Humans at risk

Global spatial patterns of ocean ecosystems degradation and governance scales

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Liana Talaue-McManus, Robin Mahon, Benjamin S. Halpern, Lucia Fanning, and Albert Fischer

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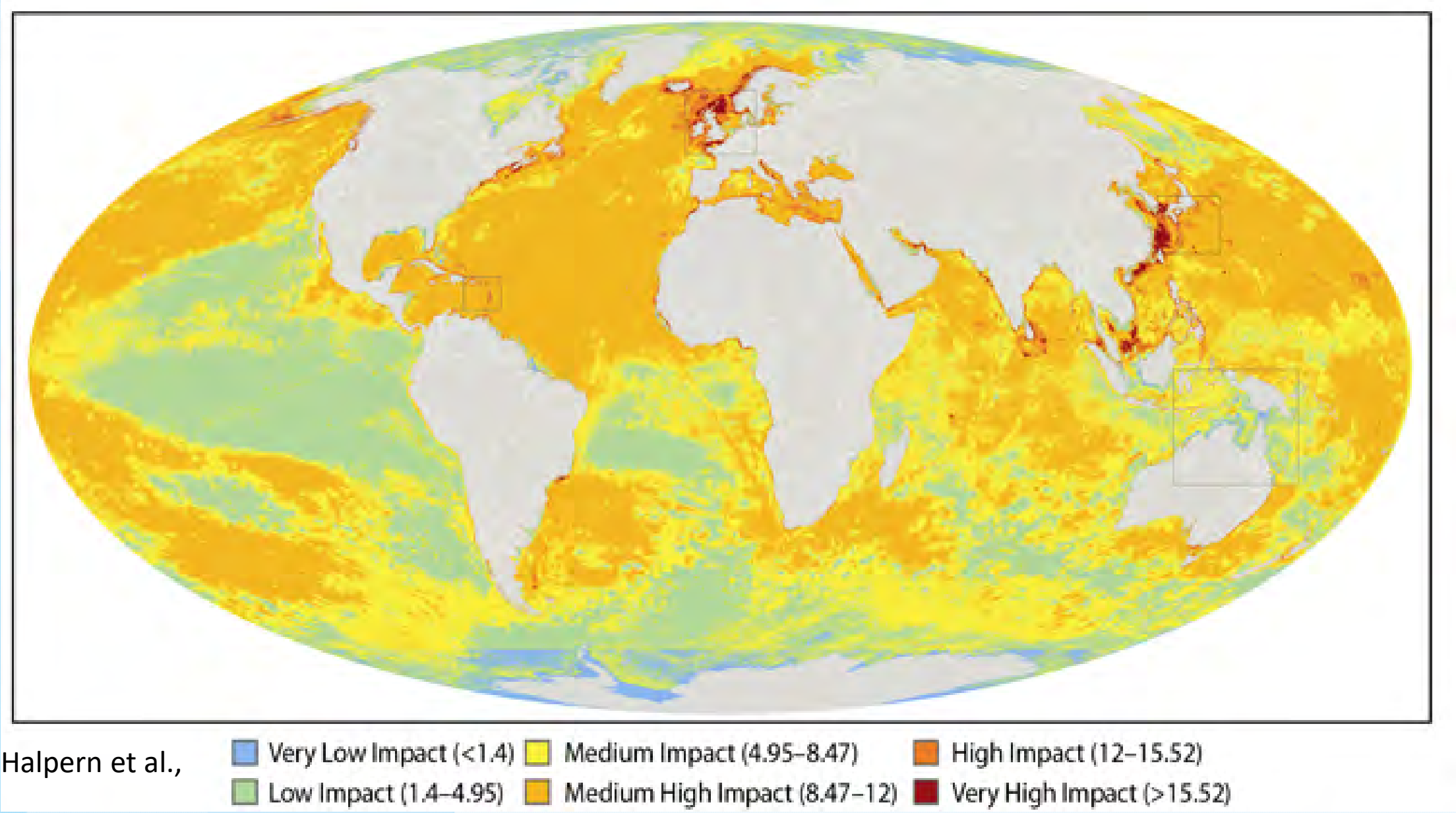
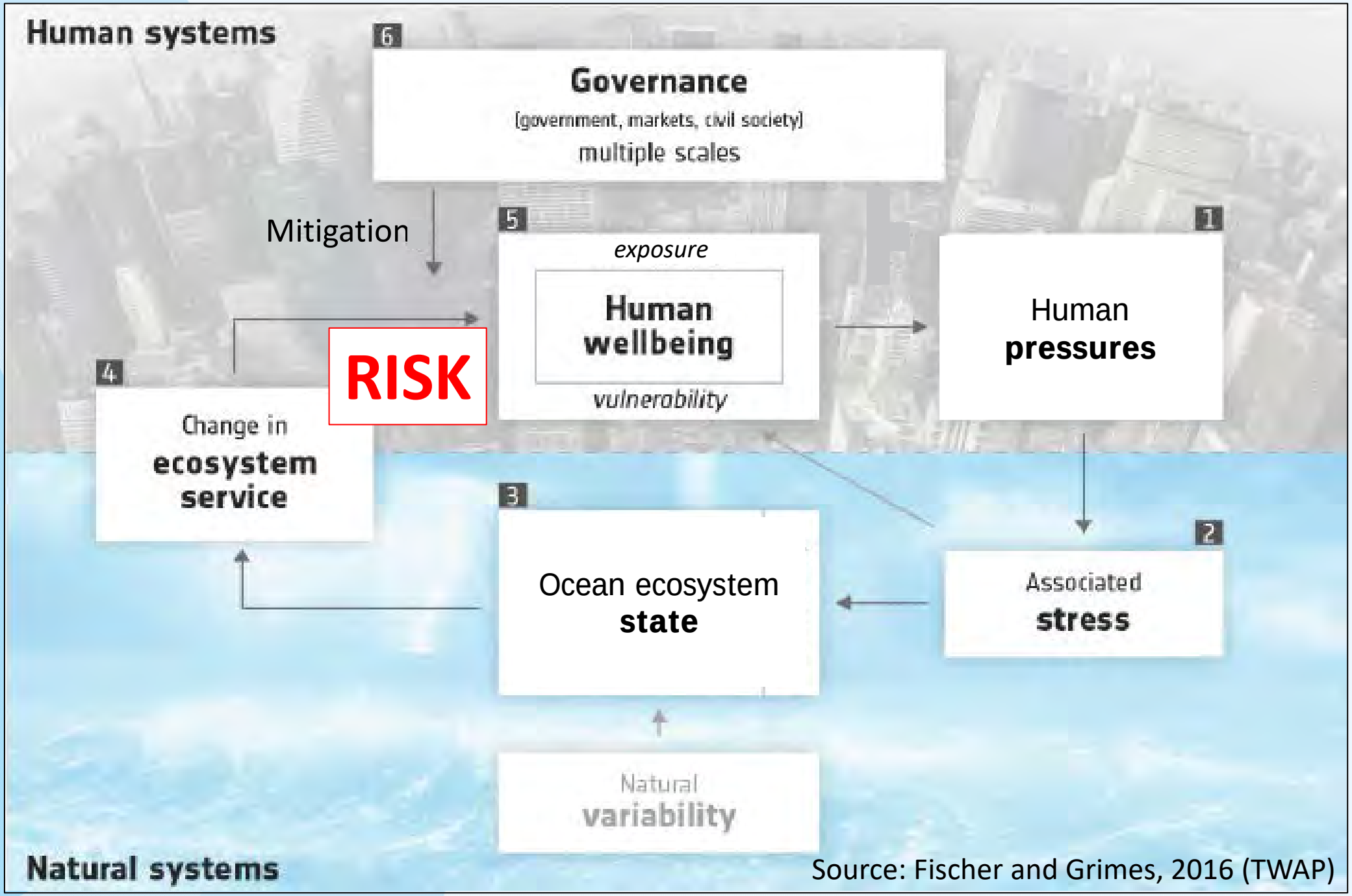
Human impacts on the ocean



Source: Halpern et al., 2009



Source: Fischer and Grimes, 2016 (TWAP)

Research Questions

1) Where are humans most affected by ocean ecosystems degradation, needing action at different governance levels?

2) Where are humans most at risk from ocean ecosystems degradation?

The Risk Framework

Cumulative Human Impact (CHI)

Human Development Index

Coastal Population (100km)

IPCC 5AR WGII

Hazards and Governance Scales

Fisheries

Pollution

Climate Change

Other

	CHI component	Global	Regional	National
1	Artisanal fishing	10	20	**70**
2	Demersal destructive fishing	20	30	**50**
3	Demersal non-destructive fishing, with high by-catch	20	30	**50**
4	Demersal non-destructive fishing, with low by-catch	20	20	**60**
5	Pelagic fishing, with high by-catch	30	30	**40**
6	Pelagic fishing, with low by-catch	30	30	**40**
7	Chemicals / inorganic matter discharge	20	30	**50**
8	Fertilizers plumes	20	30	**50**
9	Pesticides plumes	20	30	**50**
10	Ocean acidification	**80**	10	10
11	Sea level rise	**80**	10	10
12	Sea surface temperature	**80**	10	10
13	UV radiation	**90**	0	10
14	Invasive/alien species	**40**	30	30
15	Light pollution	10	10	**80**
16	Marine litter	20	30	**50**
17	Oil rigs	20	20	**60**
18	Population	10	0	**90**
19	Shipping	30	20	**50**

Some Formulas

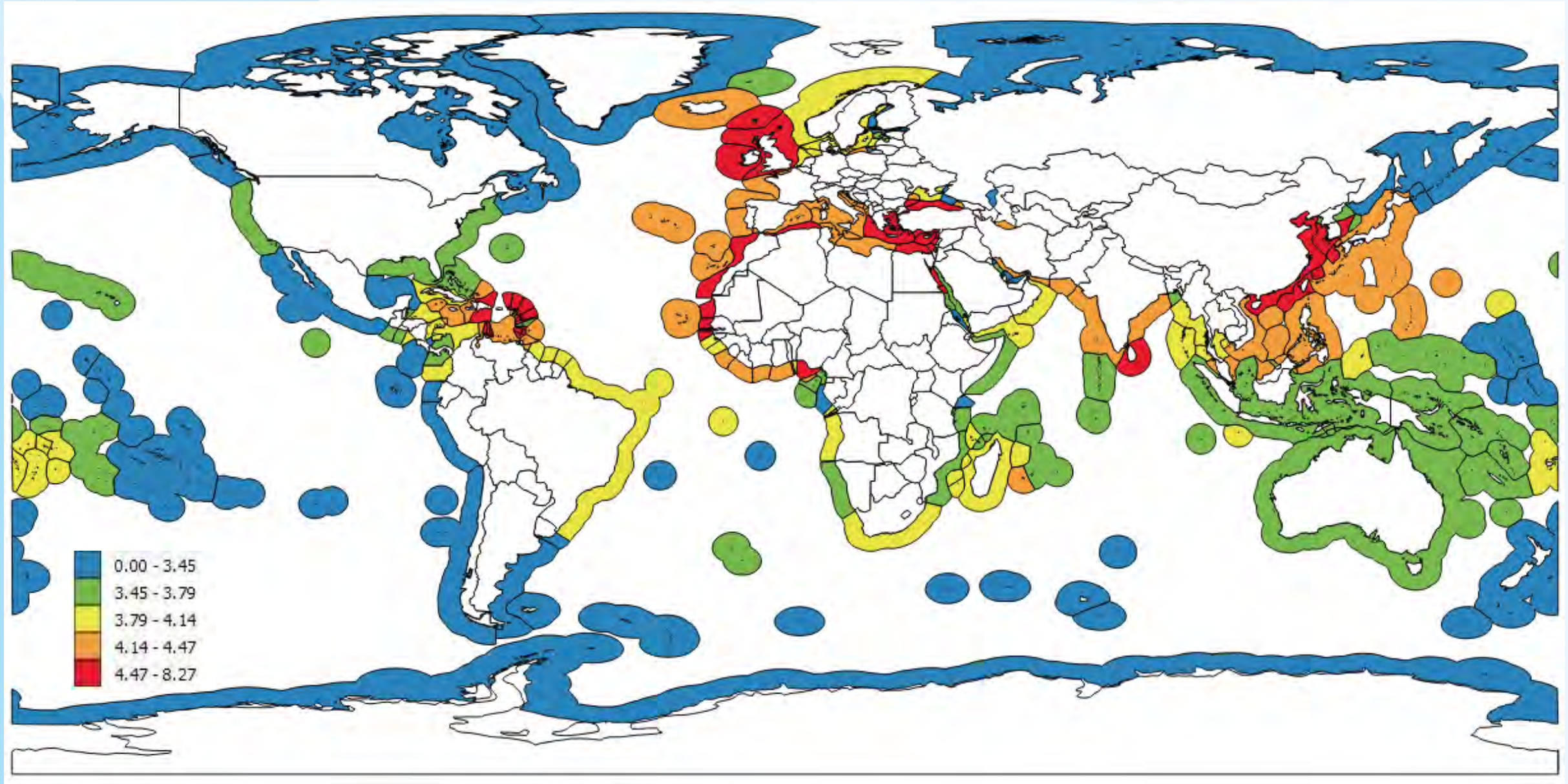
Hazard needing G/R/N governance = $\sum_{i=1}^{19} CHIi \times \text{gov. scale } (\%)$

Risk = Geometric Mean (Hazard, Vulnerability, Exposure)

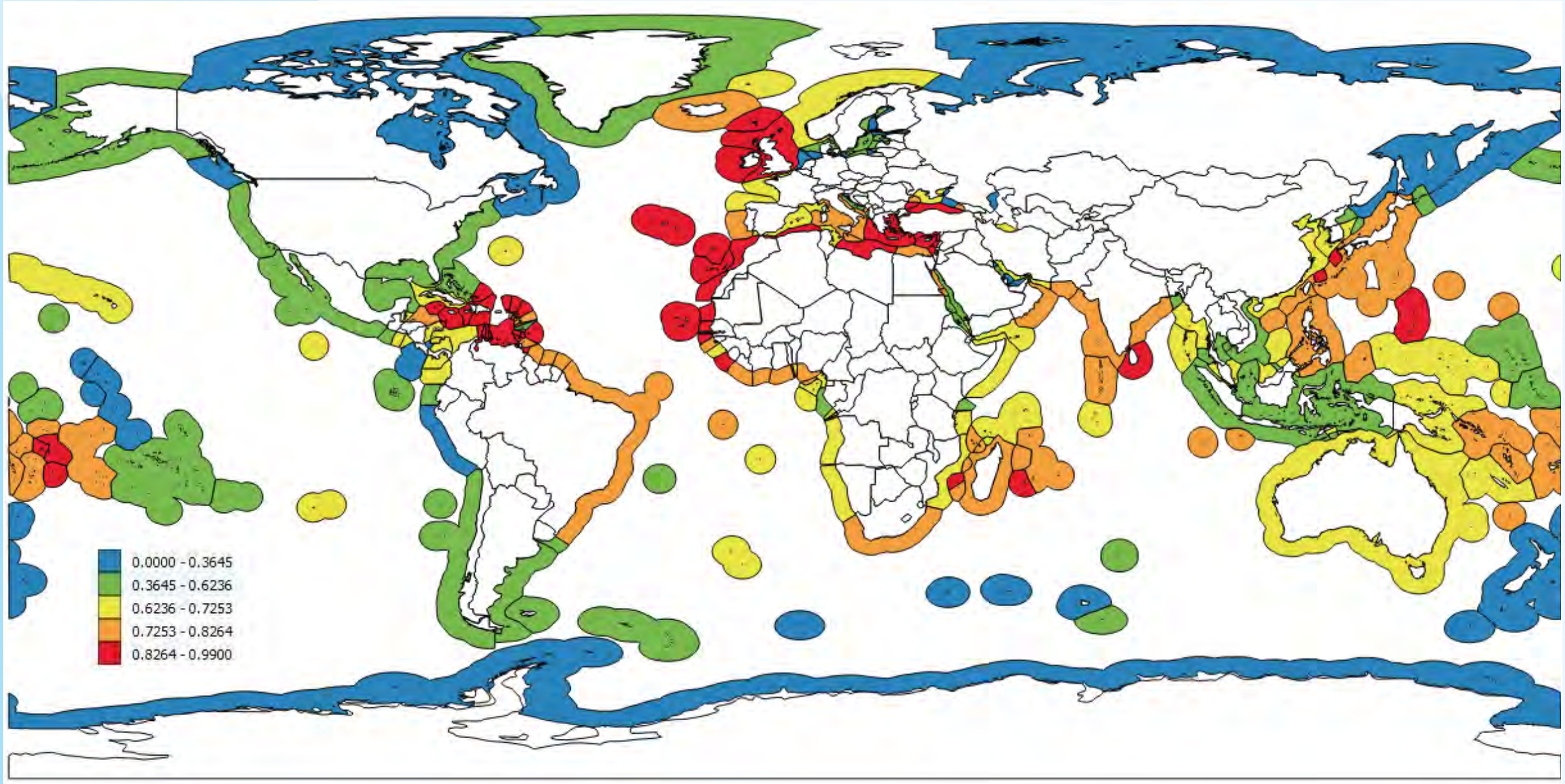
Risk needing G/R/N governance = Geometric Mean ($\text{Hazard}_{G/R/N}$, Vulnerability, Exposure)

$\text{Risk}_T = \frac{Risk\ needing\ transboundary\ (global{+}regional)\ governance}{Risk\ needing\ national\ governance}$

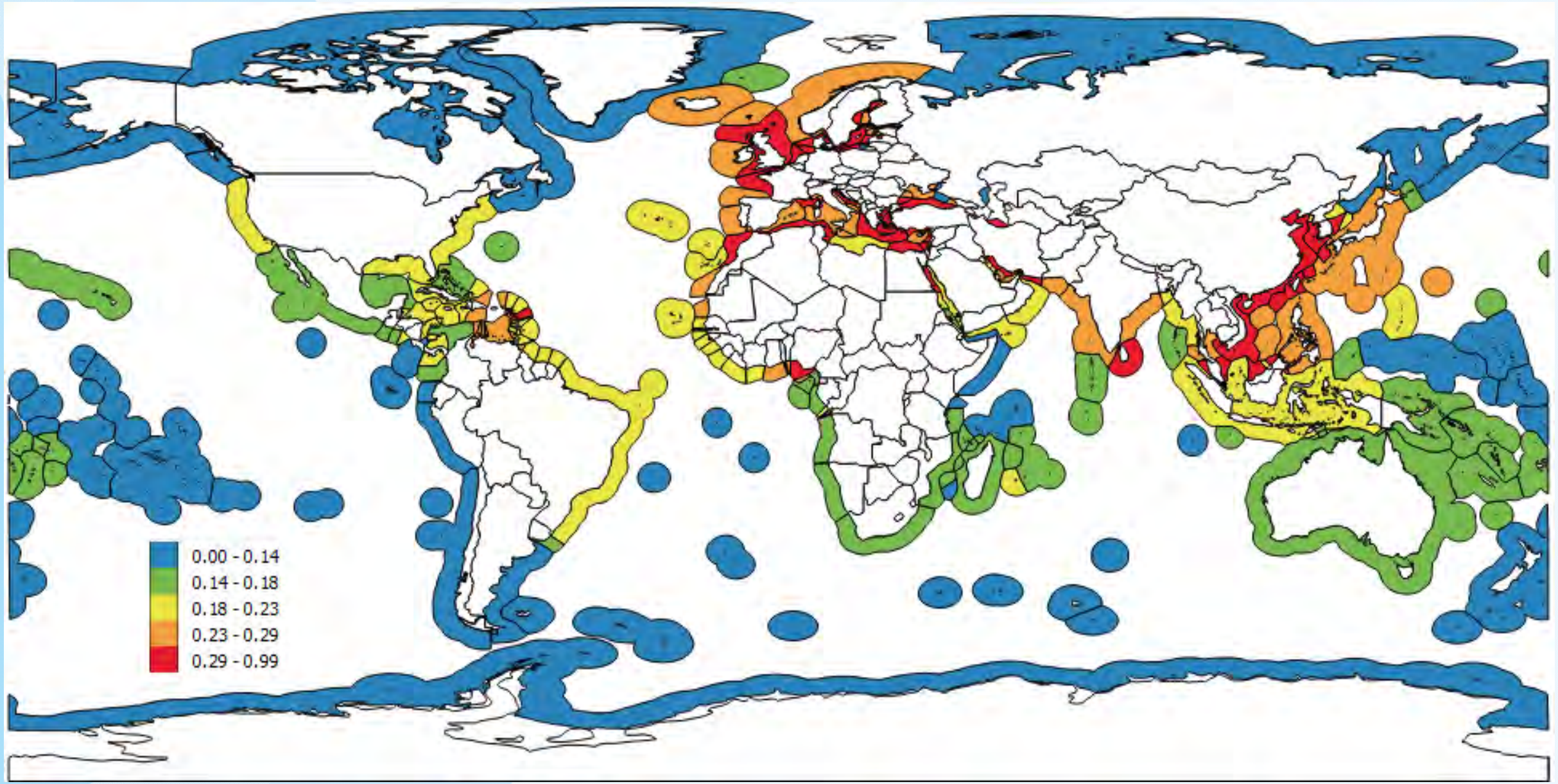
Hazards – Spatial Distribution



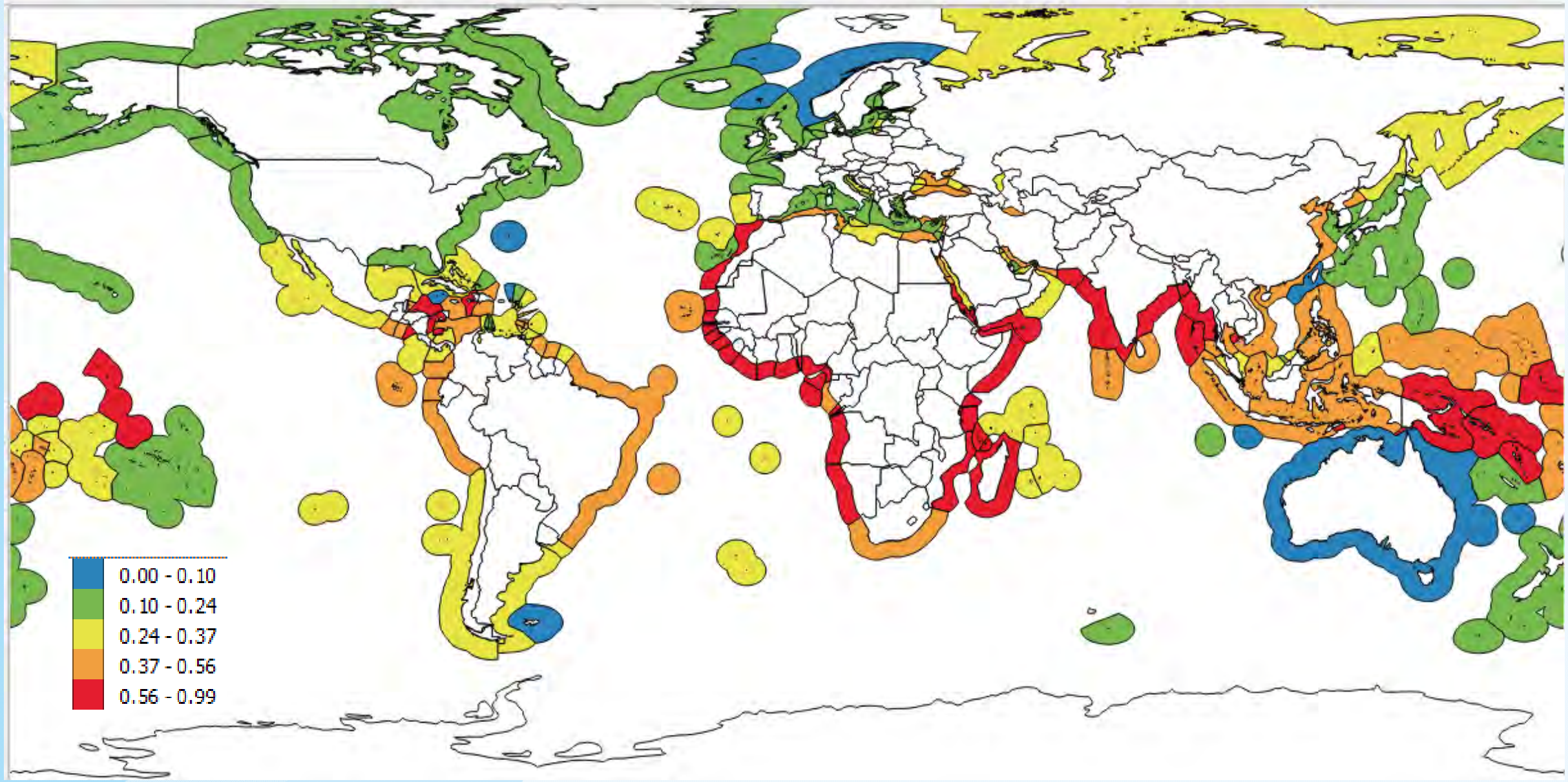
Hazards needing global governance



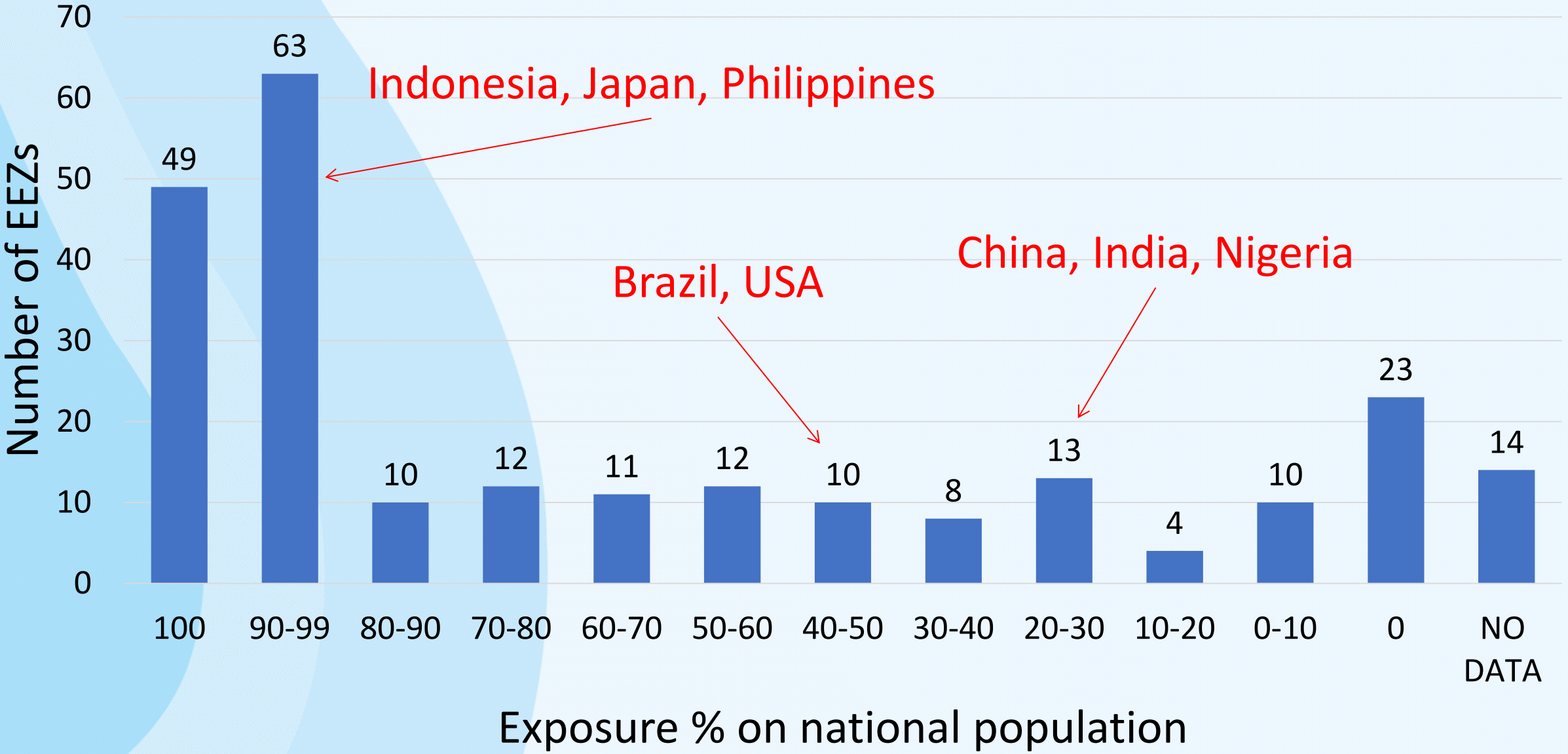
Hazards needing regional/national governance



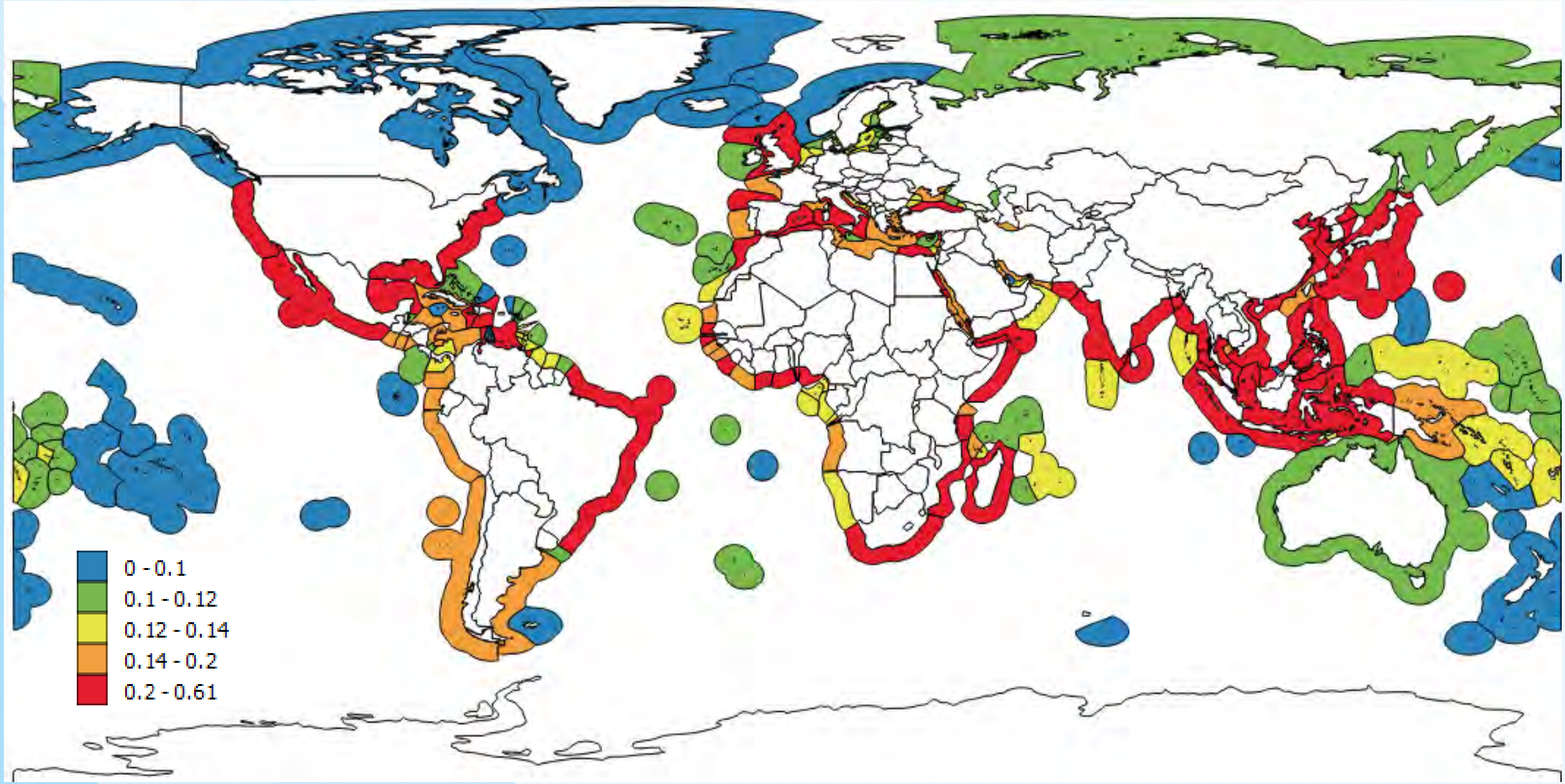
Vulnerability – Spatial Distribution



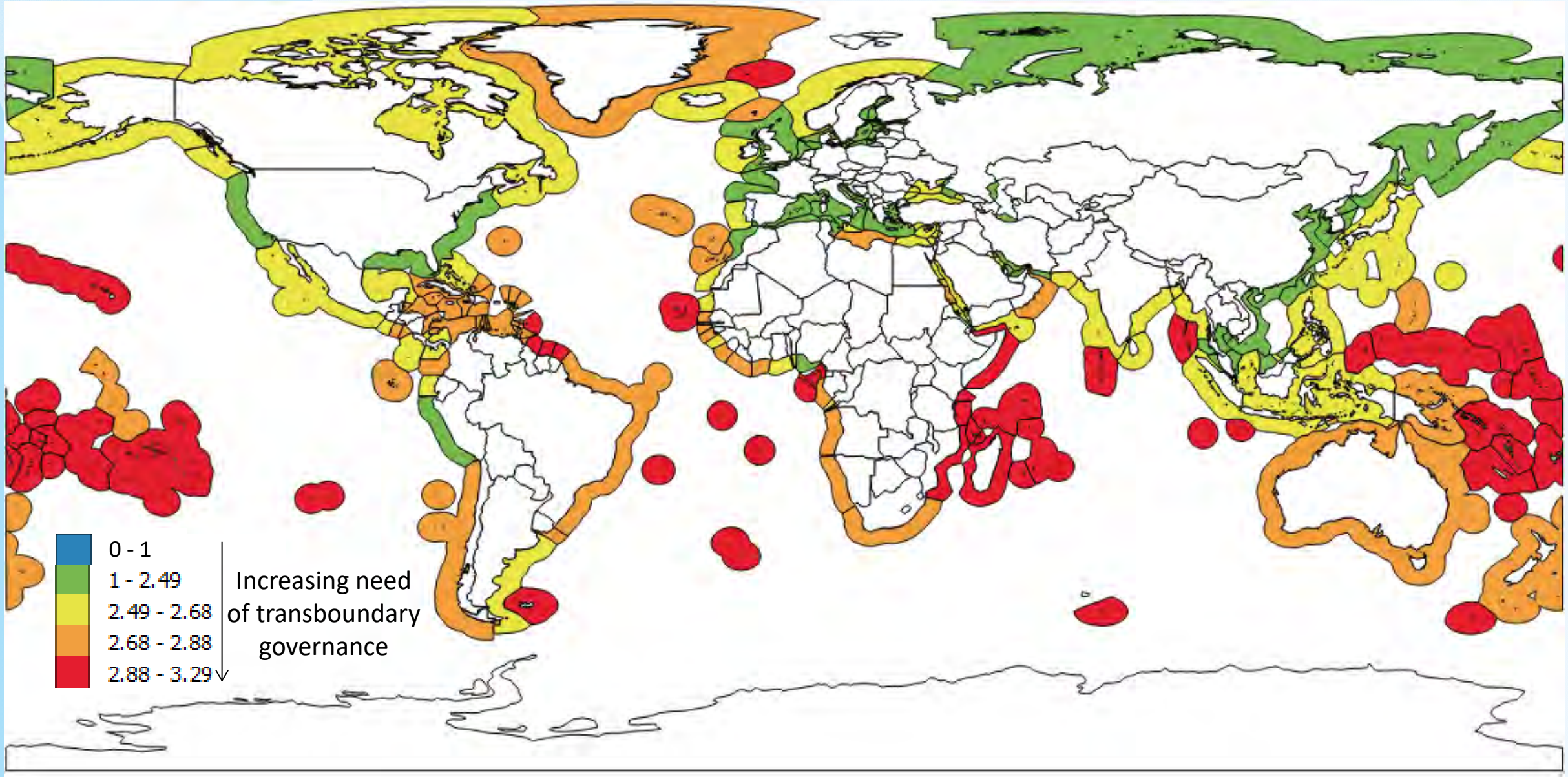
Exposure – Coastal Population Share



Risk – Spatial Distribution



Risk from hazards needing transboundary governance



Risk Ranking – Top & Bottom 15

	EEZ name	Risk	$Risk_T$
1	China	0,6075	2,1419
2	India	0,5998	2,5769
3	Indonesia	0,4750	2,5489
4	Philippines	0,3961	2,5362
5	Bangladesh	0,3747	2,5314
6	Viet Nam	0,3653	2,2970
7	Nigeria	0,3464	2,4023
8	Brazil	0,3415	2,7314
9	Egypt	0,2968	2,5398
10	Japan	0,2933	2,6368
11	Morocco	0,2761	2,4533
12	Myanmar	0,2725	2,5944
13	Pakistan	0,2607	2,5652
14	Algeria	0,2580	2,4510
15	USA	0,2460	2,4251

	EEZ name	Risk	$Risk_T$
226	British Virgin Islands (UK)	0,068	2,7915
227	Faroe Islands (DK)	0,0660	2,6824
228	Heard and McDonald Islands (Australia)	0,0658	3,2644
229	Christmas Island (Australia)	0,0639	3,0602
230	Gibraltar (UK)	0,0624	2,1432
231	Jan Mayen (Norway)	0,0596	3,1301
232	Monaco	0,0594	2,3068
233	Falkland/Malvinas	0,0582	3,0264
234	Norfolk Island (Australia)	0,0548	2,9674
235	Guernsey (UK)	0,0502	2,3501
236	Macquarie Island (Australia)	0,0457	2,8824
237	Cayman Islands (UK)	0,0375	2,8205
238	Bermuda (UK)	0,0374	2,7229
239	Jersey (UK)	0,0306	2,2283

Key Messages

- Global action on Hazards: Caribbean, West Africa, East Med
- Also local action: Asia, Europe
- Highest risk: S-SE Asia, highly populated countries – lowest: Poles, Pacific SIDS
- Risk driven by:
  - Hazard: Europe, ANZ
  - Hazard & Vulnerability: Central America & Caribbean
  - Exposure: S-SE Asia, highly populated countries, small islands (>90% pop.)
  - Vulnerability: Africa
- Global hazards/risks dominate (and expected to grow) → need for transboundary cooperation

What is missing? Future research

- Include economic exposure
- Refine governance scales attribution
- Projections (how do hazards and risk evolve in time?)
- Governance effectiveness to mitigate hazards (and for adaptation?)

Thank you!

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