Asia-Pacific
Economic Cooperation

Marine Ecosystem Assessment and Management in the Asia-Pacific Region Phase III – Pilot APEC Large Marine Ecosystems (LME)

FINAL REPORT

APEC Ocean and Fisheries Working Group

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APEC Project OF 01/2011

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Final Report of "Marine Ecosystem Assessment and Management in the Asia-Pacific Region Phase III – Pilot APEC Large Marine Ecosystems (LME) Project"
(APEC Project S OF 01 11)

The third APEC Workshop on Marine Ecosystem Assessment and Management was held by the Marine Resource Conservation Working Group (MRCWG) in Seoul, Korea on 4-5 January 2012. The two previous Workshops were held in Qingdao (2007) and Seoul (2009).

The third Phase of the APEC LME Project was the first project for the newly constituted Ocean and Fisheries Working Group (OFWG). The workshop participants represented nine economies from the Asia-Pacific Economic Cooperation (APEC) Region, including Canada China, Indonesia, Korea, Malaysia, Mexico, Peru, Philippines, and the United States.

Background:

The 27 Large Marine Ecosystems (Figures 1 and 2) of the APEC Region make a major contribution in marine ecosystem goods and services to the APEC economy. Large Marine Ecosystems (LMEs) are regions of ocean space encompassing coastal areas from river basins and estuaries to the seaward boundaries of continental shelves and the outer margins of major current systems. LMEs are designated on the basis of unique ecological criteria including bathymetry, hydrography, productivity and trophic linkages. The LME assessment and management approach is based on five modules focused on ocean productivity, fish and fisheries, pollution and ecosystem health, socioeconomic conditions, and governance, for recovering and sustaining marine goods and services.

Healthy ecosystems sustain fisheries, maintain critical habitats, and provide a safe and adequate supply of seafood for domestic use and international trade. The LME approach focuses on sustaining the resources to maintain the economic benefits for APEC economies.

Purposes:

The workshop aims were:

(i) To report on the status and baseline assessment of the APEC Region's Large Marine Ecosystems in relation to climate change,

(ii) To review best practices of ecosystem assessment and management in the APEC Region,

(iii) To plan and begin to develop two pilot LME projects recommended by the 2009 meeting, in the Indonesian Sea and the Pacific Central American LMEs,

(iv) To promote networking of APEC LMEs, and

(v) To identify the socioeconomic benefits of ecosystem-based management.

The workshop participants represented nine APEC economies. Dr. **Kyungjin Kim** and Dr. **Sinjae Yoo** welcomed the participants to the workshop. Among the speakers on Day 1, Mr. **Chang Ik Zhang** presented an IFRAME approach for assessing and forecasting fisheries in the three Large Marine Ecosystems adjacent to the Republic of Korea. Dr. **Marie-Christine Aquarone,** the overseer of the APEC Project, gave an overview of the working group activities from 2009-2011 and described the accomplishments achieved under the first two phases of the project. Mr. **Ulises Munaylla**, from Peru, discussed the contribution of the economies of the West Coast of Central America to the management of marine goods and services in the Pacific Central American LME. The Pacific Central American LME project will extend from the Gulf of California LME to the Humboldt Current LME. Mr. **Sinjae Yoo** reported a wide variation in primary productivity in the Yellow Sea LME, and described the significant problem of eutrophication.

Mr. **Sukgeun Jung** of the University of Jeju described latitudinal shifts in catch distribution of fisheries species in Korean waters as a result of climate change. He explained the southward expansion of Pacific cod off of Korea's coast in the direction of Jeju Island and suggested that artisanal fisheries will be the least able to adapt to climate change. He urged APEC member economy governments to be more concerned with artisanal fisheries and called for better international management and governance with regard to the opening of major fishing grounds in the Northwest Pacific. Professor **Qisheng Tang**, from the Yellow Sea Fisheries Research Institute, who is presently collaborating with Mr. Sukgeun Jung, discussed long term changes and biomass yields in the Yellow Sea LME and in the East China Sea LME.

Mr. **Salomon Diaz Mondragon,** provided useful socioeconomic information on the five Large Marine Ecosystems off the coast of Mexico,

particularly for the Gulf of California LME and the Pacific Central American LME. Dr. **Villy Christensen**, Associate Professor at the University of British Columbia in Vancouver, discussed fisheries, food web impacts and economic tradeoffs. He described data-based and scientifically-driven models, including Ecopath and Ecosim that have been developed by the Sea Around Us Project. He noted the availability of much improved weather forecasts.

On Day 2, Dr. **Mariano Gutierrez** assessed changing states and biomass yields in the Humboldt Current LME. He described plumes of productivity and the presence of jumbo squid in the Humboldt Current LME. He also explained the strong connection between El Nino events, fisheries harvests and socioeconomic benefits to fishermen. Mr. **Jae Ryoung Oh** discussed the quality control of marine monitoring data. Dr. **Jong Geel Je** outlined the role of marine protected areas and no-take zones in the Yellow Sea LME. Dr. **Kenneth Sherman** discussed the West Bering Sea LME project, which will be funded by the Global Environment Facility. He added that it takes time to transition to ecosystem based management and explained that the GEF-supported projects typically require two, five year cycles.

Mr. **Suam Kim** compared the ecological characteristics of fish communities and oceanographic features at the southern boundaries of the western and eastern Subarctic Pacific Ocean in relation to climate change. Dr. **Annadel Cabanban** and Dr. **Norasma Dacho** jointly presented material on the Sulu Celebes LME project. This LME is bordered by the Philippines, Indonesia, and Malaysia. The project, funded at a level of $2.89 million, aims to address the issues of overexploitation of marine resources and habitat destruction. Southeast Asia is particularly vulnerable to climate change, and is already experiencing increases in rainfall, reduced salinity in coastal waters, and impacted coral reefs. Transboundary problems have been identified in the course of two regional workshops but not enough is known about nursery areas in relation to climate change. Small pelagic species and their conversion to fishmeal for aquaculture are the focus of the project. Large pelagic species are in decline, and some canning factories have closed.

Mr. **Suh-Yong Chung** focused on the importance of the accomplishments of the Yellow Sea LME Project, on the urgent need to continue a second phase of the Yellow Sea LME Project and on addressing the inadequate balance between socioeconomic development and environmental protection. He said that the Republic of Korea is willing to share the financial burden of the project so that it might continue, albeit with a reduced budget. He urged the greater participation of the agency SOA, and recommended securing the participation of North Korea at the earliest possible time. Mr. **Young Cheol Park** discussed YSLME and East China Sea marine conservation issues.

Although Dr. **Sapta Putra Ginting**, Head of Integrated Coastal Management and Secretary for the Coral Reef Rehabilitation and Management

Program at the Indonesian Ministry of Marine Affairs and Fisheries, was unable to attend the workshop, he did provide an important Power Point presentation on Ecosystem Assessment and Management in the Indonesian Sea LME. The marine and coastal resources of Indonesia are considerable, with over 17,000 islands and 95,000 kilometers of coastline. There are major archipelagic areas and a significant biodiversity of mollusks, crustaceans, fish, turtles, marine mammals, and types of coral (10% of the world's total). The Indonesian Sea LME has an area of more than 2 million km^2, extending from east to west across a distance of 5,000 km. Sixteen million people work in the fisheries sector. The continuous deforestation of mangroves and the decline of coastal fisheries in several districts are two of the major issues.

Results:

(i) The presenters reported on the status and baseline assessment of the Large Marine Ecosystems of the APEC Region in relation to climate change. The use of the five LME modules of productivity, fish and fisheries, pollution and ecosystem health, socioeconomics and governance ensures an ecosystem-based approach to the assessment and management of LMEs of the APEC Region. Climate change is affecting coastal productivity, trophodynamics, habitats and fisheries. Issues of concern with regard to climate change are the effects of projections of lowered productivity and fishery yields and their impacts on coastal economies, jobs and food security.

(ii) The workshop focused on comparisons of best practices and the quality of science in LME assessment and management around the APEC Region. Comparisons were made among the Yellow Sea, Sulu Celebes, Indonesian Sea, Pacific Central American and Humboldt Current LMEs. The Yellow Sea LME Project reported major increases in fisheries yields as a result of sea ranching and integrated multitrophic aquaculture (IMTA).

(iii) Discussions took place to plan for two new LME projects recommended by the 2009 workshop meeting in Seoul. Planning proceeded for developing two new LME projects in the Indonesian Sea LME and the Pacific Central American LME. The groups developing the projects will produce a Project Identification Form (PIF) for submission to the GEF that will identify major transboundary issues needing to be addressed in the two proposed projects.

(iv) The groups working on the Pacific Central American LME and the Indonesian Sea LME identified scientists and partners to help draft the PIF for submission to the GEF.

(v) Group discussions centered on socioeconomics benefits and linkages to ecosystem based management based on scientific data. Among the issues put forward for consideration was the need to achieve an improved balance

and better allocation of fisheries between the artisanal and industrial sectors; improved methods for measuring the valuation of fisheries and other LME resources with regard to GDP valuations; comparisons of production levels and value of fish meal in relation to food security needs for coastal communities; and the application of IMTA as a model for augmenting fishery yields while rebuilding depleted fish stocks.

(vi) There were discussions on the carrying capacity of fisheries biomass yields in the LMEs of the APEC Region. Dr. Sinjae Yoo of KORDI presented a description of the difficulties in assessing average primary productivity. He indicated there were wide variations in productivity estimates for the Yellow Sea LME and said considerable effort was underway to refine the estimates. Dr. Villy Christensen, professor at the University of British Columbia (UBC) Fisheries Center, indicated that Ecopath/Ecosim modeling can assist in calibrating the levels of fisheries carrying capacity, based on the amount of available primary productivity and fishing effort, and an evaluation of tradeoffs that take into account ecological, economical and social considerations in the APEC Region.

(vii) Workshop discussions on sustainable fisheries data for the LMEs of the APEC Region recognized the importance of IMTA in augmenting fisheries biomass yields by focusing on the lower trophic level species. The trophic transfers from seaweed (*Laminaria*) to mollusks (abalone) - on a single buoyed array of lantern nets), while bay scallops filter the water and echinoderms (sea cucumbers) consume waste including fecal pellets, is an efficient system for protein production that is not detrimental to the environment.

Recommendations:

(1) The workshop participants agreed to move forward and draft two PIFS: one for the Pacific Central American LME and one for the Indonesian Sea LME.
(2) The participants agreed to support the West Bering Sea LME proposal put forward by the United States and the Russian Federation.
(3) The participants agreed to recommend further comparisons in relation to carrying capacity amongst LMEs of the APEC Region.
(4) The workshop voted for a continuation of the Yellow Sea LME (YSLME) project and supported the project's request for funding for a second five year phase of the LME project.
(5) The working group recommended the establishment of a YSLME Commission.
(6) A proposal was put forward by the Korean representatives to convene a follow-up biennial APEC LME workshop in Korea, in 2013 and beyond, to be hosted by the Korean Ocean Research and Development Institute (KORDI).

(7) The working group agreed to hold another workshop in Korea in 2013 on the augmentation of the carrying capacity for fisheries biomass yields of LMEs in the APEC Region during climate change.
(8) The working group agreed to apply for Phase Four of the APEC LME Project, and to submit a concept note in July 2012. Funding will be sought from the APEC Secretariat, NOAA and the Government of Korea.

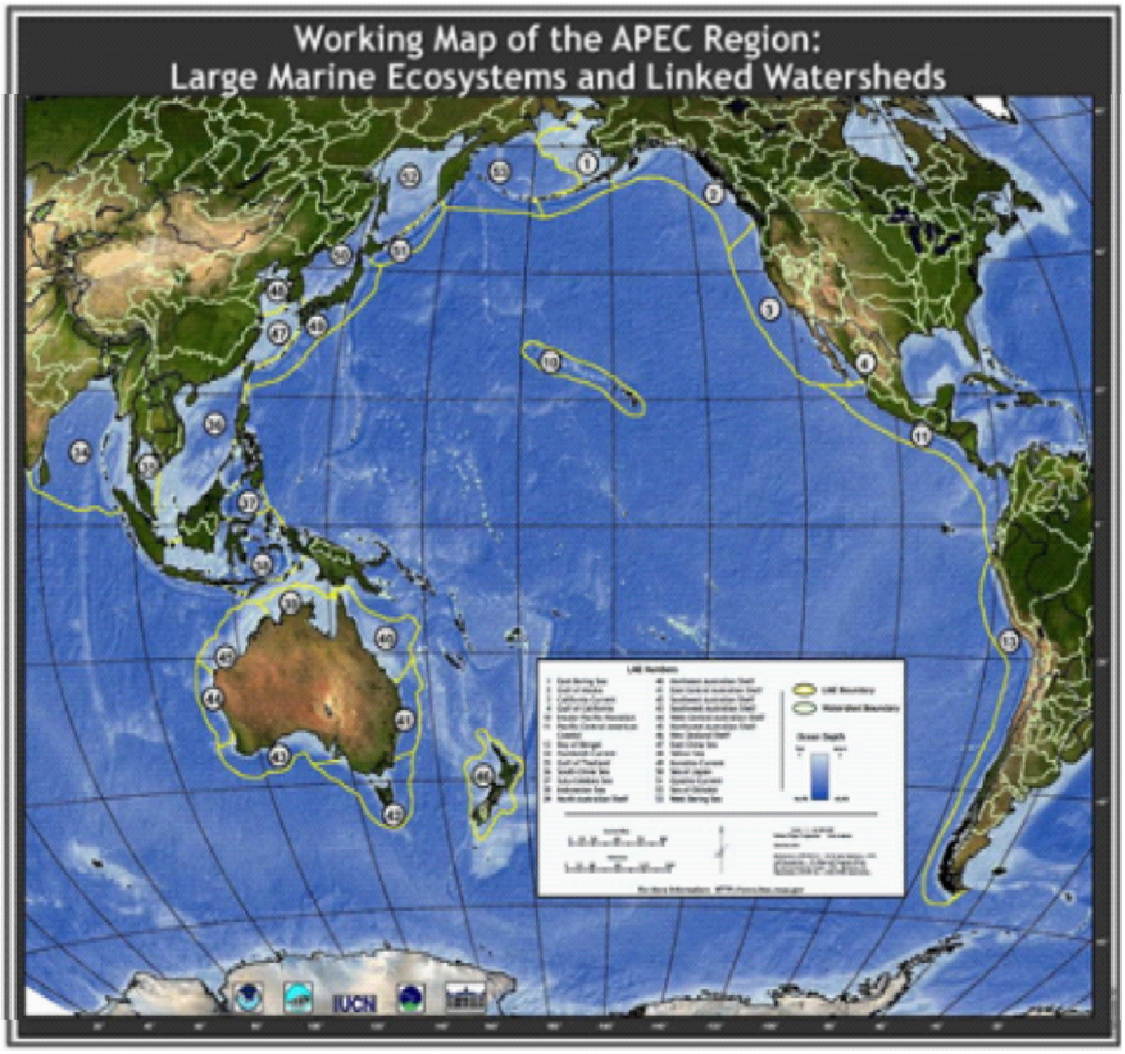

Figure 1. Working Map of the 27 Large Marine Ecosystems of the APEC Region and linked watersheds.

Table 1. *List of 27 Large Marine Ecosystems of the APEC Region. LMEs adjacent to the American continent and eligible for GEF funding are highlighted in red. LMEs adjacent to the Asian continent and eligible for GEF funding are highlighted in green.*

East Bering Sea, Gulf of Alaska, California Current, Gulf of California, Insular Pacific Hawaiian, Pacific Central American, Humboldt Current, Bay of Bengal, Gulf of Thailand, South China Sea, Sulu Celebes Sea, Indonesian Sea, North Australia, Northeast Australia, East Central Australia, Southeast Australia, Southwest Australia, West Central Australia, Northwest Australia, New Zealand Shelf, East China Sea, Yellow Sea, Kuroshio Current, Sea of Japan/East Sea, Oyashio Current, Sea of Okhotsk, and West Bering Sea.

Table 2*. List of 21 APEC Economies:*

Australia; Brunei Darussalam; Canada; Chile; People's Republic of China; Hong Kong, China; Indonesia; Japan; Republic of Korea; Malaysia; Mexico; New Zealand; Papua New Guinea; Peru; Philippines; Russia; Singapore; Chinese Taipei; Thailand; United States; and Viet Nam.

ANNEX 1
Workshop Agenda

ANNEX 2
List of Participants

ANNEX 1

APEC-LME Workshop on Marine Ecosystem Assessment and Management

Marine Resource Conservation Working Group (MRCWG)
Seoul, Republic of Korea, January 4-5, 2012

(ii) Background

The 27 Large Marine Ecosystems (see map on page 4) of the APEC Region make a major contribution in marine ecosystem goods and services to the APEC economy. Large Marine Ecosystems (LMEs) are regions of ocean space encompassing coastal areas from river basins and estuaries to the seaward boundaries of continental shelves and the outer margins of major current systems. LMEs have natural boundaries and share similar water depth, currents, productivity and food chains. The LME approach offers five assessment and management modules focused on ocean productivity, fish and fisheries, pollution and ecosystem health, socioeconomic conditions, and governance, as a pragmatic way to integrate science, management, and the economic wellbeing of coastal populations at the Large Marine Ecosystem scale. Healthy ecosystems are needed to sustain fisheries and are the basis for providing a safe and adequate supply of seafood for domestic use and international trade. The overall approach focuses on the economic benefits gained from a more sustainable resource base, upon which most APEC economies depend.

(iii) Purposes

The workshop aims are:

(iii) To report on the status and baseline assessment of the APEC region's Large Marine Ecosystems in relation to climate change,

(iv) To review best practices of ecosystem assessment and management in the APEC region,

(v) The planning and implementation of two pilot LME projects recommended by the 2009 meeting, in the Indonesian Sea and the Pacific Central American LMEs,

(vi) To promote networking of APEC LMEs, and

(vii) To identify the socioeconomic benefits of ecosystem-based management.

(iv) Programme

DAY 1

TIME	TOPIC	SPEAKER
10:00-10:10	Welcome Addresses	Kwang-youl Park
10:10-10:25	Introduction	Dr. Sinjae Yoo & Dr. Kyungjin Kim
10:25-10:50	Overview of the LME Approach. Global warming in relation to biomass yields in LMEs of the APEC Region	Kenneth Sherman
10:50-11:15	Overview of 2009-2011 APEC MRCWG activities and APEC desktop report	Marie-Christine Aquarone
11:15-11:40	An IFRAME approach for assessing and forecasting fisheries in the Large Marine Ecosystems off the coast of Korea	Chang Ik Zhang
11:40-12:05	Ecosystem assessment and management in the Indonesian Sea LME	Sapta Putra Ginting
12:05-13:30	Lunch	
13:30-13:55	Contribution of the economies of the West Coast of central America to the management of marine goods and services	Ulises Munaylla
12:55-14:20	A new estimate of the primary production of the Yellow Sea LME	Sinjae Yoo
14:20-14:45	Latitudinal shifts in catch distribution of fisheries species in Korean waters during the past 30 years in relation to climate change	Sukgeun Jung
14:45-15:10	Long Term Changes and biomass yields in the Yellow Sea Large Marine Ecosystem and in the East China Sea LME	Qisheng Tang
15:40-16:05	Socioeconomic Benefits of the LME Approach in the Gulf of California and Pacific Central American LMEs	Salomon Diaz Mondragon
16:05-16:30	Optimizing Estimated carrying capacity for fisheries biomass yields in the LMEs of the APEC Region	Villy Christensen
16:30-17:30	Workshop discussions in two groups on optimizing socioeconomic benefits in APEC LMEs at a time of climate change.	2 APEC groups
	ADJOURN	

DAY 2

TIME	TOPIC	SPEAKER
9:00-9:25	Assessment of changing states and biomass yields in the Humboldt Current LME	Mariano Guttierez Torero
9:25-9:50	QA/QC of Marine Monitoring Data	Jae Ryoung Oh
9:50-10:15	HGO networking to establish a resilient MPA network in the Yellow Sea LME	Jong Geel Je
10:15-10:40	The West Bering Sea LME pilot project	Kenneth Sherman
10:40-11:10	Coffee break	
11:10-11:35	Comparison of ecological characteristics of fish communities and oceanographic features at the southern boundaries of the western and eastern Subarctic Pacific Ocean	Suam Kim
11:35-12:00	Variability and assessment of the Sulu Celebes Large Marine Ecosystem	Annadel Cabanban & Norasma Dacho
12:00-13:30	Lunch	
13:30-14:00	Future of the UNDP/GEF Yellow Sea LME Project – What should be done?	Suh-Yong Chung
14:00-14:30	Preparation of a WCC motion document on the conservation of YSLME	Young Cheol Park
14:30-15:00	Coffee break	

15:00-16:00	Workshop discussions in two groups on best ecosystem practices in the APEC Region, best practices in ongoing LME projects, and preparation of what is needed to apply for GEF funding on the pilot Indonesian Sea LME Project, and the pilot Pacific Central American LME Project.	2 workshop groups: one for the Indonesian Sea LME, and one for the Pacific Central American LME
16:00-16:20	Summary of APEC LME Workshop Activities and Planning for the future (2012-2013); adoption of Workshop Recommendations	ALL
16:20-16:40	Continuation of APEC – LME Forum	Dr. Jong Geel Je & Dr. Kyungjin Kim
	ADJOURN	

ANNEX 2

Participant list 2012 APEC LME Workshop

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