17th LME PARIS 2015

TWAP
TRANSBOUNDARY WATERS ASSESSMENT PROGRAMME

Transboundary Waters Assessment Programme: Global comparative assessment of LMEs

S. Heileman, J. Barbiere (IOC-UNESCO)
L. McManus (UNEP)

Session: **5**
Day of presentation: **1st October 2015**

IOC UNDP gef NOAA ICES CIEM IUCN

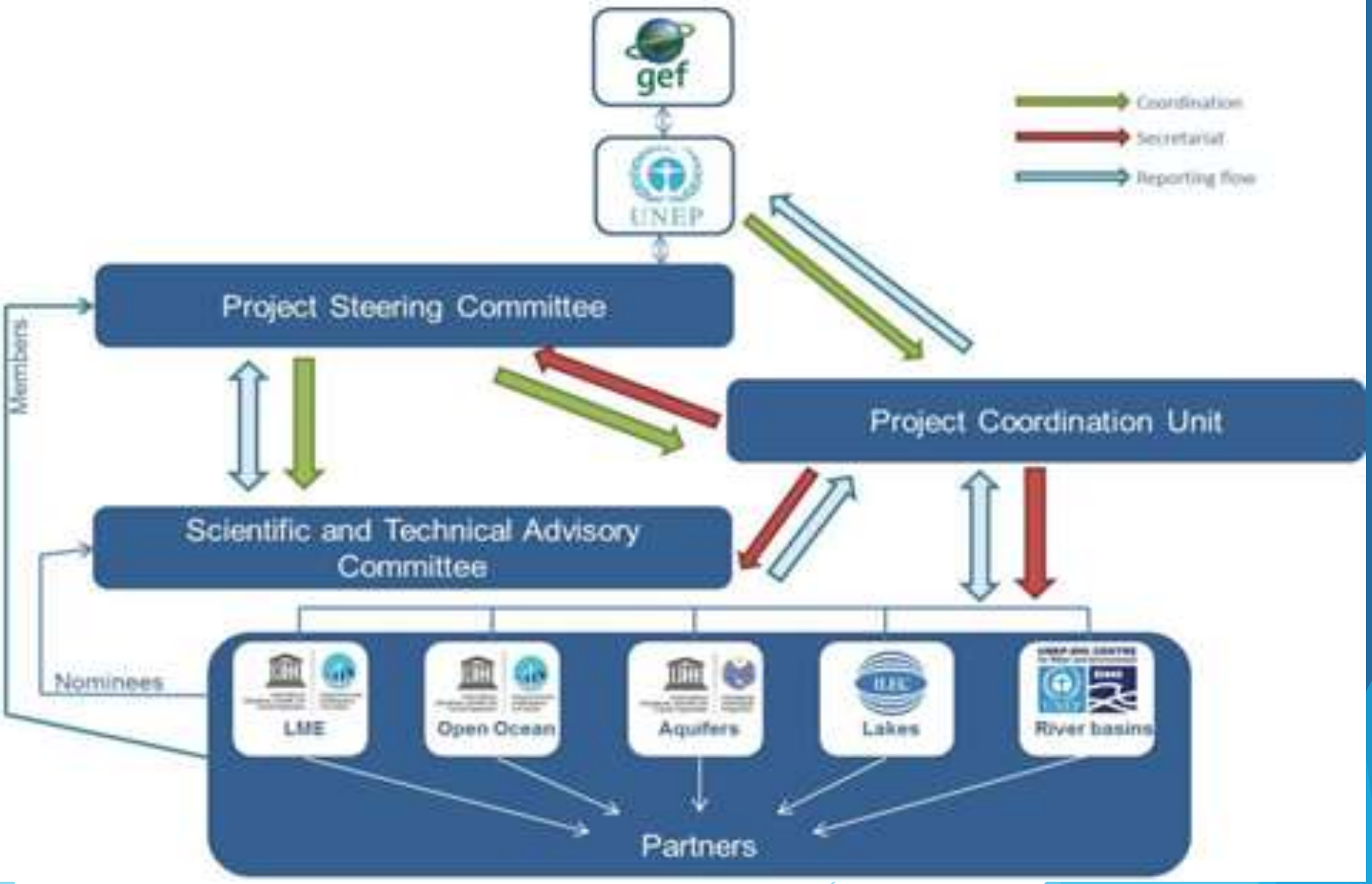
TWAP objectives

1. To undertake the first global baseline assessment of transboundary groundwater aquifers, lakes/reservoirs, river basins, large marine ecosystems, and open ocean areas through a formalized consortium of partners, that will assist GEF and other international organizations to improve the setting of priorities for funding allocations

2. To formalize a partnership with key institutions aimed at incorporating transboundary considerations into regular assessment programmes, resulting in periodic assessments of transboundary water bodies.

- Duration: April 2013 - December 2015

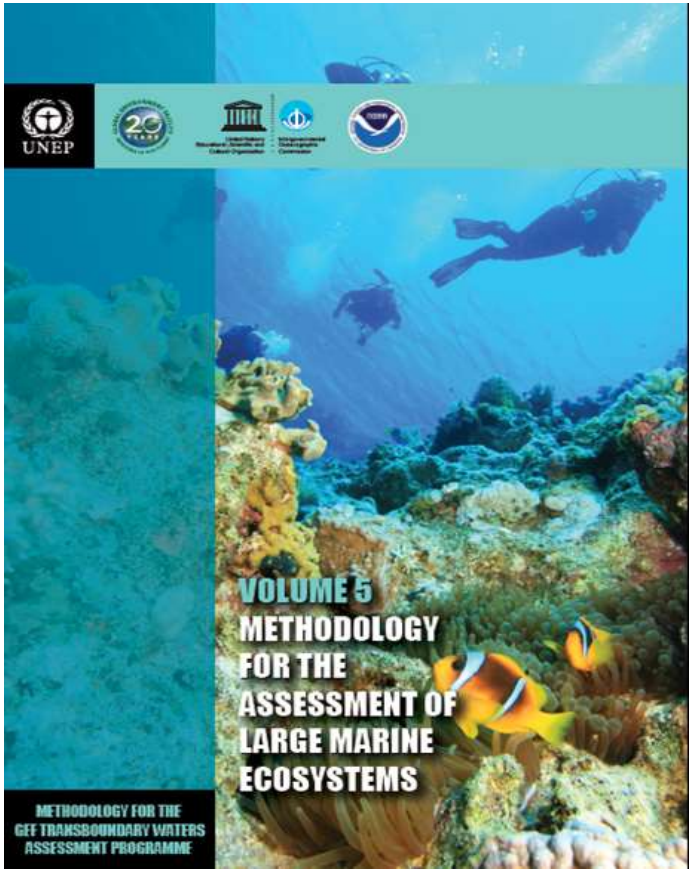
Institutional arrangements



Main Partners & Experts

Productivity	Fish & fisheries	Pollution & Ecosystem Health	Socio-economics	Governance
-NOAA (K.Sherman) -J. O'Reilly -U. Rhode Is. (I. Belkin)	UBC, Sea Around Us (D. Pauly & V. Lam)	- IGBP (S. Seitzinger) - E. Mayorga (Univ. Wash) - P. Kershaw (GESAMP) - Tokyo Univ/IWP (H. Takada) - UNEP-WCMC (M. Jones) - CMAP-UCSB (B. Halpern)	L.McManus	- R. Mahon (UWI/ CERMES) - L. Fanning (U. Dal)

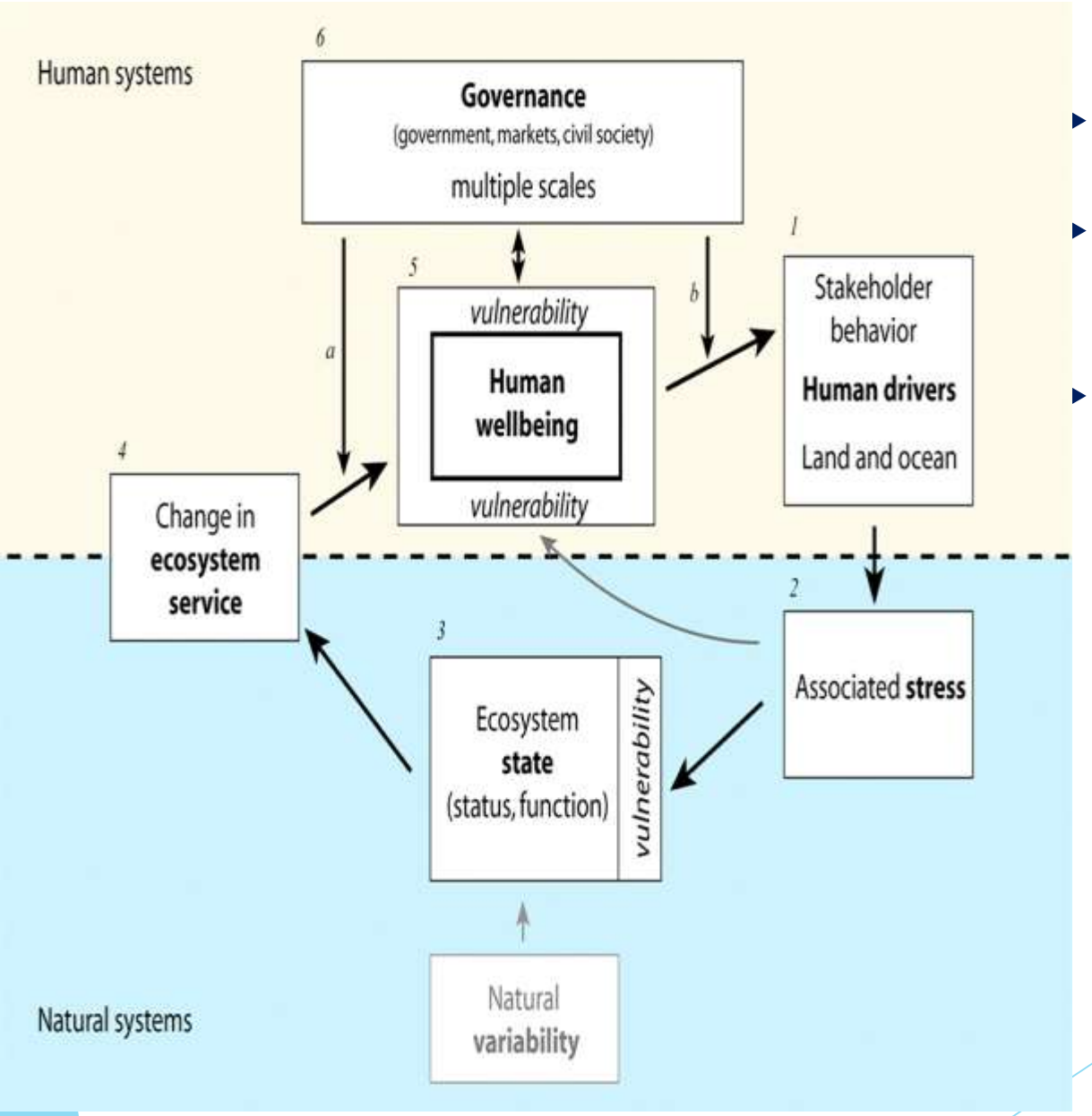
Assessment Methodology



- In previous phase of TWAP
- Selection of indicators- Priority issues in LMEs, available global datasets
- Working group of institutional partners and experts with data and expertise
- LMEs & Western Pacific Warm Pool
- Level 1: A global comparative baseline assessment
- Level 2 assessment: More detailed assessment within LMEs (Pilot in Bay of Bengal LME through GEF BoB LME project)

http://www.geftwap.org/project-results-and-reports

Conceptual framework



- DPSIR
- links between human and natural systems
- 5 LME modules:
  - Productivity
  - Fish & Fisheries
  - Pollution & Ecosystem Health
  - Socioeconomics
  - Governance

Indicators

Productivity	Fish & Fisheries	Pollution & Ecosystem Health	Socio-economics	Governance
•Chlorophyl	•Fishing subsidies	•Nutrient loads	•% fish protein	•Governance architecture-Completeness, Engagement, Integration (multi-country LMEs only)
•Primary productivity	•Catch from bottom gear	•Coastal Eutrophication Potential	•% GDP tourism	
•SST	•Fishing effort	•POPs in plastic pellets	•Coastal population	
	•MTI & FIB	•Micro & macro-plastics	•Human Development Index	
	•Ecological footprint	•Change in MPA coverage	•Night light Development index	
	•Stock	•Reefs at Risk Index	•Climate risk	

Questions for the assessment

- What are the current trends (& projections) in LME state?
- Which LMEs are at highest relative risk?
- What are the implications for humans?
  - Where is human dependency greatest on ecosystem services of LMEs?
  - Where are humans most vulnerable to changes in LME condition?
- What is the status of the governance arrangements in transboundary LMEs?

Comparing LMEs- Risk categories

- Assessment required an approach to summarize indicator results and compare LMEs
- Grouping of LMEs into 5 categories of relative risk (colour coded)

lowest	low	medium	high	highest

- Level does not necessarily relate to actual state of the LME
- Ideally, the cut-off points for the five categories should be based on set targets or reference points, but globally these do not exist for the selected indicators
- Experts decided on the cut off points
- Results do no reflect on any particular country- values are averages at the LME scale

Assessment products

Data

Spatial information and statistics will be freely available to download from the TWAP Web portal.

Reports

A synthesis report and summary for decision makers will be available, as well as technical thematic reports.

Indicators

Indicators factsheets and accessible metrics by themes will be freely available to download.

Web

Our marine website will disseminate all products and results related to LME and Open Ocean led by IOC-UNESCO.

ASSESSMENT RESULTS

Some Highlights
(single indicators & indices)

Productivity

- Chl a (2003-2013): No large-scale, consistent pattern of increase or decrease. 36 LMEs had increasing trends and 31 with decreasing trends. Trends are weakly correlated with latitude.

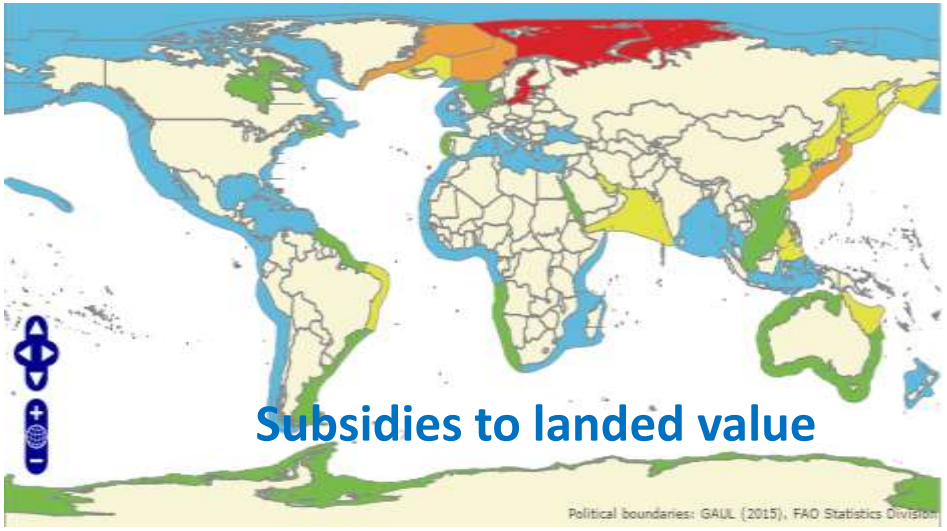
  -Significant increasing trends: Scotian Shelf, Patagonian Shelf, Labrador Newfoundland, Southeast Australian Shelf LMEs.

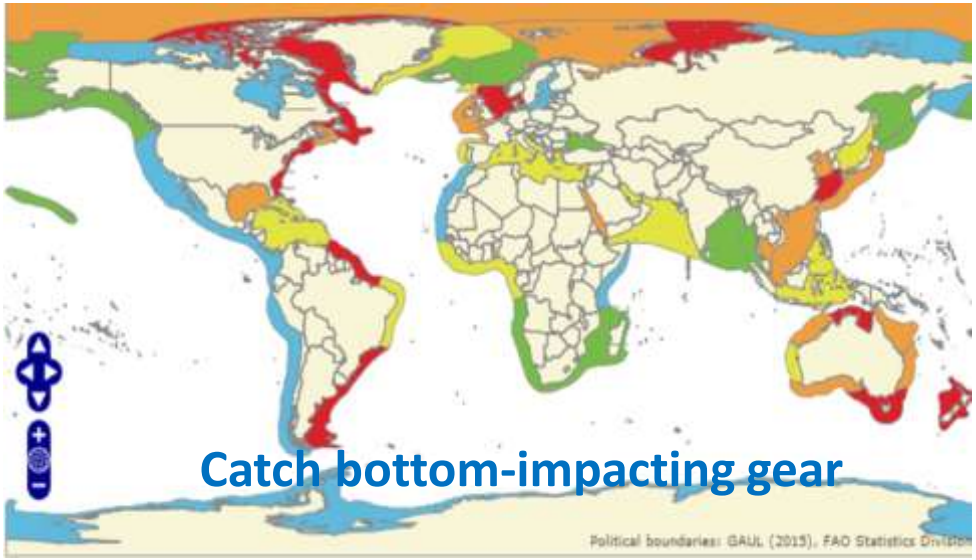
  -Significant decreasing trends: Indonesian Sea, Oyashio Current, Celtic–Biscay Shelf LMEs.

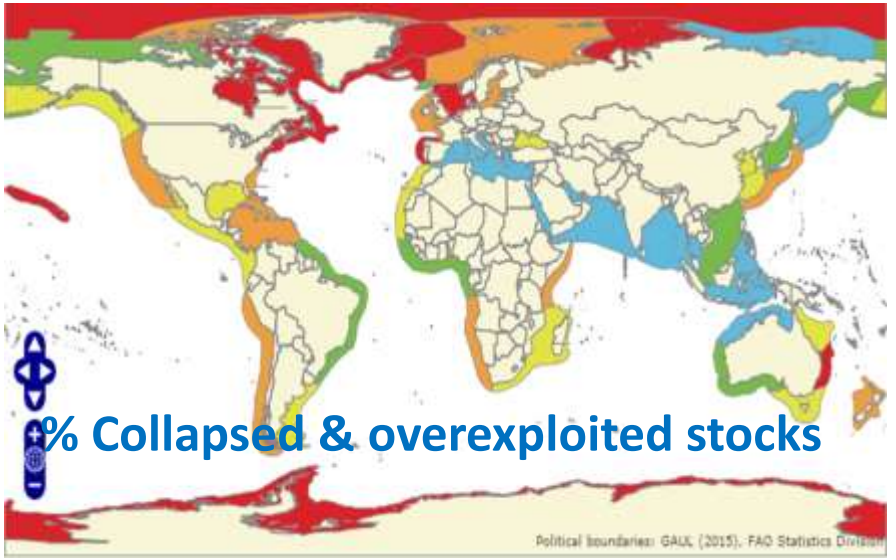
- SST (1957 and 2012): All but two LMEs warmed, East China Sea LME showing the greatest increase. The Southeast US Continental Shelf and the Barents Sea LMEs were the only two LMEs that cooled during this period.
- There is no consistent link between SST trends and environmental risks - the ongoing warming is beneficial for many LMEs, but detrimental to others. Precautionary management actions are needed in light of the uncertainties around climate warming effects in LMEs.

J. O'Reilly & K. Sherman (Prim. Productivity); I Belkin (SST)

Fish & Fisheries (2000-2010)





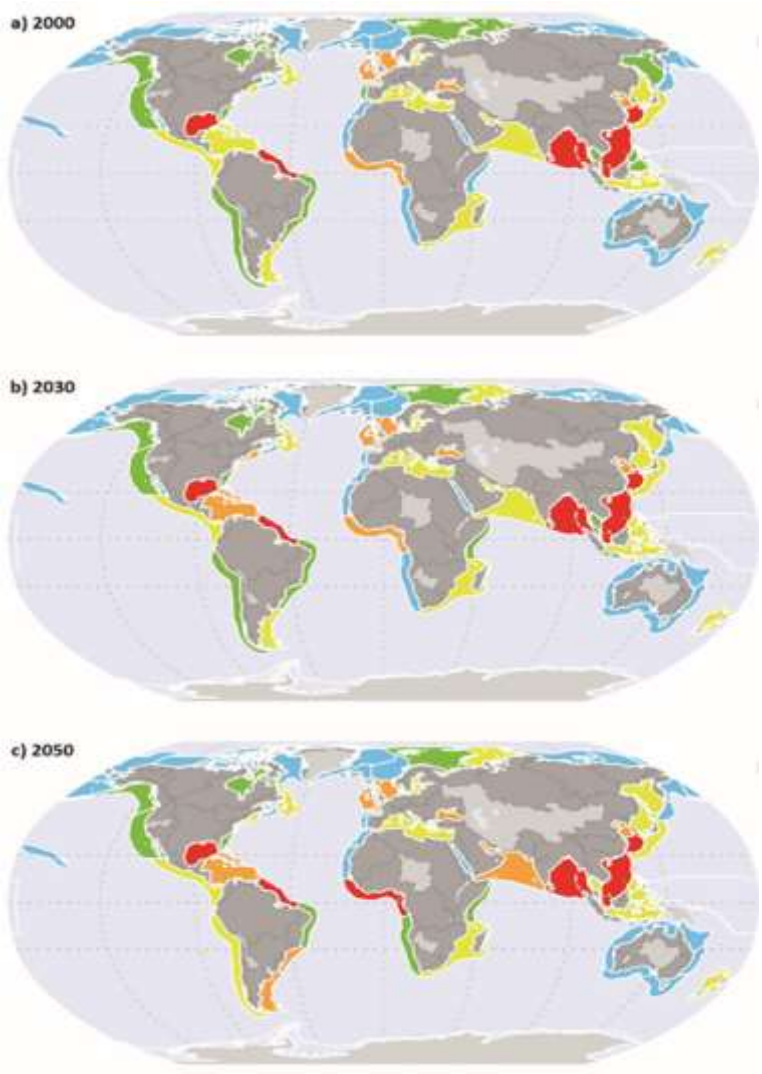


D. Pauly & V. Lam

Fish & fisheries- some highlights

- Many LMEs have large numbers of high scoring indicators.
- LMEs with the highest scores across all indicators include (not in any order of priority): Bay of Bengal, East China Sea, Gulf of Thailand, Indonesian Sea, South China Sea, Sulu-Celebes Sea, Yellow Sea, Baltic Sea, Caribbean Sea.
- Although the number of collapsed stocks is increasing, the number of rebuilding stocks in some countries is also increasing (e.g., Norway, USA).
- Decreases in the trophic levels of catches (MTI trends) and spatial expansion of fisheries (FiB Index trends) are occurring in many LMEs, indicating ecosystem impacts of fishing and the reaction of fisheries, respectively.
- The catch potential of the East Siberian Sea and Indonesian Sea LMEs is projected to be the most affected by warming in 2050s. Substantial decrease in the catch potential of certain LMEs would cause these regions to become more vulnerable under the effect of other synergistic factors such as increasing fishing and socioeconomic pressures.
- Catch data accounting for small-scale fisheries at the national level are needed to improve the accuracy of LME catch time series and hence the quality of the indicators.

Nutrient inputs & Coastal eutrophication potential

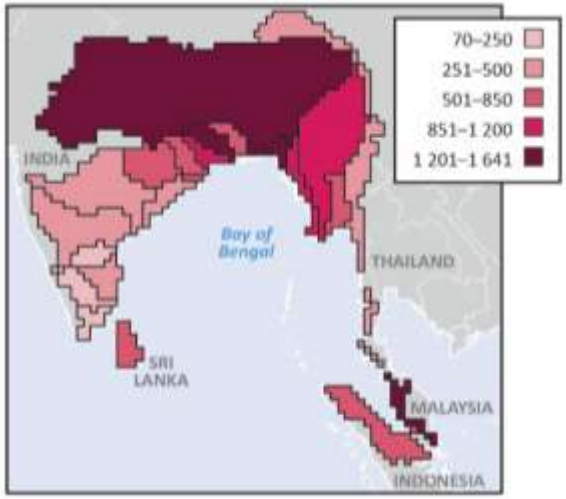


- Global NEWS model- overall indicator of coastal eutrophication developed for 63 LMEs, based on the amount of nitrogen input by rivers as they enter the land–sea boundary of the LME, and nutrient ratios (dissolved Si to N or P).
- Based on current trends, coastal eutrophication risk will increase in 21% of LMEs by 2050- mainly in southern and eastern Asia, South America and Africa.
- Iberian Coastal & Northeast US Continental Shelf are projected to lower their eutrophication risk by 2050.

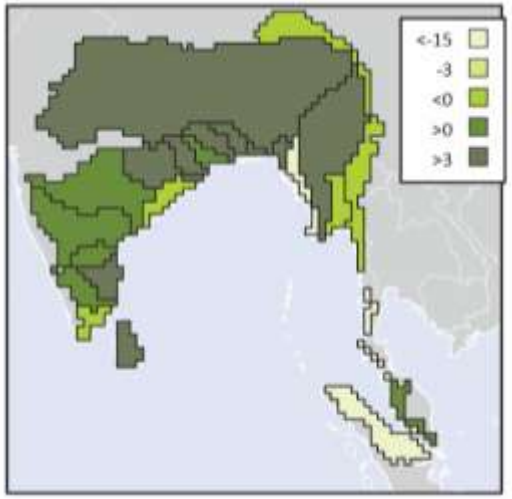
S. Seitzinger (IGBP) & E. Mayorga (Univ. Wash)

Spatial variation in nutrient inputs
Example from Bay of Bengal LME

DIN kg/km2/yr

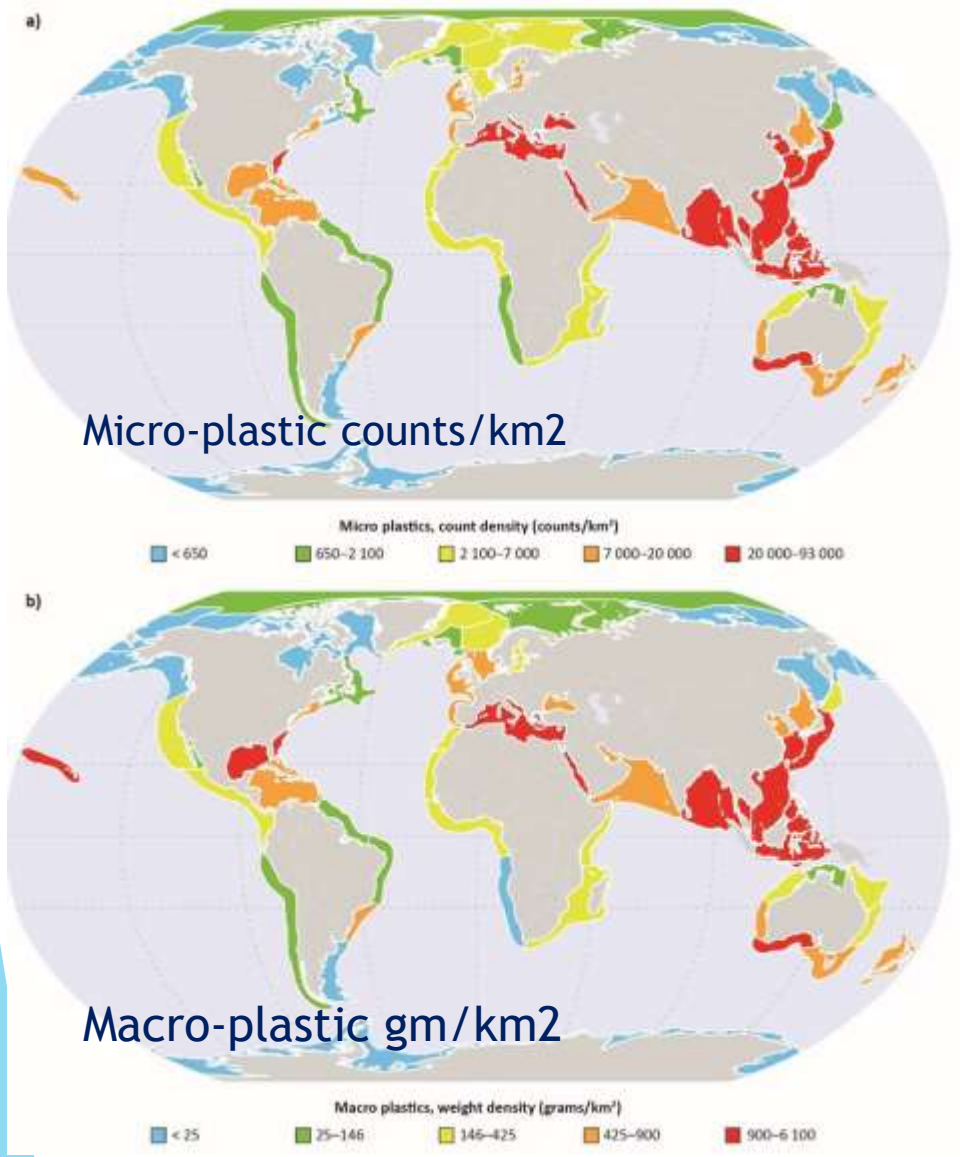


Index coastal eutrophication



- Nutrient yields, eutrophication potential, and sources of nitrogen can vary considerably among the river basins that drain into an LME.
- Such information is important in identifying the spatial variation of nutrient effects and their sources in order to achieve reductions within LMEs.

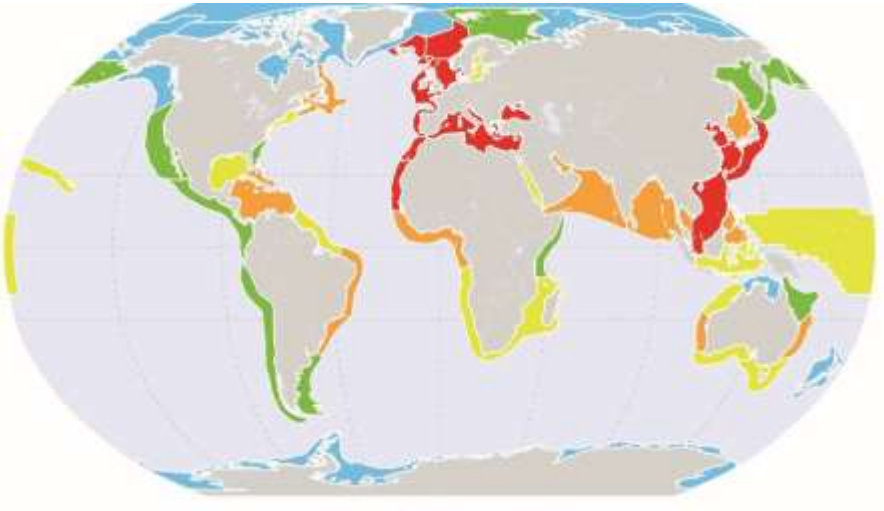
Floating micro & macro-plastic debris



- Model - simulated movements of floating plastic in the ocean
- Proxy sources of plastics - coastal population density, shipping density, & level of urbanization
- Results consistent with observational data from shipboard measurements and shoreline surveys
- Highest (both types of plastics) in E-SE Asia, Gulf of Thailand highest globally
- Others with high plastics: Include Southeast US Continental Shelf, Mediterranean, Red Sea LMEs

P. Kershaw (GESAMP) & C.M. Lebreton

Cumulative Human Impacts on habitats

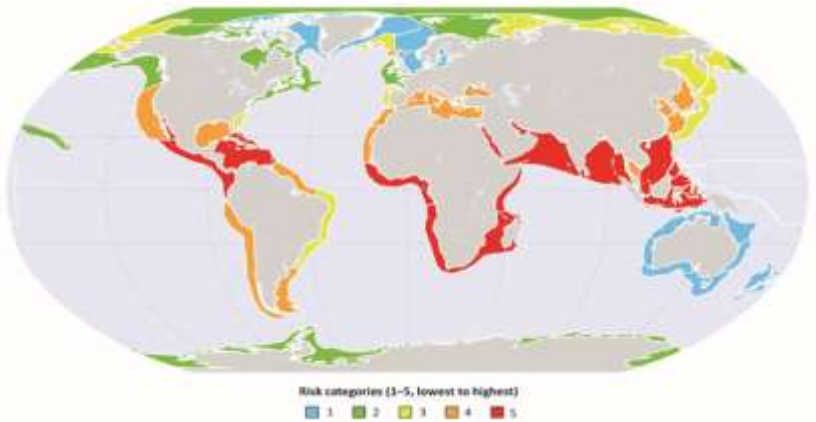


- LMEs adjacent to heavily populated coastlines, particularly in developed countries that encompass large watersheds, have the highest CHI scores. The most heavily impacted LMEs are adjacent to China and Europe.

- Stressors associated with climate change (notably acidification and increasing SST) are the top stressors for nearly every LME.
- Shipping and demersal commercial fishing are the other two main stressors at the LME scale.
- At smaller scales, particularly along coastlines, stressors such as land-based pollution and fishing play a dominant role.

B. Halpern et al

Ocean Health Index



The OHI measures progress towards achievement of performance of 10 widely-held public goals for healthy oceans (including food provision, carbon storage, coastal livelihoods & economies, biodiversity)

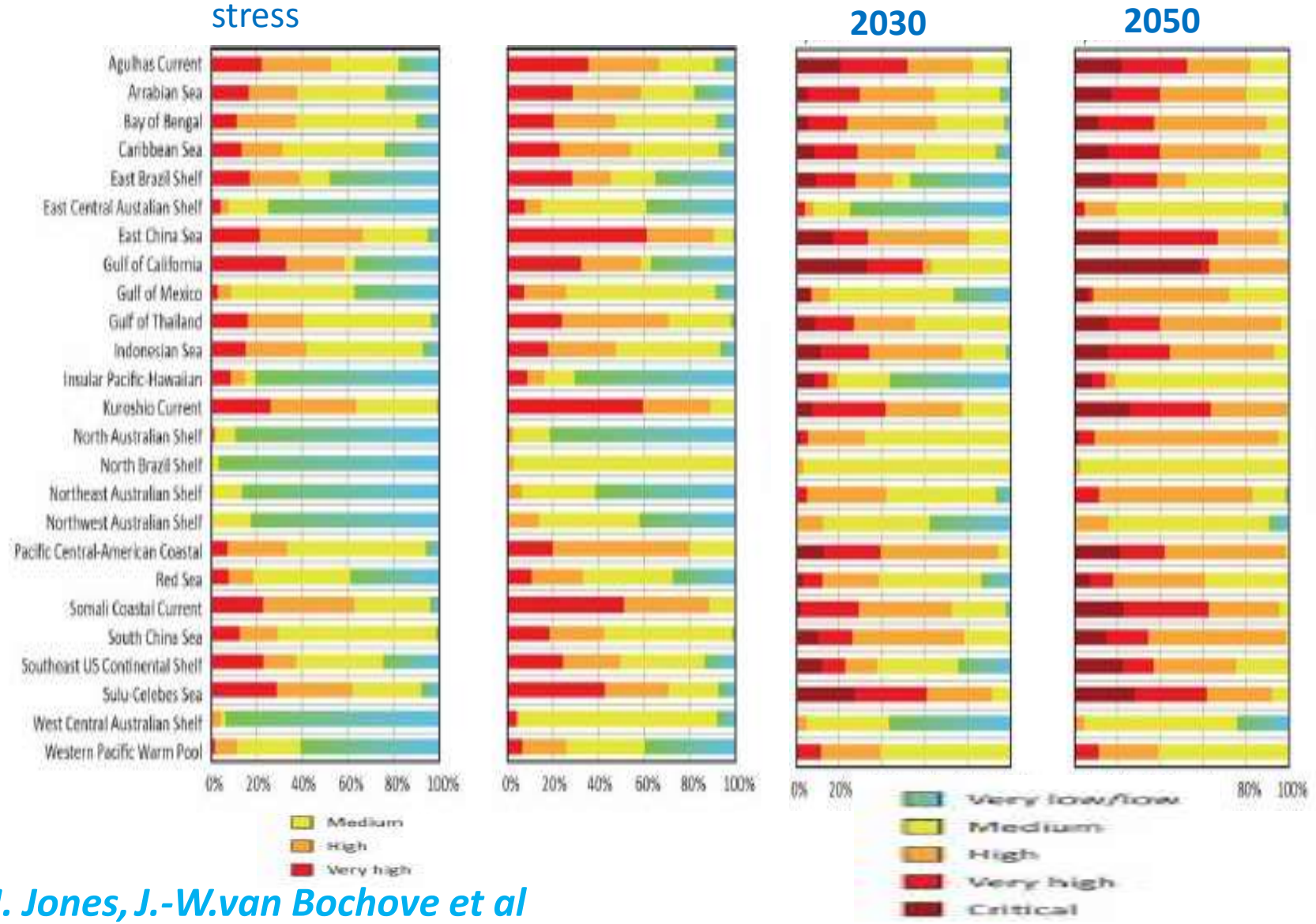
B. Halpern et al

- Tracking how scores for the 10 goals contribute to the OHI score for each LME provides insights into which goals drive overall ocean health and which parameters are in most need of improvement.
- LMEs with the lowest OHI scores are along the equator.
- LMEs with the highest scores are around Australia and in the North Atlantic.
- Overall ocean health scores lower where coastal habitats are degraded or destroyed. Habitat restoration and protection offers a key strategy to improve ocean health.
- Improving monitoring & data-reporting standards will improve assessments of ocean health and in turn decision making.

Reefs at Risk Index

Local threats & past thermal stress

Projected % LMEs and WPWP coral reef area by threat level for warming & acidification



M. Jones, J.-W.van Bochove et al

Governance

- Evaluated the formally-established transboundary governance arrangements relevant to fisheries, pollution, and biodiversity and habitat destruction in the 50 multi-country LMEs and the WPWP.
- 3 indicators:
  - (i) level of completeness of the structure of arrangements to address a given issue(s);
  - (ii) level of integration of institutions involved in addressing the suite of identified transboundary issues within a given LME; and
  - (iii) level of engagement of countries participating in arrangements that address the identified transboundary issues within the LME.

L. Fanning, R. Mahon et al

Governance

- Considerable room for improvement in the design of governance arrangements.
- Fisheries arrangements tend to have high completeness levels but need improvement in institutional collaboration for implementation.
- Few pollution arrangements have repercussions for non-compliance.
- Biodiversity arrangements have the lowest levels of completeness. Accountability is limited and lack of data and information provisions is a serious shortcoming at the LME level.
- Over 50% LMEs have very low levels of institutional integration. Efforts should focus on collaboration among organizations and/or the creation of overarching integrating mechanisms if EBM is to be effectively implemented.
- Countries have high commitment towards participation in agreements addressing transboundary issues. The nature of agreements (binding/non-binding) influences the level of commitment.

Governance (cont'd)

- The Mediterranean LME has the lowest overall level of risk, due largely to an overarching integrating mechanism for transboundary issues. Other LMEs with low risk levels are the Humboldt Current, Canadian Eastern Arctic-West Greenland Shelf, North Bering-Chukchi Sea and Beaufort Sea LMEs.
- The Indonesian Sea LME has the overall highest risk, followed by other GEF-eligible LMEs (e.g. Caribbean, North and South Brazil Shelf, Canary Current, Guinea Current, Agulhas Current, Red Sea, Gulf of Thailand, South China Sea and Sulu-Celebes Sea LMEs).

Summary

- In general LMEs in developing regions (GEF-eligible) are at highest potential risk.
- A number of LMEs have high scores across multiple indicators.
- LMEs are impacted to different degrees by each issue assessed, and the factors accounting for high relative risk vary across LMEs.
- These factors are largely anthropogenic, but global threats (warming seas and acidification) are projected to play an increasing role in determining LME condition (as seen in changes in fish catch potential under warming, Reefs at Risk with warming and acidification, and CHI).
- Under a business as usual scenario, risks levels in a number of LMEs are projected to rise in the future due to factors such as increasing nutrients inputs from watersheds and increasing coastal human populations.
- There is much room for improvement in transboundary governance arrangements related to priority issues in LMEs.
- More detailed studies needed for cause & effect (individual LMEs)
- Spatial and temporal data gaps are important constraints

Socioeconomics & Patterns of risk in LMEs

L. McManus