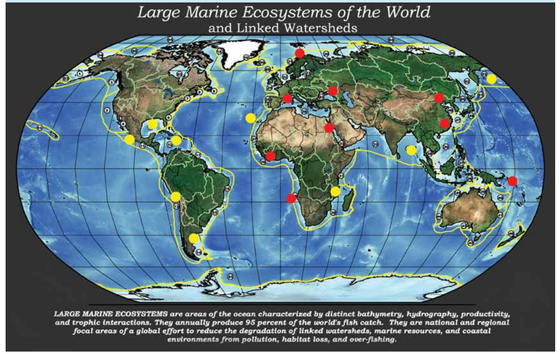
## Regional Seas and GEF-LME Linkages

- The Global Environment Facility (GEF) is a funding agency assisting developing coastal countries to meet ecosystem-related targets. The GEF recommends the use of LMEs as the geographic focus for ecosystem-based assessments and management strategies.
- In 18 GEF-LME projects currently underway, project goals include the joint preparation of a Transboundary Diagnostic Analysis (TDA) and a Strategic Action Plan (SAP), used to prioritize Project actions.
- In a GEF-LME Project TDA, the countries bordering the LME prepare a document based on consensus that ranks coastal resource issues, identifies and prioritizes transboundary problems, analyzes socioeconomic impacts, outlines root causes and advances possible remedies.
- On the basis of the TDA, the countries prepare a Strategic Action Plan (SAP). In the SAP, the countries propose to remedy the transboundary issues identified in the TDA and outline national and regional commitments to policy, legal and institutional reform.
- Countries follow Project goals and milestones leading towards an adaptive, ultimately self-financing, management regime for LMEs located within Regional Seas areas around the globe.
- The TDA and SAP processes for LMEs are consistent with the 2002 Johannesburg targets and Plan of Implementation (POI) of the World Summit on Sustainable Development (WSSD).

### The WSSD targets are useful criteria by which to gauge the progress of GEF-LME Projects

- **Achievement of substantial reductions in land-based sources of pollution by 2006**
- **Introduction of an ecosystems approach to marine resource assessment and management by 2010**
- **Designation of a network of marine protected areas by 2012**
- **Maintenance and restoration of fish stocks to maximum sustainable yield levels by 2015**




18 GEF-LME Projects in Regional Seas. GEF-LME Projects in Regional Seas already approved (red dots) or in the preparation stage (yellow dots), involve 121 countries of Africa, Asia, the Pacific, Latin America & the Caribbean, and Eastern Europe.

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### Network of United Nations Organizations and NGOs participating in GEF-LME Projects

**INTERNATIONAL PARTNERS**

GEF — The Global Environment Facility
The World Bank
IOC — Intergovernmental Oceanographic Commission
UNEP — United Nations Environment Programme
Regional Seas Programme
Global International Waters Assessment (GIWA)
Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (GPA)
UNDP (United Nations Development Programme)
UNIDO (United Nations Industrial Development Organization)
FAO (Food and Agriculture Organization, Fisheries Division)
IUCN (International Union for the Conservation of Nature—World Conservation Union)
WWF (World Wildlife Fund)

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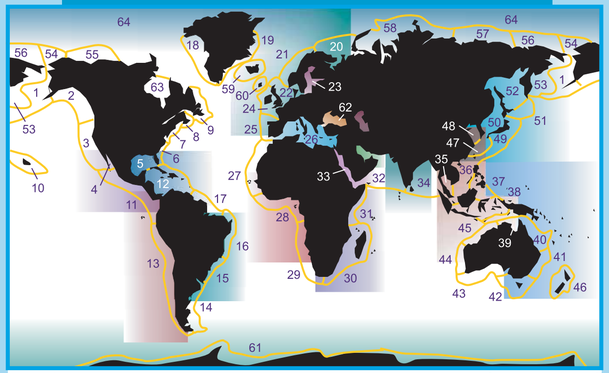
# UNEP Regional Seas Programme

## Linked with

# Large Marine Ecosystems

## Assessment and Management



**Regional Seas, West to East:** North-East Pacific • South-East Pacific • Wider Caribbean • South-West Atlantic • West & Central Africa Mediterranean • Black Sea • Eastern Africa • Red Sea & Gulf of Aden • ROPME Sea Area • South Asian Seas • East Asian Seas North-West Pacific • South Pacific **Independent Partners:** Arctic • North-East Atlantic • Baltic Sea • Caspian Sea • Antarctic

**A new partnership has been developed that links the coast and oceans activities of the United Nations Environment Programme (UNEP) and the US National Oceanographic and Atmospheric Administration (NOAA). The joint initiative incorporates NOAA's Large Marine Ecosystem (LME) assessment and management approach, using LMEs as operational/management units for translating the Regional Seas Programme into concrete actions. This will assist countries in Africa, Asia, Latin America & the Caribbean, and Eastern Europe to restore and sustain resources, coastal environments and linked watersheds.**

- The UNEP Regional Seas Programme is focused on assisting countries in protecting the coastal and marine environment. Regional Seas promotes and advances coastal programmes and legal agreements that help countries move forward to control coastal degradation.
- In 2004, a new strategic initiative was adopted by the Regional Seas Programme. Its aim amongst others is to advance "the development of a common vision and integrated management, based on the ecosystem approach, of priorities and concerns related to the coastal and marine environment and its resources in Regional Seas Conventions and Action Plans."
- Based on this priority a new partnership has been developed that links the Regional Seas Programme and Large Marine Ecosystem (LME) Projects. It focuses on the assessment and management of LMEs located in Regional Seas areas.

## Regional Seas Partners with GEF-LME Projects

### UNEP

Since 1974, the United Nations Environment Programme (UNEP), through its Regional Seas Programme, has been engaged in assisting countries in protecting their marine environment. The UNEP-Regional Seas Programme has developed regional action-oriented programmes and legally-binding regional conventions for countries bordering the 18 Regional Seas. In 1982, UNEP began to address issues related to impacts on the marine environment from land-based activities. The response to intense pressures put on coastal systems was the 1995 Washington Declaration, by 108 governments and the European Commission, to adopt a Global Programme of Action (GPA) for the Protection of the Marine Environment from Land-based Activities. UNEP was tasked to lead the coordination effort and to establish a GPA Coordination Office.

### The GPA and the control of land-based sources of pollution

Some 80% of the pollution load in the oceans originates from land-based activities (municipal, industrial and agricultural wastes, run-off, and atmospheric deposition). These contaminants affect the most productive areas of the marine environment, including estuaries and near-shore coastal waters. The health, and in some cases the very survival, of coastal populations depend upon the health and well being of coastal systems such as estuaries and wetlands. To support the GPA activity, a UNEP/GPA office was established in The Hague, Netherlands. One strategic direction for GPA/Regional Seas in the coming decade is to promote ecosystem-based management.

### UNEP's Regional Seas and LMEs

Large Marine Ecosystems (LMEs) are regions of ocean space of about 200,000 km2 or greater. They encompass coastal areas from river basins and estuaries out seaward to the break or slope of the continental shelf (e.g. Yellow Sea LME), or out to the seaward extent of a well-defined current system (e.g. Guinea Current LME). Some, like the Black Sea LME, are semi-enclosed geographical areas. LMEs are defined by ecological criteria including (1) bottom depth contours, (2) currents and water mass structure, (3) marine productivity, and (4) food webs. LMEs are located within the Regional Seas areas.

- **LMEs annually produce 95% of the world's marine fish catch.**
- **SeaWiFS satellite data provide estimates on LME primary productivity.**
- **Assessments of the changing conditions in LMEs include fish and fisheries, and the influence of land-based sources of pollutants and disruption of the nitrogen cycle on the integrity and health of LMEs.**

LMEs provide a flexible approach to ecosystem-based management by identifying driving forces of ecosystem change. Since 1984, NOAA has been supporting the development of LME assessment and management strategies, in partnership with the IOC, the IUCN and United Nations agencies. Twelve peer-reviewed volumes and case studies of LME management strategies have been published since 1986 (Duda and Sherman, 2002).

### GEF-LME Projects in Regional Seas areas

The Global Environment Facility (GEF) is a funding agency that partners with national and international agencies to assist developing coastal countries in meeting the four ecosystem-related targets agreed upon at the 2002 World Summit on Sustainable Development (WSSD) held in Johannesburg. Since the early 1990s, developing countries have approached the GEF and U.N. implementing agencies, for technical and scientific assistance in restoring and protecting their coastal and marine ecosystems. The GEF recommends the use of LMEs as the geographic focus for ecosystem-based strategies to reduce coastal pollution, restore damaged habitats, and recover depleted fisheries.

## UNEP Regional Seas Programme Linked with the LME Approach

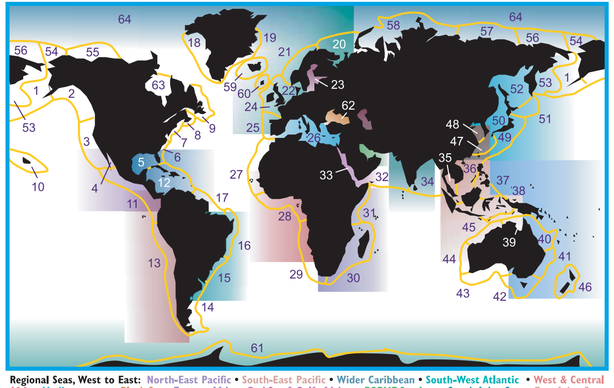
The LME approach is a way forward for promoting ecosystem-based management of coastal and marine resources within a framework of sustainable development. Country-driven GEF-LME assessment and management projects are linked to the WSSD Plan of Implementation and to the UNEP Regional Seas Programme.

- In 18 GEF-LME Projects (either approved or in the preparation stage), 121 countries are moving to meet ecosystem-related targets and to address overfishing, fishing down food webs, destruction of habitat and accelerated nitrogen export.
- In 14 Projects, 111 countries engaged in the Transboundary Diagnostic Analysis (TDA) process have already begun to scientifically characterize the LME, to identify the root causes of trends in LME biomass yields and the most pressing transboundary characteristics of coastal pollution, damaged habitats and depleted fish stocks, in order to prioritize these issues.
- 7 country-driven GEF-LME Projects are advancing to the drafting of the Strategic Action Plan (SAP), in which the countries commit to making institutional arrangements and taking policy actions, based on sound science, to address the issues identified in the TDA. The SAP addresses to correct institutional fragmentation, ecosystem assesment gaps, lack of cooperation and weak coastal policies and is signed by high-level government authorities of each participating country.
- In 13 LMEs out of 29 LME case studies, climate forcing was discovered to be the principal driver of change in biomass yield; in 14 LMEs, it was overfishing; and in one LME, eutrophication. For one LME, the results were inconclusive.
- The strategic framework for developing TDAs and SAPs is guided by the geographic area of LMEs and the application of the 5-module approach to LME assessment and management.

**Table of country-driven GEF-LME Projects with Regional Seas that have established priorities through a Transboundary Diagnostic Analysis and a Strategic Action Programme planning process:**

| GEF-LME Projects | | Regional Seas |
|---|---|---|
| Benguela Current (3 countries) | TDA and SAP | West and Central Africa |
| Red Sea (7 countries) | TDA and SAP | Red Sea and Gulf of Aden |
| Mediterranean Sea (19 countries) | TDA and SAP | Mediterranean Sea |
| Gulf of Guinea (6 countries) | TDA and SAP | West and Central Africa |
| Black Sea (6 countries) | TDA and SAP | Black Sea |
| South China Sea (7 countries) | TDA and SAP | East Asian Seas |
| Yellow Sea (2 countries) | TDA and SAP | North-West Pacific |
| Baltic Sea (9 countries) | TDA and SAP | Baltic Sea |
| Bay of Bengal (8 countries) | TDA and preliminary SAP | South Asian Seas |
| Canary Current (7 countries) | TDA in preparation | West and Central Africa |
| Humboldt Current (2 countries) | TDA in preparation | South-East Pacific |
| Guinea Current (16 countries) | Expanding the SAP and TDA | West and Central Africa |
| Gulf of Mexico (3 countries) | TDA in preparation | Wider Caribbean |
| Caribbean Sea (23 countries) | TDA in preparation | Wider Caribbean |

## Regional Seas & Large Marine Ecosystems



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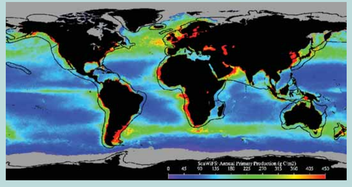
### 64 LMEs of the World

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

| Large Marine Ecosystems | Regional Seas |
|---|---|
| LMEs 1,2,3,4,11 | North-East Pacific |
| LMEs 5,6,12 | Wider Caribbean |
| LME 13 | South-East Pacific |
| LMEs 14,15,16,17 | South-West Atlantic |
| LMEs 19,20,21,22,24,25,59,60 | North-East Atlantic |
| LME 23 | Baltic Sea |
| LME 26 | Mediterranean Sea |
| LMEs 27,28,29 | West & Central Africa |
| LMEs 30,31 | Eastern Africa |
| LME 32 | ROPME Sea Area |
| LME 33 | Red Sea & Gulf of Aden |
| LME 34 | South Asian Seas |
| LMEs 35,36,37,38,39,44,45 | East Asian Seas |
| LMEs 40,41,42,46 | South Pacific |
| LMEs 47,48,49,50,51,52,53 | North-West Pacific |
| LMEs 54,55,56,57,58,64 | Arctic |
| LME 61 | Antarctic |
| LME 62 | Black Sea |



*Global Map of average primary productivity estimates based on SeaWiFS satellite data, with highs in red and lows in purple, and the boundaries of the 64 LMEs. (www.edc.uri.edu/lme)*

## UNEP Regional Seas Programme is Linked to the LME 5-Module Suite of Ecosystem Condition Indicators to Support Management Actions

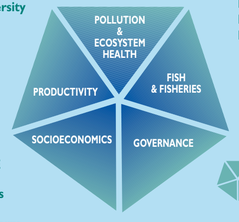
Large Marine Ecosystems (LMEs) are providing countries with a framework for progress in the direction of ecosystem-based adaptive management by recognizing the basic linkages between scientific assessments, protection of the marine environment, sustainable development of coastal and marine resources, and poverty alleviation.

The 5-module LME approach has developed indicators of productivity, fish and fisheries, pollution and ecosystem health, socioeconomics and governance to analyze ecosystem-wide changes. **Productivity** indicators measure the carrying capacity of an ecosystem for supporting living marine resources. The **Fish and Fisheries** module conducts assessments of dominant species within fish communities; and considers effects of naturally occurring environmental shifts in climate regime and excessive fishing effort causing shifts in species composition and abundance. Indicators in the **Pollution and Ecosystem Health** module help assess changes in coastal waters, estuaries and wetlands, and highlight eutrophic conditions. The **Socioeconomics** module examines how a sustainable marine resource base can meet the nutritional, social, economic and developmental needs of humans living in LME border countries. The **Governance** module engages multiple scales of national, regional and local jurisdictional frameworks needed to select and support ecosystem-based management practices leading to sustainable use of resources. The 5-modular approach, which provides the scientific foundation for management actions in ongoing GEF-LME Projects, can also be applied to the management of the 18 Regional Seas.

## Modular Assessments for Sustainable Development

**PRODUCTIVITY MODULE INDICATORS**
Photosynthetic activity
Zooplankton biodiversity
Oceanographic variability
Zooplankton biomass
Ichthyoplankton biodiversity

**POLLUTION & ECOSYSTEM HEALTH MODULE INDICATORS**
Eutrophication
Biotoxins
Pathology
Emerging disease
Health indices
Multiple marine ecological disturbances




**SOCIOECONOMIC MODULE INDICATORS**
Integrated assessments
Human forcing
Sustainability of long-term socioeconomic benefits

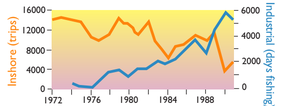
**FISH & FISHERIES MODULE INDICATORS**
Biodiversity
Finfish
Shellfish
Demersal species
Pelagic species

**GOVERNANCE MODULE INDICATORS**
Stakeholder participation
Adaptive management

## Recent Trends in LMEs within Regional Seas, identified through 5-Modular Assessments

### Need for Precautionary Approach:
**Encroachment of Industrial Globalized Fisheries on Artisanal Fisheries in the Guinea Current LME**

K.A. Koranteng (2002) conducted a time series analysis of Catch-Per-Unit-Effort for both small-sized inshore artisanal-type vessels and industrialized fishing fleets from the European Union. The industrialized trawlers are fishing species in areas previously beyond technological and economic reach to support a globalized fishmeal extraction industry, utilized in industrialized farms in the developed world as animal feed or fertilizer. Koranteng found a consistent rise in industrial trawling and a downward trend in inshore seasonal artisanal fishing, which raises concerns for the fish harvest available to meet the growing nutritional needs of the 300 million people living along the Guinea Current coast.

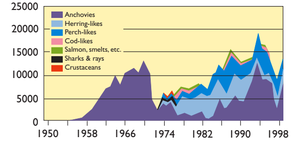



Evolution of trawling effort in the Ghanaian demersal fisheries, by K.A. Koranteng, 2002.

### Need for improved forecasts of fishery fluctuations:
**Toward long-term sustainability of pelagic and demersal fish stocks in the Humboldt Current LME**

The Humboldt Current LME contains the world's largest upwelling system and is the world's most productive marine ecosystem, providing about 15-20% of the world's annual marine catch. Anchovy, sardine and horse mackerel are used for fish meal and for human consumption. Fishing sustains thousands of fishermen and their families. While the high productivity of the Humboldt Current LME is the result of upwelling processes governed by strong southerly trade winds, the upwelling is subjected to considerable interannual climatic variability, which causes variations in marine populations and catch. The normal seasonal upwelling can be interrupted by the El Niño-Southern Oscillation (ENSO) which results in intrusions of warm water. For the long- term sustainability of the pelagic and demersal fish stocks of this LME, improved forecasts of climate-driven fishery fluctuations are required.

Catch (000 tonnes)

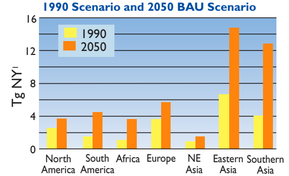



Humboldt Current LME multi-decadal fish catch
Source: UBC at http://data.fisheries.ubc.ca

### Need to curb excessive nitrogen loading:
**Model predictions of nitrogen affecting LMEs show significant increase**

Excessive levels of nitrogen contributing to coastal eutrophication constitute a growing global environmental problem that is cross-sectoral in nature. Excessive nitrogen loadings have been identified as problems in the Baltic Sea, Black Sea, Adriatic portion of the Mediterranean, Yellow Sea, South China Sea, Bay of Bengal, Gulf of Mexico, and Patagonian Shelf LMEs. Model-predicted global estimates of dissolved inorganic nitrogen (DIN) export from freshwater basins to coastal waters in 1990 and 2050 have been developed by Kroeze and Seitzinger, 1999. These estimates, based on a business-as-usual (BAU) scenario, are cause for concern for future sustainability. Given the expected future increases in population and in fertilizer use, without significant nitrogen mitigation efforts, LMEs will be subjected to a future of increasing harmful algal bloom events, reduced fisheries, and hypoxia that will further degrade marine biomass and biological diversity.

**DIN Export by Rivers for World Regions**
**1990 Scenario and 2050 BAU Scenario**




Model-predicted nitrogen (dissolved inorganic N) export by rivers to coastal systems in 1990 and in 2050 — based on a business-as-usual (BAU) scenario. Figure modified from Kroeze and Seitzinger (1999).