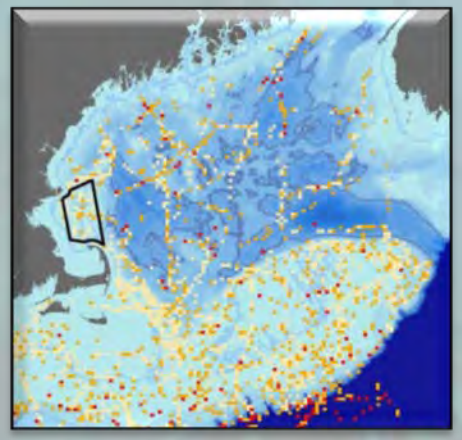
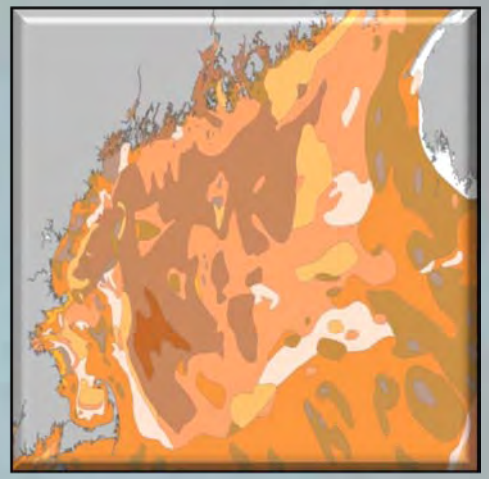
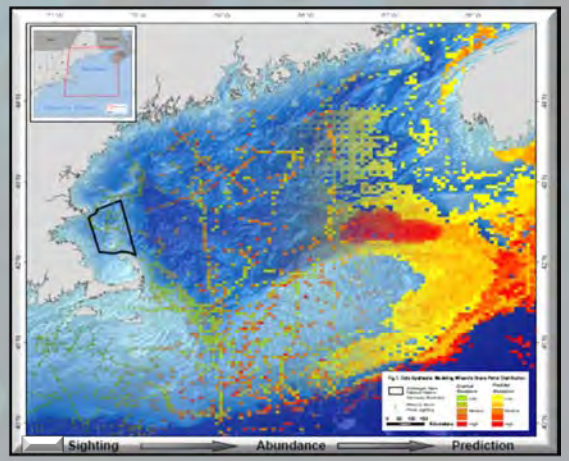
Biogeographic Assessments to Meet Regional MSP Needs







Chris Caldow

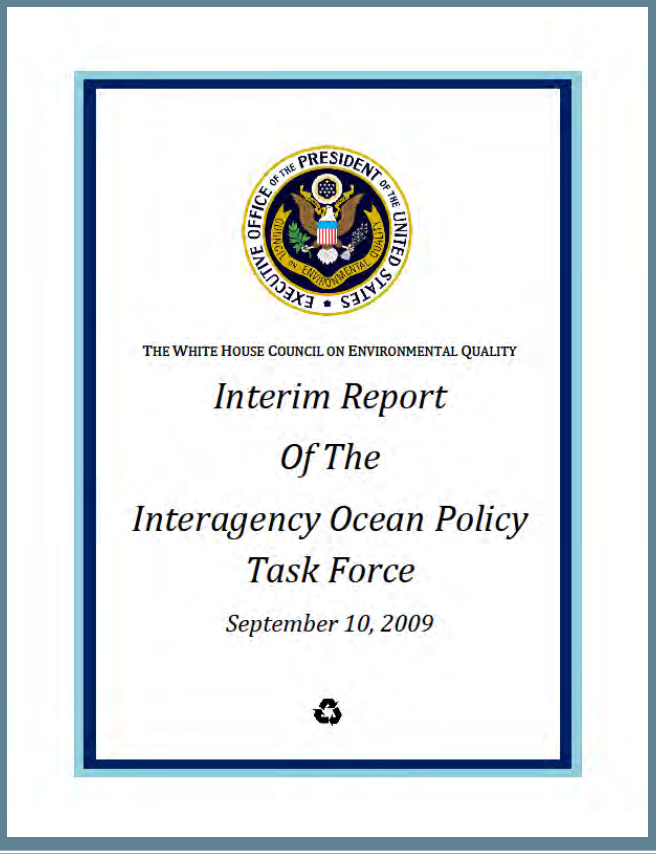
Chris.Caldow@noaa.gov

NE CZM Mtg. December 2009

NOAA / NOS
Center for Coastal Monitoring and Assessment

National Centers for Coastal Ocean Science

To conduct and support research, monitoring, assessments, and technical assistance to meet NOAA's coastal stewardship and management responsibilities.



10 Steps to MSP

1) Identifying need and establishing authority
2) Obtaining financial support
3) Organizing the process through pre-planning
4) Organizing stakeholder participation
5) Defining and analyzing existing conditions
6) Defining and analyzing future conditions
7) Preparing and approving the spatial management plan
8) Implementing and enforcing the spatial management plan
9) Monitoring and evaluating performance
10) Adapting the marine spatial management process

Biogeographic Assessment Approach

Biogeographic Data Layers

Imagery

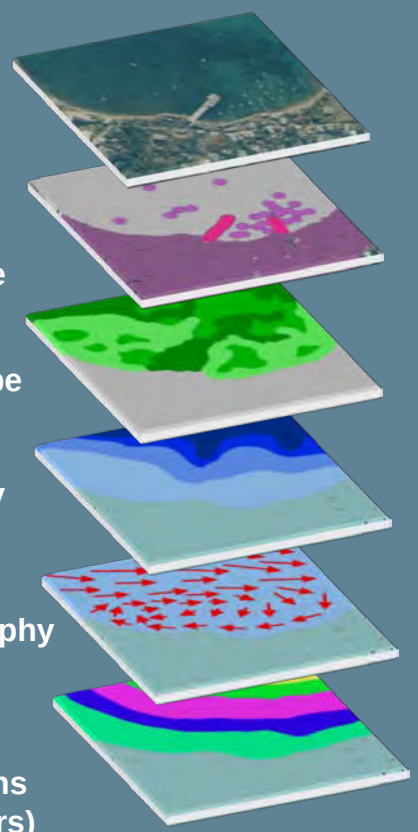
Patterns of Human Use

Bottom Type

Bathymetry

Oceanography

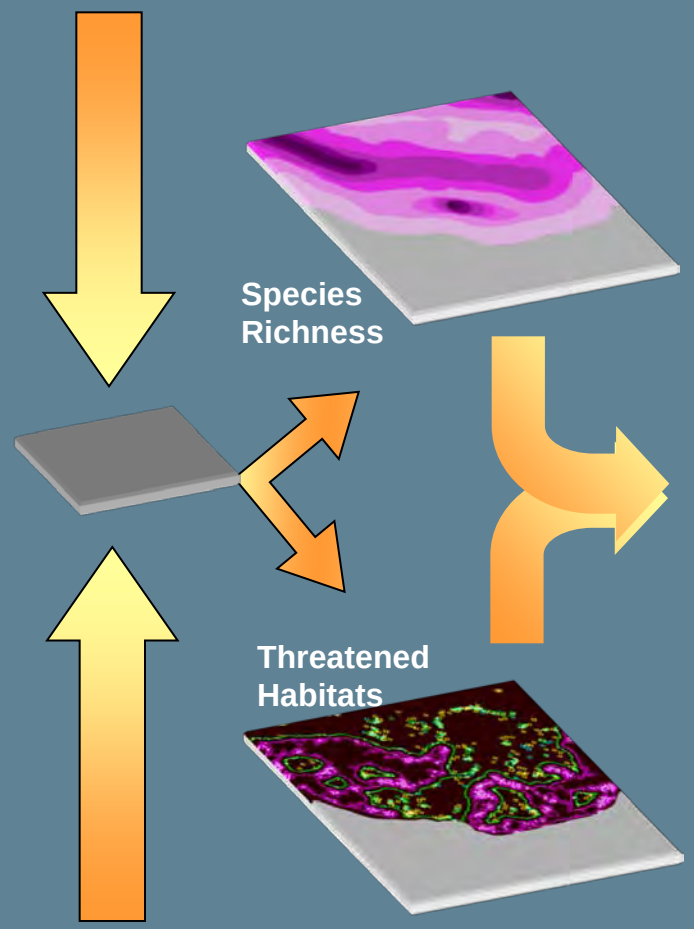
Species Distributions (many layers)



Combine Biogeographic Layers for Analysis

Example Integrated Biogeographic Analyses*

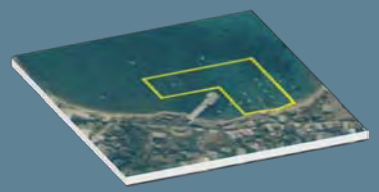
* Specific analyses targeted to management needs



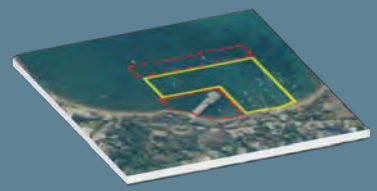
Analytical Products to Meet Management Objectives

Products to Aid Management

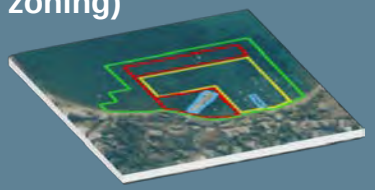
Defining and analyzing existing conditions



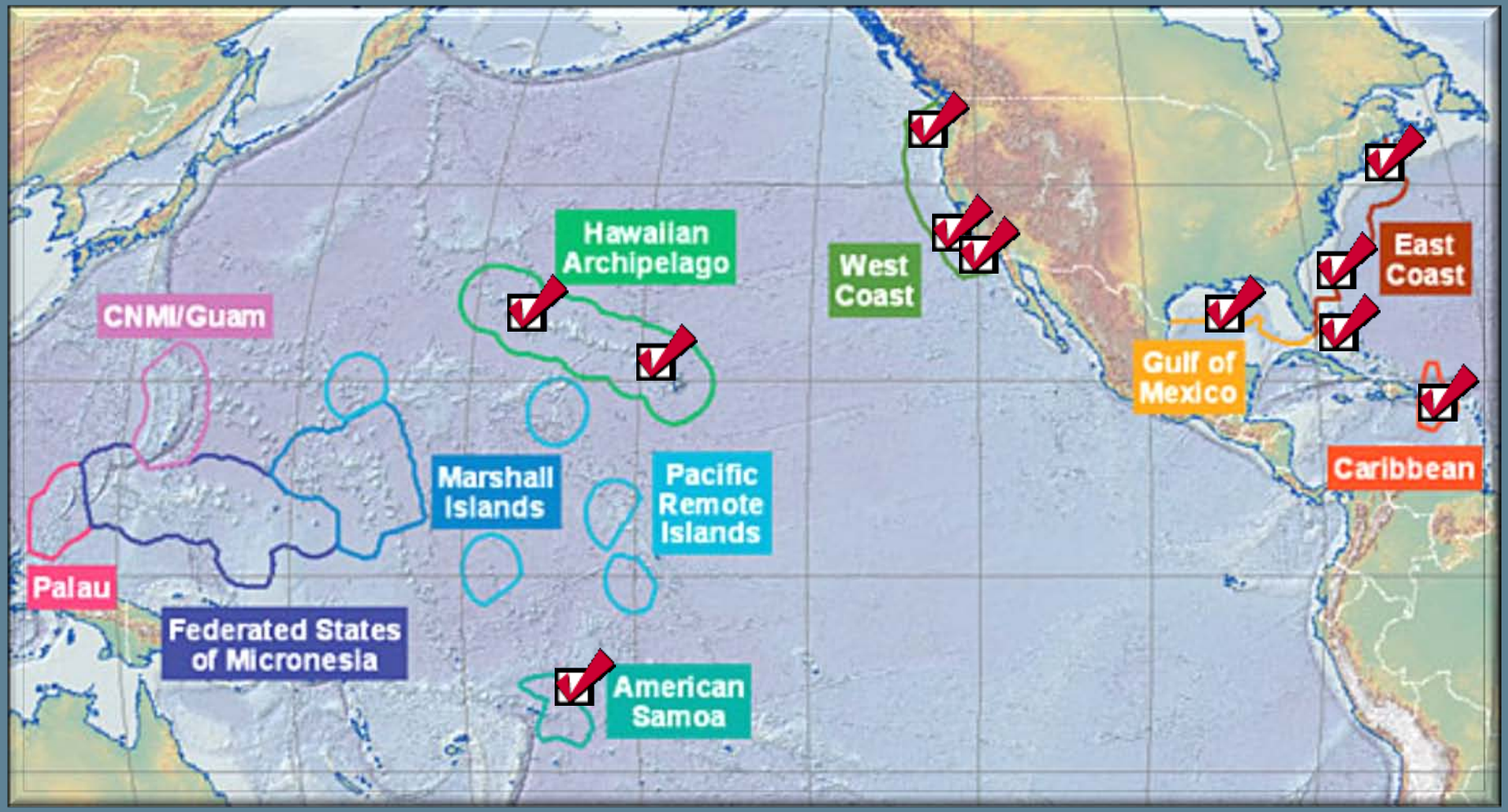
Defining and analyzing future conditions



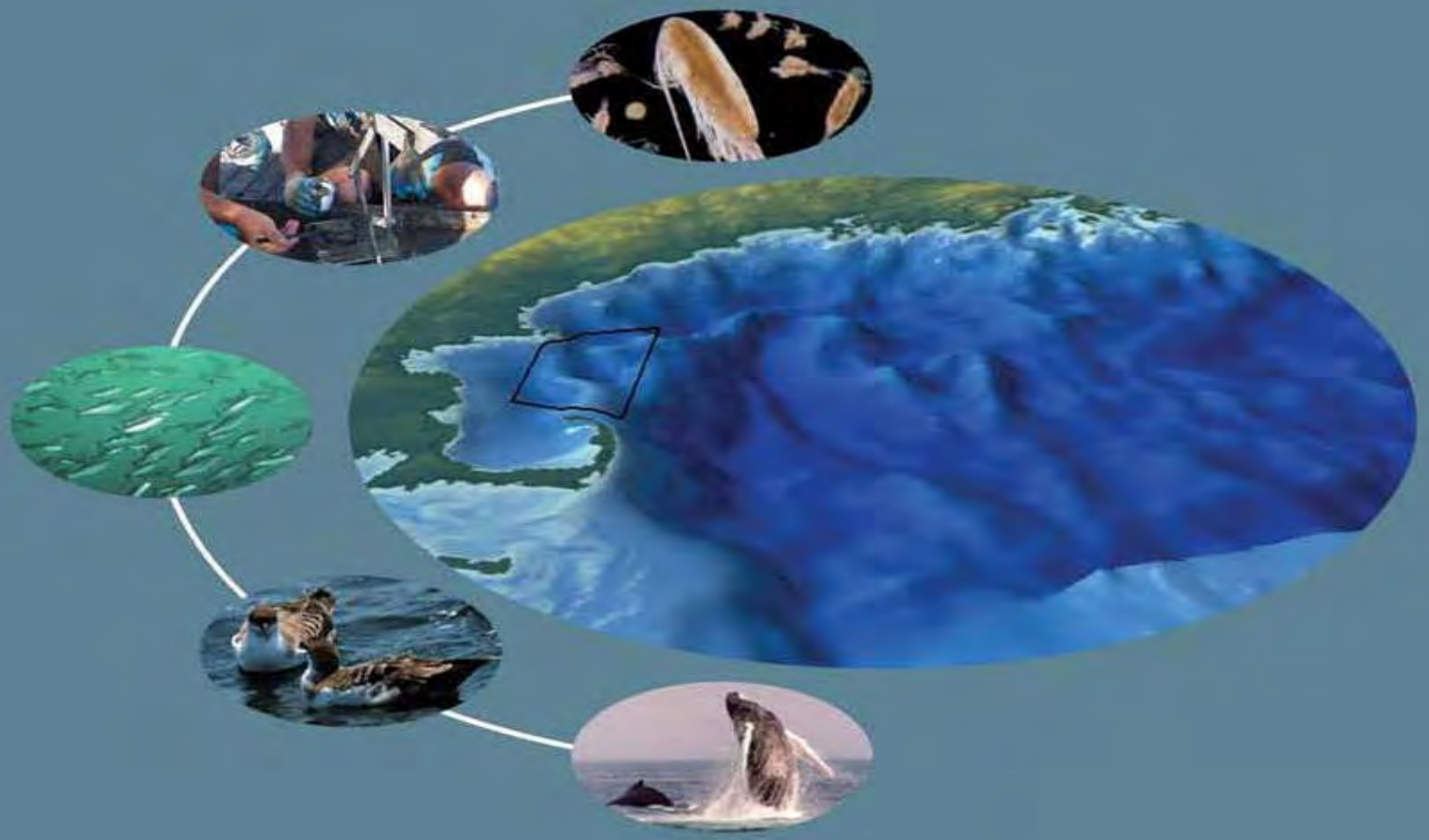
Evaluate alternative management strategies (e.g. zoning)



Efforts To-Date



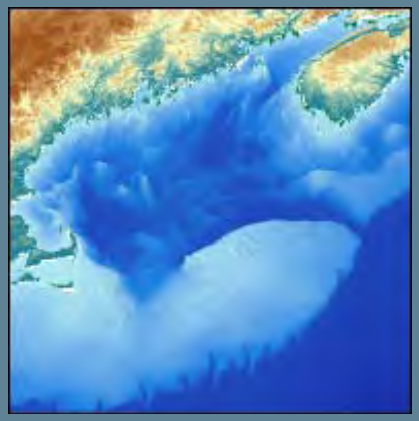
Assessment: Stellwagen Bank, MA



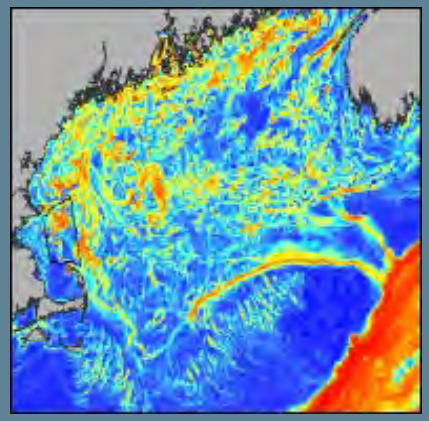
Objective: To synthesize and integrate ecological data to support management plan review process. To provide spatial models of resource distribution to inform MA Ocean Plan. *Balancing needs of shipping community and conservation*

Abiotic: Spatio-Temporal Data

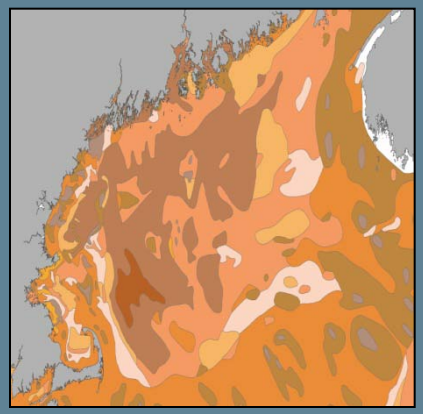
STATIC VARIABLES



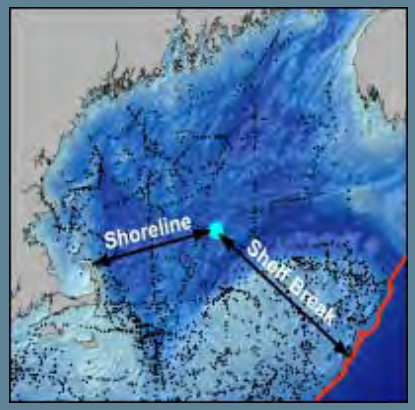
Bathymetry



Slope

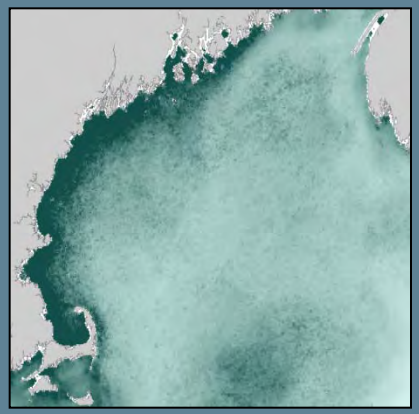


Substrate

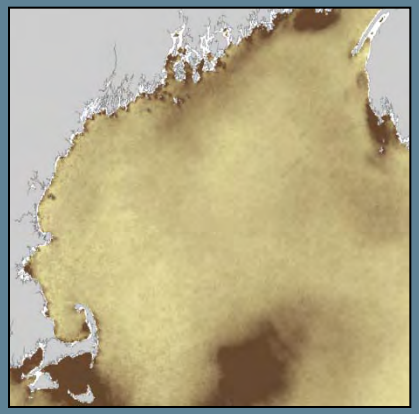


Distance to Features

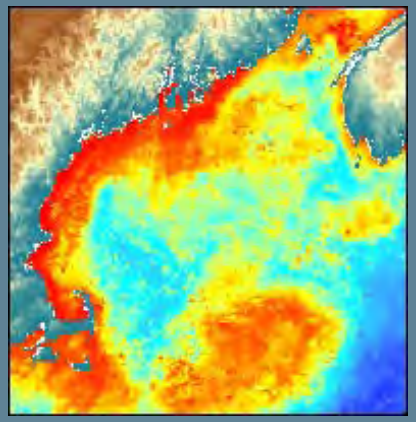
DYNAMIC VARIABLES



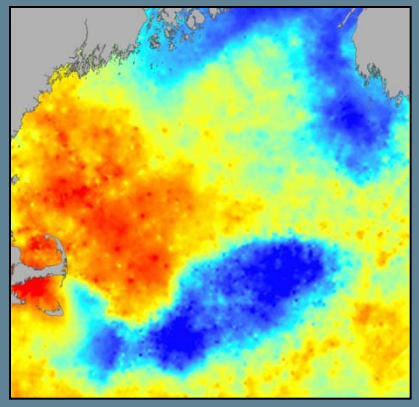
Chlorophyll *a*



Turbidity



Sea Surface Temp.

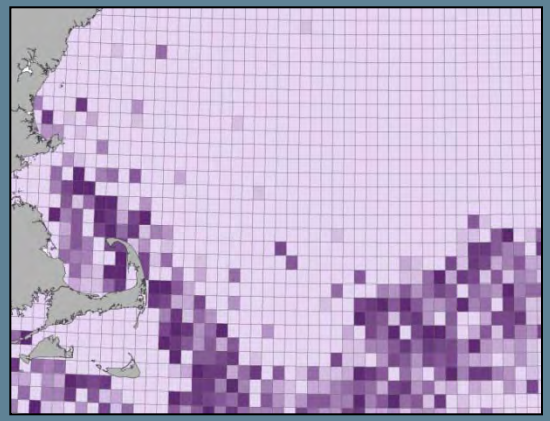


Seasonal Water Stratification

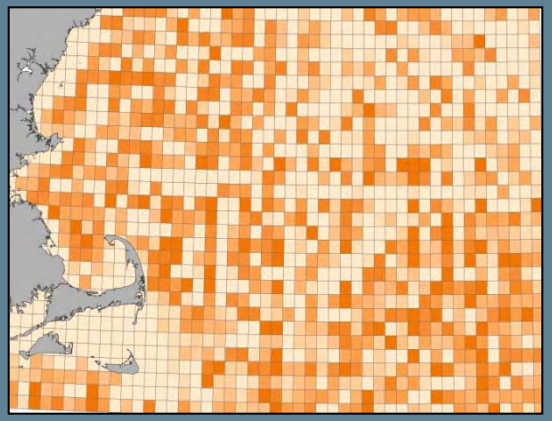
Biotic: Spatio-Temporal Data

PREY ABUNDANCES

Atlantic Mackerel

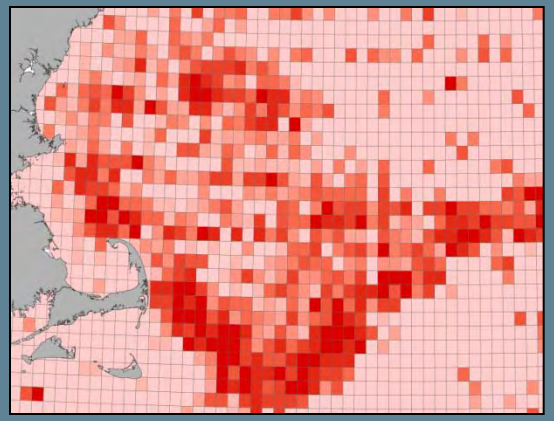


Northern Sand Lance

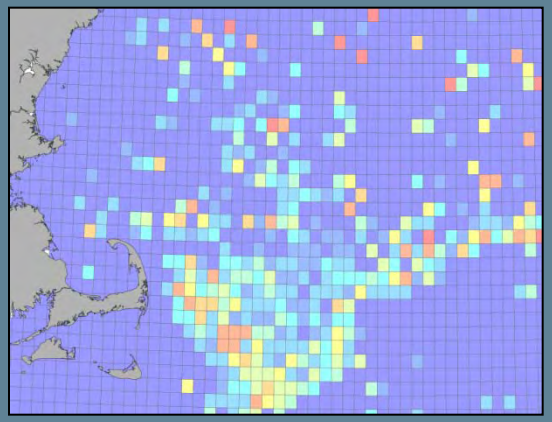


Zooplankton

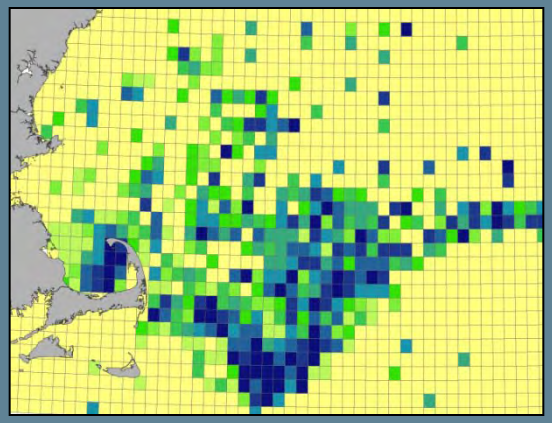
CETACEAN ABUNDANCES



Mysticeti
(Baleen Whales)



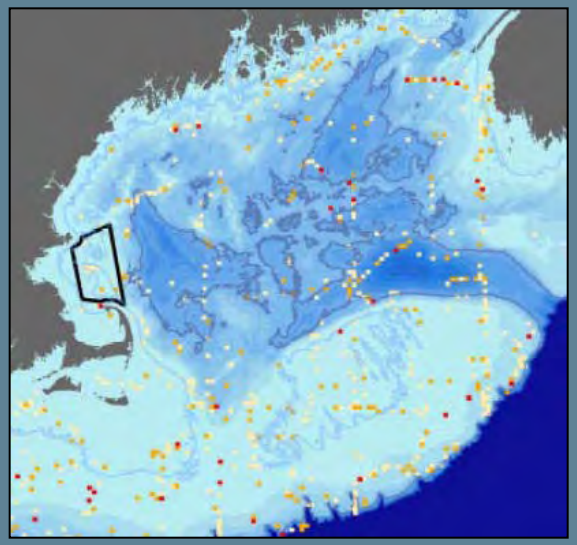
Atlantic White-Sided
Dolphin



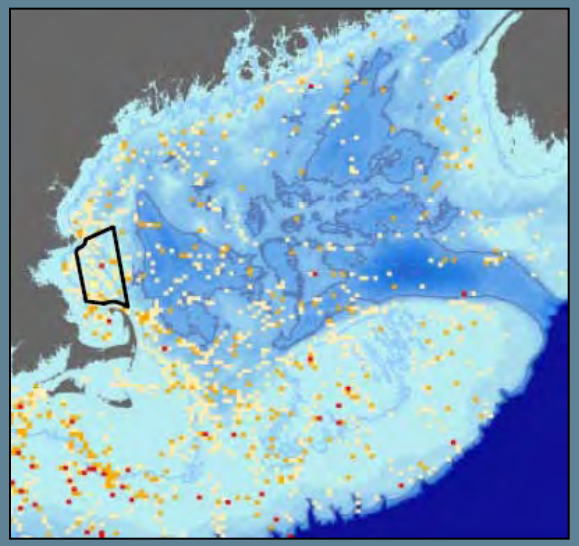
Northern Atlantic
Right Whales

Biotic: Spatio-Temporal Data

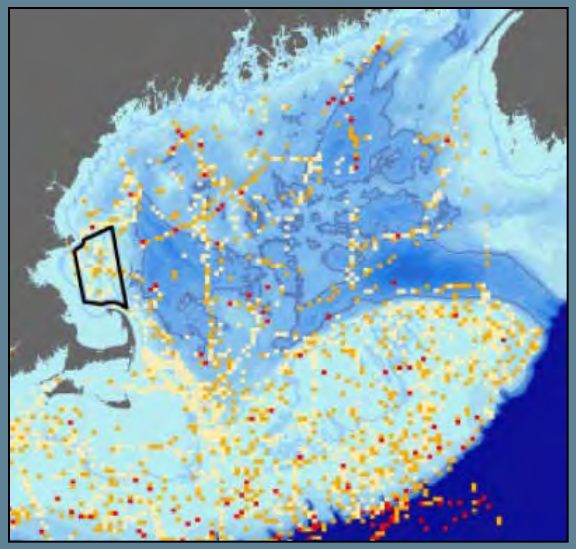
SEABIRD ABUNDANCES



Auks (Alcidae)

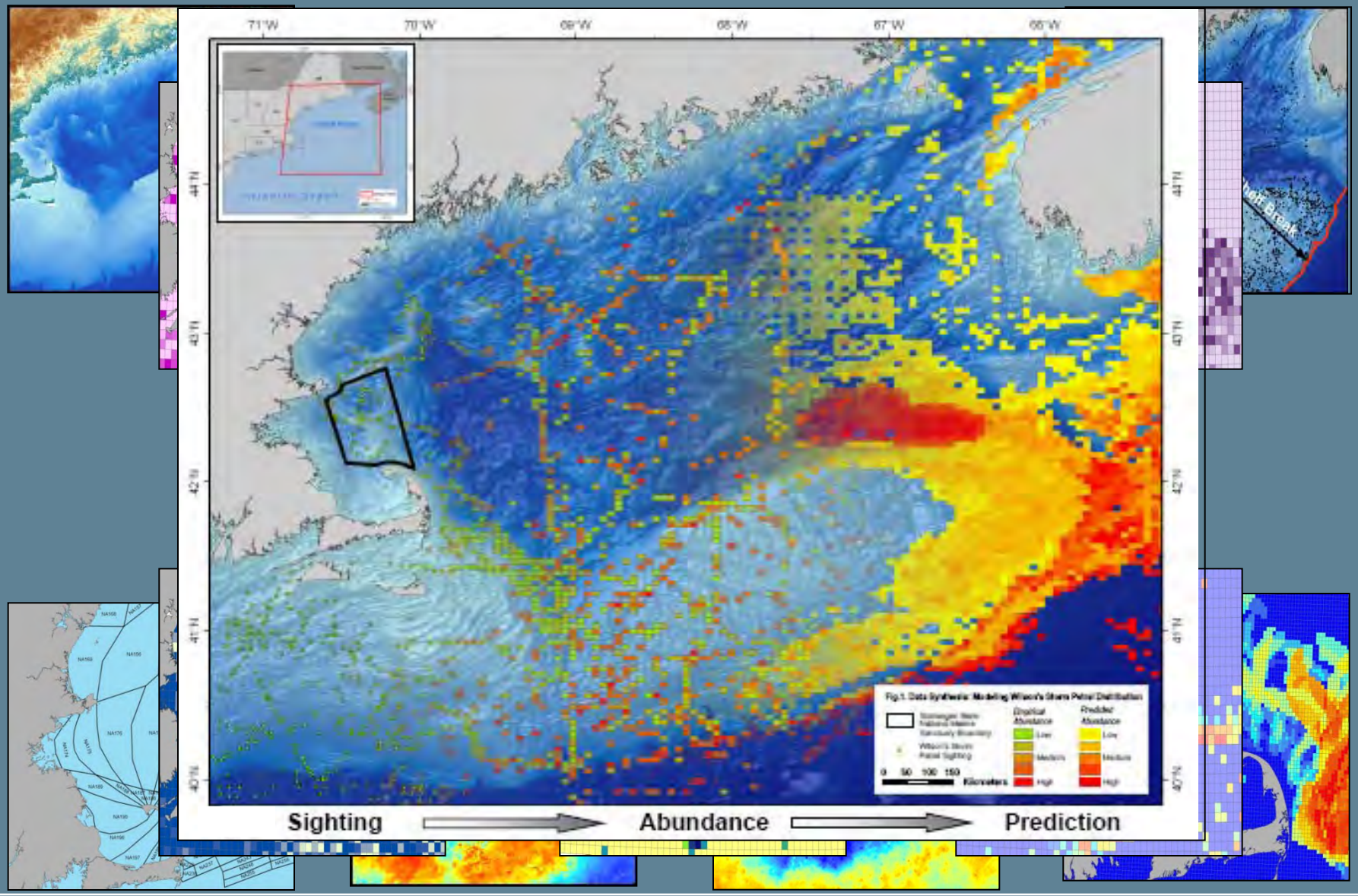


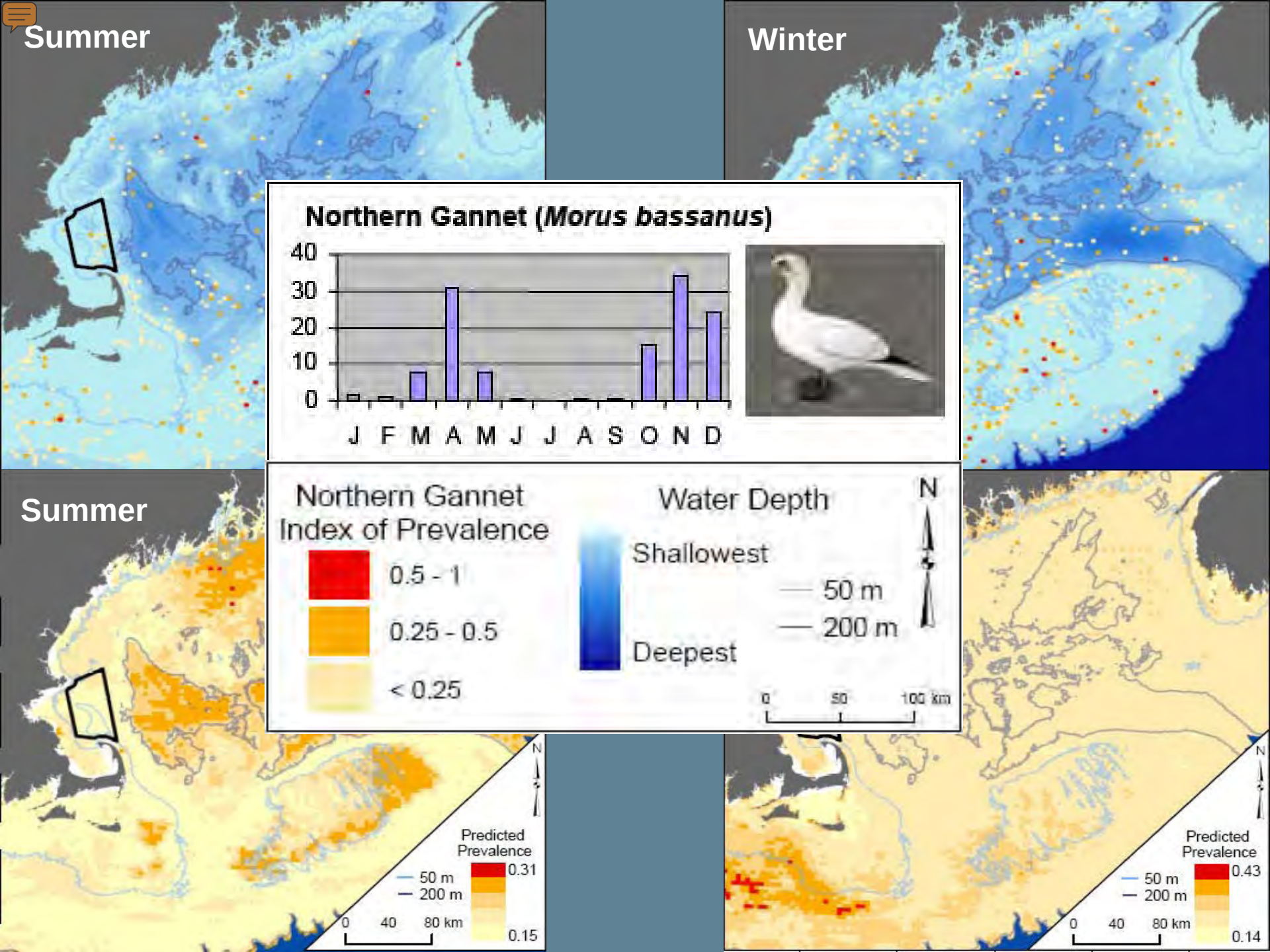
Northern Gannets

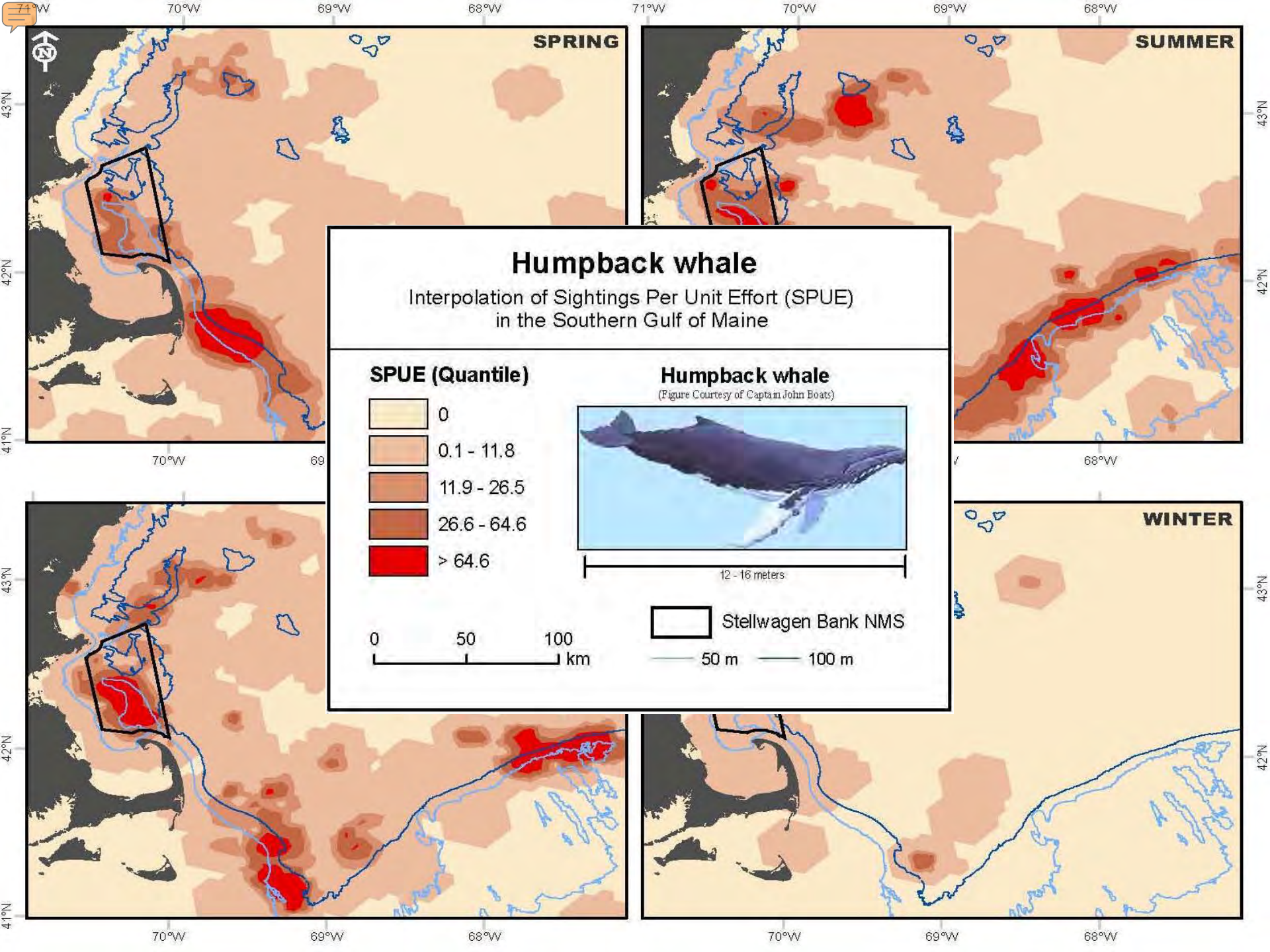


Wilson's Storm Petrel

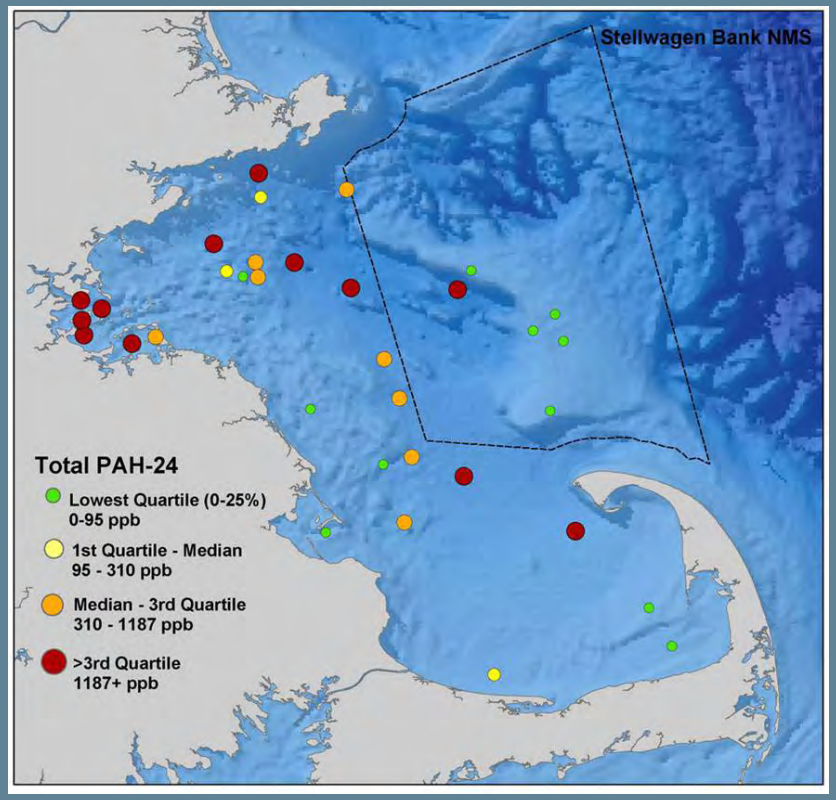
Integration

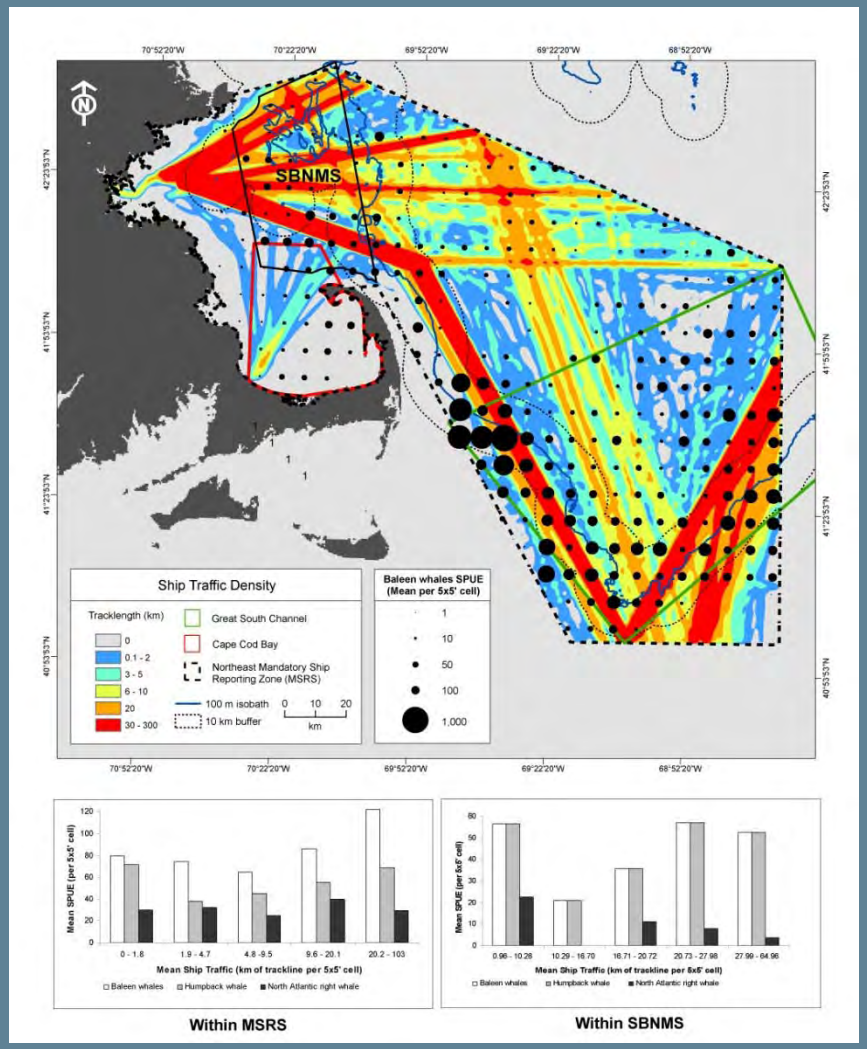



Summer
Winter
Northern Gannet (Morus bassanus)
40
30
20
10
0
J F M A M J J A S O N D
Summer
Northern Gannet
Index of Prevalence
0.5 - 1
0.25 - 0.5
< 0.25
Water Depth
Shallowest
Deepest
50 m
200 m
N
0 50 100 km
N
Predicted
Prevalence
0.31
0.15
50 m
200 m
0 40 80 km
N
Predicted
Prevalence
0.43
0.14
50 m
200 m
0 40 80 km


SPRING
SUMMER
WINTER
Humpback whale
Interpolation of Sightings Per Unit Effort (SPUE)
in the Southern Gulf of Maine
SPUE (Quantile)
0
0.1 - 11.8
11.9 - 26.5
26.6 - 64.6
> 64.6
Humpback whale
(Figure Courtesy of Captain John Boats)
12 - 16 meters
Stellwagen Bank NMS
50 m
100 m
0
50
100
km
71°W
70°W
69°W
68°W
43°N
42°N
41°N

Applications

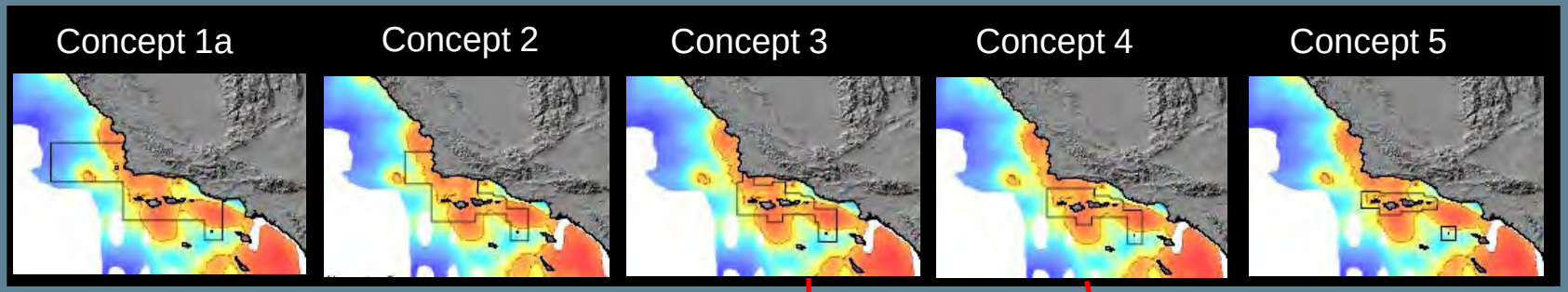




Partnerships

- NMSP
- NMFS/NEFSC
- WHOI
- NESDIS
- USGS
- USFWS
- Bedford Institute of Oceanography
- Mass. DMF
- Maine DMR
- MWRA
- Manomet Center for Cons. Sci.
- Univ. of Connecticut
- Univ. of Mass.-Boston
- Univ. of New Hampshire
- Univ. of Alaska-Fairbanks
- Univ. of Rhode Island
- Duke Univ.
- Mem. Univ. of Newfoundland
- Middlebury College
- Univ. of New Brunswick
- National Audubon Society

Assessment: Southern California Bight, CA



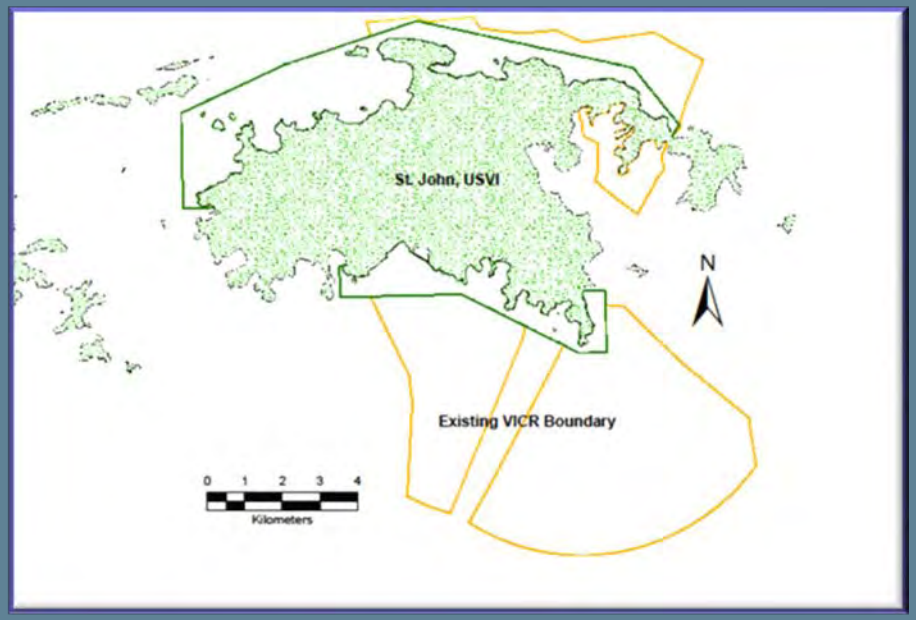
Concept	Area (km²)	Mean Bird Diversity	High Diversity Area (km²)	Δ Area (%)	Δ Mean Diversity (%)	Δ High Diversiy Area (%)	Mean Bird Diversity OAI (relative)	High Diversity Area OAI (absolute)
NAA	3745	1.485	2284	-	-	-	-	-
5	4536	1.487	2812	21	0.13	23.12	0.00638	1.094
4	7981	1.523	5507	113	2.56	141.11	**0.02262**	1.248
3	9044	1.53	6421	141	3.03	181.13	0.02141	**1.28**
2	13736	1.502	8791	267	1.14	284.89	0.00429	1.068
1a	22591	1.372	10391	503	-7.61	354.95	-0.01512	0.705
1	22613	1.375	10401	504	-7.41	355.39	-0.0147	0.705
SA	17093	1.489	9914	356	0.27	334.06	0.00076	0.937

Objective: To evaluate alternative boundary concepts proposed for the Channel Islands National Marine Sanctuary: ***Balancing needs of local stakeholders***

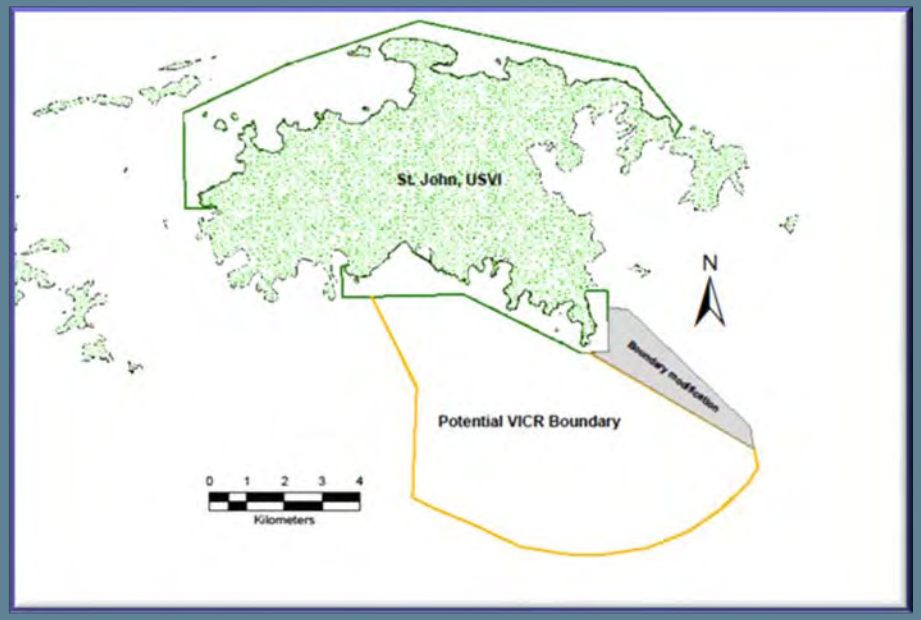
Assessment: St. John, US Virgin Islands

The Proposed Swap

Existing Boundaries



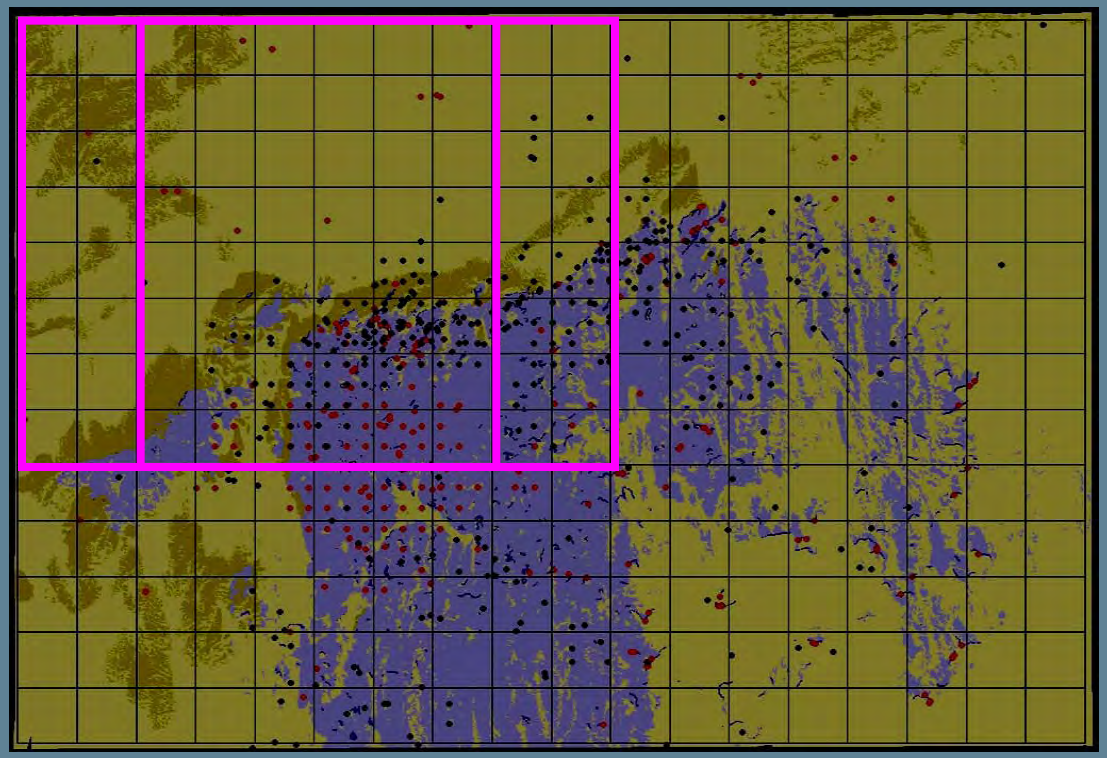
Proposed Boundaries



Objective: To monitor and evaluate the efficacy of an area zoned for conservation. To develop zoning alternatives for improved efficacy: *Balancing needs of fishing and conservation communities*

Assessment: Gray's Reef NMS, GA

Opt. #	# High ledges	Area H ledges	# Boats	# Res. Sites



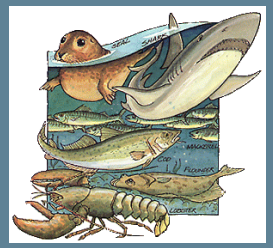
Resulted in 31,135 options!

Objective: **To measure the benefits and impacts of potential management zoning actions:** ***Balancing needs of recreational boaters, fishermen, researchers, conservation***

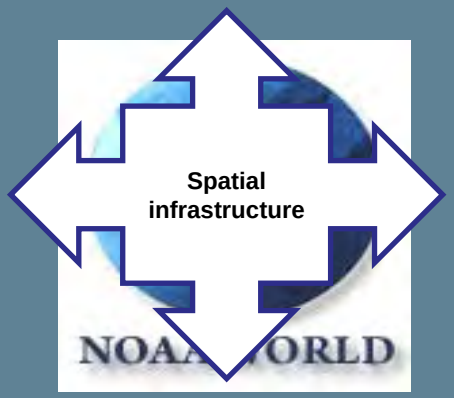
NOAA's Role

NOAA has it all!

Climate models

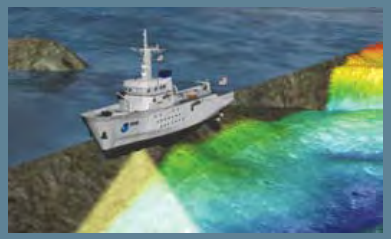


Vast archives of biological data



Ocean observing data

Bathymetry



Integrate, integrate, integrate

New knowledge creation

Critical to effective MSP

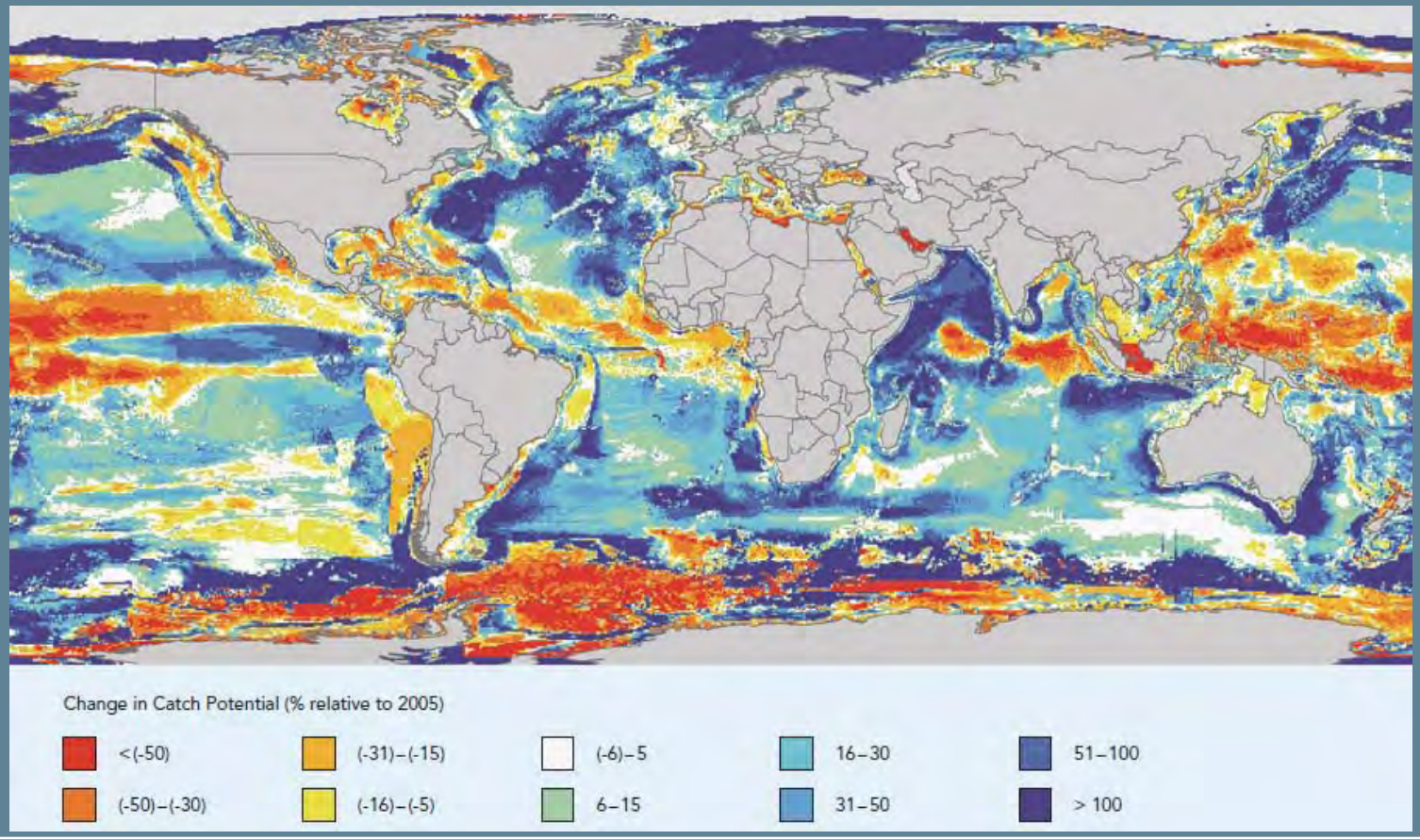
Prepare for climate change

Changing Climate

Where will marine species be in 50 and 100 years?

What are the likely consequences for people?

Predicted changes in fisheries catch potential from 2005 to 2055 based on shifts in >1000 commercial species



Cheung et al. 2009 Fish & Fisheries