



Scientific Principles and Governance Framework for Coastal and Marine Spatial Planning

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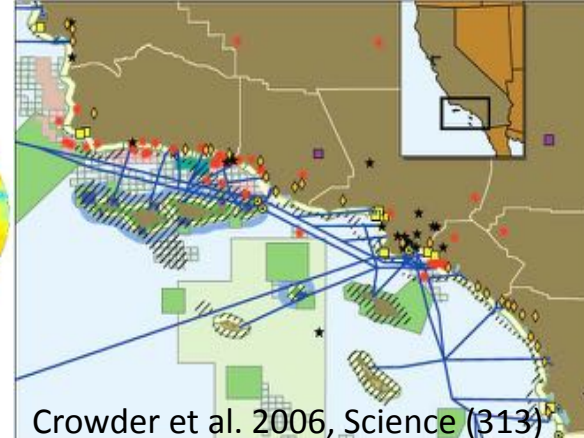
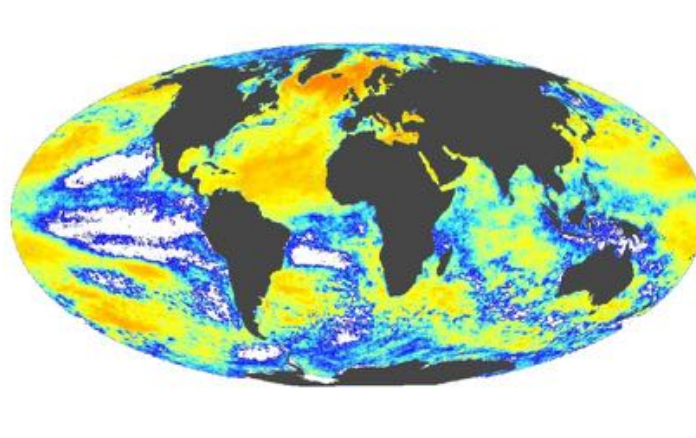
Decline of ocean ecosystems



www.reefkeeping.com



R. Loomis



Crowder et al. 2006, Science (313)

Coastal and marine spatial planning



“a comprehensive, adaptive, integrated, ecosystem-based, and transparent spatial planning process, based on sound science, for analyzing current and anticipated uses of ocean, coastal, and Great Lakes areas.”

Goals of coastal and marine spatial planning

Healthy ecosystems

Agency coordination

Conflict reduction

Proactive planning

Coastal and marine spatial planning



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Goals of coastal and marine spatial planning

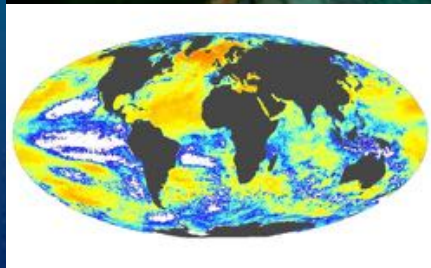
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Ecosystem objectives of CMSP



- Proactively manage ocean resources using an ecosystem-based approach
- Develop plans based on sound science and spatial information
- Increase compatibility between users and the ecosystem
- Evaluate alternatives & trade-offs
- Manage for healthy oceans & the sustainable delivery of ecosystem services

Ecological principles for CMSP



1. Maintain native species diversity

- abundance, richness, genetic, functional redundancy
- * productivity, vulnerability, stability, resilience

Ecological principles for CMSP



1. Maintain native species diversity



2. Maintain habitat diversity & heterogeneity

- representation, arrangement, dynamic habitats
- * diversity, productivity, connectivity, shelter

Ecological principles for CMSP



1. Maintain native species diversity



2. Maintain habitat diversity & heterogeneity



3. Maintain populations of key species

- keystone, foundation, top predators, basal prey
- * diversity, stability, resilience, ecosystem engineering

Ecological principles for CMSP



1. Maintain native species diversity



2. Maintain habitat diversity & heterogeneity



3. Maintain populations of key species



4. Maintain connectivity between populations

- population persistence, flow of subsidies
- * diversity, resilience, recovery

Ecosystem considerations



- Vulnerability
 - likelihood that a species or habitat will sustain losses due to a disturbance



Ecosystem considerations



- Vulnerability
 - likelihood that a species or habitat will sustain losses due to a disturbance
- Cumulative impacts
 - the total impact on ecosystems caused by the effects of multiple human activities that co-occur in space and/or time
 - synergism: total impact $> A + B + C$

Ecosystem considerations



- Vulnerability
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 - the total impact on ecosystems caused by the effects of multiple human activities that co-occur in space and/or time
- Climate change
 - impacts from sea level rise, temperature increase, and ocean acidification



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 - the overall impact on ecosystems caused by the effects of multiple human activities that co-occur in space and/or time
- Climate change
 - impacts from sea level rise, temperature increase, ocean acidification, and inundation
- Resilience
 - measure of the persistence of ecosystems and their ability to resist change or recover to a similar state following a disturbance

Bringing it all together...



Comprehensive Ecosystem Assessments

- NOAA's Integrated Ecosystem Assessment
- DFO's Eastern Scotian Shelf Assessment



1. Assess resources, ecosystem components, and human activities/impacts



2. Develop management indicators

3. Evaluate risk and uncertainty



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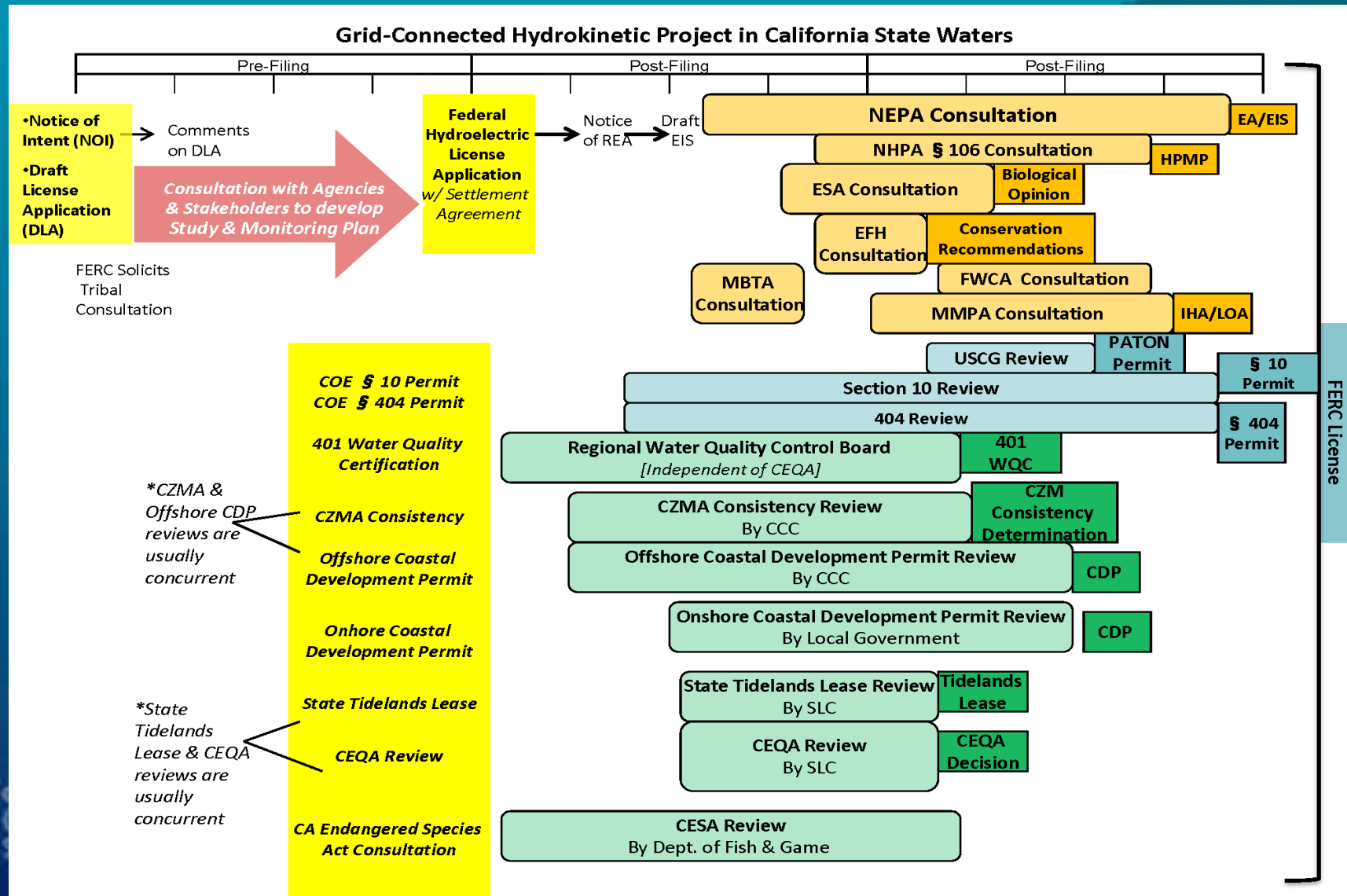
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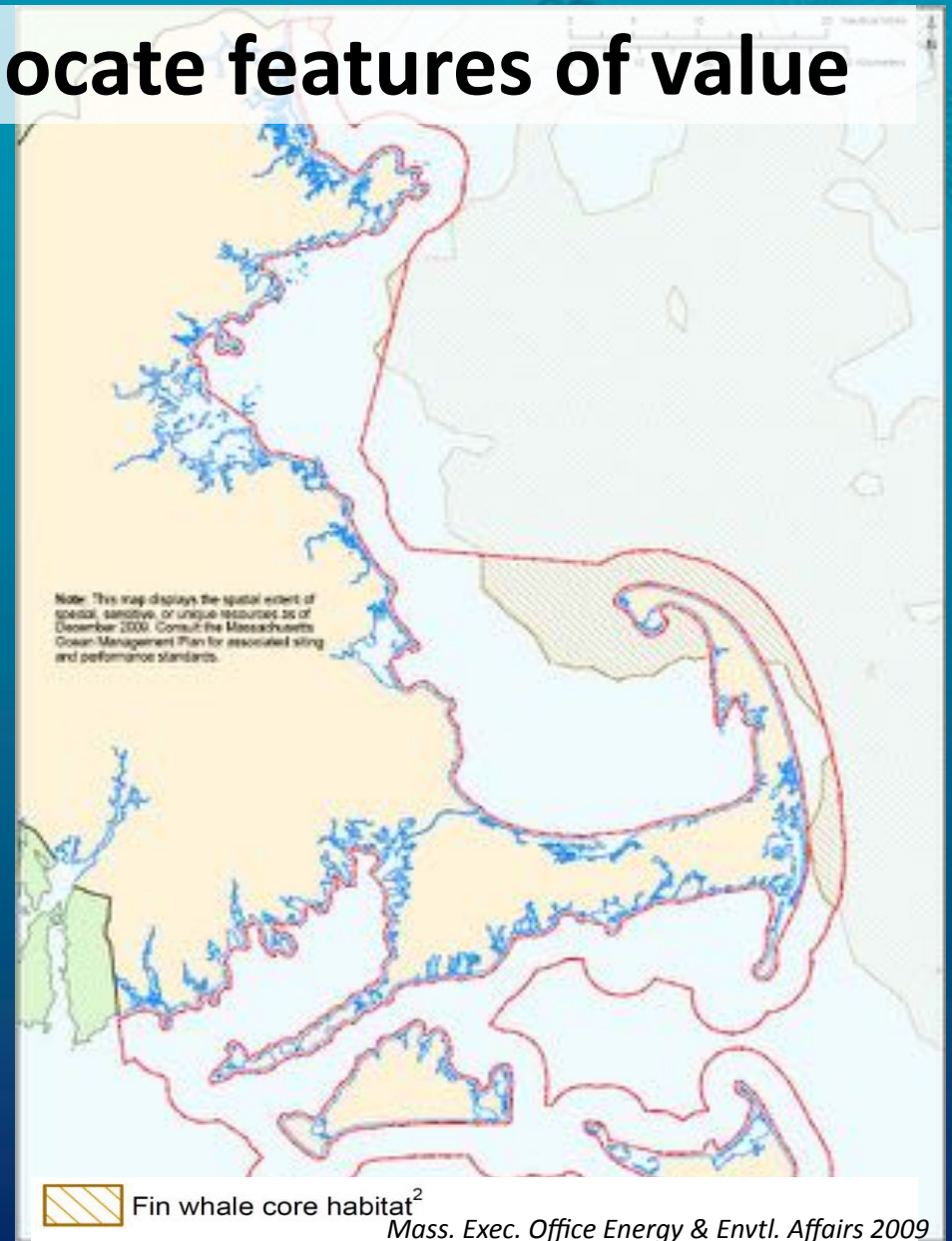
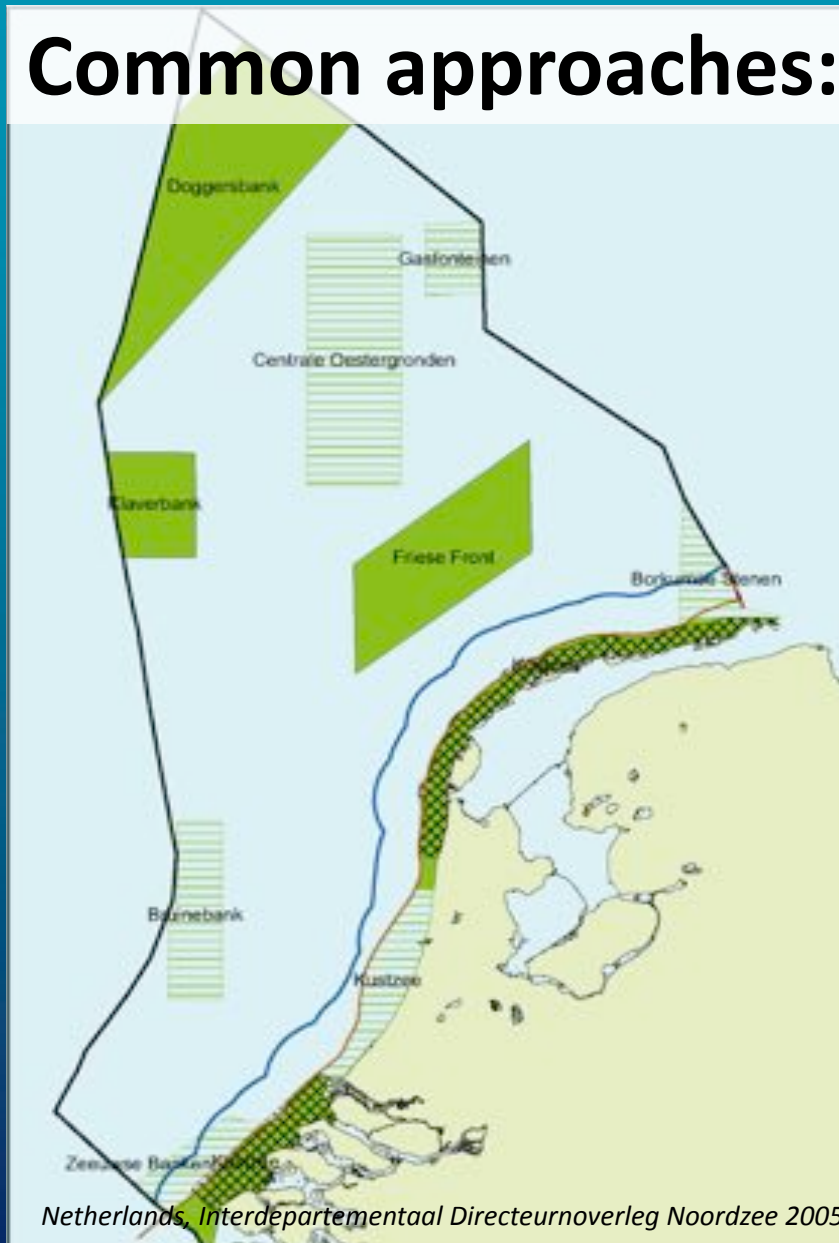
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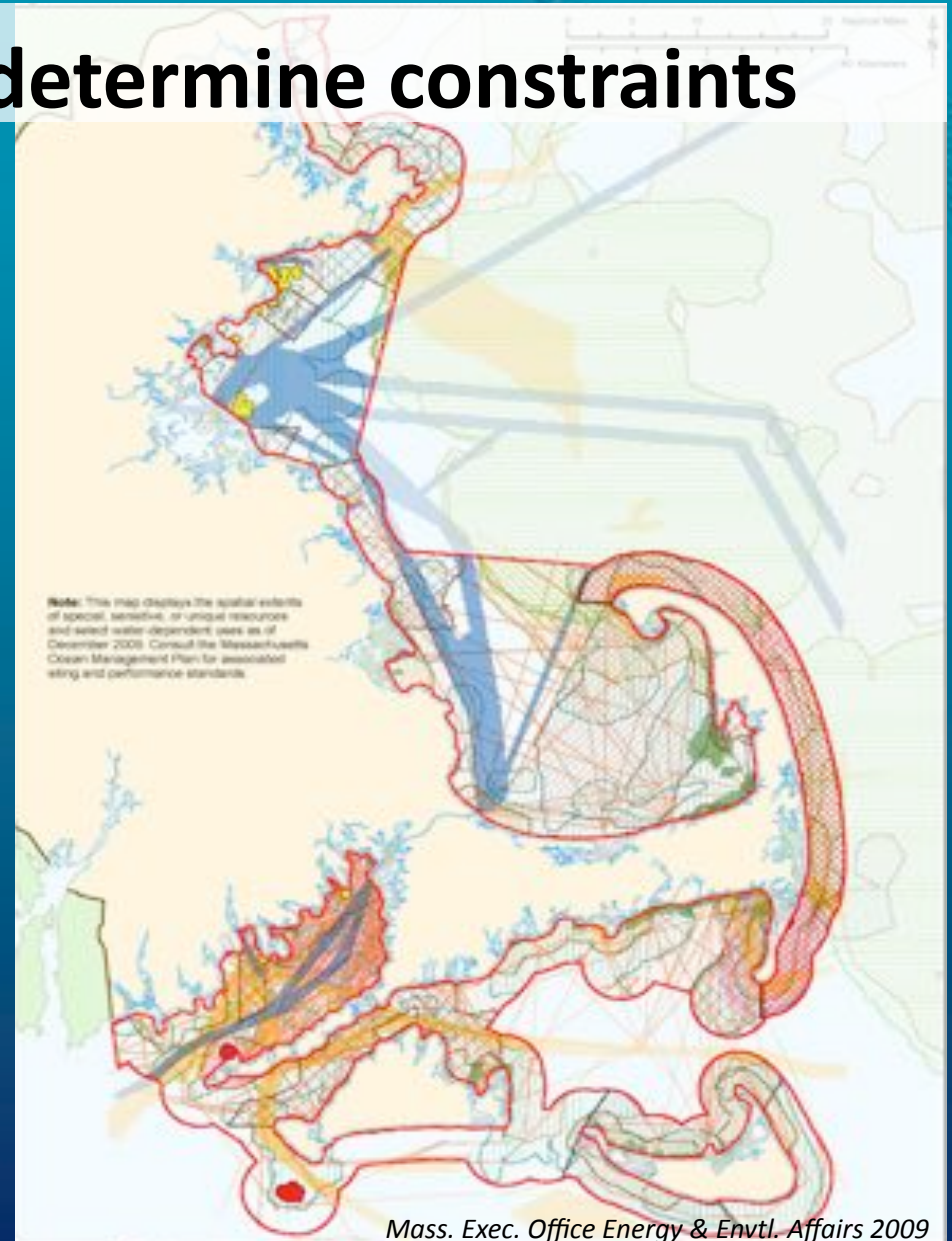
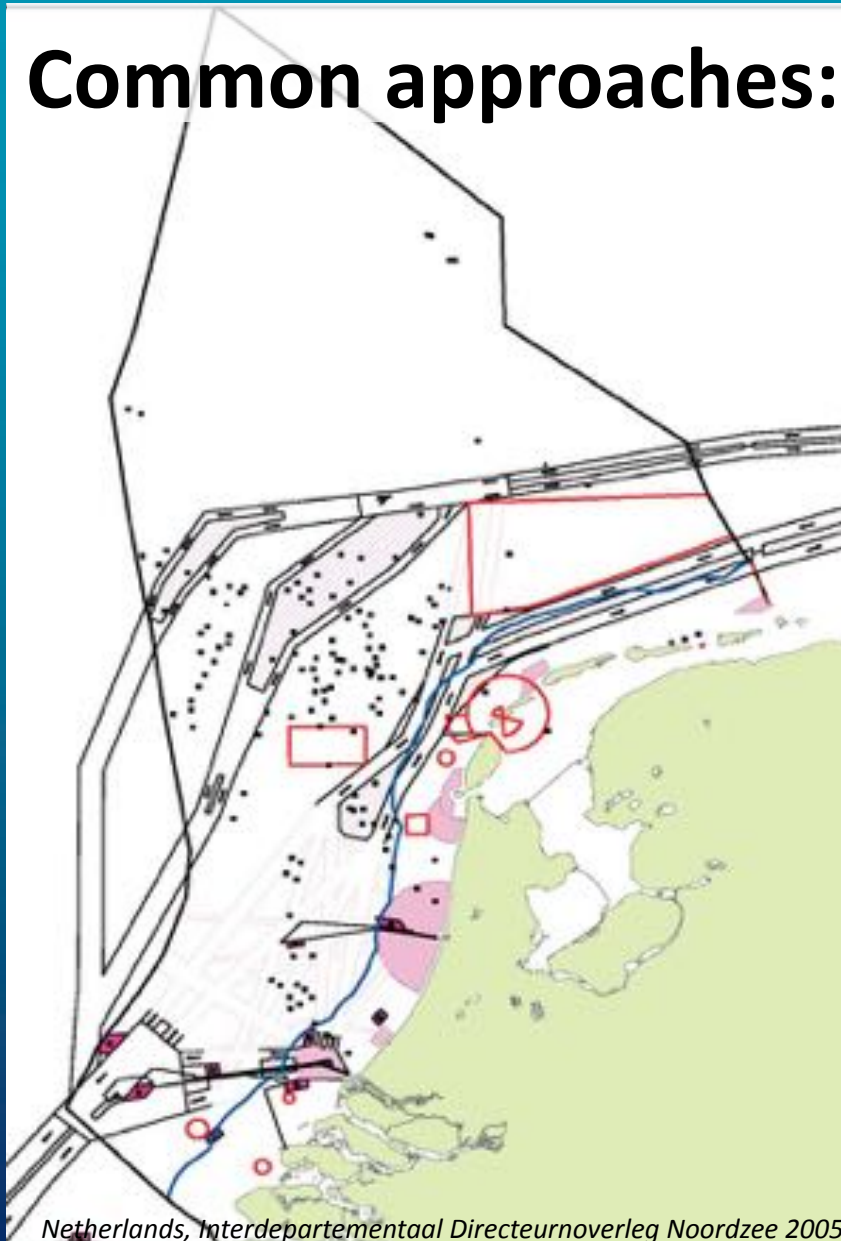
Common approaches: locate features of value



Common approaches: assess compatibility

USES		USES/RESOURCES																													
		This matrix represents existing conditions and does not consider possibilities related to advances in technologies/science			Renewable Energy			Sand & Gravel Mining	Navigation			Commercial Fishing					Recreational Fishing			Linear Infrastructure		Aqua-culture	Sensitive/Unique Habitat				Organisms				
					Wind	Tidal (demonstration project)	Wave (demonstration project)	Sand & gravel mining	Shipping	Anchorage	Ferry routes	Bottom dragging	Gill nets	Trawl	Hook/lines	Traps, pots	Shellfish	Rod/reel	Traps, pots	Shellfish	Pipelines	Cables	Deep-water aquaculture	Air	Surface	Water column	Benthic	Air	Surface	Water column	Benthic
Renewable Energy	Wind								P	P	P	P	P	P	P	P	P				P	P	P	P	P	P	P	P			
	Tidal								P	P	P	P	P	P	P	P	P				P	P	P	P	P	P	P	P			
	Wave								P	P	P	P	P	P	P	P	P				P	P	P	P	P	P	P	P			
Sand & Gravel Mining	Sand and gravel mining					T		T	P	P	P	P	P	P	P	P	P				P	P	P	P	P	P	P	P			
	Shipping					T																									
	Anchorage																														
Navigation/Transportation	Ferry routes					T			T	T	T	T	T	T	T	T	T														
	Bottom dragging	P	P	P	P	T		T												P											
	Gill nets	P	P	P	P	T		T							T	T	T			P											
Commercial Fishing	Trawl	P	P	P	P	T		T							T	T	T			P											
	Hook/lines	P	P	P	P	T		T							T	T	T			P											
	Traps, pots	P	P	P	P	T		T							T		T			P											
	Shellfish	P	P	P	P	T		T							T	T				P											
	Recreational Fishing	P	P	P	P	T		T												P											
Recreational Fishing	Rod/reel	P	P	P	P	T		T		T	T	T	T	T						P											
	Pots/traps	P	P	P	P	T		T		T	T	T		T						P											
	Shellfish	P	P	P	P	T		T		T	T	T	T							P											
Linear Infrastructure	Pipelines																				P	P	P	P	P	P	P				
	Cables					T		T													P	P	P	P	P	P	P				
Aqua-culture	Deep-water aquaculture								P	P	P	P	P	P	P	P	P				P	P	P	P	P	P	P				
Key	Compatible				T	Temporal considerations drive (in)compatibility																									
	Functionally Incompatible				P	Relevant planning policy will determine (in)compatibility																									
	Conditionally compatible																														
Mass. Exec. Office Energy & Envtl. Affairs 2009																															

Common approaches: determine constraints



Common approaches: identify opportunities



Netherlands, Interdepartementaal Directeurnoverleg Noordzee 2005



Mass. Exec. Office Energy & Env'tl. Affairs 2009

Enabling proactive planning



1. Strong and clear legal mandate

Enabling proactive planning



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2. Political support
and leadership

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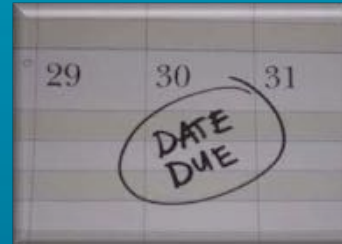


3. Adequate funding

Enabling proactive planning



1. Strong and clear legal mandate



4. Firm deadlines



2. Political support and leadership

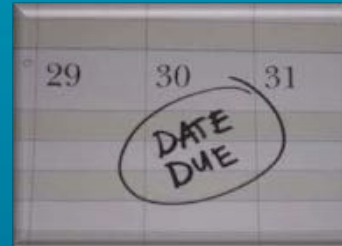


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5. Willingness and capacity of civil society to engage

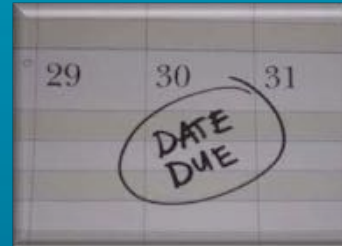


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6. **Transparent process design and structure**

Take away points



- CMSP should be ecosystem based
- Plans should incorporate vulnerability, cumulative impacts, climate change, & resilience
- CMSP should facilitate agency coordination, reduce conflicts, and enable proactive planning

Acknowledgements



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www.centerforoceansolutions.org