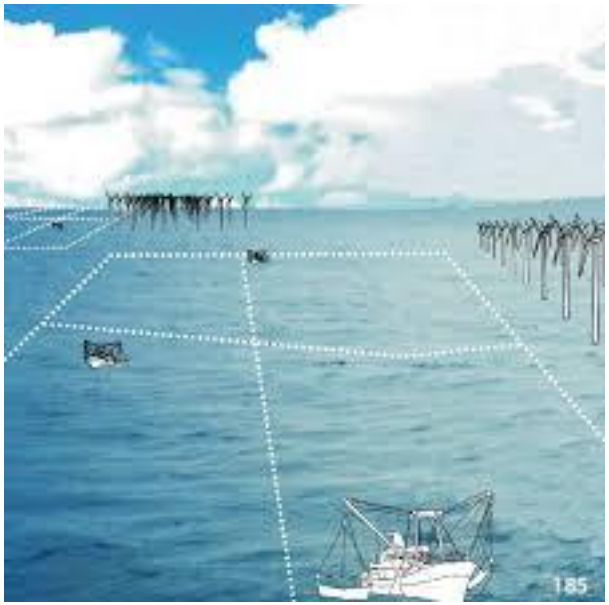
Addressing Data Needs for Marine Spatial Planning



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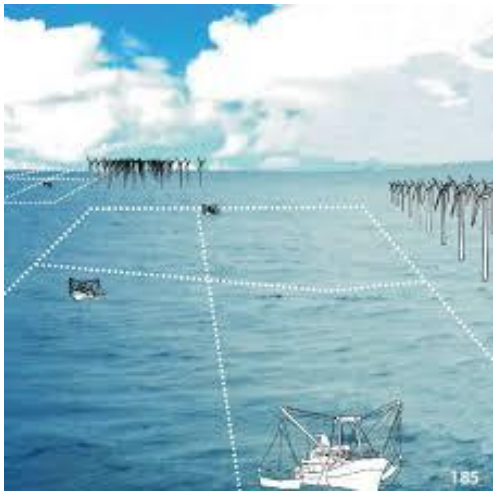
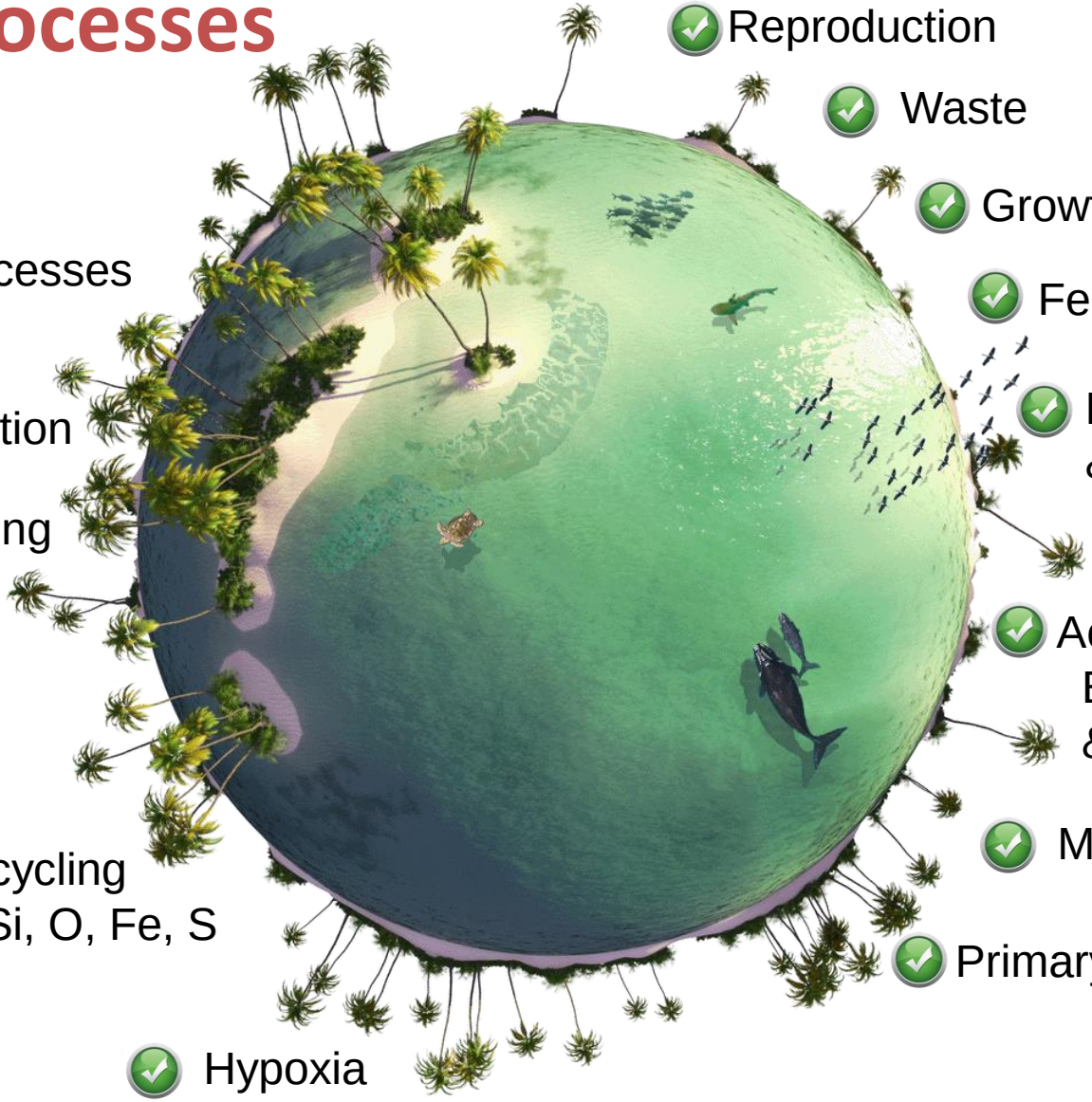
Marine Geospatial Ecology Lab
Duke University

Topics

- Data in the MSP Process
- Sector and Stakeholder Engagement
- Participatory GIS Approaches



Natural Processes



- Reproduction
- Waste
- Growth
- Feeding
- Movement & Migration
- Acclimation, Biodiversity & Evolution
- Mortality
- Primary production
- Hypoxia
- Nutrient cycling
  N, P, C, Si, O, Fe, S
- Sediment processes
- Currents, eddies, tides & stratification
- Environmental forcing
  - Temperature
  - Salinity
  - Alkalinity (pH)
  - Wind

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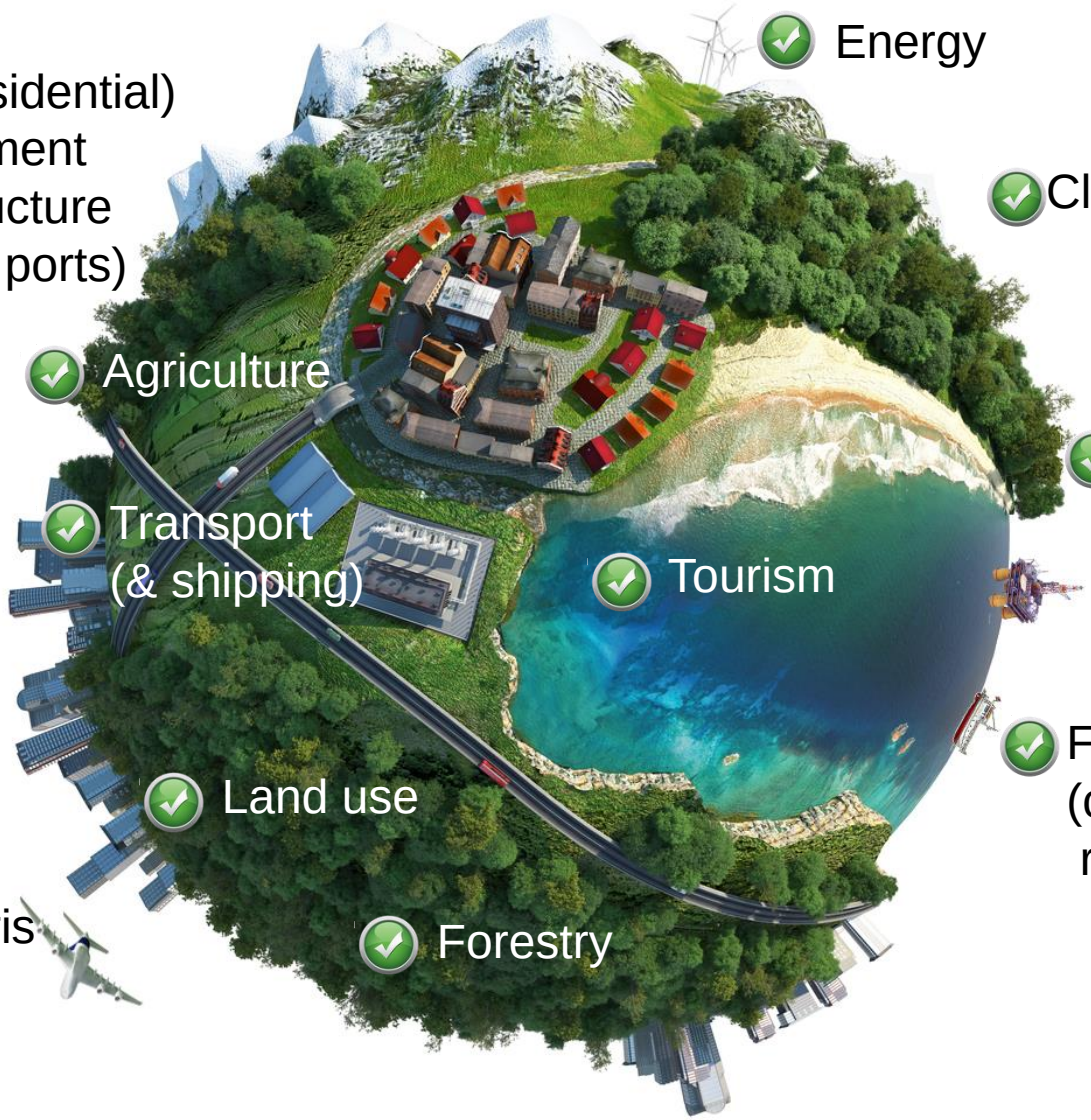
Human Use



- Energy
- Urban (& residential) development & infrastructure (including ports)
- Climate change
- Agriculture
- Catchments
- Non-renewable Resources (oil, gas, mining)
- Transport (& shipping)
- Tourism
- Population
- Fisheries (commercial & recreational)
- Land use
- Marine debris
- Forestry

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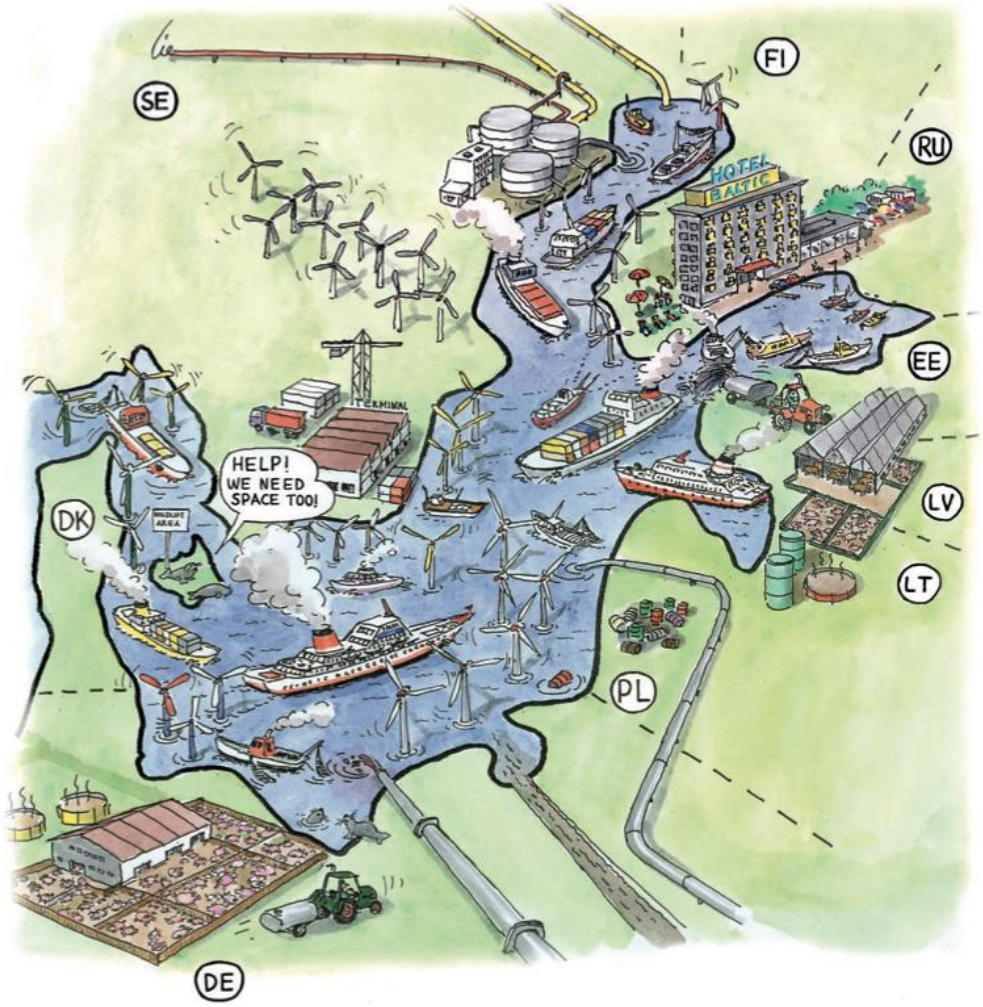
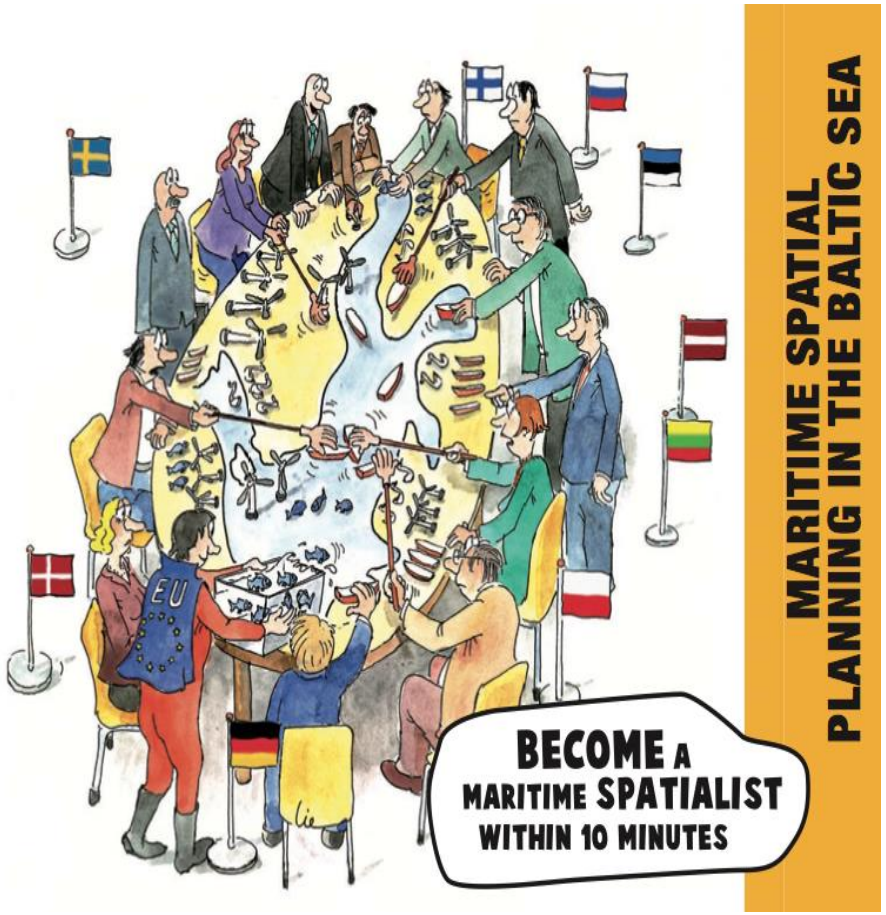
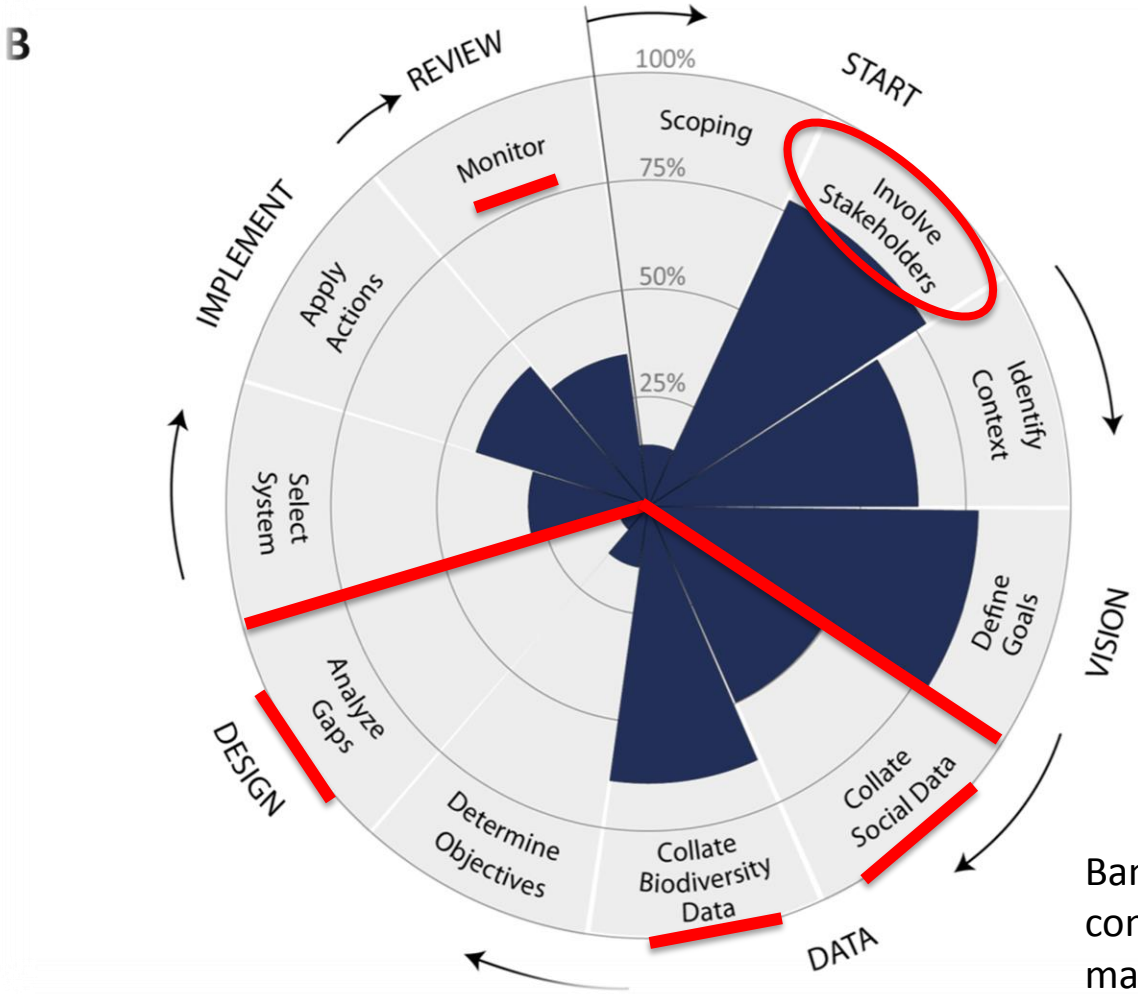
Complex …but successful examples exist





Source: WWF publication “Maritime Planning in the Baltic Sea”

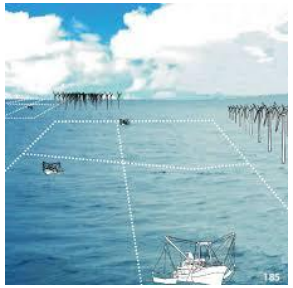
Data in the MSP Process



Ban et al. 2013 “Systematic conservation planning: a new recipe for managing the High Seas”

Key Data Questions

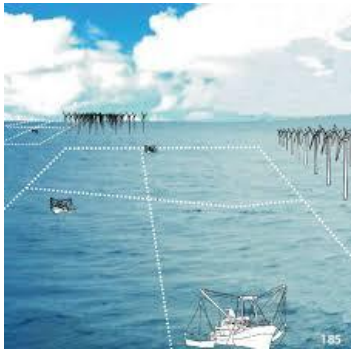
- What data do you have about your region?
- What data don't you have? Does the data exist, and how can it be accessed?
- How will the public, users, and sectors be able to use and contribute data?
- If the data does not exist, what is needed in terms of time, resources, and expertise to create it?



Source: Batelle Advanced CMSP training

Data Framework

- Physical and ecological patterns and processes
- Relative ecological importance of areas
  - Condition
- Ecosystem services
  - Vulnerability and resilience
- Economic activities, benefits and impacts
- Distribution among current and emerging ocean uses
- Existing management measures
- Future needs of existing or proposed uses
- …



Many tools exist to work with these data:

* Geographic Information Systems (GIS) to integrate

Engaging Multiple Sectors and Stakeholders

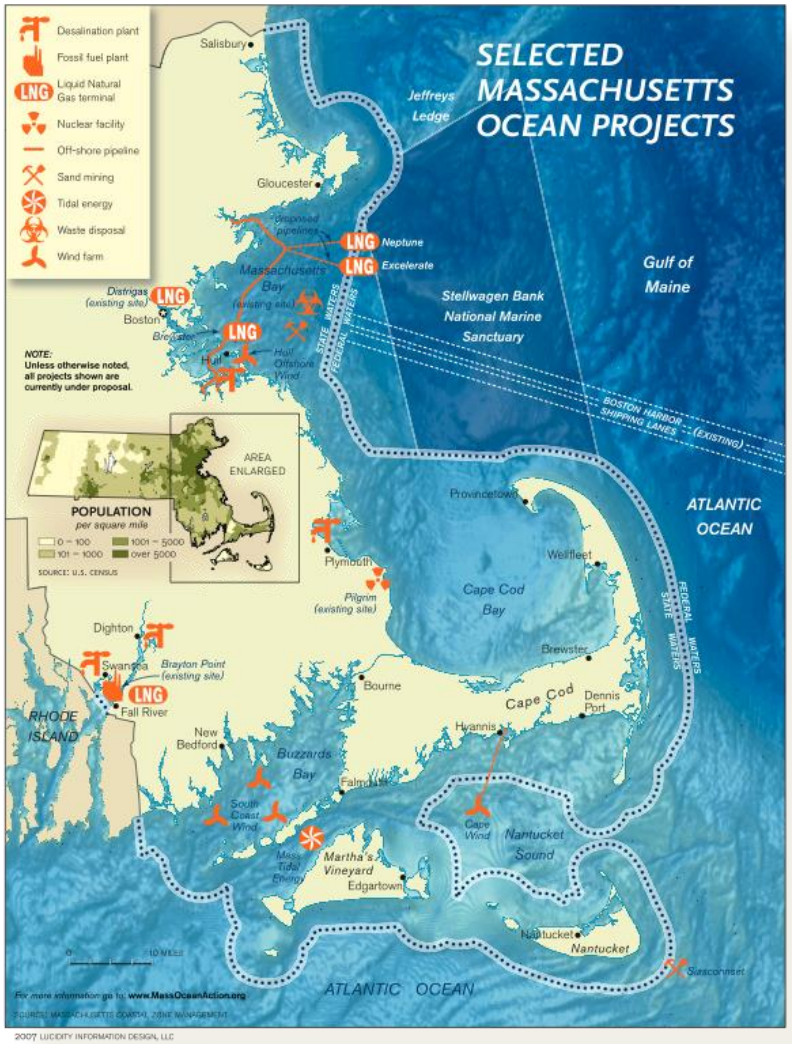
We currently conduct analysis, mapping and planning, but generally in single sectors…

marine planning sectors

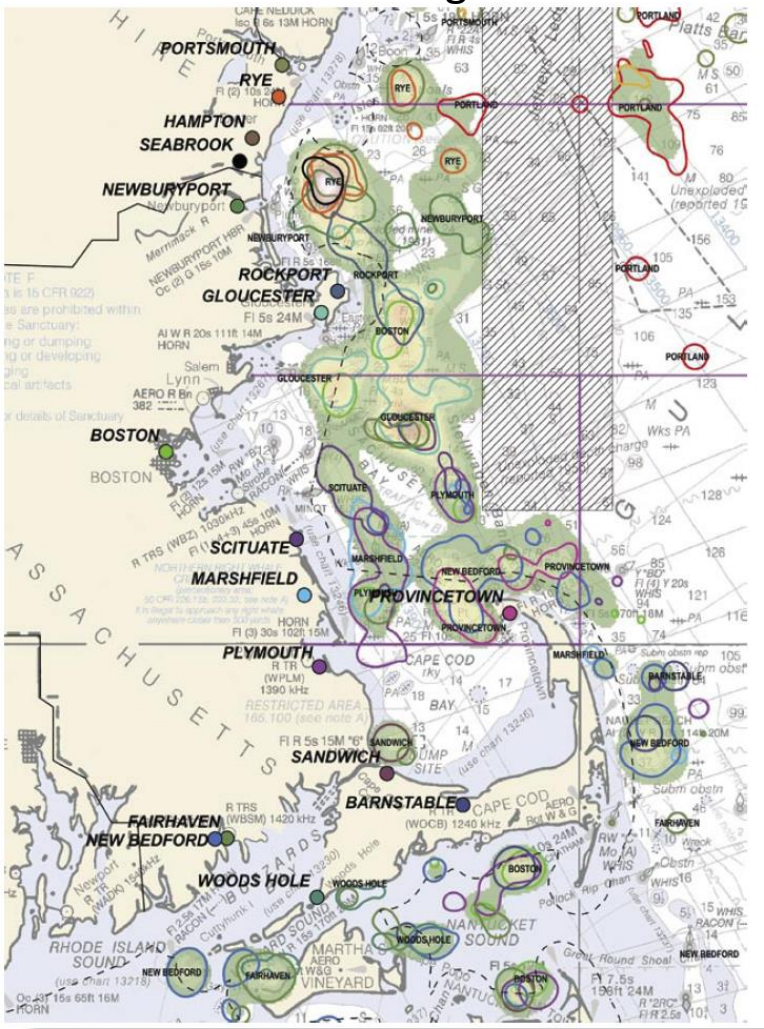
- Vessel Traffic Routes
- Vessel Traffic Separation Zones & Precautionary Zones
- Areas To Be Avoided (by vessels)
- Safety Zones Around Vessels and Terminals
- Anchoring & No-Anchoring Areas
- Security Zones in Ports and Waterways
- Oil & Gas Lease or Concession Areas
- Wind Farm and Wave Park Lease or Concession Areas
- Safety Zones Around Oil & Gas Installations, Wind Farms, Wave Parks, etc.
- Military Operations or Exercise Zones
- Dredging Sites or Areas
- Designated Dredged Material Dumping Areas or Zones
- Oil & Gas Pipeline Rights of Way
- Submarine Communications Cable Rights of Way
- Energy Transmission Line Rights of Way
- Sand & Gravel (Aggregate) Extraction Areas
- Fishery Closure Areas, including seasonal closures
- No Trawl Areas
- Critical Habitat Designations
- Offshore Aquaculture Areas
- Marine Protected Areas
- Protected Archeological Areas, e.g., Ship Wrecks
- Cultural or Religious Areas
- Scientific Reference Sites

multi-sector uses

energy



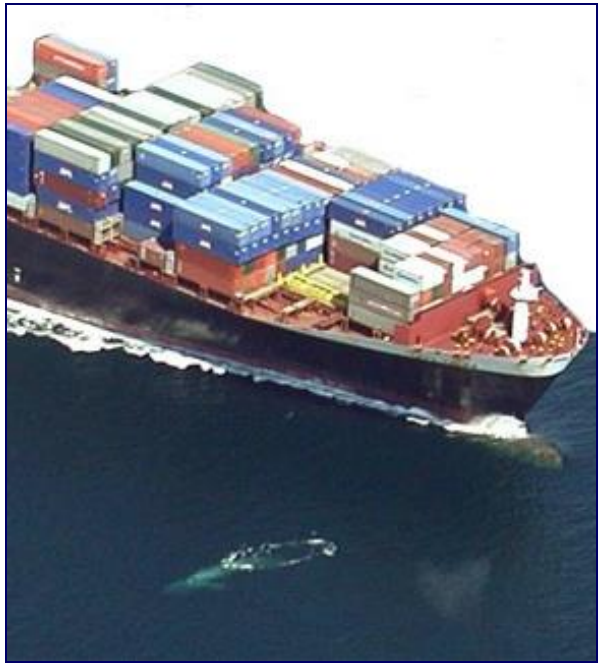
fishing

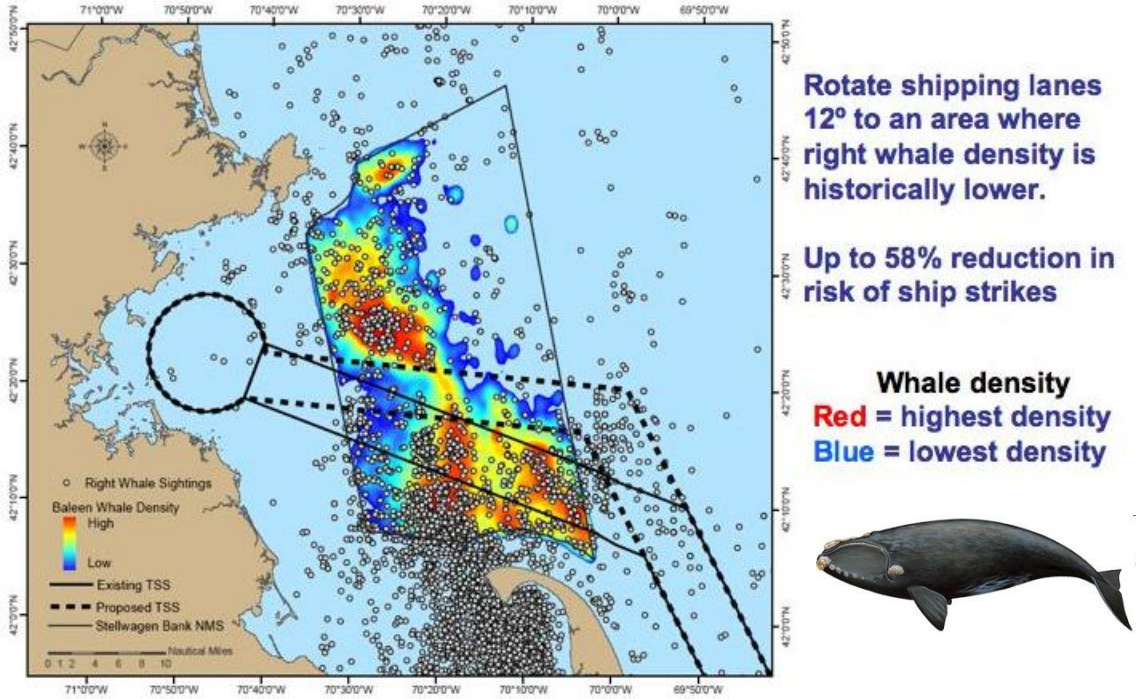


multi-sector uses

multi-sector problem solving

marine mammal conservation and shipping traffic interaction





http://stellwagen.noaa.gov/science/tss.html

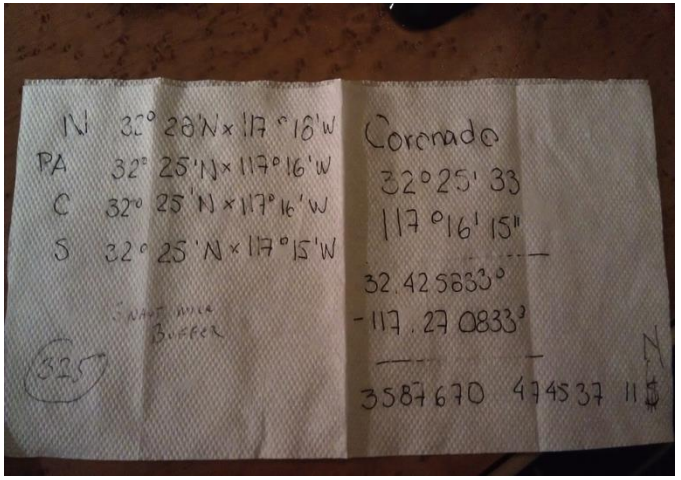
Participatory Approach

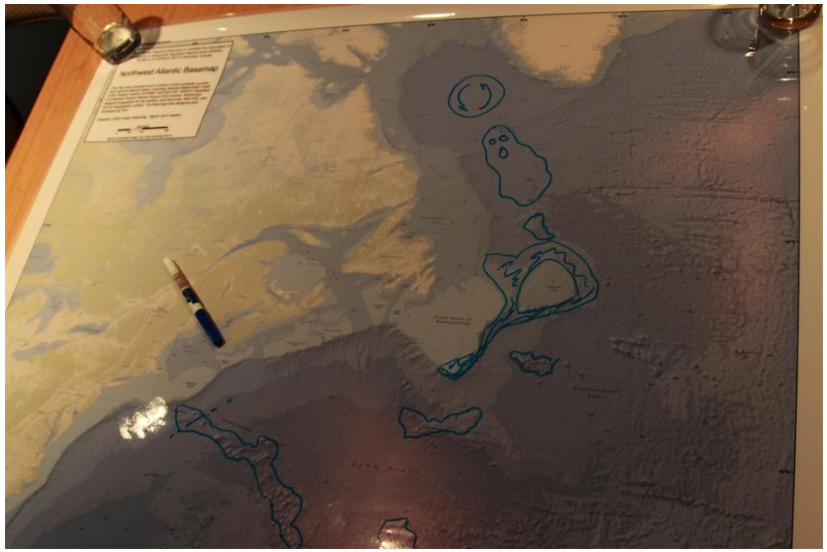
- Open, public meetings
- Transparent planning process
- Equitable representation
  - Government (Local, Federal, Tribal)
  - Stakeholders (Commercial, Recreational, Indigenous)
  - Science (Biological, Physical, Traditional Ecological Knowledge [TEK])

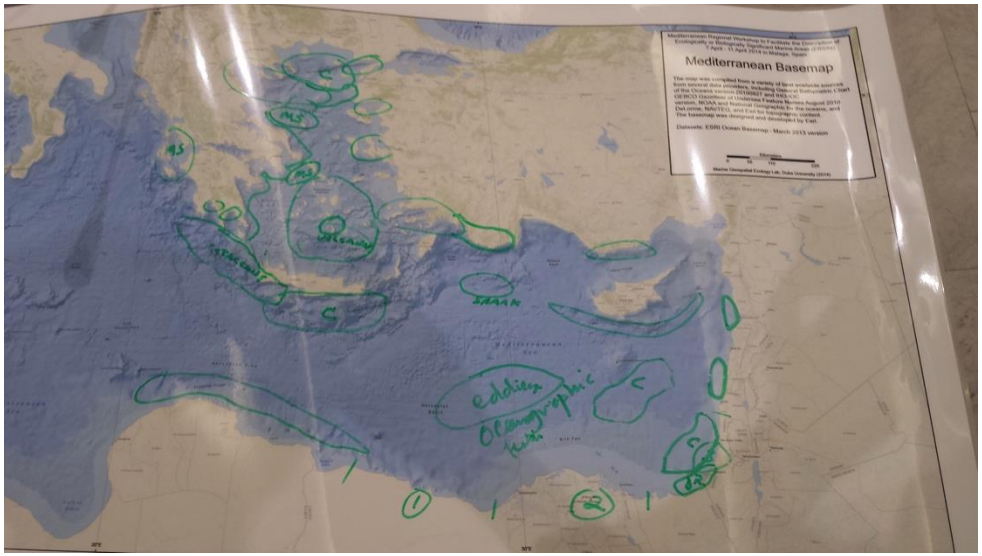
Open process supports and informs MSP data collection and creation and empowers stakeholder to engage

Participatory GIS Approach

- Not all data are digital
  - Much human use data is not
- Format shaped by stakeholders



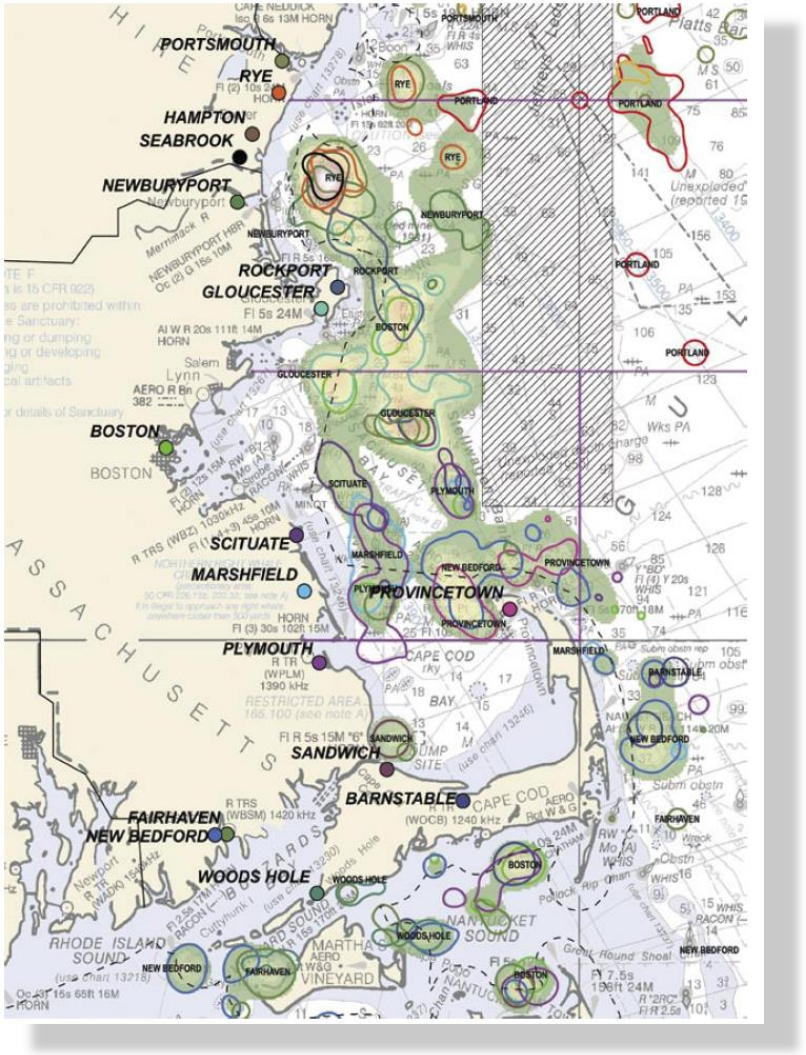




Participatory GIS approaches

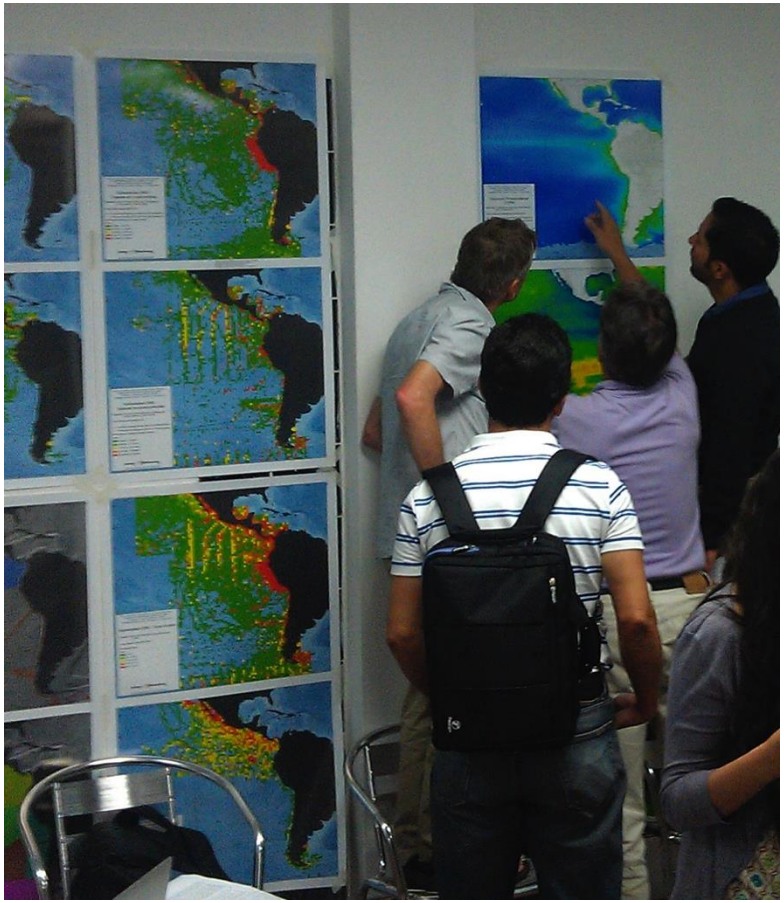
Paper maps/charts

Fig. 3. Here a fisherman amends a chart showing the locations of vessels with dredge gear in the Gulf of Maine.



Participatory GIS approaches

Paper maps/charts



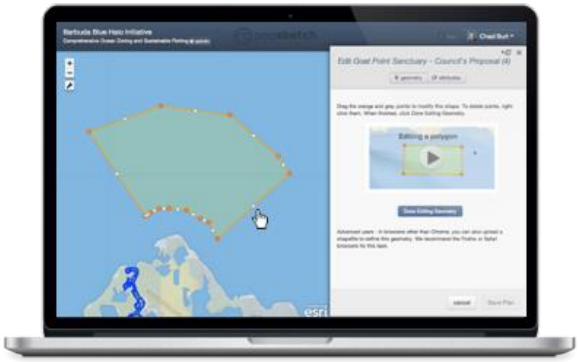
Participatory GIS approaches

Live GIS sessions with stakeholders

Participatory GIS approaches

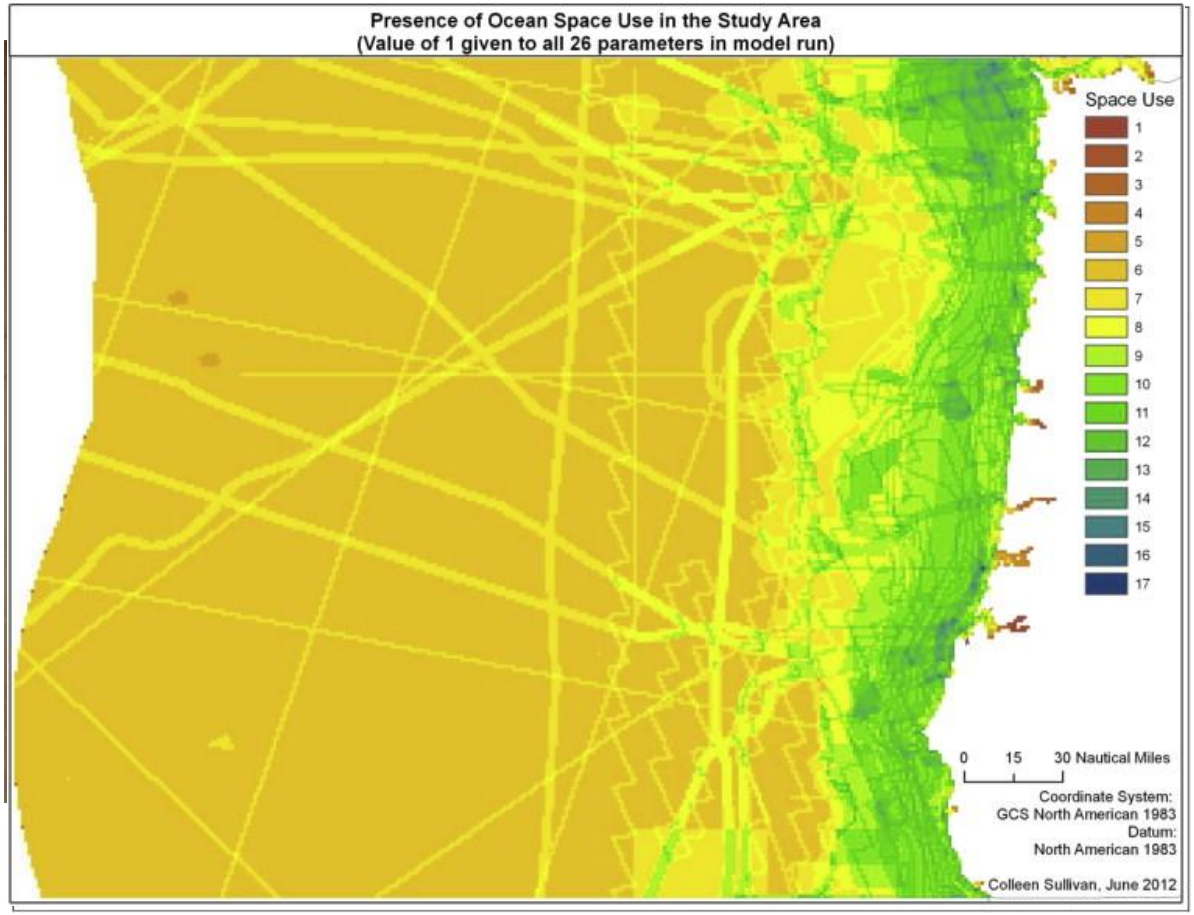
Internet GIS sessions

- Independent
- Guided, with stakeholders



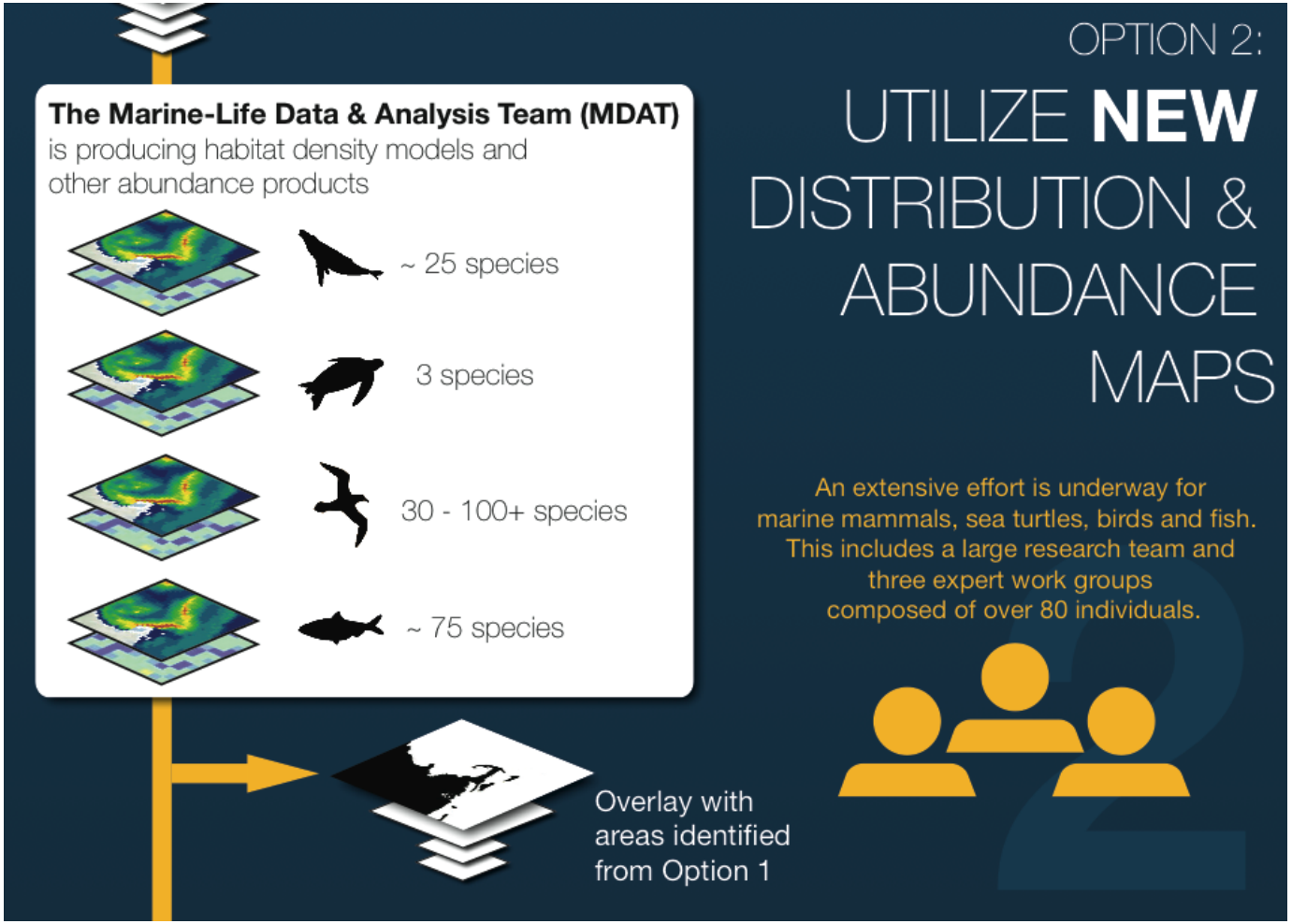
Participatory GIS approaches

Combine results



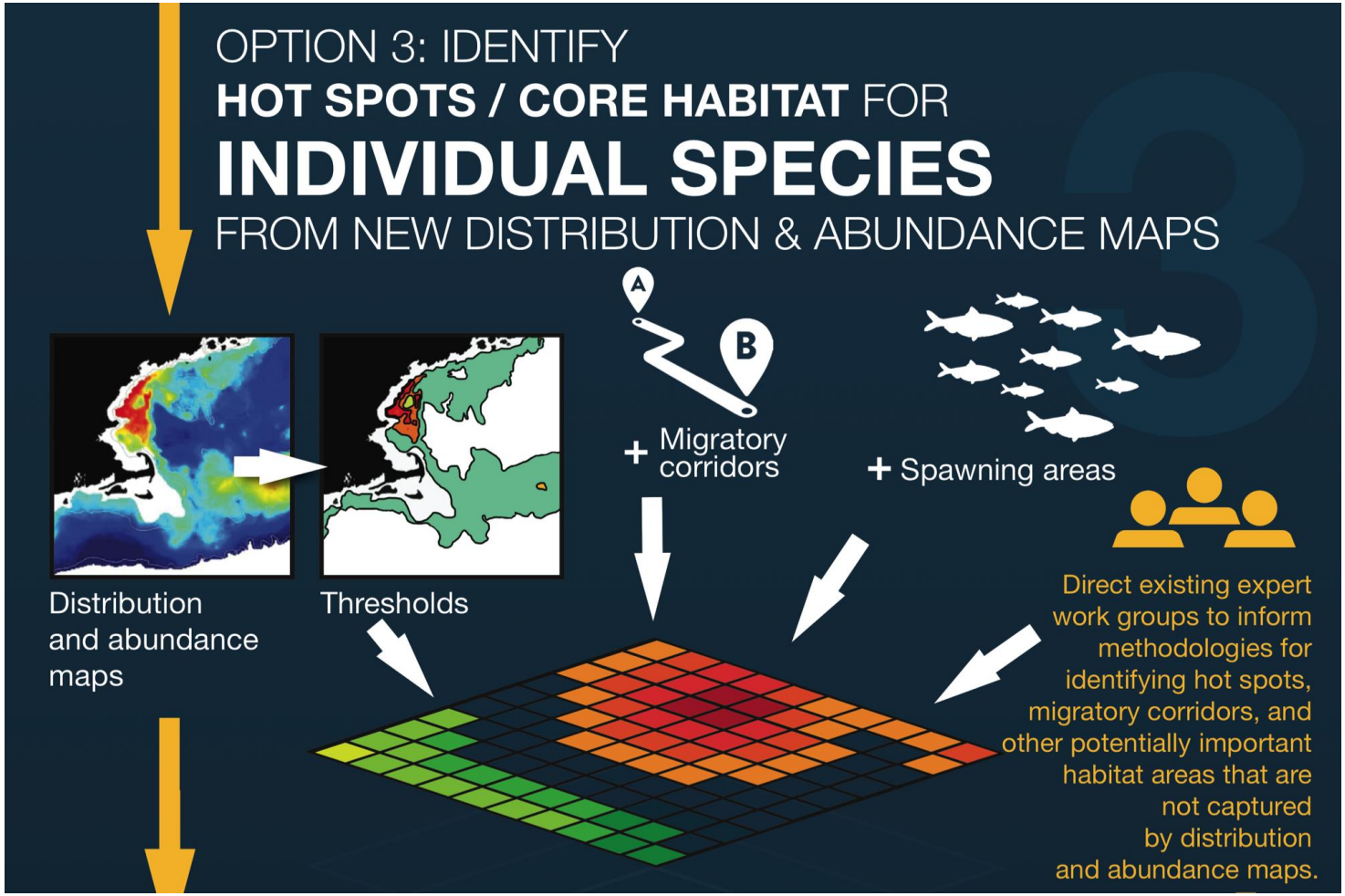
Participatory GIS approaches

Important Ecological Areas

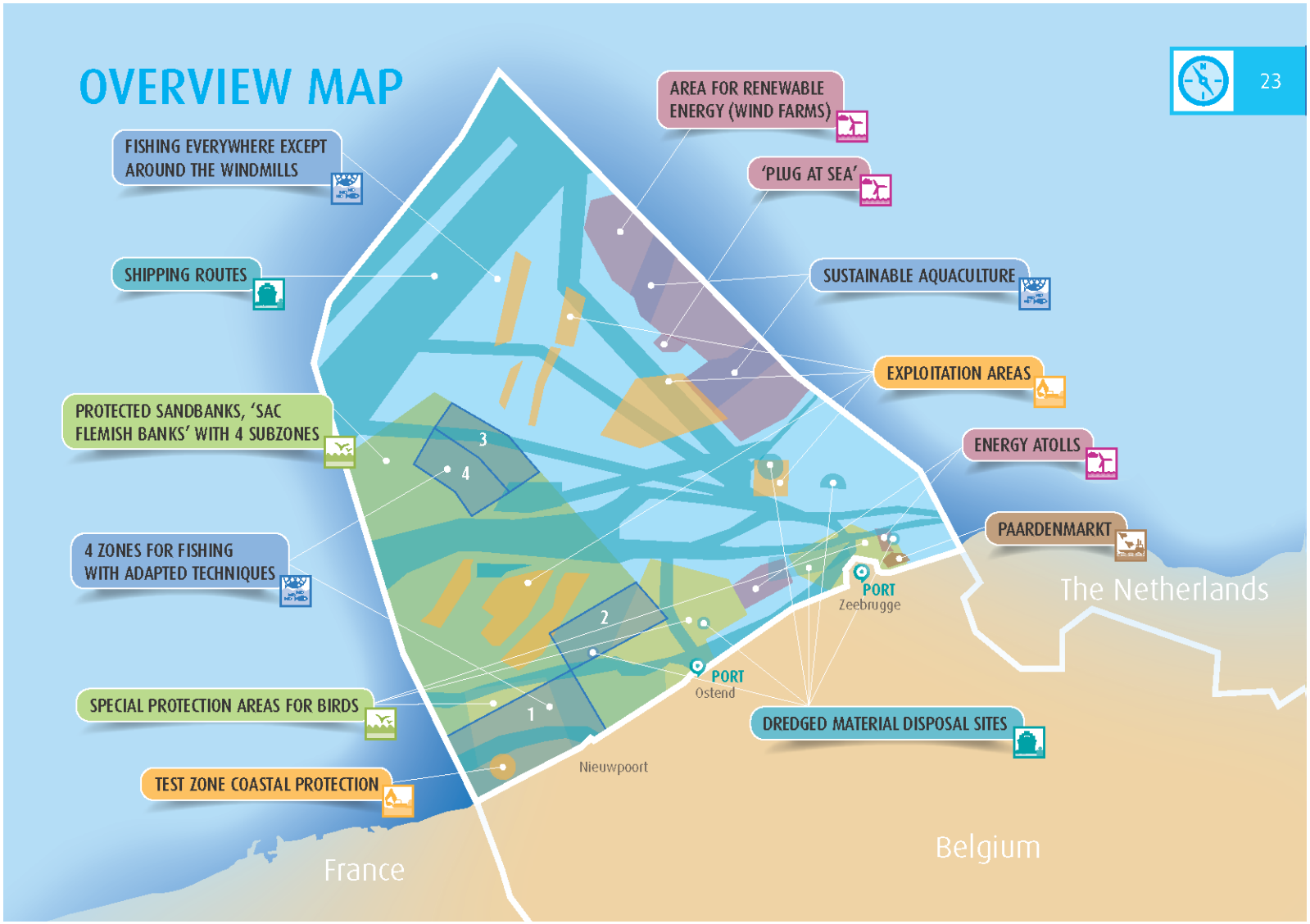


Participatory GIS approaches

Important Ecological Areas

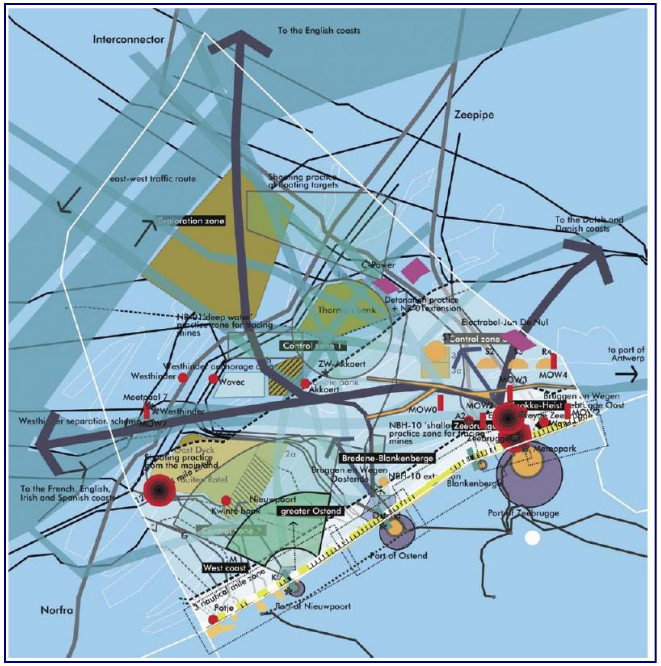


Multi-sector, multi-stakeholder input



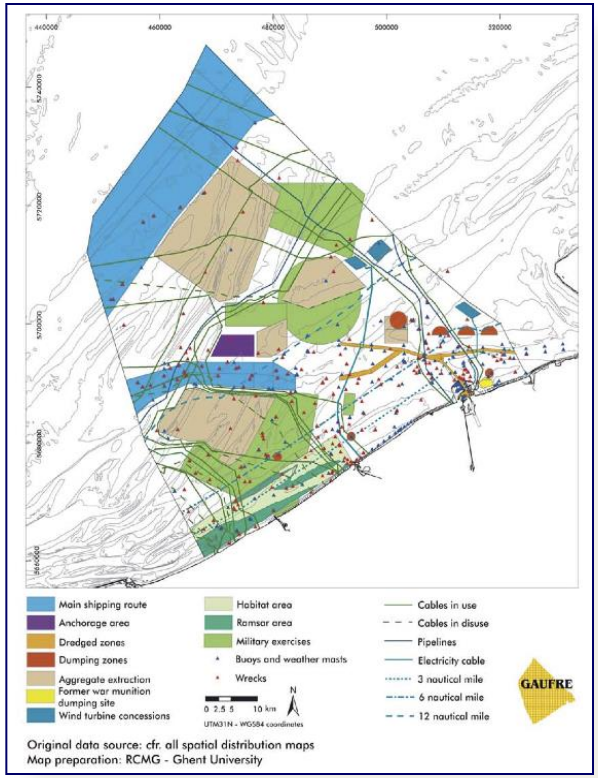
Multi-sector, multi-stakeholder input

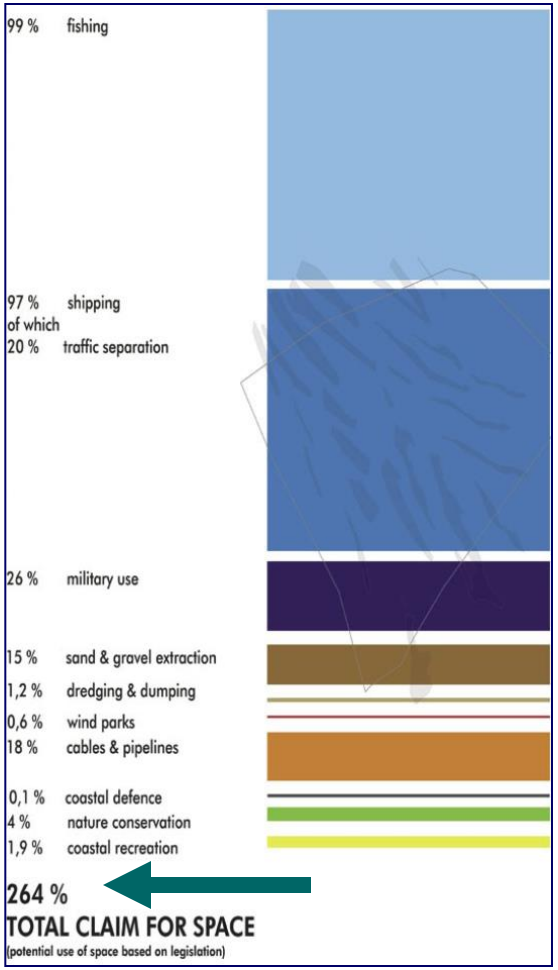
Competing uses: example Belgium



use and traffic

designated use areas





overlapping claims

Balancing competing uses

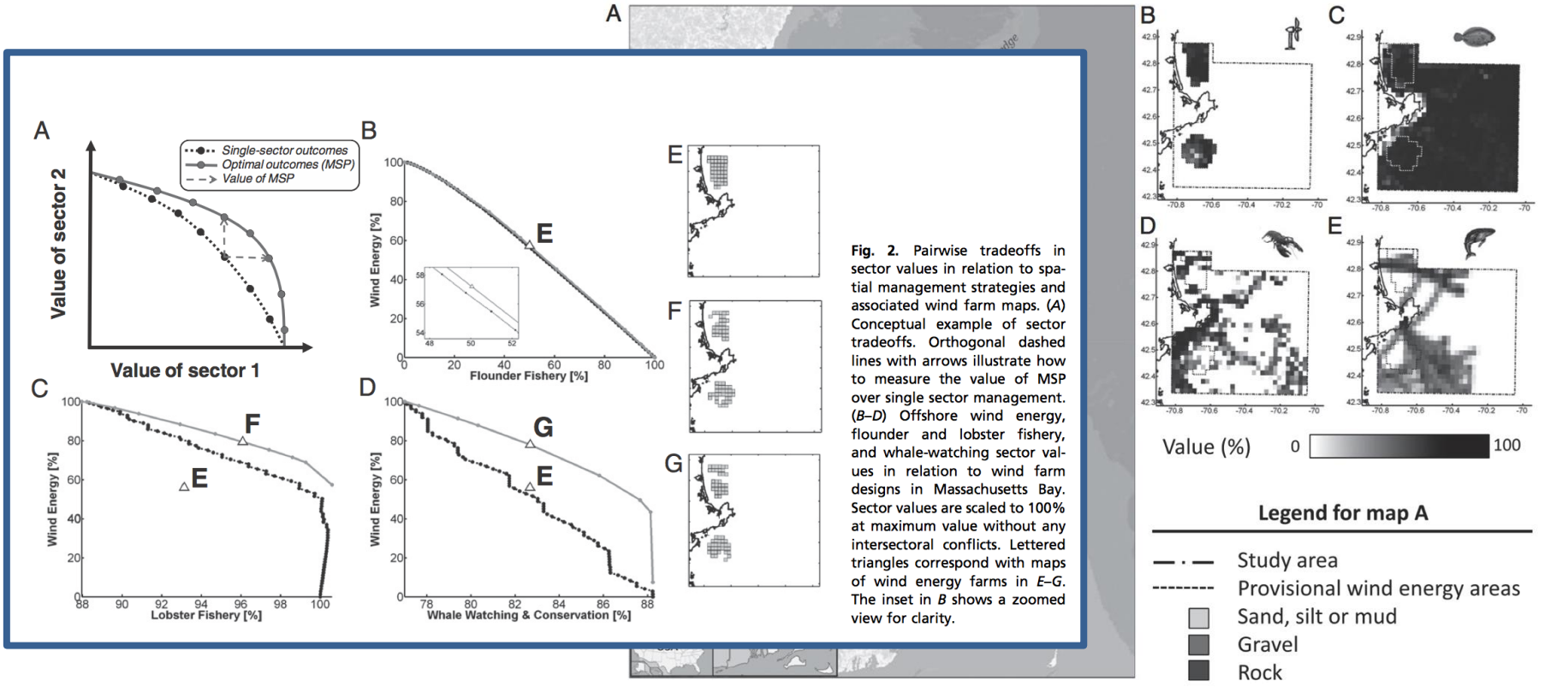
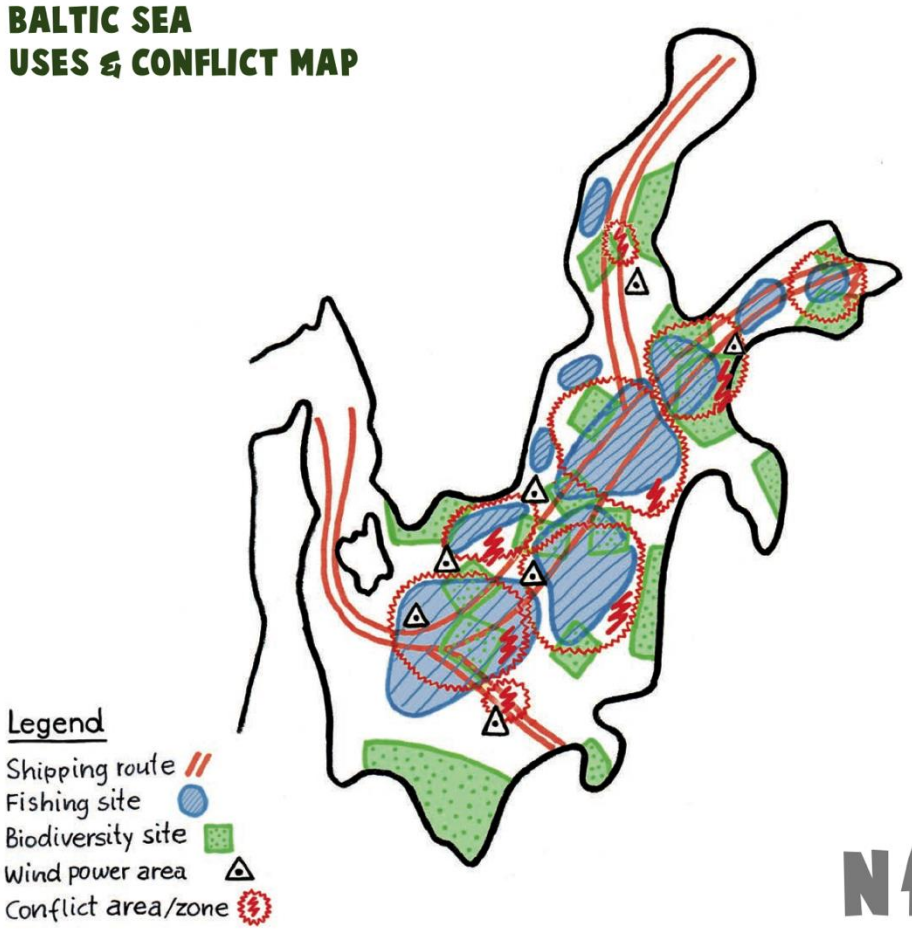


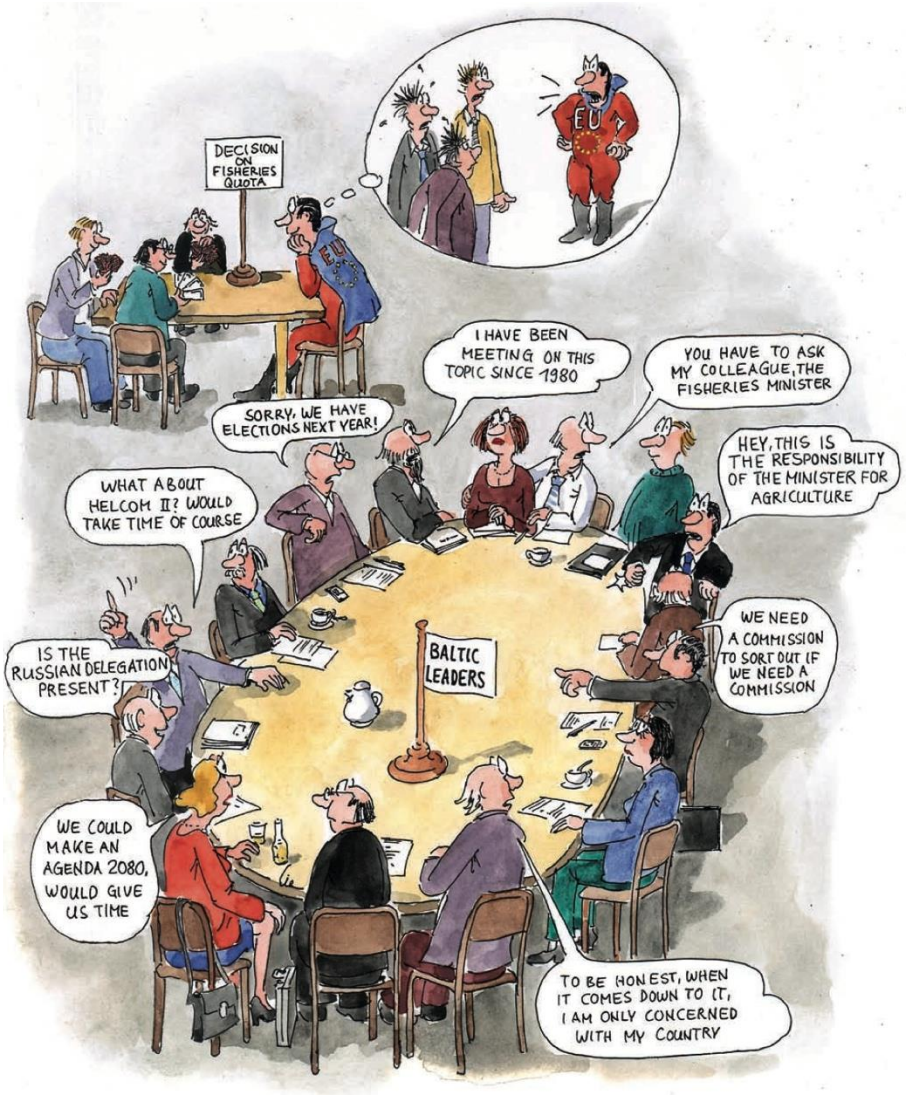
Fig. 2. Pairwise tradeoffs in sector values in relation to spatial management strategies and associated wind farm maps. (*A*) Conceptual example of sector tradeoffs. Orthogonal dashed lines with arrows illustrate how to measure the value of MSP over single sector management. (*B–D*) Offshore wind energy, flounder and lobster fishery, and whale-watching sector values in relation to wind farm designs in Massachusetts Bay. Sector values are scaled to 100% at maximum value without any intersectoral conflicts. Lettered triangles correspond with maps of wind energy farms in *E–G*. The inset in *B* shows a zoomed view for clarity.

Fig. 1. Massachusetts Bay and spatial distributions of resources and sector values. (*A*) Habitat distributions. (*B–E*) Net present values of offshore wind energy, flounder and lobster fishery, and whale-watching sectors, respectively. The value in each grid cell is scaled relative to the maximum absolute value of the sector (based on logged, scaled boat density for the whale sector and profit for the other sectors; see *Methods*) across all grid cells, in the absence of other sectors.

Source: White et al. (2012)

Balancing competing uses





source WWF publication “Maritime Planning in the Baltic Sea”

Questions?

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References and Links

- Baltic Sea Plan - http://www.baltseaplan.eu/index.php/Reports-and-Publications;809/1#10min
- Sullivan CM, Conway FDL, Pomeroy C, et al (2015) Combining geographic information systems and ethnography to better understand and plan ocean space use. Applied Geography
- St. Martin K, Hall-Arber M (2008) The missing layer: Geo-technologies, communities, and implications for marine spatial planning. Marine Policy 32:779–786
- White, Crow, Benjamin S Halpern, and Carrie V Kappel (2012). "Ecosystem Service Tradeoff Analysis Reveals the Value of Marine Spatial Planning for Multiple Ocean Uses." *Proceedings of the National Academy of Sciences*, March.
- Northeast US Regional Ocean Council - http://northeastoceancouncil.org/
- Marine Map consortium - http://marinemap.org
- Sea Sketch - http://seasketch.org