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Development of the Methodology and Arrangements for the Global Environment Facility Transboundary Waters Assessment Programme (TWAP)

Large Marine Ecosystems and Open Ocean Components

DRAFT
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DEVELOPMENT OF THE METHODOLOGY AND ARRANGEMENTS FOR THE GLOBAL ENVIRONMENT FACILITY TRANSBOUNDARY WATERS ASSESSMENT PROGRAMME (TWAP)

LARGE MARINE ECOSYSTEMS AND OPEN OCEAN COMPONENTS

1. INTRODUCTION TO TWAP

Project Title

The Global Environment Facility (GEF) medium size project (MSP) '*Development of the Methodology and Arrangements for the GEF Transboundary Waters Assessment Programme (TWAP)*'.

Objectives of the medium sized project

To develop:

(i) *An indicator-based methodology for assessment/results tracking for each of the five categories of transboundary water systems (groundwater; lakes/reservoirs; river basins; Large Marine Ecosystems; and Open Ocean);*

(ii) *A partnership and institutional arrangements to conduct a global transboundary waters assessment following completion of the MSP.*

Objectives of the TWAP full size project

The major objective of the TWAP full size project (FSP) will be to conduct an assessment of priority and emerging transboundary environmental issues in the five water systems, applying indicators of transboundary stressors and environmental state, socioeconomics (drivers and impacts), and governance/response, within an overarching framework based on ecosystems goods and services. The methodology will be used in the first instance for a comparative baseline assessment of the condition of each of the five types of transboundary water systems to enable GEF to identify and prioritize those in need of urgent intervention. Subsequent assessments will help GEF and others to track changes over time in the condition of these water bodies. TWAP will also take into account key interlinkages between water systems and cross-cutting issues (mercury and nutrients). The TWAP assessment will be conducted at two levels:

Level 1

Level 1 will consist of a cost-effective global comparison and prioritization of transboundary waters using a set of core indicators for which data are available globally. This will be a baseline assessment of current status and stressors, and where possible, future projections (to years 2030 and 2050) and likely impacts.

Level 2

The objective of the Level 2 assessment is to produce a more advanced assessment of selected transboundary waters systems in greater detail, where data are available. This could include transboundary diagnostic analysis (TDA) of transboundary concerns and causal chain analysis (CCA) based on GEF-approved TDA methodology.

Data Sources

TWAP will be based on global and regional data (and where necessary, national data) already available/being collected by its partners. It is not the intention to collect data under TWAP. A number of partners will provide data for TWAP.

Rationale

The project arose out of the need for a systematic and scientific methodology for assessing the changing conditions of transboundary water systems resulting from human and natural causes, which would allow the GEF, policy makers, and international organizations to set science-based priorities for financial resource allocation and to track the results of interventions by national authorities and international/regional communities. Currently there is no global programme focusing on transboundary water assessment nor existing global baselines. There is a need to develop a methodology to establish the baseline as well as to track changes over time.

Duration

July 2009 – November 2010, Full-sized project expected in the 2012-2014 time frame

Implementing Agency

United Nations Environment Programme Division of Early Warning and Assessment (UNEP DEWA), Nairobi

Executing Agency (Large Marine Ecosystem and Open Ocean components)

Intergovernmental Oceanographic Commission (IOC) of UNESCO. Two working groups of experts and institutional partners have been established to develop the methodology.

Major partners (LMEs and Open Ocean)

GESAMP, IGBP, NOAA, UNEP GRID-Arendal, UNEP-WCMC, University of British Columbia Fisheries Centre, National Center for Ecological Analysis and Synthesis (NCEAS, UCSB), FAO, IUCN, SAHFOS, WCRP.

End Users

The main user of the TWAP assessment results will be the GEF, with other potential users to include UN organizations, regional and global institutions and programmes, and national governments. It is hoped that close linkages will be established between TWAP and the Regional Seas Programmes as well as the UN Regular Process.

2. METHODOLOGY

Overarching framework

The conceptual framework for the TWAP LME and Open Ocean assessments is meant to clarify for the goals of TWAP the relationship between human and natural systems, and to help to identify why particular indicators are proposed and their relevance, where assumptions have been made, and where gaps in knowledge and data may exist. The framework draws on assessment efforts that focus on the idea of 'causal chains'. In short, human activities have associated stressors that in turn impact natural systems and this in turn affects the delivery (and value) of services to people (starting in box 2 below and going clockwise). Ultimately we want to know how people are affected (box 6 in bold), but these ultimate responses may not have easy indicators to develop and may take time, so there is value in having rapid 'early indicator' metrics that are earlier in the causal chain. Understanding and modeling this causal chain allows one to assess the relationship between indicators earlier in the causal chain while keeping in mind the ultimate goal.

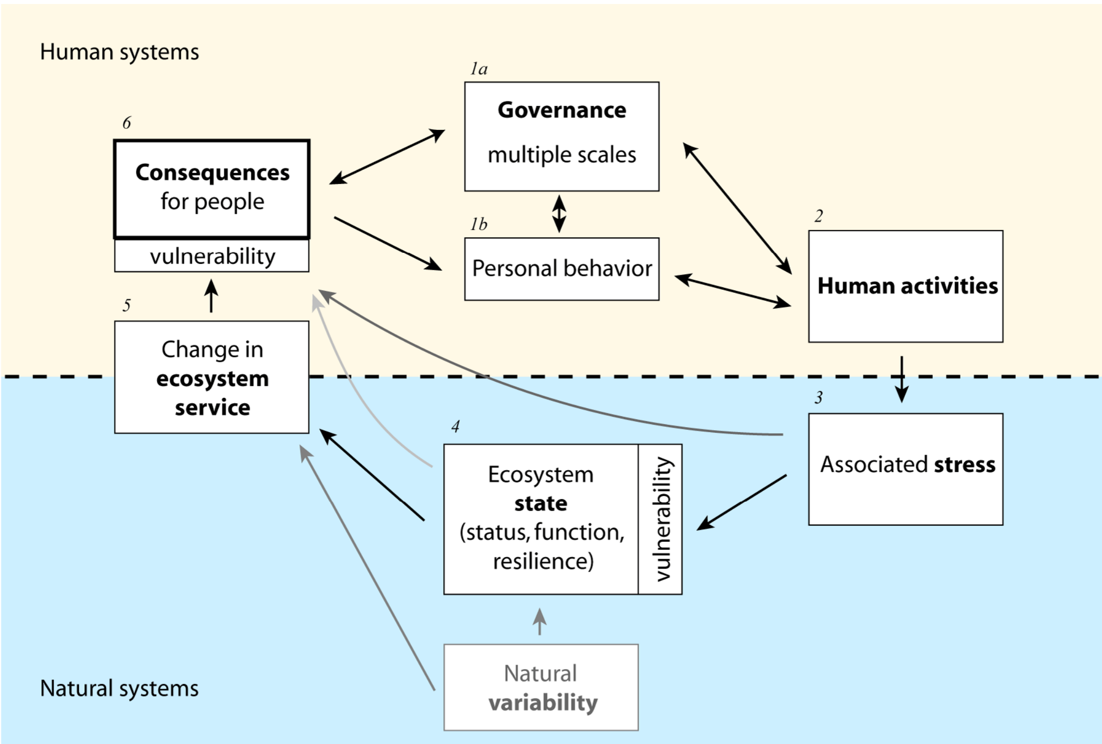


Figure 1. Conceptual framework for the TWAP LME and Open Ocean, describing the relationship between human systems and natural systems from the point of view of ecosystem services and its consequences for people. Within TWAP this allows an identification of data sources and gaps, of assumptions made, of some factors peripheral to the central framework

that may come into play, and of natural points of intervention for management.

The framework tries to merge several existing conceptual frameworks: the Driving force-Pressure-State-Impact-Response (DPSIR) framework, indicator science, an emerging focus on ecosystem services, and cumulative impact modeling, all with a strong focus on governance and socioeconomics - on how to manage the human-natural system interaction.

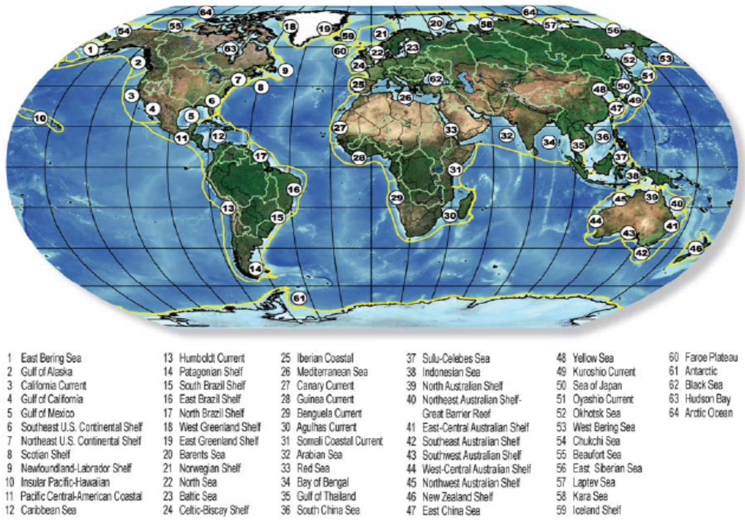
The way that indicator science fits into this framework is via the need to select indicators that actually indicate what you care about. So we ultimately care about consequences for people, such that long-term indicators should focus on this box. But all of the preceding boxes can give us insight into likely outcomes for people, and often respond on much shorter time frames. We should therefore clearly articulate our management goals and the reasons for wanting to track particular information, and then design indicators that meet those goals. For example, we might want to track the amount of area set aside in MPAs (the human activity of protection) because it gives us an easy-to-measure indicator of changes in stressors (fishing pressure) that we assume improves the status of ecosystems (which is much harder to measure, particularly in the vastness of the open ocean), and this has been shown to provide benefits to humans. The indicator is indirectly connected to the thing we care about (benefit to people) through a number of assumptions. Making clear all of these assumptions and how directly or indirectly an indicator connects to our ultimate goal is critical so that we can 1) give a sense of the amount of uncertainty in how well our indicator tracks what we ultimately care about and 2) clearly articulate exactly what the indicator is tracking within the broader framework.

The framework allows and is useful for assessing the potential consequences of different management scenarios within a context of changing human activities and associated stressors (through the addition of new stressors and the changing intensity of existing stressors). A given management decision (or change in the intensity of a stressor due to other reasons) will lead to a changing suite of human activities and stressor intensities, which will in turn alter the attributes of the following boxes in the framework. These changes can be predicted, and then monitored to test the validity of predictions.

3. LARGE MARINE ECOSYSTEMS AND THE FIVE LME MODULES

Large Marine Ecosystems (LMEs) are natural regions of coastal ocean space encompassing waters from river basins and estuaries to the seaward boundaries of continental shelves and seaward margins of coastal currents and water masses. They are relatively large regions of 200,000 km^2 or greater, the natural boundaries of which are based on four ecological criteria: bathymetry, hydrography, productivity, and trophically related populations (Sherman 1994, Duda and Sherman 2002). Sixty-four LMEs have been designated in the coastal areas around the margins of the Atlantic, Pacific, and Indian Oceans (see map). The Western Pacific Warm Pool has also been designated as an LME.

The LME approach to the assessment and management of marine resources is based on the operationalization of five modules, with suites of indicators for monitoring and assessing changing conditions in marine ecosystems: i) Productivity, ii) Fish and Fisheries, iii) Pollution and Ecosystem Health, iv) Socioeconomics, and v) Governance. The UNEP LME report presents the first global assessment of LMEs based on the five modules[1].



Map of the 64 Large Marine Ecosystems of the world and their linked watersheds

LME METHODOLOGY AND DATA AVAILABILITY

The following presents a list of indicators by LME module (see also Annex 1) and examples of some of the core indicators.

PRODUCTIVITY

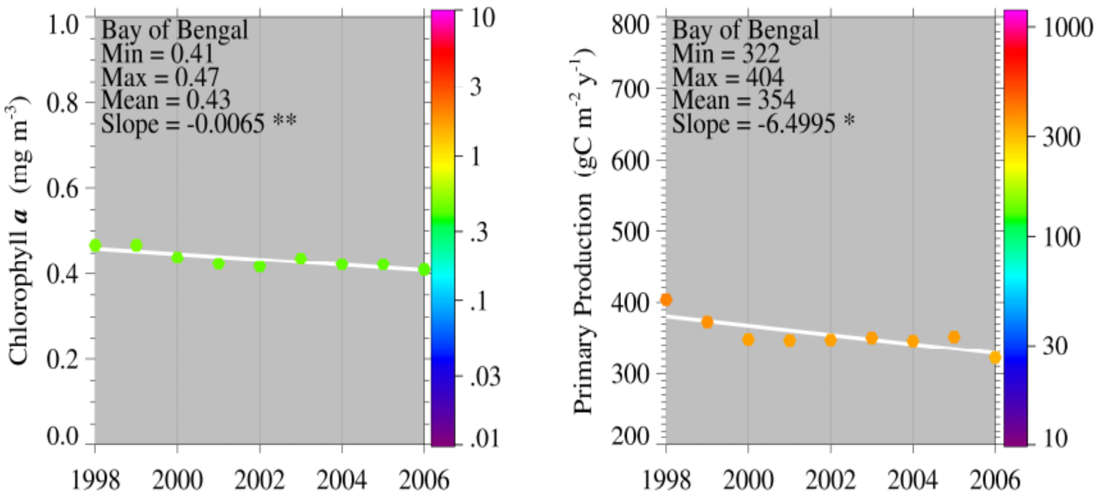
Core indicators: Primary productivity; Chlorophyll a, and Sea surface temperature (SST).

Other indicators: zooplankton and oceanographic fronts.

Primary productivity

Primary productivity estimates are derived from satellite-borne data archived at NOAA's Northeast Fisheries Science Center, Narragansett Laboratory. These estimates originate from ocean color sensors and satellites including the Coastal Zone Color Scanner (CZCS) Sea-viewing Wide Field-of-view Sensor (SeaWiFS), and Moderate Resolution Imaging Spectroradiometer (MODIS-Aqua and MODISTerra). Examples are shown below. The major partner is NOAA and University of Rhode Island.

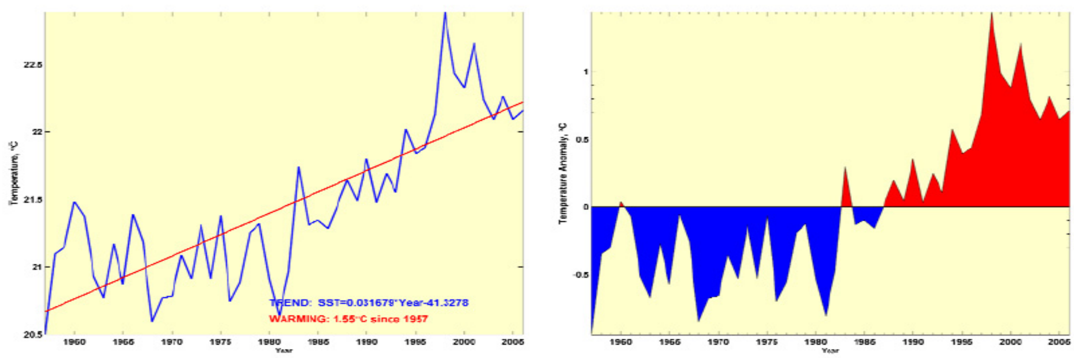
[1] The UNEP Large Marine Ecosystem Report: A perspective on changing conditions in LMEs of the world's Regional Seas. 2008. Sherman K, Hempel G, eds. UNEP Regional Seas Report and Studies No. 182. United Nations Environment Programme. Nairobi, Kenya. 872 p.



Chlorophyll (left) and Primary productivity (right) trends (1998-2006): Bay of Bengal LME.

Sea Surface Temperature

Data from the U.K. Meteorological Office Hadley Centre SST climatology will be used to compute time-series of SST and examine SST anomalies. The Hadley data set consists of monthly SSTs calculated for each 1° x 1° rectangular cell (spherical trapezoid, to be exact) between 90°N-90°S, 180°W-180°E. LME-averaged SSTs and SST anomalies would be produced for each LME.



East China Sea LME annual mean SST (left) and SST anomalies (right), 1957-2006, based on Hadley climatology (after Belkin 2009)

FISH AND FISHERIES

Indicators and data will be provided by University of British Columbia (UBC) Fisheries Centre Sea Around Us project. Where possible, time series will be presented from 1950 –present.

Core indicators are: Reported landings by species, Predicted catch potential (2055/2005) under different climate scenarios, Value of reported landings, Fishing Effort, Primary Production

Required to sustain fisheries, Marine Trophic Index and Fishing in Balance Index, and Stock-Catch Status Plots.

Other indicators are: Fisheries carrying capacity, Species distributions (Aquamaps), Carrying capacity, Species invasion and extirpation, Stock abundance and trends.

Reported landings and value

Time series of landings are provided by the Sea Around Us project (UBC Fisheries Centre) using a method developed by Watson and others (2004) to reconstruct catches reported to FAO. This relies on splitting the world oceans into more than 180,000 spatial cells of ½ degree lat.-long., and mapping onto these cells, by species and higher taxa, all catches that are extracted from such cells.

Catch value is the ex-vessel value of reported landings by LMEs, based on real 2000 prices, i.e., deflated prices (Sumaila and others 2007). To be able to evaluate the ex-vessel value of fisheries worldwide, a database of ex-vessel fish price data was constructed, based on 1) observed prices in different countries at different times for different species; and 2) inferred prices, based on observed prices and an averaging algorithm which took taxonomic affinity, adjacency of countries and time into account.

Predicted Catch Potential (2055/2005)

Cheung and others (2008) projected future changes in catch potential under the two climate change scenarios. Change in maximum catch potential (10-year average) from 2005 to 2055 is presented for ½˚ by ½˚ spatial cells (global coverage). This will be presented for each LME.