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TRANSBOUNDARY WATERS ASSESSMENT PROGRAMME

Large Marine Ecosystems

Global comparative baseline assessment

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On behalf of the LMEs Working Group

IOC-UNESCO

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gef

UNEP-DHI PARTNERSHIP
Centre on Water and Environment

UNEP DHI

United Nations Educational, Scientific and Cultural Organization

International Hydrological Programme

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

ILEC

LME indicators (relevance to SDG Goals & Targets)

Productivity	Fish & Fisheries	Pollution & Ecosystem Health
•Chlorophyl	•Fishing subsidies	•Nutrient loads
•Primary productivity	•Catch from bottom gear	•Coastal Eutrophication Potential
•SST	•Fishing effort	•POPs in plastic pellets
	•MTI & FIB	•Micro & macro-plastic debris
	•Ecological footprint	•MPA coverage
	•Stock status	•Reefs at Risk Index
	•Catch potential under global warming	•Mangrove extent
		•Cumulative human impacts
		•Ocean Health Index

LME indicators (and relevance to SDG Goals & Targets)

Socioeconomics	Governance
•% fish protein •% GDP tourism •Coastal population •Human Development Index •Night light Development index •Climate risk •Contemporary treat index	•Governance architecture- Completeness, Engagement, Integration (multi-country LMEs)

Assessment questions

- What are the current trends (& projections) in LME state with respect to fisheries, pollution, habitats?
- Which LMEs are at the highest relative risk?
- What are the implications for humans?

  - *Where is human dependency greatest on LME ecosystem services?*

  - *Where are humans most vulnerable to changes in LME condition?*

- What is the status of governance arrangements in transboundary LMEs to address the priority issues (fisheries overexploitation, pollution, habitat/biodiversity loss)

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Relative risk

- Concept of risk: the likelihood of failure to sustain the ecosystem services that transboundary waters provide.
- Grouping of LMEs into 5 colour-coded categories of relative risk based on indicator values

lowest	low	medium	high	highest

- 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 most of the indicators
- Experts decided on the cut off points
- Results do not reflect situation of any particular country-values are averages at the LME scale

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Global patterns of risk (1)

Single biophysical indicators

Examples

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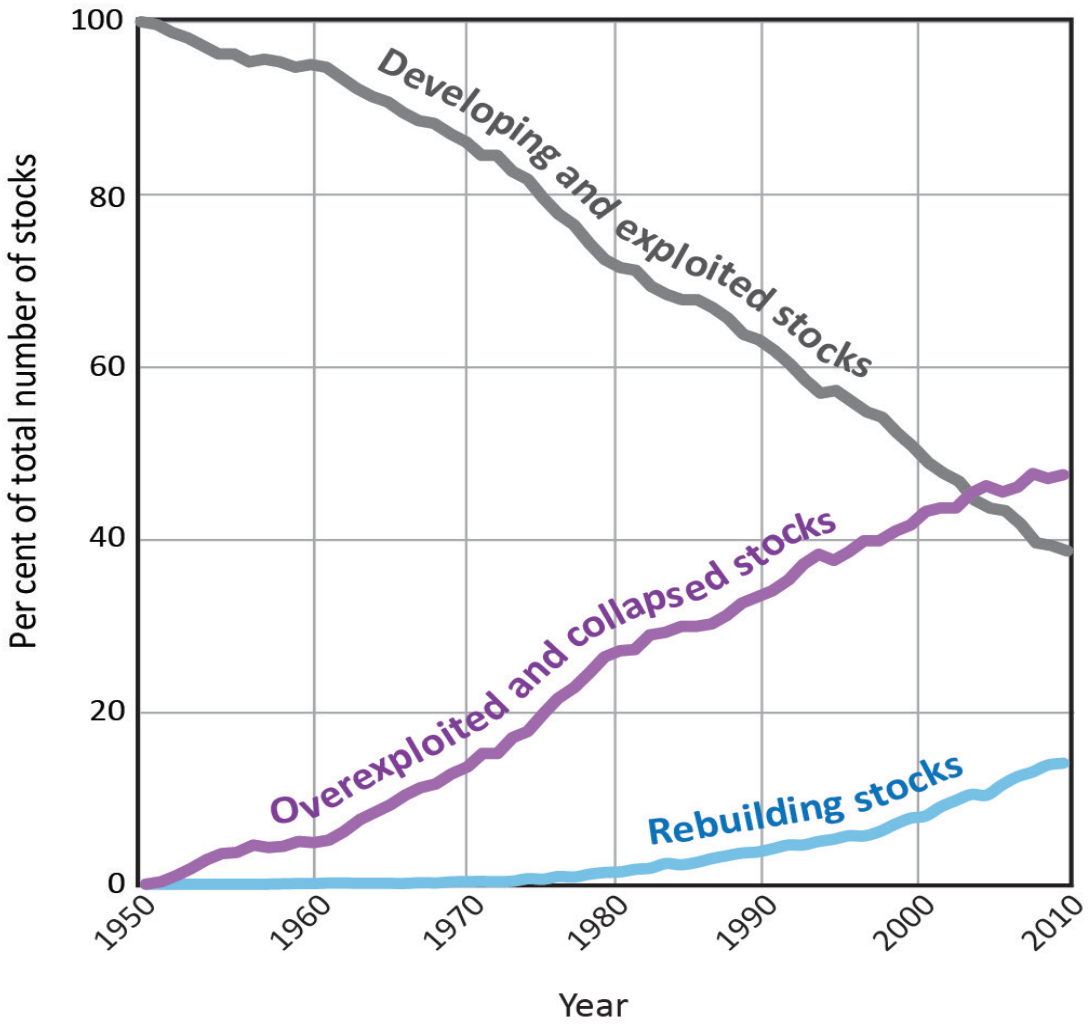
Fish & Fisheries



- 8 indicators assessed (shown here is stock status).
- Sources of pressure and degree of risk vary among LMEs → need for tailored solutions.
- Nearly all GEF-eligible LMEs each has multiple indicators at medium/high/highest risk levels.
- Relevant to SDG 14.4

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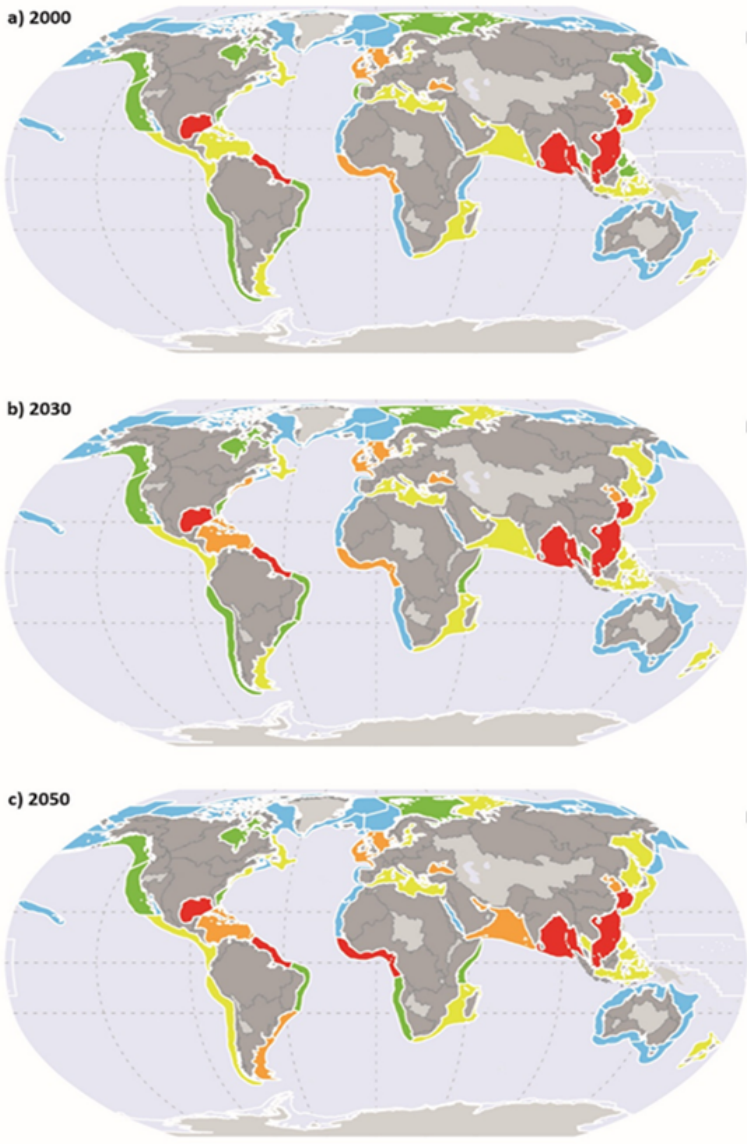
Relative risk for a subset of LMEs for the fisheries indicators assessed

LME name	Subsidy to landed value	Ecological footprint (PPP/PP)	Marine Trophic Index	Fishing in Balance Index	Stock status (biomass) in percentage	Per cent catch from bottom-impacting gear	Rate of change of effective fishing effort (kW days per year)	Per cent change in catch potential in the 2050s
Gulf of California	0.14	0.04	-0.05	1.93	6.95	10.38	803,921	-8.34
Gulf of Mexico	0.11	0.06	0.06	0.67	44.21	27.46	9,651,794	-5.09
Pacific Central-American Coastal	0.09	0.05	-0.14	2.46	34.03	6.45	5,609,491	-3.57
Caribbean Sea	0.09	0.03	-0.37	0.38	25.27	19.56	8,419,253	-1.45
Humboldt Current	0.03	0.19	-0.58	1.87	9.67	1.79	8,218,267	-6.44
Patagonian Shelf	0.25	0.20	0.28	3.40	21.99	62.25	6,315,226	-5.63
South Brazil Shelf	0.29	0.05	0.24	1.80	31.89	47.60	3,782,796	-4.55
East Brazil Shelf	0.31	0.06	0.19	1.40	18.17	19.99	2,414,615	3.58
North Brazil Shelf	0.24	0.04	-0.02	1.48	14.39	43.12	4,244,746	-10.67
Mediterranean	0.14	0.14	-0.04	0.68	10.89	18.20	33,725,342	-14.53
Canary Current	0.17	0.18	-0.02	2.41	18.23	9.15	6,033,983	-4.30
Guinea Current	0.10	0.06	-0.03	1.72	17.98	15.63	15,474,117	-4.38
Benguela Current	0.19	0.13	0.43	1.81	60.05	11.00	-1,557,565	-0.01
Agulhas Current	0.11	0.06	0.58	1.81	15.01	13.24	10,971,939	11.64
Somali Coastal Current	0.08	0.01	0.07	0.92	22.94	4.13	3,756,822	14.60
Arabian Sea	0.31	0.17	0.03	1.78	10.50	17.11	24,329,676	-4.99
Red Sea	0.20	0.11	0.26	2.29	17.67	22.80	3,982,575	-7.65
Bay of Bengal	0.14	0.25	-0.03	2.13	7.04	11.63	128,945,675	2.43
Gulf of Thailand	0.17	0.46	0.41	2.55	7.68	25.51	7,759,858	-12.72
South China Sea	0.22	0.69	-0.02	1.65	9.04	22.22	10,415,054	-12.09
Sulu-Celebes Sea	0.31	0.44	-0.12	1.90	4.21	17.09	61,822,343	-6.11
Indonesian Sea	0.18	0.23	0.03	2.10	5.81	17.97	49,883,233	-26.75
East China Sea	0.31	1.24	-0.08	0.86	15.26	33.51	5,848,689	-15.90
Yellow Sea	0.26	0.95	-0.14	0.89	8.43	32.18	2,005,531	2.97
Kuroshio Current	0.48	0.23	-0.12	-0.20	60.35	24.03	9,498,713	2.32
Black Sea	0.12	0.06	-0.14	0.17	36.27	11.37	17,186,030	-0.10

Nutrient inputs & Coastal Eutrophication Potential



S. Seitzinger & E. Mayorga

- Indicator of coastal eutrophication based on the amount of nitrogen input in rivers, and nutrient ratios (dissolved Si to N or P), using the Global NEWS model.
- 16% of LMEs are at high risk from nutrients (sewage and agriculture)
- *By 2050- based on current trends, coastal eutrophication risk will increase in 21% of LMEs, mainly in southern and eastern Asia, South America and Africa.*
- Relevant to SDG 14.1

Global patterns of risk (2)

Integrating multiple indicators:

Cumulative Human Impacts Index

Ocean Health Index

Clustering LMEs (biophysical indicators & HDI)

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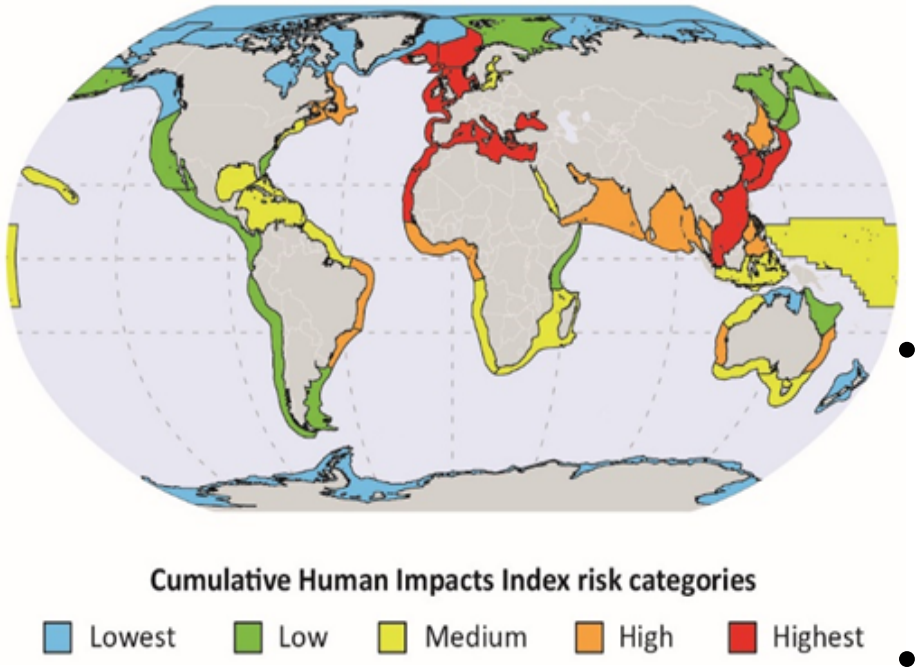
Cumulative Human Impacts

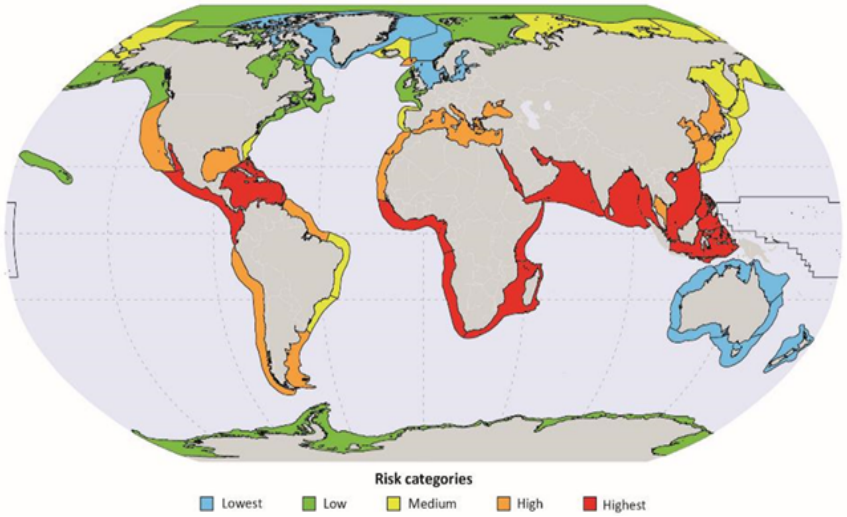


The CHI Index combines 19 measures of impacts related to climate change, fishing, land-based pollution, and commercial activities.

B. Halpern & M. Frazier

- **Highest impact**: LMEs adjacent to heavily populated coastlines, particularly in developed countries that encompass large watersheds.
- **Top sources of impact:** associated with ocean acidification & high water temperatures for nearly every LME.
- **Other stressors**: Commercial shipping and demersal commercial fishing at LME scale.
- **Stressors at smaller scales**: land-based pollution and fishing play a dominant role
- SDG 14.1- 14.5

Ocean Health Index



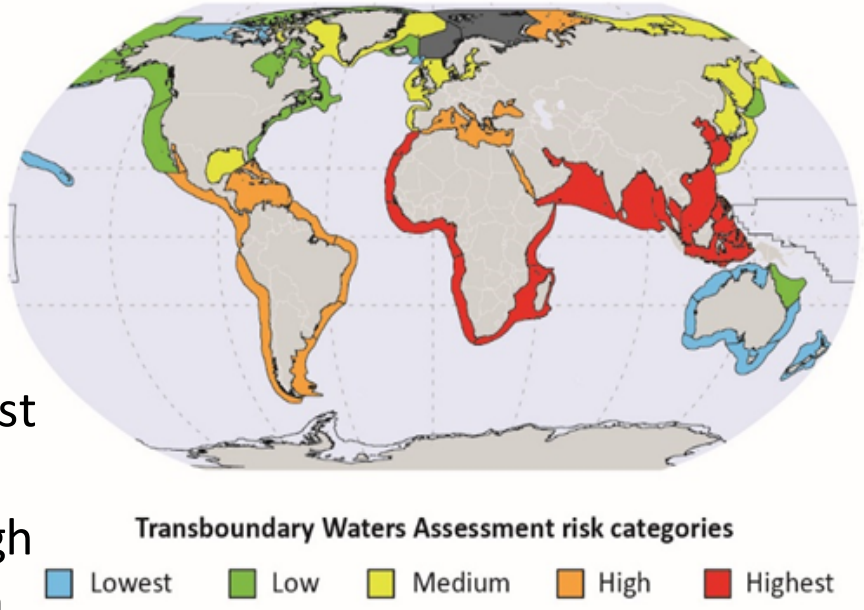
The OHI measures progress towards achievement of ten widely-agreed public goals for healthy oceans, including food provision, carbon storage, coastal livelihoods and economies, and biodiversity.

B. Halpern et al

- **Lowest OHI scores (high rel. risk)**: LMEs along the equator, which suggests that priority should be given to improving LME health in tropical regions.
- **Highest OHI scores (low rel. risk)**: LMEs around Australia and the sub-polar North Atlantic.
- Ocean health tends to score lower where coastal habitats are degraded or destroyed.
- Habitat restoration and protection is therefore a key strategy for improving ocean health.
- Relevant to SDG 14.2

Overall patterns of risk

An overall risk score based on selected fisheries, pollution, and ecosystem health indicators was developed. The score was adjusted using the HDI to rank LME (ONE of MANY WAYs to rank LMEs)



- **LMEs with developing economies**: highest risks due to coastal eutrophication and plastic litter density, and moderate to high risks from collapsed or overexploited fish stocks.
- **LMEs next to developed countries**: high risks triggered by high shipping frequencies, high capacity-enhancing fisheries subsidies, and high catches from bottom-impacting gear.
- **Almost all LMEs are at risk** due to the low percentage of established recovery zones such as MPAs.

K. Kleisner, L. McManus et al

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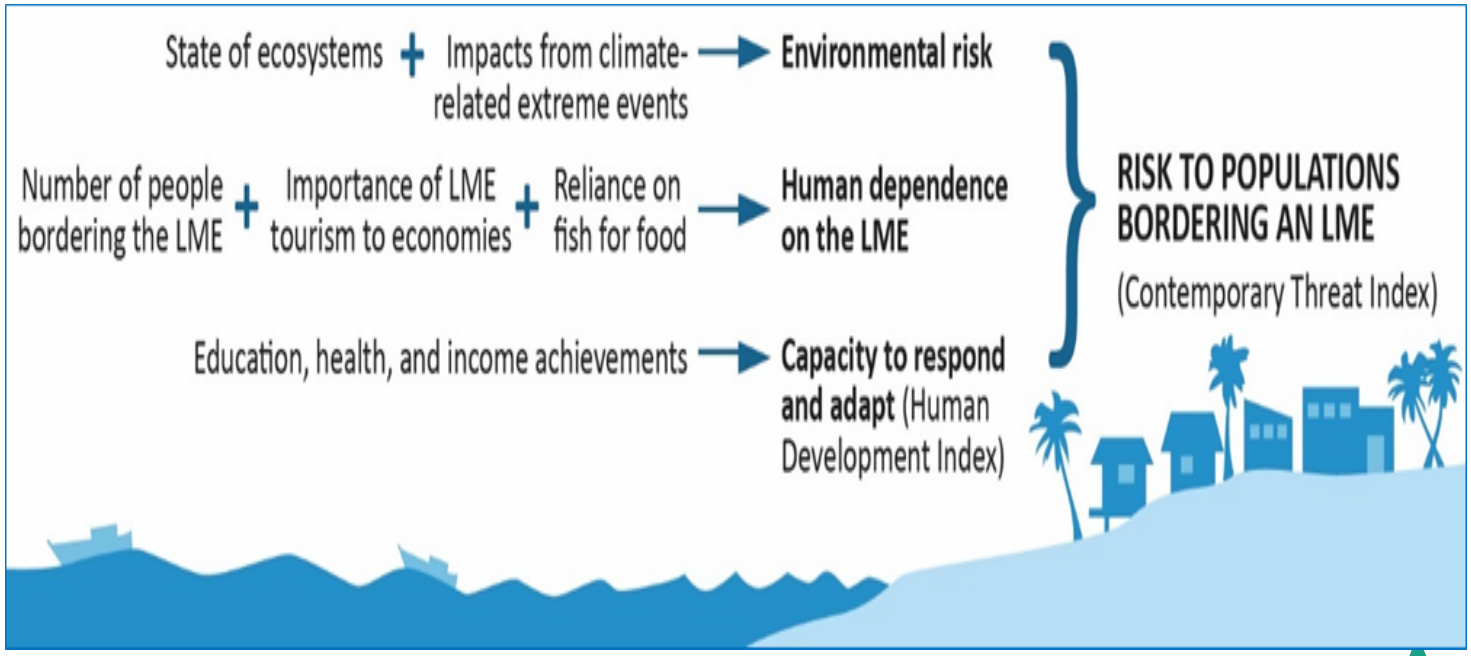
Consequences for humans: Human dependence and vulnerability

Contemporary Threat Index: Incorporates measures of:

- Environmental risk (environmental degradation & climate change)
- Dependence on LME resources (coastal population, tourism, fisheries)
- Capacity to respond/adapt to threats (HDI)



L. McManus & M. Estevanez

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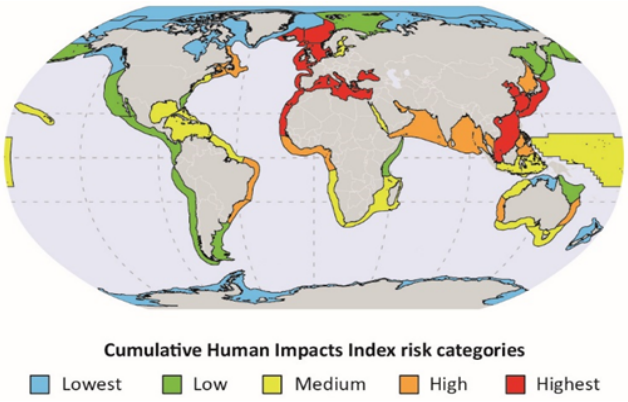
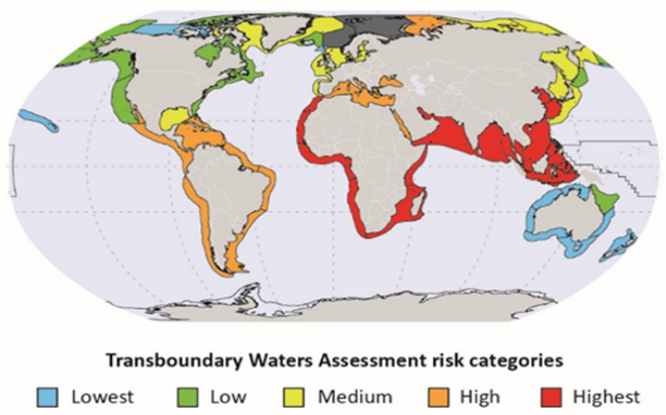
Global patterns of risk-
4 different lenses, similar story

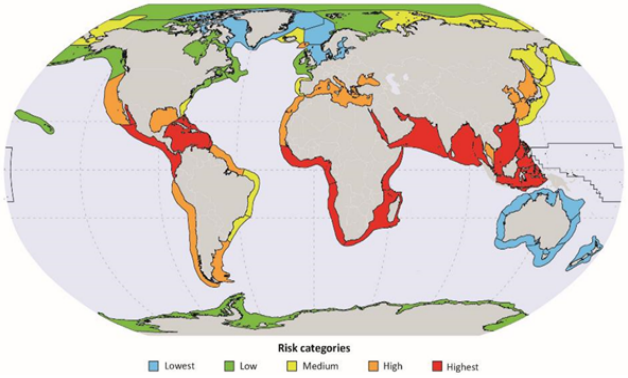
Cumulative Human Impact



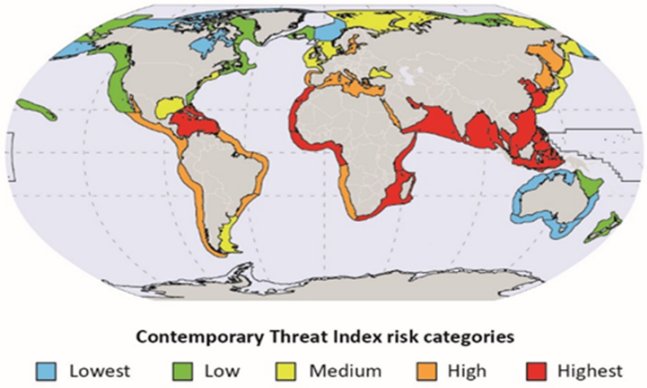
Overall risk – biophysical indicators & HDI



Ocean Health Index



Contemporary Threat Index



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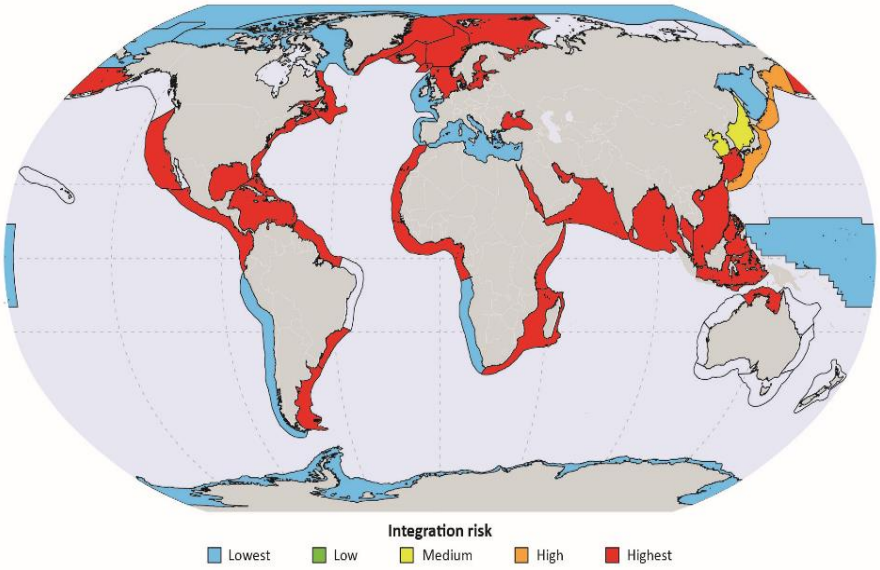
Governance- Integration

Global distribution of levels of integration and perceived risk for 49 transboundary LMEs and the Western Pacific Warm Pool (WPWP)



- **Lowest rel. risk**: 6 LMEs in the North Polar region; Antarctic, Benguela Current, Humboldt Current, Mediterranean LMEs; LMEs adjacent to countries in the European Union; and the WPWP.
- **Highest risk**: 31 LMEs, indicating that a sectoral approach to developing and implementing issue-specific agreements may be in place.
- **Lowest risk**: Mediterranean LME has the lowest risk across the 3 governance indicators (with an overarching integrating mechanism to address transboundary issues.

L. Fanning, R. Mahon et al

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Key messages

- **LMEs in developing regions are at highest potential risk**.
- LMEs experience a range of **stressors**, which are largely **anthropogenic, and local and regional in scale**. But **warming seas and acidification are projected to play an increasing role in determining LME condition**.
- 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, climate change impacts, and increasing coastal populations.
- There is **much room for improvement in transboundary governance arrangements** in LMEs.
- **Data availability constraints** need to be addressed.

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Key messages (cont'd)

- **Coastal populations in developing regions are most at risk**. Degrading LME conditions and climate-related risks are **additional** burdens for socioeconomically compromised coastal populations of mostly tropical LMEs.
- High levels of human well-being and ecosystem health are mutually reinforcing outcomes of sustainable ecosystems. **Actions to enhance the well-being of coastal populations should not sacrifice ecosystem health, and vice-versa**.
- **Maintaining LME health is critical in helping countries to achieve SDG targets** esp. those related to hunger (SDG #2), poverty reduction (SDG#1), and sustainable use of the oceans, seas, and marine resources for sustainable development (SDG #14). Regular assessment of LMEs can contribute to evaluating progress towards achievement of these targets.

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TWAP LMEs Working Group

Institutional Partner	Expert	Institutional Partner	Expert
NOAA	**K. Sherman**	UNEP-WCMC	**M. Jones, C. McOwen, D. Stanwell-Smith**
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GESAMP	**P. Kershaw**	CERMES	**R. Mahon**
IGBP	**S. Seitzinger**	IOC-UNESCO	**J. Barbiere, B. Combal**
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Thank you!

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