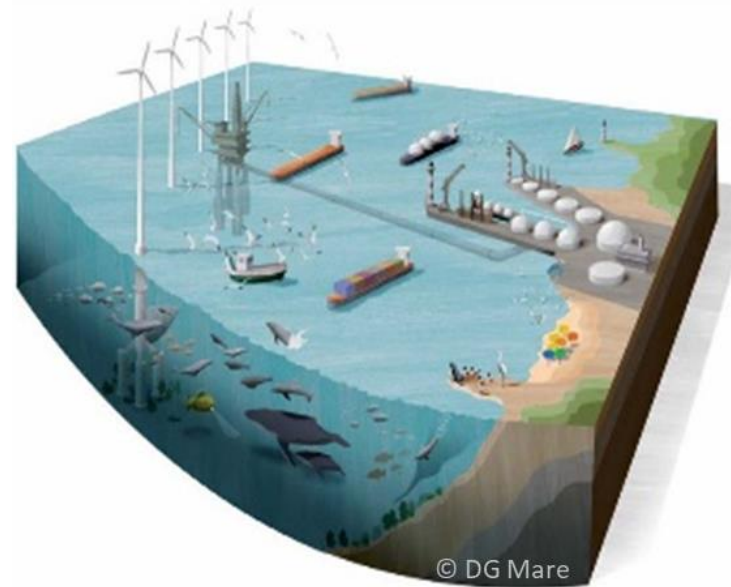


Ecosystem-based management and the role of marine spatial planning

Dr. Vanessa Stelzenmüller

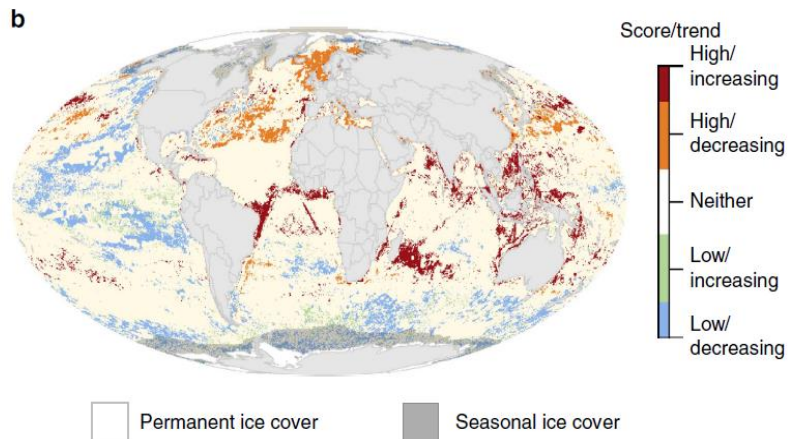
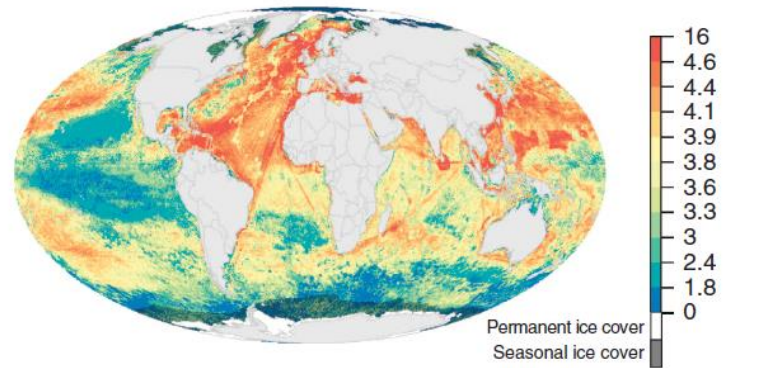
Head - Marine Spatial Management
Thünen Institute of Sea Fisheries
Herwigstrasse 31 , 27572 Bremerhaven, Germany

vanessa.stelzenmueller@thuenen.de
www.researchgate.net/profile/Vanessa_Stelzenmueller
@VanessaStelzen1



EU Marine Board, 6th of February 2019

The need for marine ecosystem-based management



Halpern et al. 2015. Nature communications 6:7615

“Doubling of the economic value of ocean industries to US\$3 trillion over the next 20 years as a result of expansion of existing industries and the emergence of new industries” OECD (2016)



“Aquaculture plays a major role in meeting the rising demands for fish products and protein”

Larsen & Roney (2013)

The need for marine ecosystem-based management

RESEARCH

REVIEW

MARINE CONSERVATION

Marine defaunation: Animal loss in the global ocean

Douglas J. McCanley,^{1*} Malin L. Pinsky,² Stephen R. Palumbi,³ James A. Estes,⁴ Francis H. Joyce,¹ Robert R. Warner¹

LETTER

doi:10.1038/nature11118

A global synthesis reveals biodiversity loss as a major driver of ecosystem change

David U. Hooper¹, E. Carol Adair^{2,3}, Bradley J. Cardinale⁴, Jarrett E. K. Byrnes², Bruce A. Hungate⁵, Kristin L. Matulich⁶, Andrew Gonzalez⁷, J. Emmett Duffy⁸, Lars Gamfeldt⁹ & Mary I. O'Connor^{2,10}

Evidence is mounting that extinctions are altering key processes important to the productivity and sustainability of Earth's ecosystems^{1–4}. Further species loss will accelerate change in ecosystem manipulations of a variety of environmental changes on primary production (biomass production by plants) and decomposition (mass loss of plant litter) in a variety of ecosystems around the world (Tables 1

nature
COMMUNICATIONS

ARTICLE

Received 12 Nov 2014 | Accepted 17 Mar 2015 | Published 24 Apr 2015

DOI: 10.1038/ncomms7936

OPEN

Biodiversity enhances ecosystem multifunctionality across trophic levels and habitats

Jonathan S. Lefcheck¹, Jarrett E.K. Byrnes², Forest Isbell³, Lars Gamfeldt⁴, John N. Griffin⁵, Nico Eisenhauer^{6,7}, Marc J.S. Hensen², Andy Hector⁸, Bradley J. Cardinale⁹ & J. Emmett Duffy^{1,10}

RESEARCH ARTICLE

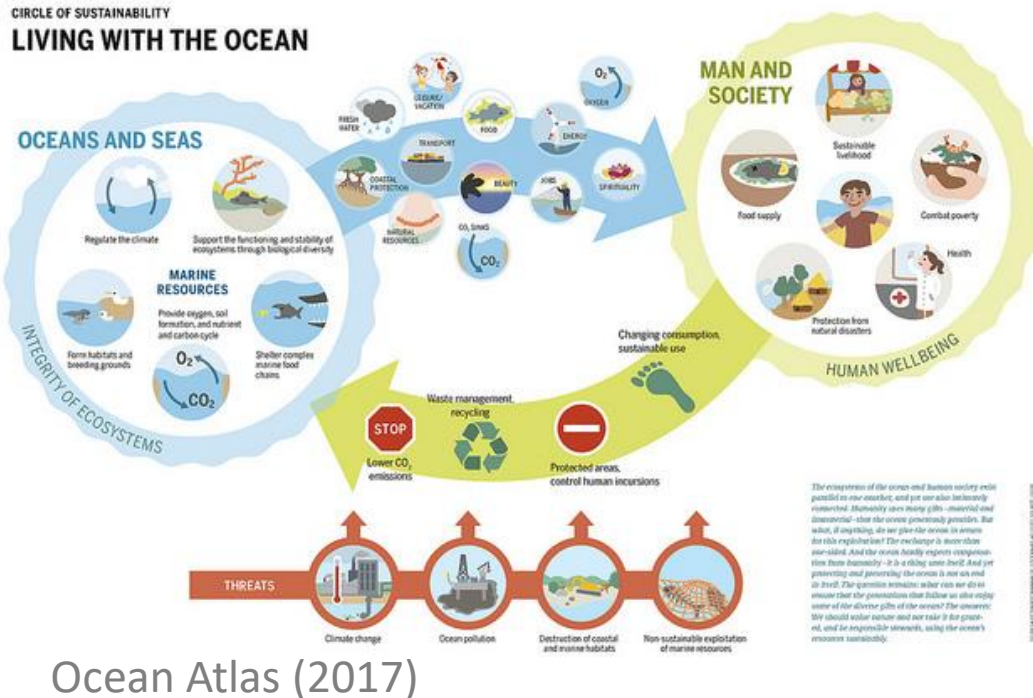
Impacts of Biodiversity Loss on Ocean Ecosystem Services

Boris Worm,^{1*} Edward B. Barbier,² Nicola Beaumont,³ J. Emmett Duffy,⁴ Carl Folke,^{5,6} Benjamin S. Halpern,⁷ Jeremy B. C. Jackson,^{8,9} Heike K. Lotze,¹ Fiorenza Micheli,¹⁰ Stephen R. Palumbi,¹⁰ Enric Sala,⁸ Kimberley A. Selkoe,⁷ John J. Stachowicz,¹¹ Reg Watson¹²

species provide critical services to society (6), the role of biodiversity per se remains untested at the ecosystem level (14). We analyzed the effects of changes in marine biodiversity on fundamental ecosystem services by combining available data from sources ranging from small-scale experiments to global fisheries.

Experiments. We first used meta-analysis of published data to examine the effects of variation in marine diversity (genetic or species richness) on primary and secondary production, biomass, nutrient cycling, and ecosystem

The need for marine ecosystem-based management



Ecosystem-based management (EBM):

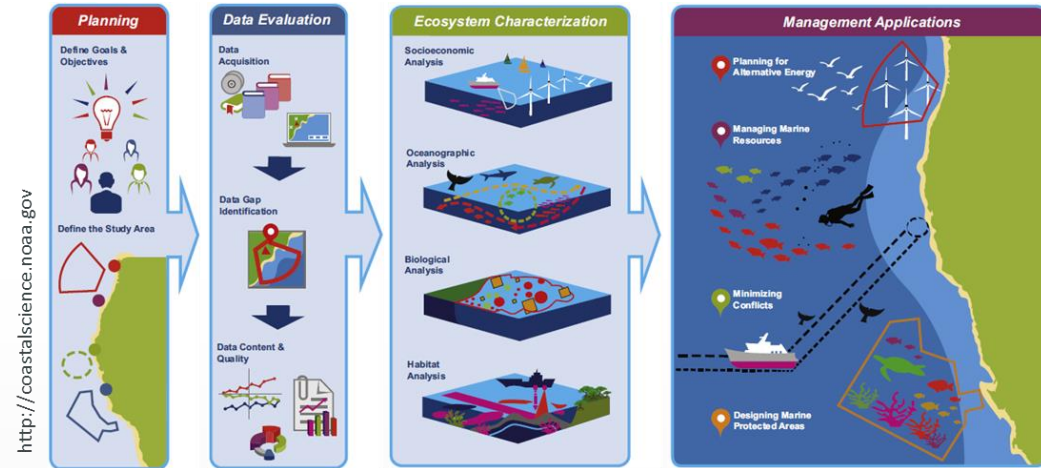
- encompasses the interconnectedness of natural systems
- Considers all ecological and socio-economic functions and processes within management boundaries

Katsanevakis et al. (2011)

Tools for EBM implementation

- Marine Spatial Planning (MSP; Ehler and Douvere 2009)
- Integrated Ecosystem Assessment (IEA; Levin et al 2009)
- Systematic Conservation Planning (SCP; Pressey and Bottrill 2009),
- Integrated Oceans Management (IOM; Foster et al 2005)
- Ecosystem Approach to Fisheries/Management (EAF/M or EBM; Arkema et al 2006; Fletcher and Bainchi 2014; Long et al 2015).

MSP process



www.plancoast.eu

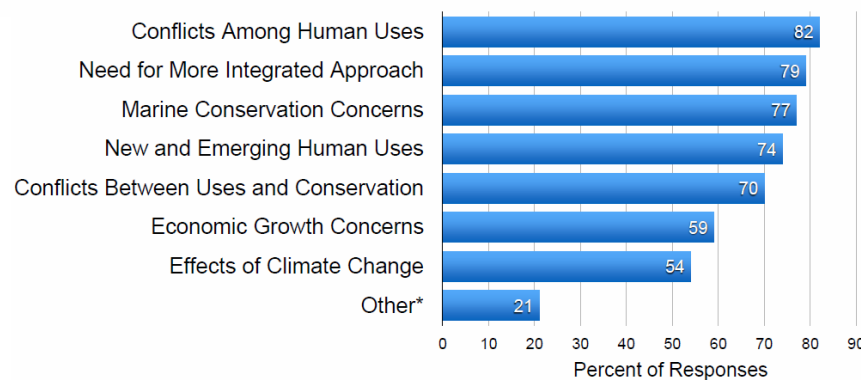
MSP - Global perspective

MSP process characteristics

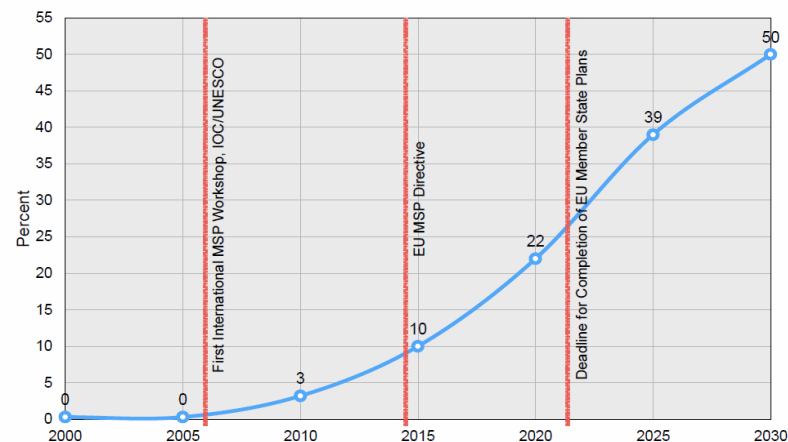
Place-based	<i>Focusing on marine spaces that people can understand, relate to, and care about</i>
Participatory	<i>Building and engaging a broad base of stakeholders to ensure long-term support for management of the marine space</i>
Multi-objective and integrated	<i>Achieving social and economic objectives as well as ecological; including all important economic sectors</i>
Strategic and future-oriented	<i>Considering alternative scenarios and means to achieve a desired spatial vision of the marine space</i>
Ecosystem-based	<i>Focusing on maintaining coastal and marine ecosystem services over time</i>
Continuing and adaptive	<i>Emphasising performance monitoring and evaluation of the success of management actions—and learning by doing</i>
Government led	<i>Engaging the institutions primarily responsible for implementing the plan</i>

Charls Ehler, UNESCO MSP conference 2017

MSP drivers; n=64 MSP responses



Percent of Surface Area of World's Exclusive Economic Zones Covered by Approved Marine Spatial Plans



Note: Surface Area of the World's EEZs is ≈ 140 million km²

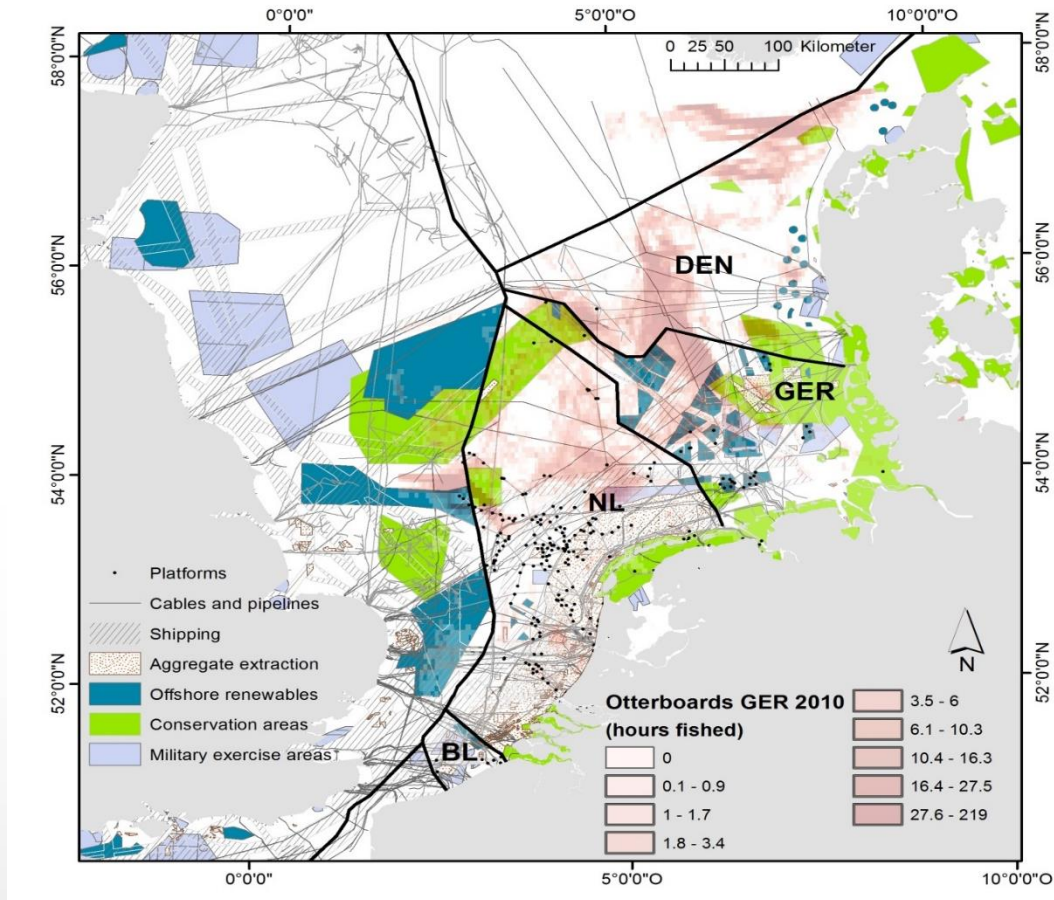
EU Marine Spatial Planning Directive (2014/89/EU)

Cross-cutting policy tool that contributes to “*sustainable growth of maritime economies, the sustainable development of marine areas and the sustainable use of marine resources*” while “*applying an ecosystem-based approach as referred to in Article 1(3) of Directive 2008/56/EC with the aim of (...) achievement of good environmental status*” (EC, 2014a)

MSP Directive (2014/89/EU):

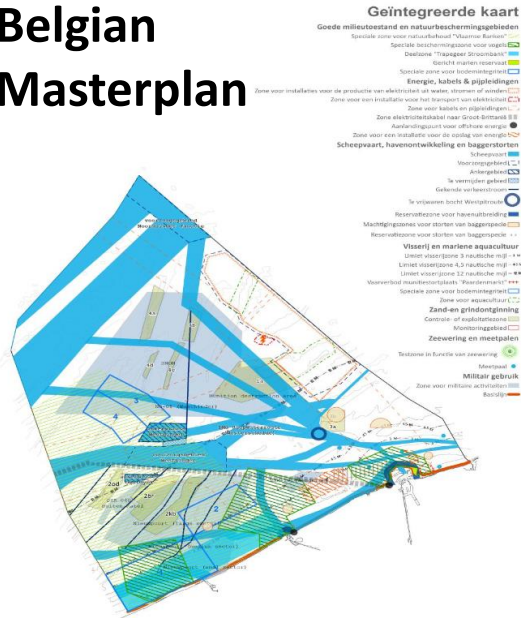
- to be integrated in national legislation by 2016
- to be completed in 2021
- method of implementation is dedicated to the member states
- cross-border coordination with other member states is desired (MSP key principle 8) to develop common standards and action plans on an international scale

Spatial management in the southern North Sea



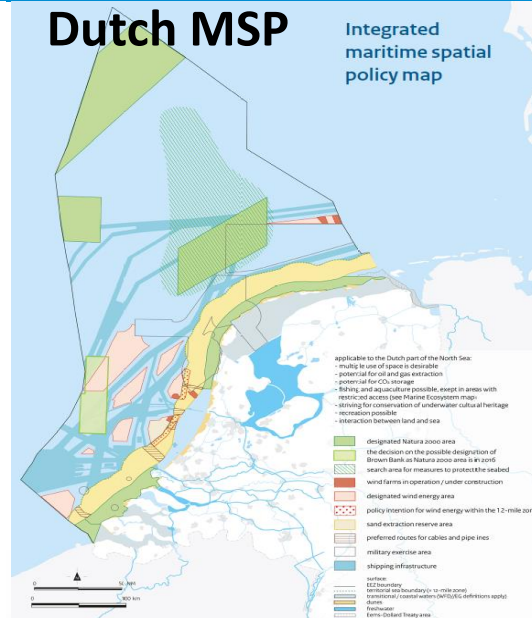
Spatial management in the southern North Sea

Belgian Masterplan



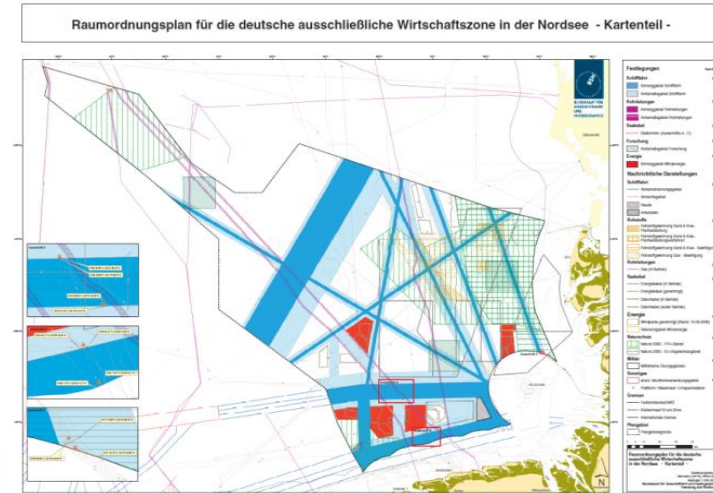
Federal Ministry of Economics
and Energy (2017)

Dutch MSP



NWP (2016-2021)

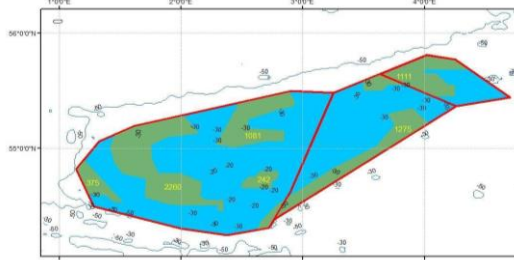
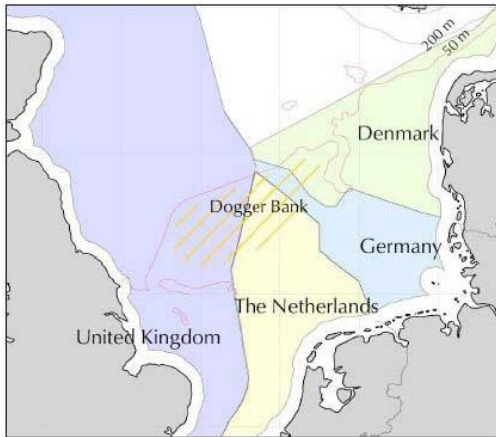
German MSP



www.bsh.de

- Member states have different planning approaches, visions and objectives
- No coherent planning across boundaries
- Fisheries is currently not considered in most MSP processes

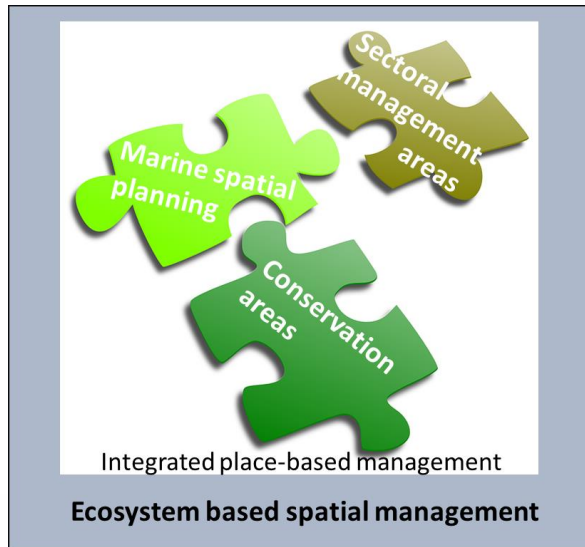
Spatial management in the southern North Sea



- DK no N2000 area
- N2000 in NL, UK, DE
- Windfarmcluster in UK

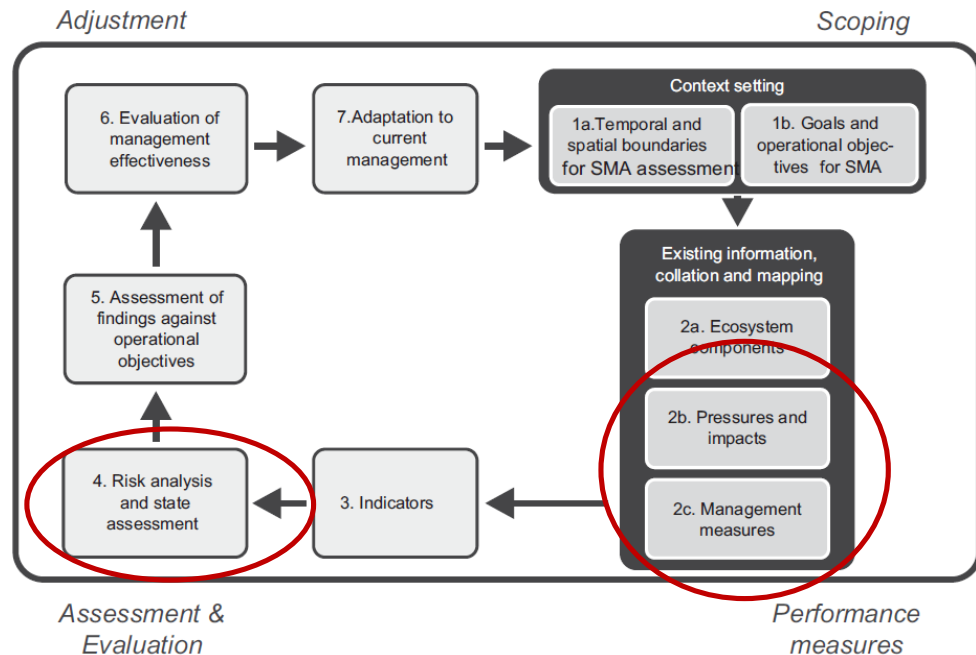


How to move towards an ecosystem-based MSP process ?



a MESMA framework

Stelzenmüller et al. (2013)

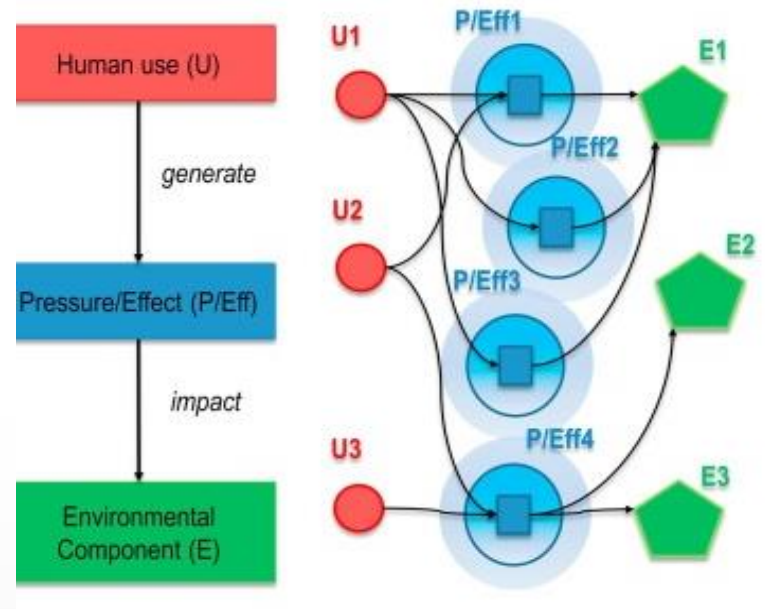


Ecosystem-based MSP processes should...

-have operational objectives which address the reduction of **the risk of cumulative effects** of human activities on key ecosystem components and functions
-consider **ecosystem state changes** due to e.g. climate change
-built in **trade-off analysis** for weighing management options

Cumulative effect assessments (CEAs) and marine management

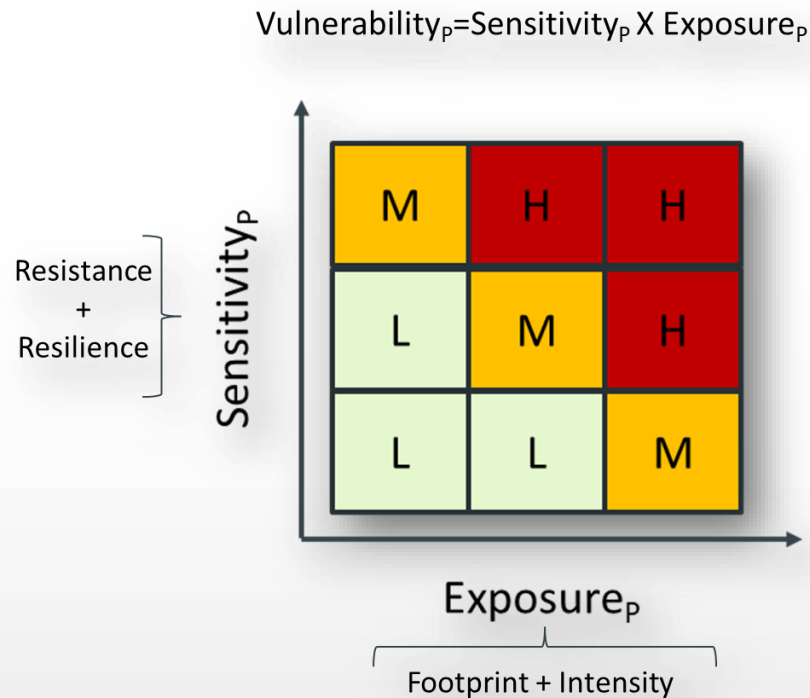
- CEAs are holistic evaluations of the combined effects of human activities and natural processes on the environment
- Marine CEAs are inherently complex due to high level of connectivity and complex bio-physical processes



Menegon et al. (2018)

CEAs and marine management

Common conceptual understanding of the quantification of ecosystem state vulnerability:



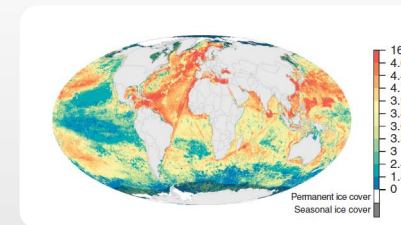
Decadal trend of quantifying/mapping cumulative effects with raster algebra:

$$I_C = \sum_{i=1}^n \sum_{j=1}^m D_i * E_j * \mu_i, \quad \text{Halpern et al. (2008)}$$

$$RiskCI_{cell} = \sum_i P_i \cdot LS_j \cdot is_{ij} \cdot w_i \quad \text{Stelzenmüller et al. (2010)}$$

$$CI = \sum_{i=1}^l \sum_{j=1}^m \sum_{k=1}^n s(U_i, P_j, E_k) i(U_i, M(U_i, P_j, E_k)) d(E_k) \quad \text{Gissi et al. (2017)}$$

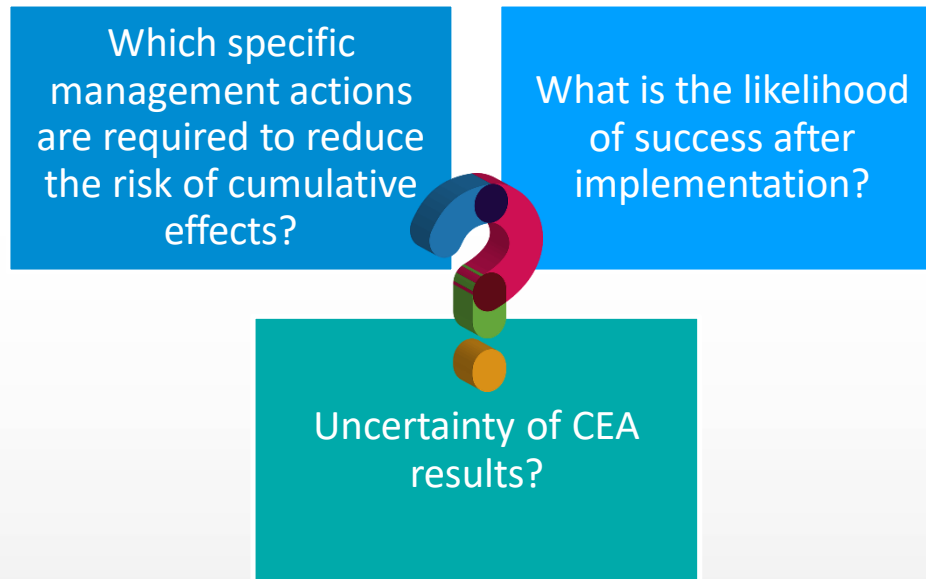
And probably many more modifications.....



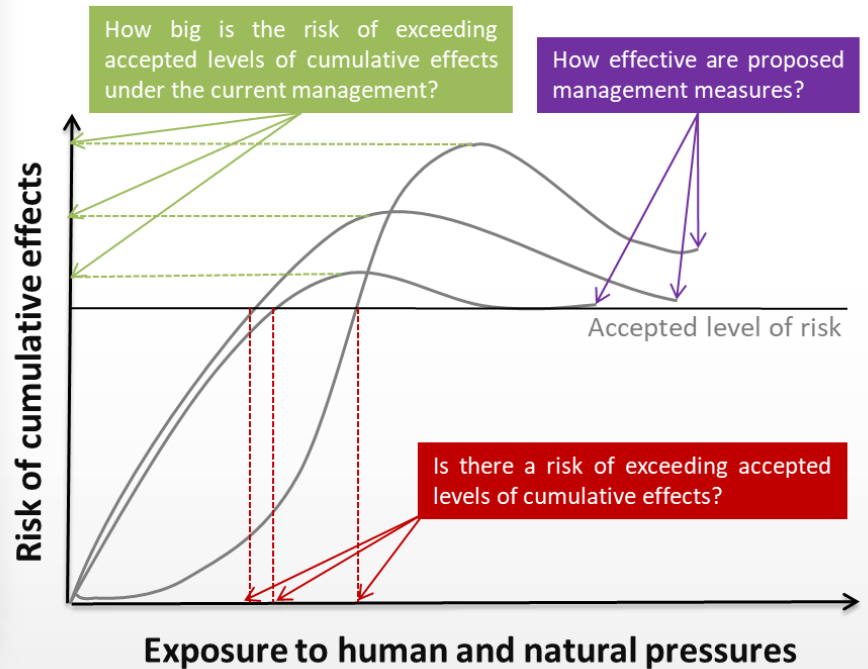
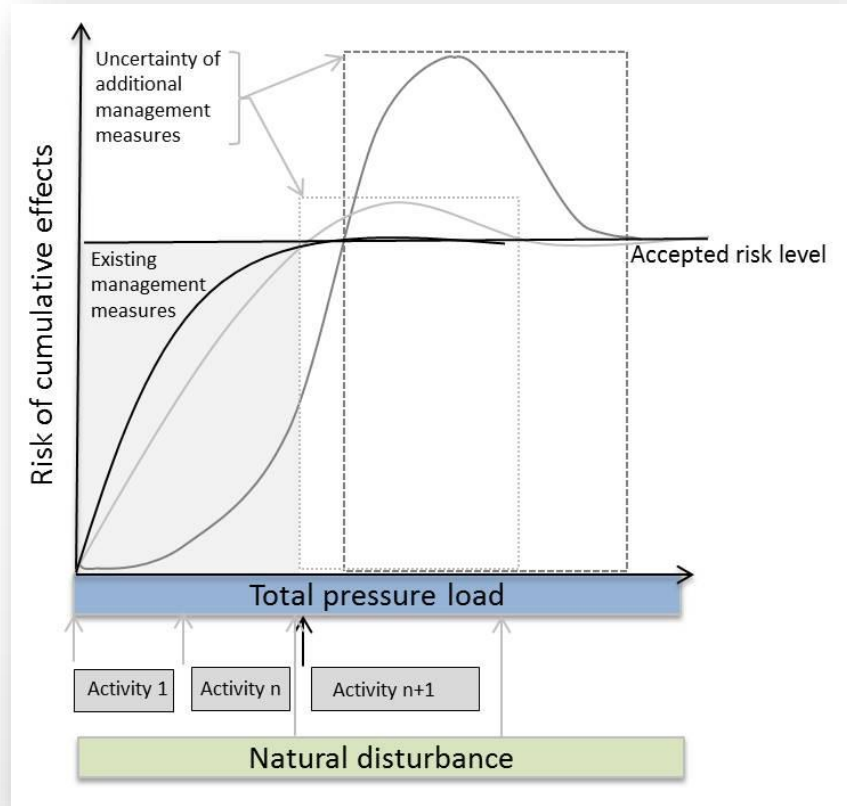
Halpern et al. (2008)

CEAs and marine management

- ❗ Policy drivers for CEAs exist from global (e.g. UNCLOS) and regional (MSFD) to national levels (MSP)
- ❗ CEAs are hardly considered in real management process



Framework for risk based CEAs – Scientific challenges



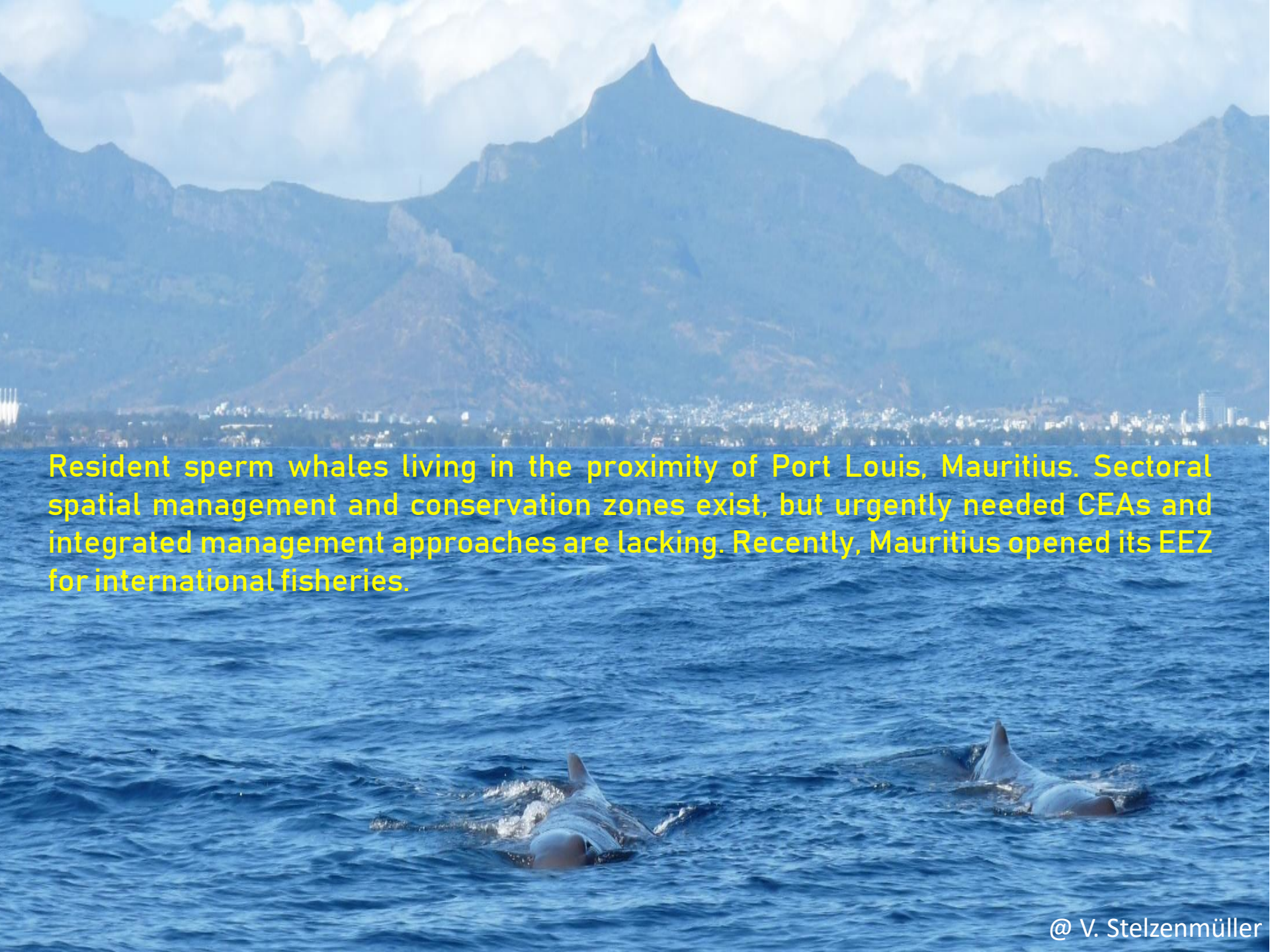
Stelzenmüller et al. (2018)

Summary

- EBM considers the complexity of coupled human and natural systems
- Policy and management tools for EBM implementation exist
- MSP goes global - with common process characteristics embracing EBM
- Current MSP practice shows a mismatch between theoretical process characteristics and actual implementation processes
- Ecosystem based MSP process requires a mandatory consideration of cumulative effects, trade-off analysis and ecosystem change
- Risk based CEA allows to better inform management processes and improve science-policy links

Future challenges

- Development of standards based on best available science to implement ecosystem-based MSP processes
- EBM implementation is not limited by science advancements rather by the mismatch of institutional arrangements (Alexander and Haward 2018)
 - How to overcome those?
- We need success stories

A photograph showing two sperm whales swimming in the blue ocean. In the background, a coastal city (Port Louis) is visible, followed by a range of rugged, green mountains under a cloudy sky. The whales are in the foreground, with their dark, rounded backs and small dorsal fins visible above the water.

Resident sperm whales living in the proximity of Port Louis, Mauritius. Sectoral spatial management and conservation zones exist, but urgently needed CEAs and integrated management approaches are lacking. Recently, Mauritius opened its EEZ for international fisheries.