Oct 31, 2018, submit the assessment report of regional license system;
3. By Mar 30, 2019, submit the draft recommendation plan for improving the license system in the YS;

Project Budget: USD 36,000;

Technical assistance to improve techniques of replanting of seagrass/microalgae

Activity 4 of Output 2.2.1 (REV)

Improve seagrass transplanting techniques, establish a seagrass transplanting demonstration and a sustaining seagrass donor supply sites at sheltered ponds

Estimated start of work: Mid-October 2017 – Mid-March, 2019

Background and Justification

As the important habitats of fishery species, seagrass meadows provide shelter and food for fish, and support the fisheries recruitment and sustainability. However, seagrass in the world has increasingly declined under the background of climate change and human activities, and faster in recent years. In China, the similar results on seagrass has been found in China coastal waters, the seagrass loss has led to key habitats loss of fishery species (e.g. spawning ground, nursing ground), further bring serious influences on recruitment of fishery resources. So, it is necessary and urgent thing to recover seagrass beds for the conservation of fishery species in coastal waters. In the present, the transplanting seagrass is mainly from the existing seagrass meadow by the digging methods, which often cause the low survival rate of seagrass, as well as the low rebuilding options. This subcontractor will improve the transplanting techniques of seagrass, establish a seagrass transplanting demonstration and a sustaining seagrass donor supply sites at sheltered ponds.

Objectives

The subcontractor is to improve seagrass transplanting techniques to establish a seagrass transplanting demonstration and a sustaining seagrass donor supply sites.

Expected Outputs

The subcontractor is expected to deliver a technical report demonstrating the following:

- Improve transplanting techniques of seagrass based on the protection of seagrass at the early replanting stage, and establish a seagrass transplanting demonstration;
- Establish a sustaining donor supply at semi-closed ponds for seagrass transplant without disturbance of the current seagrass meadows;
- Establish a seagrass transplanting demonstration site.

Activities

Under supervision of the Chief Technical Advisor and technical guidance of RWG-F in close collaboration with the local project team, the subcontractor will conduct the following activities under the two outputs:

Output 1: Improve the transplanting techniques of seagrass and establish a seagrass transplanting demonstration site

- Select the optimal transplant time (e.g. just before the bloom of seagrass) and site (with sandy or muddy substrate, low or moderate water flow).
- Design the protective devices to protect seagrass during the early transplanting stage.
- Establish a seagrass transplanting demonstration.

Output 2: Establish a sustainable donor supply at sheltered ponds

- Select closed sandy or muddy sea cucumber ponds or sheltered sandy or muddy coastal waters in PR China and ROK, and establish a grass cultivation sites for seagrass donor supply.
- Transplant seagrass from natural eelgrass beds to the cultivation sites, establish a seagrass donor sites.
- Participate the relevant workshops and training course conducted by PMO, as well as the laboratory or demonstration sites visit.

Inputs

UNDP/GEF YSLME Phase II PMO will provide the background information and documents.

Timing

The subcontractor will begin on October 15, 2017 and end on March 15, 2019.

Reporting

The subcontractor will produce reports within the following timelines:

- By July 31, 2018, submit proposal for eelgrass donor sites establishment and seedlings culture;
- By October 1, 2019, submit final draft report.

Monitoring of implementation results in three demo sites (three sites each in PR China and ROK) in the Yellow Sea

Activity 9 of Output 2.2.1 (REV)

Establish regional stock enhancement, sea ranching and artificial reef monitoring guideline, and network based on any existing ones: harmonize regional methodology and update regional monitoring guideline, realize the scientific assessment of effectiveness on these implementations.

Estimated start of work: Mid-October 2017–June 30, 2019

Background and Justification

The global fisheries are continuously in decline because of overfishing, pollution, and climate changes and so on, as well as in the YS fisheries. Many fishery species in YS have been co-exploited by PR China and ROK, such as small yellow croaker, Japanese anchovy and chub mackerel. In order to realize the sustainable fisheries in YS, PR China and ROK both have conducted the fishery implementations, including stock enhancement, sea ranching and artificial reef; however, the monitoring and effectiveness assessment of these implementations have not been well addressed. In order to better conserve fishery resources, the subcontractor will develop and implement monitoring program to assess the progress of implementation of SAP in demo sites in line with the results framework of the Project.

Objectives

The objective is to establish a regional monitoring guideline of implementations, e.g. stock enhancement, sea ranching and artificial reef, as well as to harmonize the effectiveness assessment of these implementations.

Expected Outputs

The subcontractor is expected to deliver the following results:

1. A regional monitoring guideline of implementations, e.g. stock enhancement, sea ranching and artificial reef;
2. To harmonize the effectiveness assessment of these implementations between both countries.
3. Submission of regular monitoring reports in accordance with the project M&E framework

Activities

Under supervision of the Chief Technical Advisor and technical guidance of the RWG-F, in close collaboration with the local project team, the subcontractor will conduct the following activities:

1. Review the existing monitoring guideline and methodology on stock enhancement of PR China and ROK as well as the effectiveness assessment methodology; understand the National programs of stock enhancement;
2. Review the existing monitoring guideline and methodology on sea ranching of PR China and ROK, as well as the effectiveness assessment methodology; understand the National programs of sea ranching;
3. Review the existing monitoring guideline and methodology on artificial reef of PR China and ROK, as well as the effectiveness assessment methodology; understand the national programs of artificial reef;
4. Try to harmonize the monitoring guideline and methodology on implementations in demo sites both in PR China and ROK, as well as the harmonized effectiveness assessment methodology for both countries;
5. Hold the training program /workshop on monitoring of implementation of results of three demo sites;
6. Based on agreement methodologies and indicators, taking into account the requirements of the Project M&E plan, to monitor and collect data and report the status of implementation in demonstration sites on a quarterly basis to the PMO;
7. Build the regional monitoring network for sea ranching in demo sites;

Inputs

UNDP/GEF YSLME Phase II PMO will provide the background information and documents.

Timing

The subcontractor will begin in Oct 31, 2017 and end in June 30, 2019.

Reporting

The subcontractor will produce reports within the following timelines:

1. By March 1, 2018, indicators, methodologies and frequency agreed and submit the baseline reports of the demonstration sites;
2. By June 30, 2018, submit the first quarterly report to PMO;

3. By Dec 31, 2018, based on the monitoring results and triangulation, submit a draft monitoring guideline on stock enhancement, sea ranching and artificial reef. As well as the methodology of effectiveness on these implementations;
4. By June 1, 2019, provide final monitoring reports on the status of implementation of the demonstration projects.

Socio-economic assessment of buy-back scheme and mariculture management in PR China and RO Korea

Activity 2 of Output 2.1.1 (REV)

Assess socio-economic implications of buy-back scheme and mariculture at two demonstration sites (two sites each in PR China and two sites in ROK)

Estimated start of work: December, 31 2017 – March, 31,2019

Background and Justification

Both PR China and ROK have been implementing fishing vessel buy-back scheme, mariculture development and other fishery management measures to reduce the fishing efforts in the YS to restore the fishery resources. In the YSLME Phase II Project, both countries have agreed to reduce 10% of fishing vessels. In China, 54,068 fishing vessels from Shandong, Liaoning and Jiangsu provinces would be reduced at least 10 percent before 2020(Statistics for Bureau of fisheries, 2016). The social and economic implications of the buy-back scheme need to better understand so as to advise national and local governments to take appropriate social safeguards measures in implementation of the scheme. Meanwhile, there are also fishery management and mariculture demonstration sites in PR China and ROK. (In China, the demo sites would be located in the provinces of Liaoning, Shandong and Jiangsu). Understanding of the impact of management measures to the livelihoods of fisherman and households is also needed. More sites may be added depending on the interest of the local governments but generally speaking the sites will be limited to less than 6 in total (each side 3 demo sites).

Objectives

The underlying objective of this subcontractor is to ensure adequacy of social safeguards measures in support the full and successful implementation of the fisheries and mariculture management measures.

Expected Outputs

The subcontractor is expected to deliver the following report:

- Report on the social economic implications of the fishing vessel buy-back scheme to fishermen in one city or county;
- Report on status and change in livelihoods of 2 fishery management and mariculture demonstration sites in each side;

Activities

Under supervision of the Chief Technical Advisor and technical guidance of RWG-F in close collaboration with the local project team, the subcontractor will conduct the following activities:

Output 1: Report on the social economic implications of the fishing vessel buy-back scheme to fishermen in one city or county

- Determination of study area in collaboration with members of the Inter-Ministerial Coordination Committee members in PR China and ROK;
- Develop the assessment methodologies, sampling data collection methods and prepare baseline report for Socio-economic assessment of buy-back scheme and mariculture management from the demo sites area;
- Assess income generation and contribution of fishing of sampled households, and social attitude to buy-back scheme;
- Assess economic implications of participation in buy-back scheme of sampled households;

- Review opportunities of alternative livelihoods for subsistence of participating households and assess adequacy and sustainability of social safeguards;
- Conduct two follow-up surveys of sampled households for improved livelihoods in subsequent two years after joining the scheme;
- Prepare and submit final report including recommendations for sustainable livelihoods of participating households;

Output 2: Report on status and change in livelihoods of 2 fishery management and mariculture demonstration sites in PR China and RO Korea

- Develop the assessment methodologies, sampling data collection methods and a plan to conduct assessment on social and economic status of demonstration villages or sites;
- Assess income generation and contribution of fisheries and mariculture of sampled households, and social attitude to innovation and interventions of GEF Project;
- Prepare baseline reports of demonstration sites;
- Conduct two follow-up surveys of sampled households in subsequent two years after joining the scheme;
- Prepare and submit final report and contribute to the preparation of case studies of demonstration projects;

Inputs

UNDP/GEF YSLME Phase II PMO will provide the background information and documents as well as logistics arrangements for conduct of studies and assessments.

Timing

The subcontractor will begin in November, 2017 and end in November, 2018.

Reporting

The subcontractor will produce reports within the following timelines:

- Within two weeks of signing contract, submit research methodologies and workplan to conduct baseline studies;
- Submit baseline report for Socio-economic assessment of fishery and mariculture management before March 31,2018;
- Submit assessment report of sample households one year after joining the fishing boat buy-back scheme, and the second report of demonstration sites; and
- Submit final report after second year of participation in buy-back scheme and final report of demonstration sites.

Annex 4. Presentation of Xiujuan Shan on Joint regional stock assessment methodology

YSLME-PHASE I: RGW-F



Joint regional stock assessment methodology

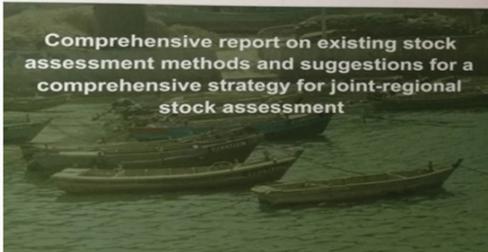
Xianshi Jin, 2007
Yellow Sea Fisheries Research Institute, CAFS, China

Revised by Xiujuan Shan

UNDP/GEF Project Entitled "Reducing Environmental Stress in the Yellow Sea Large Marine Ecosystem"

Development of joint regional stock assessment methodology

Comprehensive report on existing stock assessment methods and suggestions for a comprehensive strategy for joint-regional stock assessment



Contents

1. Methodology
2. Major Issues and Priorities
3. Recommendations

1. Methodology

1.1 Current methods of assessing fisheries stocks: Regional & International

- The **objective of management of marine fisheries resources** is desirable to obtain MSY based on scientific advices, which is based on an evaluation of the state of the stocks.

The results of fish stock assessment will provide:

- An estimate of the current stock status,
- A projection of the yield, total and spawning stock biomass and recruitment for specified scenarios of fishing mortalities, and
- The relationship between the stock status / projection and a number of biological reference points.



The stock status is defined by the:

- Stock size, the number of fish by age group at a particular point in time,
- Stock productivity, growth, maturity, fecundity and recruitment, and
- Stock mortality, made up of fishing and natural mortality rates.

1.1.1 Population Dynamic Models

- many models have been developed and applied world wide, the main references are the books and/or manuals by **Beverton and Holt (1957)**, **Ricker (1958, 1975)** and **Gulland (1969, 1983)**.
- Among the models, most used ones are **Virtual Population Analysis (VPA)**, **simple production model (Schaefer model)** and **Yield per Recruit model (Beverton and Holt model)**.
- **Multi-species modelling** is highly multidisciplinary in nature, including fishery science, fish biology, ecology, hydrography, mathematics, statistics, economics, operations research and computer science, the more extensive the inclusion of such factors, the more complex the models.

1.1.1.1 Virtual Population Analysis (VPA)

Data requirement:

- Age-structured data is required by VPA. Fisheries data may provide important information **about catch-at-age data from fisheries statistics and biological samples taken from these catches.**
- The state of the stock at a specific point in time is described by:
 - Stock in numbers by age group (cohort)
 - Mean weight per individual in the stock by age group
 - Mean weight per individual in the catch by age
 - Maturity proportion by age group

The VPA basic models:

$$\frac{1}{N} \frac{dN}{dt} = F + M$$

$$C = F \frac{N(1 - e^{-(F+M)})}{F + M}$$

$$C_t = F_t \frac{N_{t+1}(e^{(F_t+M)} - 1)}{F_t + M}$$

$$N_t = N_{t+1}e^{(F_t+M)}$$

Pope (1972) proposed a method to overcome these problems by assuming that catch of each age group is taken exactly half way through each year.

$$N_2 = N_1 e^{\frac{M}{2}} \rightarrow N_1 = N_2 e^{-\frac{M}{2}} \quad N_3 = N_2 - C \quad N_4 = N_3 e^{-\frac{M}{2}}$$

$$\text{Therefore: } N_4 = N_1 e^{-M} - C * e^{-\frac{M}{2}} \quad \text{or } N_{t+1} = N_t e^{-M} + C_t e^{\frac{M}{2}}$$

$$\text{Then: } N_t = N_{t+1} e^M + C_t e^{\frac{M}{2}}$$

- The VPA analytical model has been expanded to include multispecies interactions (Magnusson 1995, Sparre 1991).
- Multispecies VPA (MSVPA) includes estimation of the natural mortality from predator consumption. $M = M_p + M_o$,

1.1.1.2 Schaefer model

- Assuming an equilibrium relation between catch and population biomass, the rate of change in biomass can be written

$$\frac{dB}{dt} = G(B)$$

- The Schaefer model is taken this function as

$$G(B) = Bk \frac{B_\infty - B}{B_\infty} = Bk \left(1 - \frac{B}{B_\infty}\right)$$

Data requirement:

- Catch data, Y
- Fishing effort, f
- Catchability coefficient, q

The equilibrium yield is $Y_e = fqB_e$ or $Y_e = fq \frac{B_x}{k} (k - fq)$

Then, solving this equation, the maximum yield can be obtained.

$$Y_{e\max} = \frac{k}{4} B_x \quad \text{and} \quad f = \frac{k}{2q}$$

If we have an equilibrium situation, this can be fitted by plotting catch per

unit effort (u) against f : $u = \frac{Y}{f} = qB_e$

The model in non-equilibrium situations (Walter, 1975) is: $U_{i+1} = A - Cf_i$

$$Y_{\max} = \frac{k}{4} B_x = \frac{k^2}{4a} \quad \text{for} \quad f = k/2q \quad \text{or} \quad Y_{\max} = \frac{A^2}{4C} \quad \text{for} \quad f = A/2C$$

Where:

$$a = \frac{k}{B_x}, \quad A = \frac{kq}{a} \quad \text{and} \quad C = \frac{q^2}{a}$$

1.1.1.3 Beverton and Holt Model

“Yield per Recruit”

$$Y/R = Fe^{-M(t_c-t_r)} W \sum_{n=0}^3 \frac{u_n e^{-nk(t_c-t_0)}}{F + M + nk}$$

$$u_0 = 1 \quad u_2 = 3 \quad u_1 = -3 \quad u_3 = -1$$

Data requirement:

This process can be calculated mathematically. The parameters of the stock concerned are given below.

- N_t = number of fish at age t
- W_t = average weight of fish at age t
- R = no. of recruits, or no. of fish alive at time t_r
- M = instantaneous natural mortality coefficient
- F = instantaneous fishing mortality coefficient

1.1.2 Bottom Trawl Survey

$$d = \frac{D}{a} q$$

a is the area swept by the survey trawl, is often assumed to be the area swept by the trawl's wings or doors during a standard tow.

q is the catch ability coefficient which is affected by target fish behaviour and gear operation.

Data requirement:

- fish behaviour
- gear specification
- width of wings or doors of the net

1.1.3 Acoustic Survey

$$S_A = \rho \cdot \sigma$$

S_A is the acoustic index (the area back scattering coefficient (m² / n.mile²),
 ρ is the area density of fish, and
 σ is the average back scattering cross section per fish (conversion factor).

Data requirement:

- Target strength
- Biological characteristics
- Age, length and weight

1.1.4 Tagging – Recapture

$$N : T = C : R$$

Which imply that the relationship between total numbers caught in the fishery (C) and number of tags found in this catch (R) reflects the relationship between the total (N) and tagged (T) populations.

Data requirement:

- total numbers caught in the fishery
- number of tags found in catch

1.1.5 Egg and Larval Survey

The total number of eggs and larva produced per year is estimated by survey, and divided by the number of eggs spawned per female to produce the number of fish in the spawning stock, then:

$$p = \frac{E}{FR}$$

p is size of spawning stock;
 E is total annual egg and larva production in the survey area;
 F is mean annual fecundity per adult female; and
 R is the sex ratio.

Data requirement:

- total annual egg and larva production
- mean annual fecundity per adult female
- sex ratio

1.1.6 Ecosystem Model

Ecopath with Ecosim (EwE) is probably the most widely used model.

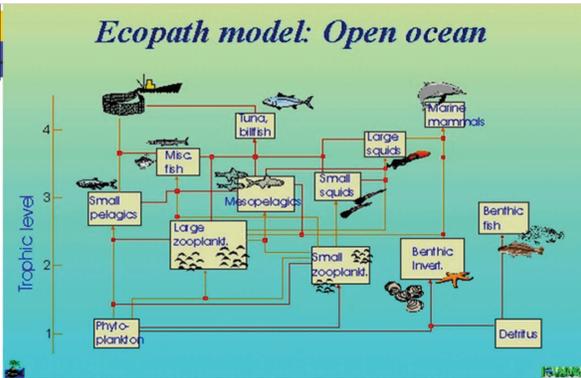
Ecopath is a static, mass-balanced snapshot of the system, and is used to organize historical data on trophic interactions and population sizes;
 Ecosim is a time dynamic simulation module and builds dynamic predictions by combining the data with foraging arena theory;
 Ecospace – a spatial and temporal dynamic module primarily designed for exploring impact and placement of protected areas.

(Christensen and Pauly 1992, Pauly *et al.* 2000, Christensen and Walters.2000. Walters 2000 etc.)

The Ecopath software package can be used to

- Address ecological questions;
- Evaluate ecosystem effects of fishing;
- Explore management policy options;
- Evaluate impact and placement of marine protected areas;
- Evaluate effect of environmental changes.

Ecopath model: Open ocean



The basic Ecopath equations are:

- Production = catches + predation mortality+ biomass accumulation + net migration + other mortality
- Consumption=production + unassimilated food+ respiration

Data requirement:

- Stomach contents
- Catches
- Biomass or density of major functional groups or species
- Migration

1.2 Location of data & info and access to each site by the public

- **FAO Yearbooks of Fishery Statistics**
- **FAO Bulletins of Fishery Statistics**
- **FAO Fisheries Circulars**
- **FAO Handbook of fishery statistics**
- **FAO Fisheries Reports**
- **FAO Fisheries Technical Papers**
- **China Fisheries Yearbook**
- **China Ocean Yearbook**
- **Korean Yearbooks of Fishery Statistics**

<http://www.fao.org/fi/>
<http://www.cnfm.gov.cn/>
<http://www.cafs.ac.cn/>
<http://www.yxfri.ac.cn/>
<http://www.eastfishery.ac.cn/>
<http://www.china-fishery.net/>
<http://www.ifishery.com.cn/>
<http://www.china-fisheries.org/>
<http://www.nmdis.gov.cn/>
<http://www.ouc.edu.cn/>
<http://www.qdio.ac.cn/>
<http://www.momaf.go.kr/>
<http://www.nfrdi.re.kr/>
<http://kocdc2.nfrdi.re.kr:8001/home/eng/main/index.php>
<http://www.pknu.ac.kr/eng/>
<http://www.ecopath.org/>

The data sources include: fisheries dependent data (fisheries), and independent data (scientific surveys).

- The fisheries data may be extracted from fisheries statistics, mostly catch statistics by major species and total landings in whole country and total fishing effort, sometimes by fleets, the area fished is not usually specified.
- The large number species caught and the many fleets operating in the Yellow Sea LME create difficulties in getting accurate figures and sufficient fisheries data for stock assessment.
- The survey data are not available to public, and it is impossible to access to any kind of survey data on stock assessment. However, the final results from surveys can be found in publications from both countries and in international journals and books.

2. MAJOR ISSUES AND PRIORITIES

Major problems in stock assessment in the Yellow Sea today are:

- The lack of agreed methods such as those used by ICES who employs VPA tuned by survey data;
- The availability of data at a regional level is limited, including insufficient fisheries data and survey data;
- The different coverage of surveys resulting in insufficient knowledge of distribution and stock status of major species;
- The different methods and gear used in scientific surveys without calibration leading to different results;
- The different objectives of surveys leading to focus on different target species;
- The different target species in catch statistics;
- The different standards in catch statistics.

Data quality and the methods used to integrate them may result in imprecise and inconsistent stock assessments. Therefore, there is a lot of work to be done before conducting stock assessment to the whole ecosystem.

To overcome these barriers, priorities are suggested as below.

- **First step** is to establish several scientific working groups, such as
 - > Fisheries data WG responsible for collection of fisheries data, data standardization, etc.
 - > Survey methods WG responsible for comparison of survey methods by different countries and calibration, looking for consistent survey methods to estimate the biomass of stocks; development of better observation tools and survey strategies.
 - > Fisheries biology WG responsible for collection of fisheries biology data, data standardization, biological characteristics of major species, e.g. growth, mortality, migration and distribution, spawning, feeding, wintering, etc..
 - > Stock assessment WG responsible for selecting adequate mathematical models to the fish stocks in the Yellow Sea ecosystem, prediction of stock size of commercially important species, providing allowable biological catch (ABC) and total allowable catch (TAC) for fisheries management.
- **Second step** is to establish exchanging mechanism of survey data and fisheries data.
- **Third step** is to establish a joint survey mechanism based on analyzing all historical individual surveys by countries from the working groups.
-

3. RECOMMENDATIONS

- Stock assessment is currently based on two methods, one is mathematic models dependent on fisheries data, and the other is fisheries-independent scientific surveys.
- The suitable models for specific fisheries are the best ones based on the available data.

The quality of stock assessment depends on:

- The quality of the assessment methods and the associated strategies;
- An understanding of dynamics of the ecosystem, including species interaction, relationships between environment and biology;
- Human activity effects;
- Reliable data, both fisheries and survey data;
- Reliability of the models chosen;
- Knowledge of ecosystem uncertainties.

3.1 Collection of Fisheries and Survey Data

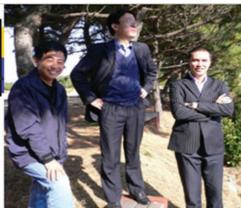
- The data collected from fisheries and scientific surveys are basic in various models.
- Fisheries data are important (necessary) for most models. A collection system of accurate catch and effort and biological data should be implemented. A regularly updated fisheries database should be established.
- Catch per unit effort (CPUE) is an index of stock abundance, used to support the prediction models, and may be obtained from either well-defined commercial fleets or from abundance surveys using research vessels.
- Biological information is the fundamental components required in the stock assessment, age composition, growth, length-weight relationship, prey-predator relationships, migration, stomach contents etc.
- There are large uncertainties in the ecosystem, therefore it is also necessary to collect data relating to the environment inhabited by the target fish, such as temperature, salinity, primary production, plankton, etc. Some of data is used to fit the ecosystem models.

3.2 Stock Assessment Modelling

- Jointly select an adequate model from the existing classical mathematical models for reiterative use in stock assessment of the fish stocks in the region after testing.
- Develop new models based on the classical and new models used in other regions.
- Agree on joint prediction of stock size of commercially important species in the region.

3.3 Jointly Scientific Survey

- A regular scientific survey is suggested every year, to monitor the state of major stocks in the Yellow Sea.
- The sampling strategy and survey design should be well-defined.
- Acoustic-trawl survey is recommended, based on the availability of research vessels and equipment in the countries around the region.
- The frequency of cruise is completely dependent on the available budget due to the high cost of using research vessels.
- The coverage should be large enough to cover the whole distribution of the major stocks.



THANK YOU!

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