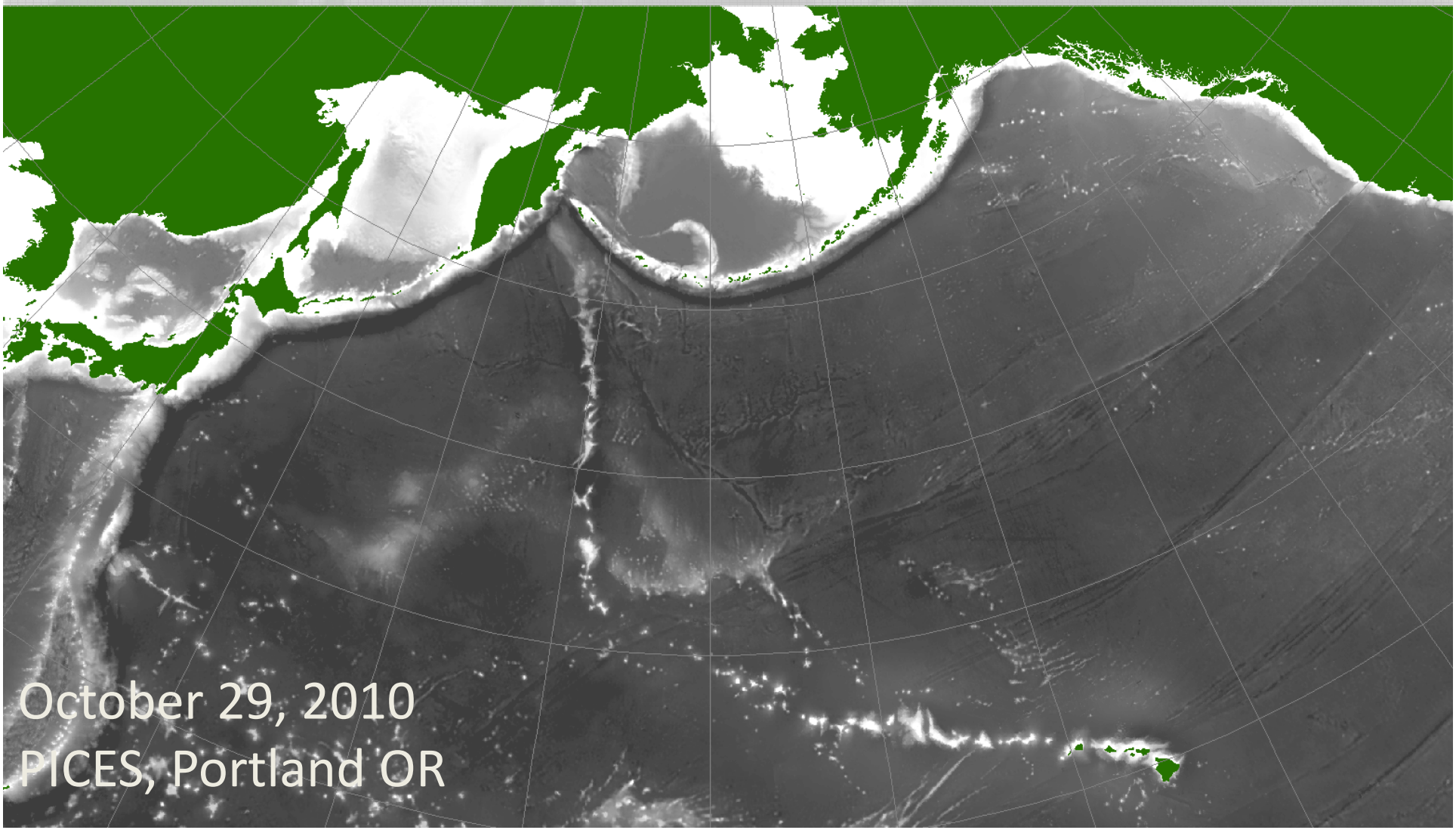
Ecologically and biologically sensitive areas in the high seas North Pacific

Edward Gregr, Andrea Rambeau, and R. Ian Perry



October 29, 2010
PICES, Portland OR

EBSAs and such

Motivation: Convention on Biological Diversity (CBD)
FAO Code of Conduct for Resp. Fishery Practices
Canada's Oceans Act (1996)

EBSMAs. Protect sensitive regions beyond national jurisdictions

VMEs. Protect important areas from bottom fishing

EBSAs. Guide selection of areas for enhanced protection

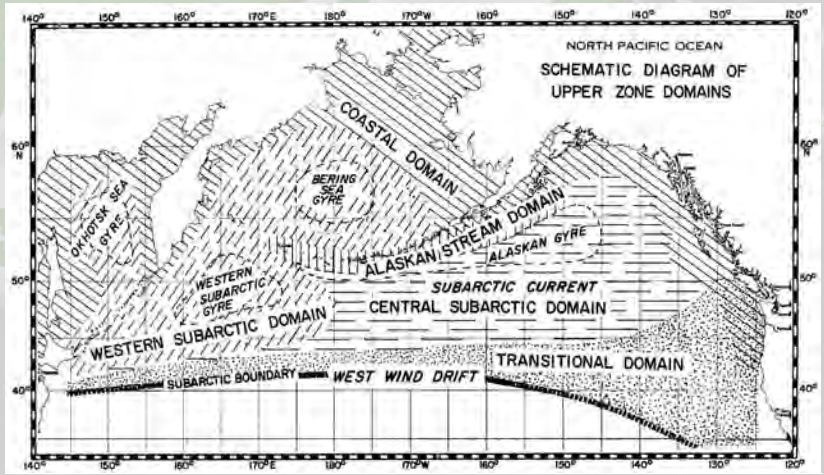
Can existing marine classifications inform the delineation of such regions?

High-seas classifications

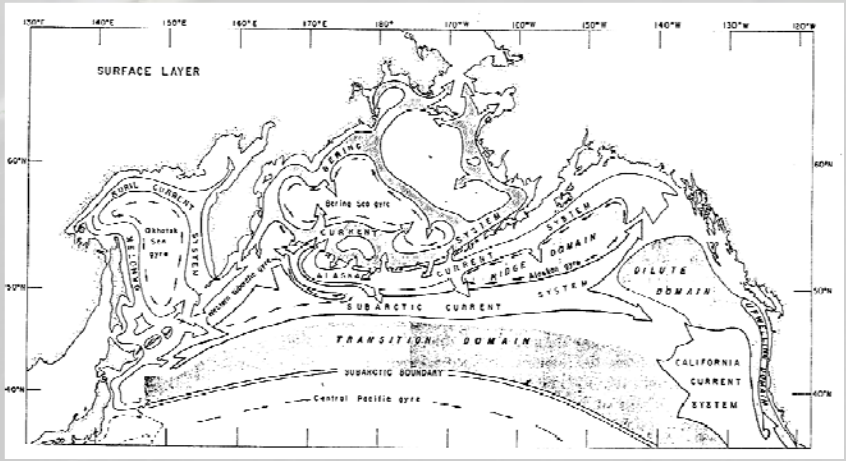
- Physical
  - Interpreted; clustering (bottom or surface)
- Zoological
  - Focal species; habitat envelopes
- Synthetic
  - Biomes, provinces, and similar

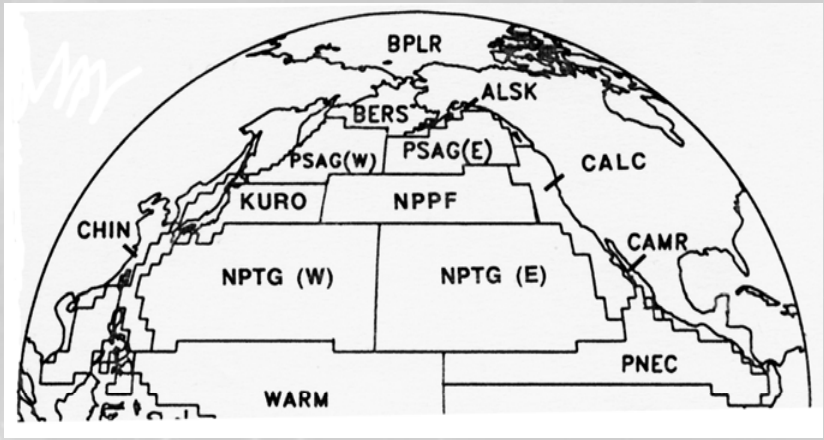
Historic high-seas classifications

Dodimead 1963



Favorite 1976

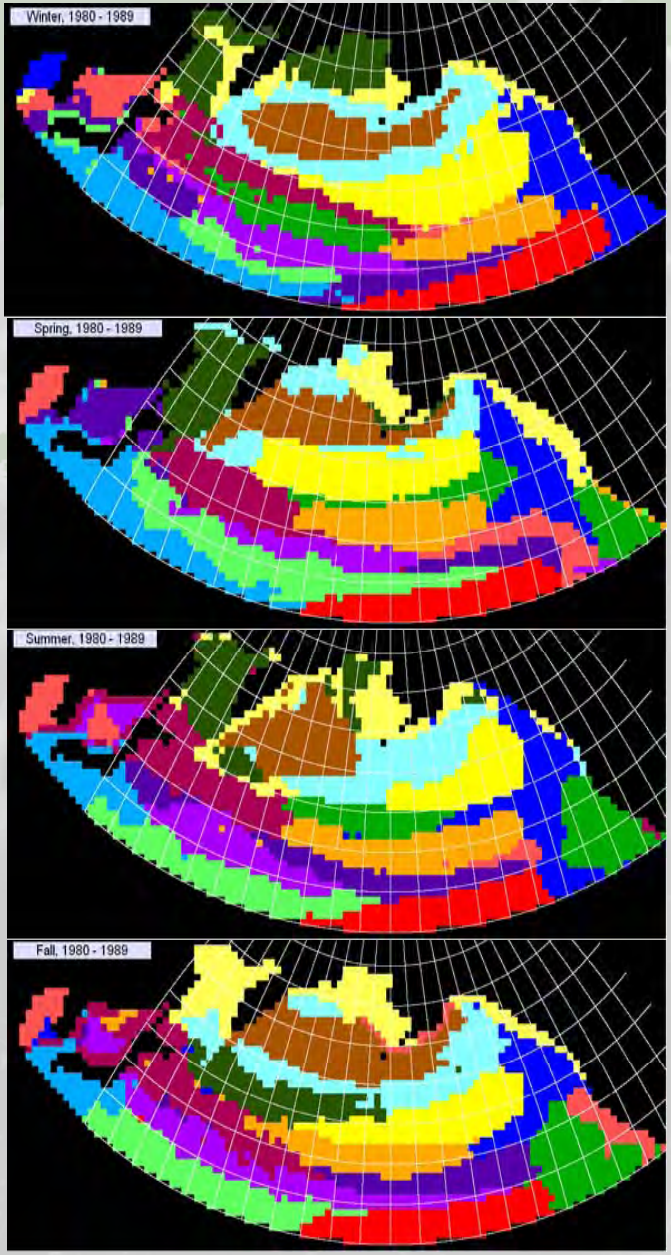




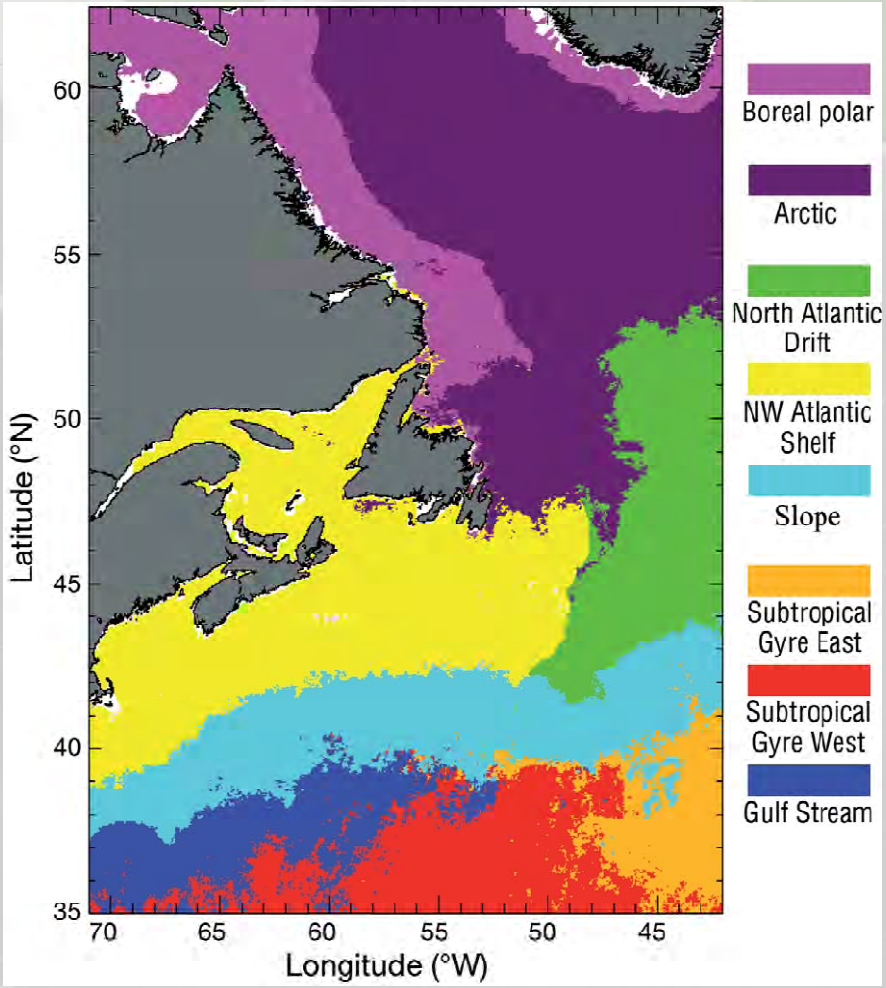
Longhurst 1998

Sherman 1986

Clustering - surface

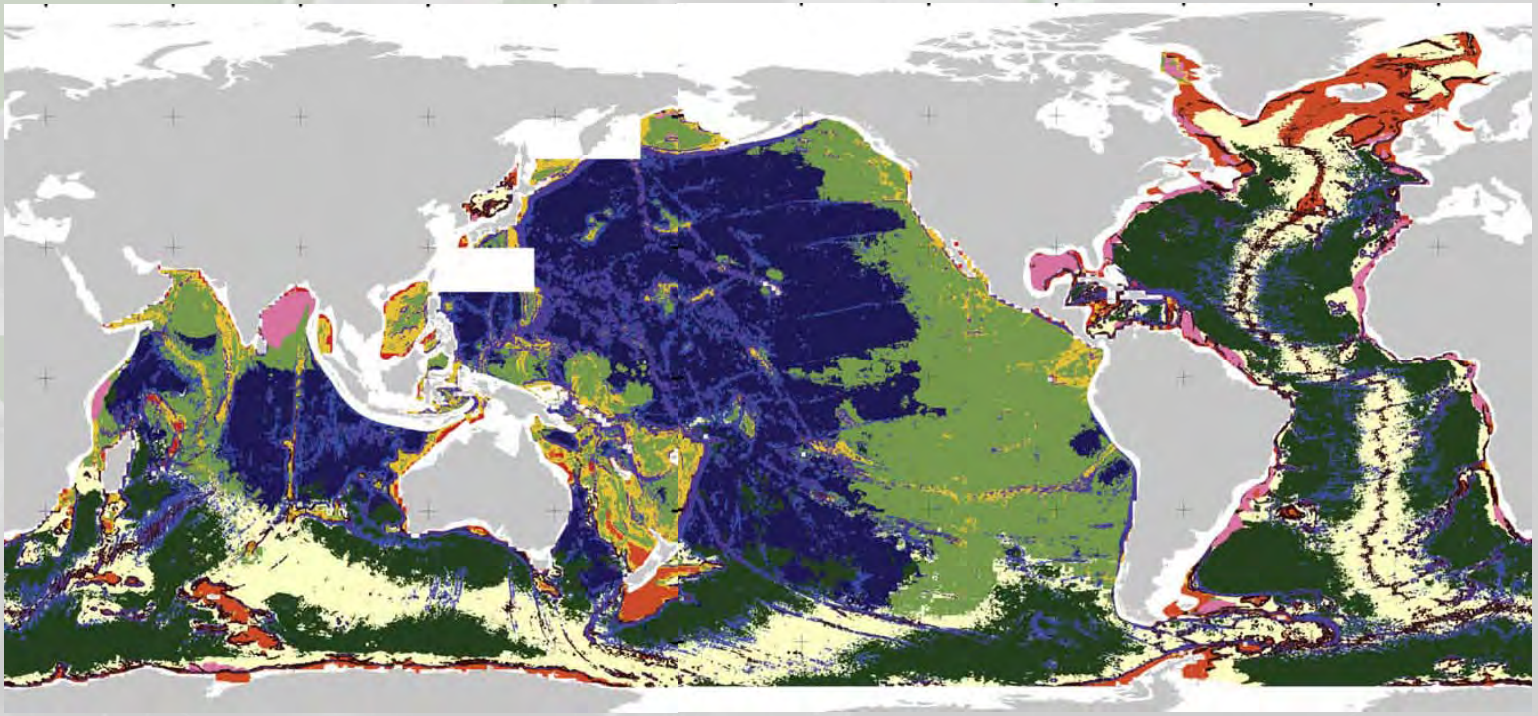


Gregr & Bodtker 2007



Devred, Sathyendranath, & Platt 2007

Clustering - Benthic

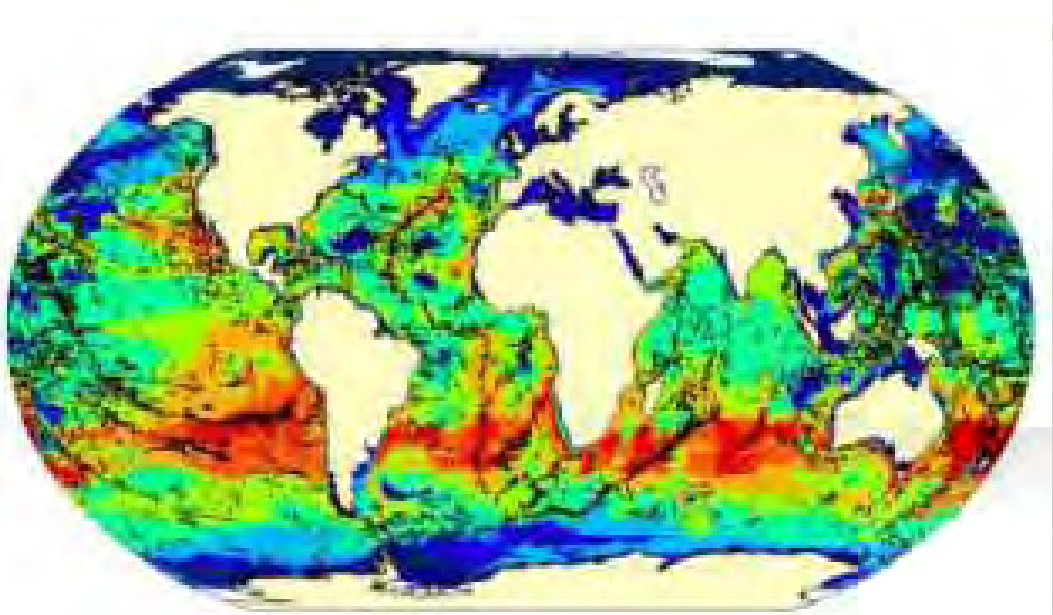


Harris & Whiteway 2009

-Depth
-Slope
-Primary production
-Sediment thickness
-Temperature
-DO
-Geomorphology and sediment type

= 11 ‘seascapes’

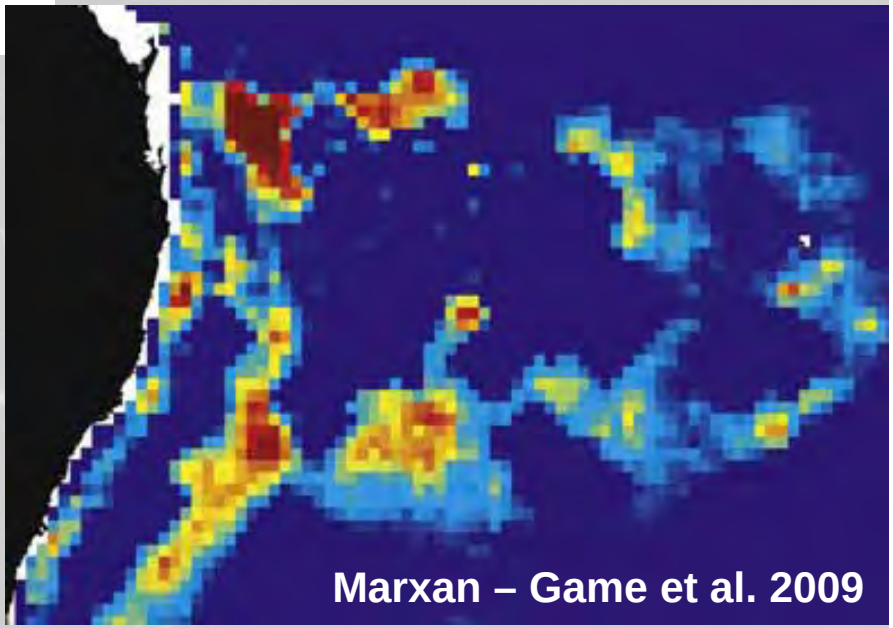
Zoogeographical approaches



MM richness – Kaschner 2007

Species richness
115 cetacean and pinniped species

Optimization
35 pelagic species, plus static and dynamic features



Marxan – Game et al. 2009

Classification assessment

- 18 classifications
- 7 criteria

- Feasible with existing data
- Appropriate resolution
- Dynamic seasonality considered
- Reproducible
- Ecological physics & biology
- Parsimonious
- Applicable across realms

18 classifications considered

Classification	Analysis	Extents	Approach	Reference
Major currents	Quantitative	Global	Geophysical	Dodimead et al. 1963; Favorite et al. 1976
Biomes/provinces	Quantitative	Global	Biophysical	Longhurst 1998
Surface clustering	Quantitative	Regional (NEP)	Ecological	Gregr & Bodtker 2007
LMEs	Expert	Global	Ecological/political	Sherman 1986
Physical synthetic	Expert	Global	Geophysical	CBD 2008
Vulnerable areas	Expert	Global	Ecological	FAO 2007
Clustered provinces	Quantitative	Regional	Biophysical	Devred et al. 2007
Envelope models	Expert	Global	Biological	Kaschner 2007
MEOW	n/a	Global	Synthesis	Spalding et al. 2007
LSA	Expert	Local	Biological	Sanderson et al. 2002
EBSAs	Expert	Regional	Biological	Clarke & Jamieson 2006a,b
LOMAs	Expert	Regional (EEZ)	Ecological	Harper et al. 2003
Ecoregions	Quantitative	Regional	Geophysical	Zacharias et al. 1998
Roff et al. 2003	Quantitative	Regional (EEZ)	Geophysical	Roff et al. 2003
Disturbance/Adversity	Quantitative	Regional	Ecological	Kostylev et al. 2005
Disturbance/Adversity	Quantitative	Regional	Ecological	Gregr & Jamieson 2008
UK SeaMap	Quantitative	Regional (EEZ)	Geophysical	Connor et al. 2006
Benthic acoustic	Quantitative	Regional	Geophysical	Greene et al. 2007

UK Seamap program

- Piloted in 2002; UK SeaMap 2006; UK SeaMap 2010
- Labour intensive

Benthic classification

Depth; bottom type; light attenuation; wave base; tidal current; temperature

Pelagic classification

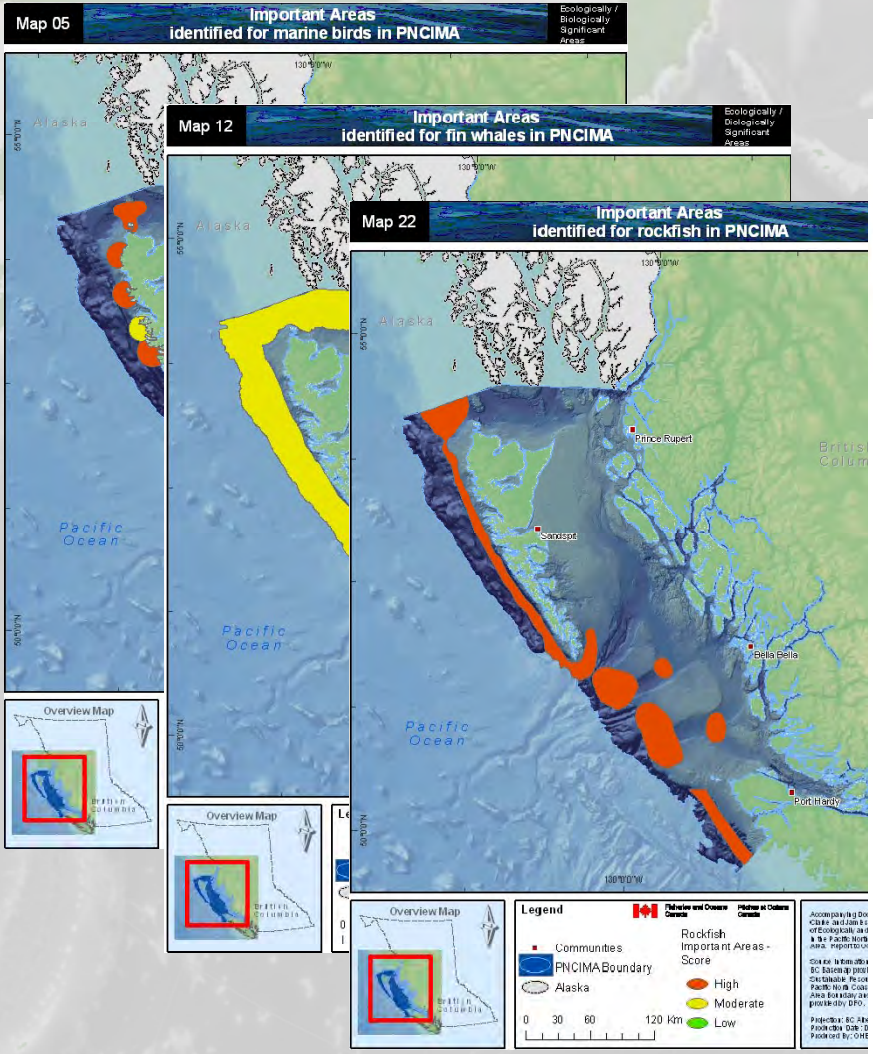
Salinity; temperature difference; frontal probability

Validated with 32,000 benthic samples and 6 plankton taxa

Can they be EBSAs?

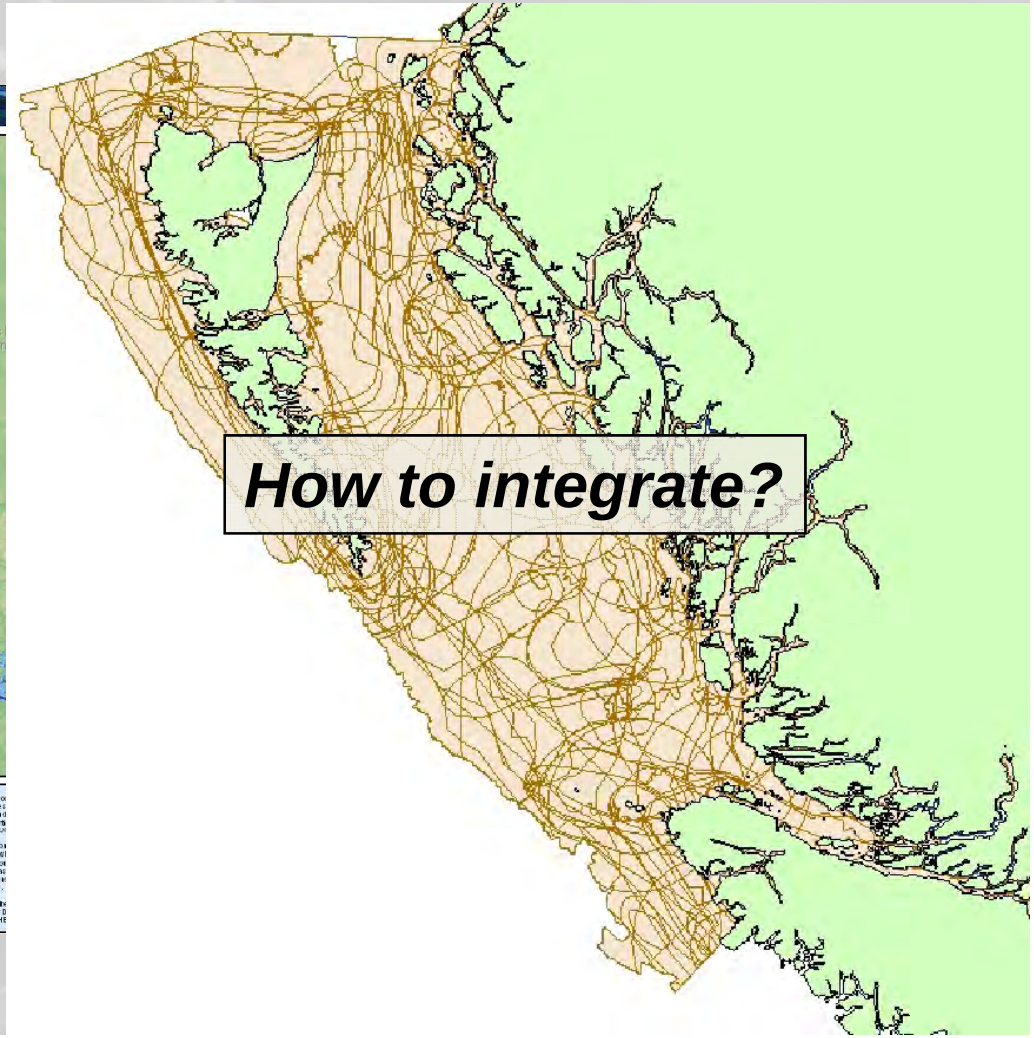
Rarity Aggregation Fitness

EBSAs - a zoological approach



Clarke and Jamieson 2006a

132 species or groups assessed



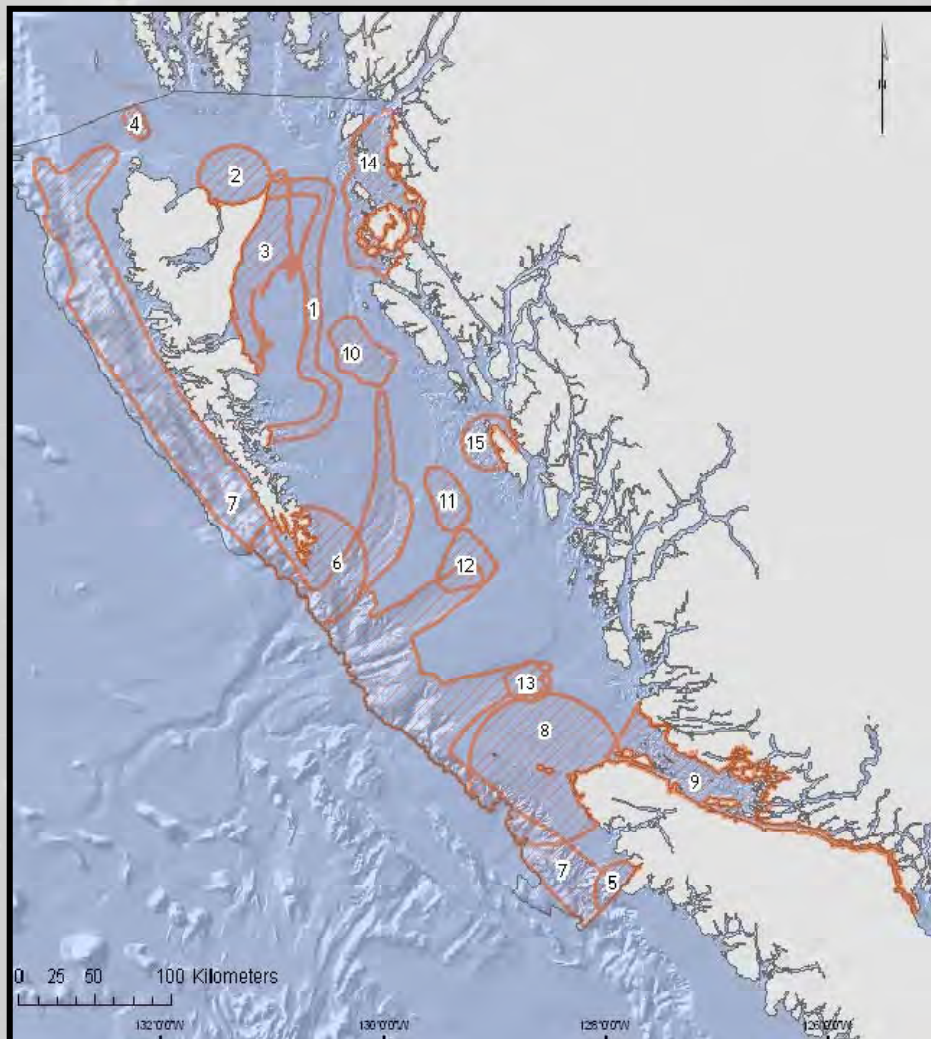
Canadian west coast EBSAs

- Concentration features
- Bottlenecks
- Sponge reefs

Grouping	IA's	Overlap	%
marine mammals, birds & turtles	47	36	76.60
fisheries	71	40	56.34
fish	50	30	60.00
macroinvertebrates	17	7	41.18
coral & sponge	14	6	42.86
plankton	30	26	86.67
benthos	44	31	70.45
structural	14	6	42.86
land-associated	30	21	70.00
prey	8	4	50.00
FW	14	3	21.43
pelagic	69	49	71.01
benthic	84	45	53.57
"at risk"	53	33	62.26

Clarke and Jamieson 2006b

44% of area defined as EBSAs



What are we really getting at?

Rarity	estuaries; reefs; bottom types canyons; seamounts; vents
Aggregation	bottlenecks; tidal rips; sills; ridges meso-scale eddies; upwelling zones; shelf edge concentration areas major convergence and divergence zones
Fitness consequences	reefs; bottom types; canyons migration routes; breeding grounds

EBSA guidelines

- Start with rare (static) physical features
- Add dynamic pelagic areas
- Identify representative taxa
- Assess contribution of defined physical features to taxa of interest
- Expand EBSAs to include ‘sufficient’ critical habitat as necessary

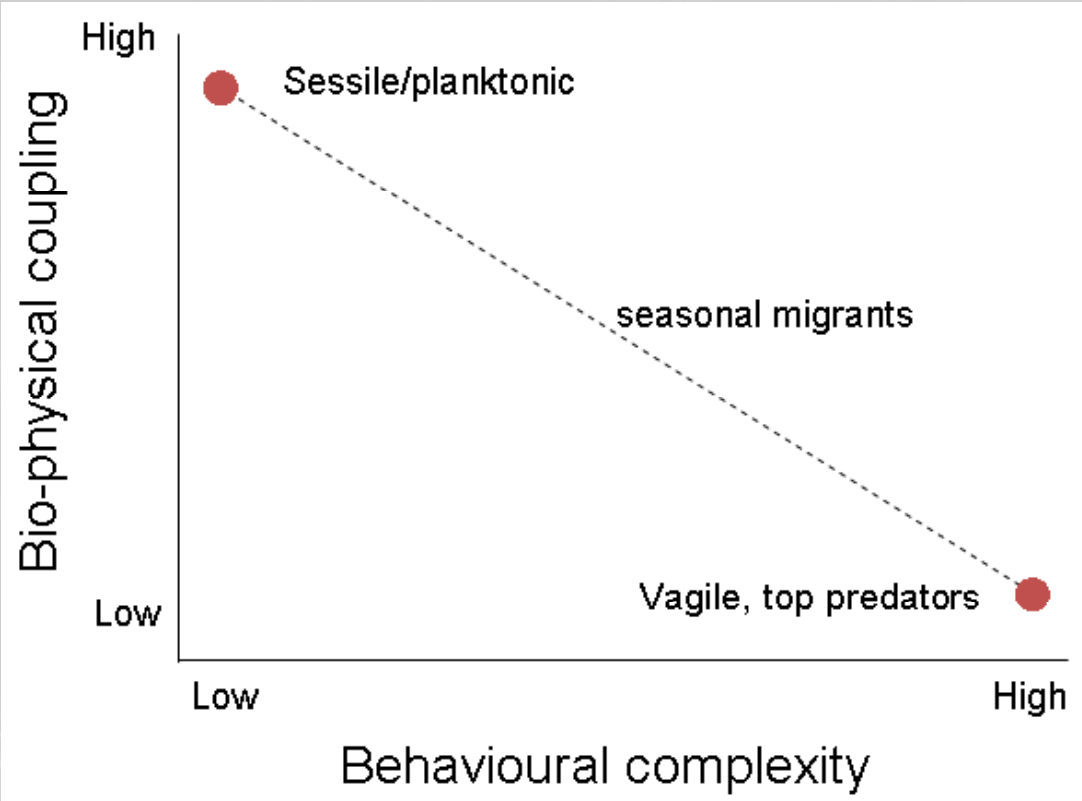
Advantages

- Fast
- Transparent
- Clarifies role of various disciplines
- Focuses on thresholds and adequacy
- Lends itself to adaptive management

Key challenge

Relating biology to physics

- Assign multiple biological attributes to EBSAs
  - Who?
  - Where?
  - When? (2 dim)
  - Why?



What about biodiversity?

- A multi-scale concept
- Difficult to reduce to a single index
- Treat as an attribute of defined EBSA system

- Support prioritisation for protection (along with *naturalness* and *representativity*)

Thank you!

Glen Jamieson, Cathryn Clarke-Murray, and the DFO working groups for doing the hard work.

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Questions, comments?
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