

Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies



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

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INTRODUCTION AND IOC WELCOME

Wendy Watson Wright, the General Secretary of the IOC-UNESCO, stated that IOC was delighted to host the annual LME Consultative Meeting for the 14th time (her third year). She acknowledged NOAA, UNEP, UNDP, and GEF as partners in this important program and said IOC will continue to support this important work. After a period of intense meetings, including Rio +20, Wright noted that the Oceans and Coast section of the Rio document is quite substantial and said it addresses a number of key issues in relation to ocean health including acidification. She said the International Acidification Initiative is opening an ocean acidification center and IOC will serve as a board member. The Rio+20 document recognizes capacity building and IOC is working to build capacity in developing nations and small island states. Wright acknowledged the Transboundary Water Assessment Program and the LME Community of Practice Project while noting that the allocation for LME assessments has been reduced. Meanwhile, status indicators across all 64 LMEs appear to be declining due to continuing degradation.

IOC completed a review of their Ocean Science Section which will provide guidelines for the scientific work of the Commission for the next eight years. Two of the themes are very relevant to LMEs: (i) Science in support of sustainability of ocean ecosystems in a changing environment, (ii) Assessing and predicting ocean health and variations in ocean goods and services. Wright wished the group an excellent meeting and looked forward to hearing the results.

Jorge Luis Valdez, Head of the Ocean Science Section at IOC-UNESCO, said he regularly notices presentations on LMEs and acknowledged the importance of the LME approach. Valdez remarked on the quality of the LME community and their work, said the group was reporting reputable science, and stated the work of conference participants was very relevant. He too wished the group an excellent meeting.

Accelerated Warming and Emergent Trends in Large Marine Ecosystems

Kenneth Sherman, Director of NOAA's Large Marine Ecosystem Program, gave a presentation entitled *Accelerated Warming and Emergent Trends in Large Marine Ecosystems* and focused his talk on climate change and some of the areas at highest risk. He described the concerted effort to avoid political boundaries and use ecological boundaries for LMEs – defined by bathymetry, hydrography, trophodynamics, and productivity. LMEs are areas with the highest levels of ocean productivity and 80 percent of marine fisheries yields are within the boundaries of LMEs. He reviewed five module approach to LME assessment and management and said those modules have served the LME community, the GEF and UN agencies well.

Human expansion is causing changes in coastal oceans as evidenced by overfishing, pollution, and habitat destruction. Sherman described the evidence for three decades of warming at the global scale. Modeling indicates that there will be an increase in primary productivity in subpolar areas with losses of sea ice and warming surface waters. Developing countries from 20 degrees N to 20 degrees S will likely be negatively impacted by lower primary productivity due to intense stratification of the upper water layers. If projections hold true, food security in 14 LMEs will be at risk from reduced levels of primary productivity and fish. In these LMEs, the average length of fish in the catches is declining. Sherman said this is a very serious issue and could lead to a tipping point. He wanted to stress the importance of extending GEF support in these LMEs where food security was extremely important.

The total GEF funding for 17 projects in 110 countries reached a level of \$3.1 billion and by 2020 Sherman would like to see that double to \$6 billion. He described the greatest current need in LMEs is the training of 10,000 practitioners in the ecosystem approach through a

certification program. NOAA leadership is in a position to help economically developing nations toward sustainable development of marine resources through the LME program.

Humboldt Current LME

Michael Akester, Regional Project Coordinator for the HCLME Project, reviewed some of the goods and services provided by the HCLME and said the HCLME contains some of the world's most productive fisheries, producing 12 million mt per year, as well as the highest global production of fishmeal. Mariculture is currently thriving in Chile but has not been fully developed in Peru. Akester said there is great potential to develop pharmaceuticals from macroalgae and excellent potential for tourism in Peru. He described a Peruvian alternative to the Galapagos and the development of sport fishing enterprises.

In recounting the status of the goods and services of the HCLME, Akester described how overfishing and pollution are degrading these goods and services. Anthropogenic stresses, red tides, HAB Harmful Algal Blooms, coastal erosion and sedimentation are all on the rise and climate change is also having an impact on the LME – as increased precipitation contributes more runoff.

There is currently a large scale oxygen deficiency in the Eastern Pacific as the Minimum Oxygen Zone intensifies and comes closer to the surface. This OMZ is impacting marine life and sonar is a useful tool for detecting affected species. This issue may lead to more government funded research. One species, the Big eye tuna, are found at depths up to 450 meters and can extract oxygen even with minimum levels available.

Unlike most LMEs, sea surface temperatures are declining in the upwelling zone, especially along Peru. Upwelling seems on the increase due to increased wind speed and this will likely increase the recruitment of fish species. Productivity in the HCLME is increasing as evidenced by increasing chlorophyll concentrations. The area is characterized by low pH.

Several good practices are underway to improve the wellbeing of the HCLME including the establishment of Marine Protected Areas, promotion of the direct human consumption of fish – especially for anchovy, certification of fish meal and fish oil producers, creation of an innovative waste recycling at a Nitratos facility, as well as education programs in area schools.

In conclusion, Akester explained that threats from anthropogenic impacts are increasing and climate change is leading to intensified upwelling in the HCLME. Natural productivity cycles in the HCLME are complicated by the expanding OMZ and red tides are increasing due to land based pollution. He said good management practices and EBM are being put in place but the positive impacts of these actions may not be readily detectable for several years.

Fisheries in Large Marine Ecosystems

Daniel Pauly, of the Sea Around Us Project at the University of British Columbia, reported that global fisheries landings have been declining despite increased fishing efforts, primarily due to over-reporting by China. Pauly also pointed out that the percent of exploited ocean areas are increasing. These areas have expanded deeper and further south while the size of fish catch is declining. He explained that fish catches are 30 percent higher than the actual reported landings for many countries due to factors such as lack of reporting from sports fisheries.

The Sea Around Us project is reconstructing catch time series for all countries of the world as catches reported to the FAO are, according to Pauly, essentially useless data, especially for small scale fisheries. Pauly explained that catches from China don't look right – due to previous over reporting and said that in 1988 the government decided the catch would not be increasing any more. Chinese vessels are fishing all over the world (except U.S.) in 80

countries. To determine the amount of catch per vessel – he said you need to estimate the number of vessels. The Sea Around Us project estimated that China has 1,000 vessels while China reports 2,000 vessels. According to Pauly, China has an enormous number of vessels in Korea. Overall, Pauly said fisheries landings and the number of vessels are difficult to sort out. He estimates the world marine catch is higher than 70-80 million tons, while at the same time the catch is declining more rapidly than previously thought. In tropical areas, increasing temperatures will cause species to shift to northern latitudes. This dynamic will change the catch potential over the next 50 years. Also, fish sizes tend to be smaller in warmer temperatures. Pauly explained that as a result of global warming, the dissolved oxygen and the productivity of stocks go down. He summarized that we all end up losing with global warming.

ICES Working Group on LME Best Practices

Michael O'Toole, Program Manager of the Sea Change Management Unit – Marine Institute in Galway, Ireland, reported on the ICES Working Group (WG) meeting on LME Best Practices meeting held July 3-4, 2012. First he gave an overview of the WGLMEBP Report of 2011 and proceeded to summarize presentations from the two day meeting. As the first speaker, Hein Rune Skoldal provided an overview of the Arctic followed by Gotthilf Hempel who reviewed the various science and management organizations working in the Arctic. Finally, Vladimir Mamaev described the new GEF project in the West Bering Sea to conclude the session.

Day two began with Adi Kellermann covering ICES activities in the Arctic. Next, Anne Christine Brusendorff, ICES General Secretary, reviewed lessons learned from the Baltic Sea LME project. Next, there were presentations on ecosystem indicators in the Benguela Current (BCLME) by Nico Willemse and indicators of ecosystem change in the Yellow Sea by Yihang Jiang. The session on capacity building included presentations on the Bay of Bengal (BOBLME), the Guinea Current (GCLME) and Nansen Project given by Birane Sambe, as well as ICES training programs presented by Adi Kellermann and a new training initiative by the International Ocean Institute in Namibia (as well as other courses) presented by Werner Ekau.

The next session focused on best practices in communication, information, and knowledge sharing with presentations on the Agulhas Somali Current (ASCLME) by David Vousden, the Canary Current LME (CCLME) by Birane Sambe, the Benguela Current LME (BCLME) by Hashali Hamukuaya, and the Gulf of Mexico LME (GoMLME) by Porfirio Alvarez. Next, Gotthilf Hempel reviewed ICES publications and Vladimir Mamaev gave an update of the GEF LME Community of Practice project. This \$4 million dollar project includes \$1.5 million in co-financing. The PIF is completed and preparations are underway for the Project Preparation Grant - \$100,000 is available to prepare the project document. Paul Holthus of the World Ocean Council spoke about engaging the ocean business community in LMEs through the Smart Ocean/Smart Industries Program.

The Working Group meeting concluded with the adoption of recommendations to continue the Working Group beyond the initial three years in order to foster coordination and communication between ICES and LME stakeholders. Likewise, the WG will promote lessons learned, best practices, use of indicators, knowledge sharing, dissemination of ICES publications and continue to aid in training needs. If the GEF LME CoP project gets approval, a coordination center will be established. The working group plans to meet at IOC-UNESCO in July 2013 prior to the LME Consultative Meeting.

The Transboundary Waters Assessment Programme (TWAP) Revision

Sherry Heileman, Fisheries and Environment Consultant at IOC-UNESCO, explained that the PIF for the second Transboundary Waters Assessment Program was approved by the GEF Council in December 2011 but with a reduced budget. The original sum of \$1.8 million has been reduced to \$400,000 for LMEs and \$600,000 for assessing the open ocean. This second TWAP is moving into the project preparation phase (the original medium sized GEF TWAP ended in 2010).

The TWAP includes the partnering of many agencies – UNEP is the executing agency and IOC-UNESCO is the implementing agency for the LMEs/Open Ocean component.

The project is expected to start in January 2013 and run for two years. Project leaders are reducing the scale and scope of the assessments and preparing the project document.

The LME Assessment Methodology is based on the five LME modules with a number of indicators in each module. There is a new approach for assessing LME governance and the TWAP will include the mapping of cumulative human impacts, as well as an Ocean Health Index with scores for individual LMEs. This comparative assessment will allow the GEF to identify LMEs that are in need of intervention. Heileman concluded by saying she thought this would be a meaningful assessment despite the reduced budget.

Governance Assessment in the Transboundary Waters Assessment Program

Robin Mahon, Director of the Centre for Resource Management and Environmental Studies at the University of the West Indies, presented on the TWAP approach to assessing governance through process, pressure, and state indicators. He said the ultimate focus is on human well being and explained how a governance architecture assessment requires a conceptual framework. The concepts included in assessing governance architecture include: scale, nestedness, interplay of organizations, fit of institutions to ecosystems, regime complexes and subsidiarity. The steps for a level one assessment include identifying key issues and assessing the arrangement in place for each issue.

Mahon went on to explain a pilot project for the North Brazil Shelf LME (NBSLME). The transboundary issues for this LME include: shrimp and groundfish fisheries, coastal habitat destruction, land-based pollution, and piracy. Part of the assessment process involves creating tables for each individual issue and identifying what organization is responsible for dealing with the issue. Issues are scored in terms of the number of countries involved and the percent completeness of governance response. Issues are ranked by priority for governance intervention.

A cluster analysis is performed to determine which issues share a responsible body. In the NBSLME, no organizations share responsibility for issues – there is zero integration. The conclusions for the NBSLME indicate that there is no decision making body for fisheries, there is no mechanism to engage in an Ecosystem Approach to Fisheries and there is no transboundary mechanism for coastal habitat destruction or piracy.

The final outputs of a level one assessment include identifying which areas might benefit from strengthened programs as well as governance benefits as determined by stakeholders.

Integration of LME and ICM Projects

Ivan Zavatsky, of the Global Environment Facility, presented a talk on the Integration of LME-ICM Projects. First, he covered the key issues affecting ocean sustainability – unsustainable fishing, climate change and ocean acidification, pollution and waste, invasive species and loss of habitats and biodiversity. To date, the GEF has invested in 21 LMEs around

the world including the Pacific Warm Pool. The West Bering Sea is the latest project. Of the 21 LME projects, there are 110 GEF recipient countries working with 20 non-recipient countries. UNDP, UNEP and FAO have led these efforts with financing from the GEF and World Bank. GEF has provided \$403 million in grants accompanied by \$2.4 billion in investments from countries, partners and the World Bank.

The GEF has invested \$126 million in 32 Integrated Coastal Management Projects – this includes \$914 million in co-financing. Examples of LME/ICM projects include: the Seas of East Asia, Mediterranean, and the West Bering Sea.

GEF LME projects focus on all different scales – LME scale, ICM scale, river basin scale, and the community-based demonstration scale – to make a difference at the transboundary level. At the global scale – GEF just started a project on Blue Carbon as a strategy to mitigate CO₂. Carbon storage is an ecosystem service and the project operates at the LME scale. The GEF is working on African fisheries in Sub-Saharan Africa (GCLME, BCLME, ASCLME). There are four PEMSEA projects ongoing at the ICM scale and seven LMEs have their own individual projects. Zavatsky reviewed the six GEF LME-ICM related programs and projects and stated the need for dialogue because the viewpoints of a minister are very different from those of a fisherman. In 2013, the GEF-IW strategy includes prioritizing LMEs to retain donors. He mentioned the reduction in funding for the TWAP for LMEs.

Complimentarity of LME's and CI's Seascope Program

Leah Karrer, head of CI's Marine Science Program, gave a presentation on the complimentarity of LMEs and Conservation International's Seascope program. She explained how it is widely recognized that ocean health is declining due to unsustainable practices and reviewed how old thinking indicated people are bad for the environment (and that conservation efforts were going to be bad for people) while new thinking focuses on how much people benefit from the oceans.

CI concentrates efforts on useful science dealing with economics, climate change, fisheries, and vulnerability assessments. They also communicate knowledge to inform policy. Currently, CI is working in the W. Indian Ocean, Sulu-Celebes LME, Agulhas LME, and the Bay of Bengal LME, to name a few. In the Sulu-Celebes, they are facilitating the TDA and SAP while in the BOBLME, they have prepared outreach materials.

Seascapes are large, multiple-use marine areas, defined scientifically and strategically, in which government authorities, private organizations, and other stakeholders cooperate to conserve the diversity and abundance of marine life and to promote human well-being. Karrer described how LMEs with the five modules and Seascapes use similar approaches. Seascapes have indicators that are specific to nine elements.

CI is also involved with marine spatial planning, with an emphasis on GIS analysis. Metrics are used for performance evaluations of ecosystem health - species richness, biomass, and resilience; ecosystem services - food provision – e.g. local seafood availability, diet component, tourism and recreation opportunities – e.g. tourism visitation days, marine activities, shoreline storm protection – e.g. extent of mangroves and reefs; and human well-being - human health and income.

In marine protected areas, Karrer explained there is more biomass, coral reef resiliency, increased human well being, and improved food security. CI's Ocean Health Index develops ratings using their indicators – food provision, artisanal fishing opportunities, natural products, carbon storage, shoreline protection, sense of place, tourism and recreation, livelihoods, clean waters and biodiversity.

Catalyzing Ocean Finance

Andrew Hudson, head of UNDP Water and Ocean Governance Program and Principal Technical Advisor for International Waters, presented a talk entitled *Catalyzing Ocean Finance* based on a 120 page document with six core studies. He explained how most ocean threats – hypoxia, acidification, habitat loss, ocean warming, invasive species – are accelerating geometrically and are due to policy and market failures. For example, there is no policy or incentive to reduce nutrients or CO₂ emissions. He went on to describe how three methodologies have achieved reforms in addressing key ocean threats – TDA/SAP, ICM, and building on global and regional legal frameworks. For ICM, there is a generic approach that builds on global and regional frameworks. These methodologies are replicable and scalable to address other ocean challenges.

With modest sums, the GEF can catalyze sizeable sums of public and private financing to transform ocean sectors toward sustainability. He reviewed the GEF TDA/SAP methodology including SAP implementation and highlighted successful case studies in the Black Sea, FrePlata, Yellow Sea, PEMSEA, Pacific fisheries, and GloBallast. In the Danube/Black Sea project, the issues were eutrophication, hypoxia, and habitat loss. Total GEF investments of \$51.9 M resulted in investments of \$3 billion for nutrient reduction efforts. This was a catalytic finance ratio of 57:1.

The issues in FrePlata were eutrophication, habitat loss, and toxic pollution. The catalytic finance ratio was 281:1. In the Yellow Sea, the issues were overfishing, eutrophication, and habitat loss. This project had a catalytic finance ratio of 737:1. The PEMSEA issues included land and ship-based pollution, habitat loss, and invasive species. A total GEF grant of \$36.1 million resulted in a catalytic finance ratio of 277:1. In the Pacific Fisheries Case Study, the issues were overfishing and an insufficient ecosystem approach. The catalytic finance ratio was 213:1. The aim of the GloBallast Case Study was to reduce aquatic invasive species. A total GEF grant of \$14 M, co-financing, and private financing resulted in a catalytic finance ratio of 2,500:1.

Status of Marine Spatial Planning International

Charles 'Bud' Ehler, President of Ocean Visions Consulting, spoke on the status of MSP International by presenting information on a UNESCO guide entitled Marine Spatial Planning. There are ten steps to MSP and four fundamental MSP questions. The questions are: 1. Where are we today? A baseline characterization, 2. Where do we want to be? Alternative scenarios, 3. How do we get there? Management plan, 4. What have we accomplished? Monitoring and evaluation. The document is available at www.unesco-ioc-marinesp.be/.

Ehler contrasted single-sector planning for various uses such as oil and gas and commercial fishing versus integrated marine spatial planning. He referred to the definition of MSP as developed by Ehler and Douvère in 2006 and 2009 – MSP is the public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that are usually specified through a political process.

According to Ehler, MSP planning is an idea whose time has come - four countries have MSP plans for EEZs, eight countries have completed pilot projects, three countries have completed plans at the sub-national level, and by the end of 2012, 10 percent of the world's EEZs will have approved MS Plans. Ehler described MSP efforts in the North Sea, Norwegian Sea, Germany, Netherlands, U.S. and Australia. Australia is an impressive example with five marine bioregions.

Over the next 10 years, 60-80 plans will be completed and the EU will likely require its 22 coastal states to implement MSP. There is a growing interest in MSP in Asian countries and by 2020 Ehler said that 25-30 percent of world's EEZs will have approved MSPs.

Gulf of Mexico LME Goods and Services

Porfirio Alvarez, Chief Technical Advisor for the GoMLME, provided a review of recent activities in the GoMLME and began his talk by saying the TDA for the GoMLME was completed in 2011 and the SAP is six months ahead of schedule. National Plans will be developed after the SAP. One main objective is to rehabilitate marine and coastal areas, recover depleted fish stocks, and reduce pollution and nutrient over enrichment in the Gulf. Several major advances in governance issues resulted from the Summit 2011 and the GoMLME has provided scientific advice, baseline research, and support to Mexico's government after the 2010 oil spill. Academic institutions that are well linked to the GoMLME and the Mexican government include Harte Research Institute, CINVESTAV, ICML, UNAM, and CICESE.

In terms of socioeconomic results, the GoM at a Glance document highlights socioeconomics of the region. The economic value of oil/gas, fisheries, shipping and tourism in the Gulf was \$136 billion in 2009.

In terms of pollution/ecosystem health – Hypoxia and Nutrient Reduction in the Coastal Zone was completed by the Global Environment Facility (GEF) and the Scientific Technical Advisory Panel (STAP). A PIF on hypoxia in the Southern Gulf will be submitted to the GEF.

A Harmful Algal Blooms Integrated Observing System (HABIOS) project was kicked off in March 2012. There are four pilot monitoring locations. The GoMLME project has also recently helped complete the National Coastal Conditions Report III and participated in a pilot lagoon monitoring study, in addition to baseline monitoring related to the BP oil spill. There are many ongoing efforts to restore marine and coastal areas including the restoration of mangroves and the recovery of depleted fish stocks. Mangrove restoration is especially useful to combat coastal erosion and local people are empowered to help in these efforts.

Alvarez concluded his presentation by stating there are still major challenges and constraints in the GoMLME. An upcoming task is to implement the SAP through National Action Plans and to continue addressing issues such as coastal pollution.

R/V Dr. Fridtjof Nansen Survey Program

Birane Sambe presented information on the R/V Dr. Fridtjof Nansen Survey Program for Kwame Korentang. FAO supported GEF-LME projects through the Nansen Project include ASCLME, GCLME and the BCLME.

FAO provides direct support for fisheries management, training in survey data analyses, EAF university courses, EAF management planning, as well as training on guidelines and legal issues.

The EAF-Nansen Country Projects to improve fisheries are in Sierra Leone and Liberia; Benin, Cote d'Ivoire, Ghana, and Togo; Seychelles and Tanzania; Cameroon, Gabon and Nigeria; Mozambique; Mauritius; Comoros and Madagascar; and Kenya. The output of many of these projects is the development of Fishery Management Plans.

In the BCLME and the CCLME, the Nansen Project is providing guidance on implementing EAF into fisheries management. Work in the Canary Current concentrates on the management of small pelagic species.

The 2012 Cruise Plan has been very busy including hake and hypoxic surveys for the BCLME, pelagic and demersal surveys in Angola, and environmental monitoring in Ghana. Similar surveys have been planned for the 2013 cruise calendar.

The R/V Nansen Surveys help with the preparation of the TDAs and SAPs and the surveys contribute to the implementation of the ecosystem and five module approach as EAF is based on ecological wellbeing, social and economic outcomes, and the ability to achieve management objectives.

Socioeconomic Importance of Small Pelagic Fish in the Canary Current LME

Birane Sambe, CCLME Regional Coordinator, gave a presentation on the Socioeconomic Importance of Small Pelagic Fish in the Canary Current LME. The CCLME is an area of intense upwelling, highly dependent on wind forces. This is a very productive LME but most fish species are fully exploited or overexploited except *Sardinella pilchardus*. There has been a devastating effect on incomes, jobs, the gross domestic product, and food security as fish stocks have collapsed. The most important small pelagic fish in the CCLME are the round and flat sardinella, horse mackerel, scad and bonga. The total catches of small pelagic fish have increased since 1994, but there was a drop in 2011.

Sambe reviewed the contribution of fisheries to employment and food security in the region. There are 321,000 fishermen employed within the CCLME and an estimated 726,000 indirect jobs associated with the fisheries. He also discussed the contribution of fisheries to state revenues – especially those agreements with countries in the European Union.

In the CCLME, pelagic stocks are shared by two or more neighboring countries and the resource is exploited nationally and regionally. The majority of pelagic stocks are overexploited with management actions aimed at limiting catches and fishing effort. Small pelagic fish are important to the food security of the region – 65 percent of animal protein consumed in the area is from fish.

The BOBLME Project Update

Chris O'Brien, Regional Coordinator of the BOBLME, provided an update on project activities and achievements. The TDA has been completed by the eight countries in the BOBLME to identify the major issues affecting the Bay of Bengal. There is excellent work going on in the Gulf of Mannar and the Mergui Archipelago involving capacity building and partnering with existing organizations. Currently, the BOBLME provides training in science writing, science presentation, stock assessments, ICM (post graduate certification), oceanography/climate change, and project management. The project has working groups on the hilsa, Indian mackerel, fisheries statistics, sharks, ICM (with IUCN), MPA (with FAO), oceanography (with IGOOS), pollution (with UNEP), and a Regional Fisheries Management Advisory Committee.

Three years after project inception, the TDA has been adopted, the SAP completion plan has been developed, and a draft SAP has been completed with ecosystem objectives, indicators, and actions. The SAP to be unveiled at a Regional Ministerial Meeting in 2014, translates issues from the TDA to actions. Themes of the ecosystem quality objectives of the SAP include: overexploitation of marine living resources, degradation of critical habitats, and pollution and water quality.

Issues from the TDA on the overexploitation theme include: decline in availability of fish resources, changes in species composition of catches, high proportion of juvenile fish in the catch, and changes in marine biodiversity. One major objective is to restore fisheries by increasing the abundance of transboundary fish stocks by 5 percent by 2020, reducing fishing capacity, and minimizing IUU fishing in the region by 2020. Indicators for this theme are: total annual catch and fishing effort, CPUE, biomass, and mean size of fish landed.

There are many ongoing efforts in the BOBLME to restore hilsa shad and Indian mackerel including the Regional Fisheries Management Advisory Committee. This is not a

decision making body but an advisory committee working on ecosystem status and governance issues – with existing organizations.

The BOBLME maintains partnerships with close to 30 organizations and the second phase of the project is funded by multiple donors. Upcoming tasks include national research activities, completing National Action Plans, ongoing SAP development, twinning with the ASCLME and CCLME, increased science communication, development of an ICM postgraduate certificate, and creation of a regional fisheries decision making forum.

IUCN Activities Related to LMEs

Aurélie Spadone and James Oliver of IUCN Global Marine and Polar Programme presented ongoing IUCN activities related to LMEs. Their program operates in over ten countries and one project involves applying an ecosystem-based approach to fisheries management, and focuses on seamounts in the Southern Indian Ocean. Activities in the seamount project include cruises on-board the Nansen (pelagic species and benthic fauna), a taxonomic workshop, a governance workshop, and a management workshop.

Another IUCN project involves better management to reduce biodiversity loss in the Mediterranean Sea, focusing on pelagic habitat and submarine canyons. IUCN also launched the Sargasso Sea Alliance to protect the unique and vulnerable ecosystem of the Sargasso Sea, as well as the Livelihoods Fund – with \$25 M Euros committed by six French multinational companies for ecosystem restoration/mangrove restoration – in Senegal, Indonesia, Mexico and India. Mangrove restoration helps sequester large amounts of carbon and IUCN has two working groups on Blue Carbon – a science group in partnership with CI and a policy group in partnership with UNEP. Furthermore, IUCN chairs an Ocean Acidification User Group providing policy and scientific advice to decision makers and the Global Coral Reef Monitoring Network with projects in Egypt and Maldives.

Specific LME activities include working on governance issues in the ASCLME and MPAs, mangrove restoration, and fisheries management plans in the BOBLME. Other IUCN selected activities include arctic ecosystem-based management in the Bering Strait and Svalbard, and a ballast water management program to control invasive species in the Persian Gulf.

Assessing the Changing Status of Goods and Services in the ASCLME

David Vousden, Regional Director for the Agulhas and Somali Currents LME, gave a presentation entitled *Assessing the Changing Status of Goods and Services in the ASCLME*. Five key steps are used in the ASCLME Project to manage and govern the ecosystem: 1. Baseline – status and boundaries of LMEs, 2. Impacts and Causes – main threats to the ecosystem, 3. Monitoring, 4. Science to Governance – translating outputs into policy and management, 5. Cooperative Management – alliance of partners

Baseline data collection has involved 24 cruises on two vessels from 2008 to 2012.

The ASCLME has been collecting coastal information for the baseline and each country has undergone a national Marine Ecosystem Diagnostic Analysis. MEDAs are combined with offshore information into a regional TDA to determine threats, impacts and potential solutions to ecosystem issues. A whole host of information has been collected through the TDA and SAP process – governance analysis reports, inshore surveys, marine pollution reports – to name a few. Once the MEDA and TDA processes are complete, the ASCLME will choose indicators to monitor over the long term to observe changes in: productivity, fisheries, pollution levels, ecosystem health, social changes in human communities, and economic changes.

The proposed annual cruises will maintain existing moorings, expanding the UTR, tide gauge, and ADCP network, and monitor specific indicators. The first cruise of alliance partners took place in 2012 using the South African RV Algoa. Eight countries have received monitoring equipment and each country has produced monitoring plans. Also, the ASCLME is designing a comprehensive inshore monitoring network.

In translating science to governance, the ASCLME takes the weight of evidence approach versus the traditional precautionary approach. In this way, decision makers can act and create policy immediately while accepting that the science may need further fine tuning.

The ASCLME is building partnerships and agreements throughout the region and has formed the Western Indian Ocean Sustainable Ecosystem Alliance (WIOSEA). The alliance is built around three components: science/technical, capacity building/technical, and policy steering. By the end of 2012, the ASCLME hopes to adopt the SAP and formally create the Alliance. The World Ocean Council is a new partner in the alliance and will cooperate with the ASCLME in ecosystem monitoring and engaging the private sector in LME management.

Engaging the Ocean Business Community in LMEs: The World Ocean Council and the Smart Ocean/Smart Industries Program

Paul Holthus, Executive Director of the World Ocean Council, presented a talk entitled *Engaging the Ocean Business Community in LMEs: The World Ocean Council and the Smart Ocean/Smart Industries Program*. The World Ocean Council is a business alliance of over 50 companies in shipping, oil/gas, fisheries, aquaculture, tourism, and offshore renewables. The WOC aims for a healthy and productive global ocean and its sustainable use, development and stewardship by a responsible ocean business community.

The WOC Programs include Ocean Governance; MSP – EU, U.S., Australia; Environmental Issues – ballast water, marine mammals, marine debris, water pollution/waste discharge; Regional Ocean Business Councils – Arctic, Baltic, Australia, Atlantic, Mediterranean, Arabian Gulf; Smart Ocean/Smart Industries – observations and data from ships and platforms; and Climate Change/Sea Level Rise.

Holthus explained that ocean users can be collecting data from vessels and platforms and create a more comprehensive data collection system by using business community. There are over 50,000 ships available for data collection and over 65,000 oil/gas wells and rigs/platforms.

Sulu-Celebes Sea LME: Updates, Findings, Lessons Learned

Annadel Cabanban, Senior Fisheries Expert, provided updates, findings, and lessons learned from the Sulu-Celebes Large Marine Ecosystem Project. There have been three transboundary assessments to date – WWF late 1990s to 2004, Global International Waters Assessment 2002, and the TDA 2011-2012. The project developed an Ecoregion Conservation Plan complete with a vision, ten objectives, three action plans, and a governance structure and is working with CI on a Sulu-Sulawesi Seascape Program, species conservation, and establishing a network of MPAs.

The project is currently scaling up to the Coral Triangle Initiative through a \$2.89 M grant from the GEF and \$3 M in co-financing from Indonesia, Malaysia, and the Philippines. The Sulu-Sulawesi Marine Ecosystem has made strides in governance by developing the Sulu-Sulawesi Marine Ecoregion sub-committee on sustainable fisheries and the Action Plan on Sustainable Fisheries 2008-2012.

The Sulu-Celebes Sea Sustainable Fisheries Management Project focuses on small pelagic fisheries and the first component was to conduct a TDA in 2011-2012. The

results of the TDA indicated there is an overexploitation of marine resources, habitat loss, climate change, marine pollution, freshwater shortage, and alien and invasive species. The next components were to formulate recommendations for the regional management of fisheries (similar to SAP) and to strengthen institutions for fisheries management. Component four involved demonstrating EAF management in various regions. The indicators of successful fisheries management include: increased fish stocks (especially small pelagics), better understanding of the stocks, protecting the spawning grounds of small pelagics, increased per capita income and socio-economic benefits, and ICM plans for demonstration sites. The last component was to disseminate the knowledge gathered for fisheries management.

The expected outputs are a regional fisheries agreement on how to manage small pelagic fisheries and ecosystem management of fisheries at demonstration sites.

The lessons to date are to: engage middle managers, convince policy makers on the benefits of regional management, develop partnerships with fisheries agencies, NGOs, private sector, fishing community, and disseminate highlights and successes to build advocacy. Cabanban said the TDA needs to engage local and regional experts, build capacity and constituency, and incorporate existing institutions. The SAP is a basis for collaboration on shared stocks and adaptive management. She said the challenge is for all partners to work together and improve conditions of fisheries.

Environmental and Economic Benefits of the Management Actions in the YSLME.

Yihang Jiang, YSLME Coordination Consultant, spoke on the *Environmental and Economic Benefits of the Management Actions in the YSLME*. The YSLME has completed the SAP and has submitted a PIF for the next phase of the project. Some of the biodiversity issues in the YSLME include proliferation of sea stars, macroalgae and jellyfish. The influx of giant jelly fish may be because overfishing created a niche for these species and less silicate in the water may have shifted dominant populations from diatoms to dinoflagellates – resulting in declining pelagic fish stocks.

Jiang gave some examples of the Environmental and Economic Benefits from Management Actions in the YSLME. One of these actions is increased application of Integrated Multitrophic Aquaculture – to supplement the reduction in seafood protein as a result of reduced fishing efforts. IMTA in Sungo Bay provides an economic benefit and does not adversely impact the environment.

Along the Korean Coast, evaluation of a proposed tidal power plant indicated a decrease in the area of the tidal flat by 15 percent. Based on studies of the biodiversity of the area and economic analysis, the tidal power plant will not provide any environmental or economic benefit.

A Korean Demonstration Project investigated shrimp aquaculture with minimal environmental impacts. Profits with the new method could double the net profits per year without environmental pollution.

The talk concluded with the question “Do we care about social impacts ?” In this regard, Jiang spoke about the use of sea grass for roofs on historical buildings. This culture could be lost as ecosystems deteriorate.

BCC/BCLME Strategic Action Program Implementation Status

Nico Willemse, Senior Project Manager for the BCLME SAP implementation project, provided an update on this program. He began his presentation by discussing barriers to the LME approach including the absence of a regional structure, limited national level resources and institutional capacity, inadequate long-term capacity for the LME approach, and limited

access to knowledge and best practices. Willemse pointed out the usefulness of a web-based platform for exchanging information.

The goal for implementing the SAP is to reduce the degradation of the ecosystem and restore depleted fisheries. The BCC is implementing the SAP with numerous actions and collaborations. For example, in determining institutional arrangements, the Ministers decided that transport ministries should become part of BCC. The proposed Commission structure is in place and this will be finalized in 2012.

A key SAP action is soliciting wider cooperation and many countries including Norway and Germany, have contributed to BCC monitoring, training, and stock assessments to date. Another SAP action is focused on the management of mining and drilling activities. A working group on minerals and oil is now part of the BCC Ecosystem Advisory Group.

Other key SAP actions include understanding ecosystem health and managing pollution. The BCLME collaborates with many groups on these issues. The BCC's training and capacity building strategy was implemented in 2009 and the BCC is now its own autonomous organization managing its own finances. The SAP also has new actions related to climate change. Climate change and variability were not prominent during the TDA and SAP processes.

A key lesson from the TDA and SAP processes is to develop partnerships and trust. This can result in a commitment for a regional transboundary LME approach. Likewise, strong political support can fast track policy and management actions and one country playing a mediating role and acting as a friend can serve as a champion for important decisions and bring others on board.

Willemse reviewed the challenges and constraints in the BCLME project – lack of resources, high staff losses to the mining industry, delay in Convention signing (Interim agreement ends Dec. 31 2012).

At the conclusion of the presentation, **Hashali Hamukuaya** read the recent recommendations from African caucus:

Acknowledgement of the Global Environment Facility (GEF) by the African Large Marine Ecosystem Caucus for the support in the development and implementation of LME Strategic Action Programs and a recommendation

- 1) This memorandum is prepared by the African Large Marine Ecosystem (LME) Caucus and is directed to Global Environment Facility (GEF)
- 2) The Large Marine Ecosystem Projects of the African continent and associated island countries have formed a Caucus for better coordination and communications, for sharing of best lessons and practices, and for improving communication and coordination and developing ways to work in synergy. At present, the Caucus represents the following LMEs: Agulhas Current, Benguela Current, Canary Current, Guinea Current and the Somali Current. The MedPartnership of United Nations Environment Programme Mediterranean Action Plan (UNEP/MAP) is also a partner in the Caucus.
- 3) The five LMEs comprised of 33 coastal States with an estimated total population of about 600 million people of which more than 50% live within 100 km from the coast and overwhelmingly dependent on the marine ecosystems goods and services particularly fisheries for their livelihoods;
- 4) At its fourth meeting on 2 July 2012 hosted by UNESCO-IOC in Paris, France, the Caucus unanimously agreed to produce this acknowledgement to GEF. The Caucus acknowledges with gratitude the enormous and irreplaceable contribution that the Global Environment Facility has made (and continues to make) to the development and implementation of Strategic Action Programs for the

effective management and governance of Large Marine Ecosystems in Sub-Saharan Africa and throughout the World;

5) The African LME Caucus is also very cognizant of the need for sustainability and ownership of this development and implementation process by the countries, and in the context of reliable support and funding. The Caucus and the countries that it represents in Africa recognizes that such support and funding needs to be maintained and dependable throughout the full life-cycle of the TDA-SAP process including SAP implementation, development of effective institutional mechanism, adoption of policy and legal reforms and realignment of governance practices to address the ecosystem-based management approach, etc.

6) The African LME Caucus therefore urges GEF to reaffirm its previous understanding [and agreement] that such a process requires two distinct stages that correspond to two GEF Project phases (the first five years to finalize a TDA and adopt a SAP; the last five years to implement the SAP and establish a management and governance regime). In this context it is essential that GEF can confirm the understanding by the LME community of practices that, if the first phase of a project has successfully delivered a Strategic Action Programme for adoption by the countries and, once this has been adopted by a majority of the countries, GEF will build on this successful investment of funding and commitment by providing realistic and appropriate financial support for the critically important second phase for SAP Implementation.

7) Furthermore, the Caucus would also request GEF to explore, with some urgency, mechanisms to provide bridging support and funds for administration and coordination between project phases. Such a 'bridging' mechanism is essential where a SAP implementation phase has been approved in principle (i.e. through approval of a PIF into the GEF work-plan) but where funding may not be released until sometime after the closure of the first phase and its budget lines.

8) This request was unanimously endorsed by the IOC-IUCN-NOAA-LME 14th Consultative Meeting that was held on 5-6 July 2012 in Paris, France.

9) Once more, the African LME Caucus is grateful for the immense support GEF contributes towards the development and implementation of SAP for the sustainable management of the global LMEs.

Signed by:

David Vousden, Regional Director, Agulhas and Somali Current LME Project Date: July 10, 2012

Hashali Hamukuaya, Executive Secretary Benguela Current Commission

Date: July 10, 2012

Birane Sambe, Regional Coordinator Canary Current LME Project

Date: July 11, 2012

Jacques Abe, Regional Coordinator & Executive Secretary Guinea Current LME Project

Date: July 13, 2012

Ecosystem Approach to Management of Arctic LMEs

Hein Rune Skjoldal of the Institute of Marine Research presented an *Ecosystem Approach to Management of Arctic LMEs*. There is a history of applying the Ecosystem Approach by the Arctic Council and in a 2002 Johannesburg meeting, EA implementation was

planned for 2012. Skjoldal noted the Council is not quite there yet and said the EA concept has been around at least 30 years.

According to Skjoldal, EA is an approach to management that requires heavy involvement of science. It is the integrated management of human activities needed to keep an ecosystem in good condition. The EA framework defines/describes the ecosystem, sets ecological objectives, assesses the ecosystem, values ecosystem goods and services, and is used to guide ecosystem management.

In setting ecological objectives, no species should be threatened and sufficient habitat should be protected. Skjoldal cited the example of the N. Bering Sea/Chukchi Sea – due to habitat considerations, the boundary for this LME may be shifted to the south. The movement of fish stocks and migrations of Arctic birds and mammals to other LMEs is common and makes setting boundaries difficult.

Changing the boundary of an LME will require peer review. The Arctic Council adopted a working map for LME boundaries and explanations for boundary adjustments. This map will be peer reviewed, adopted by the Protection of the Arctic Marine Environment (PAME) working group of the Arctic Council and the LMEs will be used for management.

Multidecadal Changes in Russian Arctic LMEs

Gennady Matishov of the Murmansk Marine Biological Institute, spoke on the *Multidecadal Changes in Russian Arctic LMEs*. He said there is new knowledge on the impacts on LMEs in the Russian Arctic – seismic-acoustic impacts, noise of vessels, impact of pumping water and oil, drilling. Some startling developments of late include the mass death of migratory birds in poachers' nets and the replacement of local ichthyofauna by alien-species. He also mentioned the cryopreservation of sturgeon species.

A new atlas of Climatic Changes of LMEs of the Russian Arctic Region was published in 2012. Matishov explained that there has been a return to the averaged long-term climate conditions in 2007-2011 and shifts and anomalies in bottom temperatures, fish diversity, fish distribution, and benthos biomass. For example, the range of Black Halibut in Kara Sea is expanding to northern part of Kara Sea. The warming climate in the Barents Sea has increased the abundance of red king crab.

Matishov also discussed abnormal weather conditions and described weather dynamics creating warmer Arctic conditions but colder conditions in Europe. He cited a recent collaboration on a book with Professor Gotthilf Hempel on the Russian Arctic and two decades of cooperation between Murmansk Marine Biological Institute of the Russian Academy of Sciences (MMBI) and the Alfred Wegener Institute for Polar and Marine Research.

Advancing Sustainable Development in the Mediterranean in view of Climate Change

Virginie Hart, of the MedPartnership, spoke on *Advancing Sustainable Development in the Mediterranean in view of Climate Change*. The TDA for the project was adopted in 1997 and 2005 and SAPs were also adopted during this time frame. The long-term goal of the MedPartnership (Investment Fund and Regional Component) is: to facilitate full implementation of national participation in approved SAPs and NAPS, leverage long-term financing, and ensure sustainability of the projects. Components of the SAPs/NAPS include controlling pollution from land based activities and conserving biodiversity.

Climate change has been a recent focus of work in the Mediterranean and there is much coordination needed between all the organizations working on this issue. A current focus is integrating climate variability and change into national strategies and to implement ICZM protocol in the Mediterranean, as well as determining the impact of climate change on

biodiversity. There are 11 executing partners in the MedPartnership and components of the project involve information sharing, strengthening the knowledge base, supporting ICZM, and translating science to policy recommendations. The 2011 Annual Report is on the website at www.themedpartnership.org.

A project manager from UNESCO/HP spoke about a GEF funded project in this LME – it is the first time looking at coastal aquifers. UNESCO promotes best practices to reduce the degradation of groundwater quality and has developed a new framework to address coastal areas in an integrated fashion. To supplement the TDA on coastal aquifers – eight demonstration projects will be replicated in 13 countries in the project.

Arafura and Timor Sea Ecosystem Action and The Indonesian Sea LME

Tonny Wagey, ATSEA Regional Project Manager, presented on the Arafura and Timor Sea Ecosystem Action Plan and the Indonesian Sea LME. The ATS region includes four countries, is a crucial link between the Pacific and Indian Oceans, and greatly influences the world's climate and ocean circulation. This is an area of high biodiversity with key coastal habitats of mangroves, sea grasses, and coral reefs.

The aim of this four year project is to develop strategic programs in the region. To date, there have been two oceanographic cruises and the TDA has been developed. The priority environmental concerns in the ATS are: unsustainable fisheries and decline and loss of living coastal and marine resources; decline and loss of biodiversity and key marine species; degradation of coastal/marine habitats; marine and land based pollution; and the impacts of climate change.

The Arafura Sea is one of the most productive areas in the world and Red snapper is a huge export. There have been a reduced number of foreign fishing vessels entering Australian waters from 2006 to 2008. Progress in the ATSEA project includes finishing the TDA, implementation of SAPs and NAPs, and development of a regional cooperation mechanism. For next steps, the project needs to include Papua New Guinea in SAP and fully implement the SAP.

The Indonesian Sea LME is an important tuna spawning area. Fisheries production in the area is expected to increase by 33 percent and likewise there is a significant increase in aquaculture (shrimp, seaweeds). The structure of the national fishing fleet is dominated by ships less than 30 GT. There is a big effort underway to revitalize shrimp ponds – 135 Ha. The Savu Sea National Marine Fisheries Sanctuary was established in 2009 and covers 3.5 million ha – the largest MPA in Southeast Asia and the third largest in the world. The Coral Triangle Initiative has set a target of 20 million ha of MPAs across Indonesia by 2020.

A possible GEF project in the Indonesian Sea LME would focus on supporting reforms for sustainable fisheries, investments in alternative livelihoods, ecosystem approaches to fisheries management, habitat restoration, and engaging the business community.

2012 World Conservation Congress (WCC) Motion on Conservation in the Yellow Sea

Young Cheol Park from the Korean Society of Oceanography spoke on Conservation in the Yellow Sea. First, he provided some background on the Yellow Sea – the average depth is 44 m and water in the sea is exchanged every seven years. This semi-enclosed sea has a low bottom temperature and salinity. Rivers discharge 1.6 billion tons of sediment and 1,500 billion tons of freshwater into the Yellow Sea.

Major risks to the Yellow Sea include the vulnerable environment, prevalent industrialization, and increasing fishing intensity. A major indicator of industrialization and coastal developments is the decreasing area of tidal flats - 22 percent in Korea since 1987.

YSLME Project made much progress and three current goals are to: review risks and problems/review YSLME Action programs, globalize conservation issues and public awareness through network workshops, and to develop and submit a WCC resolution on the conservation of the Yellow Sea in 2012.

Major achievements to date are: An established regional cooperation mechanism and governance framework – participating countries agreed to establish an YSLME Commission and the completed SAP – an ecosystem-based approach with regional targets such as a 25-30 percent reduction in fishing boats and a 10 percent reduction in nitrogen discharge.

The Yellow Sea Project staff worked to develop a motion to improve the conservation and sustainability of the Yellow Sea as a result of increased pollution and resource depletion, as well as a motion to improve the governance mechanism for marine conservation.

In September 2012, the IUCN World Conservation Congress called on countries bordering the Yellow Sea to reverse negative impacts on the ecosystems of the Yellow Sea and encouraged those countries to facilitate working groups to expedite the SAP.

Members sent a request to the Director General of IUCN calling for collaboration to strengthen regional governance actions and to increase international awareness for conservation of the Yellow Sea.

Integrated Adaptive Management of the West Bering Sea LME in a Changing Climate

Vladimir Mamaev, GEF Regional Technical Advisor, of the UNDP/GEF presented on the project: *Integrated Adaptive Management of the West Bering Sea LME in a Changing Climate*. Financing for the project included \$3.2 M from the GEF, \$6.2 M of in kind contribution from NOAA, \$3.3 M from the Russian Federation, with additional funding from the private sector, IMO, and the WWF. Most of the NOAA funding was for monitoring.

Component 1 of the project is determining the state of the WBSLME, agreeing to transboundary issues through the development of the TDA, understanding the impact of climate change, and identifying key knowledge gaps for ecosystem-based management of the WBS LME and local ICM plans.

Component 2 is the Ecosystem-based management of WBSLME related to governance reforms, improved National inter-sectoral coordination for the sustainable use and management of WBSLME resources, improved National capacities to increase inter-governmental cooperation and coordination in WBSLME management and assessment, and a proposal on a joint management framework.

Component 3 is for Targeted demonstration projects and Component 4 is for learning and knowledge management – exchanging best practices and transferring lessons and experiences to other LME projects.

The outputs of the project will be a TDA, a geospatial database, a long-term monitoring system in the WBSLME, ecosystem modeling, and a regional SAP. Other outputs include forming a National Inter-ministerial committee, new stakeholder participation mechanisms, a pilot marine electronic highway, fisheries management and ICZM demonstration projects, education programs, transfer of lessons and best practices, participation in IW: learn and the LME/ICM CoP.

At present, the Project Preparation Grant is under way, Russian partners and key experts have been contacted, international experts are being recruited, meetings and submissions are taking place, and the implementation is expected to be initiated in January 2013.

GLOBAL CoP to Improve the Management of LMES and their coasts (LME/ICM-CoP)

Vladimir Mamaev discussed the *GLOBAL CoP to Improve the Management of LMES and their coasts (LME/ICM-CoP)*. The objective of the project is to generate knowledge, build capacity, harness public and private partners, support South to South learning and improve performance of IW projects through a CoP for ecosystem-based management approaches to LMEs and their coasts.

The project consists of four objectives and the first objective calls for partners to enhance ecosystem-based management, to provide support for GEF-IW LME/ICM projects, and to address MPA needs. The second objective is an information sharing tool - to synthesize knowledge and to incorporate this into policy making while capturing best practices and developing new methods and tools to enhance the management effectiveness of LMEs. The third objective is to build capacity and partnerships through twinning and learning exchanges, workshops and trainings. The goal of this component is to train 10,000 practitioners, twinning earlier projects with more advanced projects. Objective 4 is to share and disseminate project achievements and lessons learned.

This \$4 million GEF project includes \$22 million in co-financing. Mamaev reported the PIF is complete, the draft PPG is ready, and the PIF and PPG will be submitted in 2012.

The Caribbean LME Project: Concept and Methodology (Challenges, Solutions), Current Status, and Opportunities for Twinning

Patrick Debels, Regional Project Coordinator of the CLME, provided an update on the CLME Project: Concept & Methodology, Current Status, and Opportunities for Twinning. The project started in May 2009 with a \$7 million GEF grant (GEF 4) and is expected to end in April 2013 with the delivery of an (endorsed) Strategic Action Programme (SAP). There are 23 partner countries, two GEF-eligible states, and the project covers two LMEs – the Caribbean LME and the North Brazil Shelf LME.

The CLME is geopolitically very complex, with a tourism driven economy, important shipping routes, and the presence of hydrocarbons, biodiversity, SIDs and frequent hurricanes. The goals of the project were to restore and sustain fish stocks/biological diversity through the implementation of an ecosystem approach aimed at *shared living marine resources management*, while addressing three priority issues: unsustainable fisheries, habitat degradation, and pollution.

These priority issues were identified through the TDAs prepared in 2006 during the project preparation phase. Updated TDAs developed under the project itself, focus on the three ecosystems known to support the most important fisheries (reef, pelagic, continental shelf), include an assessment of the governance framework, and are complimented by seven pilot projects and case studies.

Debels discussed the challenging timeframe and said endorsement of the SAP at the ministerial level is expected by April 2013. The CLME Vision is to achieve: a healthy marine environment in the wider Caribbean that is adequately valued and protected through robust, integrative, and inclusive governance arrangements at all levels that effectively enable adaptive management, which maximizes in a sustainable manner the provision of goods and services in support of enhanced livelihoods and human well-being.

Biodiversity Information for Evaluating Climate Change Impact on LMEs (& the Nereus Program)

Villy Christensen of the University of British Columbia and the Nippon Foundation's - UBC Nereus Program gave a presentation entitled: *Biodiversity Information for Evaluating Climate Change Impact on LMEs*. He said that fisheries have collapsed across the globe. This fact is linked to the overcapacity of fishing fleets, raising the question: Will there be fish for coming generations?

The NF-UBC Nereus Program is working on answering that question (to predict the future of the global ocean) with \$13 million (2010-2019) from the Nippon Foundation, UBC, and other partners. The Nereus modeling is complex and integrates much data. For example, for fish biomass distribution, the model uses 252,000 cells. Christensen reported that we can expect that climate change will cause the large scale redistribution of fish species over the coming decades. He said fish species are moving toward the poles and presented a map illustrating the intensity of local extinctions by 2050, as well as a map predicting species invasions by 2050. Likewise, he projected the change in catch potential by 2055.

The implication of all the modeling is that climate change is impacting LMEs at a scale larger than LMEs. Christensen indicated the need to evaluate how species distributions have changed already to predict what may happen in the future. There is a lack of data and a need for biodiversity and biogeography data to make better predictions. The program is tapping into different data bases and has used data from the R/V Nansen for 1975-1993.

According to Christensen, climate change is transcending the individual countries and individual LMEs. Also, Christensen said survey data needs to be made more accessible. Much of the access to this data remains elusive. He is looking to the EUs Trawlbase initiative to make the survey data available.

Nereus offers assistance to LME projects on analysis of species distributions to facilitate biodiversity and climate change studies.

COMMENT and SUMMARY

Professor Gotthilf Hempel provided an overview of the meeting including a short summary of each speaker's presentations. He discussed how LME projects are more assessment minded versus how to apply assessments. He suggested helping to mentor young scientists and expressed that this year's meeting was interesting and informative. His summary notes are as follows:

Disclaimer: The 14th LME Consultation was a well attended lively meeting of the global LME community under the leadership of Ken Sherman and with the support of IOC/UNESCO, IUCN and NOAA. The numerous presentations and discussions provided a wealth of information. In my brief summary, presented in the closing session, I had to be very selective emphasizing matters which had not been dealt with at previous Consultations. The contributions are grouped in a more convenient way than in the agenda which was adjusted to the specific time table of various speakers. The meeting was preceded by the third session of the ICES Working Group on LME best practices and the second Caucus on African LMEs. Those important meetings will be mentioned only briefly

Introduction

On behalf of IOC/UNESCO, **Wendy Watson-Wright** welcomed the participants and reviewed the outcome of the recent Rio summit highlighting an increasing focus on the role of the Oceans and of the LME approach to sustainable management. She announced the creation

of a new advisory board acidification and increased support of LME work by GEF. She reiterated the promise of continued support by IOC to foster LME monitoring activities in support of the coastal oceans' health and resources.

Three general presentations

In a global review, **Ken Sherman** predicted trends for the period 2020 – 2060 based on data from more than 50 LMEs. Productivity will increase in subpolar waters, but decrease in low latitudes, except for upwelling areas. Already, planktivorous fish have become more abundant in subpolar LMEs, while in adjacent LMEs in the Northeast Atlantic, plankton-feeding fish stocks are in a declining trend.

Daniel Pauly was – as always – thought provoking. The World's fishing effort and fishing area are still increasing as is the area exploited by fishing in deeper waters and further south. The global catch is substantially higher than presented by FAO because of discards and non-reporting. The hidden (not reported) catch amounts to 30% in Northern Europe. This rate is even higher in other parts of the World, particularly in China with its fishing fleet of over 1000 vessels operating in all oceans and catching presumably 5 -6 million tons annually, of which only about 300,000 tons were reported to FAO. Global warming will affect individual growth in all fish because of the metabolic reaction to warming (higher metabolic rate) and oxygen loss (oxygen being the limiting factor to growth in fish).

Villy Christensen gave an excellent presentation of the NEREUS project to answer crucial questions on the former and present state of fish stocks and biodiversity round the world. Based on the largely augmented Fish Base and other data banks, NEREUS is an important tool for predictions on the development of natural resources and biodiversity under the pressure of climate change in the various regions of the world's ocean. The wealth of information contained in the data sets of LME assessments or produced by industry has not yet been fully used for approaches like NEREUS. As part of the NEREUS study, fish and fisheries survey data collected by the LME projects, particularly by the R/V Nansen in African LMEs, are important data sources. The NEREUS project offered to assist LME project leaders in the retrieval and analysis of this data.

News from Organizations

Mick O'Toole's review of the ICES Working Group on LME best practices focused on the 17 Arctic LMEs. Here climate change is most pronounced. Furthermore, the working group's discussion confirmed that the LME approach is increasingly applied both in developing and developed economies. Progress is made in terms of communication, publication, outreach and training activities. The WG should continue to meet back to back with future LME consultations in Paris.

Later in the meeting, **Ken Sherman** returned to the ICES WG and stressed the need for its continuation for the sake of the LME movement. He pointed to its great potential for the exchange of practices of LME workers with ICES professionals, and hence bridging knowledge gaps between developed and developing economies. Both become increasingly interested in the LME approach. The WG can serve as a good platform for dialogue of mutual interests in the global economic system, and with regard to population growth and demographic change, as well as in global environmental conditions like global climate change.

In a brief presentation, **Sherry Heileman** described the revision of GEF's Transboundary Waters Assessment (TWAP) on LMEs and the Open Ocean and the application of the LME methodology of the five modules. In general, LME practitioners are more interested in the assessment itself than in its application for decision making but the process of assessment has already generated a positive effect towards governance.

Ivan Zavadsky of GEF listed the key issues affecting ocean sustainability: overfishing, climate change, acidification, pollution and waste disposal, loss of habitats and biodiversity, invasive species. Up to now, GEF has been involved in 21 LMEs with approximately \$400 million. GEF's LME/ Integrated Coastal Management projects have received \$126 million dollars with \$914 million in investments. The U.S. co-financing is from mostly national sources. The GEF's International Waters support works on all levels from global to community base as far as it is needed to have a transboundary effect. Later in the discussion **Vladimir Mamaev** reported that the CoP on communication, best practices and capacity building is still in the pipeline of GEF. According to Ivan Zavadsky, competition for funding is increasingly hard in GEF, so the project would require particularly strong justification to get funded.

Leah Karrer represented Conservation International. The organization operates in various parts of the World, e.g. China and Mozambique. It cooperates with many national and international institutions and organizations. Their program Seascapes overlaps geographically with the LMEs. Instead of the five LME modules they use 11 elements. Conservation International aims to use good science on the ecological and economic effects of MPAs. They are heavy on stakeholder engagement (e.g. fisheries, wind energy, oil and gas, tourism) in spatial planning and in mapping fishing activities. They stress the interface between science and public action by improving communication and outreach, including brochures such as *Scientists guide to decision making* and *Decision maker's guide to use science*.

Andy Hudson speaking for UNDP referred to a new 120 page book on catalyzing ocean financing. Most ocean threats are due to market and policy failures. Three support methodologies have proven effective in terms of cost/benefit ratio, with UNDP funds acting as catalyst: 1. GEF's TDA/SAP methodology was effective in 18 GEF LME projects at a financial ratio of about 1:700. 2. Integrated Coastal Management, e.g. PEMSEA, ratio 1:277. 3. Fostering global and regional legal framework, e.g. for W/C Pacific Fisheries 1:213. Global ballast convention 1:2500. In reflecting on the Rio conference, Hudson confirmed the statements by Wendy Watson-Wright regarding the strong recognition of the Oceans and the emphasis on the LME concept. The mandate of UNDP for its future work in the marine realm has been fully endorsed in Rio.

Aurelia Spadone and **James Oliver** outlined briefly the activities of IUCN in its marine and polar programs in four countries. Examples are: Baseline exploration of hitherto unexploited seamounts in the SW Indian Ocean, Mediterranean canyons, Sargasso Sea Alliance, global coral reef monitoring, support of various LME projects. A Livelihood Fund is used in various projects to quickly cope with natural or anthropogenic disasters. Under the heading of Arctic ecosystem management, IUCN will focus on the Bering Sea and the Svalbard region.

Charles Ehler of Ocean Visions Consulting spoke on ten steps and four key questions for spatial planning in coastal regions, which is no longer a single actor approach but involves several actors in a complex system of interaction. MSP refers to large marine areas of coastal and oceanic waters in contrast to the small scale coastal zone management of a bay or a river mouth. Until now, integrated marine spatial planning is found only in a few EEZs (Norway,

Belgium, Germany, Australia) and is rarely on a transboundary multinational LME scale like the North Sea.

News from the LMEs

Michael Akester reported in a comprehensive way on substantial progress in research and monitoring of the Humboldt Current LME. With over 12 million tons of fish landings per year mostly used for fish meal, it is one of the most important fishing areas in the World. He listed in detail the goods and services of the LME. Good measures to improve the well-being of the HCLME include establishment of MPAs, protection of submarine volcanoes and direct human consumption of anchovies. Climate change means increased upwelling and hence expanding oxygen minimum zones. Red tides are becoming more frequent.

Antonio Diaz de Leon, Porfirio Alvarez and Bonnie Ponwith provided impressive reports on the substantial achievements in evaluating of the goods and services of the Gulf of Mexico LME.

For the Gulf of Bengal LME, **Chris O'Brien** and **Rudolf Hermes** spoke about their goal to develop ecosystem-based advice addressing governance issues in plain language. An excellent outreach program has been initiated and contacts with African LMEs (BCLME, ACLME) have been intensified.

Kwame Korentang was unable to attend, but he had prepared a paper for presentation by Birane Sambe. On behalf of FAO, he emphasized the key importance of the Dr. Fridtjof Nansen cruises in support of African LMEs. The Nansen program also includes training courses attached to those cruises. This has helped to develop close contacts between African LMEs. Eight cruises are planned for 2012. **Villy Christensen** stressed the need for the cruises to be continued and their data sets to be used much more widely and intensively.

Birane Sambe's report on the Canary Current LME showed the general increase in the fully exploited stocks of small pelagic fish like sardinella, horse mackerel and mackerel. The fishery for small pelagics is vital for the people and countries of the region as a source of employment, animal protein, state revenues from local fisheries, and export of fish (particularly from selling fishing licenses to foreign fishing fleets). Those various interests are often conflicting and require advanced governance including protection against poaching by unlicensed foreign fleets.

David Vousden reported on the ongoing assessment of the goods and services of the Agulhas/Somali Current LME and Western Indian Ocean Sustainable Ecosystem Alliance. By emphasizing the need for translating science into advice, he introduced the World Ocean Council and the Smart Ocean/Smart Industry Alliance as attempts to engage the ocean business community in LME research and monitoring activities. The World Ocean Council is an international cross-sectoral business alliance involving direct ocean users and their support industry. Those contacts between science and industry are important for adequate ocean governance, marine spatial planning, operational issues of vessels and platforms. On the other hand, ocean industries produce a magnitude of data sets which would be extremely useful for science.

In the subsequent discussion, the need for addressing middle level managers and for involving more local and regional experts in the development of TDAs was stressed. Scientists should seek partnerships with existing institutions (rather than creating new ones with new acronyms) as well as with fisheries agencies, fishing communities, NGOs and the private sector.

Yihang Jiang reported on the Yellow Sea LME. Local populations increasingly disturb the implementation of the Strategic Action Plan because of adverse local short-term socio-economic effects of measures aiming for sustainability on a larger spatial and time scale: The restoration of overexploited fish stocks calls for reduction in fishing, hence less seafood and less employment for the local population. Macroalgae and jellyfish are starting to prevail in the YSLME, in part to the reduction in fish predators. Compensation for the loss in wild catch by mariculture results in eutrophication, with adverse ecological effects. (But large scale mariculture proved to have little long term effects on benthos). Siting a tidal power-plant in the coastal water of the YSLME for the production of *clean energy* will reduce the ecologically valuable tidal flat in the region by 15 percent.

Later in the agenda, **Young Cheol Park** (the first Korean speaker at the LME Consultations) added to the report on the Yellow Sea. He provided an informative description of near-shore parts of the YSLME with emphasis on the rapid decrease of the tidal flats, particularly at the southern tip of the Korean Peninsula.

Nico Willemse gave an excellent review of achievements, barriers, and shortcomings in the modern multi-stakeholder use of the Benguela Current LME. Actions jointly addressing all five LME modules are starting to lead to cross-sectoral maritime integrated planning and management. An in-depth-study of the barriers to the LME approach pointed to shortcomings in the regional structure, as well as in the national support and in the access to knowledge. The SAP actions address institutional arrangements, governance and socio-economics. Long-term policy takes into account climate change and the needs for adaptation. One country playing a mediating role and being regarded as *friend* in the region can serve as a champion to bring others on board for important decisions/actions.

Hashali Hamukuaya, also from BCLME, reported on the recommendations of the Caucus of five African LMEs addressing the governments of 15 countries for continued funding of the LME activities, for strengthening transboundary actions within and between African LMEs and for outside support including further cruises of R/V *Dr. Fridtjof Nansen*.

Patrick Debels spoke on the Caribbean LME and Northern Brazil Shelf LME. In spite of the high political complexity of the areas, substantial progress in terms of cooperation in research and management were recorded. They aim at broader ocean governance. A key priority under the Caribbean LME Project is *Shared Living Marine Resources Governance and Management*.

Virginie Hart spoke on the Mediterranean LME. In the course of the implementation of its SAP, 100 hot spots of pollution have been identified by the Mediterranean Partnership. Thirteen countries with a multitude of issues and players/organizations are involved dealing with issues of coastal management and development including coastal groundwater and aquifers and potential impacts of climate change.

Gabriel Tonny Wagey emphasized the key importance of Indonesian waters, particularly Arafura Sea and Timor Sea as the most productive area of the world's ocean. The region is part of the Coral Triangle, a biogeographical cross road and hot spot of marine biodiversity including corals and fish. It is home to a quarter of the mangroves of the world and a through flow of warm water from the Pacific to the Indian Ocean. New projects of assessment

and monitoring are finding their way. **Annadel Cabanban** from the Sulu-Celebes LME supplemented updates, new findings and lessons learned on LME management.

Turning to the Arctic, **Vladimir Mamaev** outlined the first steps taken in the Western Bering Sea LME project, which is a newly started GEF project based on Russian/US cooperation with strong involvement of industry. The work plans are mostly built on the wealth of experience gained by GEF and others in the course of the LME movement in temperate, upwelling, and tropical waters.

Gennady Mathishov, assisted by **Roman Mikhalyuk**, spoke on multidecadal changes in Russian Arctic LMEs, as recorded in the Kara Sea since 1882 and in detail since 1935 for the Barents Sea and adjacent waters by the Murmansk Marine Biological Institute. It includes the use of bio-indicators like *Clamys* and *Mytilus*, records of biological pollution by alien species and recent studies on ecological impacts of fisheries, noise by drilling and seismic activities, chemical pollution by drilling solvents and oil. The temperature dependence in the distribution of feeding and spawning grounds are recorded for fish species and Kamchatka crab. An atlas of climate changes was published in collaboration with NOAA, demonstrating 30 years of cyclic changes of sea surface temperature in Barents Sea. In most recent years, incidences of extension of sea ice cover were found in some parts of the Arctic. Mathishov is inclined to negate any long term climate trend superimposed on the cyclic changes. He points to the recent harsh winters in southern Europe and the Caspian area caused by an expansion of the West Siberian Anticyclone to the Southwest. This phenomenon has been described by Voikov in the early 20th century (Voikov axis).

The Arctic Ocean in general was the topic of the fascinating talk by **Hein Rune Skjoldal**. He described the development of the concept of the ecosystem approach (EA) and its implementation for management. In 2004, the Arctic Council adopted the EA as the core principle of the Marine Strategic Plan for the Arctic seas.

The EA is more than 30 years old. The term ecosystem is vague, covering different scales in space and time, one scale nesting in the other. EA has a hierarchy from general principle to practical implementation, which differs with the ecological and socio-economic conditions. The various steps include: define ecosystem, describe it, set ecological objectives, assess the ecosystem, value it, and finally manage the ecosystem. Researchers from Norway and Germany, now engaged in Arctic studies, have profited greatly from the experience gained in their participation in the BENEFIT and BCLME projects.

The EA to fisheries is basically not science but management oriented. Management, however, has to be strongly supported by good science. The EA focuses on human well being and on good ecosystem status. The conflict of *How much use?* versus *How much conservation?* is answered by the EA as *Sustainable use is conservation*. No species should be threatened and sufficient habitat should be protected.

Ken Sherman confirmed that the EA is gaining acceptance in the Arctic LMEs under the pressure of changing ecosystem conditions. There is a general push for multisectoral solutions –just as in the South – setting the stage for science as helper in decision making on national and transboundary level.

In closing the summary above, **Gotthilf Hempel** noted an impressive progress in the LME movement worldwide including a substantial shift in the content of the present discussions compared to former Consultations. In earlier years, issues of stock assessments, regime shifts and climate change often dominated the presentation. There had been also much discussion on

organizational and financial matters related to GEF support. This time the presentations focused primarily on the interface of science and management in multisectoral systems where fisheries are just one of several users impacting LMEs. Seemingly the buzz word climate change is partly replaced by terms like multi-sectoral ocean planning. Nowadays a new generation of LME workers has become engaged in closing the gaps between ecological , economical and political sciences as well as in building bridges to industry, politics and general public.

He noticed little mentioning of the need for improved recruitment to LME staff. On the science side of the LME projects a great number of PhDs and M.Sc.s have been produced but many of them did not stay in LME work. The scientific work in LMEs should be made more attractive to good young scientists. Publishing good papers by local LME scientists in recognized journals is one of several ways for bridging the gap between LME work and basic marine science. Junior local scientists should be assisted by experienced scientists, peer reviewers and editors from abroad in the long process of preparation and publication.