



# Intergovernmental Oceanographic Commission – UNESCO's support for management of Large Marine Ecosystems



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## ABSTRACT

Over the past two decades the Intergovernmental Oceanographic Commission (IOC) of the United Nations Education, Scientific and Cultural Organization (UNESCO) has been a key actor in the global effort to promote sustainable use and management of Large Marine Ecosystems (LMEs). Among the Commission's LME initiatives are a global comparative assessment of LMEs under the Transboundary Waters Assessment Programme and the LME: Learning Exchange and Resources Network project, both supported by the Global Environment Facility, and annual meetings of the LME Consultative Committee. A brief description of each of these initiatives is given in this commentary.

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## 1. LME initiatives

### 1.1. Transboundary Waters Assessment Programme: Large Marine Ecosystems component

Since the mid-1990s, 110 developing countries in Africa, Asia, Latin America, the Pacific, Arctic and eastern Europe, have been provided with over US\$3 billion, principally by the Global Environment Facility (GEF) but also other financial institutions including the World Bank, to advance toward ecosystem-based management (EBM) in 22 Large Marine Ecosystems (LMEs). Despite these efforts, however, the need remained for a global comparative assessment of LMEs and other transboundary water systems (Open Ocean, River Basins, Groundwater Aquifers, and Lakes and Reservoirs) that would assist GEF, policy makers, and the international community to set priorities for the management of transboundary waters, and provide a baseline for monitoring future changes in the condition of these systems. Thus, in 2009, the GEF-supported Transboundary Waters Assessment Programme (TWAP) was initiated, with the United Nations Environment Programme (UNEP) as the implementing agency and the Intergovernmental Oceanographic Commission (IOC) of UNESCO the executing agency of the LMEs and Open Ocean components. Other executing partners are UNEP-DHI (River Basins), the International Hydrological Programme of UNESCO (Groundwater Aquifers), and the International Lake Environment Committee (Lakes and Reservoirs). Each executing agency convened a working group of international experts and institutional partners who possess the required data and expertise to contribute to the TWAP.

The first TWAP project (2009–2010) focused on the development of scientifically robust, indicator-based methodologies and institutional arrangements for assessment of the five transboundary waters systems. The LMEs assessment methodology is available at (<http://www.geftwap.org/publications>). A central theme of the LMEs assessment is the vulnerability of ecosystems and human communities to natural and anthropogenic stressors, and impairment of ecosystem services and

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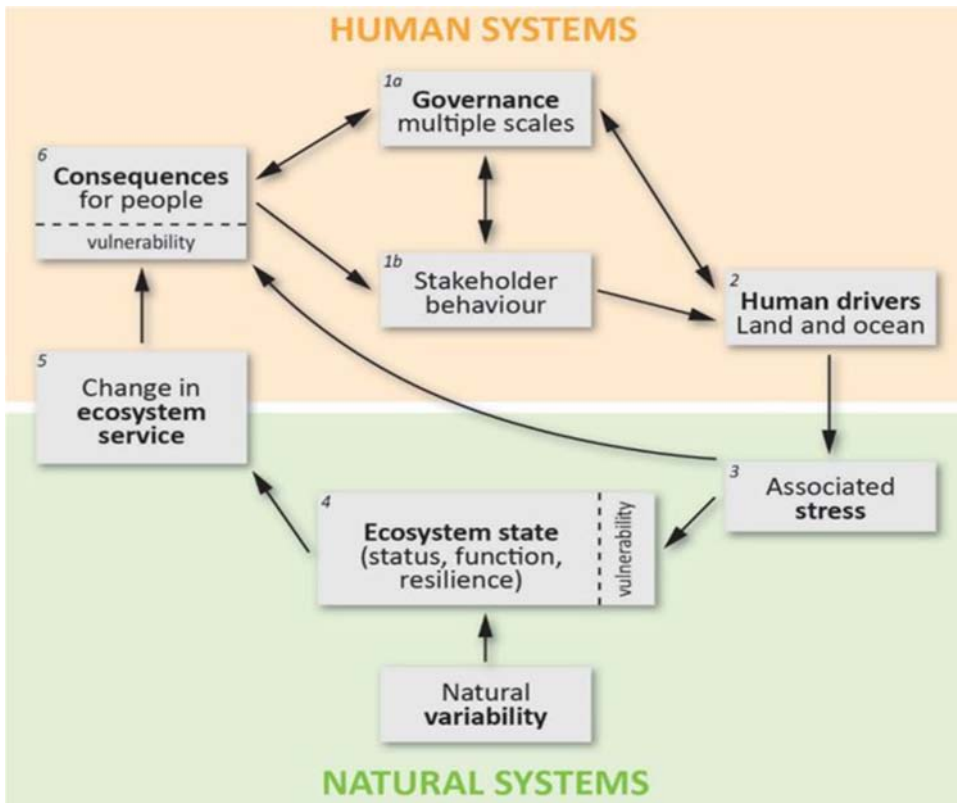


Fig. 1. TWAP LMEs assessment conceptual framework depicting interactions between human and natural systems.

consequences for humans. These links (with governance as an overarching concept) are illustrated in a conceptual framework (Fig. 1), which builds on the five LME modules (Productivity, Fish and Fisheries, Pollution and Ecosystem Health, Socio-economics, and Governance).

The second TWAP project, conducted from 2013–2015, has two major objectives:

1. To conduct a global baseline comparative assessment of the status and changing condition of transboundary water systems resulting from human and natural causes, which will allow the GEF, policy makers and international organizations to set science-based priorities for financial resource allocation; and
2. To establish the institutional arrangements for conducting periodic future assessments of transboundary water systems to allow the GEF and others to track the results of their interventions.

The TWAP LMEs assessment, which is the first indicator-based global comparative assessment of all 66 LMEs, seeks to identify LMEs that are most impacted by human and natural stressors. Projections to years 2030 and 2050 under different scenarios are given for several of the indicators. An assessment of the Western Pacific Warm Pool (WPWP), based on a subset of the indicators is also included. Because the assessment is a global comparative assessment, the selection of indicators was constrained by the availability of globally available datasets. Indicators in each of the five LME modules that are used in the current assessment are shown in Table 1.

To facilitate a comparative assessment, a consistent indicator scoring system with a sufficient number of categories to identify patterns of risk among LMEs (i.e., LMEs at different levels of risk or degradation) is required. A five-point system was developed, with 1–5 corresponding to lowest, low, medium, high and highest risk or level of degradation, respectively. This approach, however, is not suitable for indicators without clear directionality in terms of what could be considered “good” or “bad” (such as primary productivity and sea surface temperature); the interpretation of such indicators is context-specific. LMEs were placed into the five categories based on single indicators and on multivariate statistical analyses of multiple indicators with clear directionality.

Using the selected indicators, key questions that the comparative assessment seeks to answer are:

- Which LMEs are most heavily impacted for each issue?
- What are the current trends in LMEs and main drivers?
- Which ecosystem services are most at risk?

**Table 1**  
Indicators used in the TWAP LMEs assessment, under the five LME modules.

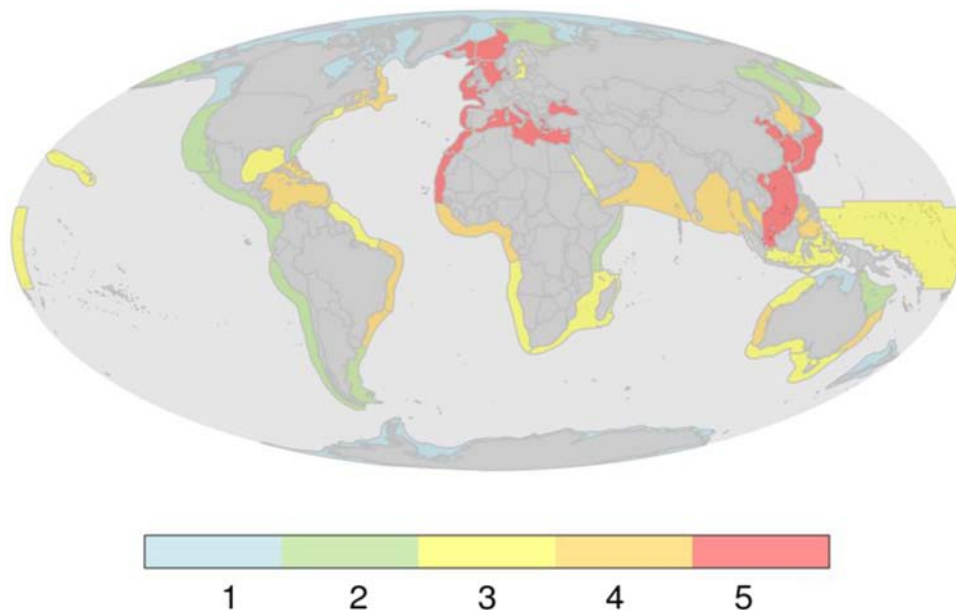
Productivity	Fish and Fisheries	Pollution and Ecosystem Health	Socio-economics	Governance
<ul style="list-style-type: none"> <li>• Chlorophyll a</li> <li>• Primary productivity</li> <li>• Sea surface temperature</li> </ul>	<ul style="list-style-type: none"> <li>• Annual landings</li> <li>• Catch value</li> <li>• Marine Trophic Index/ Fishing in Balance Index</li> <li>• Fishing subsidies</li> <li>• % overexploited and collapsed stocks</li> <li>• Catch from bottom impacting gear</li> <li>• Fishing effort</li> <li>• Catch potential projections under global warming</li> </ul>	<ul style="list-style-type: none"> <li>• Nutrient inputs</li> <li>• Index of Coastal Eutrophication Potential</li> <li>• POPs in plastic pellets</li> <li>• Plastic debris density</li> <li>• Change in MPA coverage</li> <li>• Reefs at Risk Index</li> <li>• Coral reef and mangrove extent</li> <li>• Cumulative Human Impacts</li> <li>• Ocean Health Index</li> </ul>	<ul style="list-style-type: none"> <li>• Fisheries revenues</li> <li>• Tourism revenues</li> <li>• Coastal population</li> <li>• Human Development Index</li> <li>• Night Light Development Index</li> <li>• Climate Threat Index</li> <li>• Sea Level Rise Threat Index</li> </ul>	<ul style="list-style-type: none"> <li>• Governance architecture in trans-boundary LMEs</li> </ul>

- Where is human dependency on LME ecosystem services the greatest?
- Where are humans most vulnerable to changes in LME condition?
- What is the status of the governance architecture or arrangements in transboundary LMEs?

LMEs assessment results and underpinning data will be available in the main assessment report, and through the LMEs website and data portal. As an illustration of some of the assessment results, the following map is presented (Fig. 2) showing the Cumulative Human Impact in the 66 LMEs and WPWP, grouped into the five risk categories.

While the main client of TWAP is clearly the GEF, such a mechanism will also help regional and national decision-makers in assessing the overall health of their LMEs while also anticipating future stressors that may affect their marine ecosystems and the services they provide to humans. The TWAP LMEs assessment can contribute scientific data and indicators to the Transboundary Diagnostic Analysis/Strategic Action Programmes for individual LMEs, to other global and regional assessment processes such as the UN World Ocean Assessment (WOA) and the UNEP Regional Seas Programme as well as to monitoring with respect to the Sustainable Development Goal for the ocean and coasts.

The TWAP LMEs component will also set the foundation for future periodic assessments, which will be dependant on various factors, including sustaining the current partnership that is led by the IOC. The experts and institutional partners who are participating in this assessment have indicated their interest in participating in future assessments, and the IOC will identify other appropriate partners as necessary. It is anticipated that the LMEs assessments would be conducted at regular intervals of at least five years. Future assessments will include level 2 assessment, i.e., more detailed assessments at the sub-LME scale and using additional relevant indicators.



**Fig. 2.** Cumulative Human Impact in LMEs, arranged into the five, colour-coded risk categories (Source: B. Halpern, University of California, Santa Barbara). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

### 1.2. *Building a global community of LME practitioners: integration of expertise and best practices*

The TWAP LMEs assessment will also contribute to reinforcing the LME community of practitioners by providing a robust, tested and harmonized assessment methodology that can be used to engage local stakeholders responsible for marine resources management. The numerous GEF LMEs and Integrated Coastal Management projects have already amassed considerable knowledge and experiences. There is need for a coordinated approach to harvest this knowledge and to capitalize on the experiences, to build consensus with existing and new partners, and to generate coherent knowledge products, and educational and training materials to share with nation States, LME project scientists and managers, and regional and global partners and practitioners. To meet this need, the GEF-supported LME-LEARN (Learning Exchange and Resource Network) project, which will be led by the IOC, will focus on

- Building global and regional networks of partners to enhance ecosystem-based management and to provide support for the GEF-International Waters LMEs/Integrated Coastal Management (ICM)/Marine Spatial Planning (MSP)/Marine Protected Areas (MPA) projects;
- Mobilizing knowledge, capturing best LME governance practices, and developing new tools to enhance the management effectiveness of ICM, MPAs, and MSP within the spatial domains of LMEs;
- Strengthening capacity and partnership building through twinning, learning exchanges, and training among LMEs and similar initiatives;
- Providing communication, dissemination and outreach of GEF LME/ICM/MSP/MPA project achievements and lessons learned.

The LME-LEARN project was approved by GEF in May 2015 and is expected to be initiated in the fall of 2015.

### 1.3. *LME Consultative Committee annual meeting*

As a key mechanism for bringing together LME leaders around the world, the IOC, in collaboration with the US National Oceanic and Atmospheric Administration, the International Union for Conservation of Nature, the United Nations Development Programme, the International Council for the Exploration of the Sea and the GEF, has convened the annual meeting of the LME Consultative Committee since 1995. The 17th annual meeting will be held in September 2015 at the IOC headquarters in Paris. Specific objectives of the meeting are to

- Foster a mutually supportive global network of leaders and institutions engaged in marine and coastal ecosystem based management by providing a forum for project (i.e. LME, ICM, MPA, others) leaders to discuss experiences and lessons learned;
- Mobilize knowledge resources, new scientific applications and tools to support project implementation and organizational action related to priority knowledge topics;
- Review marine and coastal project progress in regions, disseminating best practices amongst projects, and discuss emerging issues requiring common responses;
- Share lessons learned from existing efforts with regard to the LME-LEARN project priorities and identify future priorities to help guide the LME-LEARN project.

The above activities along with the numerous other LME initiatives around the world are positive signals with respect to ecosystem-based management of the ocean and coasts. The LME initiatives are contributing to the paradigm shift, helping nations to move from sectoral, single species management approaches to integrated and ecosystem-based management. LMEs are hence providing a key framework for meeting international commitments such as the one made at Rio+20 to 'protect, and restore the health, productivity and resilience of oceans and marine ecosystems' as well as to 'effectively apply an ecosystem approach and the precautionary approach in the management.'

The adoption in September 2015 by the UN of a new post-2015 development agenda, supported by a set of Sustainable Development Goals (SDGs) that include the ocean, is very encouraging. The proposed SDG #14 calls for nations to "Conserve and sustainably use the oceans, seas and marine resources for sustainable development" and identifies a number of key targets that are well-aligned with those of LMEs. These include the need to reduce marine pollution of all kinds (including nutrients), to sustainably manage and protect marine and coastal ecosystem, and to support sustainable development of fisheries. LMEs, through their robust assessment methodologies and Strategic Action Programmes, can help to translate these global targets to the regional and national scales. The IOC is fully committed to supporting the GEF and the LME community in meeting these objectives.