

Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies



IOC-IUCN-NOAA
Consultative Committee Meeting
on Large Marine Ecosystems
(LMEs)

Ninth Session
Paris, France
July 2007

UNESCO 2007

1.0 INTRODUCTION

The Ninth Consultative Committee Meeting on Large Marine Ecosystems (LMEs) was held on 10-11 July 2007. The consultation was convened by the Intergovernmental Oceanographic Commission (IOC) of UNESCO, the US Department of Commerce's National Oceanic and Atmospheric Administration (NOAA), and the World Conservation Union (IUCN). It was hosted by IOC at UNESCO headquarters, Paris, France. The meeting was co-chaired by IOC Executive Secretary, Dr. Patricio Bernal, and Dr. Kenneth Sherman of NOAA. The meeting agenda is given in ANNEX I and a list of attendees in ANNEX II. The powerpoint presentations of the meeting are available on the LME website at: <http://www.edc.uri.edu/lme/intro.htm>.

Dr. Patricio Bernal, General Secretary of the IOC-UNESCO, welcomed the group to the 9th Consultative Committee Meeting on Large Marine Ecosystems. In his remarks he indicated that the community has expanded the LME concept and has built synergy among projects that were not considered jointly at first. Funds to support LME resource management projects have in 2007 reached over \$1 billion. The core LME methodology is sufficiently flexible to be applicable in coastal environments around the globe. The IOC-Unesco has long supported LME projects, in the Caribbean, Asia and Africa. Dr. Bernal indicated that while the science of global warming is clear and has been well explained, the Kyoto Protocol is presently insufficient to achieve the necessary goals for carbon dioxide reduction. The opportunity to discuss and negotiate necessary measures to address human-induced climate change will be a topic at the United Nations Climate Change Conference in Bali in December 2007. Climate change is altering the political landscape and is reshaping international activities including those of the Global Environment Facility (GEF). It is important to use science to apply what has now become convincing evidence on climate change into adaptation strategies that take into account all the economic interconnections. The existence of scientific gaps cannot postpone action.

The discussion following Dr. Bernal's presentation considered the need to better connect LME activities and the proposed U.N. sponsored Global Marine Assessment as it relates to biodiversity conservation and the ecosystem approach. Dr. Bernal indicated that LME projects such as the Benguela Current and Guinea Current are creating new governance institutions which are bottom up rather than top down. A major obstacle identified by the United Nations is the excess and complexity of agreements and conventions in ocean affairs, a top down approach that is a burden to the resources of countries. Dr. Sherman mentioned that the GEF 4th replenishment guidelines will generate cross focal interactions with biodiversity and climate change. Professor Hempel identified a major gap to be bridged in Germany between LME practitioners who are affiliated with government supported projects and biodiversity practitioners, who often belong to academic institutions. Academic institutions and governments have different points of view, with much of the momentum for linking complementary new ideas coming from NGOs.

2.0 A REPORT FROM THE IUCN

James Oliver, representing the IUCN, described recent IUCN activities as they relate to the LME community, including fisheries agreements concluded in West Africa, Marine Protected Areas, publications on climate change, and combating illegal, unregulated, and unreported (IUU) fishing in the Western Indian Ocean. An IUU fishing workshop for experts took place in February 2007. In the Bay of Bengal the focus is on climate change impacts on coastal ecosystems and coastal livelihoods. An IW:Learn sponsored economic valuation workshop is to take place in Cape Town on July 29-30, focusing on principles of ecosystem valuation, LME benefits and costs, and the use of economic valuation to influence decision-making, with examples taken from the Benguela Current LME. This is to be followed by the 4th biennial International Waters Conference on sustaining marine fisheries and

conserving marine resources. The IUCN team has expanded, with Jennifer Palmer now in the Washington DC office. The IUCN plans to participate in the Qingdao 2nd Global Conference on LMEs, and is also preparing for its own World Conservation Congress, to take place for 9 days in October 2008 in Barcelona, in the expected presence of 8,000 delegates. The Congress is held every four years and addresses the natural environment and human, social and economic development. It approves the IUCN Program for 2009-2012. The topic for the 2008 Congress is to be a diverse and sustainable world, with one of the 3 Congress themes focusing on climate change. The Congress represents an opportunity for the LME community to put forward a proposal and screen the DVD on LMEs. The six IUCN Commissions, including three on human related issues, represent many of the world's leading conservation scientists and experts. It was agreed that the LME community would bring forward a workshop proposal for the Congress. Hein Rune Skjoldal invited the meeting to provide additional LME input to the Commission on Ecosystem Management (CEM), of which he is a representative.

3.0 LMES AND GEF INTERNATIONAL WATERS STRATEGY FOR 2007-2010

Kenneth Sherman reviewed the global LME progress in relation to the 4th GEF International Waters (IW) Strategy for 2007-2010, and provided an LME map update. The IW strategy under the leadership of the new CEO Monique Barbut focuses on two objectives: (1) to foster international multi-state cooperation on priority transboundary water concerns through more comprehensive, ecosystem-based approaches to management; and (2) to play a catalytic role in addressing transboundary water concerns by assisting states to utilize the full range of technical assistance, economic, financial, regulatory and institutional reforms that are needed, including active leveraging of co-financing. As GEF resources are finite, IW funds will be directed to 4 global priority programming themes: (i) Ecosystem-based approaches to address depletion of coastal and marine fish stocks and associated biological diversity; (ii) Nutrient enrichment from land based pollution of coastal/marine waters leading to eutrophication and "dead zones" in LMEs; (iii) Overuse and conflicting uses of water resources in surface and groundwater basins; and (iv) Adapting to melting ice in high altitude basins, and Polar systems. It is expected from GEF preliminary planning documents that GEF International Waters will leverage \$110 million in support of groundwater resources, \$90-95 million to support ongoing LME projects in Africa, Latin America, the Caribbean, East Asian seas and the Pacific to recover depleted fish stocks, \$90-95 million to support East Asian LMEs and the Mediterranean to address coastal nutrient over-enrichment and biodiversity issues, and \$25-35 million for climate change adaptation, including the effects of melting ice in polar waters and glaciers of Asia and South America. GEF IW in a bottom up approach to transboundary water concerns has played a catalytic role which has proven successful in improving human well being, health, and food security and in alleviating poverty reduction. The 64 LMEs contribute \$11 trillion a year in goods and services to the global economy.

Dr. Sherman presented a 50 year time series of sea surface temperatures (SST), and discussed the emergent patterns relative to climate change. Of the 64 LMEs examined, 61 showed a pattern of SST increases from 1957 to 2006, ranging from mean annual values of 0.08 degrees C to 1.35 degrees C. The rate of surface warming in LMEs from 1957 to 2006 far exceeds the recent estimates of the IPCC and of the Japan Meteorological Society's COBE estimate for the world's oceans. There is good reason to be concerned with climate change and its effects on fisheries and trophic cascading, especially in already stressed and heavily exploited LMEs like the Baltic Sea, North Sea and East China Sea. Fishery yields during the past 25 years have changed in the 6 LMEs with the highest rates of warming. Dr. Sherman encouraged further outreach efforts to be launched relative to climate change within the framework of GEF-supported LME projects.

4.0 REPORTS ON PLANNING AND IMPLEMENTATION OF LME ASSESSMENT AND MANAGEMENT PROJECTS

GEF assistance is presently provided to 16 LME Projects that are implemented by U.N. agencies including UNDP, UNEP, FAO and UNIDO.

4.1. THE PERSGA PROJECT (RED SEA AND GULF OF ADEN)

Khulood Tubaihat, representing the Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA), discussed the Red Sea LME Project. The LME is rich in natural beauty and biological diversity, with a variety of reef types greater than anywhere else. The LME is an important transport route between the Far East and Europe for the transportation of oil and other commodities; 30% of the annual trade in crude oil is carried through this area and the Suez Canal. The Red Sea LME is ecologically undisturbed relative to other enclosed water bodies. There is however a growing risk of increasing marine pollution and environmental degradation from rapidly expanding maritime activities. The Red Sea LME has significant economic importance and provides a major potential for tourism. The Sinai Peninsula and its coral reefs generated \$1.8 billion in tourist revenues in 2000. Fisheries employ 89,000 fishermen, and the fishing industry generated almost \$30 million in export revenues in 2000. Marine aquaculture is a rapidly growing industry. The Red Sea LME has extensive non petroleum mineral deposits offshore that are thought to be very valuable.

The PERSGA Project began in the early 1970s as an effort to harmonize ongoing activities in the region including the Jeddah Convention (1982) on MPAs and biological diversity; the Action Plan for the Conservation of the Marine Environment and Coastal Areas in the Red Sea and Gulf of Aden (1982); the Protocol on Regional Cooperation in combating Pollution by Oil (1982); the Protocol on the Conservation of Biological Resources (2005); and the Protocol on the Protection of the Marine Environment from Land Based Activities (2005). Seven countries were involved in the Project. These were: Djibuti, Egypt, Jordan, Saudi Arabia, Somalia, Sudan and Yemen. Governance regimes are heterogeneous. The 1999-2005 GEF-funded Project produced a Strategic Action Plan (SAP) for the Red Sea and Gulf of Aden, which has helped the countries to share their knowledge. Some of the results include: a new ship traffic separation scheme for the Southern Red Sea, guidelines for the ornamental fish trade, and some progress made in habitat and biodiversity conservation. Progress in the management of shark fisheries has been made to address the issue of the shark fins being exported to China. Other results are the regional strategy, established in 2001, for the conservation of coral reefs, a regional action plan for the conservation of marine turtles and their habitats, and the establishment of a regional training center in Aden. There are 7 Marine Protected Areas (MPAs), with new proposed MPAs in Somalia, Djibuti, Sudan and Yemen. Publications include a 2002 Report on the status of living marine resources and Handbook on Integrated Coastal Zone Management (2006). Publications (e.g. on fisheries, sharks and living marine resources) are available in English at: <http://www.persga.org/UI/English/Activities.aspx?&ContentId=4&SubContentId=1>. National ICZM plans have been produced and adopted as national regulation.

PERSGA has been active in educational outreach, targeting 12-16 year-old boys and girls in schools, with a series of stories and case studies about the marine environment. School teachers have attended training workshops, and have pre-tested the educational materials in the field, in the classrooms and in scientific experiments in school laboratories. Educational materials in both electronic and hardcopy form are now available to be used by teachers and students. There is also a community outreach program that provides equipment to fishermen and tries to overcome some of the local cultural and political barriers to the effectiveness of development projects. The PERSGA Project needs champions in the region, and a convincing rationale for the countries to work together and adopt

an LME wide approach. The Red Sea and Gulf of Aden Region is experiencing an economic boom and needs a baseline economic valuation of its marine goods and services. PERSGA needs better definition of its role in balancing biodiversity conservation, economic development, the alleviation of poverty, and governance arrangements. Dr. Sherman remarked on the timeliness for extending the PERSGA activity in the Red Sea LME, and linking activities with six other LME projects established around the African continent.

4.2. THE BALTIC SEA LME PROJECT: PHASE 1 AND PHASE 2

Dr. Andris Andrushaitis reported on activities for the Baltic Sea LME. The goal of Phase 1 of the GEF-funded Baltic Sea Regional Project was to introduce ecosystem-based management (EBM) to the Baltic Sea LME by building the monitoring and assessment capacity necessary for EBM. This was accomplished through the establishment of a network of thematic coordination centers, lead laboratories, and 12 partner institutes, funded at a level of 1 million euros for priority monitoring and assessment equipment and to support training and networking activities. To date, 300 scientists and marine specialists have participated in various ICES and HELCOM events. The Project is making progress toward Phase 2, which will focus on the eastern Baltic States. Planned activities will include: indicator-based integrated assessments of the Baltic Sea, stock assessment data, and Ships of Opportunity (SOOP) monitoring of coastal fish and phytoplankton. Ships of Opportunity provide an operational monitoring system for the Baltic Sea, its state, and recent changes. BONUS 169, a network of scientific research agencies with a bottom-up approach, will support the science for ecosystem-based management. Information and BONUS publications are available at www.bonusportal.org. The Helsinki Commission (HELCOM) contracting parties routinely monitor nutrient discharges to the Baltic Sea, estimate the magnitude of nutrient losses to watercourses in the drainage area, and identify nutrient sources. The HELCOM Baltic Sea Action Plan, organized to address EBM needs, is being developed and will be completed late in 2007. ICES provides scientific and coordination expertise to the project and cooperates closely with HELCOM. For reports and presentations on the Baltic Sea Project, see www@ices.dk.

Since Phase 1, several Baltic countries have joined the EU, leaving the Russian Federation as the only GEF-eligible country in the Baltic Sea region. Russia has expressed a willingness to carry on with the project in collaboration with other Baltic Sea States. The gap in time between Phase 1 and Phase 2 is being used effectively to revisit the Phase 2 work plans and design the best implementation mechanism. Summaries of achievement are underway. A CD and a number of publications highlighting the results of the project have been prepared and distributed. The socioeconomic analyses should be developed in the very first stages of the project. The project needs the leadership of a strong Steering Committee able to coordinate across all involved sectors (environment, agriculture, fisheries, regional development and transportation) and to provide national ownership. The activities planned for Phase 2, e.g. relating to wind parks, military sites and coastal protection, need to be managed in relation to climate change and regime shifts in the Baltic. Formerly separate sectors such as fish and fisheries, biodiversity, and eutrophication need to fit into integrated assessments. In the move toward EBM, there needs to be a major shift in governance and institutions based on the ecosystem approach.

4.3 THE STATUS OF THE HUMBOLDT CURRENT LME PROJECT

Dr. Kenneth Sherman stated that there is money in the pipeline for moving forward with the Humboldt Current LME Project. An old boundary problem between Peru and Chile had stalled the project, but recent elections taking place in both countries have established new presidents who are inclined to go forward with regional cooperation for the assessment and management of this LME, which is notable for its major upwelling system, responsible for extremely high levels of organic

production. The Humboldt's high rates of primary and secondary productivity support the world's largest fisheries (approximately 18-20% of the world's fish catch). The project is supported by UNIDO.

4.4 MEDITERRANEAN LME PROJECT UPDATE

Alex Lascaratos, Project Manager, reported on the activities of the Mediterranean Sea LME Project. With the support of GEF, UNEP, UNEP/MAP, and FFEM, 13 GEF-eligible Mediterranean countries are cooperating under the Barcelona Convention to revise the Transboundary Diagnostic Analysis (TDA), initially prepared in 1997. The major transboundary environmental concerns for the Mediterranean Sea LME are the decline of biodiversity, decline in fisheries and decline in seawater quality, the risks of human health and the loss of groundwater dependent coastal ecosystems. The countries are jointly agreeing on what interventions are needed to address the priority environmental concerns through two Strategic Action Programs (SAPs): (i) to address pollution from land-based activities (SAP MED); and (ii) to conserve the Mediterranean's marine and coastal biological diversity (SAP BIO). The GEF-funded Mediterranean Sea Project will be implemented by UNEP and the World Bank, and executed by UNEP/Mediterranean Action Plan and a number of co-executing agencies. The Partnership will serve as a catalyst in leveraging policy, legal and institutional reforms, and bring additional investments for reversing the degradation of the Mediterranean LME, the freshwater basins feeding into it, its habitats and coastal aquifers.

The Barcelona Convention on the Protection of the Mediterranean Sea against Pollution entered into force in 1978 and has served along with the Mediterranean Action Plan as an example of regional cooperation. The Convention was revised in 1995 to align it with the principles of the Rio Declaration and evolving international law on the environment, and in order to make it an instrument for sustainable development. The Barcelona Convention includes: a Protocol for the Prevention and Elimination of Pollution of the Mediterranean Sea by Dumping from Ships and Aircraft or Incineration at Sea; a Protocol on Co-operation in Preventing Pollution from Ships and in Cases of Emergency, Combating Pollution of the Mediterranean Sea; A Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities; a Protocol on Specially Protected Areas and Biological Diversity in the Mediterranean; a Protocol on Pollution Resulting from Exploration and Exploitation of the Continental Shelf, the Seabed and its Subsoil ; and a Protocol on the Prevention of Pollution of the Mediterranean Sea by Transboundary Movements of Hazardous Wastes and their Disposal. A new Protocol addresses integrated coastal zone management. The Coordinating Unit, responsible for all activities related to the Mediterranean Action Plan under the Barcelona Convention, is located in Greece. A Mediterranean Commission for Sustainable Development (MCSDD) was established in 1995 as an advisory 'think tank'. Participating countries are Albania, Algeria, Bosnia and Herzegovina, Croatia, Egypt, Lebanon, Libya, Montenegro, Morocco, Syria, Tunisia, Turkey, and the Palestinian Authority. These are non European Union countries that are eligible for GEF funding. All Barcelona Convention countries are invited to participate and to be donors to the Project. There are close institutionalized links between the Barcelona Convention and the Project (through a joint office, and Steering Committee representation on the Project). The 5 components of the Project are: the sustainable use of fisheries resources through ecosystem-based management approaches; the conservation of biological diversity; the management of coastal aquifers and groundwater; the reduction of pollution from land based activities; and the reduction of POPs. The total project cost is \$44 million. The Project was successful in obtaining \$6 million in investment funds to support the biological diversity component, MPA network establishment, and sustainable fisheries using the EBM approach. The Mediterranean LME Project showcases the application of GEF Investment Funds to LME activities and points towards future LME project design and financing.

4.5 CARIBBEAN SEA LME PROJECT IMPLEMENTATION

Robin Mahon reported on the progress of the Caribbean LME Project, which includes part of the North Brazil Shelf LME, and which will be underway in 2008. Its overall objective is the sustainable management of the shared living marine resources of the Caribbean LME and adjacent regions through an integrated management approach that will meet WSSD targets for sustainable fisheries. Some of the transboundary marine resource issues are the decline of coral reefs and associated biodiversity, the decline of critical coastal habitats, and the inadequacy of coastal and marine protected areas. Most fisheries resources, especially coastal fisheries, are fully exploited or overexploited. Most of the resource assessment effort is put into lobster, conch, and shrimp.

Approaches by governments and organizations to reverse the trends of overexploitation and degradation have been piecemeal and uncoordinated. While ocean-wide large pelagics are assessed by ICATT, the status of the pelagics within the LME is unknown. Now in its PDF-B phase, the Project is completing its Project Document. Preliminary TDAs have been prepared for the Insular Caribbean Sub-Region, the Guianas-Brazil Sub-Region, and Central/South America Sub-Region. The Caribbean Sea LME is geographically and politically complex: There are 33 geopolitical State entities, with a variety of cultures, ethnicity, and language, and disparities in size and levels of economic development. It is the LME with the largest number of countries and highest number of SIDS. With regard to marine governance it has institutional complexity, with memberships to WECAFC, the Association of Caribbean States (ACS), WECAFC LAC, CARIFORUM, CARICOM, OECS, OSPESCA, OLDE-PESCA, and ICCAT. As a result of this governance complexity, we modified the 5 module approach to focus more on the overarching governance module and emphasize governance processes and institutions. It was decided to organize governance mechanisms to sustainably manage each key resource, and to be mindful of these resources at multiple scales. The scales are different for large pelagics, reef fish, flyingfish, shrimp, lobster and conch. This multi scale approach resonated with the countries. The Pilot programs provide the opportunity to explore governance mechanisms at different scales, supported by sound science-based information. They include: (i) the Large Pelagics Project, which increases ICCAT's involvement and seeks regional governance arrangements for all species of the Wider Caribbean area; (ii) the Guianas-Brazil Shrimp and Groundfish Project, which establishes and operates a sub-regional cycle for cooperation in the management of shared stocks; (iii) the Eastern Caribbean Flyingfish Project, which establishes and operates a sub-regional cycle for cooperation in management; (iv) a Reef Fisheries and Biodiversity Project, which enhances local level linkages among fishery and non-fishery stakeholders and upward linkages to national and regional levels; and (v) a Spiny Lobster project, which enhances local capacity and linkages among western Caribbean fishery stakeholders and upward linkages to national and regional levels. The research and assessments being conducted include traditional and local ecological knowledge, stock assessment, resource mapping and economics at all scales. The analysis which focuses on addressing fisheries and environmental management problems will lead to advice that is usable by decision makers such as local groups, national committees, regional scientific bodies and NGOs. Governance of the fisheries resource is fragmented due to the high number of participating states and territories. The issues needing to be addressed are capacity building, new legislation, and direct enforcement. To be functional, governance policy cycles need a framework that includes global, LME-wide, national and local scales, with vertical and lateral linkages. The linkages are strong at a technical level, but weak at the analysis and decision-making levels. Framework building interventions can be specifically targeted at establishing or completing policy cycles, and building or enhancing linkages. It is important to recognize the Caribbean Sea LME as a special area. We cannot make progress with ecosystem-based management until we have a functional governance process to pursue this. Information on the Caribbean LME project is available at: <http://www.cavehill.uwi.edu/cermes/clme.html>.

Hein Rune Skjoldal commented on ecological scales, management scales and institutional scales, and how these have to be dealt with at the same time. Dr. Mahon agreed that the region has

great ecological complexity, with the Amazon River as an upstream driver of nutrient inputs into the LME. In answer to a question from Dr. Cyr, Dr. Mahon clarified the use of indicators, which will vary according to the scale of each of the monitoring projects. Dr. Sherman said that while the GEF has guided the Caribbean LME project, the direction presently taken by the project has an unusual focus on only one of the 5 modules.

5.0 A FAO PERSPECTIVE

The Fisheries and Agriculture Department of FAO is developing an ecosystems approach to fisheries and is moving forward to complete planning documents for the GEF-funded Bay of Bengal and Canary Current LME projects for which it is the executing agency.

5.1 THE BAY OF BENGAL LME PROJECT

Merete Tandstad, from the Fisheries and Agriculture Department of FAO, presented the Bay of Bengal LME Project (BOBLME). The Project involves 8 countries (Bangladesh, India, Indonesia, Malaysia, Maldives, Myanmar, Sri Lanka, and Thailand), with a population of 1.5 billion constituting 25% of the world's total population. 400 million people live in the coastal catchment areas of the BOBLME. The expected population growth is 20% by the year 2015. The region is characterized by its fishing dependency (including part time and small scale fisheries), small GDPs and high levels of poverty. The Bay of Bengal Programme has been in place since 1980. Phase 1 focused on fishery development, Phase 2 on fishing communities, and Phase 3 on sustainable development. The emphasis now will be to broaden the scope of the project, which was approved by GEF as a PDF Block B in 1998. The goal is the sustainable management of the BOBLME, with FAO as the executing agency, and the World Bank as the implementing agency. The FAO has had a long engagement with the Project. Partners to the project include GEF, SIDA and NOAA. Priority issues are the overexploitation of living marine resources, critical habitats and land based pollution. The selected transboundary species are sharks, Indian mackerel and hilsa. There is a need for overarching fisheries data and a sound information system. The development objective is enhanced food security and reduced poverty in coastal communities while at the same time protecting the LME and managing the living marine resources in a sustainable way. The Project was revised to respond to post-Tsunami priorities, was approved in 2005, and was endorsed by all 8 country focal points. A consultative meeting took place in Bangkok in June 2007. As a result of the tsunami, many assessments were undertaken in the region. The Project is co-financed by national governments and donors such as SIDA, Norway, China, Russia and NOAA. Some initiatives critical to the project are the mangrove and fisheries projects. The Project is expected to start up late in 2007.

5.2 THE CANARY CURRENT LME PROJECT

Merete Tandstad also presented the Canary Current LME (CCLME) Project. The CCLME extends from the Atlantic coast of Morocco to the Bijagos Archipelago of Guinea Bissau and westwards to the Canary Islands (Spain) and western extent of the continental shelf. The countries bordering the CCLME are Spain (Canary Islands), Morocco, Mauritania, Senegal, the Gambia, Guinea Bissau, Guinea and Cape Verde. Seven of the countries are eligible for GEF funding. The CCLME has 3 distinct sub-areas: a northern, sub-tropical, upwelling zone centered off northern Mauritania; a southern, tropical, estuarine zone, centered off Guinea Bissau and extending from Gambia to Guinea, dominated by estuaries and mangroves; and a western, sub-tropical to tropical, oceanic zone (including the Canary Islands and the adjacent waters of Cape Verde. The CCLME is one of the world's major cold water upwelling boundary currents, with a high productivity and coastal zone providing important

goods and services to coastal states. The CCLME region also has significant petroleum reserves. There are disparate socio-economic conditions between high income countries (Spain -Canaries), middle income countries (Morocco), and low-income, food-deficient, countries (Senegal, Guinea Bissau, Guinea). The two Guineas rank among the poorest countries in the world according to published socioeconomic indicators. The CCLME project is presently in the pdf b phase, with UNEP as Implementing Agency and FAO as Executing Agency. Partners and collaborating agencies are SRFC, ATLAFCO, the Abidjan Convention, IUCN, UNIDO, NOAA, and CECAF.

Early regional and national processes began in 2005, with a TDA workshop taking place in 2006 and the project document being submitted to GEF in 2007. The main transboundary issues identified are concerns relating to depleted fisheries and habitats, and associated biodiversity and water quality critical to fisheries. There are declining or vulnerable small pelagic resources, demersal finfish fisheries, elasmobranchs (sharks & rays), marine turtles, and cetaceans. The status of tuna resources is uncertain. In terms of habitats there is increasing modification, disappearance or destruction of mangroves, seabed habitats and seamounts, wetlands, coral reefs and estuaries. The water quality has declined, with the changing salinity upstream of river mouths, hydrocarbon pollution, eutrophication of coastal waters, alien invasive species, sediment mobilization in water columns and toxicity from pesticides. Two further issues are ecosystem variability and loss of biodiversity. The goal of the CCLME is to ‘reverse the degradation of the Canary Current Large Marine Ecosystem caused by over-fishing, habitat modification and changes in water quality by adoption of an ecosystem-based management approach.’ The Project aims to take the CCLME countries through LME assessments, the TDA-SAP process, and demonstration projects selected to test and strengthen management capacity on the ground, and to serve as concrete steps towards achieving agreed ecosystem objectives and the broader project goal. Three demonstration projects in the fisheries component are ecosystem-based management of shared small pelagic stocks, reduction of the impact of shrimp trawling through by catch reduction, and transboundary management of migratory coastal pelagics of importance to artisanal fisheries (mulletts, bluefish and meagre). Two demonstration projects on stress reduction measures are MPAs as tools for multiple resource management, and a regional mangrove conservation plan that will demonstrate an approach to be replicated or adapted for other critical habitats. The demonstration projects are meant to test model multi-country approaches; feed into the TDA/SAP process; make concrete progress towards stress reduction on the ecosystem, and provide the basis for replication within and beyond the CCLME.

The Project objectives are to recover and sustain depleted fish stocks and restore degraded coastal habitats, conserve biodiversity and reduce coastal pollution. The Project is consistent with GEF’s IW Strategic Program for the 4th replenishment: to restore and sustain coastal and marine fish stocks and associated biological diversity. Component 1 includes specific activities relating to socioeconomics (e.g. an evaluation of CCLME goods and services). The total project cost is \$27 million.

6.0 YELLOW SEA LME PROJECT STATUS REPORT; AND UPCOMING QINGDAO 2ND GLOBAL CONFERENCE ON LMES

Professor Qisheng Tang, Director of the Yellow Sea Fisheries Research Institute in Qingdao, gave an overview of the progress made in the Yellow Sea LME Project (YSLME), which was initiated in 2005 with GEF funding support. The Project goals are to restore food fish for the sustenance of growing populations, and conserve the integrity of the ecosystem by developing ecosystem-based, environmentally sustainable management strategies for the Yellow Sea LME and its watershed. The YSLME Project countries (China and Korea) completed a Transboundary Diagnostic Analysis (TDA), National Yellow Sea Action Plans (NYSAPs), and a Strategic Action Plan (SAP); and established a regional framework for cooperation. In the first 2 years of the project, the major activity was data and

information gathering by China and Korea. The information gathered by five Working Groups will be used for ecosystem-wide syntheses of the fisheries, biodiversity, ecosystem, pollution, and investment components of the YSLME. This will in turn feed into the TDA. No summer cruise has yet taken place this year. The trophic level of important fish food species has declined from 4.1 to 3.4. The species composition and feeding habits in the Yellow Sea LME are changing. There is serious overfishing, eutrophication, and pollution in the coastal areas, and some dead zones have developed off the Chanjiang estuary. A population explosion of jellyfish has been documented from an event in August-September 2006, of jellyfish diameters of up to 40 centimeters and jellyfish abundance up to 30 meters deep in the water column. One of the major forces affecting the LME appears to be climate change, which is clearly impacting the herring stocks. Other drivers under consideration are overfishing and eutrophication. Actions are needed to restore stocks and biodiversity, improve water quality and protect human health, and reduce nutrient over-enrichment, oxygen depletion and coastal pollution. Professor Tang is the Chief Scientist for the \$9 million dollar GLOBEC Project for the Bohai Sea, East China Sea and Yellow Sea, which aims to advance understanding of the structure and functioning of these ocean systems and their response to physical forcing, and to develop forecasts of their responses to global change. The efforts underway in China are consistent with the GEF 4th replenishment guidelines that aim to restore and sustain coastal and marine fish stocks and associated biological diversity, reduce nutrient over enrichment and oxygen depletion from land based pollution, and balance conflicting uses of water resources and overuse in transboundary surface and groundwater basins. These guidelines will be applied in the East Asian Regional LMEs. Dr.Tang also provided an update on the 2nd global Conference on LMEs, to be held in Qingdao, China on September 11-13, 2007.

Professor Tang was asked if a return of herring abundance is likely, now that the pelagic component in the Yellow Sea LME has become highly variable due to jellyfish. He said that the resilience of the Yellow Sea ecosystem was being tested by eutrophication, which increased after 2000 due to an expansion of agricultural production. He showed on a map the increase in the extent of dead zones. Many fishermen have lost their jobs and need alternative livelihoods to gain income. These are serious issues for the LME project to address. He mentioned that the jellyfish are not being marketed because they are not the kind that can be consumed, nor used for aquaculture or other purposes. Dr. O'Toole mentioned the presence of significant jellyfish biomass in the Benguela Current LME, and the plan, led by Norway, to harvest them to extract the bioactive components for pharmaceutical purposes.

7.0 MAINSTREAMING THE LME CONCEPT: THE NEXT GENERATION OF LME SCIENTISTS AND POLICY-MAKERS

Professor Gotthilf Hempel provided some thoughts on the future of the LME approach world wide and on the next generation of LME scientists and policy-makers. He has participated in the LME movement from the beginning and notes that after more than 25 years of LME activity, the concept of the five LME modules of ecosystem productivity, fish and fisheries, pollution and ecosystem health, socioeconomics and governance has been adopted world wide including at NOAA in the United States. The LME projects are striving towards the recovery of depleted fish stocks, the restoration of degraded habitats, the reduction of nutrient over-enrichment, coping with the invasion of alien species, conservation of biodiversity and adaptation to climate change. Good science continues to be necessary, with marine scientists very competent in their field willing to enter fruitful discussions with experts in other fields such as academia, social science, industry, and administration. Common funds and organizational structures should help further develop the theoretical and methodological basis of LME work and to strengthen communication and exchange programs between the LME projects. This will help address the scarcity of regional expertise and inconsistencies in ecosystem monitoring, assessment and management.

To assure that the LME concept will be carried into the future, he advocates a strong participation of young scientists (“youngsters”) who are exposed early in their careers to the international scientific arena. These scientists must be encouraged to remain in LME projects and in their countries rather than become attracted to other more lucrative jobs elsewhere. Academia is the nursing ground for the next generation of marine scientists, advisors and administrators and will be the main source of new concepts that will eventually supersede today’s approaches. Through years of engagement, LMEs have gained recognition in the political arena but need more recognition throughout the scientific arena. LME projects need to exchange information on lessons learned. Professor Chidi Ibe has told us that no less than 7,000 scientists, technical officers and experts on marine policy and management have been recruited in the LME projects of Africa. Human capacity was created by overseas fellowships, training courses in Africa, and particularly through training on the job. Capacity enhancement has to be continued in all parts of the world, not only in developing countries. Much of this can be achieved in the regions themselves through mutual assistance. An estimated total of 5,000 scientists and marine experts should be trained each year. We should capitalize on a strong and coordinated leadership where we can find it.

Michael O’Toole agreed that training and capacity building in marine science was important in the Benguela Current LME Project. African centers of expertise can realistically be built for two or more LMEs. Hein Rune Skjoldal said that LME training could be provided by the IUCN taking on a facilitating role through the Commission on Ecosystem Management. Ned Cyr mentioned that NOAA has a hard time recruiting well-qualified people. There is almost a generational void, spanning developed and developing countries. Professor Hempel reminded the meeting that young LME scientists and the future of LMEs would be discussed at the Qingdao 2nd Global Conference on LMEs in September. This would be attended by many Asian countries and it was likely that new participants would be contributing a wealth of new ideas.

8.0 STATUS OF MEDIUM SIZED PROJECT ON GLOBAL FISHERIES

The GEF-IOC is supporting a Medium-Size Proposal (MSP) for promoting ecosystem-based approaches to fisheries conservation and LMEs. The MSP has 6 components: (1) training by colleagues from the University of British Columbia in the application of ECOSIM and ECOPATH modeling for 64 LMEs; (2) a fisheries ecosystem capacity building project, which is an electronic networking project for members of International Fisheries Societies conducted by the American Fisheries Society; (3) training in the application of Nitrogen flux models to all 64 LMEs under the direction of Sybil Seitzinger, NEFSC/Rutgers University; (4) the development and expansion of an information portal for LMEs by the University of Rhode Island; (5) training on modeling focused on biological particle size spectra as potential indicators of ecosystem condition, under the direction of Princeton University, the University of California-Berkeley, the International Center for Theoretical Physics (ICTP), the International Institute for Applied Systems Analysis (IIASA) and NOAA; and (6) a project by the Sea Around Us group to re-arrange 2001-2005 FAO global capture statistics into LMEs.

8.1. THE COMPONENT ON ECOPATH/ECOSIM

Dr. Villy Christensen reported on the University of British Columbia’s activities regarding the second phase (2007-2008) of the GEF-supported mid-size project (MSP), “Promoting Ecosystem-based Approaches to Fisheries Conservation in LMEs”. This component of the project is designed to strengthen the capacities of countries by providing training in the use of ecosystem modeling and its applications for the GEF-LME projects. ECOPATH/ECOSIM workshops continue to be conducted

with wide representation from GEF-LME projects. With this simple modeling, it is possible to evaluate the ecosystem effects of fishing and environmental factors including nutrient loading, and fit models with observations. The ECOPATH models constructed for all LMEs can identify the major interactions and dependencies and contribute to the ecosystem based management decision-making process: how do we optimize the exploitation of marine resources? And how might climate change impact fisheries or biodiversity in a given region? Predictive models are useful for addressing different scenarios quickly, and can help find answers by evaluating complex trade offs or predicting the variety of impacts on marine resources from land and sea use patterns. We had a clear example from Professor Tang of the Yellow Sea LME's numerous environmental factors, which must be examined all at once for an evaluation of their combined effects. Oftentimes there is no simple explanation. Four modeling workshops and training courses were conducted, focusing on the Baltic Sea (2004), the Benguela Current (2005), the Guinea Current (2006), and Southeast Asian Seas LMEs (2007). A fifth follow up workshop will take place in the Guinea Current LME Region in November 2007. We are interested in working with other GEF-LME projects.

Ken Sherman gave the SeaAroundUs group the daunting task of constructing ecosystem models for all 64 LMEs from the 1950s to the present. We used databases on benthos, plankton, mesopelagics, marine mammals, birds, fish diversity, fish growth, and fish diets to construct the models. We used FishBase, SeaAroundUs data, the new SeaLifeBase covering all marine life, and SeaWifs for climate data. The preliminary results can be accessed at www.seaaroundus.org. Each LME description includes the area of coral reefs, seamounts, the primary production, a list of estuaries, biodiversity, commercial fish, cephalopods, marine mammals, marine birds, a trophic pyramid and marine trophic indexes, catches and value of catches by species and by country, carrying capacity estimates for the major fish groups, and governance profiles. In the Guinea Current LME, it is a surprise to see the estimates of what is being taken by overseas countries and distant water fleets. The work will be completed and the finalized data will be posted on the UBC website in April 2008.

Dr. Andrushaitis from the Baltic Sea LME Project asked if LME modeling had demonstrated that overfishing had decreased the trophic level in the Baltic Sea LME. Dr. Christensen answered that several hypotheses were possible. The models show linkages between pelagic stocks and medusa outbreaks. Dr. Daskalov in the Black Sea Region has done interesting work on trophic cascading as a reaction to the human impacts on fisheries. Models are difficult to demonstrate or to prove. We can however use them for testing purposes and for adaptive management.

8.2 FISHERIES MANAGEMENT IT NETWORK AND LMEs

Gus Rassam, representing the American Fisheries Society (AFS), provided an update on the project component dealing with fisheries ecosystem capacity-building electronic networking, which is being conducted by the World Council of Fisheries Societies and the American Fisheries Society (AFS). The IT component was launched in 2004 with two aims: to establish fisheries science associations where they do not yet exist in developing countries; and to provide online information to run an international virtual fisheries science network. There was an increase in the number of fisheries scientists with membership in the Fisheries Societies of India, China, Zoological Society of Pakistan and Asia Fisheries Society. A new Mexican Fisheries Society has been established and has since organized 2 congresses. In 2004, the project provided training at the 4th World Council of Fisheries Congress in Vancouver. The new virtual fisheries science network, which is focused on the ecosystem-based management of fisheries, is free of charge and gives its members access to online information published by the AFS since 1870, to **Fisheries InfoBase** (which provides abstracts and the full-text PDF versions of 1988-1997 articles appearing in AFS journals), to associated publications, and to fisheries scientists, their work and contributions. The work being done on LMEs needs to be brought to their attention to link the relevant scientific expertise. The Project will be

completed by the end of 2007 and is in its last stages. Events targeted by the project for capacity and training purposes include a Tagging of Fish conference in New Zealand (February 2008), a Climate Change and Fisheries symposium (planned for 2009), and the Fifth World Council of Fisheries Congress in Yokohama, Japan (planned for 2009). A journal, "Coastal and Marine Fisheries", covering science, policy and management issues is to be published online.

9.0 AFRICAN LME PROJECTS ON THE CUTTING EDGE

Africa has shown remarkable leadership in advancing the ecosystem-based approach to the recovery and sustainability of renewable marine goods and services. In doing so it is helping to meet the four ecosystem-related targets agreed upon at the World Summit on Sustainable Development (WSSD), held in Johannesburg in 2002. A newly established Africa LME Association (ALMEA) will collaborate with the African Union in assisting countries to expedite investment loans and revolving fund financing from the World Bank and regional development banks to support marine fisheries recovery and sustainability, reduce and control marine nutrient over-enrichment, adapt to the effects of climate change on renewable marine resources, restore wetlands and other habitats including sea grasses, coral reefs, and mangroves, control coastal pollution, control erosion, and further train through education and outreach LME technical experts, scientists, policy experts and resource managers.

9.1 OCEAN VARIABILITY IN THE BENGUELA CURRENT LME; THE BENGUELA CURRENT COMMISSION

Dr. Michael O'Toole, Chief Technical Advisor, described in detail the main activities and some of the results of the Benguela Current LME (BCLME) Programme. His presentation covered ocean variability in the LME and provided information on the Benguela Current Commission, a newly established ecosystem-based governance mechanism. The main physical features of the highly productive, complex and variable BCLME situated at the confluence of the Atlantic, Indian, and Antarctic oceans, are the warm Angolan Current, the cool Benguela Current, and the warm Agulhas Current. The changes observed in the system, which has a higher degree of variability than the Humboldt, Canary and California Current systems, are believed to be the result of climate change. SST time series since 1982 are based on a combination of observations using Reynolds SSTs and satellite remote sensing. The warming is of at least 1 degree, with hot spots off Angola and South of Cape Town. Conditions in the ocean basins around southern Africa, including the interplay of tropical, sub tropical, and mid latitude air pressures, influence marine resources, weather patterns and rainfall over the entire region, with winds driving the upwellings and 5 major Benguela Nino warm events occurring. Low oxygen events are becoming more frequent. The Angola Front that separates the Angola and Benguela systems between the latitudes of 15 and 17 degrees is moving further south. The impacts of these changes can be observed on lobster dynamics, an eastward shift of the sardine, and the depletion of the biomass of anchovies and of the North Benguela Sardine. Dominance has shifted from anchovies and sardines to jellyfish, horse mackerel and gobies. The seabirds in the northern Benguela e.g. the gannets have declined along with the decline of fish stocks. There is a more marked difference between the northern and southern Benguela, with a pronounced regime shift in the north. Other indicators are the mass mortalities of rock lobster from low oxygen events, with a loss of 2,000 tons from the lobster 'walkout' in Elands Bay, and variations in copepod production as studied in the 1951-2005 time series in St. Helena Bay. Fish catch trends in Namibia (1950-1999) show a decrease and species shift. The anchovy has disappeared following a collapse of the sardine fishery in Namibia. In the Southern Benguela there has been a change toward a greater abundance of small pelagics, seals and seabirds. There was a spectacular sardine recovery in the early 1990s. The West coast rock lobster is shifting around the Cape, a trend that began in the 1990s. There are sub decadal

scale changes in the relative distribution of sardine eggs, with both the west coast and south coast being important spawning areas at different times. Beginning in the mid 1990s there was a dramatic shift from west coast spawning to south coast spawning by sardines, anchovies and other pelagics. The African penguin population is in decline in Namibia and South Africa, and seal pup numbers are showing a downward trend. The decline of penguins and gannets has reached a level of 85% in Namibia. Decadal changes indicate an increase in phytoplankton abundance in 1980-2000, and a 100-fold increase in zooplankton abundance estimates. Harmful Algal Bloom (HAB) events are increasing in frequency in the BCLME. The changes observed have had major socioeconomic consequences: a decimated processing and canning industry, and job losses. Hake resources have failed to recover in Namibia from the hypoxic event, despite conservative management. The eastward spread of pelagics is impacting jobs, the processing industry, and fish quality. The developing mariculture industry is under threat from HABs.

The Benguela Current Commission (BCC) was endorsed by South Africa and Namibia in 2006 and by Angola in 2007. It is a full cooperative ecosystem agreement for the Benguela region of Southern Africa, whose mandate covers transboundary fish stock management, biodiversity conservation, CZM international obligations, MPAs, HAB management, EIAs, industrial impact mitigation, oil spill contingency planning, and implementation of regional standards and harmonization of policies on water quality, pollution, sewage, maritime safety, data and information exchange. Its role is to approve any changes to the SAP, ensure the effective implementation of the SAP, harmonize regional and national policy, implement recommendations on fisheries, ecosystem monitoring, coastal development, mining, pollution, and ecosystem based management focused on transboundary zones, and facilitate the engagement of stakeholders. Its function is to ensure scientific coordination among participating institutes and countries to improve Benguela predictability through the monitoring of climate variability, and to carry out regional stock assessment, biodiversity conservation plans, training and capacity building. A fully binding agreement will be in place by 2012. The BCC has a Ministerial conference, a management board, an ecosystem advisory committee, working groups, and a secretariat, with a budget of ½ million dollars a year to support staff and operations, and an overall budget of \$13 million over 4 years to cover scientific activities, administrative and coordination costs, meetings, workshops, data management and service training. GEF is funding the BCC at a level of \$5 million.

The discussion following Dr. O’Toole’s presentation focused on the oceanographic work accomplished in the Benguela Current, including the contributions of Russian and Spanish vessels. The Soviets provided a good collection of plankton data. Regarding mining and shipping in the Benguela Current LME there is a need for proper codes of conduct and pollution contingency plans. These are issues that can be dealt with by the multi-sectoral Commission. As for the changes observed in the BCLME, the consensus of scientists and climate modelers is that this is more than multi-decadal variability, it is climate change. Professor Hempel raised the issue of Africa’s brain drain and loss of well trained scientists, and the impacts of this loss for producing continuously reliable datasets. Dr. O’Toole agreed that public institutions (governments, universities, national scientific institutes) are losing scientists to the uranium, diamond, and oil companies. A solution might be to semi privatize or privatize the laboratories, or team up with the other African LME projects to share the technology and research vessels.

9.2 GUINEA CURRENT LME ASSESSMENT AND MANAGEMENT AND THE ACTIONS OF THE NEW GOVERNANCE COMMISSION

Dr. Chidi Ibe, Regional Director of the 16-nation Guinea Current LME (GCLME) Project, reviewed the GCLME approach and evolution of the project. A healthy ecosystem is a resource for healthy economies, but its role is diminished by a plethora of stressors. From an ecological

perspective, the critical processes controlling the structure and function of biological communities can best be addressed on an ecosystem-wide basis. The 5-module LME approach considers resources, ecosystem processes, human activities and the interactions of these components. This approach holds the greatest promise for finding sustainable solutions for the management of marine and coastal environment and resources. The goals of the project are to recover depleted fish stocks, restore degraded habitats, reduce land and ship-based pollution, and create an ecosystem-wide assessment and management framework for the sustainable use of living and non-living resources in the GCLME. The early Gulf of Guinea Project involved 6 African countries (1995-1999). In Accra in 1998, the Ministers liked what they saw and issued the Accra Declaration on the Sustainable Development of the Coastal and Marine Environment of the GCLME. They formally invited the ten additional countries bordering the GCLME to participate in an expanded 2nd phase of the project, now called the Guinea Current LME Project, a major step forward in ecosystem-based management.

The Strategic Action Plan (SAP) is a negotiated policy document which describes policy, legal and institutional reforms, and investments needed to address the priority problems of a transboundary nature identified in the Transboundary Diagnostic Analysis (TDA) for the GCLME Region. To make sound management decisions it is necessary to collect scientific information on ecosystem conditions, and to track perturbations and resources at risk. To address Modules 1 (Productivity) and 2 (Fish & Fisheries), 3 LME-wide cruises have been conducted that have gathered baseline scientific information on primary and secondary production in upwelling areas and on the biodiversity status of plankton on the LME scale. This information, along with historical data, is being assessed to constitute a regional database. Prior to the GCLME Project, the data for the LME was spatially and temporally fragmented, inaccessible and difficult to compare. Currently, the data obtained from the time series assessments is organized around the 5 modules. Progress is being made in establishing MSY levels for fishery management plans, in defining the target species of commercial fisheries and in establishing the best practices for aquaculture. Monitoring, surveillance and restrictions in the licensing of boats (except for tuna) are part of an effort to ease industrial/artisanal conflicts.

For Module 3 (Pollution & Ecosystem Health), progress has been made in setting common effluent standards for pollution monitoring, putting in place a regional oil spill contingency plan, and creating standardized ESI maps. A Protocol linking the 23 countries of the Abidjan Convention addresses land-based sources of pollution. The first mangrove reserve has been established in southeastern Nigeria. Others are to follow in Cameroon and Angola. A major challenge is the achievement of a level field among countries that are numerous and diversified. For Module 4 (Socioeconomic Conditions), an evaluation of LME goods and services has been conducted for the GCLME with the assistance of the Woods Hole Oceanographic Institution and the University of Rhode Island. GCLME fisheries, oil and gas, forests, and mining have been estimated at a total annual value of \$50 billion dollars. For Module 5 (Governance), on the institutional level, a Ministerial level Meeting of all 16 countries of the GCLME took place in Abuja, Nigeria in September 2006, and endorsed the establishment of an interim Guinea Current Commission (IGCC). The IGCC is mandated to act on behalf of all 16 countries of the GCLME. Dr. Chidi Ibe is Executive Secretary of the IGCC. The Regional Coordination Unit is fully functional, with an effective steering committee. The IGCC will rapidly give way to a Guinea Current Commission (GCC). The Headquarters of the IGCC is in Accra, Ghana. The host country provides support, resources and regional coherence. In 2007 the Ministers talked about quotas to bring stability to the spurious nature of the fish stocks. There are many examples of joint actions in resource management, where the countries see the Commission as a major channel for addressing identified marine problems. The 5-module methodology is leading to a management system that will include regulatory, institutional, and decision-making aspects relating to marine ecosystems and their resources. Additional information on all five modules can be found on the GCLME website at: <http://gclme.org>.

10.0 GEOSS, GOOS, AND IOOS

The Global Earth Observation System of Systems (GEOSS) is an international program that routinely and continuously provides quality controlled data and information on earth's current and future states. The Global Ocean Observing System (GOOS) is intended to be a permanent global system for observations, modelling and analysis of marine and ocean variables needed to support operational ocean services worldwide. GOOS is coordinated by the Intergovernmental Oceanographic Commission (IOC), World Meteorological Organization (WMO), United Nations Environment Programme (UNEP) and the International Council for Science (ICSU). The Integrated Ocean Observing System (IOOS) provides data and information on current and future states of the oceans and Great Lakes of the United States from the global scale of ocean basins to local scales of coastal ecosystems.

10.1 LME PROJECTS AND GOOS & GEOSS IN AFRICA

Justin Ahahanzo, the GOOS-Africa Coordinator at the IOC-Unesco, reviewed the progress of Africa GOOS. GOOS is to provide: (i) accurate descriptions of the present state of the oceans, including living resources; (ii) continuous forecasts of the future conditions of the sea for as far ahead as possible; and (iii) forecasts of climate change. In Africa, offshore observation systems are useful for determining offshore oil and gas, shipping and trade, mining, fisheries, integrated coastal zone management, seaside tourism, public safety and health, and early warning systems for floods, droughts, and sea level rise. Africa GOOS has adopted the 5-module approach in the development of its links to the operational LMEs in Africa. The Pan African LME Forum Declaration, issued in Cape Town on 13 November 2006 by African Ministers, brought together the leaders of marine and coastal areas of the countries participating in African LME Programs. Through the establishment of the Benguela Current Commission and the Guinea Current Commission, the Ministers responsible for fisheries, environment, energy, mining and tourism have committed their countries to the recovery of depleted fish stocks, the restoration of degraded habitats, and the reduction and control of coastal pollution. These are the first two LME Commissions worldwide to focus on reducing risks to the sizeable contributions made by the goods and services of these LMEs to the African GDP. The Declaration establishes a closer connection between civil societies, maritime industries and the LME Programs of Africa, in collaboration with GOOS-Africa and other international efforts to monitor and assess global environmental conditions. The way forward is to enforce synergies between LMEs, GOOS, and GEOSS in Africa. For the Pan African LME Forum Declaration, see the website at: http://209.85.165.104/search?q=cache:z7U11ryKO2sJ:www.ioinst.org/templates/ioinst/Docs/IOInfor/ma/IOInforma_18_06.pdf+pan+african+lme+forum+declaration&hl=en&ct=clnk&cd=1&gl=us. In Cape Town, an international workshop with representation from all GOOS Regional Associations took place for the first time. The workshop reviewed the progress already made and planned future actions in support of the regional operations of GOOS around the world.

Following Mr. Ahahanzo's presentation, Professor Chidi Ibe stated the GCLME Project's willingness to support GOOS-Africa. Dr. Sherman said there were lessons to be learned from the LME projects in addressing fisheries issues for sustainable management. He also noted that there was now LME activity around the entire African continent. The GEF 4th replenishment would make funds available for African projects to address nutrient over-enrichment and habitat restoration. Waste water treatment plants would be funded within already existing transboundary LME projects. He also mentioned the recent interest of the Academy of Sciences for the Developing World and African Academy of Sciences in building educational structures in Africa for science, technology and sustainable development. There is increasing interest among developed countries to support scientific and technological capacity building in low-income countries, especially in Africa. A critical element for success is homegrown science. The call for enduring partnerships in science and technology

between Africa and the rest of the world is described in the editorial “A New Dawn for Science in Africa”, on the web at: <http://www.sciencemag.org/cgi/reprint/316/5833/1813.pdf>, published by Science Vol 316 29 June 2007 .

10.2 THE CONTRIBUTION OF LME INDICATORS TO CLIMATE CHANGE ASSESSMENTS: GEOSS AND IOOS

Ned Cyr, Chief of Marine Ecosystems Division, NOAA Fisheries Office of Science and Technology, described the contribution of LME indicators to GEOSS and GOOS. The ecosystem objectives of the GEOSS observing systems are to improve the management and protection of terrestrial, coastal and marine ecosystems. The goal of GOOS is to protect and restore healthy ecosystems and restore and sustain living marine resources more effectively. The goal of IOOS is to more effectively protect and restore healthy coastal ecosystems and enable the sustained use of ocean and coastal resources. There are easy opportunities for collaboration between LME Projects and GEOSS/GOOS due to overlap and synergy between coastal GOOS observations and LME observations of mutual benefit. The 16 LME projects operate in countries most in need of capacity building and scientific and technical assistance. LMEs and GEOSS/GOOS have similar observations, a regional scale, limited resources, and a mutual emphasis on capacity building. The third GOOS regional Forum took place in Cape Town in November 2006. GOOS Regional Alliances are US GOOS, IOCARIBE GOOS, GRASP, EUROGOOS, GOOS-AFRICA, IOGOOS, SEAGOOS and NEARGOOS. These Regional Alliances should partner with LME Projects to achieve common goals in those regions where both are active. To stimulate this process and demonstrate the power of collaboration, GOOS-Africa and the Benguela Current LME Program should implement an observations, data management, and modeling pilot project that contributes to the development of both efforts.

11.0 U.S. PERSPECTIVE ON THE GULF OF MEXICO LME PROJECT

Alexander Chester, Acting Director of the NOAA Southeast Fisheries Science Center, gave a thorough presentation on the Gulf of Mexico LME Project from the US perspective. The objective of the Project is “to rehabilitate marine and coastal ecosystems, recover depleted fish stocks and to reduce nutrient overloading to the Gulf of Mexico Large Marine Ecosystem (GoM LME), based on an assessment and management approach that considers LME productivity, fish and fisheries, pollution and ecosystem health, socioeconomics and governance”. He described the Loop Current, eddies, and hurricanes that characterize the physical environment, as well as its coral reefs, hypoxic zone, oil platforms, and shrimp habitats. Hurricane Katrina took place in August 2005. The economic importance of the Gulf of Mexico for the USA is considerable, with tourism revenues valued at \$20 billion. The Gulf accounts for 30% of the US offshore oil production and about 23% of the US gas production. For information on the impact of hurricanes on oil and gas production, see www.Gulfbase.org, a database of resources about the Gulf of Mexico, its use and conservation. Energy production and exploration has ecological impacts on fisheries and habitats through pollution, noise, platform removals and LNG Terminals. In commercial fishing, domestic landings are estimated at 1.2 billion pounds, valued at \$617.8 million (representing 12% and 16% of total domestic landings and value). Recreational fishing landings are 94.2 million fish landed on 35.1 million angler trips, representing 54% of total recreational landings and 42% angler trips. Oil production is forecast to reach a possible high of 2.1 million barrels per day over the next decade, according to the U.S. Department of the Interior Minerals Management Service Report, “Gulf of Mexico Oil and Gas Production Forecast: 2007-2016”. Governance authorities within the LME include the Committee on Ocean Policy (Subcommittee on Integrated Management of Ocean Resources, and Joint Subcommittee on Ocean Science and Technology), Ocean Research Priorities Plan, NOAA Strategic Plan 2006-2011,

NOAA 5 and 20 year Research Plans, and legislation such as the Magnuson-Stevens Fishery and Management Act, the Endangered Species Act, and the Marine Mammal Protection Act. On the national level, the U.S. Commission on Ocean Policy submitted its final report, "An Ocean Blueprint for the 21st Century," to the President and Congress in 2004, which contains 212 recommendations addressing all aspects of ocean and coastal policy. The U.S. Ocean Action Plan was released in December 2004, and it led to the creation of a Cabinet level Committee on Ocean Policy, under which resides the Joint Sub-committee on Ocean Science and Technology (JSOST) and the Subcommittee on Integrated Management of Ocean Resources. In 2007, the JSOST released the report, "Charting the Course for Ocean Science in the United States for the Next Decade: An Ocean Research Priorities Plan and Implementation Strategy."

A major transboundary threat in the Gulf of Mexico LME is the loss of wetlands, valuable as habitats for living marine resources, storm surge protection, sediment traps and nutrient filtration. The threats to wetlands come from development, channelization, invasive species, hurricanes, and subsidence. Since 1932, the Mississippi delta has lost many wetlands, with Louisiana losing more wetlands than any other state (25 to 35 square miles or 20,000 to 25,000 acres of coastal wetlands lost each year). In a hurricane year, shoreline retreat can amount to over 100 feet each year. With 60 to 70 percent of the state's residents living within 50 miles of the coast, wetland loss must be effectively addressed. Another major threat is the Gulf of Mexico hypoxic zone, a large, fluctuating area of low DO which impacts productivity. NOAA is supporting multi-year, interdisciplinary research studies to address HABs and hypoxia and is developing models that can lead to HAB forecasts, using satellites and ocean observing systems, and biochemical analysis for the detection and tracking of algal species and their toxins. The Gulf of Mexico Hypoxia Watch is a cooperative project of the National Marine Fisheries Service (NMFS), the National Coastal Data Development Center, and the CoastWatch Regional Node for the Caribbean and Gulf of Mexico. Transboundary issues relating to living marine resources in the Gulf of Mexico have been identified as the monitoring of fisheries and habitats, life history research, population assessments (single and multi species), habitat modification, bycatch reduction (especially shrimp), science-based management, strong governance systems and enforcement. Protected resources are turtles, marine mammals and corals. An annual Southeast Area Monitoring and Assessment Program (SEAMAP) by NMFS in the Western and North-central Gulf of Mexico aboard the NOAA Ship OREGON II surveys summer groundfish.

An Integrated Ecosystem Assessment (IEA) is a synthesis and quantitative analysis of information on relevant physical, chemical, ecological and human processes in relation to specified ecosystem management objectives. IEAs are an emergent approach used to tackle complex, ecosystem-level issues in the Gulf and other places and fit well with the LME concept. IEAs incorporate multiple indicators of the environment and ecosystem, including human factors; are geographically specified; establish target levels and thresholds for important ecosystem components; and evaluate the impacts of management options and risks of not attaining target ecosystem states.

12.0 THE NEW GESAMP

Fredrick Haag, Officer of the Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), presented the new GESAMP, originally established in 1969, and its mission to provide authoritative, independent, and interdisciplinary scientific advice to organizations and governments to support the protection and sustainable use of the marine environment. The agency is sponsored by UN agencies including UNEP, FAO, IOC-Unesco, UNIDO, WMO, IMO, and IAEA. It has published 47 scientific reports and has developed a new strategic vision, on the basis of an independent external evaluation in 2000-2002, with plans to establish a pool of experts available for scientific review. Support for GESAMP comes from the UN agencies and the Swedish government, which provides funds of \$1.1 million for capacity building in marine and related

sciences in developing countries. Some of the work focuses on economic valuation of ecosystem services, capacity building in developing countries, and training and mentoring of young scientists on how to conduct analysis on cross-cutting issues, and how to “translate” scientific results in a marine resources management context. GESAMP has three active working groups: one on the evaluation of hazards of harmful substances carried by ships (IMO); another on environmental risk assessment and communication in coastal aquaculture (FAO); and a third, which reviews ‘active substances’ for use in ballast water management systems (IMO). Four new working groups are examining deep water fisheries, habitat and related ecosystem concerns (FAO); developing an ecosystem approach to offshore mariculture (FAO); studying threats of mercury and its compounds to the marine environment (UNIDO); and evaluating the atmospheric input of chemicals to the ocean (WMO). The new website is under construction at www.gesamp.net. All previous reports, on issues ranging from land-based pollution to aquaculture and coastal populations, are available for download. Four forthcoming publications will include the issue of oil entering the marine environment, and risks in coastal aquaculture. GESAMP is willing to extend its network of partners to include LME experts and the United Nations.

13.0 OUTREACH ACTIVITIES OF THE LME PROGRAM OFFICE

Marie-Christine Aquarone described some of the outreach efforts of the Large Marine Ecosystems Program Office. Two DVDs have been produced, one with IW:Learn on “Turning the Tide—Sustaining Earth’s Large Marine Ecosystems” (26 minutes), and another with the Guinea Current LME Project, “Africa on the Cutting Edge—Leading Global Marine Ecosystem Recovery” (18 minutes). The Turning the Tide DVD was screened in elementary, middle and high school classrooms in four schools of Rhode Island, Virginia, and Ghana. The written evaluations by the school children indicated that the LME concept and message, and the scientific complexity of the issues, were understood and that there was a willingness on the part of the younger generation to address the problems described. The positive response to a DVD which had originally been designed for an adult audience led to the design and writing of a school curriculum based on LMEs and on the Turning the Tide DVD by a Rhode Island school teacher, Christine Kirch, who worked with the scientists of the NOAA-NMFS Narragansett Laboratory. The lesson plans produced, highlighting all five LME modules of productivity, fish and fisheries, pollution and ecosystem health, socioeconomics and governance, are interdisciplinary and have the flexibility to adapt to the educational requirements of elementary, middle and high schools. In celebration of NOAA's 200 years of science (1807-2007) and of the LME concept, identified as one of 10 major breakthroughs, an event co-sponsored by the URI Office of Marine Programs and by NOAA focused on Large Marine Ecosystems, inviting New England school teachers to attend a workshop, interact with NOAA scientists and explore the potential of the LME curriculum based on the “Turning the Tide” DVD. The keynote and workshop presentations by scientists are available on the LME website and on the Office of Marine Programs website at: <http://omp.gso.uri.edu/omp/nbc/oceansalacarte.htm>. Featured presentations include: “How to Study Primary Productivity in the Oceans from Space”, “Primary Productivity in a Large Marine Ecosystem”, “Fisheries and the Northeast US Shelf Large Marine Ecosystem”, “Ecosystem Based Fishery Management”, and “Assessing Pollution in Large Marine Ecosystems”.

14.0 IMPLEMENTING THE ECOSYSTEM APPROACH TO FISHERIES: REPORT ON THE BERGEN CONFERENCE

Hein Rune Skjoldal, from the Institute of Marine Research in Bergen, Norway, reviewed the Bergen Conference on Implementing the Ecosystem Approach (EA) to Fisheries, which took place on 26-28 September 2006. EA is defined as “the comprehensive, integrated management of human activities based on the best available scientific knowledge about the ecosystem and its dynamics, in

order to identify and take action on influences which are critical to the health of marine ecosystems, thereby achieving sustainable use of ecosystem goods and services and maintenance of ecosystem integrity". The Conference concluded that EA is an approach to management, rather than to science. However, the approach has implications for science. EA has both a horizontal and vertical dimensions and is applicable within geographically specific areas based on ecological criteria. Mr. Skjoldal also reported on the ecosystem approach in Europe and the work of NORSEPP, the North Sea Pilot Project jointly managed by ICES and EuroGOOS. NORSEPP focuses on oceanography and fish stocks, and the aim is to promote the use of operational oceanography for biological applications such as fish stock assessments. An overall report on EA is available on the ICES website at www.ices.dk. He discussed the framework and scales for an ecosystem approach to ocean management, with larger scales focusing on pollution, climate, and highly migratory stocks, and smaller scales focusing on coastal zones and watersheds. A follow up discussion to Mr. Skjoldal's presentation centered on the GEF and whether it funds research projects. Dr. Sherman said that the GEF encourages the use of good science for ecosystem-based management applications to address the most pressing management issues in GEF-funded projects. These can include priority socioeconomic issues.

15.0 ECOLOGICAL CONDITIONS IN THE RUSSIAN ARCTIC LMEs

Academician **Gennady Matishov**, director of the Murmansk Marine Biological Institution (MMBI), reviewed the variability in ecological conditions of the Russian Arctic LMEs. Under Dr. Matishov's leadership, the area of expeditionary research of the MMBI has been extended to include not only the Arctic areas (Barents Sea, White Sea, Norwegian Sea, Greenland Sea, Kara Sea, Laptev Sea, Bering Sea and Baltic Sea), but also the Sea of Azov, Black Sea and Caspian Seas, out of a newly established marine institution in Rostov-on-Don in 2001. The MMBI is an important center of Arctic studies. MMBI expeditions (2000-2006) have included year round ecosystem monitoring on board 7 atomic icebreakers in areas difficult to access along the Northern Seaway. These were started in 1997. Expeditions took place in 1992-2006 in the Kara and Laptev Seas. Seasonal biological stations have been established in the Spitsbergen archipelago. In the northern sea route area, a westward shift of the Siberian anticyclone has been observed. Thematic studies are underway on the reproduction of sturgeon, polar bears and large predator ecology, gray seals, and the determination of alien (invasive) species as indicators of 'biological pollution' levels in marine ecosystems. Winter expeditions take place every year in the Sea of Azov, which was noted for its extreme weather in 2005-2006. Climate is seen as an important key factor on Large Marine Ecosystems. A Climatic Atlas of the Sea of Azov has been published by the MMBI, NOAA and the Russian Academy of Sciences. In the lower Don Basin there are considerable changes in the species composition and relative abundance of indigenous ichthyofauna.

There is a decrease in the total fish catch, and a decrease of cod in the European part of the Russian Federation. Reproduction of the sturgeon species is a big problem. Natural stocks are overfished, which has led to a fishing ban on sturgeon. The species is now farmed. Biological pollution began with the expansion of the red king crab, introduced in the Barents Sea LME in the 1960s. New alien species have since been registered. These are: (i) natural (climatic) migrants; (ii) alien biota coming from the ballast waters of tankers during marine transportation; (iii) introduced species needing acclimatization; and (iv) genetically modified species, aquaculture hybrids, and escapes from fish farms. Introduced species in the Sea of Azov include the haarder, a species of mullet. There is a strong need for a ballast waters control system in all large ports of the Russian Federation's southern seas, to be established in cooperation with the Russian Ministry of Transport. In a review of commercial salmon farming data for the Barents and Norwegian Seas, he noted that the Norwegian oil and gas industry has invested in fisheries and trout and salmon fish farms. Industrial fish breeding in Norway is having an impact on the ecology of rivers of the Kola Peninsula, through the invasion of the Atlantic salmon, trout and other fish species from the Norwegian Sea into the

Barents Sea. The Norwegian oil and gas complex “snow white” taps Arctic gas beneath the Arctic Ocean at more than 100 kilometers off of Norway’s northern coast. There are possible transfer routes of oil and gas pollutants to the Barents Sea, an LME shared by Norway and the Russian Federation. Professor Matishov announced a symposium on LMEs of Russia in the epoch of global changes (climate, resources, management), to take place on October 10-13 2007.

16.0 THE AGULHAS AND SOMALI CURRENT LME PROJECT

Tony Ribbink, on behalf of the Agulhas-Somali LME project, outlined its progress. The Project is in partnership with NEPAD, the Census of Marine Life, SWIOFP, ACEP, GOOS, WIOMSA, WCS, CI, the Sustainable Seas Trust, and other agencies to ensure the long-term sustainability of the living resources of the Agulhas and Somali Currents Large Marine Ecosystems for the benefit of humankind. The Southwest Indian Ocean Fisheries Project (SWIOFP) is a GEF-funded project to better manage the living resources and habitat of the 2 LMEs of the Southwest Indian Ocean: the Agulhas Current LME and the Somali Current LME. Countries supporting the ASLME Project are Norway, Japan, the United Kingdom, and the countries representing the European Union. The funding agencies are the IUCN, NOAA, IOC-Unesco, the GEF and WWF. The Project goals are (i) to develop the knowledge necessary to better manage fisheries and biodiversity through capacity building and ecosystem studies; (ii) to understand the processes that drive the energy and economies of the Western Indian Ocean; and (iii) to contribute to the achievement of the Millennium Development Goals and WSSD targets. The ten countries involved (Comoros, Kenya, Madagascar, Mauritius, Mozambique, Reunion (France), Seychelles, Somalia, South Africa and Tanzania) are to engage in a TDA and SAP process to identify the priority transboundary concerns. The Project is called the African Coelacanth Ecosystem Programme (ACEP), with the coelacanth, a living fossil unchanged over an enormously long period of time, serving as a regional symbol for marine conservation and the ecosystems approach. A cruise along the east coast of Africa took place on board the *Algoa* in July-August 2003. The cruise, supported by the New Partnership for Africa's Development (NEPAD), monitored biophysical conditions, conductivity, temperature, and depth. The Agulhas and Somali Currents are very different from the Benguela Current on the West coast of Africa. The South Equatorial Current in the Indian Ocean extends from 8°S to 20°S. While oligotrophic it does support rich biodiversity. The Current, making its way down towards the south with high velocity eddies, has unique nutrient and energy pumps and upwellings supporting nutrient-rich areas which have a direct impact on the livelihoods of millions of people living in coastal communities. Only half of the LME’s rich biodiversity (deep reef system, invertebrates) has been taxonomically described.

Building regional capacity is seen as a crucial component of the project: to stop the brain drain, train a critical mass of people, and increase public awareness. This already involves teaching on board ACEP research vessels and establishing virtual centers of excellence in geosciences, oceanography, marine ecology, genetics and genome resources, socioeconomics, indigenous knowledge, and GIS. Floating research facilities arriving at east African ports are opened to schoolchildren, students, and teachers. In these two LMEs, economic growth lies in biodiversity and MPAs rather than fish biomass. To rely on investment in fisheries alone would be short sighted. A growing human population of 140 million is depending on a diminishing resource. The Sustainable Seas Trust (Africa) is a vehicle for the long-term sustainability of the LME approach in the West Indian Ocean, through long-term funding mechanisms for Africa and the provision of opportunities for young African scientists. It is to allow African countries to sustain and expand their natural resource based economies and to address the overall trend of depleting resources on an LME scale. In a follow up discussion to Dr. Ribbink’s presentation, Ken Sherman mentioned that a 10 year cycle in GEF supported projects is needed to address transboundary concerns and all 5 modules in a systematic way. Other comments pertained to conflicting regional uses in ASLME fisheries.

ANNEX 1-- AGENDA
ANNEX 2-- LIST OF PARTICIPANTS

ANNEX 1—MEETING AGENDA

**IOC-IUCN-NOAA-UNEP Large Marine Ecosystem
9th Consultative Committee Meeting
10-11 July 2007 - Paris, France**

DAY 1 - 10 July 2007

TIME	TOPIC	SPEAKER(S)
9:00 am - 12:00 pm	IOC Welcome & Marine Ecosystems Overview	Patricio Bernal Julian Barbieri
	Report from IUCN	James Oliver
	LMEs and GEF IW Strategy for 2007-2010, Review of Global LMEs, and Map Update	Kenneth Sherman
	PERSGA - Red Sea and Gulf of Aden	Khulood Tubaishat
	Baltic Sea LME Project: Phase 1 and Phase 2 Mediterranean LME Project Update	Andris Andrusaitis Alex Lascaratos
	Status of the Humboldt Current LME	Pablo Huidobro
12:00 pm - 1:00 pm	LUNCH	
1:00 pm - 5:00 pm	Ocean Variability in the Benguela Current LME; The IBCC	Mick O'Toole
	Guinea Current LME Assessment & Management in Relation to Actions of the New Commission	Chidi Ibe Chika Ukwé
	Bay of Bengal LME: FAO Status Report Update	Ned Cyr
	Caribbean Sea LME Project Implementation (TDA, SAP)	Robin Mahon Alex Chester
	Yellow Sea LME Project Status Report	Qisheng Tang
	Status of Medium Sized Project on Fisheries; ECOPATH/ECOSIM; Nutrient Over-Enrichment; Particle Size Spectra; Update on Fisheries Time Series Data	Villy Christensen
	Fisheries Management IT Network and LMEs	Gus Rassam
5:00 pm - 6:00 pm	Africa LMEs - Lessons Learned and the Way Forward	Chidi Ibe Kenneth Sherman
6:00 pm	ADJOURN	

9th Consultative Committee Meeting (cont'd)

DAY 2 - 11 July 2007

TIME	TOPIC	SPEAKER(S)
9:00 am - 12:00 pm	Report on Bergen Conference: Implementing the Ecosystem Approach to Fisheries	Hein Rune Skjoldal
	Arctic Council/PAME/APEC	Kenneth Sherman
	Variability in Ecological Conditions of Russian Arctic LMEs; Conference on LMEs of Russia	Gennady Matishov
	UNEP-LME Report - A Perspective on Changing Conditions in LMEs of the World's Regional Seas	Kenneth Sherman Gotthilf Hempel Sherry Heileman, Marie-Christine Aquarone
	Mainstreaming the LME Concept: The Next Generation of LME Scientists and Policy-Makers	Gotthilf Hempel
	Pollution & Ecosystem Health Indicators for LMEs	TBA
	The Contribution of LME Indicators to Climate Change Assessments--GEOSS & IOOS	Ned Cyr
12:00 pm - 1:00pm	LUNCH	
1:00 pm - 5:00 pm	UNIDO, UNDP and the LME Approach to Marine Resource Management	Chika Ukwe
	The 5-Module Approach to the Canary Current LME Project	Merete Tandstad
	The Agulhas Current LME and Somali Current LME	Tony Ribbink
	U.S. Perspective on the Gulf of Mexico and Caribbean Sea LME Projects	Alex Chester
	GESAMP Status	Fredrick Haag
	LME Projects and GOOS & GEOSS in Africa	Justin Ahanhanzo
	LME Outreach: DVD, LME Curricula, Educational Event	Marie-Christine Aquarone
	Round Table Discussion/Planning Session 2007-2010; Planning for Qingdao Conference	ALL
5:00 pm	ADJOURN	

ANNEX 2

**IOC-IUCN-NOAA-UNEP Large Marine Ecosystem
9th Consultative Committee Meeting
10-11 July 2007 - Paris, FRANCE**

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(Updated 7/6/07)

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