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TOWARDS ECOSYSTEM-BASED MANAGEMENT OF THE GUINEA CURRENT LARGE MARINE ECOSYSTEM



November 2013



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Towards Ecosystem-based Management of the Guinea Current Large Marine Ecosystem

2013 Synthesis Report



Executive Summary

The approach to ecosystem-based assessment and management of marine goods and services was introduced to Africa during the Global Environment Facility-United Nations Development Programme-United Nations Industrial Development Organization Gulf of Guinea project from 1995 to June 1999. With financial assistance from the Global Environment Facility (GEF), ministers responsible for the environment and marine resources, from six Gulf of Guinea countries—Benin, Cameroon, Ghana, Cote d'Ivoire, Nigeria, and Togo—committed their national resources in marine scientists, technicians, facilities, and in-kind services to conduct transboundary assessments of marine resources and support actions for resource recovery and sustainability.

From 2004 through 2012, based on the interests expressed by West and Central African countries, the Gulf of Guinea project was extended to a Strategic Action Programme Development/foundational capacity building project for the full extent of the Guinea Current Large Marine Ecosystem (GCLME) from Guinea Bissau in the northwest to Angola in the southwest, encompassing the coastal waters of 16 countries.

During these first two projects, collectively referred to in this report as the GCLME programme, participating countries established a network of scientists and marine resource specialists responsible for operationalizing national and regional activities within a five-module ecosystem-based framework focused on GCLME: (i) productivity, (ii) fish and fisheries, (iii) pollution and ecosystem health, (iv) socioeconomic conditions, and (v) governance. The GCLME network was established in cooperation with the United Nations agencies (United Nations Industrial Development Organization, United Nations Development Programme, United Nations Environment Programme, International Maritime Organization, Food and Agriculture Organization of the United Nations, Intergovernmental Oceanographic Commission-United Nations Educational, Scientific, and Cultural Organization), Organization for Economic Co-operation and Development donor countries and agencies (e.g., United States-National Oceanic and Atmospheric

Administration, Institute Marine Resources-Norway, and non-governmental organizations (International Union for the Conservation of Nature, World Wide Fund for Nature, Centre for Biodiversity and Sustainable Development-Cameroon, Living Earth [Tierra Viva], World Promus, Community for Human Development, Esuene Foundation, AdaderAgbo-Zegue). A Regional Coordination Unit was established in Accra, Ghana, to initiate and coordinate transboundary actions for recovering and sustaining goods and services of the GCLME, including recovery of depleted fish and fisheries, improving the health of the ecosystem through restoration of degraded habitats (e.g. sea grasses, mangroves), controlling coastal pollution and nutrient over-enrichment, conserving biodiversity, sensitizing the GCLME countries to mitigating and adapting to the stresses of climate change, promoting socioeconomic development, and establishing an interim Guinea Current governance regime.

Since 2005, support for moving the 16 countries bordering the GCLME—Angola, Benin, Cameroon, Congo, Democratic Republic of Congo, Côte d’Ivoire, Ghana, Equatorial Guinea, Guinea, Guinea-Bissau, Liberia, Nigeria, São Tomé and Príncipe, Sierra Leone, and Togo—towards ecosystem-based assessment and management for sustainable development has grown. In the past decade, partnerships matured, and GCLME countries declared clarity of purpose in their country-driven request for a Strategic Action Programme implementation project for 2013 to 2017 leading toward sustainable development of ecosystem goods and services. This report summarizes accomplishments and catalytic activities in the movement towards sustainable development goals of the GEF-supported GCLME programme.

Foreword

Dr. Remi Allah-Kouadio is the Minister of Environment, Public Safety and Sustainable Development from Cote d'Ivoire and current Chair of the Interim Guinea Current Commission (IGCC), established by the Abuja Ministerial Declaration (2006) for leadership and coordination of the Guinea Current Large Marine Ecosystem (GCLME) Project.



The Large Marine Ecosystem (LME) approach offers an unprecedented achievement and example for sustainable development in western Africa. LME projects have demonstrated success at uniting 16 diverse GCLME countries with common purpose and cooperative governance. Therefore, on behalf of the IGCC and all 16 GLME countries, I strongly encourage future LME projects.

I am convinced that the implementation of the National Action Plans (NAPs) developed by the 16 countries, during the SAP preparation phase, with accompanying sustainable financing plans, will lead to the way towards continued incremental improvement to environmental state of the GCLME. The investment projects contained in the NAPs are based on an elaborate country level consultative process, which brought together Governments, NGOs, Private sector and Academia in the IGCC member states. The SAP implementation project for the next years will be based on these concrete actions on the ground.

We welcome working with the GEF, United Nations agencies, and other international, national, local, and private partners to continue this positive momentum for the West and Central African Region.

Dr. Remi Allah-Kouadio
July 2013

Foreword (continued)

Dr. Hashali Hamukuaya is the chairman of the African Large Marine Ecosystem Caucus that is composed of the African LME projects and commissions. He has served the coastal communities of Africa as the Director for the UNDP-GEF Benguela Large Marine Ecosystem Project and he is presently serving as the Executive Secretary of the Benguela Current Commission.



I am a longtime supporter of the ecosystem approach to the assessment and management of marine resources and the potential they hold for African nations. A firm scientific basis is essential in developing options by African marine resource managers for mitigating growing stressors on LME goods and services vital to the development of emerging coastal economies of nations around the coastal margins of Africa.

In the mid-1990s the Gulf of Guinea project pioneered the application of the ecosystem approach in Africa coastal waters. The success of this effort has led to the commitment of multi-sectoral interests for extending the pilot Gulf of Guinea project along coastal boundaries of the 16 nations bordering the Guinea Current LME southward from Guinea-Bissau to Angola. The infrastructure developed through the transboundary diagnostic analysis and strategic action programme supported by national ministries of the environment, fisheries, energy, tourism, development, and finance has forged a strong political, economic, and scientific framework of the GCLME countries to support the next phase of the GCLME programme and the Interim Guinea Current Commission.

On behalf of the people of Africa, we in the African LME Caucus look forward to working once again with our colleagues in the GCLME region on the elimination of poverty and the emergence of robust economic and sustainable growth from the enormous potential of oil, gas, minerals, fisheries, and tourism that the GCLME can provide in support of driving forward western Africa's economic engine, and the well-being of its people.

We are highly encouraged by the successes of the initial phases of the GCLME, and look forward to lending support of the African LME Caucus to an anticipated GEF co-financed project supporting implementation of the GCLME Strategic Action Programme.

Hashali Hamukuaya
June 2013

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Introduction

Since 1992, the Global Environment Facility (GEF) has assisted economically developing countries with projects supporting the introduction and practice of ecosystem-based recovery, assessment, and management of coastal ocean goods and services within the geographic boundaries of the World's Large Marine Ecosystems (LMEs) (Appendix 1). In partnership with five United Nations agencies (FAO, IOC-UNESCO, UNDP, UNEP, UNIDO), two non-profit organizations (IUCN, WWF), several intergovernmental organizations, and a growing number of OECD country donors, the GEF and World Bank have catalyzed \$3.1 billion in financial support to 110 countries participating in 17 LME projects in Africa, Asia, Latin America, and eastern Europe (Sherman *et al.* 2010; Hume and Duda 2012).

The Guinea Current Large Marine Ecosystem (GCLME) is the largest GEF-supported LME project in Africa. It encompasses 16 countries from Guinea Bissau in the northwest coast of Africa to Angola in the southwest (Figure 1).

A series of two GEF International Waters projects in the GCLME have provided local, national, and LME-wide opportunity for strengthening assessment and management of ecosystem goods and services. All 16 participating countries have demonstrated political will for ecosystem recovery and sustainable development. From 1995 to 1998, six countries conducted the GEF-supported Gulf of Guinea project, involving the Cote d'Ivoire, Ghana, Benin, Nigeria, Cameroon, and Togo. Based on the positive results expressed in the Accra Declaration (1998), the Gulf of Guinea project extended to 10 other contiguous countries to constitute an unprecedented collaboration among 16 countries in West and Central Africa: Angola, Benin, Cameroon, Congo, Democratic Republic of the Congo, Côte d'Ivoire, Gabon, Ghana, Equatorial Guinea, Guinea, Guinea-Bissau, Liberia, Nigeria, São Tomé and Príncipe, Sierra Leone, and Togo (Figure 1). Over the past decade, this transboundary effort has focused on recovery of depleted fish stocks, improvement of degraded habitats, minimization of coastal pollution and nutrient over-enrichment, conservation of biodiversity, and mitigation and adaptation to climate change (Donkor and Abe 2012; Accra Declaration 1998).

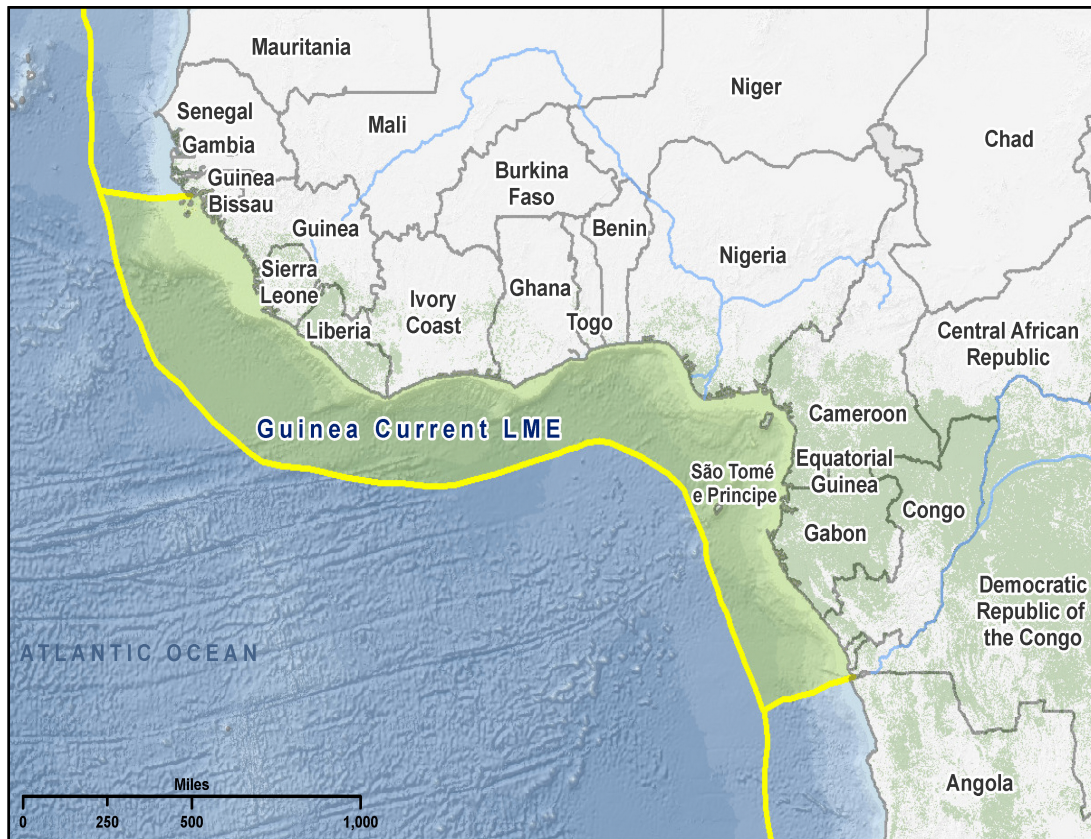


Figure 1: GCLME programme area. Image source: NOAA LME project office.

Project History

From 1995 to 1999, six West African coastal countries, united to improve coastal and marine management in the Gulf of Guinea, carried the initial GEF-UNDP-UNIDO Gulf of Guinea project forward. Cote d'Ivoire, Ghana, Benin, Nigeria, Cameroon, and Togo introduced the ecosystem approach to the assessment and management of marine resources in West Africa. In 1998, these six countries signed the Accra Declaration to express their commitment to the LME approach in the Gulf of Guinea for future management of fisheries, water pollution, and biodiversity conservation (GCLME 2010b). The GOGLME pilot project concluded in November 1999 and, through its Accra Declaration, paved the way for all 16 West and Central Africa countries bordering the GCLME to join in the SAP development project for the GCLME.

In 2004, GEF funding expanded the GCLME programme to officially include all 16 countries in a foundational capacity building project. Building on the GOGLME pilot project, this expansion provided a new framework for ecosystem-based

development. Between August 2004 and December 2012, the GEF funded nine GCLME demonstration projects.

The GCLME countries developed National Action Plans (NAPs) with 15 NAPs formally approved for the implementation of the Strategic Action Programme (SAP). Customized for each participating country, these documents integrate GCLME Project and programmes with related activities at the national, regional, and local levels including: the Biodiversity and Climate Change Adaptation efforts, Integrated Water Resources Management (IWRM) projects, Integrated Coastal Zone Management (ICZM) initiatives, African Water Vision 2025 Action Plans, and Niger Delta Development Commission efforts (GEF 2012). Shared objectives across NAPs are to reverse decades of detrimental impacts from pollution and environmental degradation, while improving the livelihoods of people.

In the broader context of western Africa governance and legal frameworks, GCLME efforts support and augment the:

United Nations Convention on the Law of the Sea (1982) – defined rights and responsibilities of nations in the international use of the world’s oceans.

Abidjan Convention (1981) – “Convention for Cooperation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region” or Abidjan Convention created a comprehensive umbrella agreement and legal framework, with jurisdiction in western African countries from Mauritania to South Africa, for the protection and management of the marine environment, coastal zones, and related inland waters. Of the 16 GCLME countries, twelve have ratified the Abidjan Convention with the remaining at various stages of accession process.

Accra Declaration (1998) – agreed to the environmentally sustainable development of the Large Marine Ecosystem of the Gulf of Guinea, with the agreement signed by all six coastal countries.

Abuja Ministerial Declaration (2006) – established the Interim Guinea Current Commission (IGCC) with the framework of the GCLME Project, demonstrating strong national commitment to addressing environmental issues and challenges through local and regional networks (e.g. Regional Coordinating Units) for effective implementation throughout West Africa.

Osu Ministerial Declaration (2010) – reaffirmed the GCLME Ministers’ intention to create a permanent Guinea Current Commission (GCC).

Abidjan Ministerial Declaration (2012) – decision to establish GCC by a protocol to the Abidjan Convention (GEF 2012).

To financially support these efforts, the GEF awarded the GCLME pilot project in 1995 with a \$6 million grant, in addition to approximately \$10 million in co-financing from participating countries and other sources, which ran through to 1999. The project was implemented by UNDP and executed by UNIDO. As efforts expanded into the GCLME-SAP foundational project, the GEF funded the project in 2003 with \$21 million. Building on their respective strengths, UNEP joined UNDP as co-implementing agencies and the project was again executed by UNIDO. The 16 GCLME countries, the UN agencies, and other sources augmented this GEF funding with approximately \$33.9 million in co-financing between 2005 and 2012. In 2011, the GEF, overseeing the SAP Development Phase, granted a “no cost extension,” allowing the GCLME programme to continue efforts and consultations toward establishment of a permanent GCC. Due to administrative issues, the project funds continued the no cost extension to 2012.

Today, the GCLME countries are committed to implementing their agreed Strategic Action Programme (SAP) and linked NAPs. Reflecting the scale and complexity and multi-sectoral nature of effective actions to reverse degradation and maintain the GCLME ecosystem’s goods and services, the GCLME countries are now working with four GEF agencies – UNDP, UNEP, FAO and UNIDO – in the development of a multi-agency Programme Framework Document for possible GEF financing in support of SAP implementation.



GCLME Modules and Progress for Sustainable Development

Managing GCLME resources from the LME ecosystem perspective requires a paradigm shift separate from a sector-by-sector approach (e.g. fisheries, oil and gas, or mining) towards ecosystem-based management (Figure 2). This involves the evolution of scientific and governance approaches from small spatial scales to the larger LME scale, each nested for coordinated actions that link bottom-up efforts with top-down infrastructure. It further involves shifting from a short-term perspective to a long-term perspective, viewing humans as embedded and interdependent with ecosystems for the goal of long-term profitability through sustainable goods and services from a resilient and healthy ecosystem. With the GCLME programme, western Africa has embraced this LME modular approach as a mechanism for 21st Century change to the ecosystem-based management paradigm (Lubchenco 1994, Sherman and McGovern 2011).

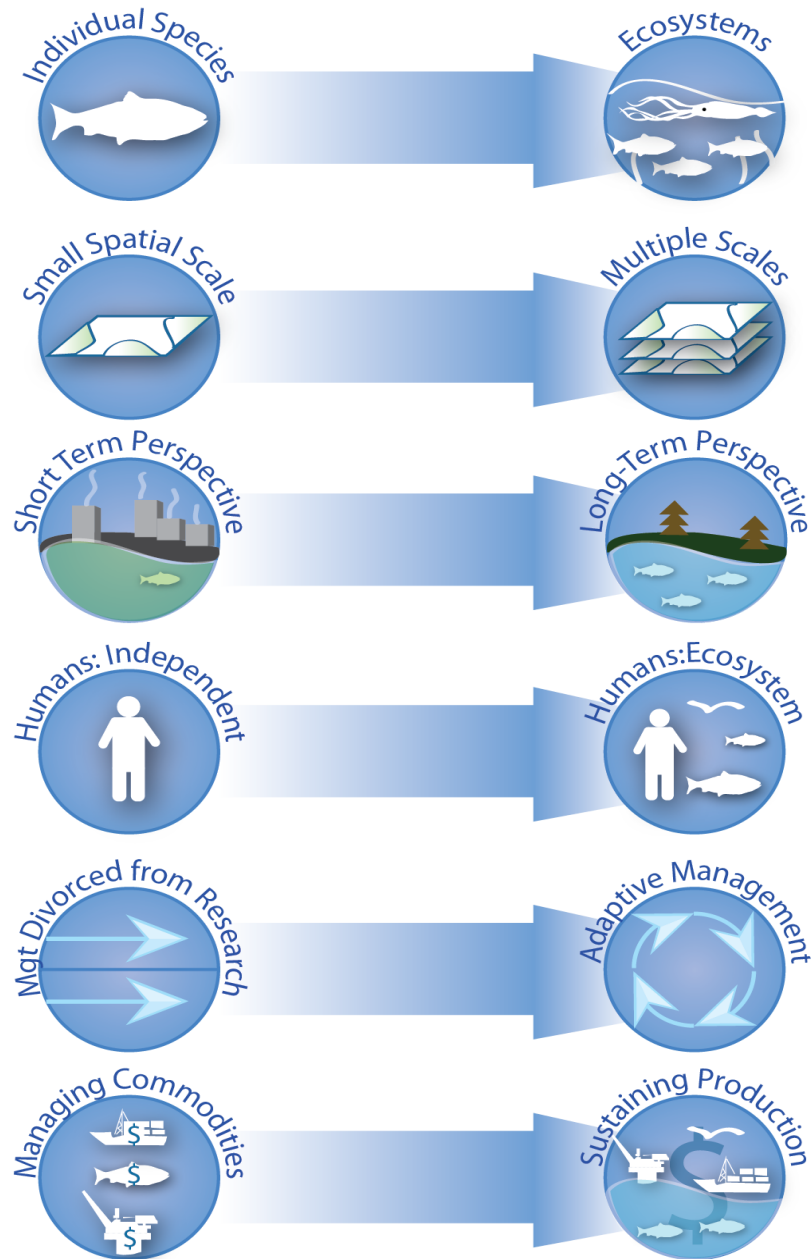
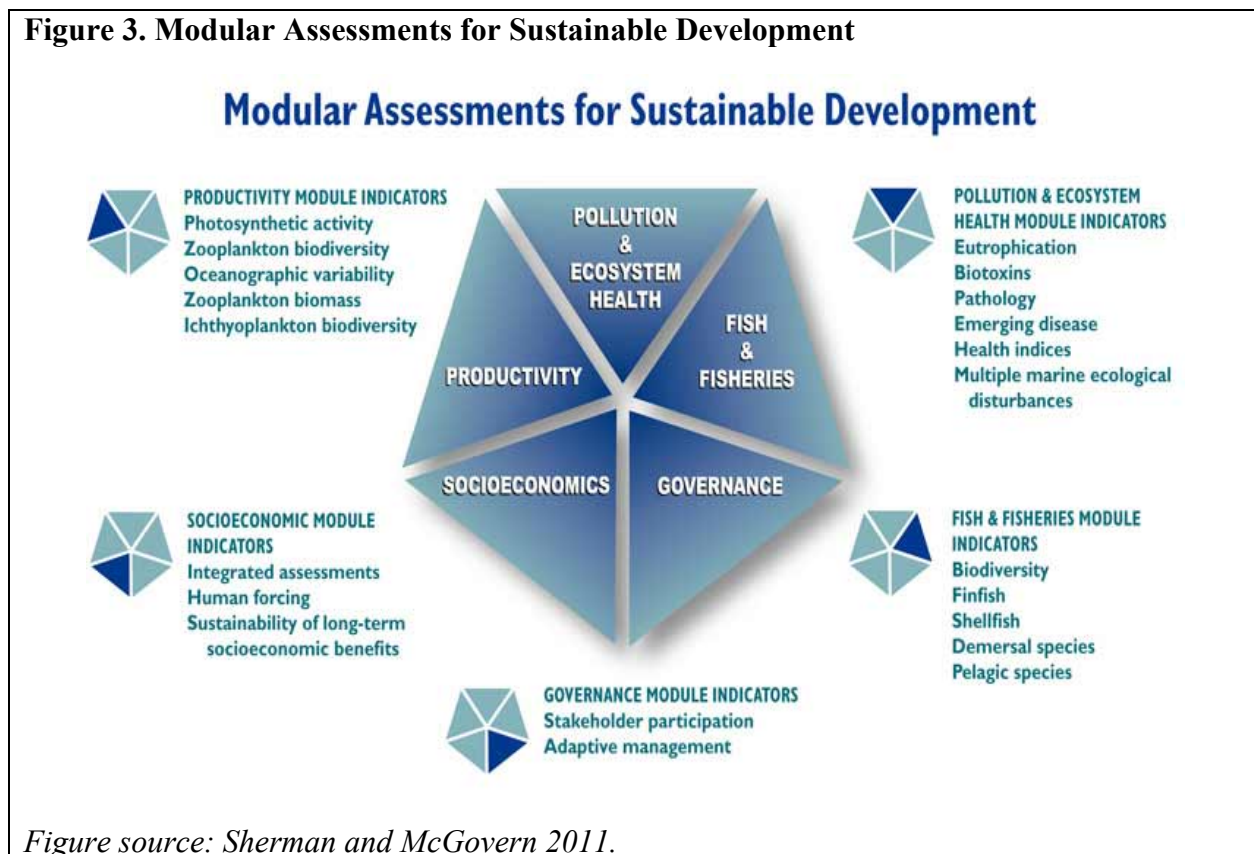


Figure 2. The Ecosystem-Based Management Paradigm.

The LME modular approach involves a paradigm shift from single-species or single-sector management to ecosystem-based management of the entire ecosystem as an integrated whole. As such, emphasis shifts from: (i) individual species to ecosystems; (ii) small spatial scale to multiple scales; (iii) short-term perspective to long-term perspective; (iv) humans as independent of ecosystems to humans an integral part of ecosystems; (v) management divorced from research to adaptive management driven by best-available science; and (vi) managing commodities to sustaining production potential for goods and services (e.g., ecosystem services) (Lubchenco 1994, Sherman and McGovern 2011). Figure by A. Litwack and K. Honey, NOAA.

Figure 3 depicts the five LME modules used to support the paradigm shift to ecosystem-based management practices. Collectively, these modules provide indicators and metrics to assess the changing states of the LME and support actions for recovery, sustainability, and management of goods and services. This approach is particularly important in adapting to climate change, as it is inherently designed for adaptive management, iteratively informed by best-available science.



Customizing the LME ecosystem-based management approach to GCLME needs included long-term development goals articulated under the GCLME SAP, including:

- Recover and sustain depleted fisheries.
- Reduce uncertainty regarding ecosystem status.
- Restore degraded water quality.
- Restore degraded habitats.
- Reduce land and ship-based pollution.
- Develop capacities and governance structures to implement socioeconomic policies informed by best-available science at all levels: local, sub-national, national, and international (transboundary at the LME scale).

For sustainable development goals, the project included assessments of GCLME productivity, fish and fisheries, ecosystem health, governance, and socioeconomics. Priority action areas included reversing coastal area degradation and living resources depletion, while building regional capacity throughout the GCLME countries. To achieve these goals, the GCLME programme established a regional management framework for sustainable use of living and non-living resources in the GCLME. This regional framework recognized Regional Activity Centres (RACs) to connect regional GCLME goals with on-the-ground actions.

GCLME Regional Activity Centres (RACs)

The GCLME Project recognized five RACs, each designed around a scientific theme as a data sharing and training centres to connect transboundary objectives with on-the-ground efforts at the regional and local levels. The original objective for establishing RACs was to provide GCLME outlets for a bi-directional information flow scheme, based on a hub and spoke model with RACs at the centre. Each RAC would create a professional network and infrastructure for implementation actions, across multiple scales of governance.

The RAC concept is relatively new to African marine science and management as practiced through the operationalization of the five-modules linking science to management. RACs are an innovative method for meeting the challenge of connecting science with management actions. The GCLME countries successfully achieved operational capability in two of five RACs, with those emphasizing the productivity and the fisheries modules becoming the most successful:

- RAC 1: **Regional Marine Productivity Laboratory**, University of Ghana, Legon, Greater Accra Region, Ghana.
- RAC 2: **Fisheries Activity Centre, National Institute of Fisheries of Angola** organized in Luanda, Angola.
- RAC 3: *(limited capacity, inactive since 2012 when GCLME Project funds ended)* **Regional Environmental Information Management (EIMS) Centre**, University of Lagos (Unilag), Lagos, Nigeria.
- RAC 4: *(limited capacity, inactive since 2012 when GCLME Project funds ended)* **Regional Pollution Monitoring and Research Centre** in the Imo State Environmental Protection Agency (ISEPA), Owerri, Nigeria.
- RAC 5: *(to be set up)* **Activity Centre for Comprehensive Risk Analysis**, Libreville, Gabon.

Challenges remained in efforts to move ahead with information on management, pollution, and risk analysis RACs. The two successful RACs could be fitting examples, should future SAP implementation efforts provide support for the original five RACs deemed appropriate by the participating 16 countries for the GCLME programme.

Across each of the five LME modules, the GCLME programme sought to strengthen existing human and institutional capacities for addressing transboundary, water-related concerns on a LME scale and to assist countries to better understand environmental concerns of shared international waters and collaboratively address them. GCLME local and regional expertise is significantly greater today for all five modules because of two decades of investments in human capital. Today, West and Central African universities and scientists consistently receive competitive contracts. Beyond training students and scientists, the GCLME programme has contributed to public, managerial, and decision-maker awareness of marine resource risks. It has raised LME issues to a greater level for scientific, socioeconomic, and policy actions in all 16 countries.

Selected Summary of GCLME Capacity Building Actions: Regional Training Workshops

- Regional Training Workshop on Geographic Information Systems, Lagos, Nigeria, 6-10 December 2004.
- Transboundary Diagnostic Analysis and Indicators Workshop, Accra, Ghana, 18-22 April 2005.
- Workshop on Fisheries Resource Survey Planning and Methodology, Accra, Ghana, 1-4 June 2005.
- Training Workshop on TDA and Strategic Action Programme, Accra, Ghana, 15-19 August 2005.
- Promoting Sustainable Fisheries Access Arrangements in the Guinea Current Large Marine Ecosystem Countries, co-sponsored with World Wide Fund for Nature, Accra, Ghana, January 2006.
- Regional Training Workshop on the Use of ECOPATH with ECOSYM fisheries production models, Accra, Ghana, 18-22 April 2006.
- Ship Ballast Water Management, co-sponsored GloBallast of the International Maritime Organization (IMO), Ghana, July 2009.
- Regional Workshop and task Force Meeting on the Ratification and Implementation of the IMO Convention on Ballast Water Management, Togo, Lome, 2011 Workshops addressing Fisheries Management Plans held, Douala, Cameroon, 2-7 November 2009, and at the Fisheries RAC, Luanda, Angola, 27-29 March 2006 and 5-7 September 2007.
- 2nd Regional ECOPATH with ECOSYM in Accra, Ghana, 13-17 December 2010.
- Mariculture Development, in collaboration with the YSLME and Water Research Institute, 23-15 February 2011.
- Oil Spill Reponse and Dispersant Use Policies, IGCC in cooperation with the IMO and International Petroleum Industry Environmental Conservation Association, 22-24 June 2011.
- National Training Workshops on the Ratification and Implementation of the IMO Convention on Ballast Water Management, Nigeria, Liberia, Sierra Leone, Cote d'Ivoire, Congo, November-December 2012.

The following sub-sections for each of the five LME modules summarize GCLME programme efforts.

(i) GCLME Productivity Module

This module assesses GCLME productivity patterns, nutrient levels, to determine ecosystem dynamics and carrying capacities for living resources. The productivity module also offers pragmatic methods for evaluating and tracking environmental changes, whether from climate change or anthropogenic impacts.

The productivity module is fundamental to the LME approach and GCLME scientific efforts, as it characterizes conditions at the base of the food web in quantitative terms ($\text{gC}/\text{m}^2/\text{year}$) that determine species abundances, diversity, and richness. It sets the environmental context for ecosystem services, including maximum sustainable yields of fisheries biomass.

Capacity Building

While collecting and evaluating productivity information to support the Transboundary Diagnostic Analysis (TDA) and the Strategic Action Programme (SAP), the GCLME programme simultaneously prioritized investments in human capacity and established long-term monitoring protocols for the region. The productivity module was established at the University of Ghana and its Ghana Fisheries Laboratory as a RAC. Subsequently, the Ghana Fisheries Laboratory partnered with NOAA (USA) and the Plymouth Marine Laboratory (UK) for scientific and technical training.

As a RAC, the Ghana Fisheries Laboratory trained regional scientists to lead the effort to characterize GCLME taxonomic species using Continuous Plankton Recorder (CPR) technology. Although commonly used in Europe and USA, these ichthyoplankton and zooplankton survey methods were new to Africa with the GCLME programme pioneering their use in Gulf of Guinea waters. After acquiring two CPRs, the RAC developed local capacity to deploy these instruments. Investment in human capital went beyond simply educating local scientists—it emphasized the need to empower GCLME scientists to do world-class research in the region with appropriate support of a research environment and infrastructure.

Dr. George Wiafe is a scientist and professor at the University of Ghana. His PhD research analyzed Continuous Plankton Recorder (CPR) samples collected from Cote d'Ivoire to Cameroon under the Gulf of Guinea LME pilot Project. Dr. Wiafe attended training workshops for the plankton analysis, some of which took place at the Sir Allister Hardy Foundation for Ocean Science in Plymouth, England. He contributed to the first assessment of variability in plankton productivity across the LME and has prepared a manual on the identification of zooplankton in the Gulf of Guinea.



Centre of Excellence

Commitment from the University of Ghana helped catalyze GCLME productivity module success, as this RAC was the hub for productivity efforts on the ground. The Economic Community of West African States (ECOWAS) recently designated the University of Ghana's Department of Oceanography and Fisheries as a Centre of Excellence. This Department hosted the GCLME Ecosystem Centre for Productivity and Biodiversity, which has a mission to coordinate productivity and biodiversity research and training for 16 countries (Guinea Bissau to Angola). Through this Centre of Excellence, the University is poised to facilitate future efforts of the GCLME programme, particularly through capacity building and cooperative efforts with other countries. This Centre of Excellence and its efforts continue today, even after GCLME Project funding ended. Additional implementation support from the GEF would strengthen these existing capacities, originally part of the GCLME programme, and enable them to become more regionally focused.

Science in Action

Between July 2002 and April 2007, satellite remote sensing (i.e. MODIS and MERIS) augmented the in-situ data from CPRs. GCLME Project funds proved too limited for regular, comprehensive surveys of all waters but individual countries participated in joint fisheries and oceanographic surveys on the Norwegian vessel *R/V Dr. Fridtjof Nansen* (hereafter *R/V Nansen*), in partnership with the FAO EAF-Nansen Project. Between 2005 and 2007, GCLME scientists processed benthic fauna samples and zooplankton samples collected by *R/V Nansen*. Subsequent analyses created a GCLME database of 67 phytoplankton taxa, 26 zooplankton (<2mm) taxa, and 38 zooplankton (>2mm) taxa identified by CPR methods. They also characterized the GCLME macro benthic community. This

data became the basis for GCLME productivity assessments and produced a user-friendly manual for identification of common zooplankton species.



Scientists boarding the
R/V *Dr. Fridtjof Nansen*,
GCLME (www.nefsc.noaa.gov)

For data analyses, CPR and remote sensing information fed into a depth-integrated, vertically-generalized model to estimate mean monthly GCLME primary productivity ranges between 110-310 gC/m²/month. This was the first-ever quantification of productivity levels for the GCLME. Temporally, estimates during the major upwelling period (i.e. July to September) had the highest primary productivity rates. Spatially, the shallow waters surrounding the Bijagos Islands in the Sierra Leone Guinea Plateau proved most productive. Sea surface temperatures drove spatial variation in primary productivity. For the first time ever, scientists characterized GCLME spatio-temporal patterns and documented a planktonic community shift between hydrographic seasons. Results provided primary and secondary trophic indices for ecosystem-based fishery modeling, as well as informed climate models to evaluate climate change impacts. Climate impacts will likely reduce plankton density and diversity, due to lowered upwelling, thereby negatively impacting abundance and distribution of fishery resources.

The GCLME productivity module established regional networks of capacity that proved invaluable in 2012, when a harmful algal bloom (HAB) emerged in western Ghanaian waters. In this emergency situation, local experts through the RAC assisted with science and management recommendations. They quickly responded using cooperative efforts with researchers in the adjoining waters in Cote d'Ivoire, assessing HAB impacts.

Local and regional commitment for the GCLME programme is strong. Even after the SAP foundational/SAP preparation project for the GCLME officially ended, the University of Ghana supported a workshop to train regional scientists in analysis methods of benthos collected on the *R/V Nansen* cruises.

Highlights

- Human capital investments yielded success stories like Dr. George Wiafe's.
- Scientific results have been summarized in a comprehensive report on GCLME productivity (GCLME 2010).
- University of Ghana's Department of Oceanography and Fisheries functioned as a GCLME Regional Activity Centre (RAC) for productivity efforts and is a Centre of Excellence to implement the Economic Community of West African States programme for the region, funded by the EU.
- The RAC for productivity efforts coordinated production of assessments across 16 GCLME countries, while training West and Central African students, researchers, and scientists in productivity assessment technologies and remote sensing methods. RAC capacities include: (1) nutrient monitoring from coastal lagoons and estuaries and assessment of anthropogenic effects on ecosystems; (2) research on primary and secondary producers, including abundances, feeding, breeding, behavior, and habitat information; and (3) assessments of harmful algal bloom (HAB) proliferation in the region.

Looking Forward

- Build on existing capacity through the RACs, enabling the productivity module monitoring 2nd assessment to have more regional focus for greater impact at all levels of science and governance: local, regional, national, and transboundary.
- Provide infrastructure for the collection of longer and more regularly monitored time series data for on-going assessments. Monitoring surveys should encompass all GCLME waters.
- Pursue cost-effective ways to support local capacity—for example, the acquisition of a camera fitted to a microscope in the University of Ghana's Productivity and Biodiversity Centre would greatly improve productivity and the plankton image database, for little cost.

(ii) GCLME Fish and Fisheries Module

The fish and fisheries module evaluates both fisheries dependent (commercial) catch data and fisheries independent (research) surveys to obtain time-series information on changes in fish biodiversity and abundance levels critical for industry and food security. This module advances standardized sampling procedures, while providing a framework for monitoring, control, and surveillance with a goal of recovery of depleted fish stocks and sustaining the fisheries.

Sustainable Fisheries

Through their commitments in the SAP, the 16 GCLME countries unanimously support LME measures to forestall the decline in living resources, with explicit focus on fisheries. Fishing is a critical economic activity, providing food security and livelihoods for many coastal communities and an estimated 300 million inhabitants in the GCLME region. To protect these resources, the GCLME programme first characterized regional biodiversity with 850 marine species, including 745 recorded fish species (FAO 1994, TDA 2006). The TDA evaluated GCLME markets and use of finfish and shellfish. Targeted species include small coastal pelagics, large offshore pelagics, demersal finfish, shrimp, and mollusks (e.g., squids, cuttlefish, and octopus). GCLME fisheries consist of local stocks, caught by coastal artisanal fisheries and consumed locally, as well as offshore stocks in Exclusive Economic Zones (national waters to 200 miles offshore) and international waters within the national boundaries of the GCLME that attract commercial fleets from Europe and Asia.

Monitoring, Control, and Surveillance

For a successful fisheries management programme, the GCLME-SAP development project emphasized sound monitoring, control, and surveillance (MCS) effort. Unfortunately, GCLME countries have little capacity to effectively monitor or enforce fisheries management rules—neither of local artisanal fleets, nor of offshore commercial fleets. Best estimates of GCLME annual catch are between 800,000 metric tons (mt) and 900,000 mt for the period of 1995 to 2006 (Pauly *et al.* 2006). Information on the estimated annual value of the catch varies between \$700 million and \$800 million between 2000 and 2006 (Pauly *et al.* 2008). Nigeria and Ghana account for nearly



half the average annual fisheries landings. EU countries and illegal, unreported, and unregulated (IUU) fishing also contribute to the overexploited and collapsed state of an estimated 60 percent of the fish stocks (Pauly *et al.* 2008). During a recent GCLME programme workshop with WWF, scientists and decision makers supported a transboundary approach to address the serious problem of IUU fishing.

GCLME surveys supported the finding of overfishing for local and offshore stocks in the Gulf of Guinea. Prior analyses reported declines in catch per unit effort, suggesting fishing is unsustainable for some stocks (Ajayi 1994; CECAF 2011).

Science in Action

Fishery independent surveys are core to the LME approach, as trends from research vessel surveys allow scientists to more precisely estimate population trends and sustainable harvest levels than is possible with landings data alone. In a document prepared for the GCLME Project development phase, Nigerian scientists stressed this importance with emphasis on comprehensive surveys and a suitable regional vessel for near shore waters.

During the pilot phase, researchers conducted trawl surveys of the Gulf of Guinea in 2005, 2007, and 2010. These were the first such complete surveys of these waters since the 1960s. The GCLME programme repatriated the 1960s data to the RAC for evaluative comparison and future use as fisheries independent data. As funding allowed, the GCLME programme supported fishery-independent surveys of marine resources with data collection by the *R/V Nansen*, in partnership with the FAO EAF-Nansen Project. Limited budgets for vessel time and interruptions of projects inhibited regular surveys with repetition throughout all GCLME waters. Still, GCLME's fisheries scientists received training through professional exchanges, training sessions, and workshops on survey cruise planning and operations.

Fishery-independent surveys combined with fisheries and modeling workshops, played a catalytic role in moving towards fisheries management plans (FMPs) for implementation in the GCLME region. Importantly, the GCLME programme developed MOU's with the Regional Fisheries Management Organizations.

Fisheries achievements include developments in mariculture, a priority issue for Ministers regulating Fisheries because of their interest in regional food security. In response to this political and economic interest, towards the end of the last GCLME programme period with GEF funding, the GCLME Project identified and

connected with international and regional experts to evaluate baseline conditions and best practices for expanding mariculture in the region. Efforts culminated in a GCLME exchange with the UNDP-GEF Yellow Sea LME (YSLME) Project involving China and the Republic of Korea, where mariculture rests on a highly productive system of multi-trophic polyculture.



Integrated Multi-Trophic Aquaculture (IMTA) methodology buoy field in the YSLME project, which recently partnered with GCLME for aquaculture and fisheries implementation efforts.

The GCLME mariculture partnership with YSLME will aid implementation efforts, including future co-financing with the private sector encouraged to invest and expand mariculture for a diversified GCLME economy. Given strong growth in the GCLME oil and gas sectors and international interests in commercial aquaculture, maritime cage culture could be developed on inactive platforms for increased food security. Future public-private partnerships could exchange commodity leasing rights for private industry investments, with some funds supporting offshore cage culture research as an alternative livelihood for fishers and economic diversification for coastal communities.

Due to expected deleterious impacts to some GCLME fish stocks with climate change, greater data sharing and policy harmonization are being developed. Information sharing and standardized reporting will be critical to effectively manage stocks. GCLME artisanal fishermen are most vulnerable to increased storminess and seasonal changes in fish abundances or distribution patterns from climate change, especially if the fish stocks move northward and further offshore. Measures are needed to provide artisanal fishermen greater support, as climate change impacts fisheries. To be effective in the GCLME region, these future policies—especially policies transboundary in scope—must recognize strong national interests and economic trade agreements beyond fisheries agreements.

Highlights

- While building local and regional capacity, GCLME scientists developed field manuals on marine survey methods and methods for analyzing fish diets through stomach contents, yielding new information for ecosystem modeling and ecosystem-based fisheries management.
- GCLME resource managers and decision makers are receptive to LME ecosystem approaches and the precautionary principle. Significant local human capacity has been developed by a decade of GEF support at the local and regional levels for the GCLME fisheries module, as demonstrated by growing scientific expertise in resource management, and trophic dynamics.
- Strong international support exists for the GCLME fisheries module, including established relationships and resource commitments from the non-profit organization World Wildlife Fund for Nature (WWF) and the IUCN, with headquarters in Switzerland, NOAA Fisheries (USA), the FAO Nansen project on Ecosystem Approach to Fisheries (Norway and Italy), and The Sea Around Us Project at the University of British Columbia (Canada) with world- renowned experts like Dr. Daniel Pauly, Dr. Villy Christensen, and Dr. Rashid Sumaila leading ECOPATH/ECOSYM workshops for the GCLME.
- Mariculture research and commercial aquaculture—including alternative, polyculture livelihoods for fishing communities beyond traditional methods—present opportunities for co-financing and public private partnerships to leverage funding for GCLME programme implementation.

Looking Forward

- The GCLME programme is an existing framework for transboundary monitoring, control, and surveillance (MCS) efforts to manage fisheries. Whether implemented by a LME coordinated programme or other international efforts, MSC of GCLME waters is necessary to appropriately address Illegal, Unregistered and Unreported (IUU) fishing challenges.
- Due to expected deleterious impacts to some GCLME fish stocks with climate change, greater data sharing and policy harmonization are needed. Information sharing and standardized reporting will be critical to effectively manage stocks.
- GCLME fishing activities and climate-change adaptation efforts in international waters have benefitted from a collaborative, transboundary approach that recognizes and balances strong national interests.

(iii) GCLME Pollution and Ecosystem Health Module

The GCLME pollution and ecosystem health module addressed the influx of pollutants into coastal waters, and actions for improving water quality and habitats.

The Challenges

While much of western Africa is reasonably pristine, relative to the rest of the world, contamination in urban areas is a serious problem that results in localized “hot spots” of pollution. Discharge of untreated sewage, agricultural runoff, and industrial wastes in GCLME waters is the norm with limited water treatment facilities throughout the region. Continued support in promoting ecological sanitation could reduce the detrimental impacts of water contamination. Human health benefits from eliminating pollutants in the food chain, especially in the GCLME region since much of its population consumes fish as a primary protein source.



The Gulf of Guinea region exports oil with major producers including Nigeria, Angola, Equatorial Guinea, and Gabon and other countries, such as Ghana, coming on line. Oil spill and pollution risks to coastal GCLME countries impose the constant need to proactively organize and prepare emergency responses to accidental oil spills and other sources of marine pollution. Given these risks, the Gulf of Guinea pilot project coordinated across six GCLME countries to develop training. This training addressed and mitigated pollution challenges by standardizing analytical methods for data collection throughout the region.

Over two decades, training has addressed catastrophic risks in the region like major oil spills that can originate from passing tankers, offshore oil exploration, or platform explosions. The GCLME programme has contributed to training in emergency response and contingency plans at the national and transboundary levels, especially by fostering co-operation among governmental authorities. The GCLME programme developed a Terms of Reference (TOR) for a Centre of Excellence to coordinate intervention actions in case of oil spills in GCLME waters. Continued efforts are needed to prevent catastrophic impacts in the event of major spills.

Low-Cost, Low-Technology Solutions

The GCLME programme emphasizes low-cost, low-technology solutions to habitat recovery, and control of water pollution, land pollution, ship-based pollution, mining pollution, and other ecosystem health challenges. A pilot project in Togo successfully prepared plans for the reduction of transboundary pollution from untreated sludge discharged directly into the ocean by a phosphate mining company. This pilot project is the only one of its kind and it would cost an estimated \$13 million dollars to fully adopt interventions. Most GCLME factories dump untreated effluents into rivers or coastal waters. Low-cost/low-technology solutions are needed for pollution control.



Erosion of beaches and coastal habitats negatively affects development and tourism. To address this challenge, the GCLME programme established linkages with the U.S. Army

Corp of Engineers. Efforts facilitated interchanges between countries for information sharing and technology transfer. The GCLME programme promoted low-cost/low-technology solutions to pragmatically prevent coastal erosion and promote sustainable tourism. A demonstration project assessed these environmental and social impacts of the most appropriate low costs solution and evaluated with mathematical models at the Centre for Remote Sensing of the University Félix-Houphouët-Boigny of Abidjan, Cote d'Ivoire.

Integrated Coastal Zone Management (ICZM)

During the Gulf of Guinea pilot project in the 1990s, extensive efforts were directed to integrated coastal zone management (ICZM). Each of the six GCLME countries developed a Coastal Profile under the SAP development project for the GCLME. Following phase II of the GCLME programme, the 10 newly participating countries prepared Coastal Profiles as the basis for developing ICZM plans. As a national demonstration project, Cameroon developed a multi-sectoral ICZM plan.

The ICZM process helped to identify locations for mangrove restoration, conservation areas, and Marine Protected Areas (MPAs) implementation, including MPAs in Benin that were deemed valuable to protect habitat and biodiversity. The GCLME programme prioritized habitat and mangrove restoration efforts through coordinated national actions, educational workshops/trainings, and pilot project demonstrations. Efforts demonstrated how degraded mangroves and coastal habitats can be restored. They pioneered methods to produce high-quality firewood and food products, using the invasive *Nypa* palm to economically support conservation, restoration, and economic activities. Restoration efforts inventoried degraded GCLME habitats and prepared a report on Physical Alteration and Destruction of Habitats (PADHs) in western Africa, as well as produced a mangrove restoration handbook for local and regional use on the ground.



Mangrove restoration

www.celebrating200years.noaa.gov

ICZM efforts emphasized cooperation and embraced a more participatory approach at the regional level, compared to earlier top-down approaches inherited from colonial systems in Africa. The GCLME programme facilitated ICZM in western Africa through workshops and exchanges, including the training of over 250 individuals in GIS methods as a tool for ICZM implementation. With support from the International Maritime Organization (IMO) under an agreement with UNIDO, as executing agency for GCLME Project, other trainings and workshops covered ballast water (e.g., GEF-UNDP-IMO GloBallast Partnerships Project) and oil spills-dispersant-preparedness best practices, as part of the broader ICZM framework. Throughout this capacity-building process, local and regional ICZM experts leveraged GCLME Project funds with external support to present research at international conferences and participate in exchanges, for example between the Lagos University Centre of Excellence (Nigeria) and University of Rhode Island, USA. Today, the Lagos University Centre of Excellence (Nigeria) liaises with GIS experts in all 16 GCLME countries.

Strong local, regional, national, and international support exists for ICZM, ecosystem conservation, and pollution mitigation in the 16 countries working through the GCLME programme. A GCLME Regional Task Force developed A Regional Strategy and an Action Plan through 2011. It was legally adopted at the 17th Ordinary Meeting of the Contracting Parties to the Abidjan Convention in 2012 with the expectation that the Convention will enter into force in two years.

Highlights

- ICZM in the GCLM region has found success in the education and planning phases, as well as through the on-the-ground implementation with ICZM micro-projects.
- The GCLME programme emphasized low-cost/low-technology solutions as measures to control coastal erosion and promote sustainable tourism, successfully facilitating south-south interchanges between countries for technology transfer and information sharing.
- The GCLME programme facilitated public-private dialogue to include branches of the oil and shipping industry operating with governmental authorities at national, regional, and global levels to address potential risks and challenges. In case of major oil spills, the GCLME programme has agreed on a TOR for a Centre of Excellence to coordinate action for oil spill response.
- GCLME pilot projects and evaluations vetted and evaluated numerous low-cost/low-technology solutions, which are now ready for implementation and scaling up to address large-scale pollution, habitat, and ecosystem health challenges throughout the region.
- The GCLME module on pollution and ecosystem health can serve as a vehicle for future public-private partnerships and co-financing for implementation efforts, as already demonstrated by international partnerships and successes with the GloBallast Partnerships Project, transboundary oil and gas emergency response programmes, and ICZM planning.

Looking Forward

- There is on-going need to develop monitoring and evaluation indicators of pollution and ecosystem health, to consolidate best practices and guidelines (as learned from demonstration projects).
- Future implementation can emphasize low-cost/low-technology solutions to replicate these LME methods in other areas of the coast and develop a second generation GCLME programme that expands upon prior successes.

(iv) GCLME Socioeconomics Module

Connecting international development goals with local and regional actions is a challenge for all sustainable development efforts, which the GCLME programme addressed by establishing and recognizing regional activity centres (RACs) to connect international and national policy goals with local and regional on-the-ground actions. For example, to improve food security and alleviate poverty, the international community recommends national policies that promote a level playing field to ensure broad access to nutritious food throughout western Africa. In theory, such policies can simultaneously bring food security and protect the welfare of the local, artisanal fishermen sector—but the question remains:

How to achieve these objectives through harmonized policies and concrete actions?

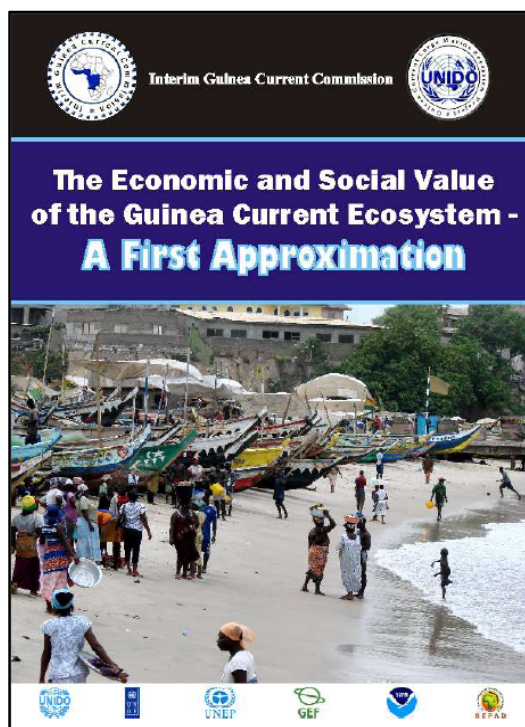
The GCLME programme has accomplished this by establishing RACs, which partly serve as regional intermediaries to connect local and regional efforts with international recommendations and best practices for implementation. As one example, the GCLME Project incorporated economic data and socioeconomic goals into its ECOPATH/ECOSYM workshops, training, and models to evaluate alternative socioeconomic scenarios and predict expected future carrying capacity of the GCLME for sustainable fisheries. These fisheries efforts have been recognized by the regional fishery management organization by signing MOUs with IGCC.

The Human Dimensions

Unlike the other modules in this GCLME programme, socioeconomic data is collected by independent entities like International Monetary Fund (IMF), country Finance Ministries, and statistical bureaus. The GCLME programme and partners did not directly collect socioeconomic data. Instead, the GCLME programme analyzed information collected by existing, on-going surveys.

For the GCLME region the IMF recently forecast economic growth of 5.4 percent in 2013 and 5.7 percent in 2014 with sub-Saharan Africa among the fastest growing places in the world. This growth stems primarily from booming extractive industries of natural resources. Oil and gas exploration and production in the region are steadily increasing and in the near future will result in the GCLME region becoming a major exporter of natural resources. Such development is changing the political and economic fortunes of the GCLME region.

The future challenge for sustaining the goods and services of the GCLME lies in its management of the socioeconomic and environmental issues, arising from rapidly expanding oil and gas exploration and production. Coastal areas are under increasing pressures with populations potentially doubling in 20-25 years and an annual growth rate of over 3 percent (TDA 2006). Socioeconomic challenges result from this rapid growth and migration from rural to coastal and urban areas (UNEP 1999, TDA 2006). Social problems in urban areas include inadequate housing facilities, poor educational facilities, poor health facilities and public hygiene, and high crime rates from high unemployment and poverty (TDA 2006). Rural regions face challenges of poor health and public utilities, inadequate educational facilities, poor quality of housing, and inadequate nutrition. Addressing socioeconomic challenges in the GCLME region has historically proven difficult because of political instability. Intergroup rivalry has been the most common cause of conflict. Despite language, and regional differences, all 16 West and Central African nations continue to engage in the GCLME programme, united with optimism and resolve for pragmatic solutions through transboundary LME efforts.



Based on TDA descriptive information, the GCLME Project conducted an economic study to estimate the value of goods and services obtained from living resources in the region (GCLME 2010b, 2011). Efforts documented the role of economic valuation of ecosystem services in LME conservation with an initial valuation effort for GCLME resources. It outlined various environmental accounting methods with recommendations for generating value estimates for natural resources and ecosystem services across all 16 GCLME countries. The 2010 report estimated the direct output value of GCLME goods and services at approximately \$51 billion with four key sectors: marine fisheries, offshore oil production, non-timber forest products, and mining (sand, salt, granite and phosphate)(GCLME 2010b). The 2011 report used more conservative assumptions to estimate that GCLME ecosystems generate \$17.2 billion each year for the region and that habitat loss costs western Africa a minimum of \$32,000 for each lost hectare of mangrove (GCLME 2011).

The valuation of ecosystem goods and services highlights the importance of long-term sustainable development. Continued economic valuations are encouraged to document how future GEF funding may impact and substantially improve the socioeconomic well-being of GCLME fishermen, mariculture industries, and coastal communities. GCLME return-on-investment estimates of ~\$1 billion dollars for each year of \$5 million GEF support need refining, as they likely overestimate, but these numbers emphasize the importance of ecosystem services.

Highlights

- Despite civil wars, intergroup conflicts, and diverse languages in the GCLME region, the GCLME programme has successfully united 16 West and Central African countries with a shared vision and promised commitment for transboundary cooperation to sustainably manage GCLME goods and services.
- The GCLME programme is the only known programme, project, or effort that consistently proved capable of bringing together top leaders from all 16 GCLME countries to identify and implement solutions to large-scale socioeconomic problems by addressing root causes in a peaceful, collaborative, constructive manner. This infrastructure for socioeconomic solutions is primed for future GCLME implementation efforts.
- The GCLME Project commissioned socioeconomic studies that concluded future GEF funding for GCLME implementation will directly improve the socioeconomic well-being of GCLME fishermen and coastal communities, which translates into ~\$1 billion in additional annual rent for fishermen and coastal communities. Refining is needed, but preliminary valuation estimates highlight the importance of ecosystem services to society.

Looking Forward

- Socioeconomic trends and GDP growth for GCLME countries have improved since the GCLME programme began, with IMF projections positive for Africa, so now is a critical time to foster momentum and scale-up what the GCLME Project demonstrated can work.
- For success with the socioeconomic model, any future GCLME implementation phase should prioritize the development of monitoring indices with measurable metrics to track socioeconomic changes.
- To continue positive trends and improve socioeconomic conditions before they deteriorate beyond the point of irreversible damage and impossible repair, the GEF and international community should support SAP implementation in the GCLME region.

(v) GCLME Governance Module

Inherent to the LME approach, the module for GCLME governance rests on nested scales with communication between local municipal, sub-national, national, LME transboundary, and international levels of government. Except for the GCLME programme and its interim GCC, there are no other institutions or organizations implementing a multi-national ecosystem approach for the sustainable development of the goods and services, resilience and health of the GCLME.

International Cooperation

Intergovernmental Organizations (IGOs), including the GEF and the United Nations, have supported western Africa's GCLME programme and LME framework with significant grants. Resources from IGOs also provide scientific guidance and a proven strategy for long-term sustainable development and self-sufficiency. These international efforts connect to on-the-ground change through national laws, and ministries of the 16 participating countries, typically through Regional Fisheries Management Organizations (RFMOs), the Regional Coordinating Unit (RCU), and RACs developed by the 16 countries through the GCLME programme.



(Interim) Guinea Current Commission (I)GCC

The establishment of the IGCC, soon to become the GCC, initiated a coordinated approach across all 16 countries for the long-term sustainable use and cooperative management of goods and services of the GCLME. The creation of the GCC demonstrates western Africa's commitment to sustainable development. This innovative ecosystem-based governance approach embodies bottom-up efforts for the self-assessment and management of GCLME resources. It transforms the LME vision of adaptive management into concrete action by creating governance agreements and rules to guide 16 countries towards GCLME resource sharing. Despite a lack of GCLME Project funds at the present moment, collaboration continues on the governance front to establish a legal, permanent GCC to coordinate and adaptively manage SAP implementation efforts.

Achieving Governance Success

Through its governance module efforts, the GCLME programme identified political and institutional barriers to sustainable ecosystem development and joint governance of natural resources. Barriers lead to political uncertainty. This translates into uncertainty in ecosystem status and undermines long-term development goals like recovering and sustaining depleted fisheries, restoring degraded habitats, and reducing land and ship-based sources of pollution. To overcome these barriers and advance adaptive management actions, the GCLME programme identified bridges that lend themselves to governance success. Specifically, the GCLME Project developed the Strategic Action Programme (SAP) as a

regional management framework for sustainable use of living and non-living resources. All 16 GCLME countries negotiated the SAP, officially ratifying this policy document in 2007. The SAP details policy, legal and institutional reforms and investments needed to address problems identified in TDA, while providing measurable and quantifiable performance indicators for the GCLME region. The SAP identified the following recommended bridges for governance success, including (SAP 2008):

- Integrated sustainable development of GCLME goods and services.
- Adoption of the precautionary principle, in absence of complete information on ecosystem variability.
- Initiation of anticipatory and cooperative actions, such as ICZM and regional contingency planning.
- Adoption of clean technology methods for pollution control.
- Introduction of multilateral economic and policy instruments, for example, by aligning economic and environmental incentives.
- Agreed upon policies for advancing mandatory environmental, ecosystem, and human health actions.
- Encourage public involvement with private sector in policy and SAP implementation.
- Promote to transparency and accountability in project implementation.



The GCLME programme helps to translate the SAP's policy goals into concrete action at the national level through coordinated and integrative local and regional efforts with international cooperation. This is accomplished through National Action Plans (NAPs), developed and signed by each of the 16 participating countries. NAPs document each country's baseline with incremental processes and costs for future SAP implementation. All of the 16 GCLME countries have committed to these NAPs and future SAP implementation.

Highlights

- Building trust across diverse groups and nations requires long-term commitment and time, as the GCLME programme demonstrated over two decades while establishing trust and partnerships among 16 West and Central African countries.
- The GCLME programme successfully established the IGCC, soon to be the permanent GCC, as a transboundary ecosystem-based governance structure to oversee GCLME ecosystems and resource use.
- Regional centres of capacity for productivity and fisheries created by the GCLME Project effectively connect international development goals with on-the-ground implementation efforts at the regional and local scales.

Looking Forward

- It is the intention of the 16 countries to replace the Interim Guinea Current Commission (IGCC) with a permanent commission serving as a mechanism for coordination and agreement on resource use among the 16 GCLME countries—embracing the LME modules from local to transboundary levels of governance, consistent with the benefits of the ecosystem-based approach being implemented by the Benguela Current LME Commission initiated by Angola, Namibia, and South Africa to the south (see Abidjan Declaration and Abuja Declaration).

GCLME Lessons Learned

Based on the review of project literature and participation in key events, the contributors to the report have noted the following lessons and make subsequent recommendations for positioning future GCLME project interventions.

Since the GOGLME and GCLME SAP development projects began in 1995, the general outlook for the coastal and marine environment of western Africa has improved, especially over the last ten years when GCLME Project efforts went beyond the initial GOGLME efforts. Projected estimates by the GCLME programme and IMF both indicate that positive trends can continue for GDP growth and sustainable development, but these projections depend on commitment and investment from the international community. Such future projections for the GCLME coastal and marine environment based on observed trends and modeling scenarios, are important because they can enhance general awareness and understanding of current and emerging issues. They can act as a wake-up call for appropriate governance, and enable adequate planning and strategy, to build upon the lessons learned and infrastructure of the GCLME programme.

The GCLME programme and networks provide a tractable path for long-term sustainable development, regional stability, and self-sufficiency. All 16 participating countries have committed to work together for sustainable development through legal and political frameworks like the IGCC and GCC. This is a lesson learned for the long-term commitment and emerging self-sufficiency for western Africa. The GCLME programme demonstrates that commitment from all 16 GCLME countries is not only possible, but is a reality today. This commitment, developed over years of prior effort and relationship building, is a solid foundation for future effort and implementation.

Lessons Learned — Capacity Building

Investments in GCLME human capital and local capacity building leads to regional networks like RACs, which effectively address local emergencies, from harmful algal blooms to oil/toxic spill responses. Developing such networks and capacity, however, happens only through long-term commitments. Socioeconomic solutions rely on a foundation of trust, which is built over time through repeated interactions like south-south exchanges, workshops, and meetings, as the GCLME programme committed and demonstrated to bring potentially competing sectors together for common purpose. Developing technical capacity through scientific training and

education has been achieved through RACs. However, capacity building remains a long-term challenge for marine scientists and technicians in western Africa.



After 10 years of scientific investments through the GCLME productivity module, a solid foundation of regional networks exists today. This scientific network only recently began to yield results and scientific insights about GCLME waters, yet is doing so now with regular frequency. Many GCLME experts are now local when it comes to ocean productivity, aquaculture, ICZM planning, emergency response, and environmental sustainability. Fisheries assessment capacity will take longer to develop, as stock assessment science requires doctoral-level training with advanced mathematics and computer programming skills. For the GCLME programme, fisheries science capacity has yet to reach its full potential due to this extremely long-term horizon for developing advanced quantitative skills, but a solid foundation exists. On-going investment in human capacity is recommended, especially if investments are continuous (without project interruptions) with on-site mentoring from full-time, on-site fisheries expert(s) to maximize the development of local talent with investment from SAP implementation.

Lessons Learned —Data Collection & Sharing

Proactively planned data collection with comparable methods and reporting criteria will benefit the GCLME region. The LME approach and ecosystem based management require fishery independent data and ecosystem surveys to most effectively inform management decisions. Therefore, continued data collection and assessment are encouraged to validate initial oceanographic, fisheries, and ecosystem findings through application of the GCLME modules, yet it is critical to strategically conduct scientific efforts with methods embraced by all 16 GCLME

countries. Data should be consistently collected in all 16 countries with regularly repeated surveys, as funding allows. The GCLME Project suffered from lack of repeated and comprehensive surveys, so it would benefit from secure access to a research vessel and monitoring support to regularly survey all GCLME waters. After decades of local capacity building including north-south and south-south exchanges, GCLME regional infrastructure and local networks now exist with capacity to augment fisheries data with fisheries independent surveys. Should funding become available for SAP implementation and future surveys, GCLME experts have the capacity today to conduct surveys and analyze standardized data to guide local, national, and LME management actions with best-available science.

Lessons Learned — Habitat Restoration

The GCLME Project demonstrated that restoration of GCLME mangroves and degraded habitat is possible through the LME approach. Moreover, pilot projects demonstrated new win-win methods of restoring habitat while fostering economic development. For example, the invasive *Nypa* palm can produce high-quality firewood and food products, thereby offering a practicable and replicable way to economically support small-scale industry while restoring mangrove habitats.

Lessons Learned — Low-cost/Low-technology Solutions

Low-cost/low-technology solutions can mitigate and/or prevent habitat loss, water pollution, land pollution, ship-based pollution, mining pollution, and other ecosystem health challenges in the GCLME region.

Lessons Learned — Scale of Challenges to Match the Solution

Some challenges are too big for the GCLME nations to tackle themselves. For example, climate change and IUU fishing are large-scale GCLME challenges that warrant international attention. It is important to match the scale of the challenges to LME efforts and solutions. Within this context, the GEF and international community can assist with funding to augment national efforts, thereby integrating efforts into one united front to match challenges that are beyond the scope of any one country alone.

Lessons Learned — Climate Change

The 16 GCLME countries are ill-equipped to deal with climate change challenges, so support and investment from the international community are necessary. Global

climate models predict that West and Central Africa will suffer disproportionately from climate change impacts, including droughts, floods, decreased fishery yields, and severe weather that will cause socioeconomic and environmental damage. To mitigate impacts, future GEF funding for implementation should incorporate capacity building and knowledge generation to address climatic variability and change. Multiple stresses must be addressed and multiple uses must be reconciled. Future GCLME programme implementation can help to balance these multiple, and potentially competing, goals in a way that involves all 16 GCLME countries.

GCLME Stage Set

The IGCC is an existing framework to combat living resource depletion and coastal area degradation through ecosystem-based regional actions, providing the most logical units to work through in order to achieve sustainable development and self-sufficiency in the GCLME region. All 16 GCLME countries have been active participants committed to continued training and application of the LME assessment and implementation framework for moving ahead recovery and sustainable development of GCLME goods and services. Even in the face of language and cultural differences, all 16 GCLME countries are committed to working together collectively on their shared transboundary ecosystem.

Positive dialogue and LME support exists among all GCLME countries that are primed for capacity building and agreement for improved legal and governance matters at multiple levels—from GCC transboundary to sub-basin, national, and local efforts through the RCU and RACs. The GCLME programme is geared up to continue cross-project learning and knowledge management, as piloted by some local networks and universities in West Africa.

Moving from the planning stage to the implementation stage in the GEF process, the GCLME programme offers opportunity to the global community to advance ecosystem-based management (EBM) in terms of transboundary policies and novel governance structures. Contribution of scientific and technical capacities will still come from partnering with the other countries, including north-south and south-south partnerships. Today, the GCLME countries have a comparative advantage for implementing EBM practices more efficiently without the historical legacy of as much bureaucratic layering of existing rules with shipping, fisheries, and industry regulations going back 100 years, in more industrialized areas. As less of that exists, Africa offers a comparatively clean slate for 21st Century management of global environmental commons. As the GCLME region demonstrates, these countries have effectively implemented EBM practices without bureaucratic layering and historical legacy delays. This puts developing nations, including West African GCLME countries, at the cutting edge of ecosystem-based management. Their experiences offer lessons learned for the world.

For implementation success, the GCLME programme will need GEF and other donor support to help advance the next stage of SAP implementation. GEF support for sustainable development of LME goods and services needs to effectively build upon past GEF investments in coastal and international waters, food security, and sustainable urban development.

- (1) **Coastal and International Waters:** Rebuilding global fisheries is essential for western Africa food security and international trade agreements. The LME approach embraces a coordinated, ecosystem-based approach for assessing and sustainably managing fisheries within a broader ICZM context. Combined with the ocean productivity module to help maximize GCLME fisheries and aquaculture production, the integrated approach of the IGCC will contribute to maintaining fish stocks at sustainable production levels for long-term economic benefits. GEF investment can catalyze a transformation of the GCLME fisheries sector by introducing sustainable fishing practices through applying ecosystem-based frameworks, improved monitoring and enforcement, sustainable aquaculture/mariculture, the expansion of MPAs, and other LME approaches.
- (2) **Food Security:** Land degradation, pollution, and overfishing threaten the livelihoods and food security of people globally, with over 280 million people in the GCLME region directly dependent on coastal areas and resources from the ocean, lagoons, estuaries, creeks, and inshore waters. The GCLME programme directly addresses this challenge through its building of regional capacity and sustainability for optimal harvesting of fisheries, aquaculture, mariculture, and ICZM for agriculture in the coastal zone. The IGCC project offers the best available mechanism, through its existing GCLME platform and network, for a cooperative and transboundary MCS programme to appropriately address the international problem of IUU fishing off West Africa.
- (3) **Sustainable Urban Development:** The GCLME programme has two decades of on-the-ground experience with harnessing local action for global commons, demonstrating how efforts can effectively work through cities, local universities, and regional networks (e.g., RACs and RFMOs). The GCLME programme and existing network are ripe for facilitating the GEF objective of empowering cities with a strong role in facilitating equitable access to and sustainable use of living resources. Because coastal areas and river deltas are population concentrations for major cities in West Africa, the IGCC is a vehicle for facilitating the smart, resilient, and sustainable growth of cities through ICZM efforts and GCLME programme planning capacity.

A Way Forward

The cumulative impact of GEF funding for future GCLME programme implementation will be transformative from a systemic perspective. Future programme implementation will transform tested pilot programmes and small-scale innovative approaches into large-scale successes that fully realize sustainable outcomes along the densely populated West African coast.

Lack of further transboundary GCLME action could lead West and Central Africa to move backwards, risking irreversible environmental degradation and intolerable socioeconomic consequences. This risk is too great to take, given the viable path forward with GCLME programme implementation.

GEF support for financing catalytic SAP implementation is an expeditious and viable path forward for western Africa. Participating countries can build upon prior momentum of the GCLME programme to strengthen existing and establish new NGO and public-private partnerships, as the African economy grows. Financial commitment will strengthen existing relationships, effectively linking all 16 parties together through a shared goal of integrated governance, and scientific leadership and management for sustainable use of GCLME resources.

International support for GCLME SAP implementation will ensure that different sectors of governance—from transboundary to local levels—are nested for cooperative coordination and integration of the project across scales. This involves a long-term commitment to connect inter-linkages that exist across the five LME modules of: (i) productivity, (ii) fish and fisheries, (iii) pollution and ecosystem health, (iv) socioeconomic conditions, and (v) governance with GEF support as a financial mechanism to catalyze co-financing investment and grants for SAP implementation.

The GCLME programme—through its established 16 country-strong infrastructure, network, and Regional Activity Centres—provides a country-driven mechanism for local and regional effort to recover and sustain billions of dollars in marine and coastal goods and services vital to poverty reduction and the economic development of coastal communities throughout western Africa. Momentum exists to scale-up GCLME programme actions and results proven by earlier phase GEF International Waters projects. The 16 countries are primed to begin a country-driven Strategic Action Programme implementation phase for the GCLME with support from the GEF and other key partners for long-term sustainable development and self-sufficiency of the countries and people of West and Central Africa.

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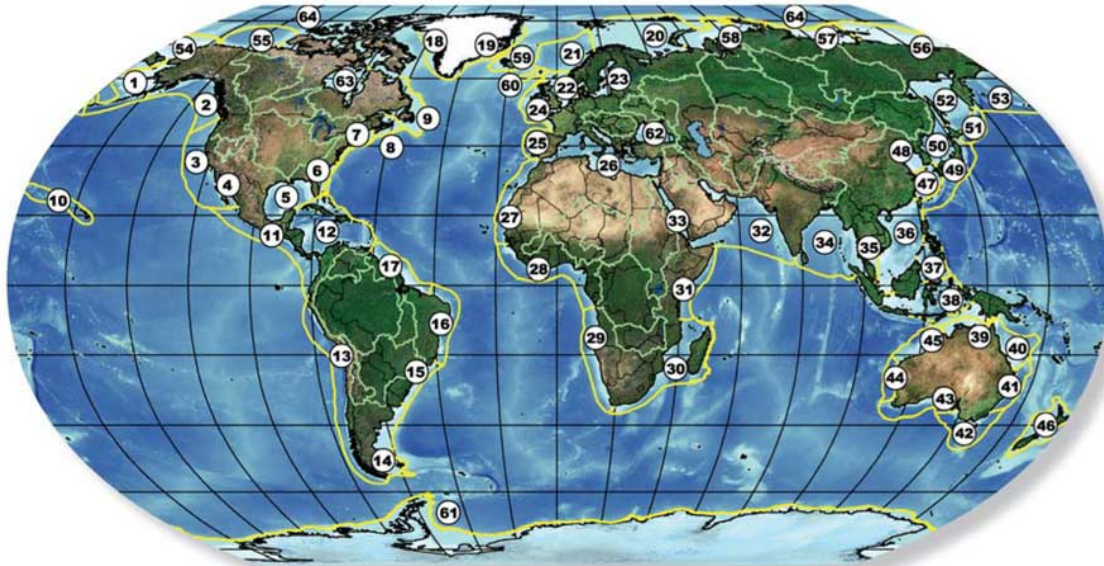
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Appendix 1: The World's Large Marine Ecosystems (LMEs)

Large Marine Ecosystems of the World and Linked Watersheds



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|-------------------------------------|-------------------------|---------------------------|--|----------------------|------------------|
| 1 East Bering Sea | 13 Humboldt Current | 25 Iberian Coastal | 37 Sulu-Celebes Sea | 48 Yellow Sea | 60 Faroe Plateau |
| 2 Gulf of Alaska | 14 Patagonian Shelf | 26 Mediterranean Sea | 38 Indonesian Sea | 49 Kuroshio Current | 61 Antarctic |
| 3 California Current | 15 South Brazil Shelf | 27 Canary Current | 39 North Australian Shelf | 50 Sea of Japan | 62 Black Sea |
| 4 Gulf of California | 16 East Brazil Shelf | 28 Guinea Current | 40 Northeast Australian Shelf-
Great Barrier Reef | 51 Oyashio Current | 63 Hudson Bay |
| 5 Gulf of Mexico | 17 North Brazil Shelf | 29 Benguela Current | 41 East-Central Australian Shelf | 52 Okhotsk Sea | 64 Arctic Ocean |
| 6 Southeast U.S. Continental Shelf | 18 West Greenland Shelf | 30 Agulhas Current | 42 Southeast Australian Shelf | 53 West Bering Sea | |
| 7 Northeast U.S. Continental Shelf | 19 East Greenland Shelf | 31 Somali Coastal Current | 43 Southwest Australian Shelf | 54 Chukchi Sea | |
| 8 Scotian Shelf | 20 Barents Sea | 32 Arabian Sea | 44 West-Central Australian Shelf | 55 Beaufort Sea | |
| 9 Newfoundland-Labrador Shelf | 21 Norwegian Shelf | 33 Red Sea | 45 Northwest Australian Shelf | 56 East Siberian Sea | |
| 10 Insular Pacific-Hawaiian | 22 North Sea | 34 Bay of Bengal | 46 New Zealand Shelf | 57 Laptev Sea | |
| 11 Pacific Central-American Coastal | 23 Baltic Sea | 35 Gulf of Thailand | 47 East China Sea | 58 Kara Sea | |
| 12 Caribbean Sea | 24 Celtic-Biscay Shelf | 36 South China Sea | | 59 Iceland Shelf | |

Image source: NOAA: <http://www.lme.noaa.gov>