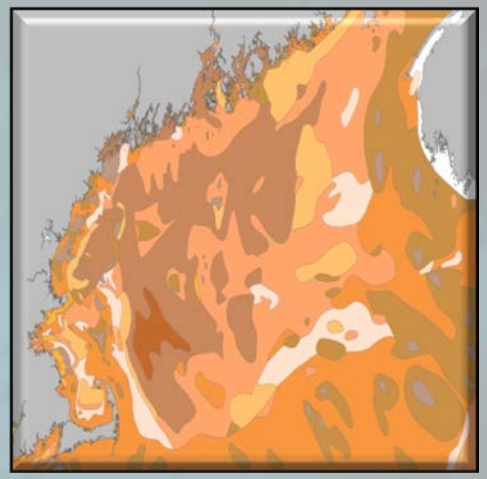
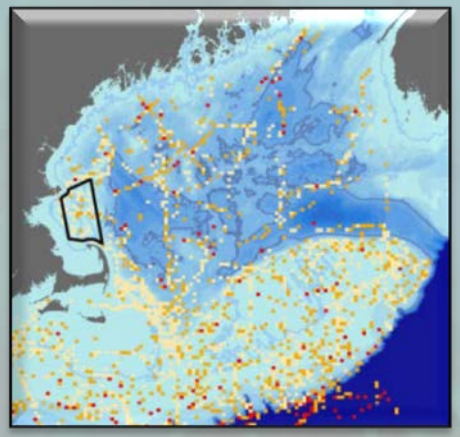
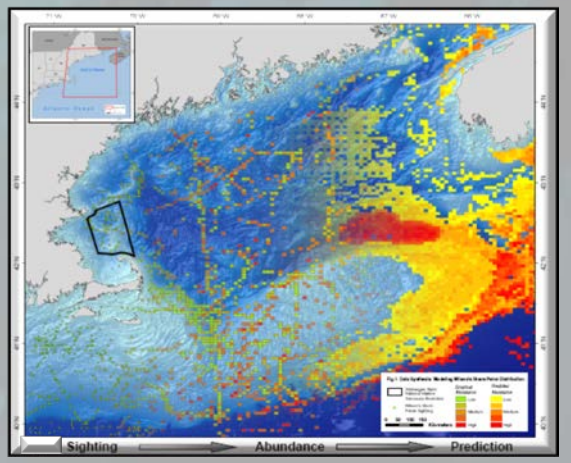
# Defining, Mapping and Interpreting Ecological Data for the TSP








Chris Caldow

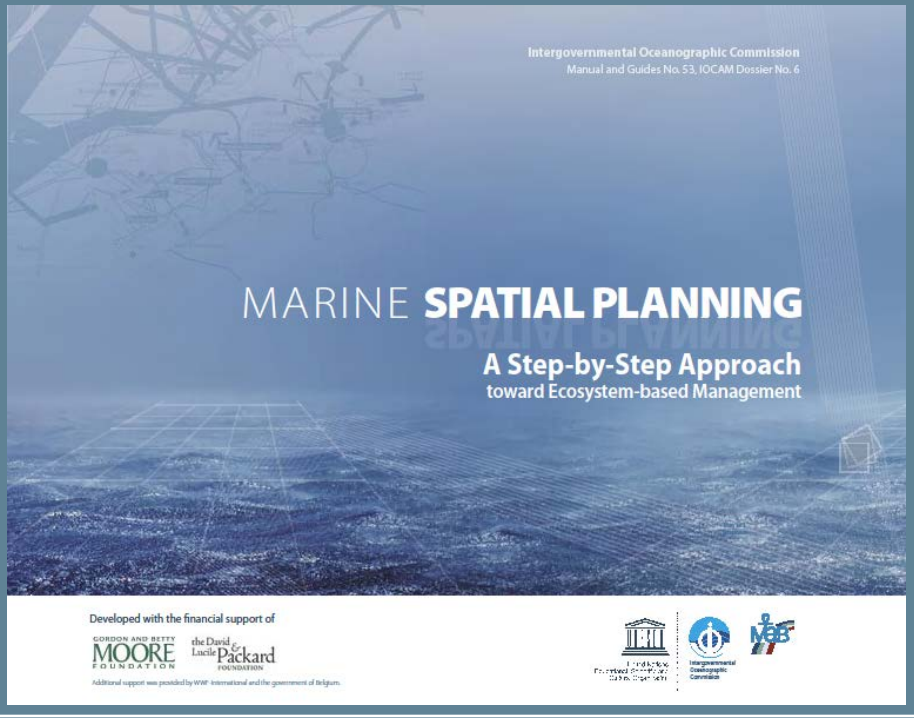
Chris.Caldow@noaa.gov

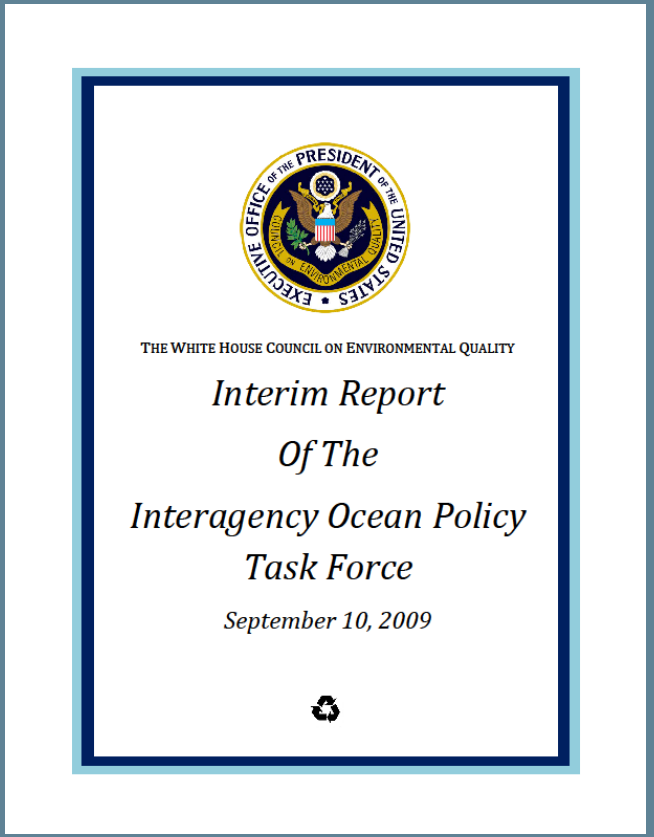
Oregon BOEMRE Task Force

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.**



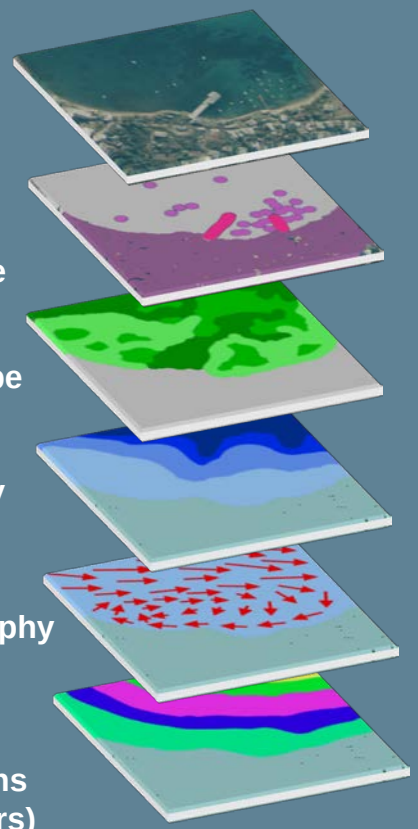



# 10 Steps to MSP

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

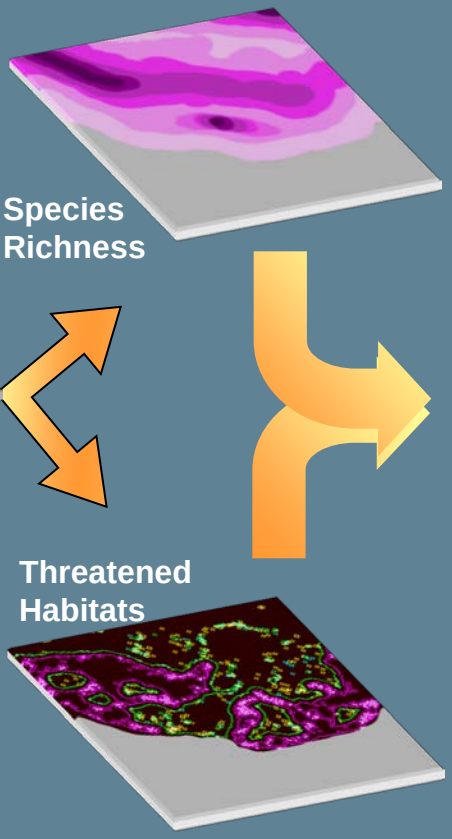


- Imagery
- Patterns of Human Use
- Bottom Type
- Bathymetry
- Oceanography
- Species Distributions (many layers)

Combine Biogeographic Layers for Analysis

## Example Integrated Biogeographic Analyses*

* Specific analyses targeted to management needs

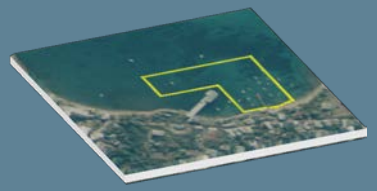


- Species Richness
- Threatened Habitats

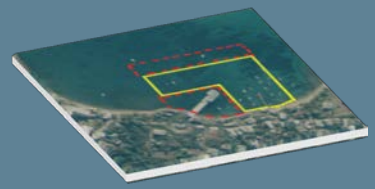
Analytical Products to Meet Management Objectives

## Products to Aid Management

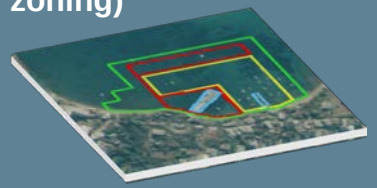
Defining and analyzing existing conditions



Defining and analyzing future conditions



Evaluate alternative management strategies (e.g. zoning)



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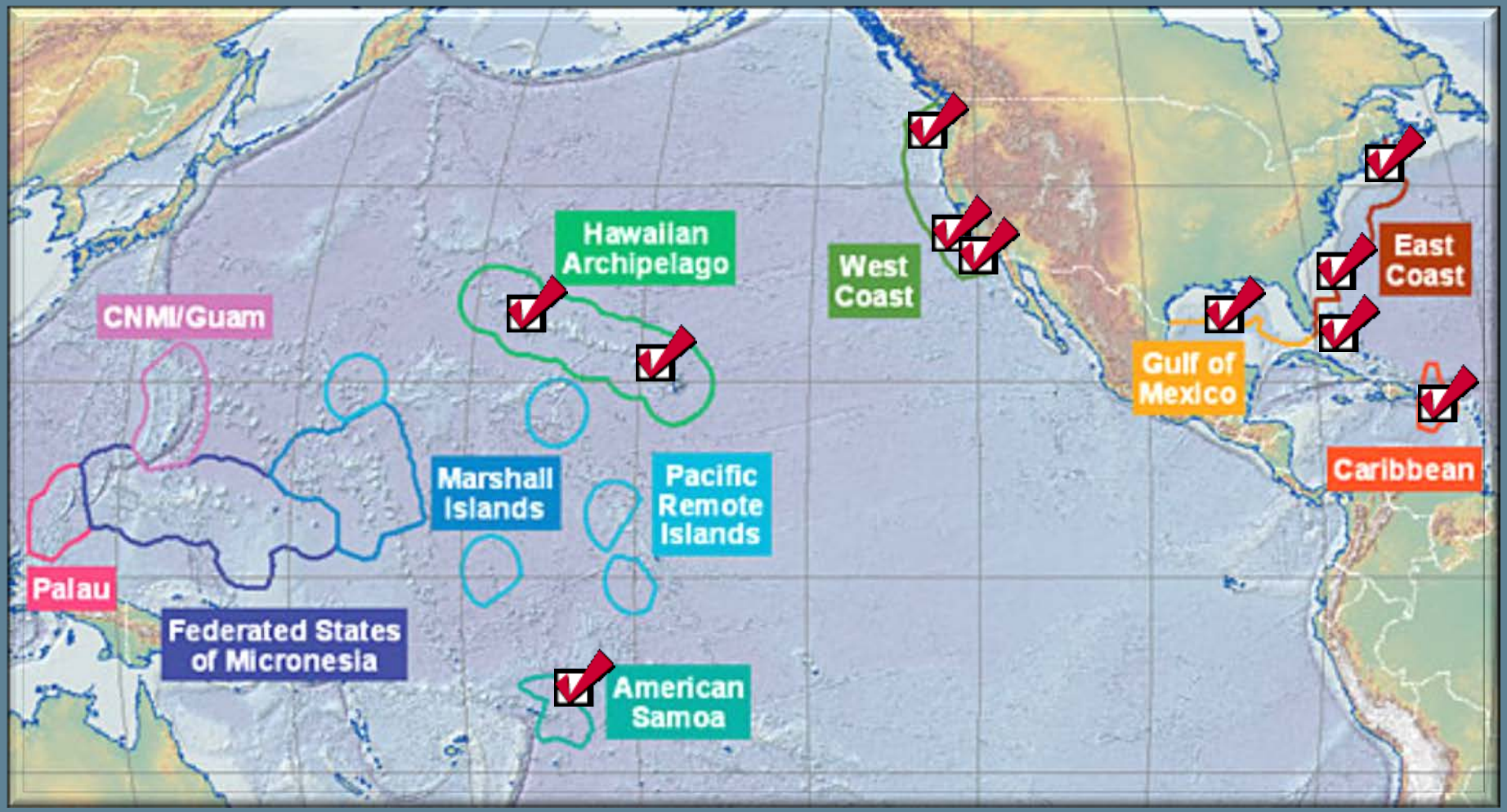
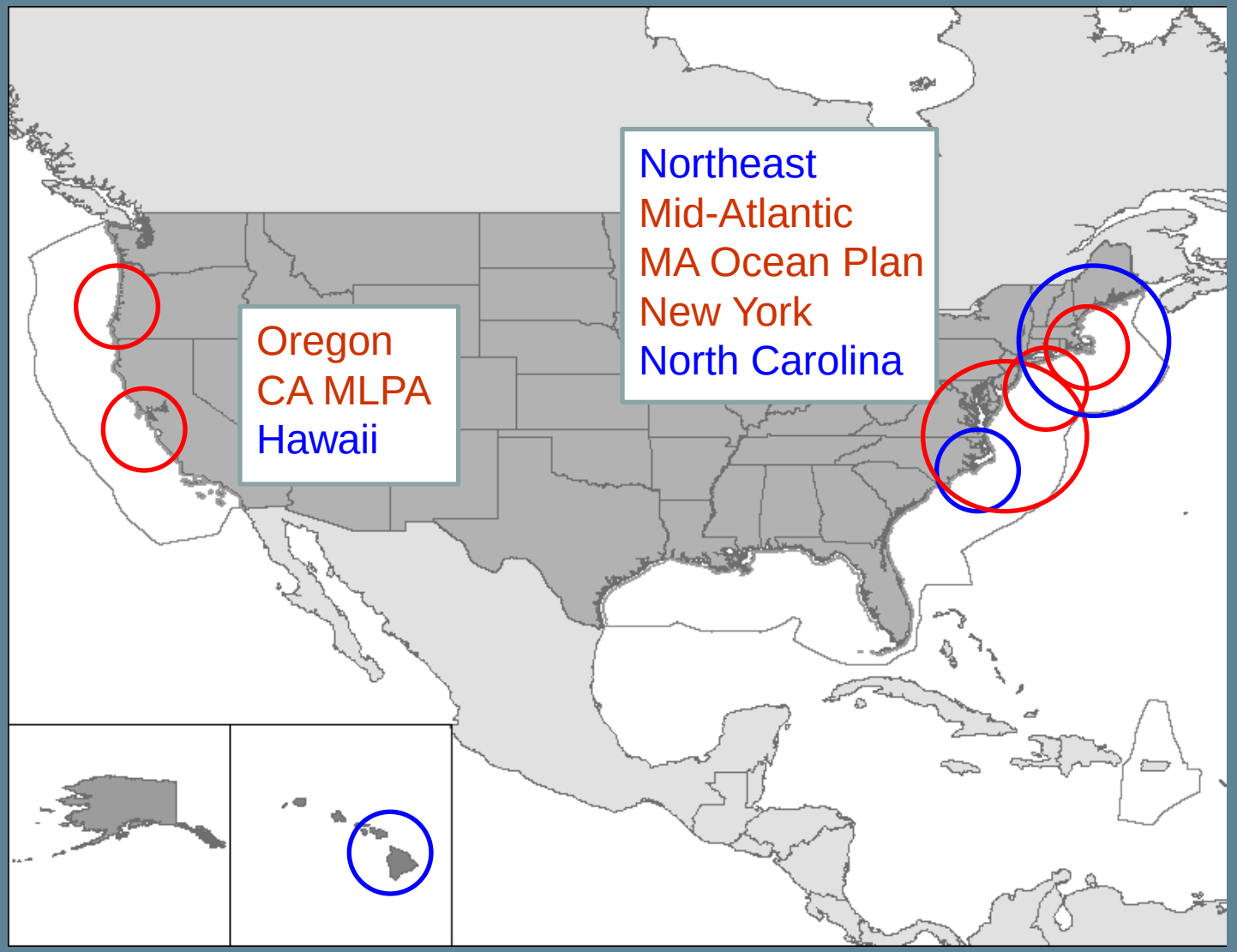
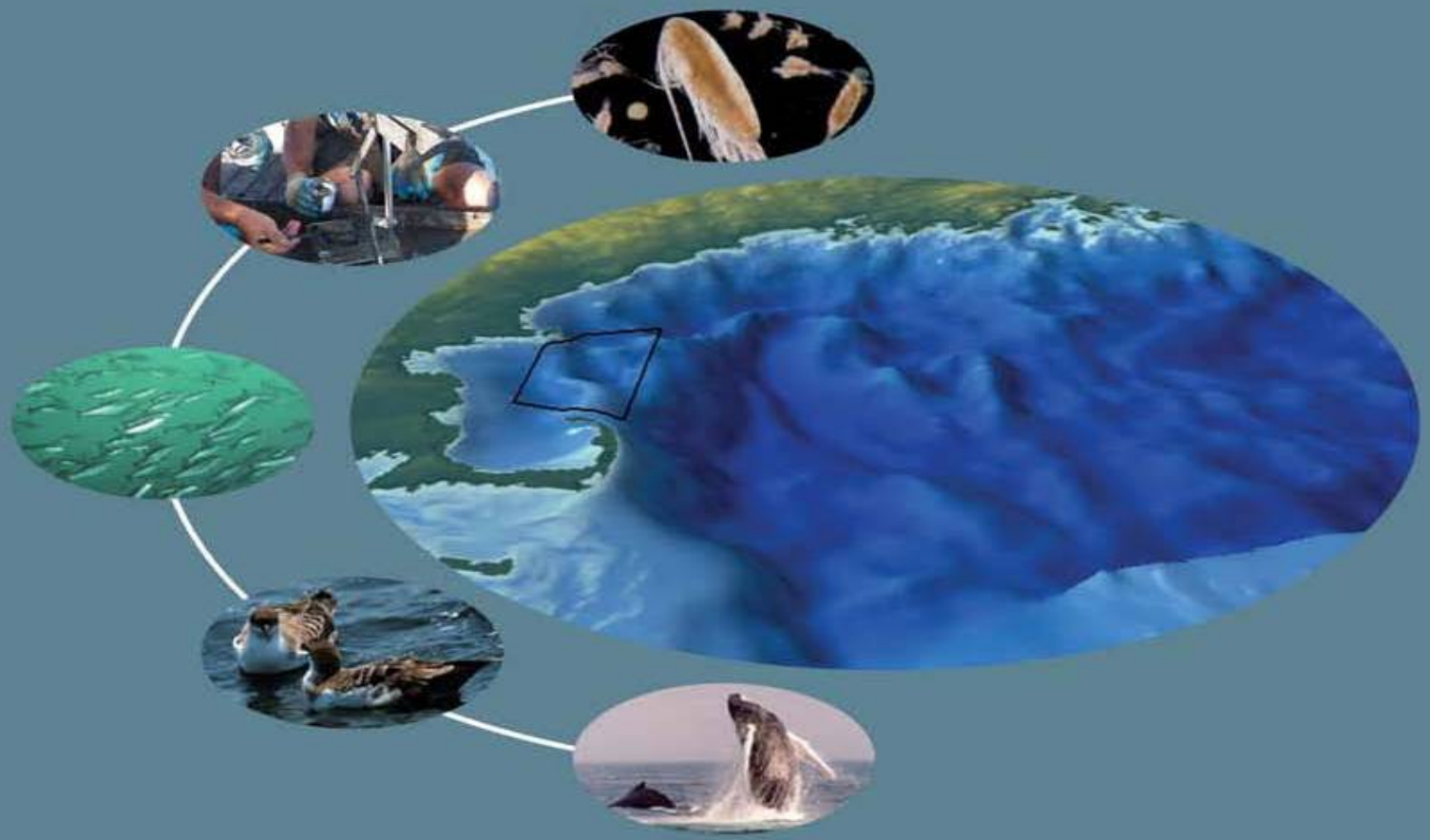
# Efforts To-Date



# CMSP Projects



# Biogeo. 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***

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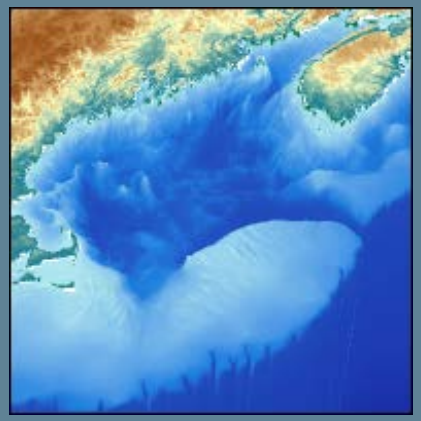
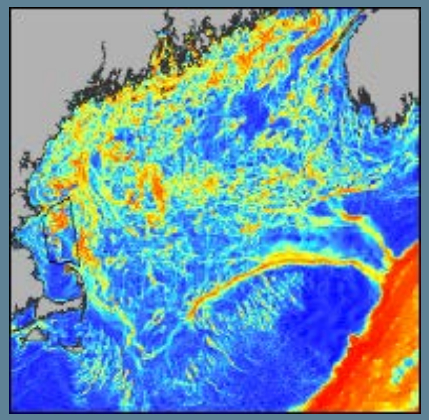
# Abiotic: Spatio-Temporal Data

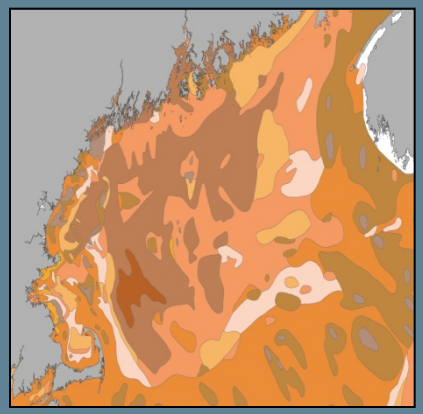
## STATIC VARIABLES



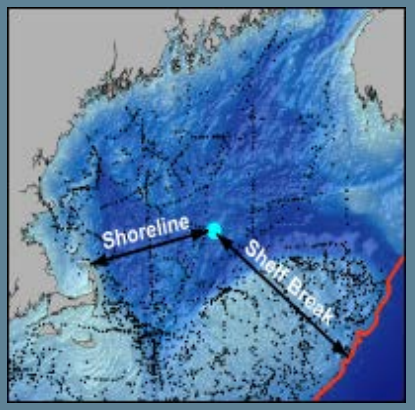
Bathymetry



Slope

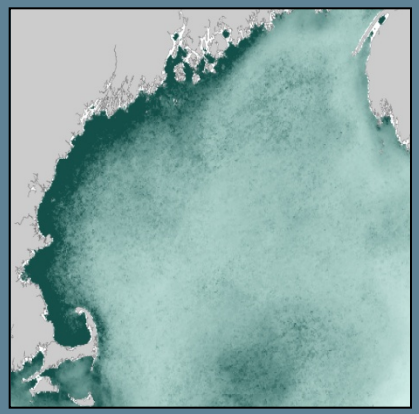


Substrate

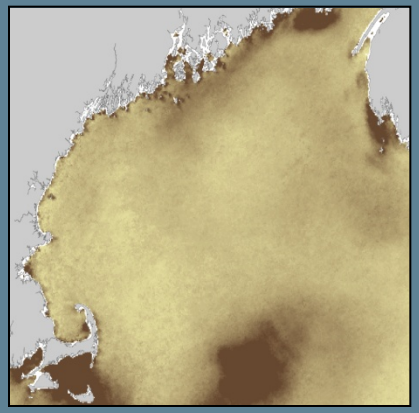



Distance to Features

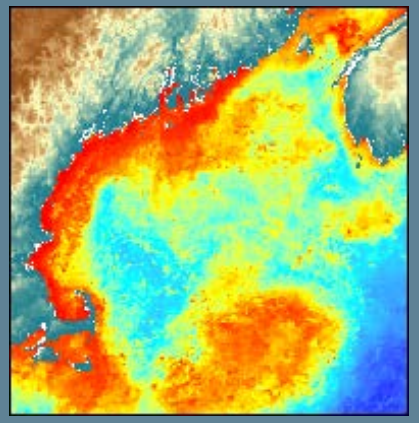
## DYNAMIC VARIABLES



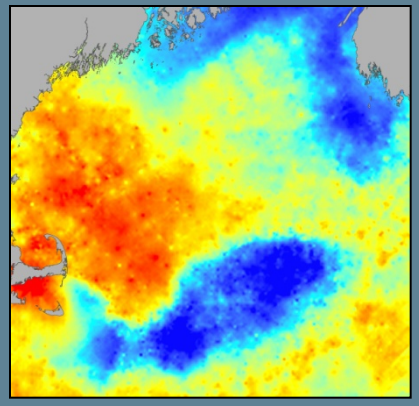
Chlorophyll *a*



Turbidity



Sea Surface Temp.



Seasonal Water Stratification

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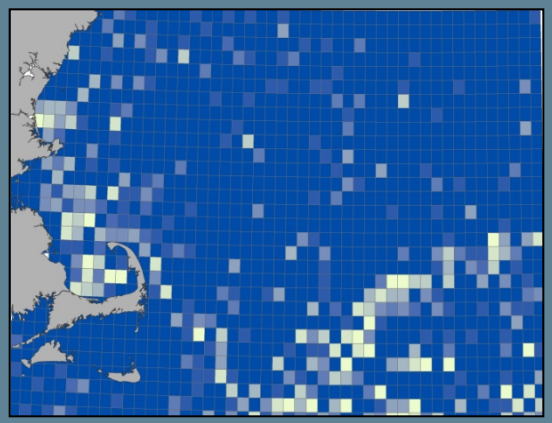
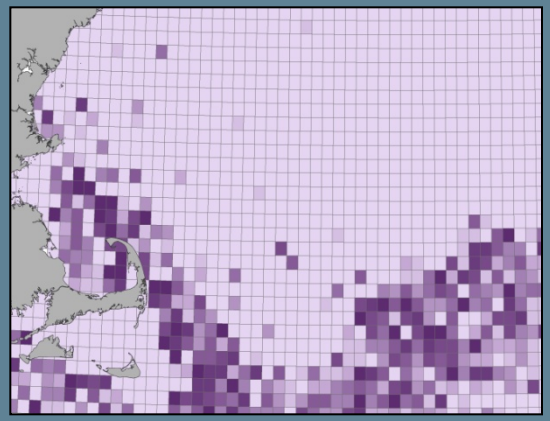
# Biotic: Spatio-Temporal Data

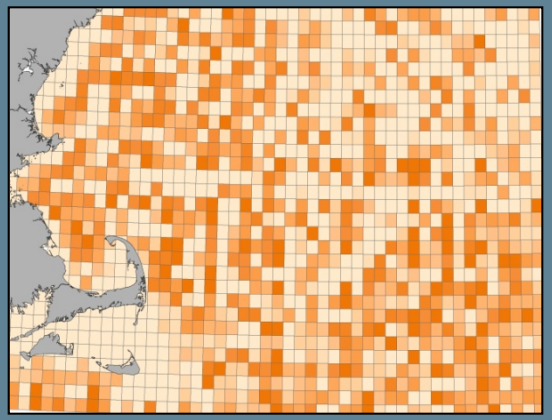
## PREY ABUNDANCES



Atlantic Mackerel

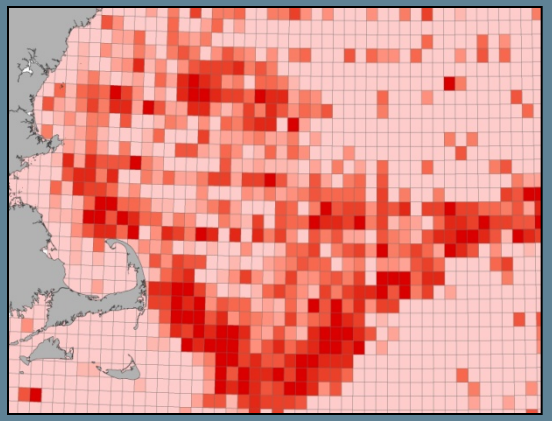


Northern Sand Lance

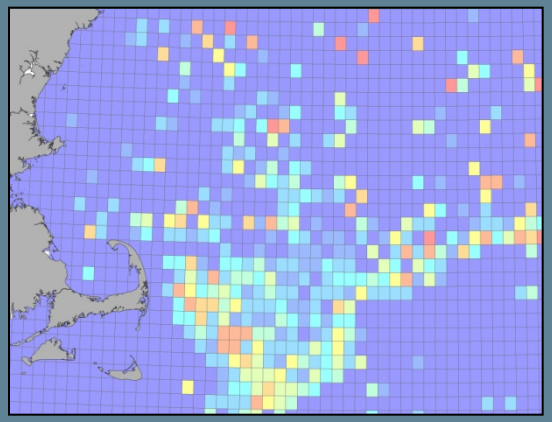


Zooplankton

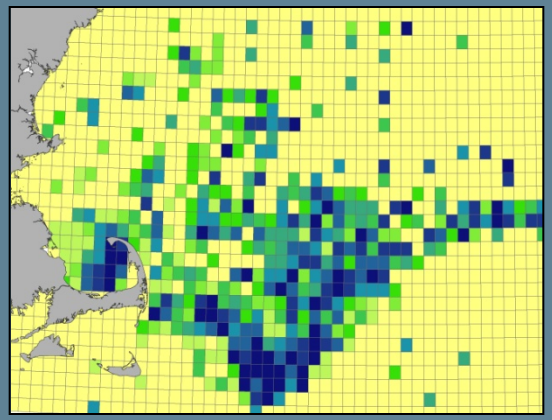
## CETACEAN ABUNDANCES



Mysticeti
(Baleen Whales)



Atlantic White-Sided
Dolphin



Northern Atlantic
Right Whales

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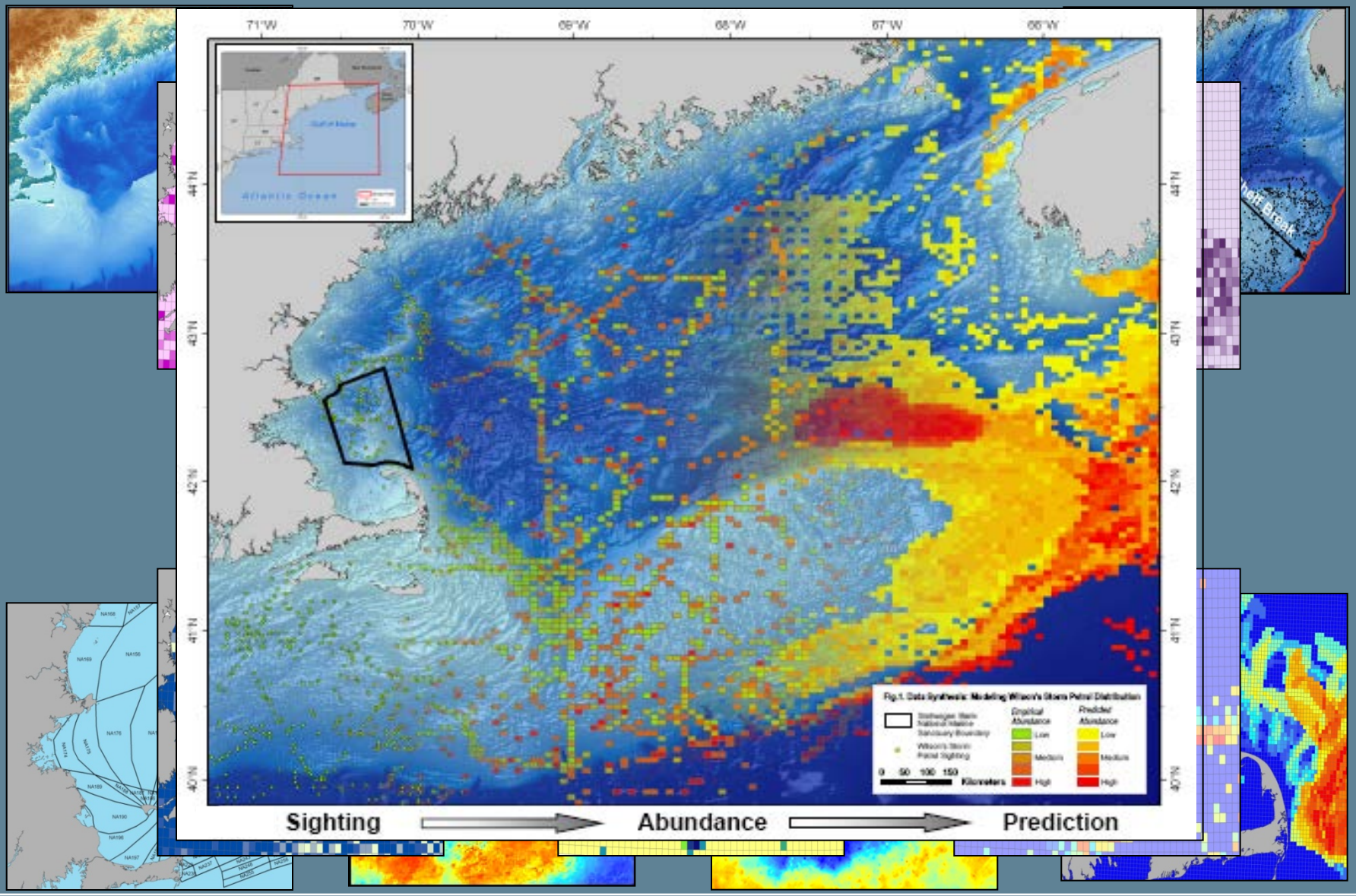
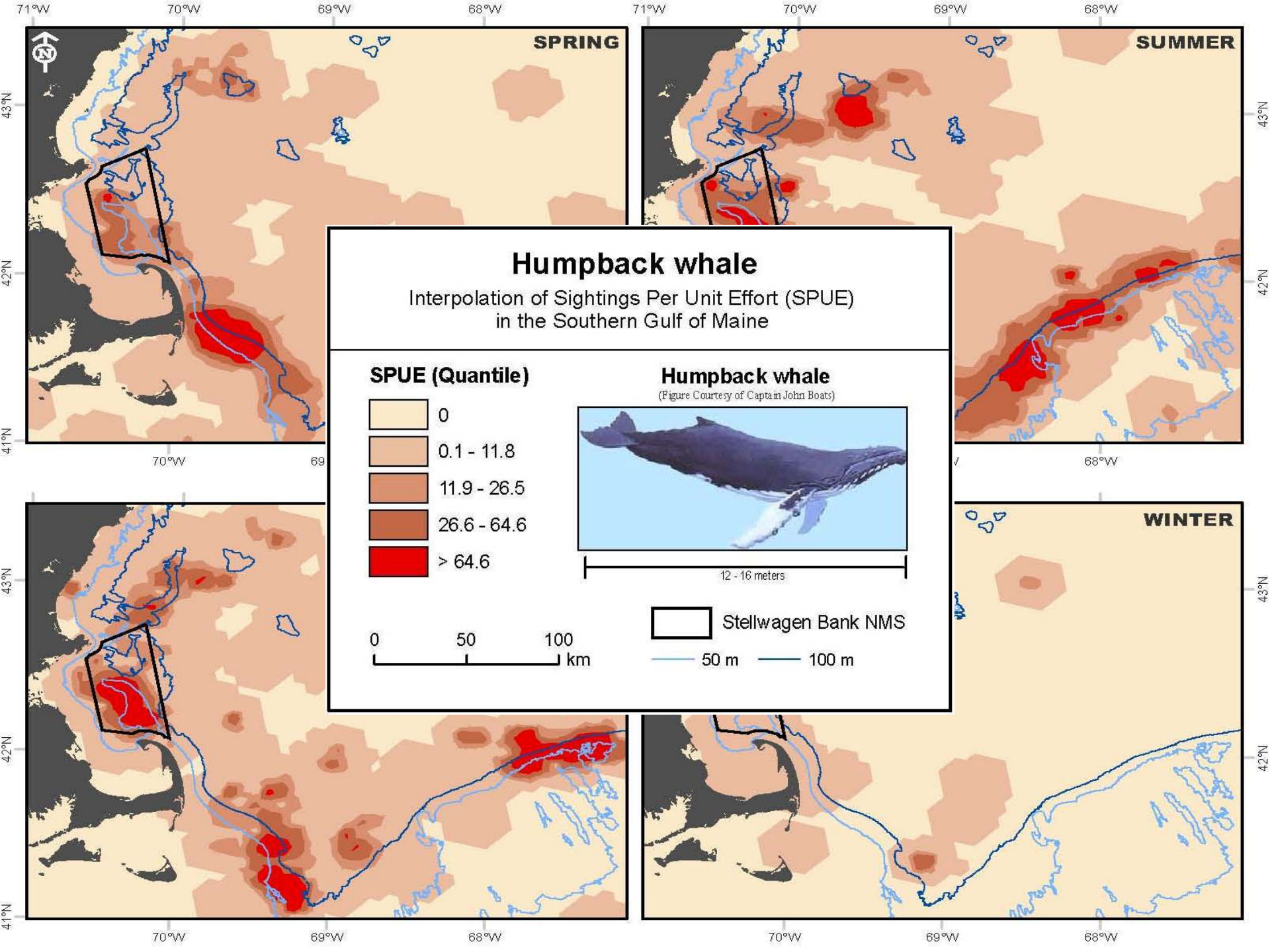
# Integration




SPRING
SUMMER
WINTER
71°W
70°W
69°W
68°W
43°N
42°N
41°N
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
0
50
100
km
Stellwagen Bank NMS
50 m
100 m

# Massachusetts Ocean Plan



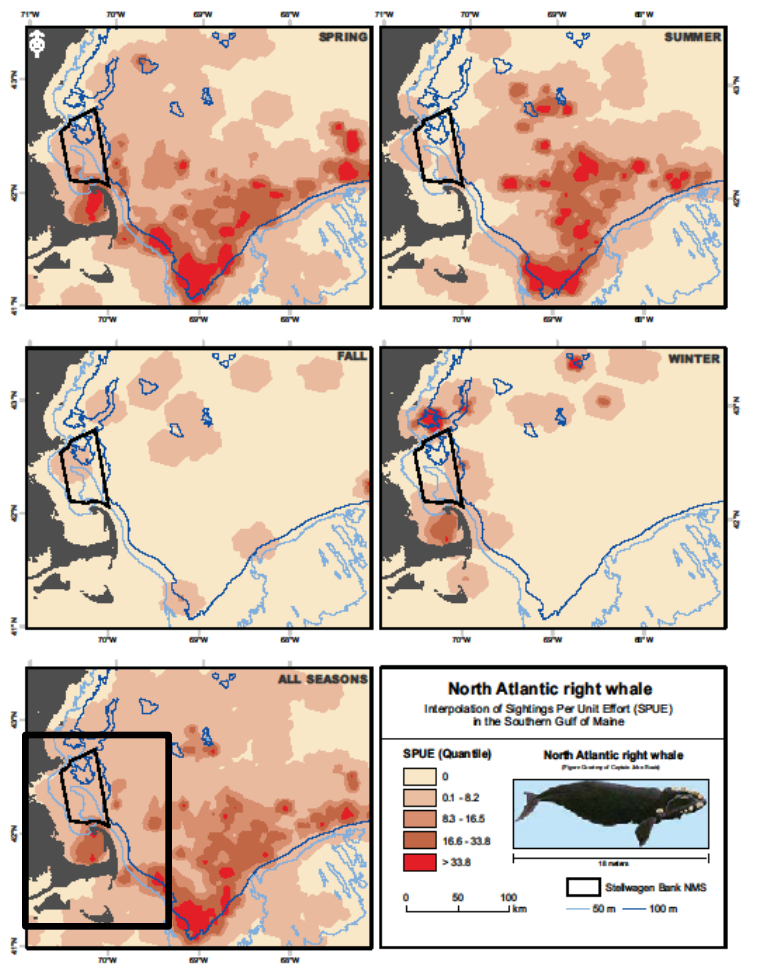
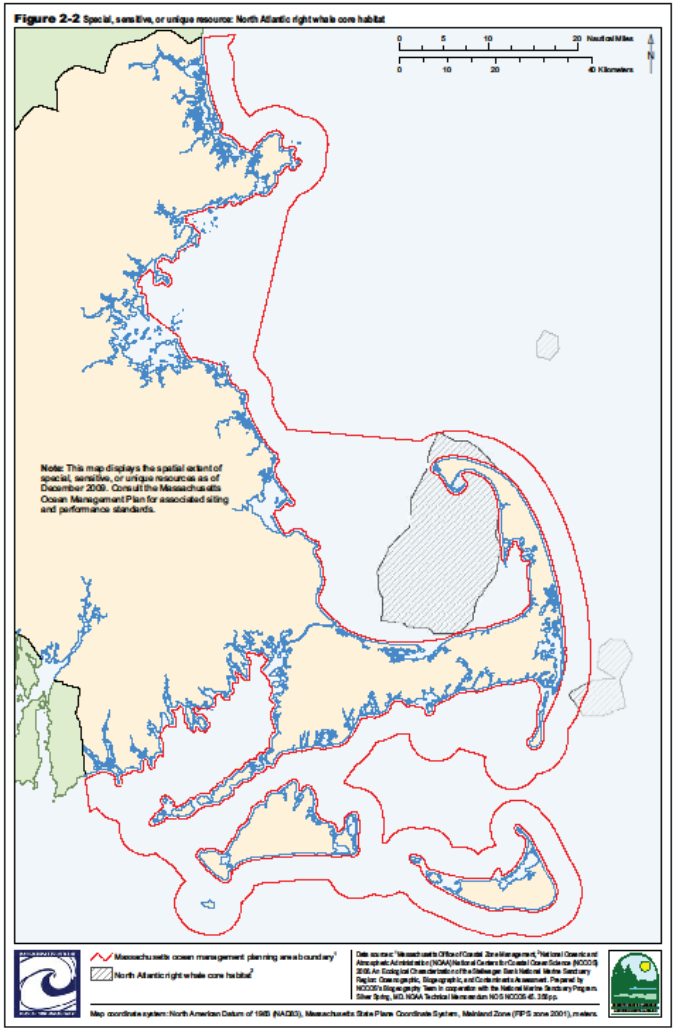


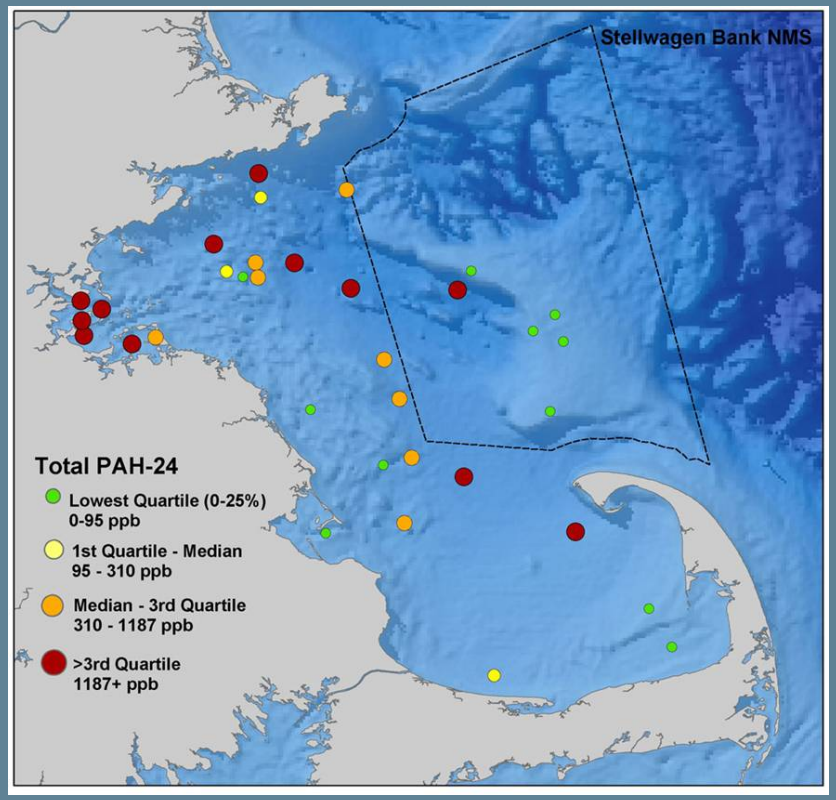

**Figure 5.3.4.** Seasonal patterns of interpolated sightings-per-unit-effort (SPUE) data for North Atlantic right whale in spring, summer, fall, winter and all seasons combined for the southern Gulf of Maine (1970-2005). SPUE values are animals per 1000 km of standardized survey track.

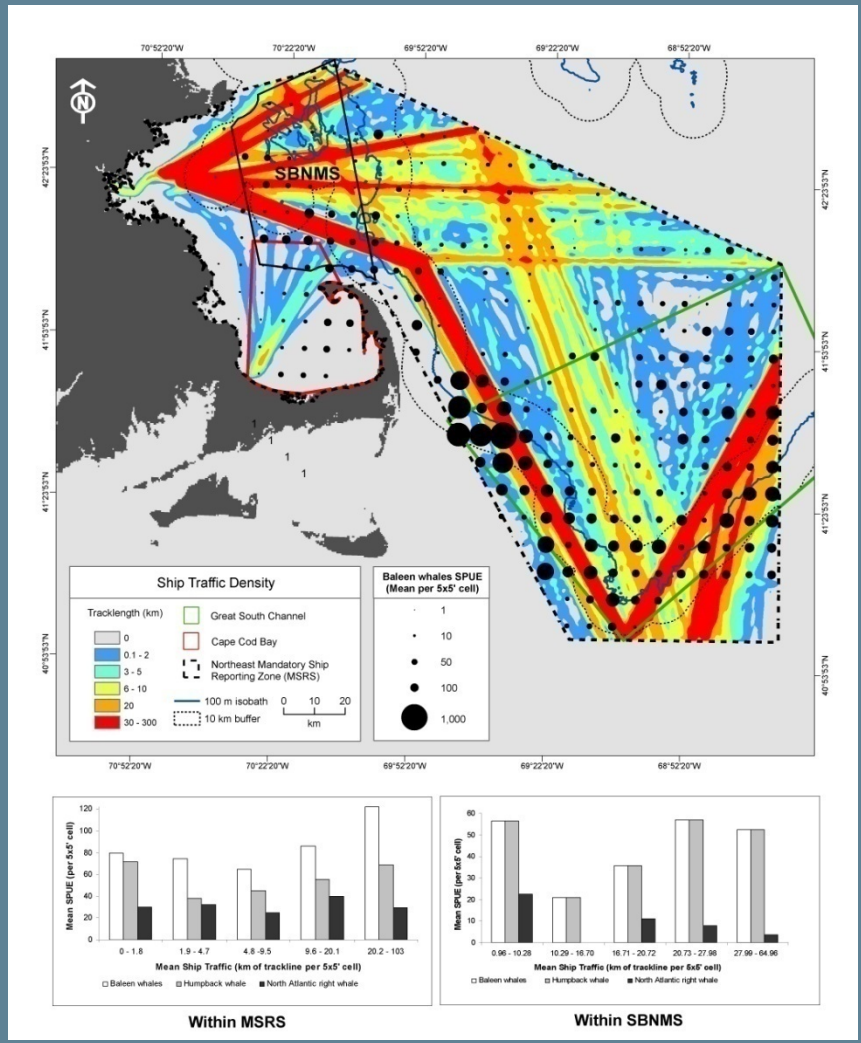






# Applications



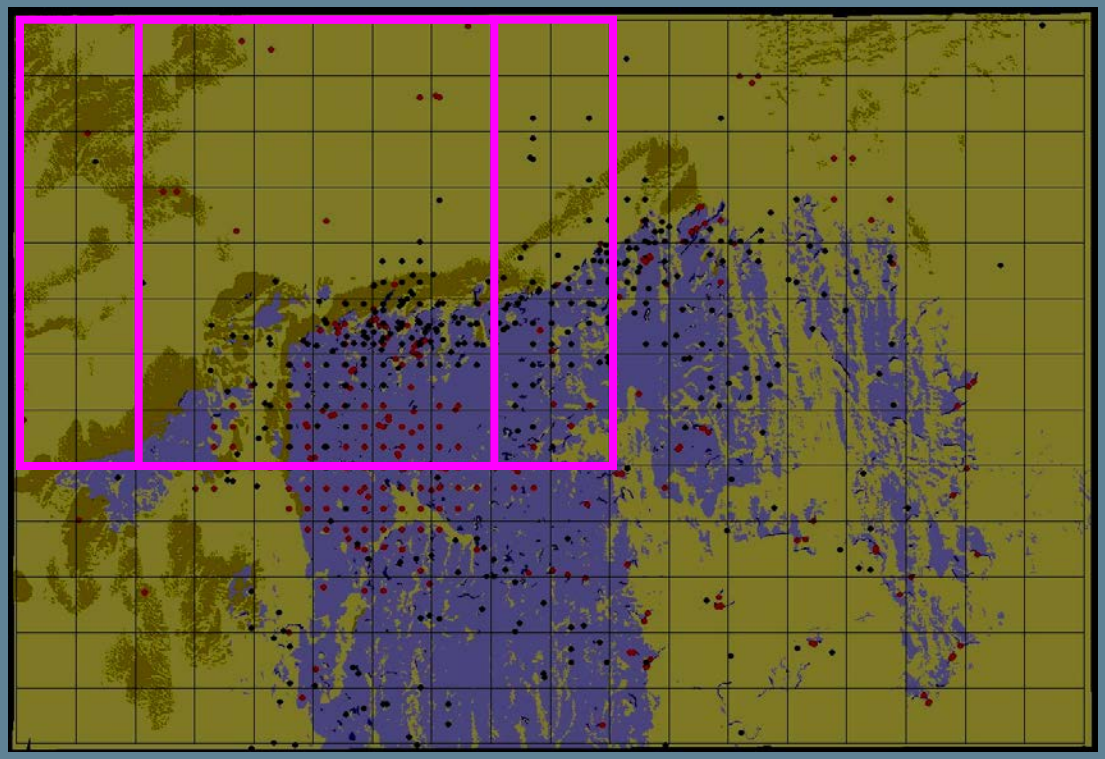



# Partnerships

- 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

# Decision Support - Gray's Reef NMS

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

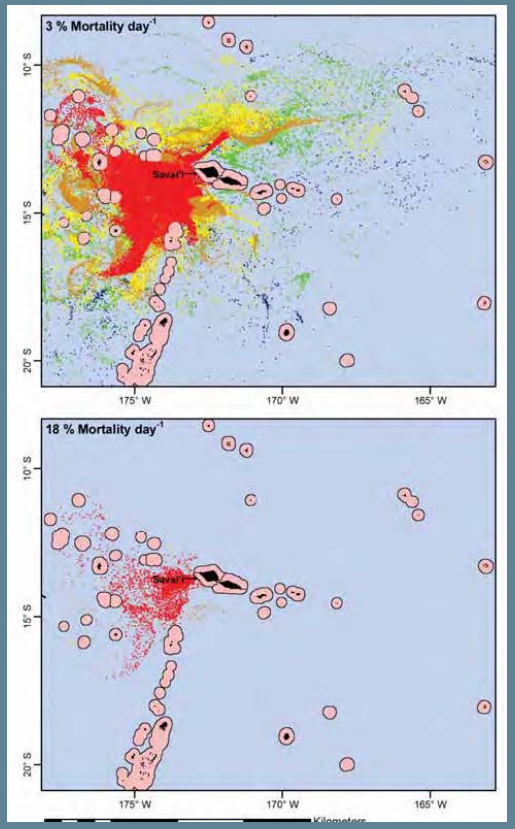


Resulted in 31,135 options!

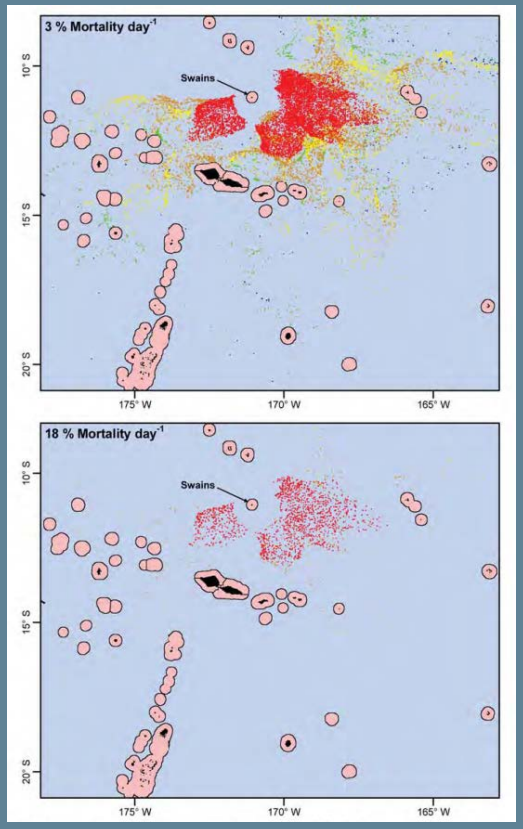
**Objective:** To measure the benefits and impacts of potential management zoning actions: ***Balancing needs of recreational boaters, fishermen, researchers, conservation***

# Connectivity: Samoan archipelago

## SAVAI'I (SOUTH COAST)

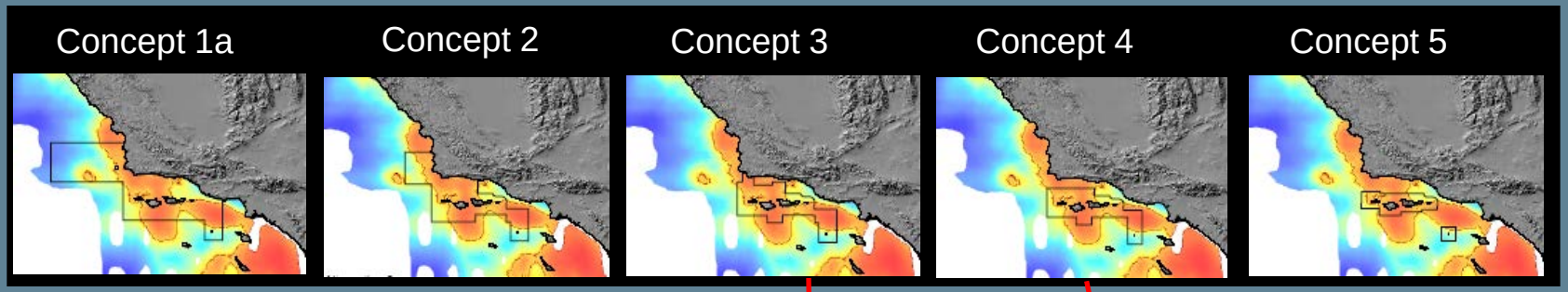



## SWAINS ISLAND




**Objective:** To support territorial effort to implement a network of MPAs.

# Decision Support - Southern California Bight




| 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***

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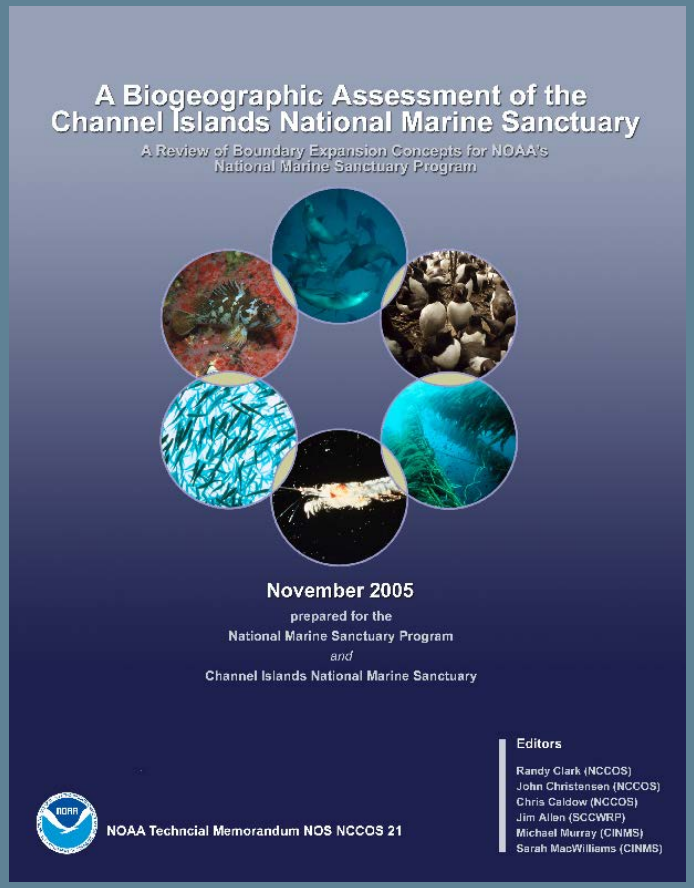
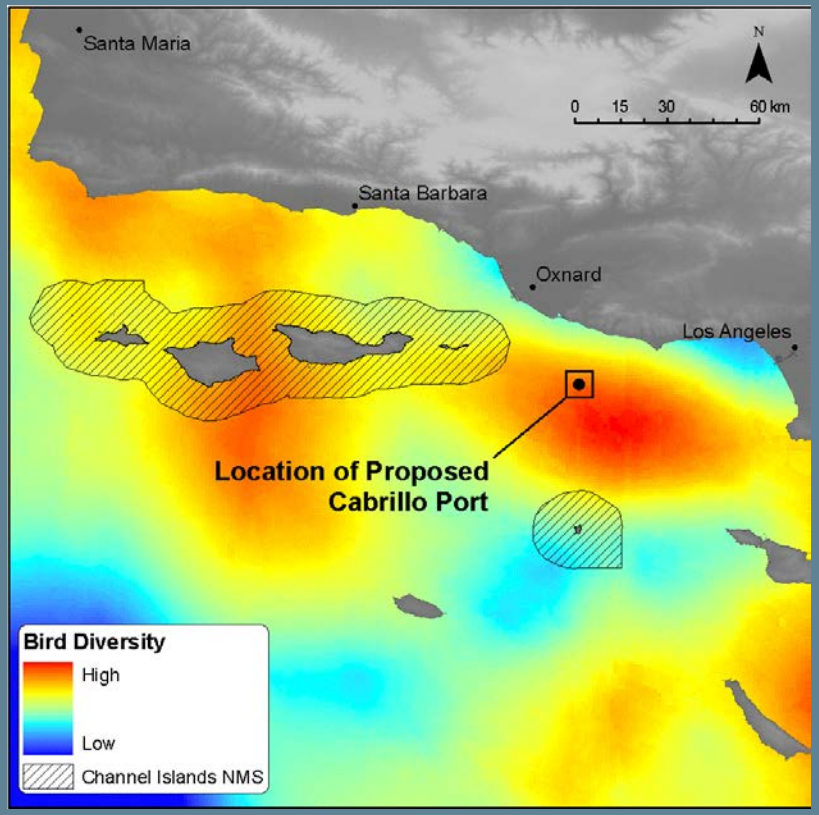
# Offshore Leasing - Southern California Bight

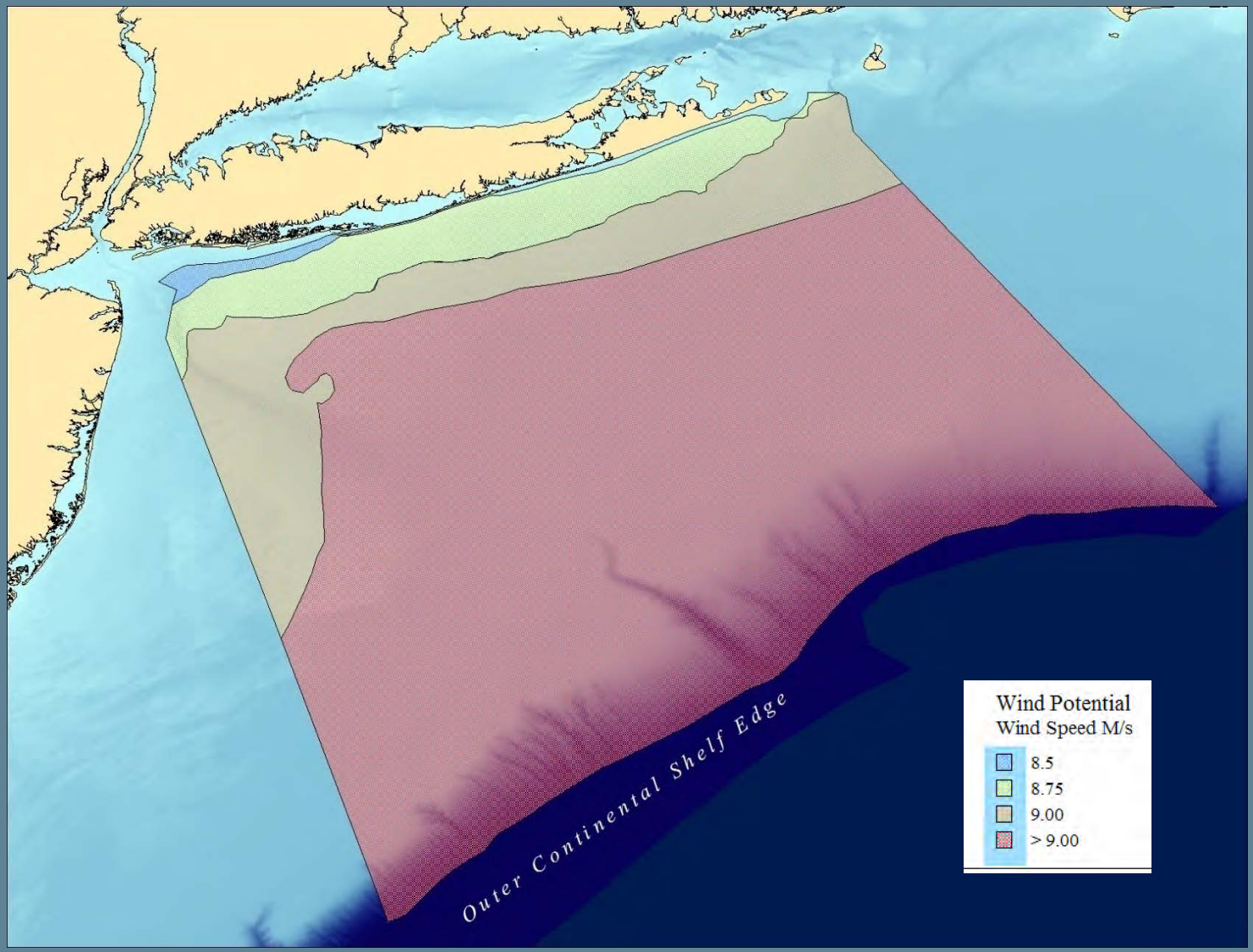



## Map of proposed site

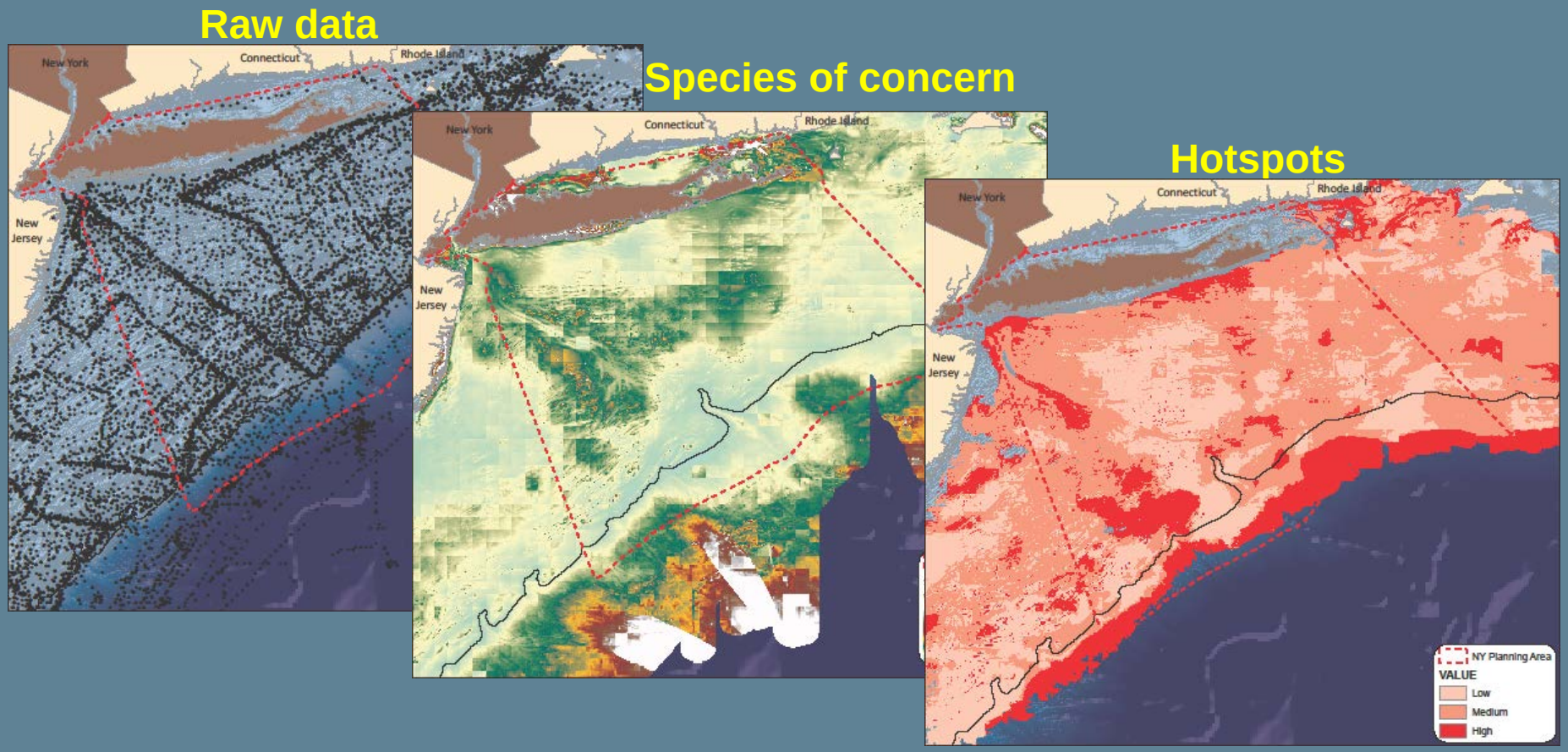



**Subsequent uses:** MLPA, CCC. The California Coastal Commission used predictive models of seabird distribution to identify potential ecological impacts of placing a liquid natural gas storage facility offshore of LA

# Offshore Wind Potential – New York



# Seabird Modeling: Offshore waters, NY




**Objective:** The New York Department of State needs to know the distribution of seabirds to help site offshore renewable energy projects. Spatial predictive models provide information on species of conservation concern, hotspots and resilience.

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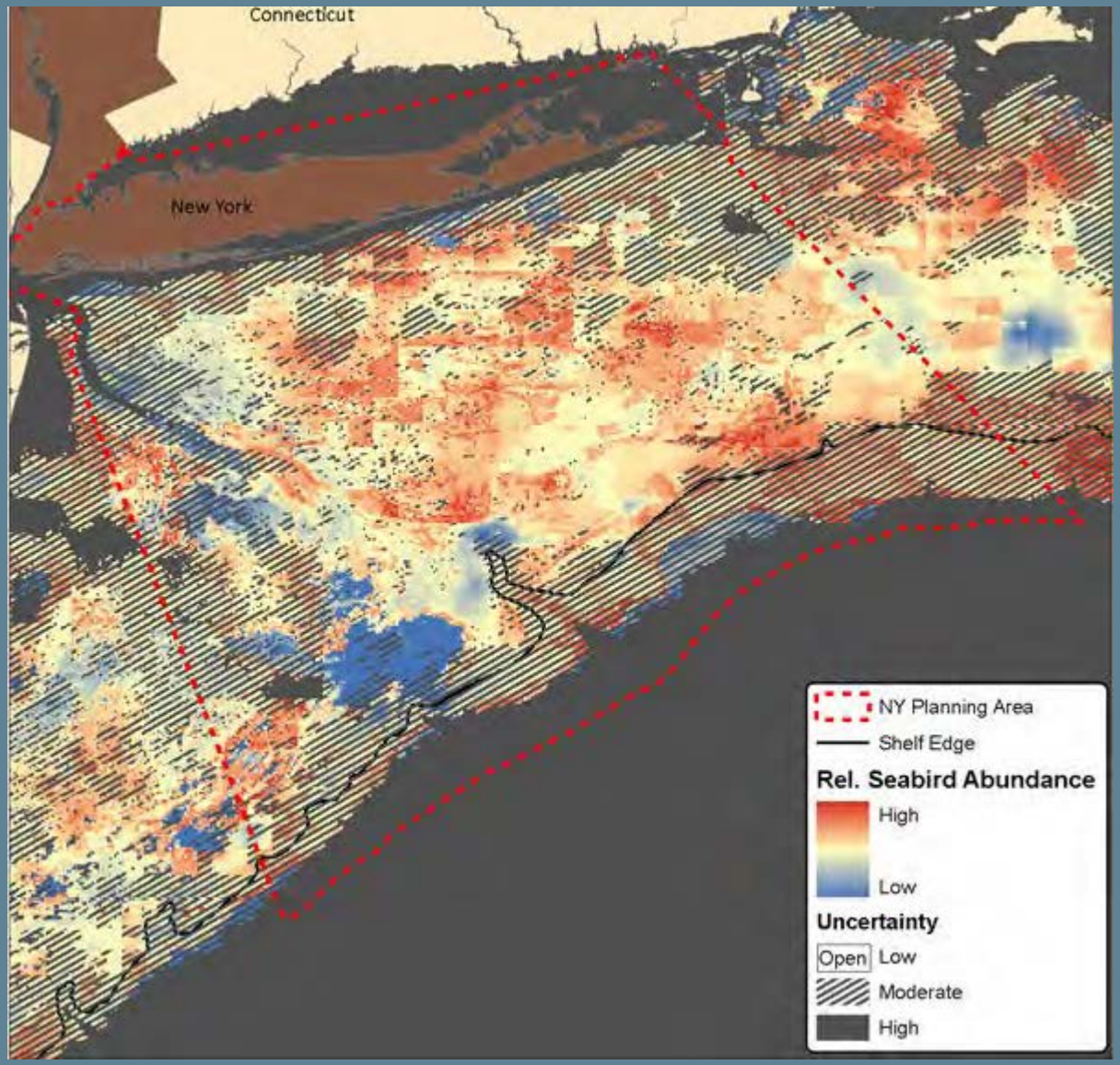
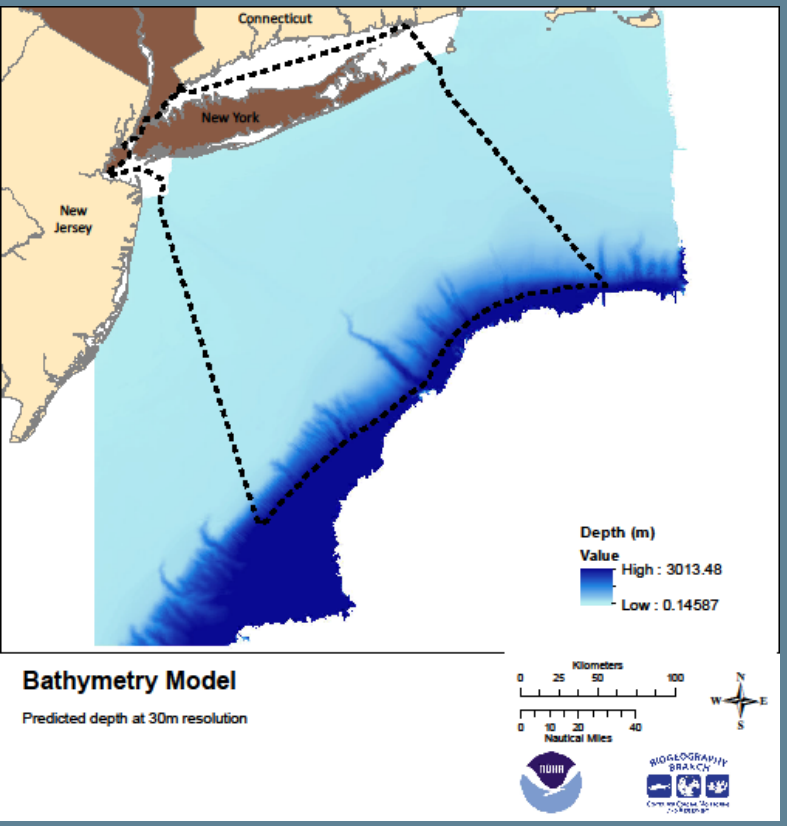
# Seabird Modeling: Offshore waters, NY

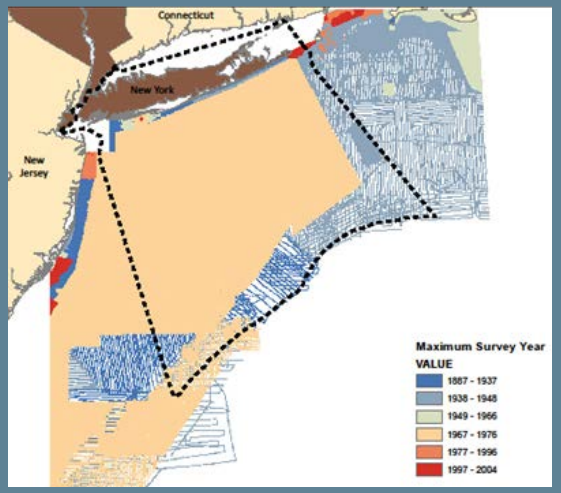


# Bathymetry – Data Quality and Uncertainty

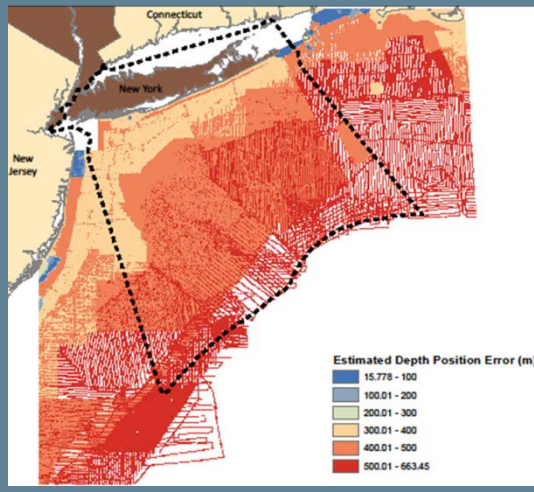
## Bathymetry Model



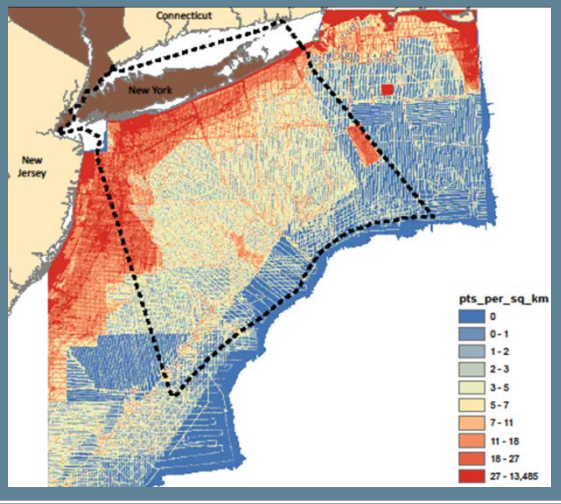

## Survey Year



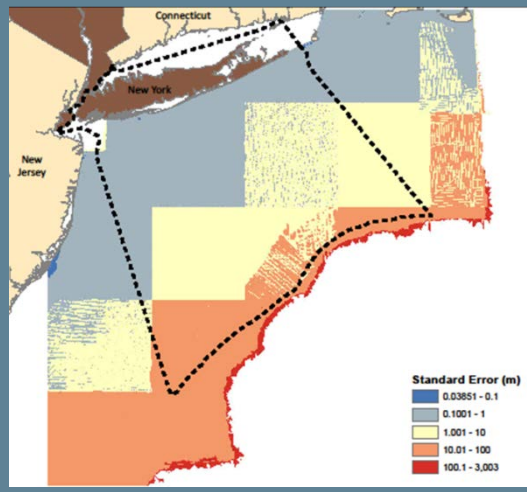

## Survey Depth Error




## Survey Density

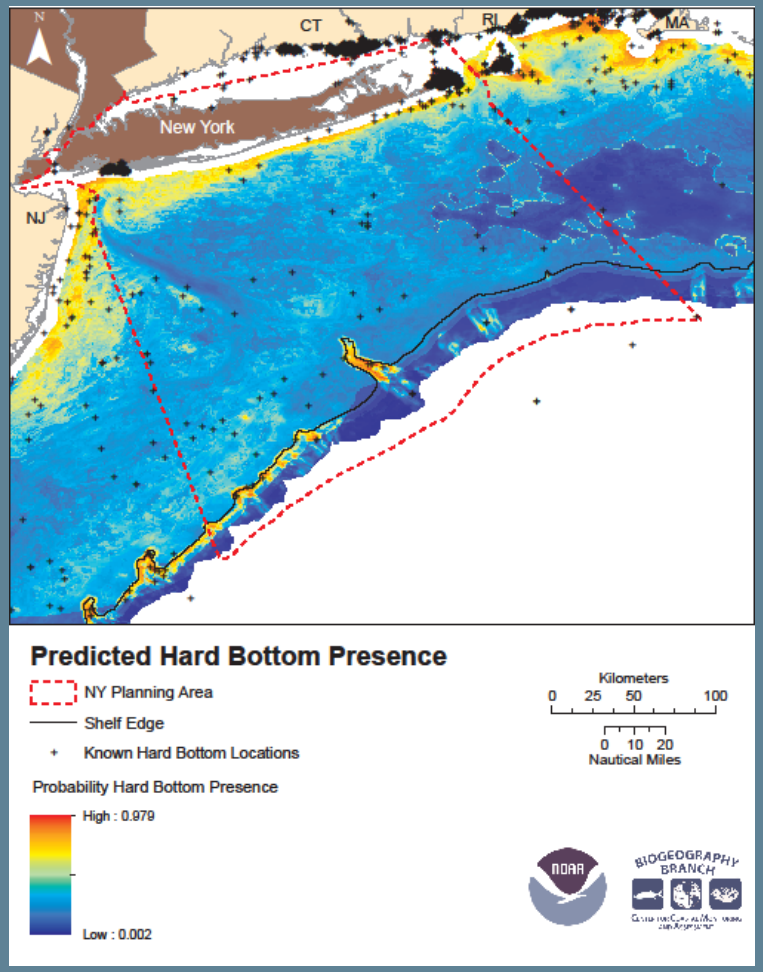



## Model Error

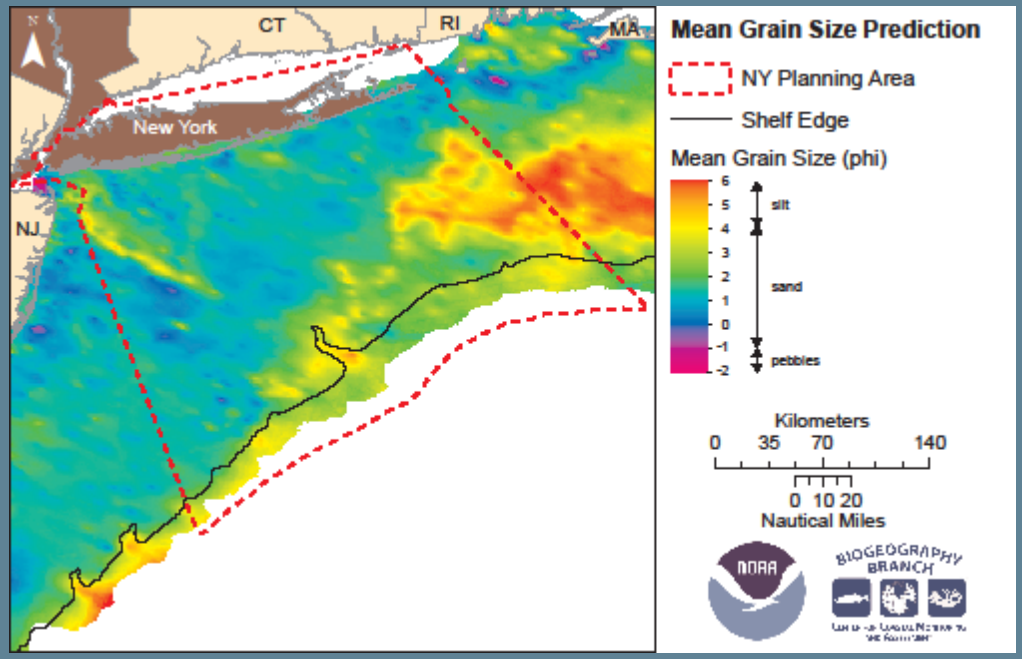


# Hard-bottom and Sediments

## Hard-bottom



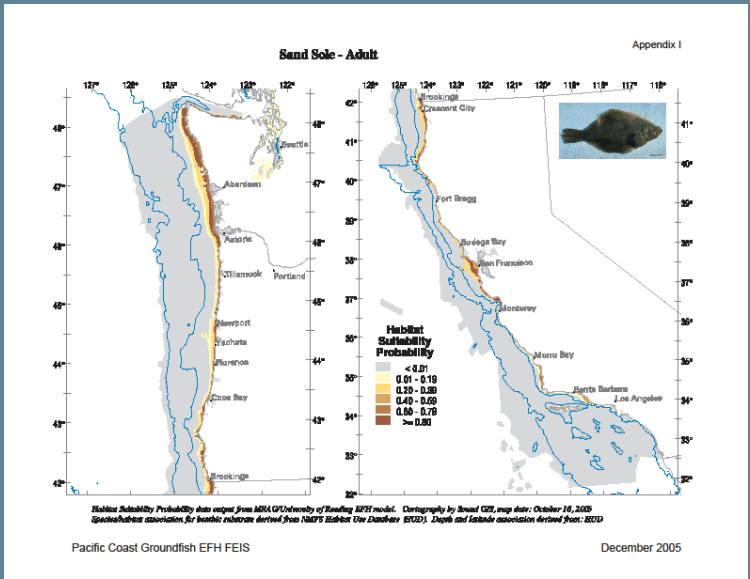

## Mean Grain Size

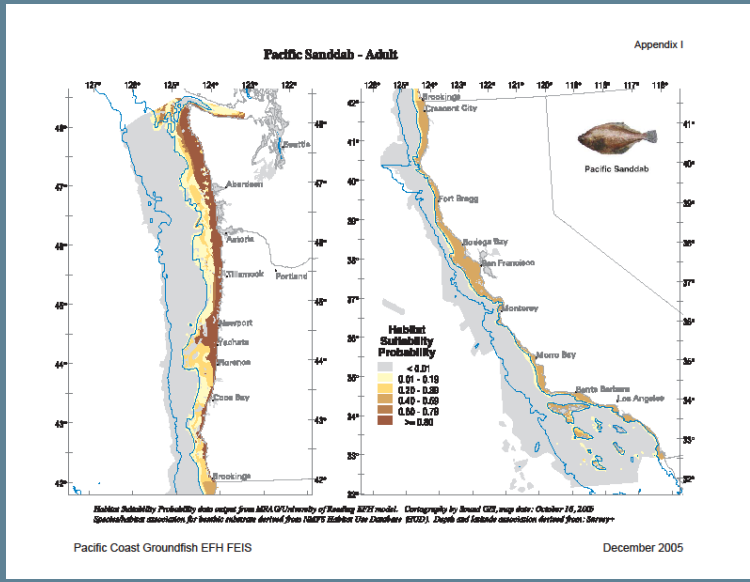


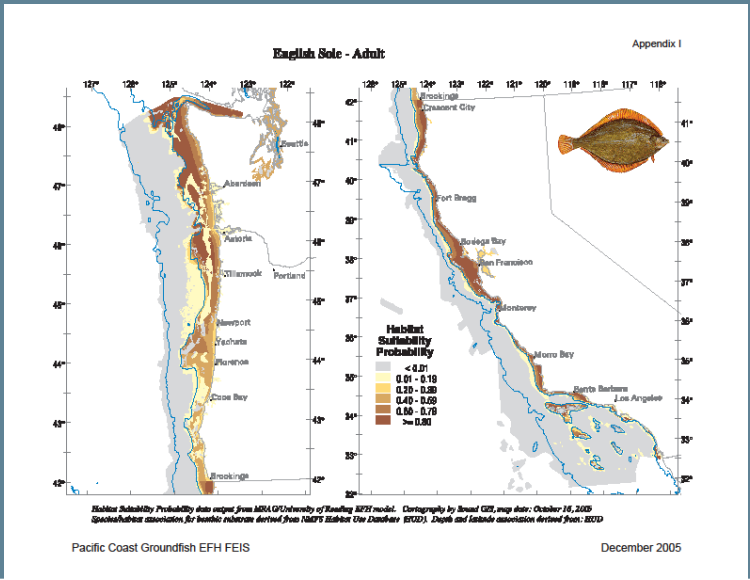
# Oregon's TSP

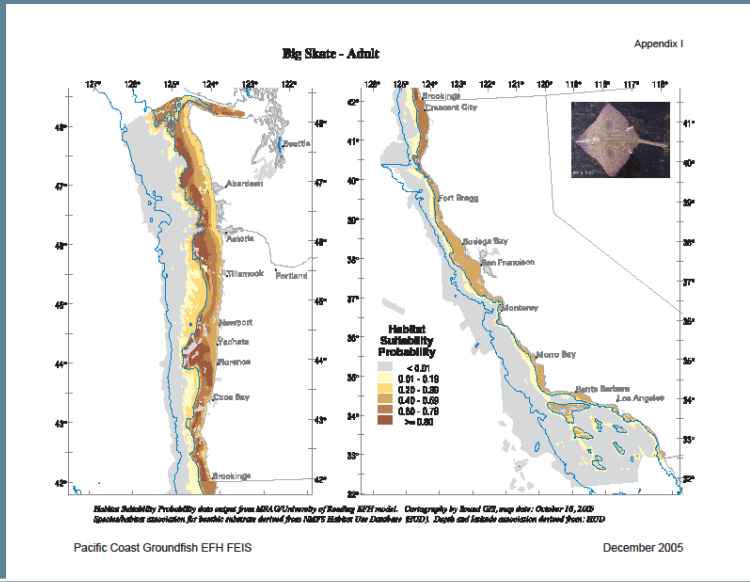

Partners
- Oregon Department of Fish and Game
- Oregon Department of Land Use Conservation and Development
- The Nature Conservancy

# Important Fishes

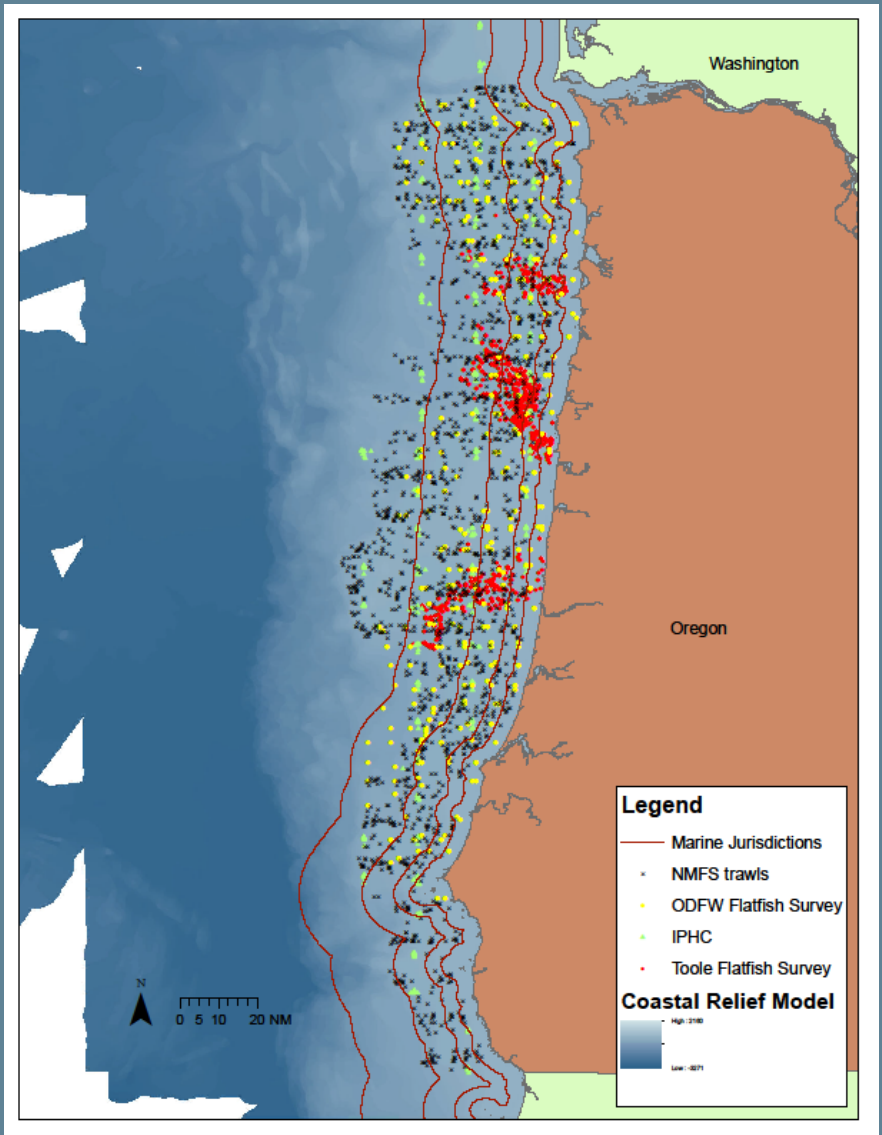


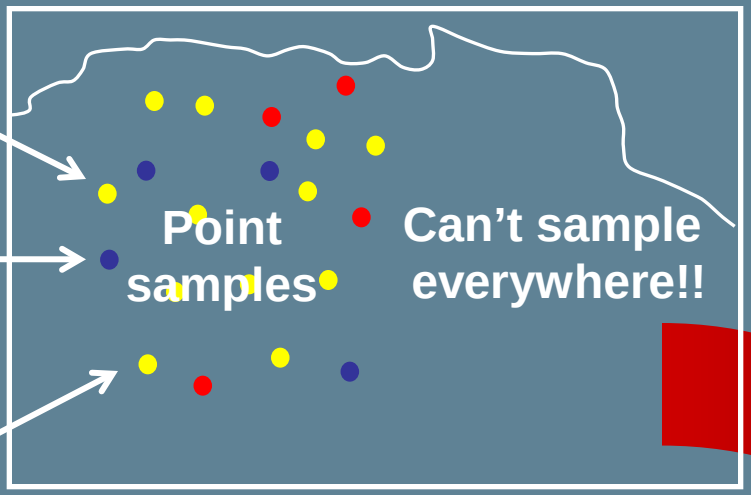
# Data Distribution

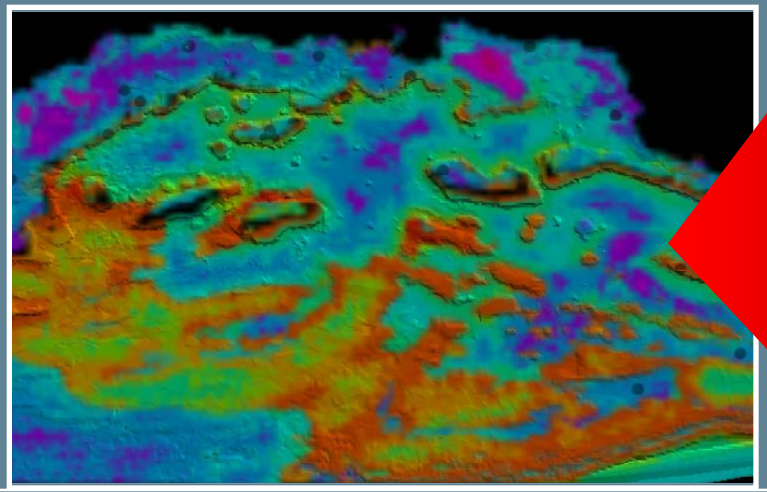



- Take in data
  - AFSC's triennial shelf (1977 – 2001)
  - AFSC's West Coast slope (1984 – 2001)
  - NWFSC annual slope trawl survey (1998 – 2002)
  - NWFSC slope and shelf trawls (2003 – present)
  - ODFW State trawls
    - 1971-1974
    - 1978
    - 1989-1994
  - IPHC
  - Site specific assessments

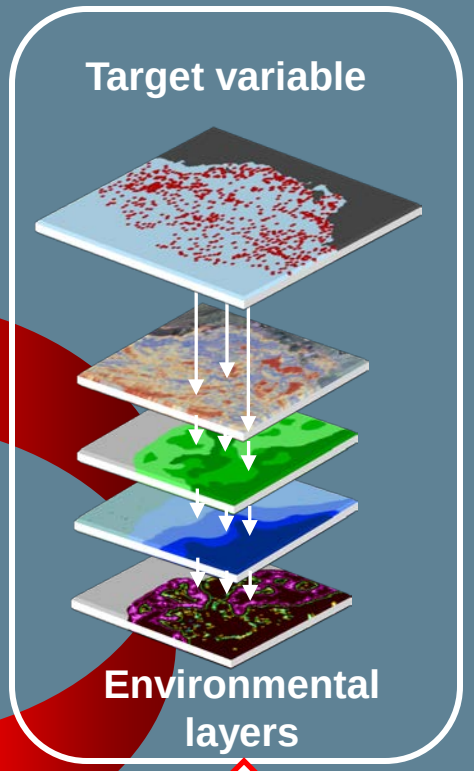
- Produce outputs which are
  - Accurate
  - Credible
  - Contiguous
  - Integrative
  - At relevant spatial scales

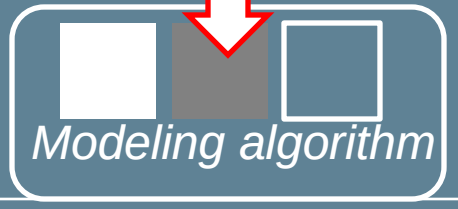
# Why spatial predictive modeling?



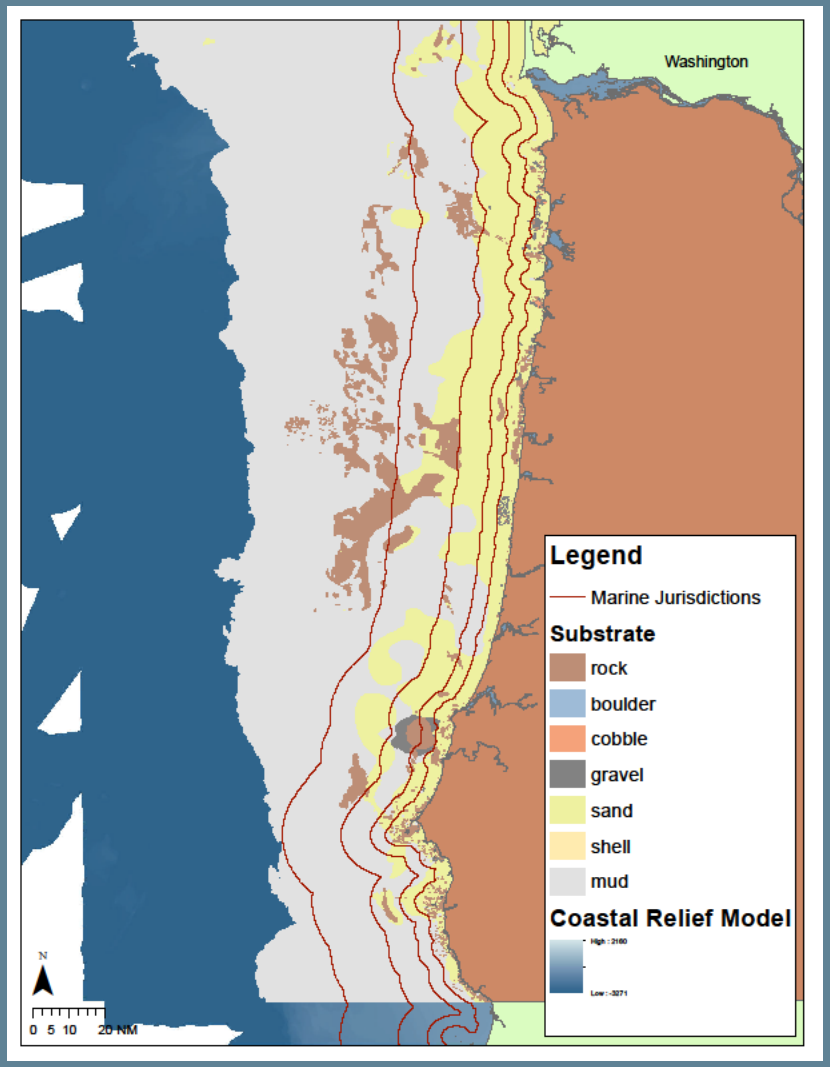
Where are the **hot spots**, & **cold spots**?



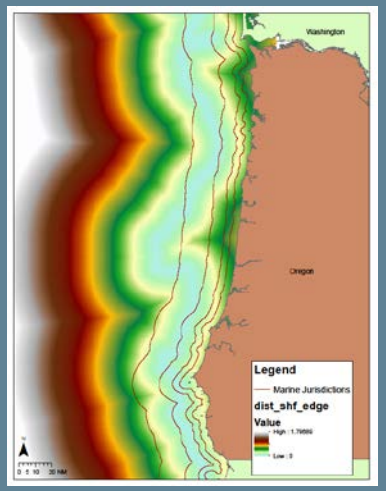



# Environmental Predictors for Fishes

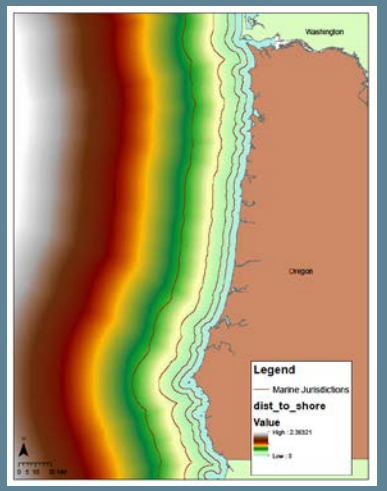
## Benthic Habitat



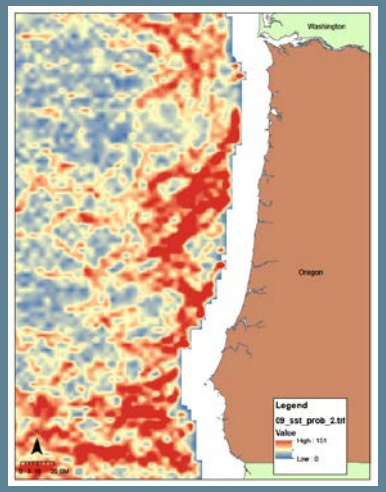

## Dist. to shelf edge



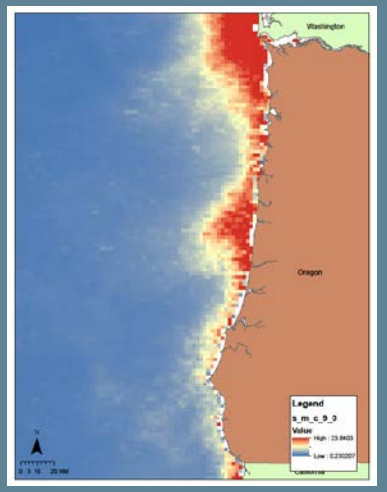

## Dist. to shore




## Front Probability

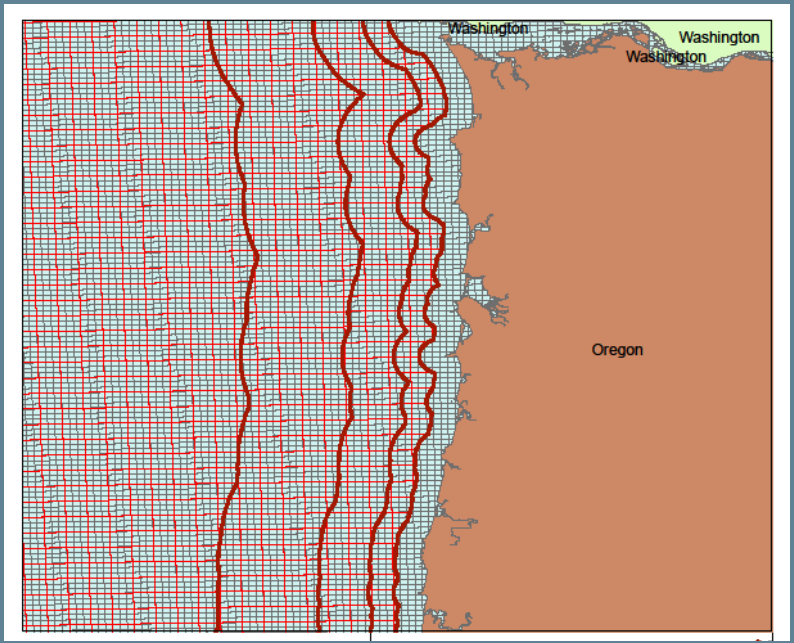



## Chlorophyll a

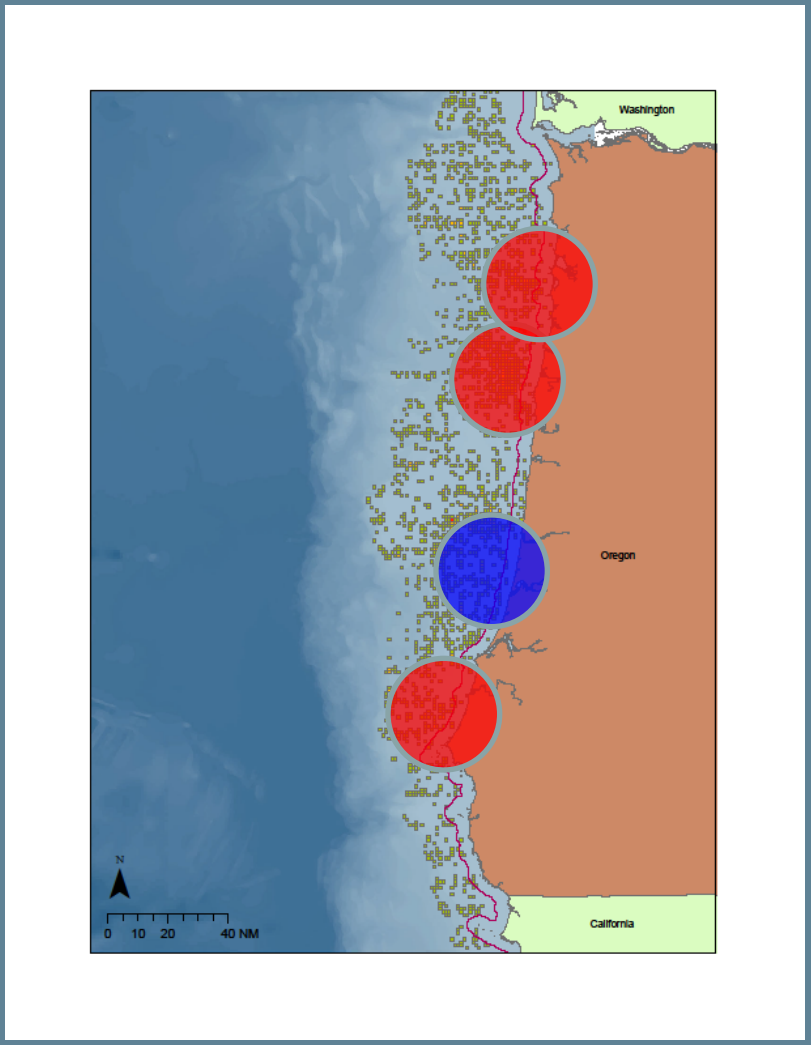


# Intended Output

Spatial framework




- Total abundance
- Species richness and diversity
- Soft bottom fish assemblage



# Where can we go from here?

- Gap analysis
- Maps and Assessments of:
  - Physical Oceanography
  - Contaminants
  - Species Distributions
  - Vessel Traffic
  - Uncertainty indices
  - Temporal changes
  - Connectivity / Migration Pathways
  - Ecological synthesis products (i.e. hotspot analysis)
  - Benthic and/or Pelagic Habitats (biological leaning)
  - Conflicts
- Geospatial Compilations
- Tradeoff Analysis
  - Conservation versus development
- Scenario development and impact assessments
- Decision Support Tools

# Analytical Framework