

# Compatibility determination & Decision support tools

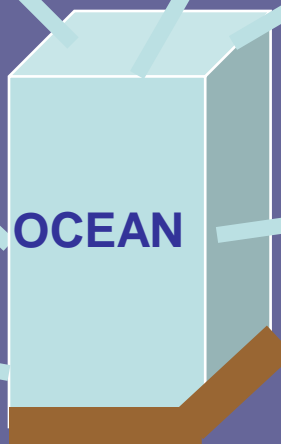


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# Outline

- **Introduction to compatibility determination (CD)**  
*The CD matrix*
- **The CD process**  
*Intro to decision support tools (a few examples)*
- **Application of CD in coastal/ocean management**  
*National Wildlife Refuge (Ward Feurt)*  
*National Marine Sanctuary (Ben Cowie-Haskell)*
- **Applying CD to the MA Ocean Management Planning Area**

# What is compatibility determination (CD)?



Process to evaluate and prioritize uses

## Outcomes of a CD:

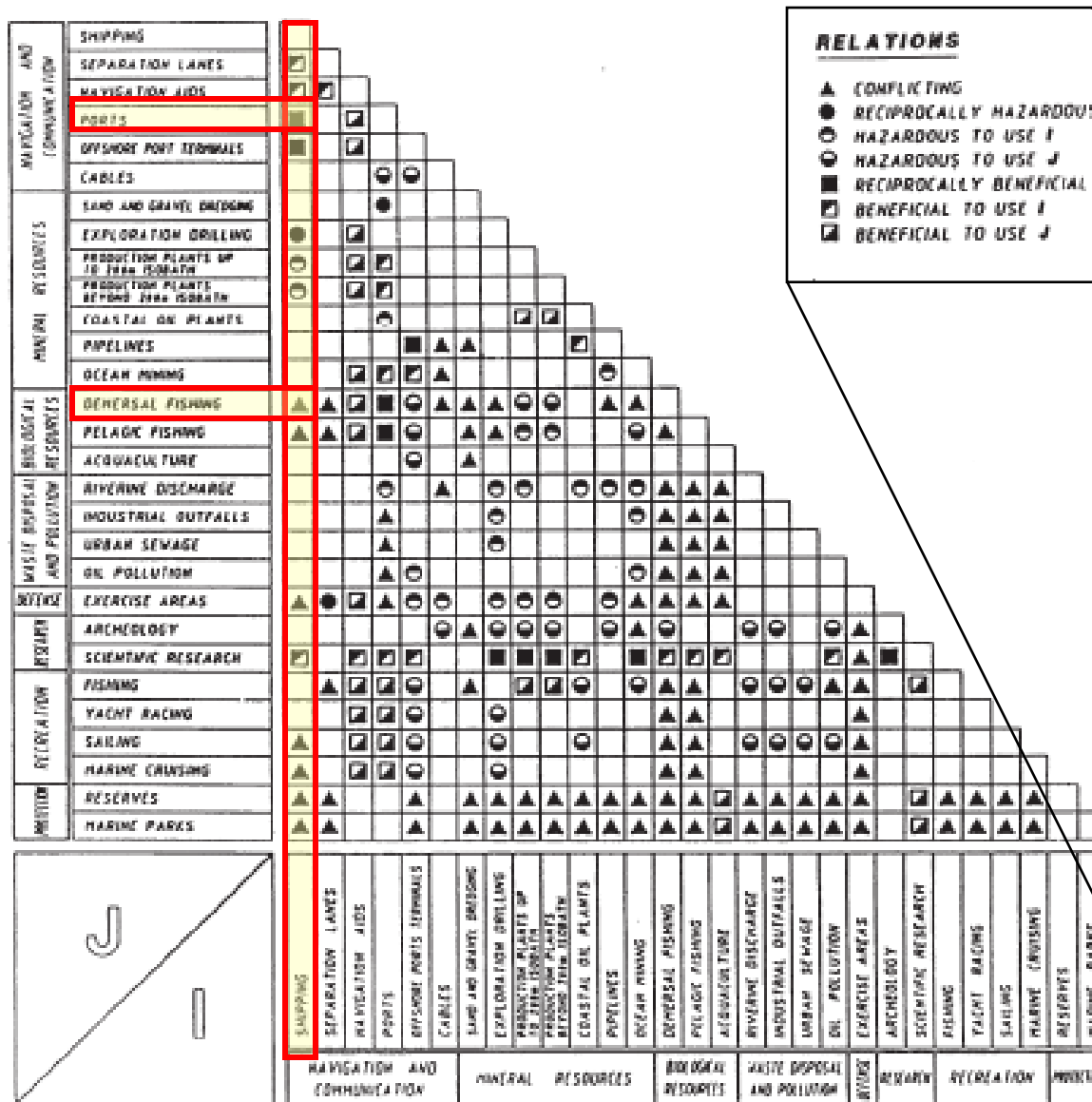
- (1) An understanding of the consequences of interactions between uses and between uses and environmental features
- (2) A determination about what uses and environmental features *should* be allowed to occur in a particular space and time

**Example of CD output:**  
*the CD matrix*

# MEDITERRANEAN SEA

SEA USES

REFERENCE : 1985 ONWARDS



## Relations

- Conflicting
- Reciprocally hazardous
- Hazardous to use I
- Hazardous to use J
- Reciprocally beneficial
- Beneficial to use I
- Beneficial to use J

Figure 2: The approach to the complexity of uses of a regional sea, demonstrated in the case of the Mediterranean Sea. Only the categories of uses are presented in the use-use interaction matrix.

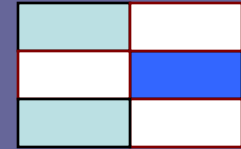
incompatible
  conditionally compatible
  compatible

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	<i>Offshore wind farms</i>	1																
	<i>Marine protected areas</i>	2																
	<i>Fisheries</i>	3																
	<i>The sea as a public good</i>	4																
	<i>Cables</i>	5																
	<i>Tourism</i>	6																
	<i>Shipping and shipping routes</i>	7																
	<i>Harbours and ports</i>	8																
	<i>Agriculture/run-off</i>	9																
	<i>Sand and gravel extraction</i>	10																
	<i>Oil and gas exploration</i>	11																
	<i>Dumping of dredging material</i>	12																
	<i>Mariculture</i>	13																
	<i>Coastal service centres</i>	14																
	<i>Nature conservation</i>	15																
	<i>Coastal protection</i>	16																
	<i>Military use</i>	17																

- ## Grid cell categories
- Incompatible
  - Conditionally compatible
  - Compatible

Fig. 9: Estimates of spatial compatibility of different types of sea use (GEE et al. 2006)

## Some limitations of the CD matrix:



### Simple matrix may not account for specific social and environmental conditions

- temporal heterogeneity; ex: sailboat races & recreational fishing; seasonal fish migrations & dredging, etc.*
- goals and priorities of specific management areas*

### Grid cell categories do not always account for different levels or types of use

- ex: certain types of fishing might be compatible with goals of a protected area*
- cumulative impacts*

**Refining the CD matrix:**  
*the CD process*

	Gravel habitat	Wind turbines	Right whales
Gravel habitat			
Wind turbines			
Right whales			
Personal watercraft			

**What needs to be considered when evaluating these complex interactions (use-use or use-environment)?**

	Gravel habitat	Wind turbines	Right whales
Gravel habitat			
Wind turbines			
Right whales			
Personal watercraft			

## Considerations for the CD process:

- (1) Existing policies related to use/s and environmental feature
- (2) Designated authority
- (3) Stated goals/objectives related to use/s and environmental feature
- (4) Who should be involved? How?
- (5) Geographic scope/Timeframe
- (6) Available information (social science, natural science, anecdotal, etc)
- (7) Available techniques for analyzing information (**decision support tools**)

## Decision support tools:

- **Provide a rational approach for evaluating and prioritizing uses and environmental features**
- **Used to supply information to decision makers**
- **Have various capabilities and constraints**  
e.g., dealing with uncertainty, accommodating value judgments, etc.

# **A few examples of decision support tools**

- **Delphi techniques**
- **Economic Impact Analysis**
- **Benefit Cost analysis**
- **Spatial analysis (GIS)**
- **Spatial optimization algorithms (MARXAN)**
- **Multi-criteria decision analysis**
- **Many, many more...**

# Delphi techniques

## **OVERVIEW:**

A method of structuring communication between a group of experts in order to obtain a reliable group opinion on a policy or set of policies (Landeta 2006)

## **CAPABILITIES/CONSTRAINTS:**

- Relies on informed judgment of experts
- Selection of panel experts
- No direct deliberation among participants

# Economic impact analysis (Input-Output modeling)



## **OVERVIEW:**

A tool for understanding and predicting the financial impacts of a certain policy change (Dalton 2004)

## **CAPABILITIES/CONSTRAINTS:**

- Results are measured in tangible terms (e.g., revenues, jobs)
- Highlights distributional impacts among segments of society
- Does not capture non-market values
- Requires disaggregated data on local/regional economies

# Benefit-Cost Analysis

## **OVERVIEW:**

A tool that compares benefits and costs associated with a set of policy options to identify the option that will provide the maximum benefit to members of society as a whole

## **CAPABILITIES/CONSTRAINTS:**

- Can capture non-market values (e.g., ecological health)
- Benefits and costs must be valued in monetary terms

# Spatial analysis

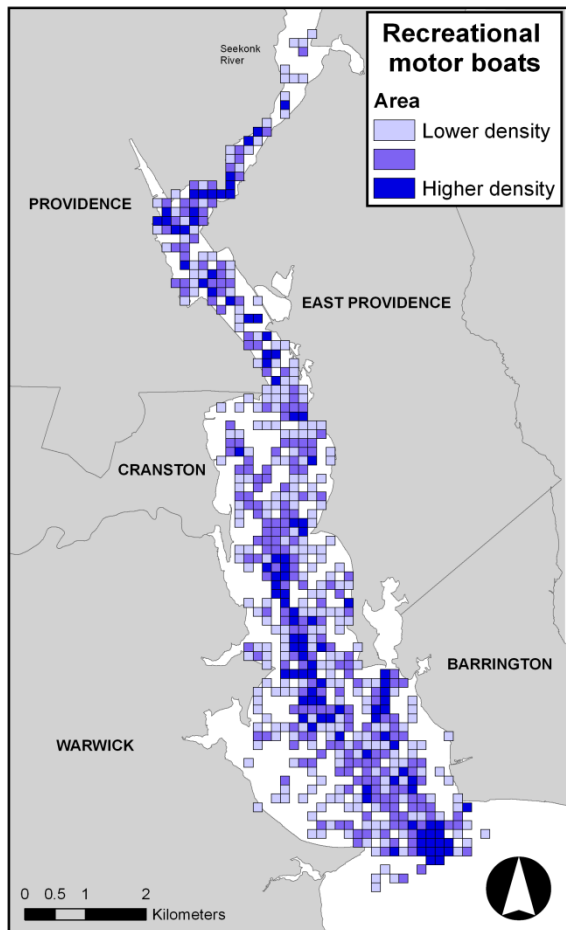
## (Geographic information systems-GIS)

### **OVERVIEW:**

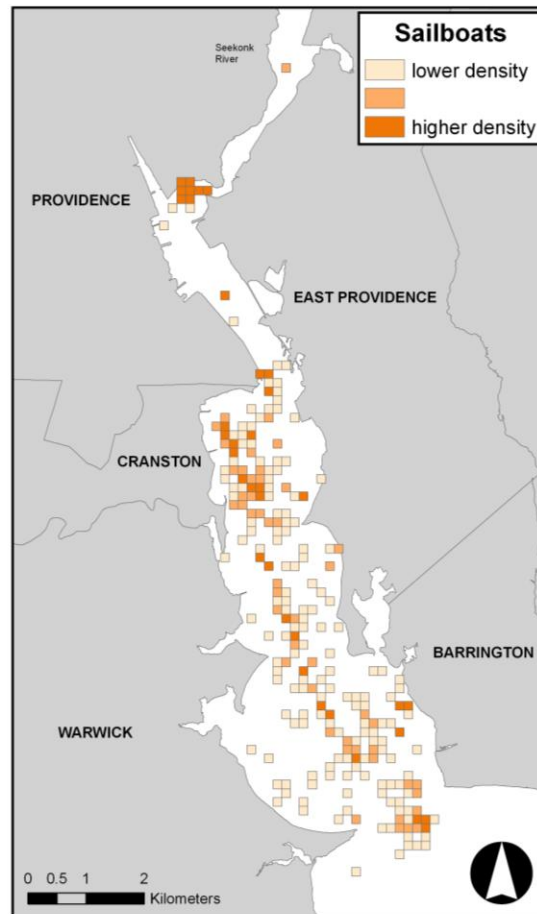
A tool that performs specified mathematical functions (i.e. addition, statistics, interpolation) on a given set of spatial data

### **CAPABILITIES/CONSTRAINTS:**

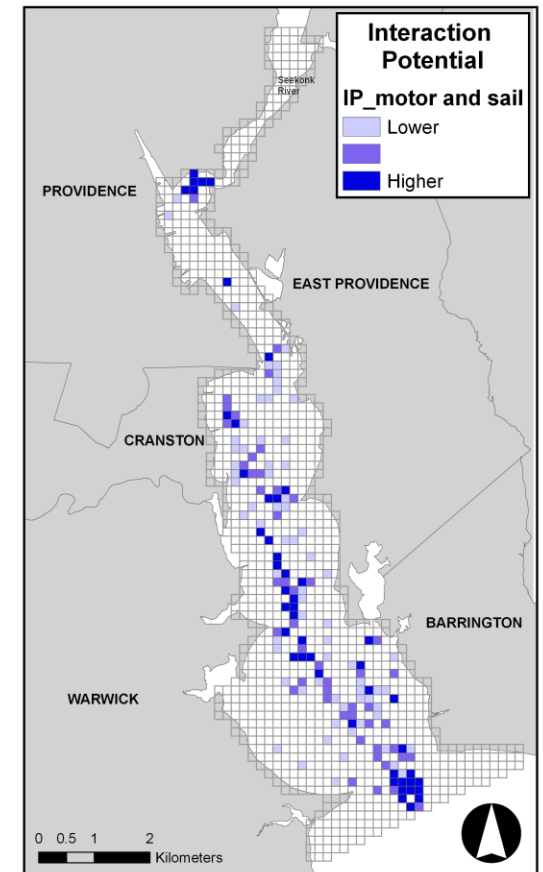
- Software is readily available, relatively easy to use  
(e.g., ArcGIS)
- Results are spatial
- Relies on spatial/temporal data



MOTOR



SAIL



INTERACTION OF  
MOTOR AND SAIL\*

Observed recreational boating activity on upper Narragansett Bay, Summers 2006 & 2007

\*See Wiley et al 2002 for more on Interaction Potential method

# Spatial optimization algorithms (MARXAN)

## OVERVIEW:

A tool that can be used to identify sites in a planning area that meet certain objectives (e.g., maximize conservation goals and minimize costs)

## CAPABILITIES/CONSTRAINTS:

- Software is freely available
- Can accommodate social and ecological goals
- Results are spatial
- Relies on spatial/temporal data



# Multi-criteria decision analysis

(analytical hierarchy process, multi-attribute utility theory, others)

## **OVERVIEW:**

A tool that allows stakeholders to assign preferences to social and environmental features (or attributes). Computations derive the preferred policy option (a defined set of attributes).

## **CAPABILITIES/CONSTRAINTS:**

- Captures abstract concepts, such as preferences
- Software available
- Can account for uncertainty
- Can be extended to consider space
- Relies on data on social and environmental features

# Which tool is best for CD?

No single tool is optimal. Most likely, several tools will be used simultaneously to inform the policy decision. Choice of tool will depend on:

- **GOALS OF THE MANAGEMENT AREA**

- Minimize job losses in a particular industry? Use economic impact analysis
- Maximize societal welfare? Use Benefit Cost Analysis
- Identify suitable areas for infrastructure development? Use spatial analysis
- All of the above goals? Use all three tools

- **AVAILABLE DATA**

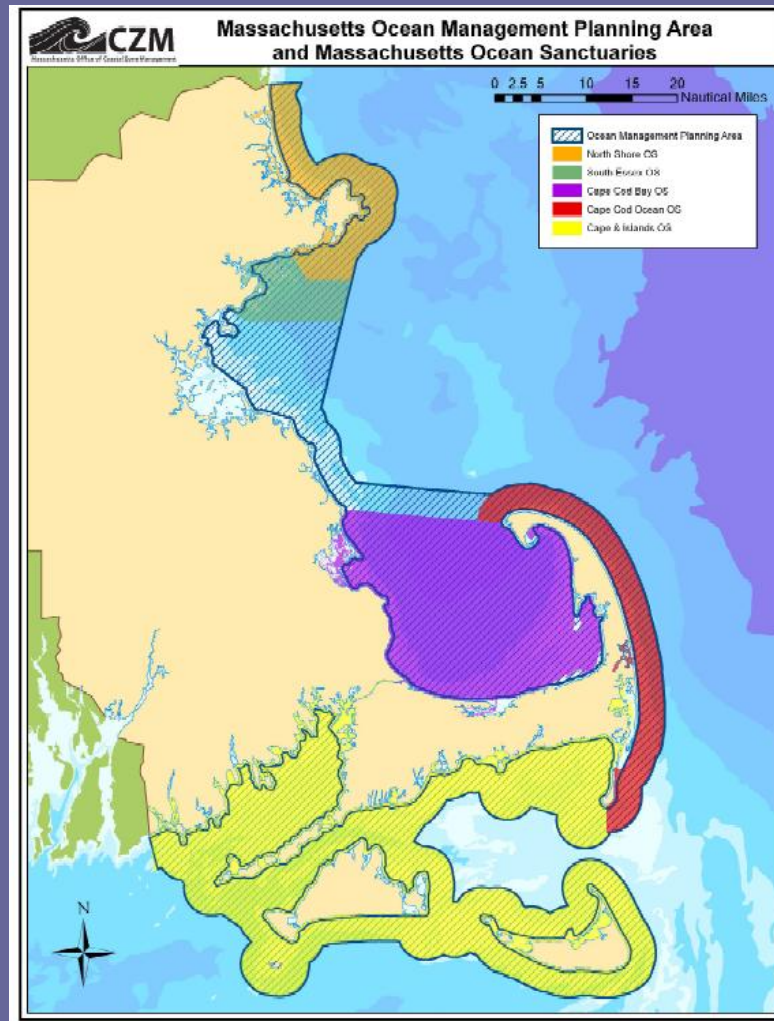
- Spatial data? Use GIS, spatial multi-criteria decision analysis, or MARXAN

- **RESOURCES: TIME, MONEY, TECHNICAL EXPERTISE**

# **Application of CD in ocean and coastal planning and management**

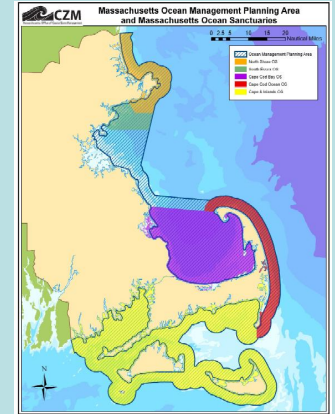
- **National Wildlife Refuge System  
(Ward Feurt, Rachel Carson NWR)**
- **National Marine Sanctuary  
(Ben Cowie-Haskell, Stellwagen Bank NMS)**
- **MA Ocean Management Planning Area**

# Applying CD in the MA Ocean Management Planning Area



# Considerations for CD in MA Ocean Management Planning Area:

- 1) Existing policies related to use/s and environmental feature
- 2) Designated authority
- 3) Stated goals/objectives related to use/s and environmental feature
- 4) Who should be involved? How?
- 5) Geographic scope and Timeframe
- 6) Available information (social science, natural science, anecdotal, etc)
- 7) Available techniques for analyzing information



# MA Oceans Act of 2008

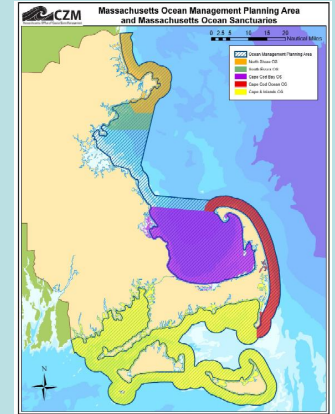
“The plan shall: (i) set forth the commonwealth’s goals, siting priorities, and standards for ensuring effective stewardship of its ocean waters held in trust for the benefit of the public...

...(v) value biodiversity and ecosystem health

...(x) foster sustainable uses that capitalize on economic opportunity without significant detriment to the ecology or natural beauty of the ocean...”

# Considerations for CD in MA Ocean Management Planning Area:

- 1) Existing policies related to use/s and environmental feature
- 2) Designated authority
- 3) Stated goals/objectives related to use/s and environmental feature
- 4) Who should be involved? How?**
- 5) Geographic scope and Timeframe**
- 6) Available information (social science, natural science, anecdotal, etc)**
- 7) Available techniques for analyzing information**



# Conclusions

- **Compatibility determination (CD) is a *process* for evaluating and prioritizing uses**
- **A matrix can be a first step in a CD process**
- **The CD process should consider existing policies/authorities, goals, stakeholder involvement, geographic scope/timeframe, available information, and analytical tools**
- **MA can build on existing examples of CD (NWR, NMS), but must tailor the CD process to its unique social and environmental conditions**