Final Report of the Mid-Atlantic Marine Wildlife Surveys, Modeling, and Data: Workshop to Establish Coordination & Communication

Appendix D: Presentations

July 2013

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Presentation #1

Seabird Survey and Observation Database & Hierarchical Models for Estimating Seabird Distributions in the U.S. Atlantic

Allan F. O'Connell[1],Beth Gardner[1,2], Andrew T. Gilbert[2,3]

1. USGS Patuxent Wildlife Research Center
2. North Carolina State University
3. Biodiversity Research Institute

USGS science for a changing world

History

- Evaluate seabird distribution for offshore development.
- No centralized repository of seabird data for the U.S. Atlantic.
- USGS/USFWS funding to catalog seabird datasets in 2005.
- Additional FWS funds to compile and standardize data into a single database in 2006.
- MMS (BOEMRE) added funds to continue work and add modeling component in 2008.

173

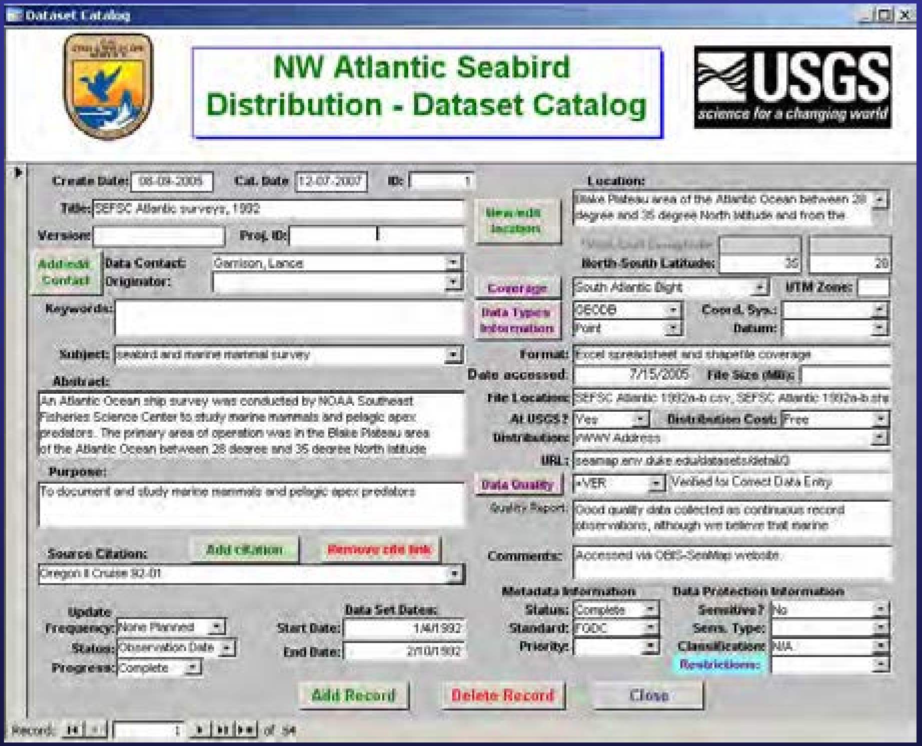
Overview of methods

- Develop a catalog of seabird survey and observation datasets
- Acquire seabird and biophysical data (e.g., bathymetry, SST, chlorophyll) for modeling
- Standardize seabird data for modeling
- Match seabird data with biophysical data
- Conduct hierarchical modeling
- Predict species distribution

USGS
science for a changing world

Seabird Dataset Catalog

- Created a catalog of seabird datasets
- Record information about datasets and information they contain (metadata catalog)
  - Coverage area
  - Abstract
  - Dates
  - Data type (digital, analog, text file, GIS)
- Locate data and archive where possible



Example seabird surveys

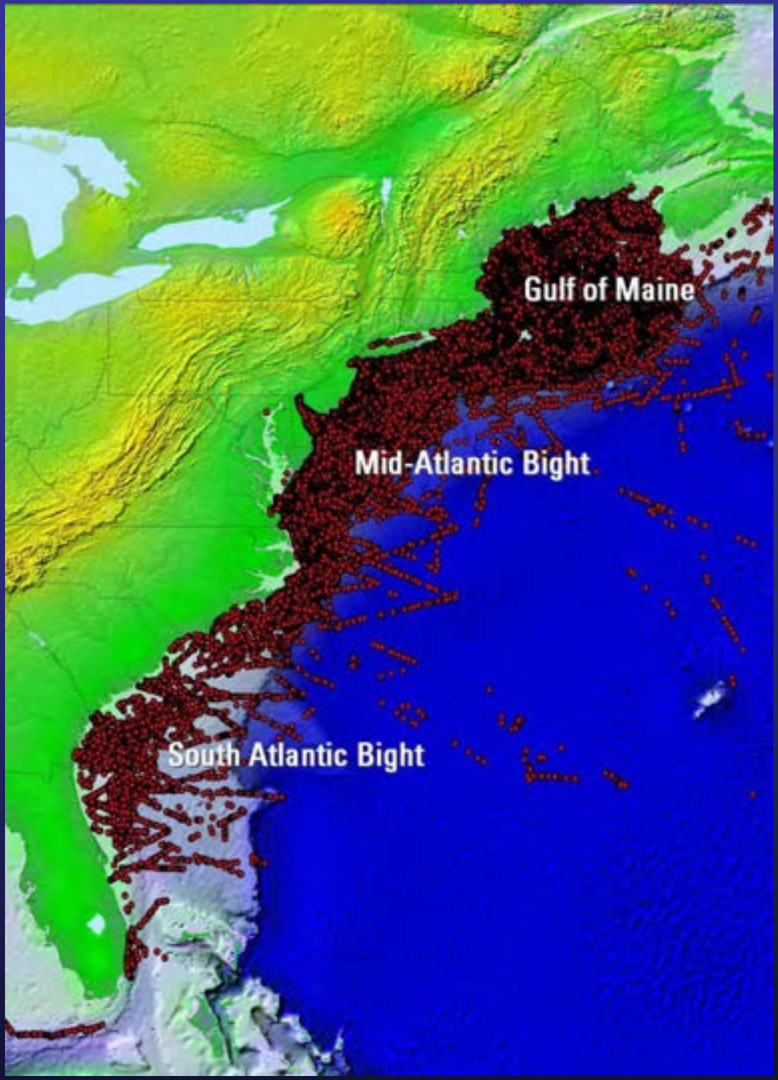
Dataset	Years of surveys	Region of survey
Manomet Center for Conservation Sciences	1978-1980	Gulf of Maine, Mid-Atlantic Bight
Cetacean and Seabird Assessment Program	1980-1988	Gulf of Maine, Mid-Atlantic Bight
Georgia pelagic surveys	1982-1985	South Atlantic Bight
Southeast Fisheries Science Center surveys	1992,1998,1999	South Atlantic Bight
Winter Survey of the Mid-Atlantic	2001-2003	Mid-Atlantic Bight
Cape Wind, Mass Audubon	2002-2006	Nantucket Sound
North Carolina shelf—trophic predators	2004-2005	Offshore North Carolina
Bar Harbor whale watch	2005-2006	Offshore Mount Desert Island, ME
NOAA Ecosystem Monitoring Survey	2007-2010	Gulf of Maine, Mid-Atlantic Bight
NOAA Herring Acoustic Survey	2006-2010	Gulf of Maine, Mid-Atlantic Bight

Data standardization

- Create master observation dataset
  - **Create standard species lists**
  - **Create common data fields (date, time, observation ID, effort ID, etc.)**
- Create effort dataset when possible and link to species observations
  - **presence AND absence data**
  - **facilitates error detection**

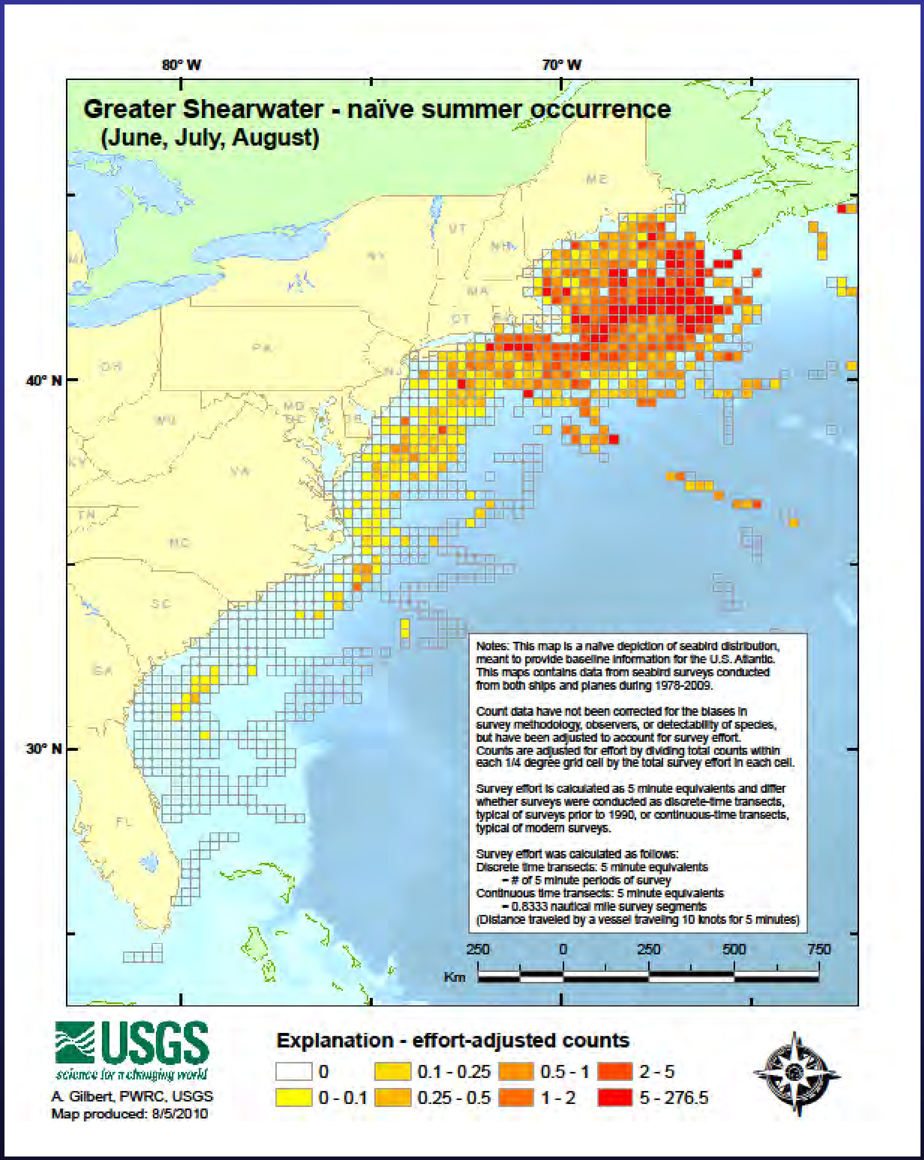
Seabird occurrence data

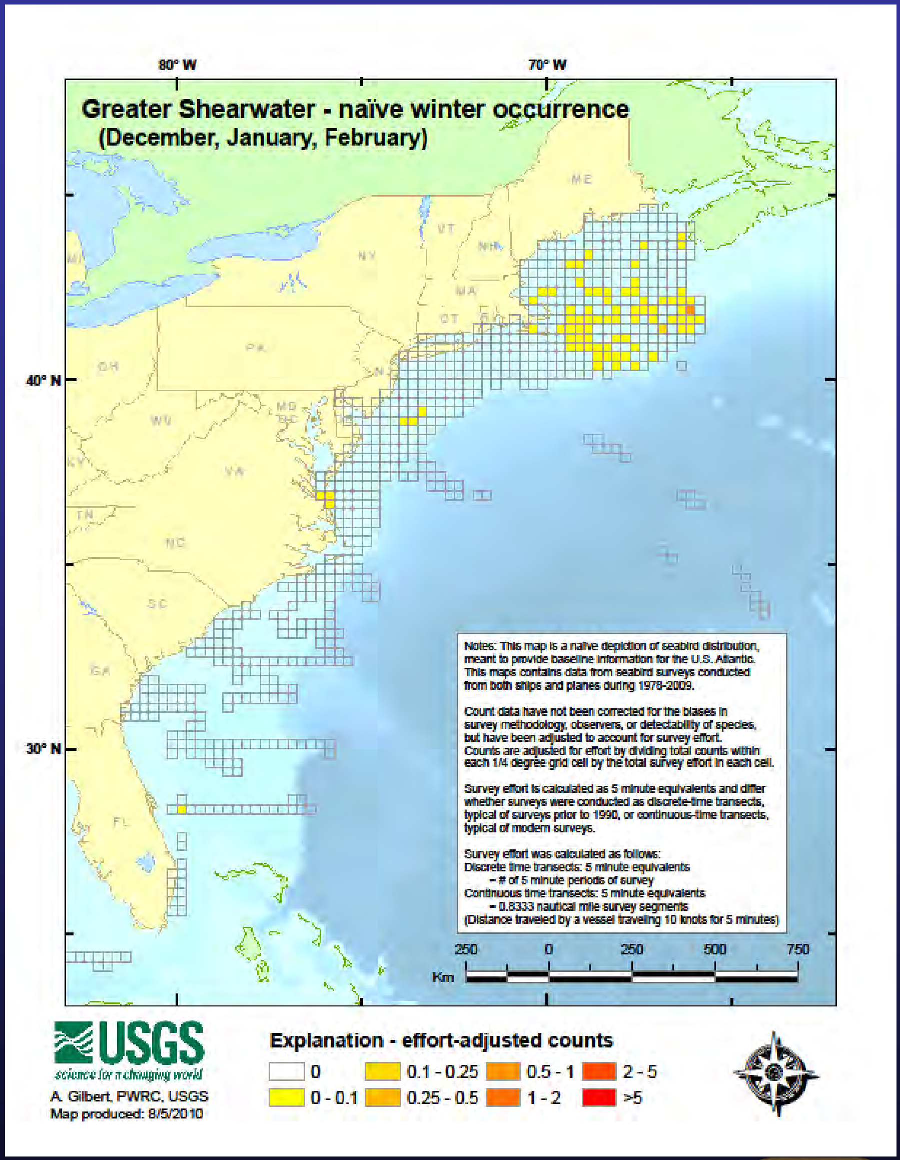
- >400,000 observations have been accumulated from 70 datasets
- >270,000 seabird observation from U.S. Atlantic waters (>100k from Canada in PIROP)
- >data spans the 1900's, most collected from 1978 through November 2010
- Data collected using a mix of scientific and non-scientific methods



Relational seabird database

- Postgresql 8.4 (PostGIS) database
- Fully relational database, efficient in design
- Very quick access and querying
- Geometry information can be stored directly in the database in open standards formats
- Allows complex geometry queries
- Can be mapped directly with some GIS products (not ArcGIS 9.3 but in 10 you can map data, but not edit it from the db directly)

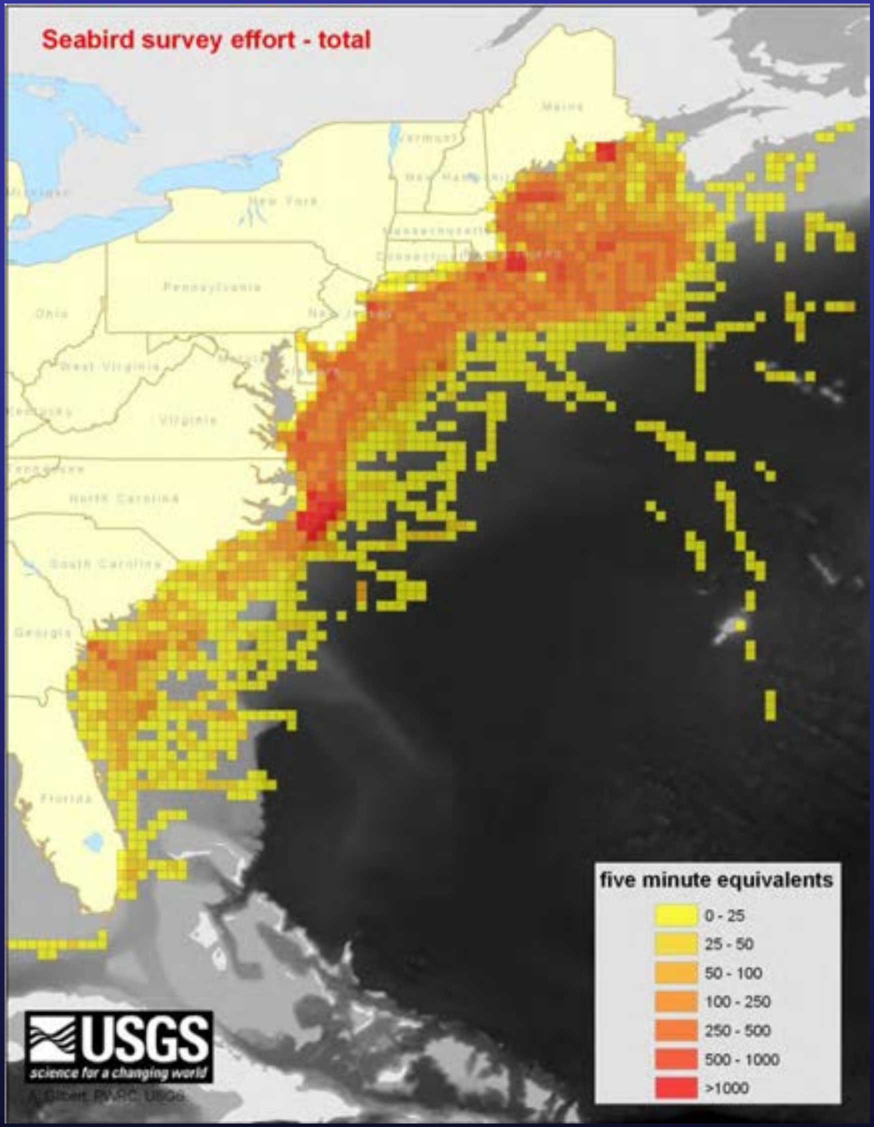




USGS
science for a changing world

Survey effort

- Standardized survey effort to account for both discrete-time and continuous-strip surveys.
- Color schemes represent a standardized range of the number of surveys conducted in each grid cell in 5 minute equivalents.
  - Discrete time transects: 5 minute equivalents = # of 5 minute periods of survey
  - Continuous time transects: 5 minute equivalents = 0.8333 nautical mile survey segments (the distance traveled by a ship traveling 10 knots for 5 minutes)



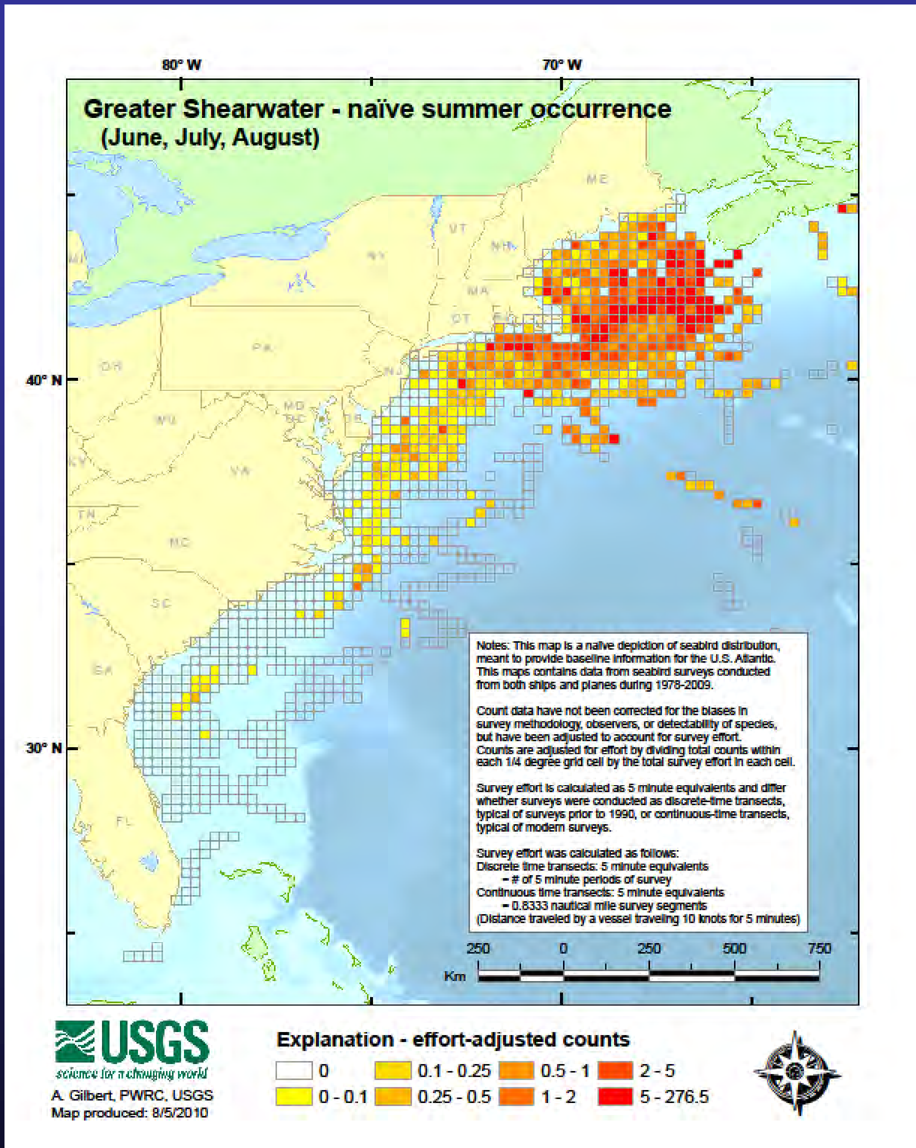
USGS
science for a changing world

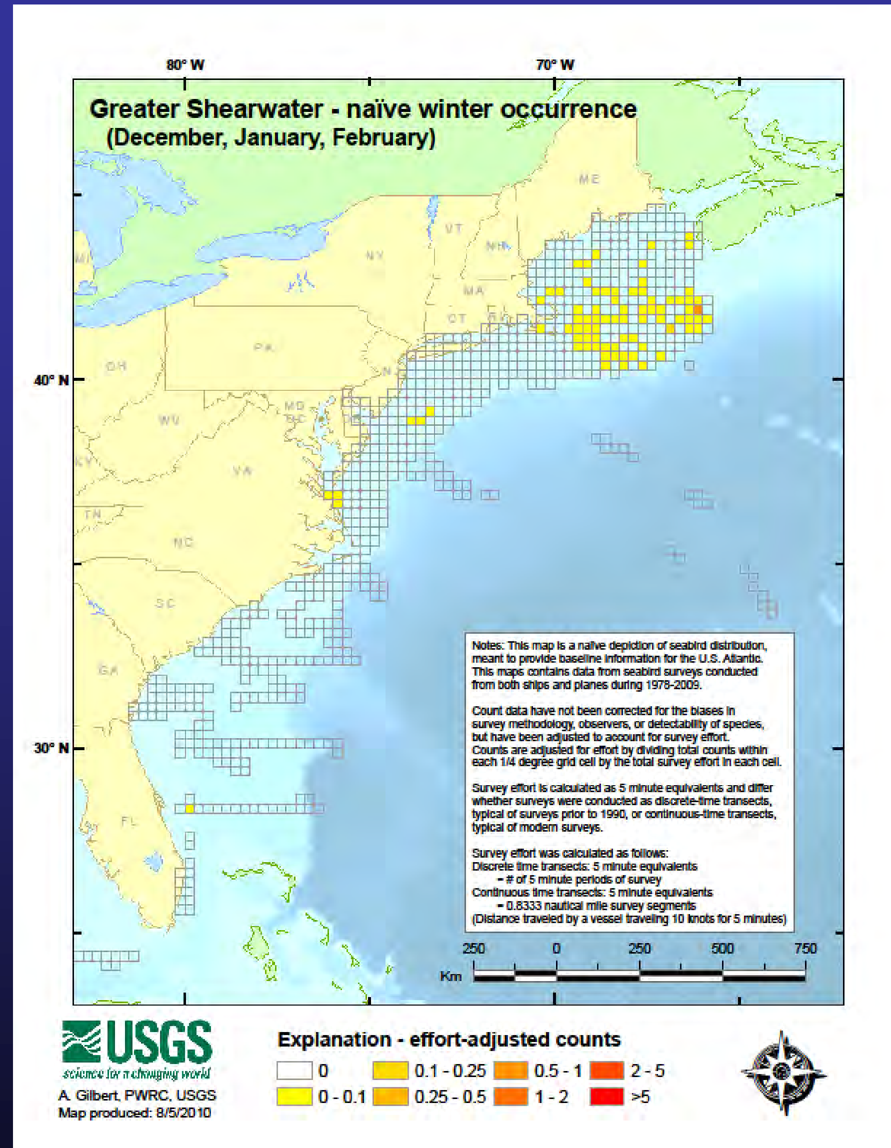
Modeling

- ~ 70 sea bird species in the data base that are typically found in the Atlantic
  - 10 -15 of particular interest

- Modeling exercises
  - Broad species distribution mapping
  - Community occupancy modeling
  - Seaducks
  - SEANET

USGS
science for a changing world

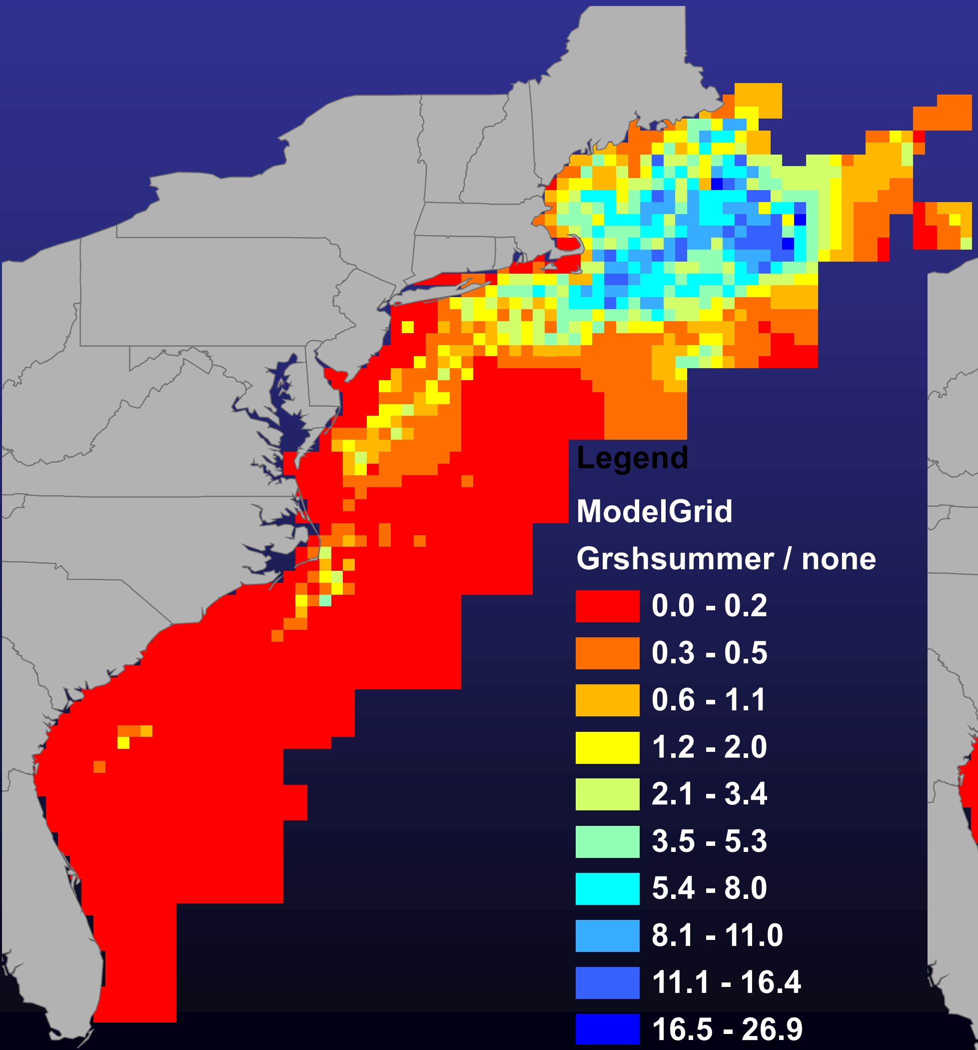




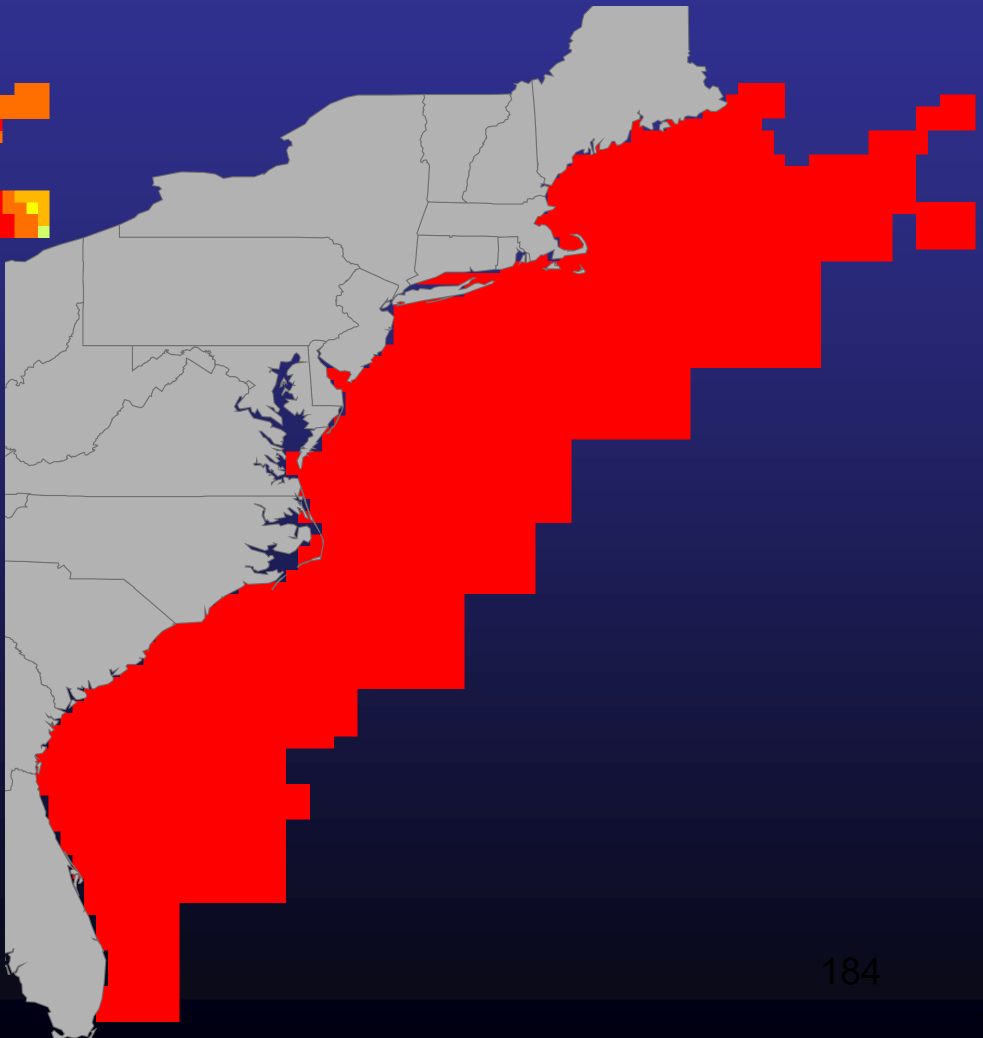
USGS
science for a changing world

Results – GRSH

Summer



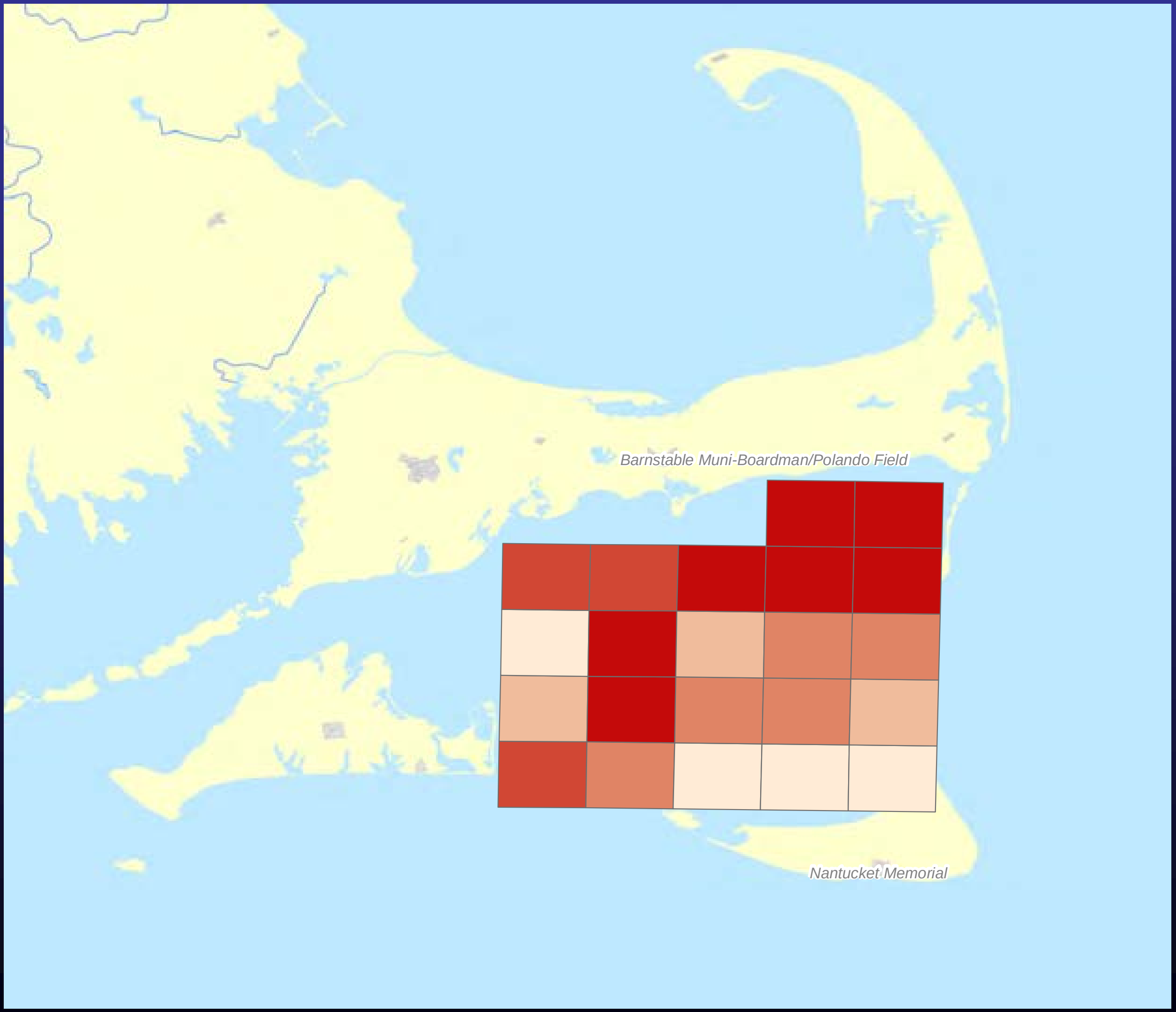
Winter



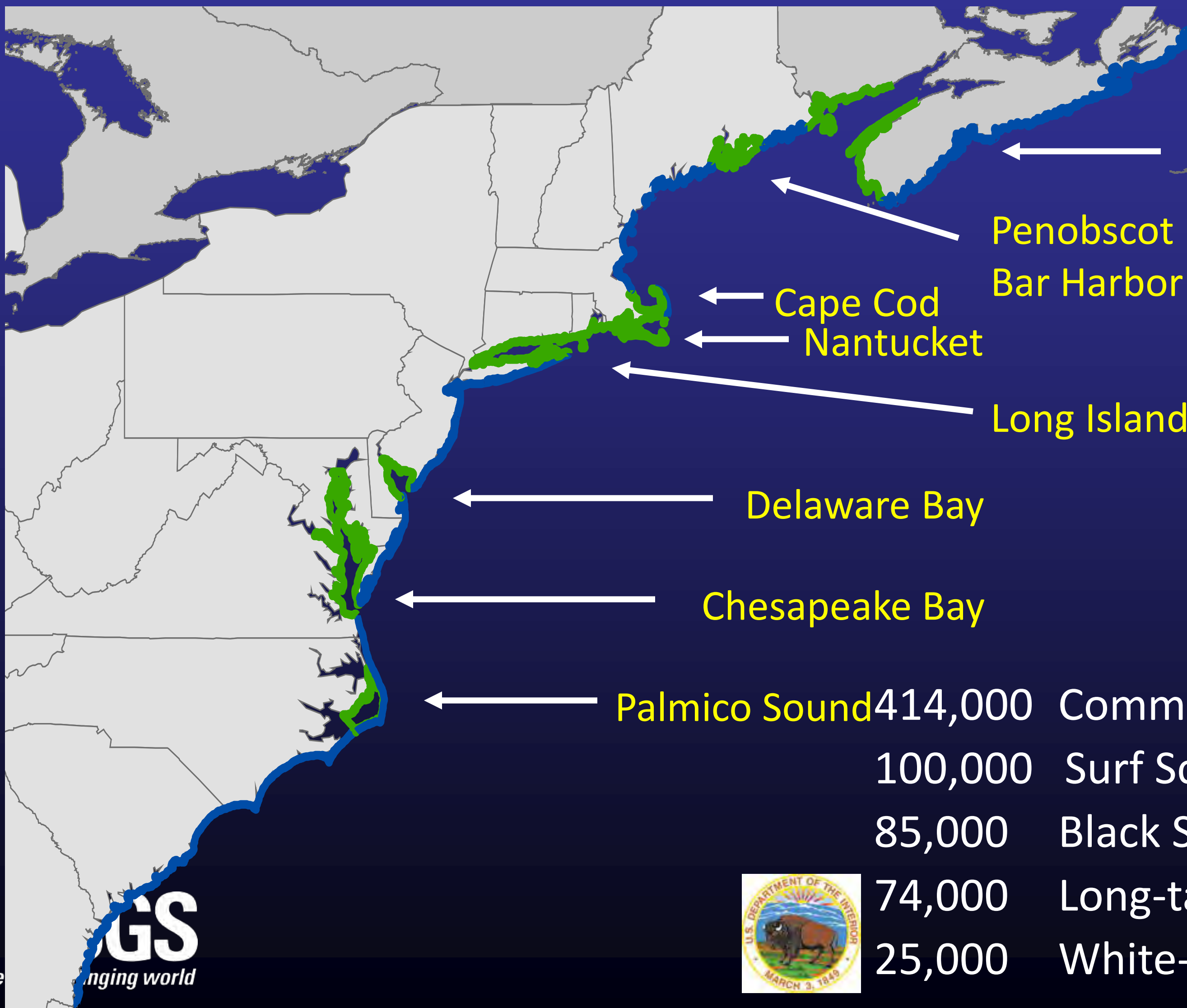
Occupancy Models

- If we look at areas with repeated aerial surveys, we can estimate detection and species richness through the use of site-occupancy models
- This allows us to understand the probability of detecting a species given that it is present
- We expect that detection is very different amongst species

Species Richness



Seaduck Surveys



Bay of Fundy

Penobscot Bay

Bar Harbor

Cape Cod

Nantucket

Long Island Sound

Delaware Bay

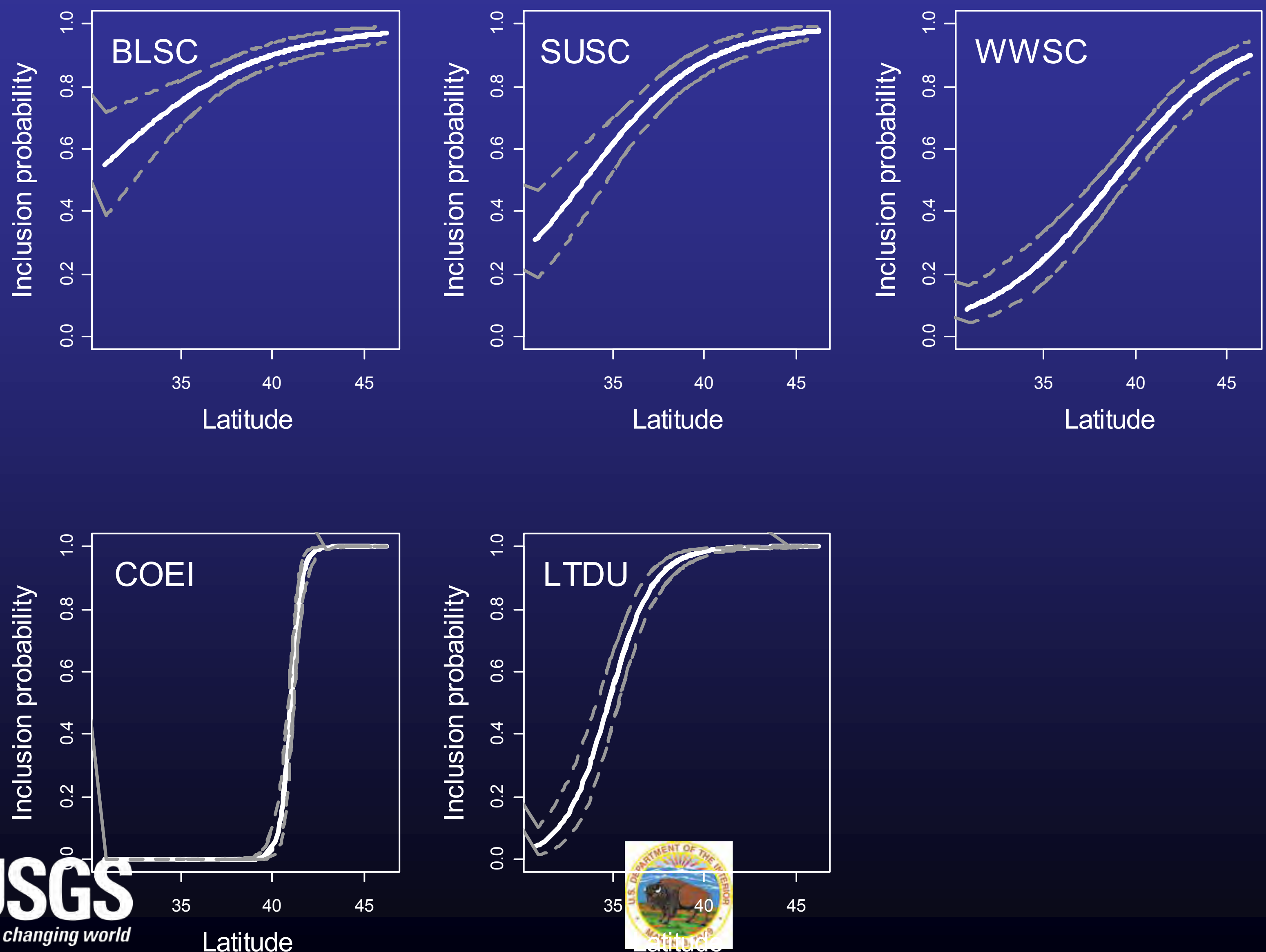
Chesapeake Bay

Palmico Sound

414,000	Common Eiders
100,000	Surf Scoters
85,000	Black Scoters
74,000	Long-tailed Ducks
25,000	White-winged Scoters

187

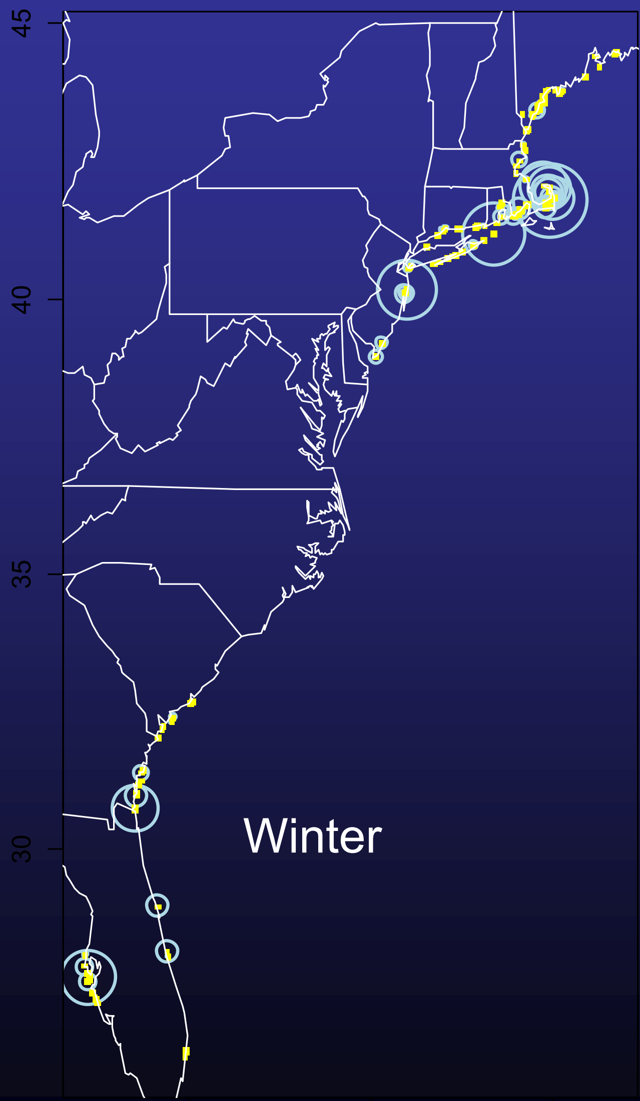
Results – Species ranges

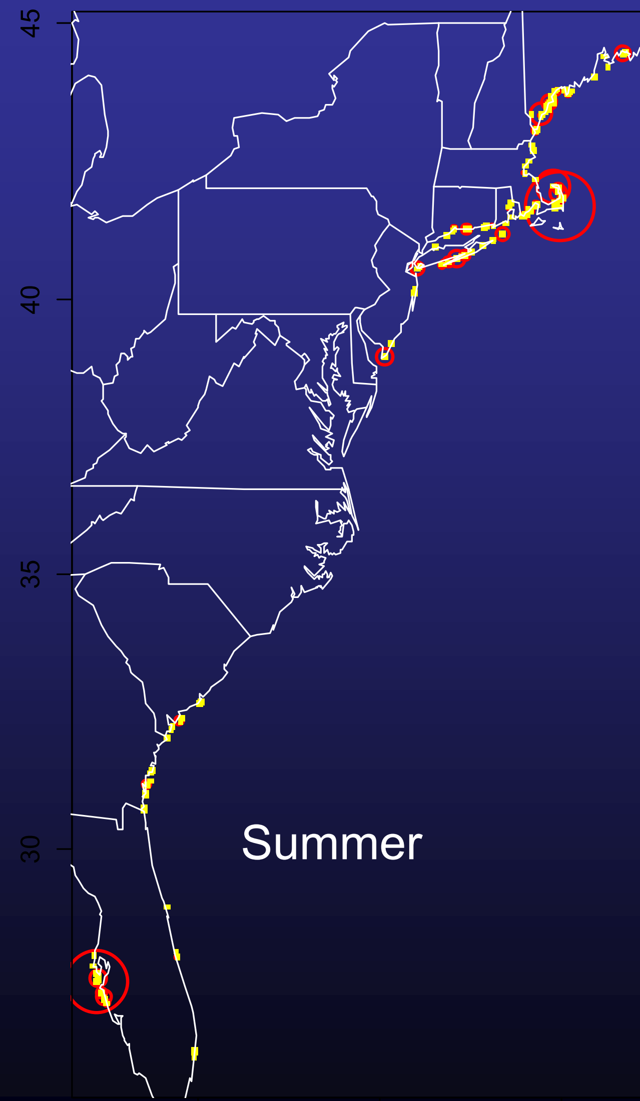


SEANET Data

- Volunteers walk stretches of beach and record the number of deceased birds
- 120 beaches surveyed
  - 3183 total surveys
- 2003-2009
- Beach length varied from 0.23 to 28.8 km

Surveys





Statistical guidelines for sampling marine avian populations

Elise F. Zipkin
Brian Kinlan
Allison Sussman
Mark Wimer
Allan F. O'Connell

USGS Patuxent Wildlife Research Center
NOAA National Ocean Service

4th International Wildlife Management Conference – July 2012

Presentation #2

OBIS-SEAMAP

marine megavertebrate geo-archive

http://seamap.env.duke.edu

OBIS-SEAMAP
Protected Species Information & Analysis System

Mid-Atlantic Marine Wildlife Survey, Modeling, and Data Workshop

Jesse Cleary, Pat Halpin, Ei Fujioka
The OBIS-SEAMAP Team

Marine Geospatial Ecology Lab
Nicholas School of the Environment
Duke University

OBIS-USA, OBIS-SEAMAP, iOBIS

OBIS-SEAMAP Niche:

* Protected species data / tools

Telemetry / tracking data

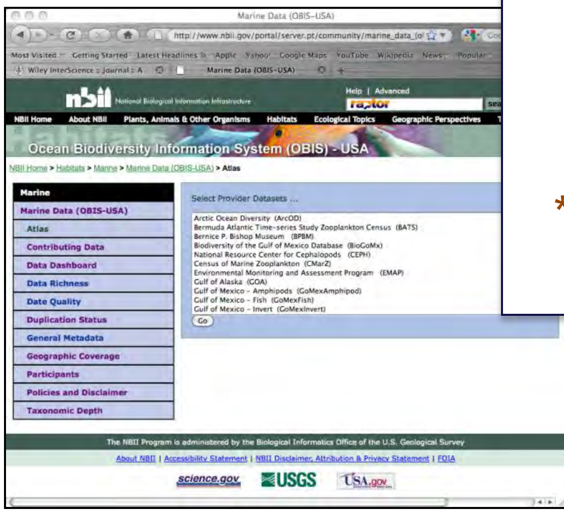
Photo-ID

Passive acoustics

Spatial Decision Support

* Mapping & Analysis R&D*

OBIS-USA

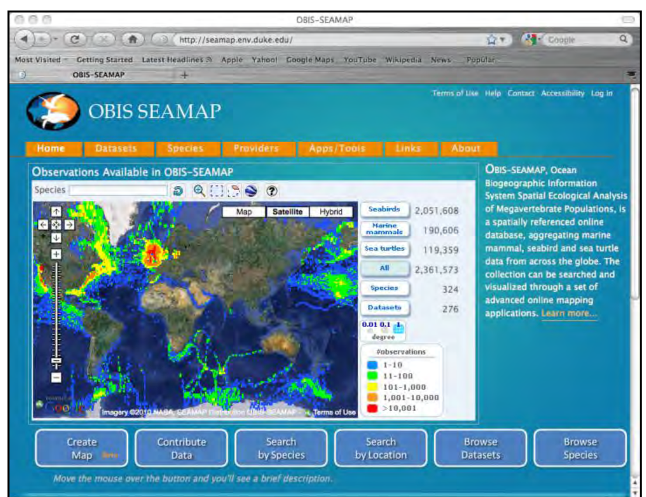


National marine biodiversity data archive

iOBIS

International marine biodiversity data archive

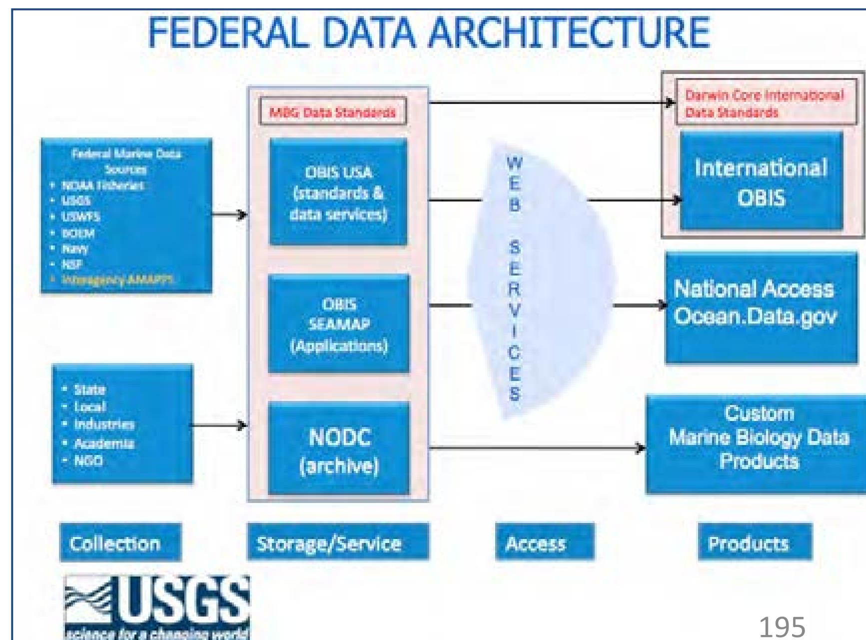
OBIS-SEAMAP



OBIS-USA / OBIS-SEAMAP partnership

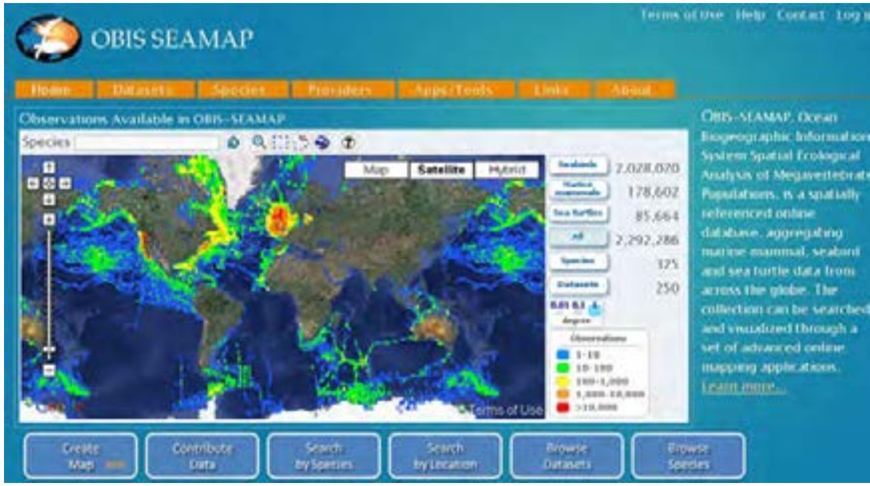
- Single point of US data enrollment in OBIS network
- Advancing biogeographic data standards
- Improved data services, products and applications

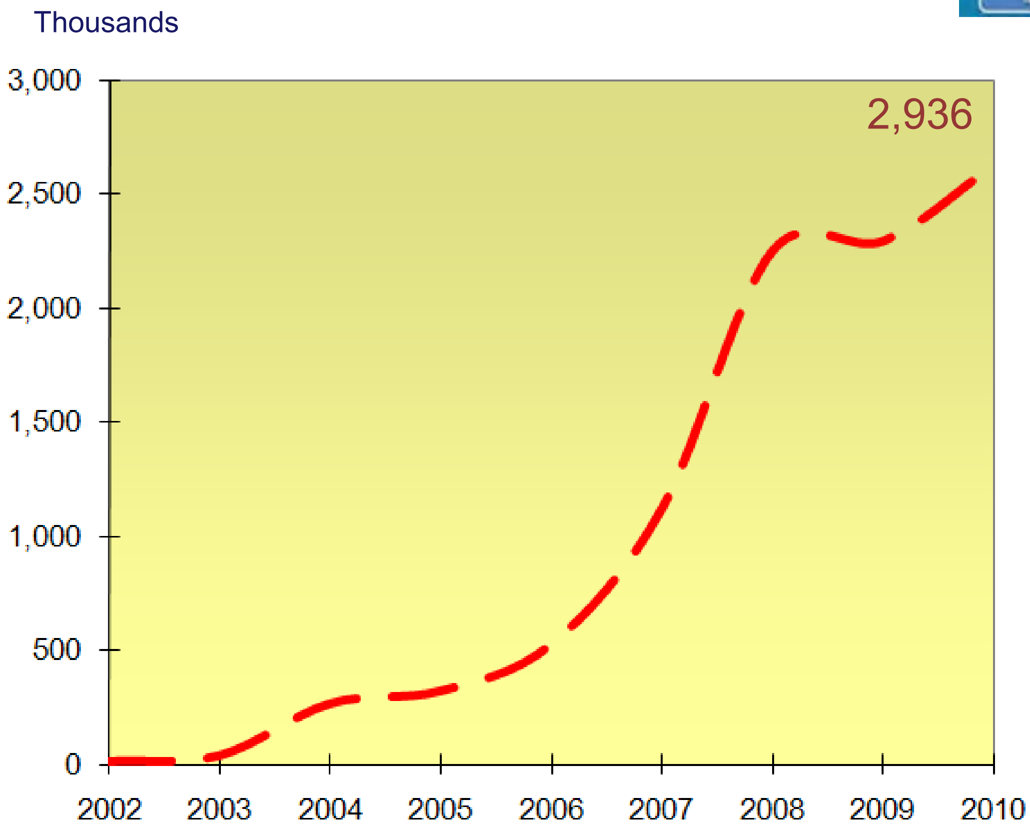
OBIS-USA / OBIS-SEAMAP talk
(data track, Wed AM)



OBIS-SEAMAP

Spatially referenced online database, aggregating marine mammal, seabird and sea turtle data from across the globe





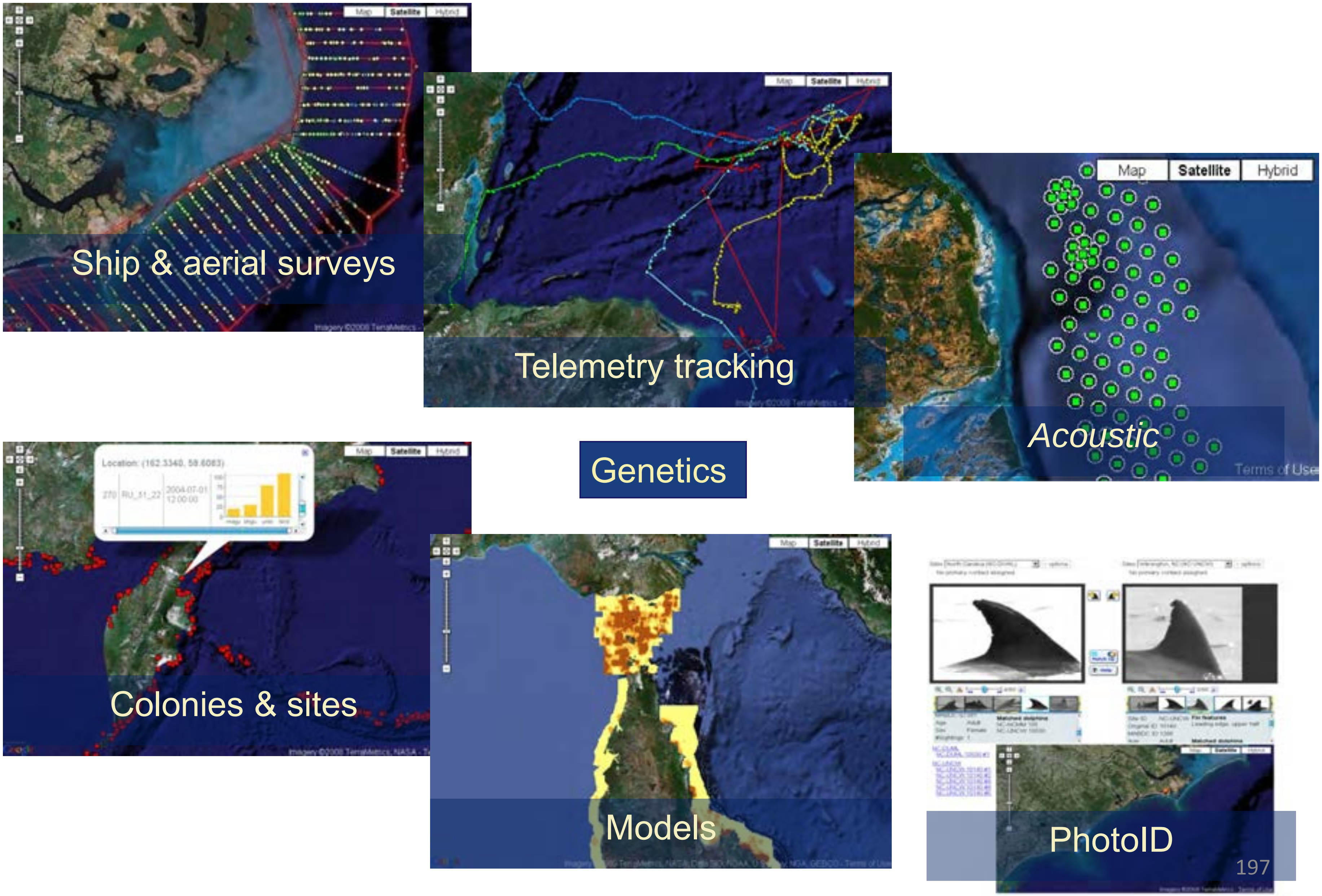
439 datasets
1935 – 2012
>2,936,000 records

National Science Foundation
WHERE DISCOVERIES BEGIN

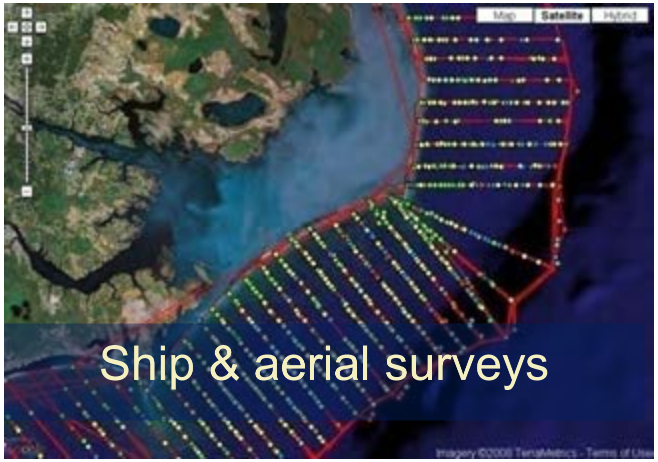
NOPP

Office of Naval Research

OBIS-SEAMAP supports multiple data types

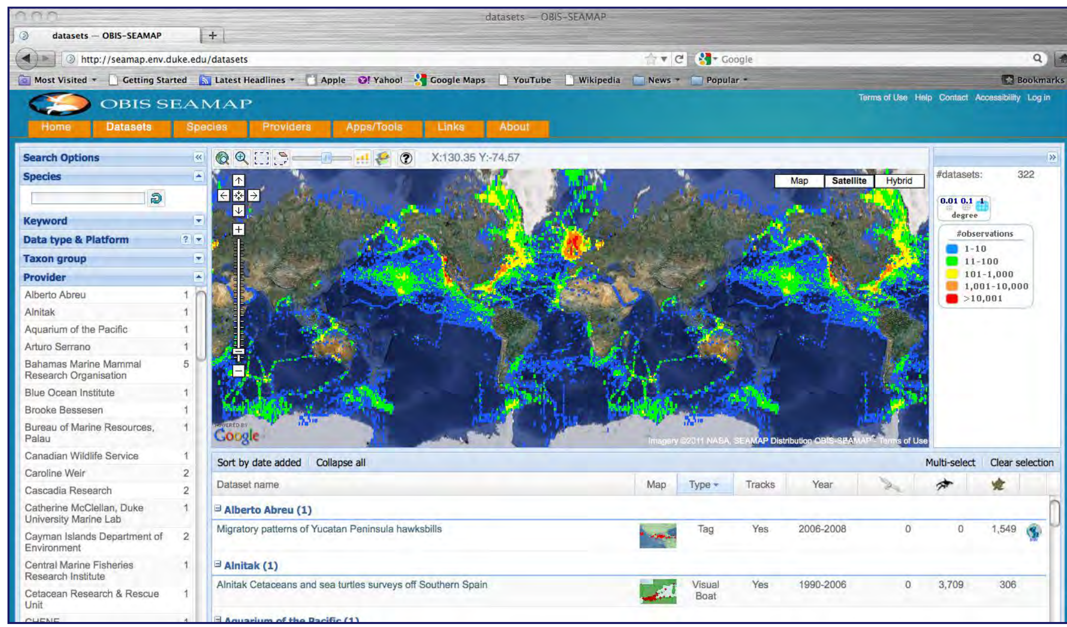


Observation data in OBIS-SEAMAP



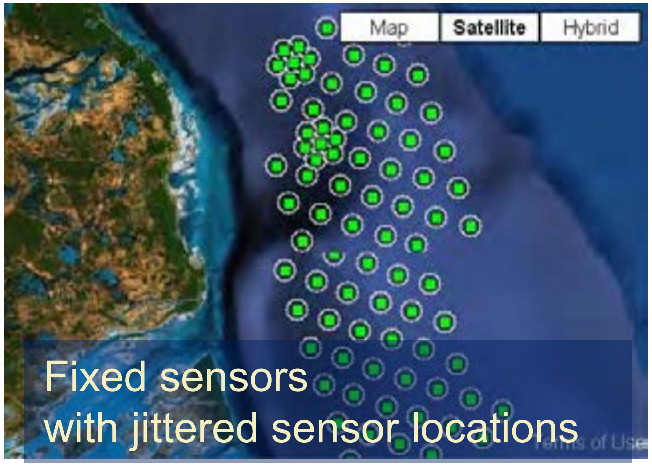
The inclusion of survey effort (tracklines) and additional attributes is essential for the development of statistical models of density or habitat preference.

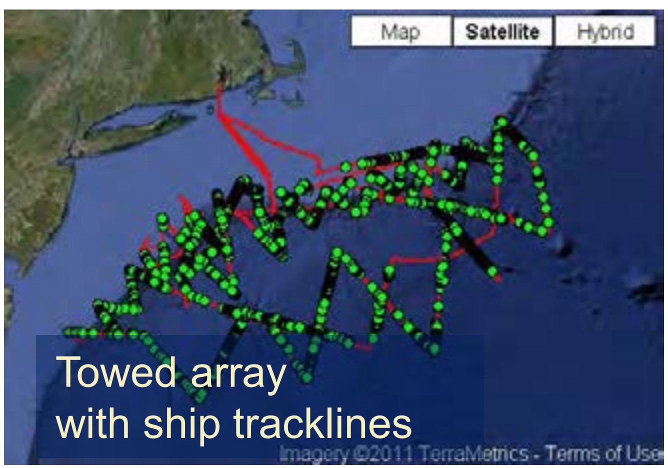
- Observation data
- Survey effort data
- Survey metadata
- Links to species pages
- Links to data providers



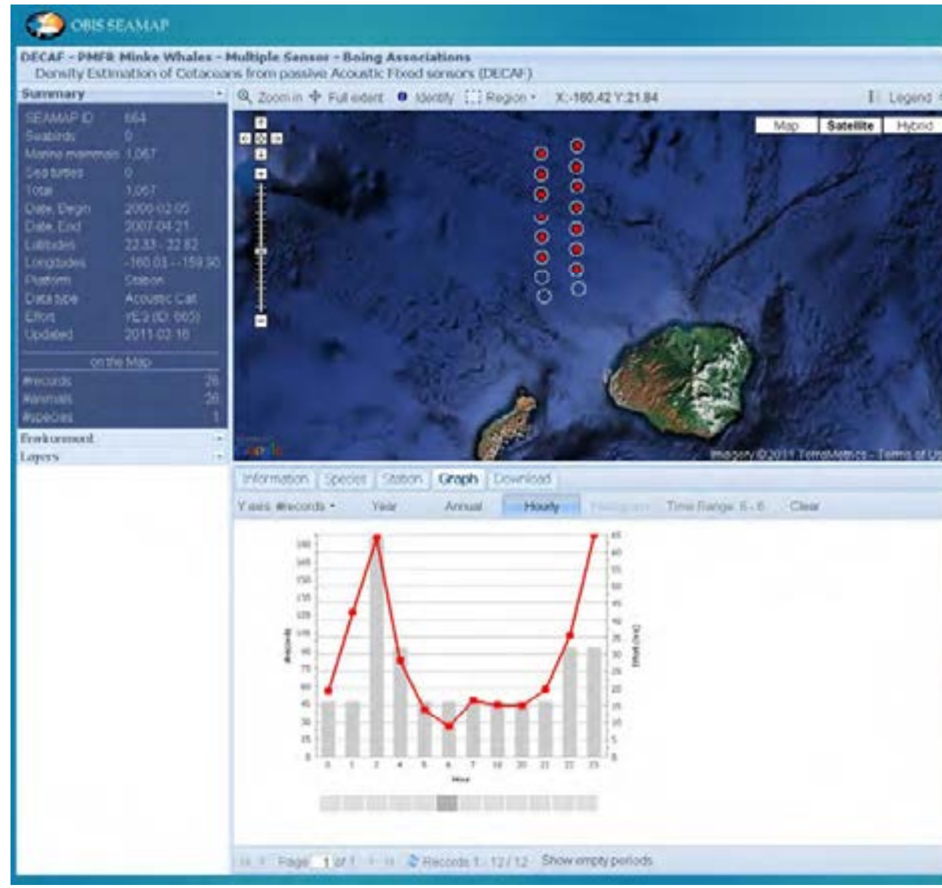
Passive acoustic data in OBIS-SEAMAP

Various acoustic data types





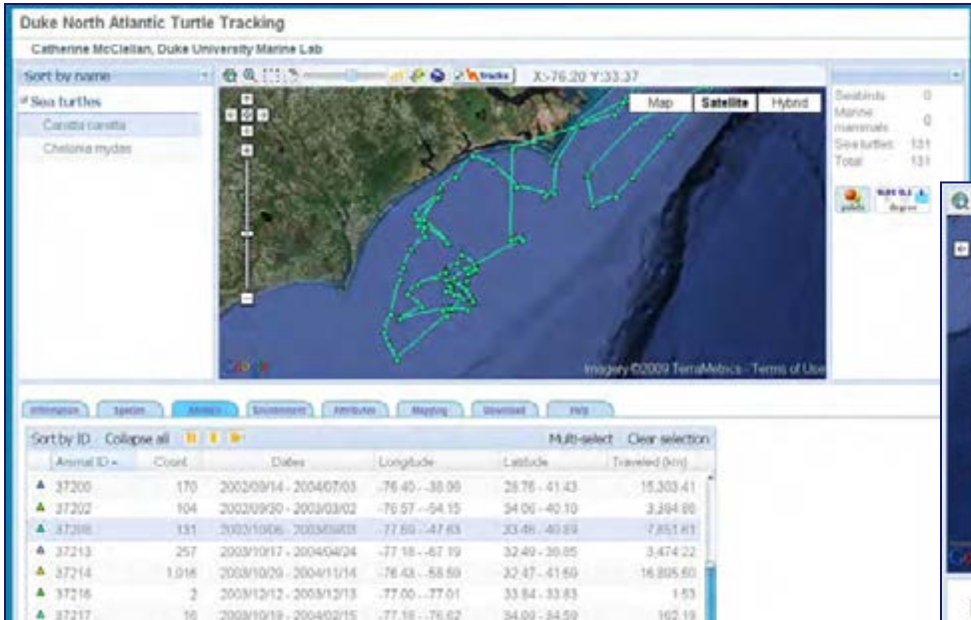
Advanced mapping & visualization



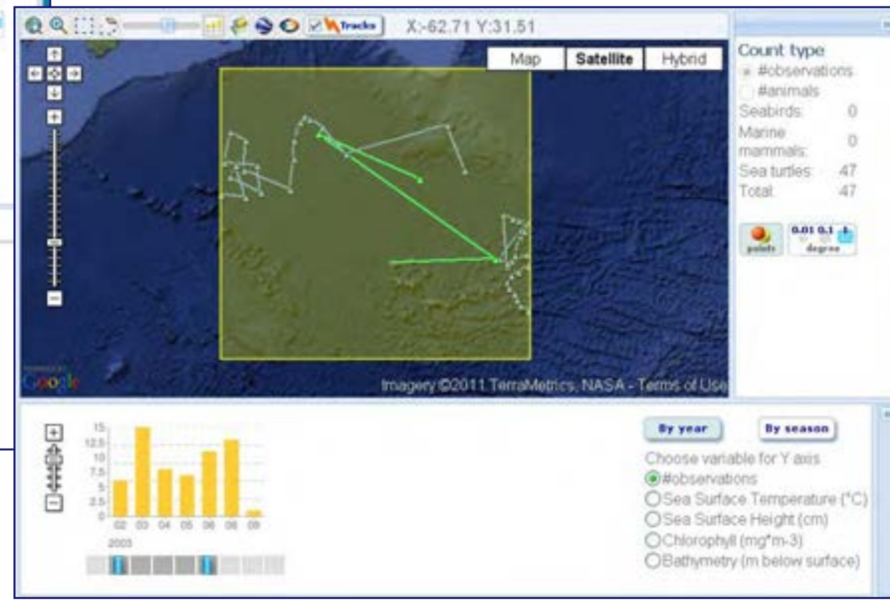
Navy-funded DCAF datasets are in the final stages of approval for publishing through OBIS-SEAMAP.

Telemetry data in OBIS-SEAMAP

Movement of individual animal



Advanced mapping & visualization

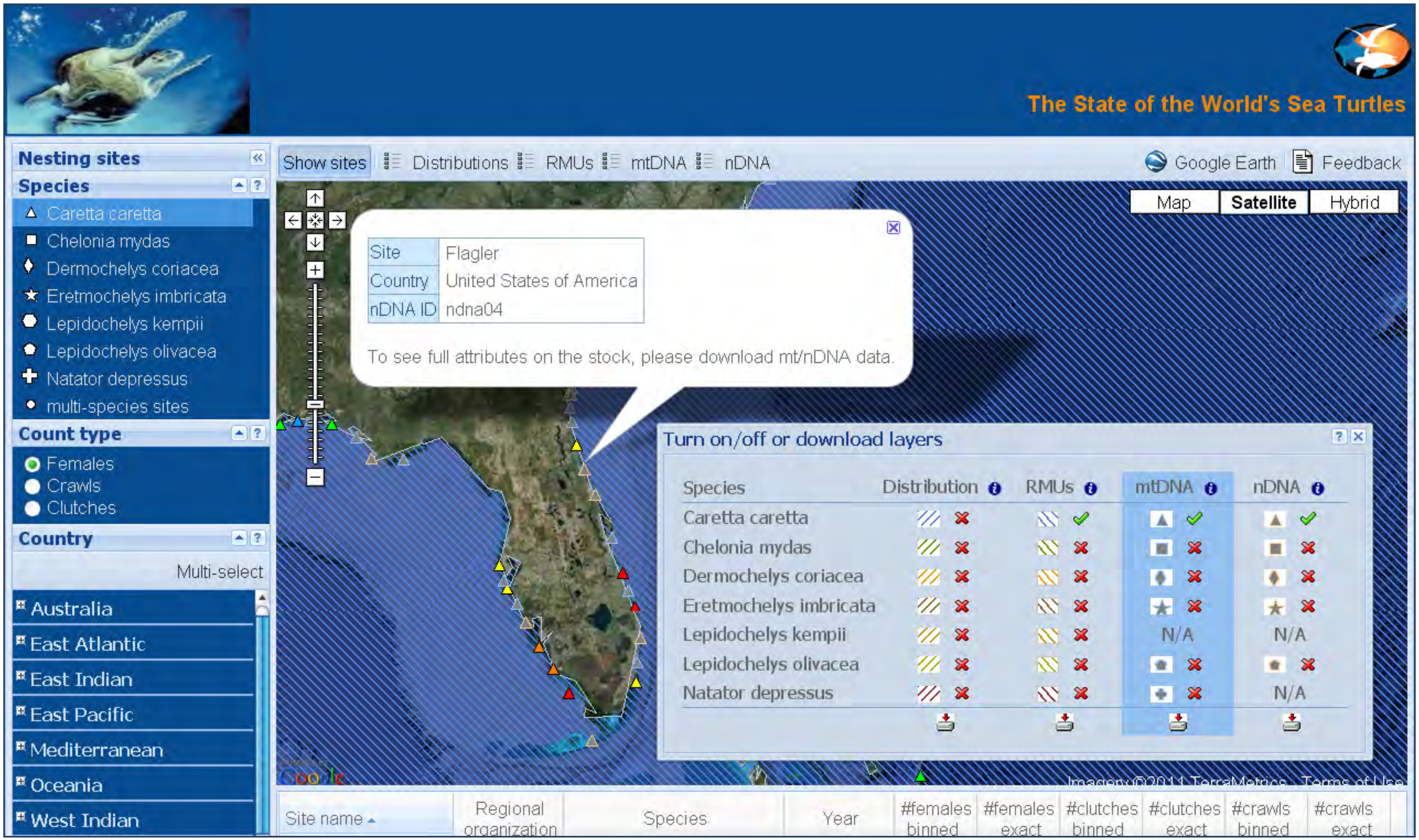


Animation of movement

Movement of multiple animals in an area of interest within a defined time period

Turtle nesting data in OBIS-SEAMAP

New approach ties genetic research with nesting site data

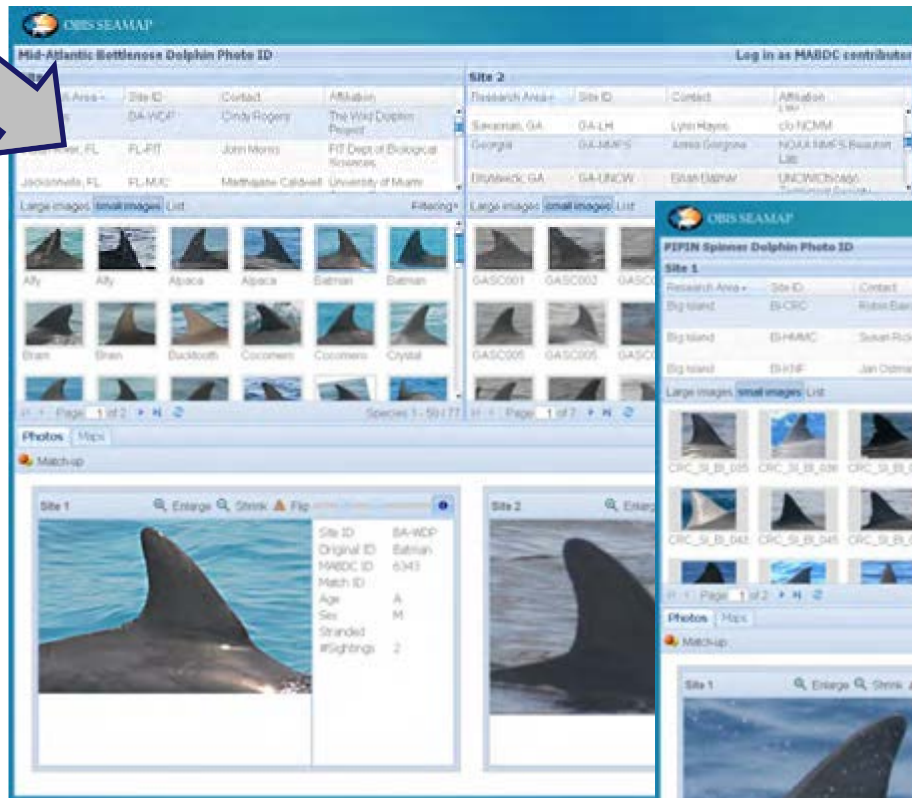


DNA sampling sites along with nesting sites (*both are downloadable*)

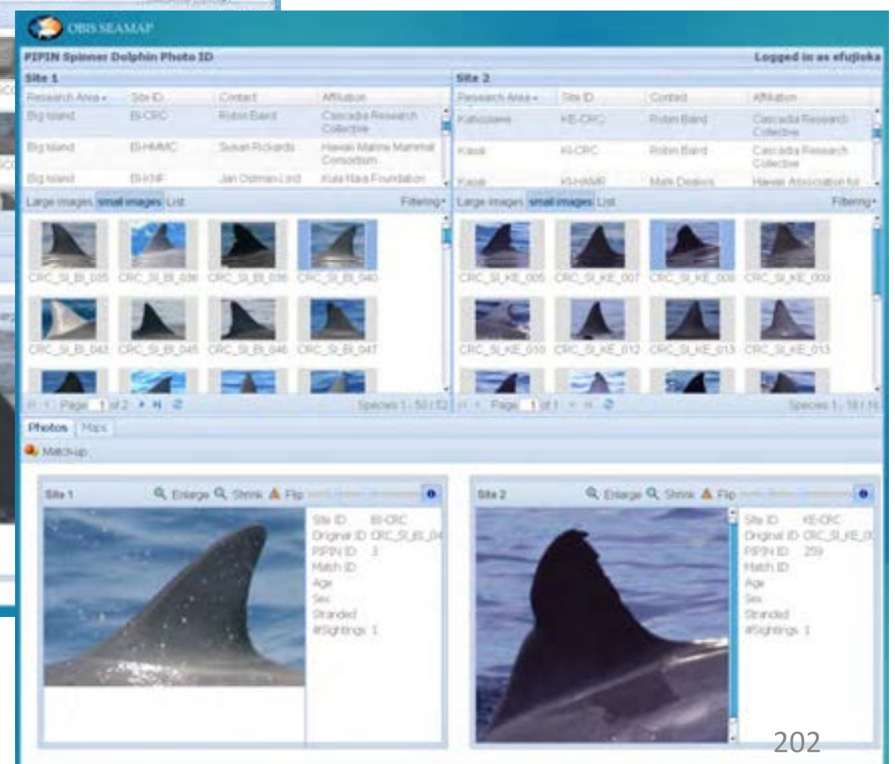
PhotoID in OBIS-SEAMAP

- Provides an online scientific workflow for fin matching processes
- Building common framework to incorporate other PhotoID catalogs

Initial application for Mid-Atlantic Bottlenose Dolphin Catalog



New interface for MABDC built on the common framework

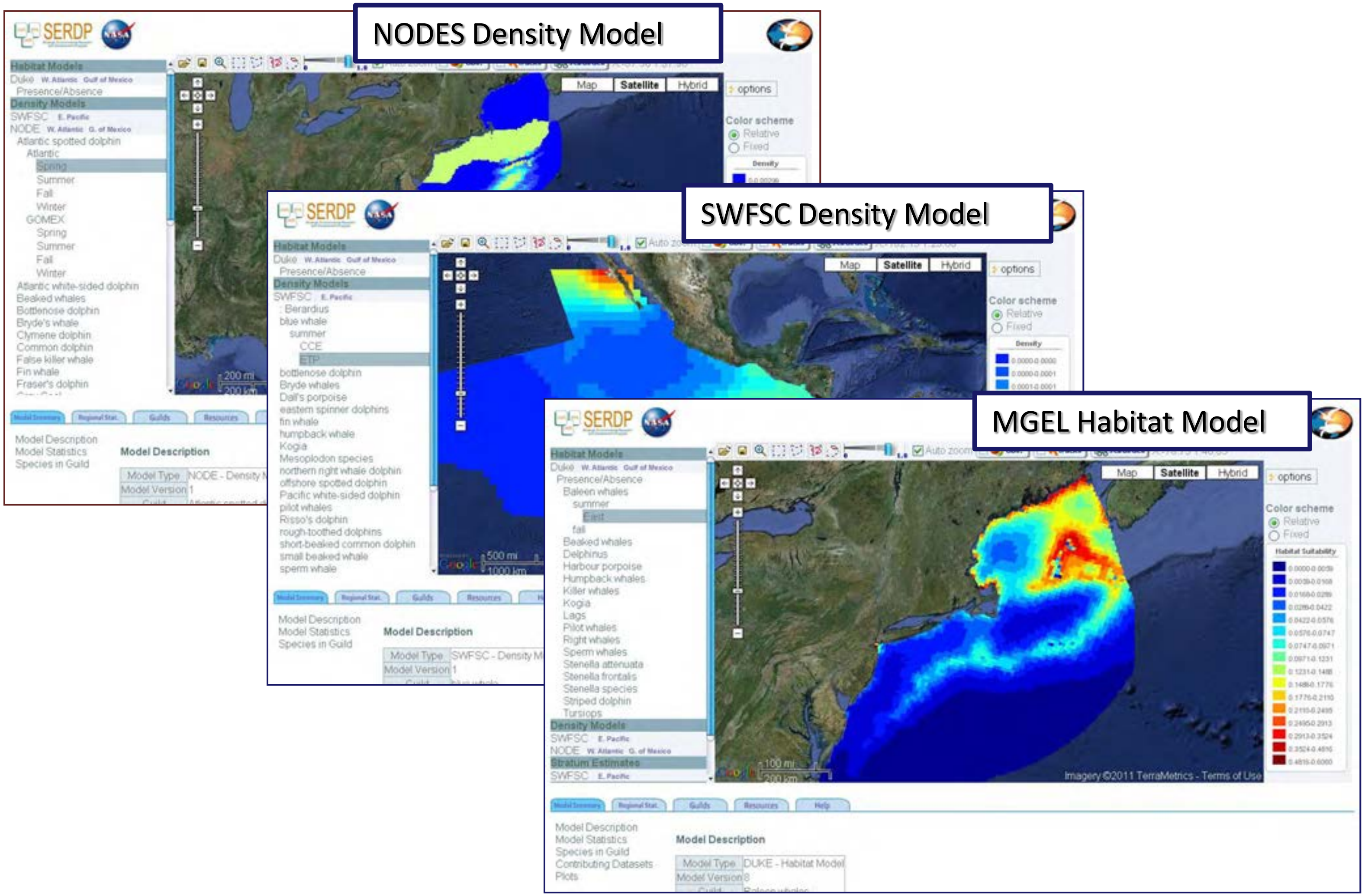


Same framework applied to PIPIN (Spinner dolphins in Hawaiian waters)

Cetacean density models in OBIS-SEAMAP

SERDP Spatial Decision Support System
originally funded by SERDP continuing development by NASA

Multiple habitat/density models from different projects



Data needs for renewable energy siting & permitting

The is significant correspondence between migratory corridors and wind-energy potential on the Atlantic Coast

Understanding the potential interaction of migratory species and wind energy development will require long-term data aggregation to support environmental impact analysis and forecasting models.

Data needs for renewable energy siting & permitting

We need to be able to provide necessary data and models to answer renewable energy siting questions at multiple scales

(a) US Atlantic coast
Migratory species data & models

Atlantic Coast scale

(b) US Atlantic coast
Renewable energy potential

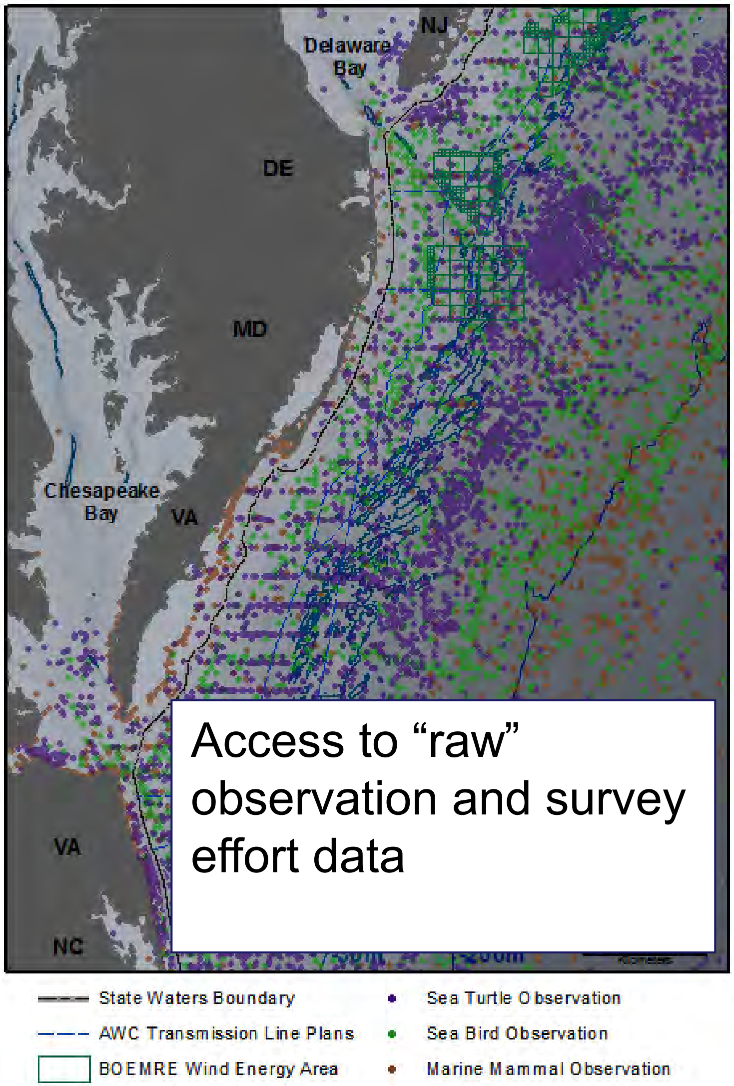
(c) NC Hatteras / Onslow Bay
Renewable energy potential
& constraints

Lease-block scale

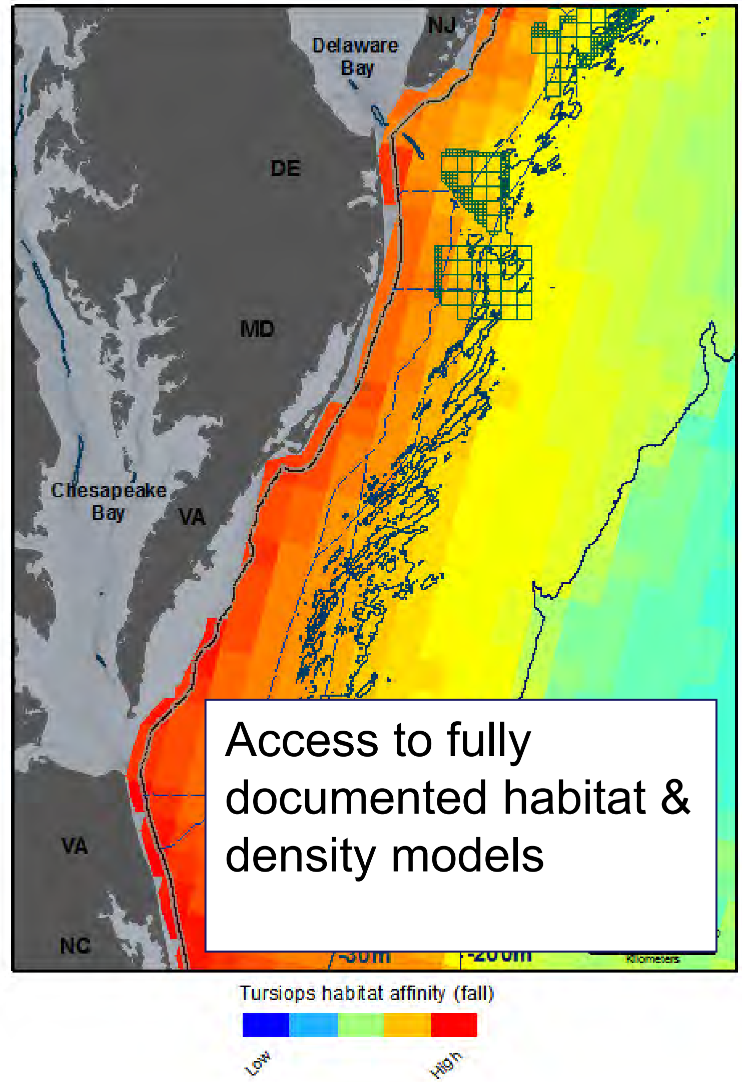
(d) NC Hatteras / Onslow Bay
Passive acoustics study area
Proposed lease blocks

Data needs for renewable energy siting & permitting

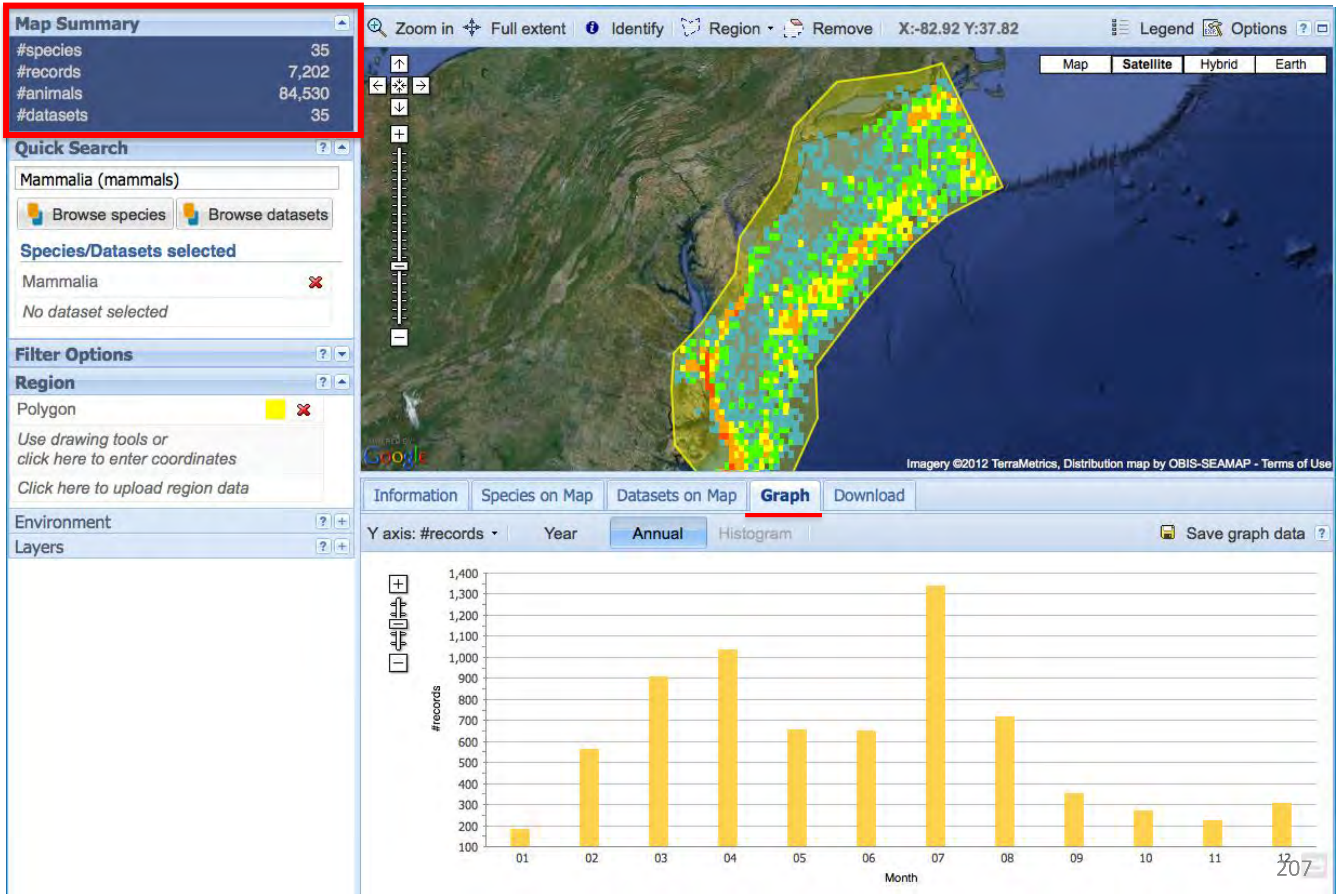
Observation data



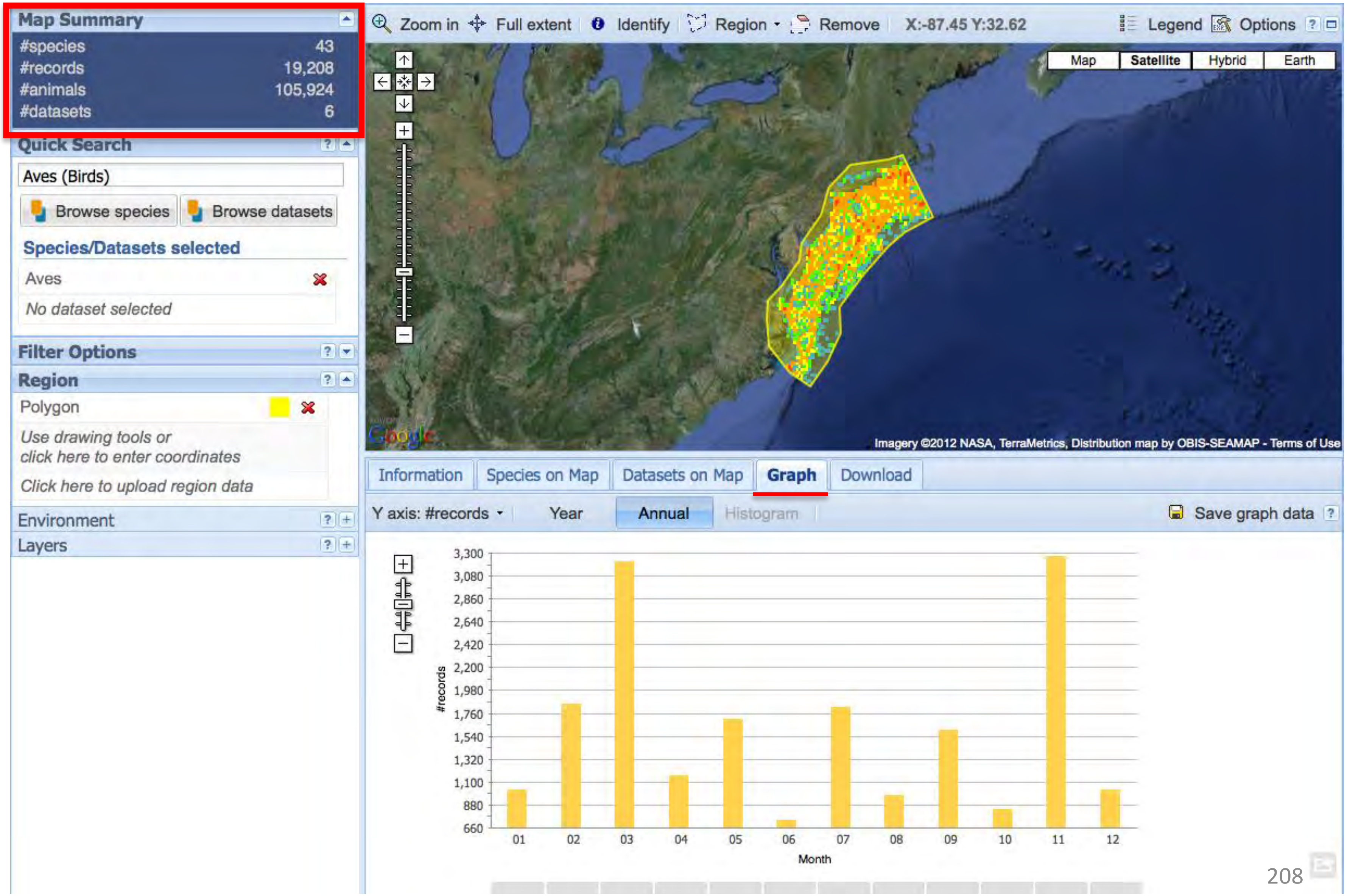
Habitat / Density models



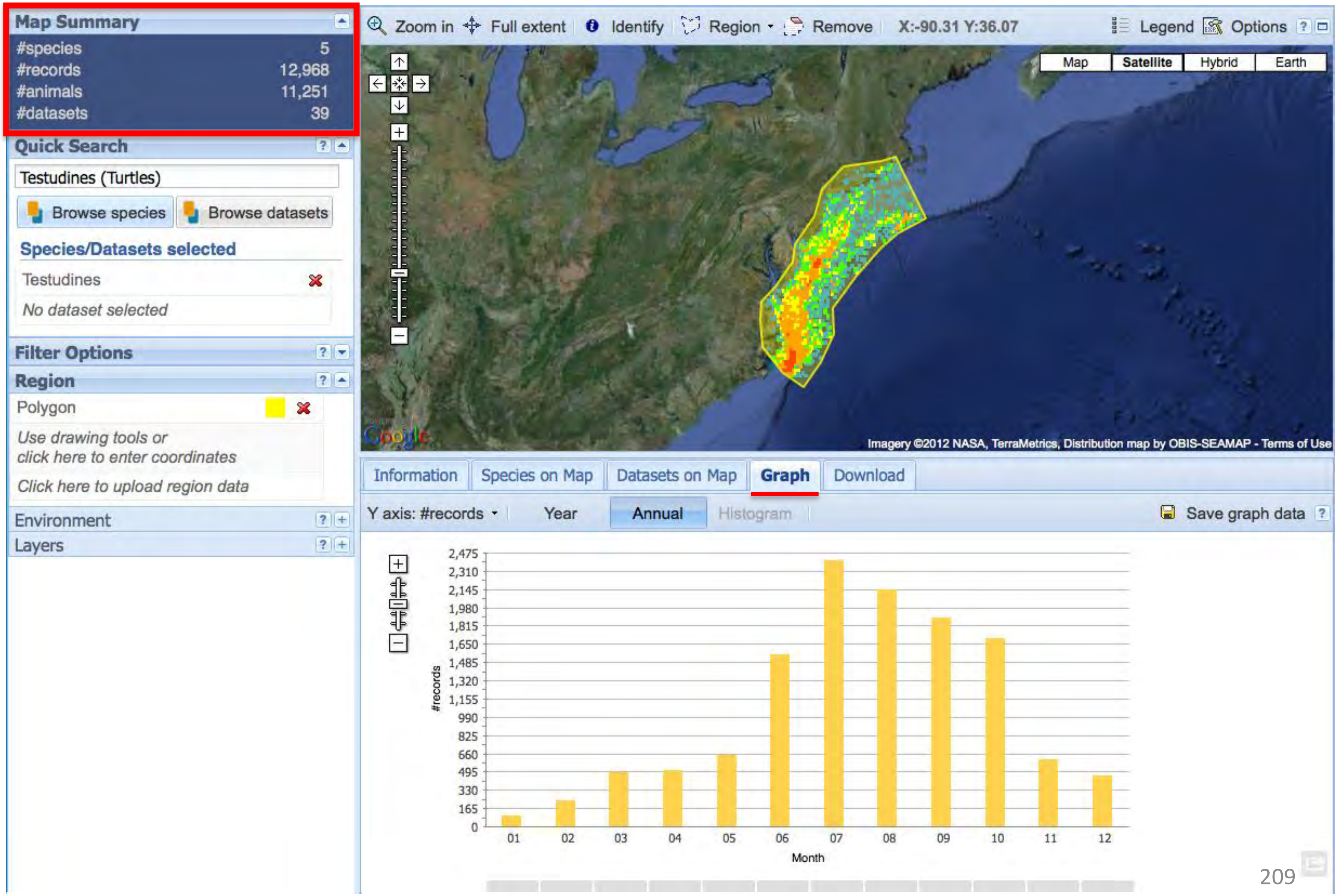
Marine mammal observations in OBIS-SEAMAP



Seabird observations in OBIS-SEAMAP

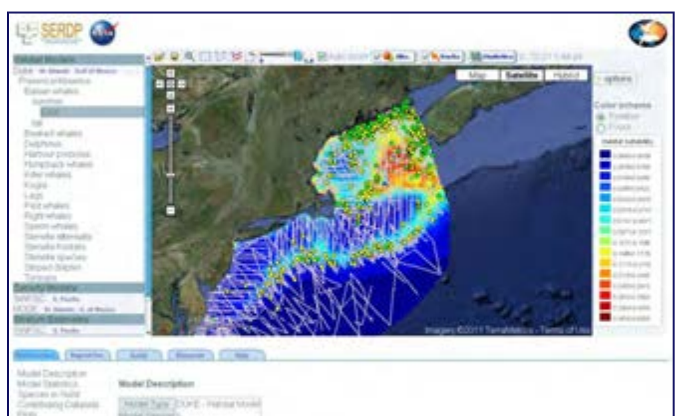


Sea turtle observations in OBIS-SEAMAP



Take-home Messages

- OBIS-SEAMAP is the protected species *observation data* & *modeling* node of the international OBIS information network;
- OBIS-SEAMAP specializes in R&D for the synthesis and analysis of marine biological data for applied science and management uses;
- OBIS-SEAMAP/OBIS-USA team is very interested in formally coordinating our work with emerging DOI / BOEM wind energy initiatives in the Atlantic Coast region.



OBIS-SEAMAP

http://seamap.env.duke.edu/

OBIS

http://iobis.org/

Thank you

National Science Foundation

WHERE DISCOVERIES BEGIN

Office of Naval Research

NOPP

NASA

SERDP

DOD • EPA • DOE

Marine Geospatial Ecology Lab

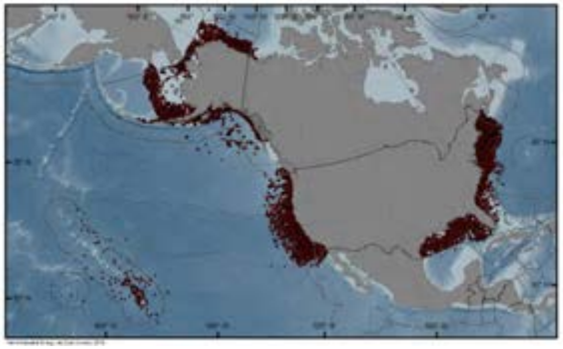
Duke University

Marine Geospatial Ecology Lab
Nicholas School of the Environment
Duke University

Presentation #3

Cetacean Density and Distribution Mapping Working Group (CetMap)

Project Overview



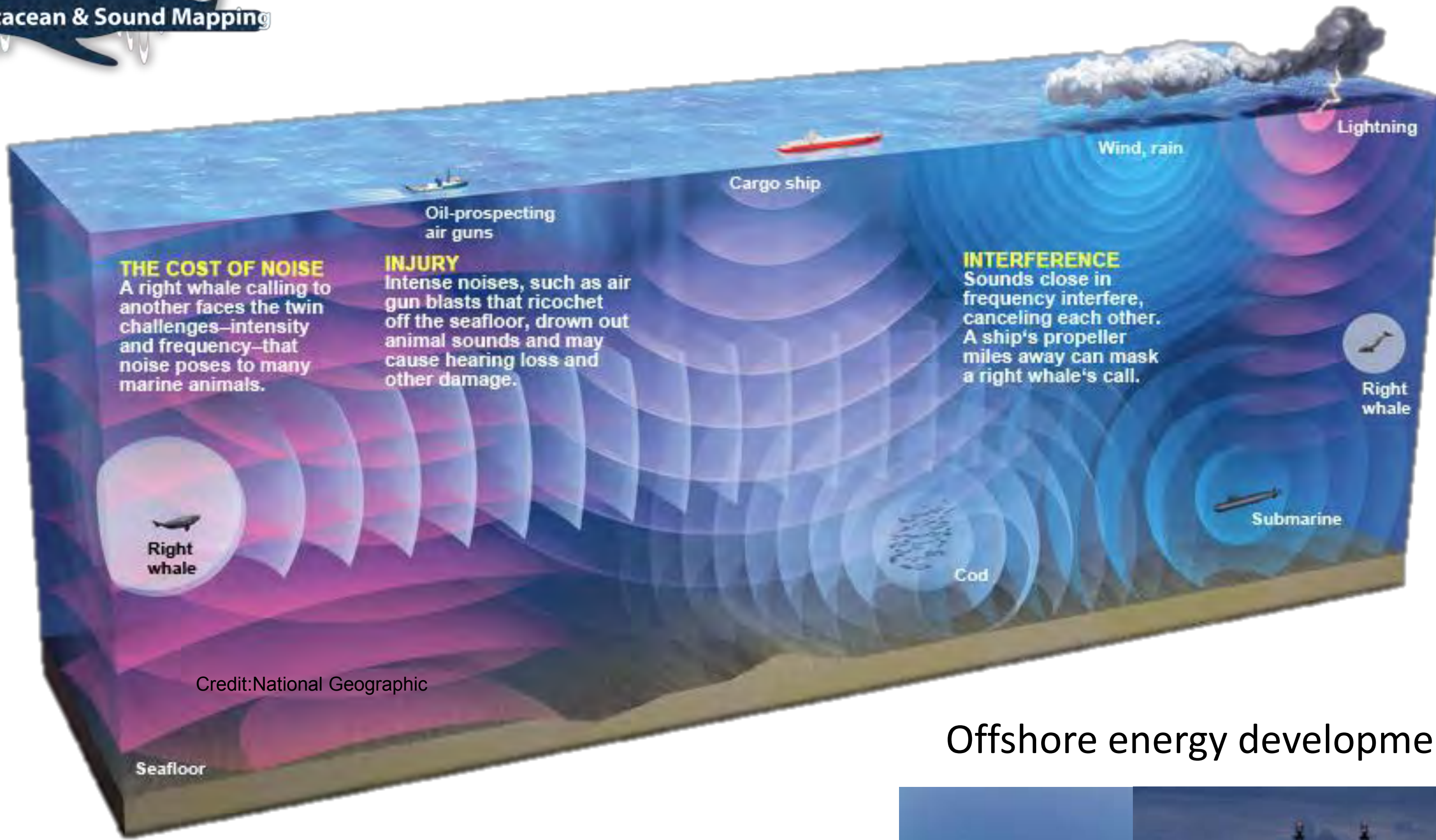
Mid-Atlantic Marine Wildlife Surveys, Modeling, and Data Workshop

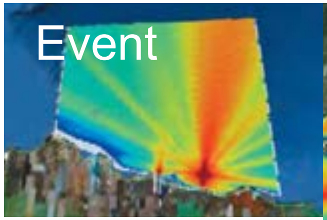
Pat Halpin, Jesse Cleary, Corrie Curtice, Erin LaBrecque
&
the NOAA CetMap Team

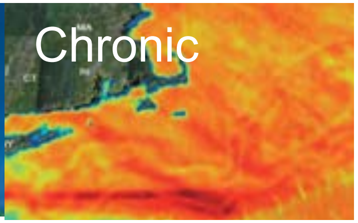
Marine Geospatial Ecology Lab
Nicholas School of the Environment
Duke University

Cetaceans, sound exposure & Marine Spatial Planning

Cetacean & Sound Mapping







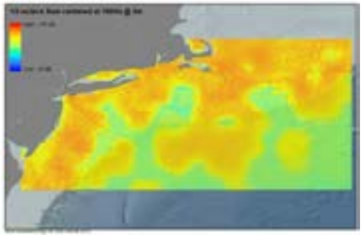
Offshore energy development

Project Context

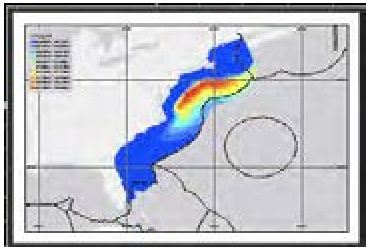
NOAA commits to improving the tools used by the agency to evaluate the impacts of human-induced noise on cetacean species.

Two data and product-driven working groups were formed:

1. Underwater Sound-field Mapping Working Group (SoundMap)
   to create mapping methods to depict the temporal, spatial, and spectral characteristics of underwater noise



2. Cetacean Density & Distribution Mapping Working Group (CetMap)
   to create regional cetacean density and distribution maps that are time- and species-specific, using survey data and models that estimate density using predictive environmental factors



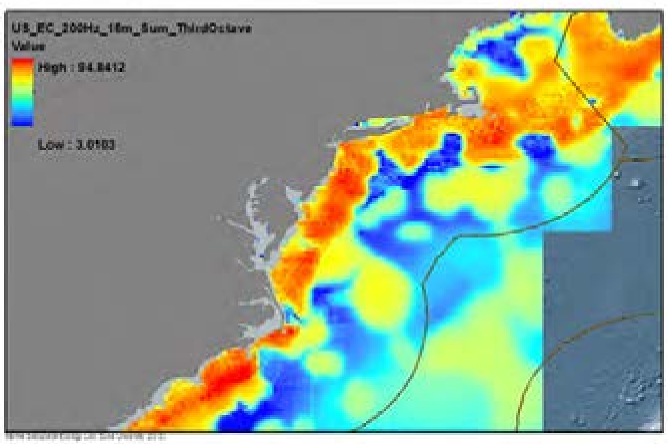
BOEM
Bureau of Ocean Energy Management

Marine Geospatial Ecology Lab
Duke University

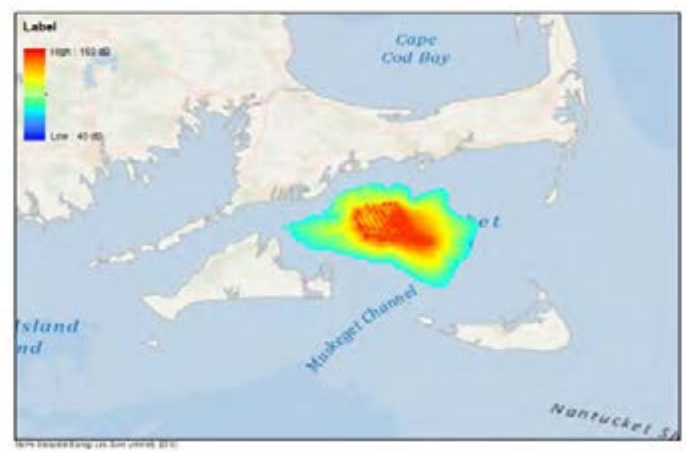
SoundMap Working Group

Chronic and Event based sound modeling

- Depth: 5, 15, 30, 200, 500, 1000m depth bins
- Frequency: 50, 100, 200, 400, 800 Hz
- Basin scale, US EEZ, Event AOIs



Chronic: global shipping, passenger vessels, seismic surveys, rig servicing vehicles => <u>summation</u>



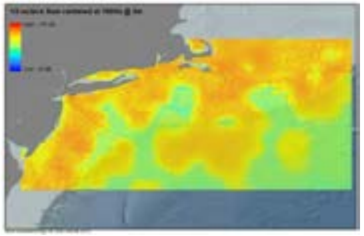
Events: active sonar training, <u>wind farm construction</u>, Alaska seismic surveys http://cetsound.noaa.gov/

Project Context

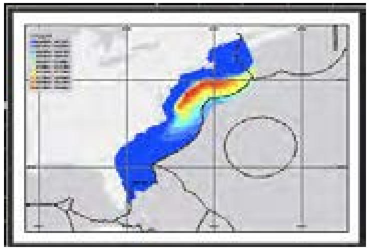
NOAA commits to improving the tools used by the agency to evaluate the impacts of human-induced noise on cetacean species.

Two data and product-driven working groups were formed:

1. Underwater Sound-field Mapping Working Group (SoundMap)
   to create mapping methods to depict the temporal, spatial, and spectral characteristics of underwater noise



2. Cetacean Density & Distribution Mapping Working Group (CetMap)
   to create regional cetacean density and distribution maps that are time- and species-specific, using survey data and models that estimate density using predictive environmental factors



CetMap Working Group tasks

1. Cetacean Data Availability Analysis

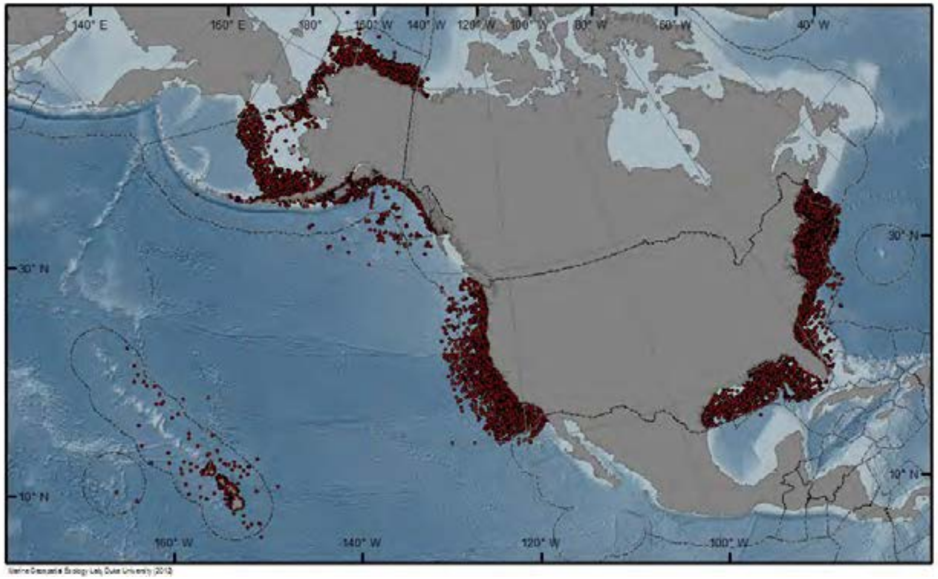
2. New Modeling Efforts

3. Biologically Important Areas

Cetacean data & model discovery tool

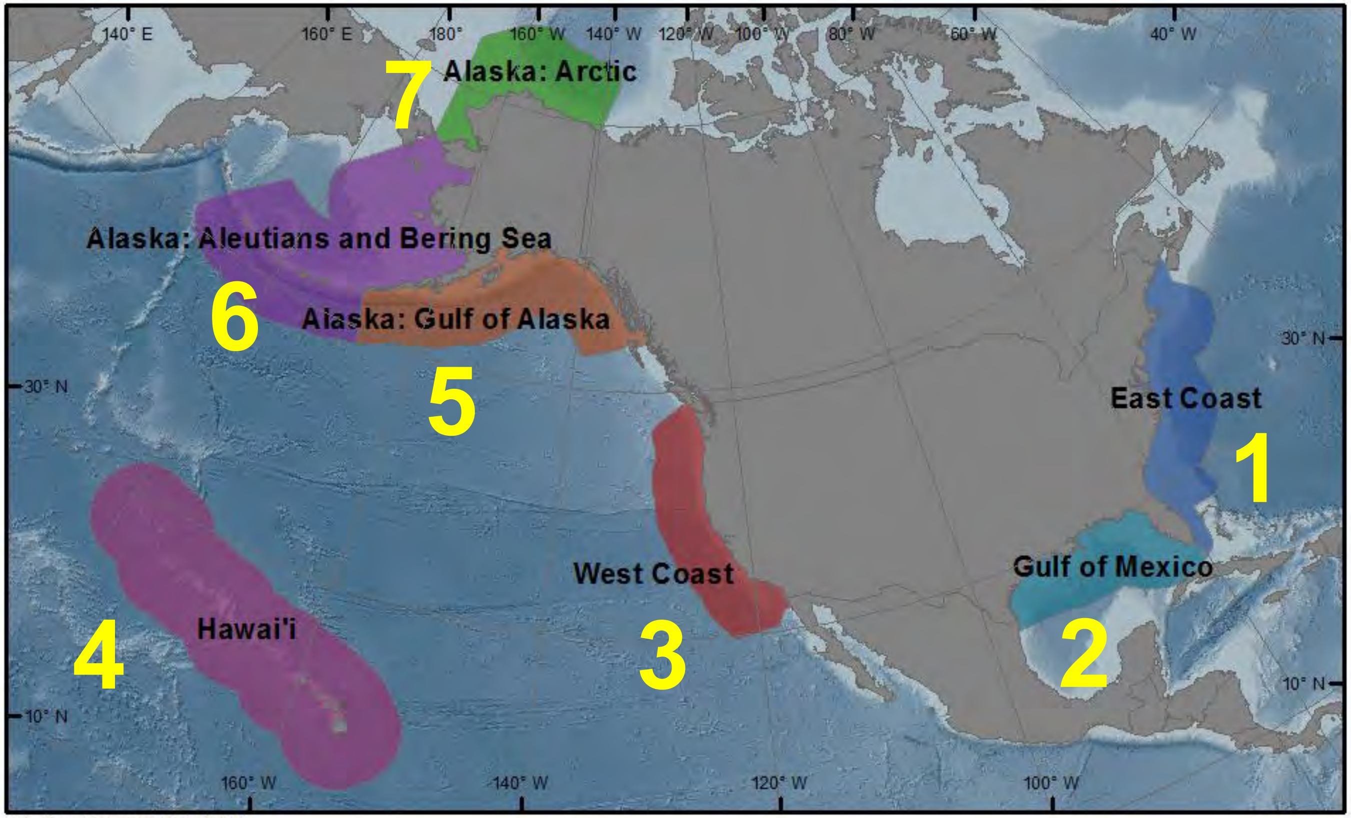
Geospatial Analysis to support the marine mammal acoustics working groups

- Assessment of available data
  - Spatial / regional gaps
  - Temporal / seasonal gaps
- Assessment of available models



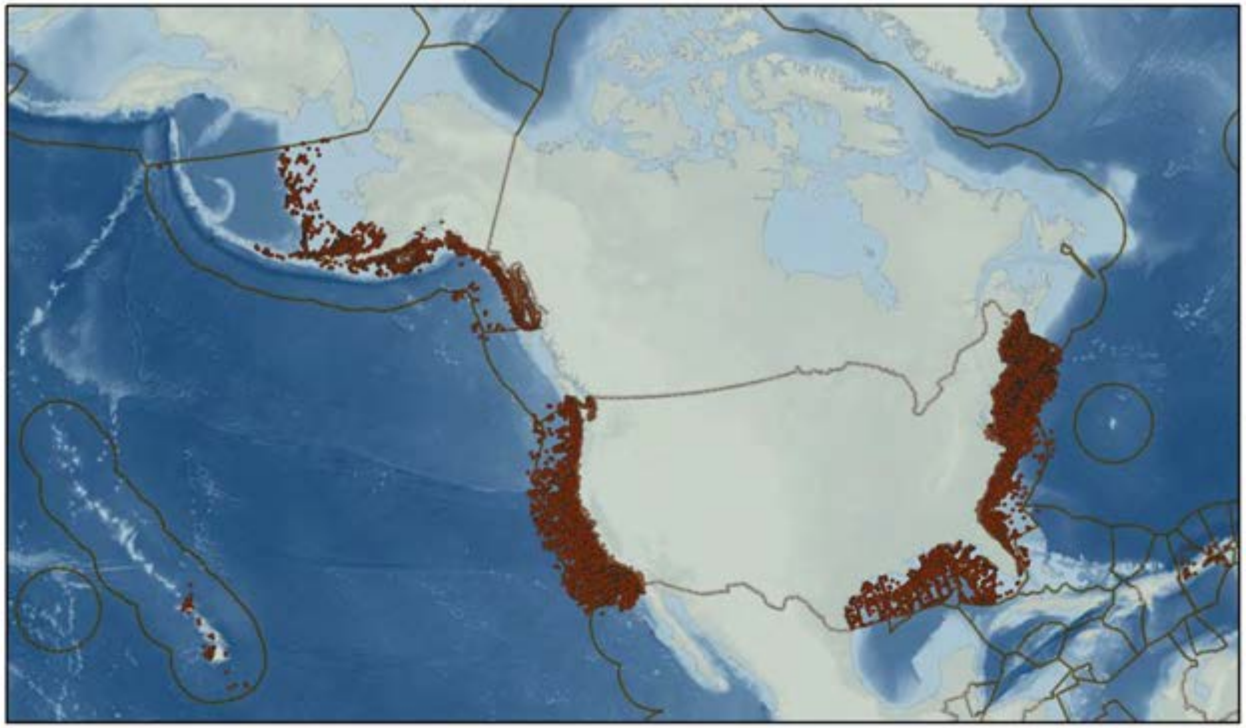
Task 1: Cetacean data availability analysis

7 working regions



Marine Geospatial Ecology Lab, Duke University (2011)

Cetacean observations in US Territorial Waters (+50 miles)

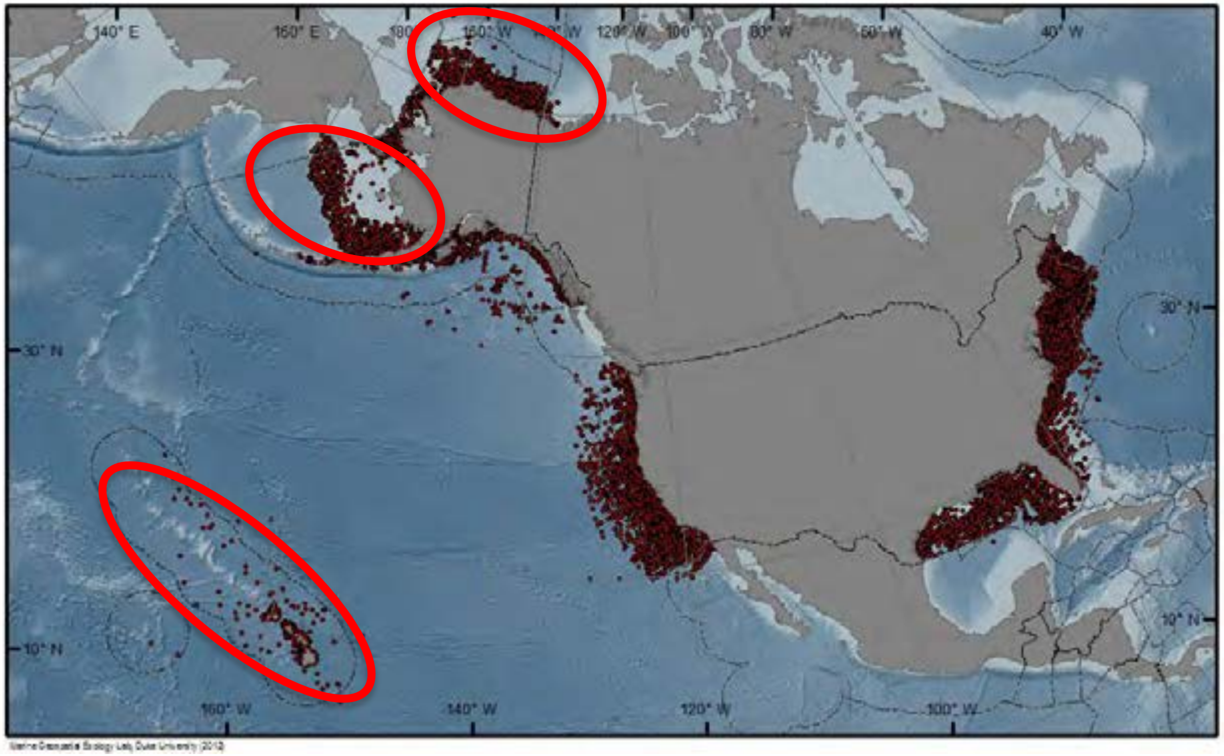


OBIS-SEAMAP Cetacea records: ~141,000

Observation types within Cetacea:

Observation Type	**Record Count**
point observations	90K
point acoustics / calls	29K
telemetry track	22K

Task 1: Cetacean data availability analysis



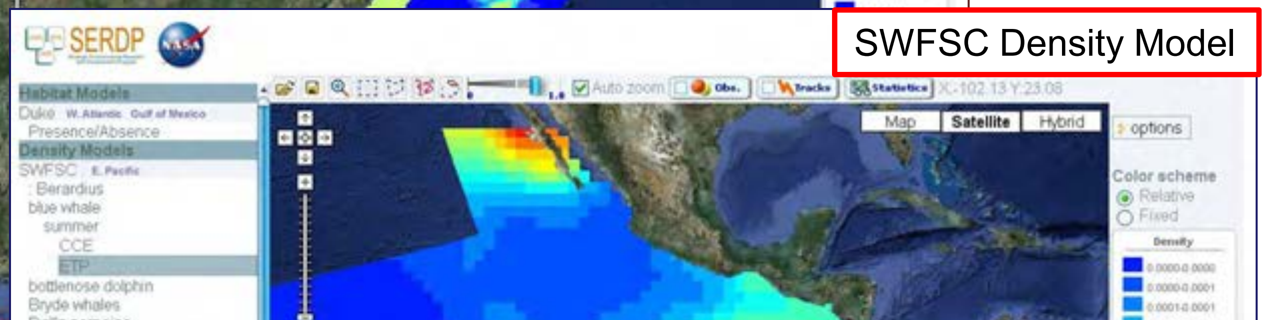
Spring 2011: 141,500

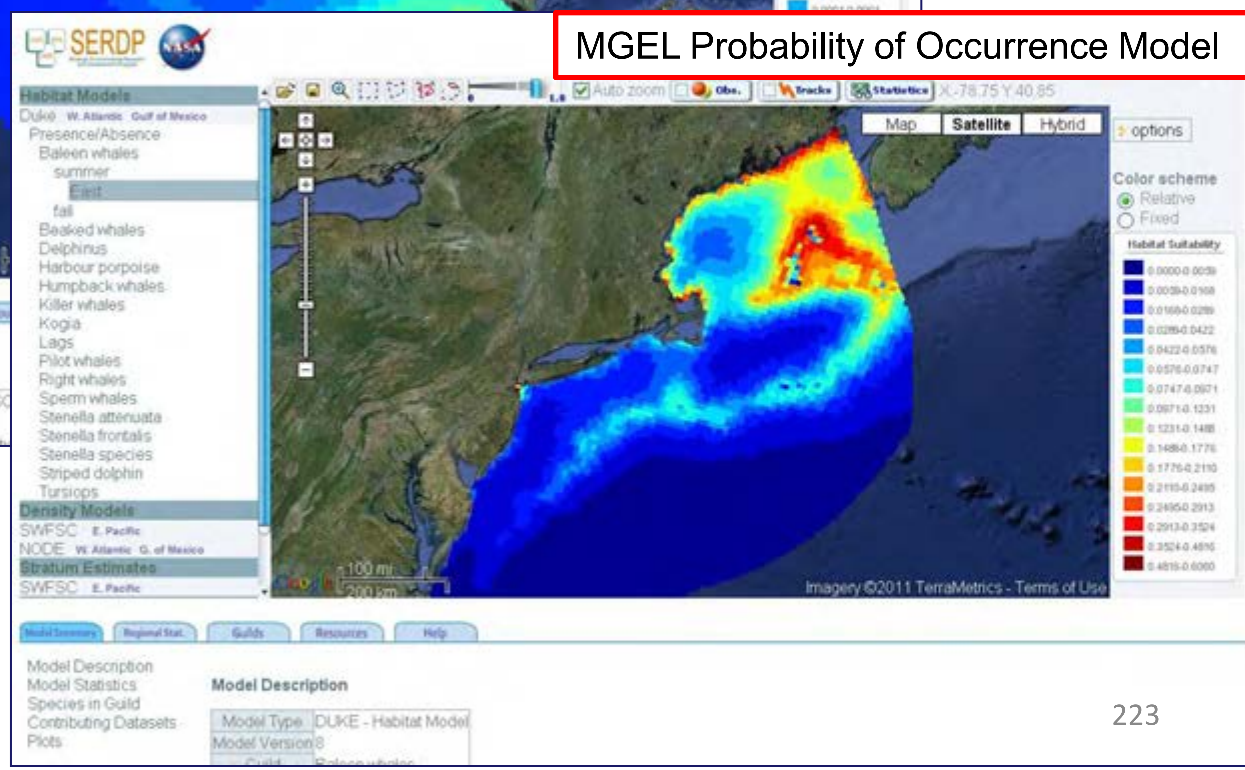
Spring 2012: 172,885

~31,400 additional observations located

~22% increase

Multiple habitat/density models from different projects

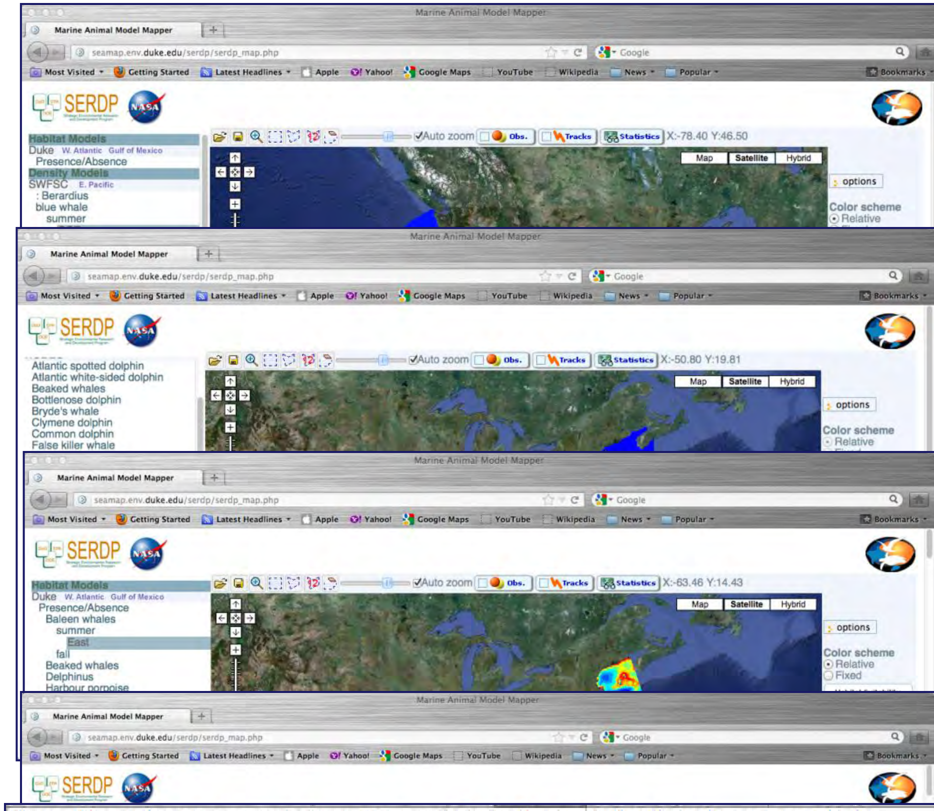




Inventory of existing models

Cetacean data hierarchy

1. Habitat-based Density
2. Stratified Density
3. Probability of Occurrence
4. Records Exist
5. Expert-based



Please add any other cetacean species known to ever exist in the Aleutians Gulf of Alaska that are not on this list.
Note whether any of the species listed below are known to NOT inhabit the Aleutians/ Gulf of Alaska.
If it is unknown whether a species is present in the in the Gulf of Alaska , leave it on the list and

Balaena mysticetus	No	
Balaenoptera acutorostrata	Yes	
Balaenoptera borealis	Yes	
Balaenoptera musculus	Yes	But very rare
Balaenoptera physalus	Yes	
Berardius bairdii	Yes	
Delphinapterus leucas	Yes	
Eschrichtius robustus	Yes	
Eubalaena japonica	Yes	But very rare
Grampus griseus	Unknown	
Lagenorhynchus obliquidens	Yes	
Lissodelphis borealis	Yes	Rare - only two sightings
Megaptera novaeangliae	Yes	
Mesoplodon stejnegeri	Yes	
Monodon monoceros	No	
Orcinus orca	Yes	
Phocoena phocoena	Yes	
Phocoenoides dalli	Yes	
Ziphius cavirostris	Unknown	
Physeter macrocephalus	Yes	

Regional Data Sheets

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total Data+Model Months
Balaenoptera acutorostrata	HD	HD	HD	HD	HD	HD	HD/PO	HD/PO	HD/PO	HD/PO	HD/PO	HD	12
Balaenoptera borealis	HD	HD	HD	HD	HD	HD	HD/PO	HD/PO	HD/PO	HD/PO	HD/PO	HD	12
Balaenoptera edeni	NoData	NoData	NoData	NoData	NoData	NoData	PO	PO	PO	PO	PO	NoData	5
Balaenoptera musculus	REC	1	NoData	3	4	1	2	1	NoData	4	1	NoData	9
Balaenoptera physalus	HD	HD	HD	HD	HD	HD	HD/PO	HD/PO	HD/PO	HD/PO	HD/PO	HD	12
Delphinus delphis	HD	HD	HD	HD	HD	HD	HD/PO	HD/PO	HD/PO	HD	HD	HD	12
Eubalaena glacialis	HD	HD	HD	HD	HD	HD	HD/PO	HD/PO	HD/PO	HD	HD	HD	12
Feresa attenuata	NoData	1	NoData	NoData	NoData	NoData	3	1	NoData	NoData	NoData	NoData	3
Globicephala macrorhynchus	HD/PO	HD/PO	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD/PO	12
Globicephala melas	HD/PO	HD/PO	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD/PO	12
Grampus griseus	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	12
Hyperoodon ampullatus	HD												12
Kogia breviceps	HD												12
Kogia sima	HD												12
Kogia spp.	HD												
Lagenodelphis hosei	NoData												1
Lagenorhynchus acutus	HD												12
Lagenorhynchus albirostris	NoData												11
Megaptera novaeangliae	HD/PO	HD/PO	HD	HD	HD	HD	HD/PO	HD/PO	HD/PO	HD/PO	HD/PO	HD/PO	12
Mesoplodon bidens	HD	HD	HD	HD	HD	HD	HD/PO	HD/PO	HD/PO	HD	HD	HD	12
Mesoplodon densirostris	HD	HD	HD								HD	HD	12
Mesoplodon europaeus	HD	HD	HD								HD	HD	12
Mesoplodon mirus	HD	HD	HD								HD	HD	12
Mesoplodon spp.	HD	HD	HD	HD	HD	HD	HD/PO	HD/PO	HD/PO	HD	HD	HD	
Orcinus orca	NoData	NoData	1	1	6	1	5	8	8	2	NoData	1	9
Peponocephala electra	NoData	NoData	NoData	NoData	NoData	2	NoData	NoData	1	NoData	NoData	NoData	2
Phocoena phocoena	HD	HD	HD	HD	HD	HD	HD/PO	HD/PO	HD/PO	HD/PO	HD/PO	HD	12
Physeter macrocephalus	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	12
Pseudorca crassidens	2	NoData	1	NoData	1	NoData	1	6	1	NoData	1	NoData	7
Stenella attenuata	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	12
Stenella clymene	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	12
Stenella coeruleoalba	HD	HD	HD	HD	HD	HD	HD/PO	HD/PO	HD/PO	HD	HD	HD	12
Stenella frontalis	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	12
Stenella longirostris	NoData	NoData	1	1	NoData	NoData	3	2	NoData	NoData	NoData	NoData	4
Steno bredanensis	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	12

An accounting of data availability in space & time

Monthly summaries

EC	Stenella frontalis	25	42	31	32	11	18	39	109	63	21	4	NoData
EC	Stenella longirostris	NoData	NoData	1	1	NoData	NoData	3	2	NoData	NoData	NoData	NoData
EC	Steno bredanensis	1	NoData	NoData	1	NoData	3	17	1	3	1	NoData	NoData
EC	Tursiops truncatus	2014	1577	1416	2381	736	690	2694	2225	478	1594	650	470
EC	Ziphius cavirostris	1	2	1	NoData	1	1	28	10	NoData	1	NoData	NoData

CetMap Working Group tasks

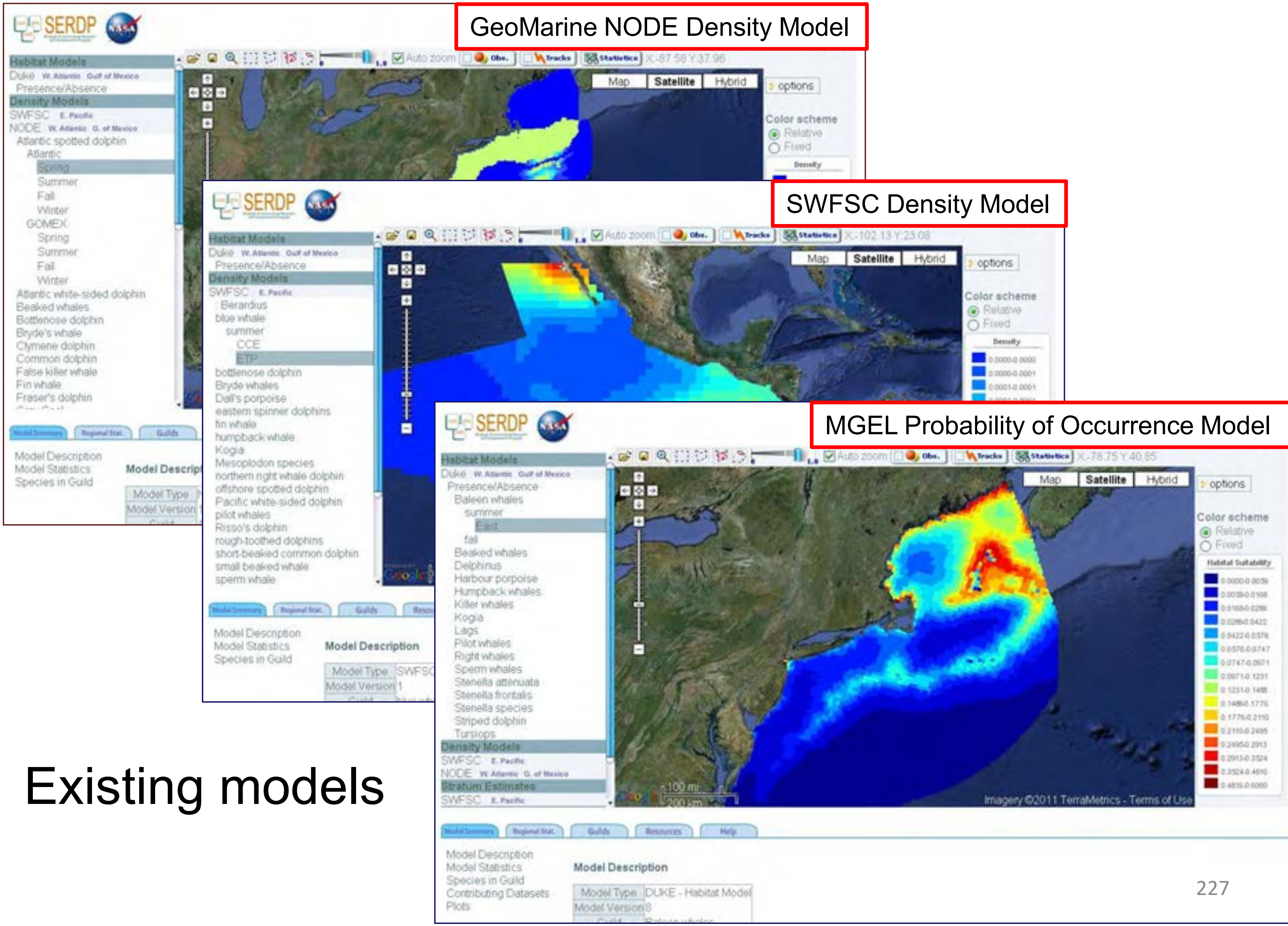
1. Cetacean Data Availability Analysis

2. New Modeling Efforts

3. Biologically Important Areas

Cetacean data & model discovery tool

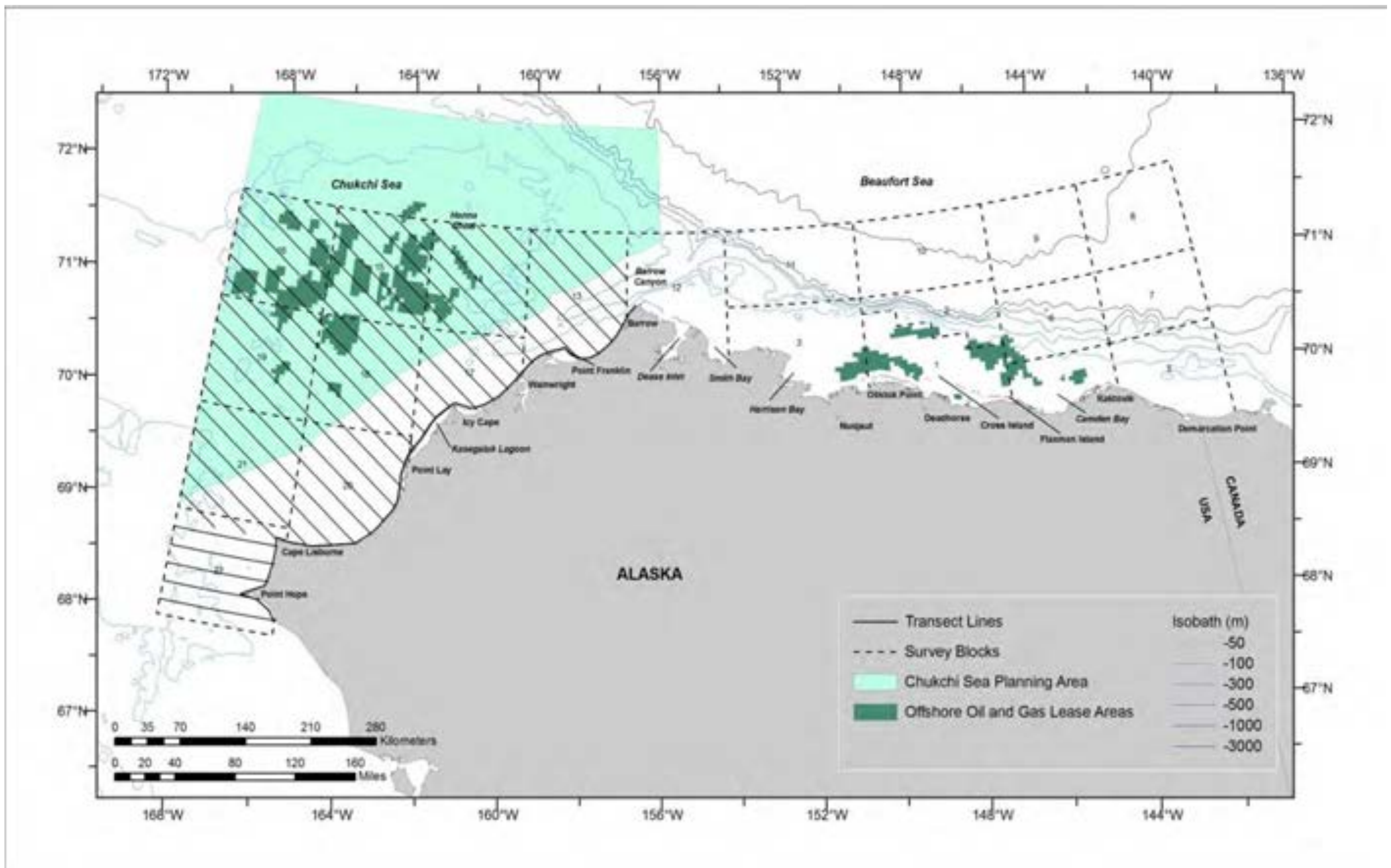
Multiple habitat/density models from different projects



Existing models

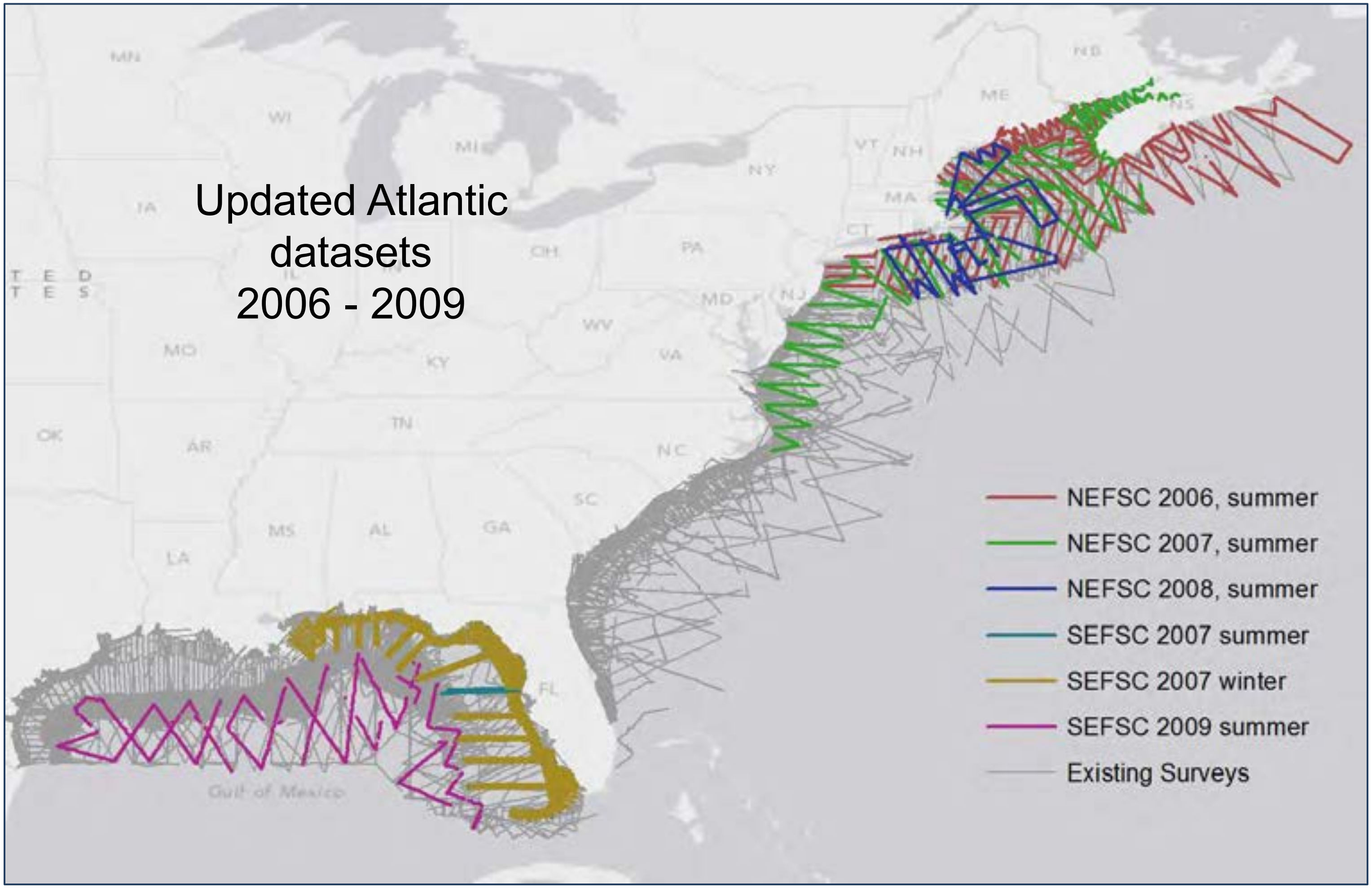
Arctic Habitat-based Density Models in-progress

- Bowhead Whales
- Gray Whales
- Belugas



Ferguson pers. comm.

Habitat Density (HD) models in progress: EC & GoMEX



CetMap Working Group tasks

1. Cetacean Data Availability Analysis

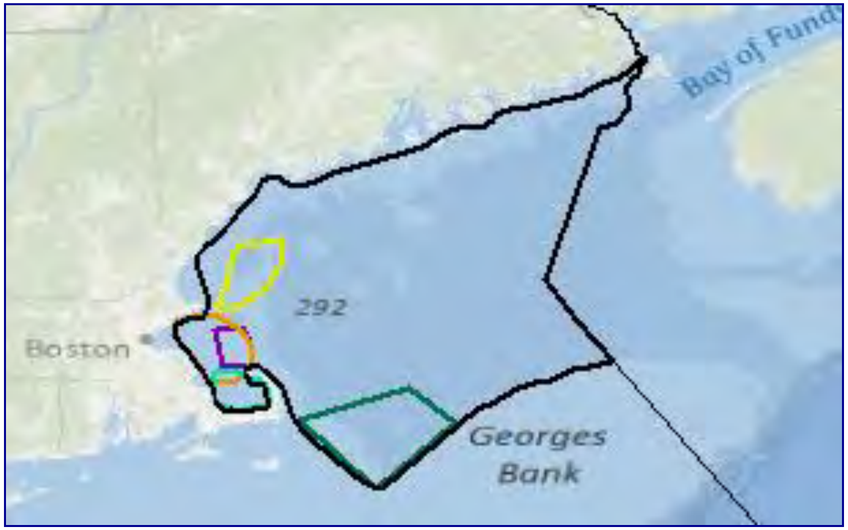
2. New Modeling Efforts

3. Biologically Important Areas

Cetacean data & model discovery tool

Biologically Important Areas Criteria

- Reproductive Areas/Times
- Feeding Areas/Times
- Migratory Corridors
- Small or Resident Populations



CetMap Important Areas: East Coast

Erin LaBrecque

Table of Contents

Megaptera novaeangliae (Humpback Whale)

Criteria: migratory species

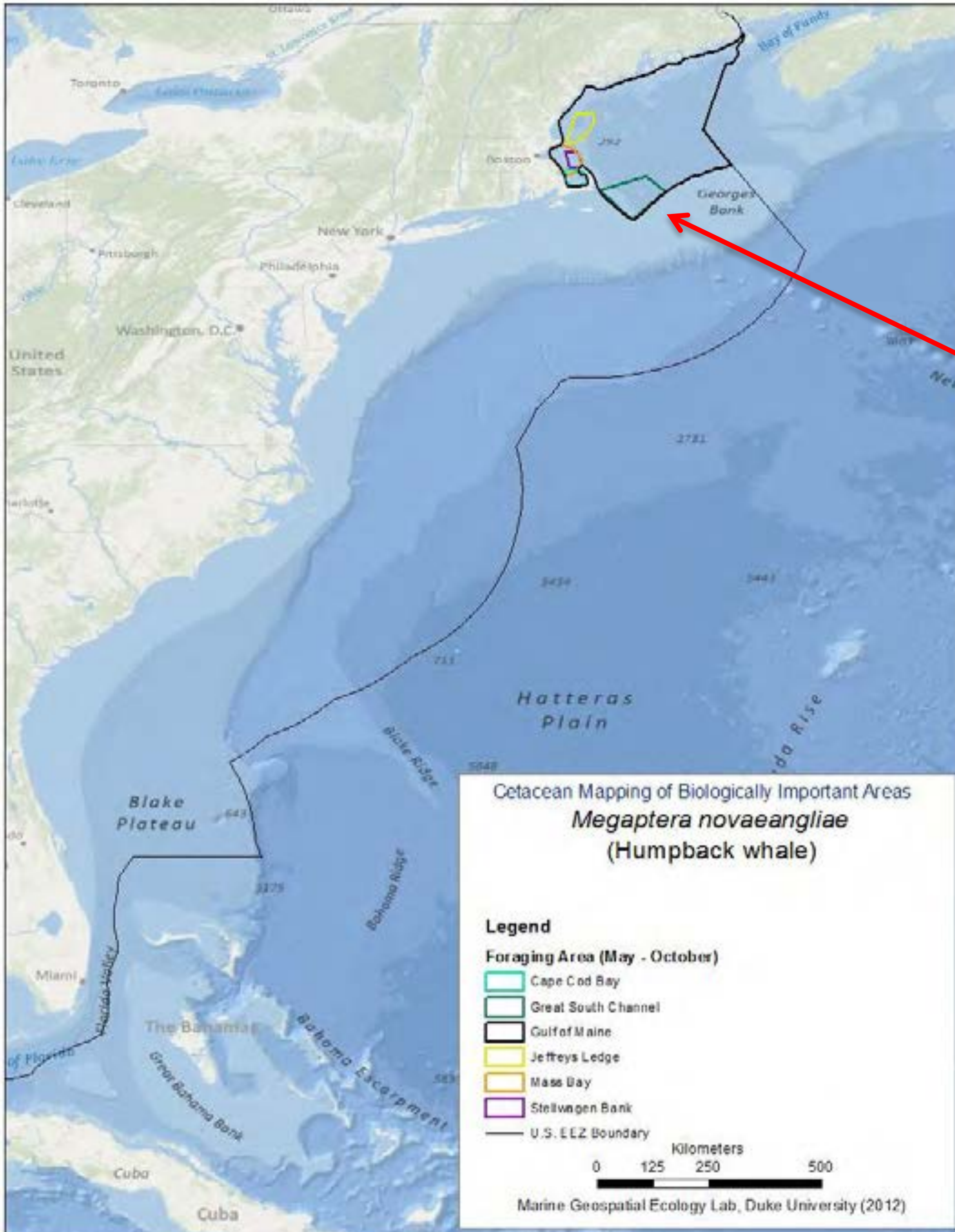
General

The Gulf of Maine feeding stock is the predominant subpopulation of humpback whales in the U.S. Atlantic Exclusive Economic Zone (EEZ) (Waring *et al.* 2010). Other areas of feeding subpopulations in the North Atlantic include Iceland-Denmark, Southwest Greenland, Southern Labrador and east of Newfoundland, and the Gulf of the St. Lawrence (Katona and Beard 1990, Perry *et al.* 1999). Whales from all the North Atlantic feeding areas migrate to the calving and breeding grounds off the West Indies in the winter (Mattila *et al.* 1989, 1994).

Feeding

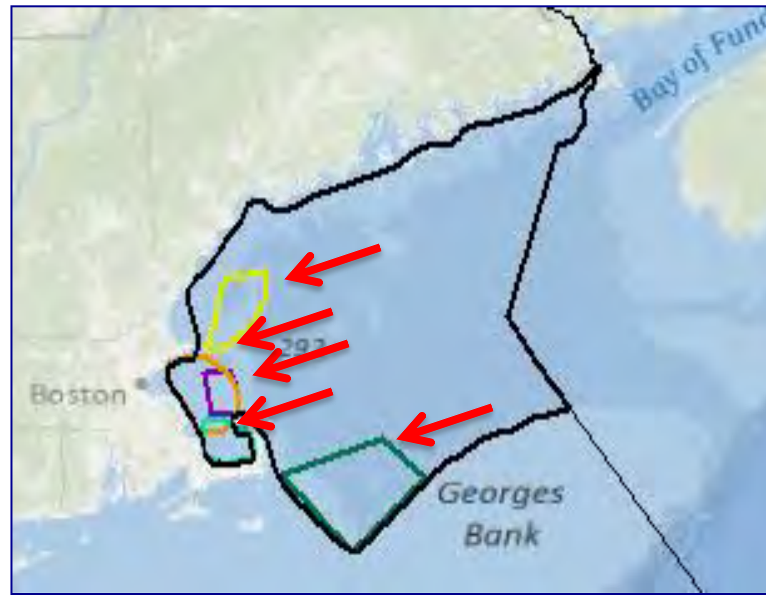
Humpback whales show strong sight fidelity to their feeding grounds that is maternally directed (Clapham and Mayo 1987). Humpbacks feed in the Gulf of Maine from May through October although they have been seen feeding in earlier and later months (personal communication Allison Henry, NEFSC). Studies of humpback whale ecology in their feeding grounds in the Gulf of Maine have been ongoing since the mid-1970s (Clapham and Mayo 1987, 1990, Clapham *et al.* 1993, Friedlaender *et al.* 2009, Hazen *et al.* 2009, Payne *et al.* 1986, Weinrich 1991, Weinrich *et al.* 1997, Weinrich and Kuhlberg 1991). The distribution of humpbacks in the Gulf of Maine is related to their prey (herring and sand lance) densities and shifts accordingly. Payne *et al.* (1986) showed that humpbacks shifted from their primary feeding grounds on Georges Bank and the northern Gulf of Maine to Stellwagen Bank and the Great South Channel in response to shifts the distribution of sand lance. Because prey densities respond to oceanographic influences that can be ephemeral, the entire Gulf Maine is considered feeding grounds for humpback whales.

Biologically Important Areas



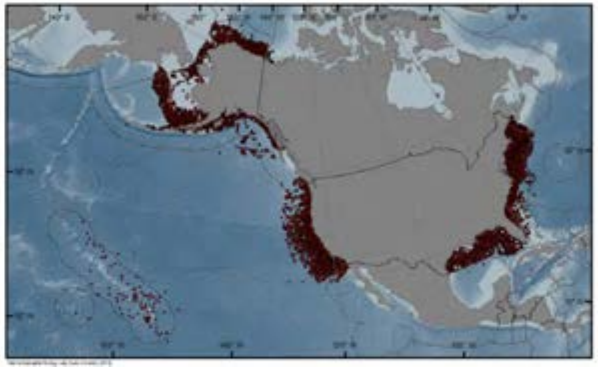
Megaptera novaeangliae
Humpback whale

Important foraging areas



CetMap Data and Model Overview

- ~173,000 records collated
  - ~200 datasets represented
- 115 region + species + season models
  - New Arctic, GoMEX and Atlantic models in process
- 56 stratified density estimates identified
- 70 Biologically Important Areas identified



CetMap Working Group tasks

1. Cetacean Data Availability Analysis

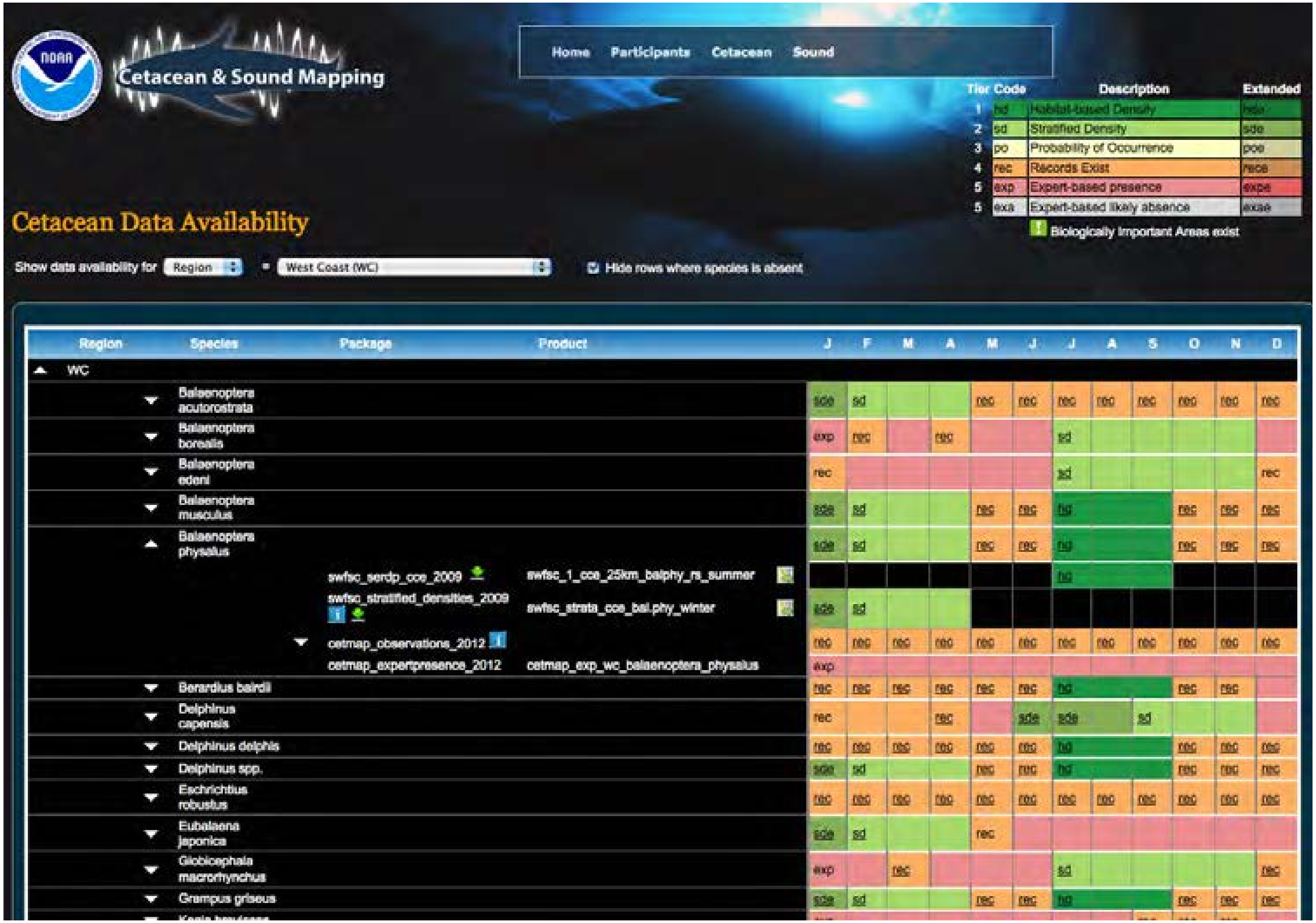
2. New Modeling Efforts

3. Biologically Important Areas

Cetacean data & model discovery tool

Cetacean Data Availability

Purpose: to provide a single tool to discover the available data and models



Take-home Messages

- CetMap project provides a one-stop data and model discovery system;
- CetMap maximizes the value of existing data & modeling efforts.
- CetMap is adaptable and will allow updates for new data & model products.

http://cetsound.noaa.gov

Thank you!

http://seamap.env.duke.edu/

Marine Geospatial Ecology Lab
Nicholas School of the Environment
Duke University

Presentation #4

NJDEP Ocean/Wind Power Ecological Baseline Studies

Mid-Atlantic Workshop

July 24, 2012

Gary A. Buchanan, Ph.D.
Office of Science
New Jersey Department of Environmental Protection

Ocean/Wind Power Ecological Baseline Studies

January 2008 – December 2009

FINAL REPORT

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
OFFICE OF SCIENCE

Volume I: Overview, Summary, and Application

Prepared by:
Geo-Marine, Inc.
2201 K Avenue, Suite A2
Plano, Texas 75074
Phone: 972.423.5480
Fax: 972.422.2736
Web: www.geo-marine.com

July 2010 | GEO-MARINE GMI
A Subsidiary of Applied Research Associates, Inc.

Specific Objectives – Fill Data Gaps

- In the Study Area, what are the abundance, distribution, and utilization of:
  - Bird Species (flight behavior)
  - Marine Mammals
  - Sea Turtles
- What areas are more/less suitable for renewable energy projects based on potential ecological/environmental impacts?
- Two year study (2008-2009): ~$7M

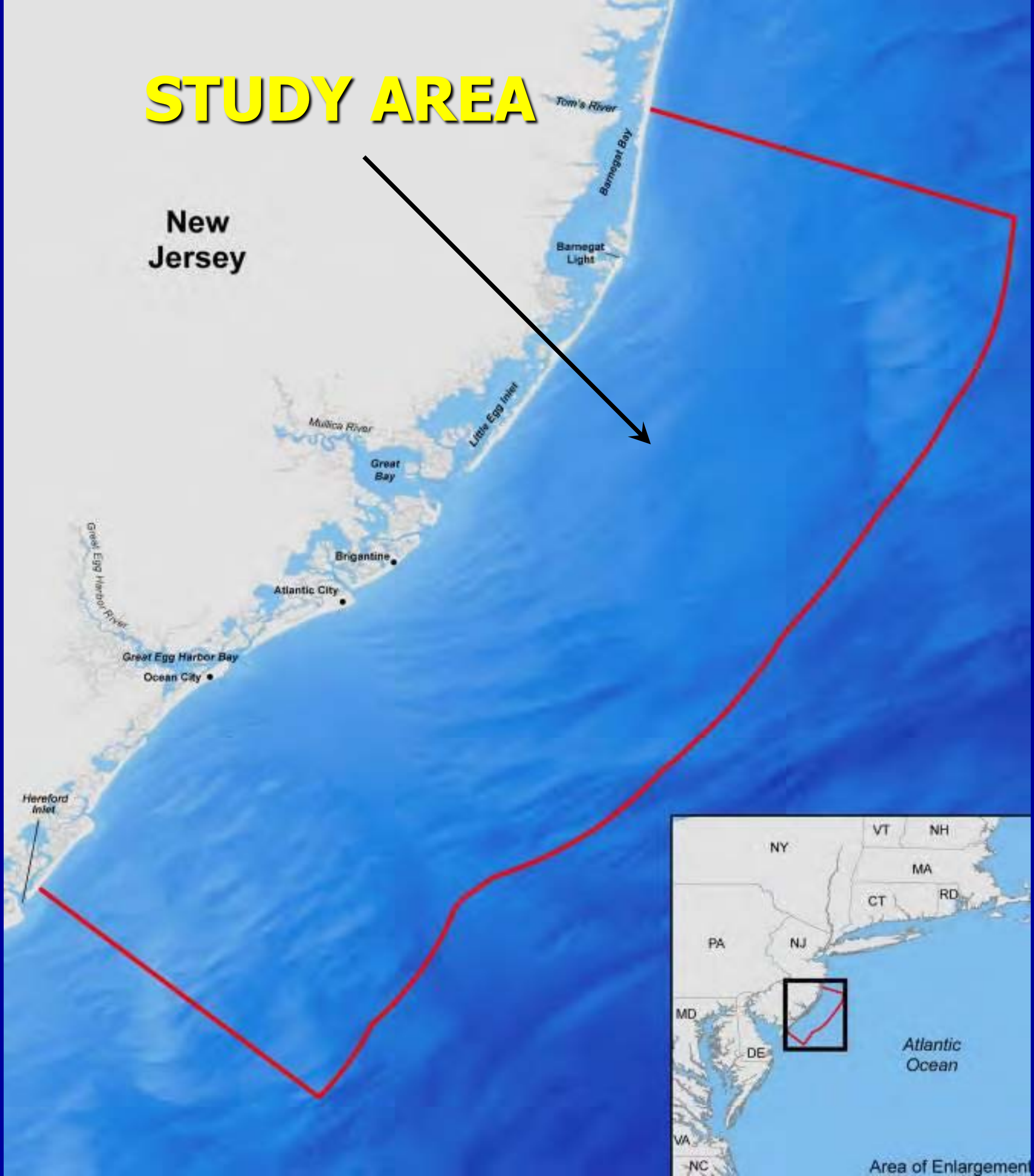

STUDY AREA
Tom's River
Barnegat Bay
New Jersey
Barnegat Light
Little Egg Inlet
Mullica River
Great Bay
Great Egg Harbor River
Brigantine
Atlantic City
Great Egg Harbor Bay
Ocean City
Hereford Inlet
VT
NH
NY
MA
CT
RD
PA
NJ
MD
DE
Atlantic Ocean
VA
NC
Area of Enlargement


Photo by Tony Leukering, GMI

Field Studies & Data Compilation

- AVIAN:
  - Small & Lg Vessel Strip Transect Surveys
  - Aerial Surveys
  - Radar: Land, Water and NEXRAD; TI
- Marine Mammal
  - Vessel Surveys
  - Aerial Surveys
  - Passive Acoustic Surveys
- Sea Turtle

245

Field Studies & Data Compilation

- Bats – TI and Acoustic
- Supporting Studies:
  - Oceanographic
  - Fish and Fisheries Data
  - Benthic Mapping
  - GIS & Modeling





J

Avian Radar

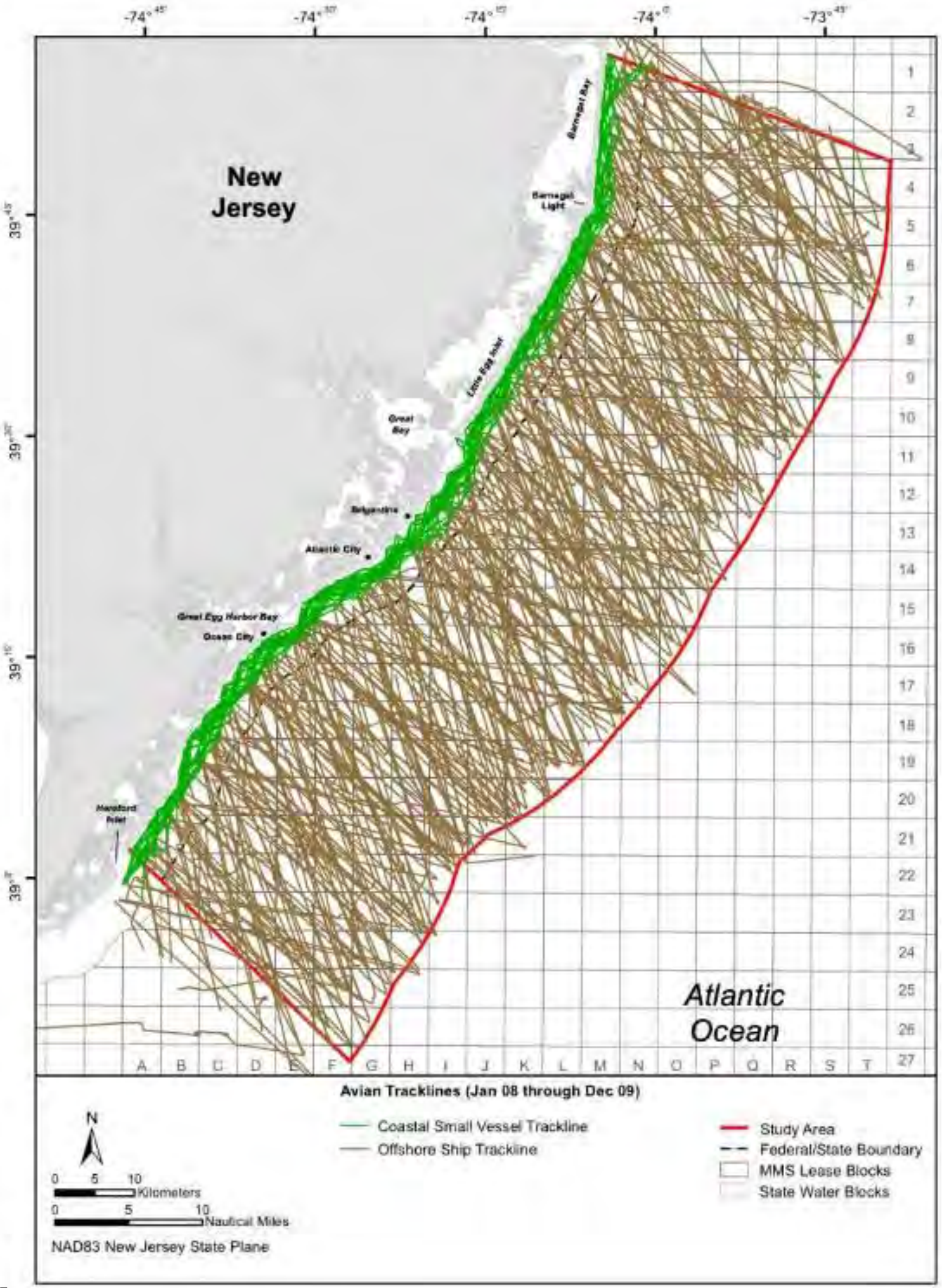
248


GEO-MARINE INCORPORATED
MARS
Mobile Avian Radar System
972-423-5480 • www.geo-marine.com
• BIRD-AIRCRAFT STRIKE HAZARD (BASH) RISK MANAGEMENT
• REMOTE ENVIRONMENTAL MONITORING SERVICES
• REAL-TIME BIRD MIGRATION SURVEYS


R/V Robert E.

J

249



J

TOTAL SURVEY EFFORT 2008-2009

Bimonthly coastal and offshore surveys

Total km 18,183

<u>Total species:</u>

<u>153 avian</u>

<u>8 marine mammal</u>

<u>2 sea turtle</u>

Detected species

Five federally threatened or endangered species:

- North Atlantic right whale (*Eubalaena glacialis*)
- Fin whale (*Balaenoptera physalus*)
- Humpback whale (*Megaptera novaeangliae*)
- Leatherback turtle (*Dermochelys coriacea*)
- Loggerhead turtle (*Caretta caretta*)

Also:

- Minke whale (*Balaenoptera acutorostrata*)
- Bottlenose dolphin (*Tursiops truncatus*)
- Short-beaked common dolphin (*Delphinus delphis*)
- Harbor porpoise (*Phocoena phocoena*) and
- Harbor seal (*Phoca vitulina*)

Activity conducted pursuant to NOAA Permit No. 10014-02. Photo by Tony Leukering, GMI

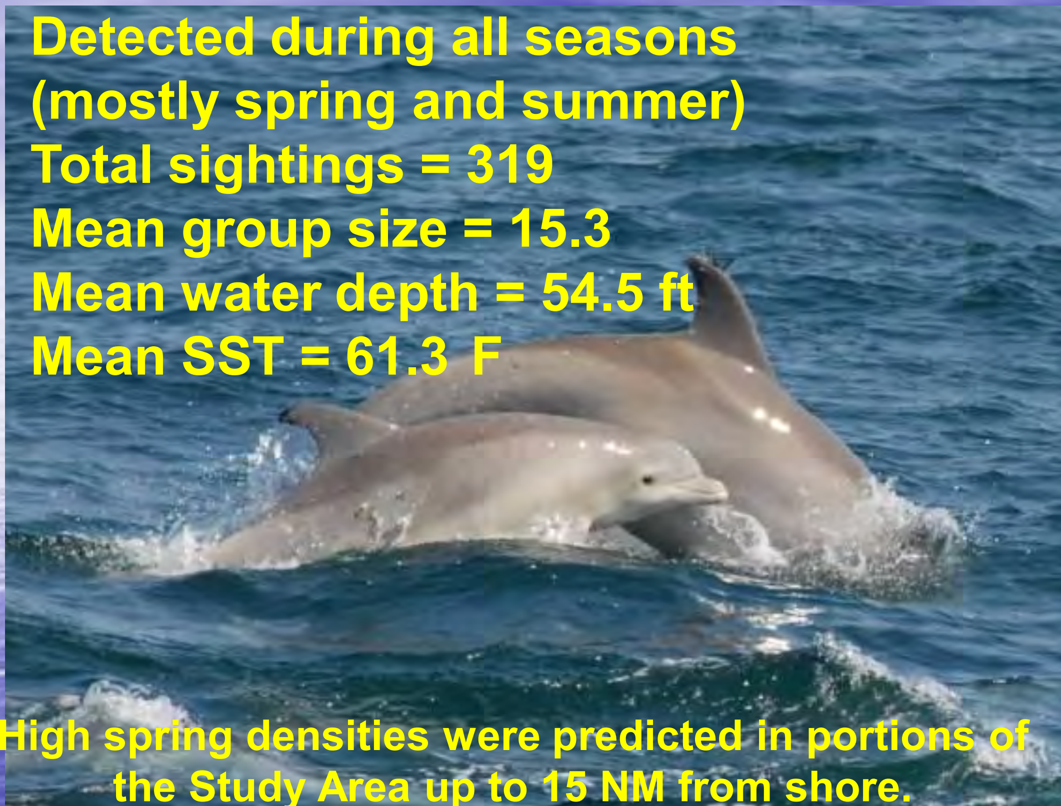
Data Analysis

- Marine Mammals and Sea Turtles: Conventional Distance Sampling (CDS, design-based approach) and Density Surface Modeling (DSM, model-based approach) methods were used to estimate abundance/density for these species or groups.

- Birds: Interpolation (e.g., kernel density), spatial regression, and generalized additive models (GAMs) were used to quantify the relationship between spatial covariates (e.g., bathymetric and distance based metrics) and birds.

J

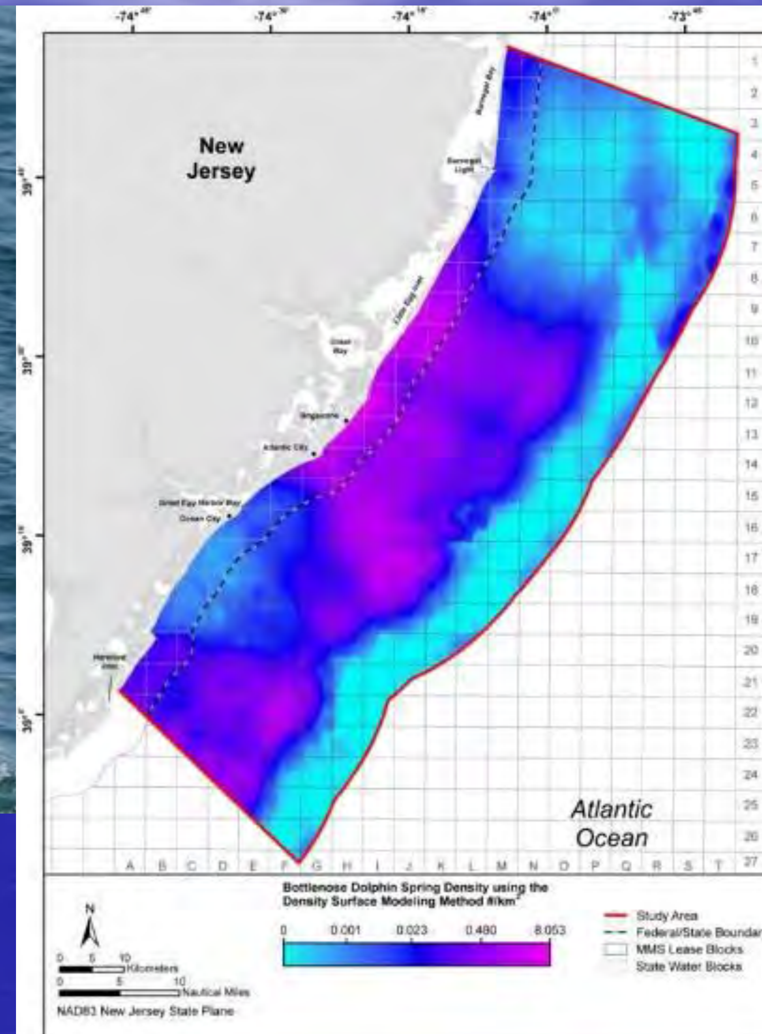
Bottlenose Dolphin



- **Detected during all seasons (mostly spring and summer)**
- **Total sightings = 319**
- **Mean group size = 15.3**
- **Mean water depth = 54.5 ft**
- **Mean SST = 61.3 F**

High spring densities were predicted in portions of the Study Area up to 15 NM from shore.

Peak densities were predicted in State waters off Atlantic City north to Brigantine and Little Egg Inlet.

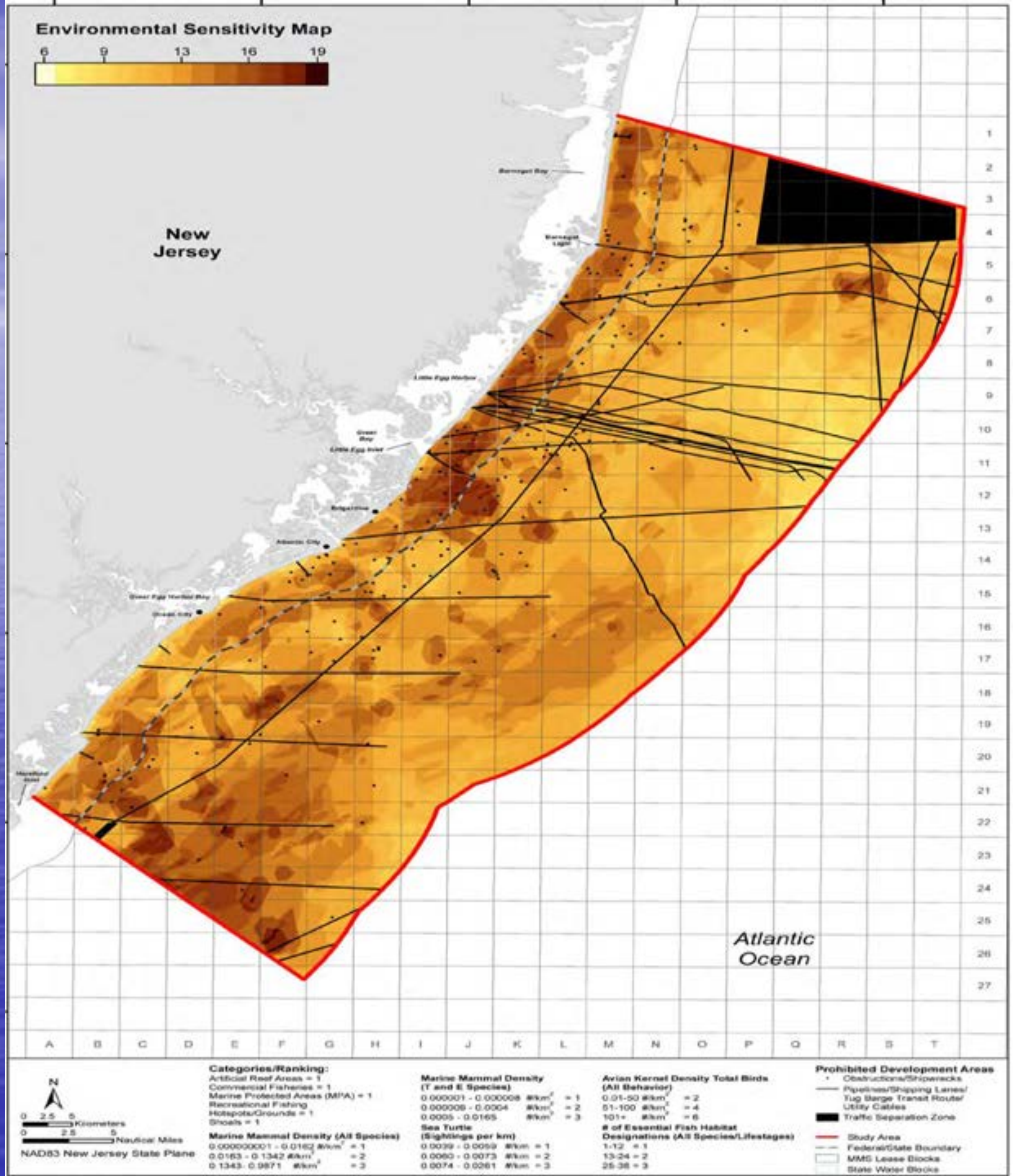


Spring abundance = 722 animals

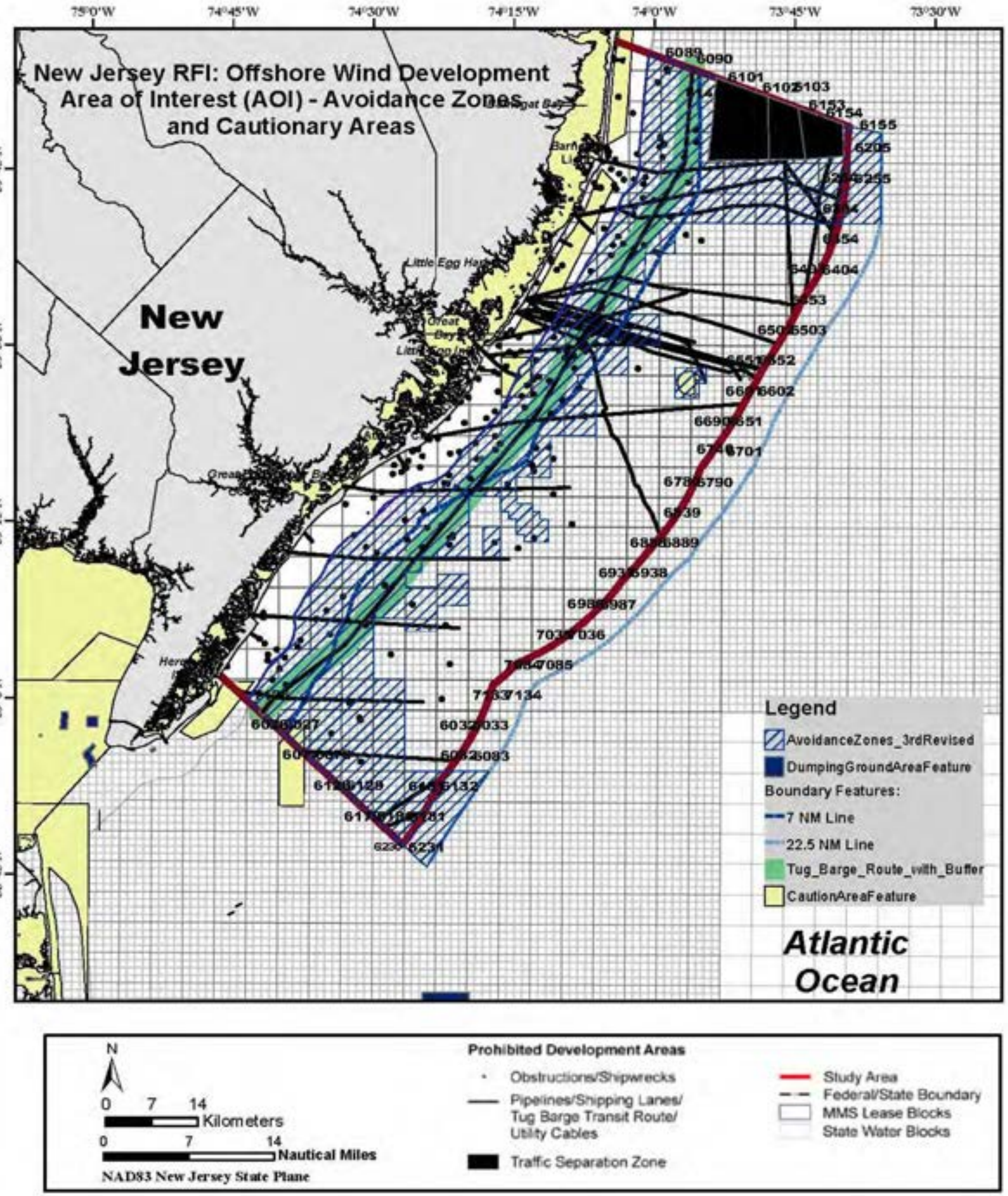
J

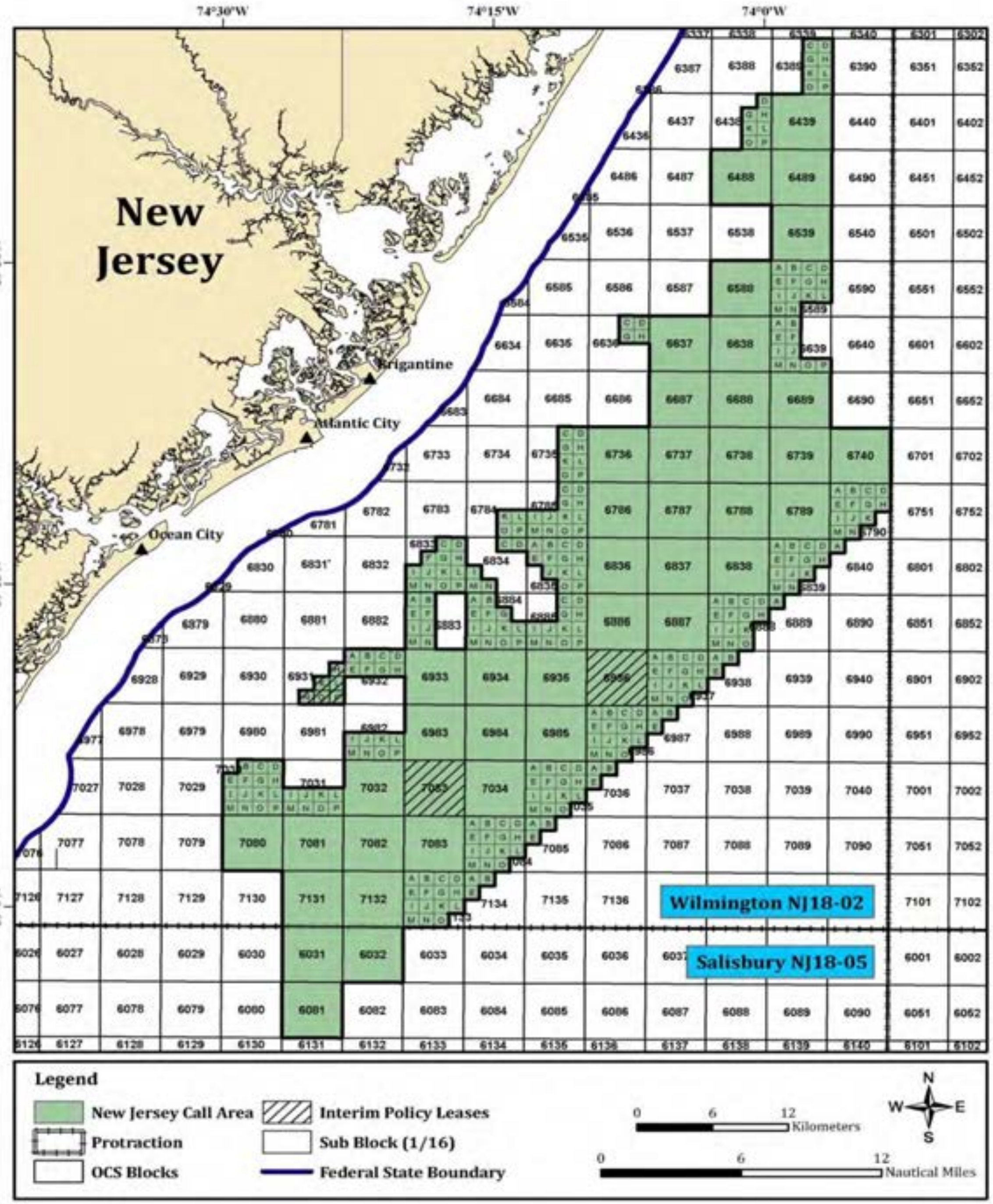
Sensitivity Map

- Simple weighting of GIS layers by natural & physical resources
- More heavily shaded areas indicate greater potential for impacts
- Used for input to BOEMRE for *Call for Information and Nominations for Commercial Leasing for Wind Power on the Outer Continental Shelf Offshore New Jersey*



Environmental Sensitivity Map
6 9 13 16 19
New Jersey
Atlantic Ocean
N
0 2.5 5 Kilometers
0 2.5 5 Nautical Miles
NAD83 New Jersey State Plane
Categories/Ranking:
Artificial Reef Areas = 1
Commercial Fisheries = 1
Marine Protected Areas (MPA) = 1
Recreational Fishing Hotspots/Grounds = 1
Shoals = 1
Marine Mammal Density (All Species)
0.000000001 - 0.0162 #/km² = 1
0.0163 - 0.1342 #/km² = 2
0.1343- 0.9871 #/km² = 3
Marine Mammal Density (T and E Species)
0.000001 - 0.000008 #/km² = 1
0.000009 - 0.0004 #/km² = 2
0.0005 - 0.0165 #/km² = 3
Sea Turtle (Sightings per km)
0.0039 - 0.0059 #/km = 1
0.0060 - 0.0073 #/km = 2
0.0074 - 0.0261 #/km = 3
Avian Kernel Density Total Birds (All Behavior)
0.01-50 #/km² = 2
51-100 #/km² = 4
101+ #/km² = 6
# of Essential Fish Habitat Designations (All Species/Lifestages)
1-12 = 1
13-24 = 2
25-36 = 3
Prohibited Development Areas
Obstructions/Shipwrecks
Pipelines/Shipping Lanes/ Tug Barge Transit Route/ Utility Cables
Traffic Separation Zone
Study Area
Federal/State Boundary
MMS Lease Blocks
State Water Blocks


New Jersey RFI: Offshore Wind Development Area of Interest (AOI) - Avoidance Zones and Cautionary Areas
New Jersey
Atlantic Ocean
Legend
AvoidanceZones_3rdRevised
DumpingGroundAreaFeature
Boundary Features:
7 NM Line
22.5 NM Line
Tug_Barge_Route_with_Buffer
CautionAreaFeature
Prohibited Development Areas
Obstructions/Shipwrecks
Pipelines/Shipping Lanes/ Tug Barge Transit Route/ Utility Cables
Traffic Separation Zone
Study Area
Federal/State Boundary
MMS Lease Blocks
State Water Blocks
Kilometers
Nautical Miles
NAD83 New Jersey State Plane


74°30'W
74°15'W
74°0'W
39°30'N
39°15'N
39°0'N
New Jersey
Brigantine
Atlantic City
Ocean City
Wilmington NJ18-02
Salisbury NJ18-05
Legend
New Jersey Call Area
Interim Policy Leases
Protraction
Sub Block (1/16)
OCS Blocks
Federal State Boundary
0 6 12 Kilometers
0 6 12 Nautical Miles
N
W
E
S

Assist in Siting/Permitting Decisions

- Information and data can be used for:
  - Baseline data for projects in study area
  - Design of future monitoring
  - Regional surveys
  - Screening of potential sites (Phase II)
  - List of species - may be impacted esp. T&E
  - Estimate of relative scale of potential mitigation

Data Gaps/Future Studies

- Site-specific (footprint) studies - radar
- OWPEBS – potential template
- U.S. accepted techniques/methods – allows comparison between studies and for comprehensive geospatial analysis
- Migratory nature of protected species indicates the need for regional or coast-wide studies

Acknowledgments – Project Team

- **Geo-Marine, Inc.**
  - Dan Wilkinson, Ph.D, Chris Clark, Suzanne Bates, Amy Whitt, Kathleen Dudzinski, Ph.D., Sid Gauthreaux, Ph.D., Jarrod Santora, Ph.D., Jason See, Ph.D., and many others…
- **Rutgers University**
- **Cornell University**
- **Aqua Survey Inc.**
- **University of Delaware**

Acknowledgements (cont)

Technical Review Committee - NJDEP

- Coastal Management – Kevin Hassel
- ENSP: Dave Golden, Sharon Petzinger, Jeanette Bowers
- Marine Fisheries - Don Byrne
- Wildlife Management - Ted Nichols
- NJGS – Jane Uptegrove
- Permit Coordination – Ken Koschek
- Land Use Management – Mark Godfrey
- DSRT/Office of Science: Joe Bilinski, Gail Carter, Joel Pecchioli (SRP)

Acknowledgements (Federal)

- USFWS - Carlo Popolizio & Doug Forsell
- NOAA/NMFS
  - Gordon Waring, Ph.D.
  - Debra Palka, Ph.D.
  - Karen Greene
- MMS/BOEM - Will Waskes

NJDEP Office of Science website:

www.state.nj.us/dep/dsr/

Activity conducted pursuant to NOAA Permit No. 10014-02
Photo by Tony Leukering, GMI

Presentation #5

Science, Service, Stewardship

Survey Efforts:

Atlantic Marine Assessment Program for Protected Species (AMAPPS)

National Marine Fisheries Service

Northeast Fisheries Science Center

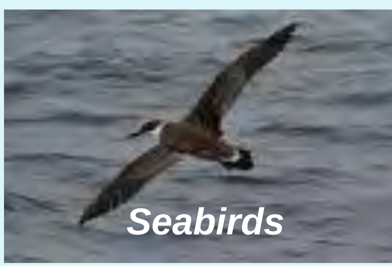
Southeast Fisheries Science Center

By

Dr. Debi Palka

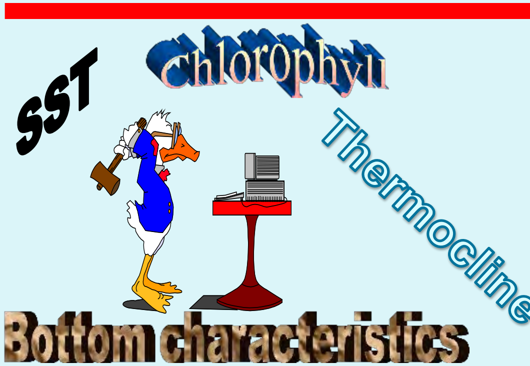
NOAA FISHERIES SERVICE

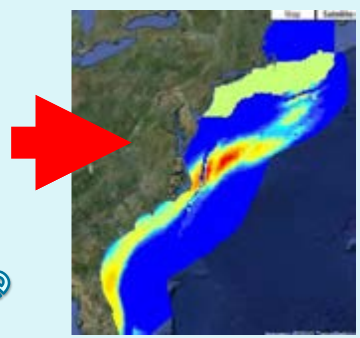
Atlantic Marine Assessment Program for Protected Species (AMAPPS) 2010 – 2014 (+?)



Quarterly collect distribution and abundance data via shipboard and aerial visual and acoustic surveys

Tag turtles, seals and seabirds to correct visual abundance data for animals not seen





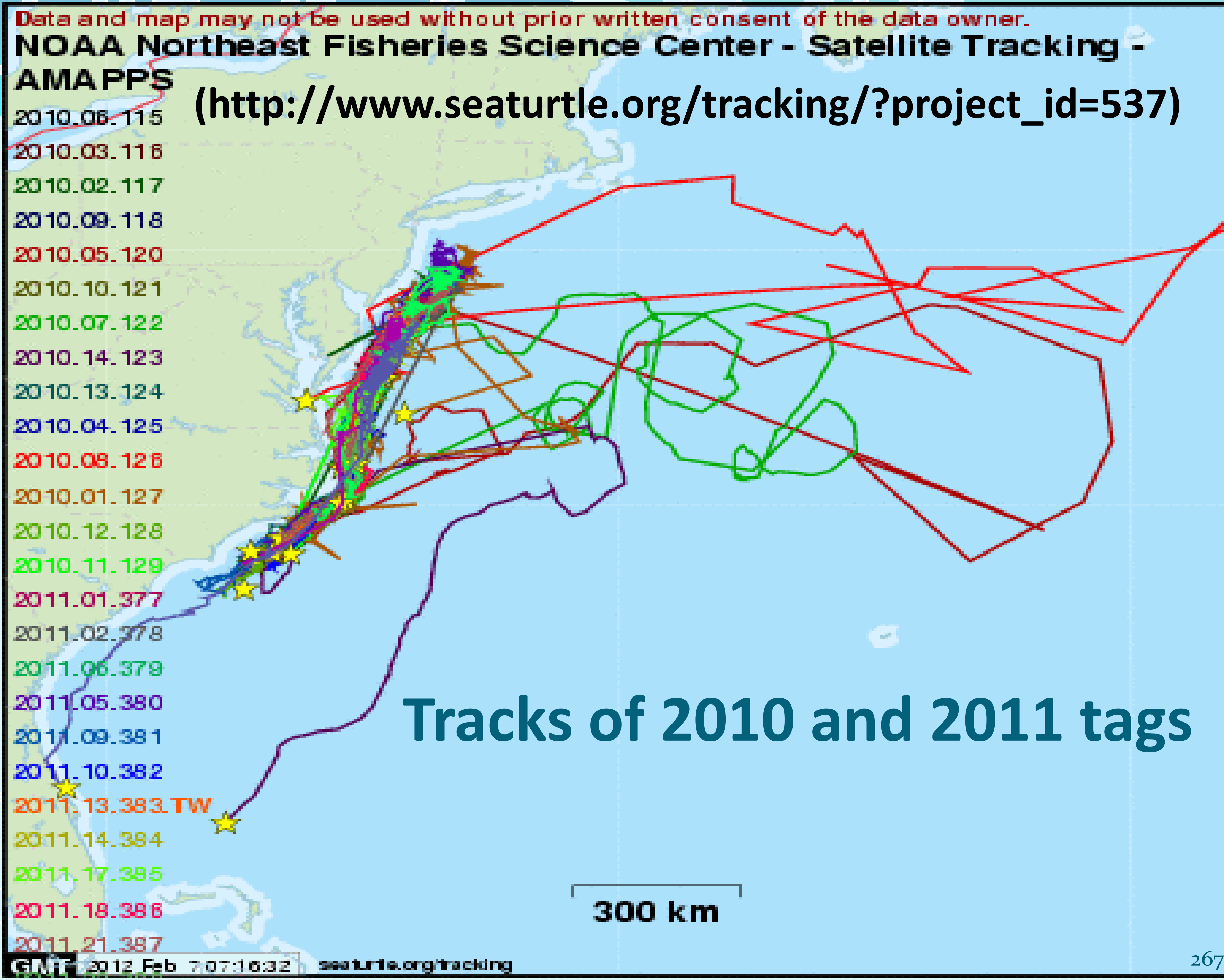
Model seasonal, spatially-explicit density estimates incorporating habitat characteristics

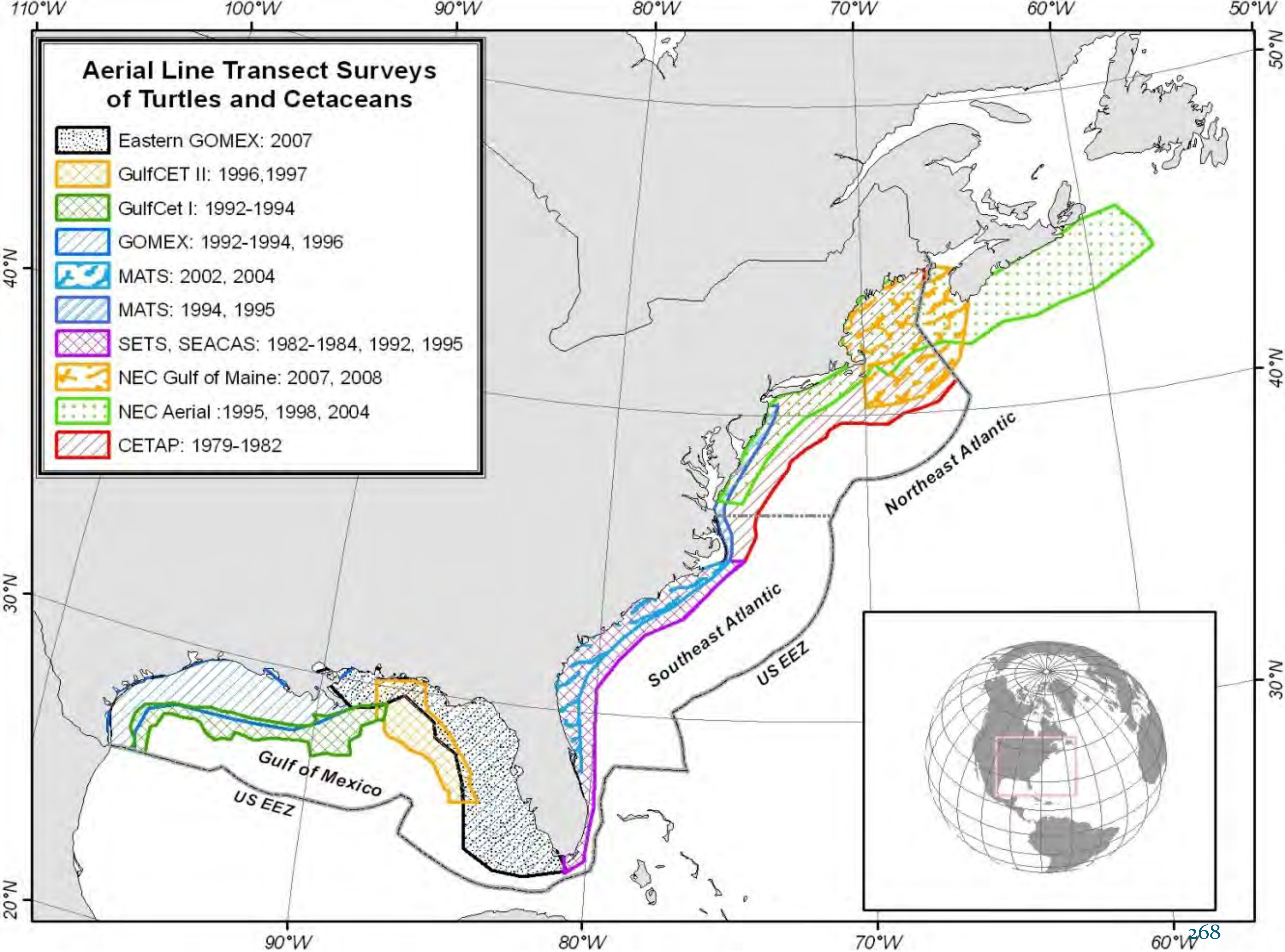
BOEM

NAVY

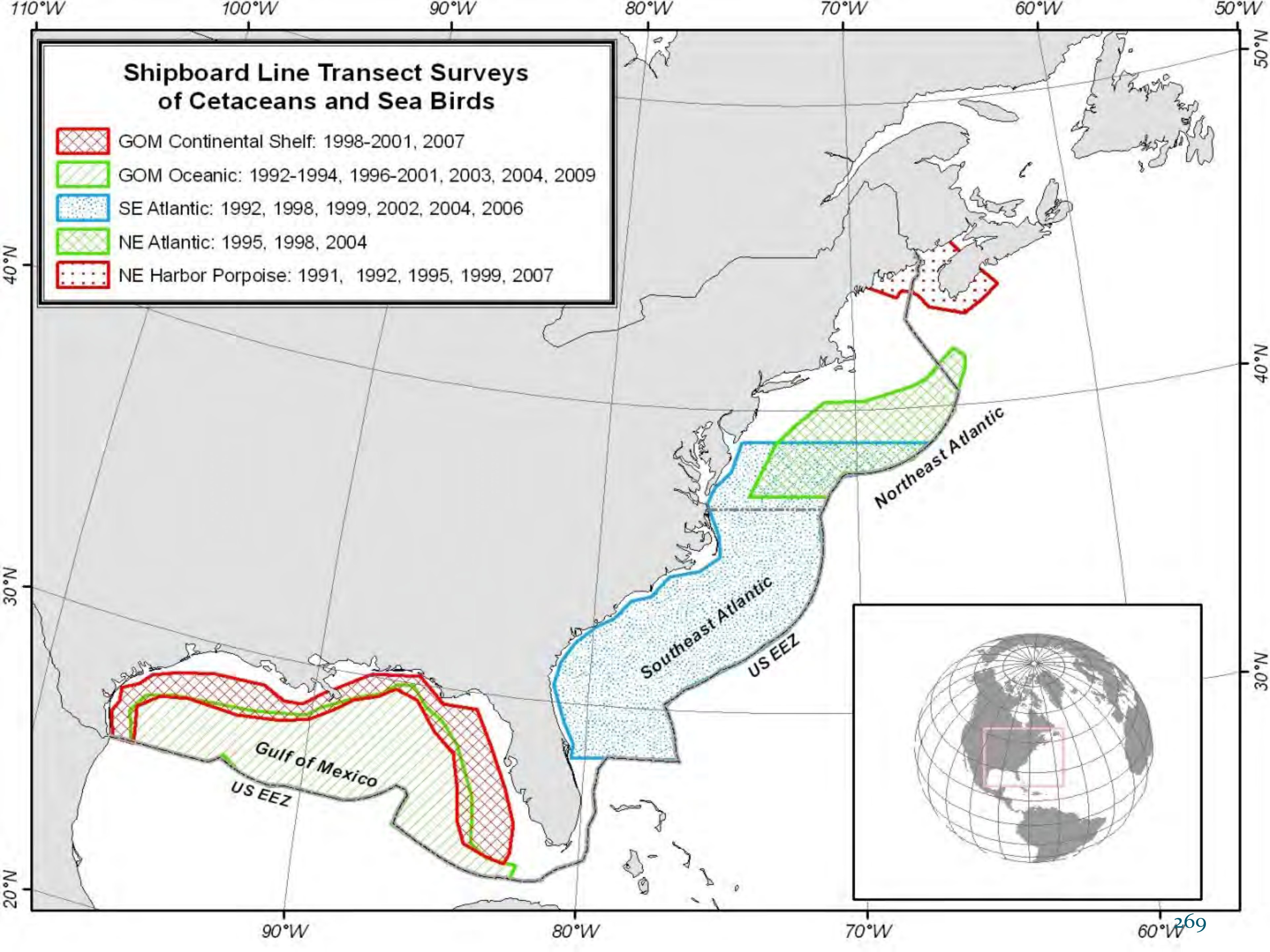
(http://www.seaturtle.org/tracking/?project_id=537)

Tracks of 2010 and 2011 tags



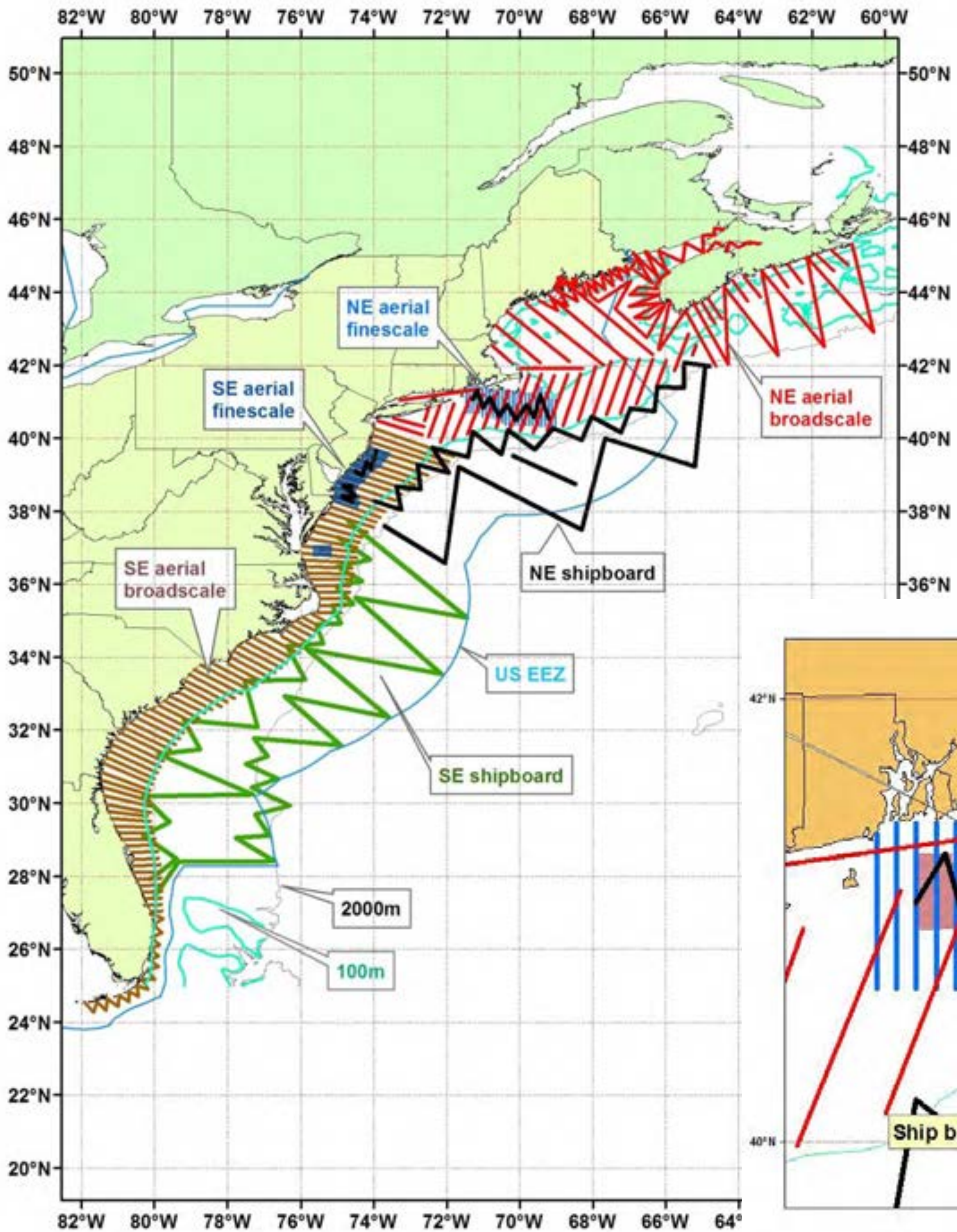


Aerial Line Transect Surveys of Turtles and Cetaceans
Eastern GOMEX: 2007
GulfCET II: 1996,1997
GulfCet I: 1992-1994
GOMEX: 1992-1994, 1996
MATS: 2002, 2004
MATS: 1994, 1995
SETS, SEACAS: 1982-1984, 1992, 1995
NEC Gulf of Maine: 2007, 2008
NEC Aerial :1995, 1998, 2004
CETAP: 1979-1982
Northeast Atlantic
Southeast Atlantic
US EEZ
Gulf of Mexico
US EEZ
110°W
100°W
90°W
80°W
70°W
60°W
50°W
50°N
40°N
30°N
20°N



Shipboard Line Transect Surveys of Cetaceans and Sea Birds
GOM Continental Shelf: 1998-2001, 2007
GOM Oceanic: 1992-1994, 1996-2001, 2003, 2004, 2009
SE Atlantic: 1992, 1998, 1999, 2002, 2004, 2006
NE Atlantic: 1995, 1998, 2004
NE Harbor Porpoise: 1991, 1992, 1995, 1999, 2007
Northeast Atlantic
Southeast Atlantic
US EEZ
Gulf of Mexico
US EEZ
110°W
100°W
90°W
80°W
70°W
60°W
50°W
50°N
40°N
30°N
20°N

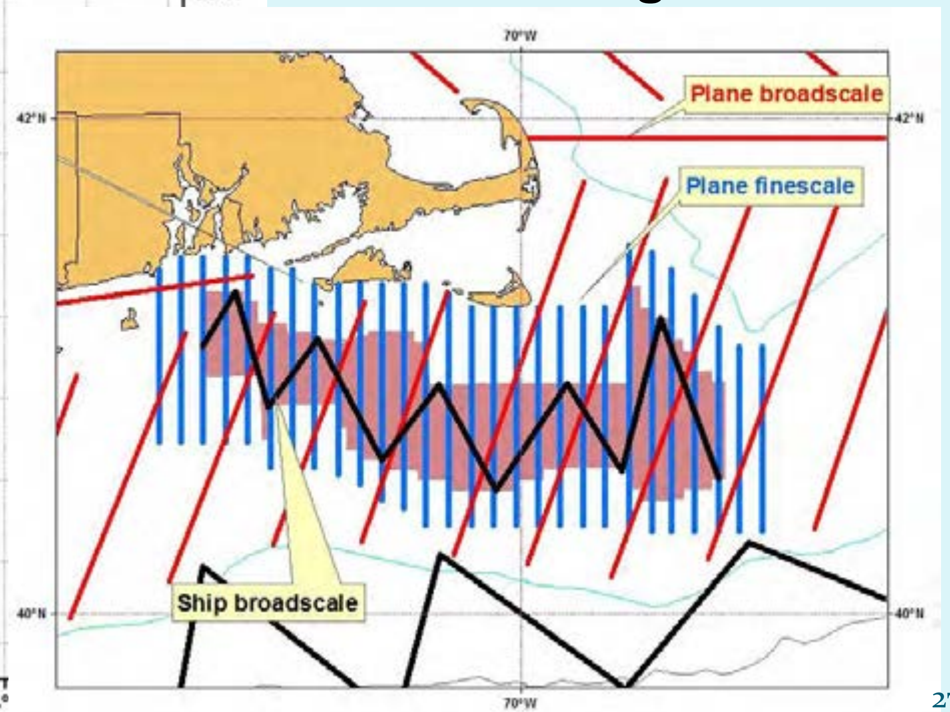
NMFS surveys:



Broad scale with some finer scale areas

NOAA Twin Otter airplanes – to 200m. Every quarter.

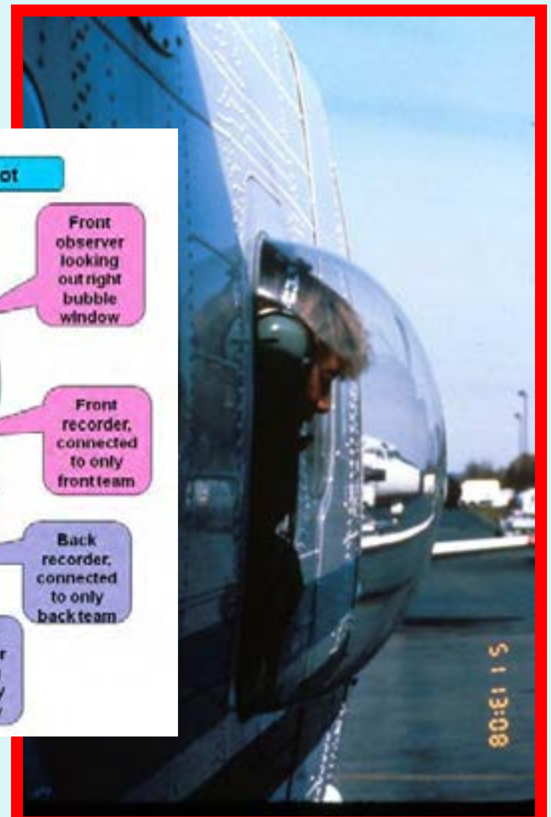
NOAA ships – 200m to EEZ. At least during summer.

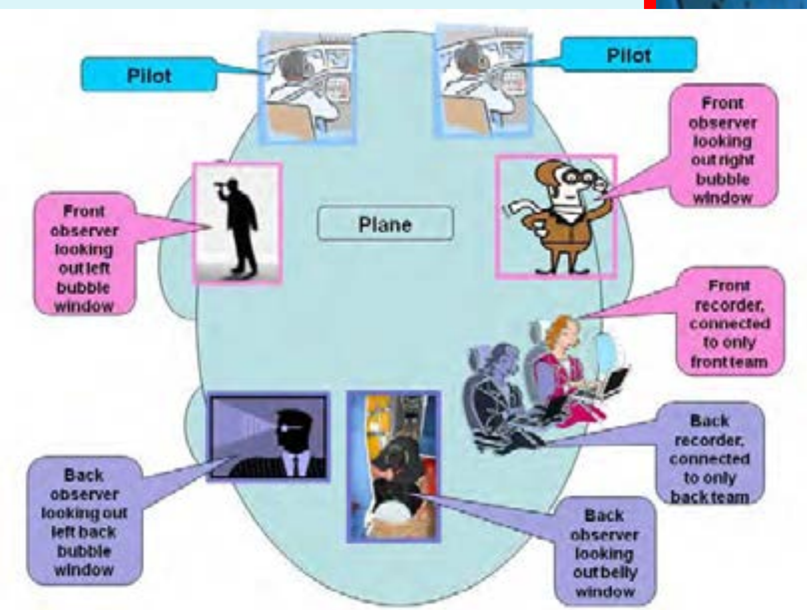


NMFS Aerial Surveys

Cetaceans, seals, turtles, sunfish, basking sharks

Surveys flown at 600 ft, airspeed of 110 knots, winds < 10 knots, up to 20 knots





Line transect data collection methods. Two teams to estimate g(0) – probability of detection.

Effort - sighting conditions, glare severity, cloud cover, Beaufort sea state

Sighting - species, group size, declination angle, behavior, swim direction, cue

FWS Aerial Surveys

Kodiak float planes

Fine scale

Coastal transects perpendicular to coast 5 nmi apart

Seasonally

FWS Aerial Surveys

Primary target: Sea birds

Secondary targets: marine mammals, boats

Flown at 110 knots at 200 ft,

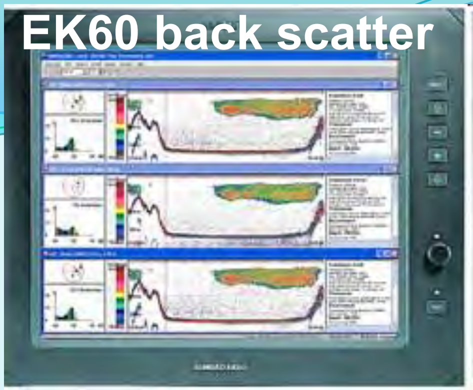
Winds < 15 knots, up to 20 knots.

Strip transect to 200 m

Sightings: type (Flying or sitting), species id, sighting condition, distance band

Effort: time and location of starts and stops, observer positions, sighting conditions, transect number

Summer shipboard surveys

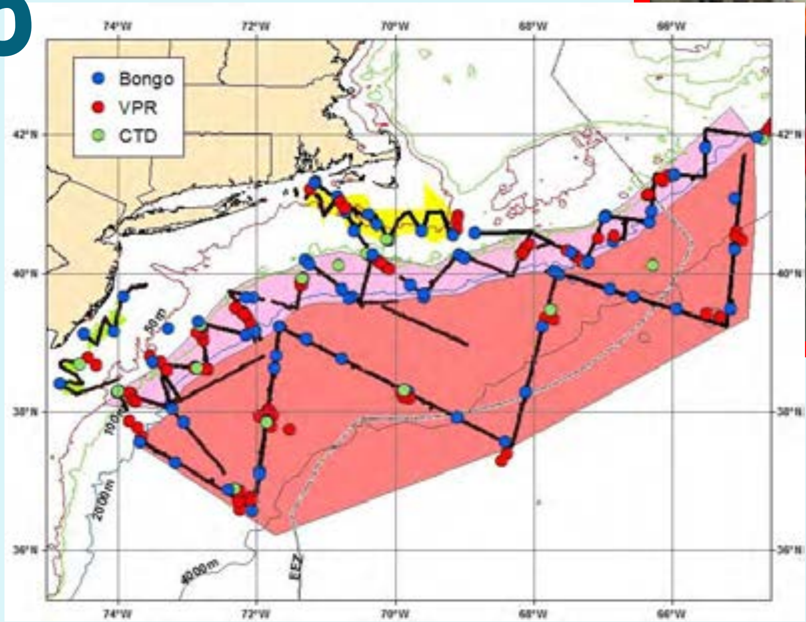


1) Two independent teams (4 people each) to collect line transect cetacean and turtle data
1) One team (2 people) to collect strip transect seabird data
2) One team (2 people) to collect passive and active acoustic data
3) One team (2 people) to collect plankton data
4) Ship's SCS system to collect static and dynamic oceanography data

2010 – summer NMFS aerial
2011 – winter NMFS & FWS aerial
– summer NMFS & FWS aerial and shipboard
2012 – spring NMFS & FWS aerial
– fall NMFS & FWS aerial

2013 – summer NMFS shipboard & FWS aerial
2014 – winter NMFS & FWS aerial
– fall NMFS & FWS aerial
2015 – spring NMFS & FWS aerial

Oceanography environmental data from the ship

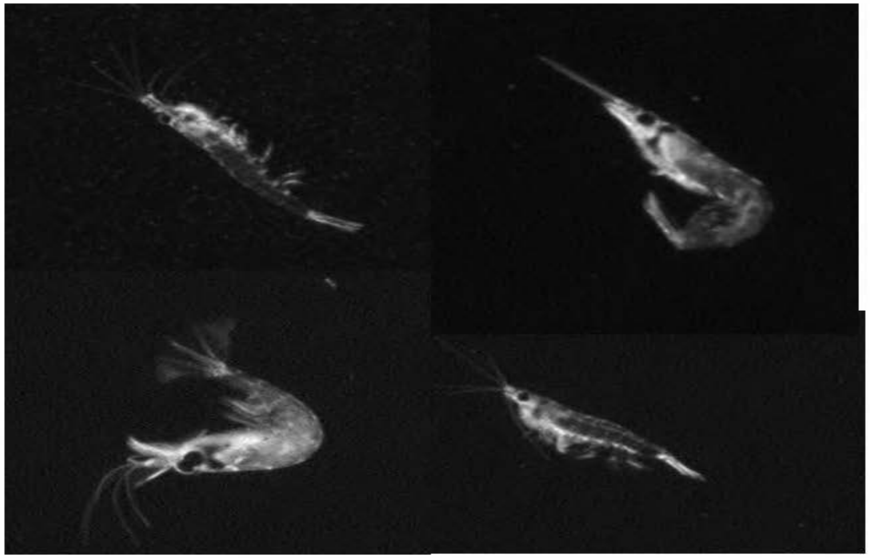


- Continuous
- Depth
- Water speed
- Surface temperature
- Surface salinity
- Surface conductivity
- Surface chlorophyll
- Sound velocity

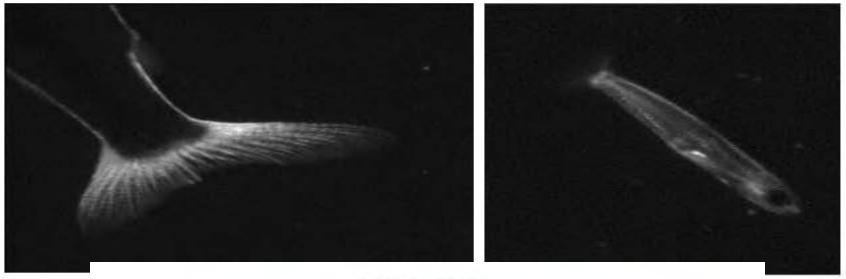
Water column
at stations with CTD
- Conductivity/salinity
- Temperature/thermal cline
- Depth

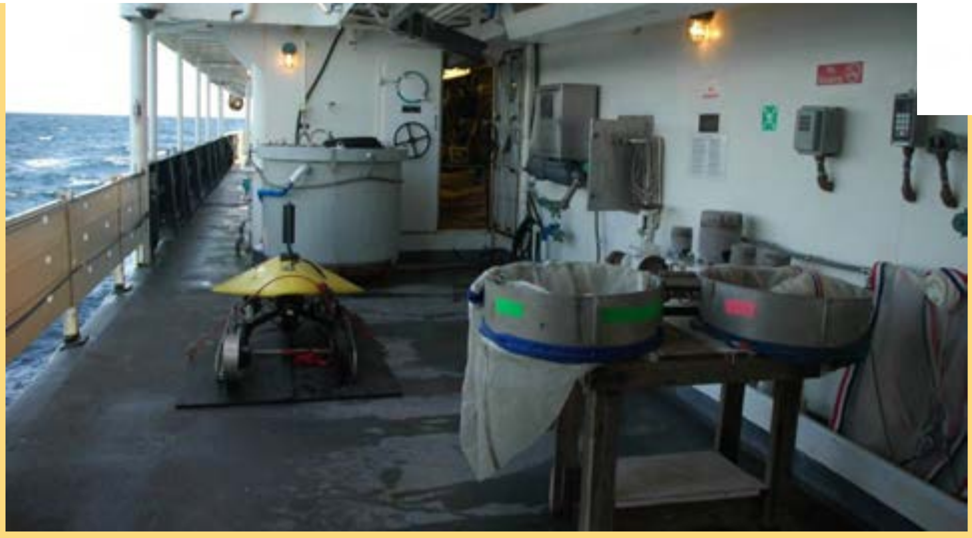
Plankton team – VPR, bongo nets, neuston nets, CTD

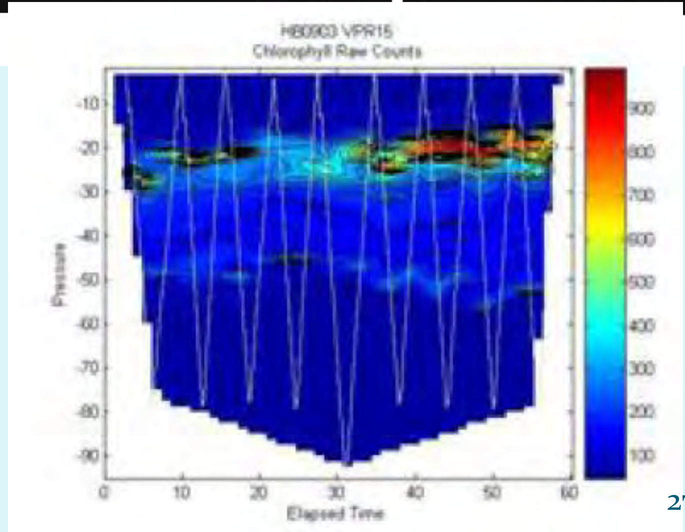
- **From water column at night:**
- Water temperature
- Water salinity
- Turbidity
- Chlorophyll concentration
- Individual zooplankton and fish



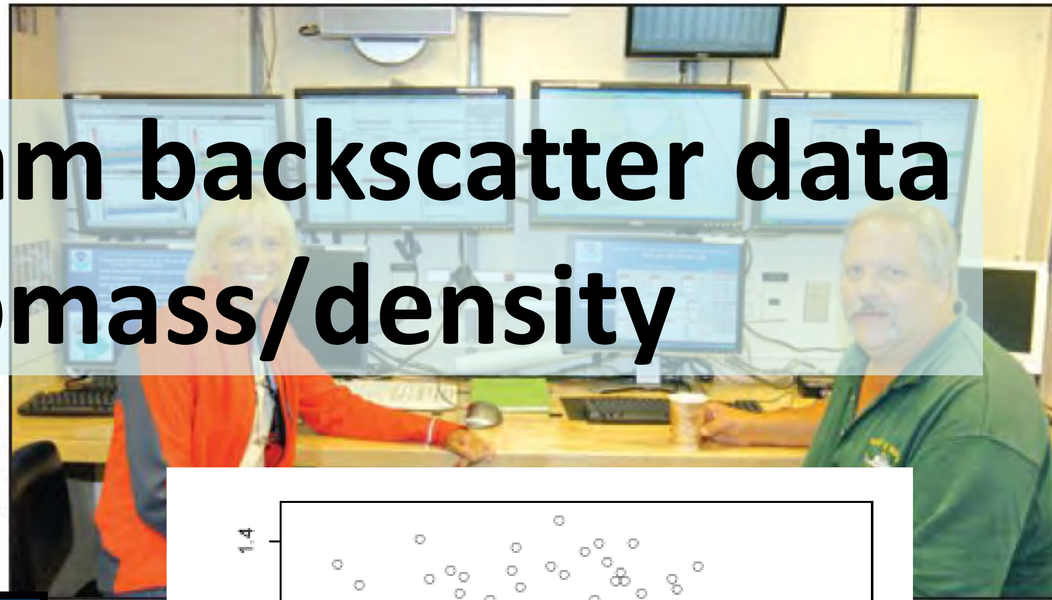
Euphausiids - Krill

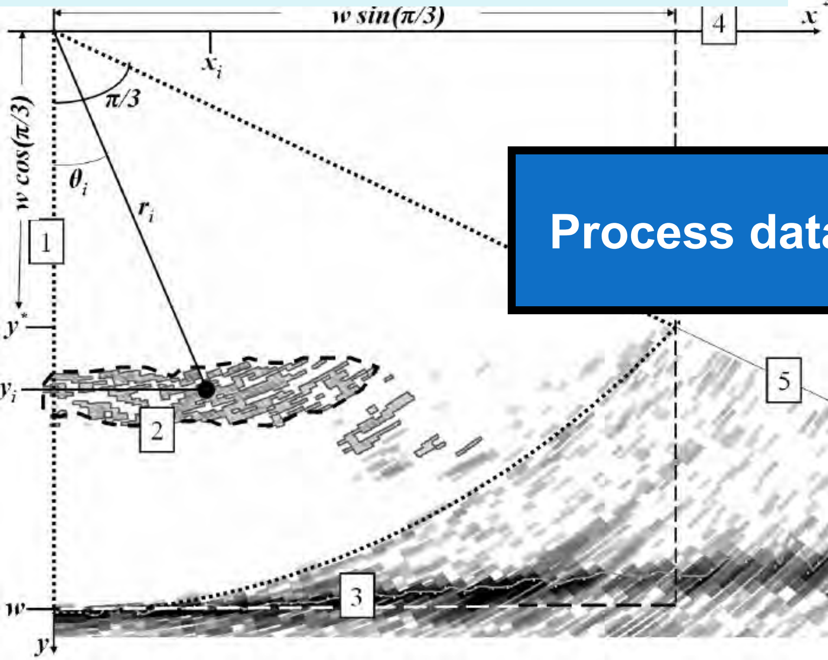




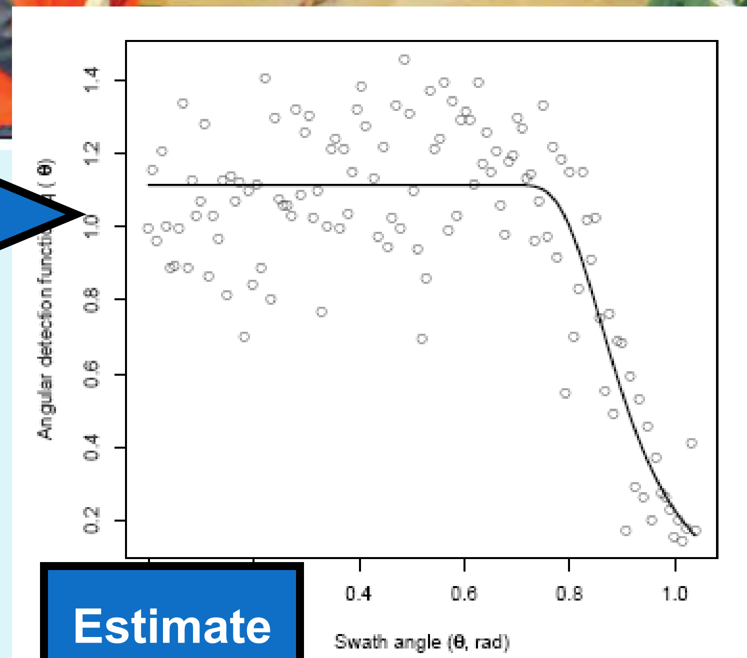


EK60 multi-beam backscatter data to estimate biomass/density





Process data

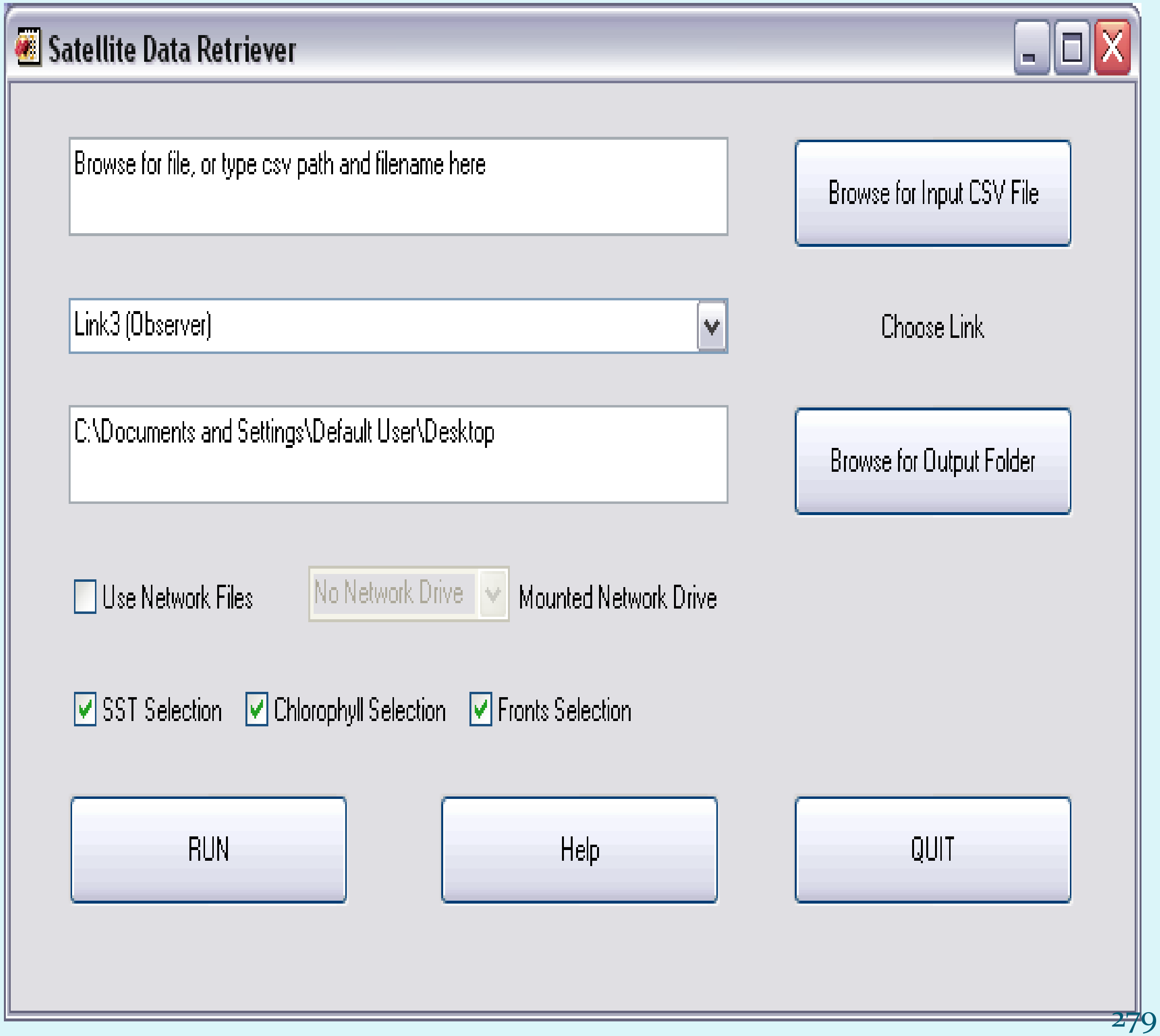


Estimate

Density and biomass of zooplankton/fish

For all surveys: Satellite oceanography data

- **Sea surface temperature**
- **Chlorophyll**
- **Fronts**



Oceanography – from other data sources

- Bottom depth
- Bottom slope
- Sediment type
- Bottom rugosity

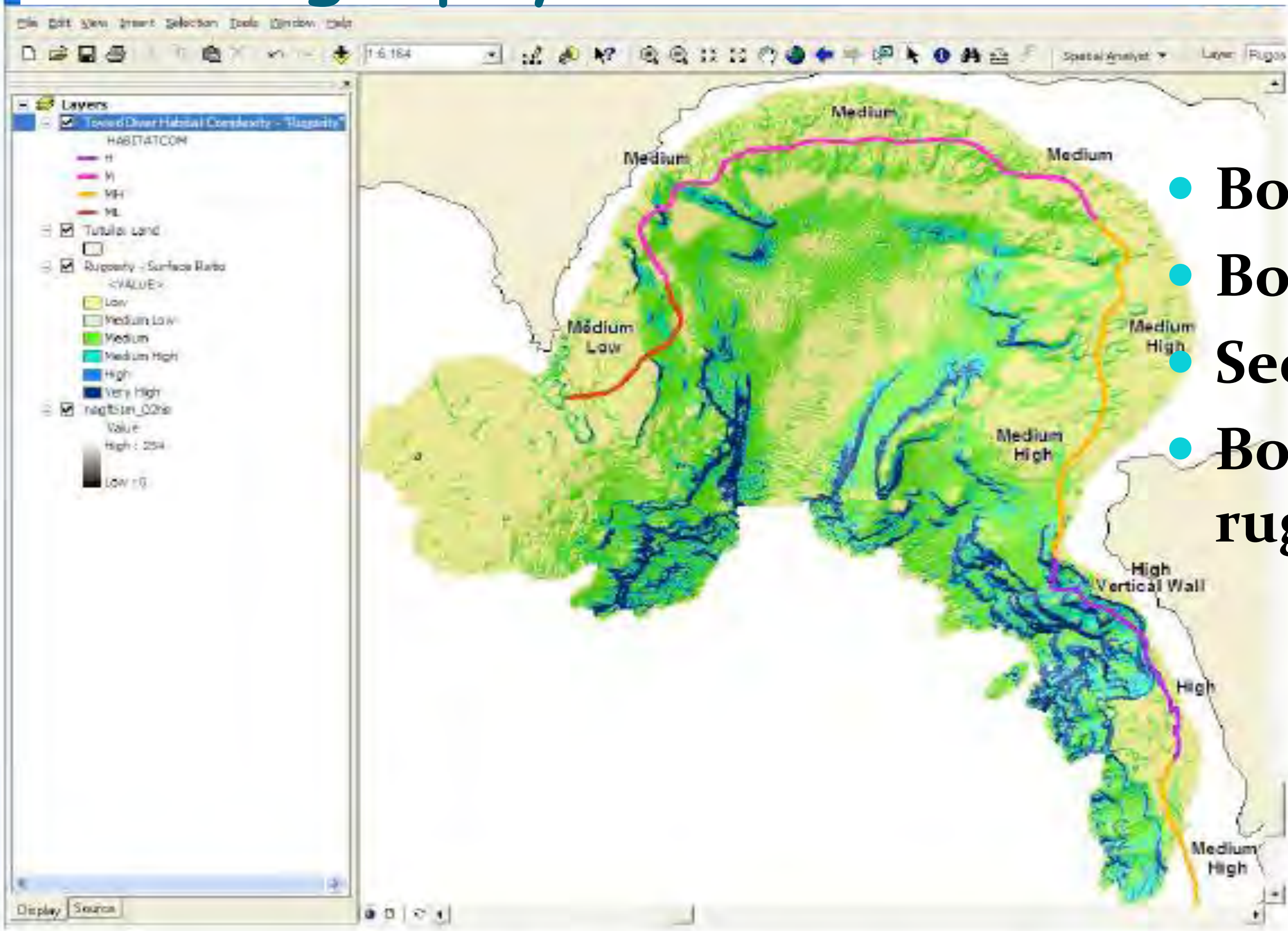
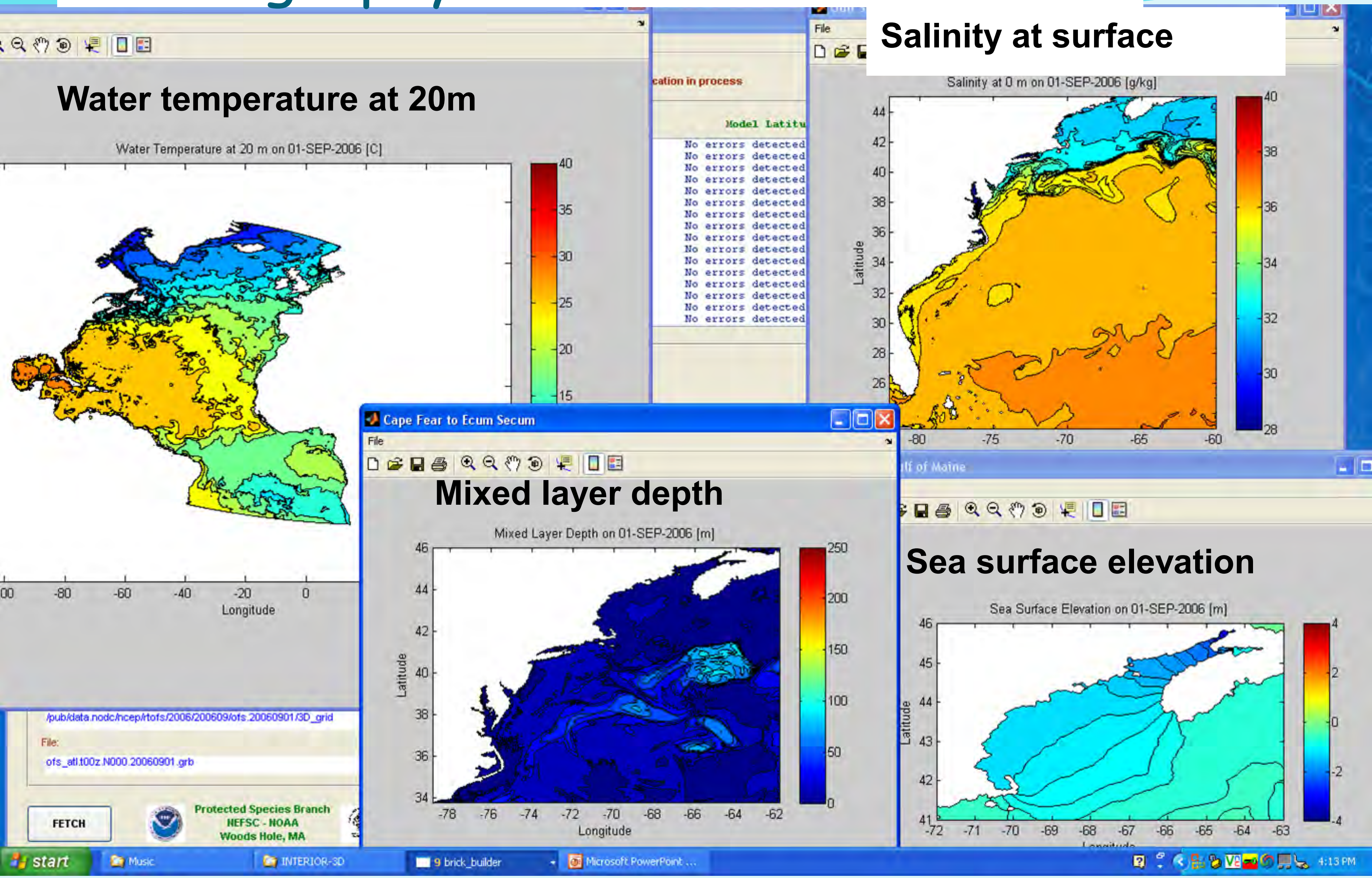


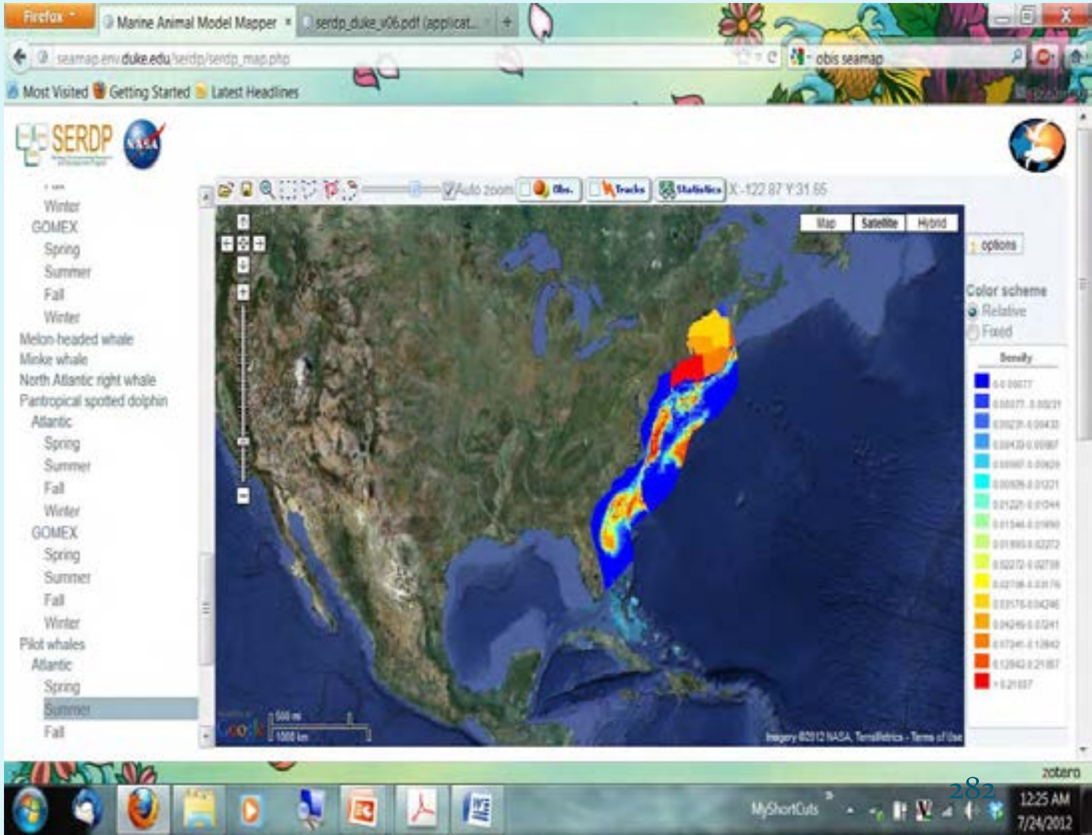
Figure 6 Rugosity derived in ArcView® 3.3 and towed-diver video transects symbolized by habitat complexity observations. Transects overlaid on rugosity grid shows the relationship between the two data sets.

Oceanography – from ocean models



Data analyses and storage

- Previously data analyzed mostly for abundance estimates for the cetacean populations using independent observer approaches assuming point independence
  - Accounting for detectability at track line and off trackline using covariates
  - Group size bias
  - Reaction to platform
- Density maps:
  - CetMap
  - NODES
  - SERDP
- Data stored in:
  - NMFS databases
  - OBIS-SEAMAP



ANY QUESTIONS?

- Sightings
- Species id
- Group size
- Declination angle
- Swim direction
- Initial cue
- Behavior
- Size of turtle

Effort

- Time, latitude, longitude
- Position of observers
- Transect number
- Sighting conditions (glare, sea state, cloud cover, turbidity, overall quality)

Plus processed info related to abundance estimates

Line transect data from the visual cetacean and turtle teams

Sightings

- Species id
- Group size
- Distance
- Bearing
- Swim direction
- Initial cue
- Behavior

Effort

- Time, latitude, longitude
- Position of observers
- Transect number
- Weather (glare, sea state, visibility, swell angle and height, cloud cover)

Plus processed info related to abundance estimates

Strip transect data from the seabird team

- Sightings
- Species id
- Group size
- Distance
- Flight direction
- Behavior
- Associations
- Age
- Molt

Effort

- Time, latitude, longitude
- Observer
- Transect number
- Weather data (from MM team)

Plus processed info related to abundance estimates

Acoustic team – Passive

Sightings

- Species id, if possible
- Group size
- First detection distance
- Bearing and distance when abeam
- Acoustic behavior
- Visual sightings detected
- All sounds detected

Effort

- Time, latitude, longitude
- Who is listening
- Transect number

Processed:

- sound library
- duplicates with visual team
- automatic detections

Sea turtle tagging project

- Objective
  - Satellite tag immature loggerhead turtles in offshore Mid-Atlantic waters to determine:
    - how turtles utilize their habitat, and
    - how much time they spend in surface waters and are available to be seen during aerial abundance surveys so that the aerial surface abundance estimate can be corrected for availability.

Sea Turtle Tag Telemetry

Wildlife Computers MK-10 AF (SE) or SMRU Satellite Relay Data Logger (NE)

- Fast-loc GPS for improved position accuracy

- Depth sensors and programming to report binned depth data and dive-duration

- Durations of several months up to one year

Sea turtle tagging project results

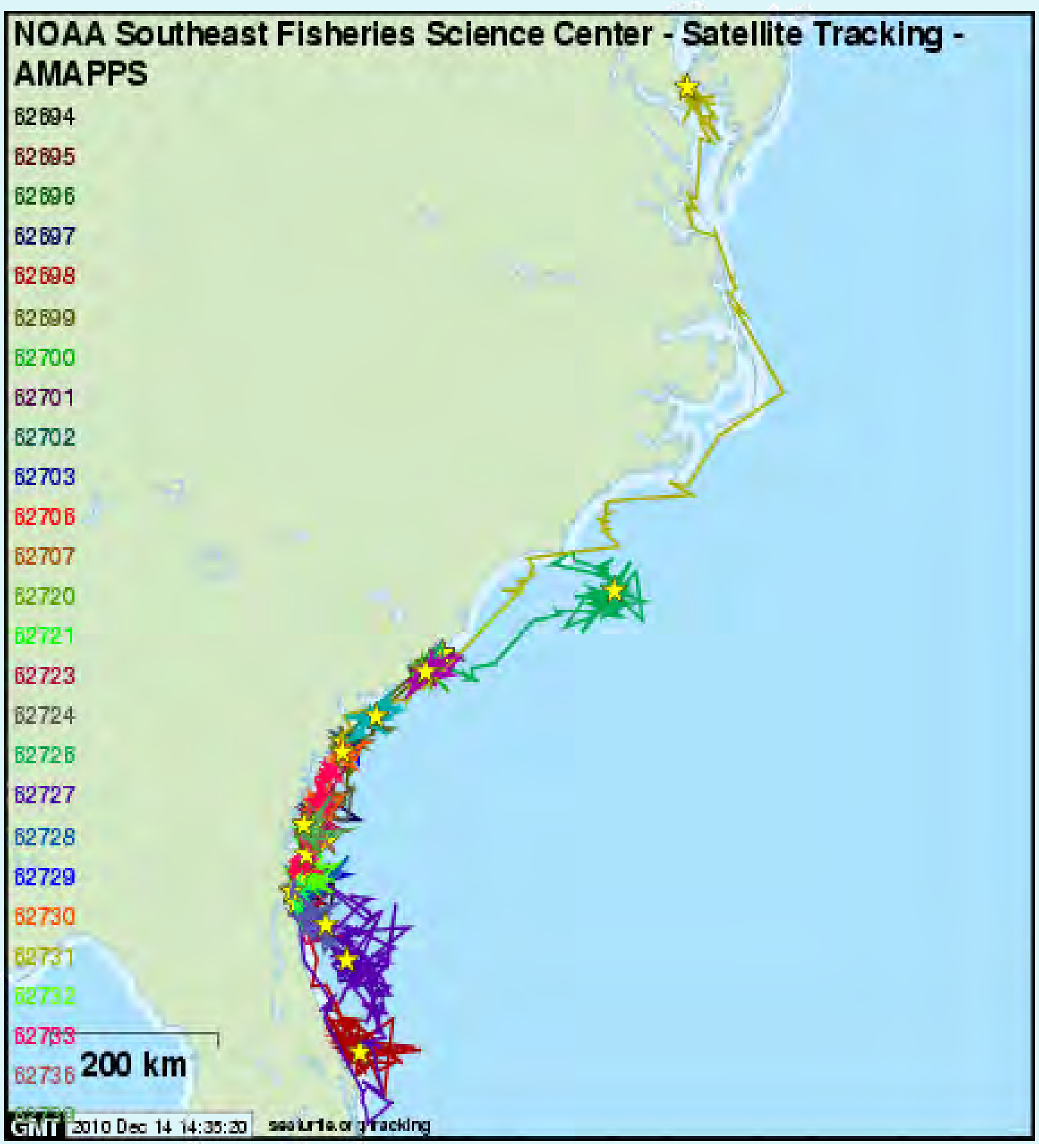
In collaboration with Coonamessett Farm Foundation:

- used 2 commercial scallop fishing vessels to locate and tag loggerhead turtles during June 2 – 6, 2011 offshore of Delaware through Virginia.

For 15 loggerheads (63-93 cm CCL) did the following:

- Attached SMRU satellite, flipper and PIT tags
- Measured length, width body depth, and weight
- Took biopsy samples for genetic analyses and stable isotope analyses
- Took blood samples for testosterone levels and general blood chemistry to identify sex and assess the health of the animal
- Photographed

Sea Turtle Tag Telemetry - SE



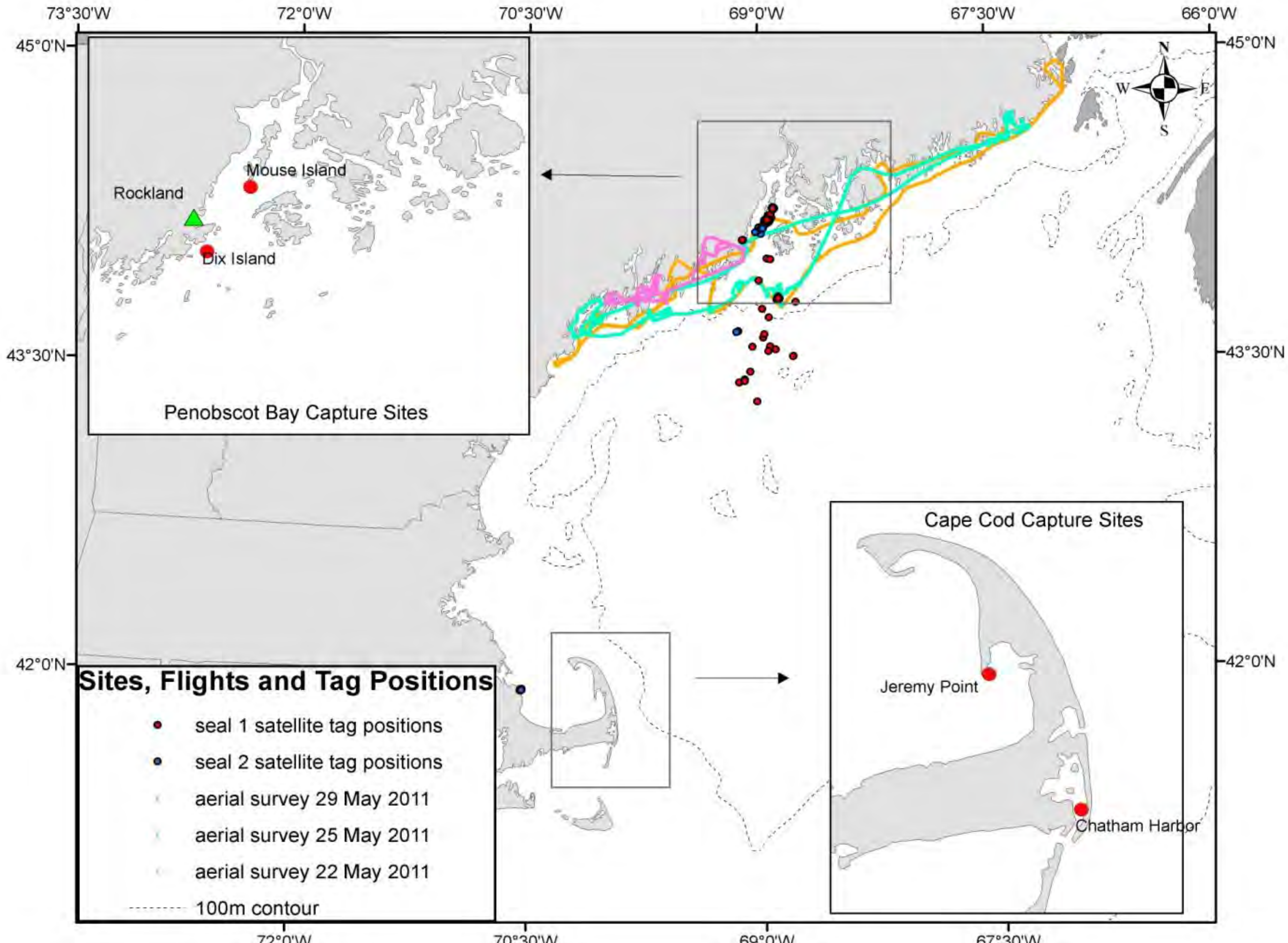
30 loggerheads were tagged between Florida and South Carolina

Average duration (as of December) of 91 days for these tags

Turtles generally stayed near the tagging location, with the exception of one animal that moved into Chesapeake Bay

Spring harbor seal abundance project

- Objectives
  - Develop a statistically robust harbor seal aerial abundance survey based on bay units
  - Tag seals in Chatham Harbor, Cape Cod and western Penobscot Bay with VHF, satellite and sonic tags
  - Conduct aerial photographic surveys and VHF radio tracking


73°30'W
72°0'W
70°30'W
69°0'W
67°30'W
66°0'W
45°0'N
43°30'N
42°0'N
N
S
W
E
Penobscot Bay Capture Sites
Rockland
Mouse Island
Dix Island
Cape Cod Capture Sites
Jeremy Point
Chatham Harbor
Sites, Flights and Tag Positions
seal 1 satellite tag positions
seal 2 satellite tag positions
aerial survey 29 May 2011
aerial survey 25 May 2011
aerial survey 22 May 2011
100m contour

Presentation #6

Mid-Atlantic Baseline Studies Project

Kate Williams, Evan Adams, David Evers, and Iain Stenhouse
Biodiversity Research Institute

Beth Gardner
NC State University

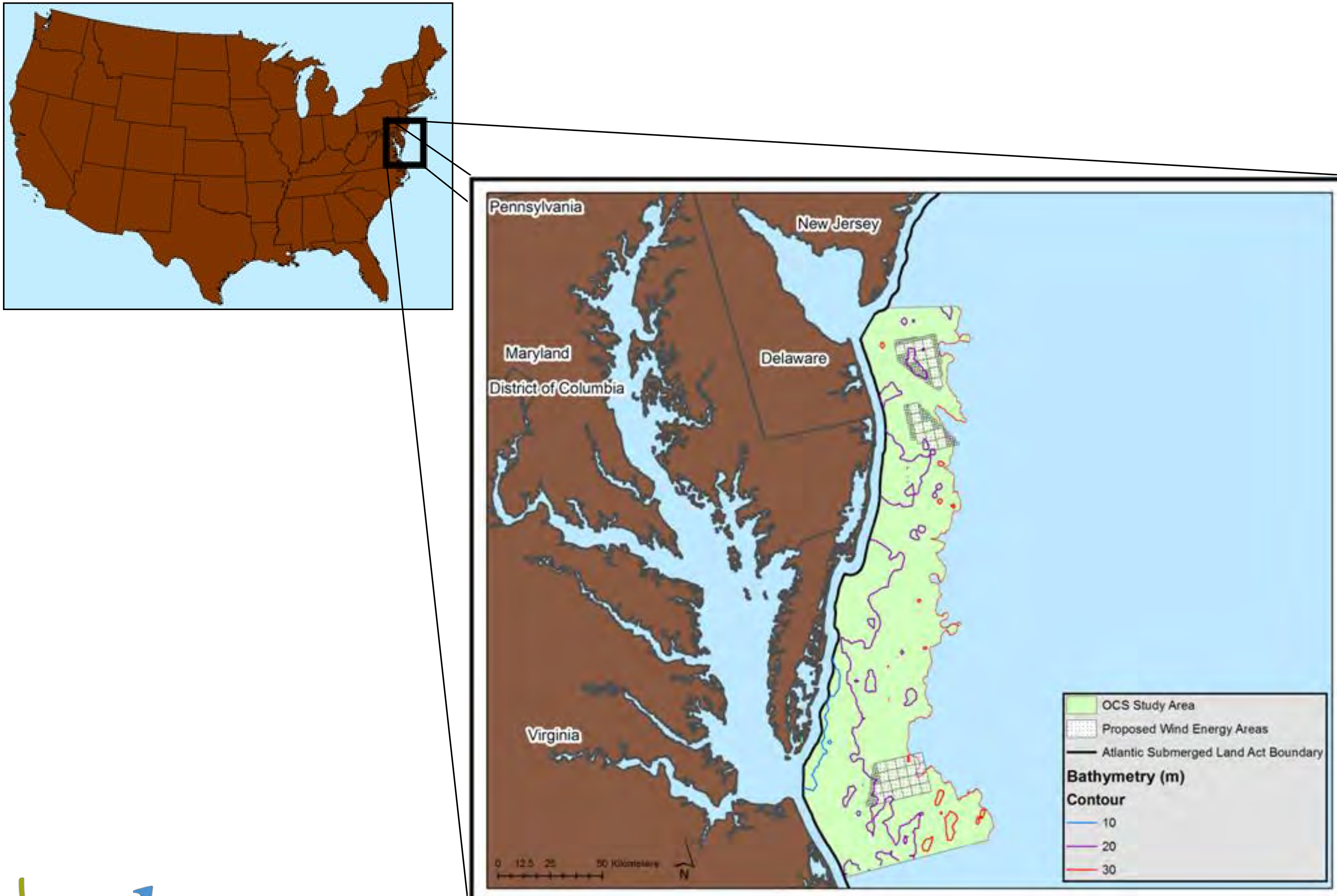
Ari Friedlaender and David Johnston
Duke University Marine Lab

Richard Veit
College of Staten Island

Mid-Atlantic Baseline Studies

- Department of Energy (DOE)-funded ecological baseline studies project
- 2012-2015
- BRI project lead; over a dozen co-PIs and collaborators
- **Project goal:** Facilitate the permitting and environmental review of offshore wind development on the mid-Atlantic outer continental shelf.

BIODIVERSITY RESEARCH INSTITUTE
innovative wildlife science



bri
BIODIVERSITY RESEARCH INSTITUTE
innovative wildlife science

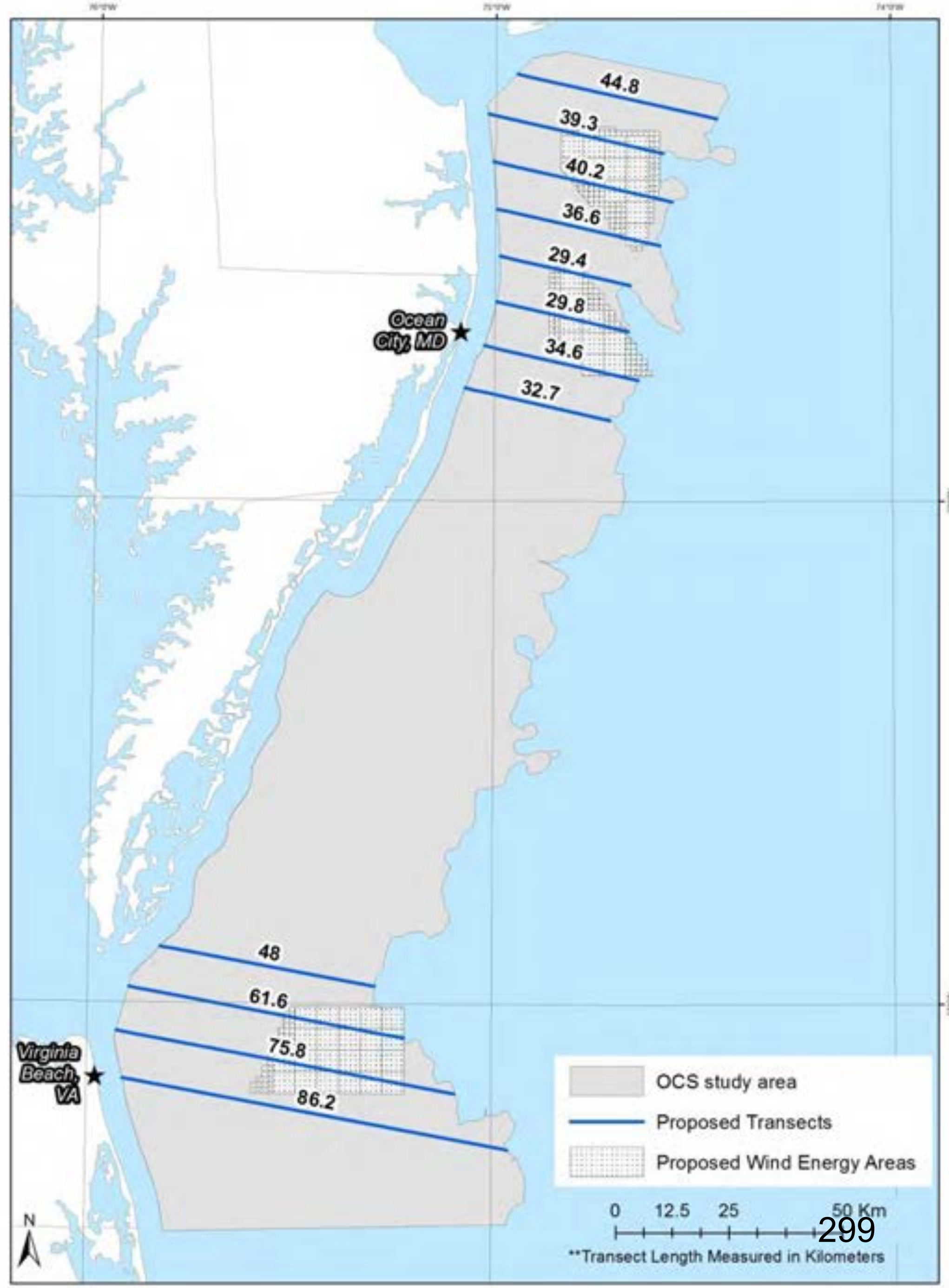
Mid-Atlantic Baseline Studies

- Boat Surveys
- Aerial Surveys (hi-def video)
- Aerial-Boat Comparison Study
- Individual Tracking of Key Bird Species
- Nocturnal Migration Studies
- Hierarchical Modeling
- Dissemination of Project Results

BIODIVERSITY RESEARCH INSTITUTE
innovative wildlife science

Boat Surveys

- 2 years
- 16 surveys
- Data on birds, marine mammals, and sea turtles
- Ancillary data collection



BIODIVERSITY RESEARCH INSTITUTE
innovative wildlife science

Boat Surveys

Photo by BRI staff

- First boat survey
  April 25-29, 2012
- Second survey
  June 18-21
- Most common species on the 1st survey: COLO, NOGA, BODO, BASW, LAGU, ROYT, FOTE

Biodiversity Research Institute
innovative wildlife science

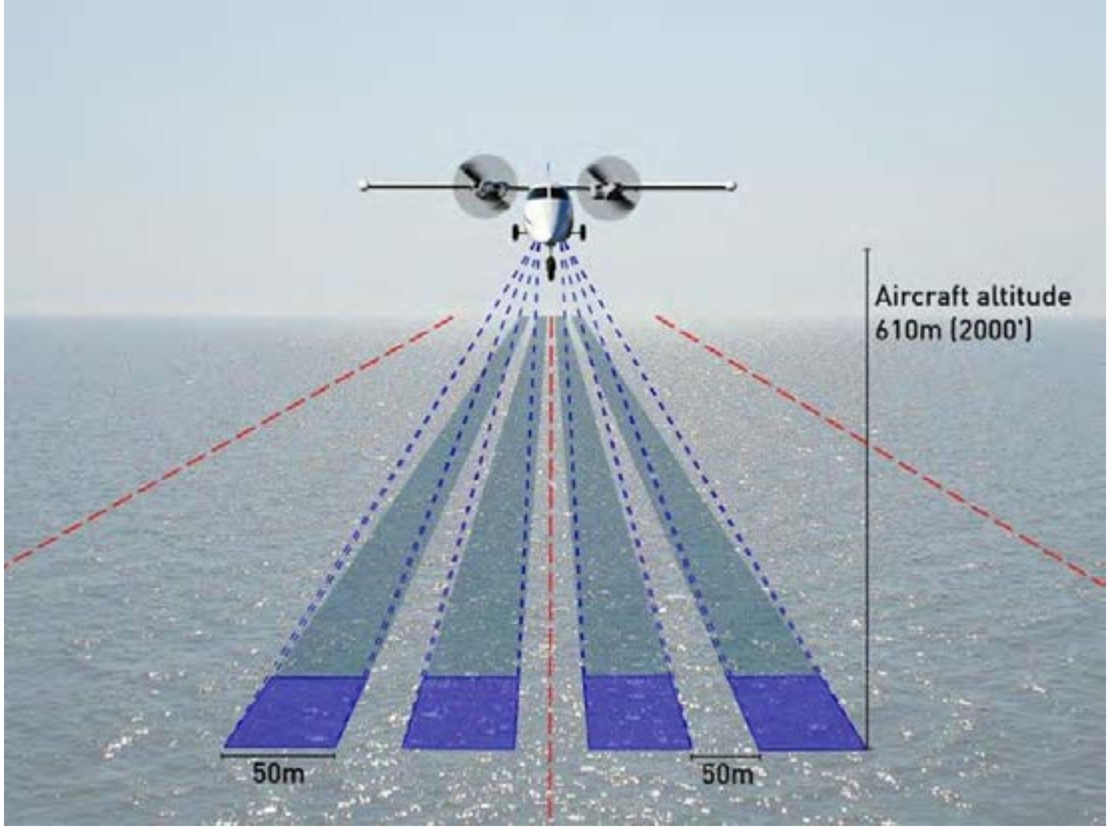
Aerial Surveys

- HiDef Aerial Surveying, Inc.
- High-definition video
- 14 surveys over 2 years
- 20% coverage in WEAs

BIODIVERSITY RESEARCH INSTITUTE
innovative wildlife science

High definition video surveys

- Four belly-mounted cameras
- Resolution of 3cm and 2cm ground sample distance
- Flown at 2000’ asl
- Objects detected by HiDef reviewers
- Objects identified by BRI biologists
- Full QA process
- Flight height calculated from video images



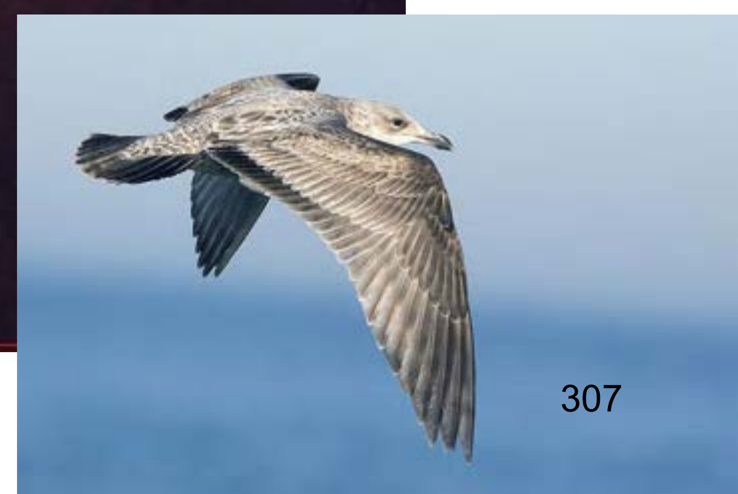
BIODIVERSITY RESEARCH INSTITUTE
innovative wildlife science

Identification Category	March count (as of 7/20)
Scoters (BLSC, SUSC, WWSC, SCNS, UNSC)	7038
Fish	2525
Loons (COLO, RTLO, UNLO)	835
Unknown or ID impossible	471
Northern Gannets	311
Gulls (BOGU, GBBG, HERG, LBBG, RBGU, UNGU, UNLG, UNSG)	262
Unidentified Birds	215
Tern or small/medium gull	172
Dolphins and sm. beaked cets. (BODO, CODO, UNDO, SBCE)	40
Turtles	29
Boats, fishing gear, misc. abiota	13
Terns (ROYT, UNLT, UNTE)	5
Grebes (HOGR, UNGR)	4
Other (sharks, seals, etc.)	4
Phalaropes (UNPH)	2
Storm Petrels (UNSP)	1
Total objects	**11927**


292.50 cm


10-18-05.152.seq | FPS: 0 | RecPos: 11079 | FrameCount: 11078 | PlayPos: 10252 | Timestamp: 0:11:18.996 | File: D:\Zone19_M03_S01_D4A_C4_12\Cam4\10-18-


TUG



Survey Comparison

- Aerial-boat comparison
- Spring 2012…?

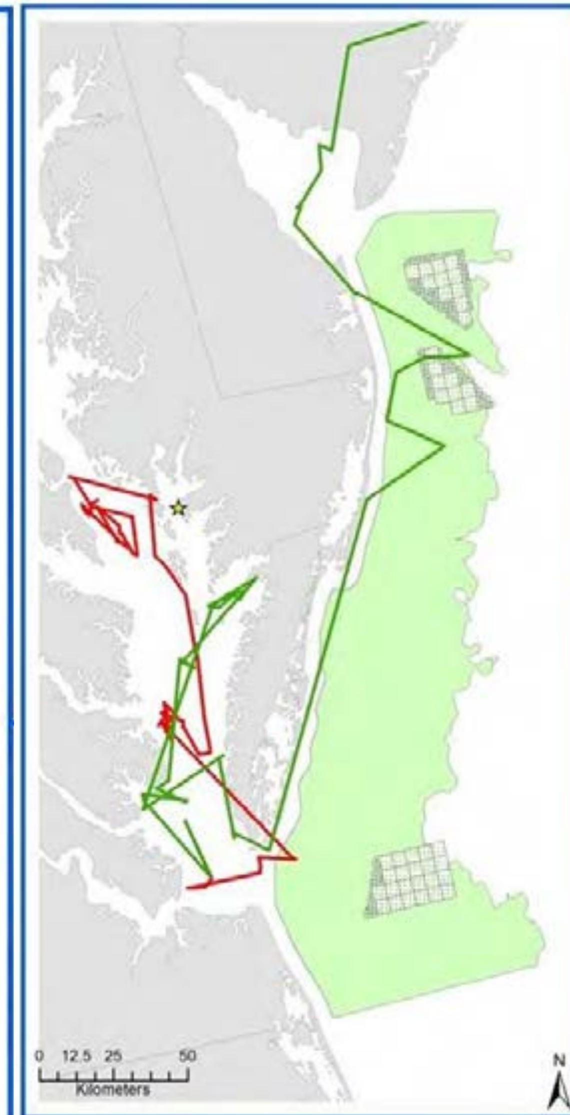
BIODIVERSITY RESEARCH INSTITUTE
innovative wildlife science

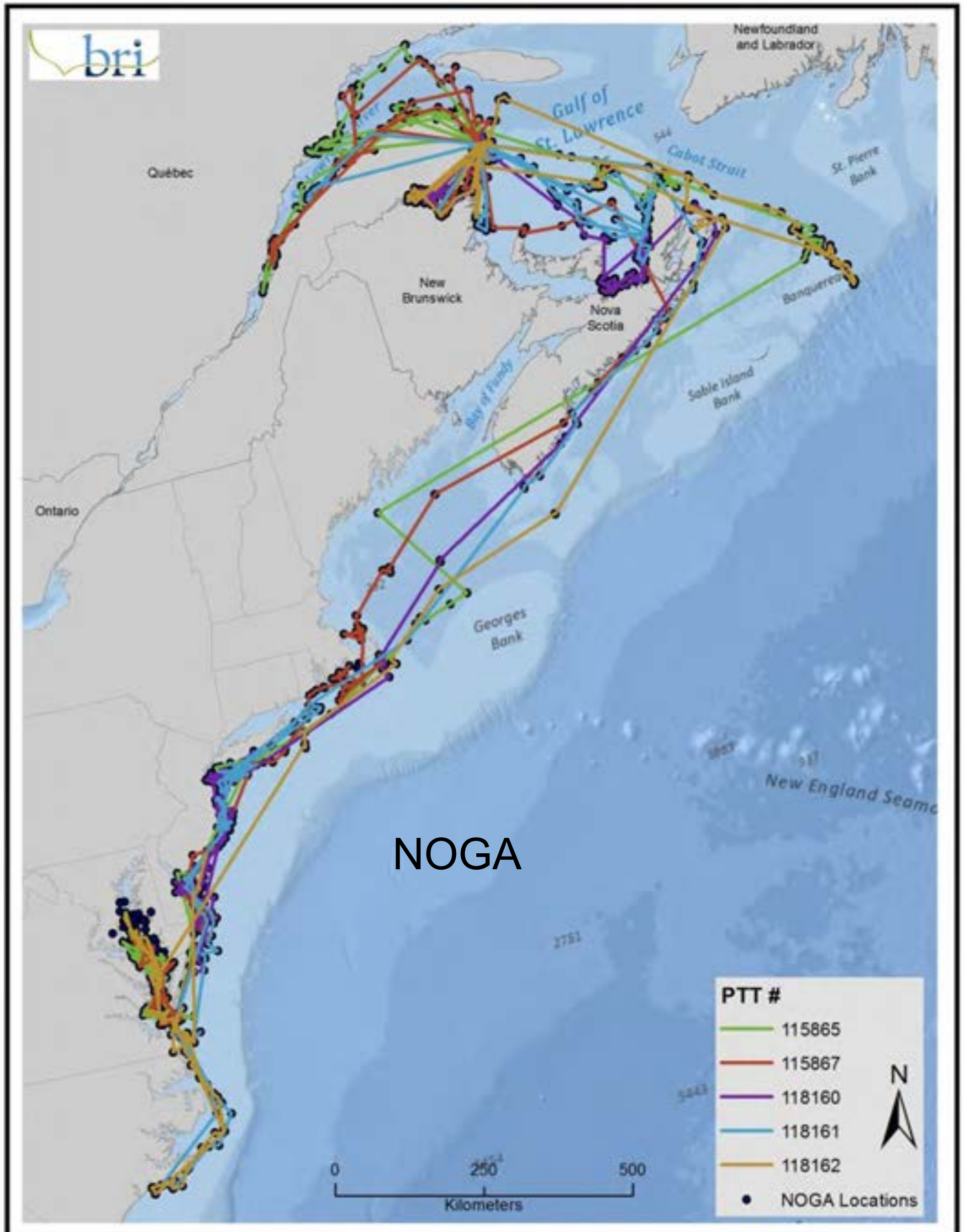
Individual Tracking of Bird Species

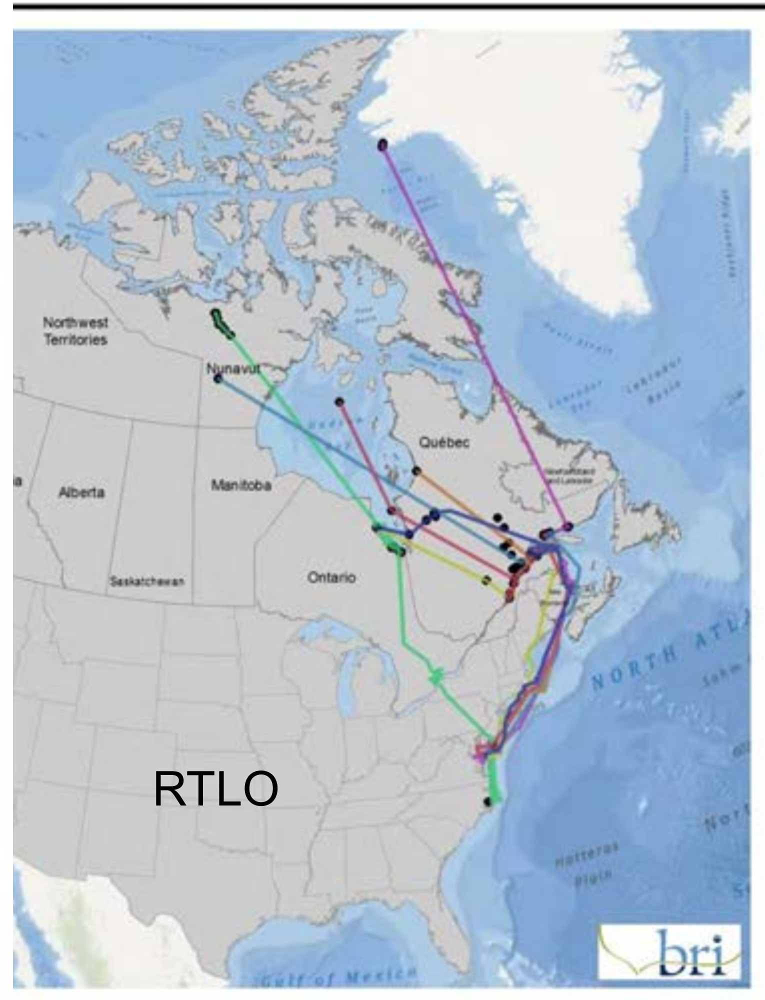
- Collaboration (BOEM, USFWS, BRI, DOE, Memorial University of Newfoundland…)
- Focal species: Northern Gannets, Red-throated Loons, Surf Scoters, and Peregrine Falcons

Photo by BRI staff

Disclaimer: Location data and movement tracks depicted in these maps have not yet been proofed for accuracy or analyzed. Lines connecting location points are theoretical, based on the shortest distance between the points, and are not necessarily the actual flight paths taken. Therefore, caution should be used in identifying patterns or drawing conclusions from the data. Formal interpretation of the data will be included in future reports submitted to the Bureau of Ocean Energy Management, and in peer reviewed manuscripts. For more information please contact: Caleb Spiegel, U.S. Fish and Wildlife Service (caleb_spiegel@fws.gov)."





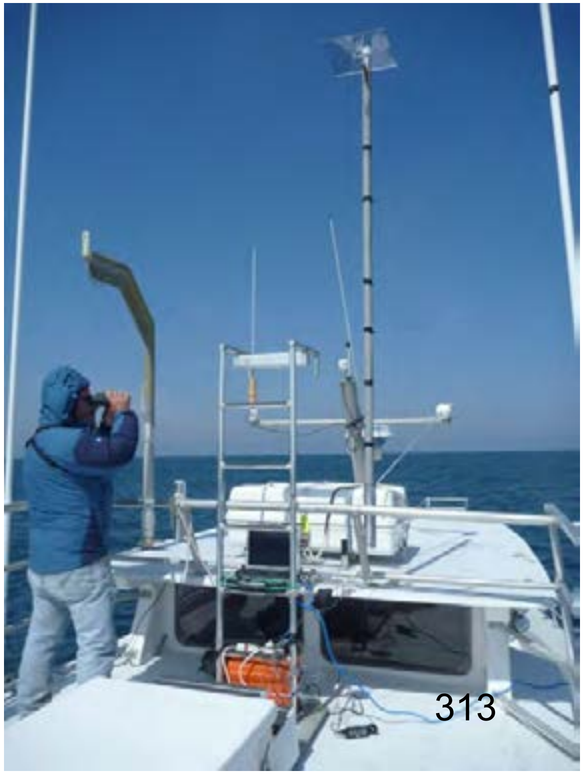


Disclaimer: Location data and movement tracks depicted in these maps have not yet been proofed for accuracy or analyzed. Lines connecting location points are theoretical, based on the shortest distance between the points, and are not necessarily the actual flight paths taken. Therefore, caution should be used in identifying patterns or drawing conclusions from the data. Formal interpretation of the data will be included in future reports submitted to the Bureau of Ocean Energy Management, and in peer reviewed manuscripts. For more information please contact: Caleb Spiegel, U.S. Fish and Wildlife Service (caleb_spiegel@fws.gov)."

Mid-Atlantic Baseline Studies

- Boat Surveys
- Aerial Surveys (hi-def video)
- Aerial-Boat Comparison Study
- Individual Tracking of Key Bird Species
- Nocturnal Migration Studies
- Hierarchical Modeling
- Dissemination of Project Results

Photo by BRI staff



This material is based upon work supported by:

- Department of Energy (award DE-EE0005362)
- Bureau of Ocean Energy Management
- US Fish and Wildlife Service
- Bailey Foundation

Thank you!

Kate.williams@briloon.org

www.briloon.org

Presentation #7

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Atlantic coast wintering sea duck survey, 2008-11

Atlantic Coast Joint Venture
Sea Duck Joint Venture
and
Population & Habitat Assessment and
Migratory Bird Survey Branches
Division of Migratory Bird Management, USFWS

Bureau of Ocean Energy Management/NOAA
(2009-11)

Goals

Design a multi-species survey to

- Inform management decisions
- Provide an index of winter popn status/trends
- Relate index to breeding population status
- Characterize winter distributions (including fidelity)
- Understand factors affecting habitat use
- Detect distributional shifts

Basic survey protocol

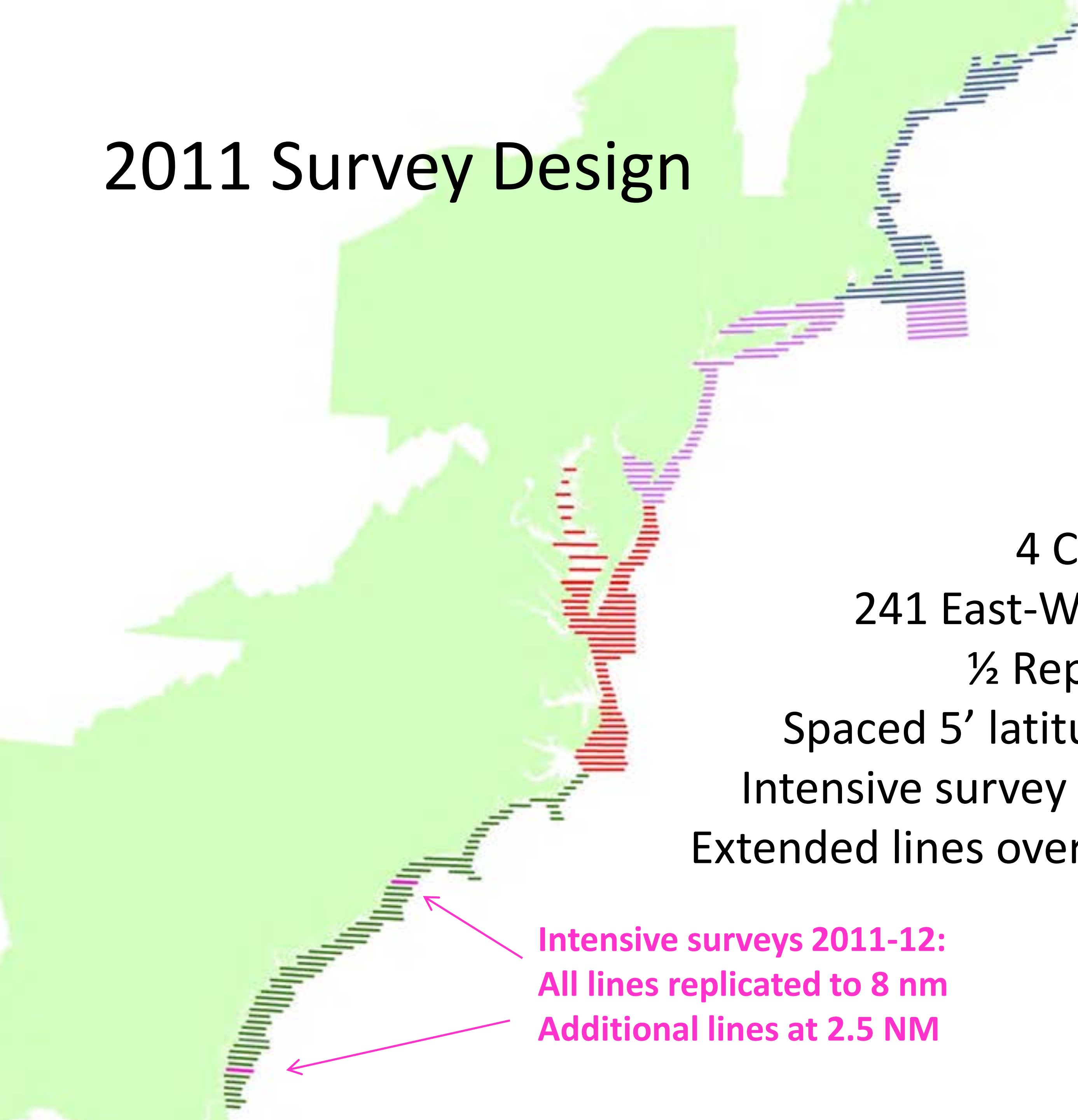
Five crews of 2 observers (*Four* in 2011)
Fixed wing aircraft
200 ft altitude at 110 knots
400m strip transect, 2 observers
Transects extend east from ¼ NM offshore
Count all sea ducks, diving ducks, seabirds
Report observation condition (1 to 5)

Feb 4-25, 2008
Jan 31-Feb 18, 2009
Jan 23-March 3, 2010
Jan 31-Feb 17, 2011

Summary of survey efforts

Year	Range	Design
2008	Cape Cod, MA Palm Beach, FL	Alternating pairs of transects to 8 & 15 NM; Flew historic coastal "transect"
2009	US/CA border Cape Canaveral, FL	Transects to longer of 8 NM or 16m depth; Flew historic coastal "transect"
2010	US/CA border Cape Canaveral, FL	Transects to longer of 8 NM or 16m depth; No coastal "transect;" 5th crew flew 4 replicates MD/DE, lower Chesapeake Bay
2011	US/CA border GA/FL border	Transects to longer of 8 NM or 16m depth; No coastal "transect;" extra survey work off SC/GA coast
2012	SC/GA coast	2.5 NM spacing, all 5 NM transects replicated;

2011 Survey Design

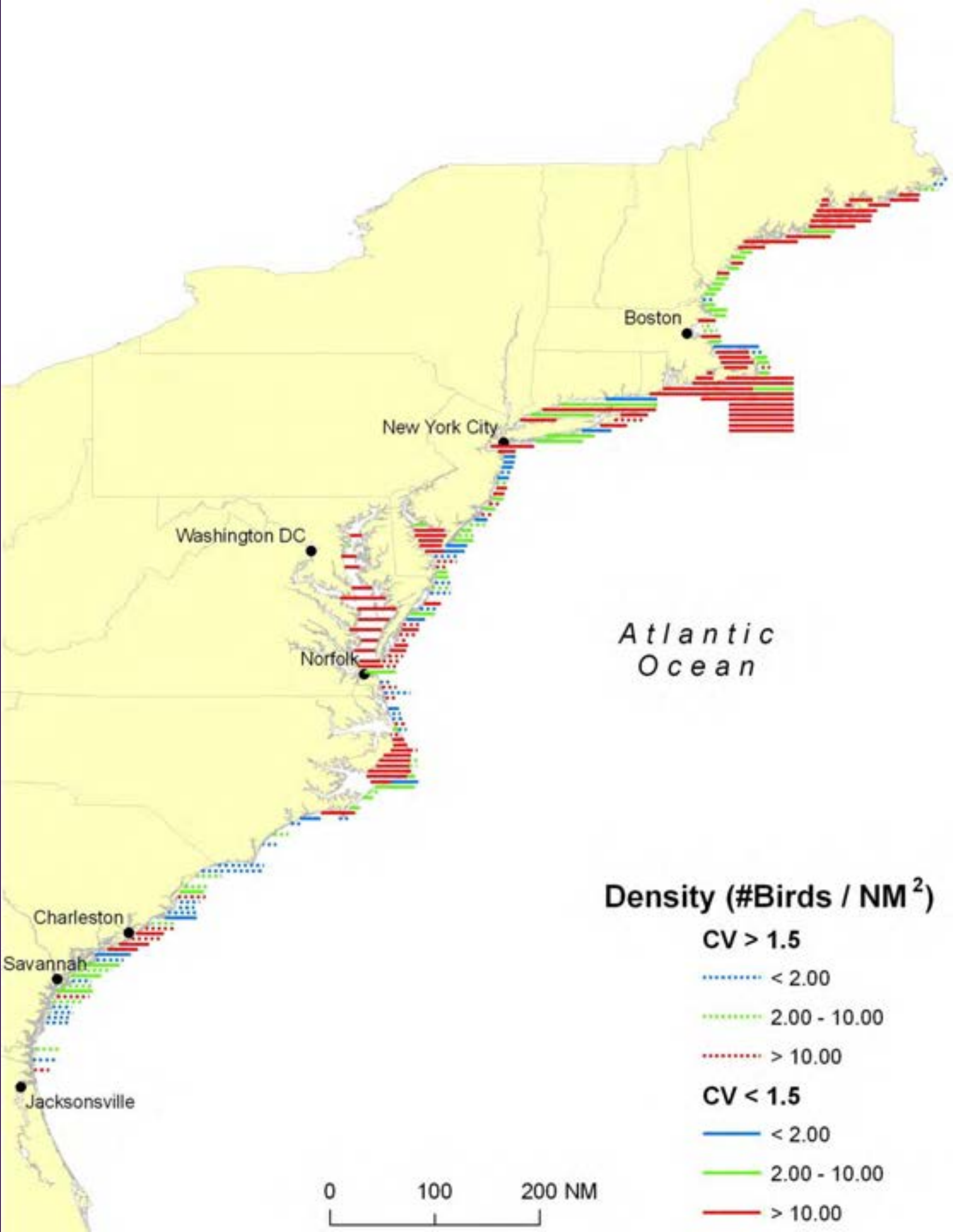


4 Crews
241 East-West transects
½ Replicated
Spaced 5’ latitude North-South
Intensive survey effort SC/GA coast
Extended lines over proposed wind area

Intensive surveys 2011-12:
All lines replicated to 8 nm
Additional lines at 2.5 NM

Products to date

- 2008-2011 Annual Reports
- Summary Report, October 2012
- Zipkin et al. 2012. *Fitting statistical distributions to sea duck count data: implications for survey design and abundance estimation.* In Review *Statistical Methodology.*
- Access Database


Boston
New York City
Washington DC
Norfolk
Atlantic Ocean
Charleston
Savannah
Jacksonville
Density (#Birds / NM²)
CV > 1.5
< 2.00
2.00 - 10.00
> 10.00
CV < 1.5
< 2.00
2.00 - 10.00
> 10.00
0 100 200 NM

AMAPPs survey efforts

Date	Range	Details
Aug 2010	Bald Head Island, NC Key West, FL	Transects to longer of 8 NM or 16m depth; Flew Florida Bay to Naples Preliminary survey effort, 2 crews
Feb 2011	US/CA border Cape Canaveral, FL	Winter sea duck survey 4 crews
Aug 2011	US/CA border Cape Canaveral, FL	Transects to 30m depth 3 crews
Mar 2012	US/CA border Cape Canaveral, FL	Transects to 30m depth 4 crews

Presentation #8

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

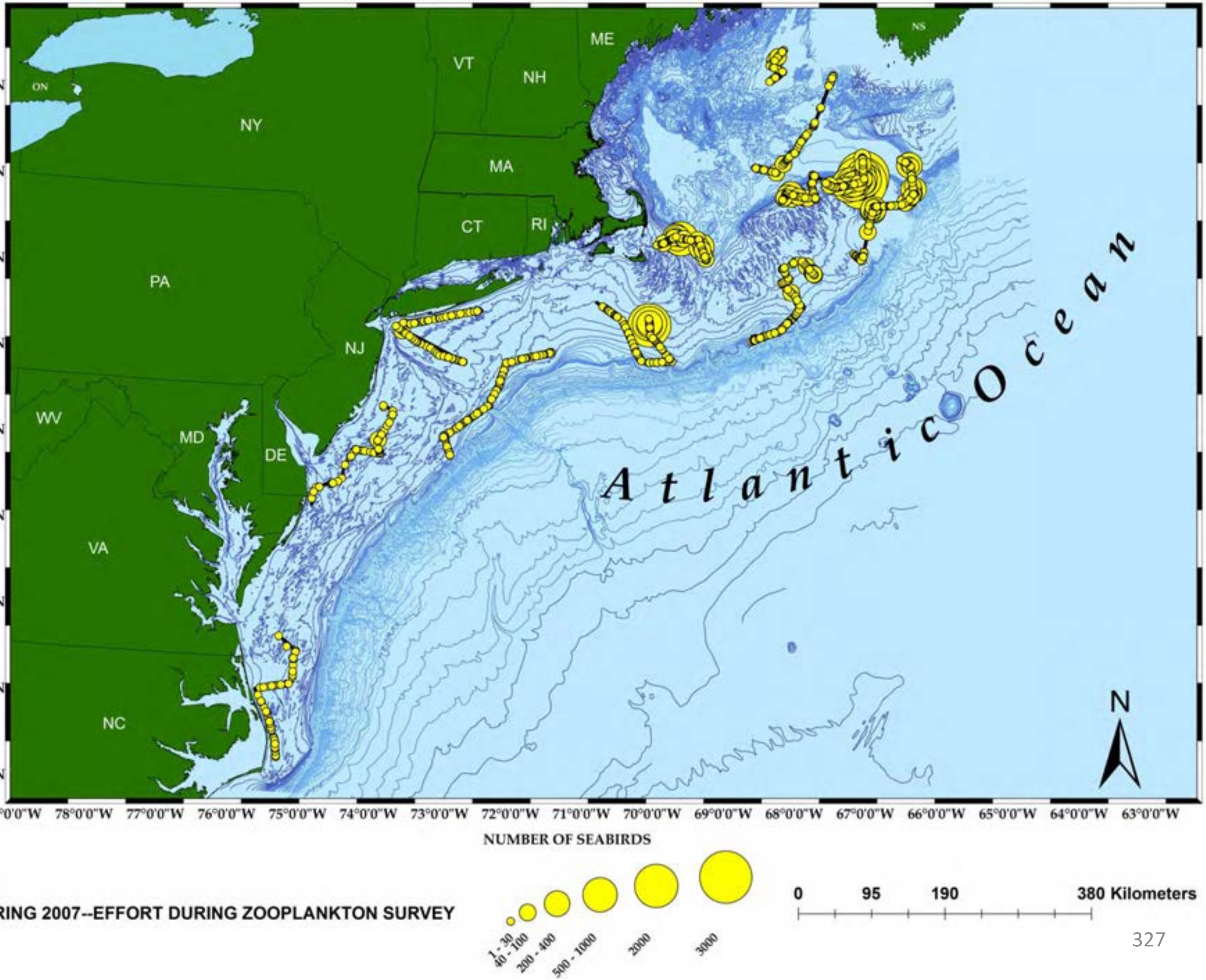
BROADSCALE DISTRIBUTION OF PELAGIC BIRDS OFF THE U.S. EAST COAST, MAINE TO NORTH CAROLINA

Richard R. Veit
Timothy P. White
Marie-Caroline Martin

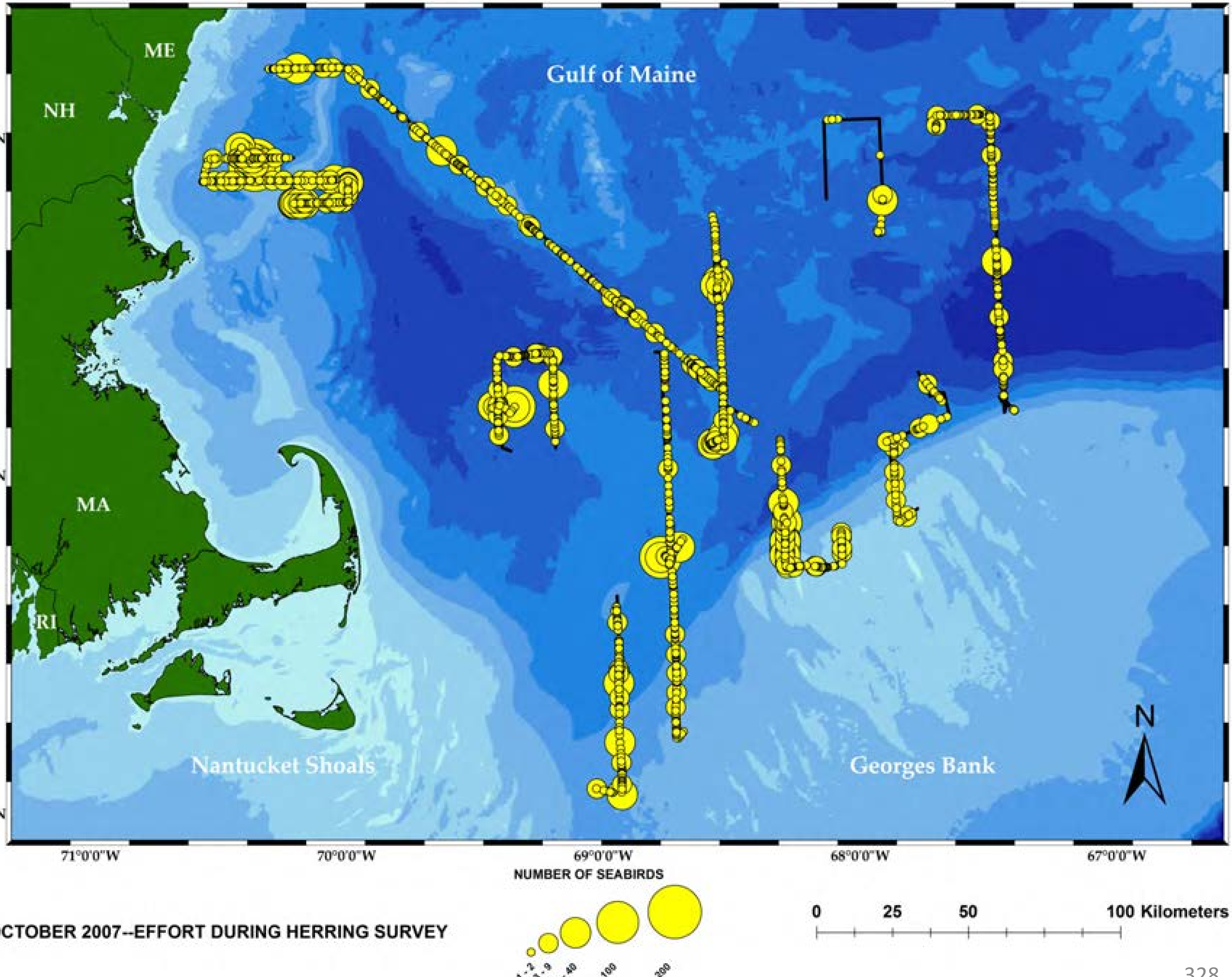
Biology Department
College of Staten Island/
City University of New York
2800 Victory Boulevard
Staten Island, NY 10309

Melanie J. Steinkamp
USFWS


NOAA
R 225
HENRY B. BIGELOW



SPRING 2007--EFFORT DURING ZOOPLANKTON SURVEY



OCTOBER 2007--EFFORT DURING HERRING SURVEY

So 31 cruises so far
Summer 2007-February 2011

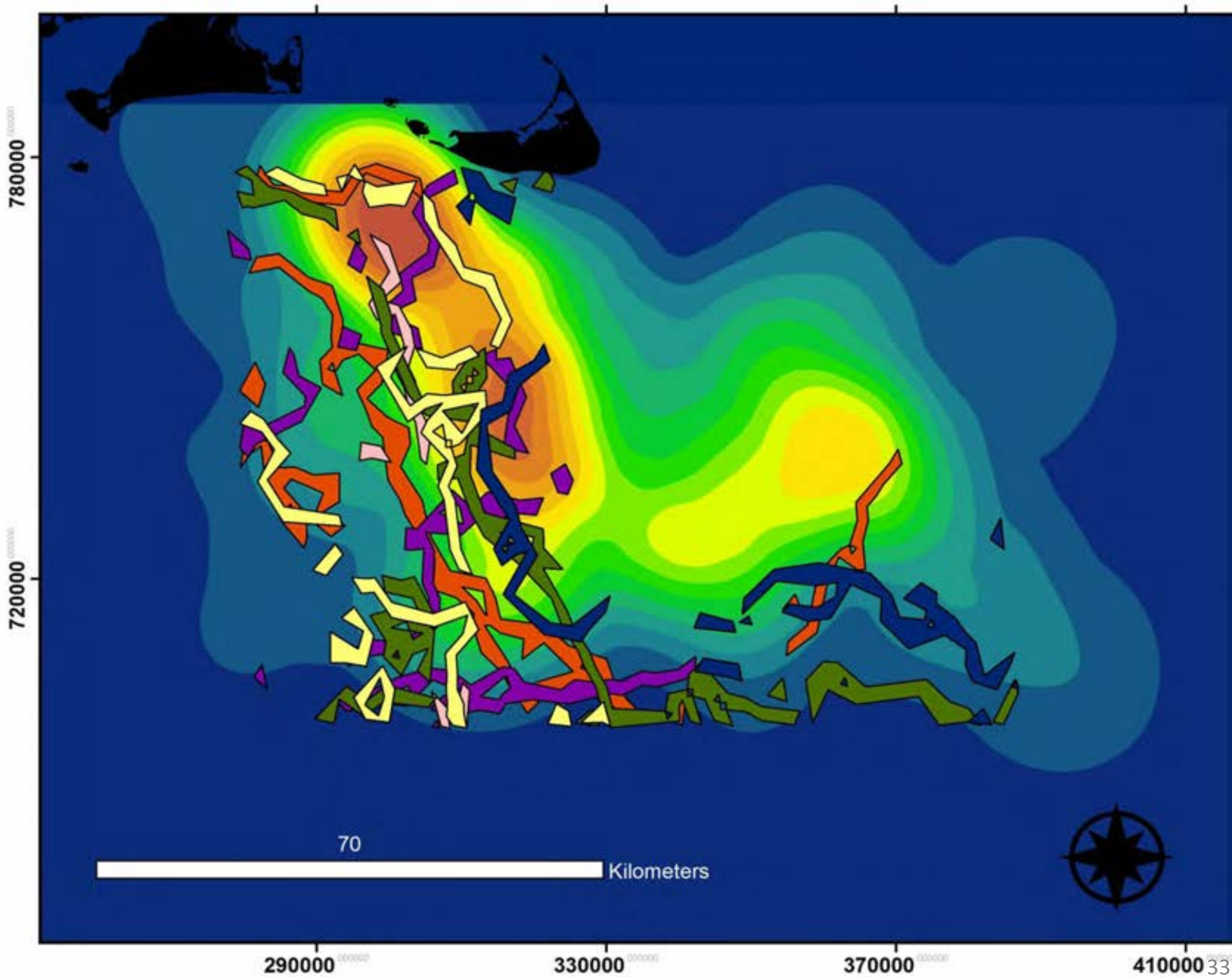
4 Ecomon per year

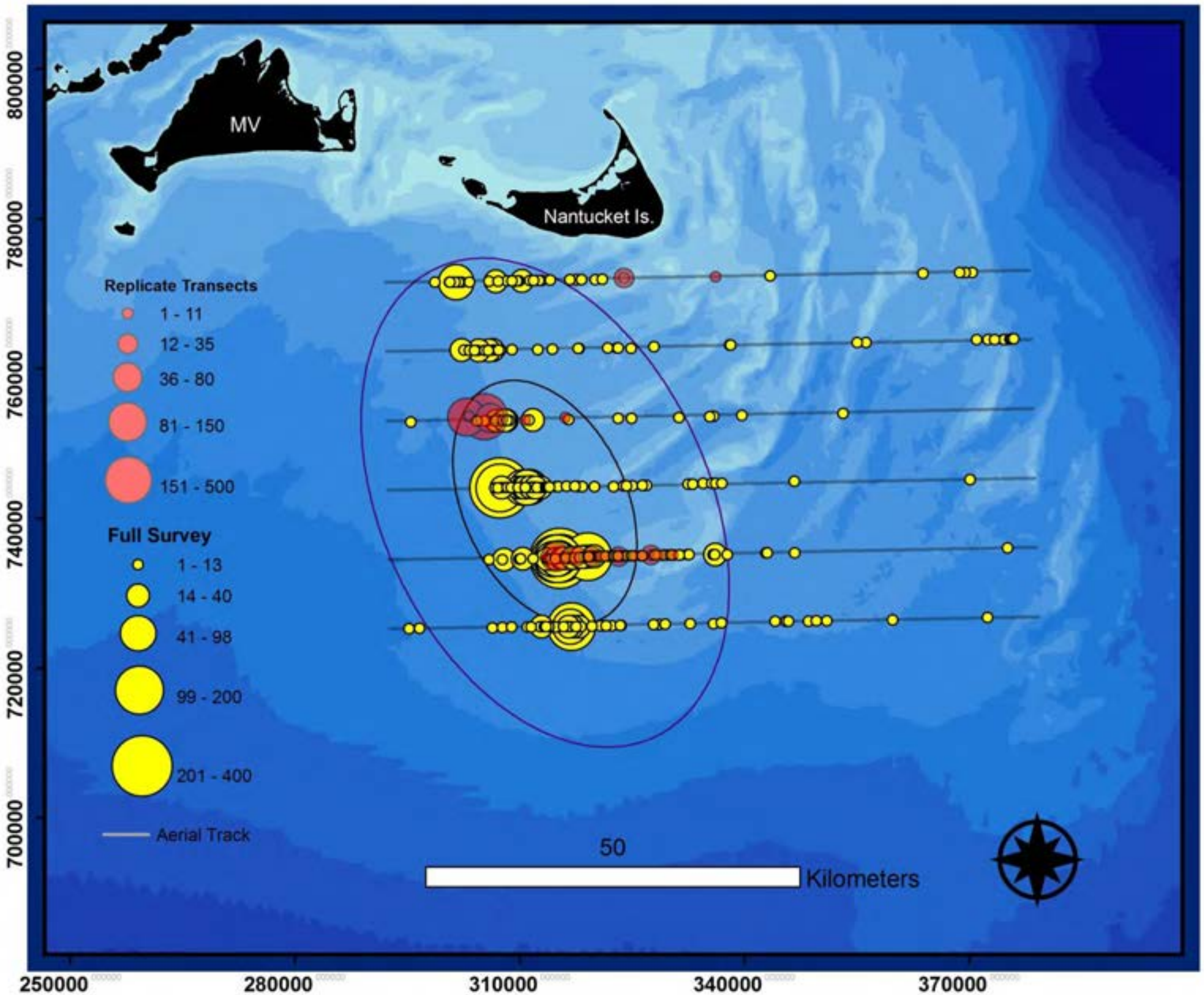
1-2 Herring per year

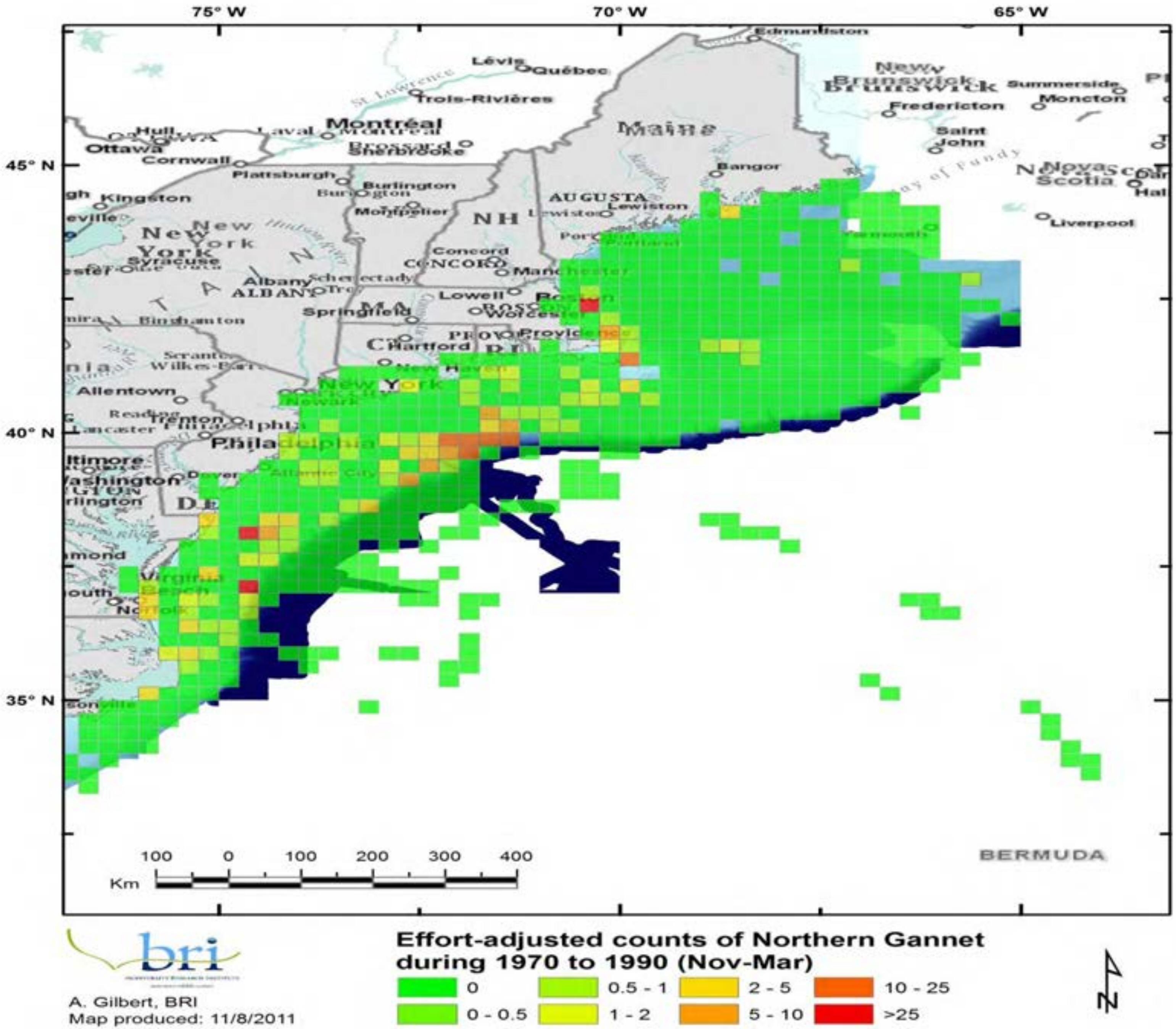
3 whoi cruises

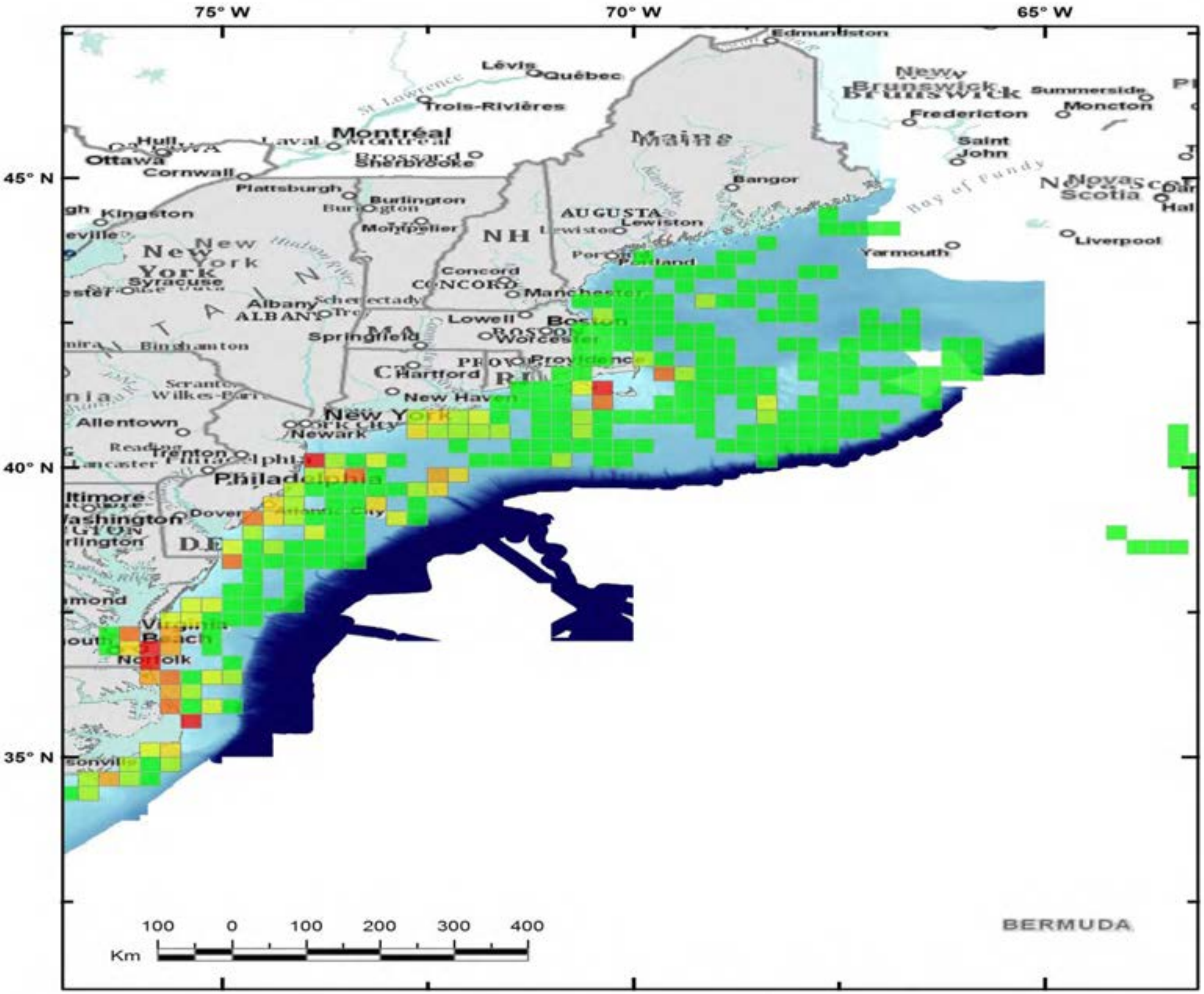
Hotspots

Combining shipboard data with large spatio-temporal databases


780000
720000
290000
330000
370000
410000
70
Kilometers


MV
Nantucket Is.
Replicate Transects
1 - 11
12 - 35
36 - 80
81 - 150
151 - 500
Full Survey
1 - 13
14 - 40
41 - 98
99 - 200
201 - 400
Aerial Track
50
Kilometers
800000
780000
760000
740000
720000
700000
250000
280000
310000
340000
370000


75° W
70° W
65° W
45° N
40° N
35° N
Maine
New Brunswick
Nova Scotia
New York
NH
MA
Boston
Philadelphia
Montréal
Bangor
Portland
Providence
Norfolk
BERMUDA
100 0 100 200 300 400
Km
Effort-adjusted counts of Northern Gannet during 1970 to 1990 (Nov-Mar)
0
0 - 0.5
0.5 - 1
1 - 2
2 - 5
5 - 10
10 - 25
>25
bri
A. Gilbert, BRI
Map produced: 11/8/2011
N



Effort-adjusted counts of Northern Gannet during 2000 to 2010 (Nov-Mar)

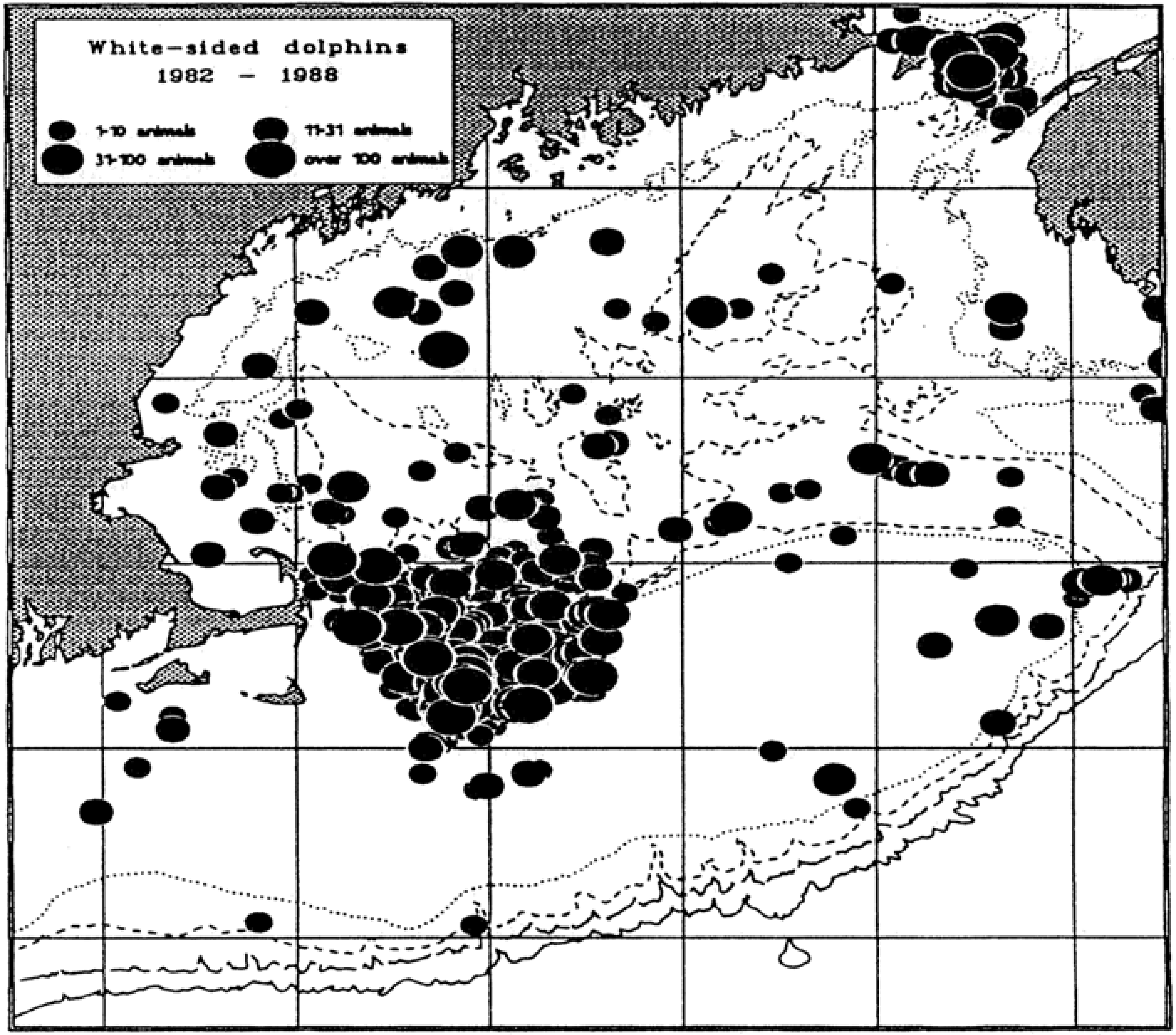
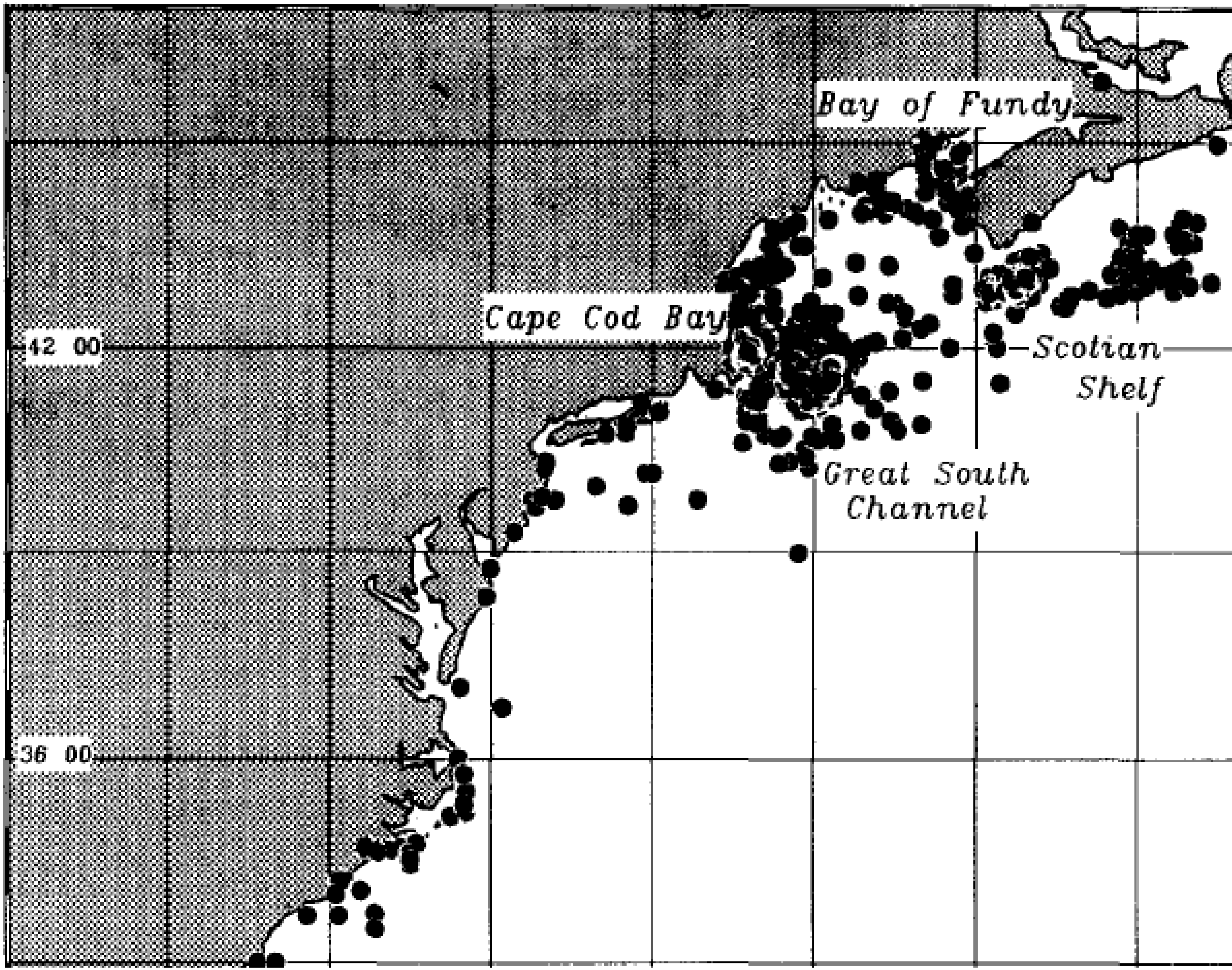
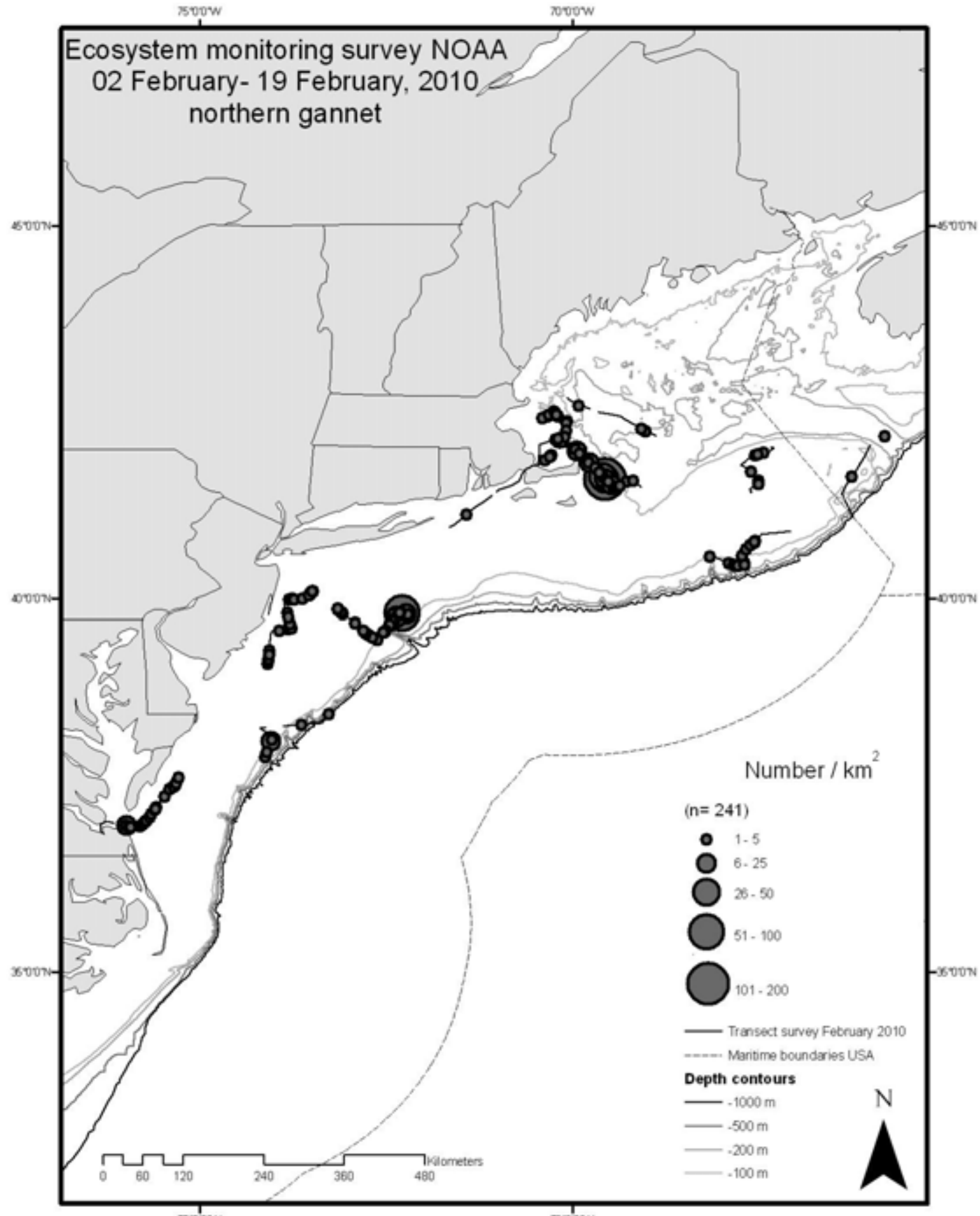


Figure 10-3. The distribution of white-sided dolphin (Lagenorhynchus acutus) sightings throughout the study area, 1982–1988.

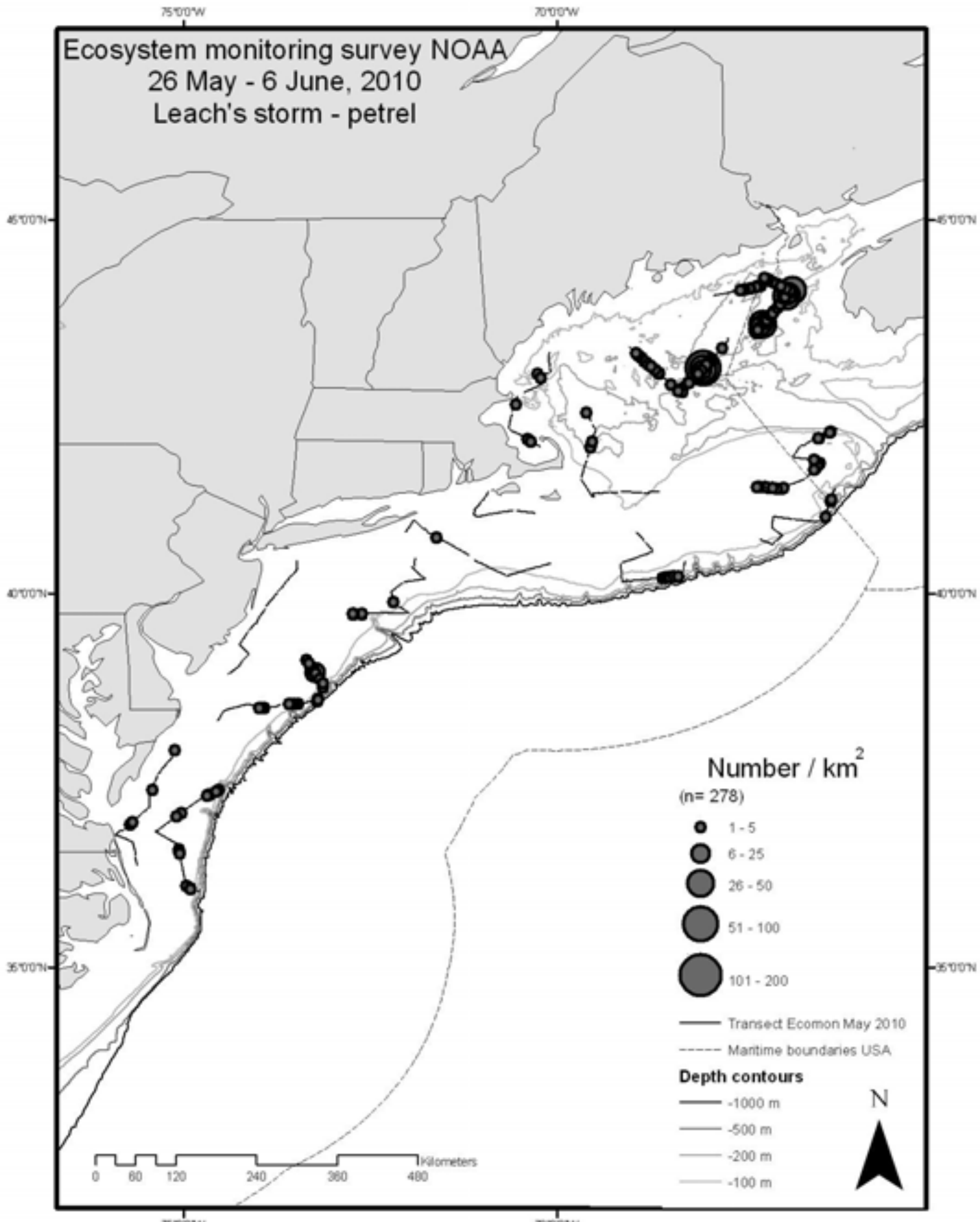

Bay of Fundy
Cape Cod Bay
42 00
Scotian Shelf
Great South Channel
36 00


Ecosystem monitoring survey NOAA
02 February- 19 February, 2010
northern gannet
Number / km2
(n= 241)
1 - 5
6 - 25
26 - 50
51 - 100
101 - 200
Transect survey February 2010
Maritime boundaries USA
Depth contours
-1000 m
-500 m
-200 m
-100 m
N
0 60 120 240 360 480
Kilometers

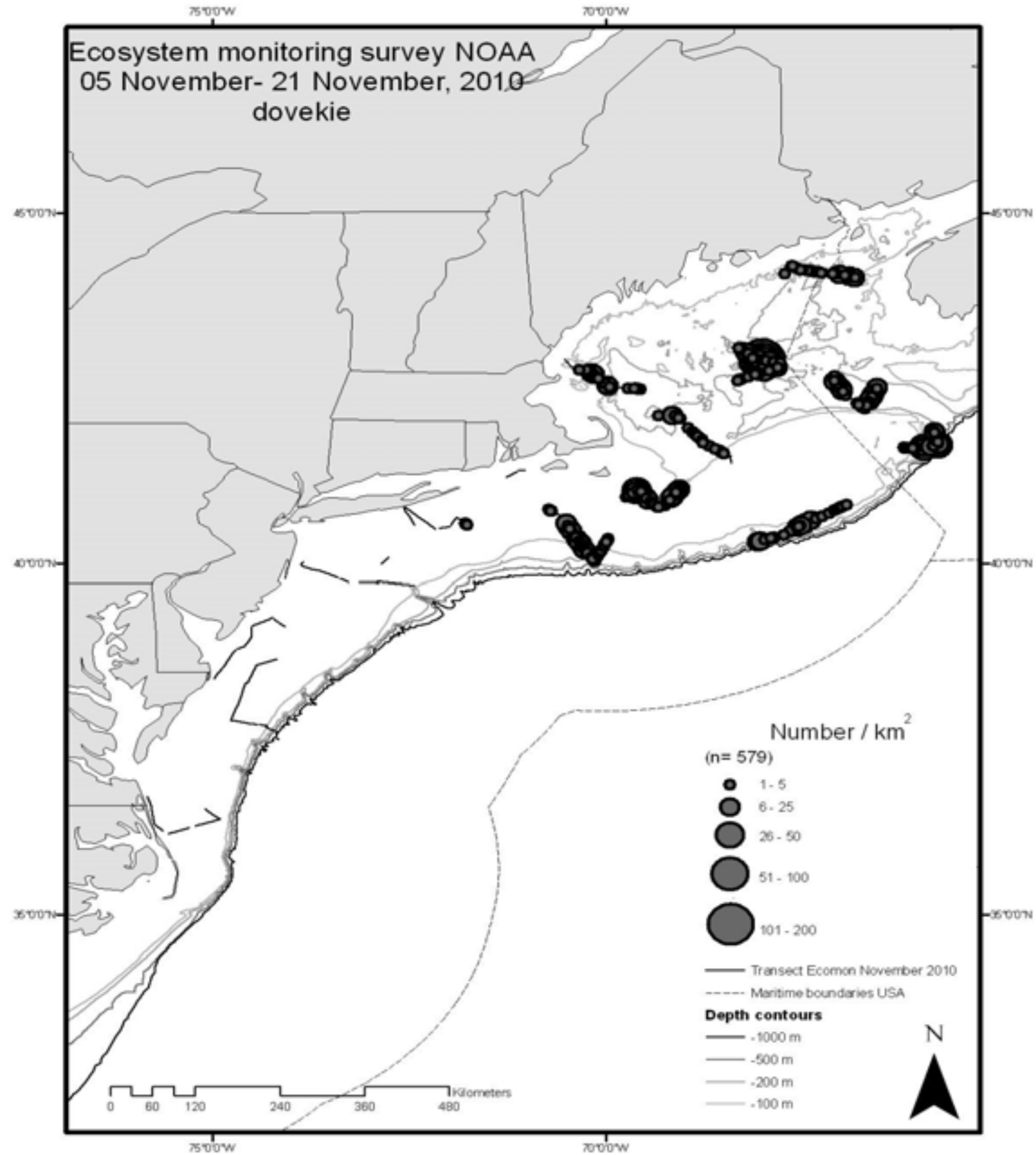
Historical Comparisons

Manomet Bird Observatory Data

1970s-1980s



Ecosystem monitoring survey NOAA
26 May - 6 June, 2010
Leach's storm - petrel
Number / km2
(n= 278)
1 - 5
6 - 25
26 - 50
51 - 100
101 - 200
Transect Ecomon May 2010
Maritime boundaries USA
Depth contours
-1000 m
-500 m
-200 m
-100 m
N
Kilometers
0
60
120
240
360
480



Ecosystem monitoring survey NOAA
05 November- 21 November, 2010
dovekie
Number / km2
(n= 579)
1 - 5
6 - 25
26 - 50
51 - 100
101 - 200
Transect Ecomon November 2010
Maritime boundaries USA
Depth contours
-1000 m
-500 m
-200 m
-100 m
N
0 60 120 240 360 480
Kilometers

Table 2. Densities of dominant species recorded in 2010 (birds/km^2). Density estimates for 1970s-1980s (from Powers 1983) given *in italics* belo

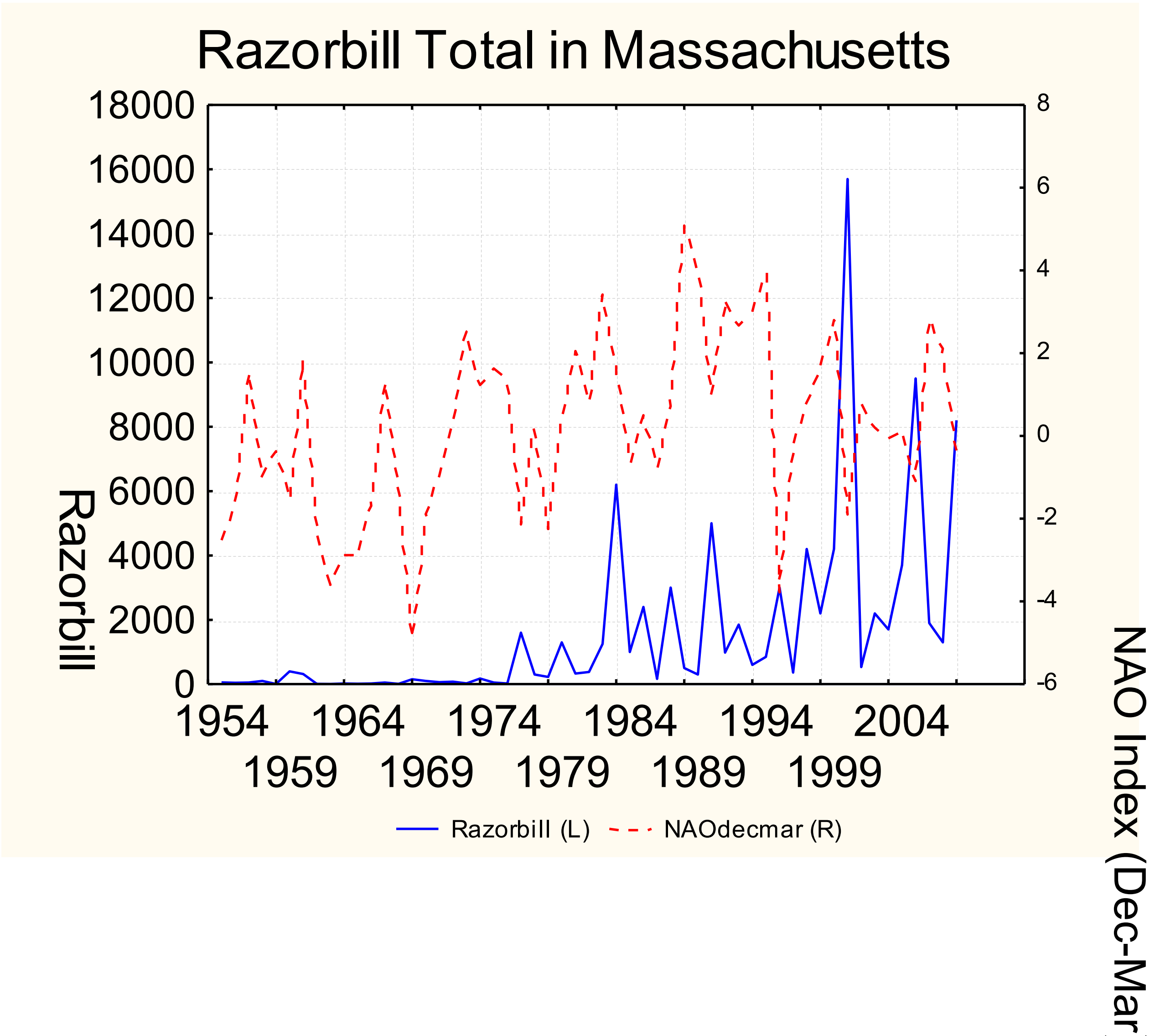
	February 2010	**May 2010**	**August 2010**	**November 2010**
Northern Fulmar	2.4 *(7.5)*	1.6 *(3.8)*	0 *(0)*	**8.5** ***(1.5)***
Greater Shearwater	0 (0)	6.8 *(1.5)*	7.3 *(2.75)*	5.7 *(7.5)*
Wilson's Storm-petrel	0 *(0)*	4.4 *(6.0)*	3.9 *(8.0)*	1.59 *(0.5)*
Northern Gannet	1.4 *(1.0)*	0.28 *(1.75)*	0.29 *(0.25)*	**6.3** ***(1.25)***
Herring Gull	2.6 *(3.75)*	0.50 *(1.5)*	1.7 *(0.75)*	2.3 *(8.5)*
Dovekie	0.36 *(1.0)*	0.09 *(1.0)*	0 *(0)*	**8.1** ***(0)***

Table 3. Greater Shearwater abundance within four strata sampled both in the 1970s (Powers 1983) , 2008-2009 and 2010 (this study).

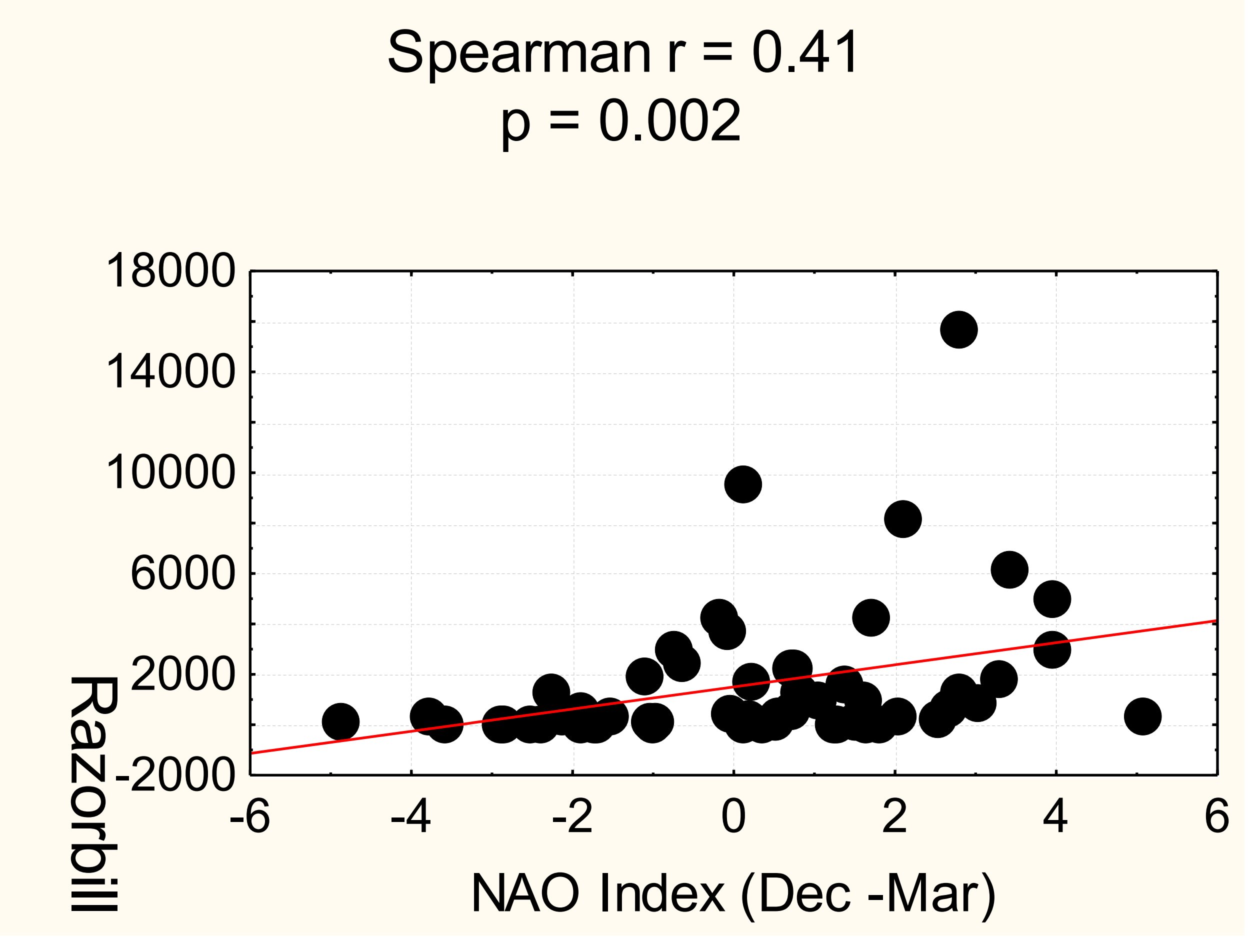
		1970s (Powers 1983) Birds/km^2		2008-2009 Birds/km^2		2010 Birds/km^2
May		2.0		**3.7**		**19.8**
		2.0		**4.3**		**7.3**
		2.0		0.1		0.2
	Mid	0		**4.1**		0.05
August		**8.0**		3.0		12.9
		3.0		0.3		8.1
		3.0		0.3		1.0
	Mid	0		0.1		0
October		**30.0**		4.4		(Nov) 6.2
		12.0		5.7		(Nov) 5.9
		15.0		0.7		(Nov) 2.8
	Mid	**2.0**		0		(Nov) 8.0

Climate Change

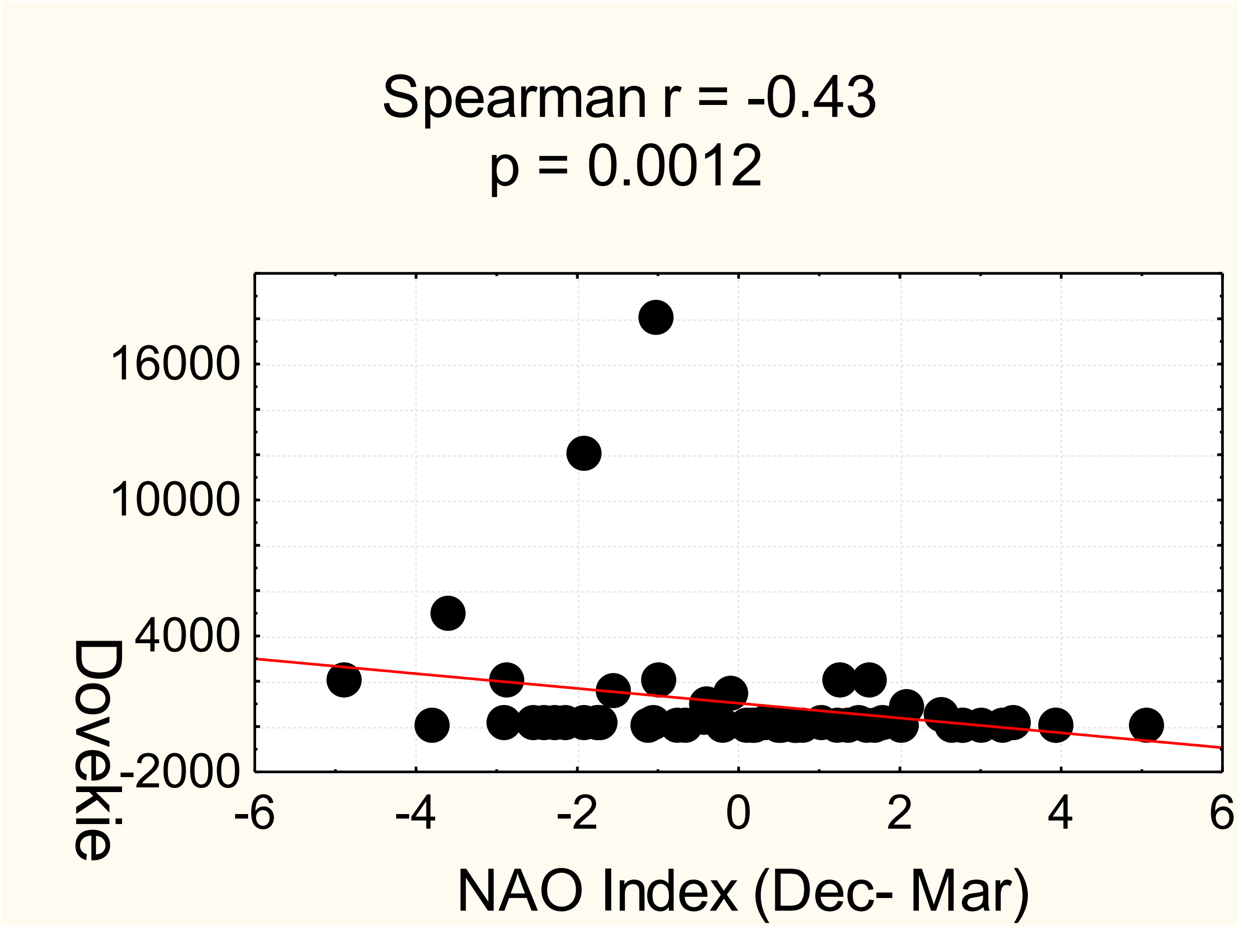
Need to know this for interpretation of current data



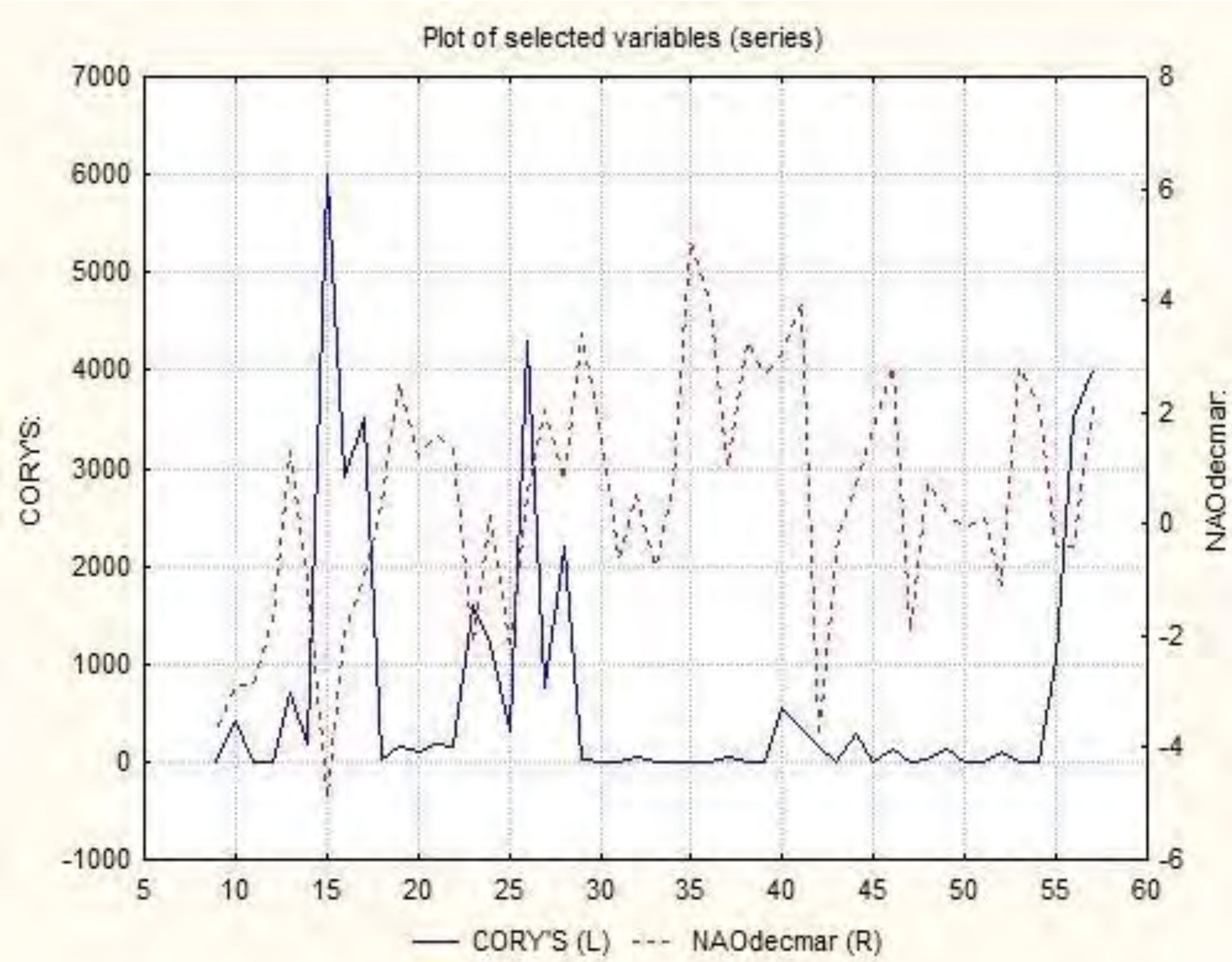
Razorbill Total in Massachusetts
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Razorbill
8
6
4
2
0
-2
-4
-6
NAO Index (Dec-Mar)
1954
1964
1974
1984
1994
2004
1959
1969
1979
1989
1999
Razorbill (L)
NAOdecmar (R)



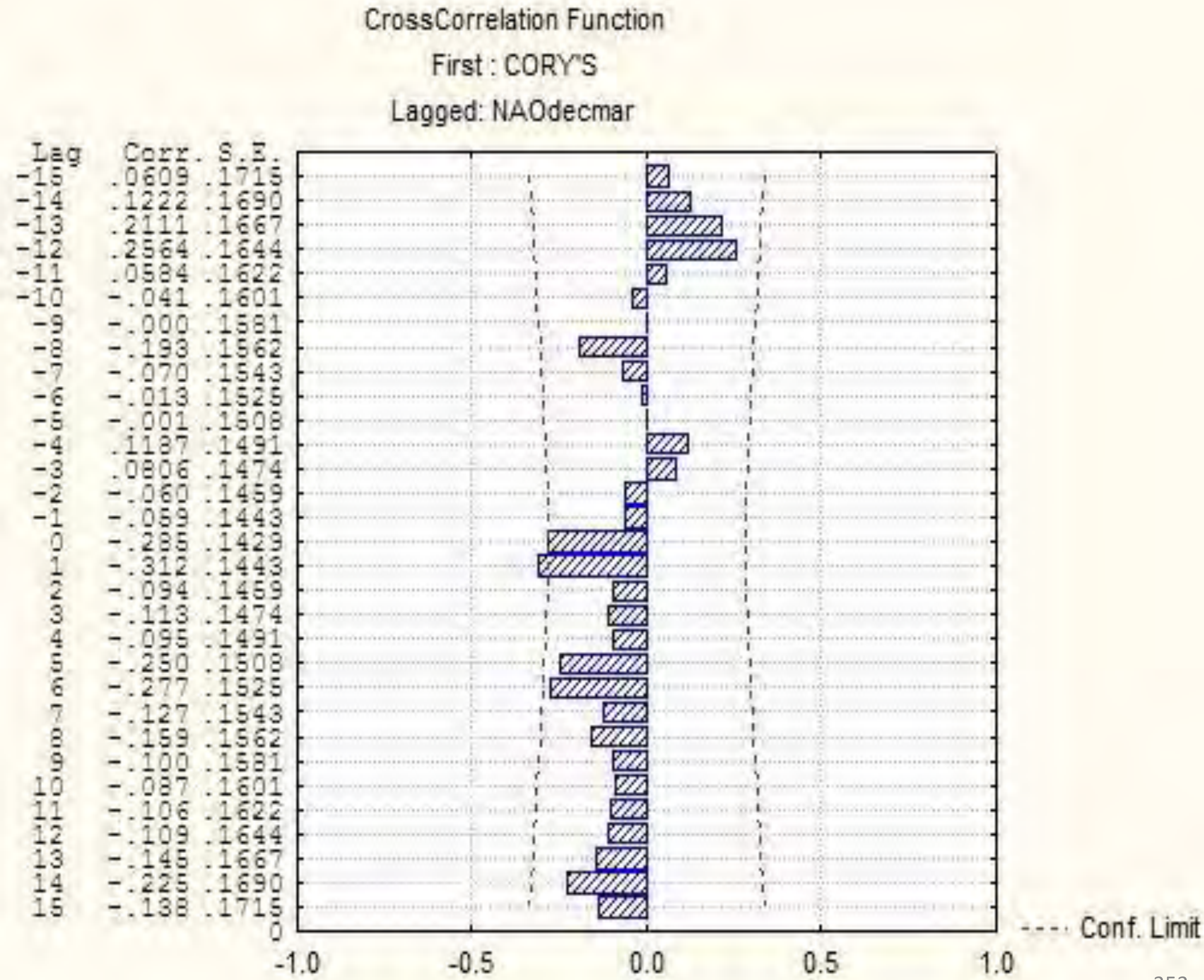
Spearman r = 0.41
p = 0.002
18000
14000
10000
6000
2000
-2000
-6
-4
-2
0
2
4
6
Razorbill
NAO Index (Dec -Mar)


Spearman r = -0.43
p = 0.0012
16000
10000
4000
-2000
Dovekie
-6
-4
-2
0
2
4
6
NAO Index (Dec- Mar)


© Aviad Scheinin



Plot of selected variables (series)
7000
6000
5000
4000
3000
2000
1000
0
-1000
CORY'S:
8
6
4
2
0
-2
-4
-6
NAOdecmar:
5
10
15
20
25
30
35
40
45
50
55
60
CORY'S (L)
NAOdecmar (R)


CrossCorrelation Function
First : CORY'S
Lagged: NAOdecmar
Lag Corr. S.E.
-15 .0609 .1715
-14 .1222 .1690
-13 .2111 .1667
-12 .2564 .1644
-11 .0584 .1622
-10 -.041 .1601
-9 -.000 .1581
-8 -.193 .1562
-7 -.070 .1543
-6 -.013 .1525
-5 -.001 .1508
-4 .1187 .1491
-3 .0806 .1474
-2 -.060 .1459
-1 -.059 .1443
0 -.285 .1429
1 -.312 .1443
2 -.094 .1459
3 -.113 .1474
4 -.095 .1491
5 -.250 .1508
6 -.277 .1525
7 -.127 .1543
8 -.159 .1562
9 -.100 .1581
10 -.087 .1601
11 -.106 .1622
12 -.109 .1644
13 -.145 .1667
14 -.225 .1690
15 -.138 .1715
0
-1.0
-0.5
0.0
0.5
1.0
Conf. Limit

Summary

1.) Hotspots are evident and persistent

2.) Changes evident 1970s-present

3.) Changing climate has impacted birds

Presentation #9

Update on Offshore Acoustic Bat Research in Atlantic & Great Lakes Regions

Mid-Atlantic Marine Wildlife Survey, Modeling, and Data Workshop

July 24-25, 2012
Silver Spring, MD

Steve Pelletier, CWB, Principal Scientist
Trevor Peterson, Senior Wildlife Biologist
Sarah Boyden, Project Scientist
Joel Perkins, Project Technician

Stantec

2009–2011 Stantec Studies

Objectives

- Test effectiveness of acoustic equipment and methods to document offshore bat activity
- Assess presence of bats in a variety of offshore locations
- Assess offshore fall migration activity patterns
  - Activity levels (mid-July – November)
  - Species composition
  - Seasonal activity trends
  - Nightly activity trends
- Assess annual variability in activity by repeating surveys
- Assess implications for offshore wind energy

Long-Distance Migrants

LABO

Eastern red bat
(*Lasiurus borealis*)

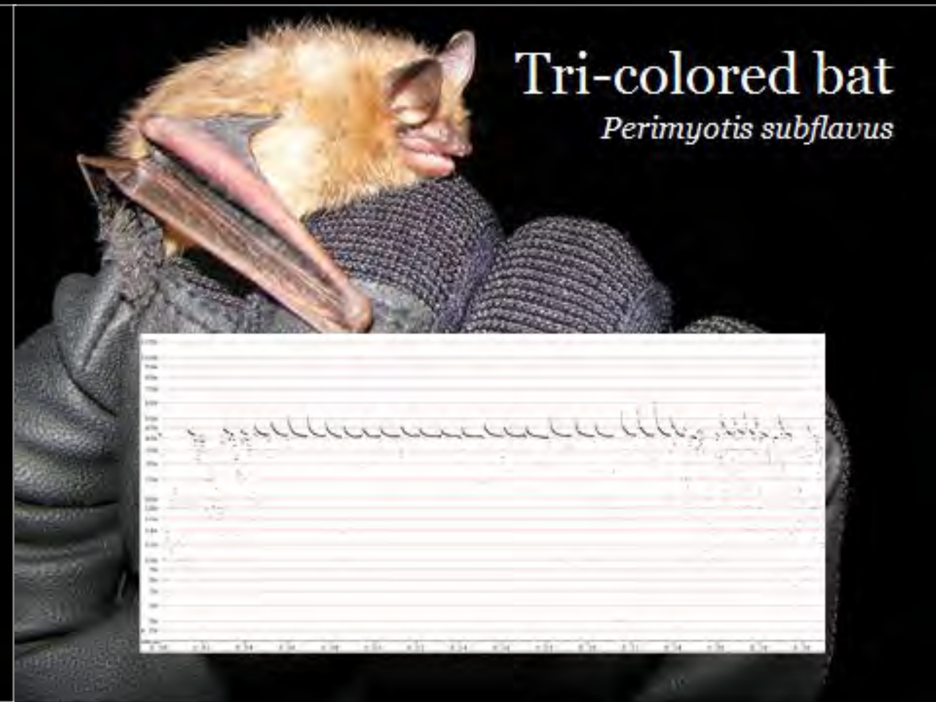
LANO

Silver-haired bat
(*Lasionycteris noctivagans*)

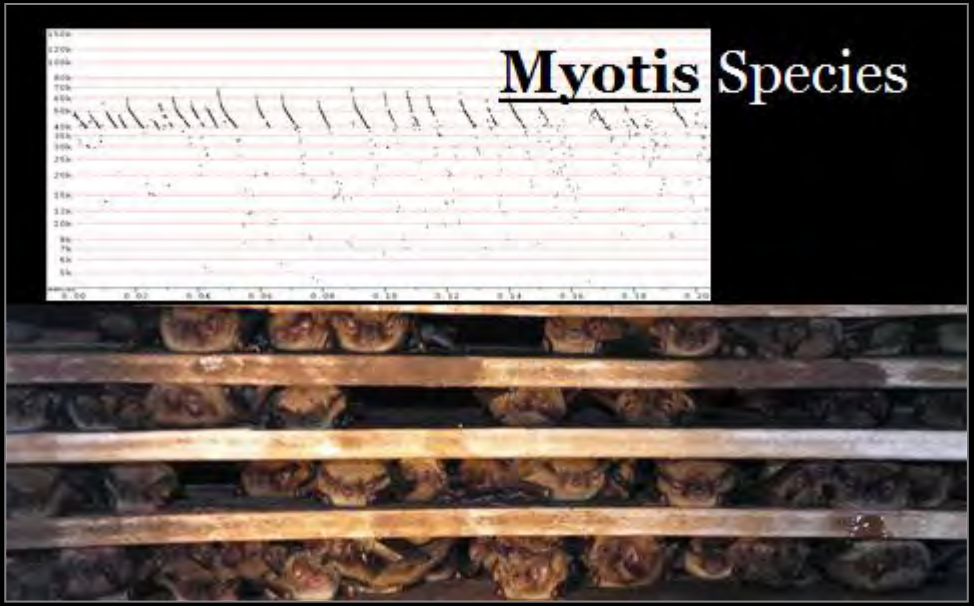
LACI

Hoary bat
(*Lasiurus cinereus*)

Big brown bat
Eptecicus fuscus



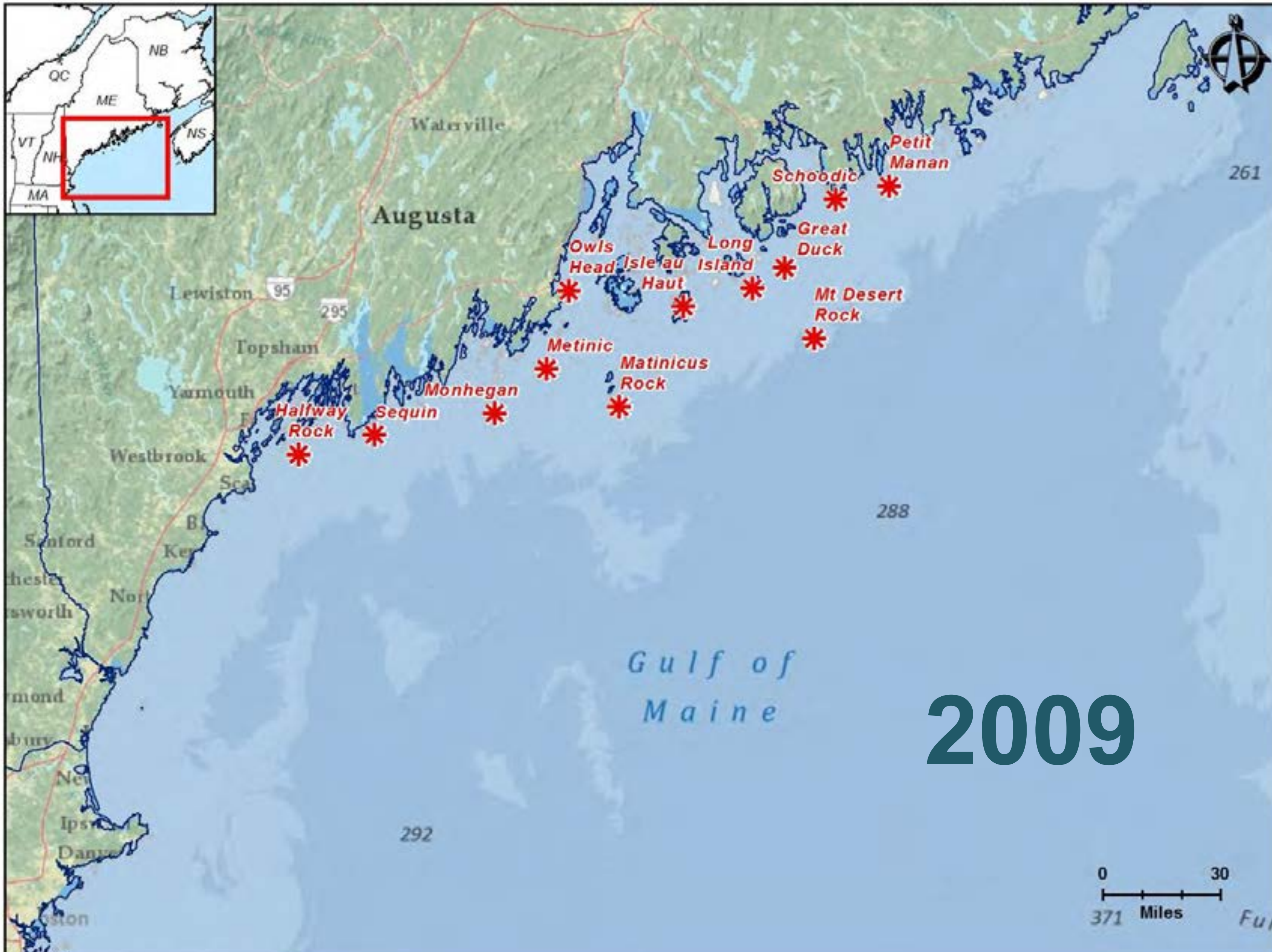
Tri-colored bat
Perimyotis subflavus

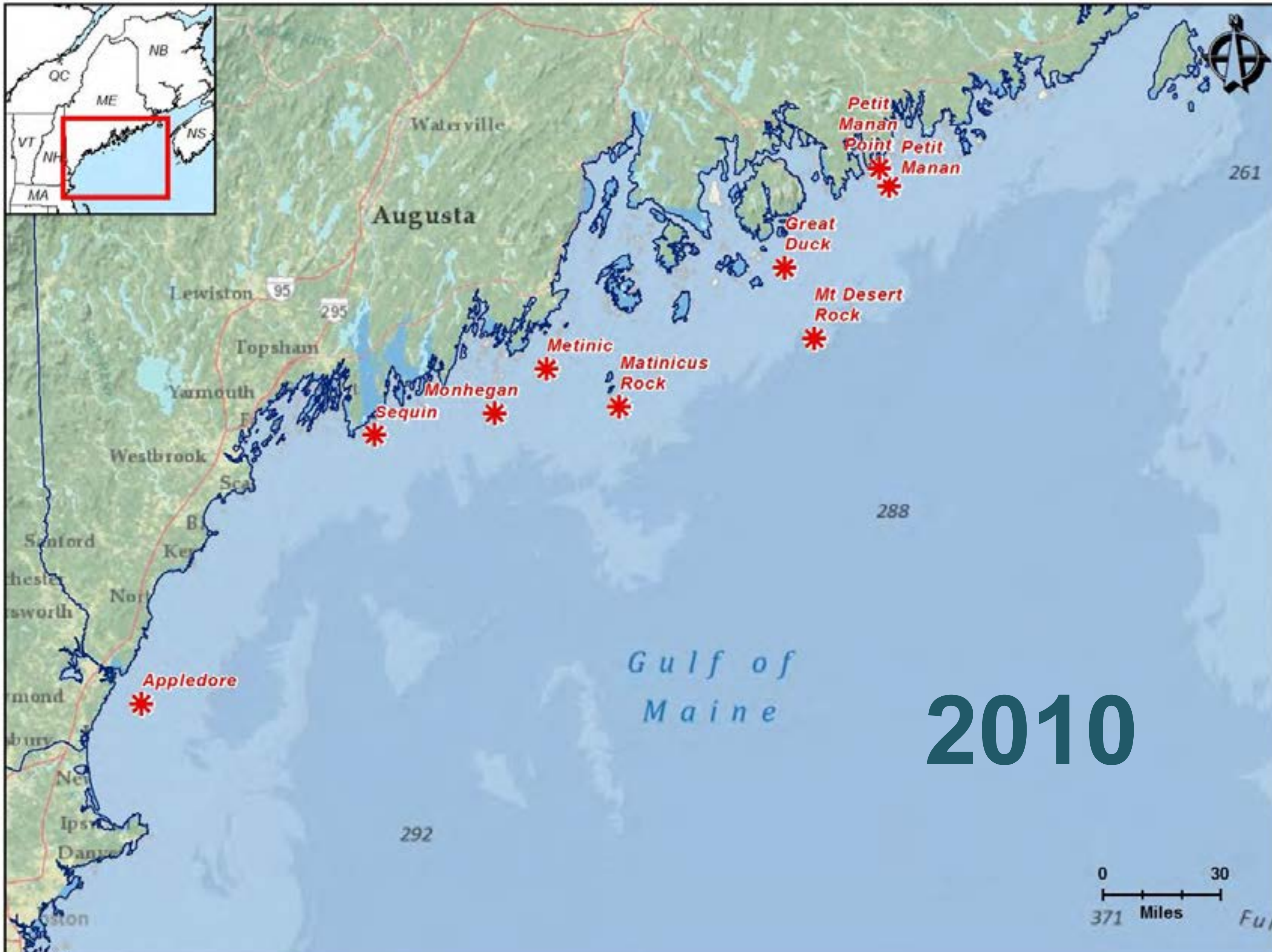

Myotis Species

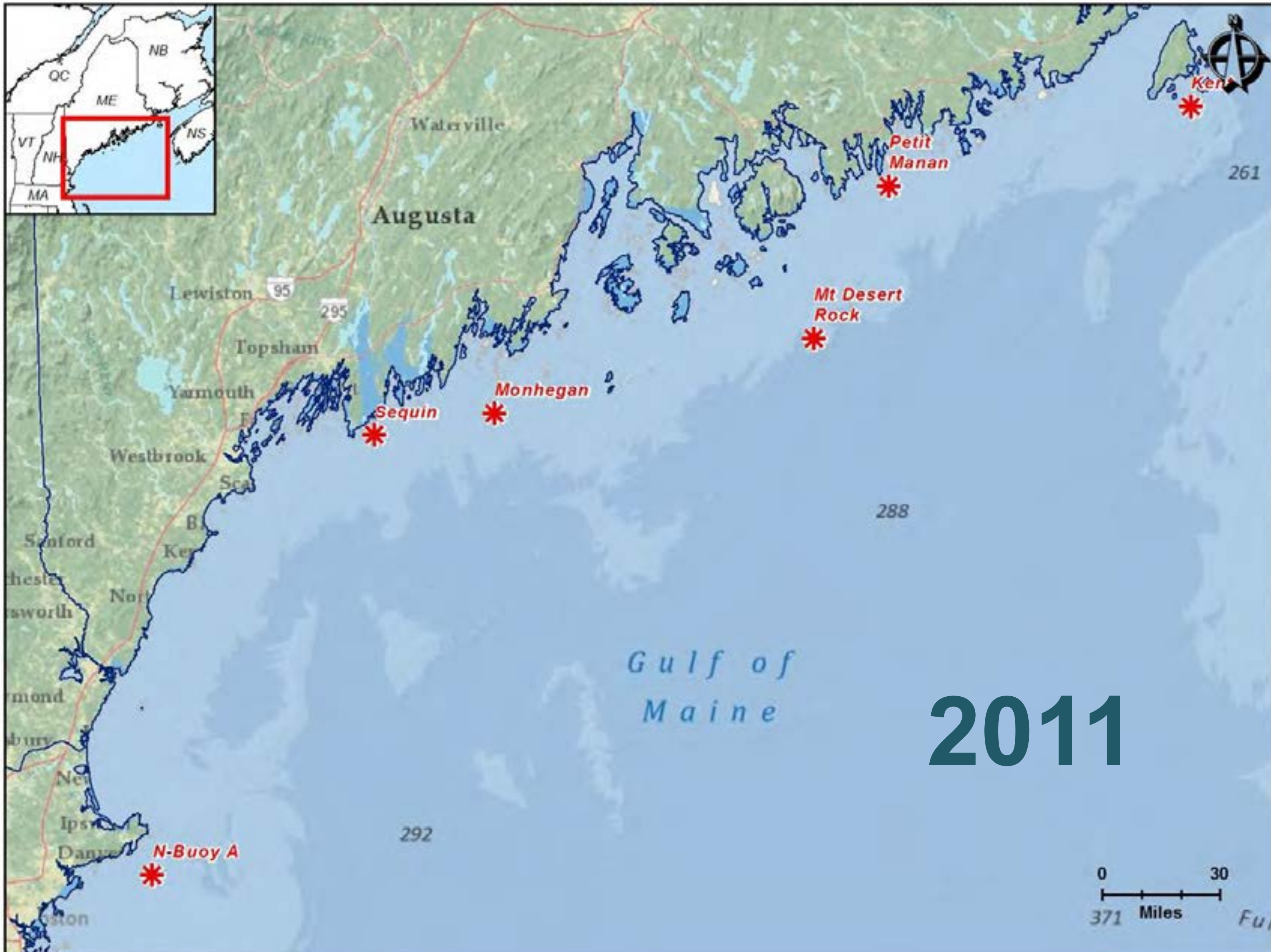

Northern long-eared bat
Myotis septentrionalis


Eastern small-footed bat
Myotis leibii


Little brown bat
Myotis lucifugus


QC
NB
ME
NS
VT
NH
MA
Waterville
Augusta
Lewiston
Topsham
Yarmouth
Westbrook
Petit Manan
Schoodic
Great Duck
Long Island
Owls Head
Isle au Haut
Mt Desert Rock
Metinic
Matinicus Rock
Monhegan
Sequin
Halfway Rock
261
288
292
371
Gulf of Maine
2009
0
30
Miles


QC
NB
ME
VT
NH
NS
MA
Waterville
Augusta
Lewiston
95
295
Topsham
Yarmouth
Westbrook
Petit Manan Point
Petit Manan
Great Duck
Mt Desert Rock
Metinic
Matinicus Rock
Monhegan
Sequin
Appledore
261
288
292
Gulf of Maine
2010
0
30
Miles
371


QC
NB
ME
VT
NH
NS
MA
Waterville
Augusta
Lewiston
95
295
Topsham
Yarmouth
Westbrook
Sanford
Petit
Manan
261
Mt Desert
Rock
Monhegan
Sequin
288
Gulf of
Maine
292
N-Buoy A
0
30
Miles
371
2011

Results

- Remote acoustic detectors effective for long-term detection and monitoring of northeast bat species
- Bats detected at all 2009 - 2011 survey sites
- Peak movement periods detected
- Bats detected April thru November
- Non-migratory and migratory species documented at most sites

2012 - 2014

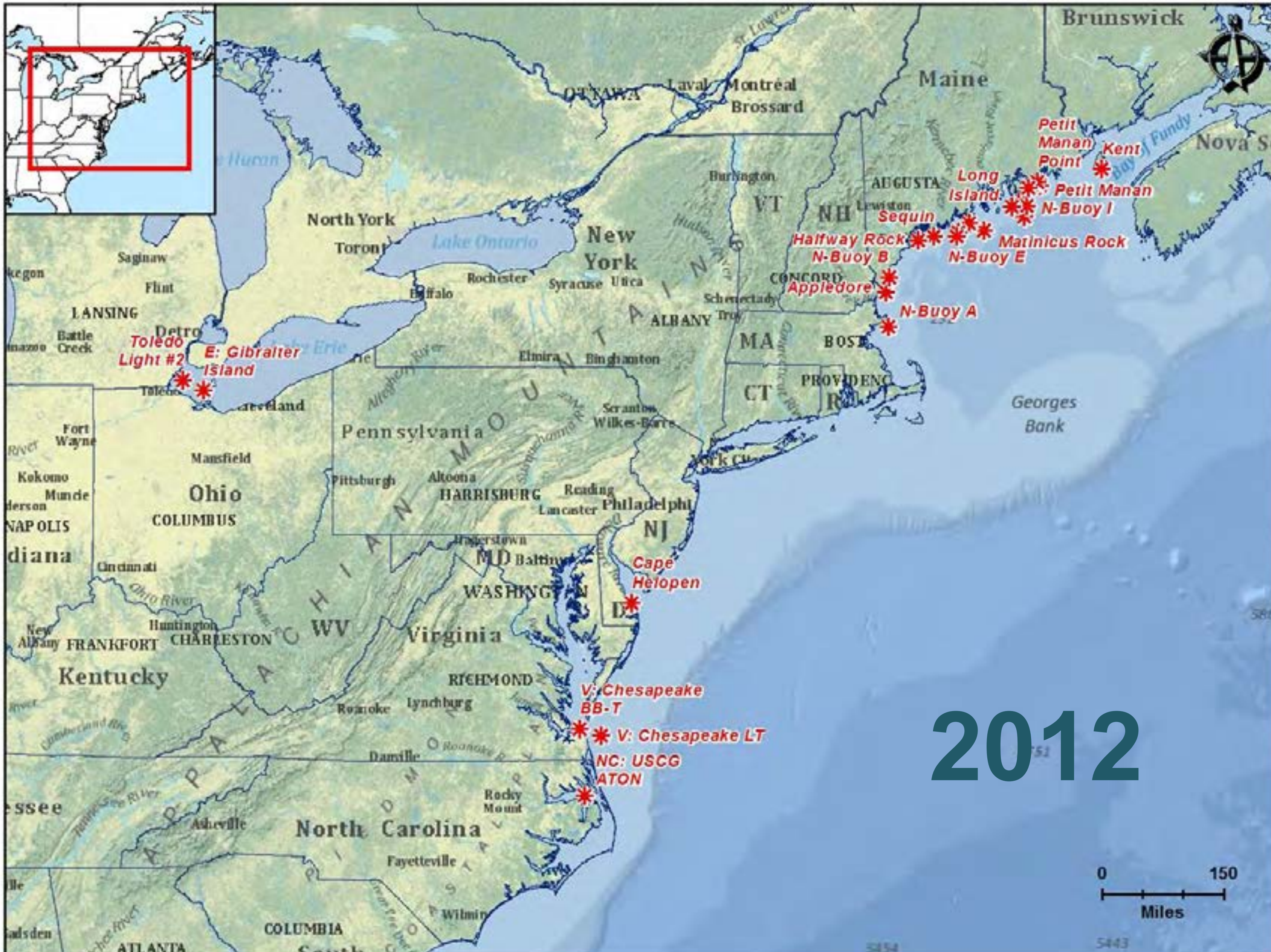
Department of Energy Study

3 Year Study

Expanded Regional Surveys

- **Gulf of Maine**
- **US Coastal Mid- Atlantic**
- **Great Lakes**

Targeted Spring – Early Winter


Toledo Light #2
E: Gibralter Island
Petit Manan Point
Kent
Long Island
Petit Manan
N-Buoy I
Sequin
Halfway Rock
N-Buoy B
Matinicus Rock
N-Buoy E
Appledore
N-Buoy A
Cape Helopen
V: Chesapeake BB-T
V: Chesapeake LT
NC: USCG ATON
Georges Bank
2012
0
150
Miles

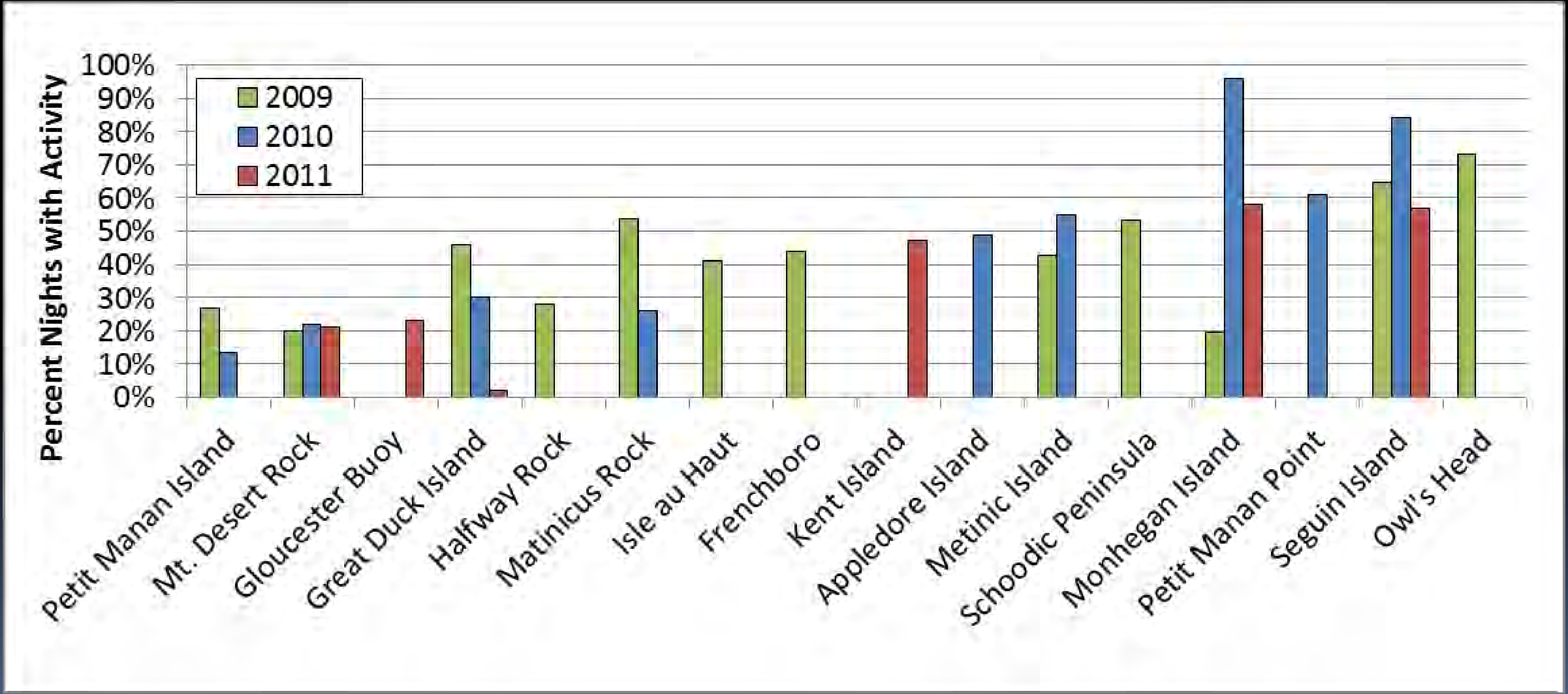
Data Analysis to Date

Survey Effort

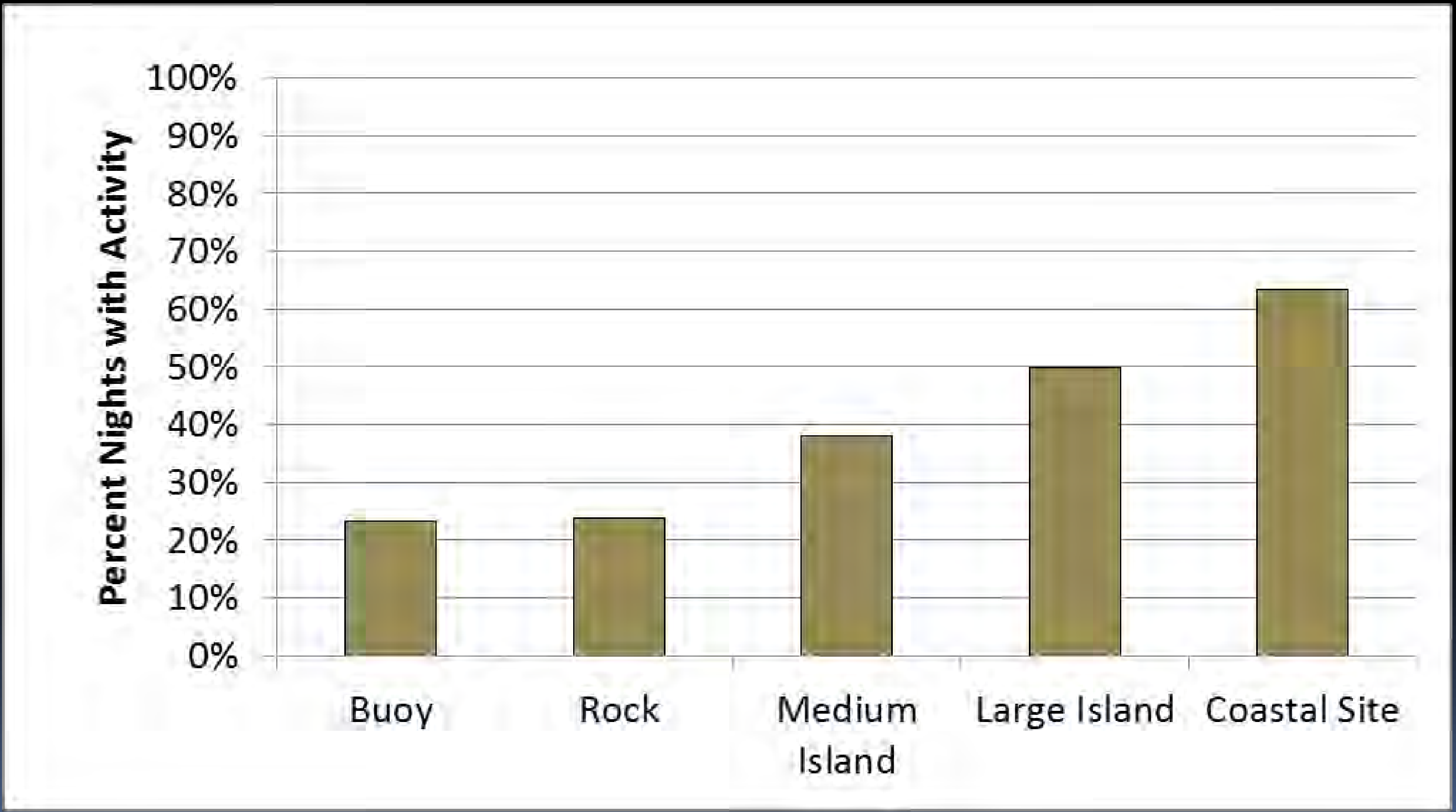
Year	2009	2010	2011
Survey Sites	12	9	6
Geographic Area	~125 miles	~170 miles	~240 miles
Survey Period	7/28–11/30	7/15–11/30	4/1-11/30
Survey Nights	948	801	600
Calendar Nights	126	139	244
% Active Nights	72	73	45

SITE	YEAR	SURVEY DATES	# SURVEY NIGHTS	% ACTIVE NIGHTS
Appledore Island	2010	8/10-11/30	113	49%
Frenchboro	2009	8/28-11/3	68	44%
Gloucester Buoy	2011	6/1-10/15	137	23%
Great Duck Island	2009	8/17-10/20	65	46%
	2010	8/27-11/30	96	30%
	2011	4/1-5/31	61	2%
Halfway Rock	2009	8/13-11/30	110	28%
Isle au Haut	2009	8/26-11/11	78	41%
Kent Island	2011	7/3-8/18	47	47%
Matinicus Rock	2009	9/2-9/14	13	54%
	2010	8/5-10/31	88	26%
Metinic Island	2009	7/29-10/27	91	43%
	2010	7/16-10/16	93	55%
Monhegan Island	2009	9/16-11/30	76	20%
	2010	7/19-9/4	48	96%
	2011	8/12-11/30	111	58%
Mt. Desert Rock	2009	8/17-11/30	106	20%
	2010	8/26-11/30	97	22%
	2011	4/1-9/17	170	21%
Owl's Head	2009	8/11-11/14	93	73%
Petit Manan Island	2009	7/28-10/29	94	27%
	2010	7/30-11/11	105	13%
Petit Manan Point	2010	9/7-11/4	59	61%
Schoodic Peninsula	2009	8/18-10/31	75	53%
Seguin Island	2009	8/25-11/11	79	65%
	2010	7/15-10/24	102	84%
	2011	8/27-11/8	74	57%
Overall	**2009**	**7/28-11/30**	**948**	41%
	2010	**7/15-11/30**	**801**	45%
	2011	**4/1-11/30**	**600**	36%

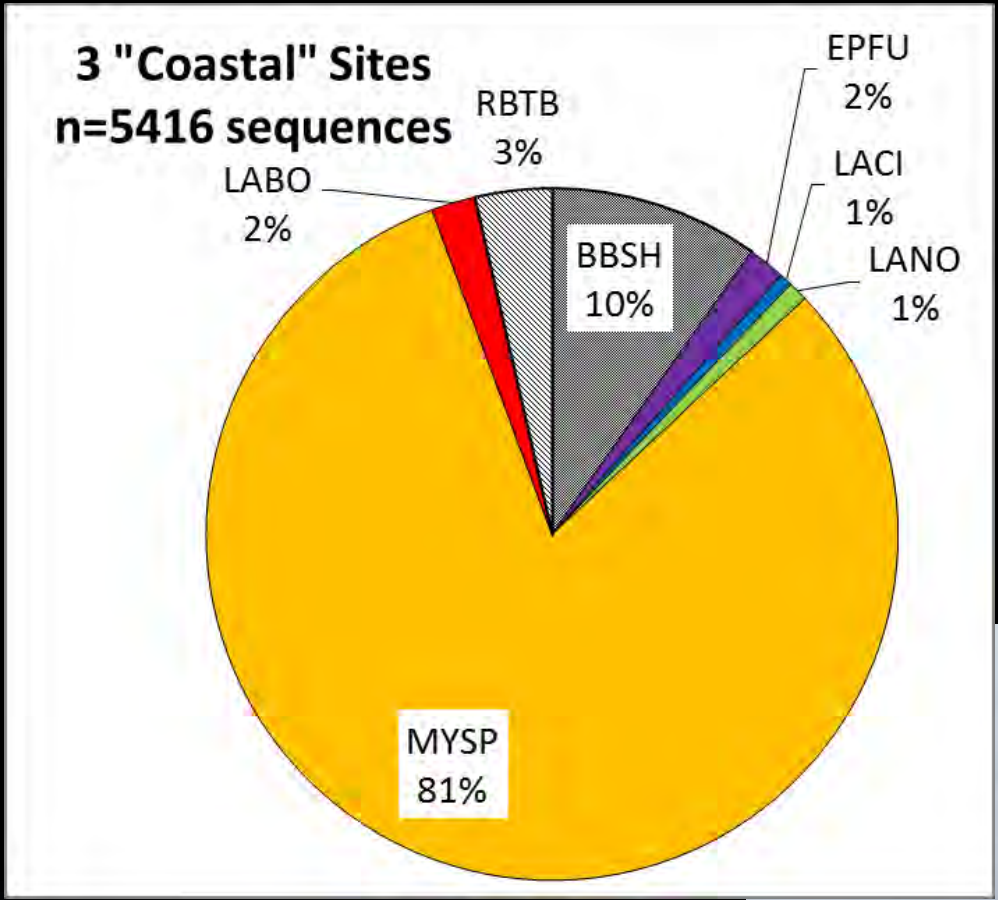
% Active Nights by Year 2009 thru 2011

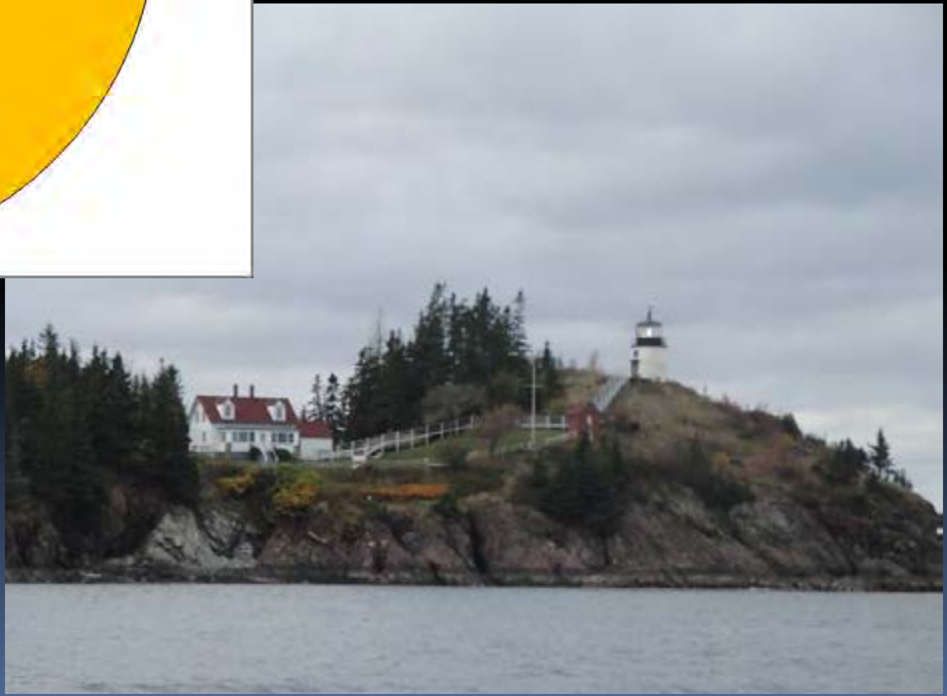


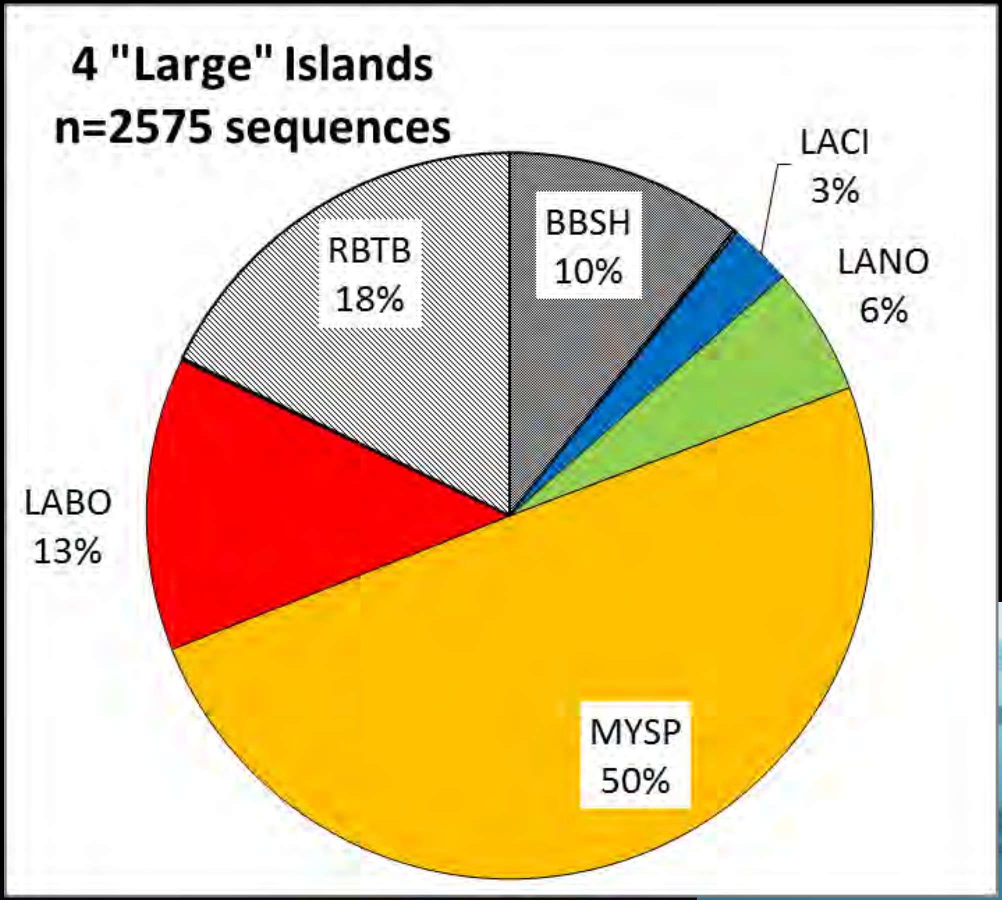
% Active Nights vs Site Type



Coastal Sites

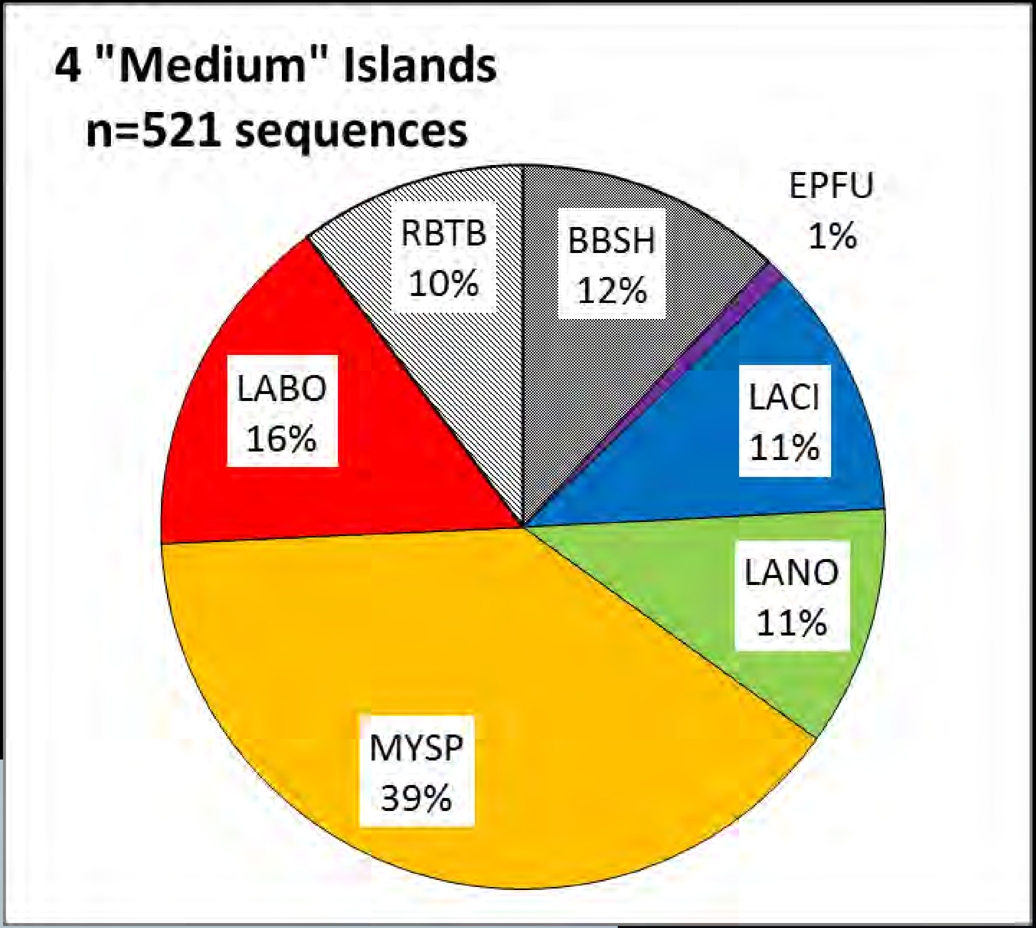


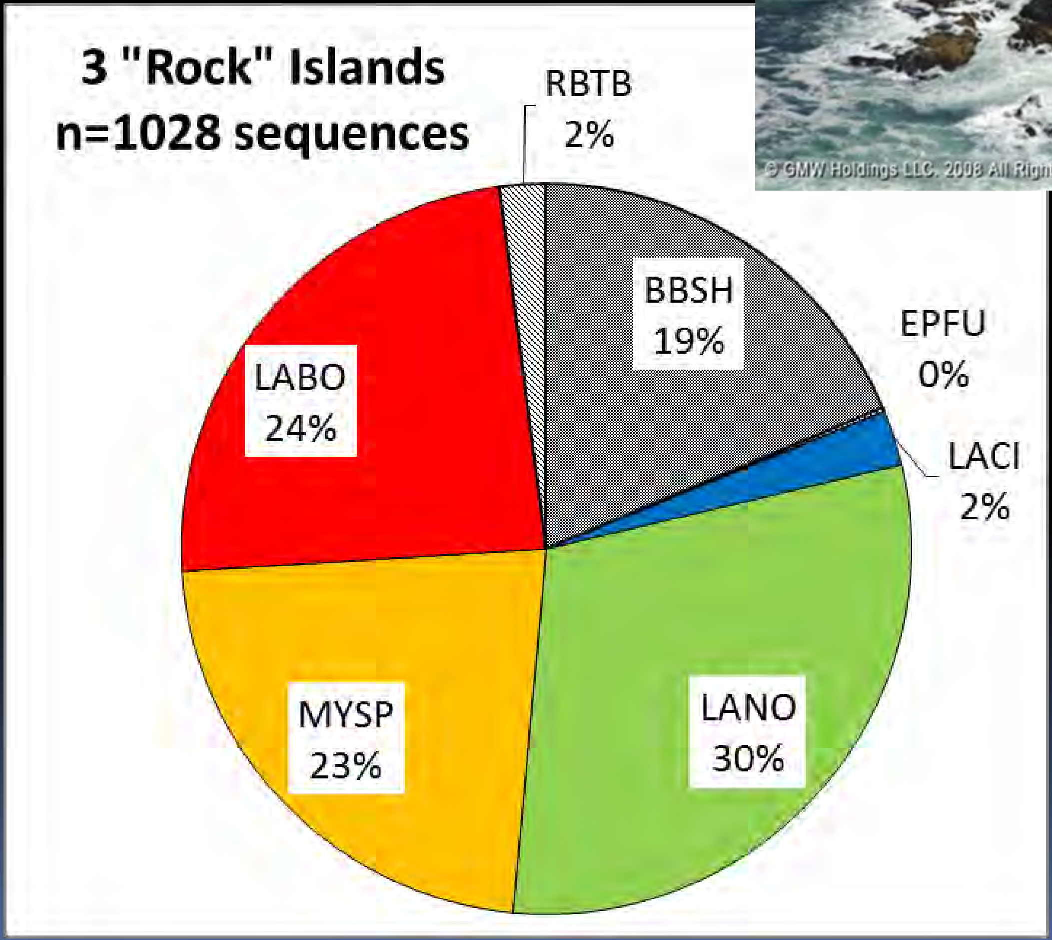




Large Island Sites

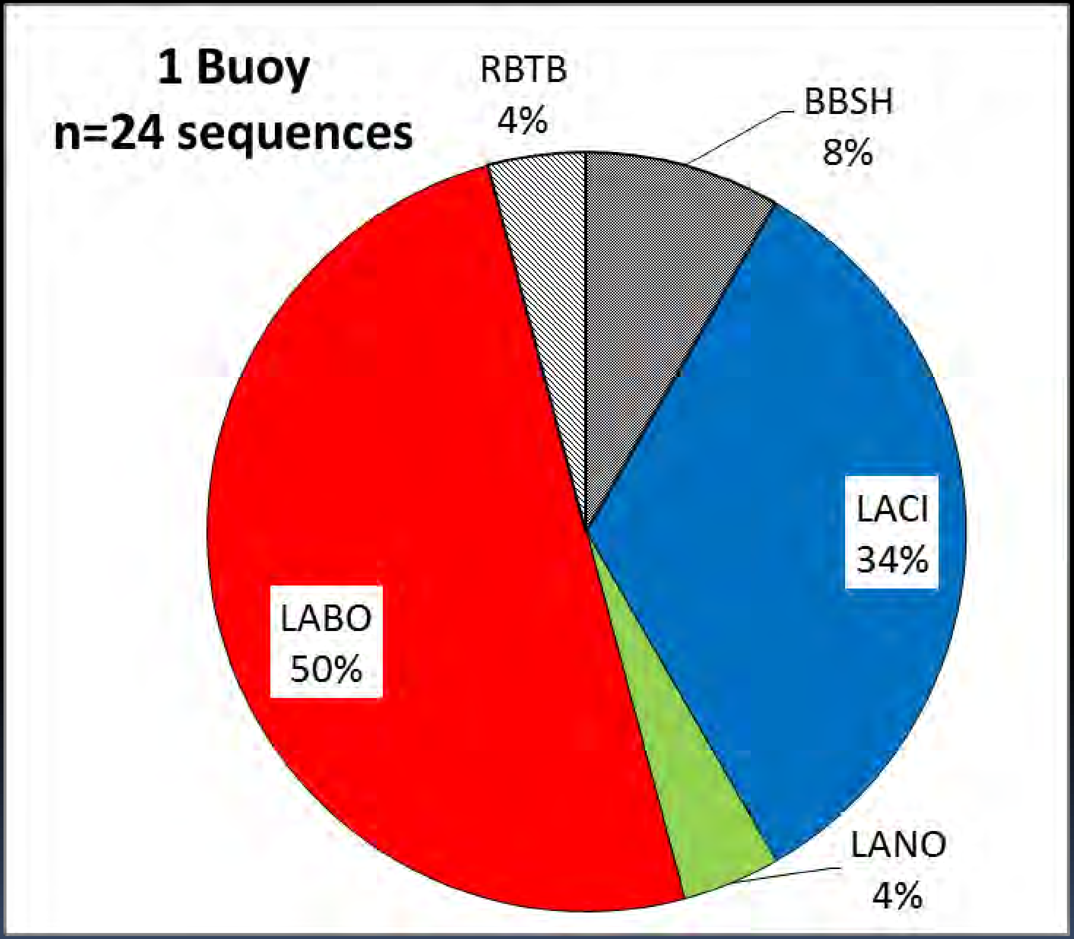
Medium Island Sites



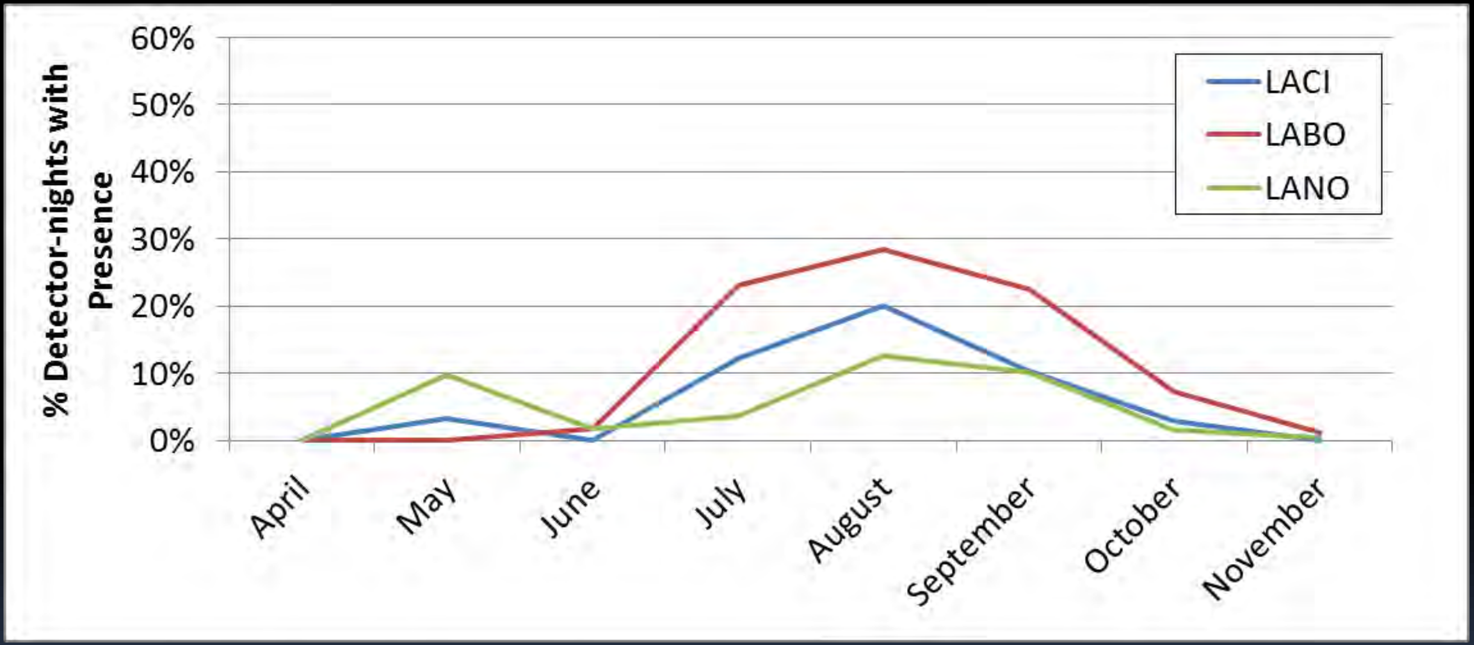


Rock Island Sites

Buoy Site



Monthly Presence – Long Distant Migrants



Collaborating Organizations

DEPARTMENT OF ENERGY · UNITED STATES OF AMERICA

U.S. FISH & WILDLIFE SERVICE · DEPARTMENT OF THE INTERIOR

NERACOOS

SHOALS Marine Laboratory

Stantec

National Data Buoy Center
Center of Excellence in Marine Technology

NOAA · NATIONAL WEATHER SERVICE

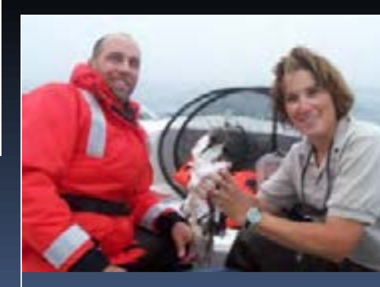
STONE LAB

NATIONAL PARK SERVICE

BOEM
BUREAU OF OCEAN ENERGY MANAGEMENT

College of the Atlantic
life changing. world changing.

UNITED STATES COAST GUARD 1790



Maine Coast Heritage Trust

Thank You


Questions:
Steve Pelletier, CWB
Stantec Consulting
steve.pelletier@stantec.com

Offshore X-Band Radar

Presentation #10

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Mid-Atlantic Aerial Surveys for Marine Mammals, Sea Turtles and Other Large Marine Vertebrates 1998 - 2012

What we did… and where we did it…

William McLellan
UNC Wilmington

Team Approach

Duke University

Extensive marine mammal management experience
15 years of vessel surveys in the mid-Atlantic
experience with acoustic monitoring

University of St. Andrews

Extensive experience with survey design
Literally “wrote the book” on line transect surveys

Virginia Aquarium & Marine Science Center Foundation

Extensive marine mammal stranding response
and survey experience all aimed at conservation

NOAA — National Oceanic and Atmospheric Administration, U.S. Department of Commerce

They invented the ocean…

Aerial Surveys

Methods

- CFR Part 135 certified aircraft
- 2 dedicated pilots
- Surveys conducted at 305 m and ~185 km/hr
- 2 observers conducting separate strip surveys

Aerial Surveys

Methods

- CFR Part 135 certified aircraft
- 2 dedicated pilots
- Surveys conducted at 305 m and ~185 km/hr
- 2 observers conducting separate strip surveys

Line Transect Methodology

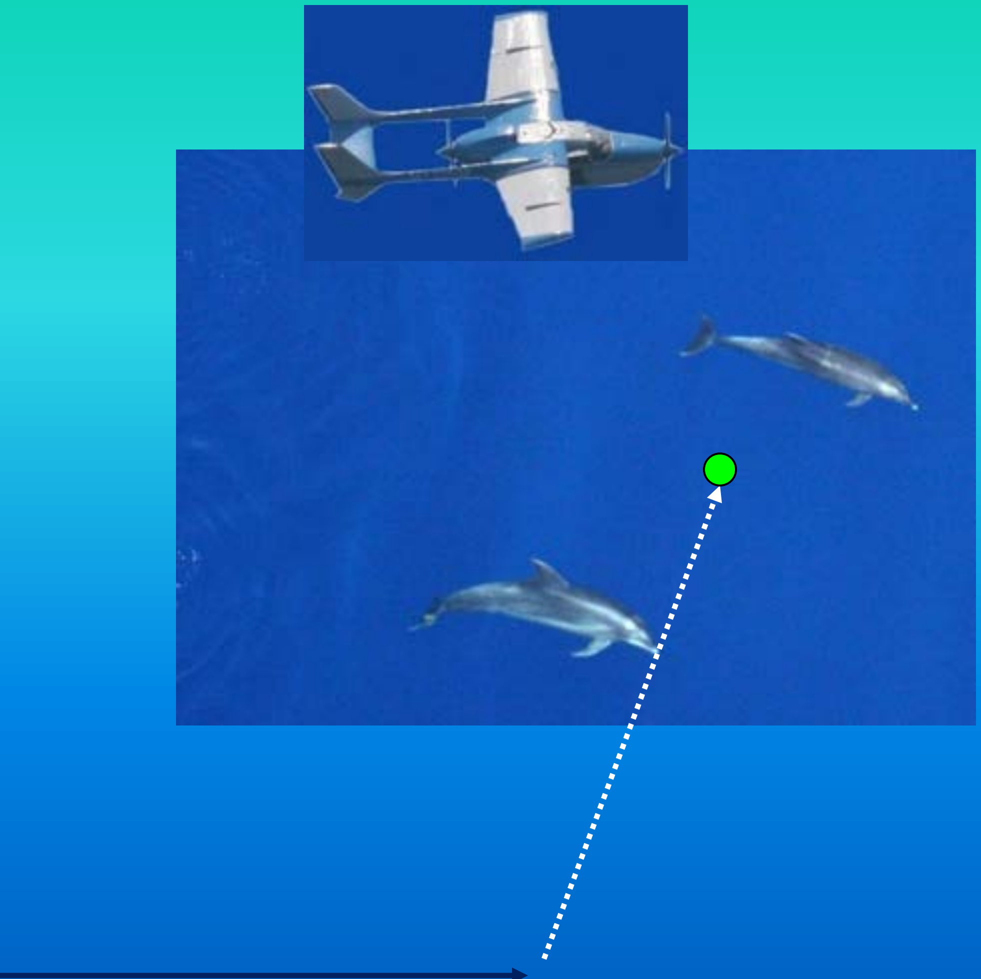
On Effort
Recording trackline points
Recording environmental variables

Line Transect Methodology

Sighting cue observed

1. Break from track line
   - Record GPS position and time
   - Record cue and confidence
   - Record horizontal and vertical angle to cue
   - Go Off Effort
   - Direct pilots to location of cue

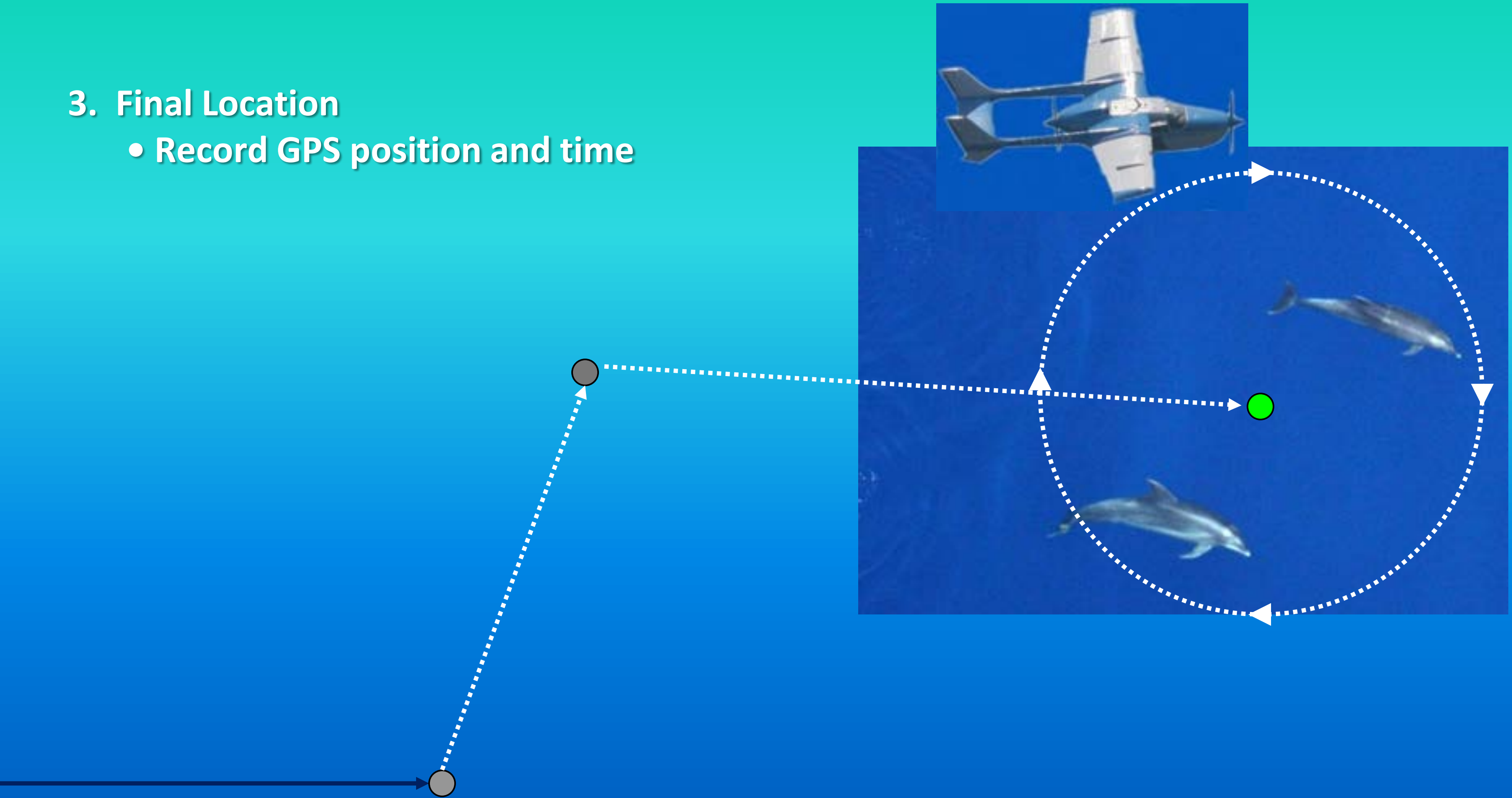
Line Transect Methodology



2. Actual Location
   - Record GPS position and time
   - Photo documentation
   - Estimate group size
   - Identify probable species
   - Note behavior

Line Transect Methodology

3. Final Location
   - Record GPS position and time



Line Transect Methodology

4. Rejoin track line
    - Return to location of break
    - Record GPS position and time
    - Resume On Effort survey

Species ID protocol

Initial species ID is made in the field while reviewing images.

Final species ID is made after reviewing digital images in lab.

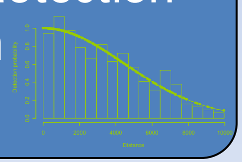
If in doubt of species ID sighting is labeled as unidentified.
Over 95% of all sightings are now identified to species.

Data Analysis

Survey Data

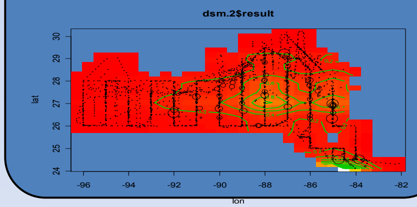
Off to Scotland

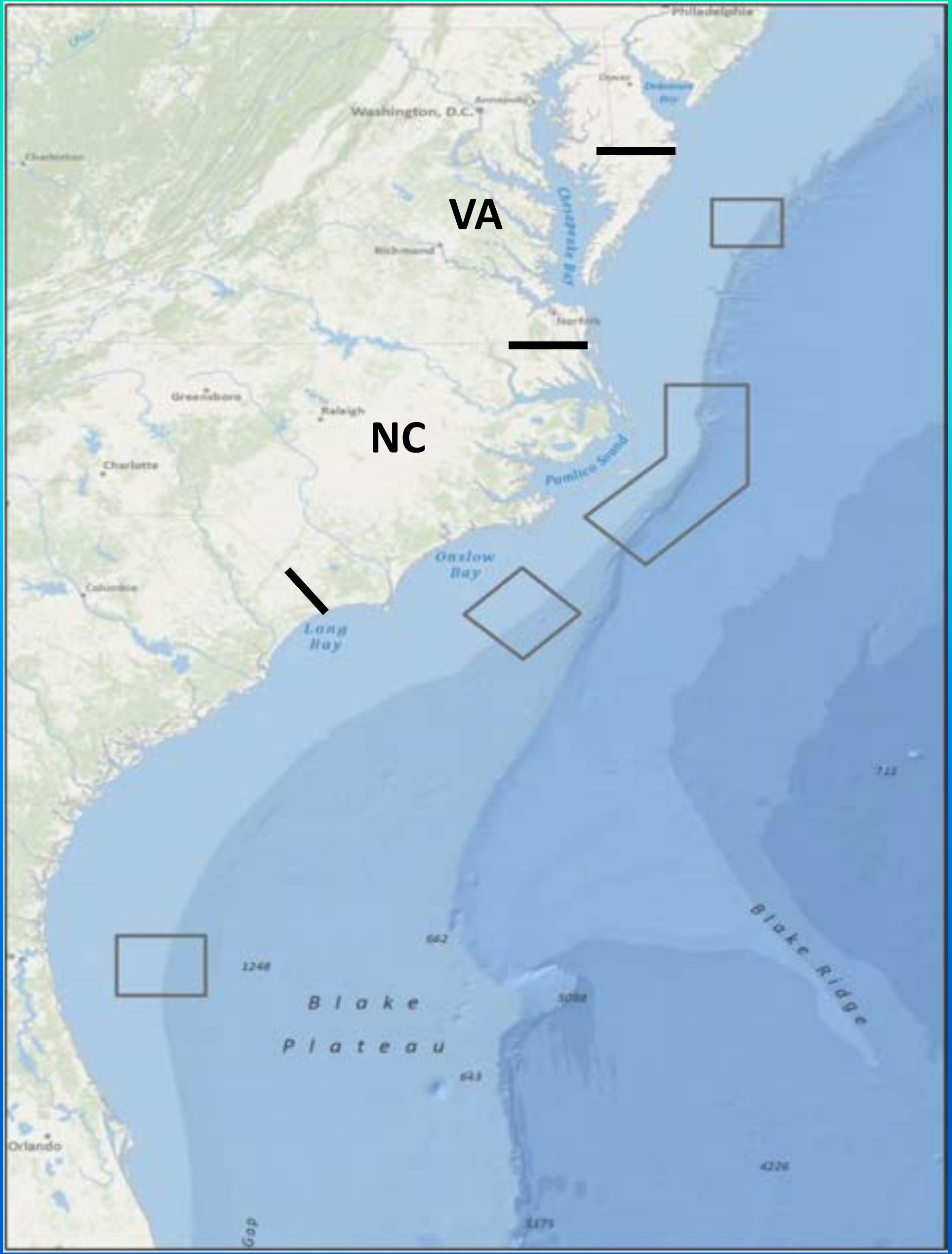
Fitting detection function *aerial*



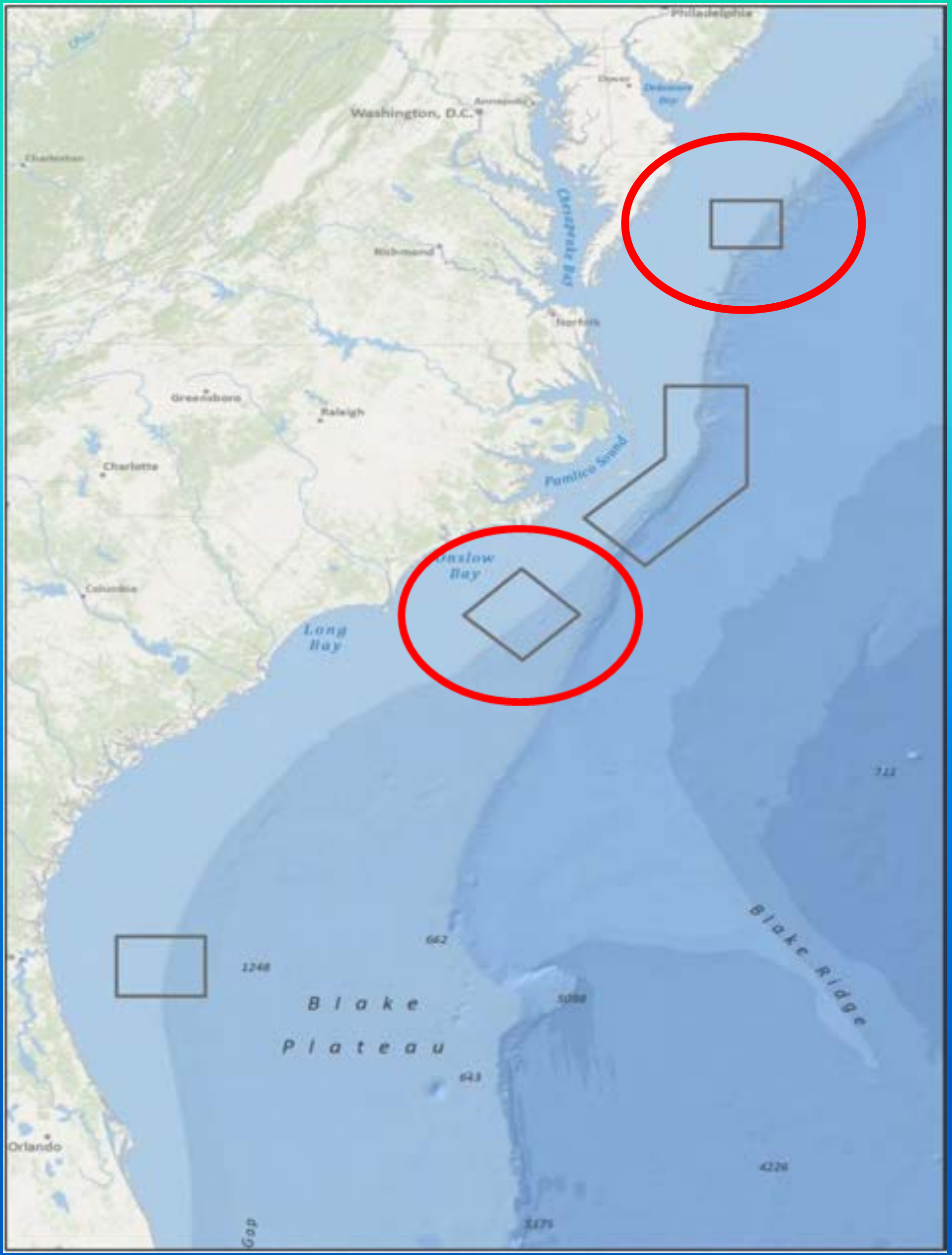
Calculate probability of detection

Survey Data





Where We Did It



Wallops Island & Onslow Bay

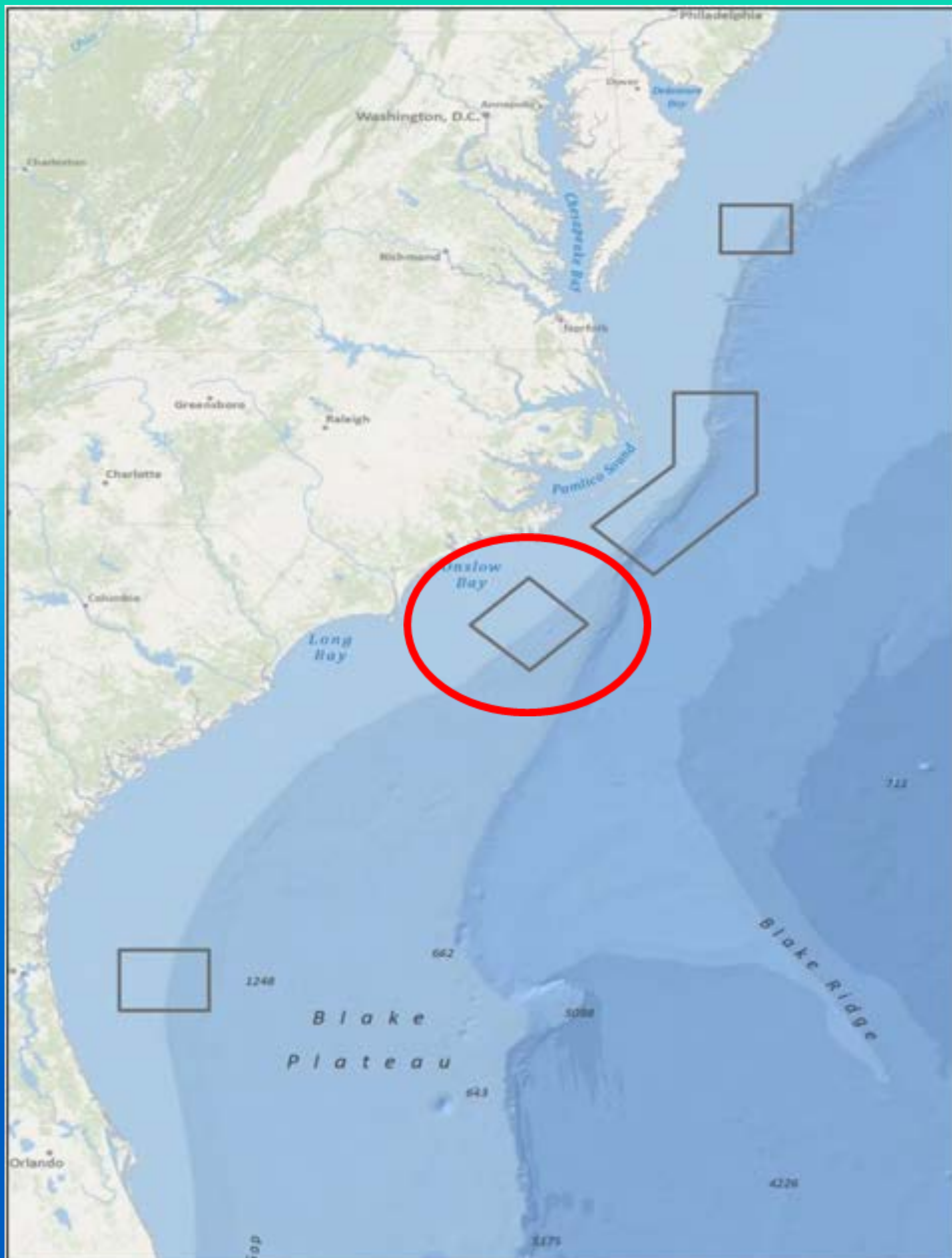
1998 - 1999

All cetaceans

Sea turtles

Large pelagic fish/sharks

<u>Funded by US Navy</u>



Onslow Bay

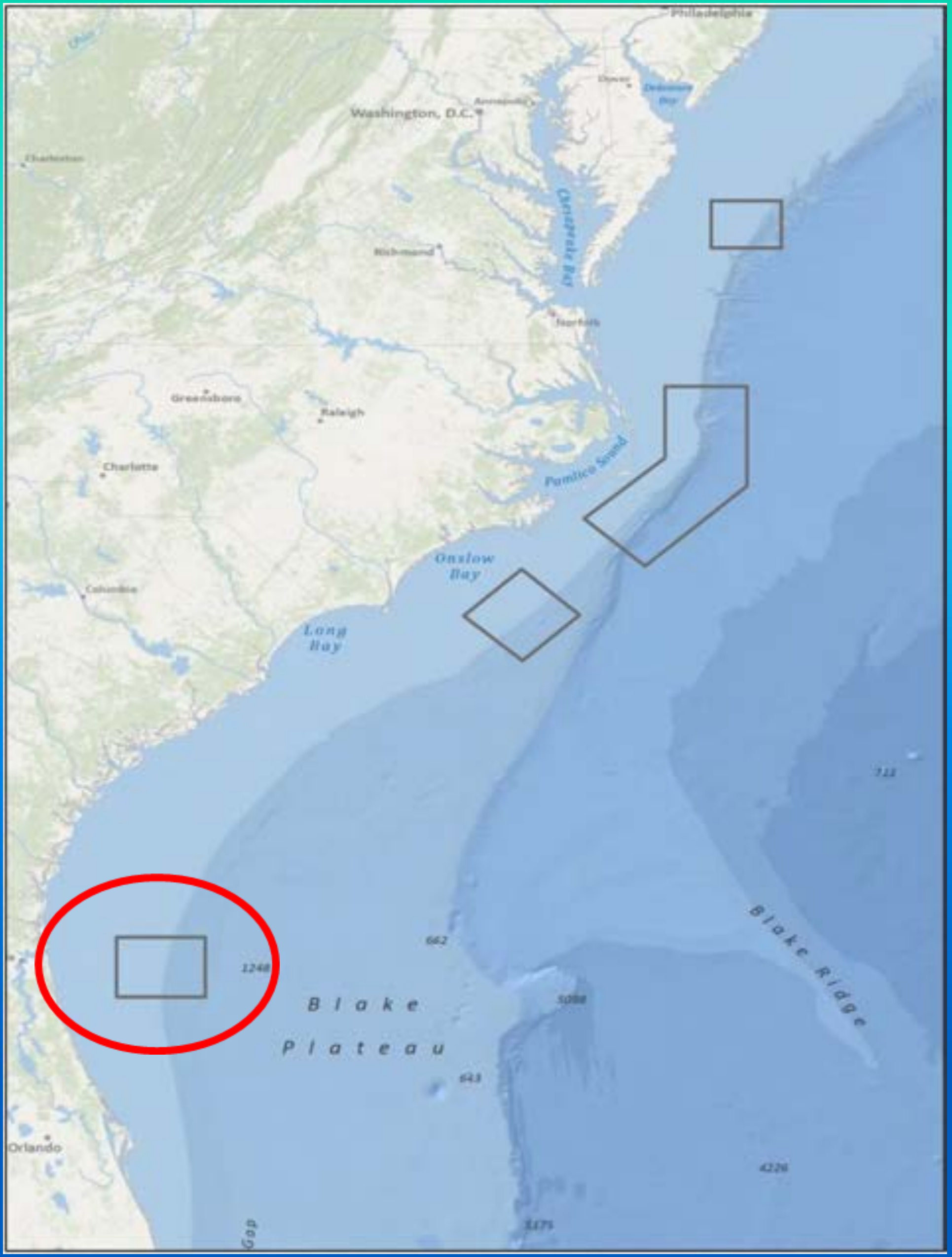
2007 – 2011

All cetaceans

Sea turtles

Large pelagics

<u>Funded by US Navy</u>



Jacksonville

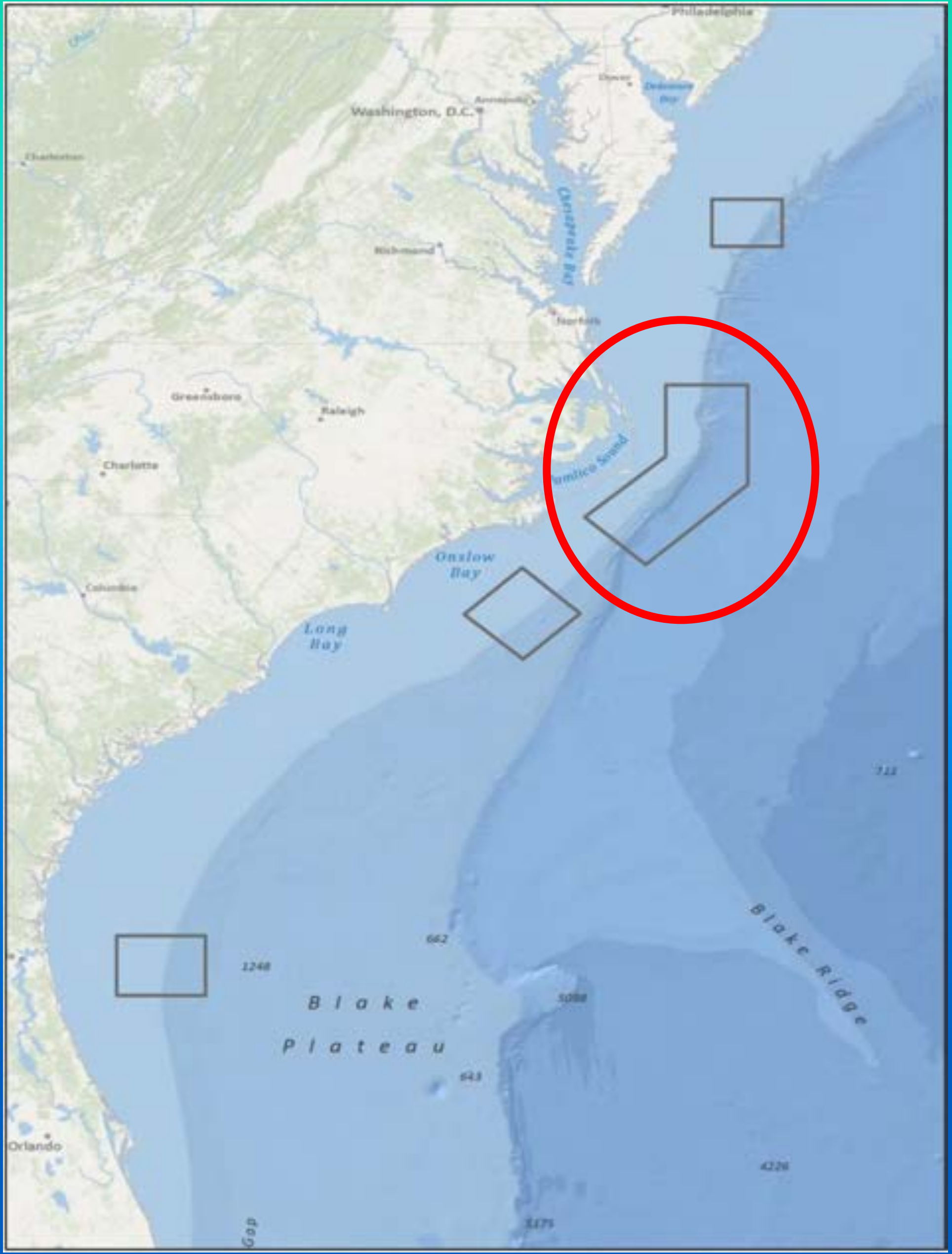
2009 – present

All cetaceans

Sea turtles

Large pelagics

Funded by US Navy



Cape Hatteras

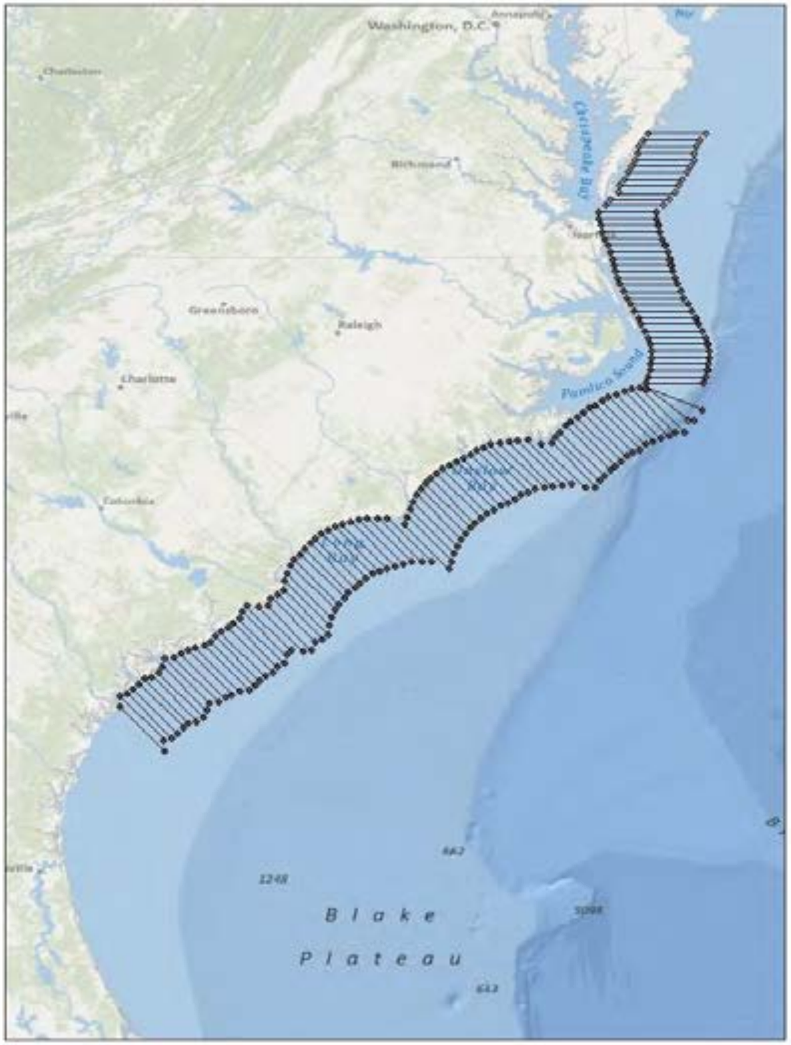
2011 - present

All cetaceans

Sea turtles

Large pelagics

<u>**Funded by US Navy**</u>



Right Whale Surveys

2001- 2008

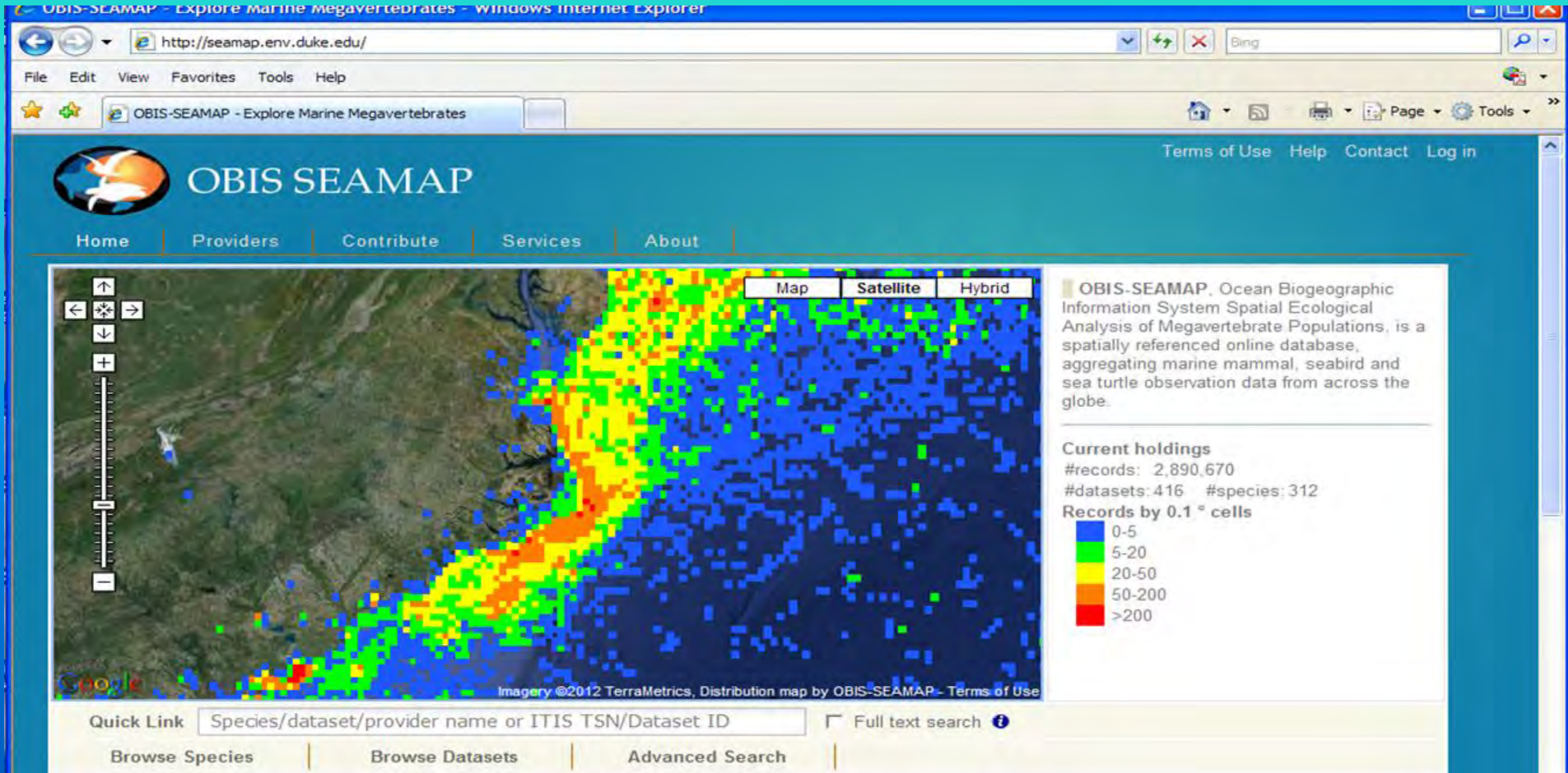
Cetaceans

Large pelagics

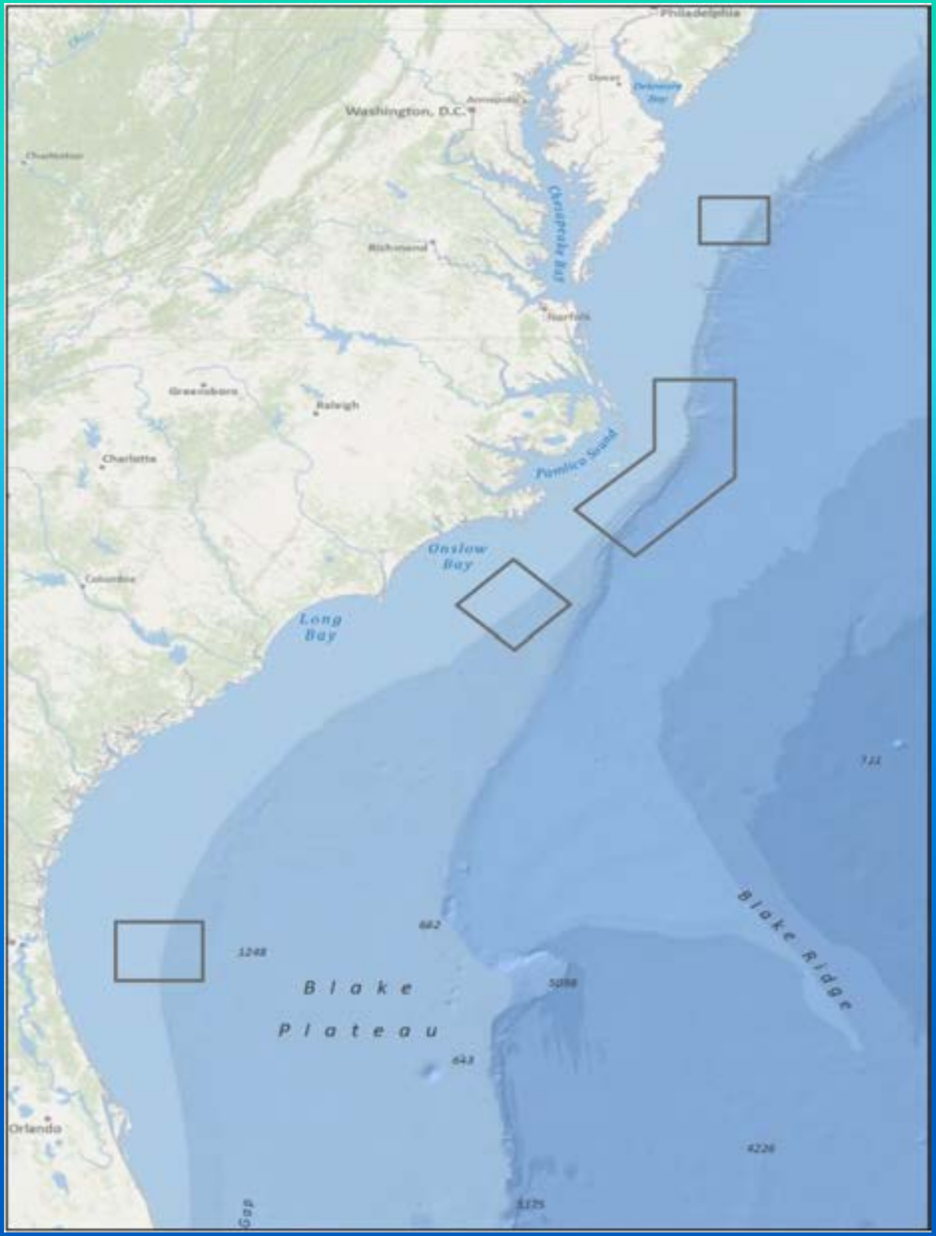
Funded by NOAA Fisheries

ALL Aerial Observations Are Now Posted On OBIS-SEAMAP

//seamap.env.duke.edu



with current data sets in cue, UNCW has provided 23 data sets to OBIS SEAMAP



Future Effort

Virginia Beach
wind energy project

Continue Cape Hatteras
monthly surveys

Continue JAX
monthly surveys

Acknowledgements

Ed Coffman and pilots of Orion Aviation
All of the observers over the years
Joel Bell, Lance Garrison, Mike Payne
Andy Read, Mark Swingle, Sue Barco
Ann Pabst

Funding from

US Navy
NOAA Fisheries

21 April 2007
25 nm offshore of the VA/NC border

All surveys conducted under NOAA Scientific Permits to UNCW

Presentation #11

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Avian Surveys for the Rhode Island Ocean Special Area Management Plan

Kristopher J. Winiarski, Peter W.C. Paton, Scott R. McWilliams, and David Miller
Department of Natural Resources Science, University of Rhode Island, Kingston, RI 02881

SILVER SPRINGS, MARYLAND
JULY 2012

COASTAL RESOURCES MANAGEMENT COUNCIL

UNIVERSITY OF Rhode Island

Avian studies for RI Ocean SAMP

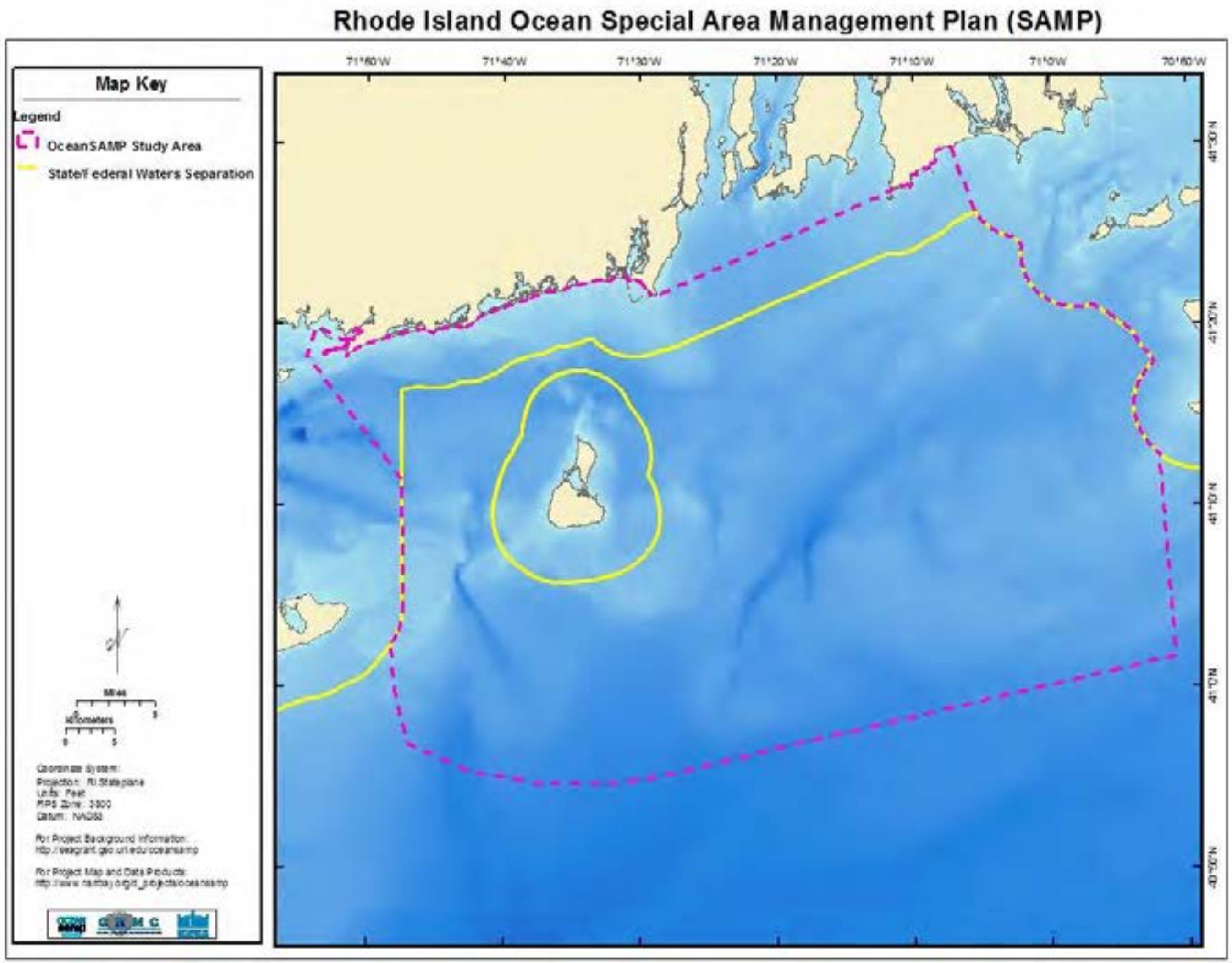
- **Goal:** Assess current spatial and temporal patterns of avian abundance and movement ecology within Ocean SAMP study area boundaries.

- **Primary Objectives:**

  1) Assess temporal variation (seasonal and annual) in avian spatial distribution and abundance in Ocean SAMP study area.

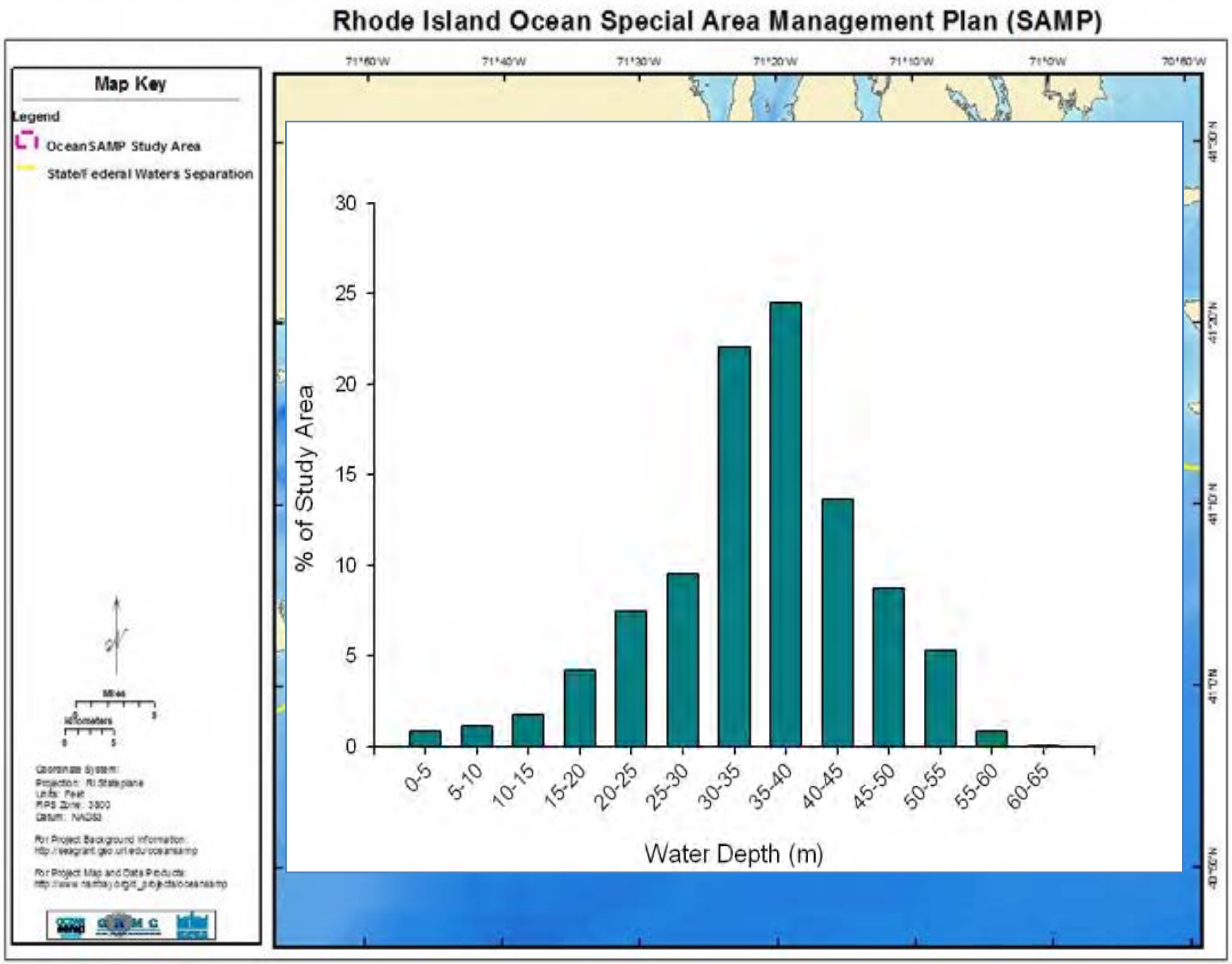
  2) Quantify flight behavior of birds in Ocean SAMP study area.

OSAMP Study Area



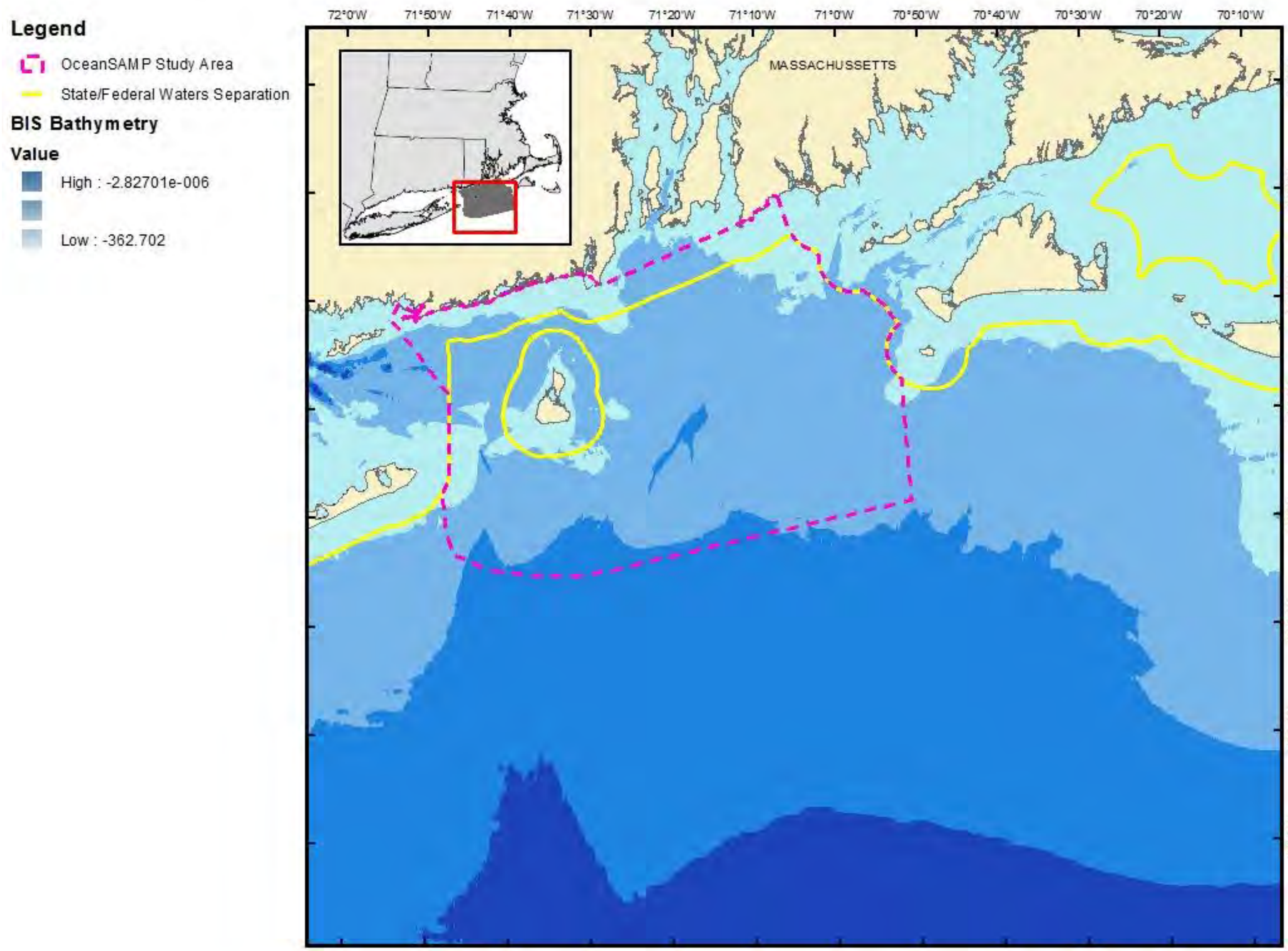
-Approximately 3,800 km².

OSAMP Study Area



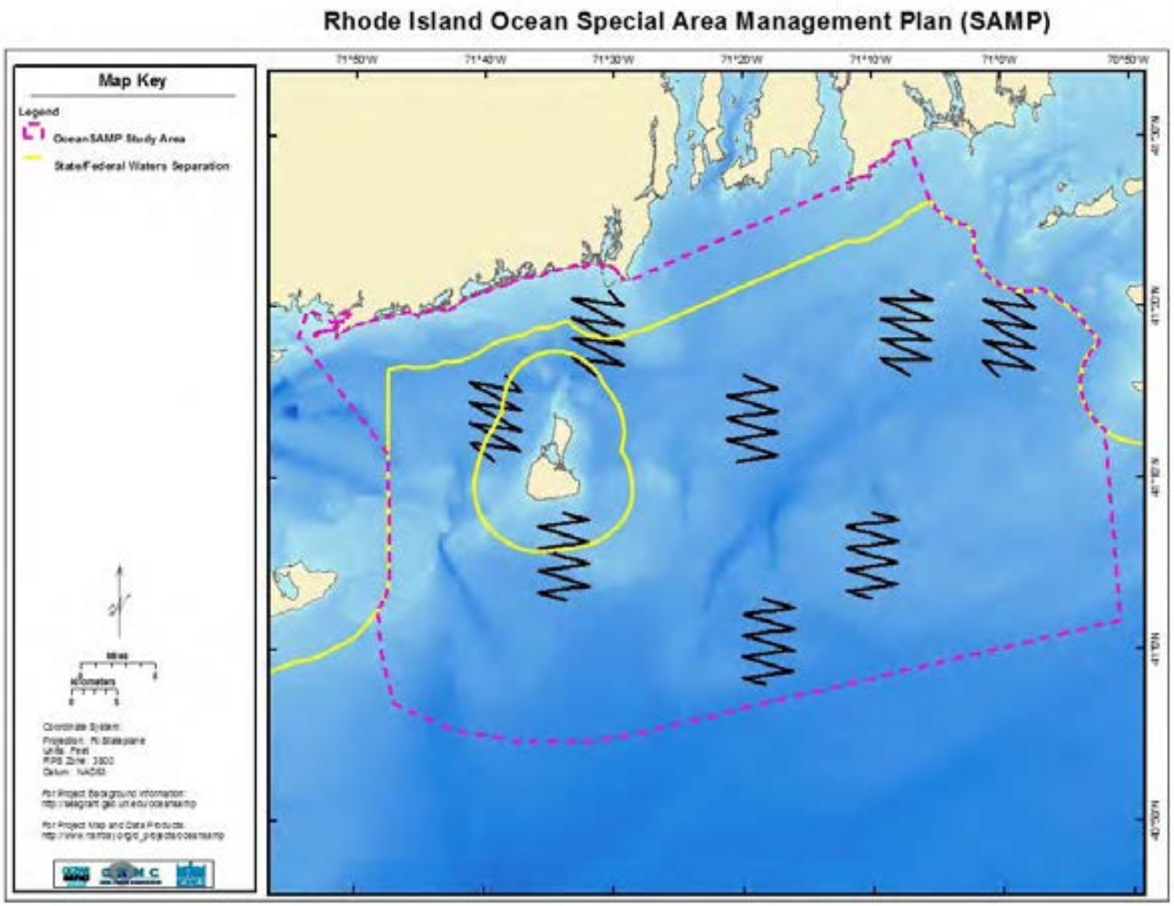
-Approximately 3,800 km^2.

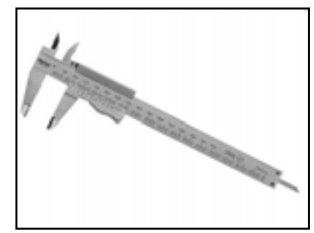
Much Different Marine Bird Habitat than Nantucket Sound




Aerial-based Strip-Transect Surveys
Aerial-based Line-Transect Surveys
Ship-based Line-Transect Surveys
Land –based Radar
Ocean SAMP Ad
Lan
200
2012
January-
February-
March-
April-
May-
June-
July-
March-
April-
May-
June-
July-

Ship-based Line Transect Surveys

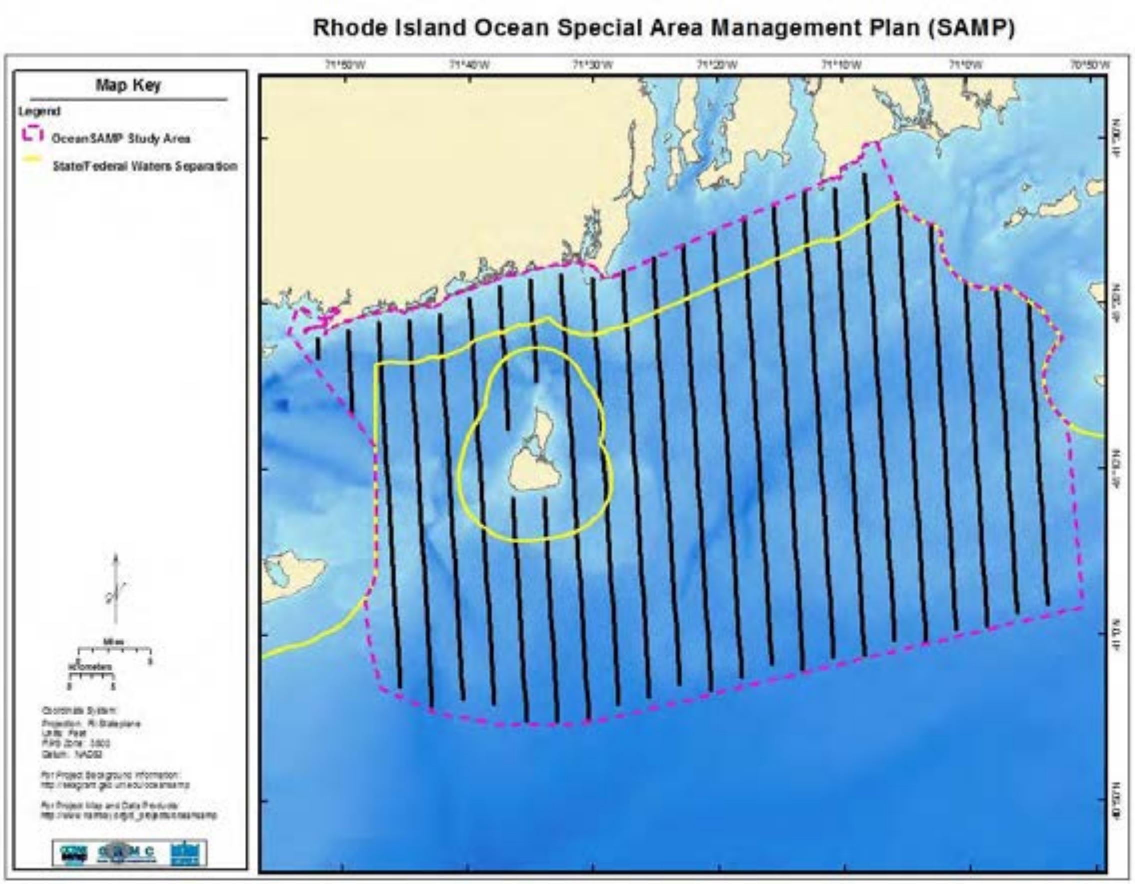




*Calipers used to estimate distance (*Heinemann*, 1981)

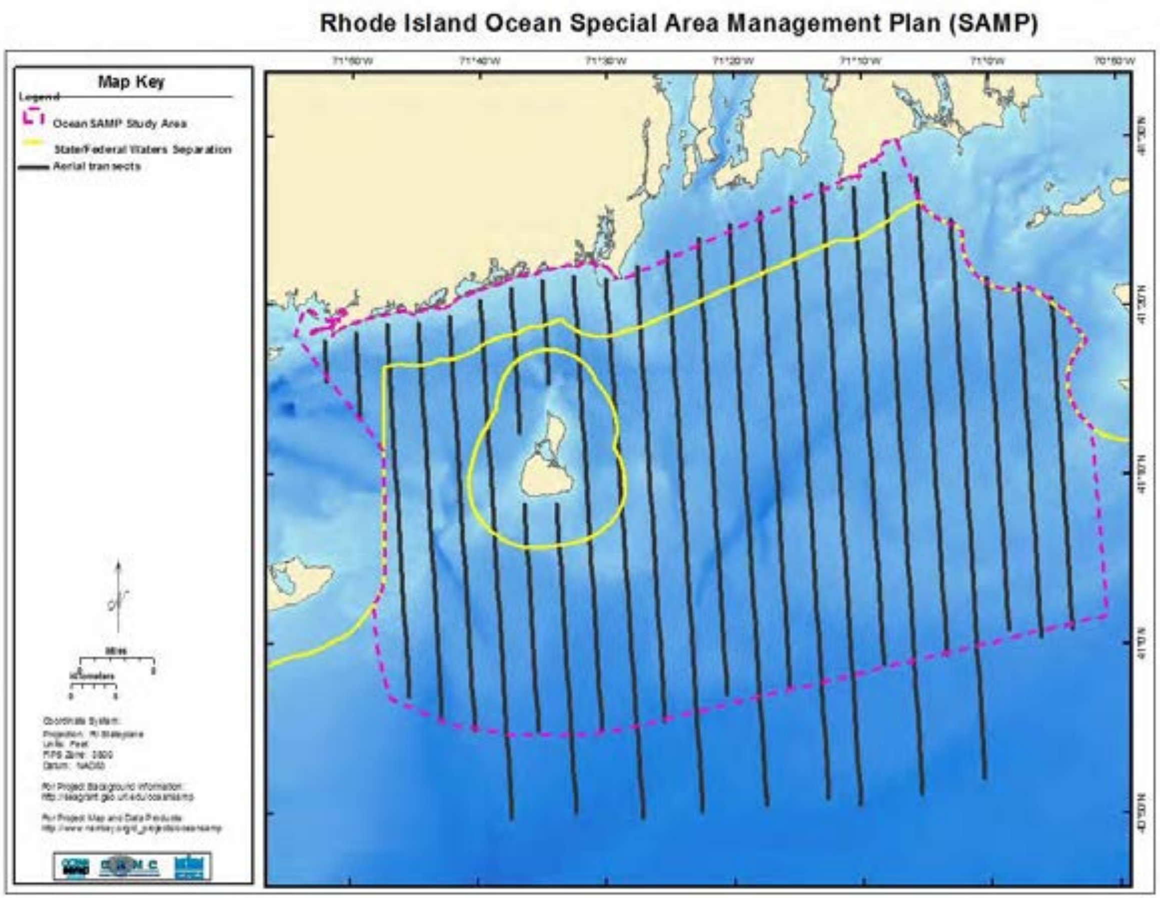
Eight Sawtooth (4x5nm) sampling areas
Each surveyed 1x per month (2.5 hours, survey 2 grids/week)
1 observer and 1 observer/recorder
<u>Recorded:</u> # individuals, species, bearing, distance estimate (first sighting), GPS location, behavior, flight elevation/direction for birds in flight and survey conditions.

Aerial-based Strip Transect Surveys



Twenty four transects perpendicular to coast
Survey 24 transects 1x per month
Fly 100kts at 500’
Survey 110m on both sides of plane (wing struts are marked)
2 observers
-<u>Recorded:</u> # individuals, species, time of sighting, behavior (flying, sitting) and survey conditions.

Aerial-based Line Transect Surveys



24 transects perpendicular to coast
Survey 24 transects 1x per month
Fly 100kts at 250’
2 observers
<u>Recorded:</u> # individuals, species, time of sighting, behavior (flying, sitting), sighting bin and environmental conditions.

Band	Boundary distances (in m.) perpendicular out from track line	Declination in degrees from the horizontal
A	44-163	60-25
B	164-432	25-10
C	433-1000	10-4

Avian Modeling for the Rhode Island Ocean Special Area Management Plan

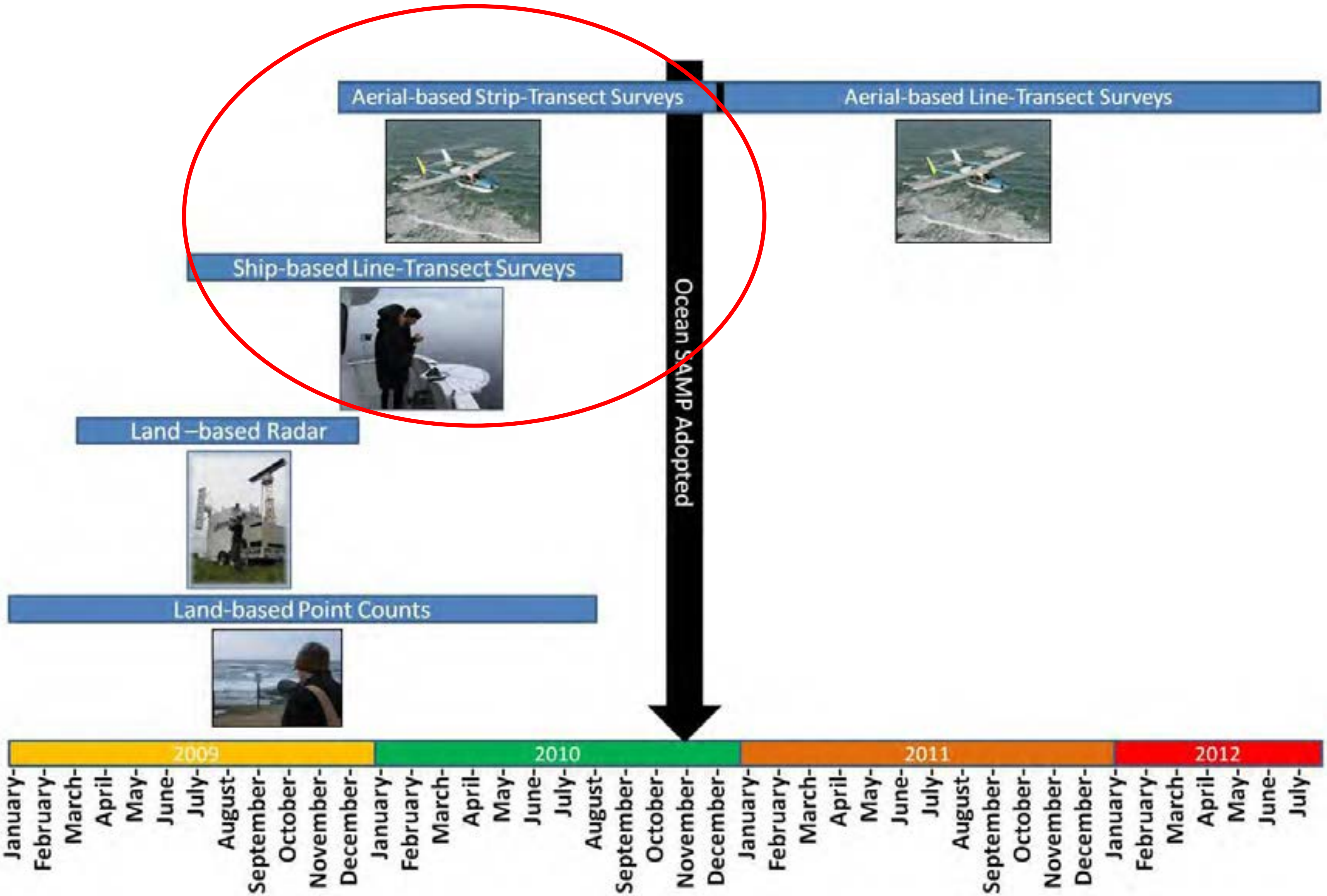
Kristopher J. Winiarski, Peter W.C. Paton, Scott R. McWilliams, and David Miller
Department of Natural Resources Science, University of Rhode Island, Kingston, RI 02881

Silver Springs, Maryland

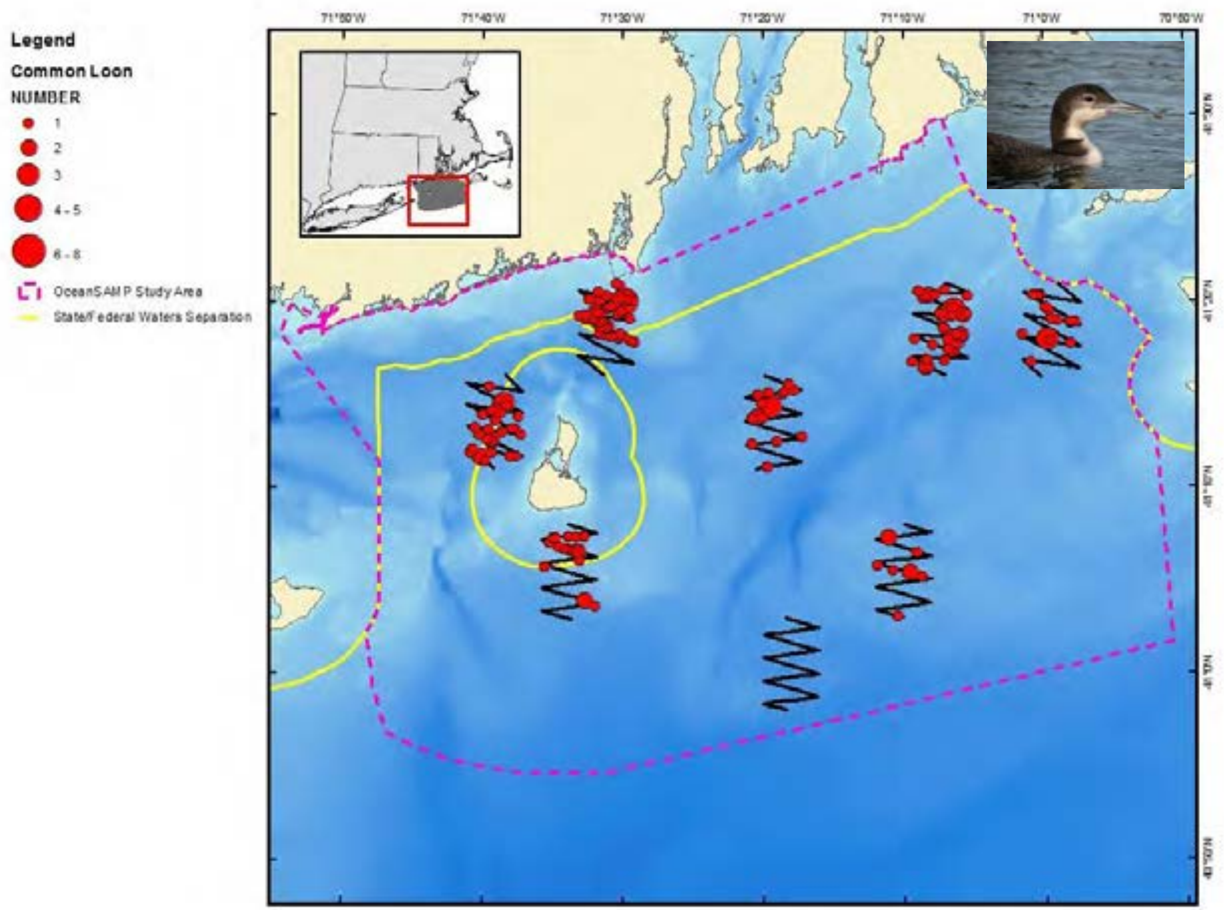
July 2012

Coastal Resources Management Council

University of Rhode Island

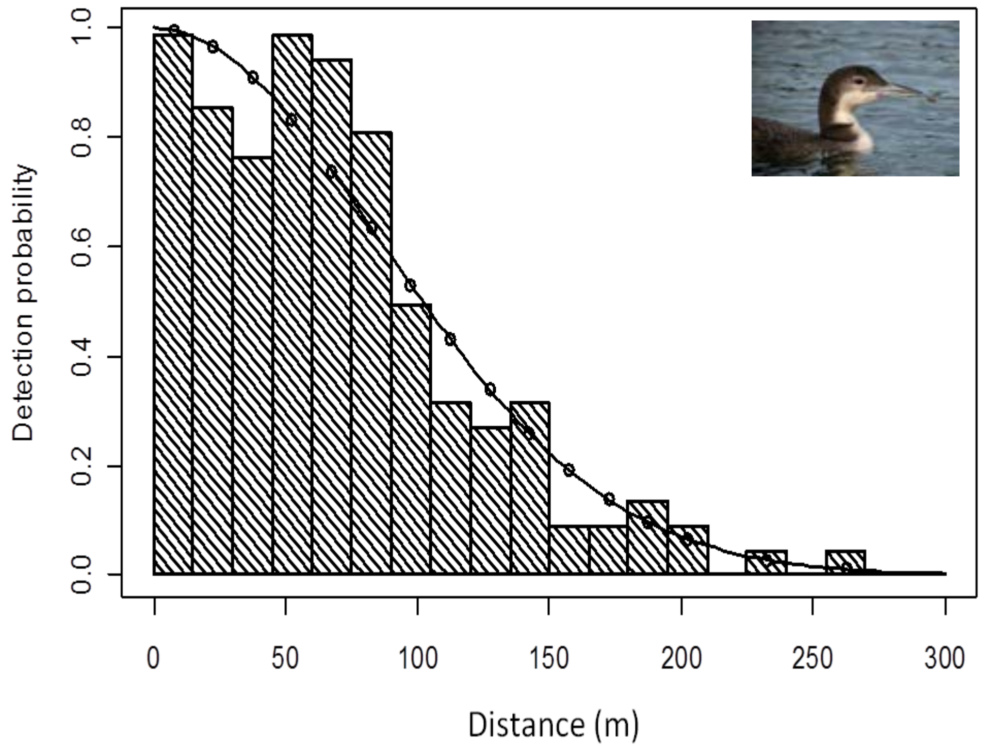

Aerial-based Strip-Transect Surveys
Aerial-based Line-Transect Surveys
Ship-based Line-Transect Surveys
Land –based Radar
Land-based Point Counts
Ocean SAMP Adopted
2009
2010
2011
2012
January-
February-
March-
April-
May-
June-
July-
August-
September-
October-
November-
December-
January-
February-
March-
April-
May-
June-
July-
August-
September-
October-
November-
December-
January-
February-
March-
April-
May-
June-
July-
August-
September-
October-
November-
December-
January-
February-
March-
April-
May-
June-
July-

Density Surface Model (DSM) Approach



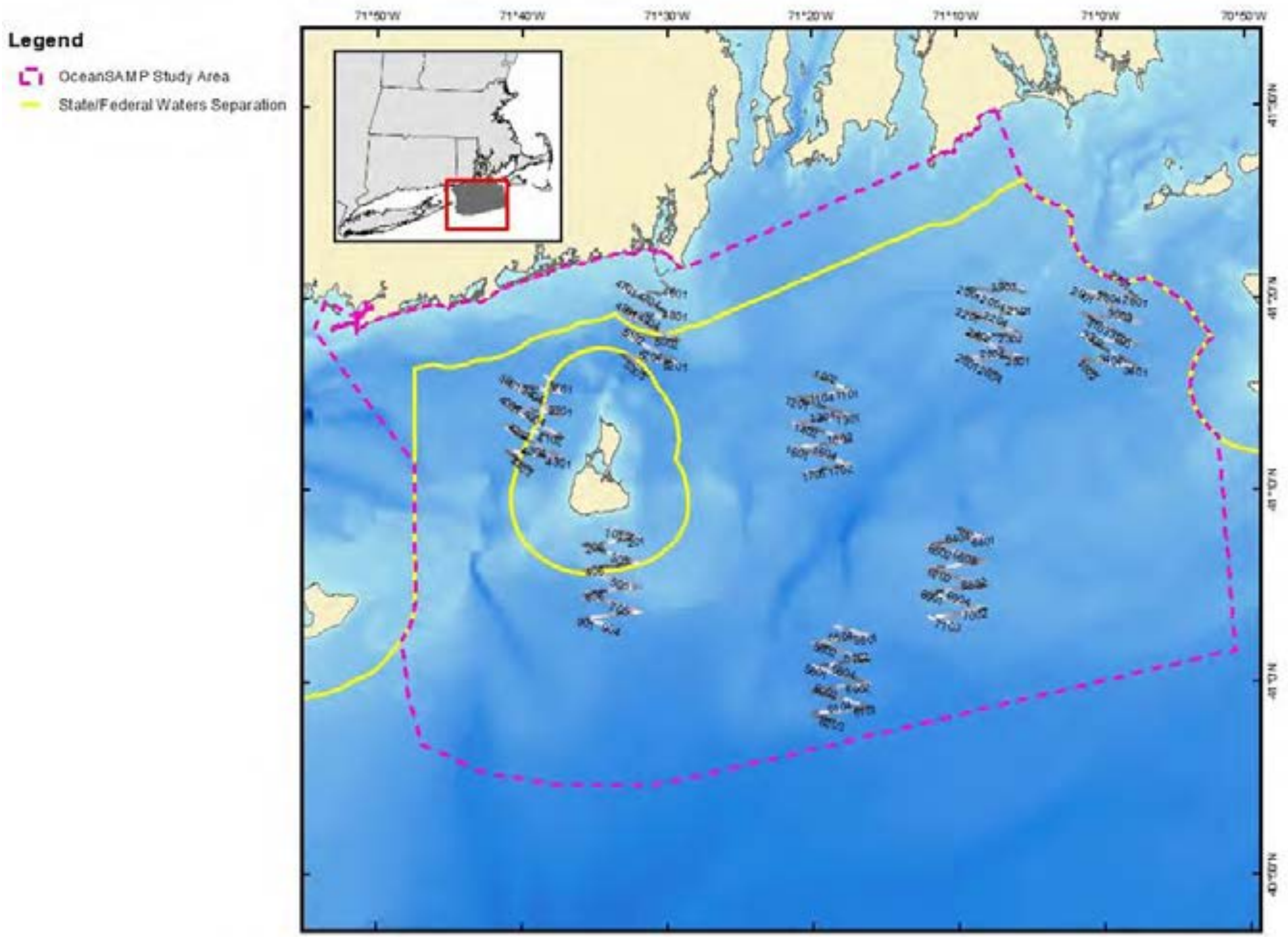
-Common Loon observations from ship-based line transect surveys.

Step #1- Fit detection function to control for incomplete detection.



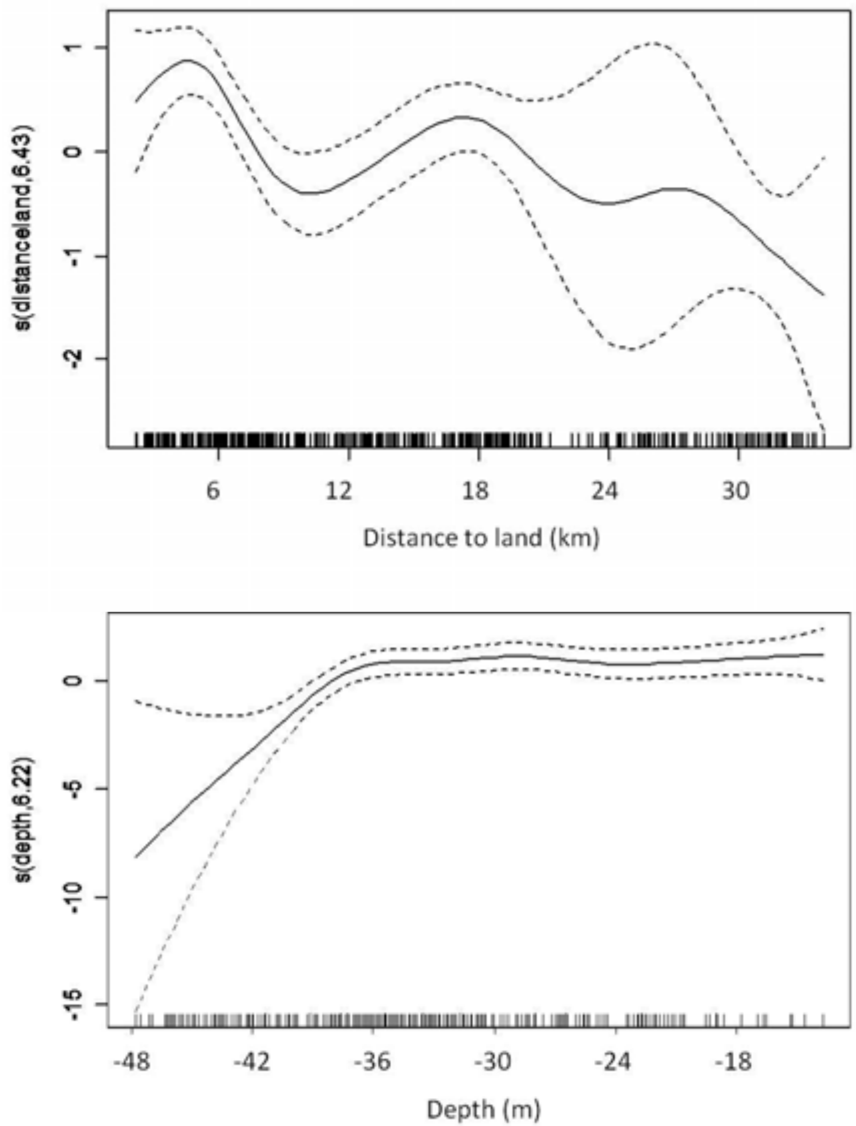
-Fit detection function to control for imperfect detection.

Step #2-Divide transects into unique segments.



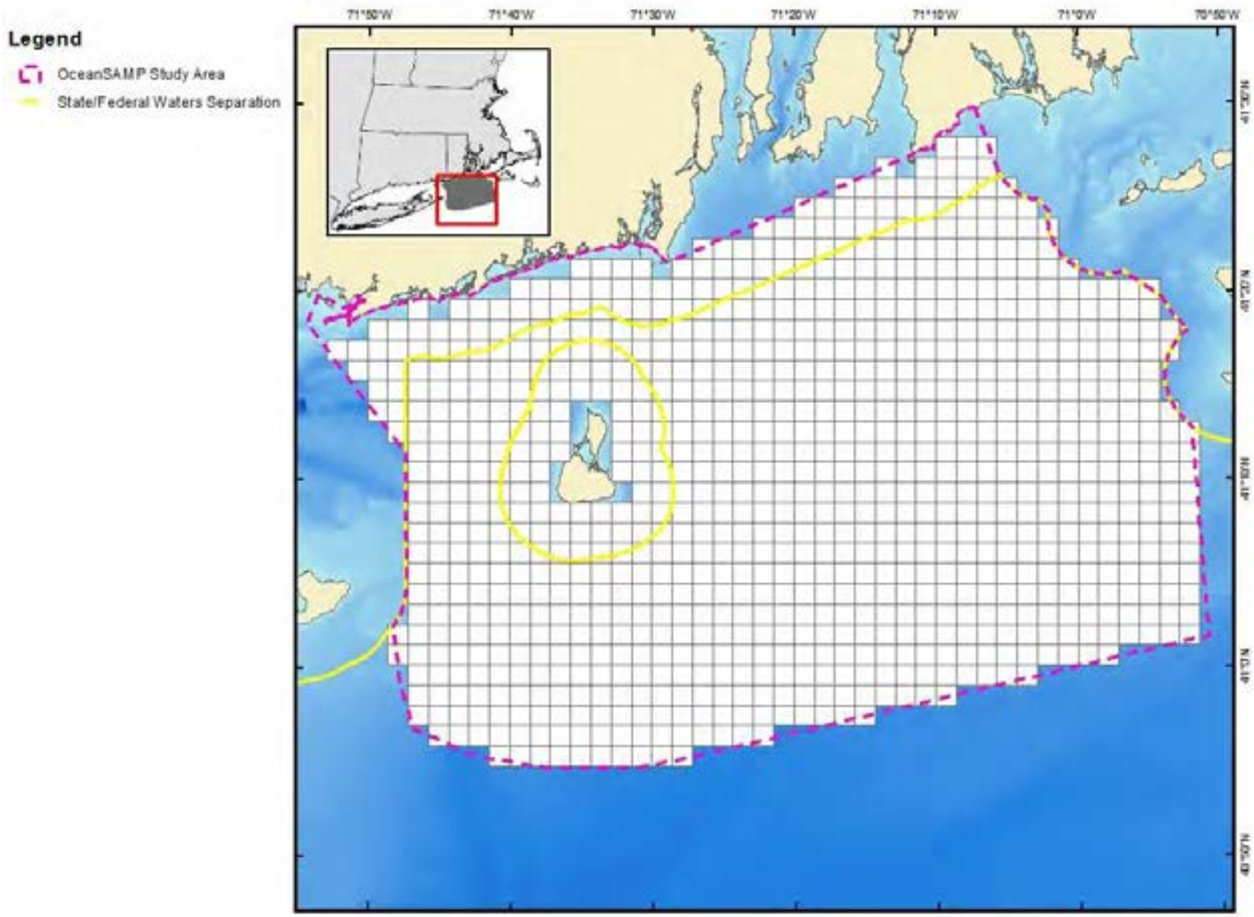
-Total of 465 unique segment (each 830m long).
-Environmental covariates at midpoint of each segment (water depth, distance from land).

Step #3 – Fit Generalized Additive Models



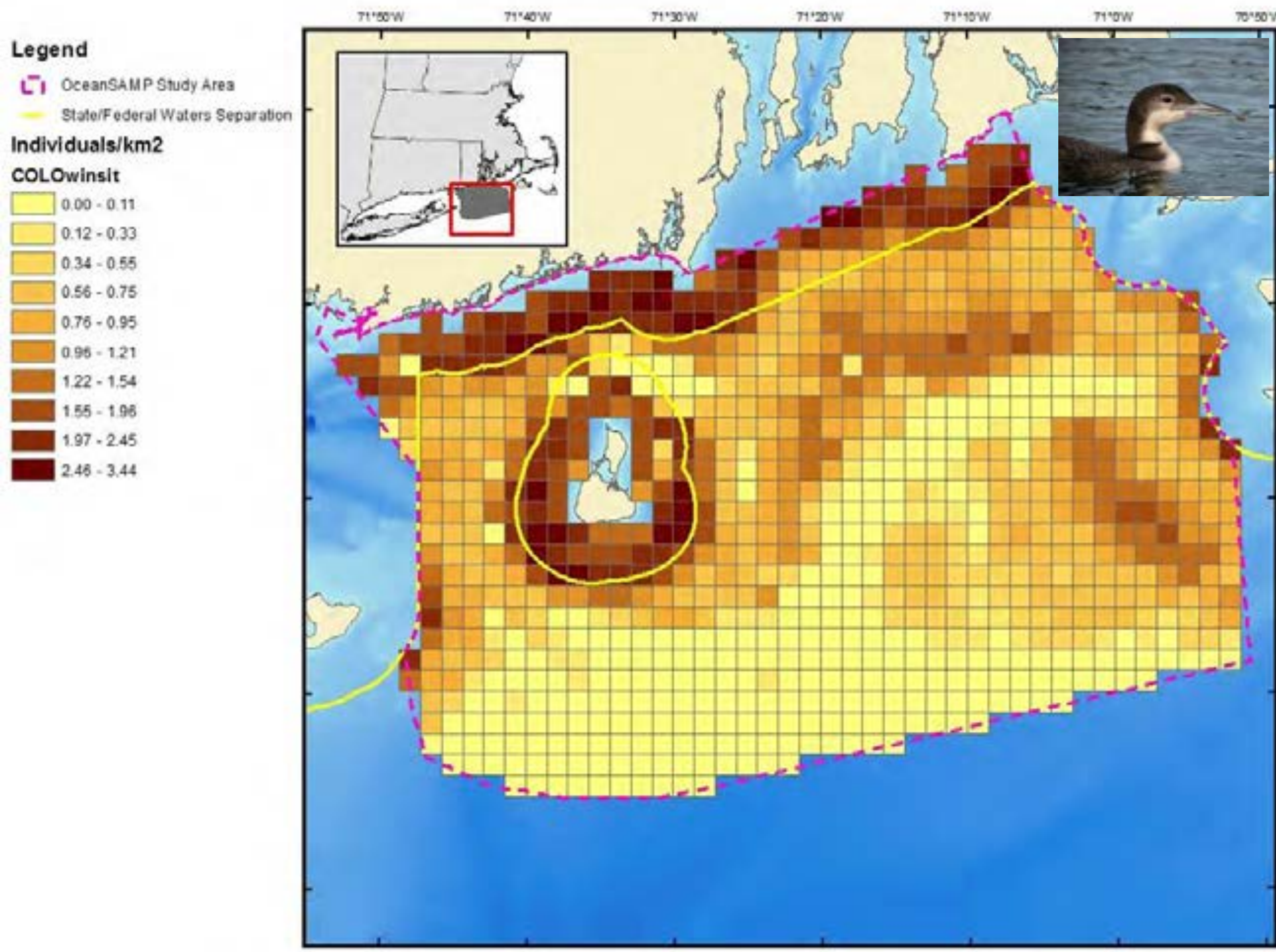
-Best Model distance to land + depth.

Step #4- Divide study area into predictive grid.



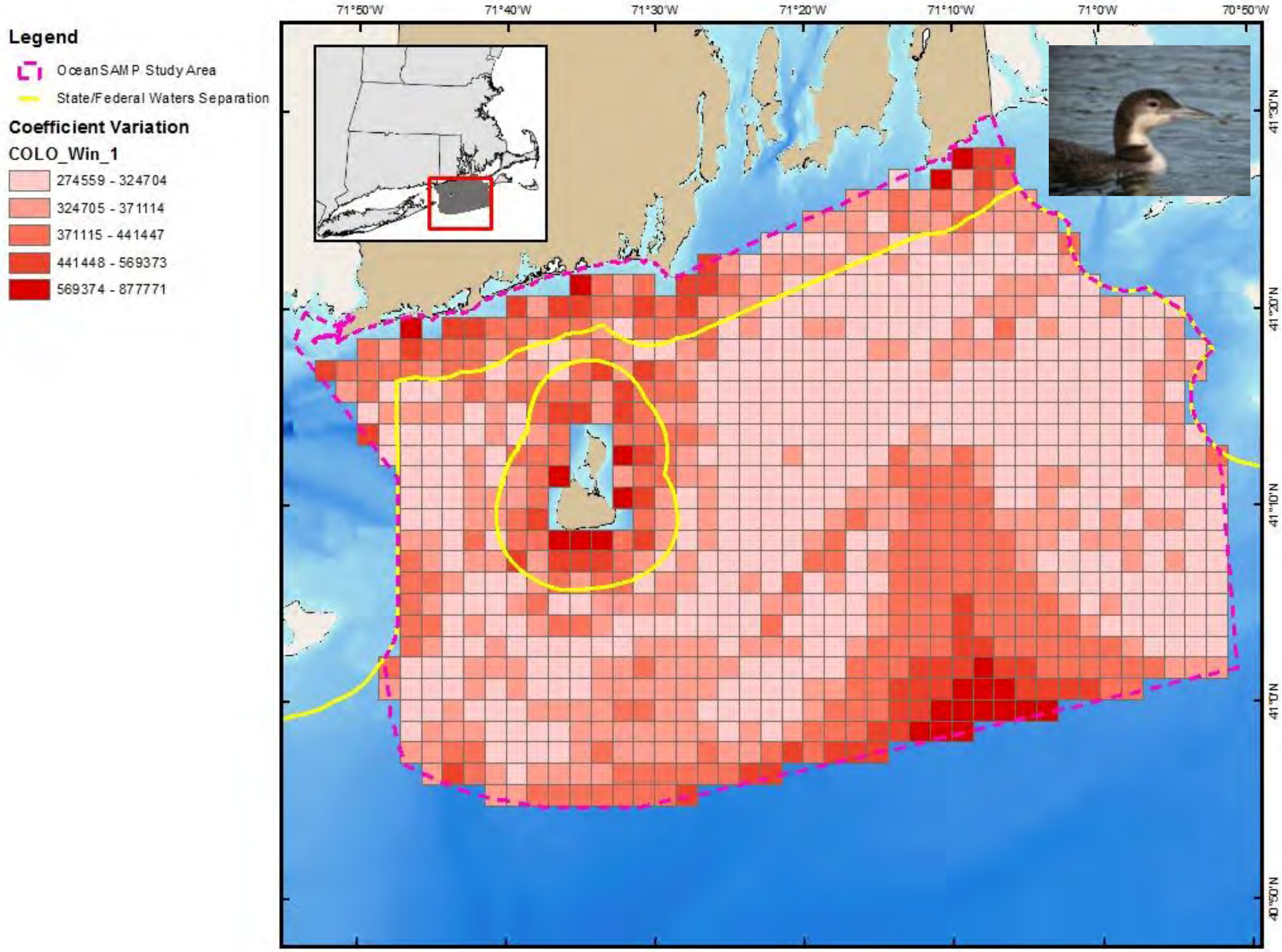
-920 cells; each 4km^2.
-Environmental covariates at the midpoint of each predictive cell (water depth, distance to land).

DSM–Common Loon

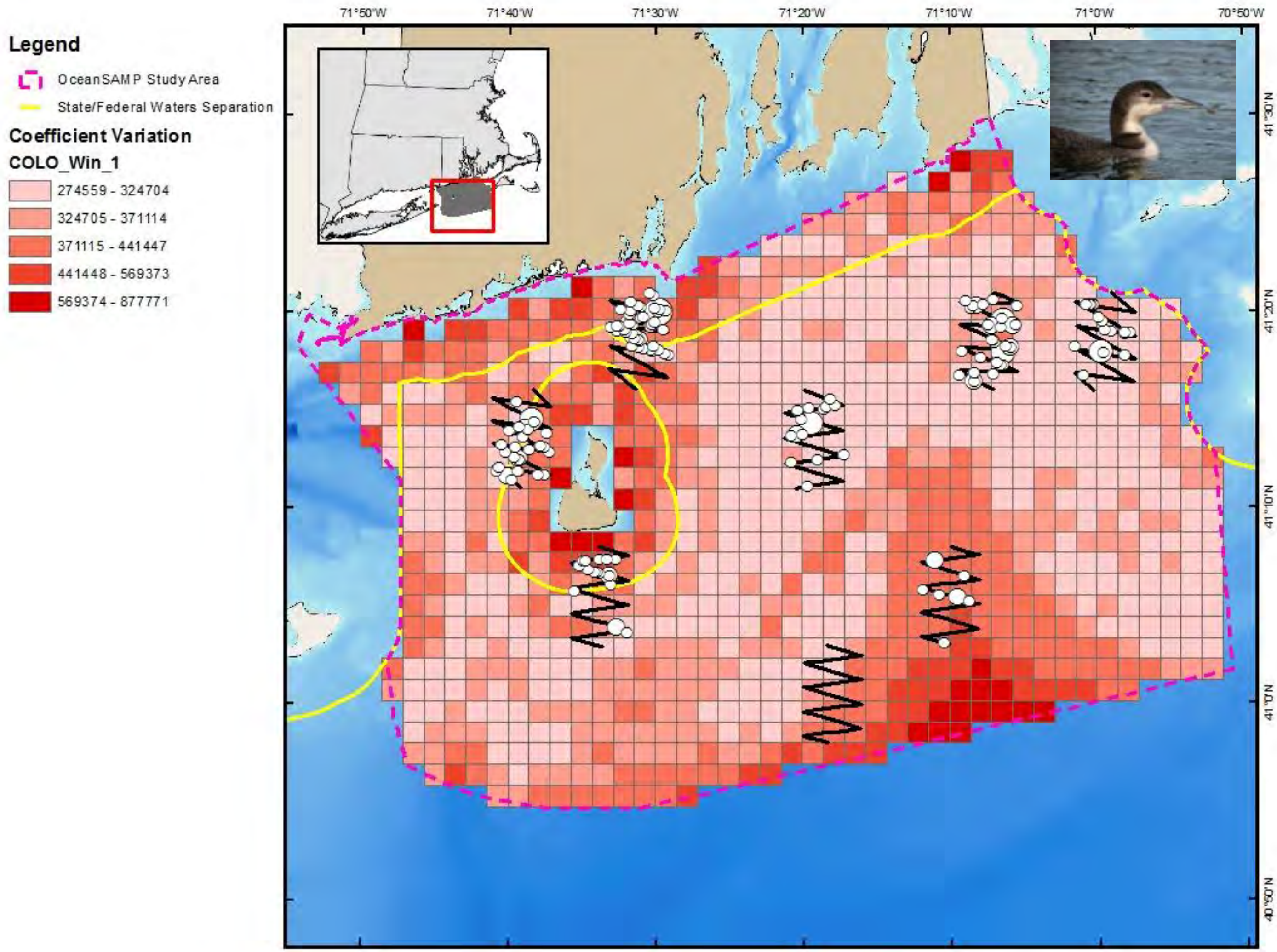


Daily population estimate winter – 7,284 (0.186)

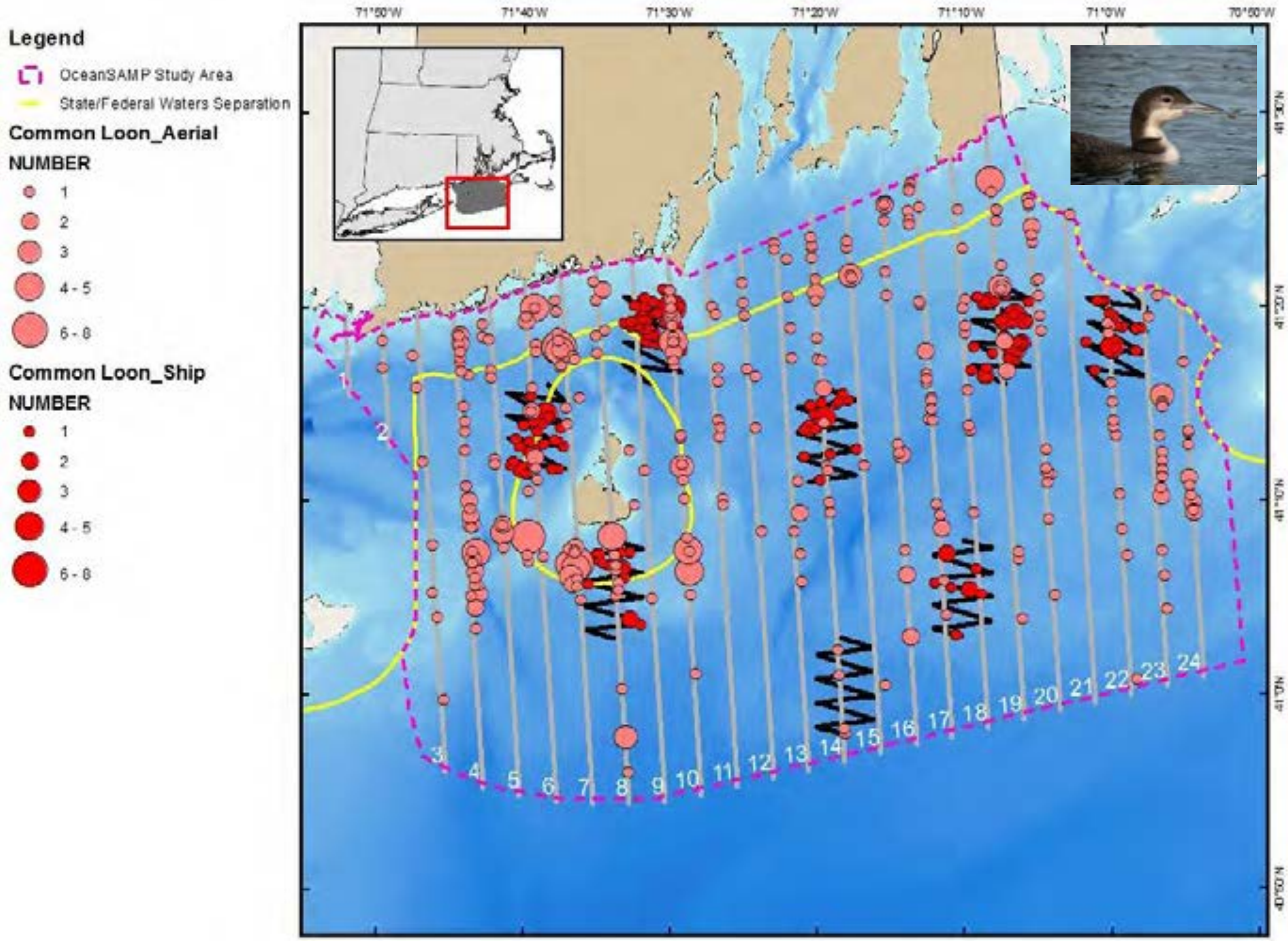
DSM–Uncertainty



DSM–Uncertainty



DSM – Using Survey Data from Multiple Platforms



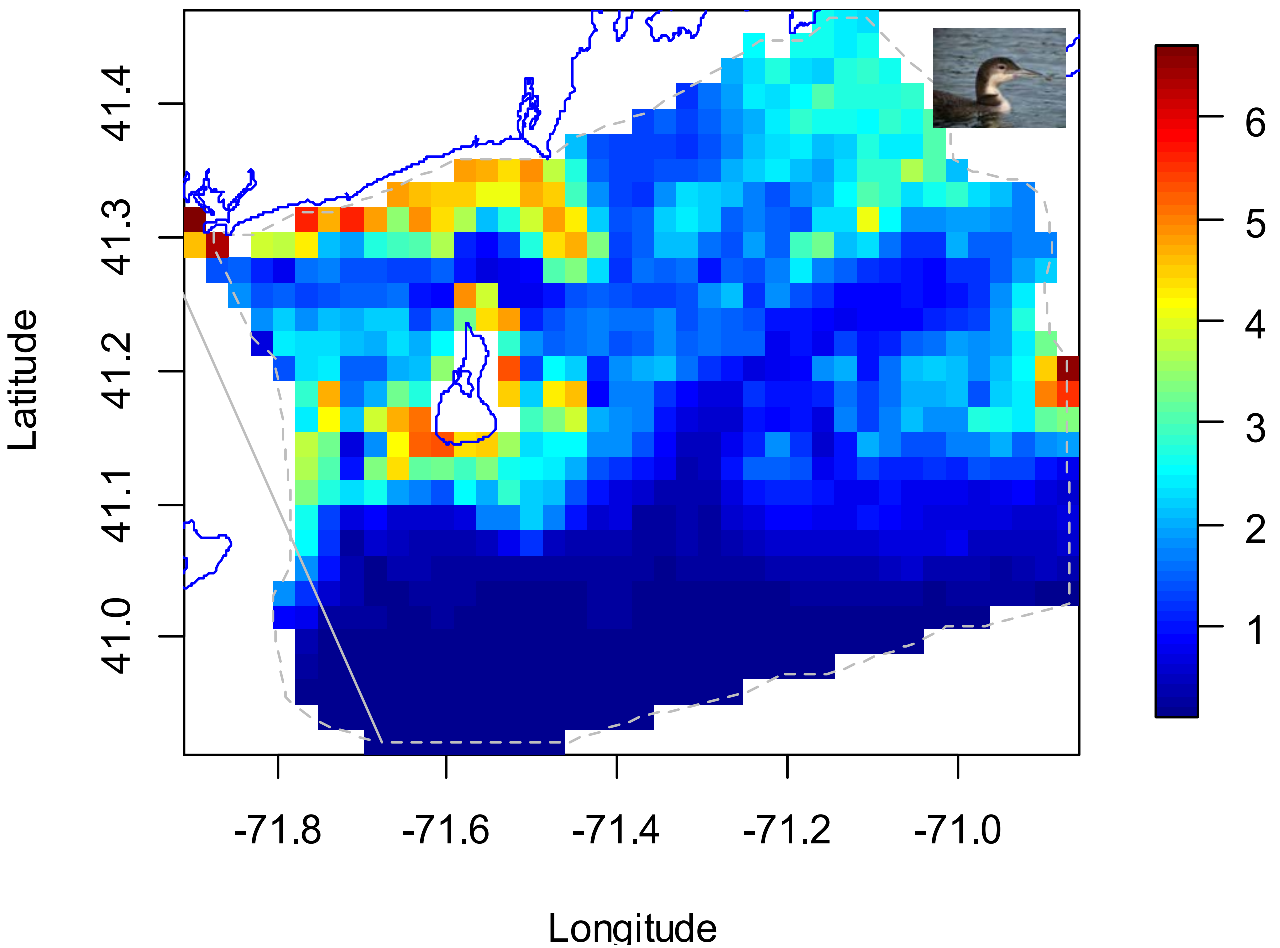
Ship

+

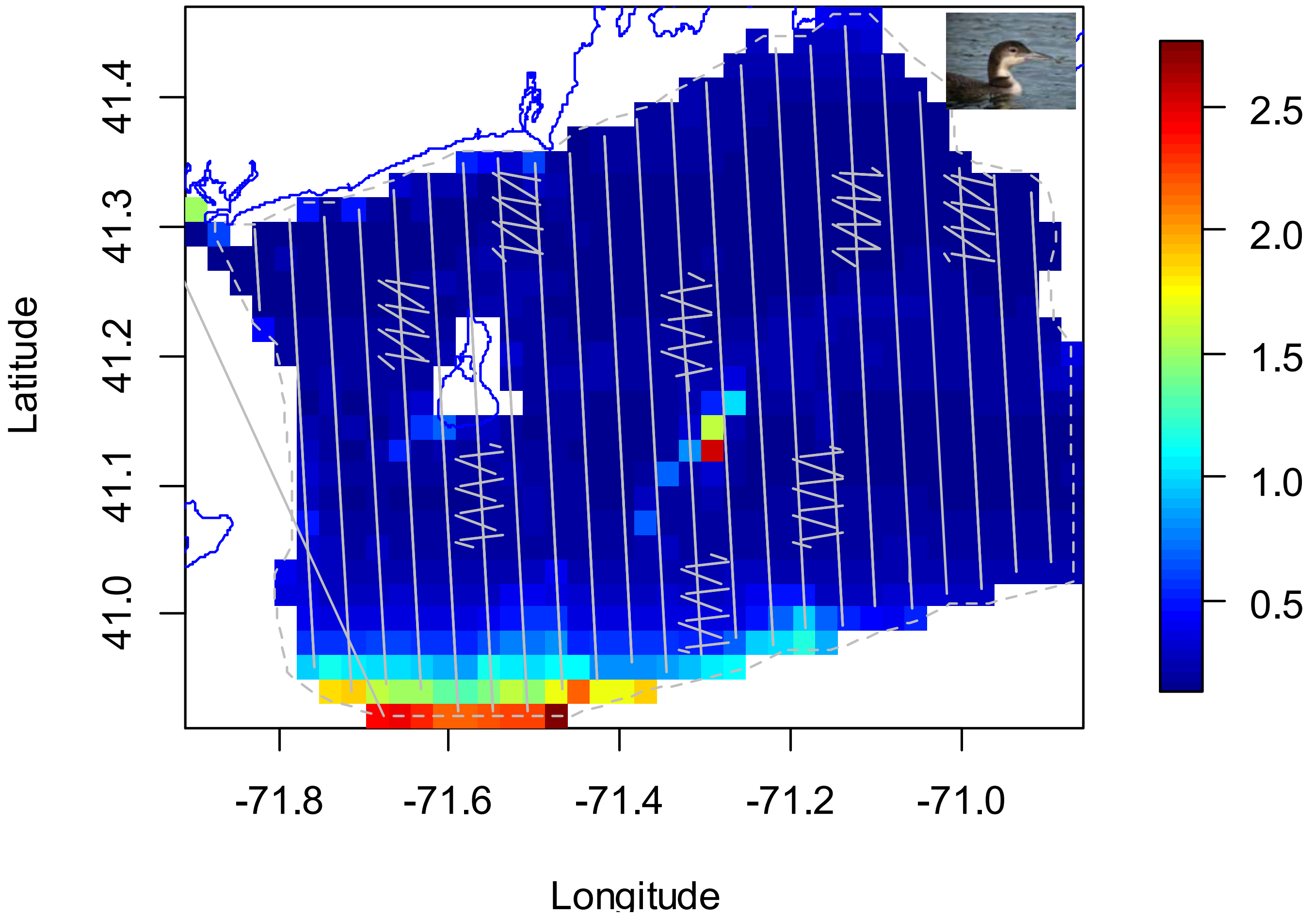
Aerial

-Raw observations of Common Loons winter 2009-2010.

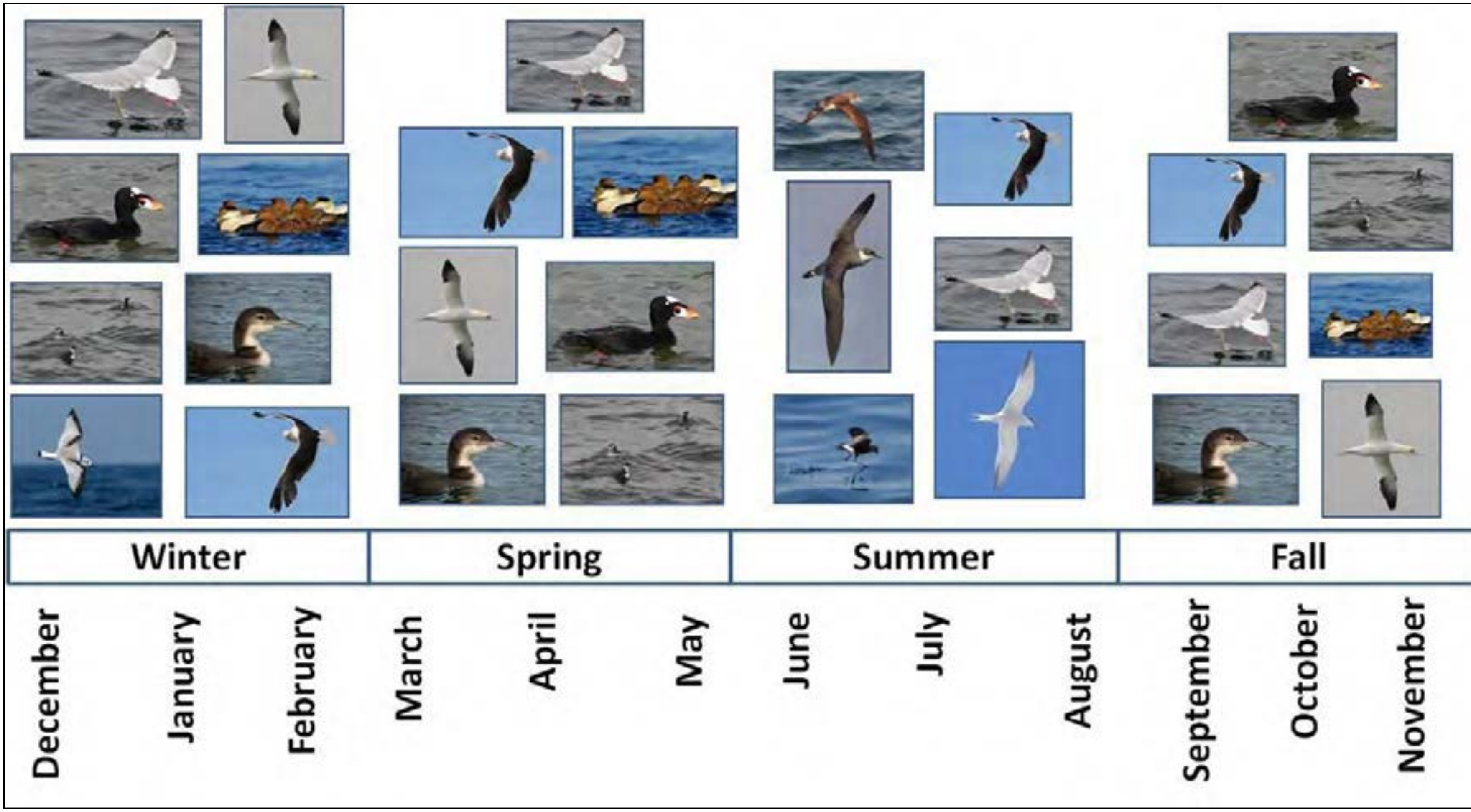
DSM – Using Survey Data from Multiple Platforms



DSM – Uncertainty

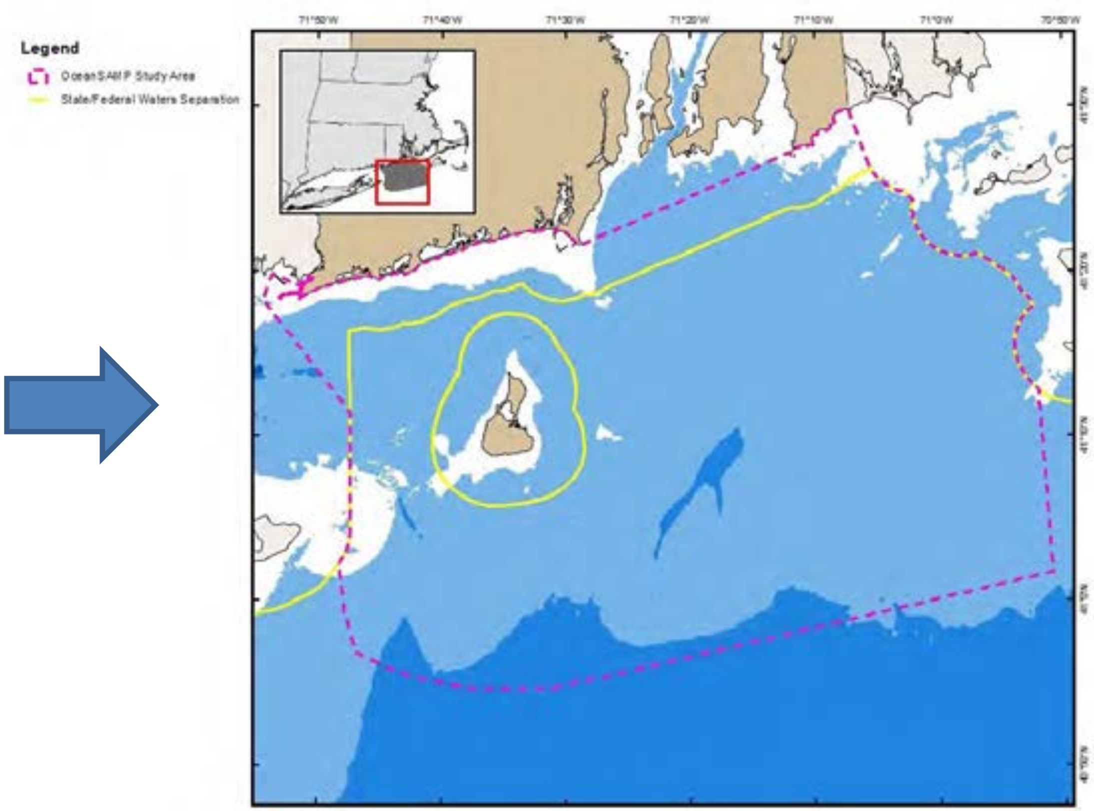


Lots of Predictive Maps for Policy Folks



-Our final OSAMP report contained 80 DSM maps.

OWED Siting in the OSAMP



•Waters <20m (in white) off limits to future development to protect seaduck foraging areas.

•Represent 8% of total SAMP study area.

How Can We Best Incorporate this Type of Modeling Output into OWED Siting Decisions?

ZONATION
Conservation planning software

PROCEEDINGS OF THE ROYAL SOCIETY B

Proc. R. Soc. B (2005) 272, 1885–1891
doi:10.1098/rspb.2005.3164
Published online 2 August 2005

Prioritizing multiple-use landscapes for conservation: methods for large multi-species planning problems

Atte Moilanen[1,*], Aldina M. A. Franco[2], Regan I. Early[2], Richard Fox[3], Brendan Wintle[4] and Chris D. Thomas[2]

Contents lists available at SciVerse ScienceDirect

Biological Conservation

journal homepage: www.elsevier.com/locate/biocon

ELSEVIER

Comparison of five modelling techniques to predict the spatial distribution and abundance of seabirds

Steffen Oppel[a,*], Ana Meirinho[b], Iván Ramírez[b], Beth Gardner[c], Allan F. O'Connell[d], Peter I. Miller[e], Maite Louzao[f,g]

Journal of Applied Ecology

Journal of Applied Ecology 2011, 48, 726–735 doi: 10.1111/j.1365-2664.2011.01985.x

Optimizing regional conservation planning for forest birds

Frederic Beaudry[1*], Anna M. Pidgeon[1], David J. Mladenoff[1], Robert W. Howe[2], Gerald A. Bartelt[3] and Volker C. Radeloff[1]

ICES Journal of Marine Science

ICES CIEM

ICES Journal of Marine Science (2012), 69(1), 75–83. doi:10.1093/icesjms/fsr180

Systematic conservation planning in the eastern English Channel: comparing the Marxan and Zonation decision-support tools

Juliette Delavenne[1*], Kristian Metcalfe[2], Robert J. Smith[2], Sandrine Vaz[1], Corinne S. Martin[3], Ludovic Dupuis[4], Franck Coppin[1], and Andre Carpentier[1]

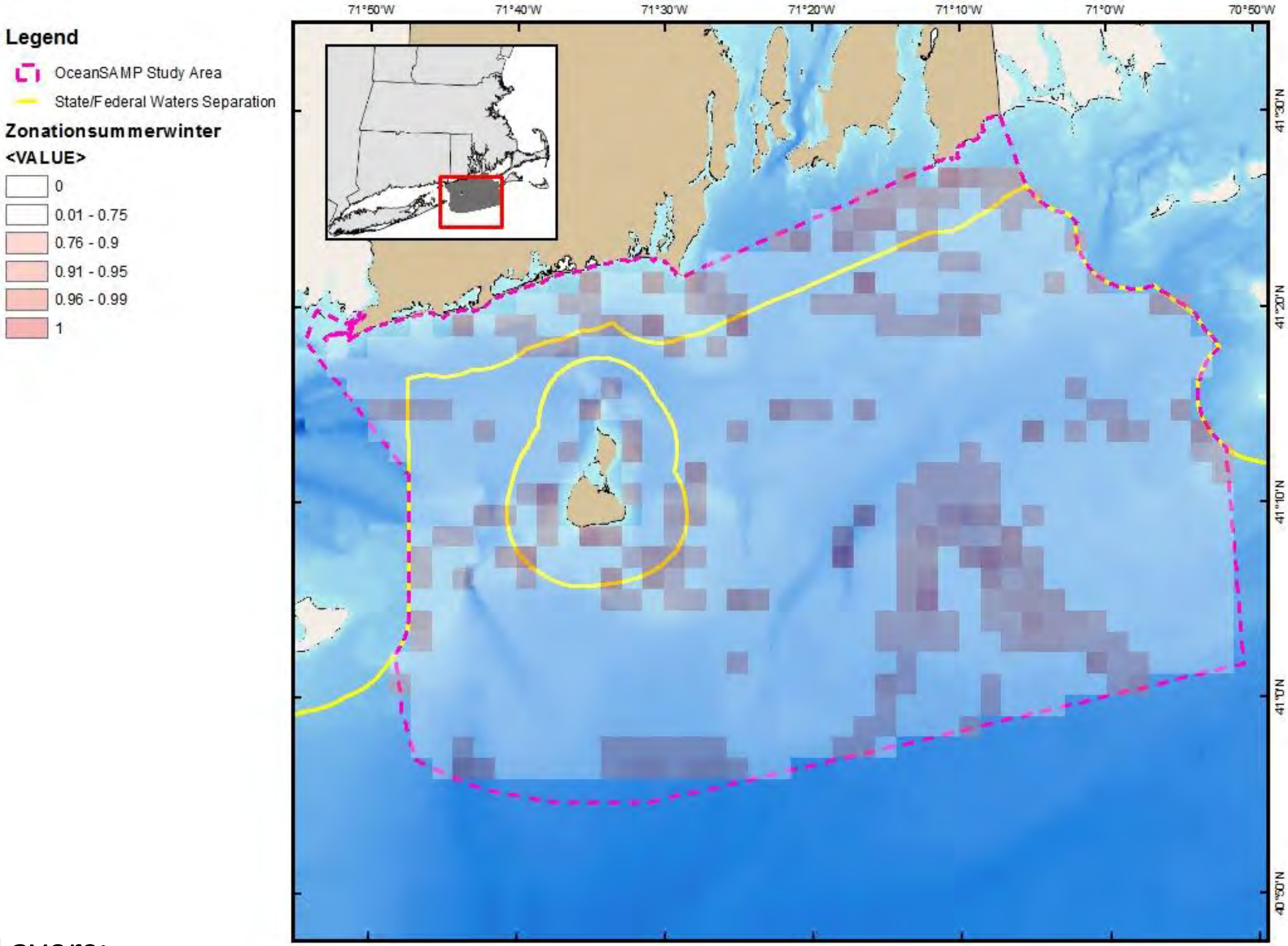
ZONATION
Conservation planning software

Aim and purpose:
To provide a tool for large-scale high resolution spatial conservation planning using GIS grid data.

Analyses:
Identification of optimal conservation areas.
Balancing of alternative land uses.

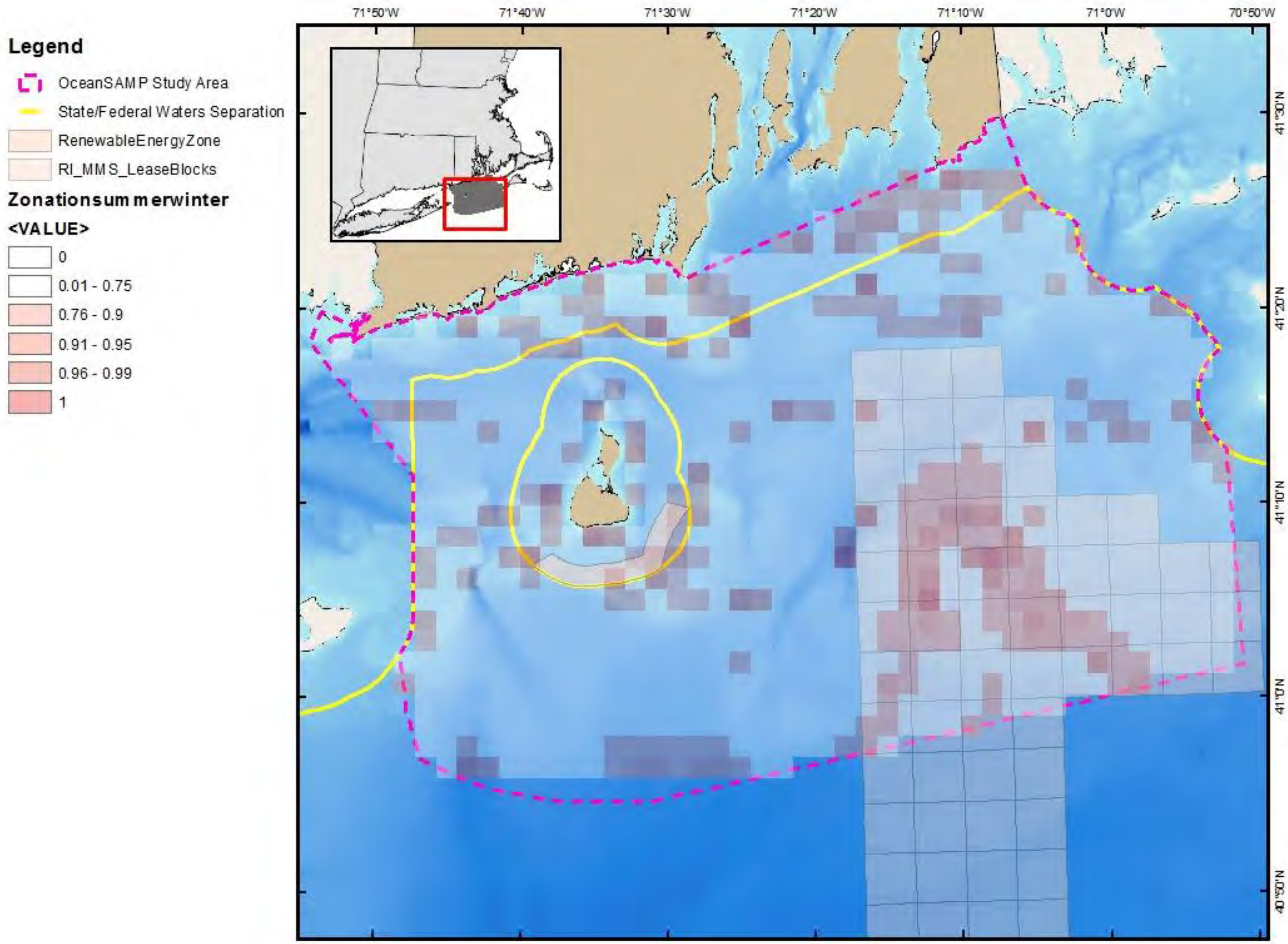
Data:
Presence/absence
Probabilities of occurrence
Abundance/density
Uncertainty

Features:
Species priorities via weighting
Methods for dealing with connectivity



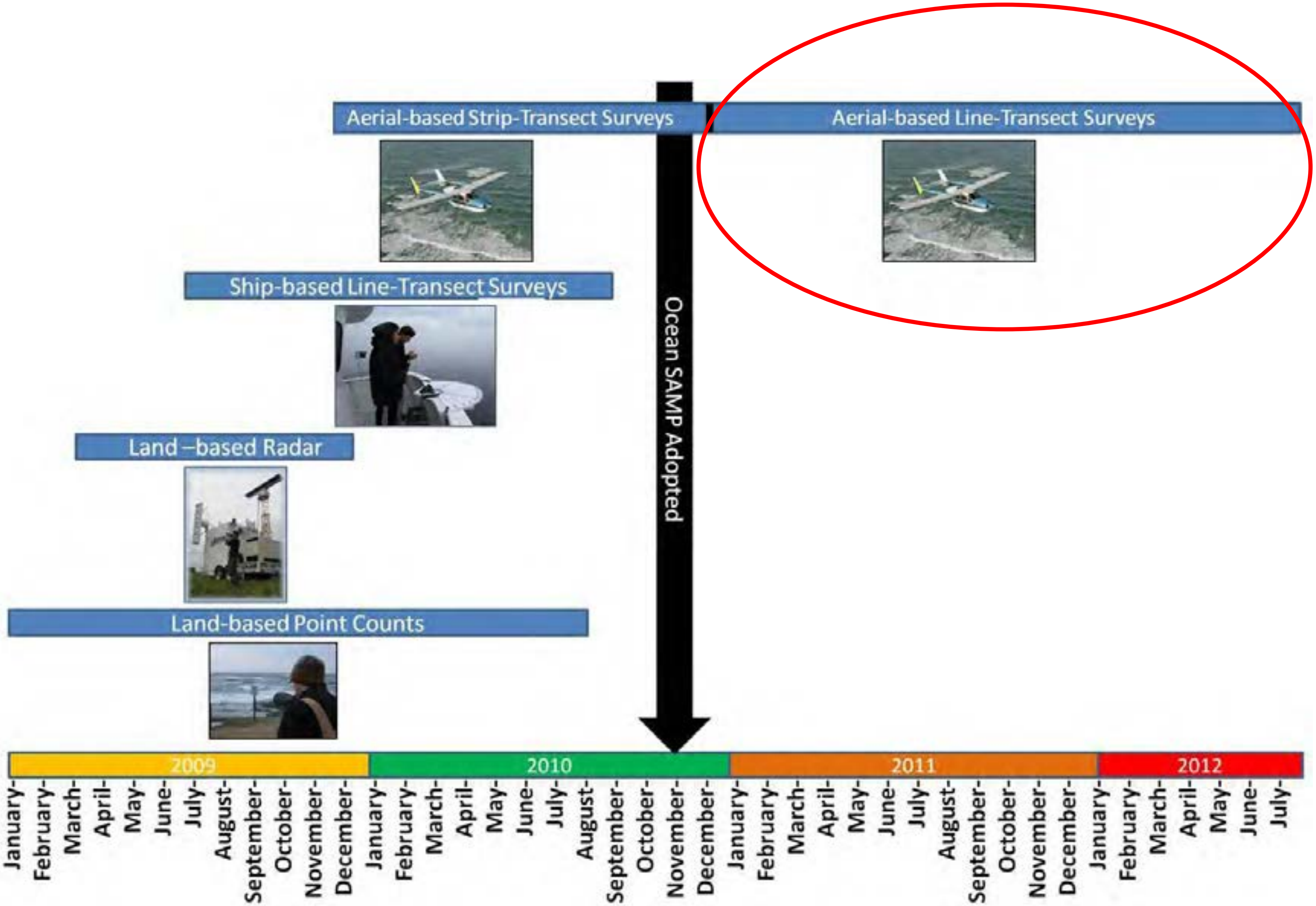
Input Layers:
Winter-Gulls, Alcids, Seaducks, Northern Gannet and Loons.
Summer-Gulls, Shearwaters, Petrels and Terns.

•All layers equally ranked.



Input Layers:
<u>Winter</u>-Gulls, Alcids, Seaducks, Northern Gannet and Loons.
<u>Summer</u>-Gulls, Shearwaters, Petrels and Terns.

•All layers equally ranked.


Aerial-based Strip-Transect Surveys
Aerial-based Line-Transect Surveys
Ship-based Line-Transect Surveys
Land –based Radar
Land-based Point Counts
Ocean SAMP Adopted
2009
2010
2011
2012
January-
February-
March-
April-
May-
June-
July-
August-
September-
October-
November-
December-

Incorporate More Predictive Environmental Covariates into Models?

Many available environmental covariates:

Static	**Dynamic**	
Distance to coast	SST	Distance to ocean front
Bathymetry	Chlorophyll a	Stratification
Slope	SSH	Turbidity
Roughness	Density of ocean fronts	Zooplankton
Grain size		Oscillation Indexes

Dynamic variables

•Temporal decisions

-Same time period as survey data or three months prior?

•Do we look at the average, min, max, variability, variability within nearby cells?

Potential issues

•High collinearity

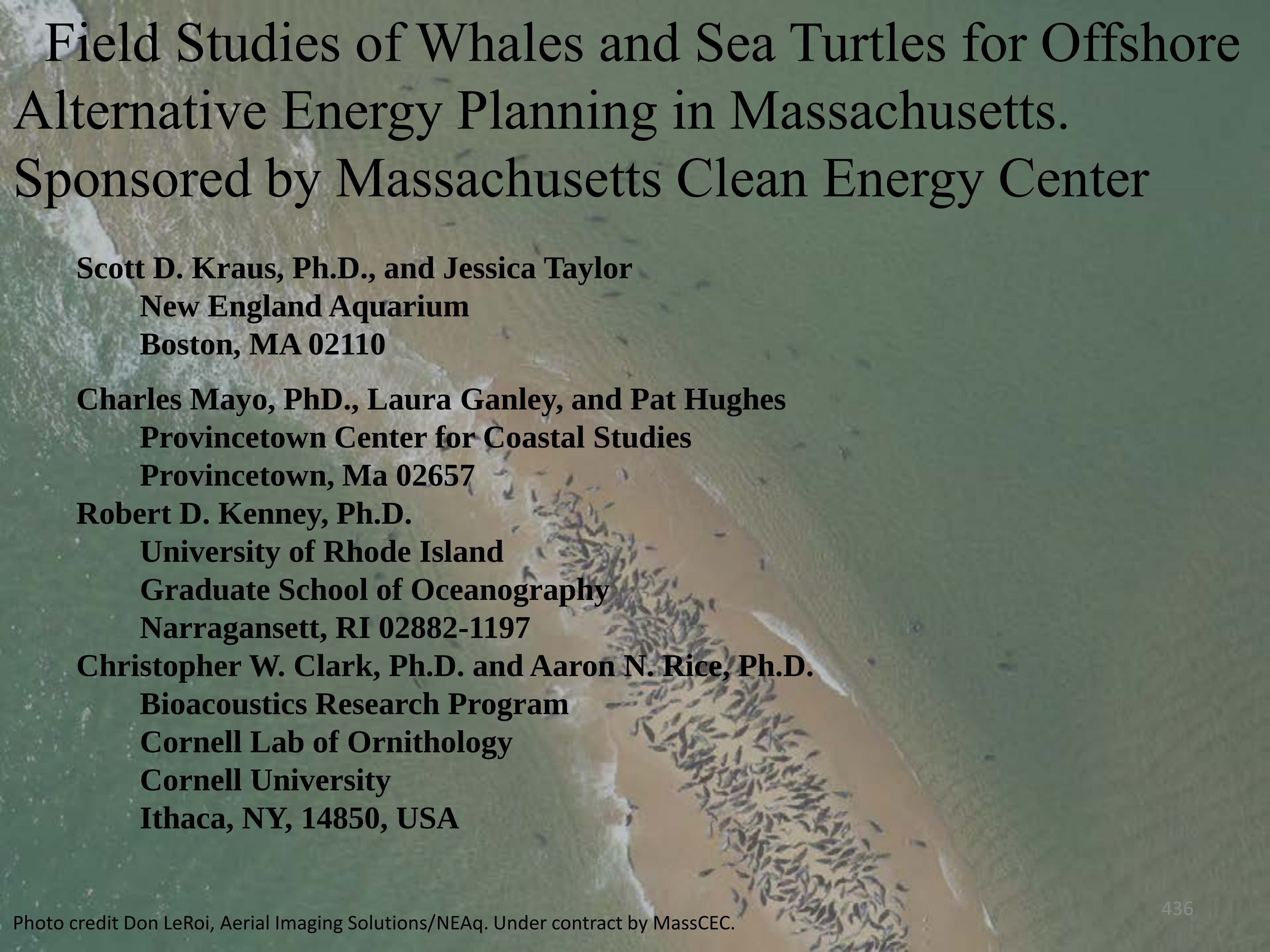
•Explanatory vs. predictive model?

-Increasing number of variables -> increase in difficulty interpreting model.

•Dynamic could be the only way to understand annual variability

-Many years of survey data.

Presentation #12



Field Studies of Whales and Sea Turtles for Offshore Alternative Energy Planning in Massachusetts. Sponsored by Massachusetts Clean Energy Center

Scott D. Kraus, Ph.D., and Jessica Taylor
New England Aquarium
Boston, MA 02110

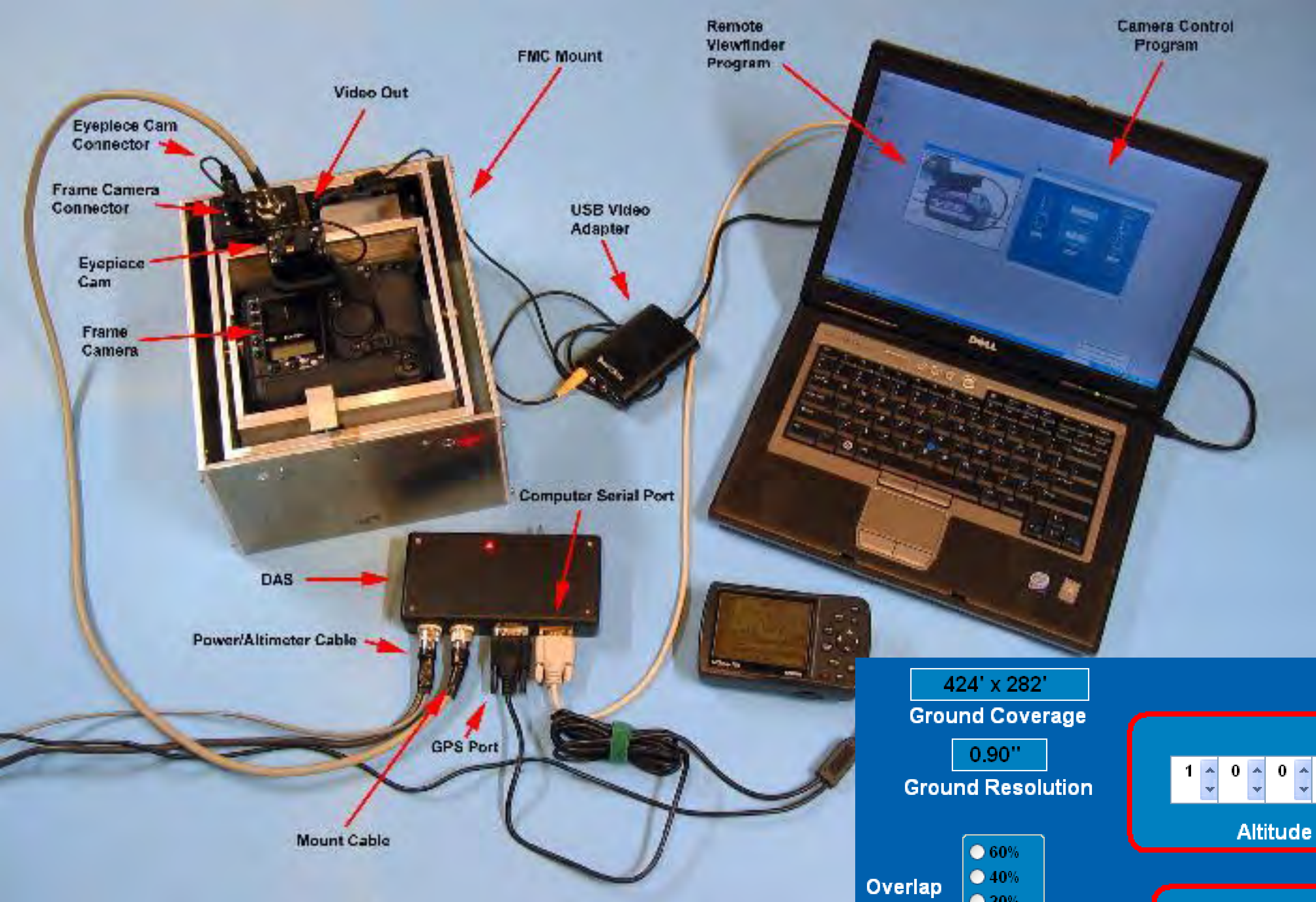
Charles Mayo, PhD., Laura Ganley, and Pat Hughes
Provincetown Center for Coastal Studies
Provincetown, Ma 02657

Robert D. Kenney, Ph.D.
University of Rhode Island
Graduate School of Oceanography
Narragansett, RI 02882-1197

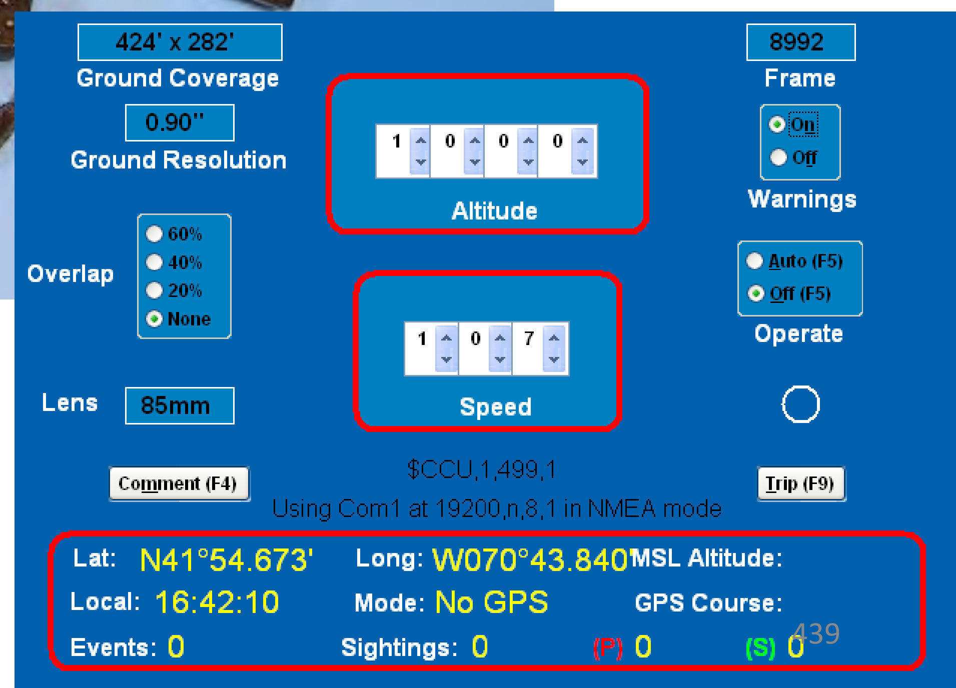
Christopher W. Clark, Ph.D. and Aaron N. Rice, Ph.D.
Bioacoustics Research Program
Cornell Lab of Ornithology
Cornell University
Ithaca, NY, 14850, USA

Photo credit Don LeRoi, Aerial Imaging Solutions/NEAq. Under contract by MassCEC.


AFT



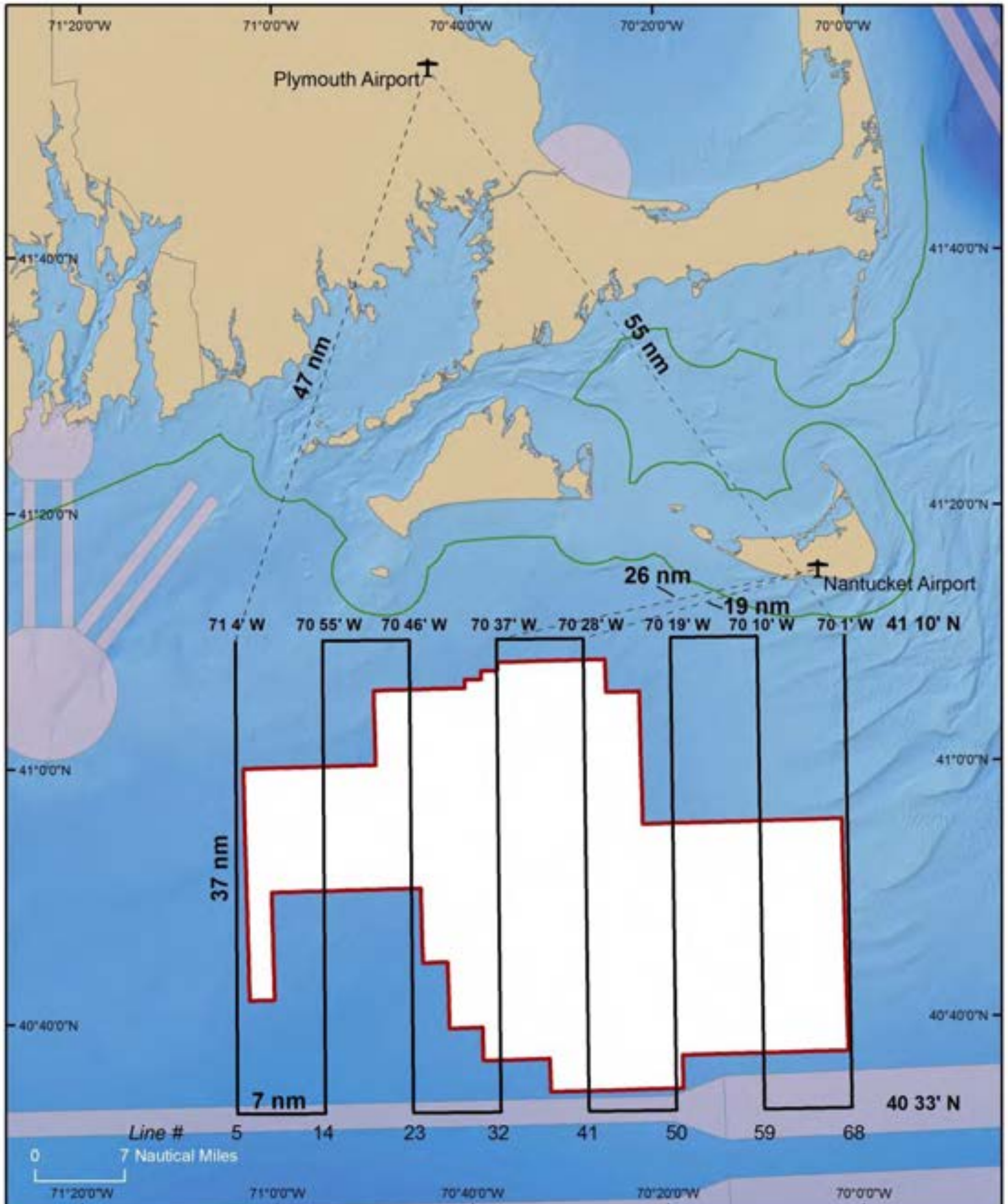
Eyepiece Cam Connector
Video Out
FMC Mount
Remote Viewfinder Program
Camera Control Program
Frame Camera Connector
Eyepiece Cam
Frame Camera
USB Video Adapter
Computer Serial Port
DAS
Power/Altimeter Cable
GPS Port
Mount Cable

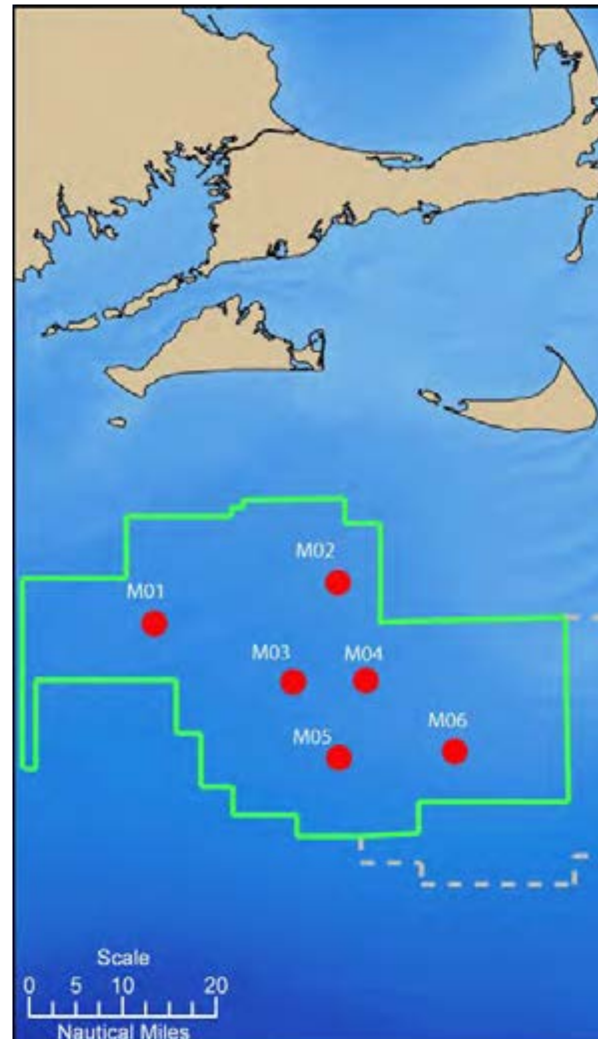


424' x 282'
Ground Coverage
0.90"
Ground Resolution
1 0 0 0
Altitude
8992
Frame
On
Off
Warnings
Overlap
60%
40%
20%
None
1 0 7
Speed
Auto (F5)
Off (F5)
Operate
Lens
85mm
Comment (F4)
$CCU,1,499,1
Using Com1 at 19200,n,8,1 in NMEA mode
Trip (F9)
Lat: N41°54.673'
Long: W070°43.840'
MSL Altitude:
Local: 16:42:10
Mode: No GPS
GPS Course:
Events: 0
Sightings: 0
(P) 0
(S) 0

Start line: W to E - Line #5: 71 4' W
E to W - Line #68: 70 1' W

Option #5





Presentation #13

Documenting Whale Migration Off Virginia's Coast for Use in Marine Spatial Planning

NOAA Coastal Zone Management Administration
Project of Special Merit Award

Virginia Aquarium & Marine Science Center Foundation
Virginia Coastal Zone Management Program
University of North Carolina Wilmington
The Nature Conservancy

Overall Project Description:

"… collect important data on the presence, density and seasonality of endangered large whale species in the vicinity of the Virginia Wind Energy Area as designated by the Bureau of Ocean Energy Management."

Study area includes an approximately 10,000 sqkm area that encompasses the Virginia WEA.
Aerial and vessel surveys to be conducted from November 2012 through April 2013.

Project Activities

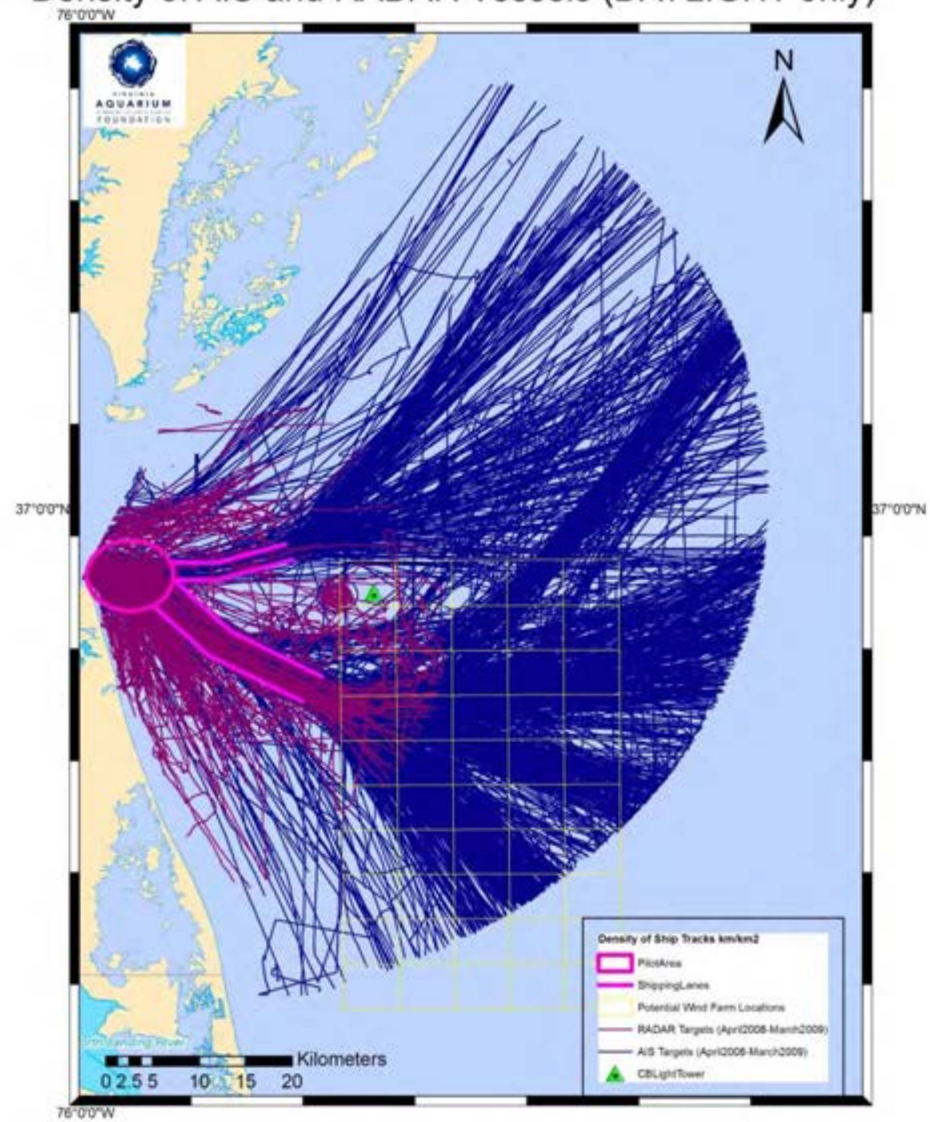
1. 2 days per month of aerial surveys for 6 months

2. 8 vessel days for directed observations of whales

3. Import of GIS data into MARCO Mapping and Planning Portal and other regional data sets such as OBIS SEAMAP

Figure 1: Large whale survey area (black box) with VA wind energy area (WEA) at the center.

Density of AIS and RADAR Vessels (DAYLIGHT only)



Project Contacts:

Virginia Aquarium & Marine Science Center Foundation

Susan Barco, Research Coordinator & Senior Scientist
Phone: 757-385-6476
E-mail: SGBarco@VirginiaAquarium.com

Gwen Lockhart, GIS Research Specialist
Phone: 757-385-6486
E-mail: Glockhar@VirginiaAquarium.com

Mark Swingle, Director of Research & Conservation
Phone: 757-385-0326
E-mail: Mswingle@VirginiaAquarium.com

Presentation #14

Virginia/Maryland Sea Turtle Research & Conservation Initiative

NOAA Section 6 Species Recovery Grant

Virginia Aquarium & Marine Science Center Foundation
Virginia Department of Game & Inland Fisheries
Maryland Department of Natural Resources

Primary Sub-contractors for Surveys:
Riverhead Foundation for Marine Research and Preservation
Research Unit for Wildlife Population Assessment, University of St. Andrews

Overall Project Description:

"… collection of a comprehensive set of data on the life history, health and abundance of sea turtle species."

Goal 1: Develop robust seasonal distribution and abundance estimates for loggerhead and Kemp's ridley sea turtles in the study area.

Study area includes the Chesapeake Bay and coastal ocean waters of Virginia and Maryland.

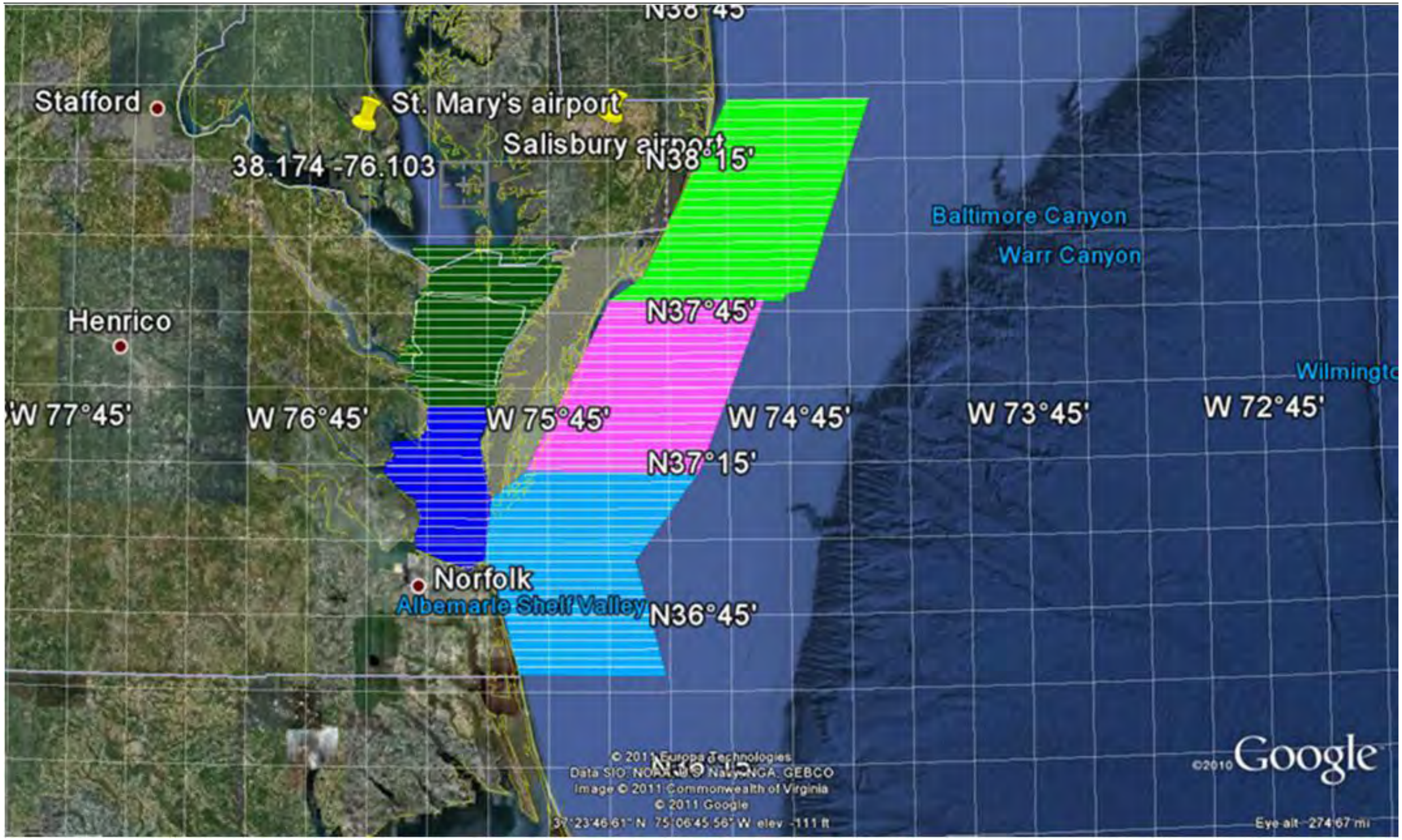
Population Assessment Action Plan

1. Quantify turtle surfacing time for calculating seasonal and annual differences in availability.

2. Conduct aerial abundance surveys in a manner that will allow calculation of perception bias to create robust estimates of seasonal and annual abundance.

3. Compare abundance estimates with previous studies.

Survey Stratum Design



5 survey stratums

113 east to west transit lines
3.3 km apart
strip width = 1 km

Survey Methodology

- Four observers – two independent teams
  - Team 1 looked out port and starboard bubble windows
  - Team 2 looked out through a belly window and a side window
- Hiby circle back technique was used in Fall 2011 and Spring 2012
- Observers report – angle to sighting, species, number of animals, other sighting information, and environmental data
- Perpendicular distance of the animal to the transect line was calculated from the angle and the height of the plane
- Animals detected by both teams (called a duplicate detection) were later identified on the basis of timing and position



Estimating Density and Abundance

- Within each stratum, group density (Ds) and group abundance (Ns) of animals available for detection were estimated as follows:

$$\hat{D}_s = \frac{1}{2wL}\sum_{j=1}^{n}\frac{1}{\hat{p}_j} \quad \text{and} \quad \hat{N}_s = A\hat{D}_s$$

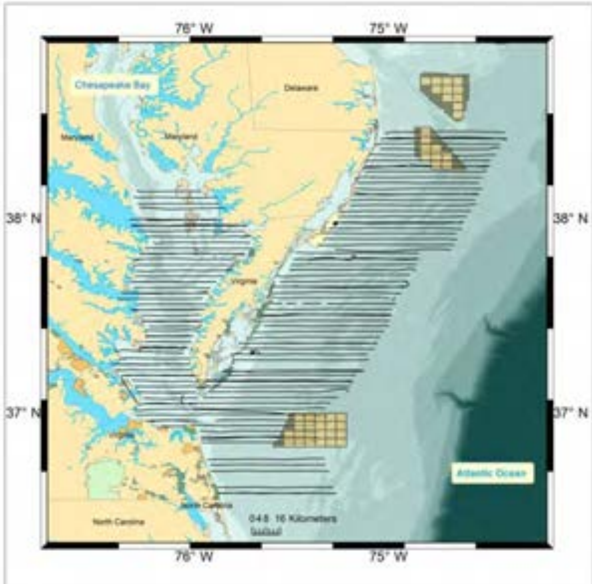
where *A* is the size of stratum, w is the truncation distance, *L* is the total effort achieved in the stratum, *n* is the total number of detections in the stratum and *p* is the estimated probability of detecting group *j* (see below). Individual animal density (*D*) and abundance (*N*) were obtained from

$$\hat{D} = \frac{1}{2wL}\sum_{j=1}^{n}\frac{s_j}{\hat{p}_j} \quad \text{and} \quad \hat{N} = A\hat{D}$$

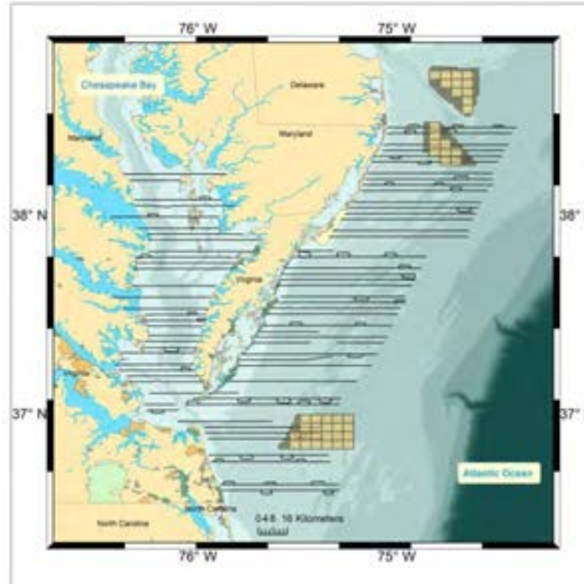
Estimation of Detection Probabilities

- Mark and recapture techniques using 2 teams of observers (Laake and Borchers 2004)
- Distance sampling model used both a hazard-rate (1-exp(-x/σ)-b) and a half-normal form (exp(-x2/2σ2)) (Buckland *et al*. 2001)
- Effects of covariates were incorporated into the model by setting the scale parameter in the model to be an exponential function of the covariates (Marques and Buckland 2004).
  - season, strata, observer position (left, right or center), group size and Beaufort sea state
- Akaike's Information Criterion (AIC) and goodness of fit statistics were used to select the final model and all model selection was performed in the program Distance (Thomas *et al*. 2010; version 6.1 Beta 1 and version 2.0.6 of the mrds R library).

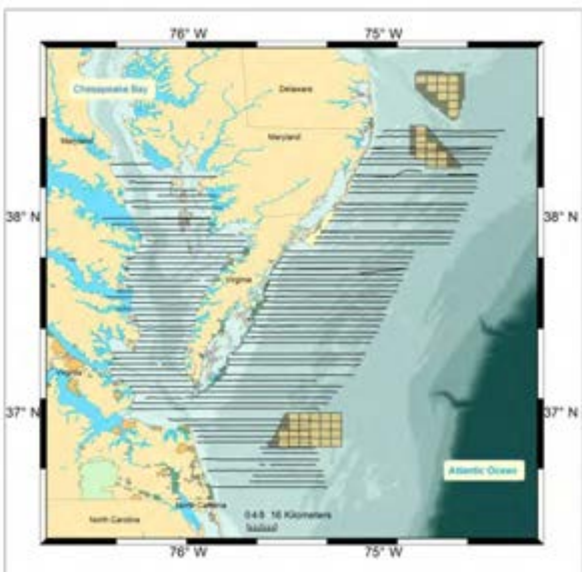
Actual Survey Transits



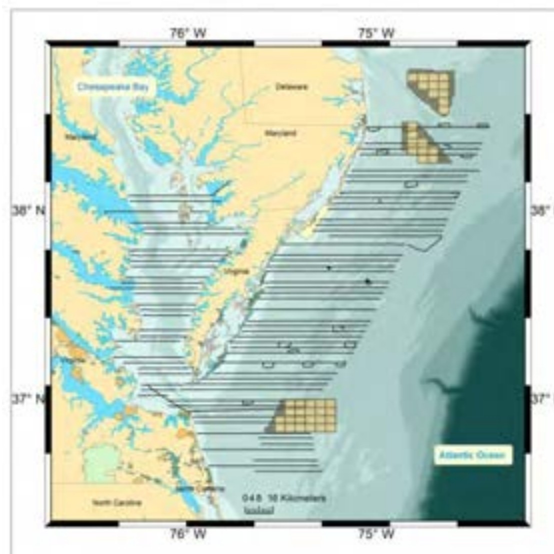
- > Spring 2011
- > 22 May to 1 June
- > Percent Area covered = 35%



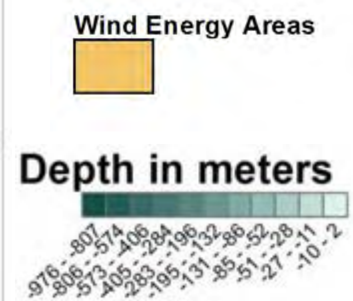
- > Fall 2011
- > Sept & October
- > Percent Area covered = 20%



- > Summer 2011
- > 22 to 28 July
- > Percent Area covered = 29%

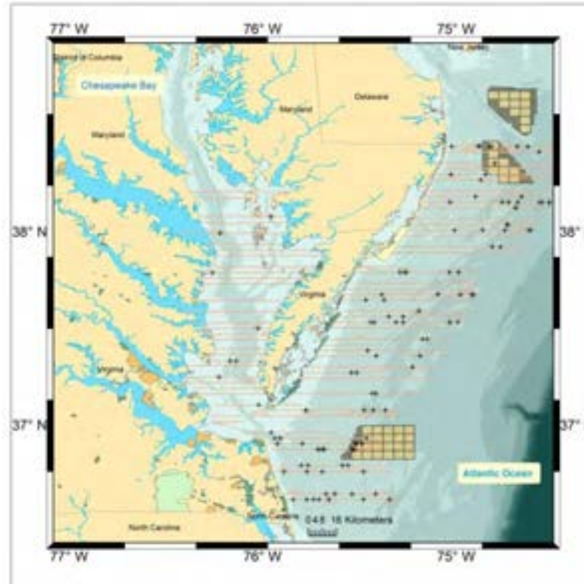


- > Spring 2012
- > 29 Sept to 7 Oct



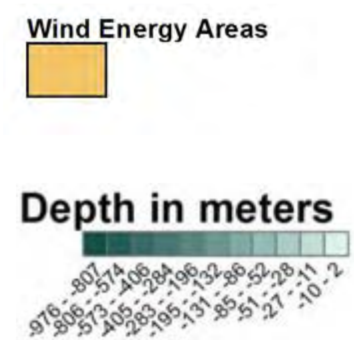
Loggerhead Sightings - 2011

- Spring 2011
- Team 1 = 769
- Team 2 = 517
- Duplicates = 130
- Unique = 1156

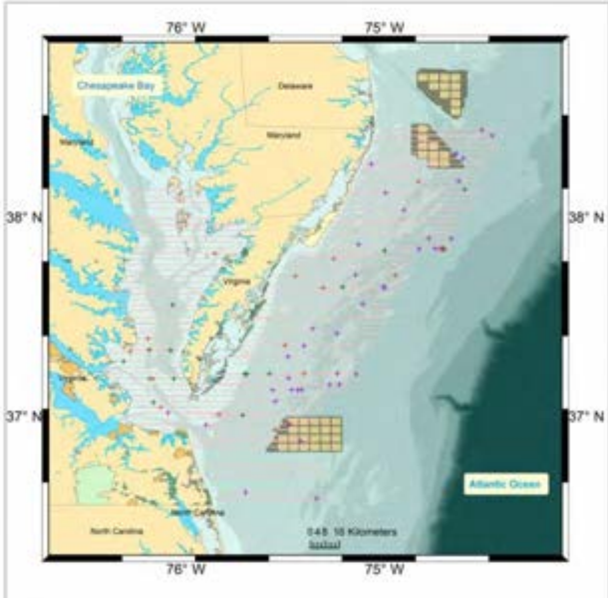


- Fall 2011
- Team 1 = 119
- Team 2 = 86
- Duplicates = 25
- Unique = 180

- Summer 2011
- Team 1 = 365
- Team 2 = 301
- Duplicates = 57
- Unique = 609



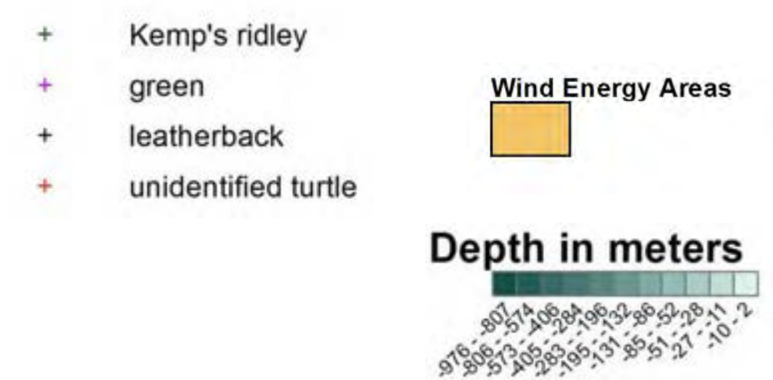
Other Turtle Sightings - 2011



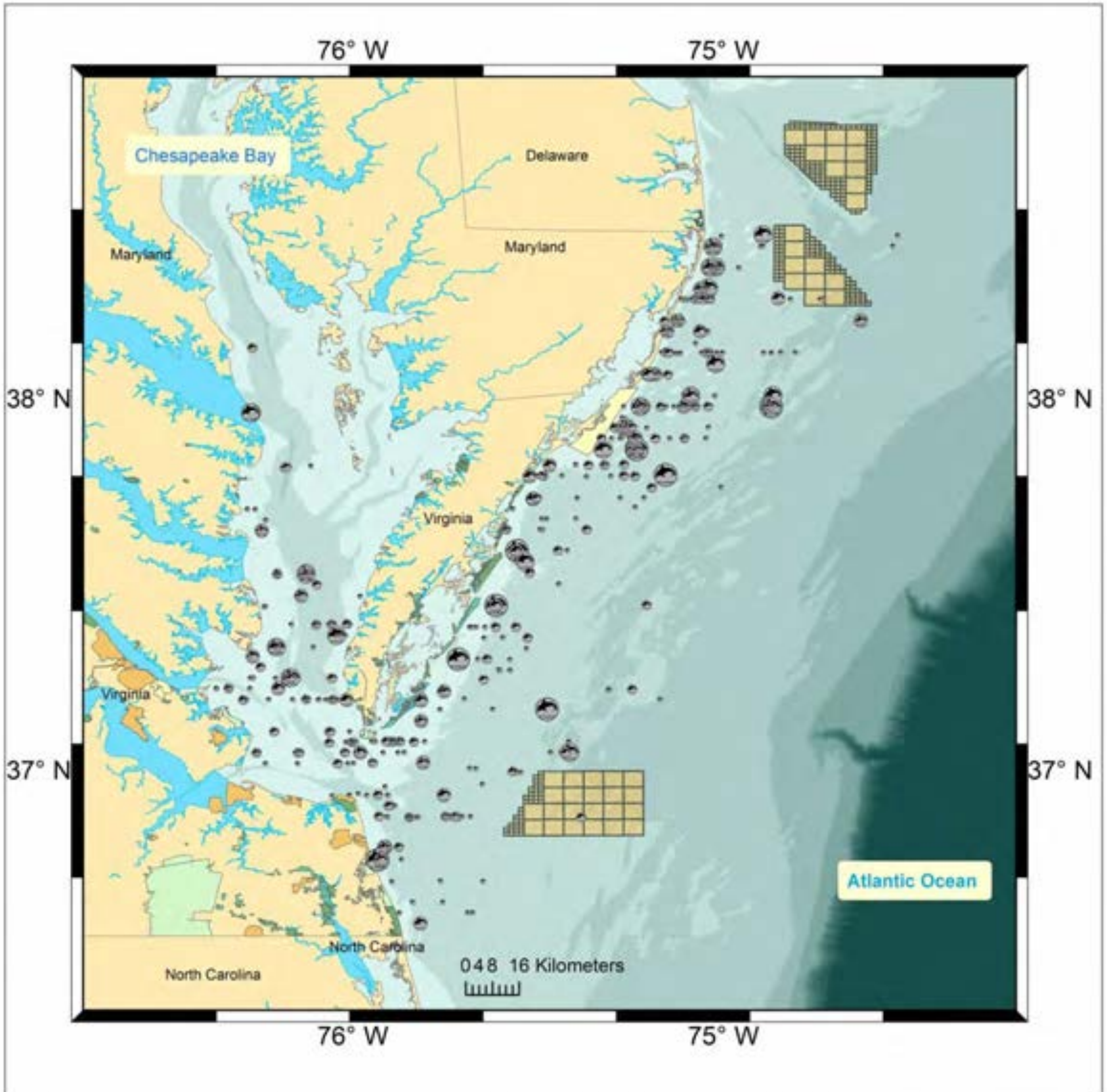
- Spring 2011
- Team 1 = 117
- Team 2 = 580
- Duplicates = 145
- Unique = 163

- Fall 2011
- Team 1 = 28
- Team 2 = 14
- Duplicates = 1
- Unique = 41

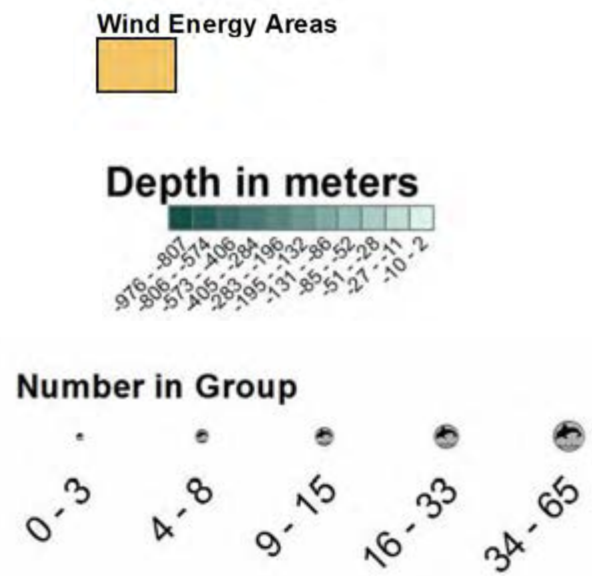
- Summer 2011
- Team 1 = 122
- Team 2 = 94
- Duplicates = 13
- Unique = 203



Bottlenose Dolphin Groups - 2011



- Team 1 = 425
- Team 2 = 306
- Duplicates = 90
- Unique = 641



Project Contacts:

Virginia Aquarium & Marine Science Center Foundation

Susan Barco, Research Coordinator & Senior Scientist
Phone: 757-385-6476
E-mail: SGBarco@VirginiaAquarium.com

Gwen Lockhart, GIS Research Specialist
Phone: 757-385-6486
E-mail: Glockhar@VirginiaAquarium.com

Mark Swingle, Director of Research & Conservation
Phone: 757-385-0326
E-mail: Mswingle@VirginiaAquarium.com

Presentation #15

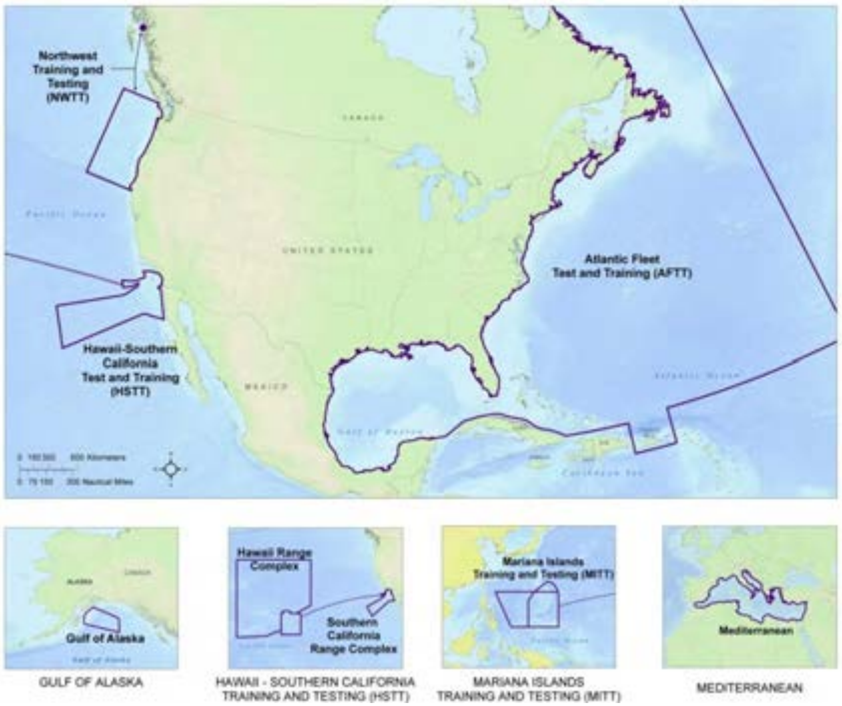
Navy Integrated Comprehensive Monitoring Program (ICMP)

Dr. Robert Gisiner

Office of the Chief of Naval Operations, Energy & Environmental Readiness Div (OPNAV N45)

bob.gisiner@navy.mil

Development of the Current U.S. Navy Risk Assessment and Monitoring Process

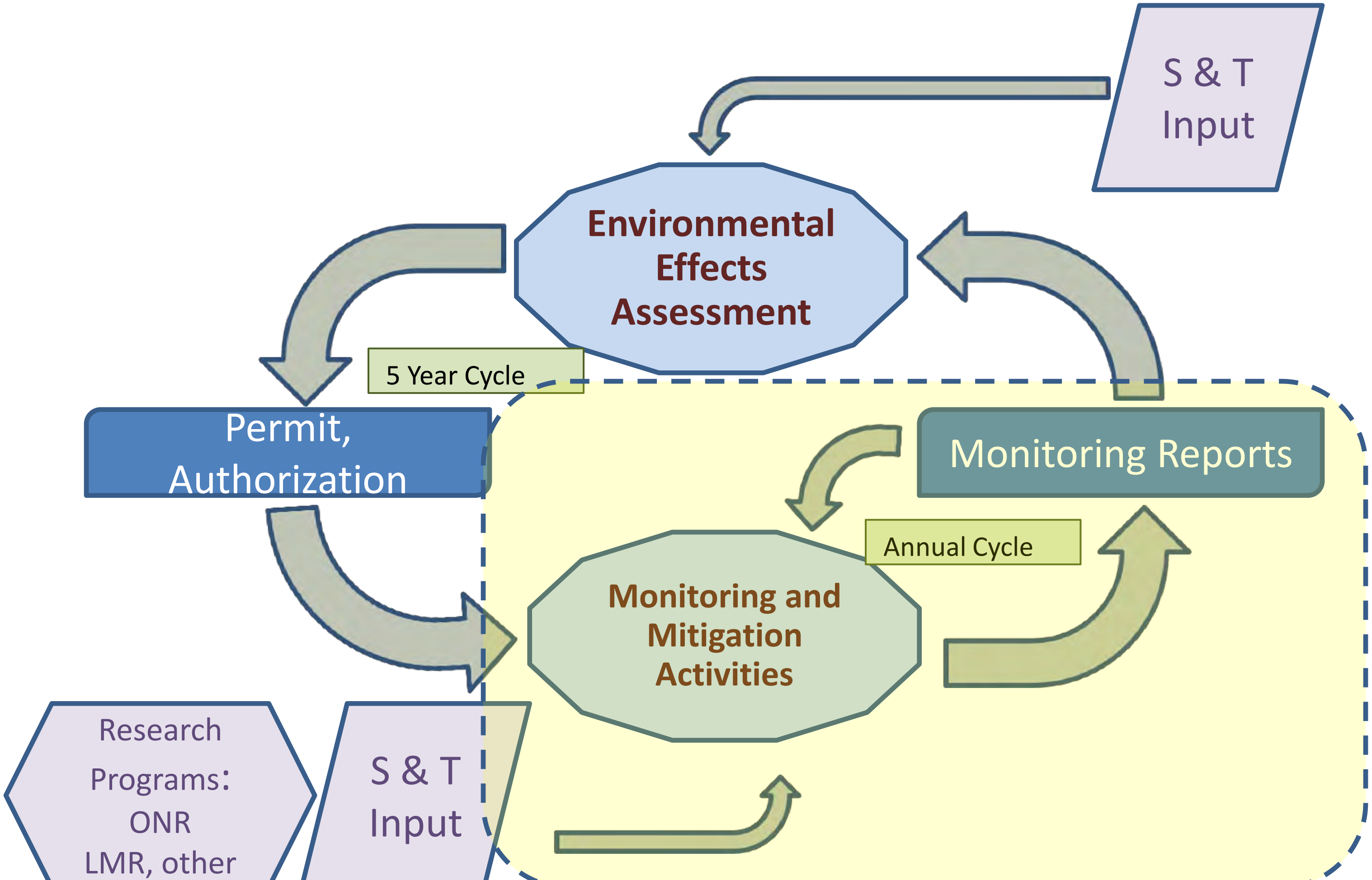


The Navy needs marine mammal and T/E species data for all waters of the United States and US Trust Territories

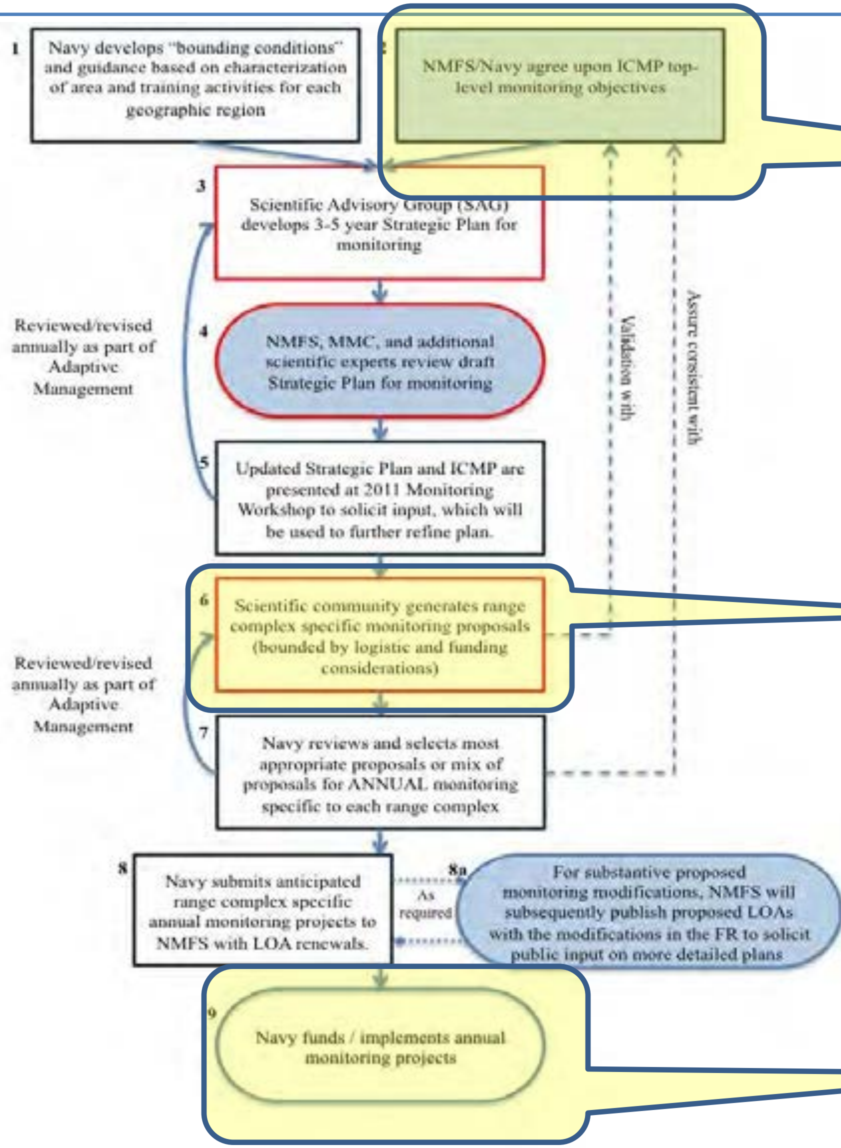
- **Phase II** permit renewals are in public and regulator agency review now, for January 2014 start
  - Number of permits have been consolidated
  - Coverage area and types of assessed activities have been expanded.

- **Adaptive Management** is used to annually review new science, and results of ongoing monitoring with the regulator (NOAA Fisheries).
- Annual Investment by Navy in research and environmental risk management is $25-30M/year.

The U.S. Navy's 5 Year Cycle for Environmental Stewardship



U.S. Navy’s Annual Monitoring and Mitigation Process, with science input/output.



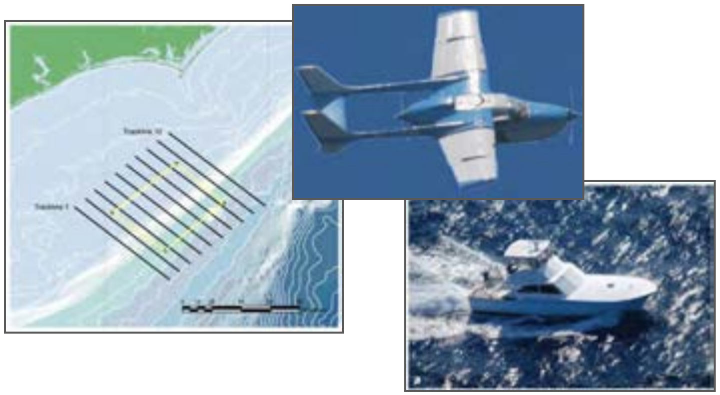
Based on ranked areas of scientific uncertainty and data needs.

Based on current technical/methodological capability and current limits to scientific understanding

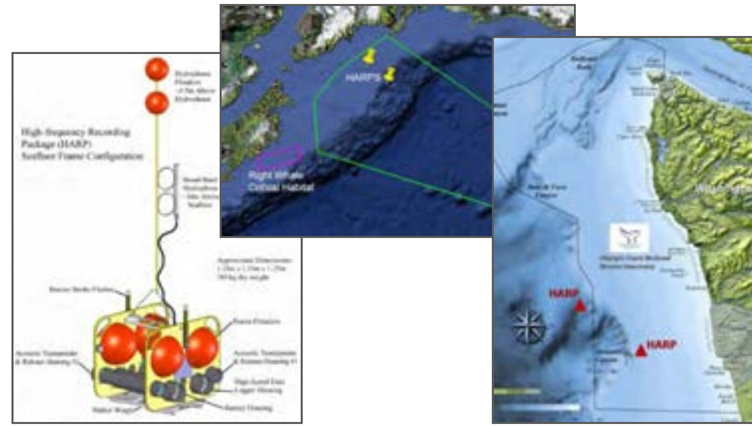
Available methods depend on cost, environmental constraints, and current capabilities. Needs for new, improved capabilities are identified and forwarded to research programs.

Navy Funded Data Collection

Visual Surveys (aerial and vessel)



Passive Acoustic Monitoring



Behavioral Response Studies

Photo Identification

A partial list of recent and ongoing data collection efforts

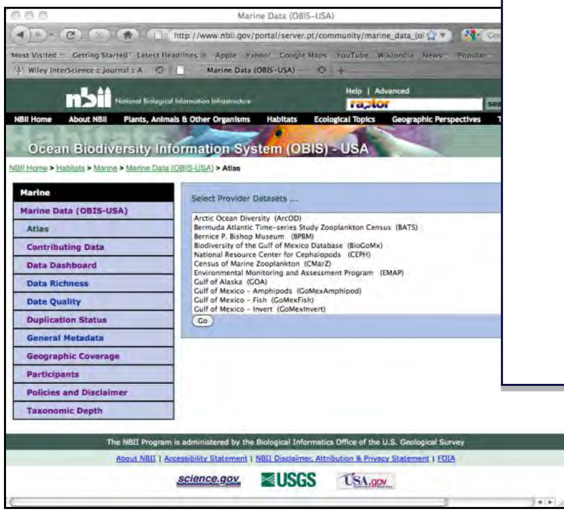
- US Atlantic Coast and Gulf of Mexico
  - Duke University et al – Cape Hatteras survey and BRS
  - AMAPPS – joint BOEMRE, NOAA , USGS, Navy and USFWS
- Southern California Bight
  - Behavioral Response Study (multiple partners)
  - SCOR range surveys, acoustics (remote and instrumented range)
  - ONR and Navy N45 research projects (Scripps, others)
- Northwest US
  - Passive acoustic monitoring, animal tagging
- Gulf of Alaska
  - Passive acoustic monitoring and visual survey (vessel-based)
- Hawaii
  - Aerial visual surveys, boat-based survey and animal tagging, passive acoustics (remote and instrumented range)
- Mariana Islands
  - Aerial and boat-based surveys, remote passive acoustics
- Navy CNO N45 research projects – acoustics, tagging, visual survey in various locations: Hawaii, southern California, The Bahamas
- Office of Naval Research – various projects

Making the Data Accessible

- OBIS SEAMAP
  - Jointly funded by Navy and the Sloan Foundation as part of the Ocean Biogeographic Information System
  - Navy data from Duke U and AMAPPS is periodically archived in OBIS SEAMAP
- OBIS USA
  - A USGS core funded activity
  - Linked to the National Biogeographic Information System (NBIS) – a national terrestrial biodiversity database
  - Linked to OBIS SEAMAP and other OBIS data collection archival efforts (FishBase, CephBase, HexBase)
  - National Ocean Data Center (NOAA NODC) backs up and archives all OBIS USA data
- An interagency goal: to place all survey data in OBIS USA for common agency and public use
  - The Navy partners with BOEM and other agencies to support this common marine biological data architecture
  - The Navy encourages other federal and private sector data collectors to contribute to a common national data archive via NODC, OBIS USA or OBIS SEAMAP
  - NODC, OBIS USA, OBIS SEAMAP are working together to ratify common data and metadata standards, data sharing protocols and data provider support services

OBIS-USA, OBIS-SEAMAP, iOBIS

OBIS-USA



National biogeographic data, standards and services
[archival at NODC]

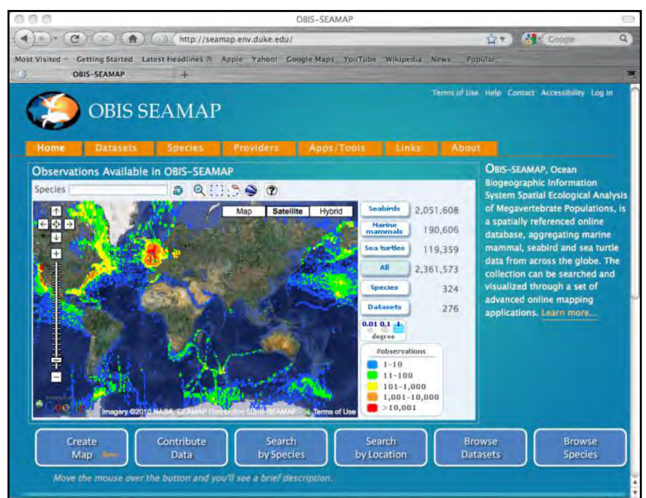
OBIS-SEAMAP Niche:

Protected species data / tools

- Telemetry / tracking data
- Photo-ID
- Passive acoustics
- Spatial Decision Support

Mapping & Analysis R&D*

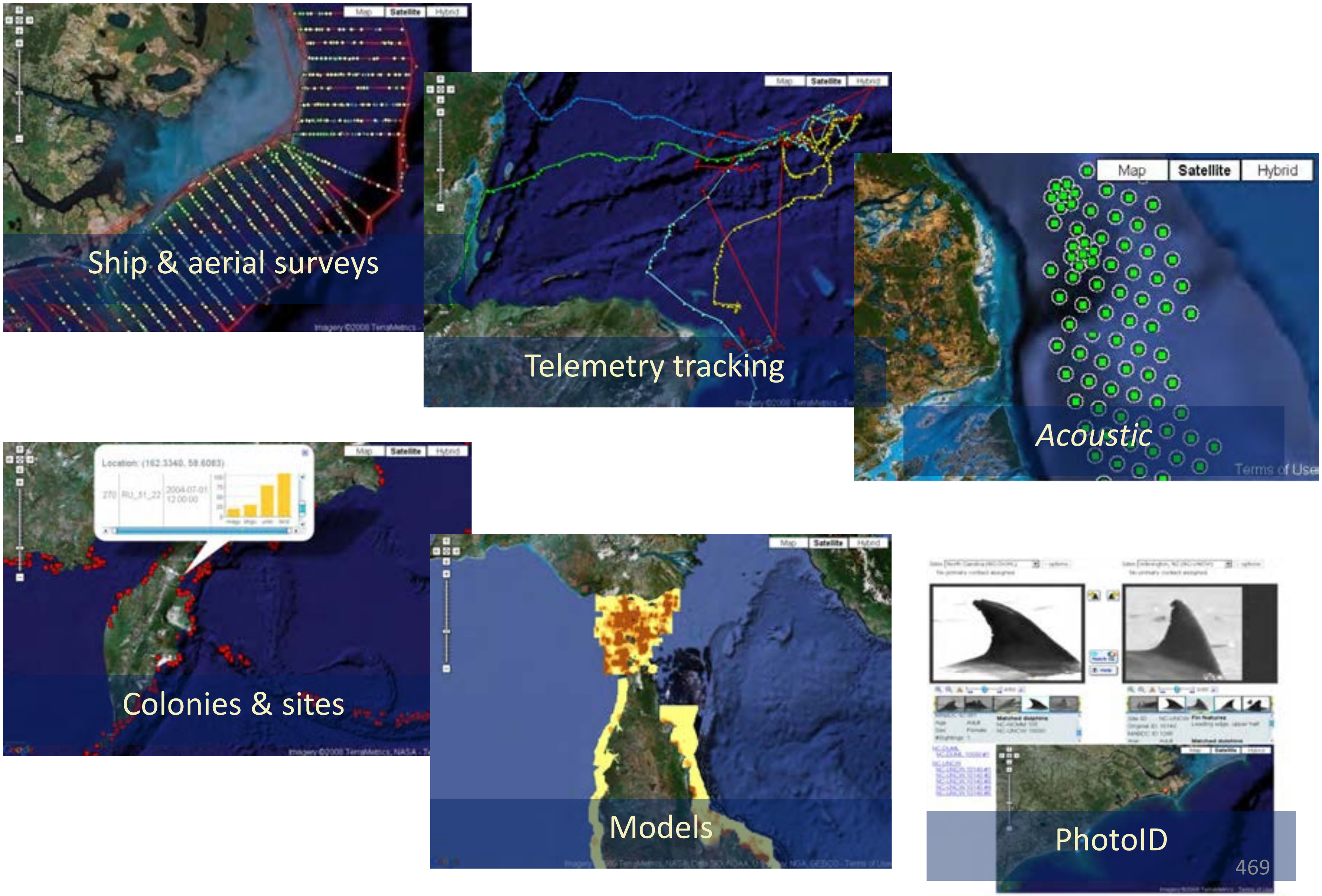
OBIS-SEAMAP



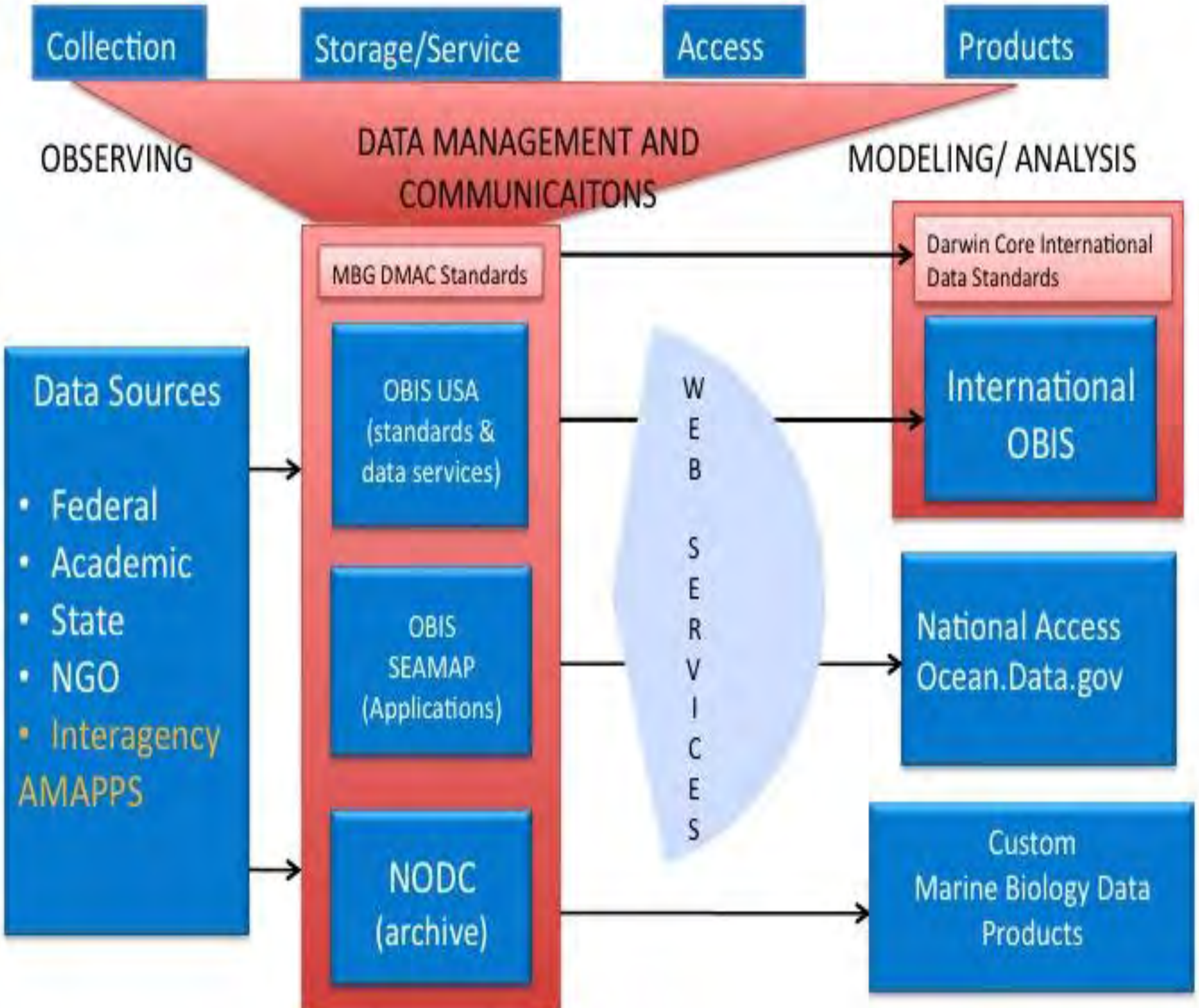
iOBIS

International marine biodiversity data archive

OBIS-SEAMAP supports multiple data types



FEDERAL DATA ARCHITECTURE



Summary: Navy Data Collection

- Data collection decisions are coordinated with the regulatory agencies (NOAA Fisheries, USFWS) through **adaptive management** processes.
- Data are collected to the highest possible standards
  - Visual surveys use **effort-based methods** (e.g. Distance), **correlated with environmental data**
  - Navy LMR and ONR research programs invest in **standards development**
- Data are archived in a **common, open data architecture**
  - to ensure **maximum utility** to all agencies and the public
  - and **minimize duplication of effort** among agencies

Presentation #16

Multipurpose Marine Cadastre

Mid-Atlantic Marine Wildlife Surveys, Modeling, and Data: Workshop to Establish Coordination & Communication

Daniel R. Martin

Room 9153

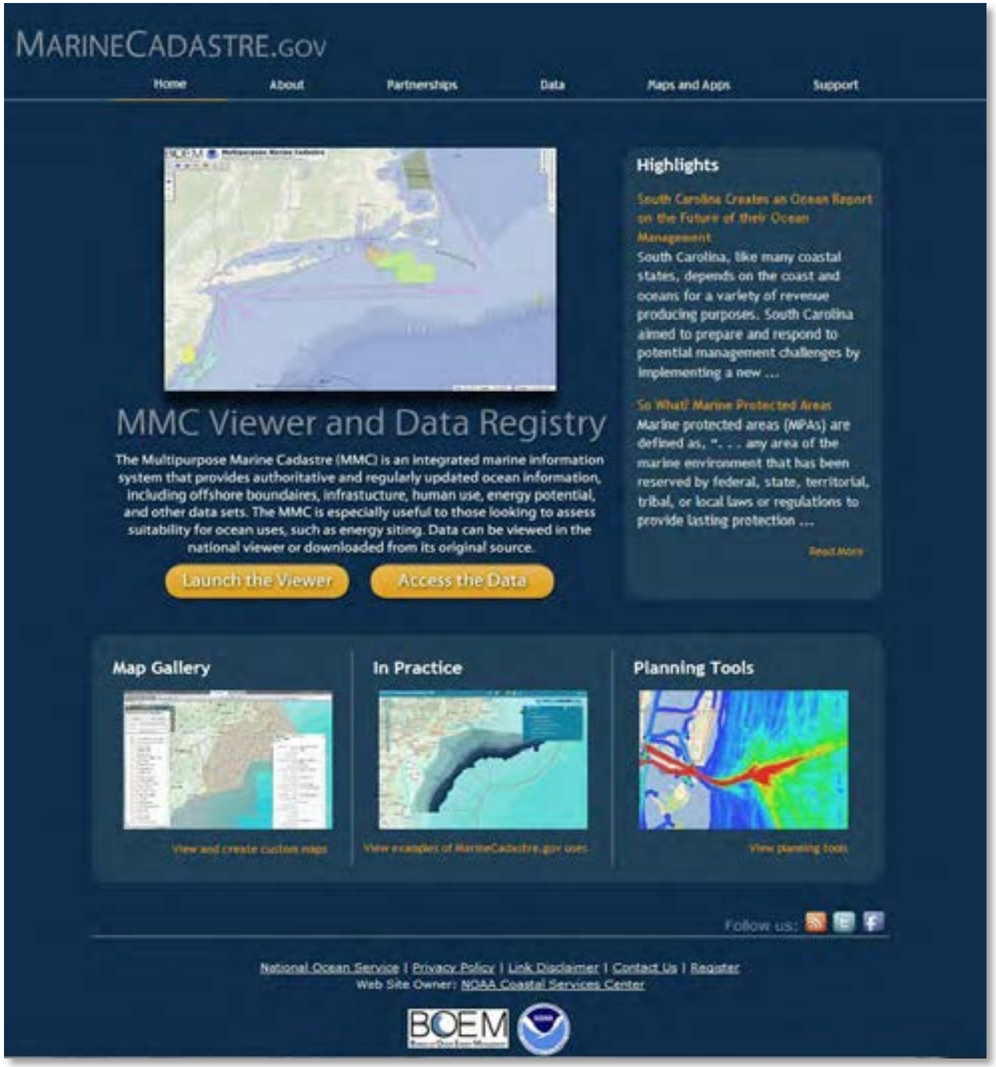
9:00-10:45 July 25 2012

BOEM
Bureau of Ocean Energy Management

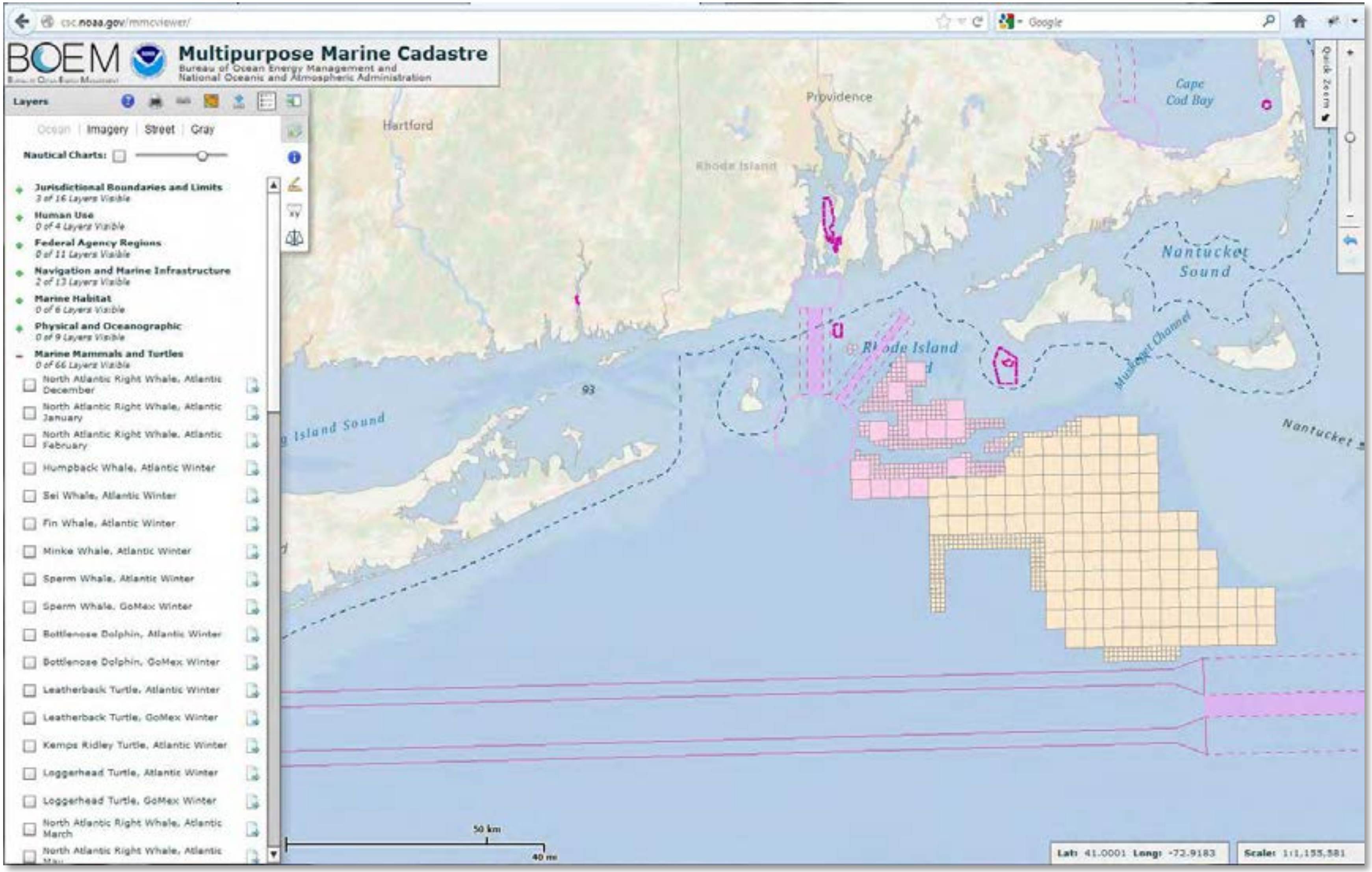
NOAA Coastal Services Center
LINKING PEOPLE, INFORMATION, AND TECHNOLOGY

Offshore Geographic Information

MarineCadastre.gov

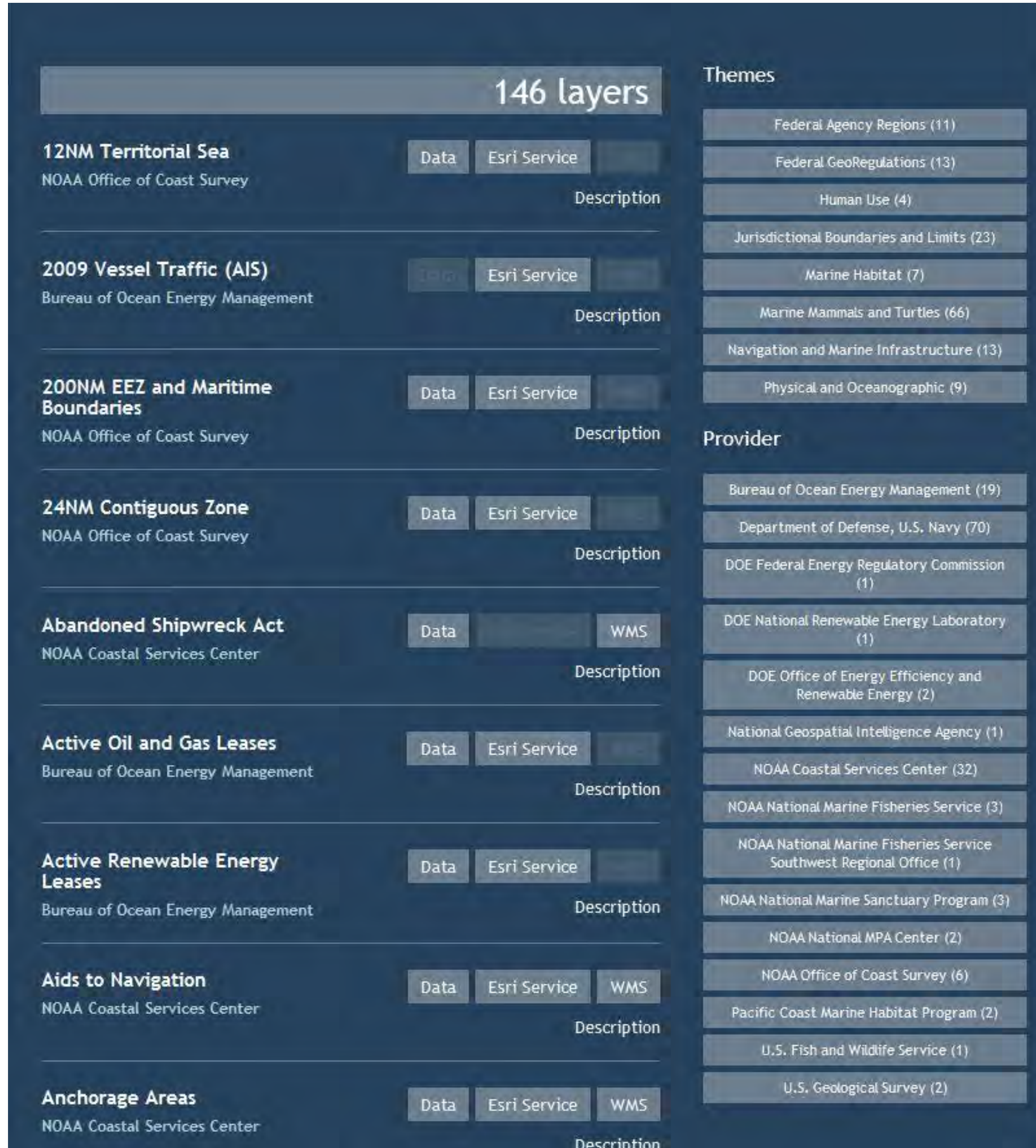


Map Viewer

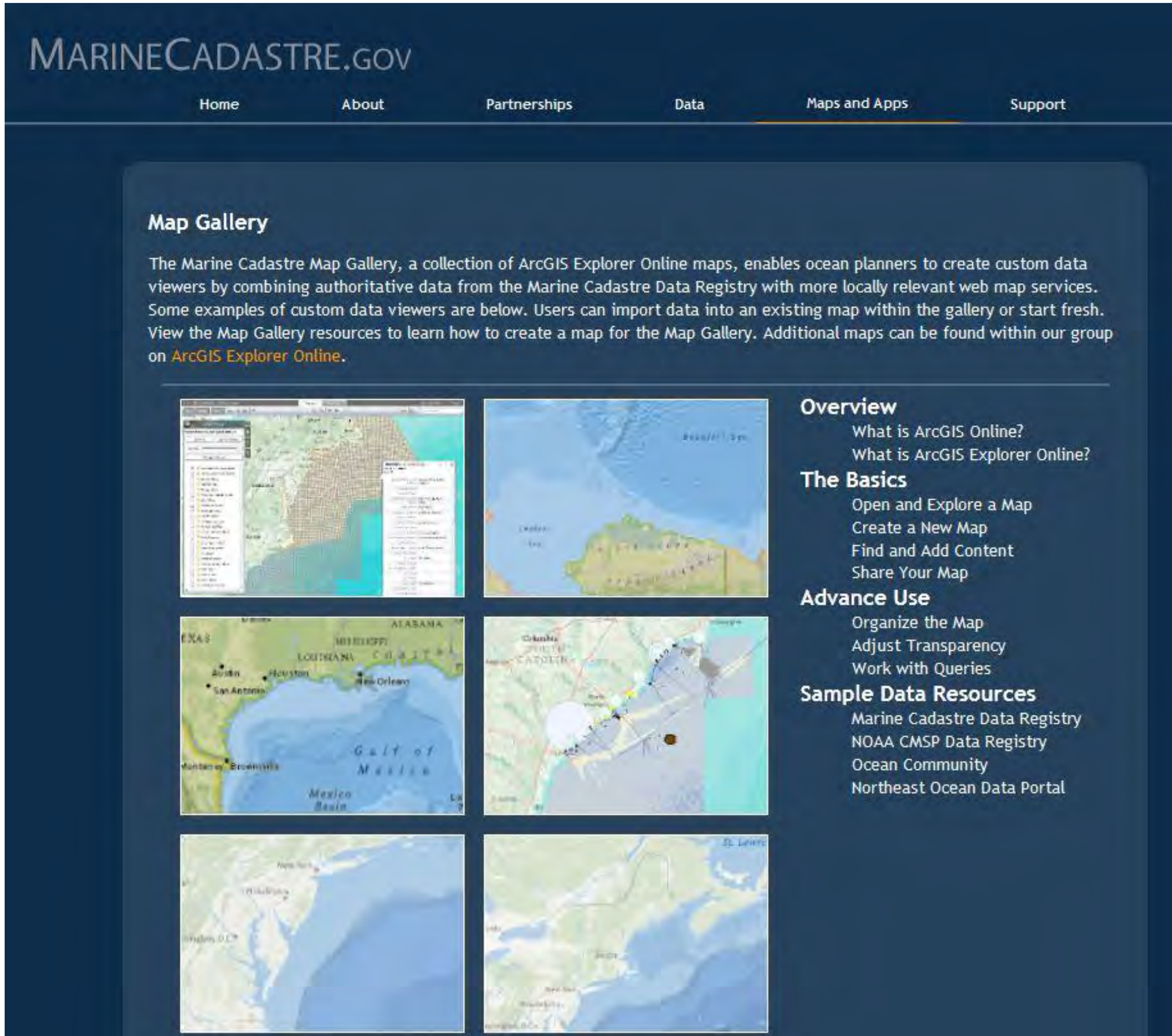


csc.noaa.gov/mmcviewer/
BOEM
Multipurpose Marine Cadastre
Bureau of Ocean Energy Management and
National Oceanic and Atmospheric Administration
Layers
Ocean | Imagery | Street | Gray
Nautical Charts:
Jurisdictional Boundaries and Limits
3 of 16 Layers Visible
Human Use
0 of 4 Layers Visible
Federal Agency Regions
0 of 11 Layers Visible
Navigation and Marine Infrastructure
2 of 13 Layers Visible
Marine Habitat
0 of 6 Layers Visible
Physical and Oceanographic
0 of 9 Layers Visible
Marine Mammals and Turtles
0 of 66 Layers Visible
North Atlantic Right Whale, Atlantic December
North Atlantic Right Whale, Atlantic January
North Atlantic Right Whale, Atlantic February
Humpback Whale, Atlantic Winter
Sei Whale, Atlantic Winter
Fin Whale, Atlantic Winter
Minke Whale, Atlantic Winter
Sperm Whale, Atlantic Winter
Sperm Whale, GoMex Winter
Bottlenose Dolphin, Atlantic Winter
Bottlenose Dolphin, GoMex Winter
Leatherback Turtle, Atlantic Winter
Leatherback Turtle, GoMex Winter
Kemps Ridley Turtle, Atlantic Winter
Loggerhead Turtle, Atlantic Winter
Loggerhead Turtle, GoMex Winter
North Atlantic Right Whale, Atlantic March
Providence
Hartford
Rhode Island
Cape Cod Bay
Nantucket Sound
Muskeget Channel
Nantucket
Island Sound
93
50 km
40 mi
Lat: 41.0001 Long: -72.9183
Scale: 1:1,155,581

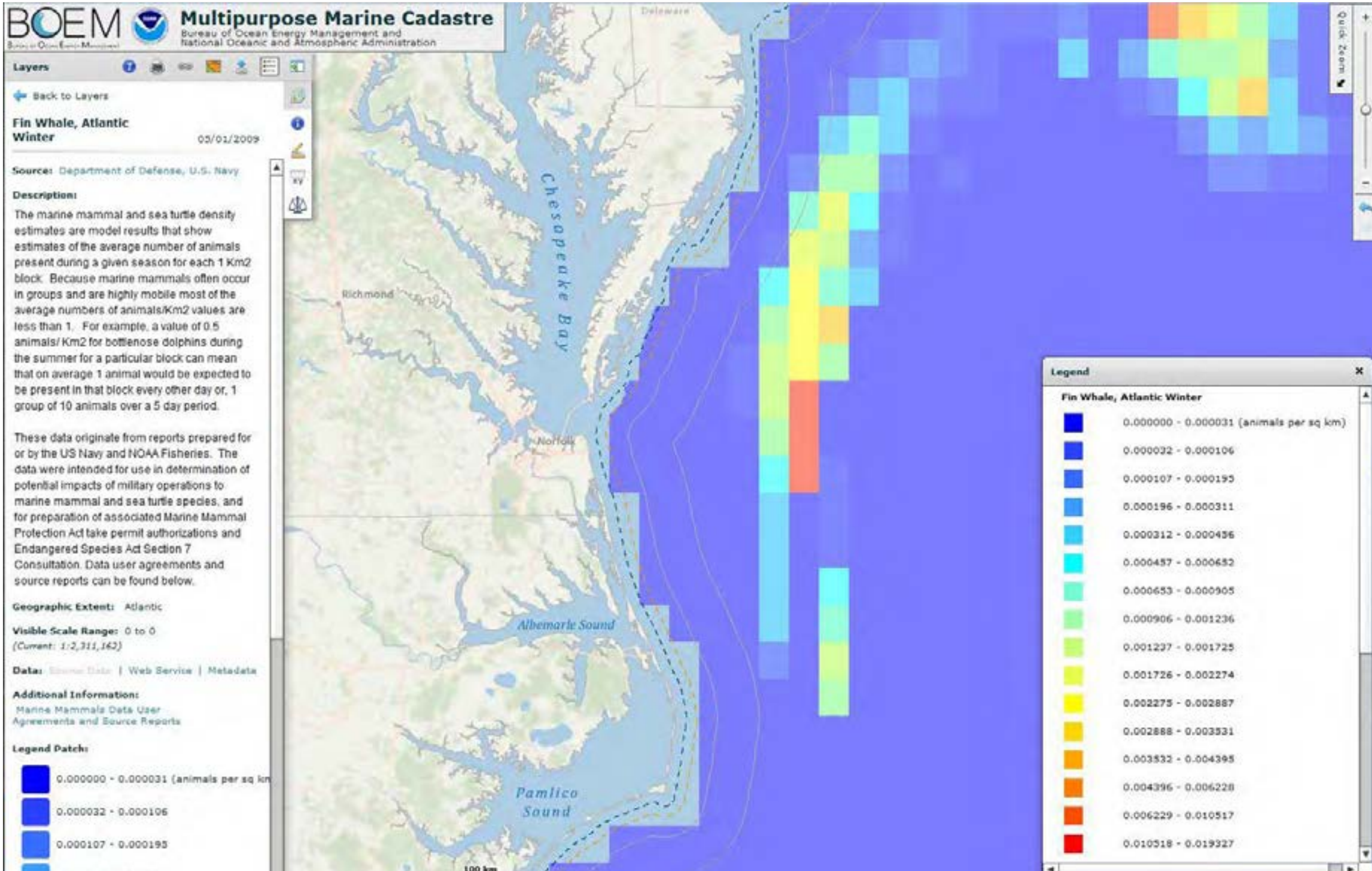
Data Registry



Gallery


MARINECADASTRE.GOV
Home
About
Partnerships
Data
Maps and Apps
Support
Map Gallery
The Marine Cadastre Map Gallery, a collection of ArcGIS Explorer Online maps, enables ocean planners to create custom data viewers by combining authoritative data from the Marine Cadastre Data Registry with more locally relevant web map services. Some examples of custom data viewers are below. Users can import data into an existing map within the gallery or start fresh. View the Map Gallery resources to learn how to create a map for the Map Gallery. Additional maps can be found within our group on ArcGIS Explorer Online.
Overview
What is ArcGIS Online?
What is ArcGIS Explorer Online?
The Basics
Open and Explore a Map
Create a New Map
Find and Add Content
Share Your Map
Advance Use
Organize the Map
Adjust Transparency
Work with Queries
Sample Data Resources
Marine Cadastre Data Registry
NOAA CMSP Data Registry
Ocean Community
Northeast Ocean Data Portal

Documentation

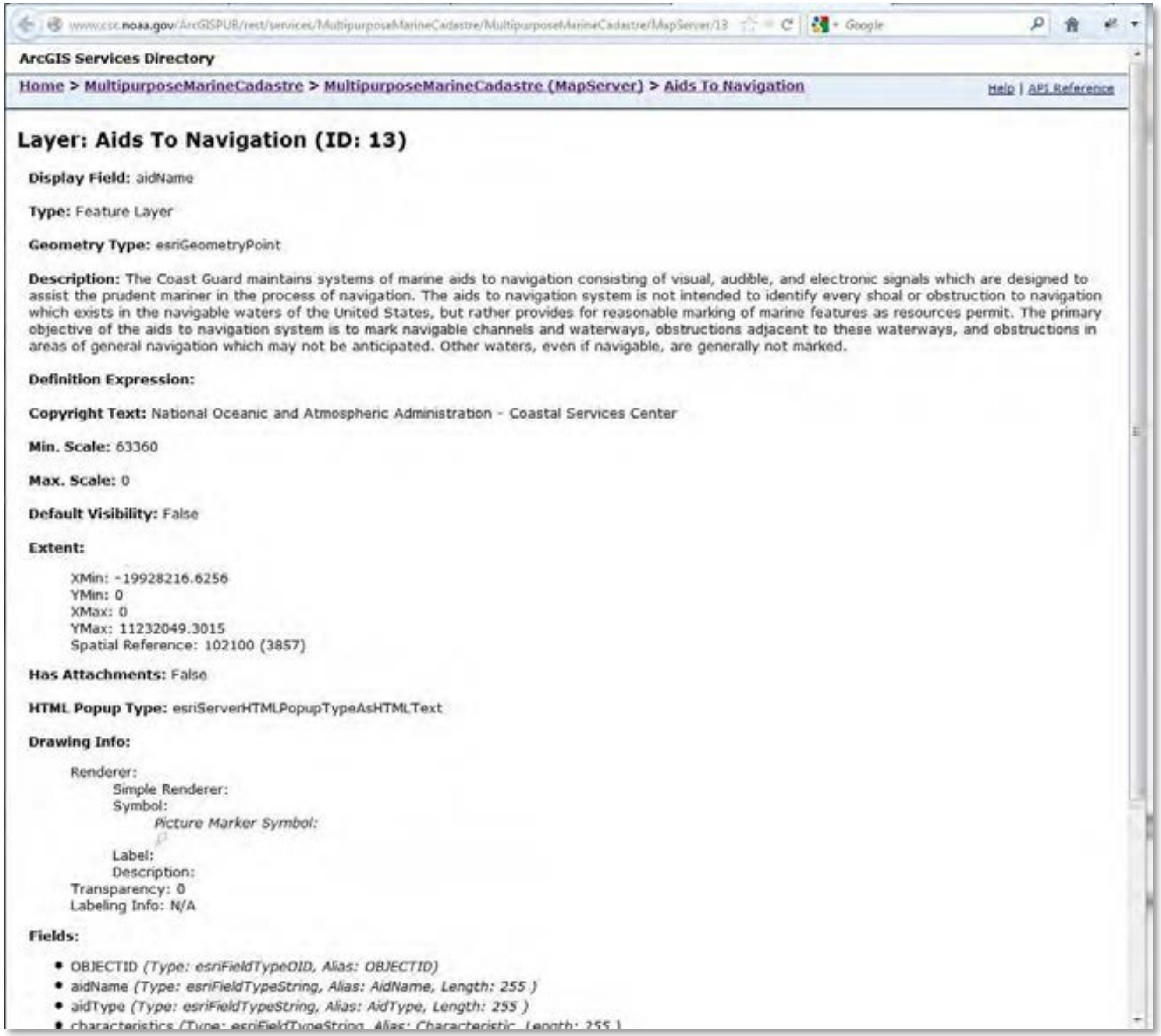


Architecture

- Distributed
- Storage
- Application Server
- Clients

- Ocean.data.gov

Our API / Web Services



Next Year

- New data products
- New map viewers and other user tools
- Ongoing requirements process
- Regional network
- Direct technical assistance

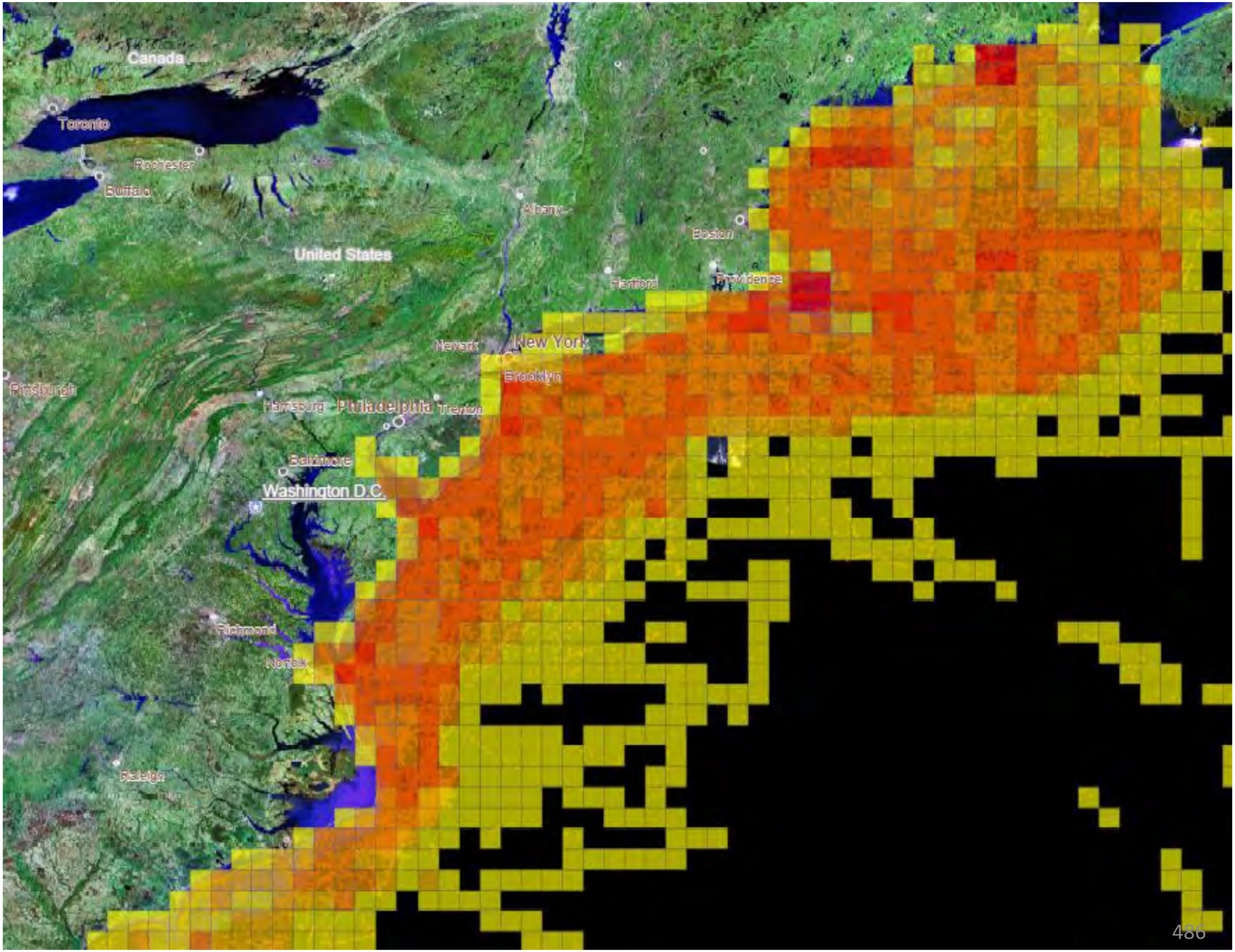
Daniel R. Martin
daniel.martin@noaa.gov

NOAA Coastal Services Center
LINKING PEOPLE, INFORMATION, AND TECHNOLOGY

Presentation #17

Atlantic Seabird Survey Compendium

DOE / NOAA Coordination Meeting
Mid-Atlantic Marine Wildlife Surveys, Modeling, and Data
24 – 25 July, 2012 Silver Spring, MD


Canada
Toronto
Rochester
Buffalo
Albany
United States
Boston
Hartford
Providence
Newark
New York
Brooklyn
Pittsburgh
Harrisburg
Philadelphia
Trenton
Baltimore
Washington D.C.
Richmond
Norfolk
Raleigh

Data Lifecycle

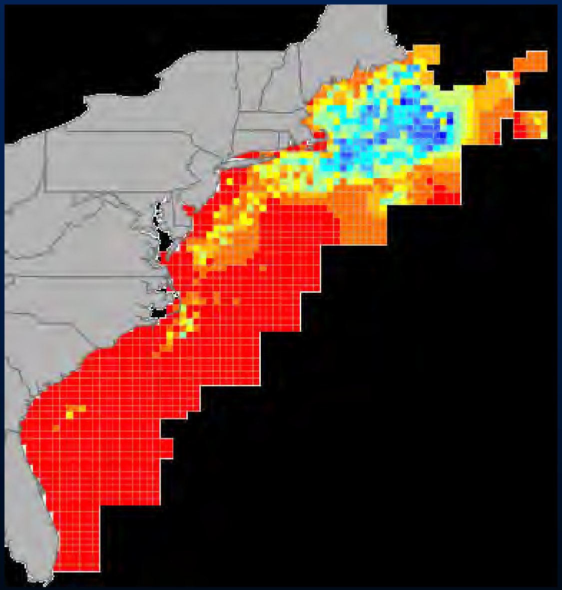
- Field…paper or file?
  - Jessica Taylor's example of a photo per second, with loc/elevation/airspeed, other covariates: metadata vs data at point, transect, survey, study.
- Capture to file
  - corrections
- Conversion, e.g to gdb / other db
  - Corrections
- To data repository or bigger gdb or other db
  - Corrections
- Who has latest copy?
  - Corrections, maybe a paper is published
- To archive / repository

Data Lifecycle, continued

- What to capture?
  - From survey
  - To local entry
  - To merged dataset
  - To archive /repository
- What gets dropped along the way?
  - It isn’t free
  - We can’t store NEXRAD data – multi-pronged studies

Primary purpose

- Supporting research & modeling
  - Supporting Brian Kinlan/ Elise Zipkin & others
  - Andrew Gilbert's work with Beth Gardner
- Management / Planning
- Sharing / broader use
  - The derived products
  - Raw data last



Sharing and Integration

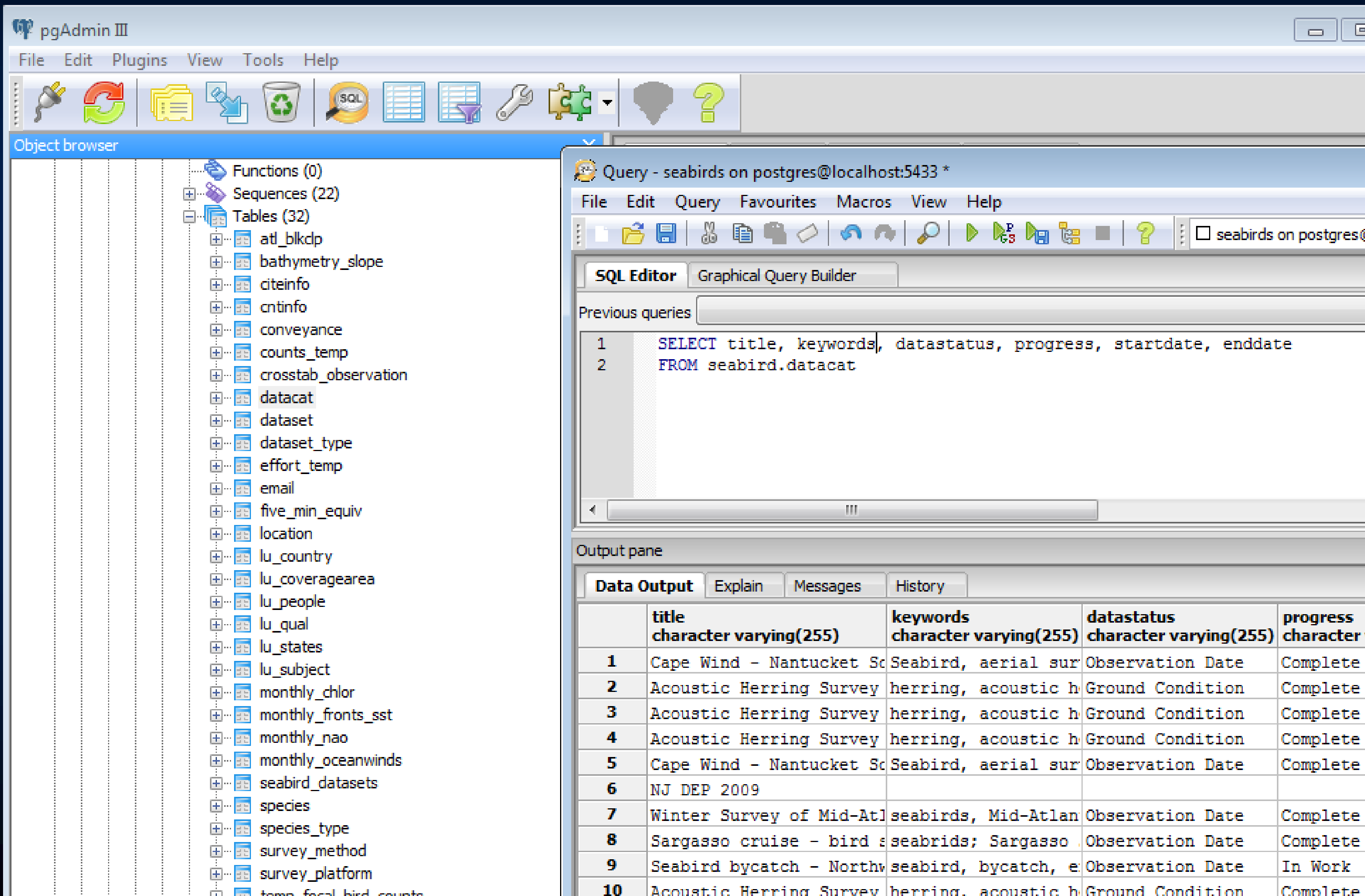
- Purpose of sharing?
  - Cost vs. value? With respect to decision-making?
- Tension: specificity vs. broad sharing
- What's bad about federal data standards and big repositories?
  - Trick question! (in space, no one can hear you…)
  - Data collectors: archiving != data mgmt
  - Planners: data != "data"
  - Part of the broader ecosystem of tools

Future: where will we be in two years?

- The future: Who cares?
  - “Owned by FWS” down the road? Pipe dreams / shared reality
  - Let’s recognizing a shared resource
    - Not a single steward or a single expert
- NOW: coordination, modeling, planning
  - Our collaboration with FWS & BOEM
  - Coordination with community

USGS

Example: interoperability vs. storage format



Getting Coordination / Communication into the Data Lifecycle

- Coordination tools are very different from archiving tools
  - What about the URI surveys? Or was that SAMP? Or was that Paton?
  - "Do you have Dick Veit's data?"
  - Where is "Onslow Bay?"
- Data policy
- Coordination

Information is Coordination

- Lifecycle includes
  - Analytical tools attached to OBIS-Seamap
  - Downloadable data with complete metadata
  - Derived tools for MARCO
- Lifecycle includes:
  - Data policy and metadata go along with occurrence datasets

USGS

U.S. FISH & WILDLIFE SERVICE

BOEM
Bureau of Ocean Energy Management

An Official Website of the United States Government | Monday, July 23, 2012 | Text: A+ A- A | Share

DATA.GOV / OCEAN PROTOTYPE

EMPOWERING PEOPLE

Login | Sign Up

Home | Data | Tools | Technical Guide | Regional Planning | Forums

Search This Community... SEARCH

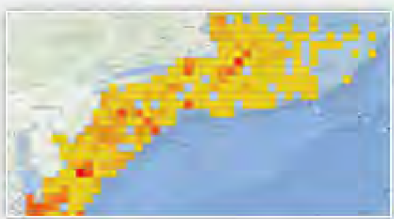
Data.gov » All Communities » Ocean

Ocean, Coast, and Great Lakes Planning Data

Explore, discover and access a variety of rich spatial and non-spatial data. We've identified a few data sources that we want to highlight. We've identified other data sources you may want to access in your search and we are providing a link to geo.data.gov where you can search all of the Federal geospatial data available through data.gov. We are just getting started, so if you can't find the data you are looking for, **please tell us**!

BROWSE ALL DATASETS

Featured Data

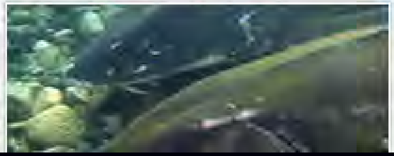


Atlantic Offshore Seabird Dataset Catalog

U.S. Geological Survey

Several bureaus within the Department of Interior compiled available information from seabird observation datasets from the Atlantic Outer...

(**View full metadata**)



Endangered Species Act Critical Habitat

NOAA, National Marine Fisheries Service, Office of Protected Resources

Critical habitat (CH) is designated for the survival and recovery of species listed as threatened or endangered under the Endangered Species Act (ESA...

(**View full metadata**)

Quick Search

- Administrative and Regulatory
- Biology and Habitats
- Ecological Functions, Processes, and Impacts
- Elevation and Bathymetry
- Energy and Mineral Resources
- Human Use
- Physical and Oceanographic

Other Data Sources

GEO.DATA.GOV

Presentation #18

National Oceanographic Data Center

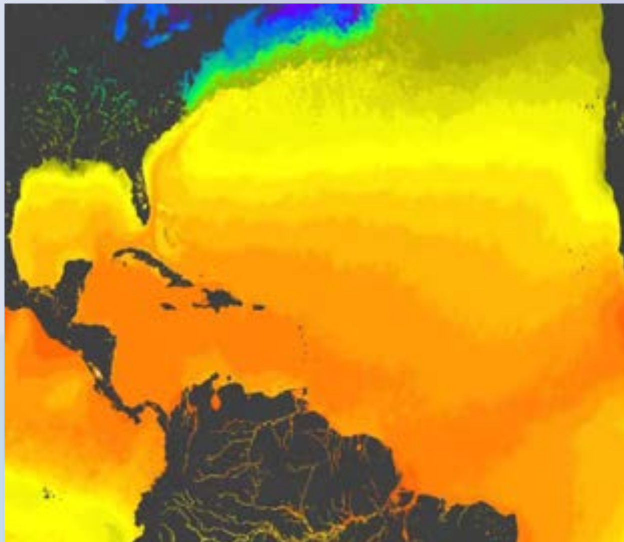
An Ocean of Data and Information

Krisa Arzayus, PhD

Mid-Atlantic Marine Wildlife Surveys, Modeling, and Data Workshop
July 24-25, 2012

NOAA Data Centers

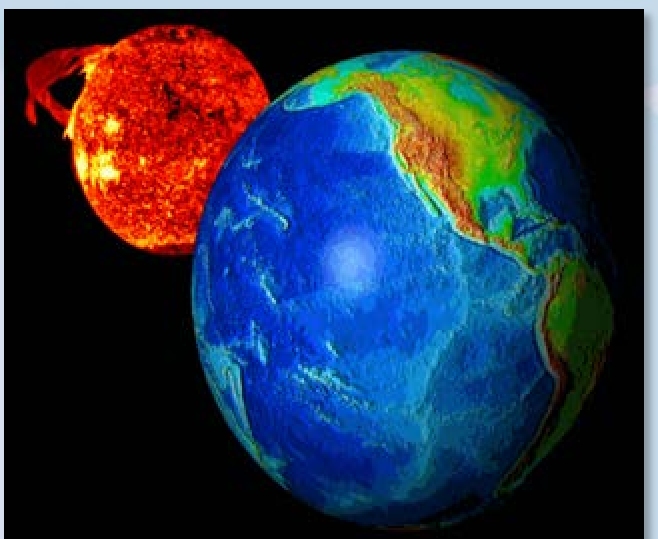
NODC - Understanding Our Coasts and Oceans



Archive – Access - Stewardship

NCDC - Understanding Our Climate

NGDC - Understanding Our World



Curators of the Nation's Environmental Data

NODC Mission

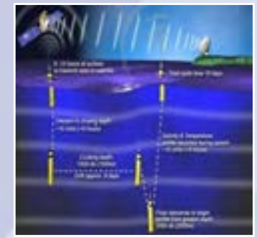
To provide scientific stewardship of marine data and information

Underway

CTD/Niskin

Buoys

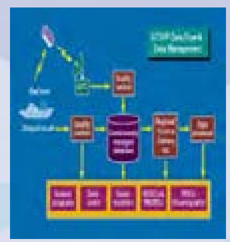
Plankton



Arg

experimental

mode
l



GTSPP

satellite

Glider

Coral Reef Information System

Instrumented Animals

SeaSor

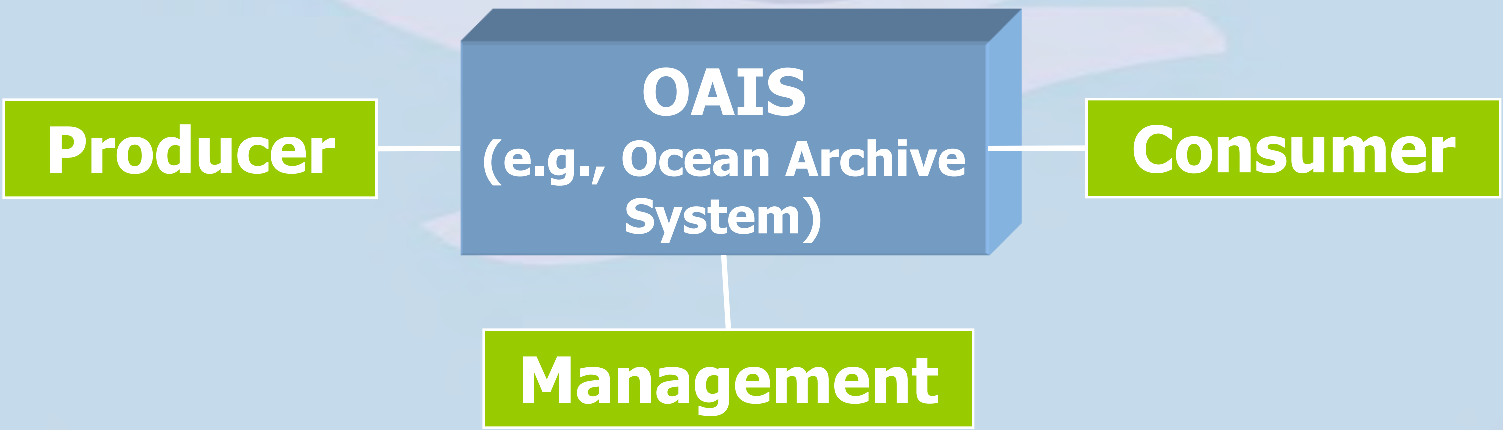
NODC manages the world's largest collection of publicly available *in situ* and remotely sensed physical, chemical, and biological oceanographic data.

NODC History

- The NOAA National Oceanographic Data Center (NODC) opened its doors in 1961, recently celebrating fifty years of acquiring, archiving, assessing, and providing access to ocean data and information.
- The NODC archive has evolved from a disparate collection of databases to a unified Archive Management System, and most recently has begun incorporating a wide range of internationally accepted interoperable data tools and services.
  - Discovery Services: the OGC Catalog Service for the Web (CSW) and Search and Retrieval by URL (SRU) profile of ISO 23950.
  - Data access and use services: OPeNDAP's Data Access Protocol (DAP), the OGC Web Mapping Service (WMS), Web Coverage Service (WCS)
  - Metadata services: FGDC metadata and increasingly ISO 19115.
  - Online browse, visualization and analysis systems: Live Access Server (LAS), ArcGIS Server, and a Geoportal

NODC's Ocean Archive System
(An Open Archival Information System)
http:/www.nodc.noaa.gov/Archive/Search/

- ***Producer*** provides information to be preserved
- ***Management*** sets overall policy
- ***Consumer*** seeks and acquires preserved information

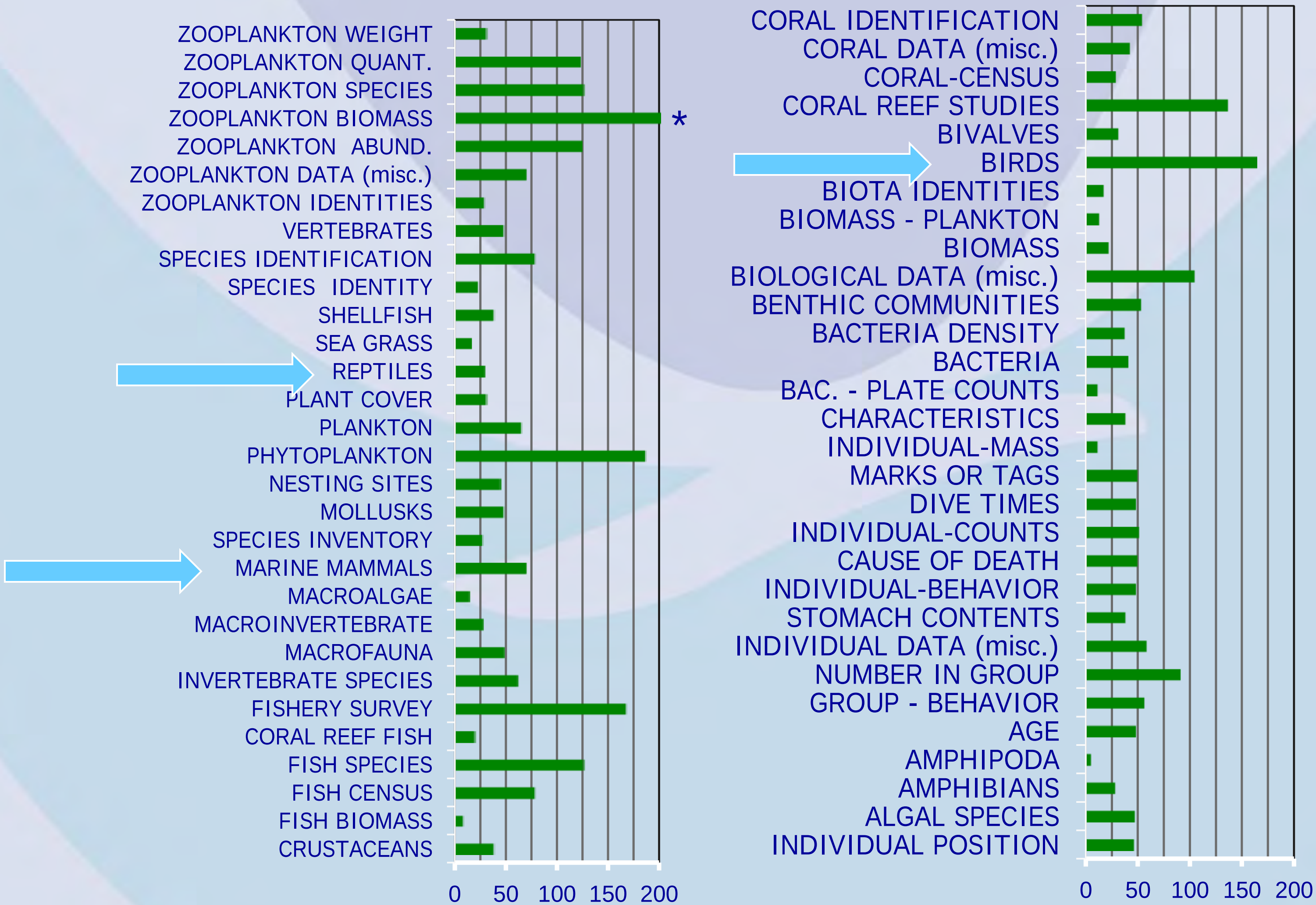


The OAIS Environment from 30,000 ft

Overview of NODC Biological Data

(as of April 2011)

2000+ accessions; 678 from Cape Hatteras to Scotian Shelf



Number of Data Sets (in units of NODC Accessions) * > 200

Ocean Data Access
NODC data used for a multitude of purposes

An effective data archive should provide for discovery, access, and integration

Objectives:

- Provide data <u>discovery</u> protocols for coastal and ocean data;
- Develop <u>tools</u> that support NOAA's requirements for data integration;
- Engage with the data providers to ensure appropriate <u>metadata</u> are submitted;
- Train and <u>educate</u> data producers and consumers in metadata production.

NODC Enables Archived Data to Serve as a Platform for Science and Applications

NODC Levels of Stewardship

Core services:

- Archive and preserve ocean data;
- Describe data to facilitate discovery and use;
- Provide access and visualization services; Improve quality of data;
- Derive products such as climatologies (which improve the quality and value of the data);
- Long term quality, consistency, accuracy
- Lead the community in development of stewardship standards

Presentation #19

Virginia and Mid-Atlantic Ocean Planning

Laura McKay

Virginia Coastal Zone MANAGEMENT PROGRAM

NOAA

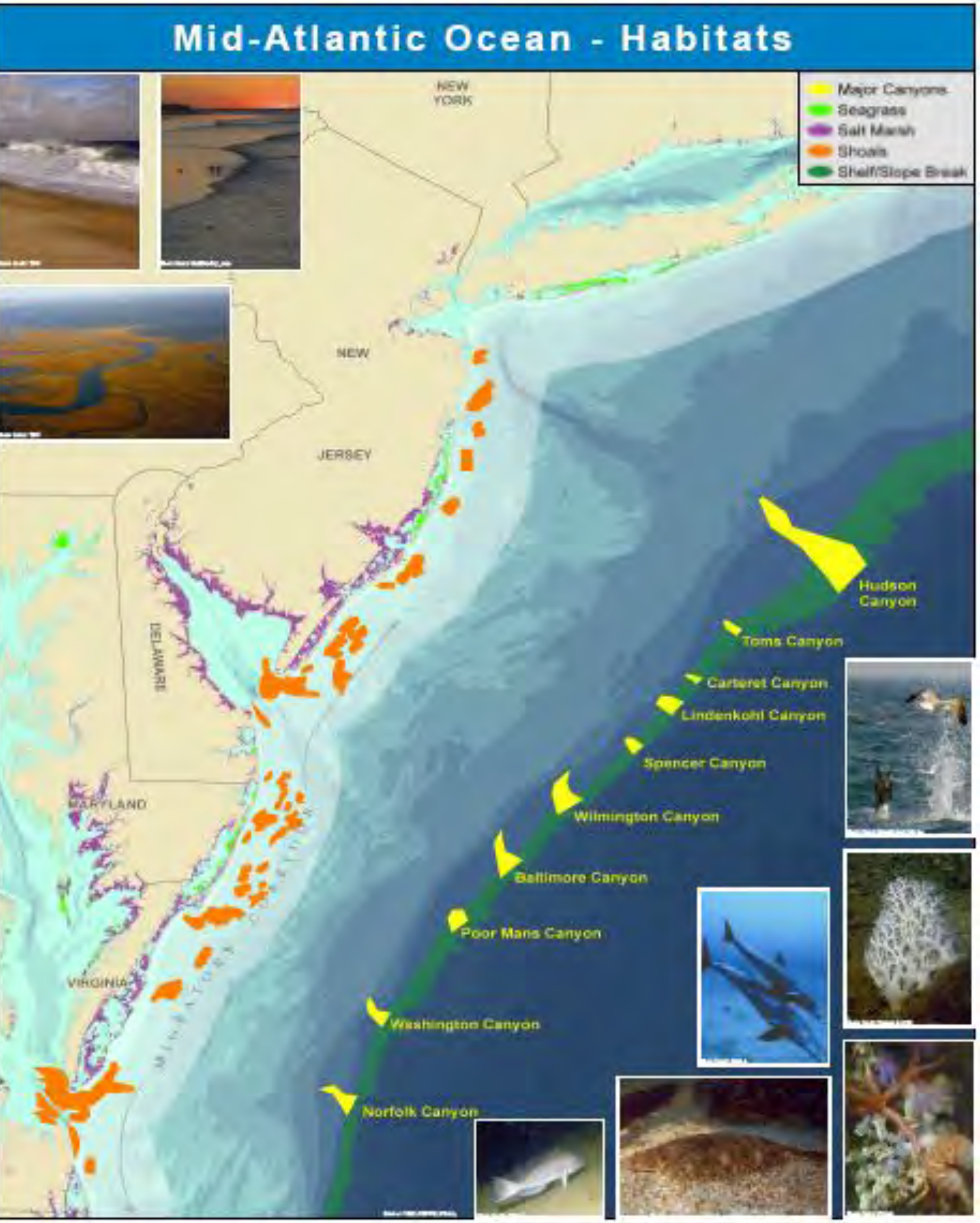
Regional Ocean Partnerships

- New England Regional Ocean Council (NROC)
- Mid-Atlantic Regional Council on the Ocean (MARCO)
- South Atlantic Governors' Alliance (SAGA)
- Gulf Mexico Alliance (GOMA)
- West Coast Governors' Alliance (WCGA)

Mid-Atlantic Regional Council on the Ocean (MARCO)

- June 2009 the five governors signed the Mid-Atlantic Ocean Governors' Agreement on Ocean Conservation

- December 2009 held Stakeholder Conference in New York



MARCO Priorities

- Protect Key Ocean Habitats
- Improve Water Quality
- Adapt to Climate Change
- Promote Renewable Offshore Energy
- Ocean Planning

MARCO Structure

Five Action Teams:

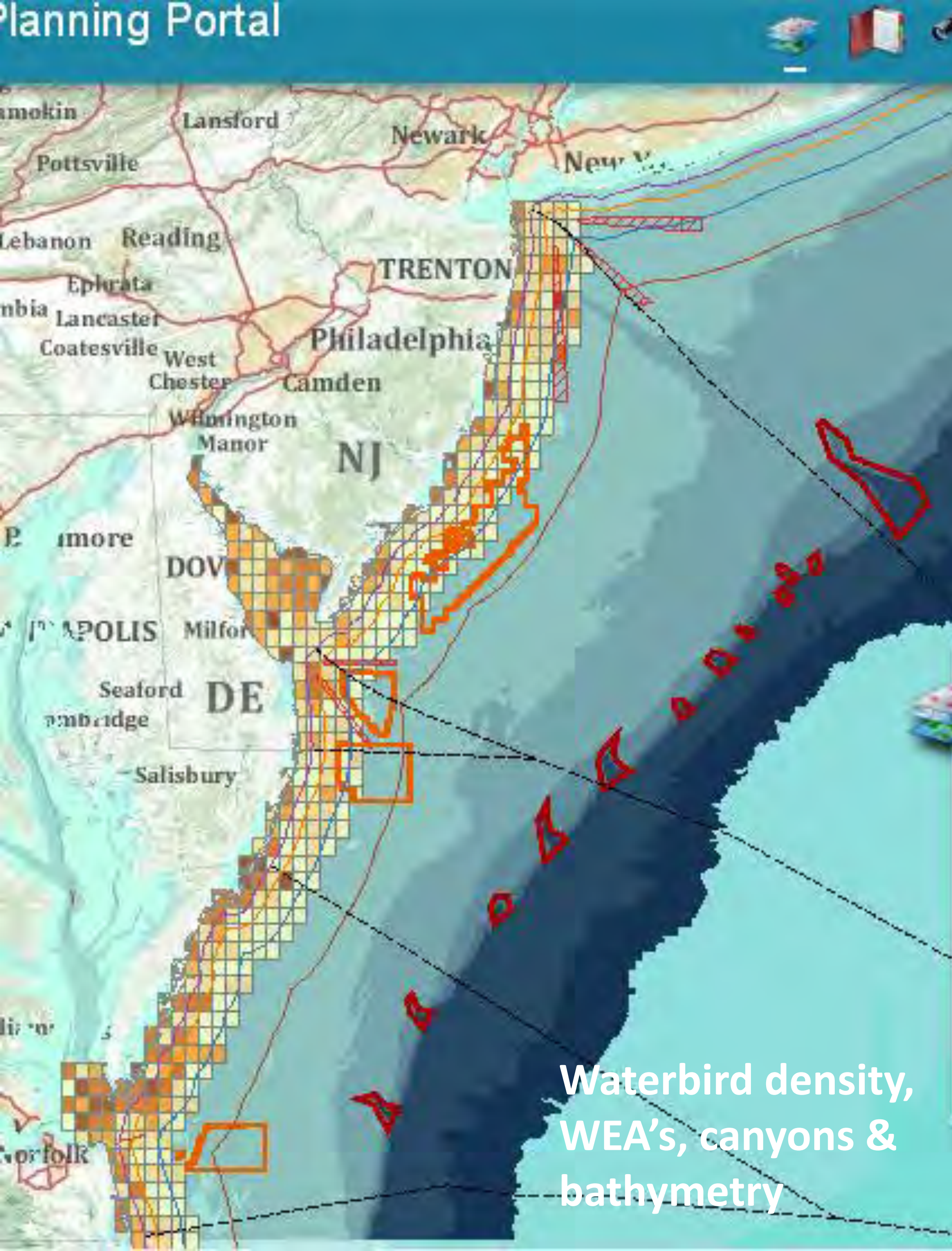
1. Offshore Habitats
   Lead: NY – Greg Capobianco

2. Water Quality
   Lead: MD – Sarah Lane

3. Climate Change and Coastal Resiliency
   Lead: DE – Sarah Cooksey

4. Offshore Renewable Energy
   Lead: MD – Gwynne Schultz

5. Ocean Planning (previously CMSP)
   Lead: VA – Laura McKay



Waterbird density, WEA's, canyons & bathymetry

- Ocean Planning

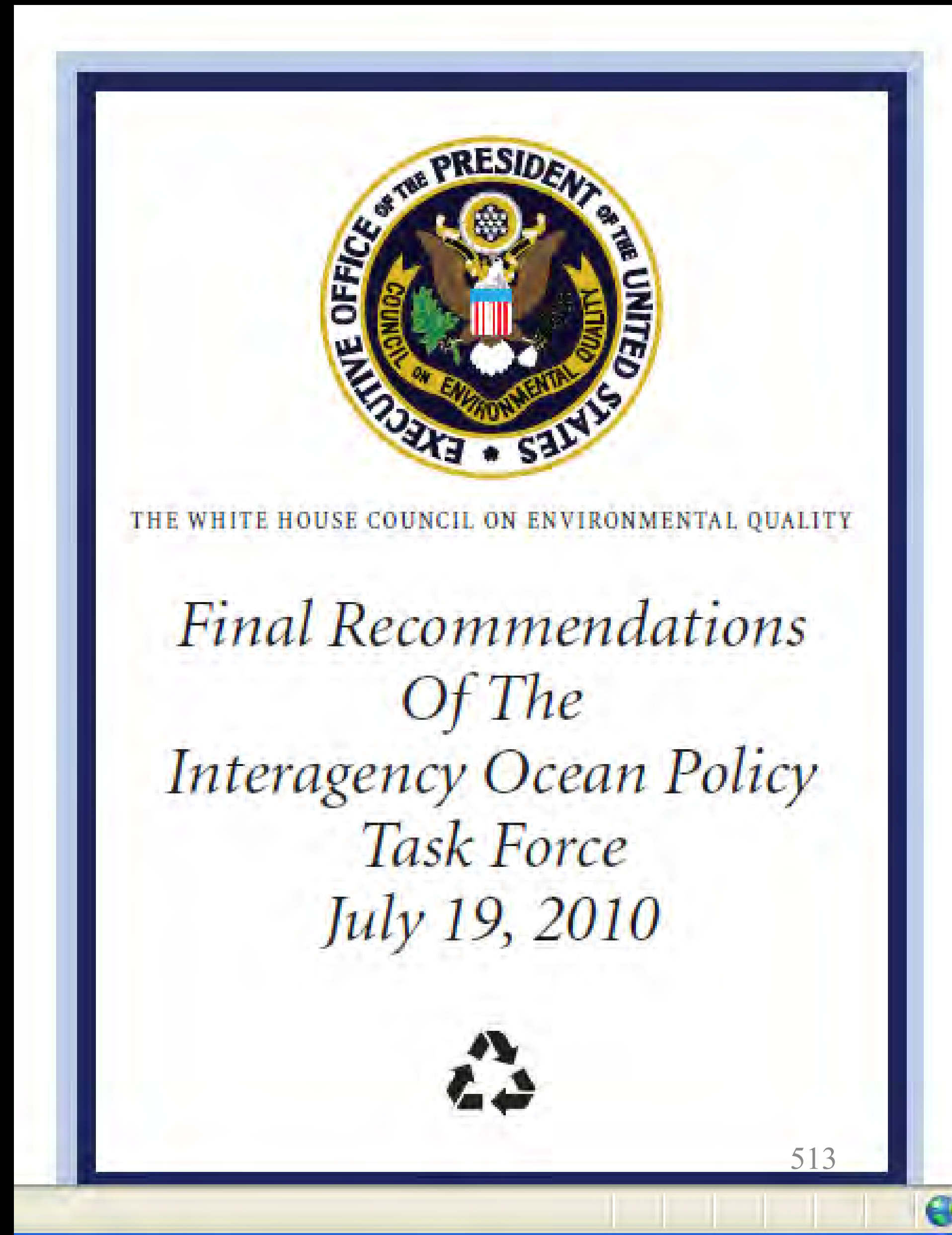
VA CZM funded portal development by TNC in December 2009

First in nation regional ocean portal launched December 2010

- 6 categories
- 30 data layers
- user-friendly fact sheets

National Ocean Policy

- Regional Planning Bodies being formed
  - Mid-Atlantic federal reps already appointed
  - NOC letters mailed to Governor McDonnell and MAFMC on June 15. Two VA appointees and one MAFMC by July 10
- 5 years to develop regional goals and ocean plans


THE WHITE HOUSE COUNCIL ON ENVIRONMENTAL QUALITY

Final Recommendations Of The Interagency Ocean Policy Task Force

July 19, 2010

513

5 Year CZM Grant for Virginia Ocean Plan

- About $100k/yr for 5 years: Oct 2011 – Sep 2016
- Funds for staff support, workshops, data
- Opportunity to compete for NOAA/CZM "Projects of Special Merit" *VA CZM Received $180k for a PSM to document whale migration off Virginia's coast*




Getting to the Portal via MARCO 's Website

Mid-Atlantic Regional Council on the Ocean (MARCO)

Page ▾ Safety ▾ Too

Mid-Atlantic Regional Council on the Ocean

New York New Jersey Delaware Maryland Virginia

Home | Agreement | Documents | State Links | MARCO Portal | Contact Us

MARCO Highlights - Moving in the Right Direction

Since the first conversations among the States in 2008, MARCO has made significant progress in establishing and embarking on a regional agenda

What is the Mid-Atlantic Regional Council on the Ocean?

The ocean waters of the Mid-Atlantic, stretching from New York to Virginia, provide a wealth of economic and environmental services to local communities, States, and the nation. At the same time, the people of the Mid-Atlantic region are a significant force that influences our ocean and coastal environment. We change the coastline and watershed through our buildings and development, we harvest the ocean's resources through increasingly efficient means, and we rely on offshore waters to support diverse activities such as maritime commerce and recreation. As the intensity of these human influences has increased, they have at times led to significant threats to the health of our ecosystems. Now our ocean and coastal resources face a new generation of challenges, and these challenges are only growing in their urgency.

To successfully address these challenges, and to ensure that future generations can enjoy healthy and productive ocean ecosystems, the Governors of New York, New Jersey, Delaware, Maryland and Virginia

...each, creating ... e states will ... nd coastal ... to the high quality of life and economic vitality of our region's communities well into the future.

Mid-Atlantic Governors' Agreement on Ocean Conservation (June, 2009)

Actions, Timelines, and Leadership to Advance The Mid-Atlantic Governors' Agreement on Ocean Conservation (August, 2009)

Regional Photo Courtesy of Jacques Descloitres, MODIS Rapid Response Team

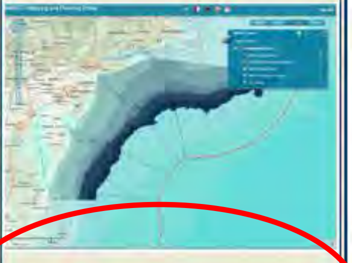
2011-2012 MARCO Workplan

The 2011-2012 MARCO Workplan describes the actions that will be completed by MARCO's five issue Action Teams. Click the thumbnail above to view the Workplan.

Governors

Martin O'Malley
Governor, Maryland
Andrew Cuomo
Governor, New York
Chris Christie
Governor, New Jersey
Jack A. Markell
Governor, Delaware
Robert F. McDonnell
Governor, Virginia

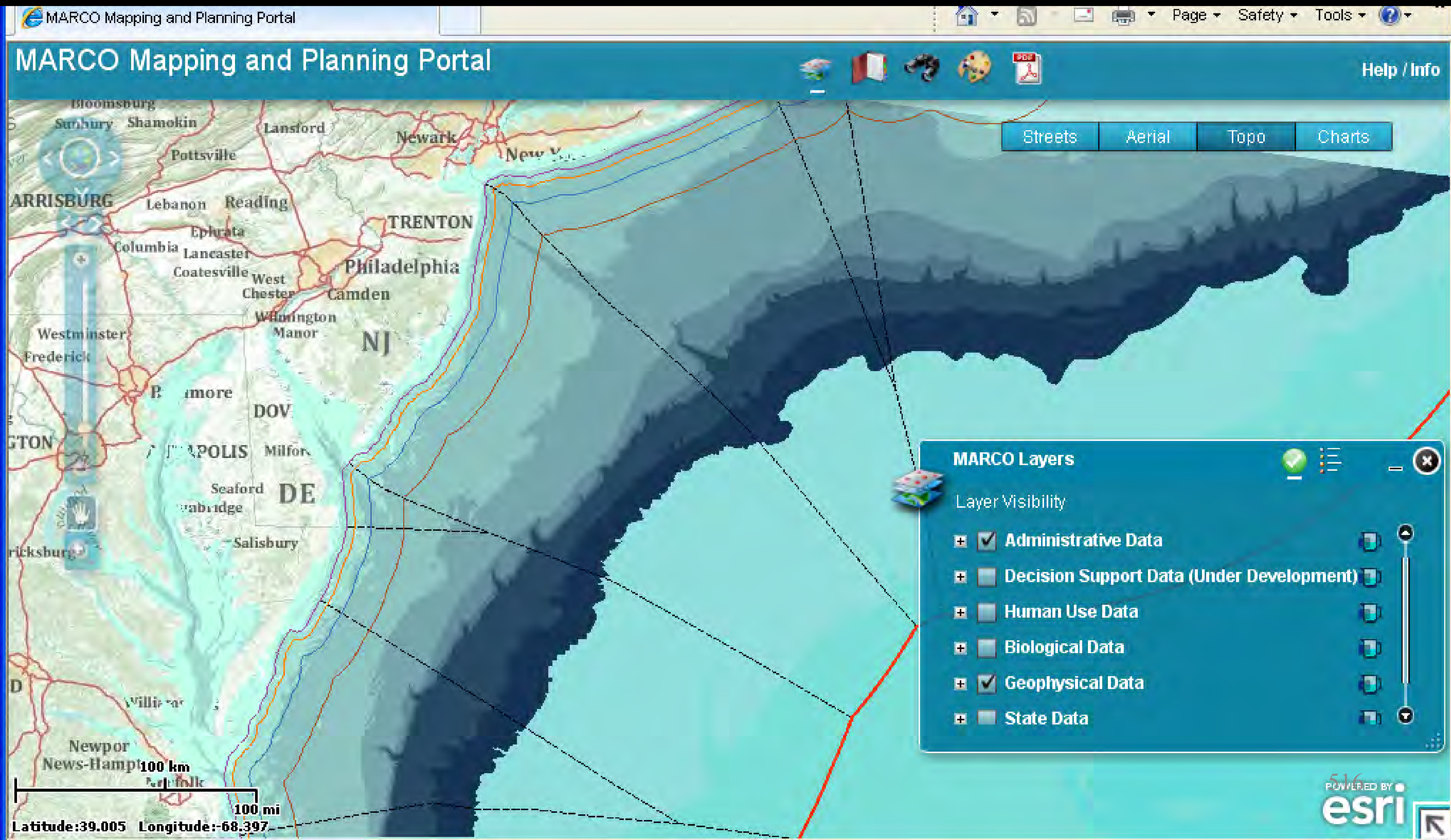
MARCO Announces New Mapping and Planning Portal for Mid-Atlantic Region



The MARCO Mapping and Planning Portal is an online tool that allows state, federal, and local decision-makers and the public to visualize, query, map, and analyze ocean and coastal data in the Mid-Atlantic region. The Virginia Coastal Zone Management Program provided funding (through their CZM Award from the National Oceanic and

MARCO Mapping & Planning Portal

Available at www.midatlanticocean.org



Data Needs Update

Administrative

- Military, hazard & restricted areas

Biological

- Coastal Bird Habitat & Migration
- Deep water corals, locations, predictive model
- Marine Mammal Migratory Pathways
- Sea Bird Predictive Distribution Model
- Select TNC NAM ERA data

Geophysical

- Finite Volume Coastal Ocean Model

Human Use

- State fisheries data
- Discharge points
- Port locations
- Energy Facilities
- Mining locations
- Recreational boating and fishing
- Commercial fisheries: VMS
- Commercial fisheries: VTR
- Commercial shipping: AIS

Legend

- No Work
- Work Underway
- Data Products Available

Monmouth Team

ROP Grant from NOAA

Portal Enhancements

July 2012

- Additional data acquisition and viewing functions
- NOAA and MARCO review

August 2012

- New website version launched
- More data
- Viewable sector-specific parameters and spatial filters

December 2012

- More data
- More spatial filters
- Ability to design/ analyze areas and generate reports

June 2013 - Final Portal

- Peer reviewed
- All stakeholder data incorporated
- Improved feature and functions

SUBAQUEOUS LANDS

DUNES

WETLANDS

SHORELINE SANITATION

Virginia Coastal Zone
MANAGEMENT PROGRAM

DEQ

LEAD AGENCY

AIR POLLUTION

FISHERIES

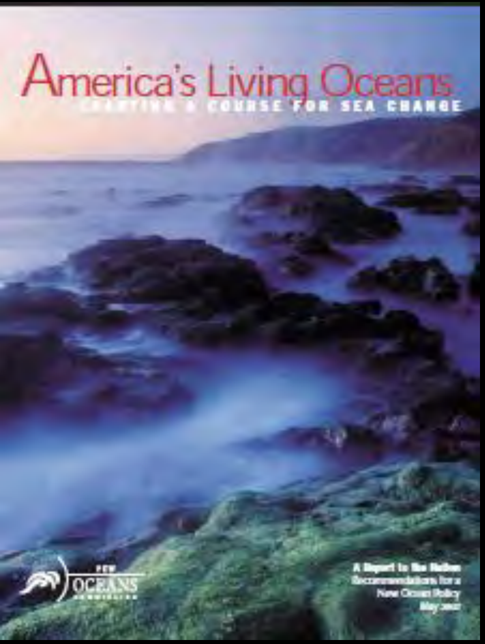
NONPOINT SOURCE WATER POLLUTION

POINT SOURCE WATER POLLUTION

COASTAL LANDS MANAGEMENT

Virginia's Coastal Zone

Why Ocean Planning?

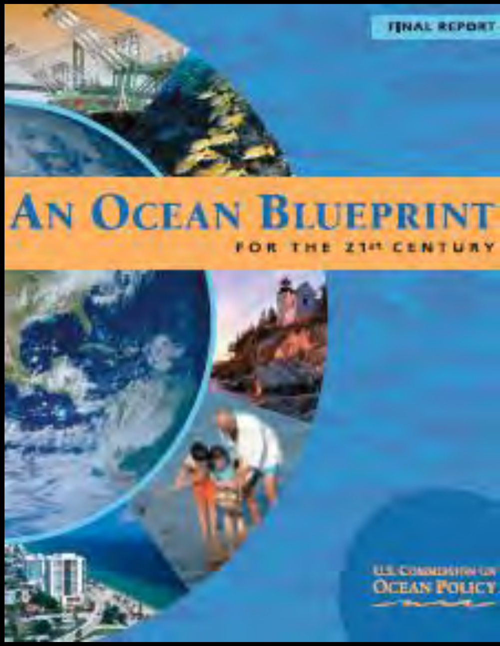


Pew Ocean Commission

2003

US Ocean Commission

2004



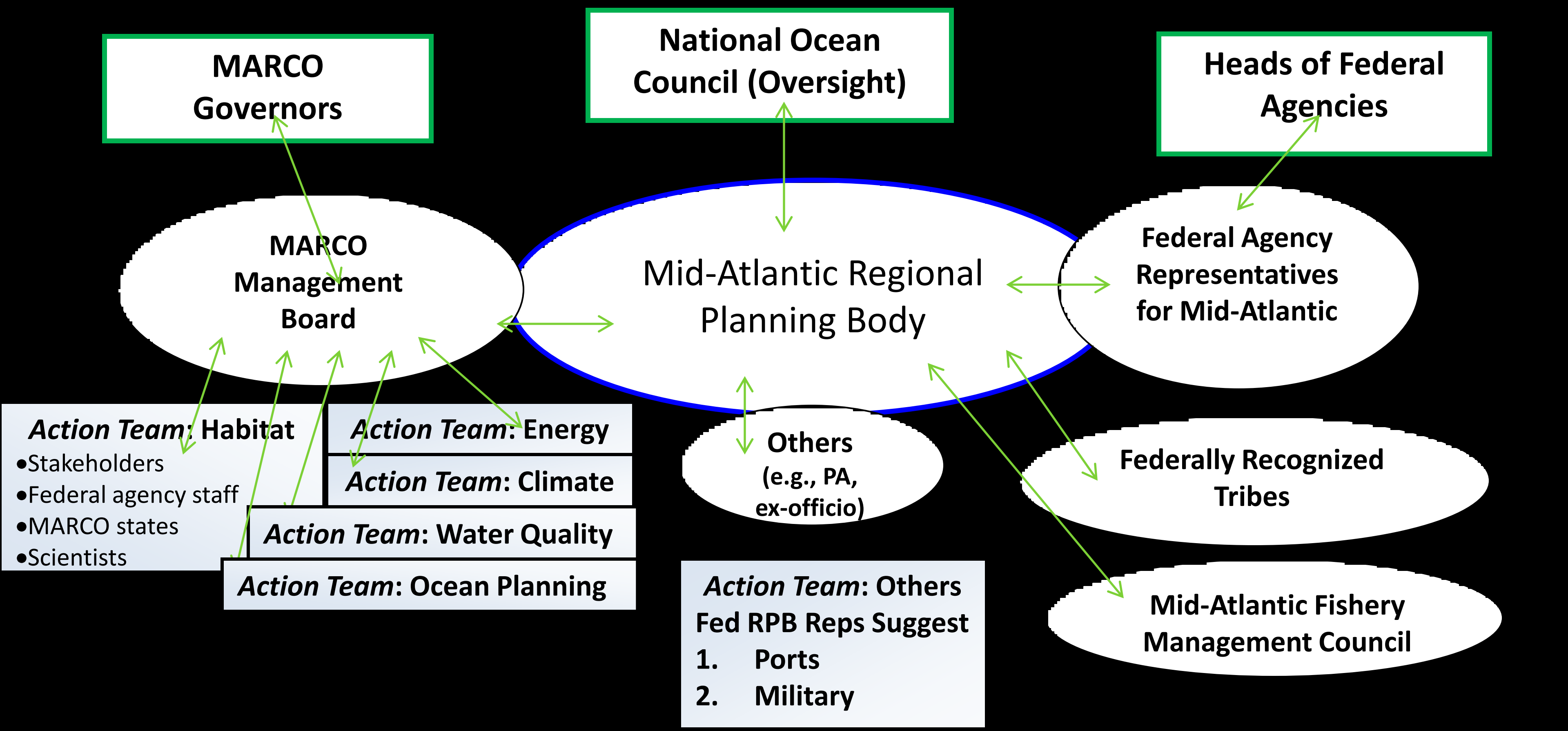
- Increasing pressures & uses
- Decreasing habitats and resources
- Lack of sense of stewardship
- Only federal agencies bear responsibility
- Call for states to form regional governance

What is Regional Ocean Planning?

A regionally-based public planning process for stakeholders to analyze current and anticipated uses of ocean in order to:

- Minimize conflicts among users
- Facilitate compatible ocean activities
- Preserve ecosystem health to meet economic, security, societal, and ecological goals.

Proposed MARCO Relationship to RPB



Next Steps

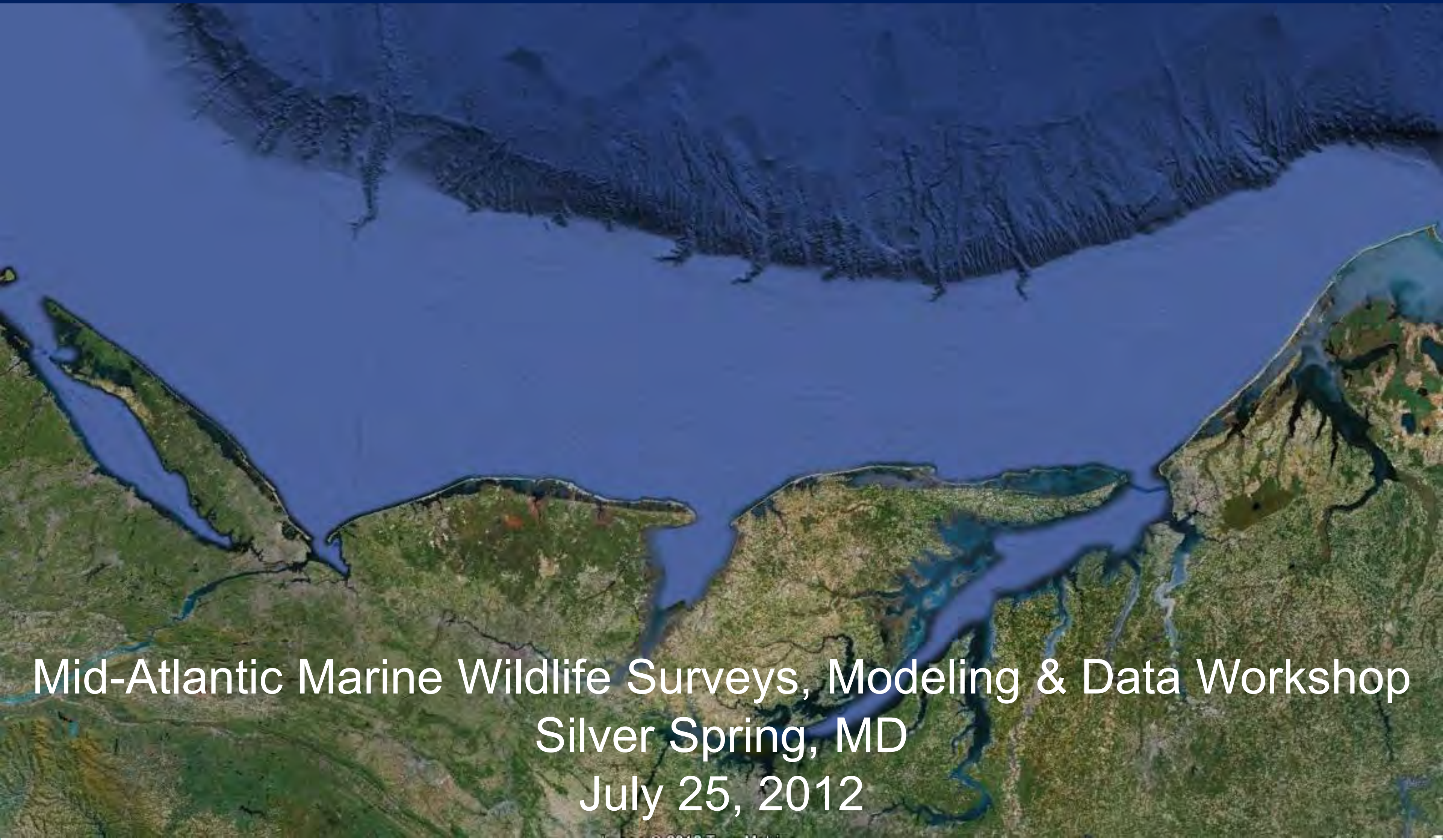
- *July 10*
  PGIS Training
- *July 11 and 12*
  Recreational Use Workshops on Eastern Shore
- November 27-29, 2012
  Regional Workshop in MD, NJ or DE

Presentation #20

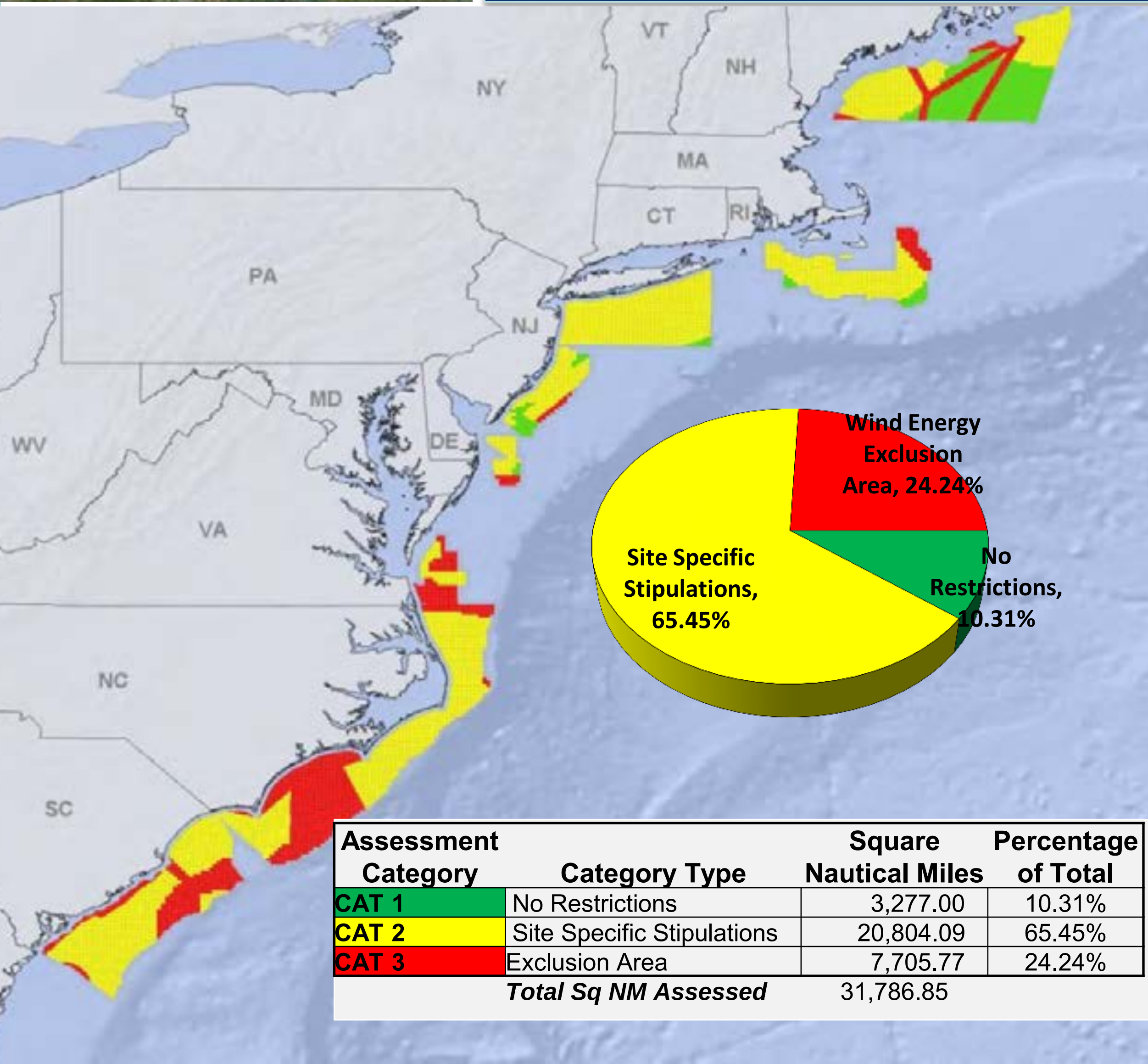
Presentation #20

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

MARCO Portal: Data and Tool Development



Administrative Data: DOD



Assessment Category	Category Type	Square Nautical Miles	Percentage of Total
CAT 1	No Restrictions	3,277.00	10.31%
CAT 2	Site Specific Stipulations	20,804.09	65.45%
CAT 3	Exclusion Area	7,705.77	24.24%
	Total Sq NM Assessed	31,786.85	

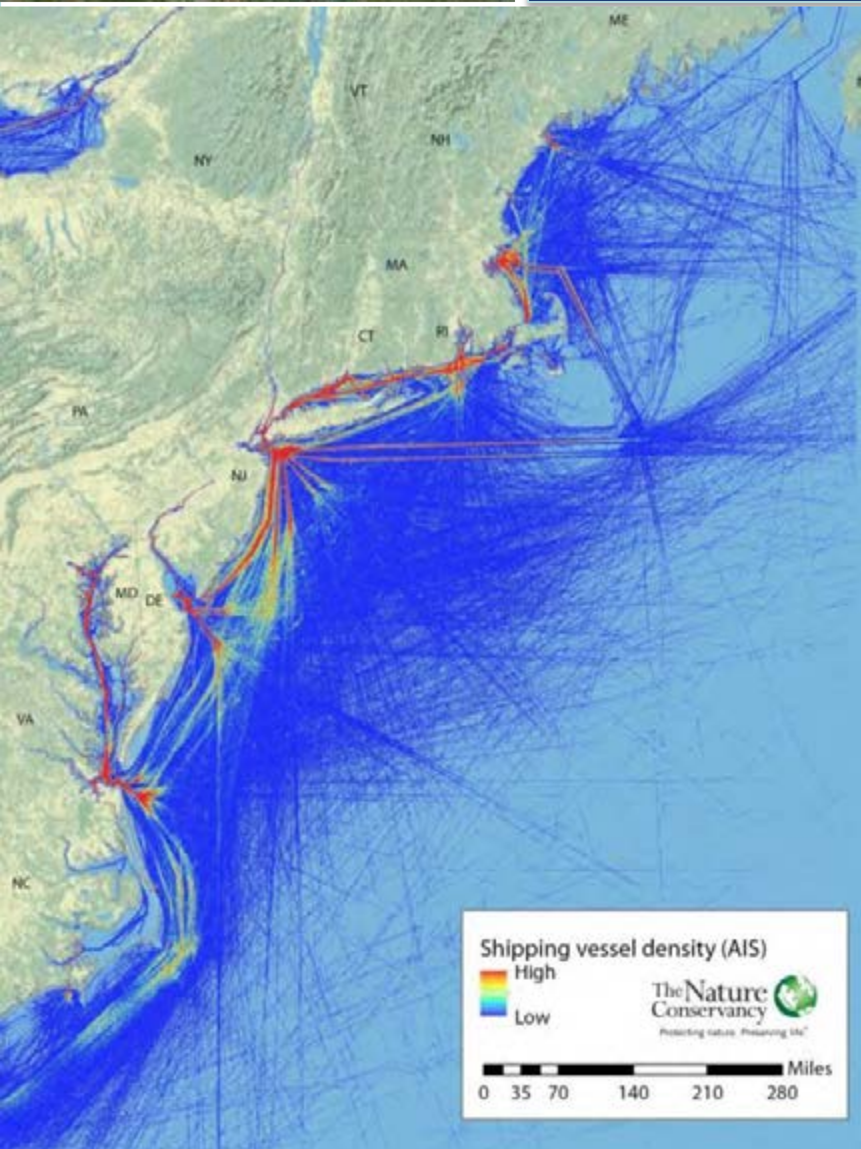
<u>Source</u>: DOD East Coast OCS Wind Energy Assessment

<u>Provider</u>: BOEM

<u>Summary</u>: Assessment of OCS blocks where wind excluded or allowed with site specific stipulations

In discussion with BOEM, NOAA and DOD to obtain

Human Use Data: Commercial Shipping

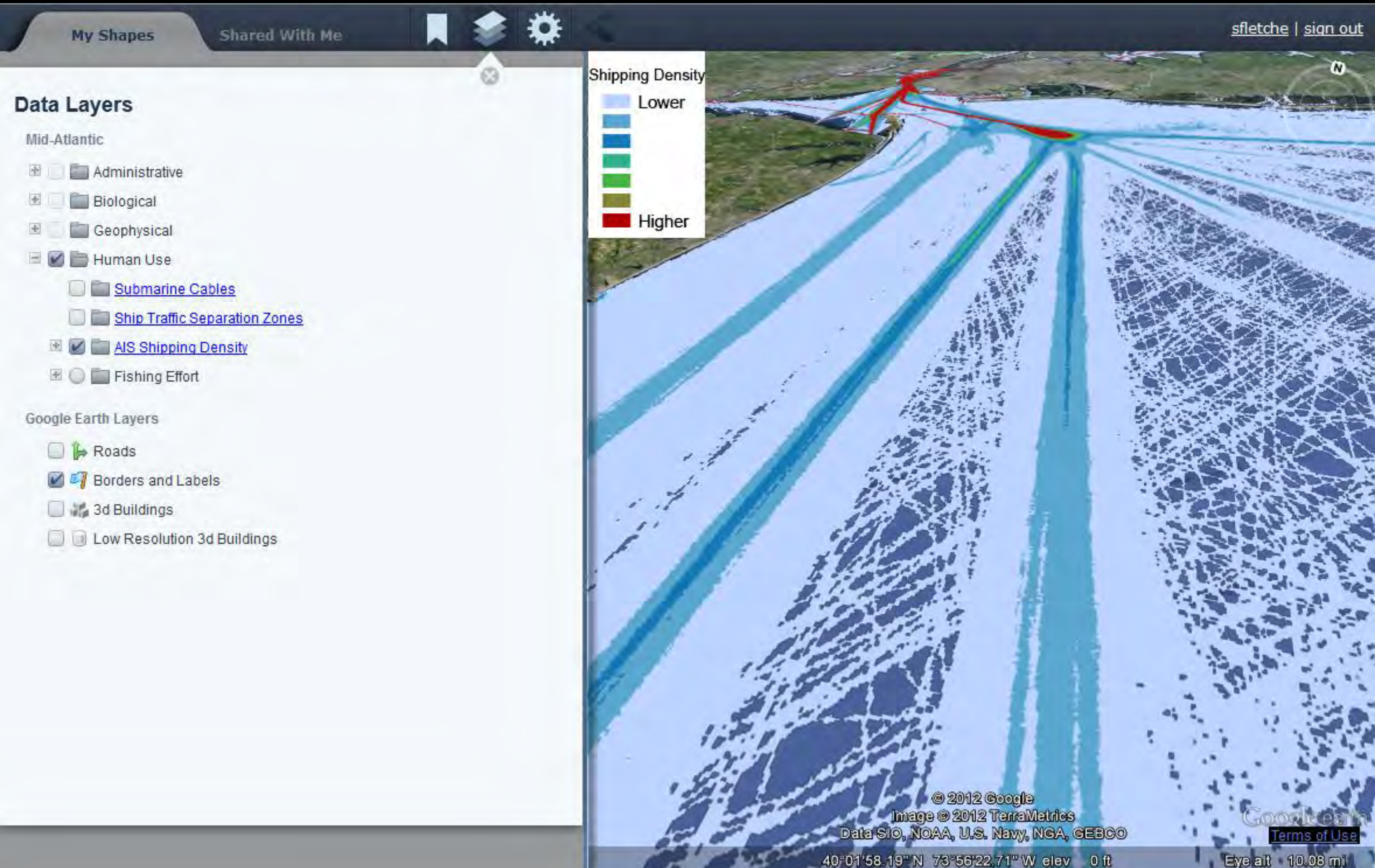


<u>Source</u>: 2009 United States Automatic Identification System (AIS) Database

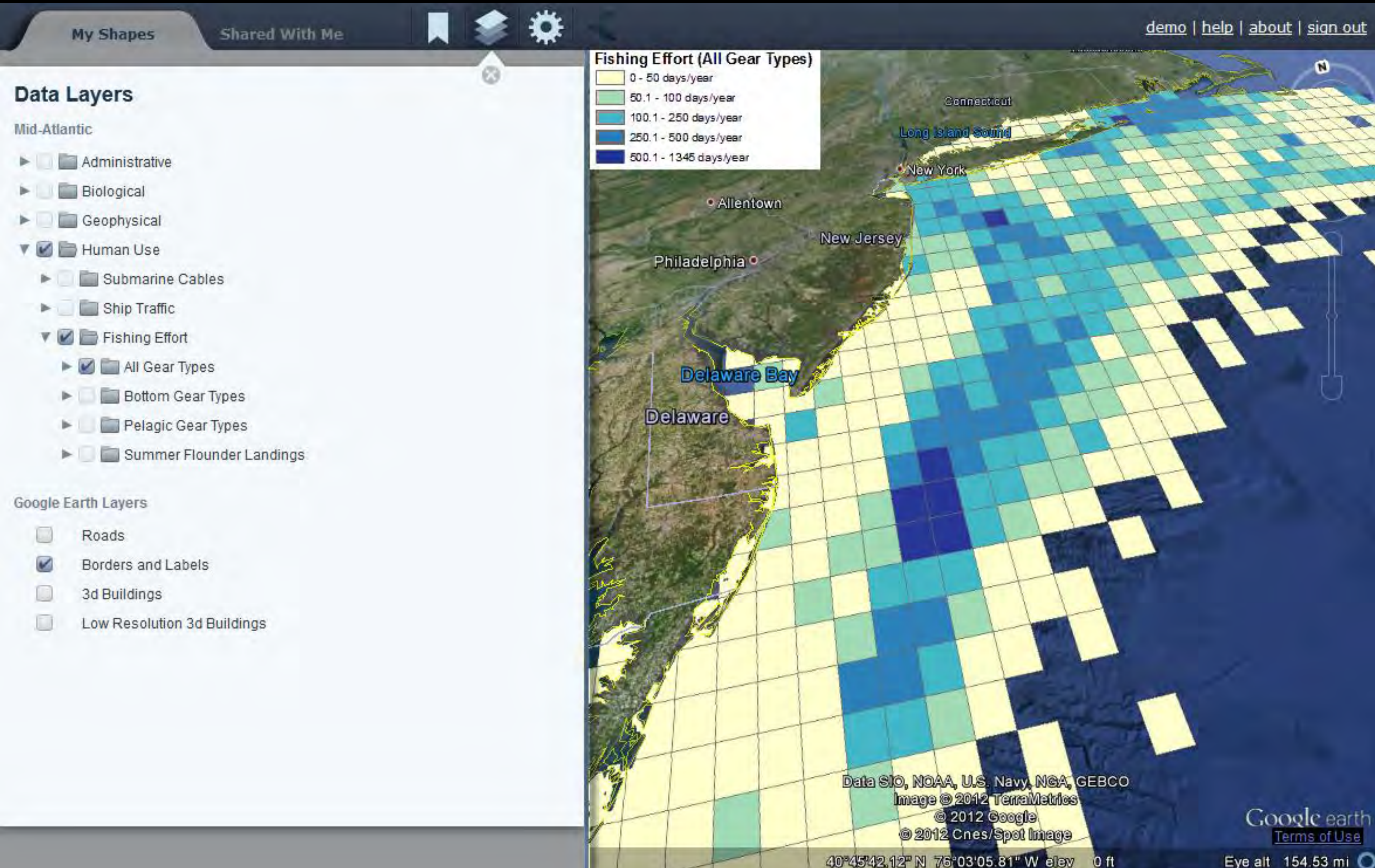
<u>Data Provider</u>: NOAA CSC, USCG's AIS program

<u>Summary</u>: Vessel traffic data summarized into a density grid for planning purposes within the U.S. coastal waters.

Complete as of this week, uploaded to Portal by June 1st



My Shapes
Shared With Me
sfletche | sign out
Data Layers
Mid-Atlantic
Administrative
Biological
Geophysical
Human Use
Submarine Cables
Ship Traffic Separation Zones
AIS Shipping Density
Fishing Effort
Google Earth Layers
Roads
Borders and Labels
3d Buildings
Low Resolution 3d Buildings
Shipping Density
Lower
Higher
© 2012 Google
Image © 2012 TerraMetrics
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
40°01'58.19" N 73°56'22.71" W elev 0 ft
Eye alt 10.08 mi
Terms of Use


My Shapes
Shared With Me
demo | help | about | sign out
Data Layers
Mid-Atlantic
Administrative
Biological
Geophysical
Human Use
Submarine Cables
Ship Traffic
Fishing Effort
All Gear Types
Bottom Gear Types
Pelagic Gear Types
Summer Flounder Landings
Google Earth Layers
Roads
Borders and Labels
3d Buildings
Low Resolution 3d Buildings
Fishing Effort (All Gear Types)
0 - 50 days/year
50.1 - 100 days/year
100.1 - 250 days/year
250.1 - 500 days/year
500.1 - 1345 days/year
Connecticut
Long Island Sound
New York
Allentown
New Jersey
Philadelphia
Delaware Bay
Delaware
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2012 TerraMetrics
© 2012 Google
© 2012 Cnes/Spot Image
Google earth
Terms of Use
40°45'42.12" N 76°03'05.81" W elev 0 ft
Eye alt 154.53 mi

Biological Data: Sea Birds

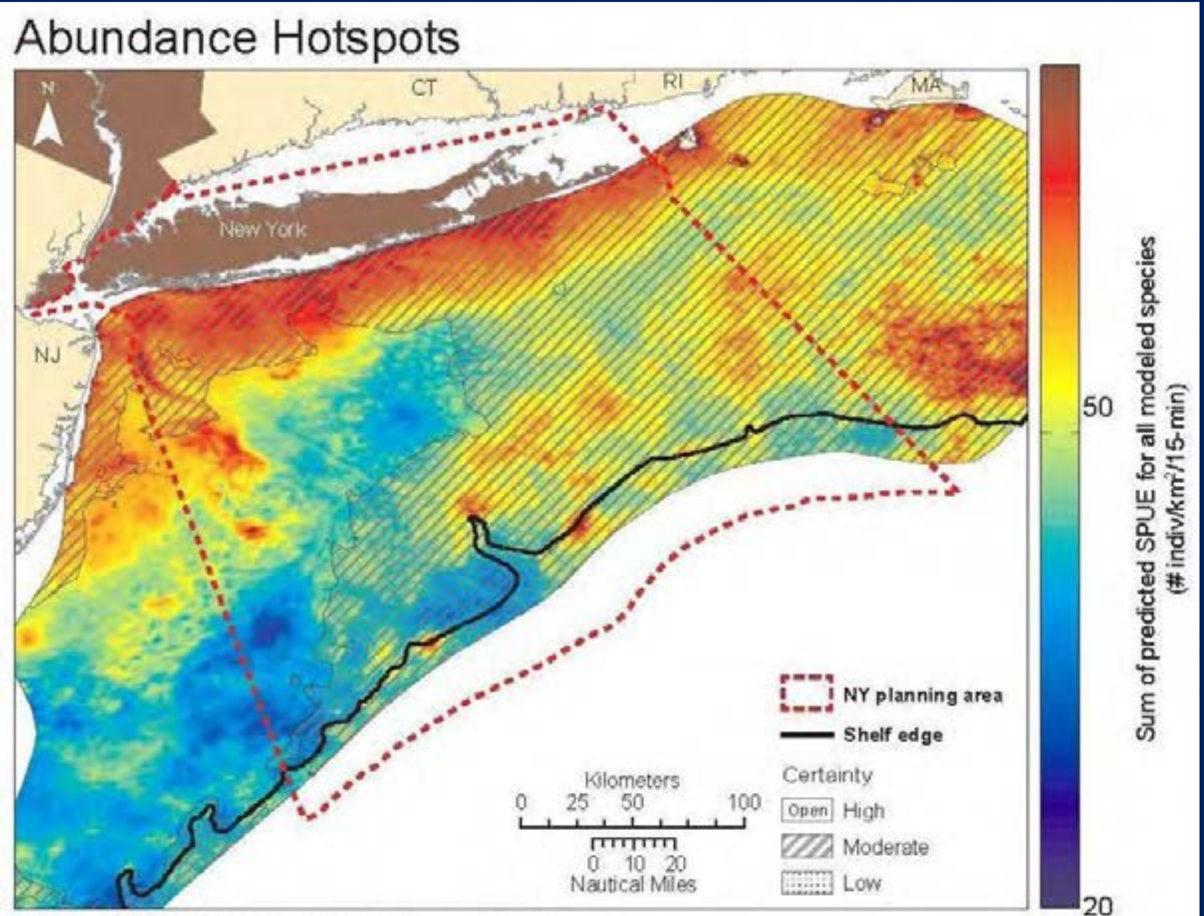


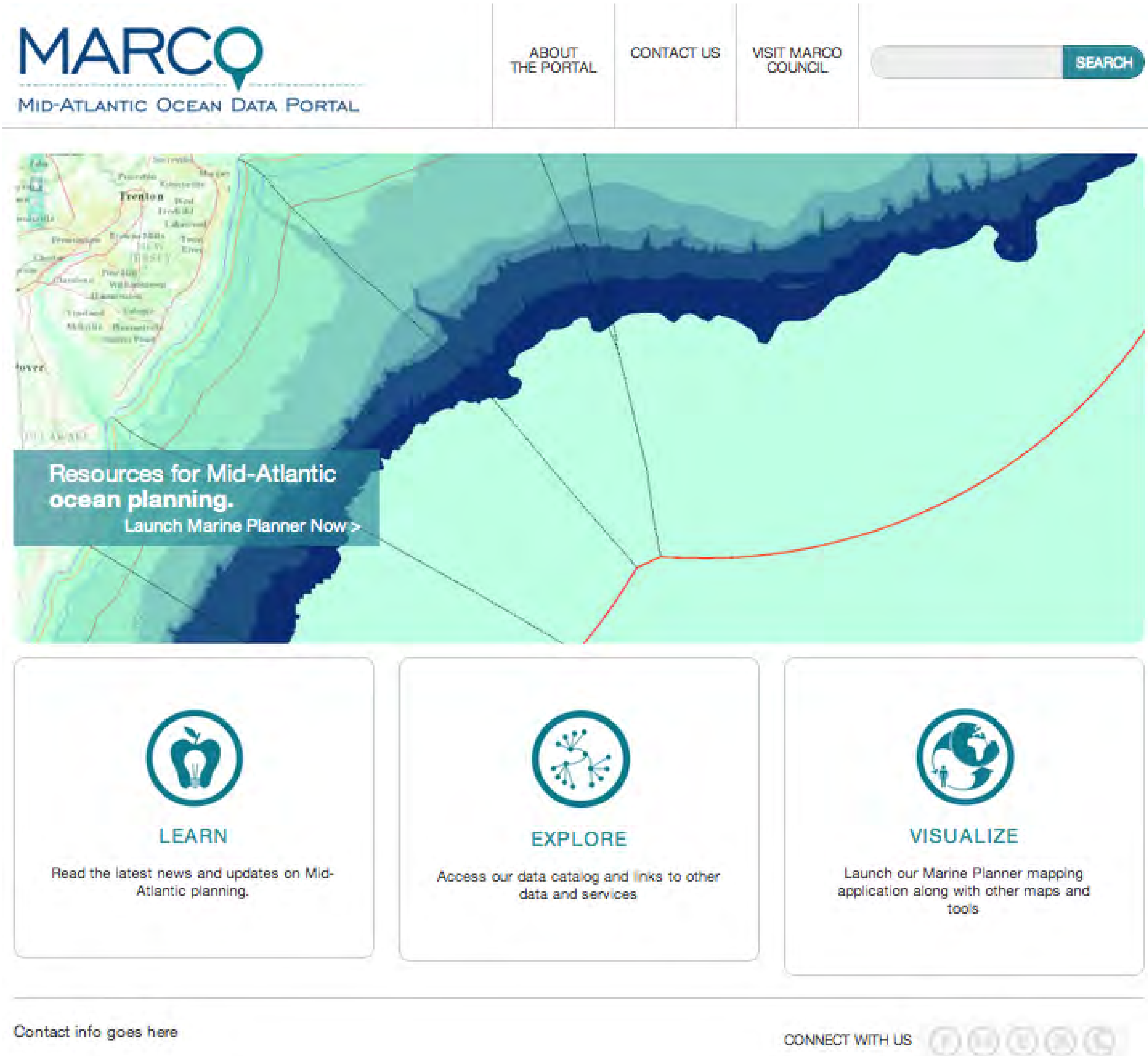
Figure 6.35. Predicted seabird abundance hotspot map.

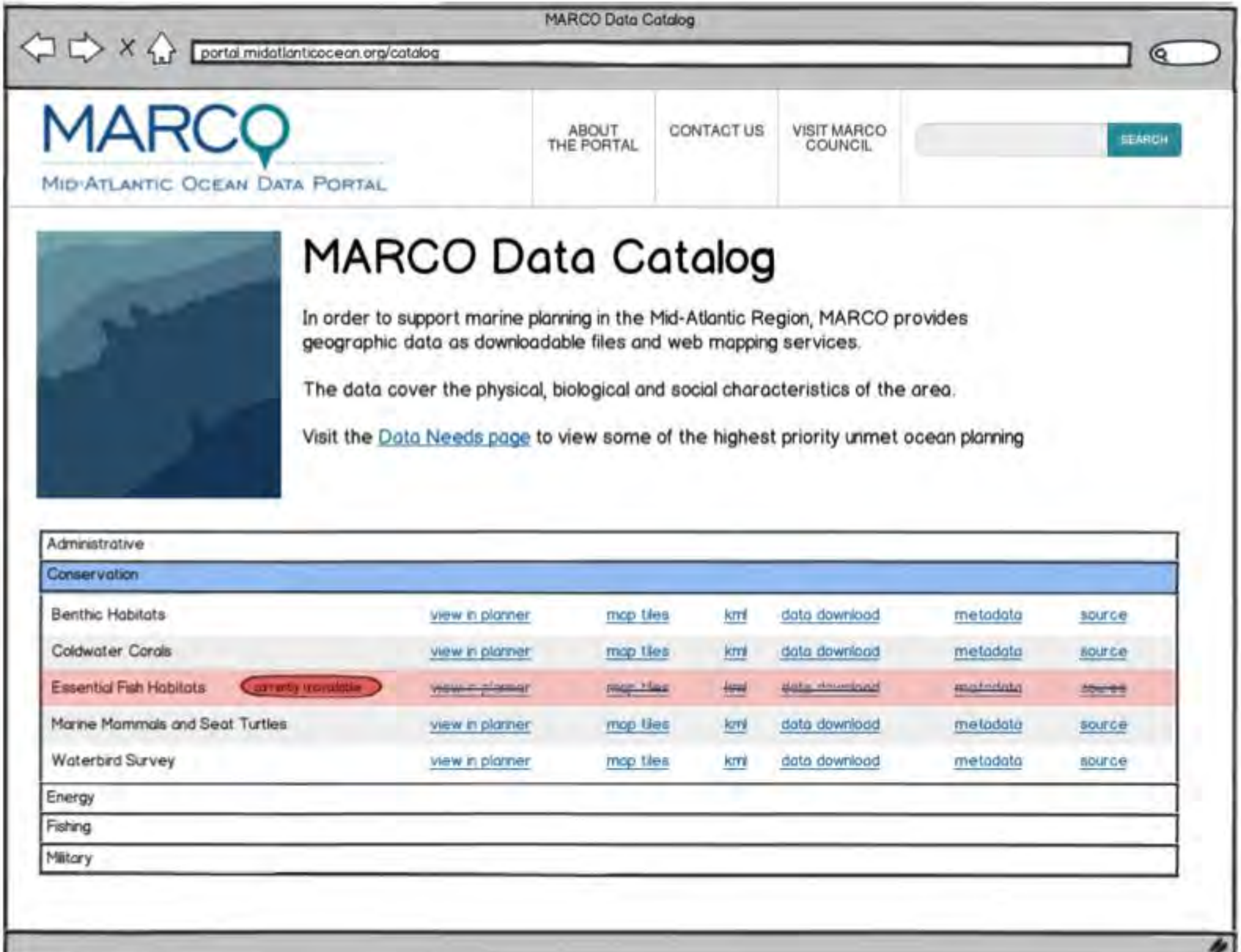
Source: Manomet Bird Observatory Seabird and Cetacean Assessment Program (CSAP)

Data Provider: NOAA NCCOS, BOEM

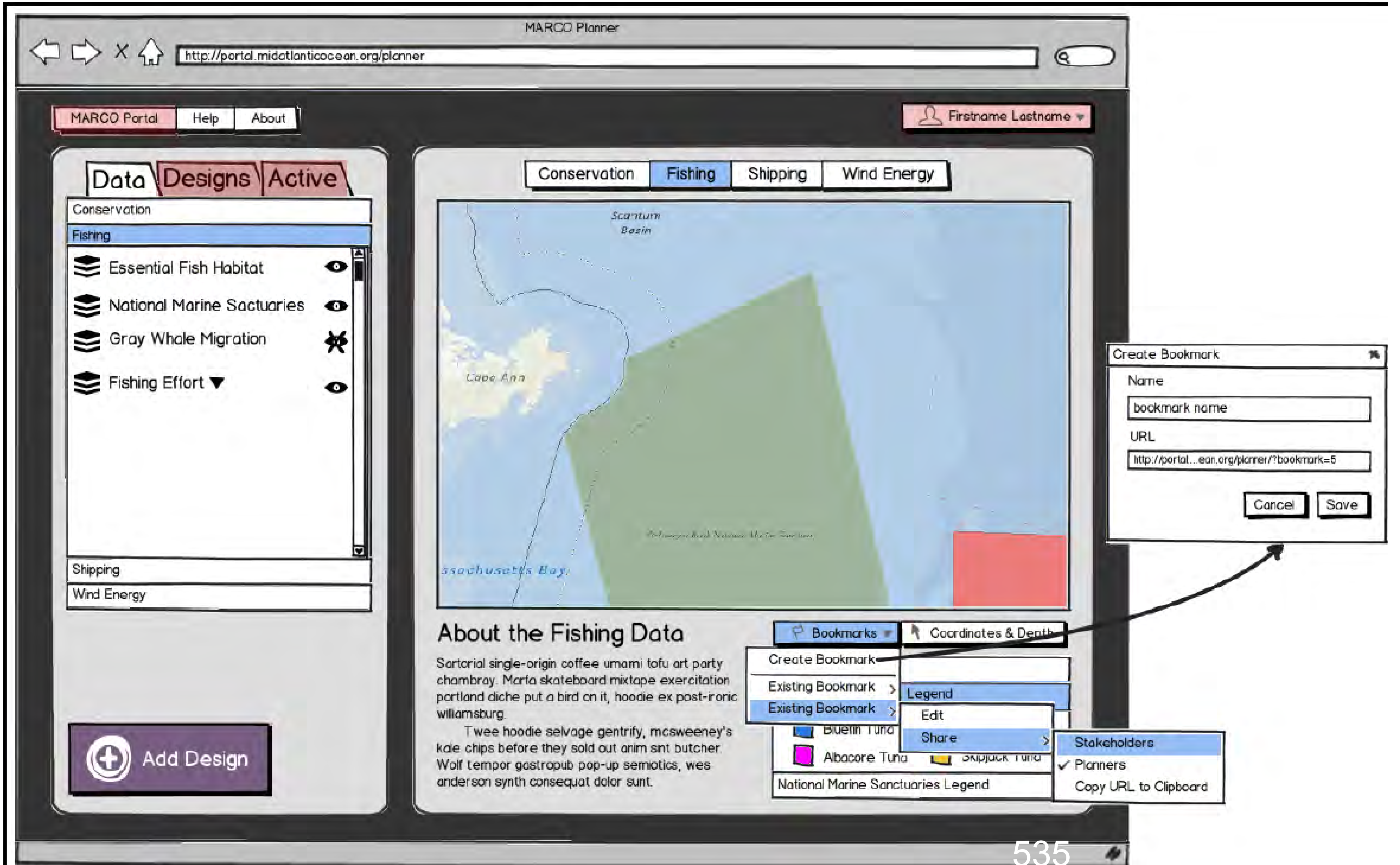
Summary:

- Relative abundance predictive models for individual species.
- Hotspots of abundance, richness and diversity for multiple species.
- *NCOOS to complete by end of 2012*

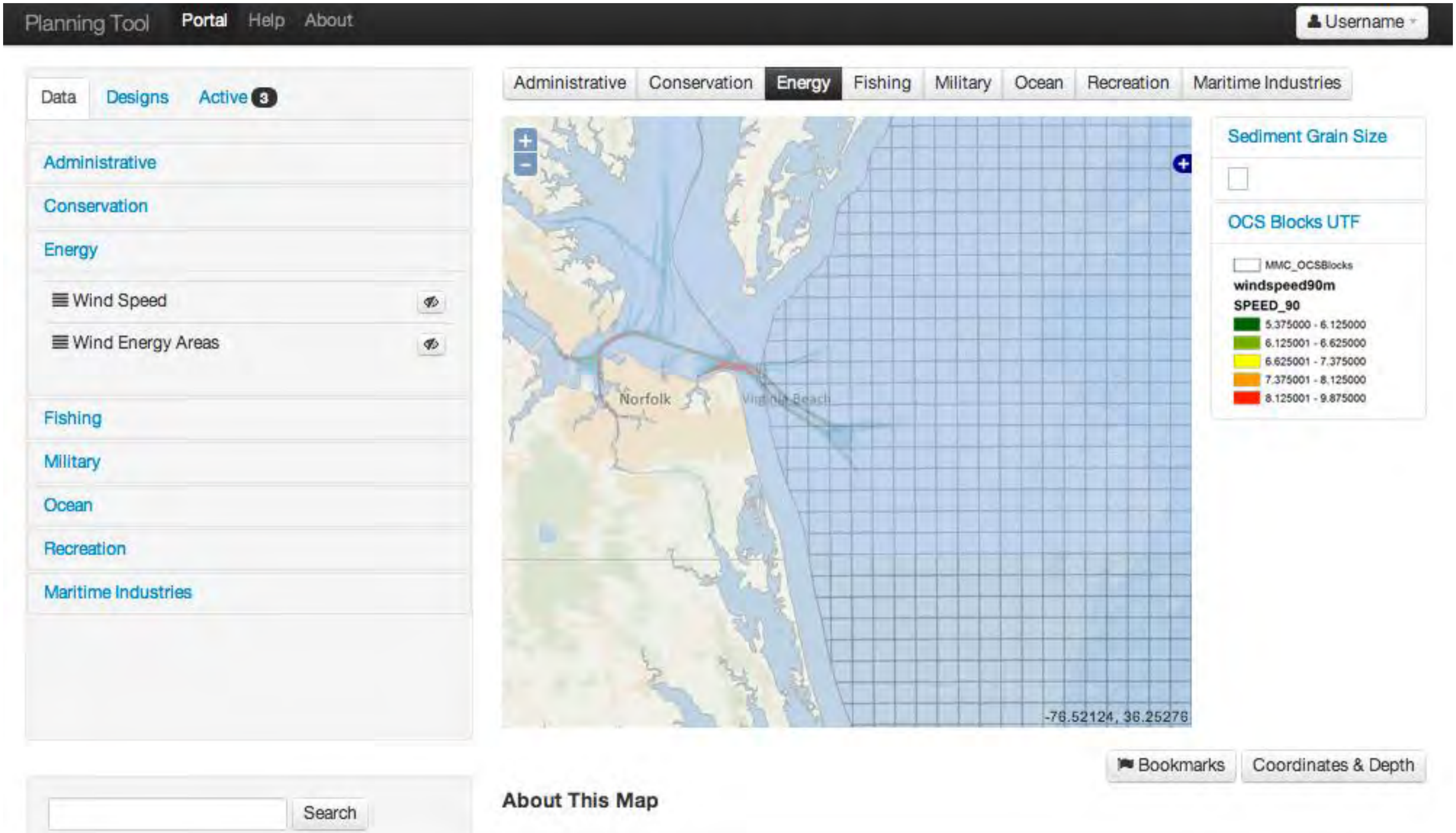

MARCO
Mid-Atlantic Ocean Data Portal
ABOUT THE PORTAL
CONTACT US
VISIT MARCO COUNCIL
SEARCH
Trenton
Resources for Mid-Atlantic ocean planning.
Launch Marine Planner Now >
LEARN
Read the latest news and updates on Mid-Atlantic planning.
EXPLORE
Access our data catalog and links to other data and services
VISUALIZE
Launch our Marine Planner mapping application along with other maps and tools
Contact info goes here
CONNECT WITH US


MARCO Data Catalog
portal.midatlanticocean.org/catalog
MARCO
Mid-Atlantic Ocean Data Portal
ABOUT THE PORTAL
CONTACT US
VISIT MARCO COUNCIL
SEARCH
MARCO Data Catalog
In order to support marine planning in the Mid-Atlantic Region, MARCO provides geographic data as downloadable files and web mapping services.
The data cover the physical, biological and social characteristics of the area.
Visit the Data Needs page to view some of the highest priority unmet ocean planning
Administrative
Conservation
Benthic Habitats
Coldwater Corals
Essential Fish Habitats
Marine Mammals and Sea Turtles
Waterbird Survey
view in planner
map tiles
kml
data download
metadata
source
Energy
Fishing
Military

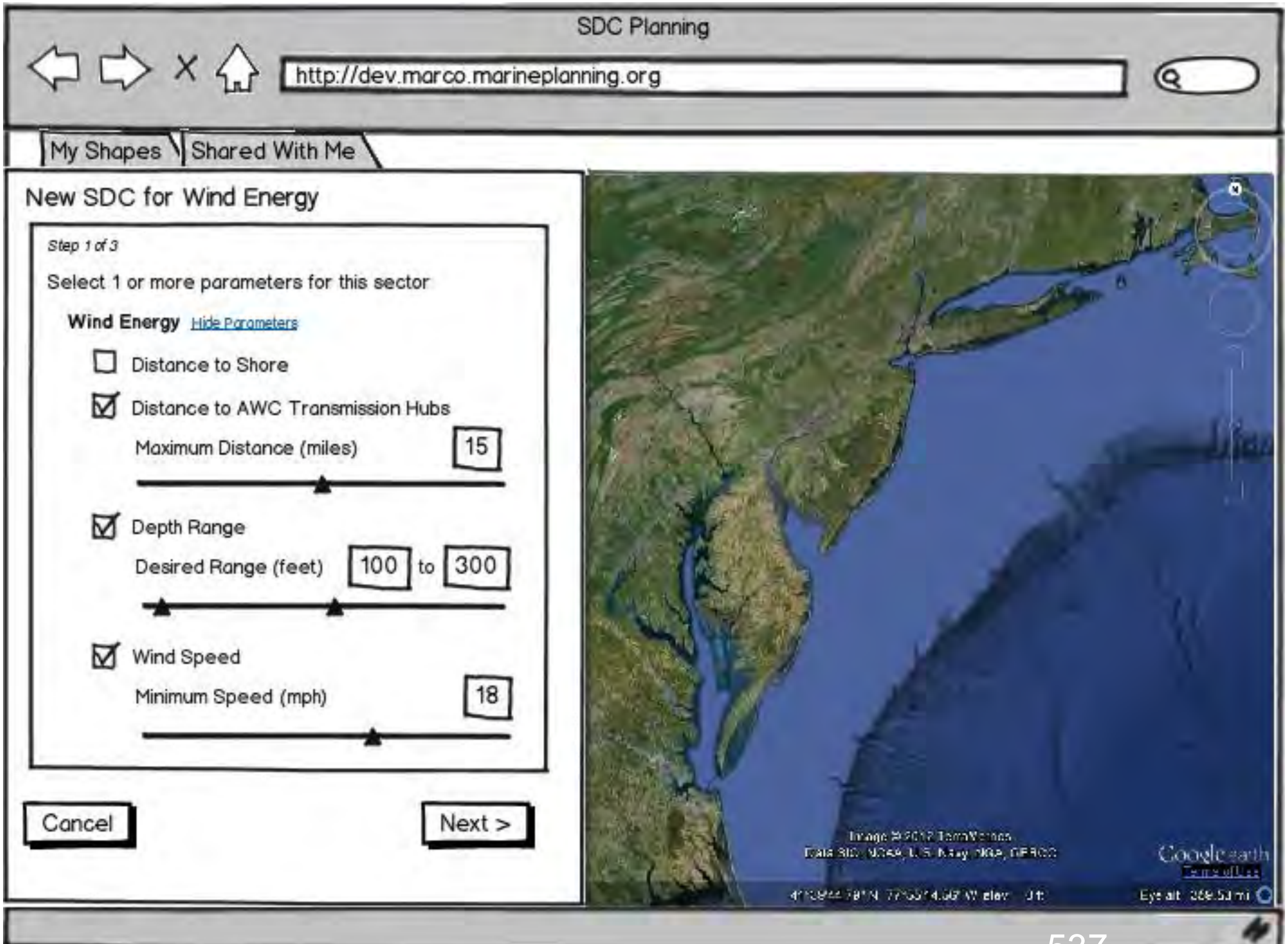
Themes preloaded with sector specific data

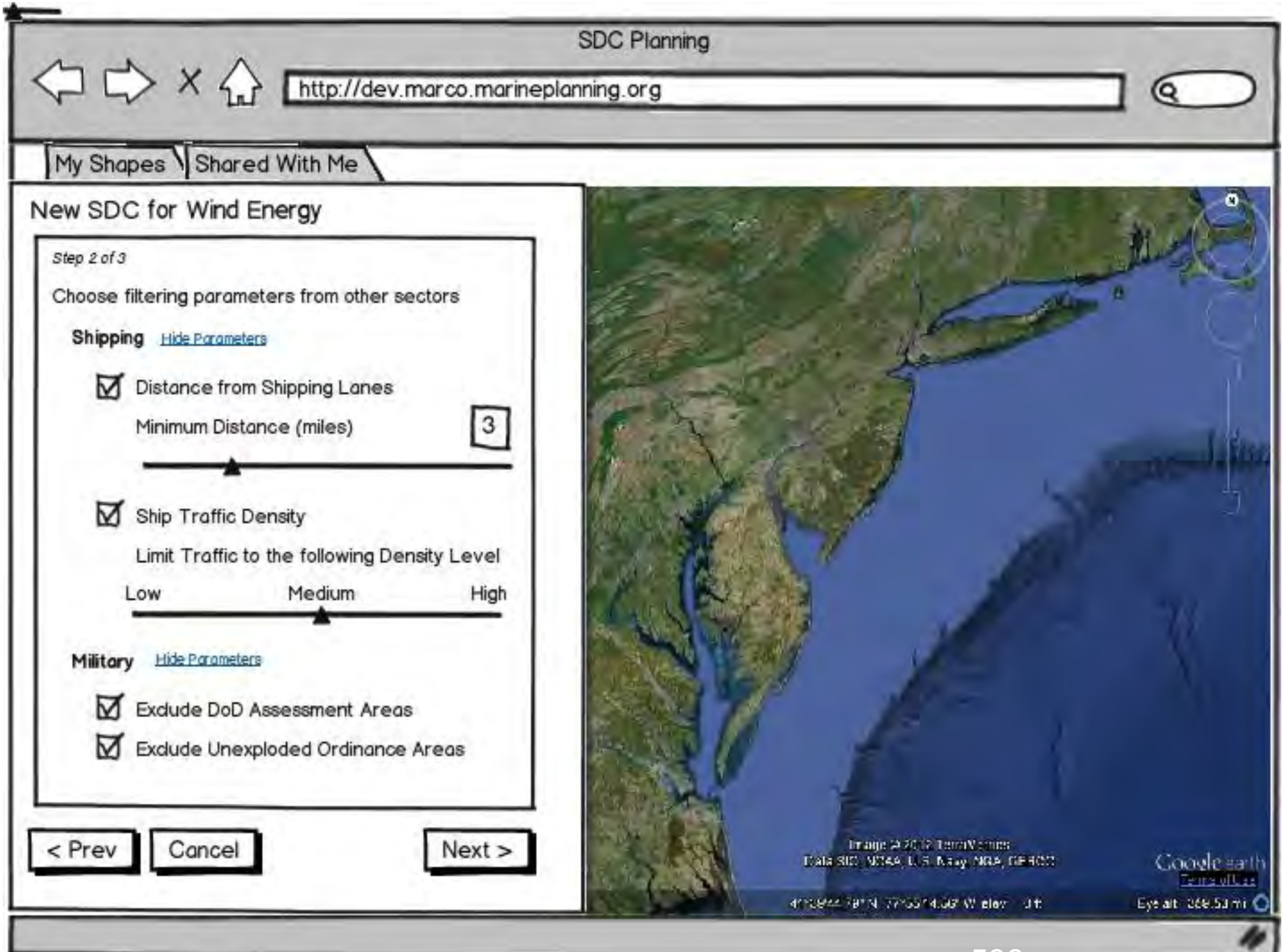


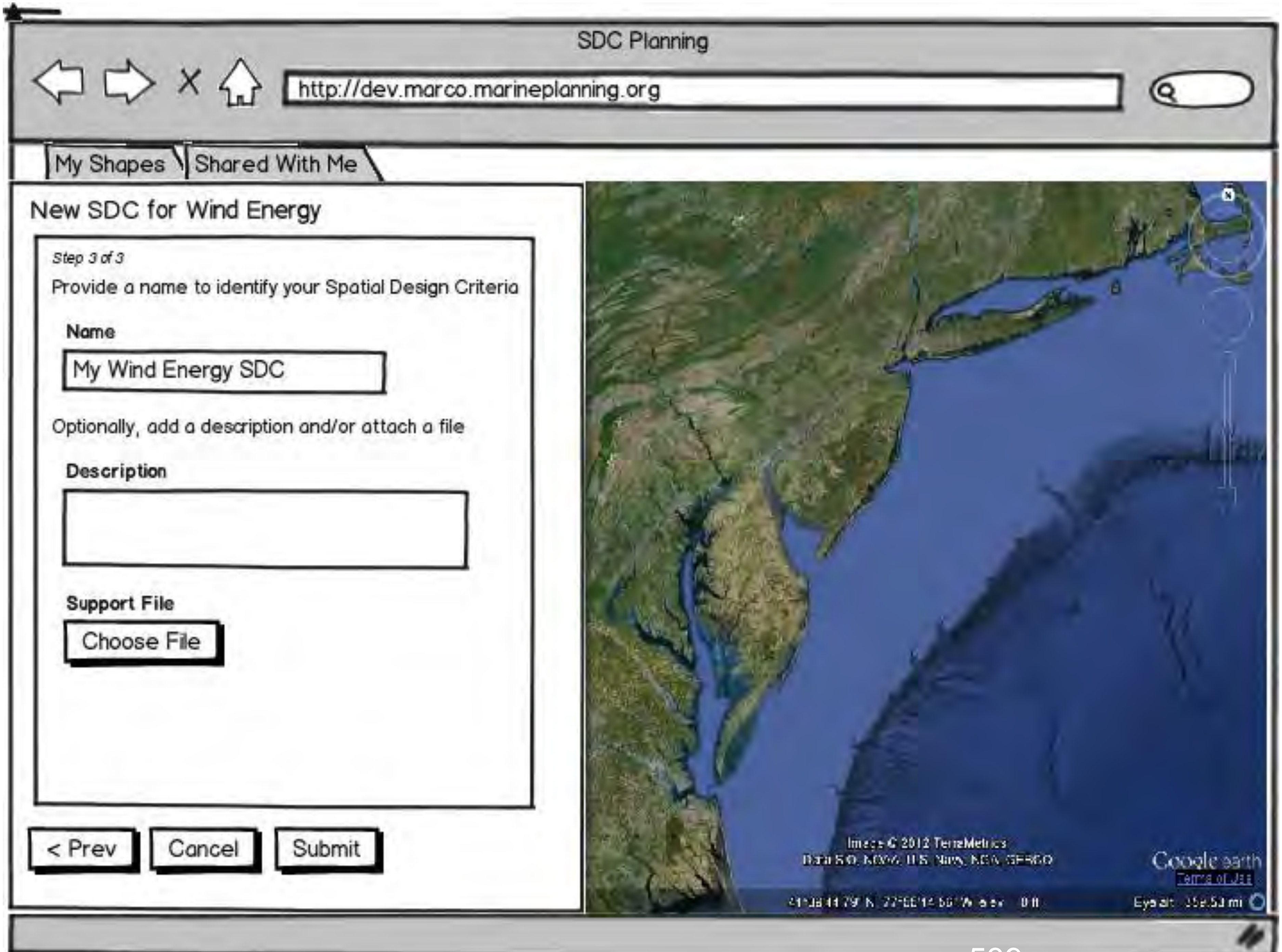
Themes preloaded with sector specific data



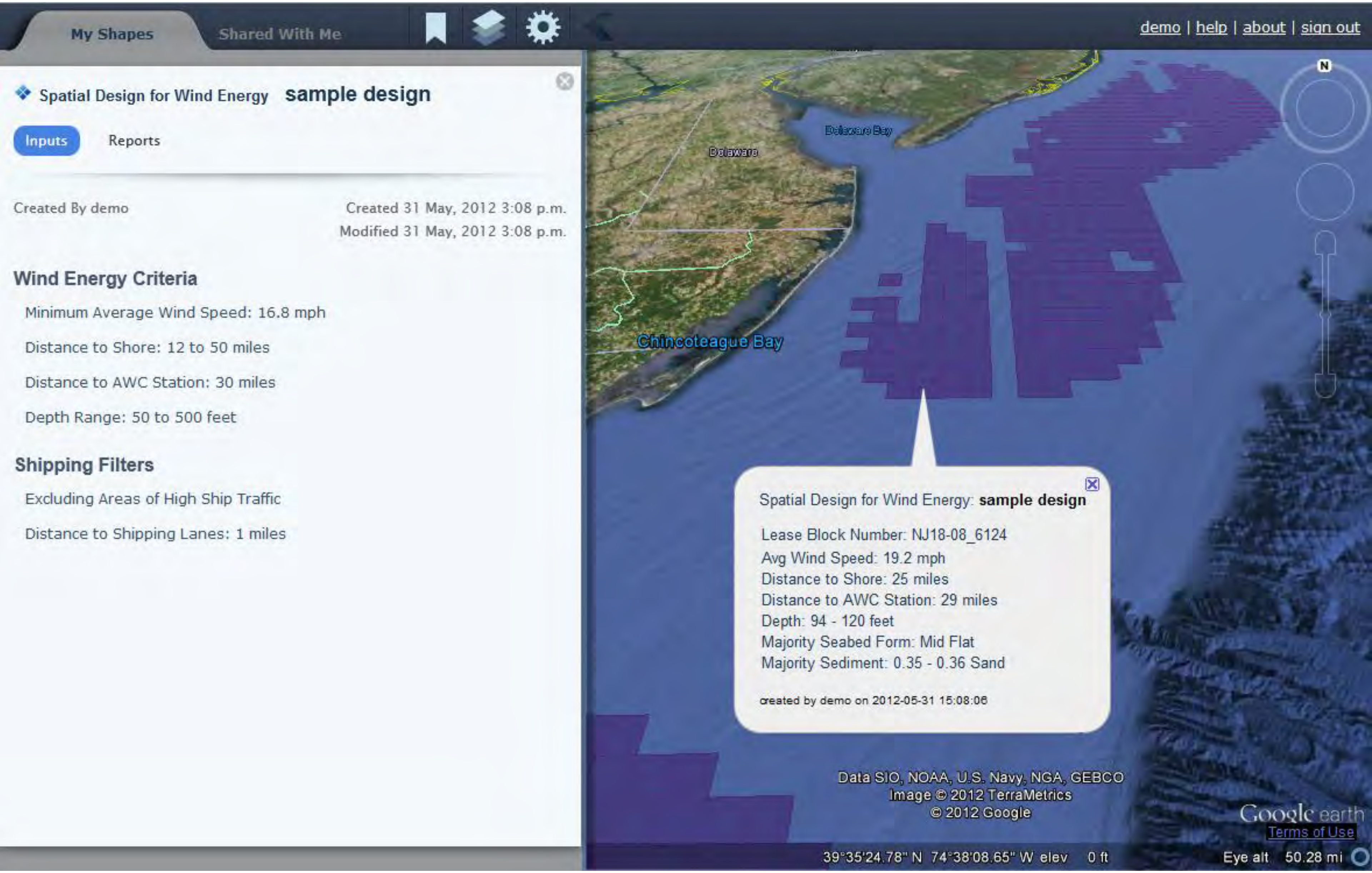
Spatial filters (show me the areas that meet certain criteria)




SDC Planning
http://dev.marco.marineplanning.org
My Shapes
Shared With Me
New SDC for Wind Energy
Step 2 of 3
Choose filtering parameters from other sectors
Shipping
Hide Parameters
Distance from Shipping Lanes
Minimum Distance (miles)
3
Ship Traffic Density
Limit Traffic to the following Density Level
Low
Medium
High
Military
Hide Parameters
Exclude DoD Assessment Areas
Exclude Unexploded Ordinance Areas
< Prev
Cancel
Next >


SDC Planning
http://dev.marco.marineplanning.org
My Shapes
Shared With Me
New SDC for Wind Energy
Step 3 of 3
Provide a name to identify your Spatial Design Criteria
Name
My Wind Energy SDC
Optionally, add a description and/or attach a file
Description
Support File
Choose File
< Prev
Cancel
Submit
Google earth

User defined results & reports



Portal Enhancement

Version I
- Enhanced Portal
- Stakeholder interviews /mtgs
- data acquisition and viewing functions
- ***July 2012***

Version II
- Portal website launch
- More data
- Viewable sector-specific parameters and spatial filters
- Stakeholder vetting
- ***August 2012***

Version III
- More data
- Improved spatial filters, based on stakeholder
- Ability to design and generate reports
- ***Late Fall 2012***

Enhanced Portal
- Peer reviewed
- All stakeholder data and views incorporated
- Improved feature and functions
- ***June 2013***


NEW HOPE
SKIMMER II
http://ecotrust.github.com/marco-portal/

Presentation #21

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

USGS
science for a changing world

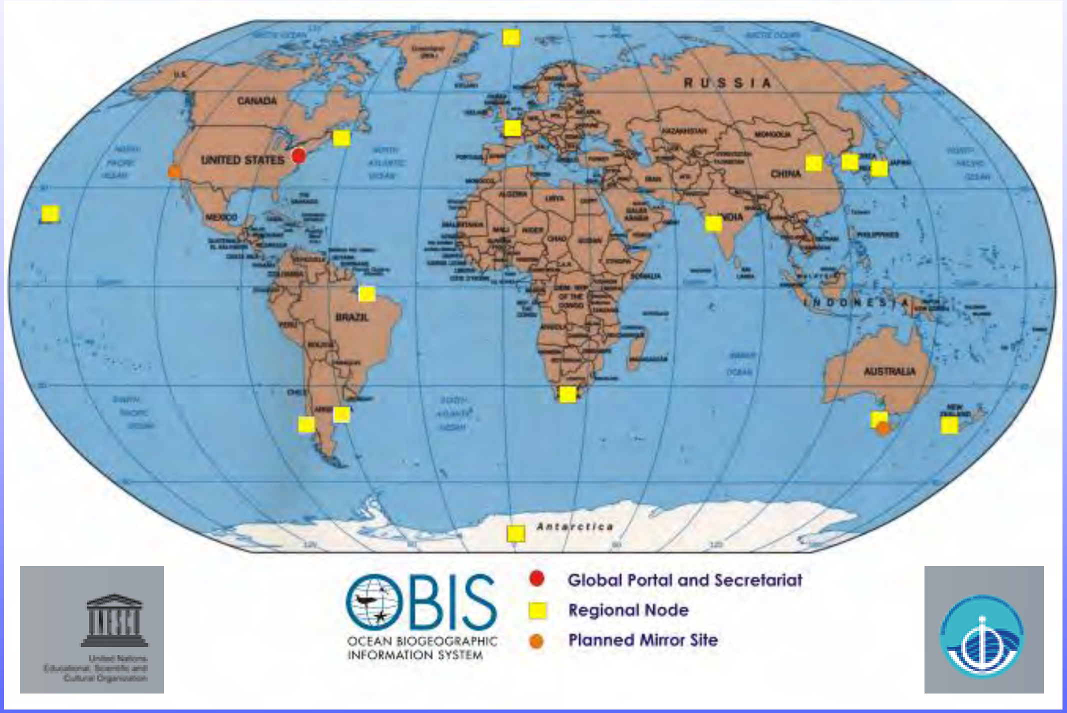
OBIS-USA Data Management: Standards, Applications and Life Cycle

July 25, 2012

Silver Spring, MD

Mark Fornwall. Philip Goldstein and Jesse Cleary

Global Network

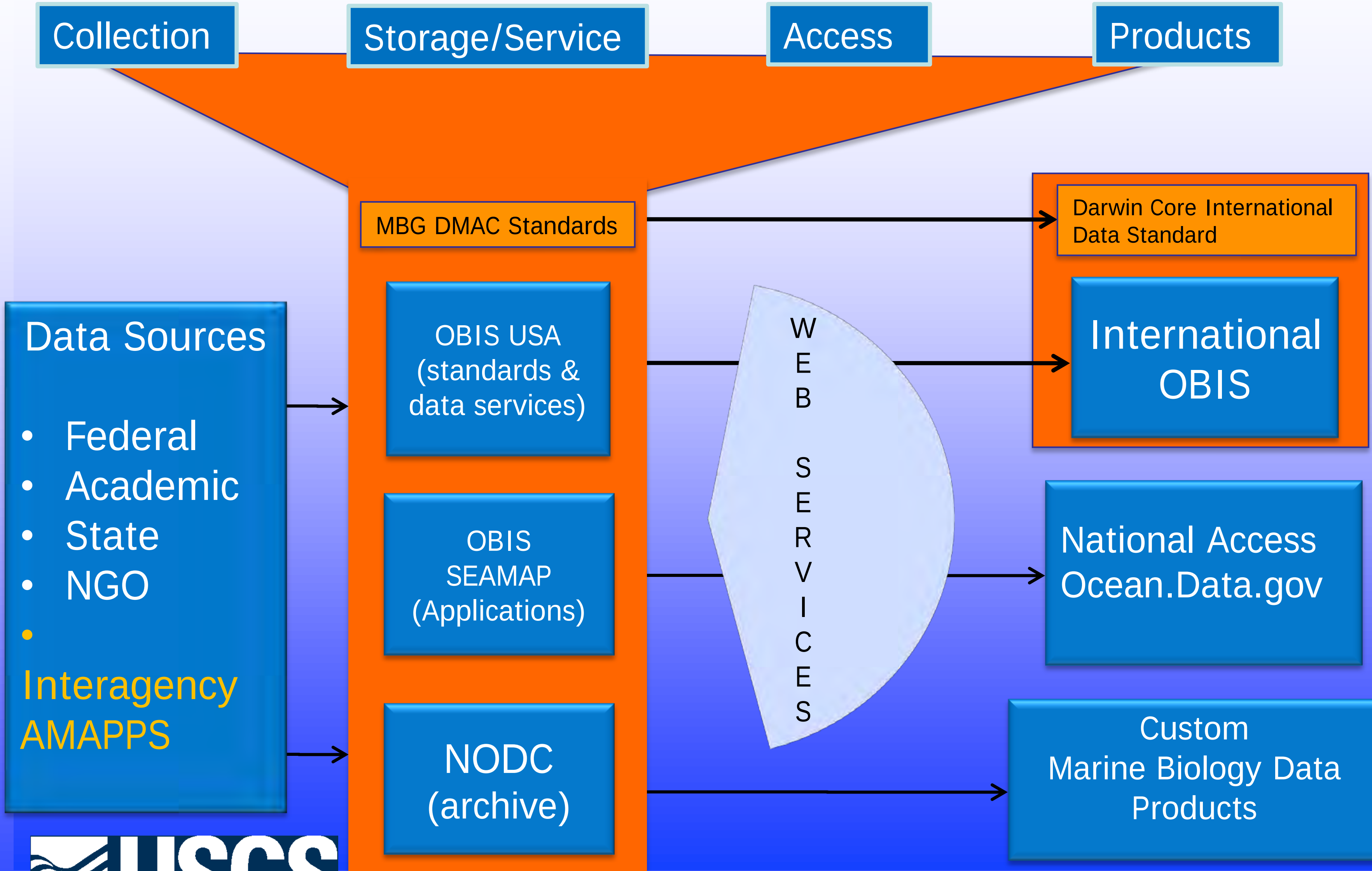


- Regional Nodes
- Thematic Nodes

- Global Network
- Data Standards
- 31 Million Records

USGS
science for a changing world

Federal Data Architecture



OBIS-USA Data

- Taxonomically, spatially and temporally resolved;
- Comply with US and international data standards;
- Accompanied by FGDC compliant metadata;
- Available through a variety of web services;
- Linked back to Data Originator/Holder; and
- Rapid evaluation of suitability for use

Data, Semantics, and Interoperability

Biological Data Contents

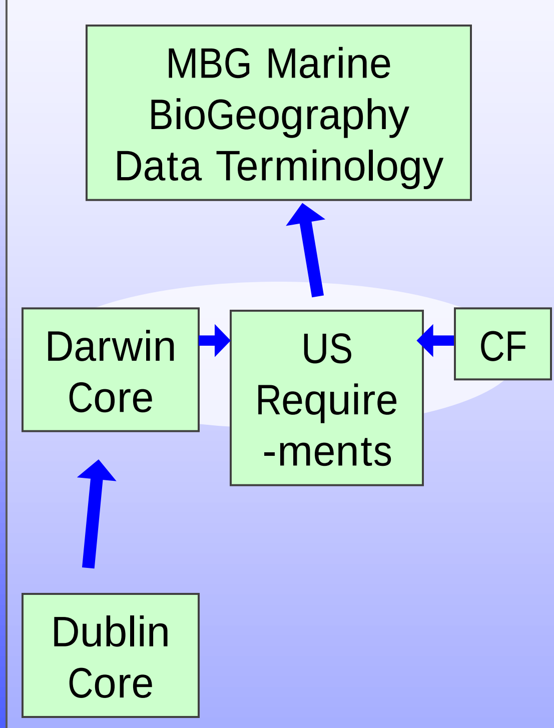
- *Each Record is …*

Observation Event
Point Data
Presence - Absence - Quantification

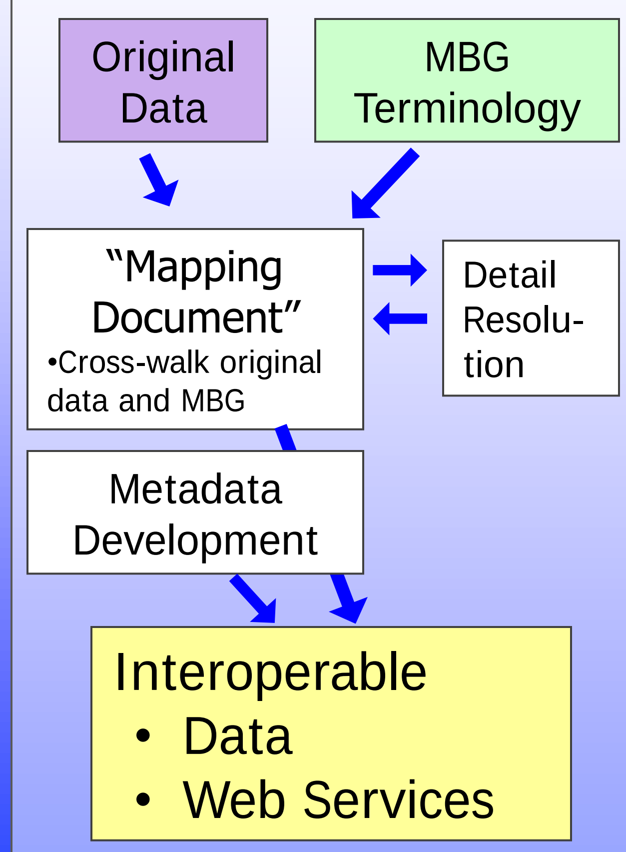
- *Record Details include …*

- Record Identity / Citation
- Georeference (x, y, z, t, e)
- Taxon / Identification
- Observation / Biological Details
- Sampling / Calculation Details (method, transect, tracking, quantification)

Semantics

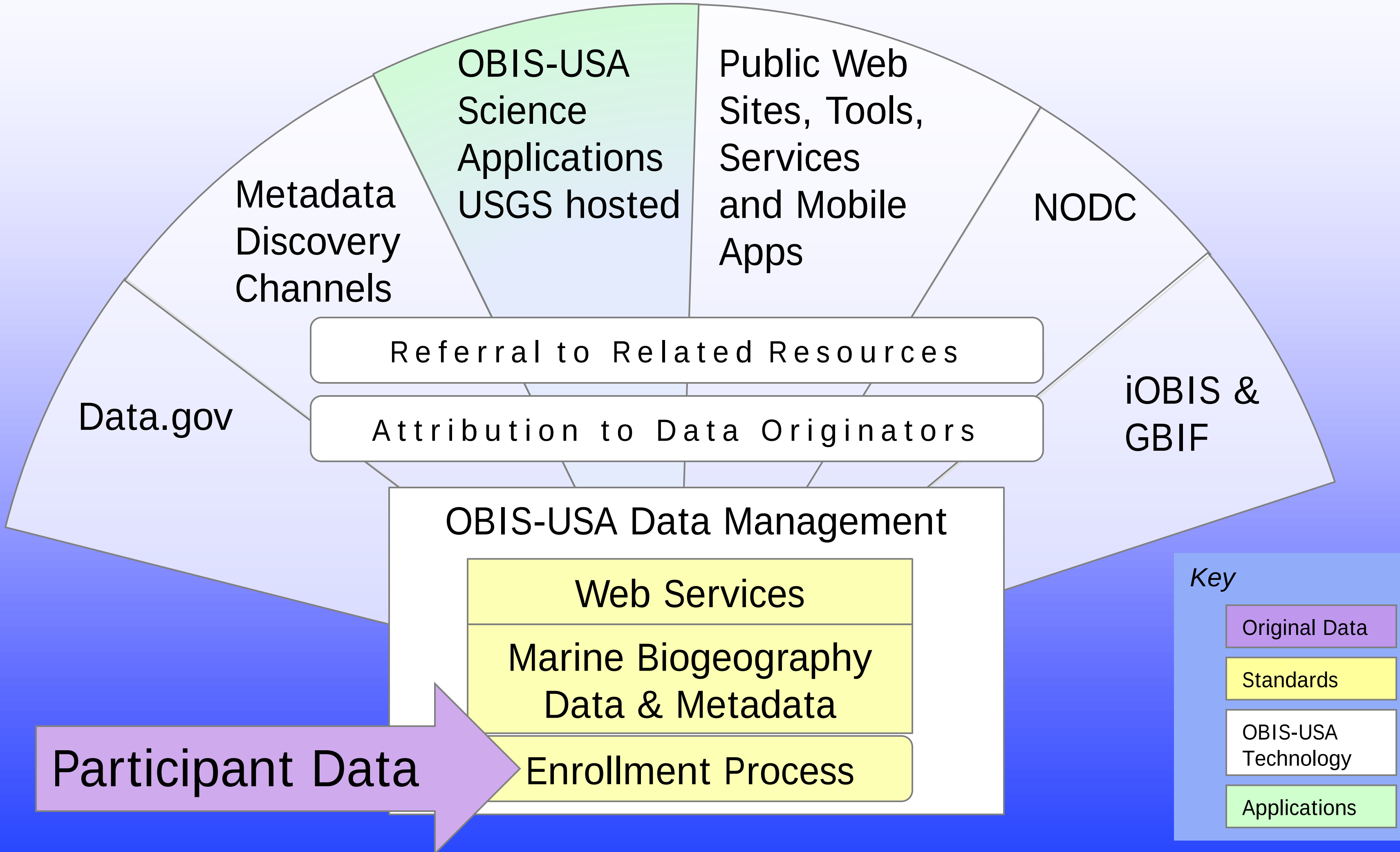


Data Mapping

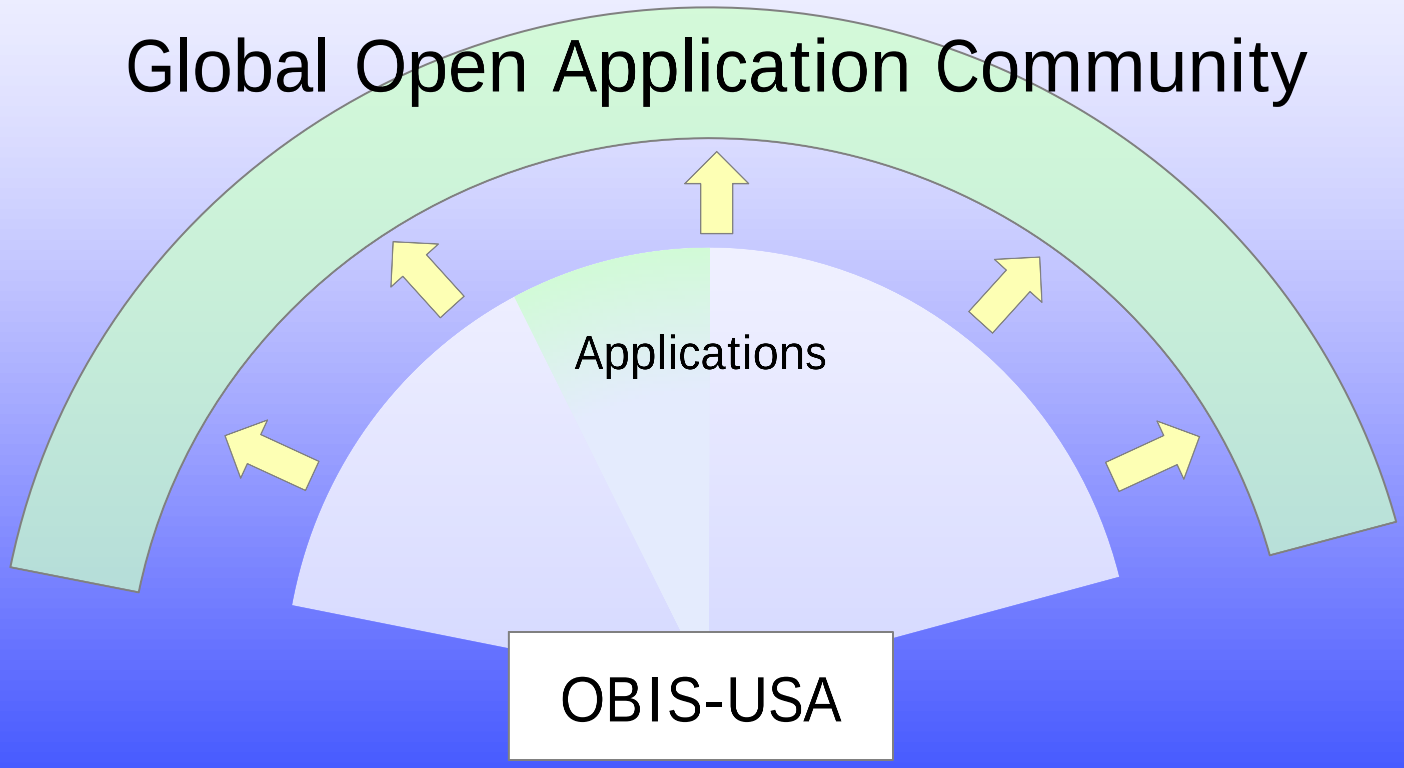


science for a changing world

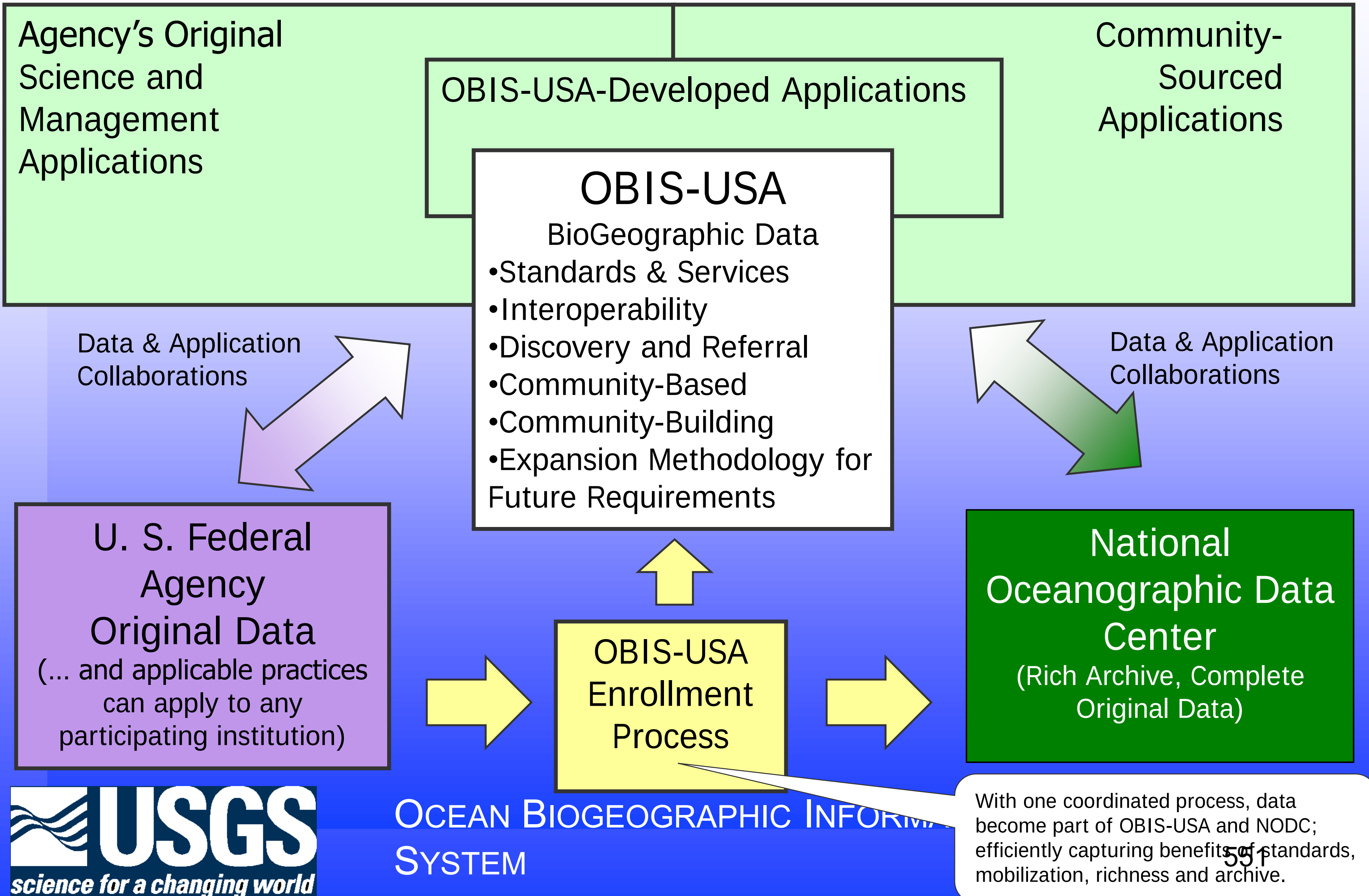
OBIS-USA Direct Community Integration



OBIS-USA Open Application Community



Federal Data Life Cycle

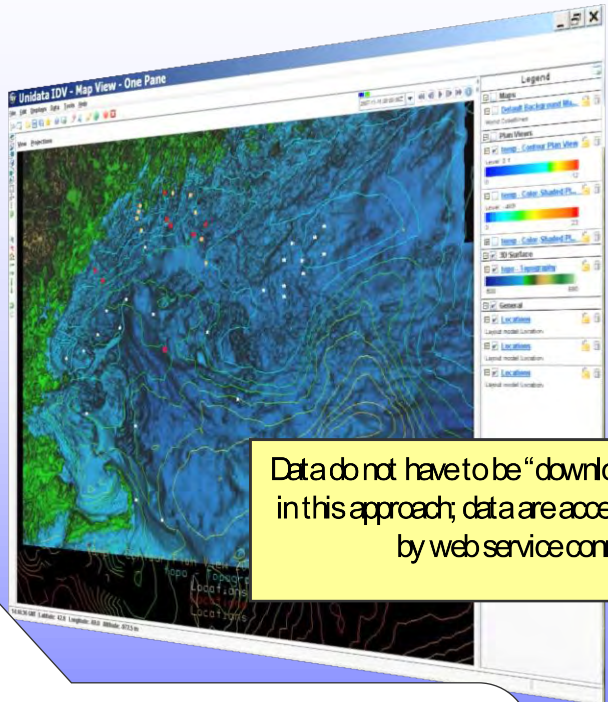


USGS
science for a changing world

OCEAN BIOGEOGRAPHIC INFORM
SYSTEM

Another Approach … IDV Example

A modeler using a web-service-connected client (Unidata IDV example)



Data do not have to be "downloaded" for modeling in this approach; data are accessible interactively by web service connection.

Internet

OBIS-USA

web services

biological occurrences

USGS Oceanographic Data

web services

- temperature
- current
- turbidity

NOAA

web services

bathymetry

Access to OBIS-USA via web services enables integration with other types of marine data that are also accessible by web service.

OBIS-USA applies standards such as CF (Climate and Forecast Conventions) that assure data can be meaningfully combined in models.

Interoperability of data and services such as the examples above require companion metadata of sufficient quality and detail. OBIS-USA uses FGDC (and developing ISO) for this interoperability support.

OBIS-USA MBG Functional Enhancement

2009

OBIS-USA is doing:

- Biodiversity (presence)
- Integration with Metadata

OBIS-USA is hearing about:

Integration with Physical Data, Quantification, Tracking

2012

OBIS-USA is doing:

- Biodiversity (presence)
- Integration with Metadata
- Integration with Physical Data
- Absence, Quantification, Tracking, Sampling Methodology, Transect Data

OBIS-USA is hearing about:

Life Stage, Behavior, Experimental Biology

Data Applications

Liaison with data providers and users to provide custom applications:

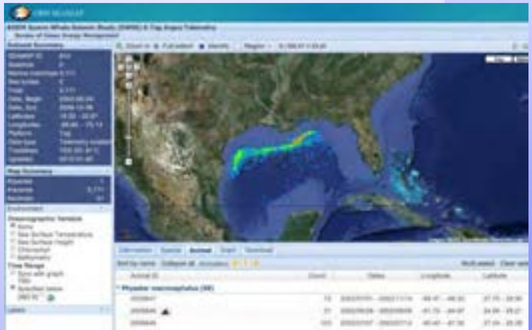
- Custom web services
- Custom web portals
- Data exploration tools
  - Integrate multiple data types
  - Integrate oceanographic data
  - Decision support tools
- Develop distribution and density models

Leverage emerging data standards and service infrastructure to build custom APIs and Portals for data users

Application Examples

- US Navy Cetacean Monitoring data
  - Single web portal to show all Navy monitoring data
  - GIS web services for USN EIMS system

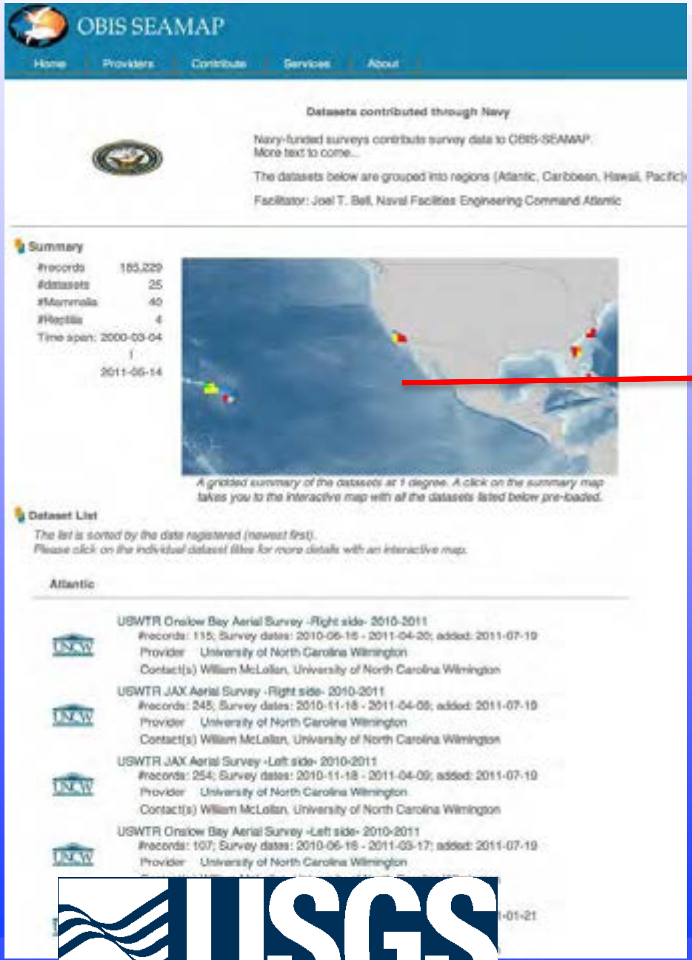
- BOEM GoMEX sperm whale data
  - Mixed data types
    - S-TAG, Acoustic, PhotoID, Genetic
  - Integrated data exploration portal

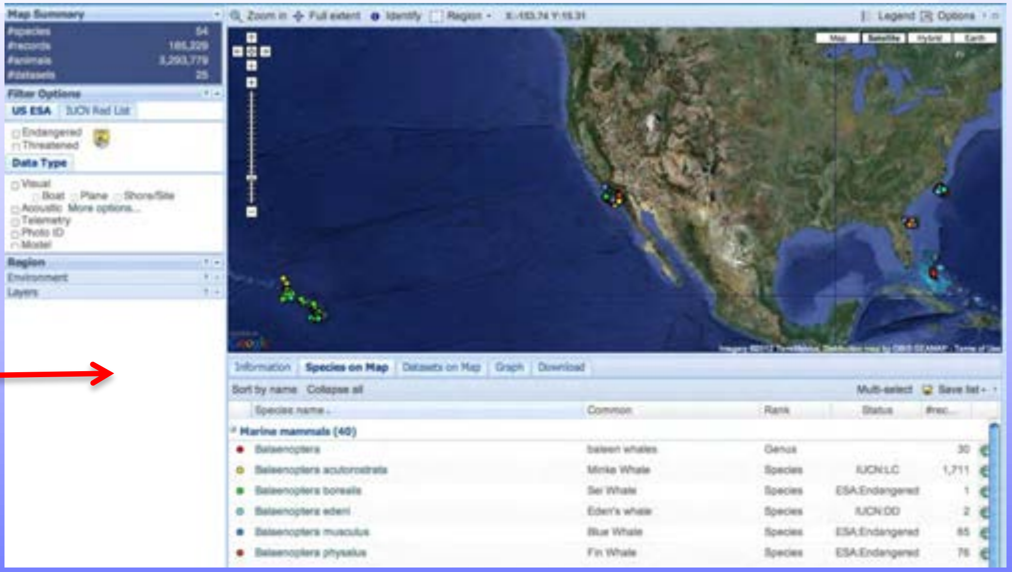


- Satellite Tracking and Analysis Tool (STAT)
  - Automated data collection
  - Customized data viewer

US Navy cetacean monitoring data

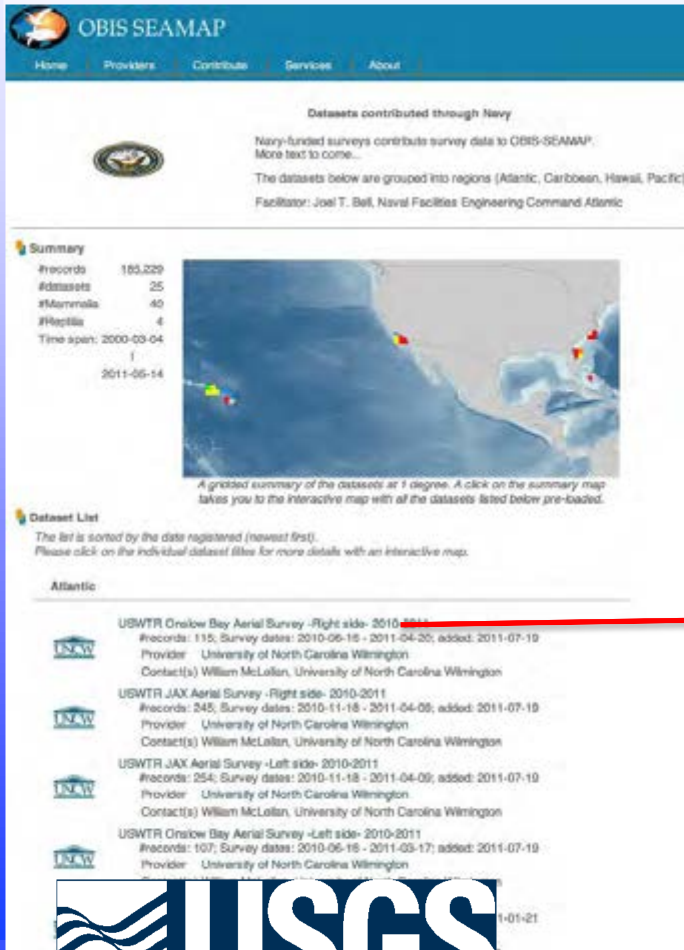
- Single view of all monitoring data
- GIS web services for EIMS data viewer

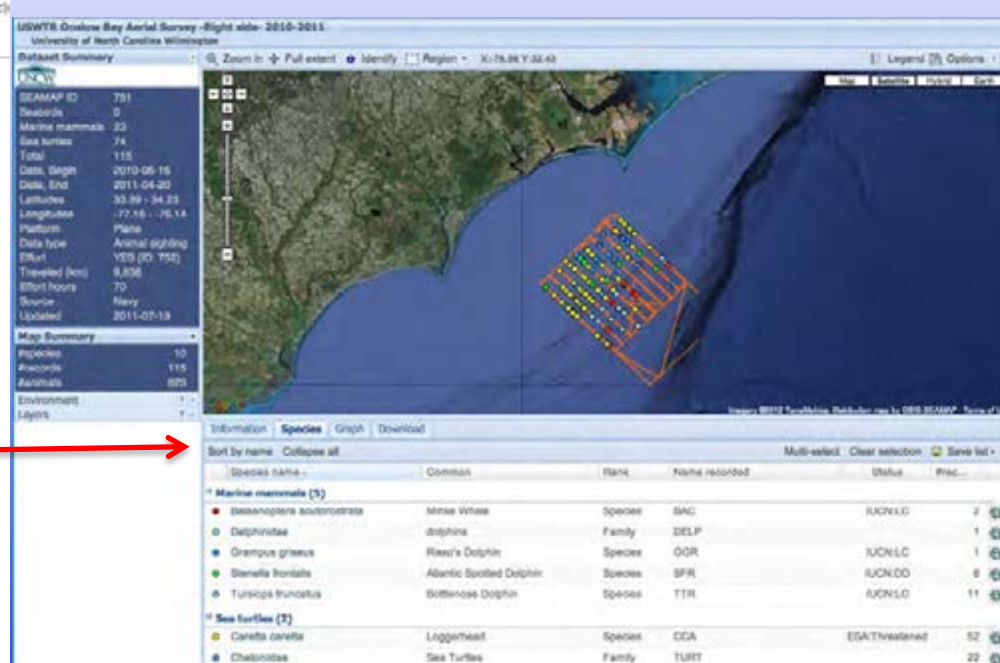




Data Applications

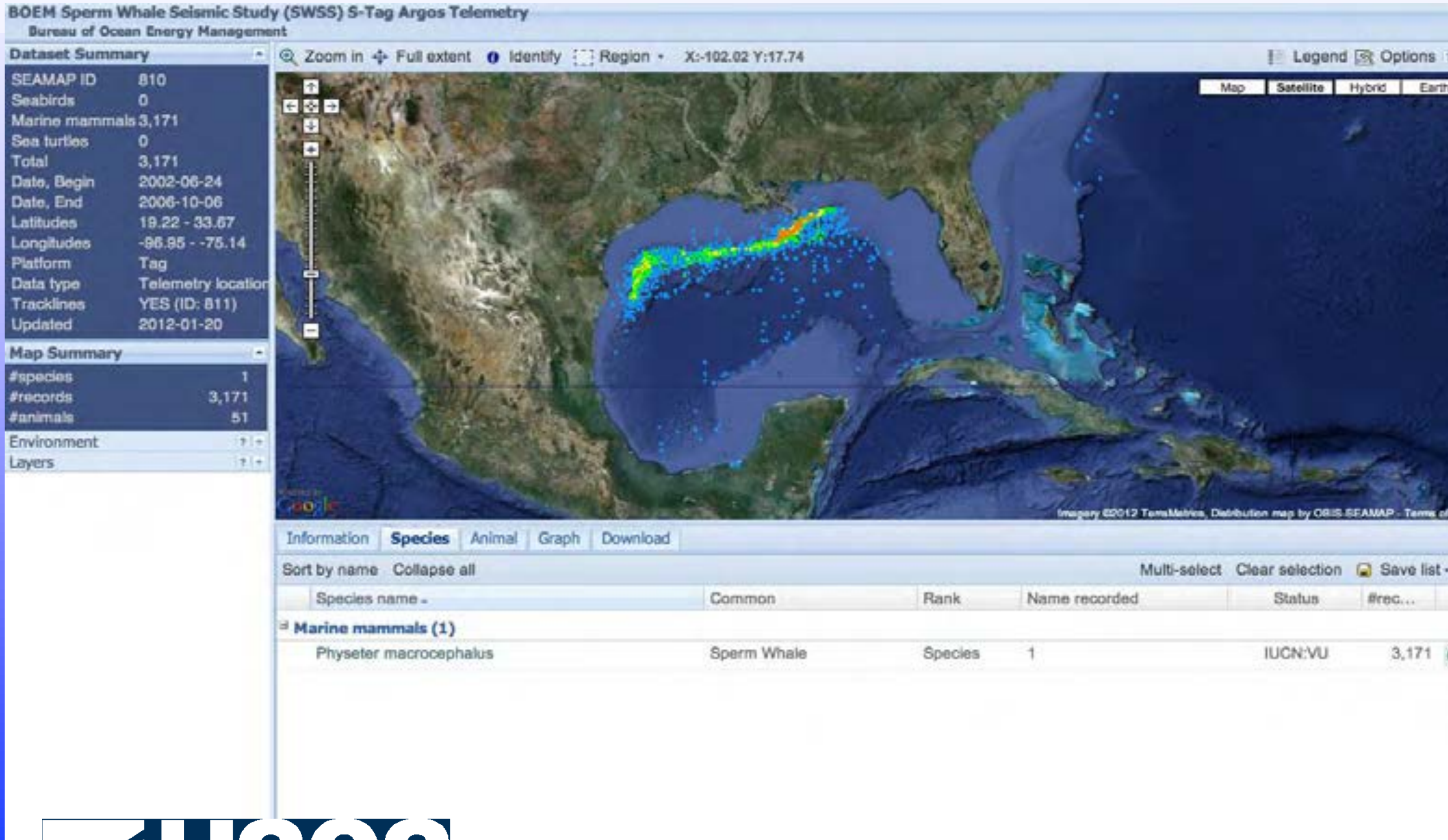
- Single view of all monitoring data
- GIS web services for EIMS data viewer





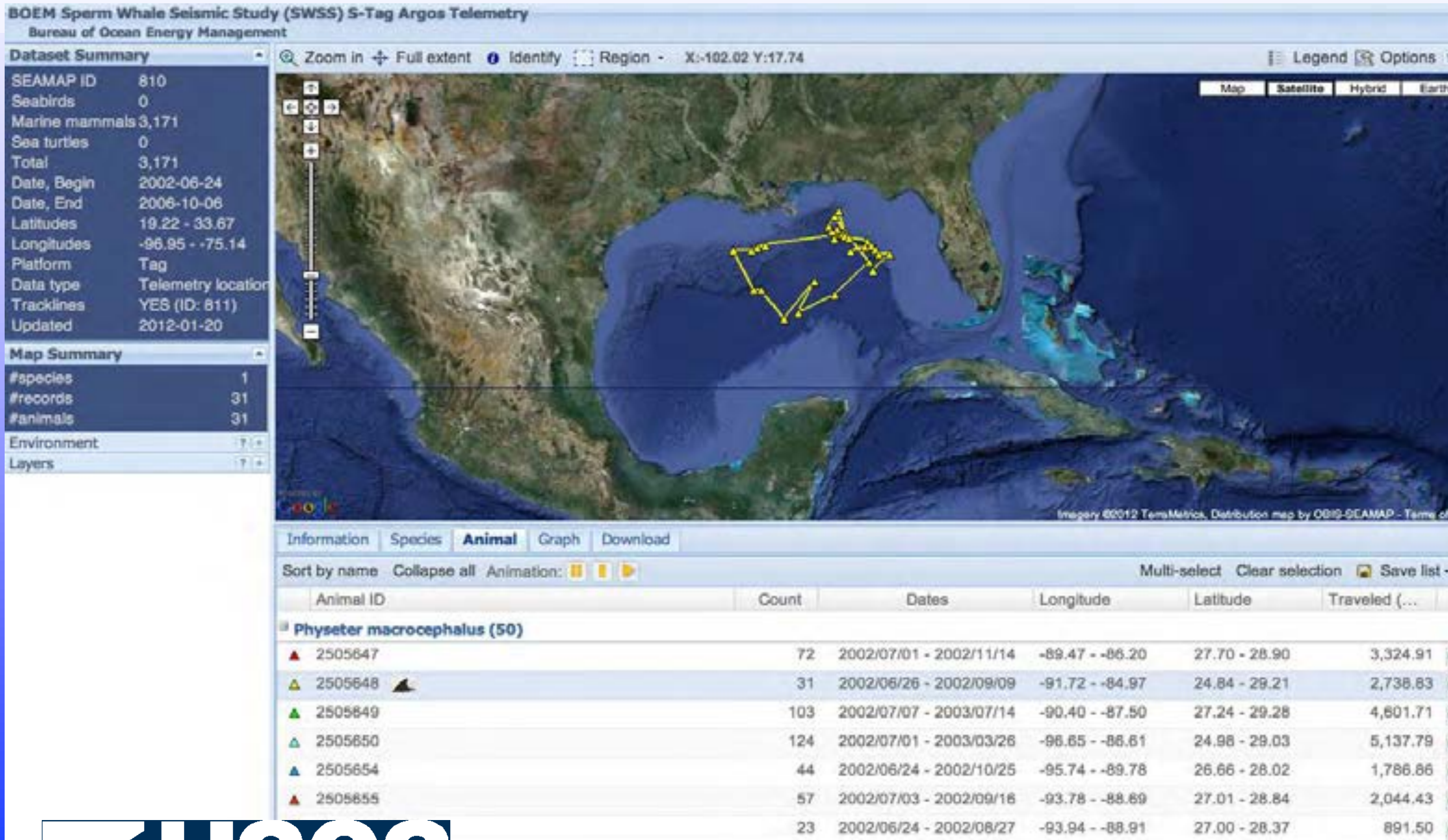
BOEM GoMEX Sperm Whale data

Integrated data viewer – explore S-TAG, PhotoID, Genetic data



BOEM GoMEX Sperm Whale data

Integrated data viewer – explore S-TAG, PhotoID, Genetic data

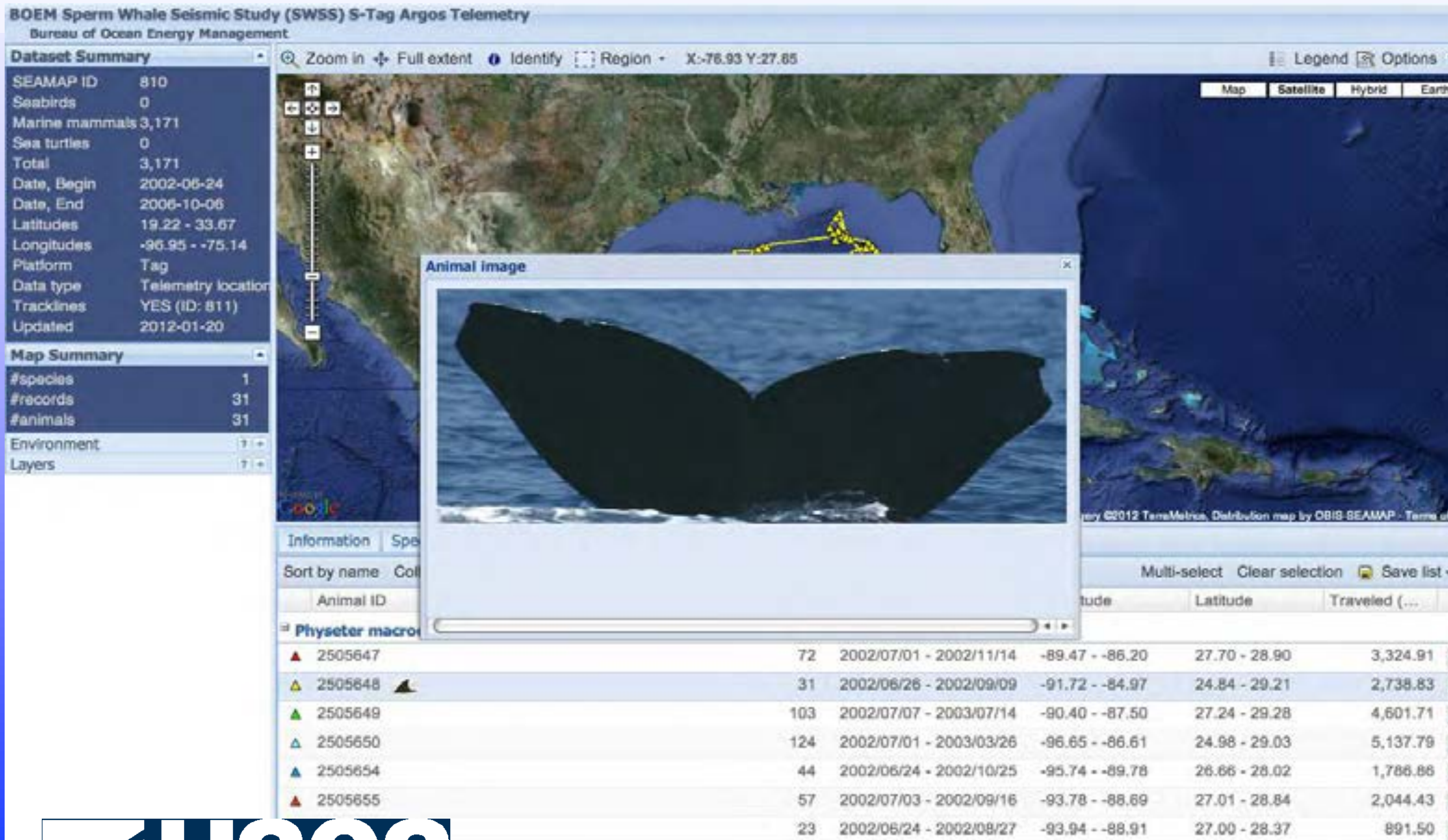


USGS
science for a changing world

OCEAN BIOGEOGRAPHIC INFORMATION SYSTEM

BOEM GoMEX Sperm Whale data

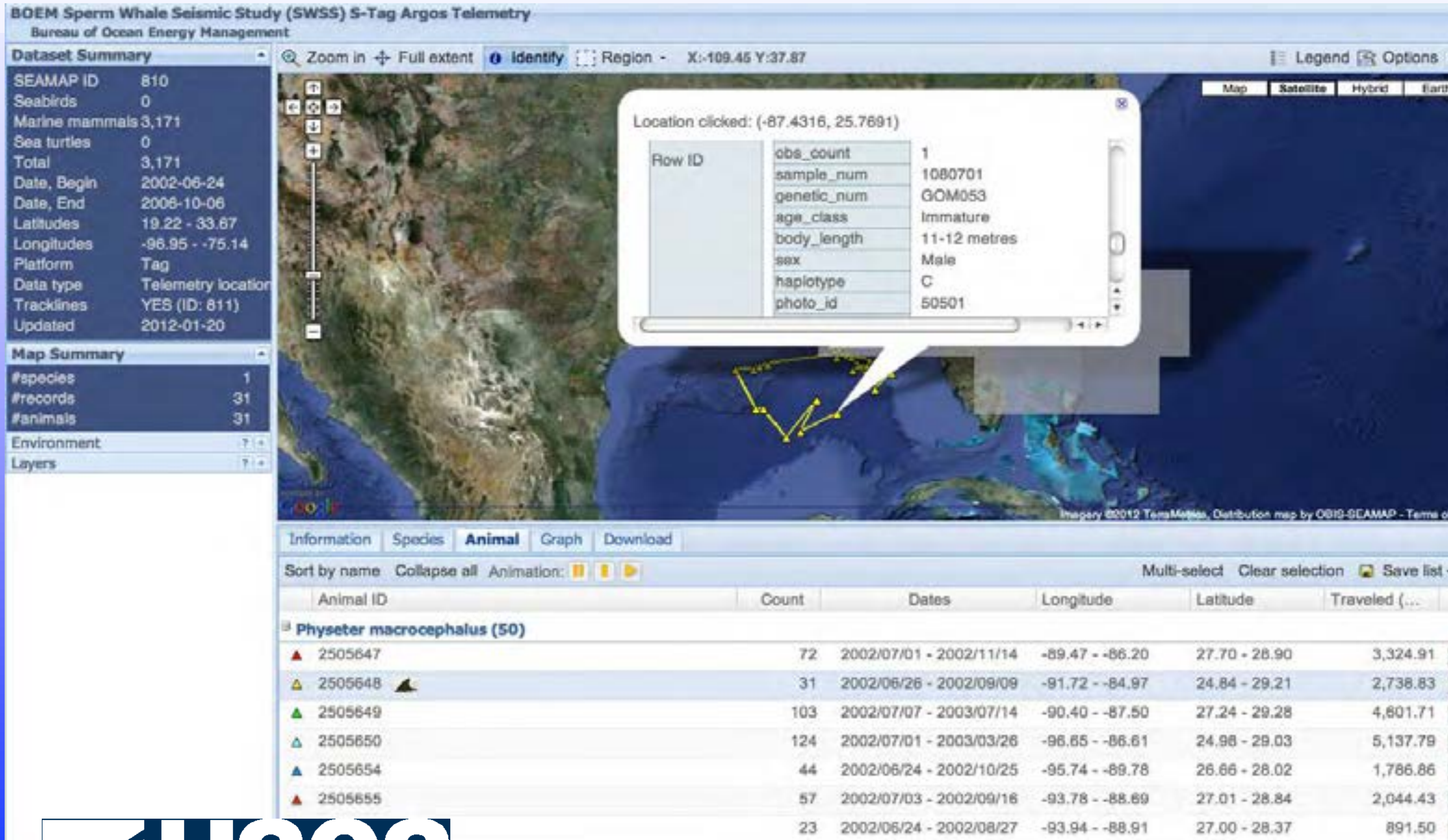
Integrated data viewer – explore S-TAG, PhotoID, Genetic data



USGS science for a changing world

BOEM GoMEX Sperm Whale data

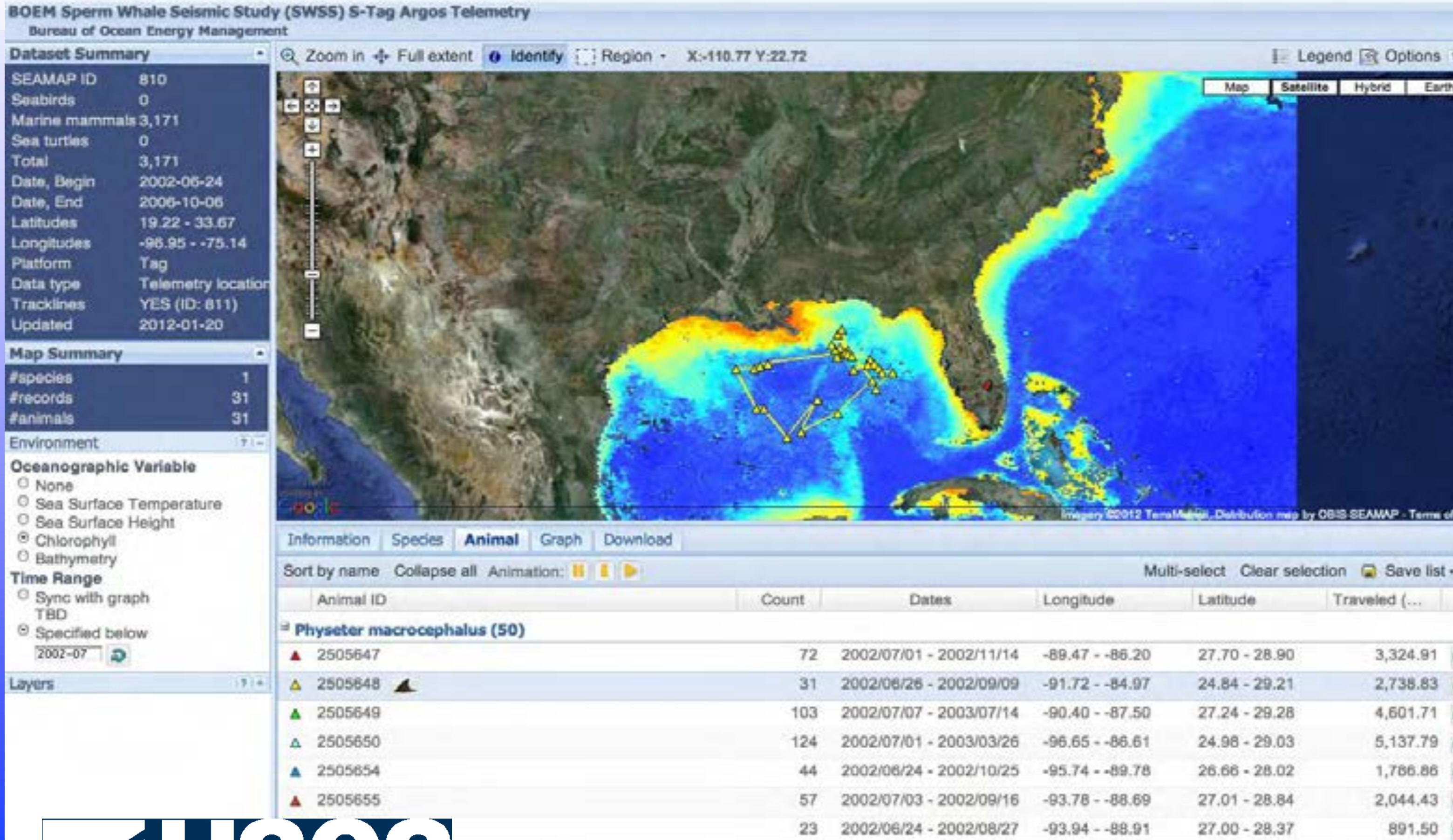
Integrated data viewer – explore S-TAG, PhotoID, Genetic data



USGS science for a changing world

BOEM GoMEX Sperm Whale data

Integrated data viewer – explore S-TAG, PhotoID, Genetic data



Application Possibilities

- Portal for BOEM data
  - Could include contextual CMSP data
- Portal focused on Atlantic WEAs
  - Animal observations
  - Distribution and density models
  - Contextual CMSP data
- Develop GIS tools for ESRI model builder including OBIS data extraction
  - Using existing OBIS-USA ERDDAP client
  - Marine Geospatial Ecology Tools (MGET) package

Conclusions

- Enrollment in OBIS-USA / SEAMAP
    - Standards-accessible Content and Services
    - Original data and contacts readily accessible
    - Benefits of Rich Metadata
    - Follow-through to NODC
- Multiple output applications
    - Reliable data meaning for applications
    - Customized service development – various queries, output formats and client applications
    - Integration into thematic portals
    - Integration into distribution, density models, future model frameworks ...

Presentation #22

NOAA/NCCOS Biogeography Statistical Modeling of Seabird Distributions

Brian Kinlan

brian.kinlan@noaa.gov

Collaborators:

Chris Caldow (Chief, NOS/NCCOS/CCMA Biogeography Branch)

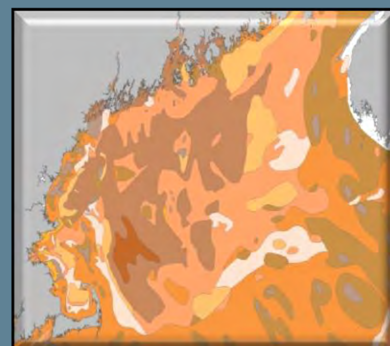
Allan O'Connell, Elise Zipkin (USGS Patuxent Wildlife Research Center)

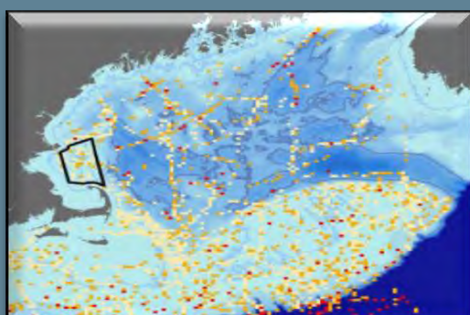
Mark Wimer, Allison Sussman (USGS Patuxent Wildlife Research Center)

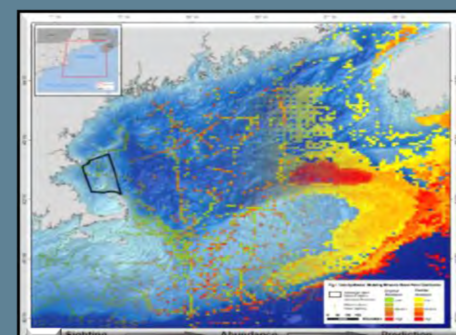
All opinions expressed in this talk are those of the lead author and do not necessarily reflect the opinions of NOAA, project funders, or project partners.

NOAA's Biogeography Branch

Mission: To develop information and analytical products through research, monitoring, and assessment on the distribution and ecology of living marine resources and their associated habitats







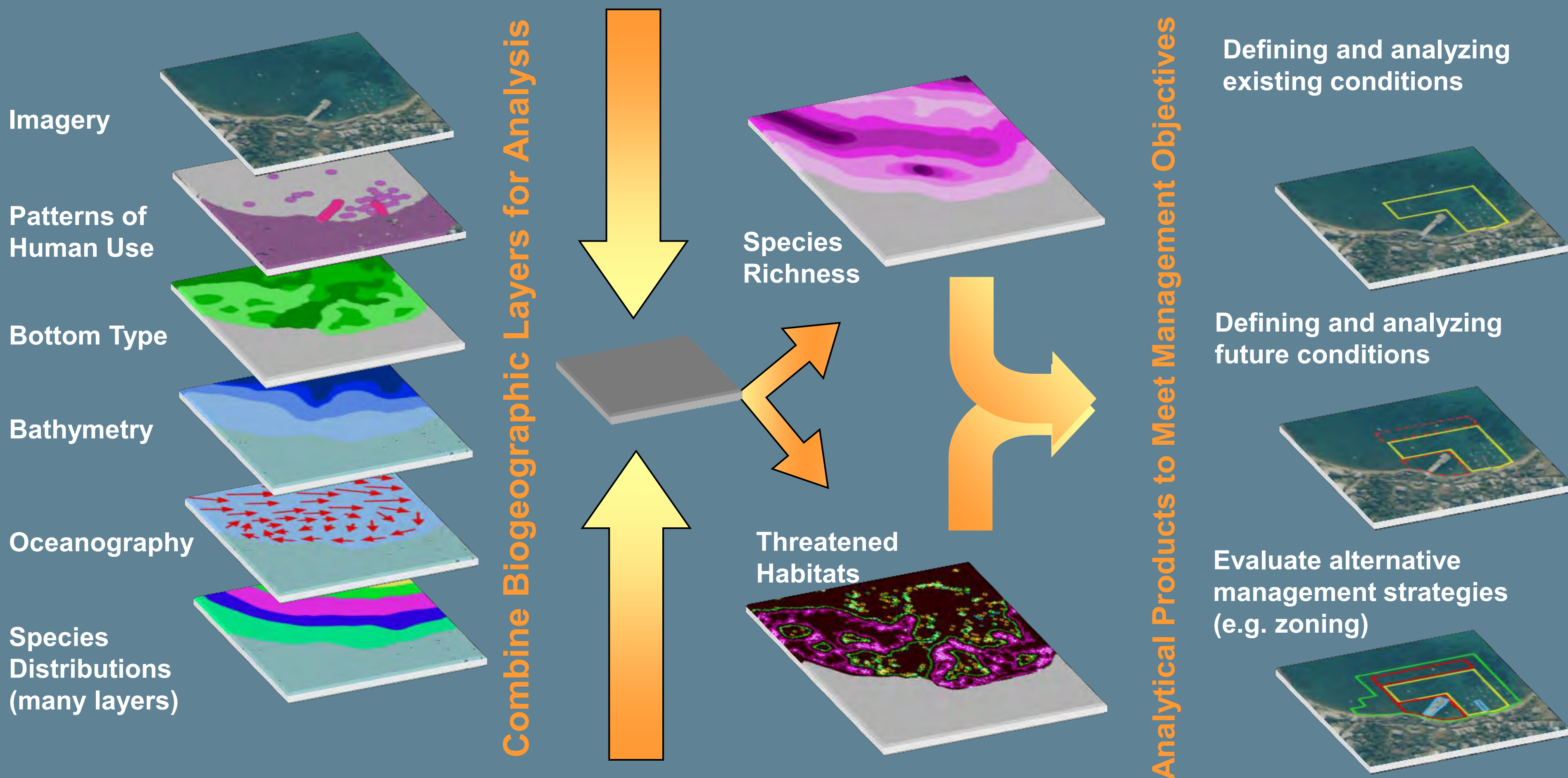
Biogeographic Assessment Approach

Biogeographic Data Layers

Example Integrated Biogeographic Analyses*

* Specific analyses targeted to management needs

Products to Aid Management



Objective: provide spatially explicit information to aid site selection and environmental assessment for offshore wind

Photo credit: David Pereksta, BOEM

Risk assessment framework

1. What species of birds are present in the vicinity of a wind farm and how many? (**Exposure**)

2. What is the per capita probability of an adverse effect of wind farms on birds of a given species, given that they are present in the area? (**Species-Specific Hazard** or **Sensitivity**)

3. How much are the potential adverse impacts from combining (1) and (2) likely to impact the population of each species, given its current status, trends, and ecological traits? (**Population Vulnerability**)

Modified from the Crichton (1999) definition: **"Risk is the probability of a loss, and depends on three elements, hazard, vulnerability and exposure."**

Crichton, D. (1999) The risk triangle, in Ingleton, J. (ed.), *Natural Disaster Management*, Tudor Rose, London, pp 102-103.

Outline:

1. Climatological Mapping/Modeling

a. Past work: NY Bight Modeling

b. Current work: Mid-Atl. Predictive Modeling

2. Power Analysis and Sampling Design

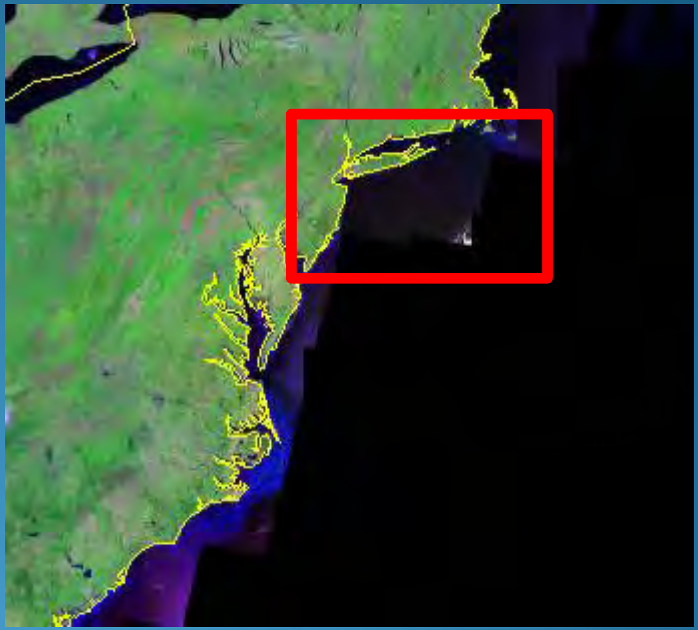
Prior work (2010-2012): Predictive Modeling of Seabirds in NY Bight

Collaboration with New York's Department of State (DOS) to collect and interpret ecological information needed by DOS to:

- Use when considering offshore renewable energy development proposals,

- Advance the protection of critical offshore habitats, and

- Support an Amendment to NY's Coastal Management Program.



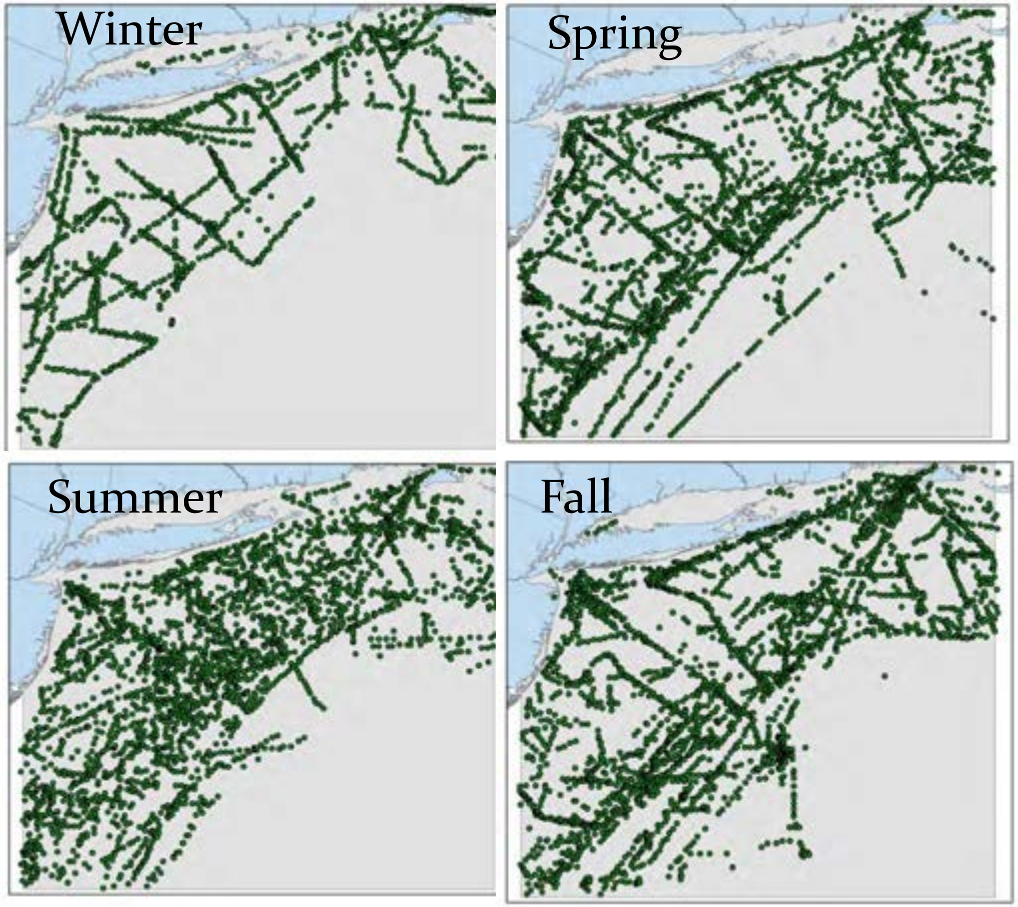
NOS Technical Memorandum:

Kinlan, B.P., C. Menza, and F. Huettmann. 2012. Predictive Modeling of Seabird Distribution Patterns in the New York Bight.

Chapter 6 in C. Menza, B.P. Kinlan, D.S. Dorfman, M. Poti and C. Caldow (eds.). A Biogeographic Assessment of Seabirds, Deep Sea Corals and Ocean Habitats of the New York Bight: Science to Support Offshore Spatial Planning. NOAA Technical Memorandum NOS NCCOS 141. Silver Spring, MD. 224 pp.

DATA: MBO CSAP Seabird Survey 1980-1988

- Manomet Bird Observatory Cetacean and Seabird Assessment Program
- Timed shipboard visual strip transects resulting in estimates of sightings per unit effort (SPUE)
- Scattered survey locations in space/time, 1980-1988
- We focused on 43 species of seabirds, shorebirds, and waterfowl



Manomet Center for Conservation Sciences, http://www.manomet.org

Species and groups modeled

- **Modeled species individually where possible**
- **Otherwise grouped taxonomically and ecologically similar species**
- **Up to four seasonal models for each species/group: Spring, Summer, Fall, Winter**

Table 3.4. Summary of numbers of identifiable species, unidentified types, and contributions to species richness of each mapped species and group.

Species or group name	# of positively identified species in group	# of unidentified categories in group	Minimum contribution to species richness	Maximum contribution to species richness
Individually mapped species				
Black-legged Kittiwake	1	0	1	1
Common Loon	1	0	1	1
Common Tern	1	0	1	1
Cory's Shearwater	1	0	1	1
Dovekie	1	0	1	1
Great Black-backed Gull	1	0	1	1
Greater Shearwater	1	0	1	1
Herring Gull	1	0	1	1
Laughing Gull	1	0	1	1
Northern Fulmar	1	0	1	1
Northern Gannet	1	0	1	1
Pomarine Jaeger	1	0	1	1
Sooty Shearwater	1	0	1	1
Wilson's Storm-Petrel	1	0	1	1
Subtotals	***14***	***0***	***14***	***14***
Modeled species groups				
Alcids, less common	4	4	1	4
Coastal Waterfowl	7	3	1	7
Jaegers	2	1	1	2
Phalaropes	2	1	1	2
Shearwaters, less common	2	2	1	2
Small Gulls, less common	2	0	1	2
Storm-Petrels, less common	3	1	1	3
Terns, less common	7	2	1	7
Unidentified Gull	0	2	0	0
Subtotals	***29***	***16***	***8***	***29***
Non-modeled species groups				
Cormorants	2	1	1	2
Rare Visitor	10	2	1	10
Skuas, less common	1	1	1	1
Subtotals	***13***	***4***	***3***	***13***
Grand totals				
Modeled	***43***	***16***	***22***	***43***
Not modeled	***13***	***4***	***3***	***13***
All	***56***	***20***	***25***	***56***

Environmental predictors

- **Synthesized satellite, hydrographic, geological, and other databases**
- **Bathymetry, bottom substrate, oceanography, biology**
- **Seasonal climatologies of dynamic variables**
- **~1km resolution (30 arc-second)**

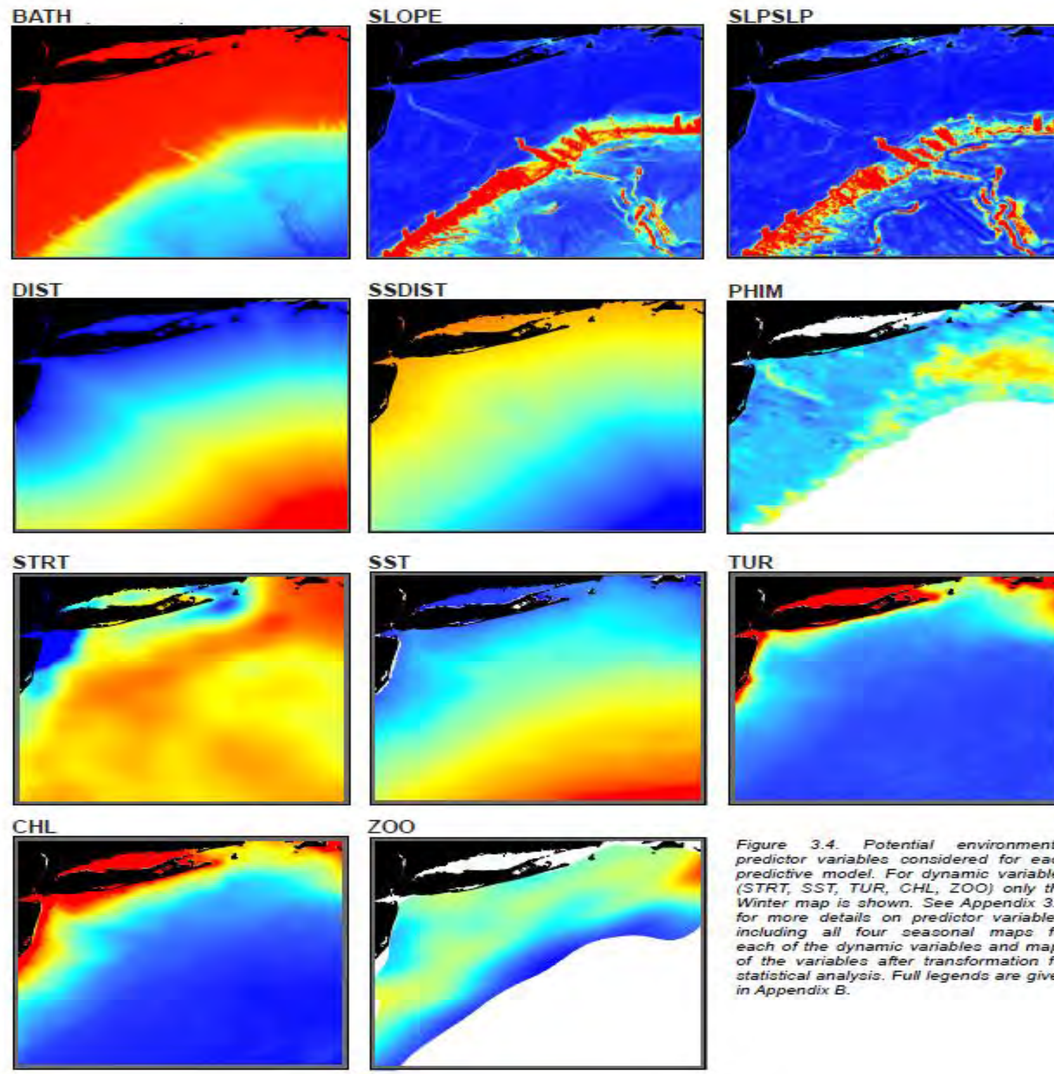


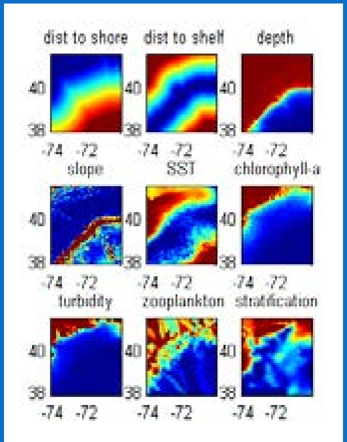
Figure 3.4. Potential environmental predictor variables considered for each predictive model. For dynamic variables (STRT, SST, TUR, CHL, ZOO) only the Winter map is shown. See Appendix 3.B for more details on predictor variables, including all four seasonal maps for each of the dynamic variables and maps of the variables after transformation for statistical analysis. Full legends are given in Appendix B.

Statistical modeling approach

Two stage regression-kriging

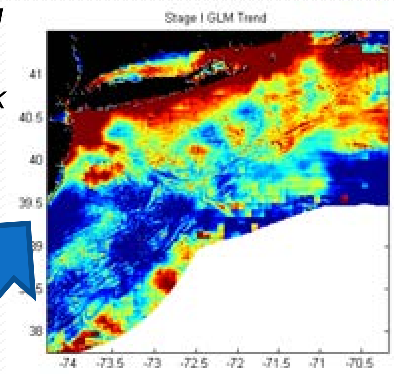
Data

Predictors



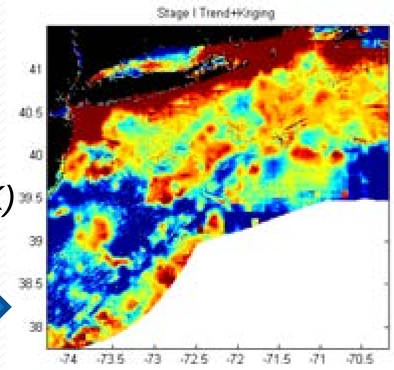
Stage I: Probability of Presence

Trend model
Binomial GLM, Logit link



Prob(Trend)

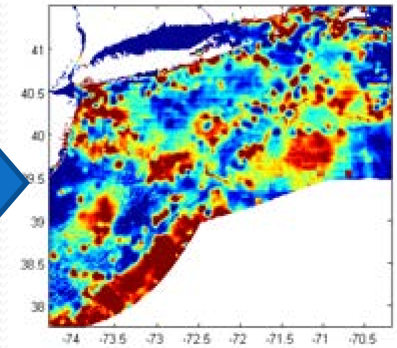
Spatial model
Indicator Kriging (IK)



Prob (Resid. | Trend)

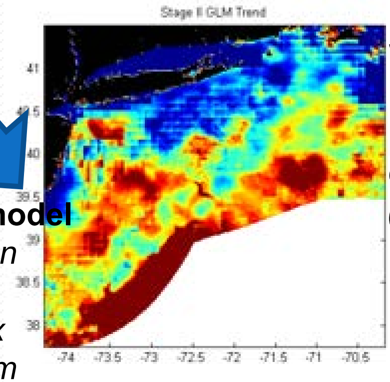
X

Predicted SPUE



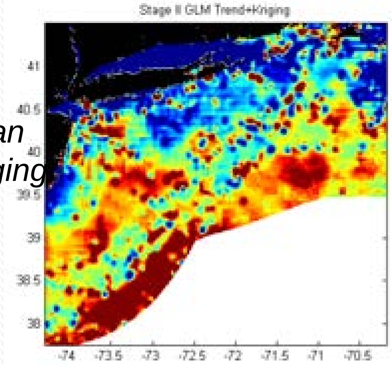
Stage II: Abundance (SPUE) if present

Trend model
Gaussian GLM, Box-Cox transform



Trend

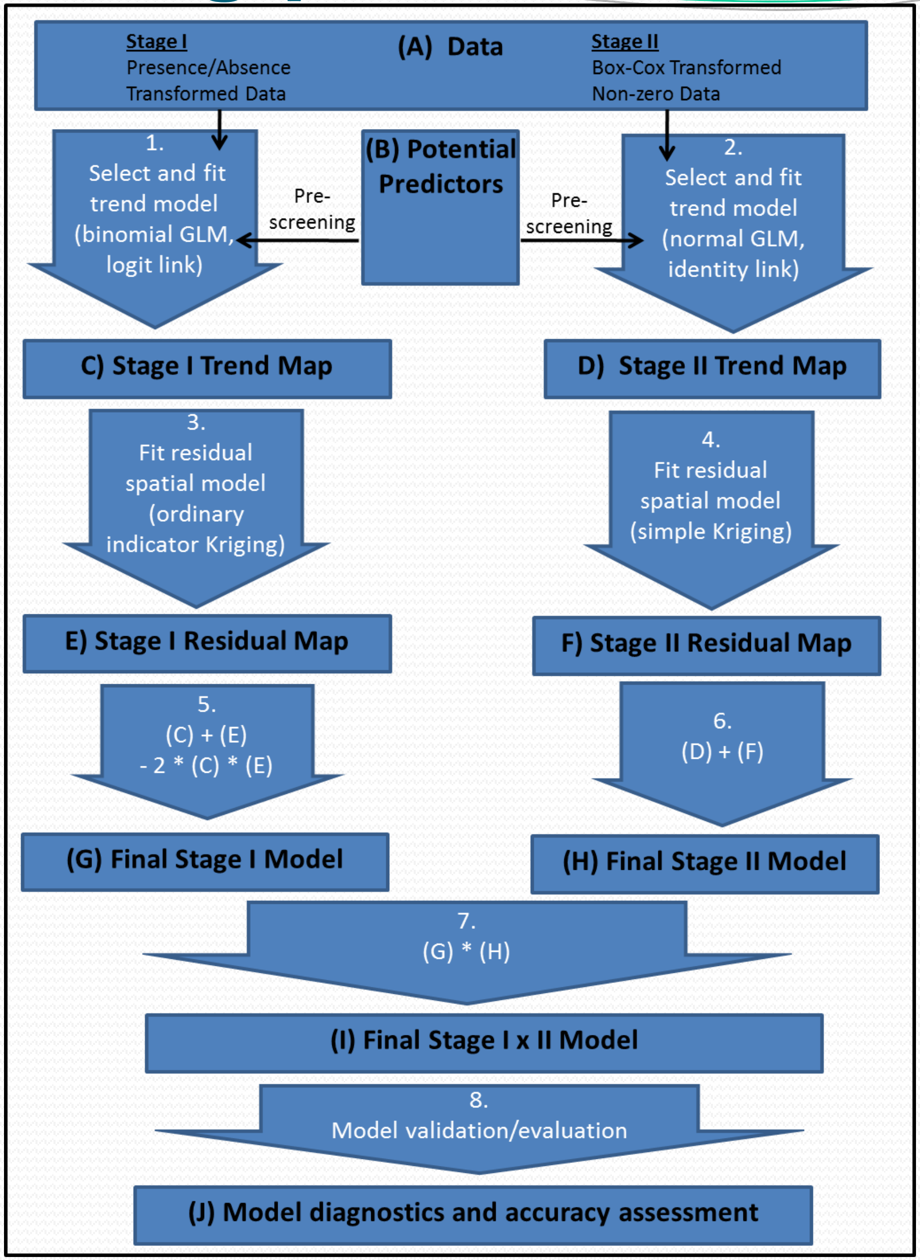
Spatial model
Transgaussian Ordinary Kriging (OK)



Trend+Residual

- Assess predictive skill with cross validation

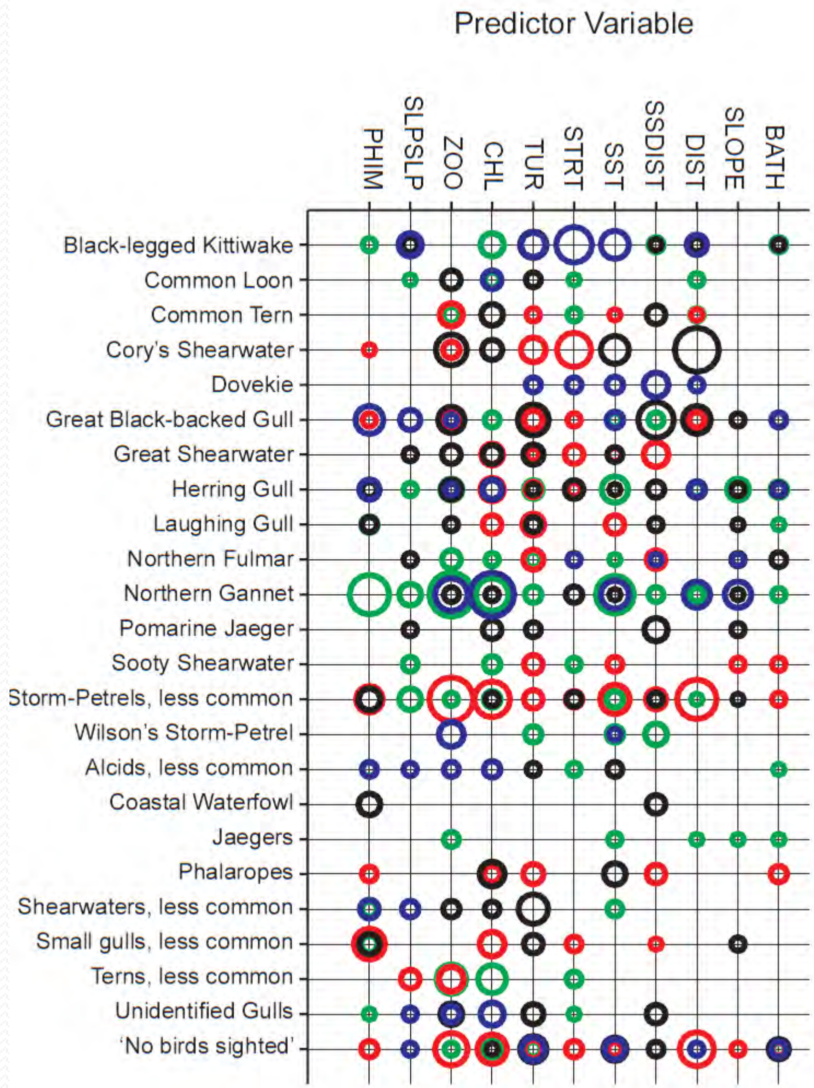
Modeling process overview



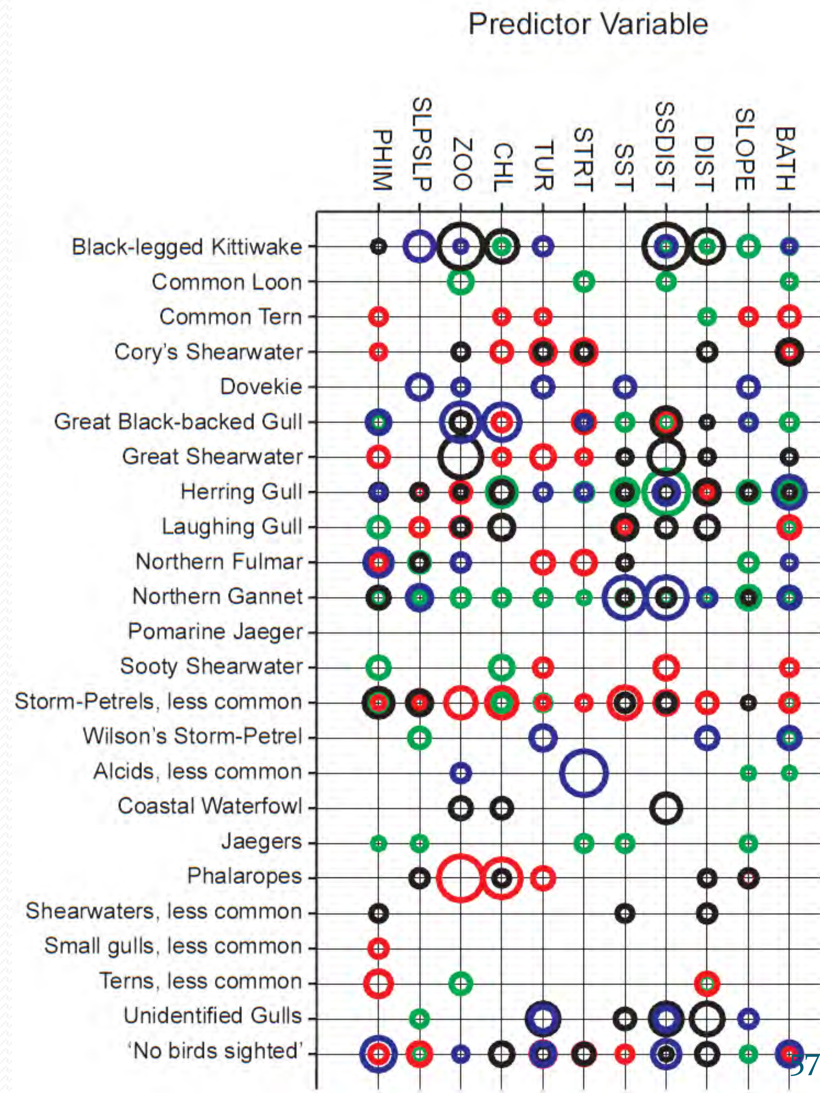
- Outputs

Predictor importances (simple slopes)

Stage I (Occurrence)

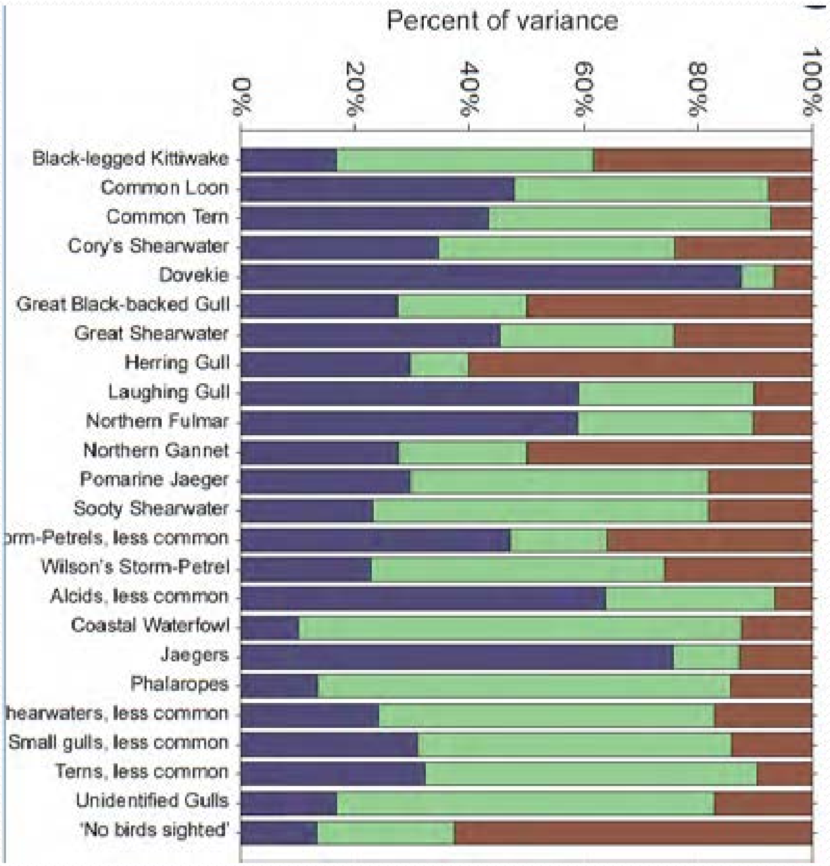


Stage II (Abundance | Present)

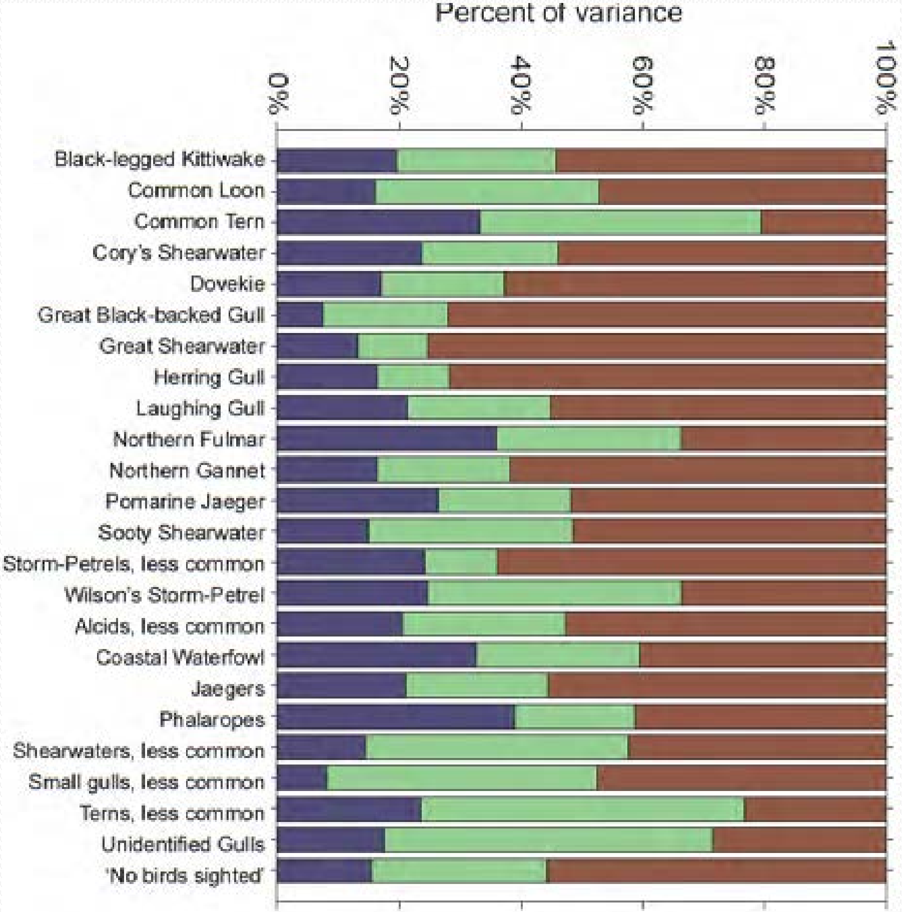


Variance partitioning

Stage I (Occurrence)



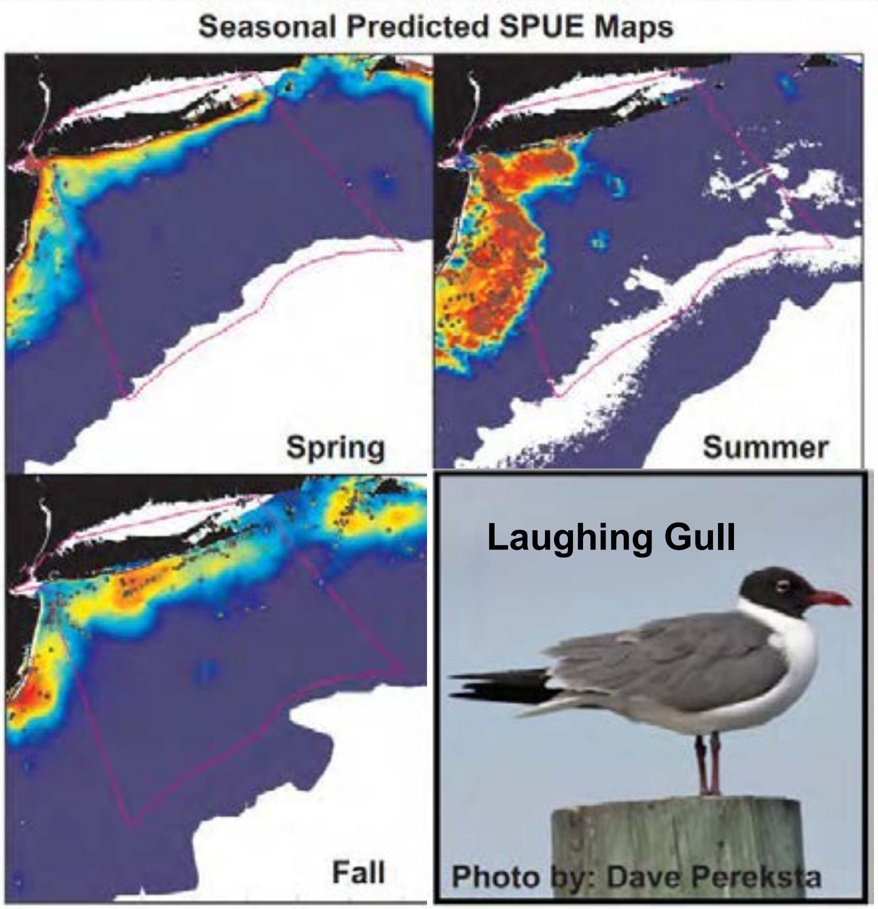
Stage II (Abundance | Present)



Species seasonal climatologies

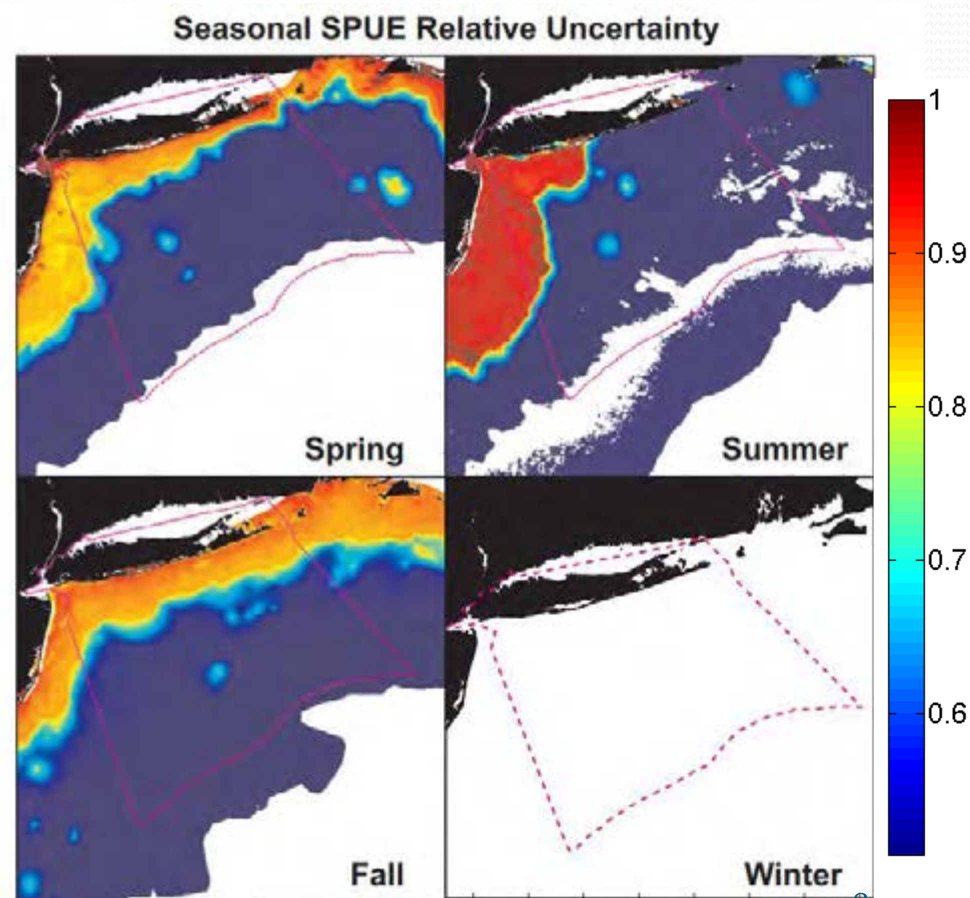
PREDICTIONS

SPUE (birds per 15 minute survey per km^2)



UNCERTAINTY

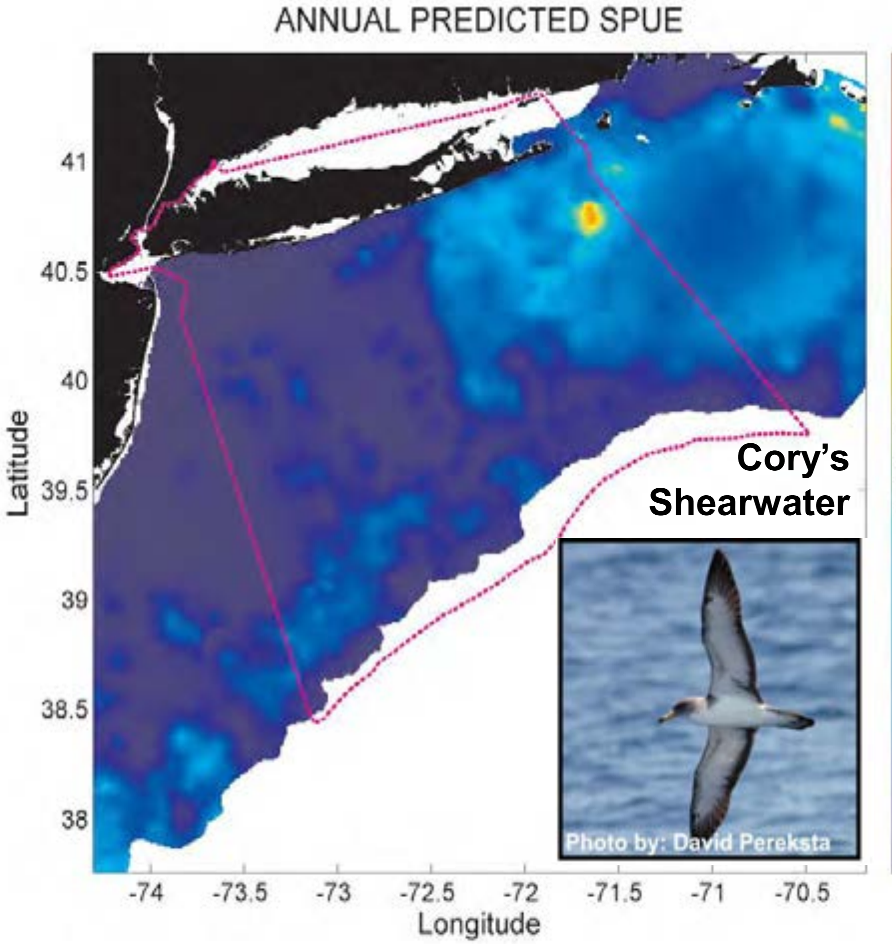
Relative units (0=perfect certainty, 1=no better than global mean)



Species annual climatologies

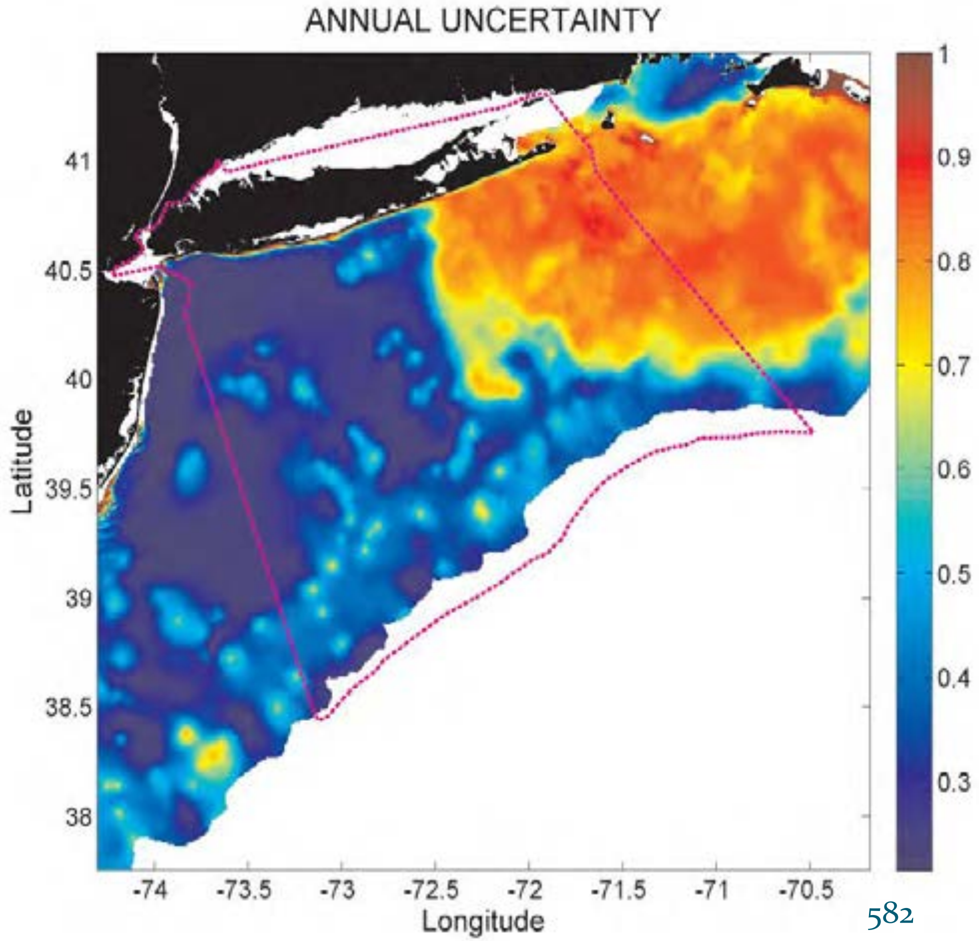
PREDICTIONS

SPUE (birds per 15 minute survey per km²)



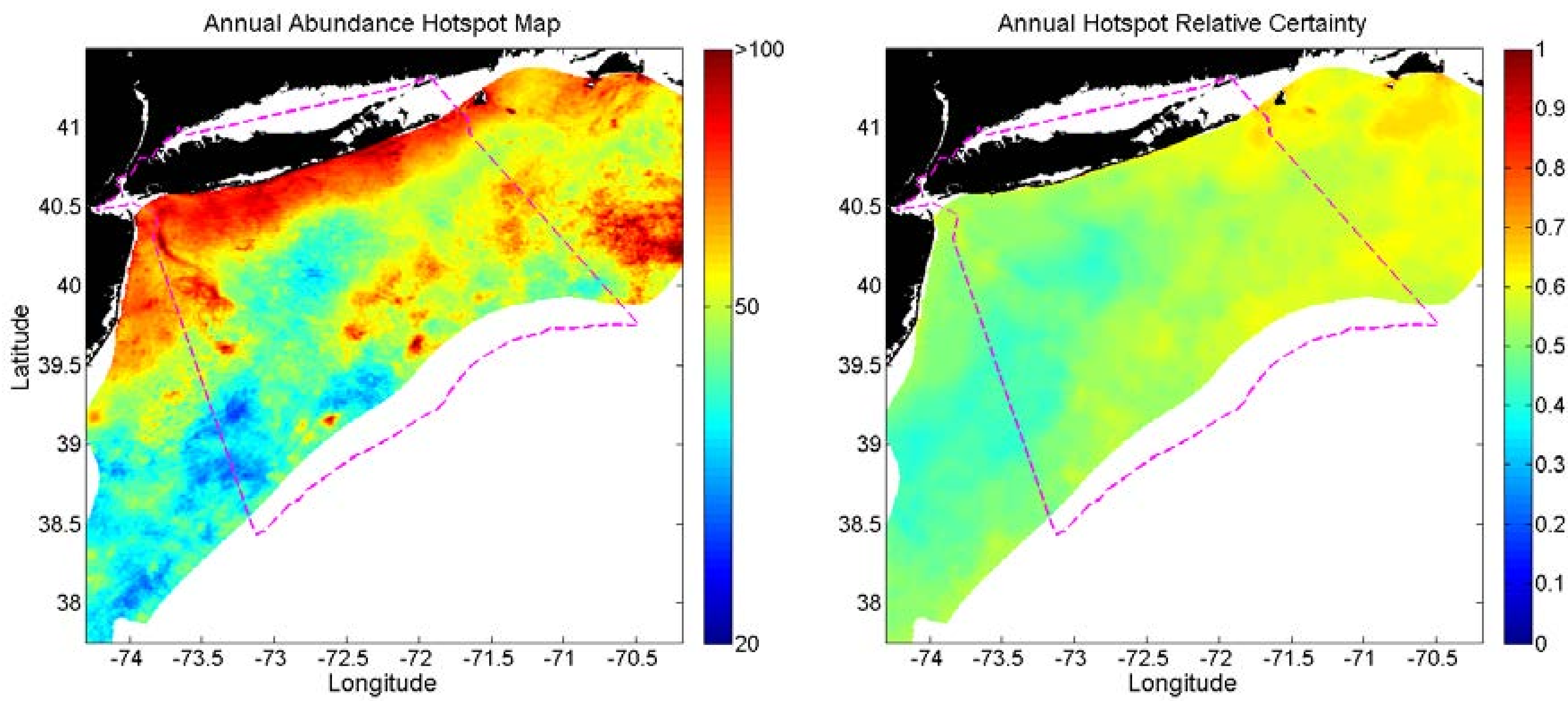
UNCERTAINTY

Relative units (0=perfect certainty, 1=no better than global mean)



“Hotspots” of total predicted abundance

PREDICTIONS **UNCERTAINTY**



Abundance “hotspot” analysis:

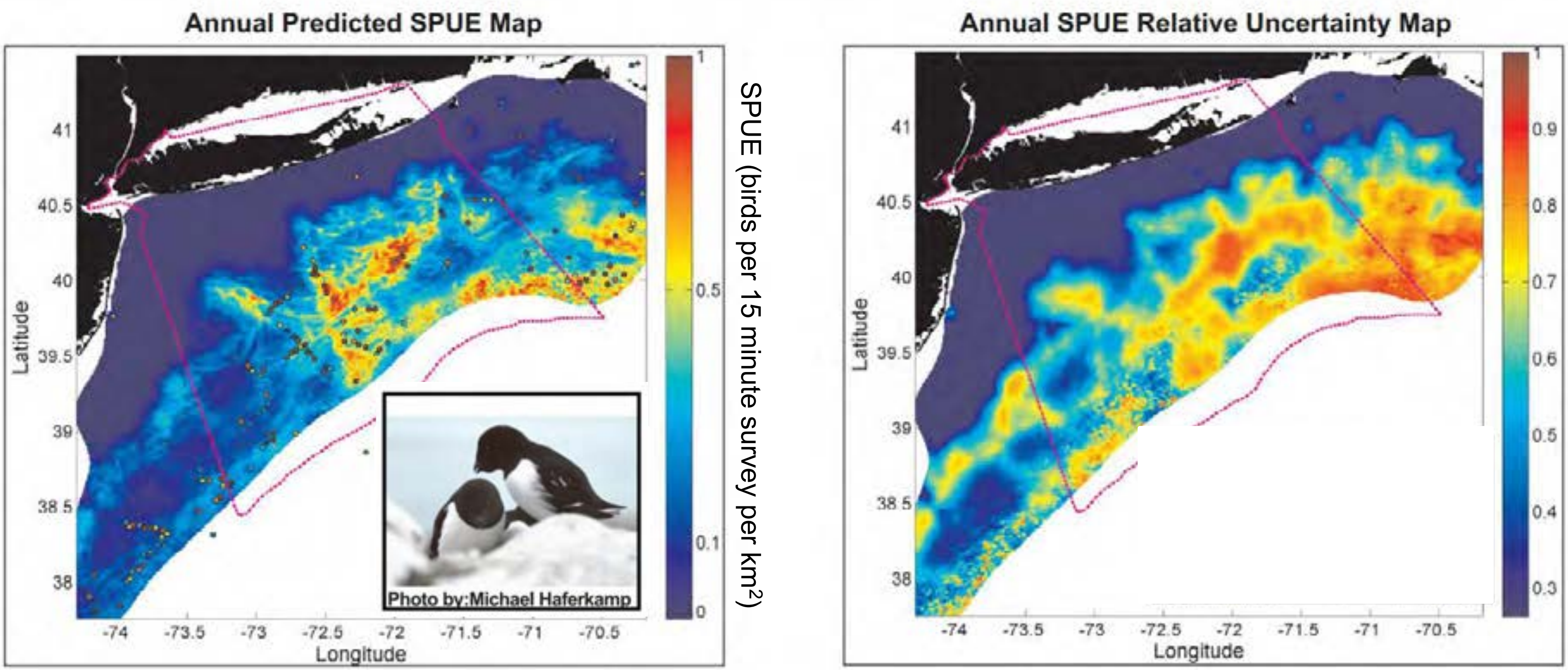
- *Summed predicted relative abundance (SPUE) over all species and groups*
- *Repeated for species richness and diversity indices*

- Uncertainty
- Model validation
- Accuracy assessment

What do the uncertainty maps mean?

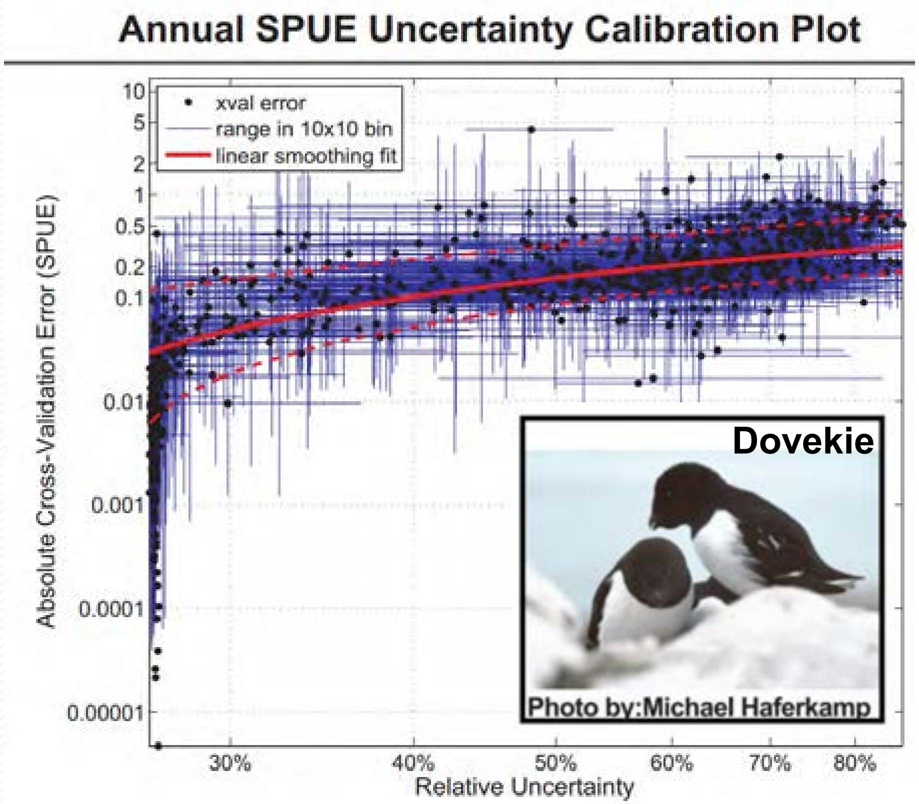
Dovekie

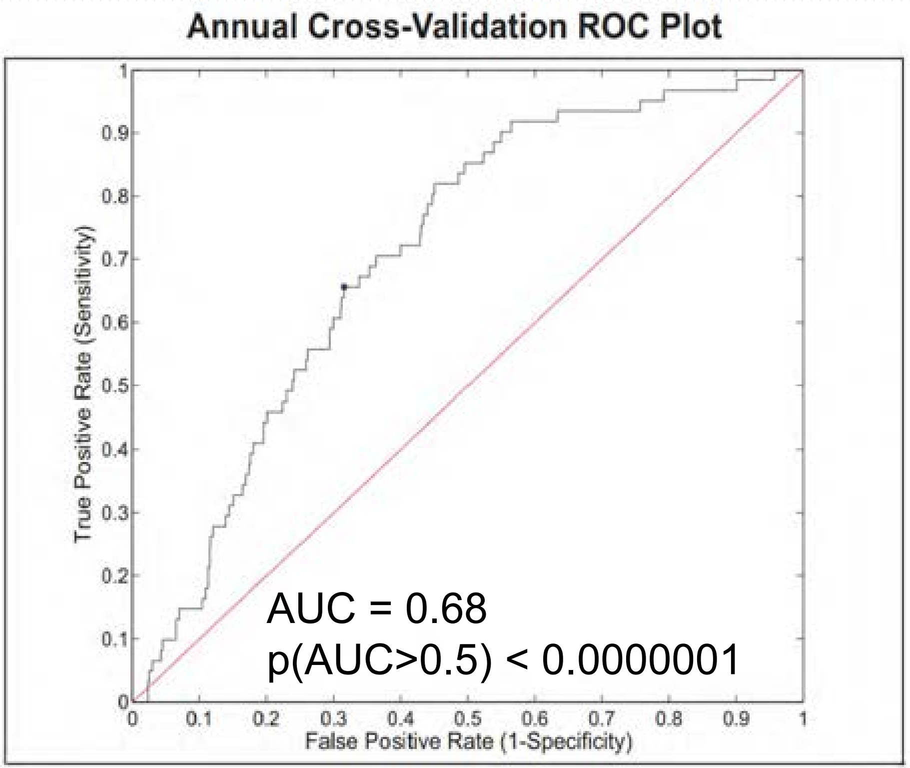
Stage I x II: Relative Abundance Predictive Model



Cross-validation model assessment

❖ Train with 50% of data, use other 50% for independent assessment of error





Diagnostic statistics

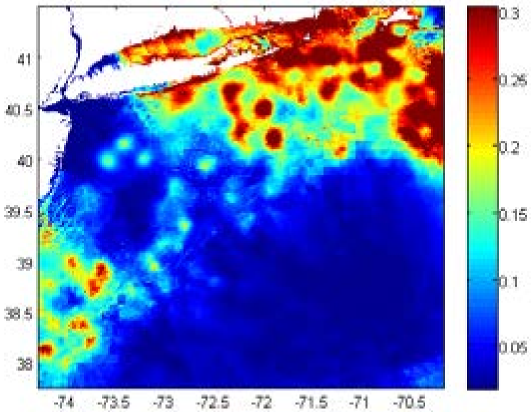
Diagnostic statistic	Description
Rank R	Spearman rank correlation coefficient of observed vs. predicted
%1SD	Percent of observations within +/- 1 standard deviation (or standard error) confidence intervals of predicted value; theoretical expectation is 68%
AUC	Area Under Curve statistic; area under the receiver operating characteric (ROC) curve
p(AUC)	p-Value for significance test of the AUC statistic
MAPE	Mean Absolute Percentage Error = mean(|obs-pred|/obs)*100%
Rel.MAE	Relative Mean Absolute Error (expressed as a % of the 90th percentile - 10th percentile range of the data)
Rel.RMSE	Relative Root Mean Square Error (expressed as a % of the 90th percentile - 10th percentile range of the data)
Rel.Bias	Relative Absolute Bias (expressed as a % of the 90th percentile - 10th percentile range of the data)
Bias Dir.	Sign (+ or -) of the Bias statistic. + indicates predicted value tends to be greater than observed value.

Table 6.7 Summmary of cross-validation diagnostic statistics for annual models.*

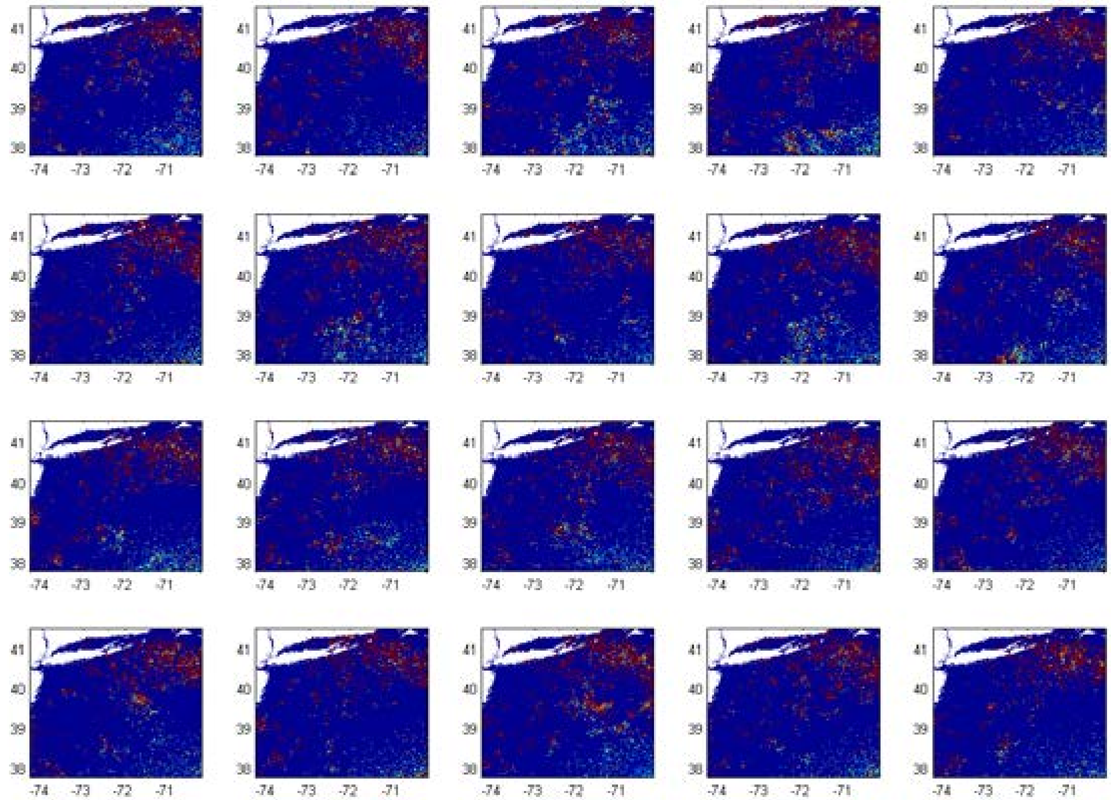
	DIAGNOSTIC STATISTICS**							
SPECIES OR GROUP NAME	Rank R	%1SD	AUC	p(AUC)	MAPE	Rel. MAE	Rel. RMSE	Rel. Bias
Species								
Black-legged Kittiwake	0.02	84.0%	0.47	0.7011	145%	44%	78%	14%
Common Loon	-0.04	33.3%	0.77	0.0000	258%	40%	67%	41%
Common Tern	0.26	46.7%	0.77	0.0000	579%	24%	34%	18%
Cory's Shearwater	0.20	78.6%	0.64	0.0000	112%	22%	69%	5%
Dovekie	0.20	62.3%	0.71	0.0000	216%	5%	15%	5%
Great Black-backed Gull	0.32	91.4%	0.77	0.0000	134%	33%	46%	7%
Great Shearwater	0.07	75.6%	0.65	0.0000	221%	27%	65%	-1%
Herring Gull	0.13	82.8%	0.56	0.3192	176%	43%	70%	-11%
Laughing Gull	0.33	76.1%	0.89	0.0000	161%	15%	28%	0%
Northern Fulmar	0.21	53.3%	0.80	0.0000	396%	60%	101%	46%
Northern Gannet	0.17	87.9%	0.64	0.0095	259%	32%	48%	0%
Pomarine Jaeger	0.30	66.7%	0.64	0.0012	590%	11%	15%	9%
Sooty Shearwater	0.28	72.4%	0.62	0.0025	135%	19%	27%	21%
Storm-Petrels, less common	0.24	61.5%	0.63	0.0072	306%	18%	25%	22%
Wilson's Storm-Petrel	0.29	75.2%	0.68	0.0000	396%	45%	95%	-17%
Mean	**0.20**	**69.9%**	**0.68**	**n/a**	**272%**	**29%**	**52%**	**11%**
Groups								
Alcids, less common	0.22	76.7%	0.59	0.0509	158%	23%	33%	26%
Coastal Waterfowl	0.20	64.3%	0.77	0.0000	395%	22%	66%	14%
Jaegers	-0.16	65.4%	0.62	0.0213	471%	13%	25%	10%
Phalaropes	0.16	70.6%	0.76	0.0000	908%	23%	77%	-9%
Shearwaters, less common	-0.05	76.5%	0.51	0.3915	156%	21%	32%	26%
Small gulls, less common	0.16	77.8%	0.72	0.0011	131%	27%	32%	34%
Terns, less common	0.52	61.9%	0.67	0.0047	874%	26%	39%	28%
Unidentified Gulls	0.14	56.8%	0.62	0.0173	291%	21%	27%	26%
Mean	**0.15**	**68.7%**	**0.66**	**n/a**	**423%**	**22%**	**41%**	**19%**

Ensemble spatial simulation

Mean

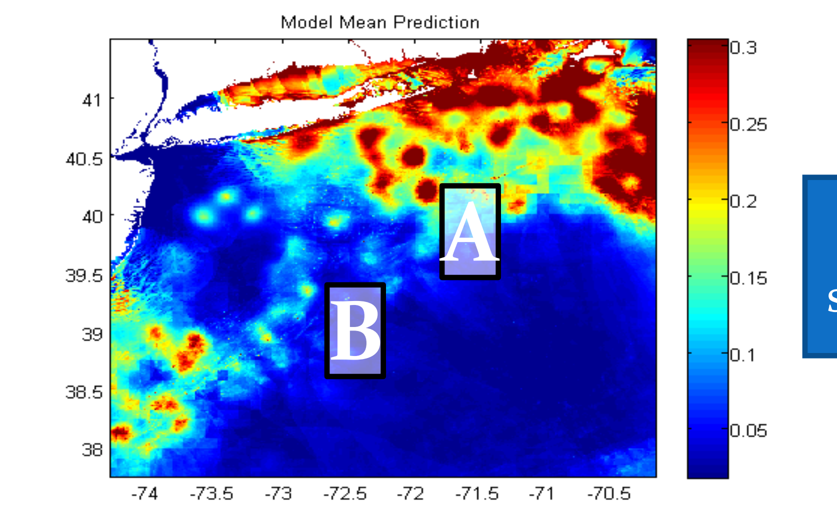


Simulated ***ensemble****:*



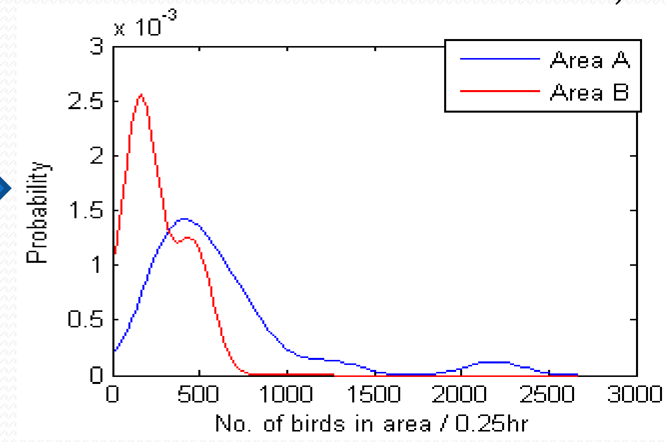
20 equally probable "realizations" of the true species distribution, generated using a ***stochastic spatial simulation*** *algorithm called conditional sequential Gaussian simulation*

Propagating uncertainty through management & decision-making processes



Spatial simulation

Probability distribution
Sum of bird abundance in A, B

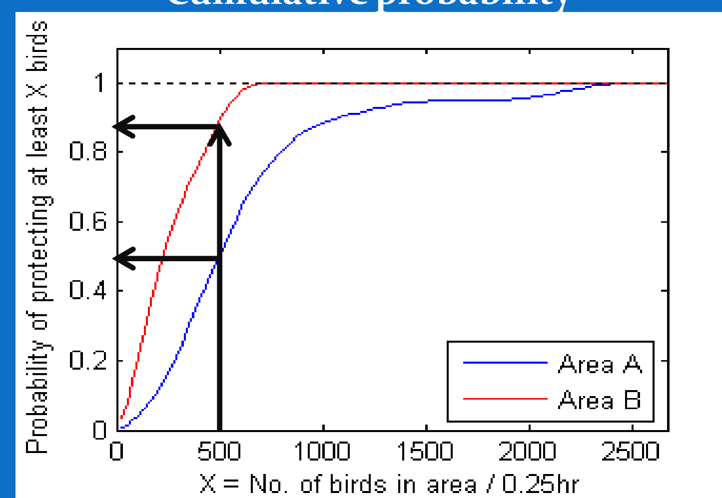


What is the probability of achieving a given management target?

<u>50% chance that area A</u> *would be found to contain 500 or more birds*

<u>85% chance that area B</u> *would be found to contain 500 or more birds*

Cumulative probability



Summary

- Predictive modeling can produce **continuous, statistically consistent maps** from discontinuous, spatially biased data
  - Maximizes value of data by incorporating relationships with environmental predictors & spatial autocorrelation
- **Fine-scale** predictions are possible
  - But uncertainty needs to be characterized
- Identifies **long-term average spatial patterns** in bird distribution
- **Uncertainty** can be quantified and dealt with
  - Quantitative uncertainty maps
  - Spatial ensemble simulation methods → risk models
- **Caveats:**
  - Temporal change
  - Data quality
  - Detectability not incorporated

Outline:

1. Climatological Mapping/Modeling

a. Past work: NY Bight Modeling

b. Current work: Mid-Atlantic Predictive Modeling

2. Power Analysis and Sampling Design

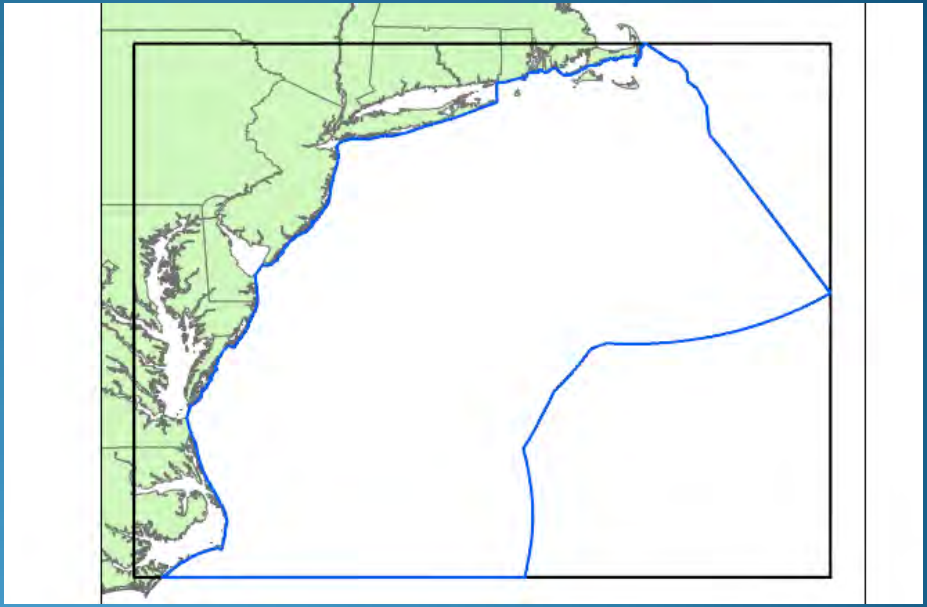
Current work (2011-2014): Predictive Modeling of Seabirds in the Mid-Atlantic

BOEM-funded collaboration with USGS Patuxent Wildlife Research Center to:

• Develop predictive spatial models of long-term average patterns of seabird abundance and occurrence in the Mid-Atlantic Bight,

• Validate products and characterize uncertainty

• Provide useful map products to support offshore wind siting and environmental assessment

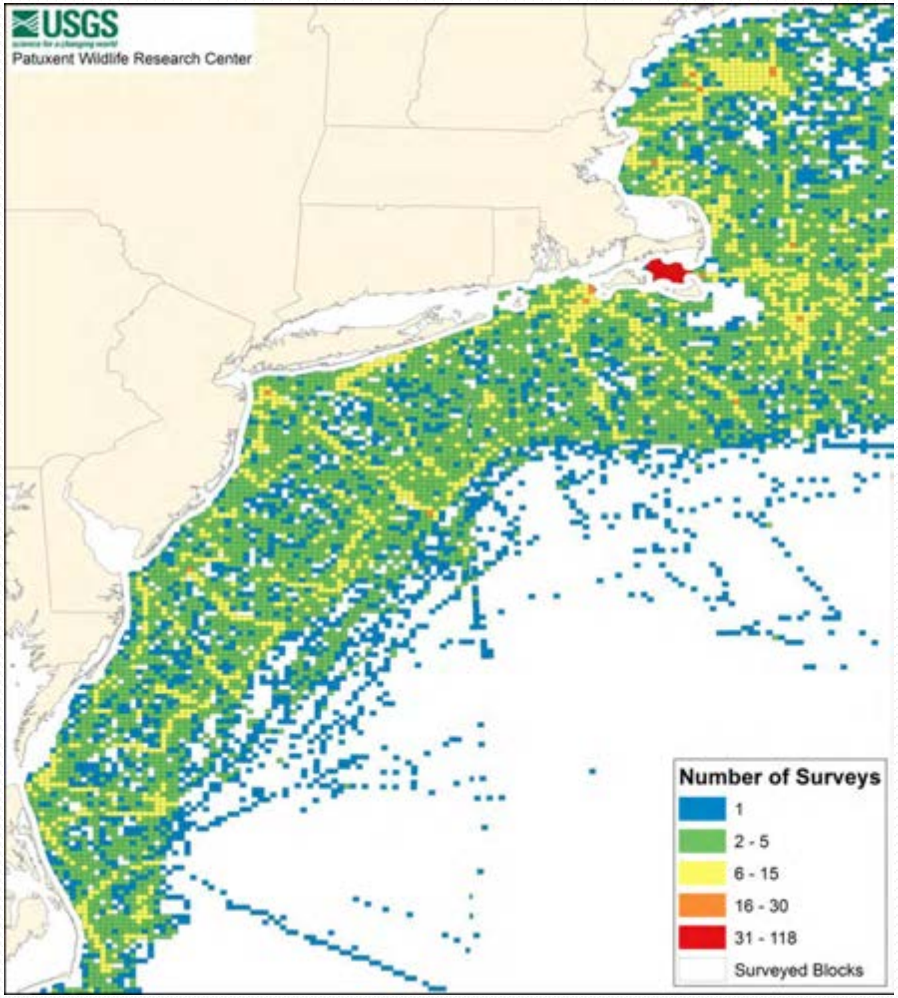


Collaboration between USGS and NOAA: Allan O’Connell (USGS), Beth Gardner (NC State), Mark Wimer (USGS)

Project started Fall 2011, ongoing

The Atlantic Seabird Compendium

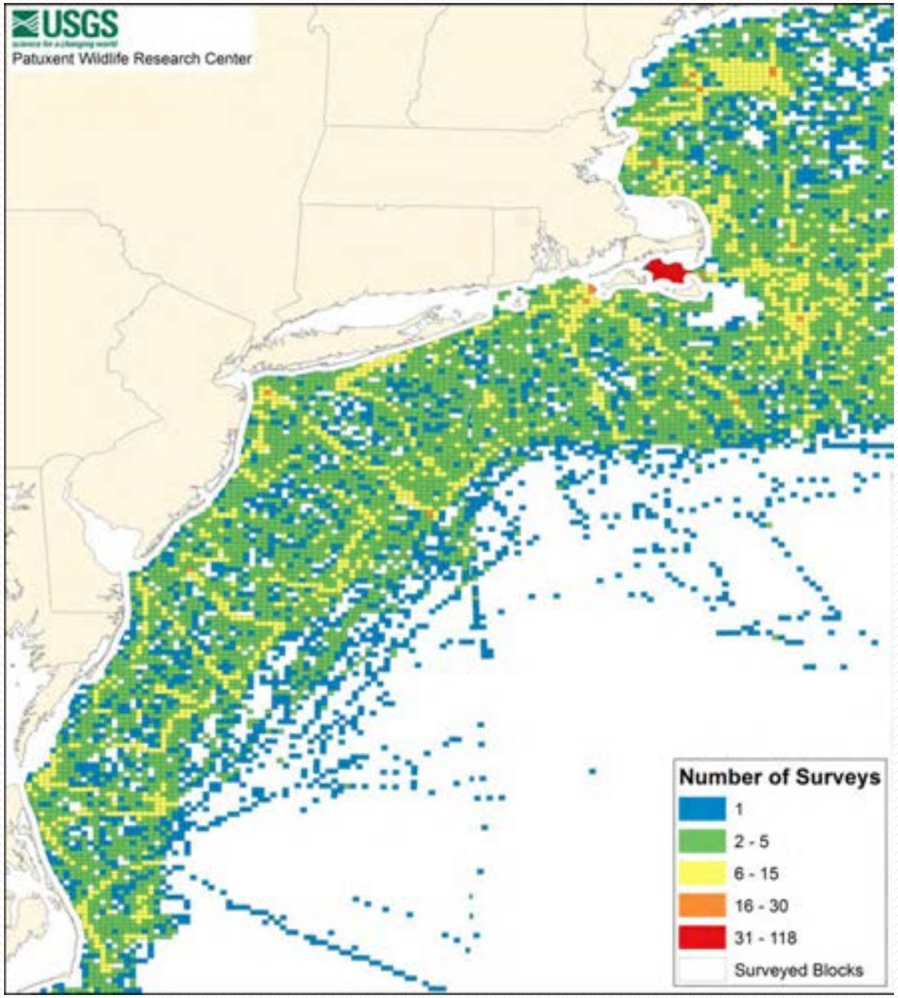
- >250,000 seabird observations from U.S. Atlantic waters
- >80 datasets Collected from 1978 through 2011
- Data collected using a mix of methods including non-scientific approaches



The Atlantic Seabird Compendium

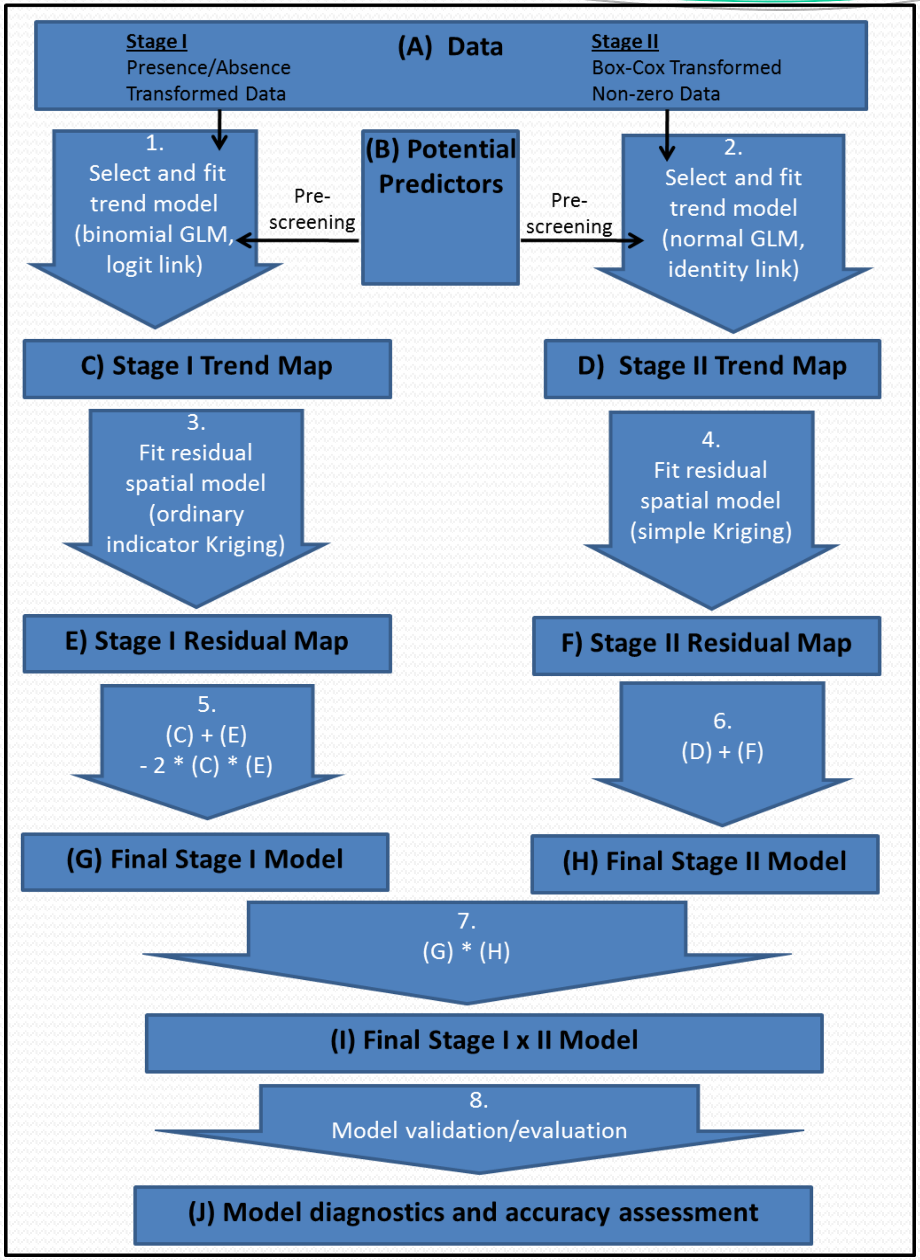
For modeling purposes:

- 32 scientific data sets – 28 ship-based, 4 aerial
- Transects were standardized to 4.63km
- 44,176 survey transects representing 463 species



Modeling process overview

Incorporate additional environmental predictors (e.g., front probability, upwelling, Lagrangian Coherent Structures, zooplankton and forage species abundance where possible



Standardize surveys to common effort unit

Incorporate different error terms and weights for different surveys and surveys/species?

Incorporate detectability from small-scale modeling results (Beth Gardner-NC State work)?

Outline:

1. Climatological Mapping/Modeling

    a. Past work: NY Bight Modeling

    b. Current work: Mid-Atl. Predictive Modeling

2. Power Analysis and Sampling Design

Current work (2012-2013): Sampling Design / Power Analysis for Seabird Surveys

BOEM-funded project led by NOAA/NCCOS

Collaboration with USGS Patuxent Wildlife Research Center

- Develop methodology for simulation-based power analysis of seabird survey sampling designs

- Focus on detecting hotspots/coldspots of occurrence and abundance in a lease block grid

- Validate and demonstrate on USGS Avian Compendium and USFWS Seaduck Survey datasets

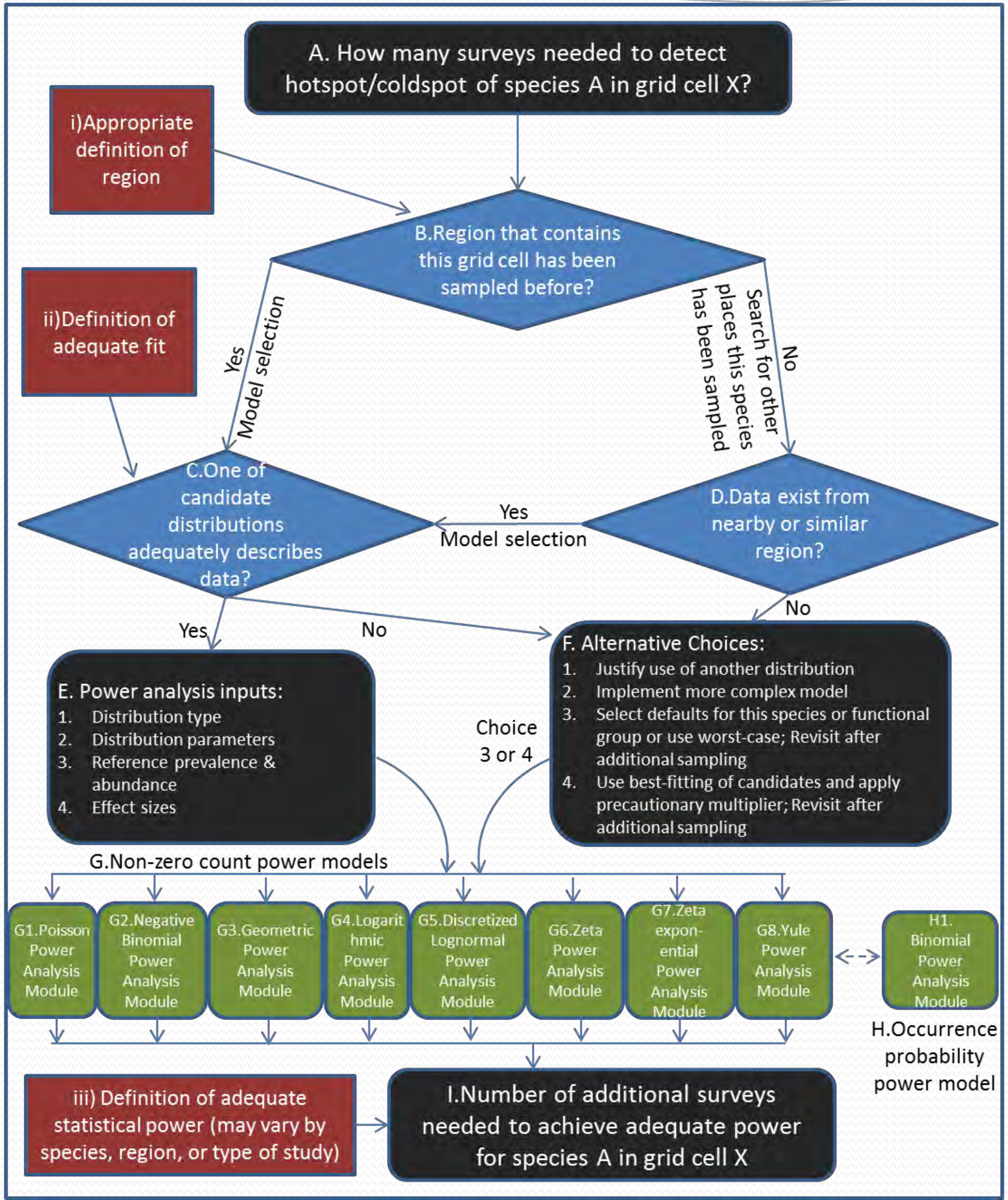
Project leads: Brian Kinlan, Chris Caldow (NOAA/NCCOS)

Collaborators: Allan O'Connell (USGS), Elise Zipkin (USGS), Mark Wimer (USGS), Allison Sussman (USGS)

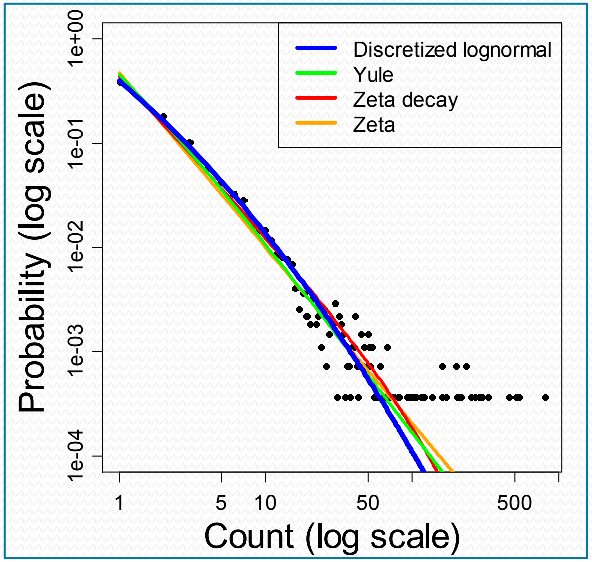
Seaduck application: Emily Silverman (USFWS), Jeffery Leirness (USFWS)

Project started January 2012, results expected late 2012

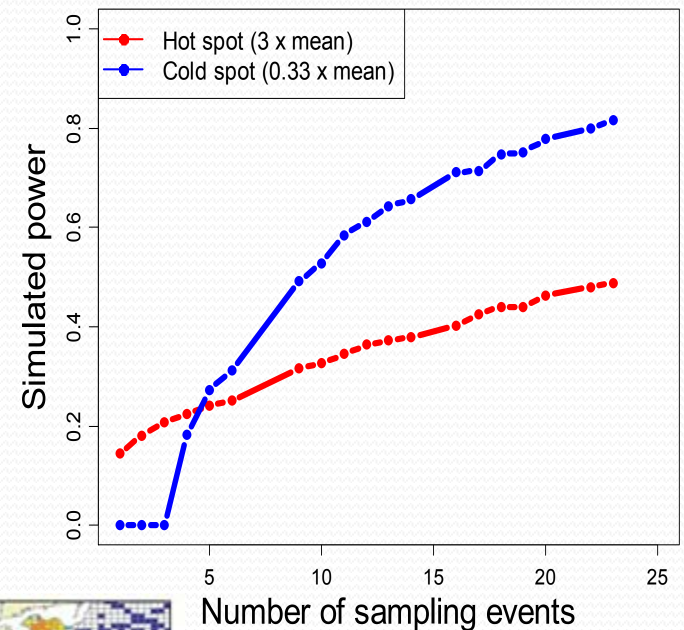
How many surveys?



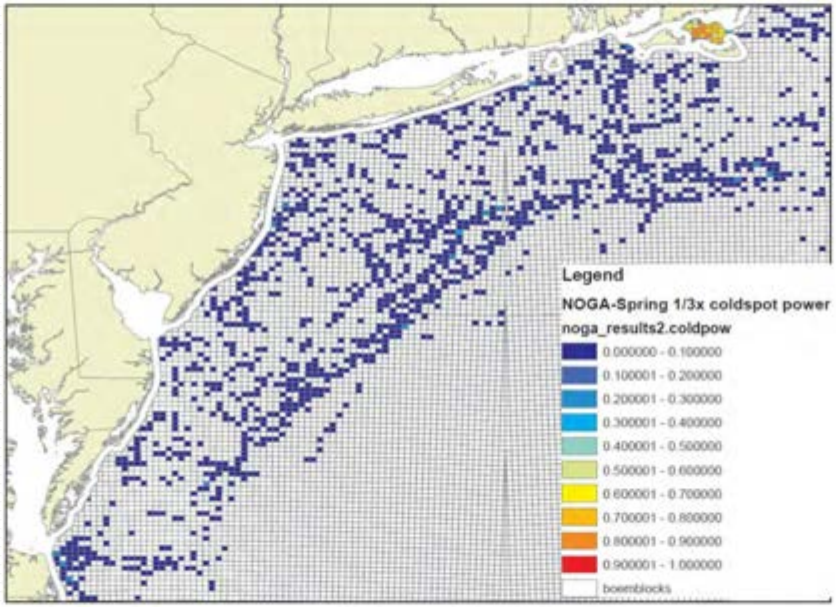
Model selection



Power curves



Power Maps



Acknowledgements

New York Bight Seabird Assessment

Charlie Menza (NOAA Biogeo)
Chris Caldow (NOAA Biogeo)
Mark Monaco (NOAA CCMA/Biogeo)
Falk Huettmann (UA-Fairbanks)
Jeff Herter (NYDOS)
Greg Capobianco (NYDOS)
& others

Data:
Manomet Bird Observatory
The Nature Conservancy

Funding:
New York Department of State; NOAA

Mid-Atlantic Predictive Modeling Project

Allan O'Connell (USGS-Patuxent)
Andrew Gilbert (BRI)
Beth Gardner (NC State)
Mark Wimer (USGS Patuxent)
Allison Sussman (USGS Patuxent)
Charlie Menza (NOAA Biogeo)
Chris Caldow (NOAA Biogeo)
Tom McGrath (NOAA Biogeo)
& others

Data :
Atlantic Seabird Survey Compendium

Funding:
BOEM, USGS

Sampling Design/Power Analysis Project

Elise Zipkin (USGS-Patuxent)
Allan O'Connell (USGS-Patuxent)
Diana Rypkema (NOAA Hollings Scholar)
Emily Silverman (USFWS)
Jeffery Leirness (USFWS)
Mark Wimer (USGS Patuxent)
Allison Sussman (USGS Patuxent)
& others

Data :
Atlantic Seabird Survey Compendium

Funding:
BOEM, USGS

Brian.Kinlan@NOAA.gov 301-713-3028 x157

BIOGEOGRAPHY BRANCH
CENTER FOR COASTAL MONITORING AND ASSESSMENT

Consolidated Safety Services
Scientific Minds. Common Sense Solutions.

Presentation #23

Avian Surveys for the Rhode Island Ocean Special Area Management Plan

Kristopher J. Winiarski, Peter W.C. Paton, Scott R. McWilliams, and David Miller
Department of Natural Resources Science, University of Rhode Island, Kingston, RI 02881

SILVER SPRINGS, MARYLAND
JULY 2012

CRMC
COASTAL RESOURCES MANAGEMENT COUNCIL

UNIVERSITY OF
Rhode Island

Avian studies for RI Ocean SAMP

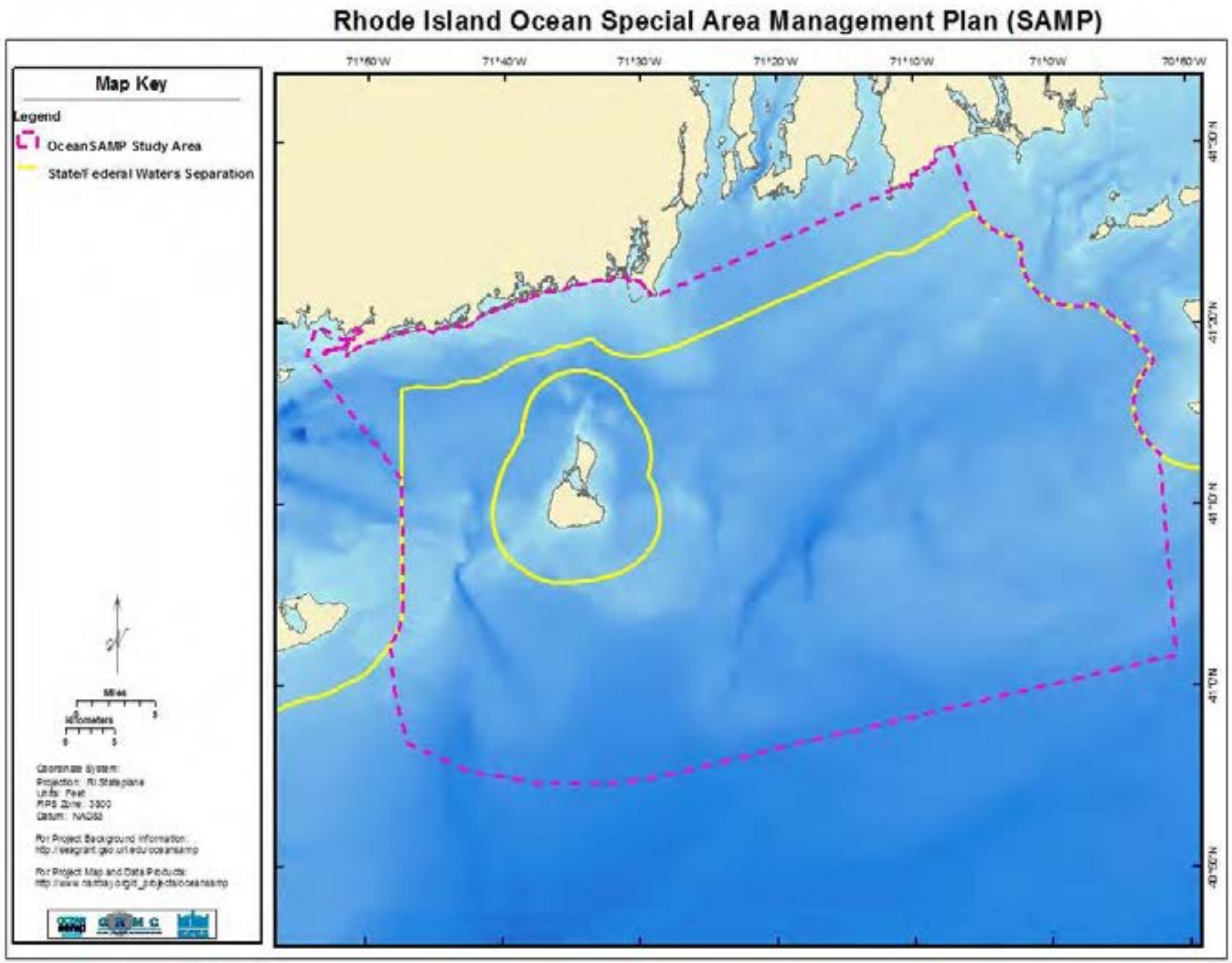
- **Goal:** Assess current spatial and temporal patterns of avian abundance and movement ecology within Ocean SAMP study area boundaries.

- **Primary Objectives:**

  1) Assess temporal variation (seasonal and annual) in avian spatial distribution and abundance in Ocean SAMP study area.

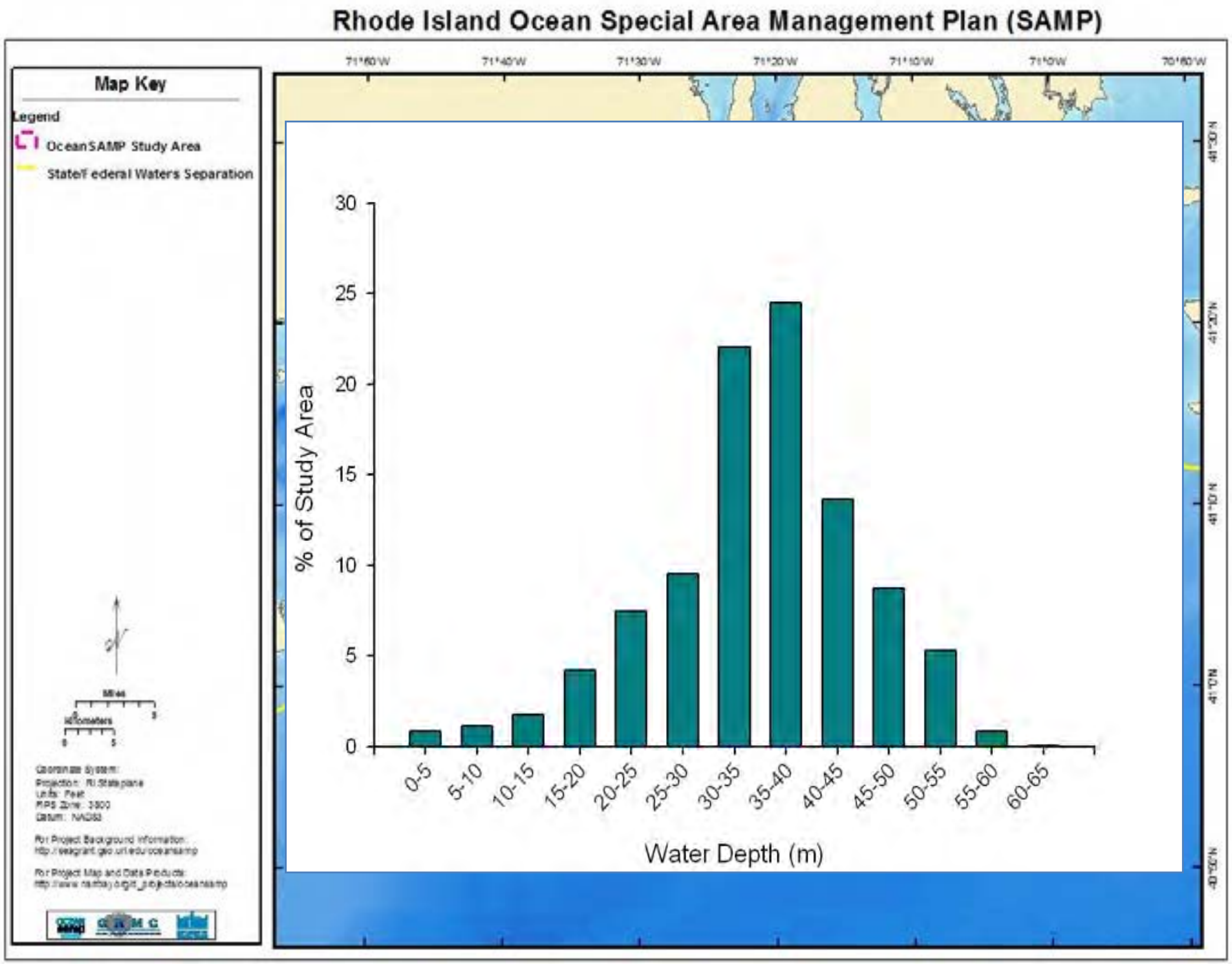
  2) Quantify flight behavior of birds in Ocean SAMP study area.

OSAMP Study Area



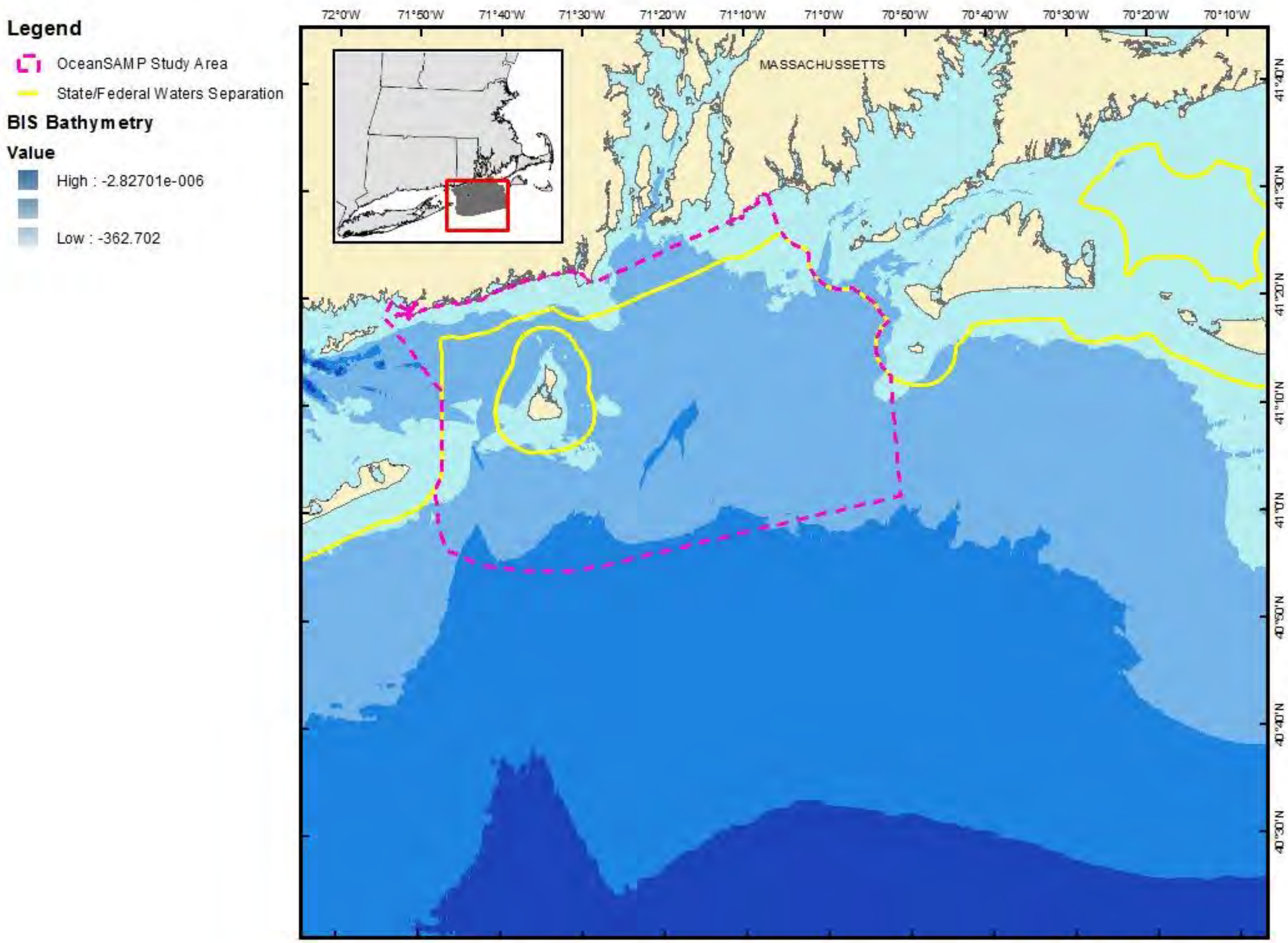
-Approximately 3,800 km^2.

OSAMP Study Area



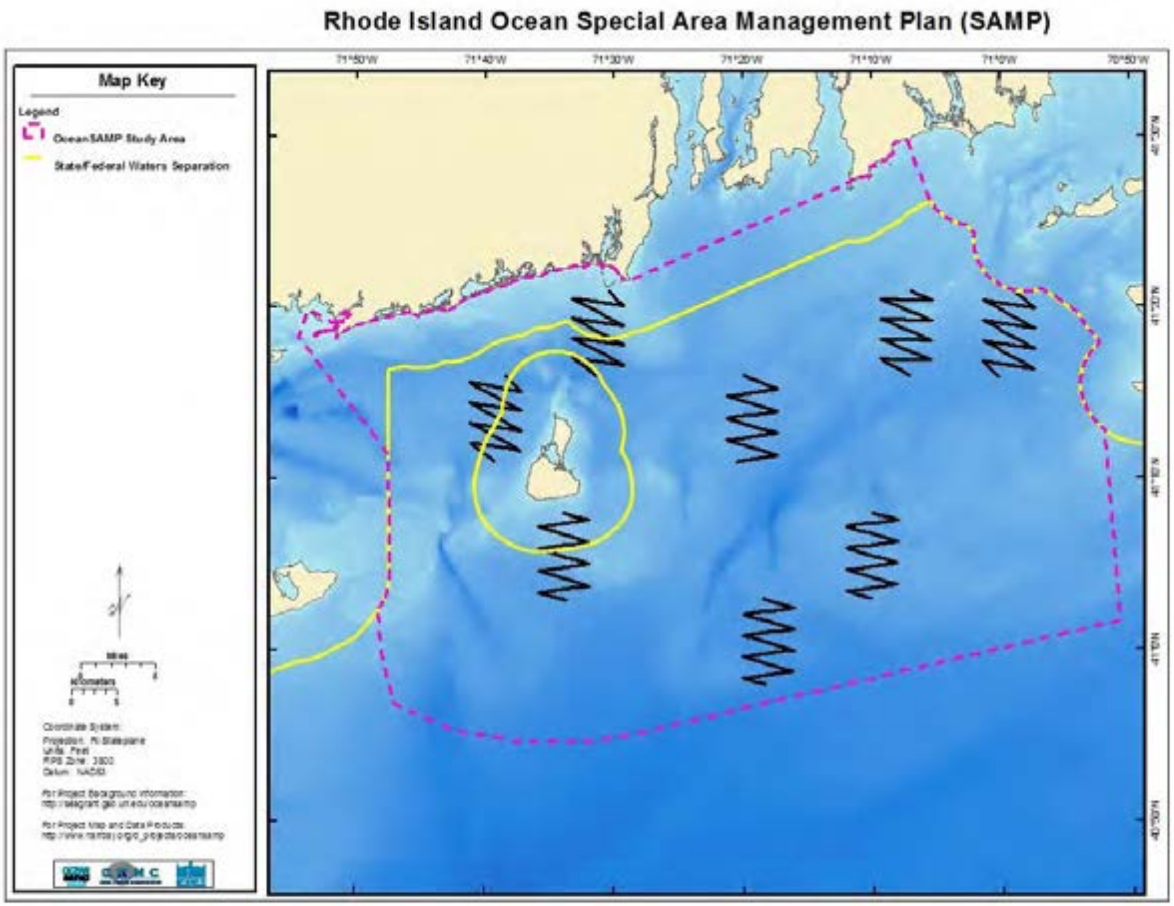
-Approximately 3,800 km^2.

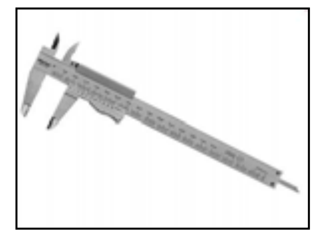
Much Different Marine Bird Habitat than Nantucket Sound




Aerial-based Strip-Transect Surveys
Aerial-based Line-Transect Surveys
Ship-based Line-Transect Surveys
Ocean SAMP Ad
Land –based Radar
Lan
200
2012
January-
February-
March-
April-
May-
June-
July-
March-
April-
May-
June-
July-

Ship-based Line Transect Surveys

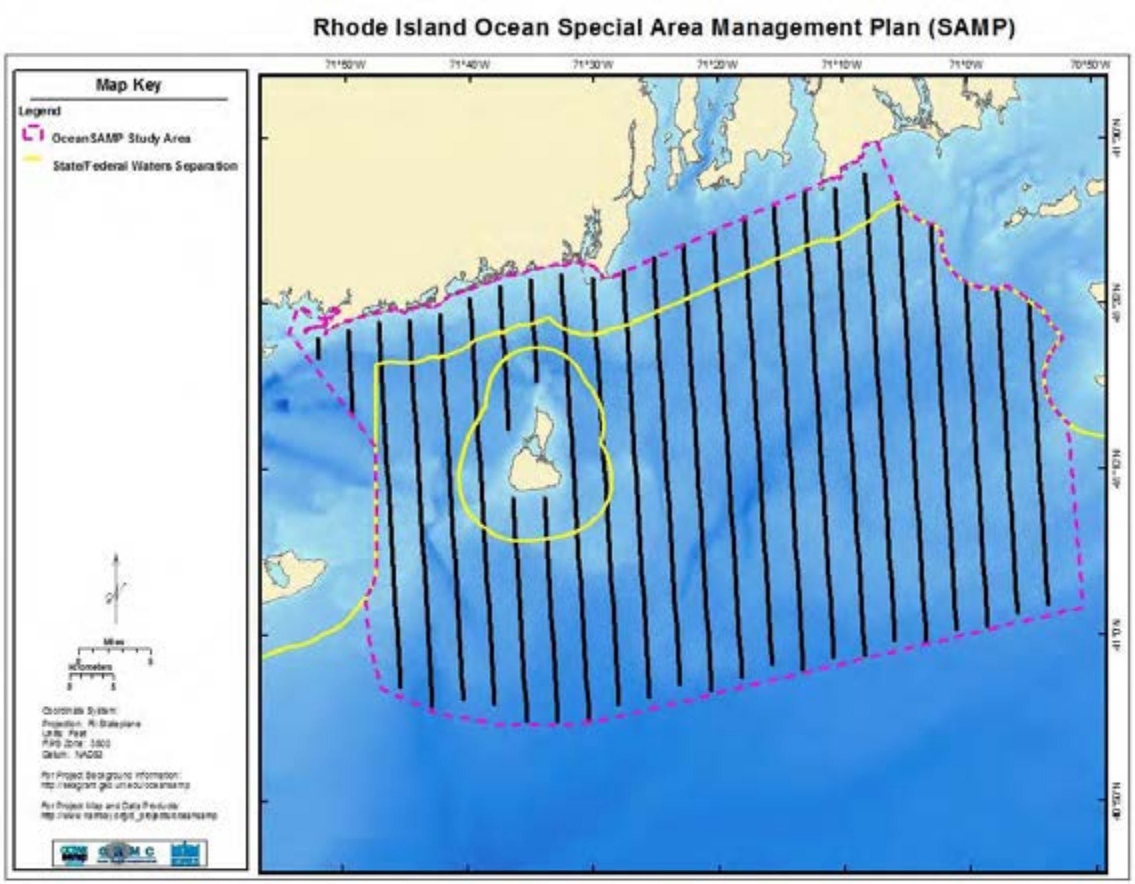




*Calipers used to estimate distance (*Heinemann*, 1981)

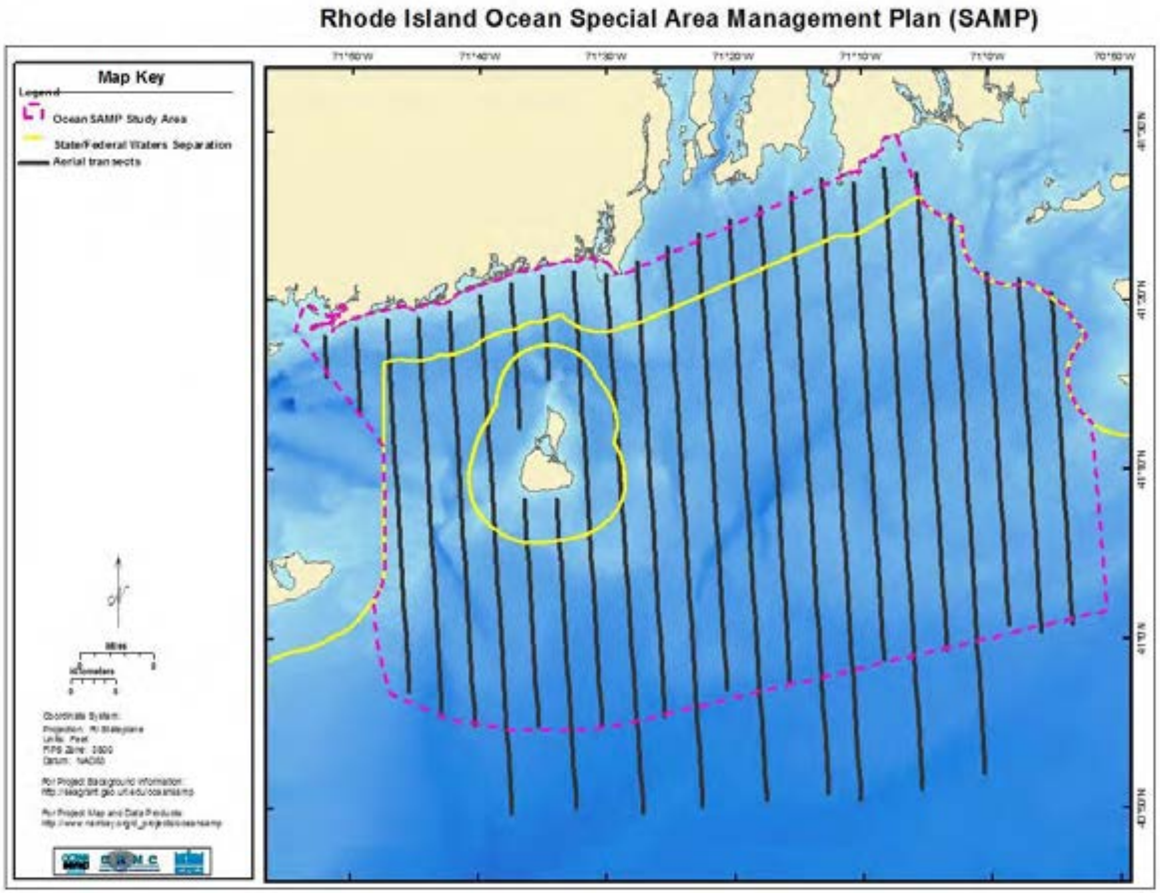
Eight Sawtooth (4x5nm) sampling areas
Each surveyed 1x per month (2.5 hours, survey 2 grids/week)
1 observer and 1 observer/recorder
<u>Recorded:</u> # individuals, species, bearing, distance estimate (first sighting), GPS location, behavior, flight elevation/direction for birds in flight and survey conditions.

Aerial-based Strip Transect Surveys



Twenty four transects perpendicular to coast
Survey 24 transects 1x per month
Fly 100kts at 500’
Survey 110m on both sides of plane (wing struts are marked)
2 observers
-<u>Recorded:</u> # individuals, species, time of sighting, behavior (flying, sitting) and survey conditions.

Aerial-based Line Transect Surveys



Band	Boundary distances (in m.) perpendicular out from track line	Declination in degrees from the horizontal
A	44-163	60-25
B	164-432	25-10
C	433-1000	10-4

24 transects perpendicular to coast
Survey 24 transects 1x per month
Fly 100kts at 250'
2 observers
Recorded: # individuals, species, time of sighting, behavior (flying, sitting), sighting bin and environmental conditions.

Avian Modeling for the Rhode Island Ocean Special Area Management Plan

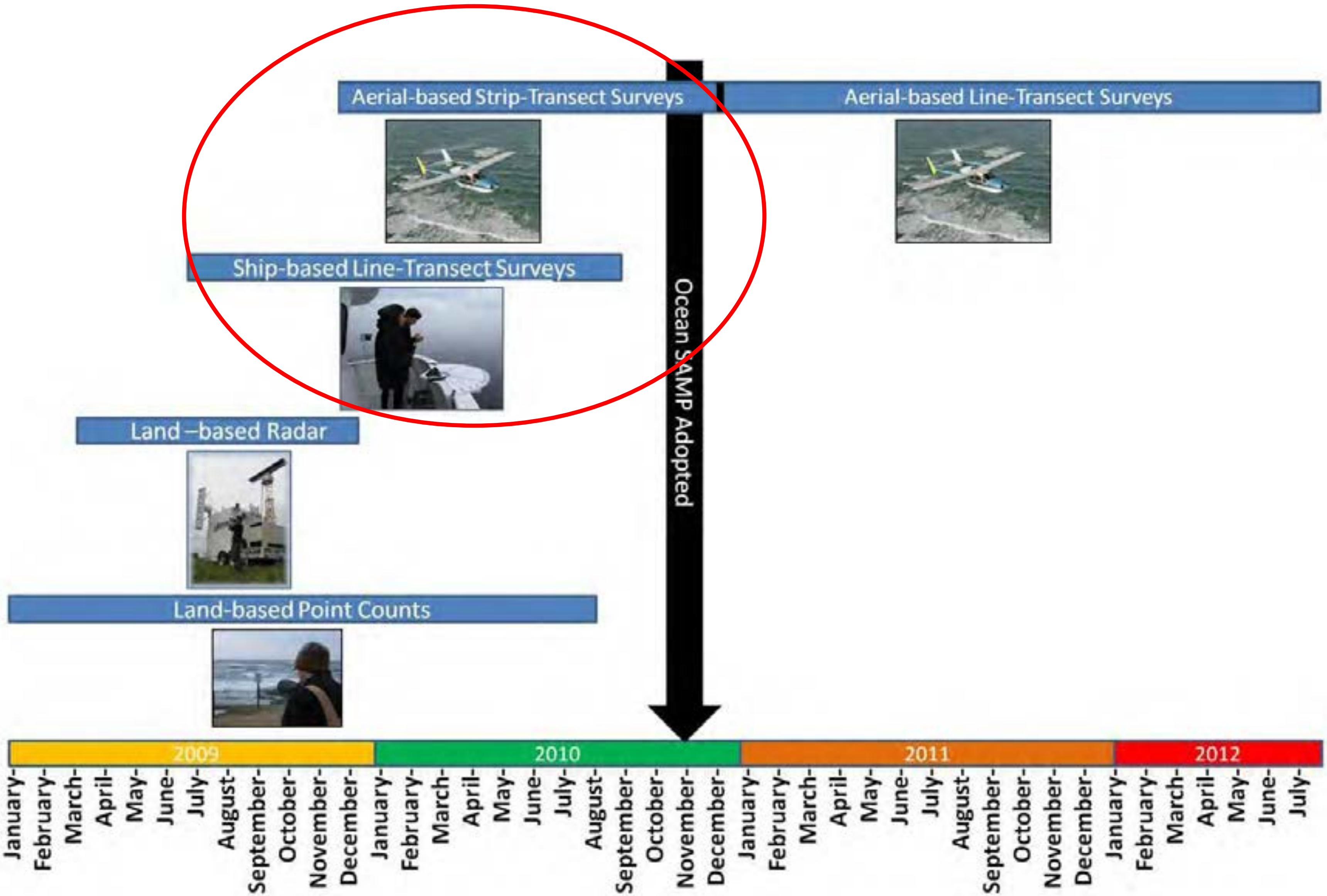
Kristopher J. Winiarski, Peter W.C. Paton, Scott R. McWilliams, and David Miller
Department of Natural Resources Science, University of Rhode Island, Kingston, RI 02881

SILVER SPRINGS, MARYLAND

JULY 2012

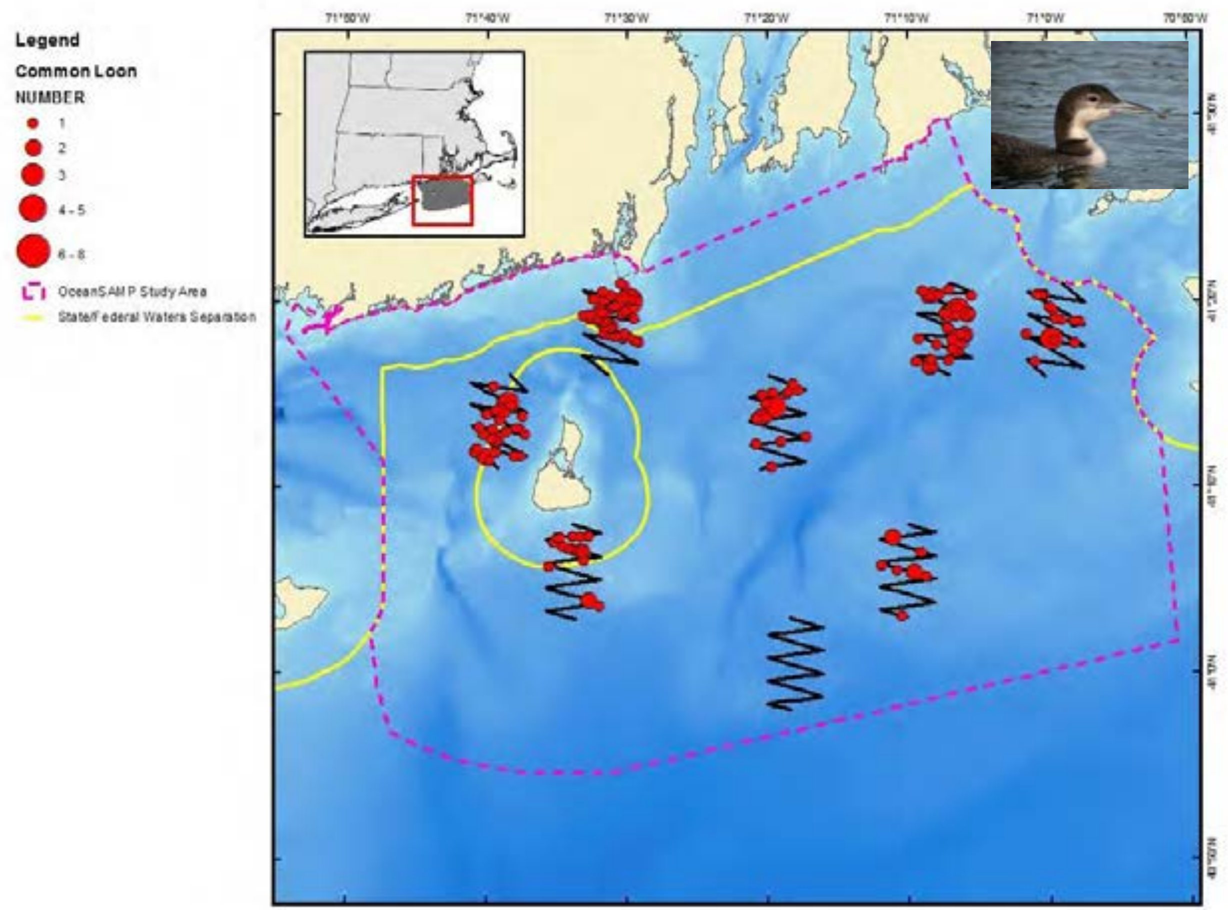
COASTAL RESOURCES MANAGEMENT COUNCIL

UNIVERSITY OF Rhode Island



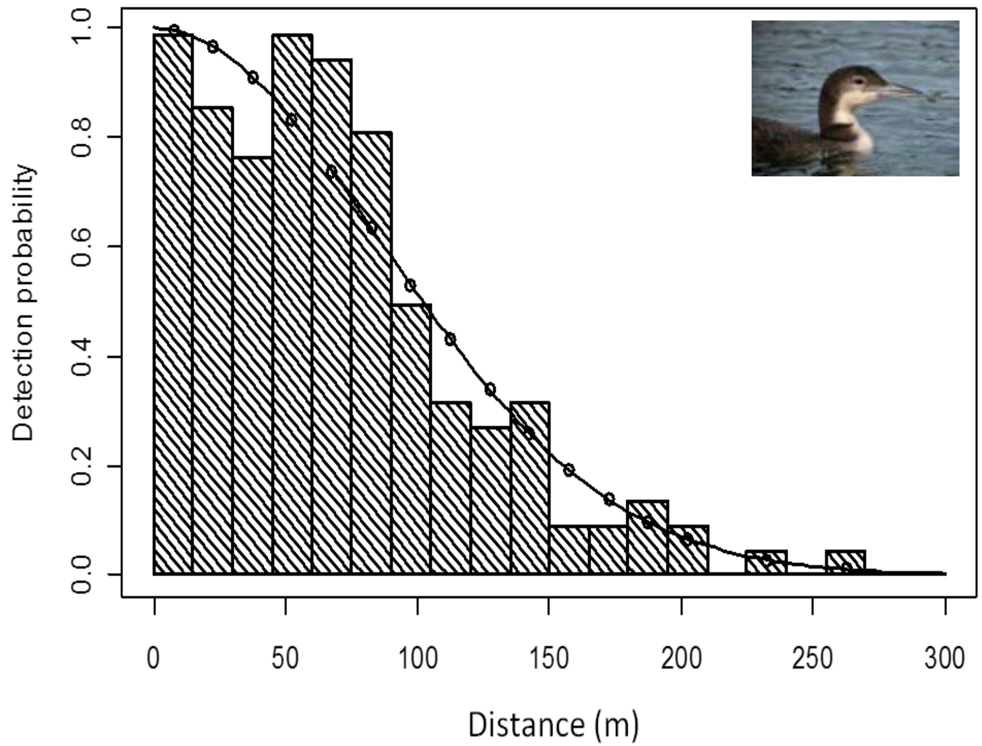
Aerial-based Strip-Transect Surveys
Aerial-based Line-Transect Surveys
Ship-based Line-Transect Surveys
Land –based Radar
Land-based Point Counts
Ocean SAMP Adopted
2009
2010
2011
2012
January- February- March- April- May- June- July- August- September- October- November- December-
January- February- March- April- May- June- July- August- September- October- November- December-
January- February- March- April- May- June- July- August- September- October- November- December-
January- February- March- April- May- June- July-

Density Surface Model (DSM) Approach



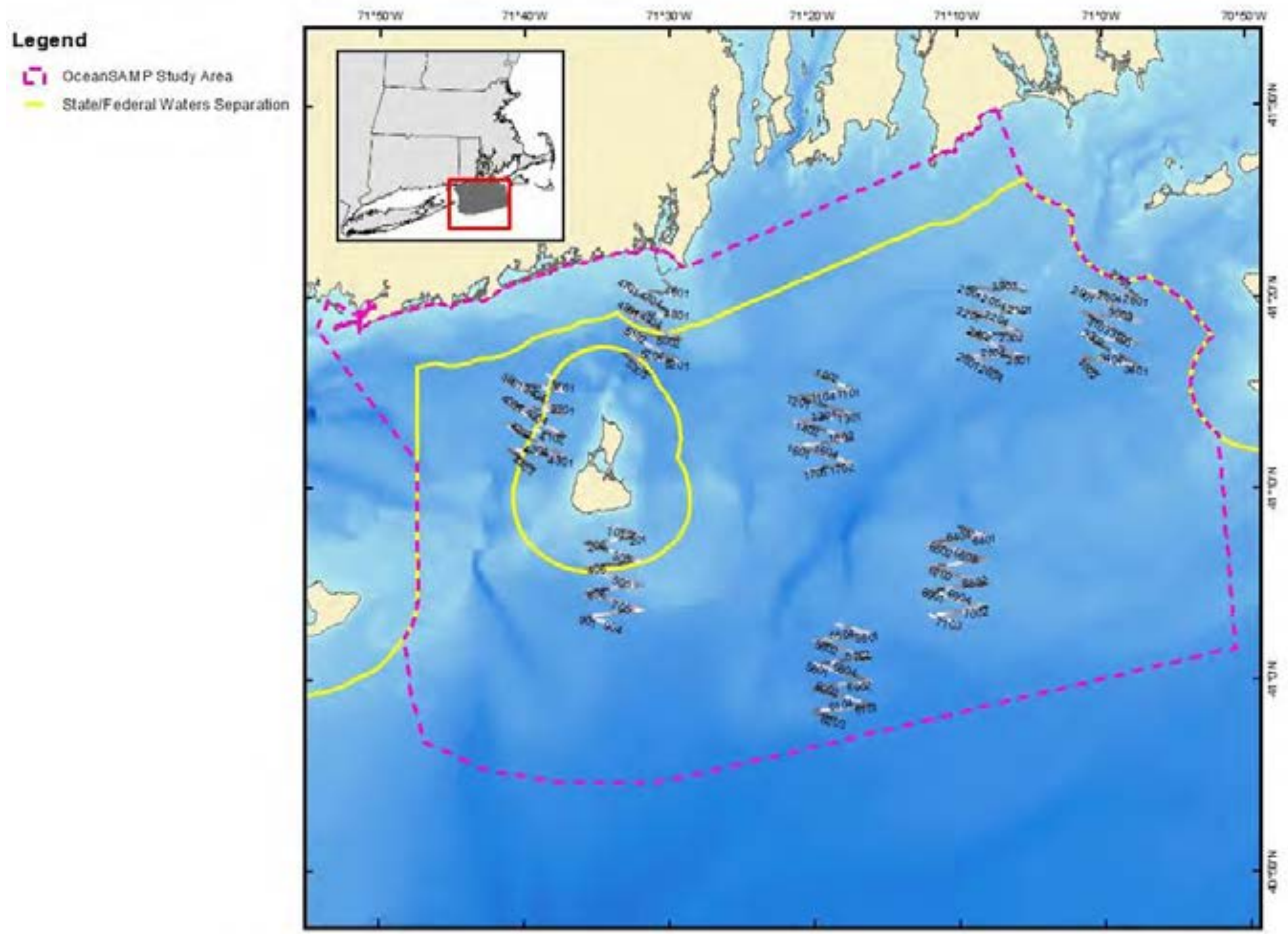
-Common Loon observations from ship-based line transect surveys.

Step #1- Fit detection function to control for incomplete detection.



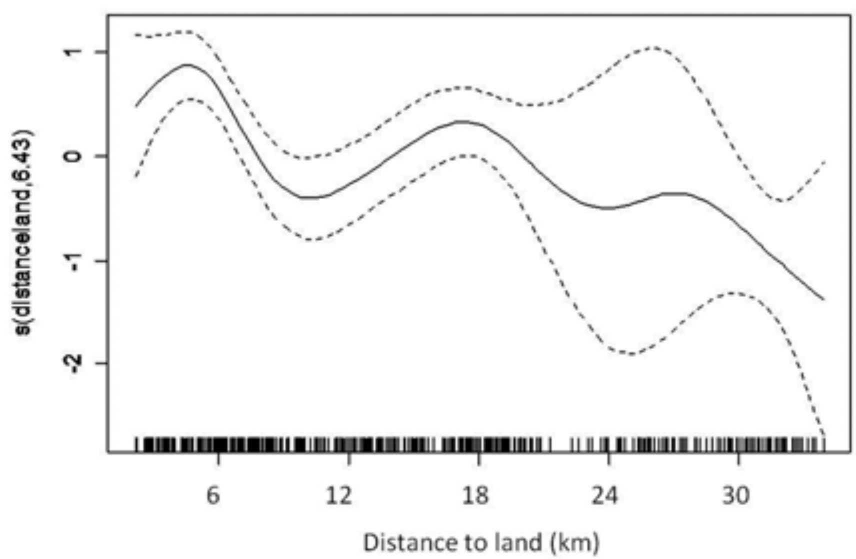
-Fit detection function to control for imperfect detection.

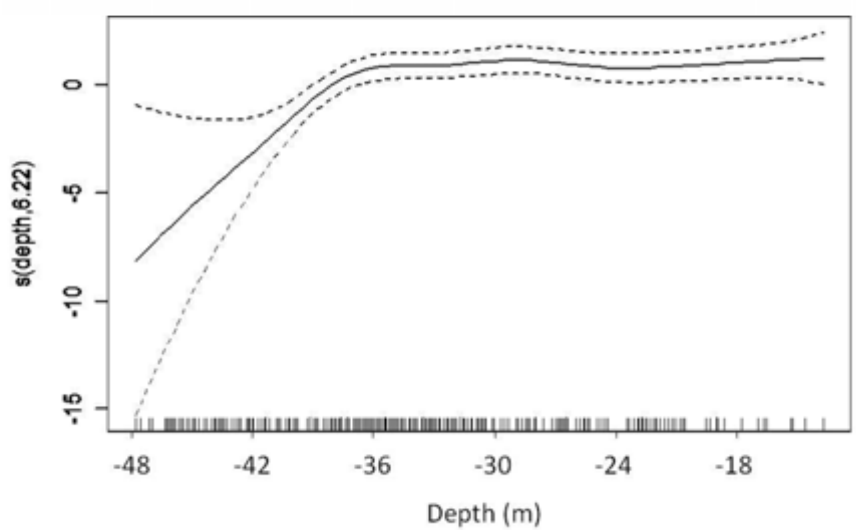
Step #2-Divide transects into unique segments.



-Total of 465 unique segment (each 830m long).
-Environmental covariates at midpoint of each segment (water depth, distance from land).

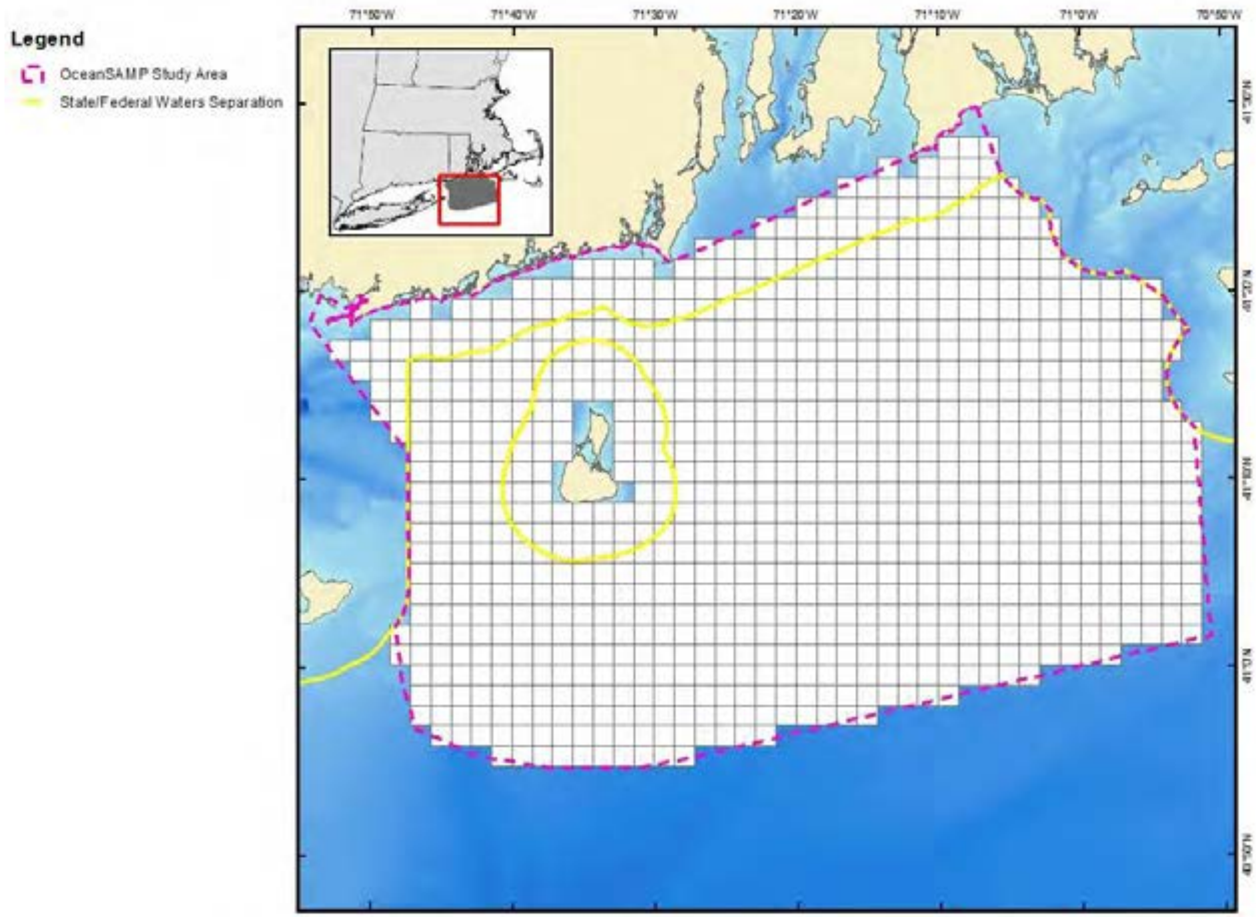
Step #3 – Fit Generalized Additive Models





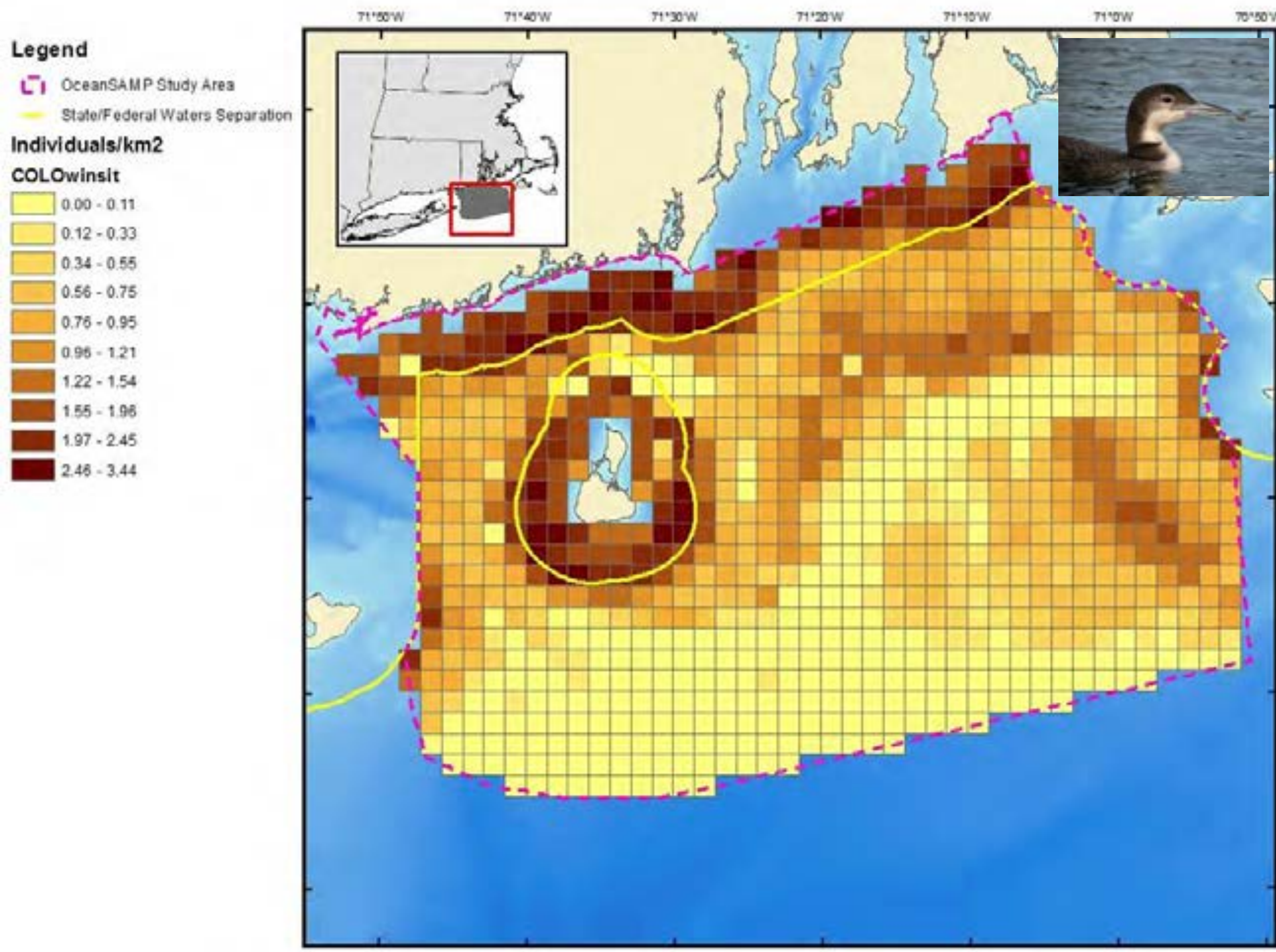
-Best Model distance to land + depth.

Step #4- Divide study area into predictive grid.



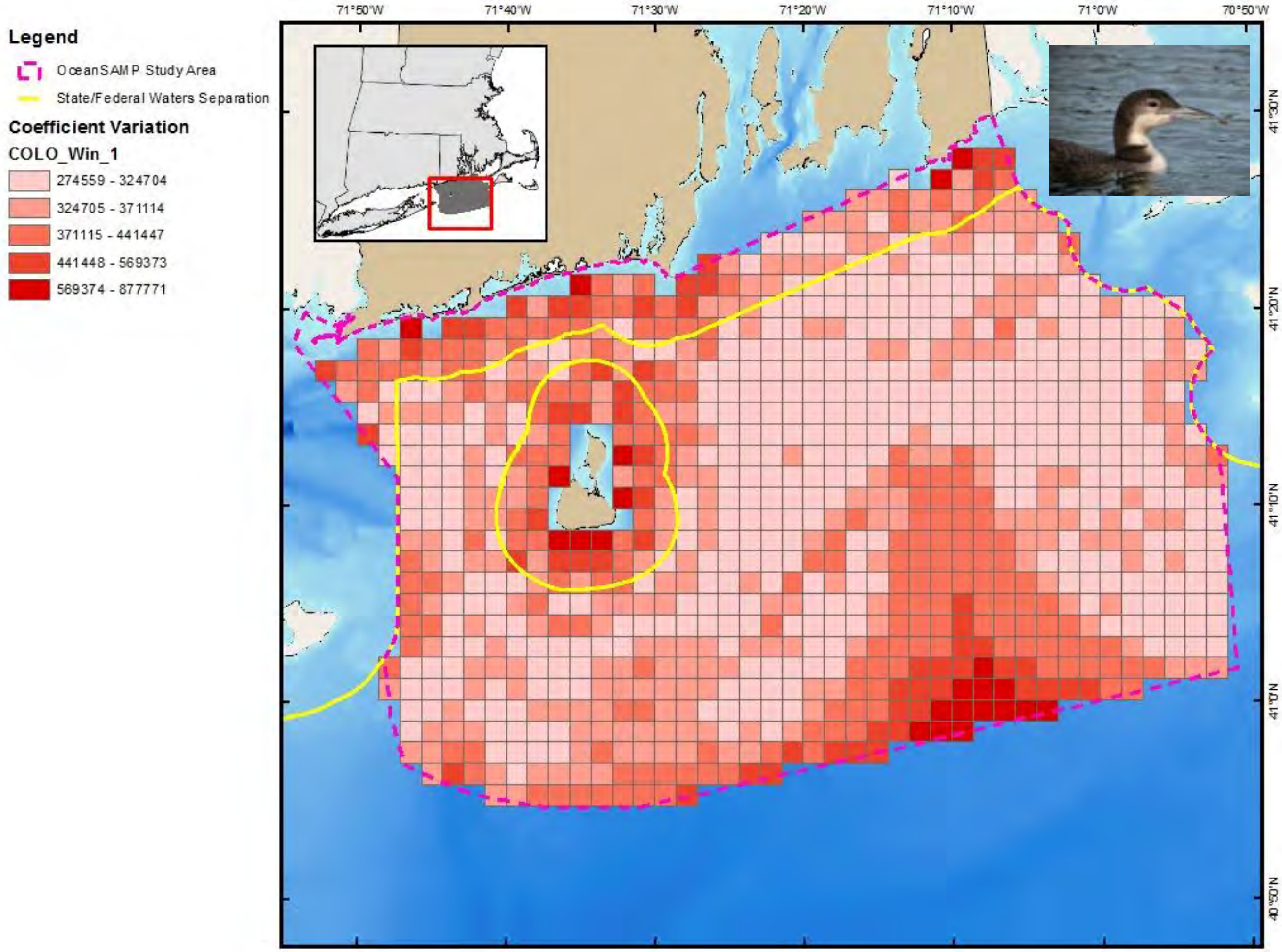
-920 cells; each 4km^2.
-Environmental covariates at the midpoint of each predictive cell (water depth, distance to land).

DSM–Common Loon

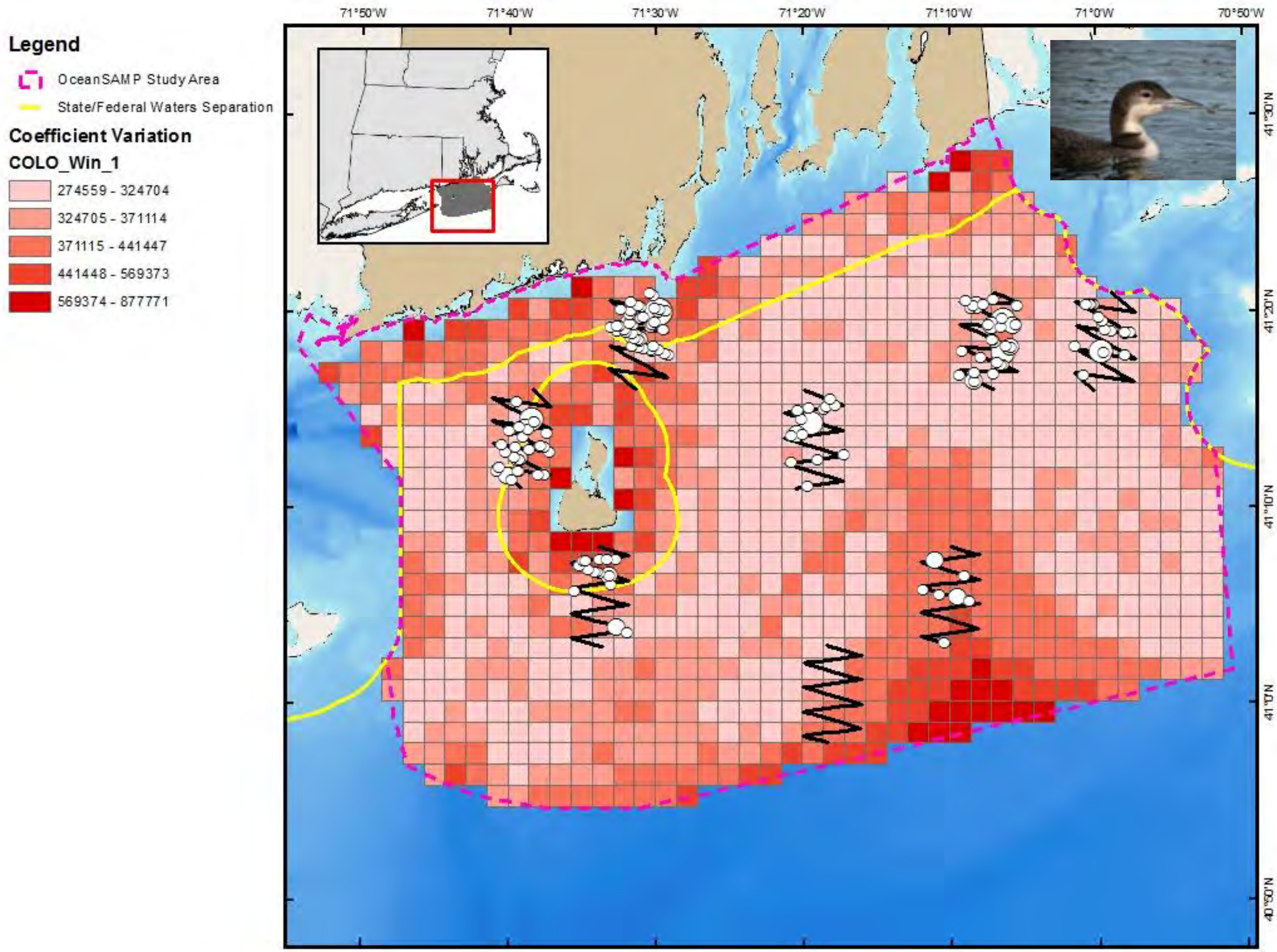


Daily population estimate winter – 7,284 (0.186)

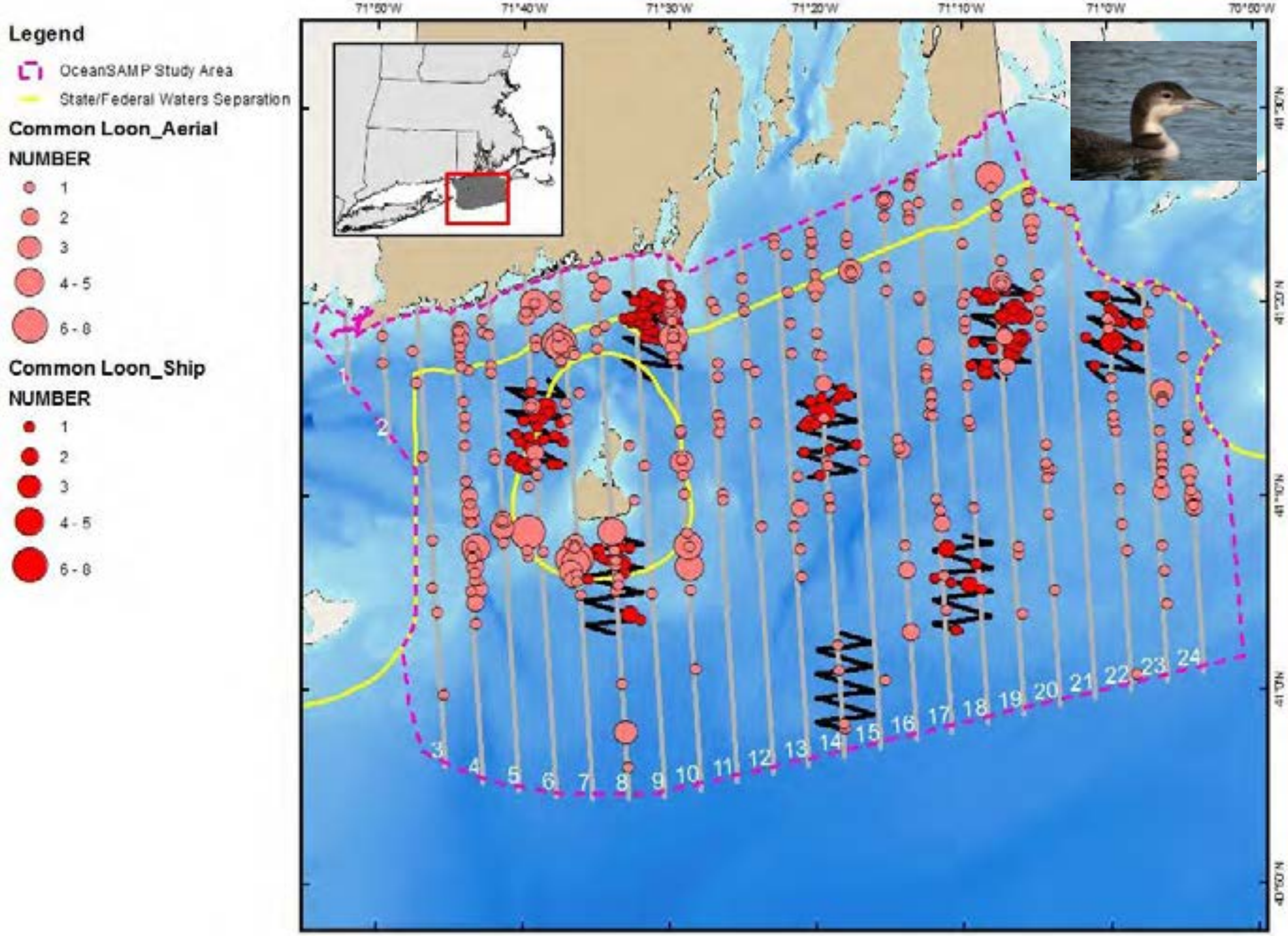
DSM–Uncertainty



DSM–Uncertainty



DSM – Using Survey Data from Multiple Platforms



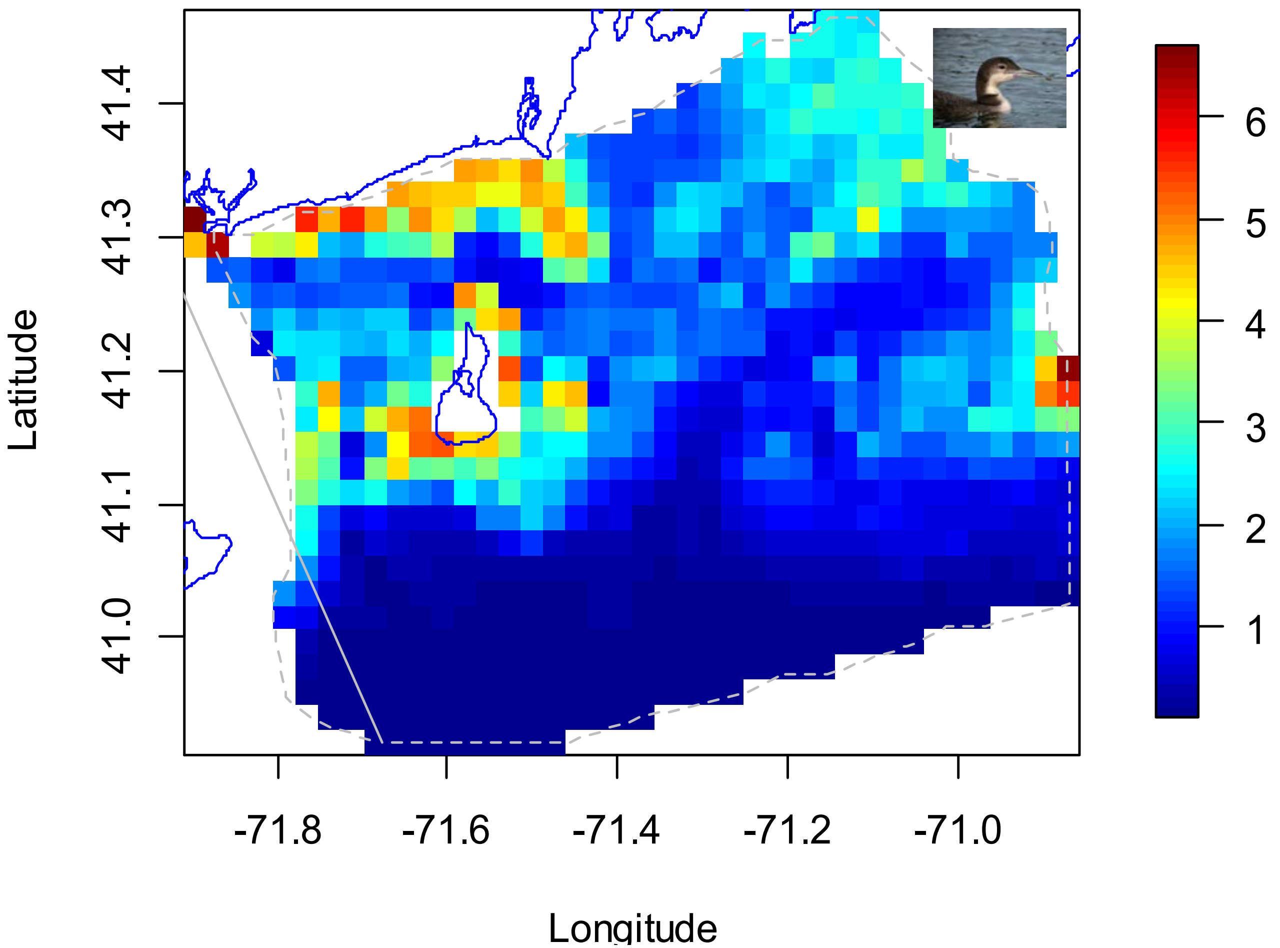
Ship

+

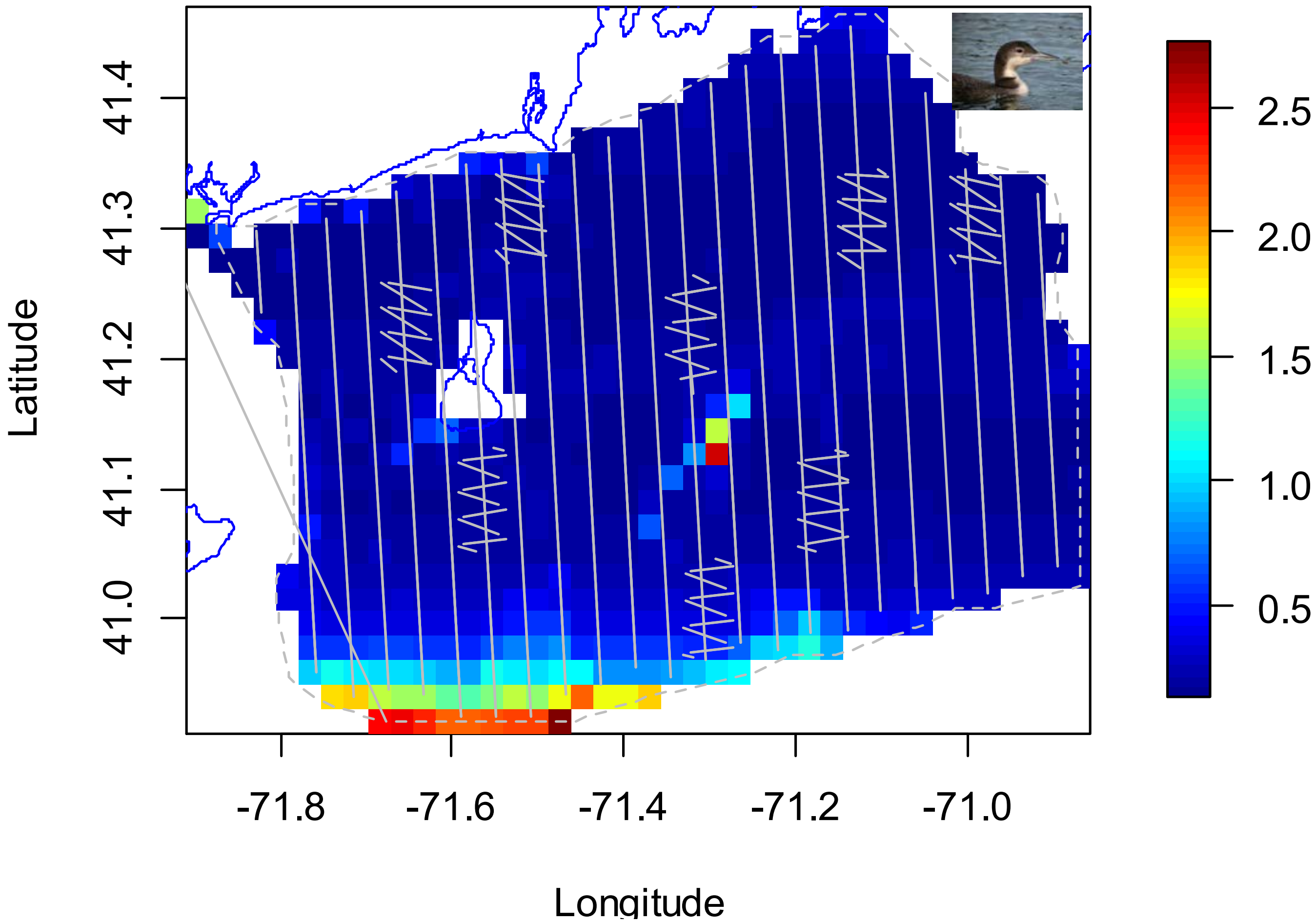
Aerial

-Raw observations of Common Loons winter 2009-2010.

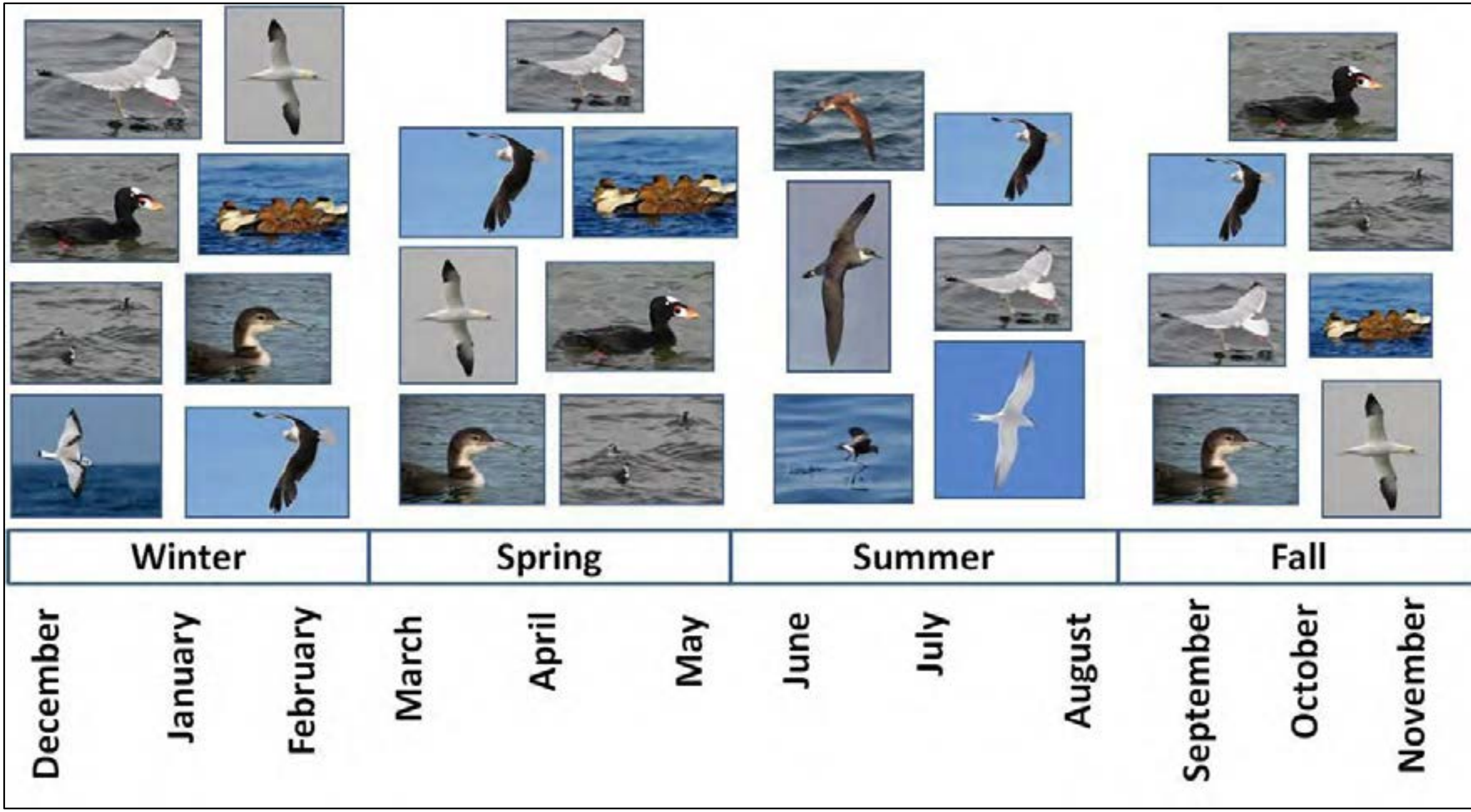
DSM – Using Survey Data from Multiple Platforms



DSM – Uncertainty

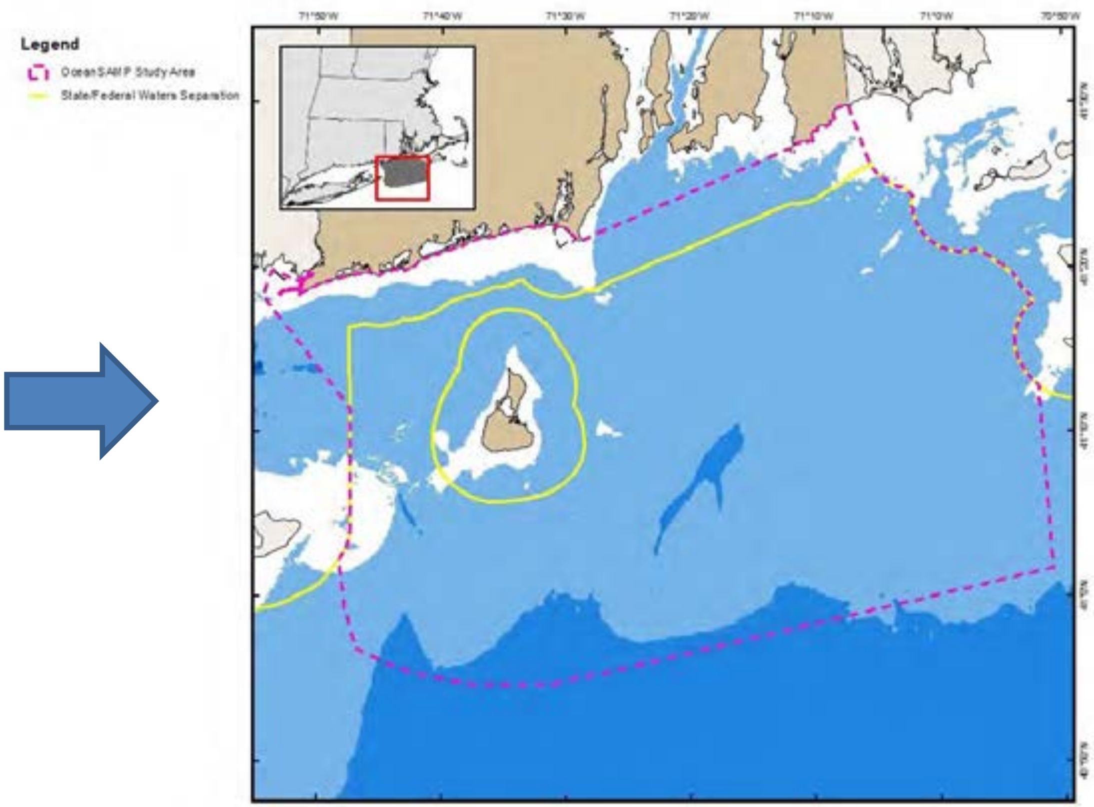


Lots of Predictive Maps for Policy Folks



-Our final OSAMP report contained 80 DSM maps.

OWED Siting in the OSAMP



•Waters <20m (in white) off limits to future development to protect seaduck foraging areas.

•Represent 8% of total SAMP study area.

How Can We Best Incorporate this Type of Modeling Output into OWED Siting Decisions?

ZONATION
Conservation planning software

PROCEEDINGS OF THE ROYAL SOCIETY B
Proc. R. Soc. B (2005) 272, 1885–1891
doi:10.1098/rspb.2005.3164
Published online 2 August 2005

Prioritizing multiple-use landscapes for conservation: methods for large multi-species planning problems

Atte Moilanen[1,*], Aldina M. A. Franco[2], Regan I. Early[2], Richard Fox[3], Brendan Wintle[4] and Chris D. Thomas[2]

Biological Conservation xxx (2011) xxx–xxx
Contents lists available at SciVerse ScienceDirect
Biological Conservation
journal homepage: www.elsevier.com/locate/biocon
ELSEVIER

Comparison of five modelling techniques to predict the spatial distribution and abundance of seabirds

Steffen Oppel[a,*], Ana Meirinho[b], Iván Ramírez[b], Beth Gardner[c], Allan F. O'Connell[d], Peter I. Miller[e], Maite Louzao[f,g]

Journal of Applied Ecology
Journal of Applied Ecology 2011, 48, 726–735 doi: 10.1111/j.1365-2664.2011.01985.x

Optimizing regional conservation planning for forest birds

Frederic Beaudry[1*], Anna M. Pidgeon[1], David J. Mladenoff[1], Robert W. Howe[2], Gerald A. Bartelt[3] and Volker C. Radeloff[1]

ICES Journal of Marine Science
ICES CIEM
ICES Journal of Marine Science (2012), 69(1), 75–83. doi:10.1093/icesjms/fsr180

Systematic conservation planning in the eastern English Channel: comparing the Marxan and Zonation decision-support tools

Juliette Delavenne[1*], Kristian Metcalfe[2], Robert J. Smith[2], Sandrine Vaz[1], Corinne S. Martin[3], Ludovic Dupuis[4], Franck Coppin[1], and Andre Carpentier[1]

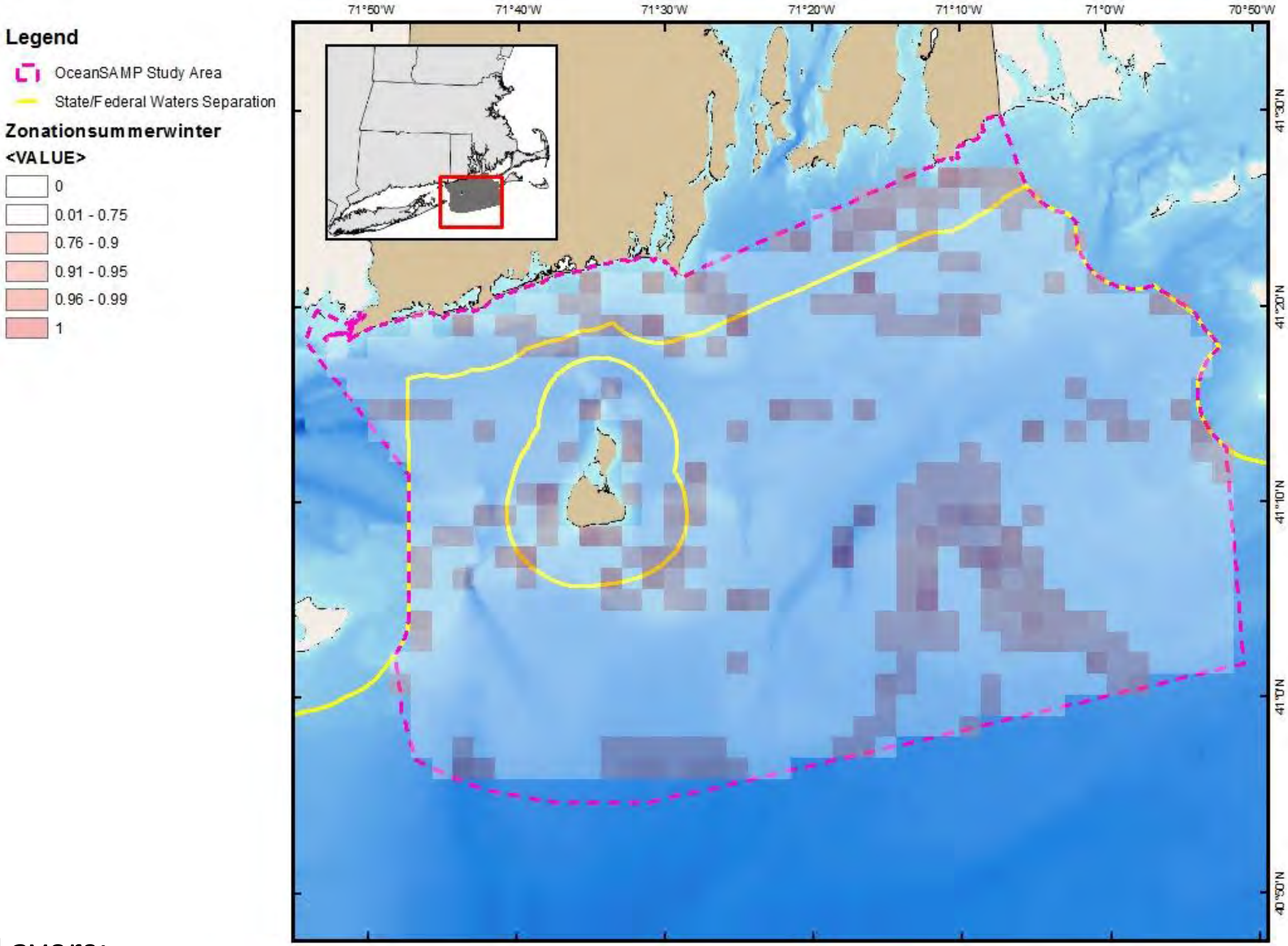
ZONATION
Conservation planning software

Aim and purpose:
To provide a tool for large-scale high resolution spatial conservation planning using GIS grid data.

Analyses:
Identification of optimal conservation areas.
Balancing of alternative land uses.

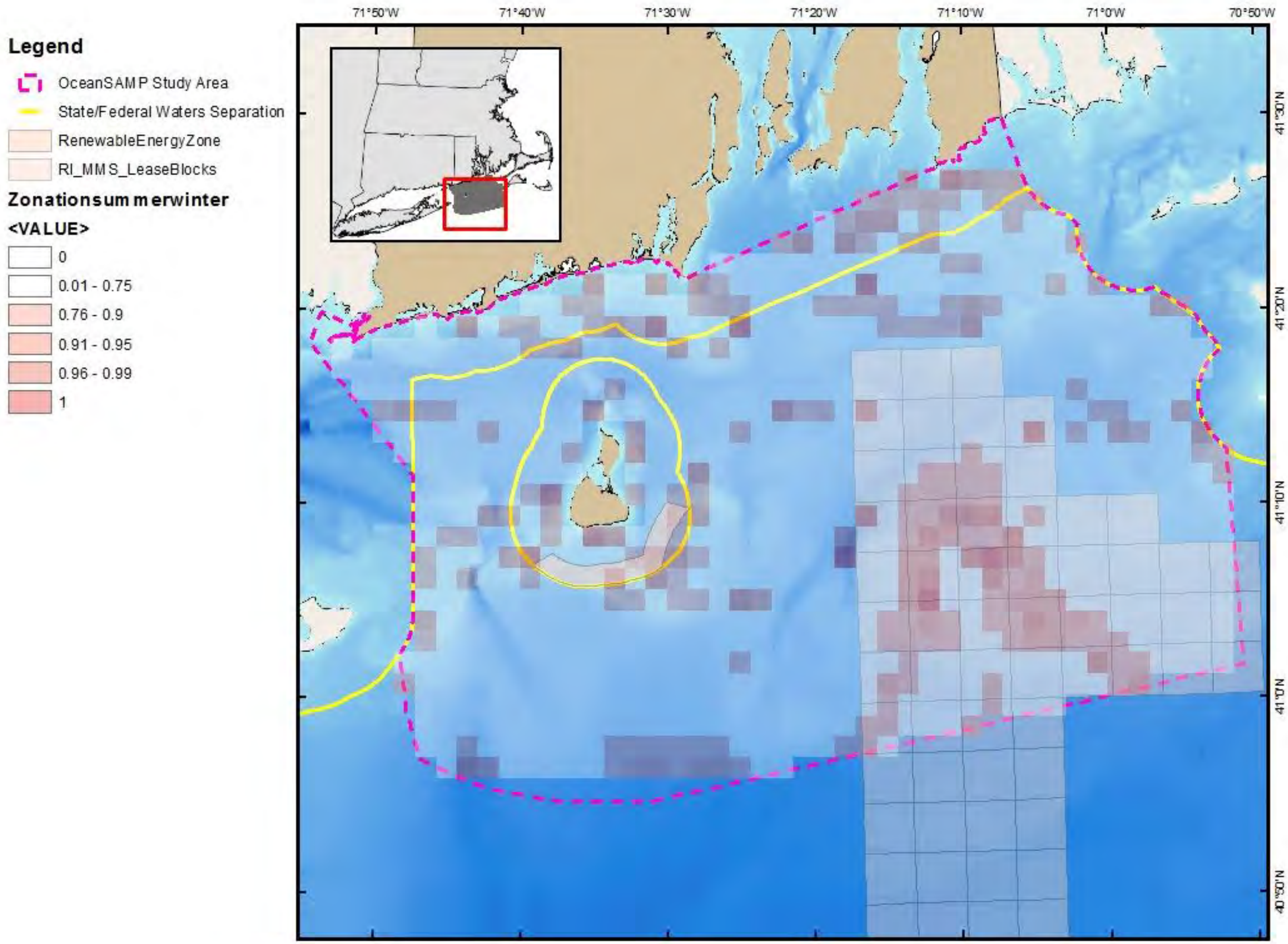
Data:
Presence/absence
Probabilities of occurrence
Abundance/density
Uncertainty

Features:
Species priorities via weighting
Methods for dealing with connectivity



Input Layers:
<u>Winter</u>-Gulls, Alcids, Seaducks, Northern Gannet and Loons.
<u>Summer</u>-Gulls, Shearwaters, Petrels and Terns.

•All layers equally ranked.

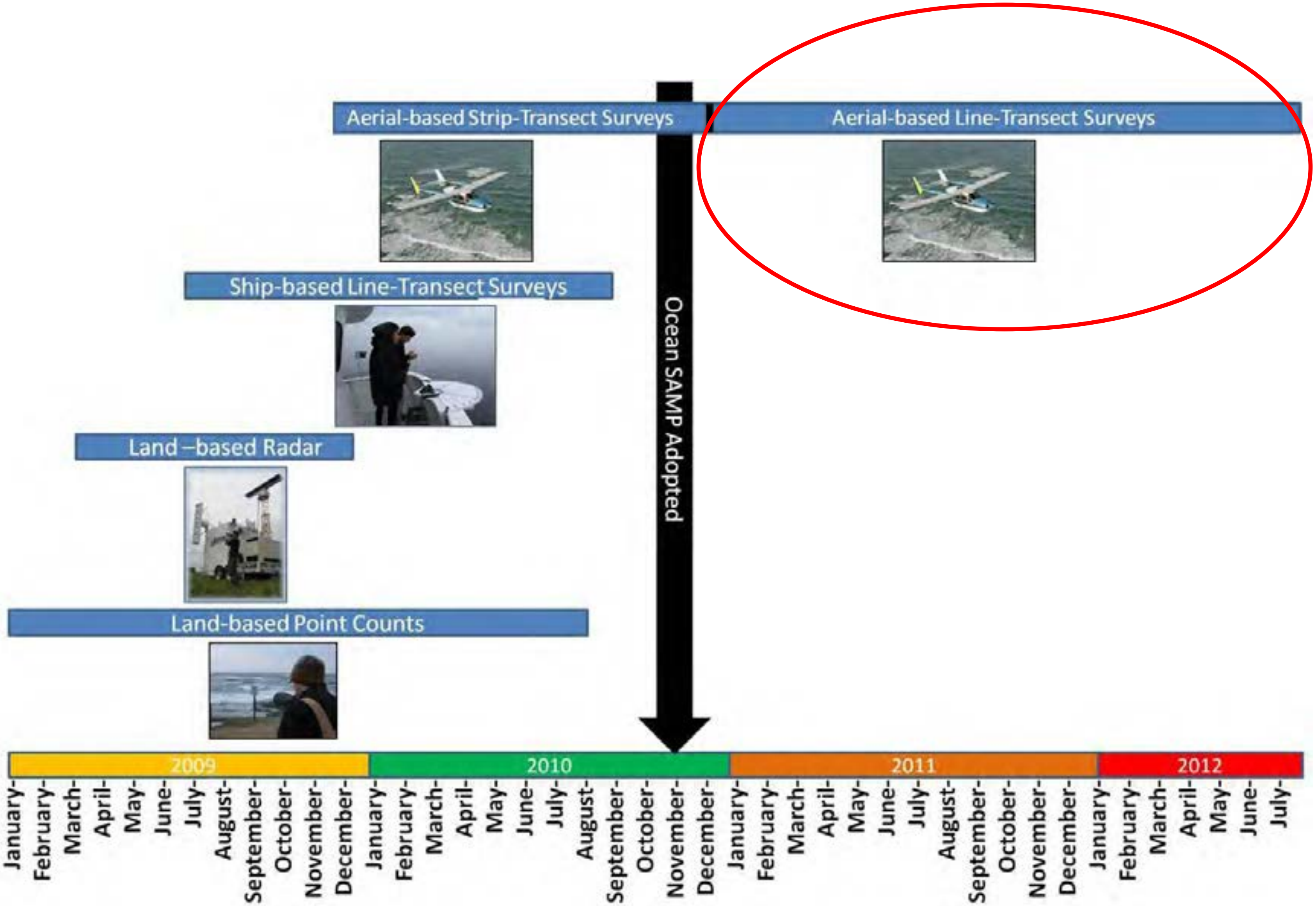


Input Layers:

<u>Winter</u>-Gulls, Alcids, Seaducks, Northern Gannet and Loons.

<u>Summer</u>-Gulls, Shearwaters, Petrels and Terns.

•All layers equally ranked.



Aerial-based Strip-Transect Surveys
Aerial-based Line-Transect Surveys
Ship-based Line-Transect Surveys
Land –based Radar
Land-based Point Counts
Ocean SAMP Adopted
2009
2010
2011
2012
January- February- March- April- May- June- July- August- September- October- November- December-
January- February- March- April- May- June- July- August- September- October- November- December-
January- February- March- April- May- June- July- August- September- October- November- December-
January- February- March- April- May- June- July-

Incorporate More Predictive Environmental Covariates into Models?

<u>Many available environmental covariates:</u>

Static
Distance to coast
Bathymetry
Slope
Roughness
Grain size

Dynamic
SST
Chlorophyll a
SSH
Density of ocean fronts
Distance to ocean front
Stratification
Turbidity
Zooplankton
Oscillation Indexes

Dynamic variables
•Temporal decisions
-Same time period as survey data or three months prior?

•Do we look at the average, min, max, variability, variability within nearby cells?

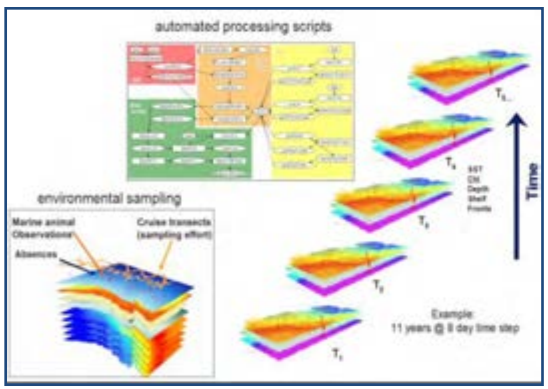
Potential issues
•High collinearity

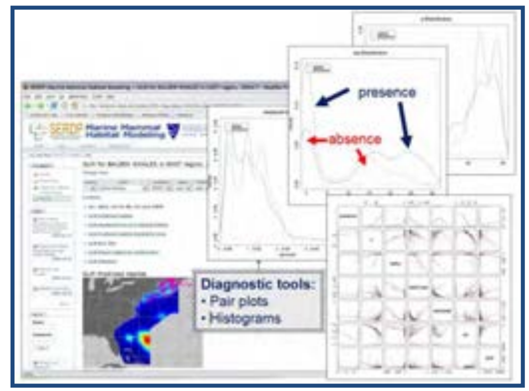
•Explanatory vs. predictive model?
-Increasing number of variables -> increase in difficulty interpreting model.

•Dynamic could be the only way to understand annual variability
-Many years of survey data.

Presentation #24

Cetacean Distribution and Density Modeling Efforts at Duke





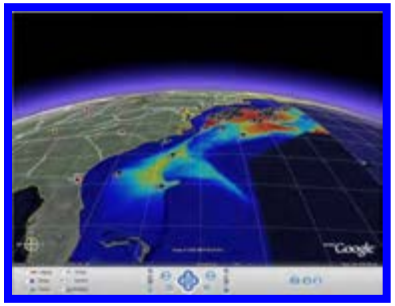
Patrick Halpin, Ben Best, Jason Roberts, Ei Fujioka, Jesse Cleary
Marine Geospatial Ecology Lab
Duke University

Modeling Efforts at Duke

- **Existing:**
  - SERDP Atlantic and GoMEX cetacean probability of occurrence models
- **Current:**
  - Update to SERDP models (Duke)
- **Upcoming:**
  - Western Atlantic cetacean modeling - US Navy Atlantic Fleet Training and Testing (AFTT) Area
- **Meta:**
  - CetMap project overview

Modeling Efforts at Duke

- **Existing:**
  - SERDP Atlantic and GoMEX cetacean probability of occurrence models
- **Current:**
  - Update to SERDP models (Duke)
- **Upcoming:**
  - Western Atlantic cetacean modeling - US Navy Atlantic Fleet Training and Testing (AFTT) Area
- **Meta:**
  - CetMap project overview



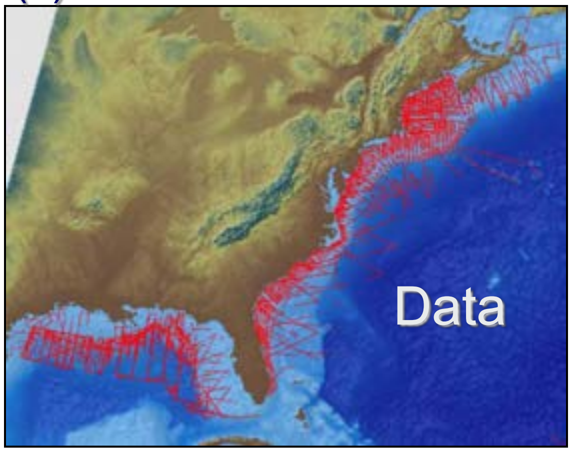
Societal need: We need to minimize risk to protected species from potentially harmful marine interactions (e.g. ship strikes, seismic surveys, oil drilling noise, Navy sonar training exercises.)

Project: Duke University and NOAA's Southwest Fisheries Science Center (SWFSC) teamed up to develop an online Spatial Decision Support System (SDSS) that provides spatiotemporally-explicit, quantitative predictions of the density and probability of occurrence of marine mammals.

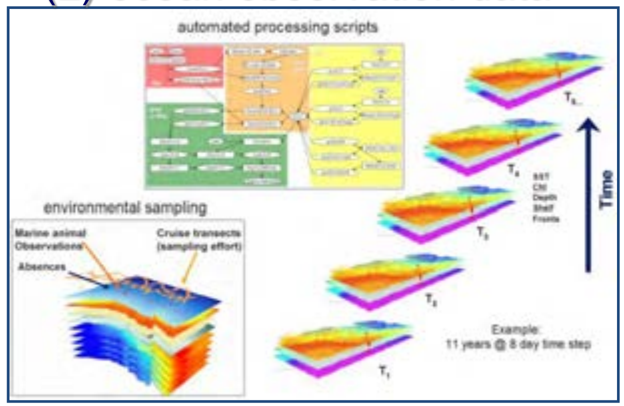
Initial development: Strategic Environmental Research and Development Program
SERDP projects SI-1390 at Duke University and SI-1391 at NOAA-SWFSC

Modeling Workflow

(1) animal observation data

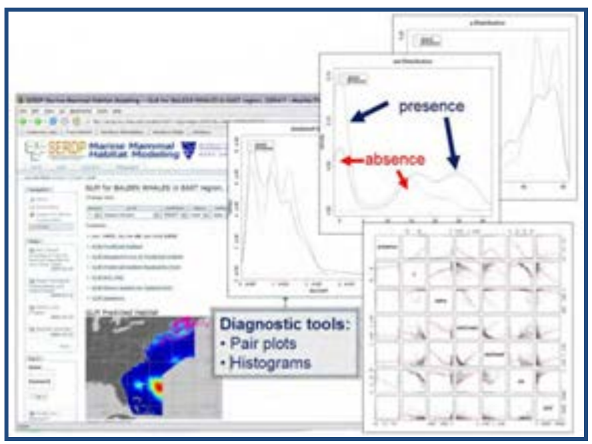


(2) ocean observation data



Temporally matched covariates

GAM models of density & habitat



(3) statistical analysis & modeling

(4) spatial decision support system

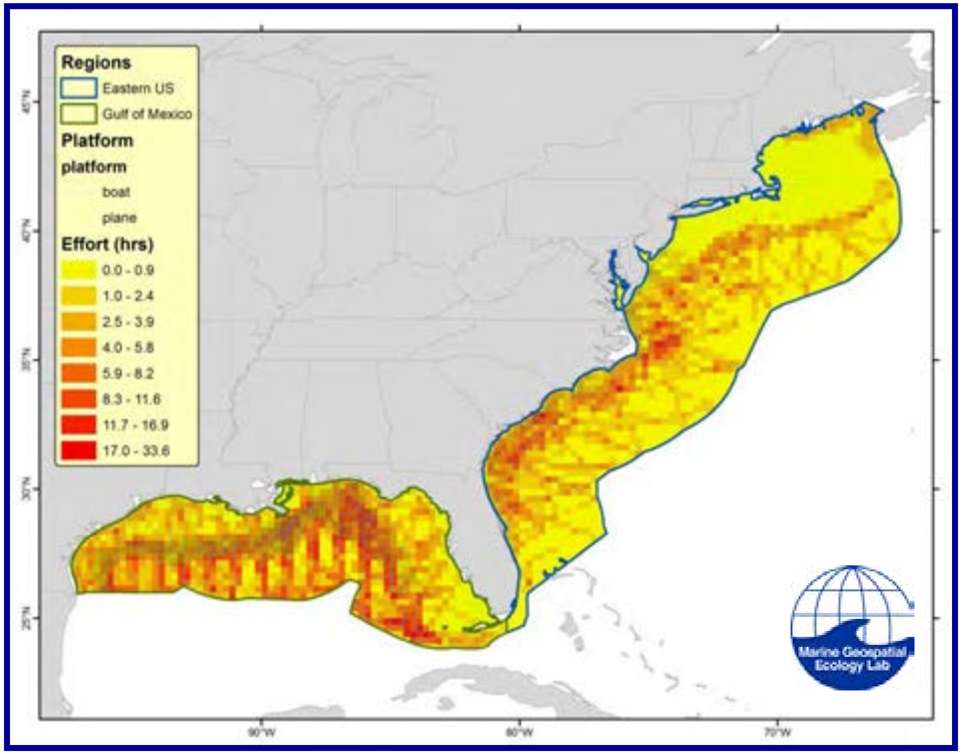
Integrating Ocean Observing Data to Enhance Protected Species Spatial Decision Support Systems

Joint Academic & Federal Agency Team

Pacific: NOAA - SWFSC

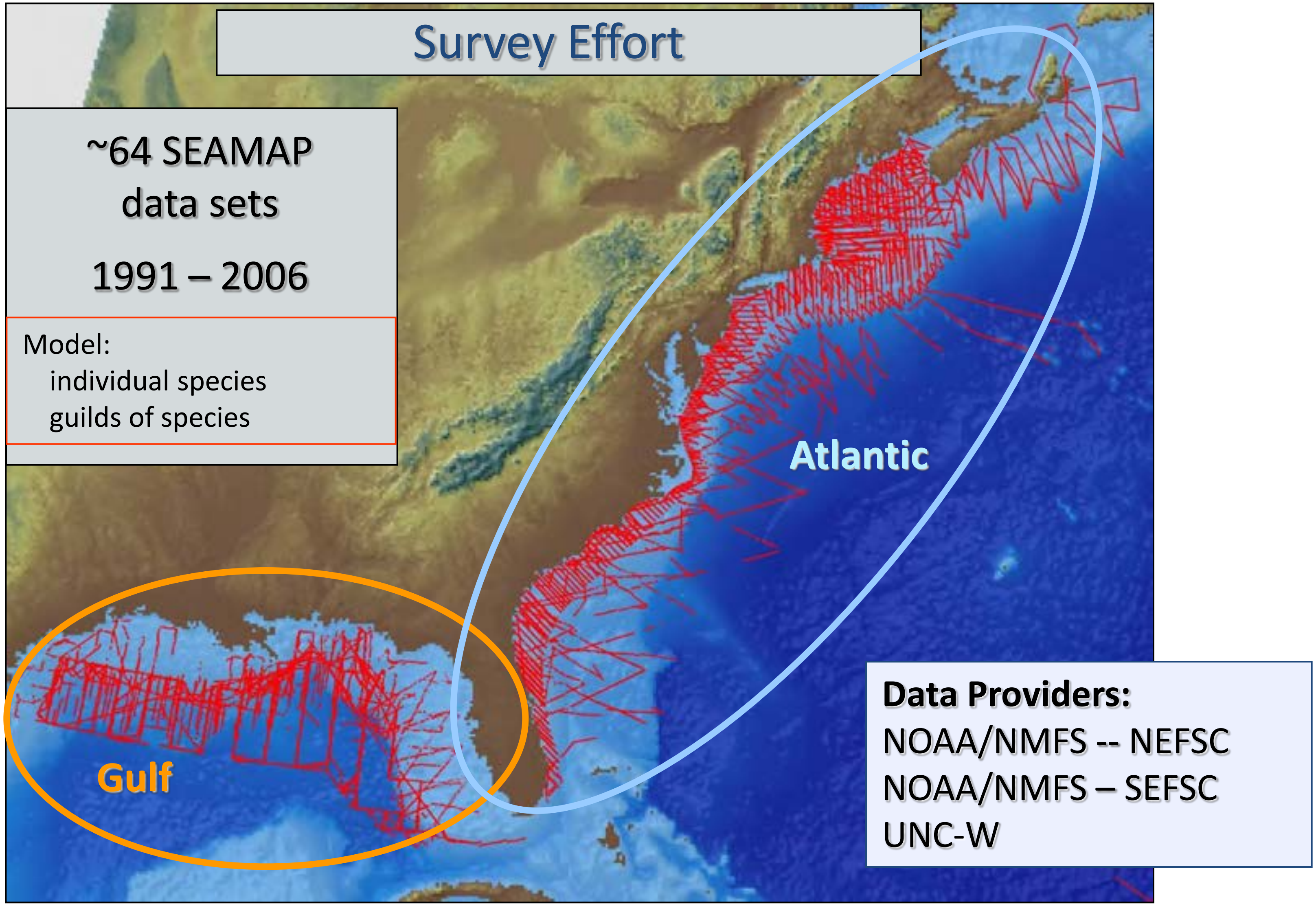
Figure 1. Cruise tracklines surveyed by the Southwest Fisheries Science Center, 1986-2005.

Atlantic & Gulf of Mexico: Duke University

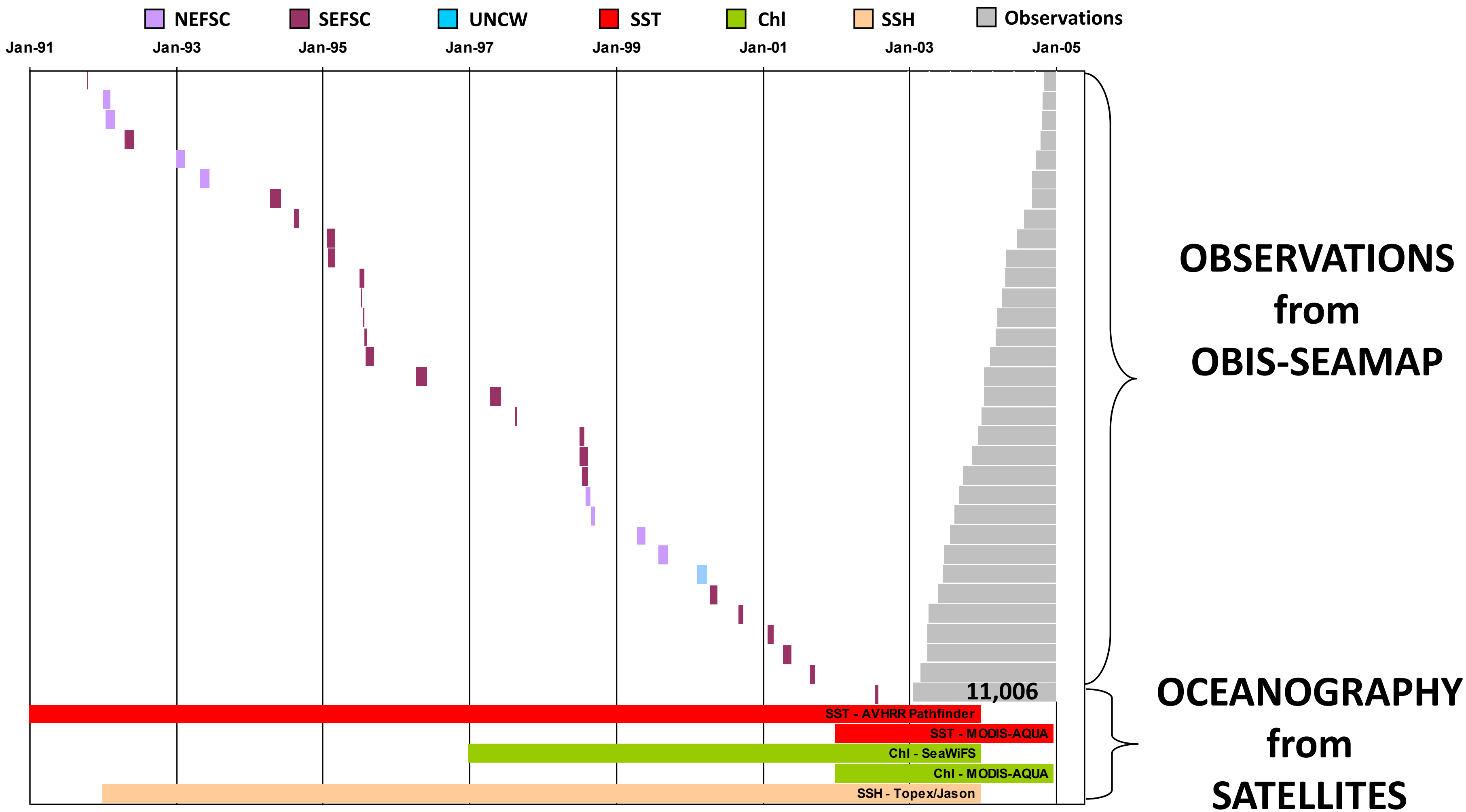


Density of protected species ship & aircraft surveys

OBIS-SEAMAP aggregated data

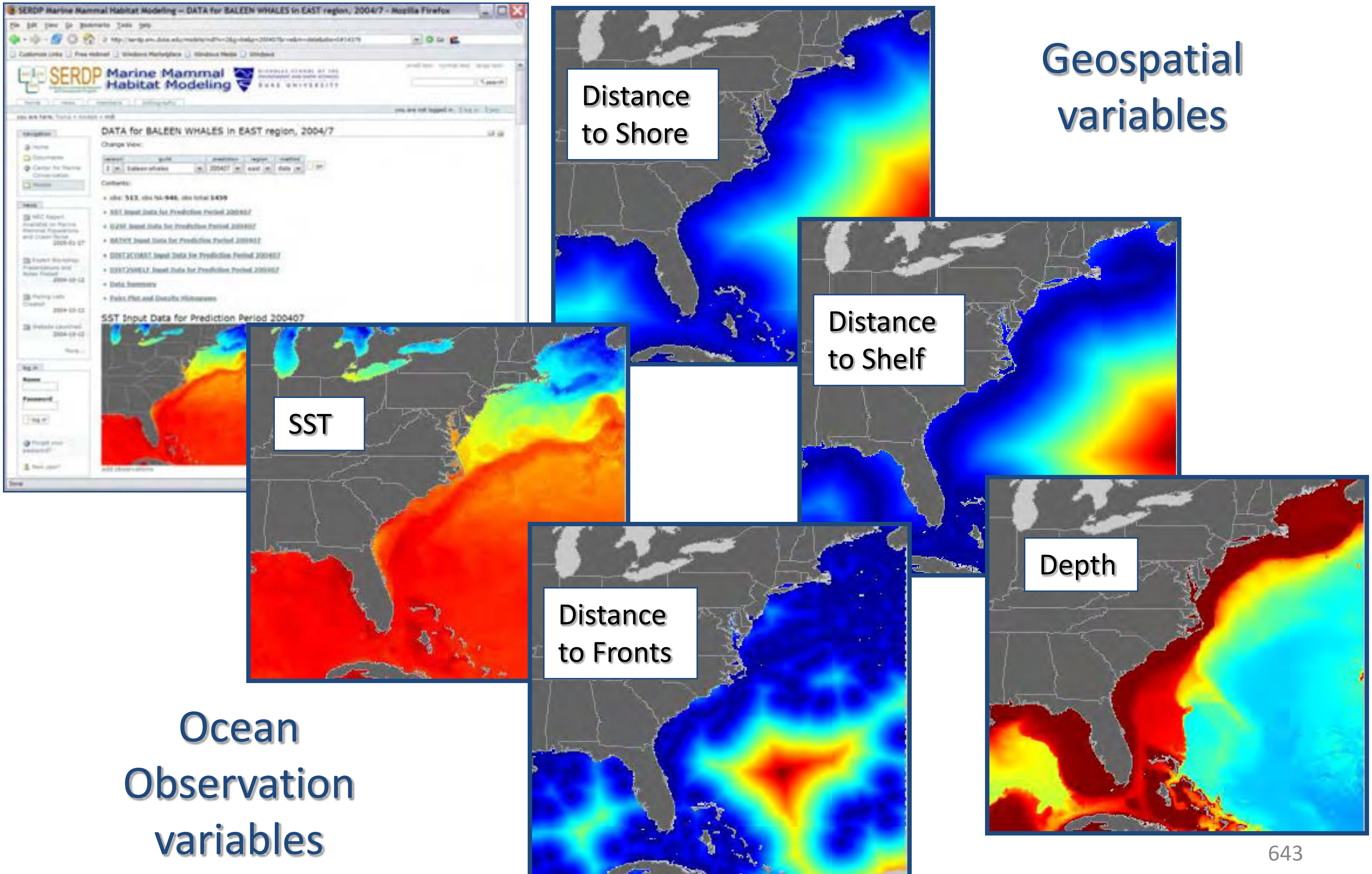


Fusion of marine animal & Ocean Observation data



- **64** datasets from 3 sources: NEFSC, SEFSC, UNCW
- **11,006** unique marine mammal observations between **1991** and **2006**

Geospatial & Ocean Observing Data



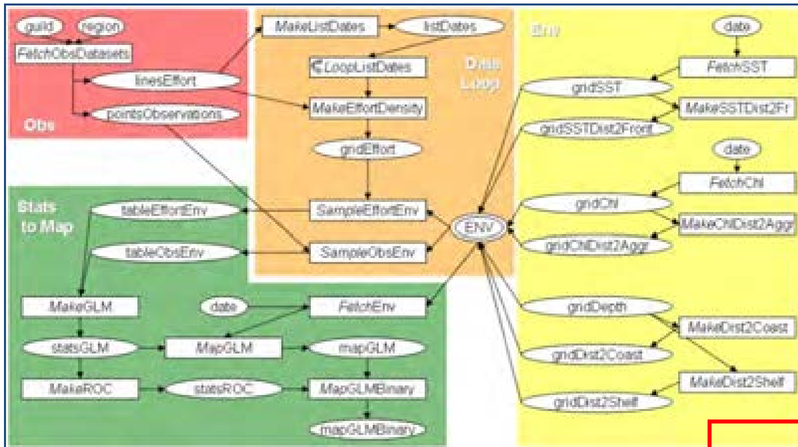
Geospatial variables

Ocean Observation variables

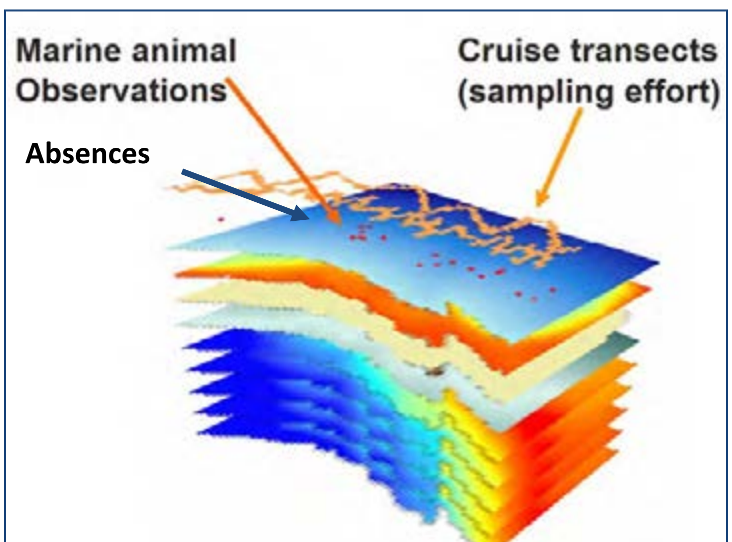
SERDP
Strategic Environmental Research and Development Program

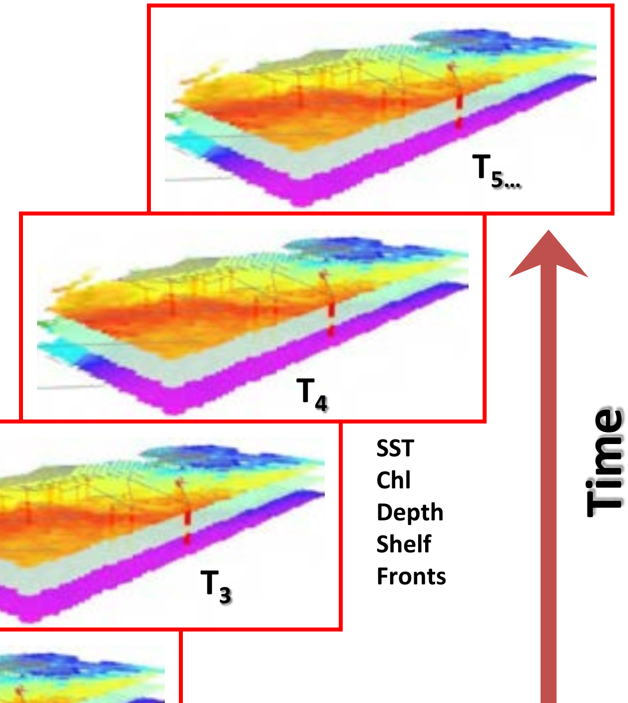
Ocean Observing sampling through time

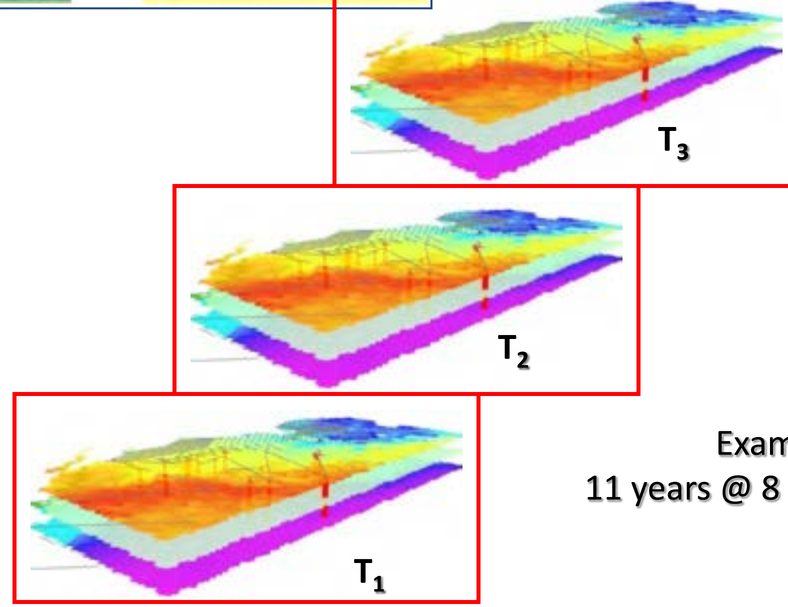
automated processing scripts



environmental sampling





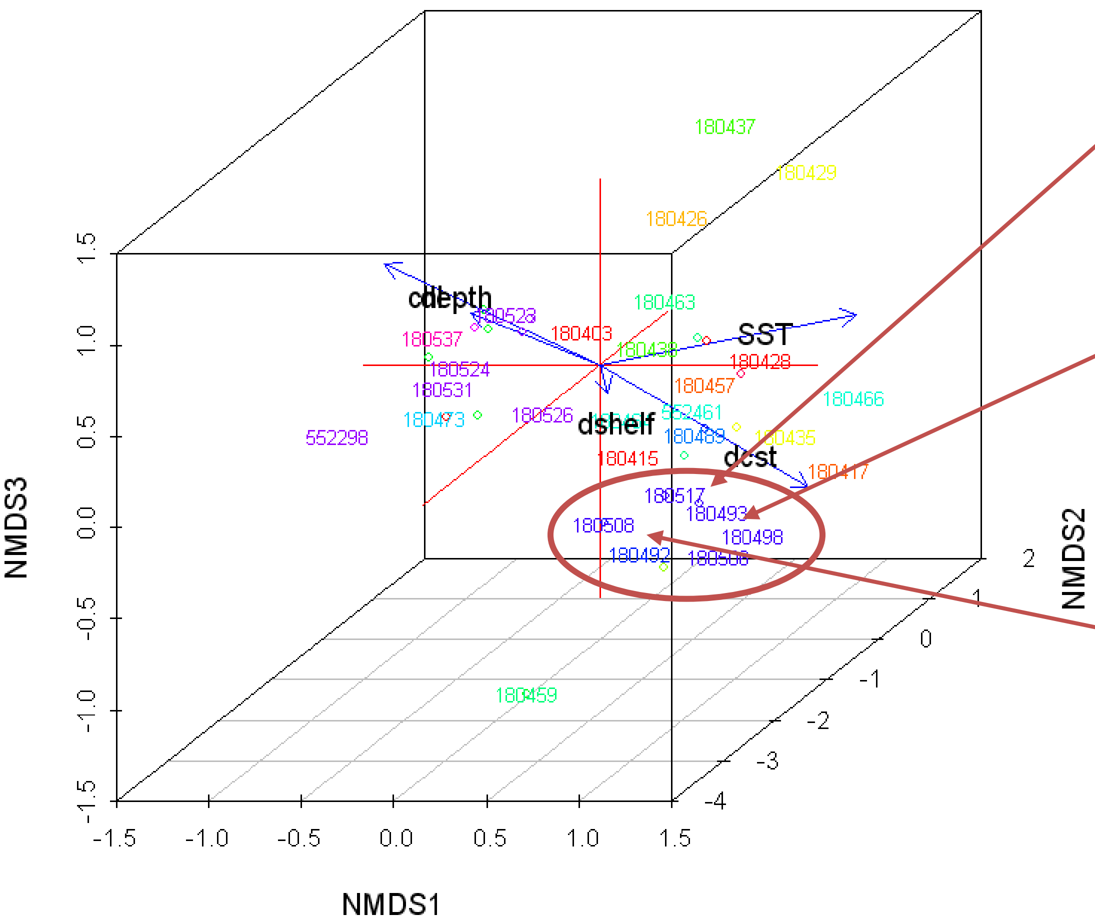


Example:
11 years @ 8 day time step

Model Guilds

Guild	Scientific name	Common name	Status
Baleen whale	*Balaenoptera* spp.	Baleen whales	
	Balaenoptera acutorostrata	Minke whale	LC
	Balaenoptera borealis	Sei whale	EN
	Balaenoptera edeni	Bryde's whale	DD
	Balaenoptera musculus	Blue whale	EN
	Balaenoptera physalus	Fin whale	EN
Humpback whale	*Megaptera novaeangliae*	Humpback whale	LC
Right whale	*Eubalaena glacialis*	North Atlantic right whale	EN
Beaked whale	*Berardius bairdii*	Baird's beaked whale	DD
	Hyperoodon ampullatus	North Atlantic bottlenose whale	LC
	Mesoplodon spp.	Beaked whales	
	Mesoplodon bidens	Sowerby's beaked whale	DD
	Mesoplodon densirostris	Blainville's beaked whale	DD
	Mesoplodon europaeus	Gervais' beaked whale	DD
	Mesoplodon mirus	True's beaked whale	DD
	Ziphiidae	Beaked whales	
	Ziphius spp.	Goose-beaked whales	
	Ziphius cavirostris	Cuvier's beaked whale	LC
Sperm whale	*Physeter macrocephalus*	Sperm whale	VU
Kogia spp.	*Kogia* spp.	Kogia	
	Kogia breviceps	Pygmy sperm whale	DD
	Kogia sima	Dwarf sperm whale	DD
Killer whale	*Orcinus orca*	Killer whale	DD
	Feresa attenuata	Pygmy killer whale	DD
	Peponocephala electra	Melon-headed whale	LC
	Pseudorca crassidens	False killer whale	DD
Pilot whale	*Globicephala* spp.	Pilot whales	
	Globicephala macrorhynchus	Short-finned pilot whale	DD
	Globicephala melas	Long-finned pilot whale	DD
Lagenorhynchus spp.	*Lagenorhynchus* spp.	White-beaked dolphins	
	Lagenorhynchus acutus	Atlantic white-sided dolphin	LC
	Lagenorhynchus albirostris	White-beaked dolphin	LC
Common dolphin	*Delphinus* spp.	Common dolphin	
	Delphinus delphis	Common dolphin	LC
Spinner dolphin	*Stenella clymene*	Short-snouted spinner dolphin	DD
	Stenella longirostris	Spinner dolphin	DD
~~*Stenella coeruleoalba*~~	*Stenella coeruleoalba*	Striped dolphin	LC
~~*Stenella attenuata*~~	*Stenella attenuata*	Pantropical spotted dolphin	LC
~~*Stenella frontalis*~~	*Stenella frontalis*	Atlantic spotted dolphin	DD
Bottlenose dolphin	*Tursiops truncatus*	Bottlenose dolphin	LC
Harbor porpoise	*Phocoena phocoena*	Harbor porpoise	LC

Analysis of species group clusters
(NMDS ordination, Schick et al 2011)



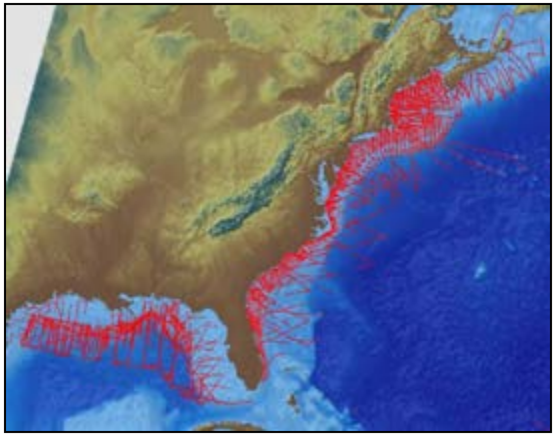
180517 Mesoplodon densirostris
Blainville's beaked whale

180498 *Ziphius cavirostris*
Cuvier's beaked whale

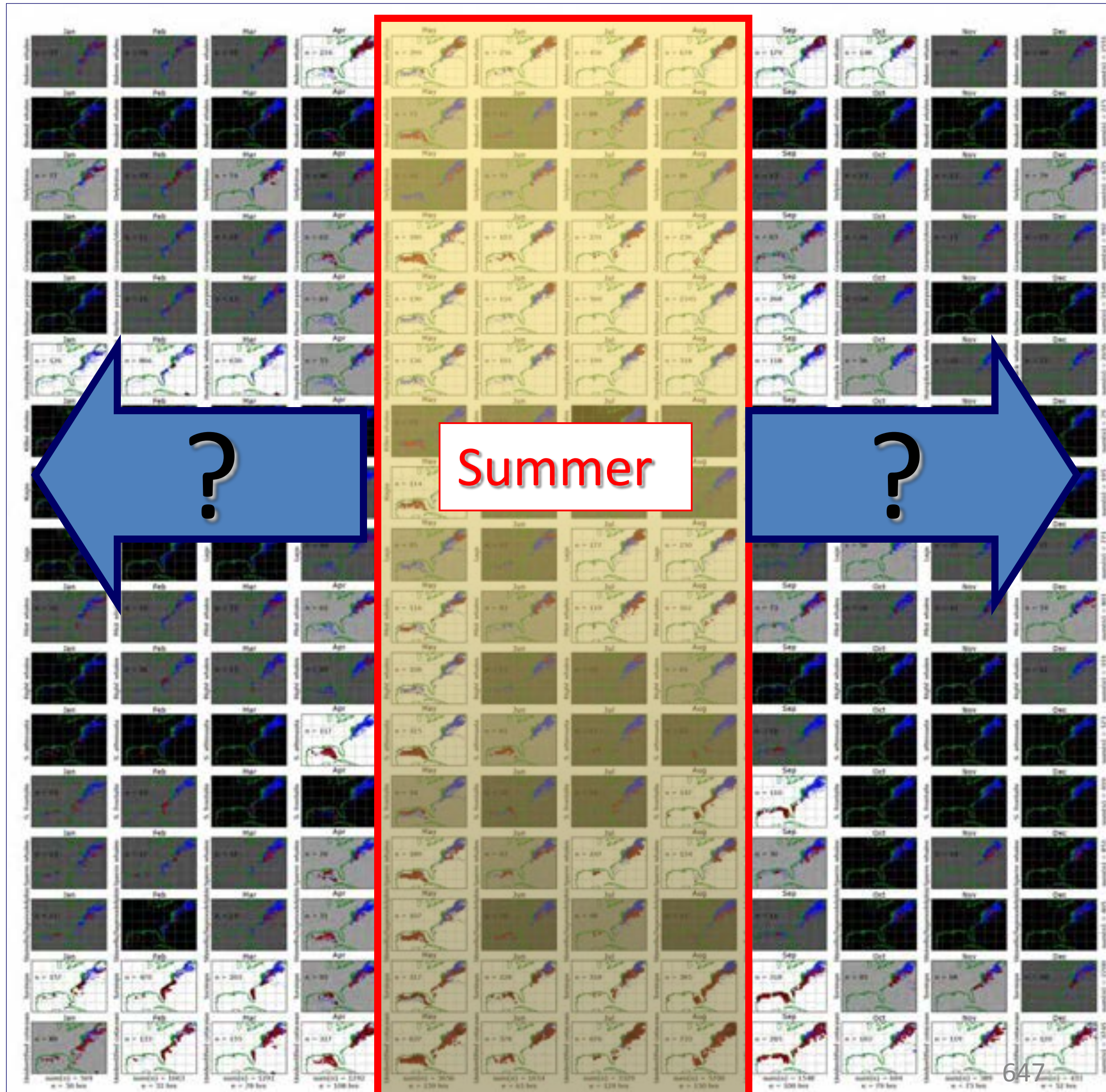
180508 *Mesoplodon mirus*
True's beaked whale

clustered guild: example beaked whale

Seasonal Data Gap Analysis:

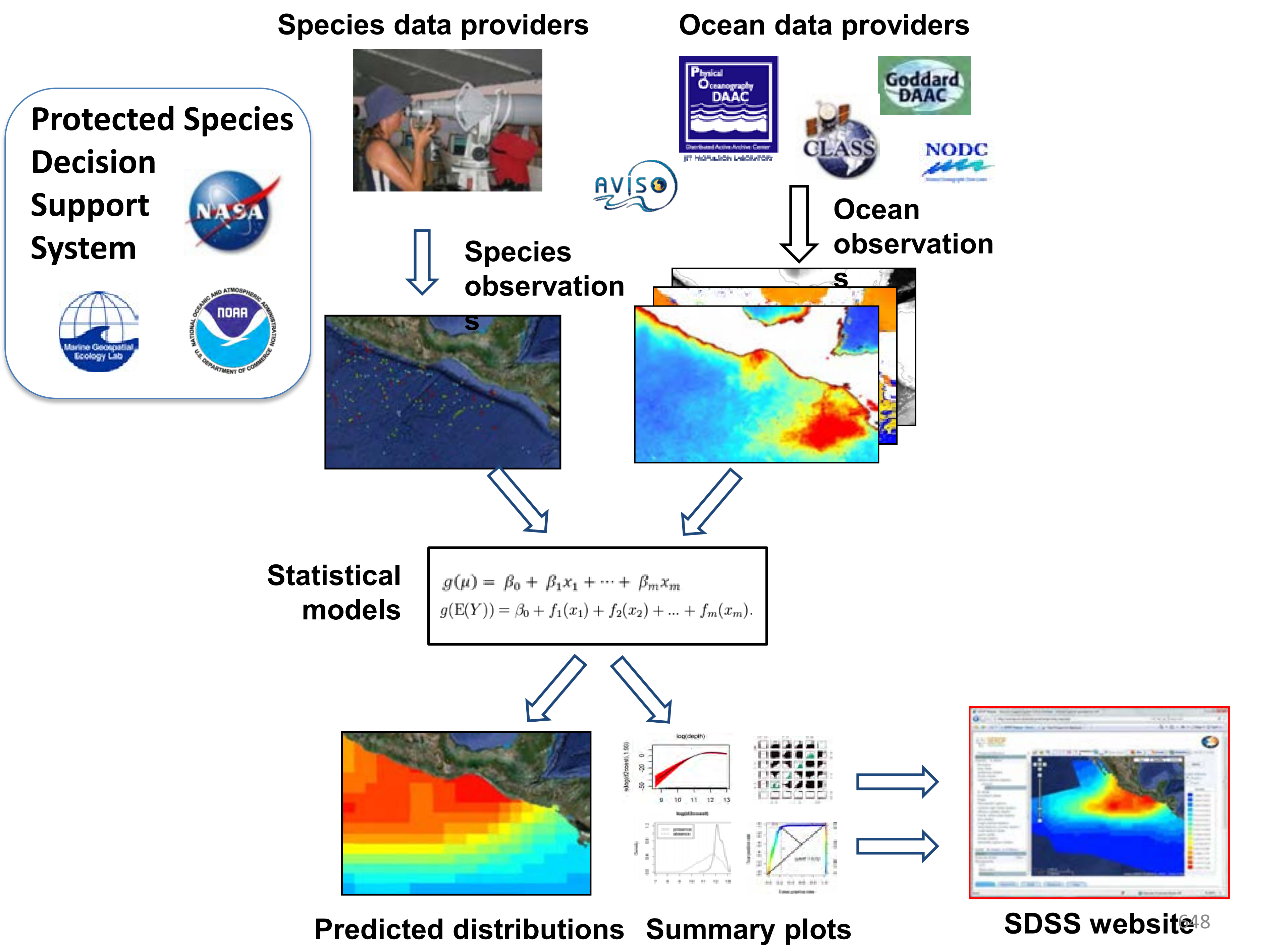


12 months



16 cetacean guilds

White >100
Light Grey >50
Dark Grey >30
Black < 10


Species data providers
Ocean data providers
Protected Species Decision Support System
Physical Oceanography DAAC
Goddard DAAC
CLASS
NODC
AVISO
NASA
Marine Geospatial Ecology Lab
NOAA
Species observations
Ocean observations
Statistical models
$g(\mu) = \beta_0 + \beta_1 x_1 + \cdots + \beta_m x_m$
$g(E(Y)) = \beta_0 + f_1(x_1) + f_2(x_2) + \ldots + f_m(x_m).$
log(depth)
Predicted distributions
Summary plots
SDSS website

Duke SERDP Model Overview

Probability of occurrence from static environmental variables and time-varying conditions

Approach: Integrated surveys conducted by ship and aircraft, weighting a GAM by minutes surveyed within space–time grid cells

- Maps of Presence versus Absence - receiver operator characteristic (ROC) curve thresholds
- Marine Geospatial Ecology Tools (MGET) were used for fetching and sampling of environmental data within ArcGIS and generation of GAMs with the R statistics package mgcv
- Covariates: depth, distance to shore, distance to shelf, sea surface temperature
- Resolution: 10km, Seasonal, Guilds

Duke SERDP Model Overview

Guilds: Sample sizes were inadequate to build separate habitat suitability models for most individual species:

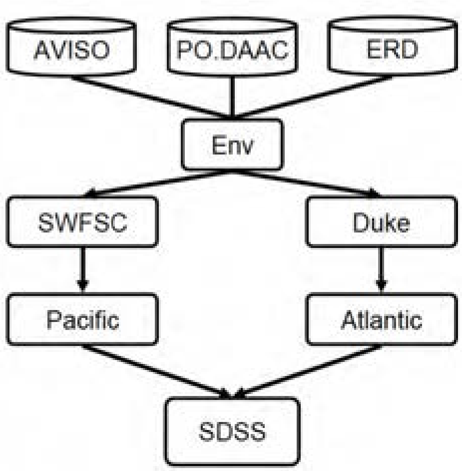
- grouped species at various taxonomic levels to create species 'guilds'
- established using information on species distributions, interactions, and other expert knowledge
- compared to environmental ordination results for validation of members

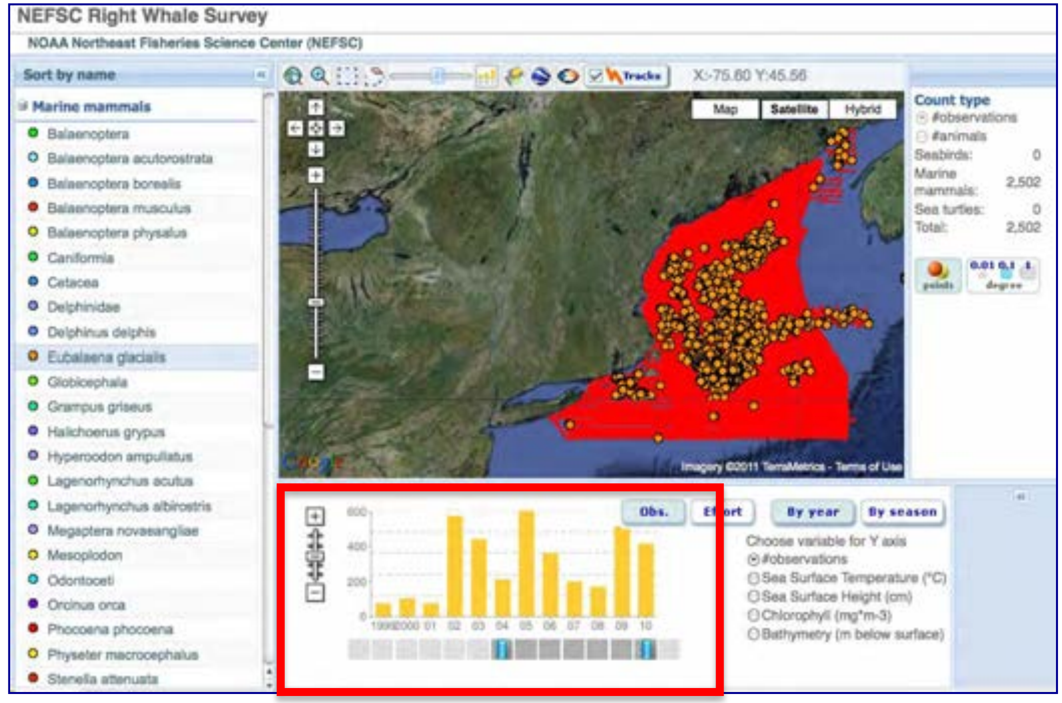
References: Best et al. 2007, Schick et al. 2011, Best et al. 2012

Spatial Decision Support System

SDSS Provides:

- Density models
- Links to data
- Links to metadata
- Links to variables
- Visualization by time



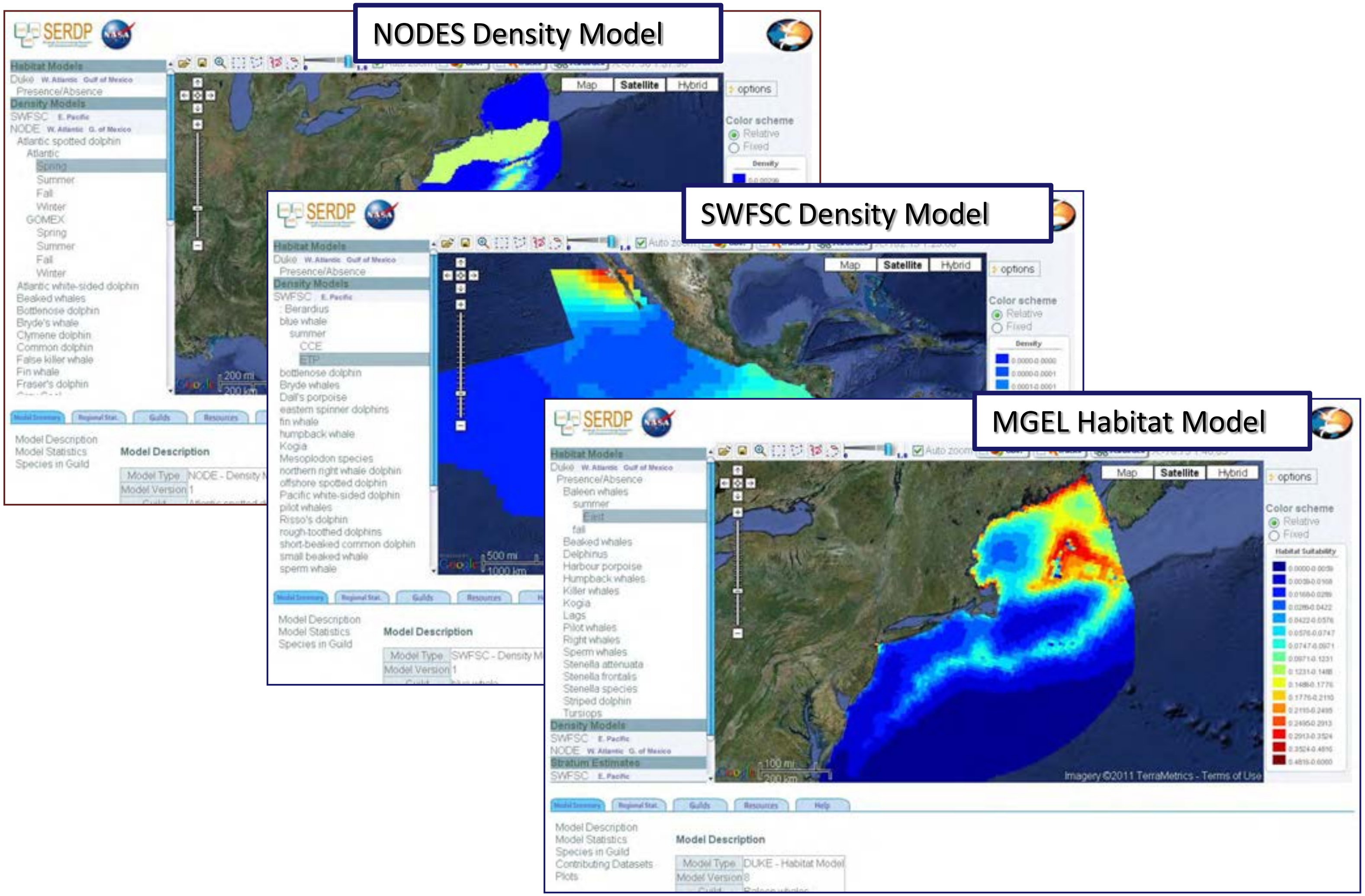


Observations and survey effort of North Atlantic right whale dataset hosted on SEAMAP since 2004 when HYCOM data is available.

Cetacean density models in OBIS-SEAMAP

SERDP Spatial Decision Support System
originally funded by SERDP, continuing development by NASA

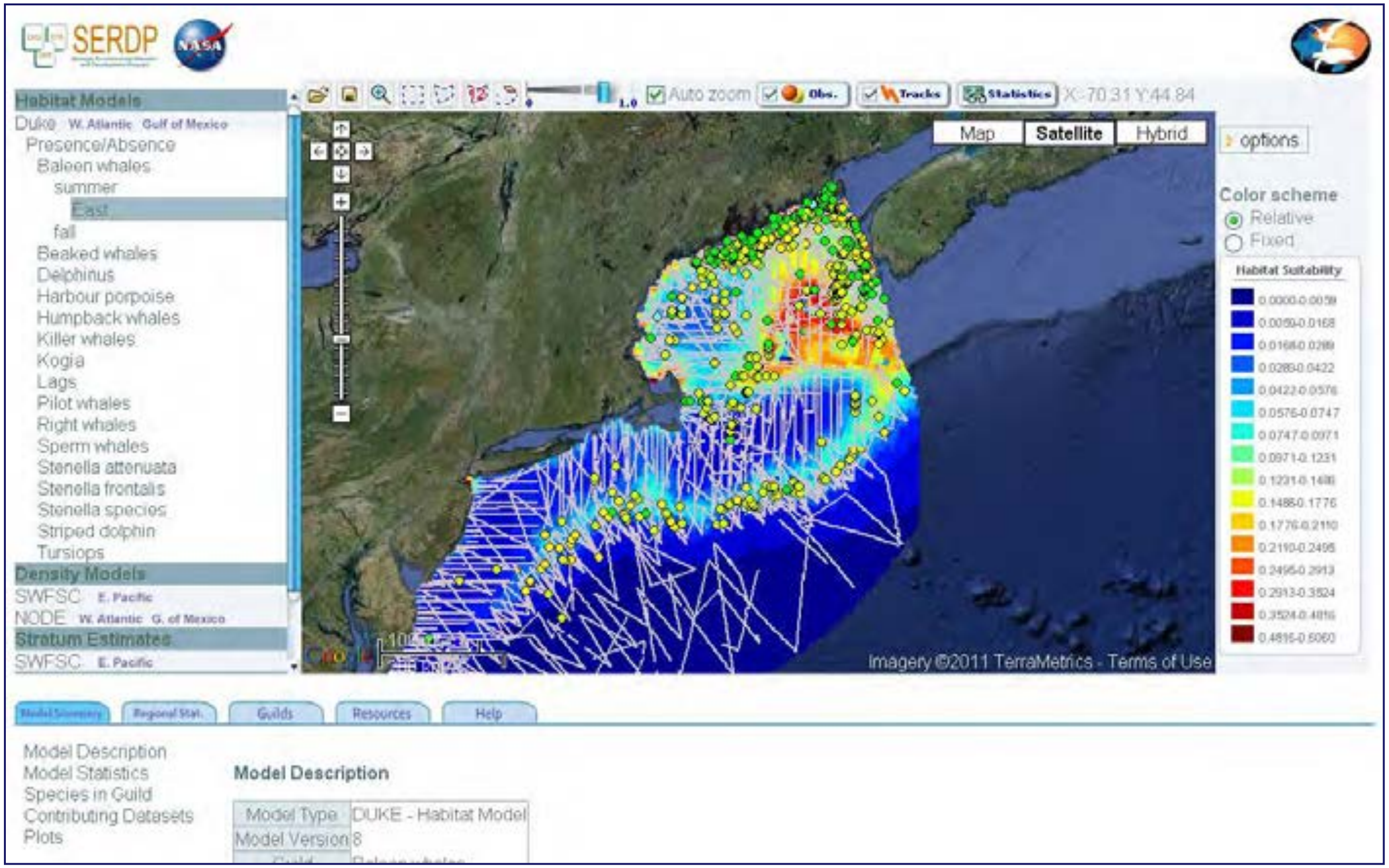
Multiple habitat/density models from different projects



Cetacean density models in OBIS-SEAMAP

Interactive decision support

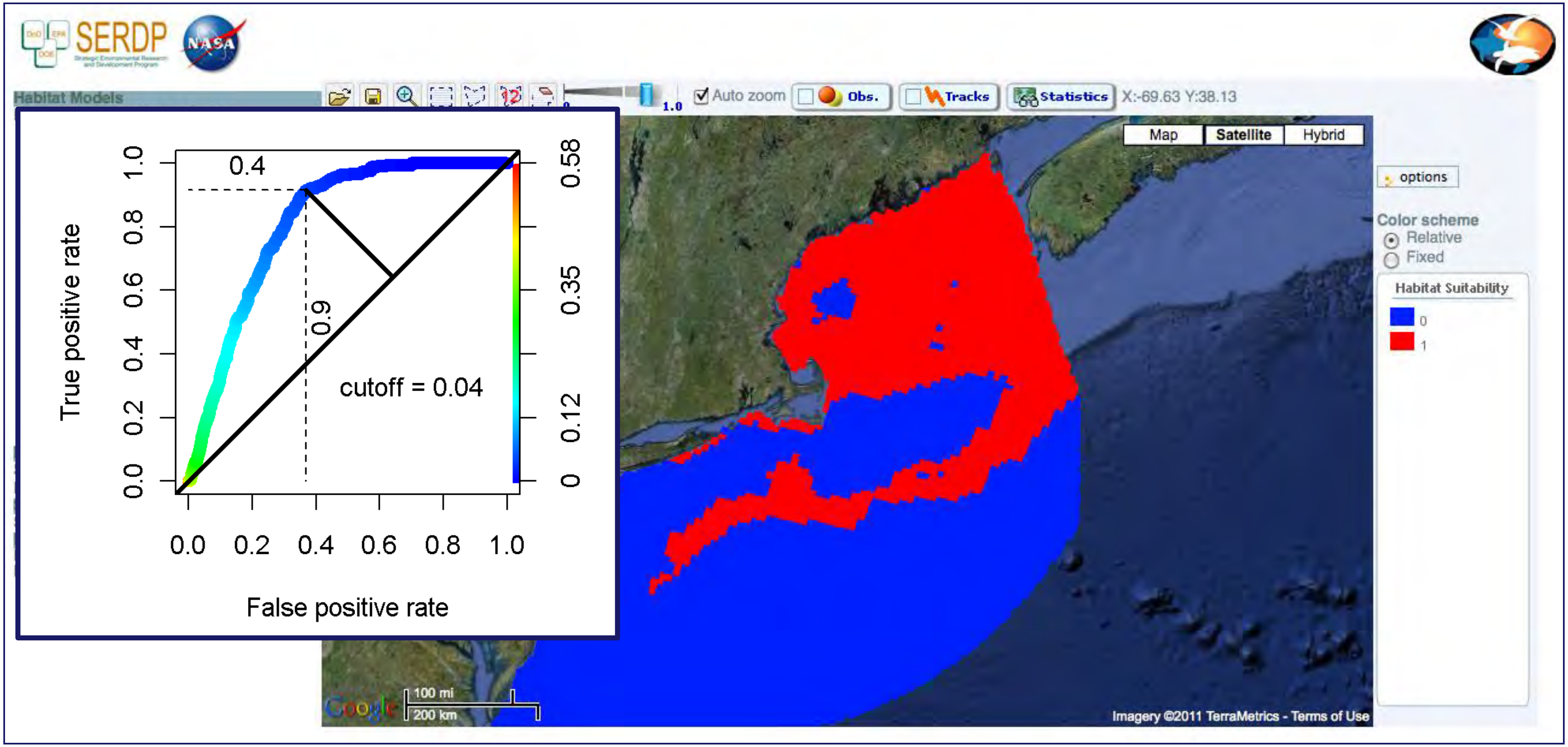
Model outputs presented with original data (including effort)



Cetacean density models in OBIS-SEAMAP

Interactive decision support

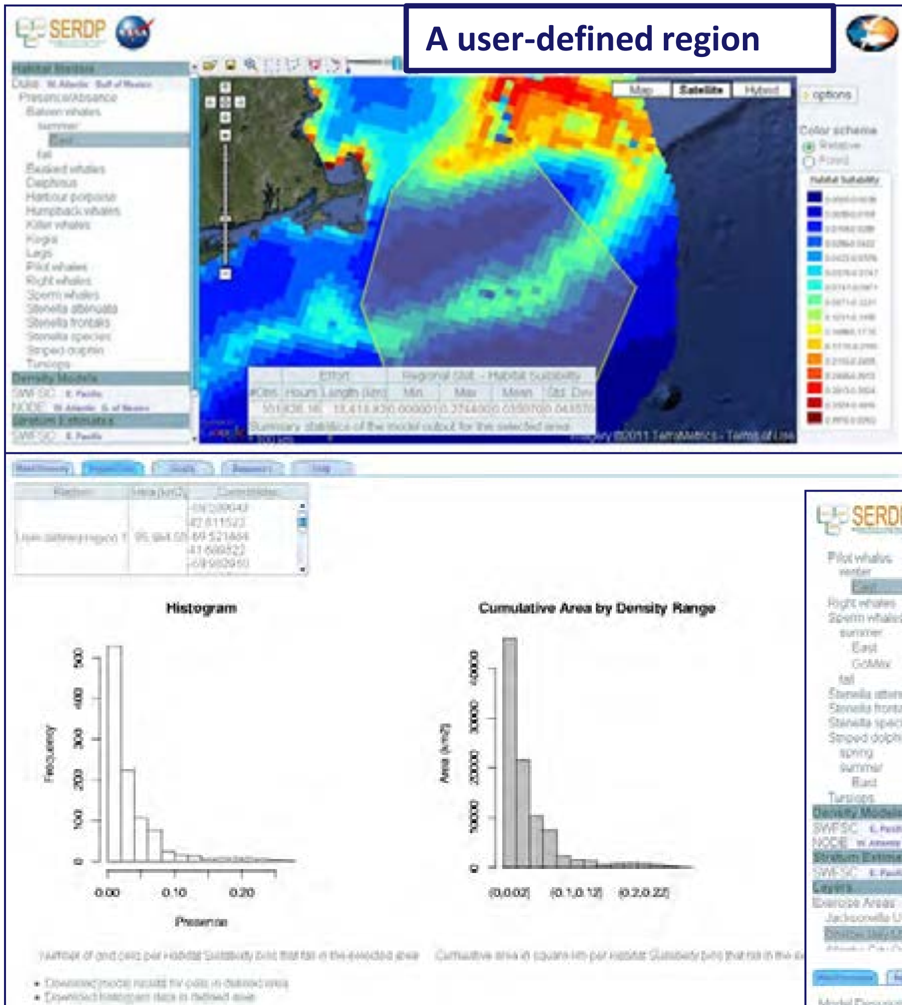
Critical habitats evaluated with ROC analysis



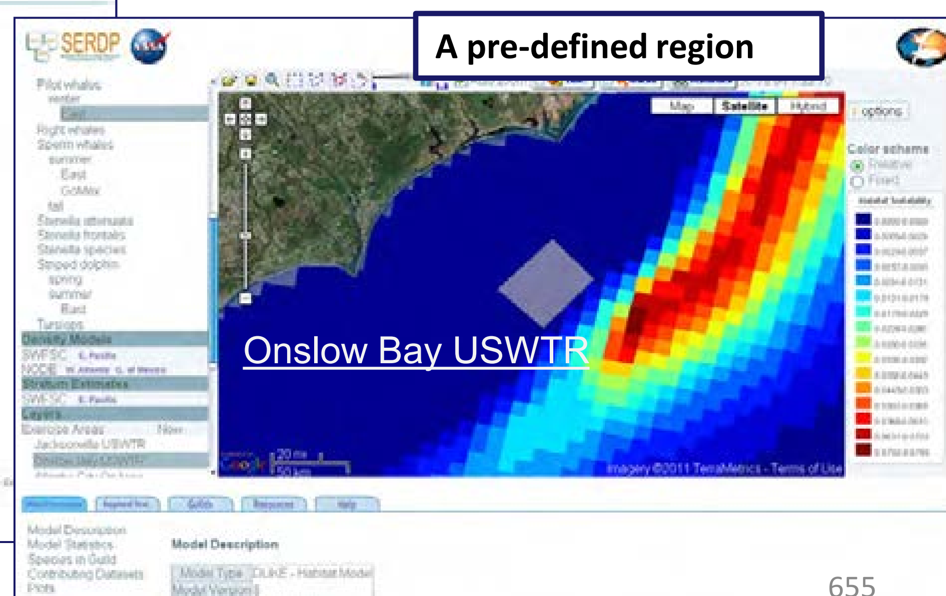
Cetacean density models in OBIS-SEAMAP

Interactive decision support

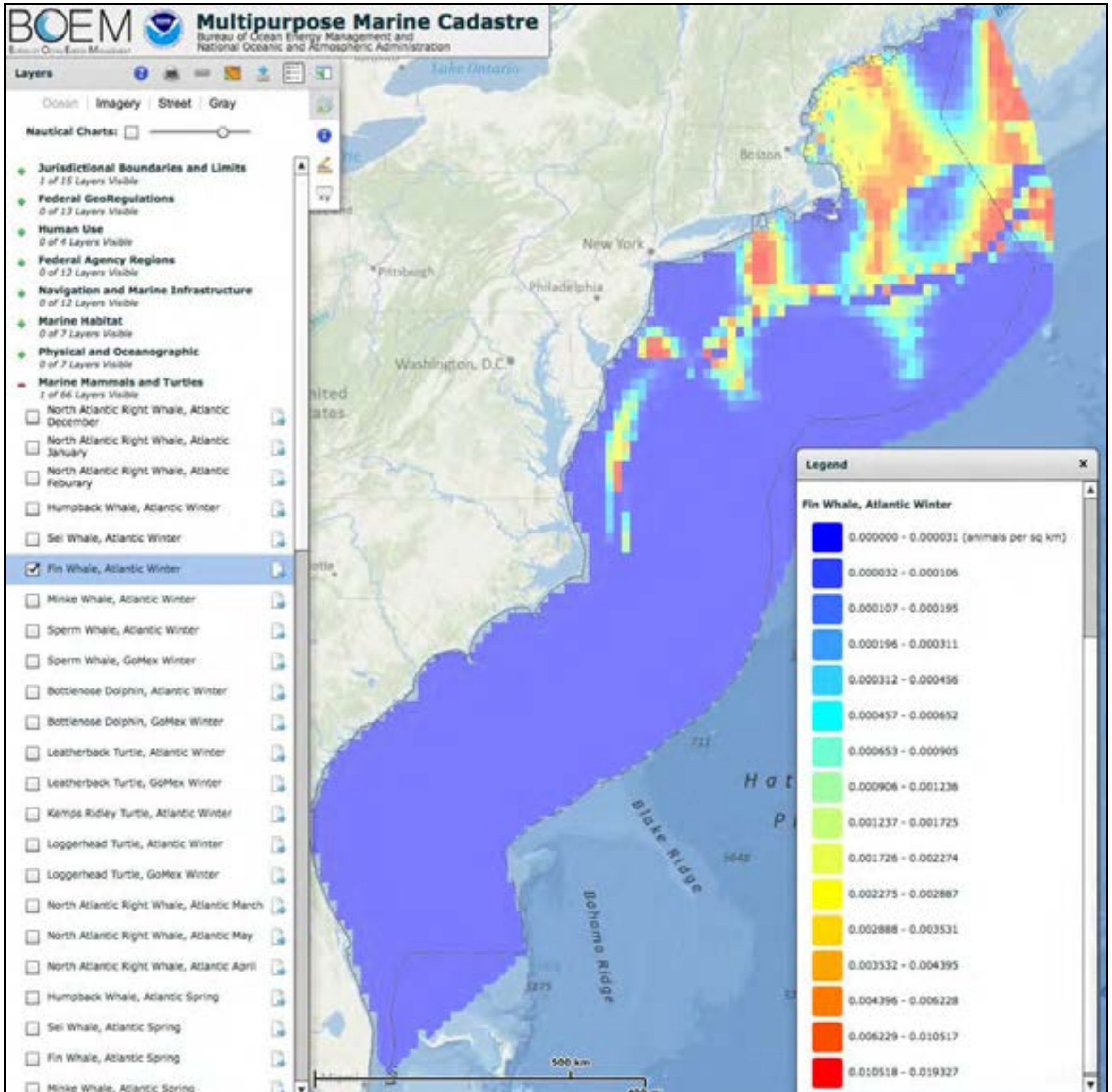
Queries by regions of interest



Queries can be calculated against pre-defined areas (*e.g.* Navy operation areas)



Model Output: Multipurpose Marine Cadastre



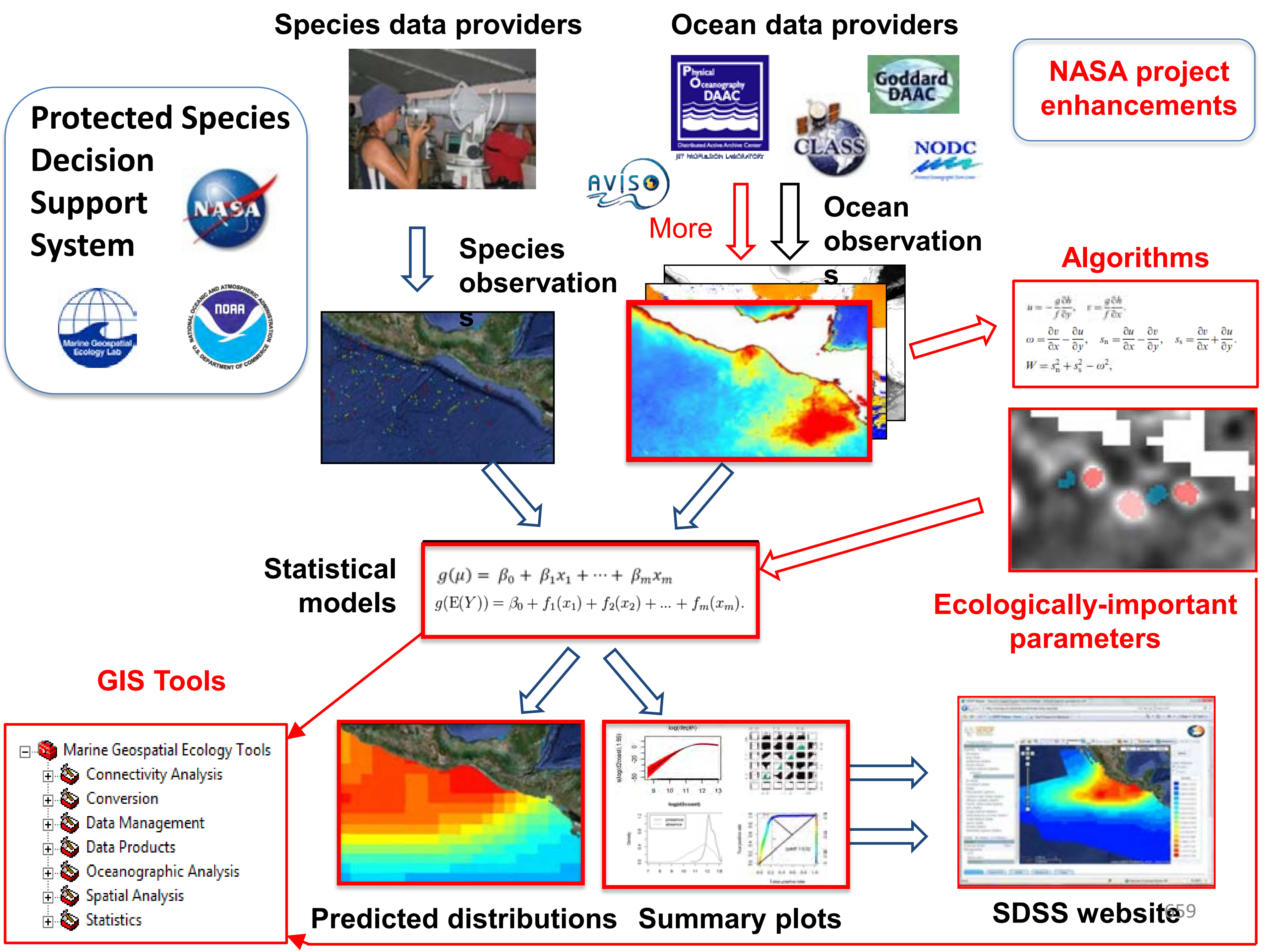
- **<u>Provided:</u>** predictive density models of cetaceans by season for US Atlantic and Pacific waters.

Modeling Efforts at Duke

- **Existing:**
  - SERDP Atlantic and GoMEX cetacean probability of occurrence models
- **Current:**
  - Update to SERDP models (Duke)
- **Upcoming:**
  - Western Atlantic cetacean modeling - US Navy Atlantic Fleet Training and Testing (AFTT) Area
- **Meta:**
  - CetMap project overview

Forecasting model & SDSS improvements

- Incorporating a wider range of remotely-sensed ocean observations, including new geographic areas.
- Deriving more ecologically-important model parameters from the ocean observations.
- Exploring the implementation of near-real-time now-cast and forecast capabilities.
- Publishing key algorithms in a free, GIS-integrated toolbox.



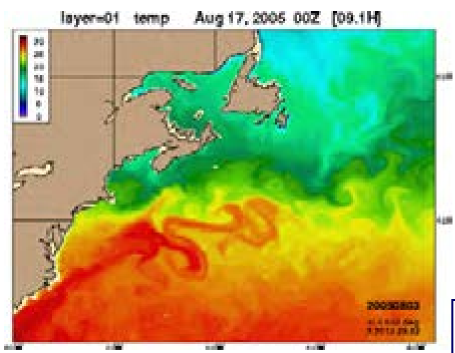
Species data providers
Ocean data providers
NASA project enhancements
Protected Species Decision Support System
NASA
Marine Geospatial Ecology Lab
NOAA
Physical Oceanography DAAC
Goddard DAAC
CLASS
NODC
AVISO
Species observations
More
Ocean observations
Algorithms
$u = -\frac{g}{f}\frac{\partial h}{\partial y}, \quad v = \frac{g}{f}\frac{\partial h}{\partial x},$
$\omega = \frac{\partial v}{\partial x} - \frac{\partial u}{\partial y}, \quad s_n = \frac{\partial u}{\partial x} - \frac{\partial v}{\partial y}, \quad s_s = \frac{\partial v}{\partial x} + \frac{\partial u}{\partial y}.$
$W = s_n^2 + s_s^2 - \omega^2,$
Statistical models
$g(\mu) = \beta_0 + \beta_1 x_1 + \cdots + \beta_m x_m$
$g(\mathrm{E}(Y)) = \beta_0 + f_1(x_1) + f_2(x_2) + \ldots + f_m(x_m).$
Ecologically-important parameters
GIS Tools
Marine Geospatial Ecology Tools
Connectivity Analysis
Conversion
Data Management
Data Products
Oceanographic Analysis
Spatial Analysis
Statistics
Predicted distributions
Summary plots
SDSS website

SERDP
Strategic Environmental Research and Development Program

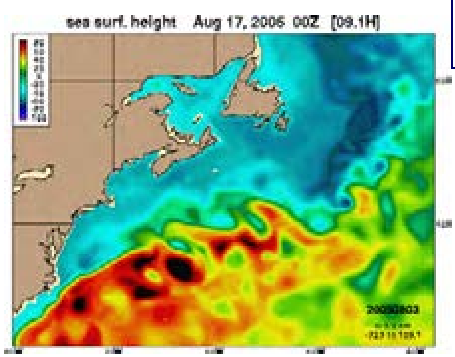
Example forecasting system

HYBRID COORDINATE OCEAN MODEL
HYCOM

SST



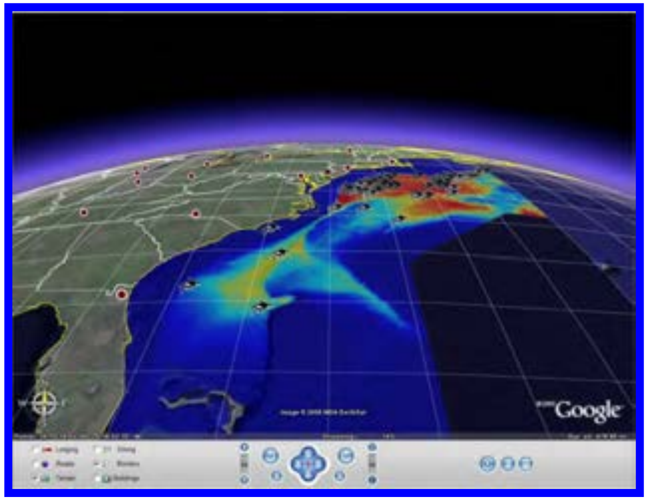
SSH



→ **1/24 deg** (3.8 km / 1.8 nm)

Prediction built from past observations

Spatial Decision Support System

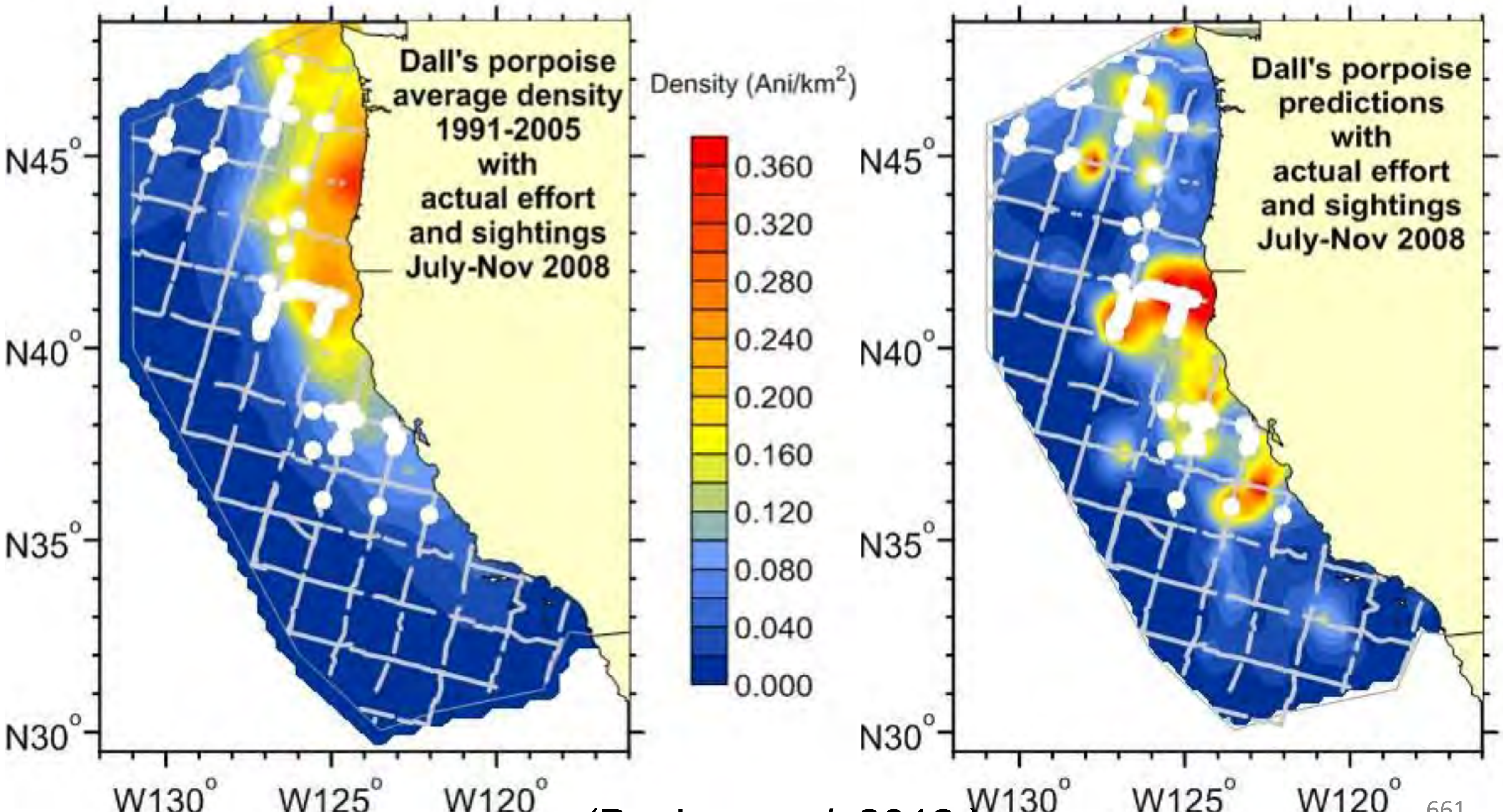


(HYCOM images from Bub 2006)

NOWCAST – Dall's porpoise density

for novel 2008 survey (July-Nov)

"1991-2005 Climatology" **"Daily forecast"**

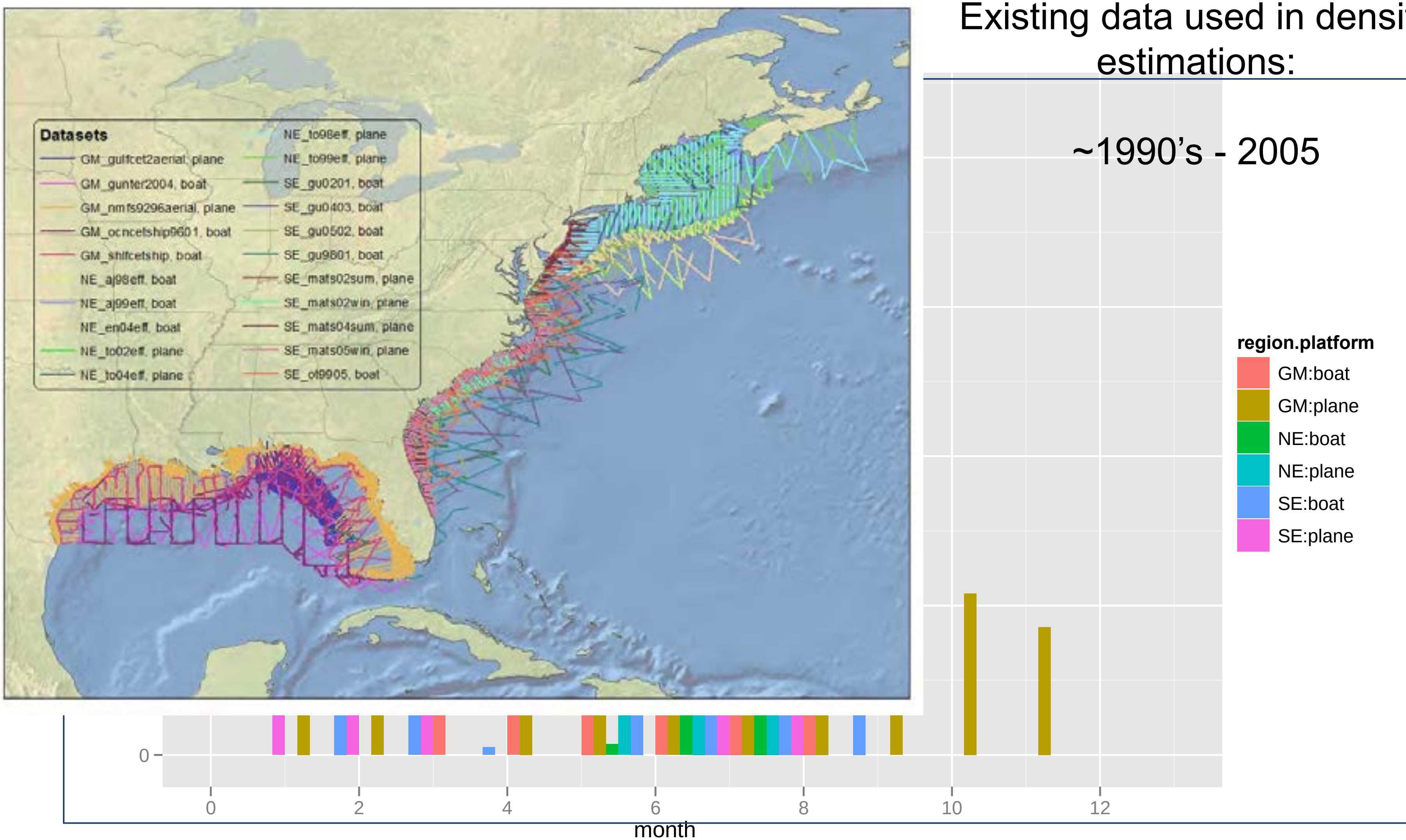


(Becker *et al.* 2012)

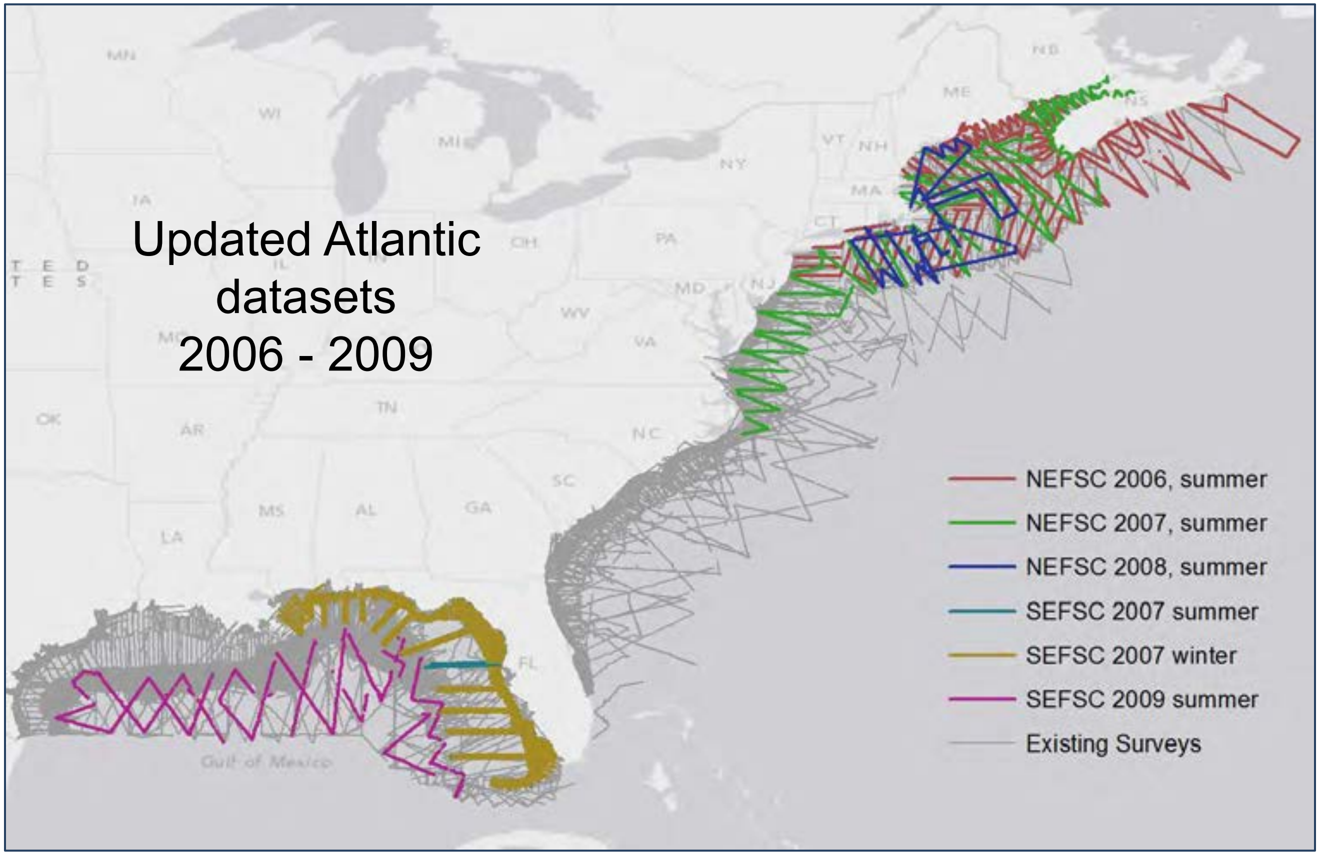
Habitat Density (HD) models in progress: EC & GoMEX

Existing data used in density estimations:

~1990's - 2005



New Density Models In Progress



New Atlantic datasets now processed for producing updated cetacean density surface models. Models are being built in two stages.

1) Using similar methods to Pacific for a comparative similar product

2) Using novel methods
- Unstructured grid with finer resolution closer to coast

New covariates

•Time of year as a circular statistic

•Oceanographic model outputs, including mixed layer depth

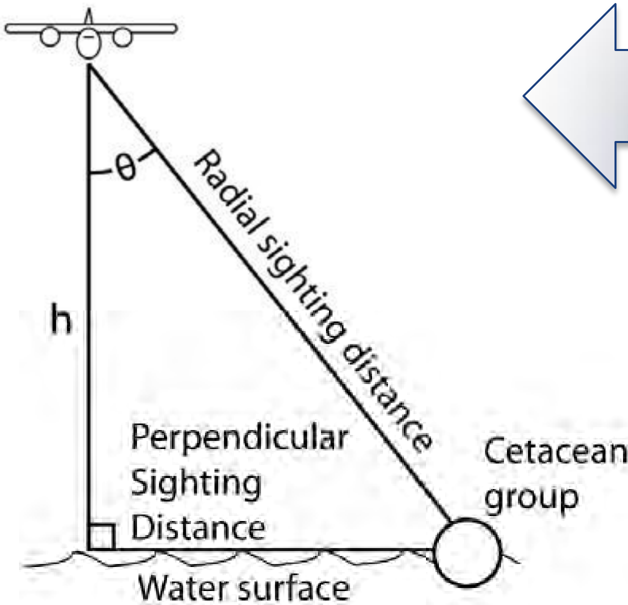
•Dynamics: fronts, eddies, Lagrangian coherent structures…

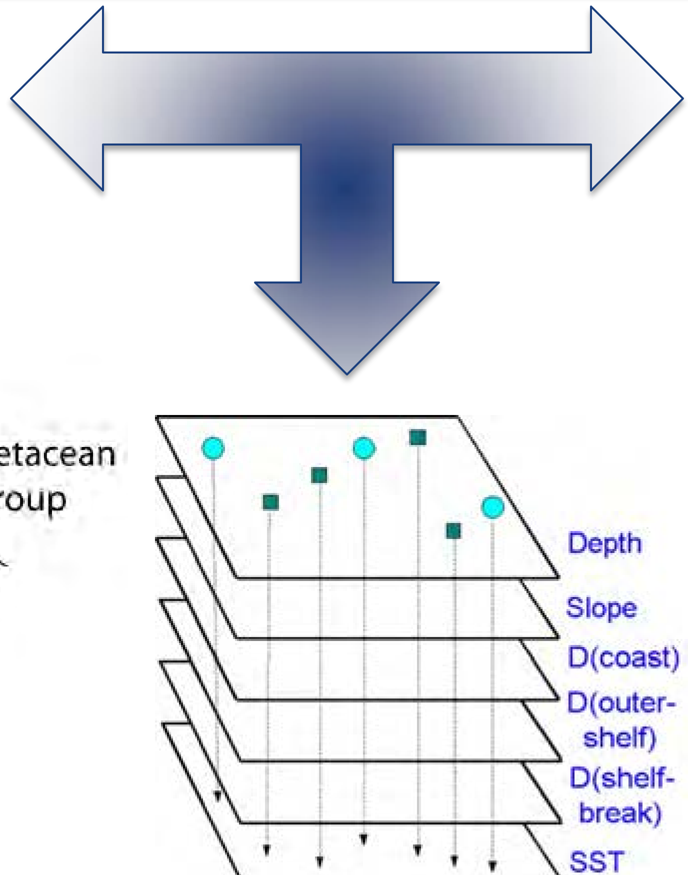
Habitat Density (HD) models in progress: EC & GoMEX

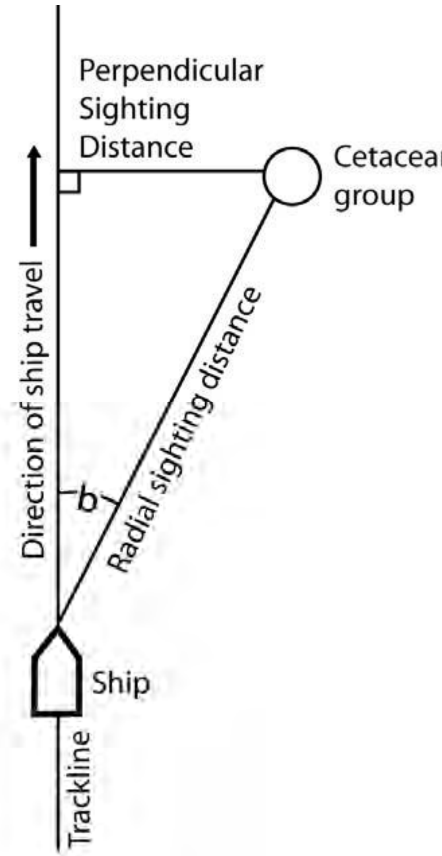
need to combine

ship

aircraft

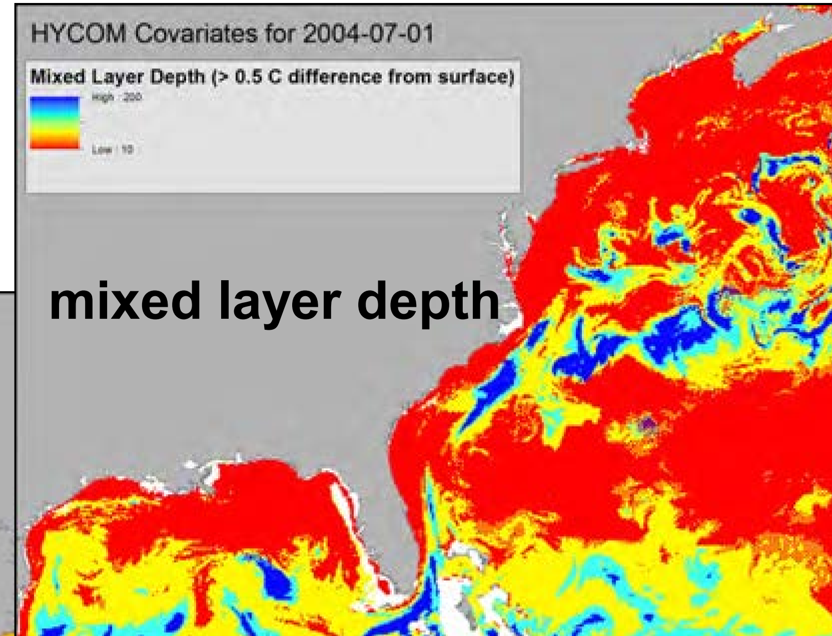


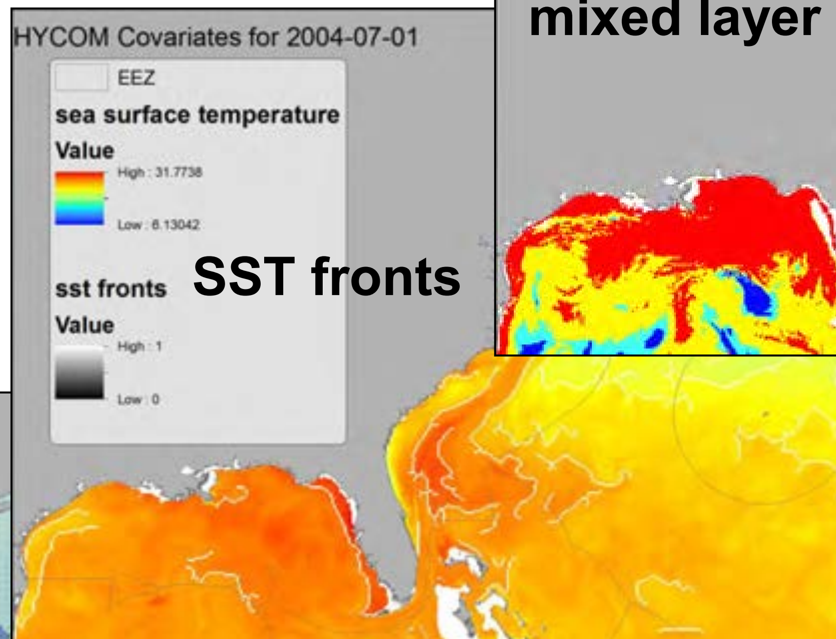


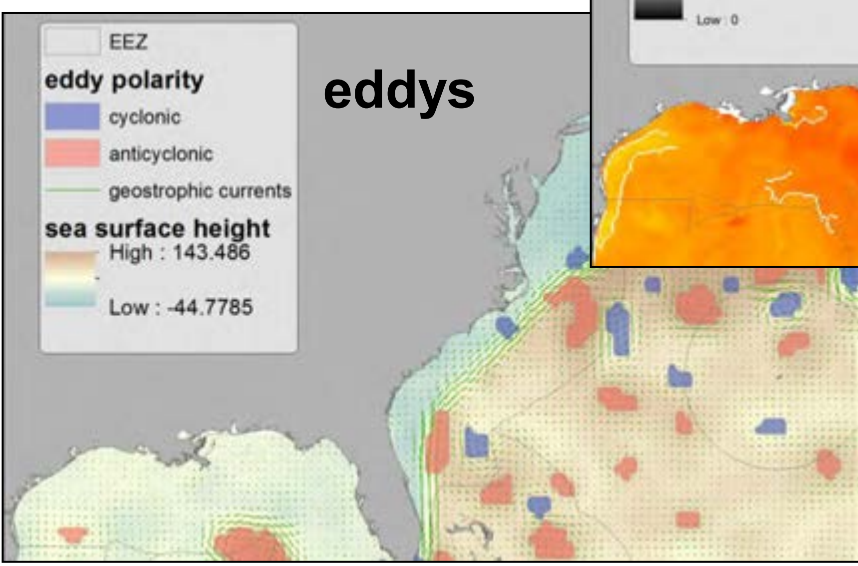


Habitat Density (HD) models in progress: EC & GoMEX

- More ecologically relevant variables
- Ability to nowcast & forecast







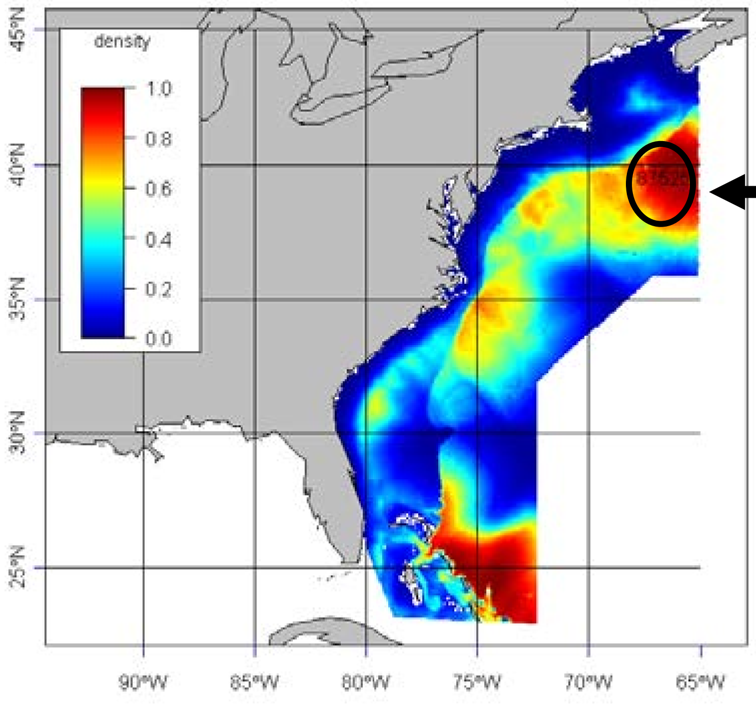
New covariates

- Oceanographic mixed layer depth
- Dynamics: fronts, eddies,
- Lagrangian coherent structures…

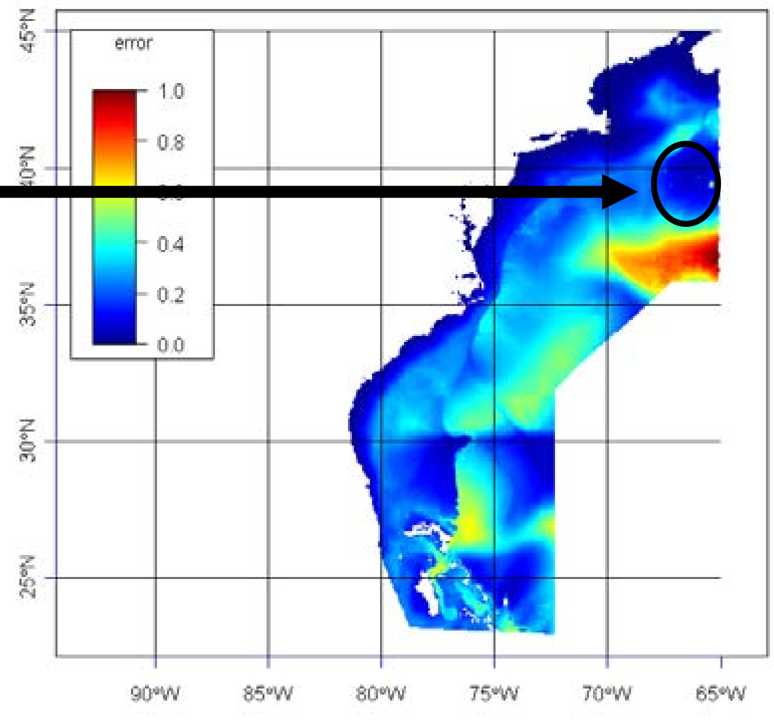
Uncertainty & risk assessment

High probability of encounter | Low model error

Prediction



Model Error



Area of high predicted encounter

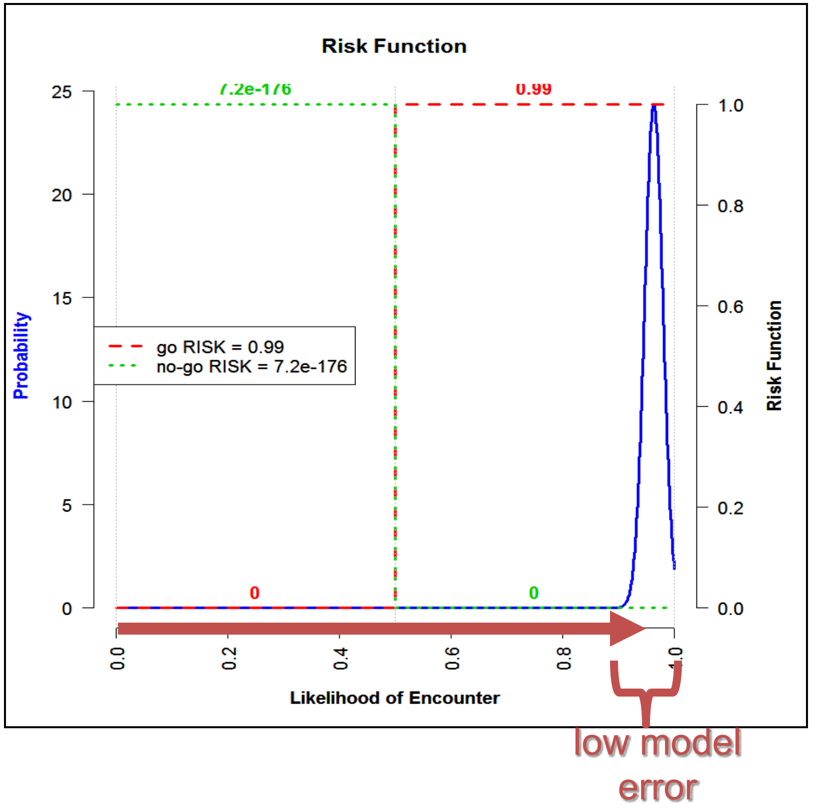
Area of low model error

Uncertainty & risk assessment

User defined threshold breaks

0	0.5	1
go	0	1
no-go	1	0

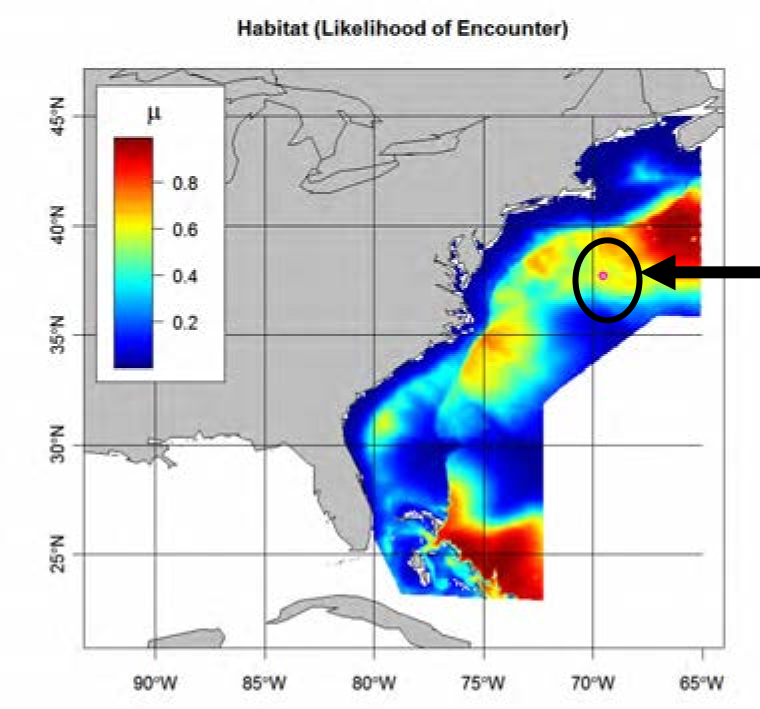
Risk of conducting an exercise in this region exceeds the selected decision threshold



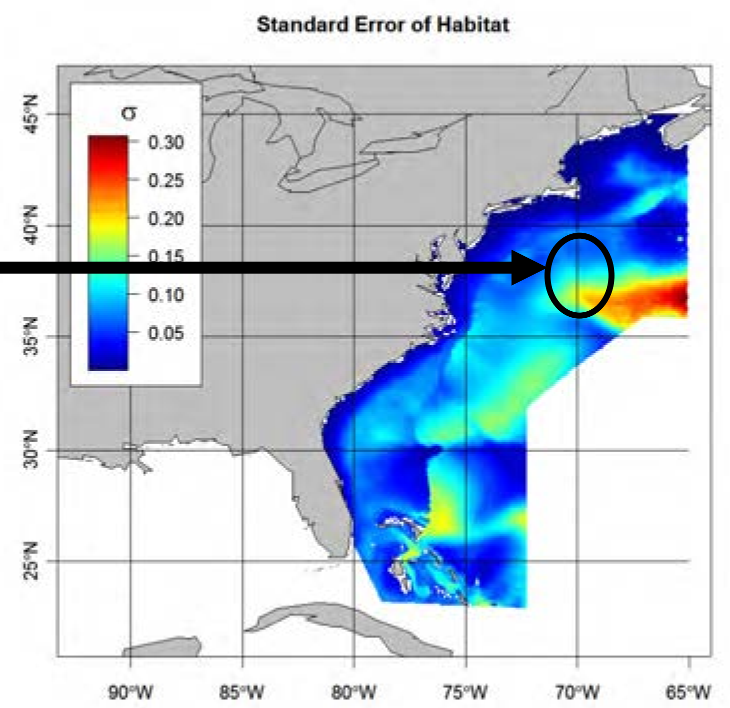
Uncertainty & risk assessment

"Moderate" probability of encounter | "Moderate" model error

Prediction



Model Error

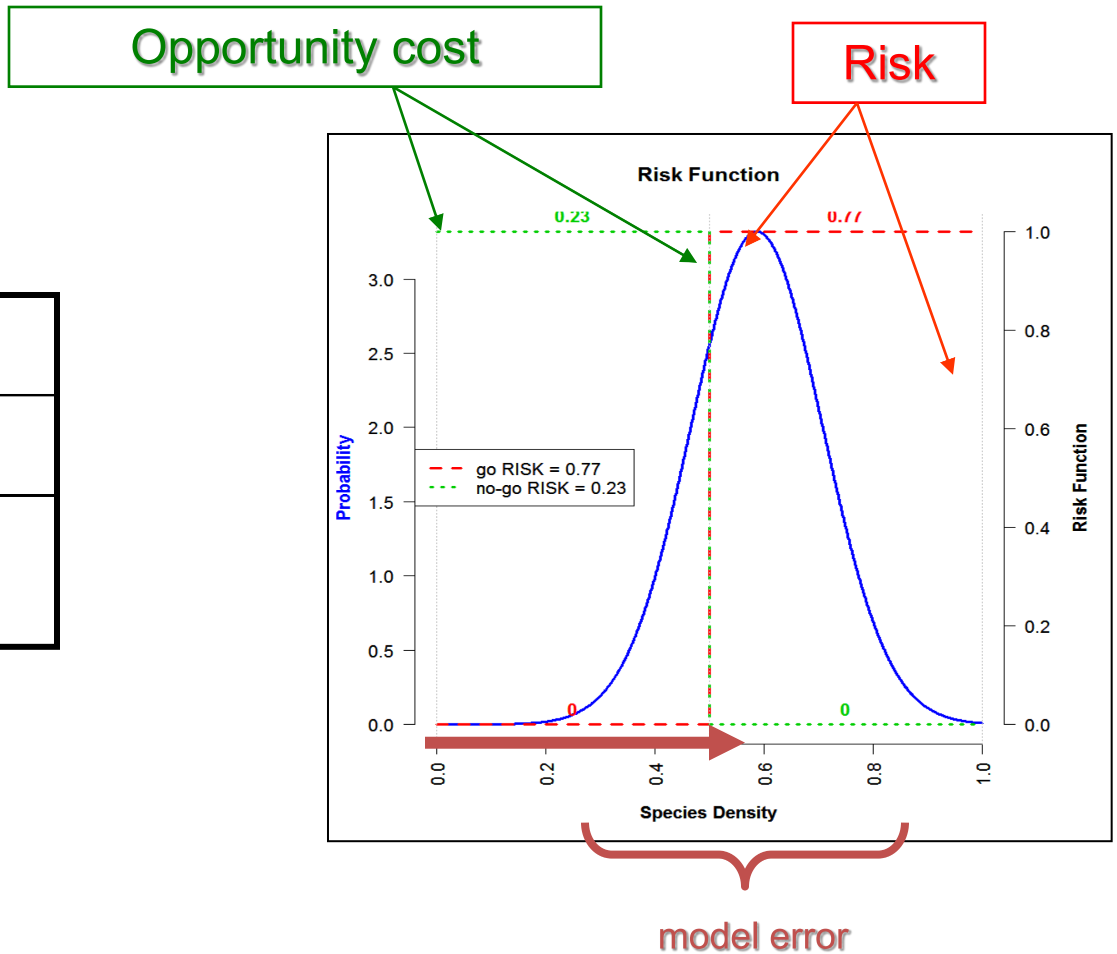


Area of medium predicted density / habitat ⟷ Area of moderate model error

Uncertainty & risk assessment

User defined threshold breaks

0	0.5	1
go	0	1
no-go	1	0



Modeling Efforts at Duke

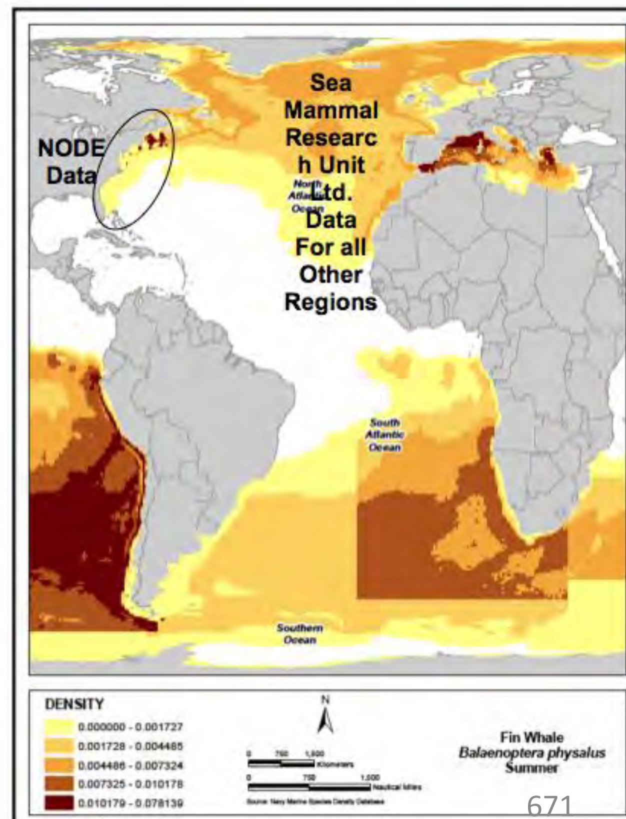
- **Existing:**
  - SERDP Atlantic and GoMEX cetacean probability of occurrence models
- **Current:**
  - Update to SERDP models (Duke)
- **Upcoming:**
  - Western Atlantic cetacean modeling - US Navy Atlantic Fleet Training and Testing (AFTT) Area
- **Meta:**
  - CetMap project overview

AFTT cetacean modeling

Current:

- Navy OPAREA Density Estimate (NODE) models
  - US EEZ (ATL/GOMEX)

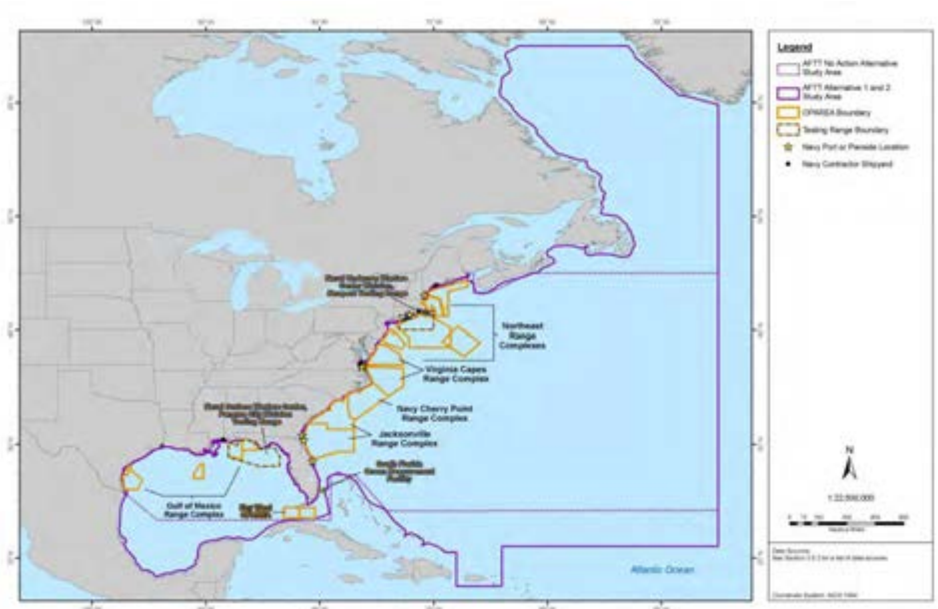
- Kaschner / St Andrew's RES density estimates elsewhere



AFTT cetacean modeling

New effort: USN, Duke, NOAA NMFS

- Investigate new statistical methods to better estimate density across the AFTT study area
- Update “pier side” data - build on CetMap work



AFTT cetacean modeling

Current:

- Navy OPAREA Density Estimate (NODE) models
  - US EEZ (ATL/GOMEX)
- Kaschner / St Andrew's RES density estimates elsewhere

New effort:

- Investigate new statistical methods to better estimate density across the AFTT study area
- Update "pier side" data – build on CetMap work

Models into Navy Marine Species Density Database (NMSDD)

-> Navy Acoustic Effects Model (NAEMO)

Workshop end of October at Duke

Modeling Efforts at Duke

– **Existing:**
  - SERDP Atlantic and GoMEX cetacean probability of occurrence models
– **Current:**
  - Update to SERDP models (Duke)
– **Upcoming:**
  - Western Atlantic cetacean modeling - US Navy Atlantic Fleet Training and Testing (AFTT) Area
– **Meta:**
  - CetMap project overview

CetMap Working Group tasks

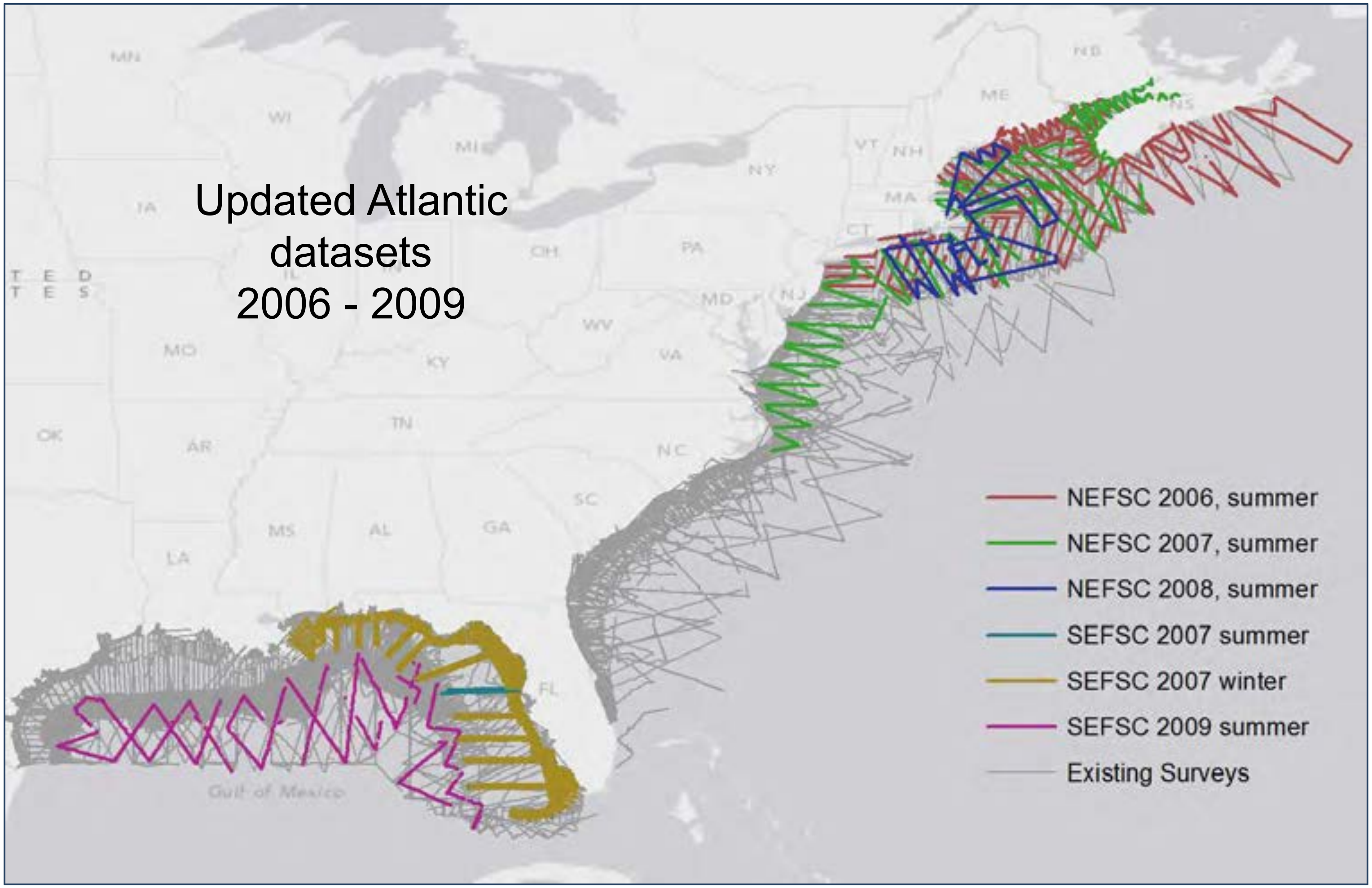
1. Cetacean Data Availability Analysis

2. New Modeling Efforts

3. Biologically Important Areas

Cetacean data & model discovery tool

Habitat Density (HD) models in progress: EC & GoMEX



CetMap Working Group tasks

1. Cetacean Data Availability Analysis

2. New Modeling Efforts

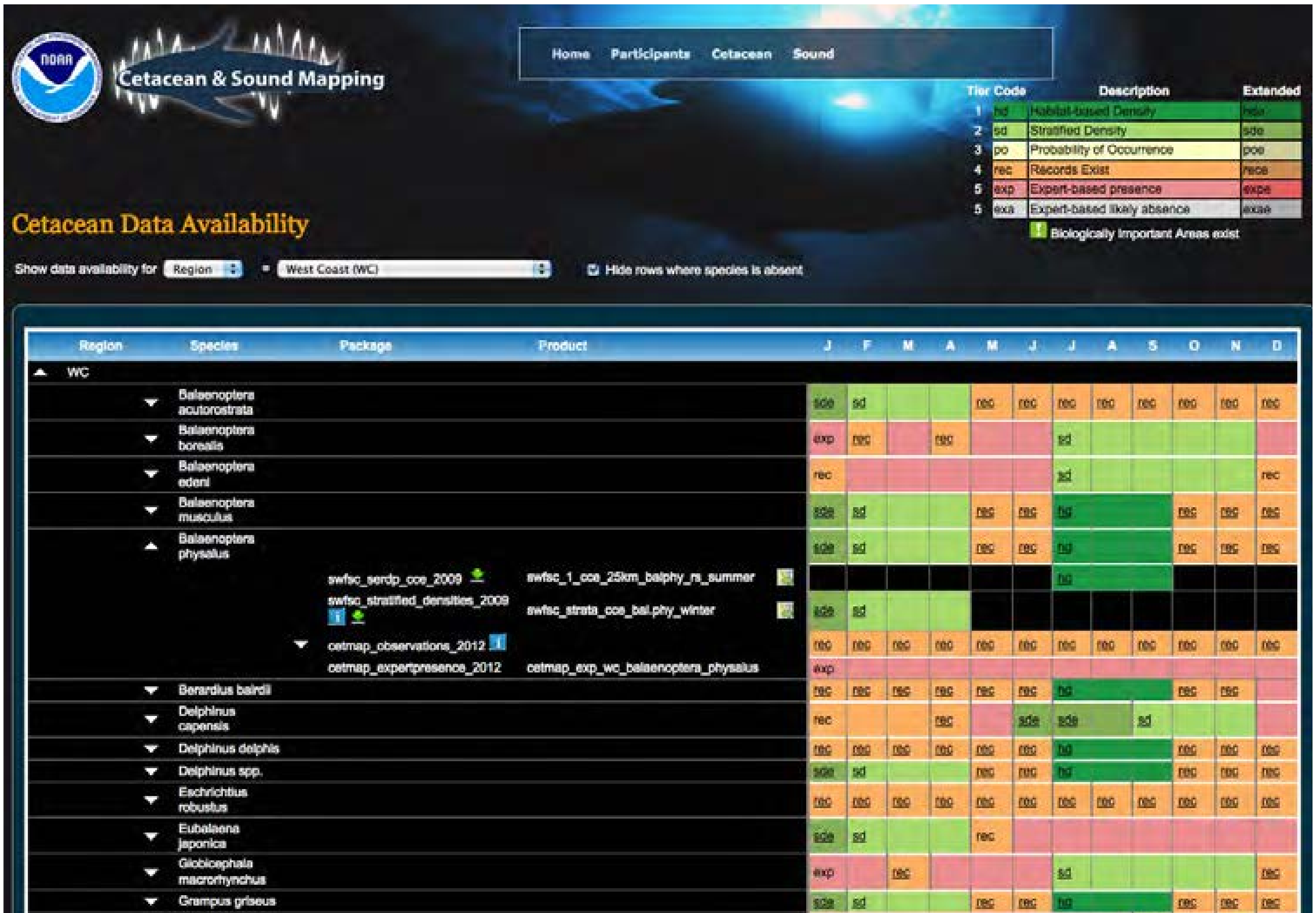
Placeholders are in CetMap
- no data download
- include this fall

3. Biologically Important Areas

Cetacean data & model discovery tool

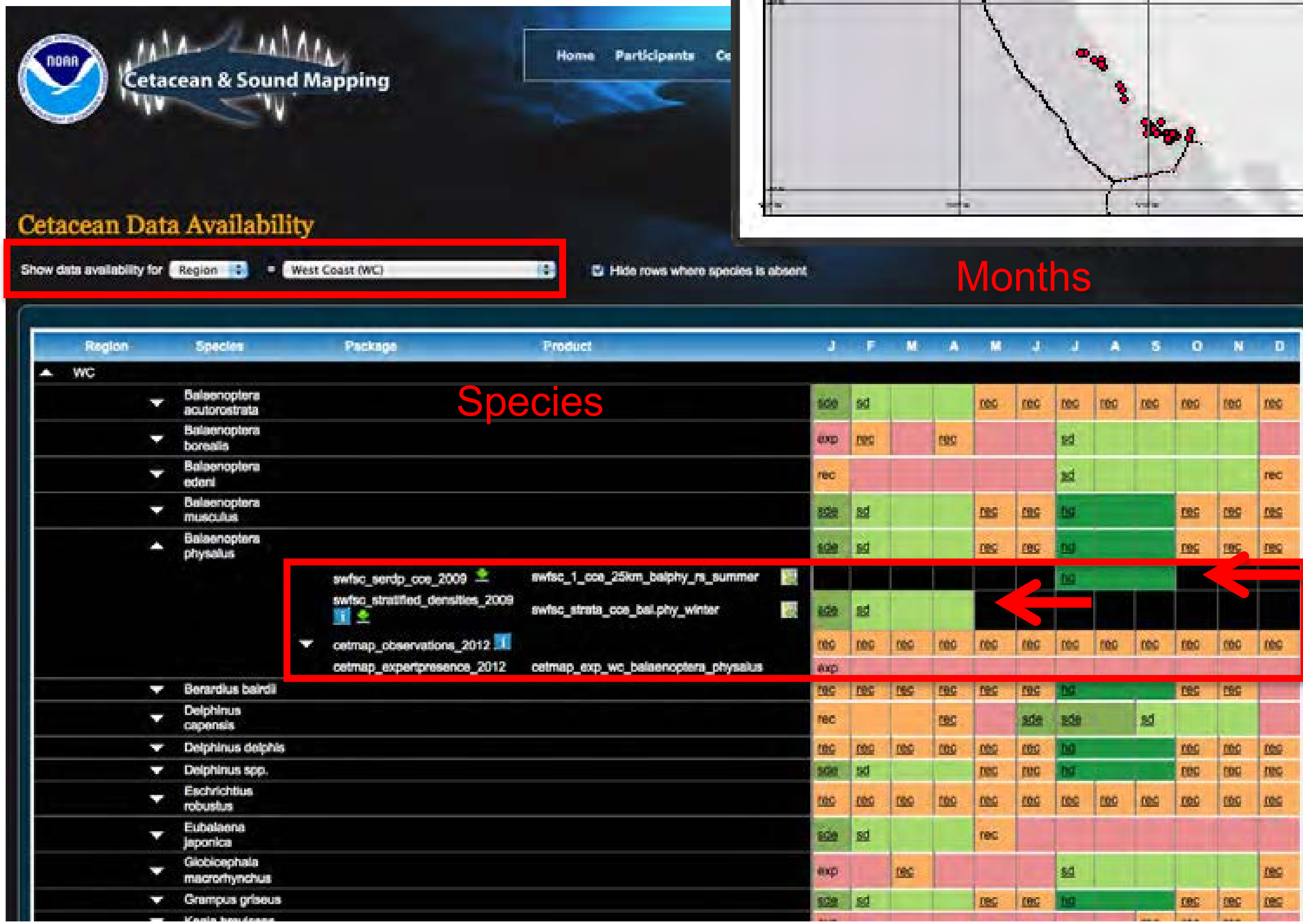
Cetacean Data Availability

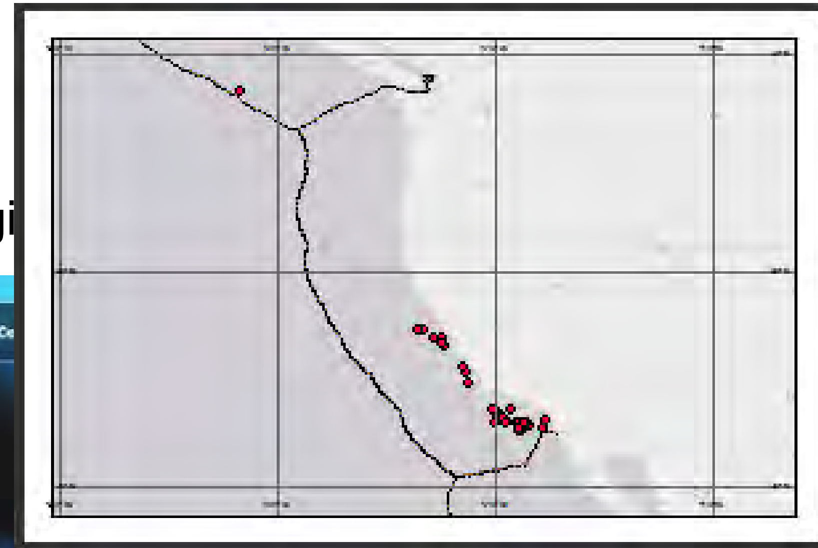
Purpose: to provide a single tool to discover the available data and models



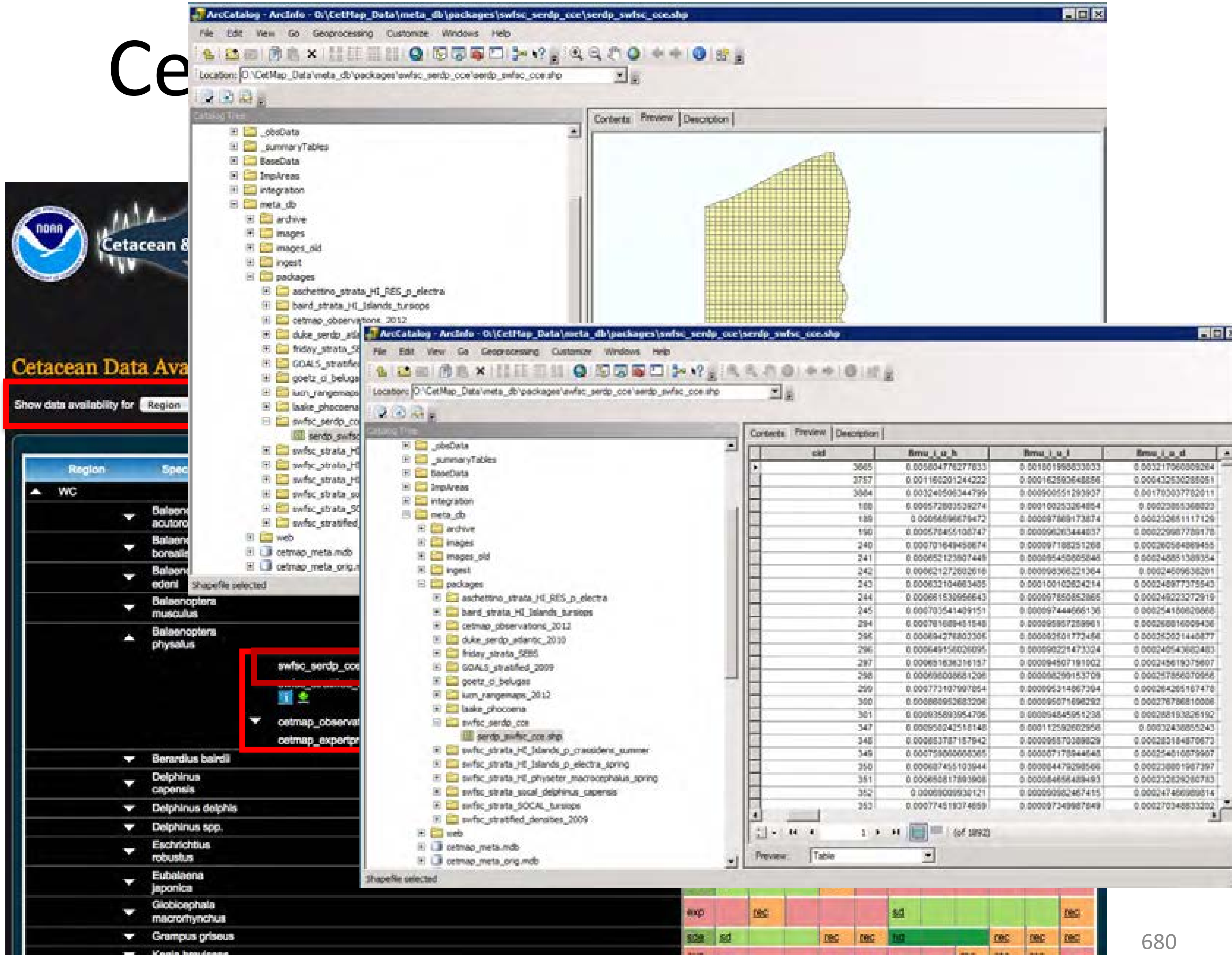
Cetacean Data

Query by regi





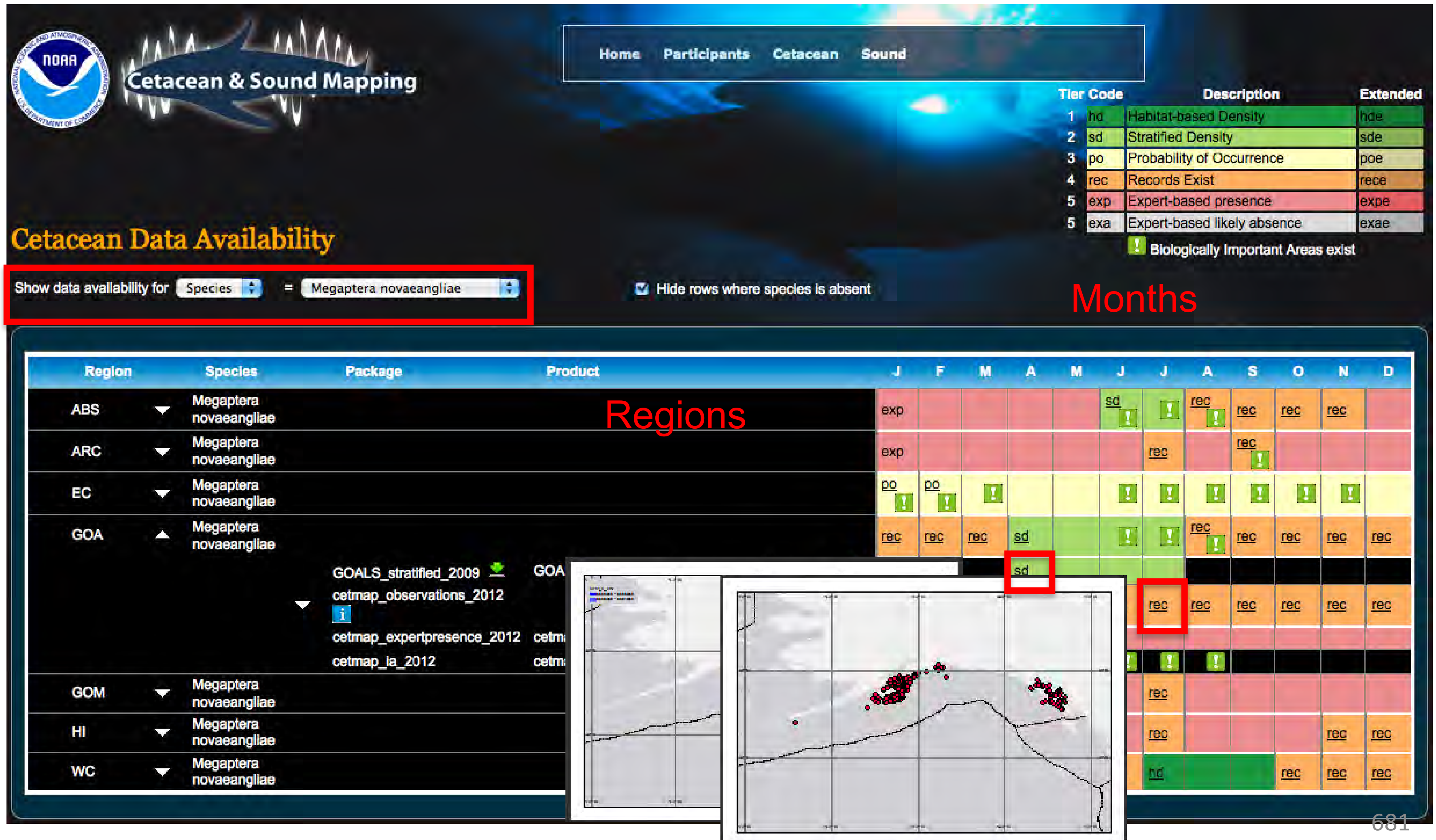
Ce



ArcCatalog - ArcInfo - O:\CetMap_Data\meta_db\packages\swfsc_serdp_cce\serdp_swfsc_cce.shp
File Edit View Go Geoprocessing Customize Windows Help
Location: O:\CetMap_Data\meta_db\packages\swfsc_serdp_cce\serdp_swfsc_cce.shp
Catalog Tree
Contents Preview Description
_obsData
_summaryTables
BaseData
ImpAreas
integration
meta_db
archive
images
images_old
ingest
packages
aschettino_strata_HI_RES_p_electra
baird_strata_HI_Islands_tursiops
cetmap_observations_2012
duke_serdp_atlantic_2010
friday_strata_SE8S
GOALS_stratified_2009
goetz_ci_belugas
iucn_rangemaps_2012
laake_phocoena
swfsc_serdp_cce
serdp_swfsc_cce.shp
web
cetmap_meta.mdb
cetmap_meta_orig.mdb
Shapefile selected
Preview: Table
Cetacean &
Cetacean Data Ava
Show data availability for Region
Region
WC
Balaenoptera musculus
Balaenoptera physalus
swfsc_serdp_cce
cetmap_observa
cetmap_expertpr
Berardius bairdii
Delphinus capensis
Delphinus delphis
Delphinus spp.
Eschrichtius robustus
Eubalaena japonica
Globicephala macrorhynchus
Grampus griseus

Cetacean Data Availability

Query by species



Modeling Efforts at Duke

End to End data system:

- Data-> Models -> Discovery -> Decision Support

Interested in collaborating on Mid-Atlantic data and modeling efforts.

Thank you!

http://seamap.env.duke.edu/

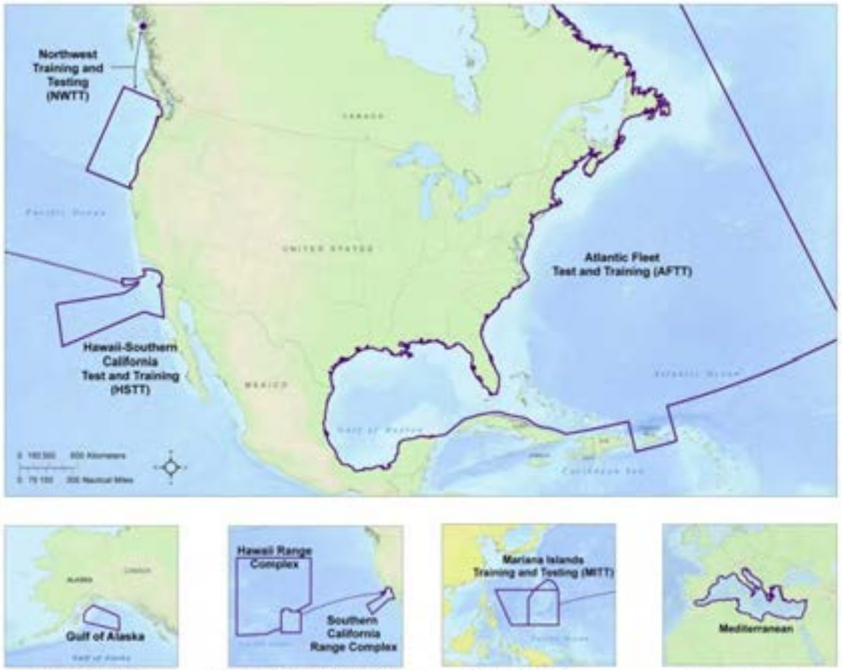
Marine Geospatial Ecology Lab
Nicholas School of the Environment
Duke University

Presentation #25

How the Navy Utilizes OBIS SEAMAP, CetMap, and other derived data products

Dr. Robert Gisiner
Office of the Chief of Naval Operations, Energy & Environmental Readiness Div (OPNAV N45)
bob.gisiner@navy.mil

Development of the Current U.S. Navy Risk Assessment and Monitoring Process



GULF OF ALASKA HAWAII - SOUTHERN CALIFORNIA TRAINING AND TESTING (HSTT) MARIANA ISLANDS TRAINING AND TESTING (MITT) MEDITERRANEAN

The Navy needs marine mammal and T/E species data for all waters of the United States and US Trust Territories

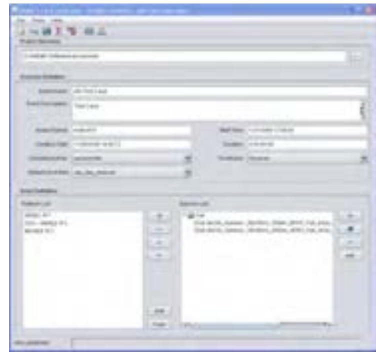
- **Phase II** permit renewals are in public and regulator agency review now, for January 2014 start
  - Number of permits have been consolidated
  - Coverage area and types of assessed activities have been expanded.

- **Adaptive Management** is used to annually review new science, and results of ongoing monitoring with the regulator (NOAA Fisheries).
- Annual Investment by Navy in research and environmental risk management is $25-30M/year.

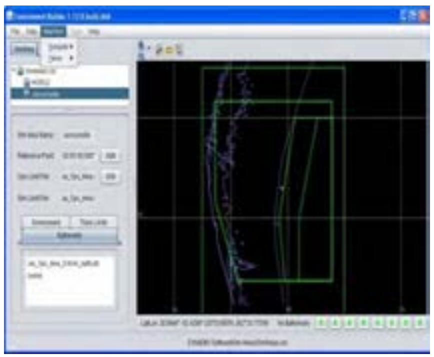
NAEMO Components

Planned Replacement by 3MB Software

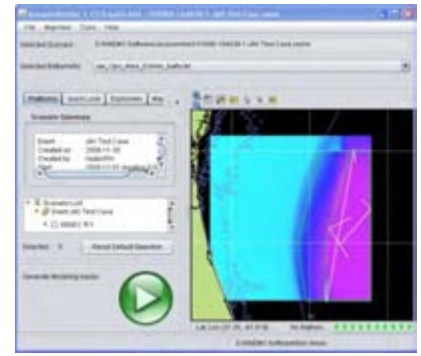
Scenario Builder



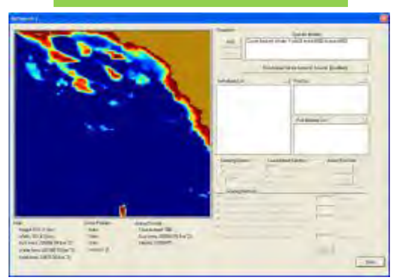
Environment Builder



Acoustic Builder



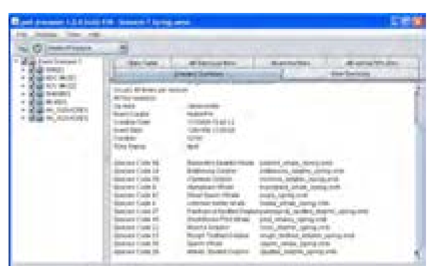
NUWC SMB



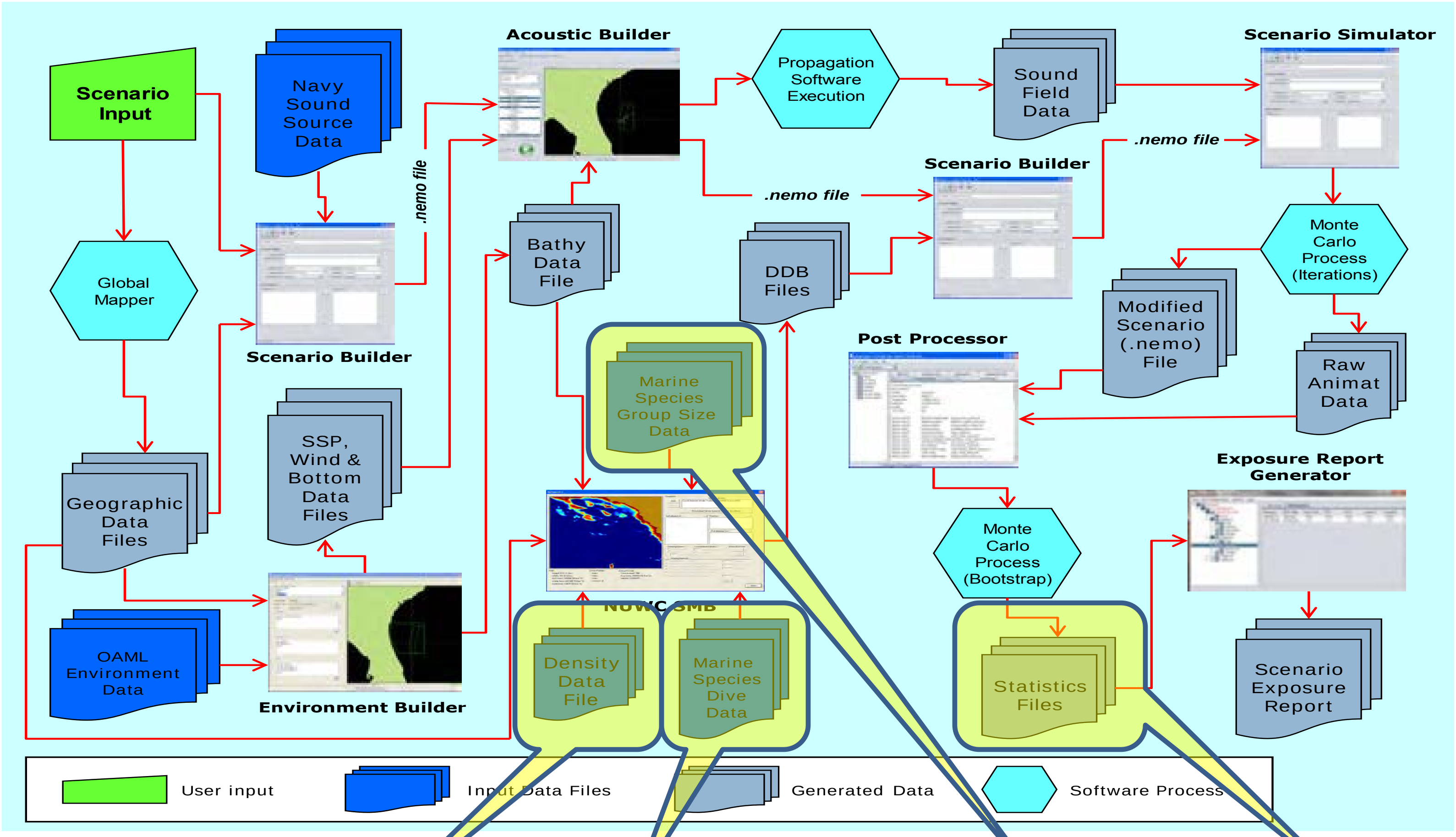
Scenario Simulator

Exposure Report Generator

Post Processor



NAEMO Model



Visual Survey, other methods

Tagged Animal Data

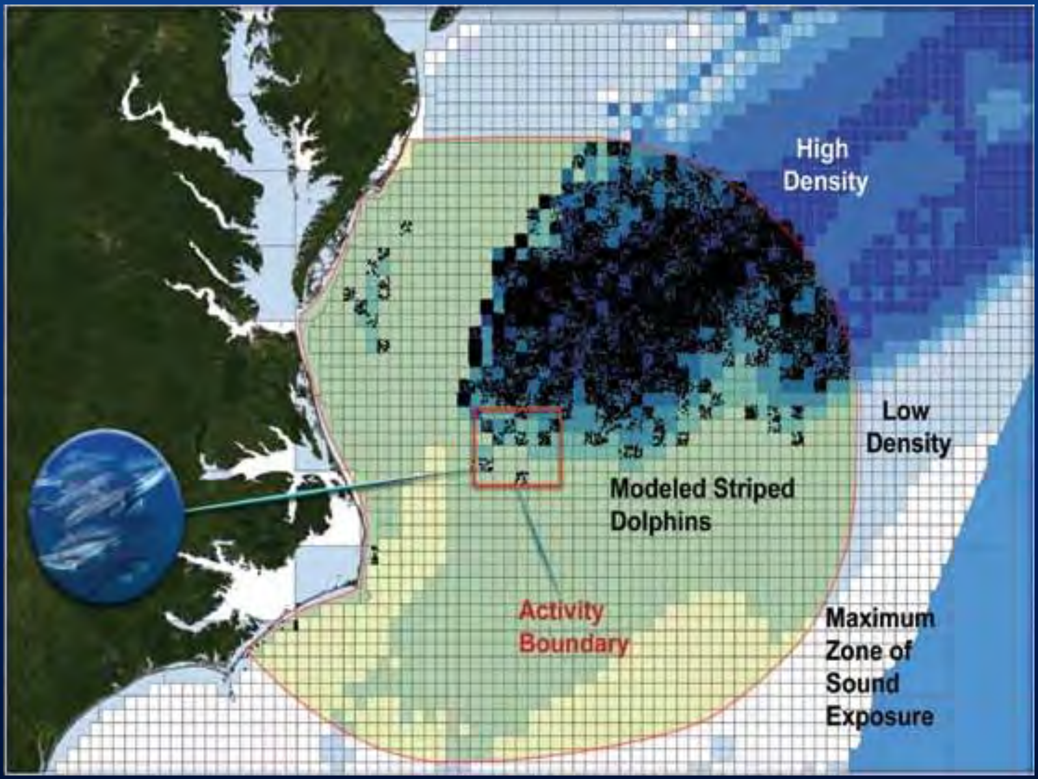
Visual Survey

Risk Threshold Criteria

NAEMO Individual-based Modeling

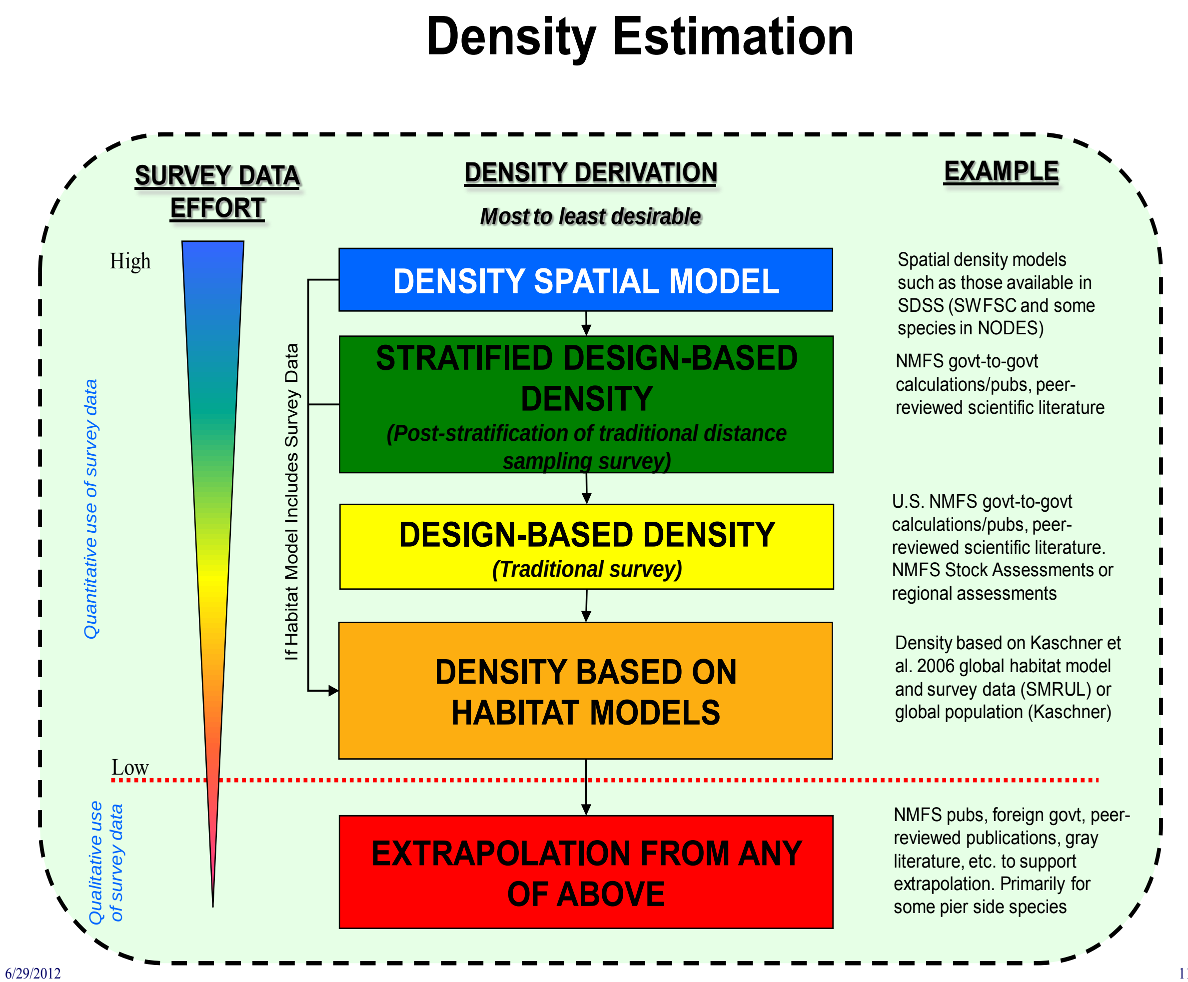
- Marine species distribution data sources
  - Gridded density data
    - Various sources
  - Species and region-specific group size data
    - NMFS cruise reports, scientific literature
  - Species-specific depth distribution data
    - NMFS, scientific literature

Navy Marine Species Density Database



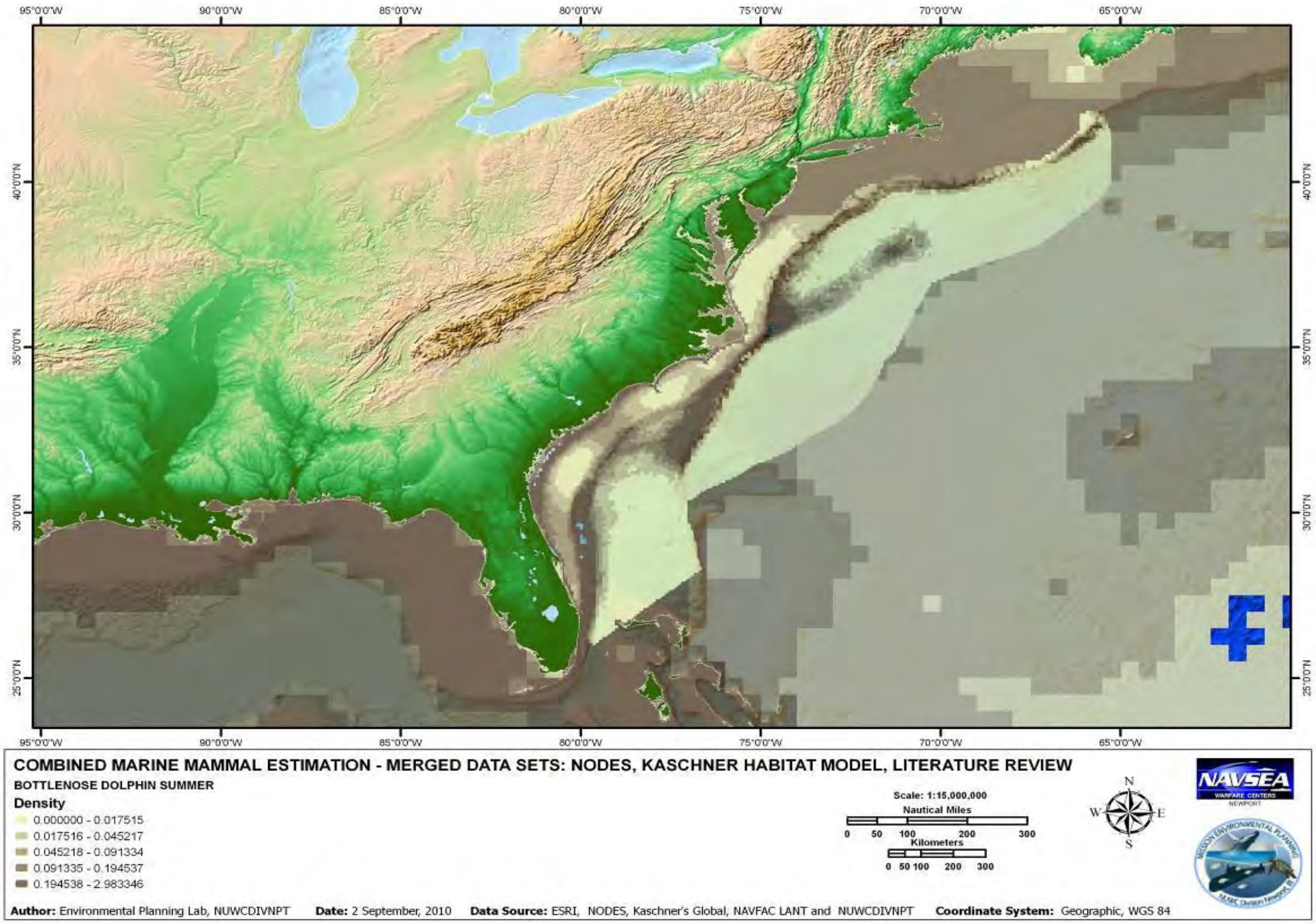
- Distribution Process
  - Individuals distributed in horizontal space according to density data
  - Individuals distributed in depth according to depth distribution data
  - Individuals change depth every 4 minutes during the simulation
  - Individuals do not move in horizontal space during the simulation
  - Houser 3MB model (ESME) of complex 3D movement planned for NAEMO v.2 (Phase III, 2015)

MSDD Hierarchical Data Use

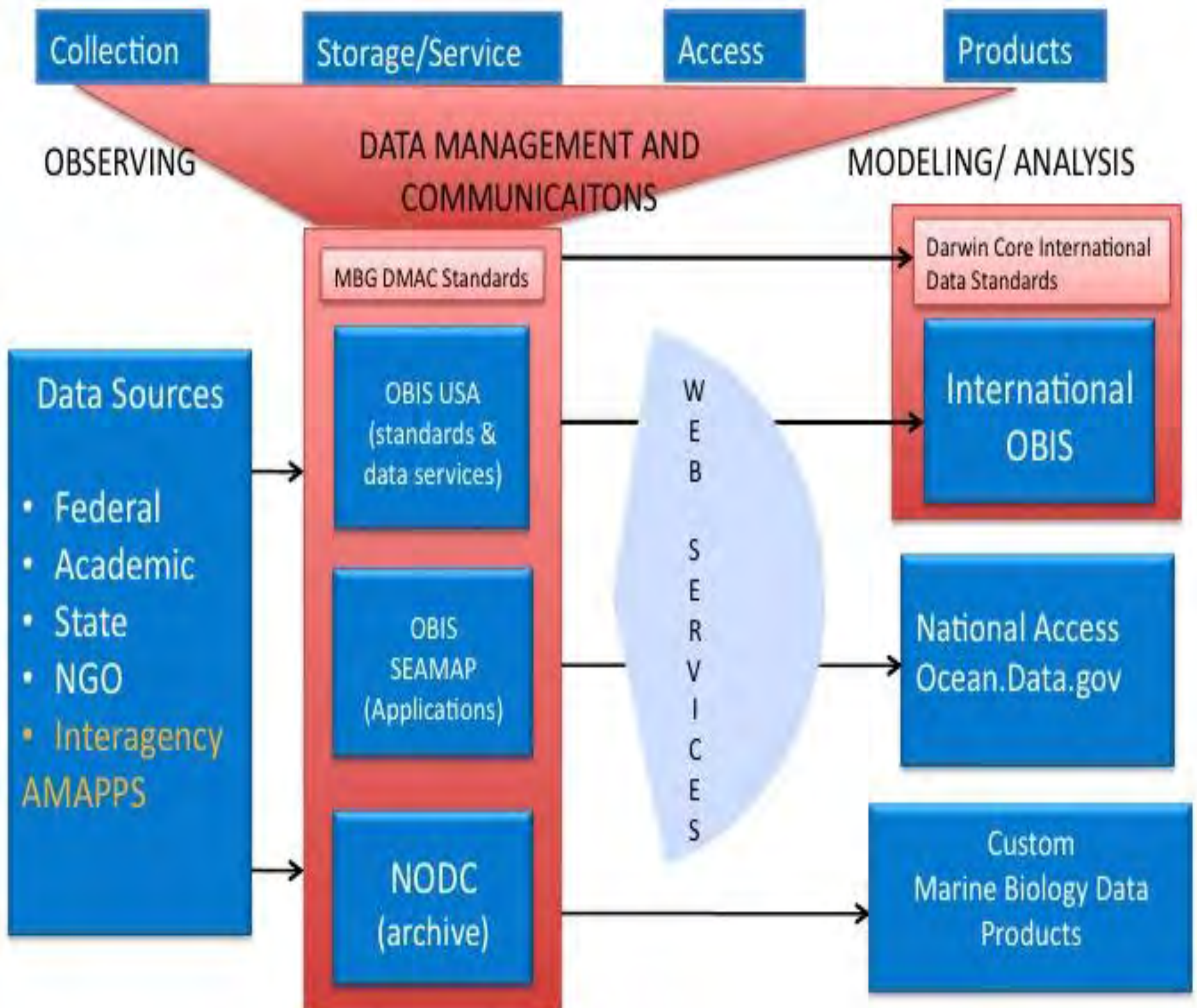


- US Marine Mammal Protection Act requires a quantitative expression of risk (take).
- NAEMO model uses gridded density values
- Preference is based on
  - Effort corrected observations
  - More recent data
  - Lowest model uncertainty (c.v.)
- **Directed surveys are conducted to fill data gaps**
  - **Gaps identified in Adaptive Mgmt. process (ICMP)**

Density Data Shapefile



FEDERAL DATA ARCHITECTURE



Summary: Navy Data Use in Risk Modeling

- All data have value
  - But some data are better than others!
  - The Navy uses a hierarchical weighting process
    - Essentially identical to the NOAA CETMAP process
- The Navy contracting process for new data:
  - Requires best effort-based methods; e.g. Distance
  - Requires derived products to use environmentally correlated geospatial density mapping
    - e.g. GAM, GLM
- Navy and contractor data collections are deposited in OBIS SEAMAP
  - Data are made available to CETMAP
  - Data are made available to the national ocean data infrastructure via OBIS USA, NODC, and IOOS

Presentation #26

A Consistent Approach to Using Density Estimates for Use In Navy Acoustic Effects Modeling

Anu Kumar

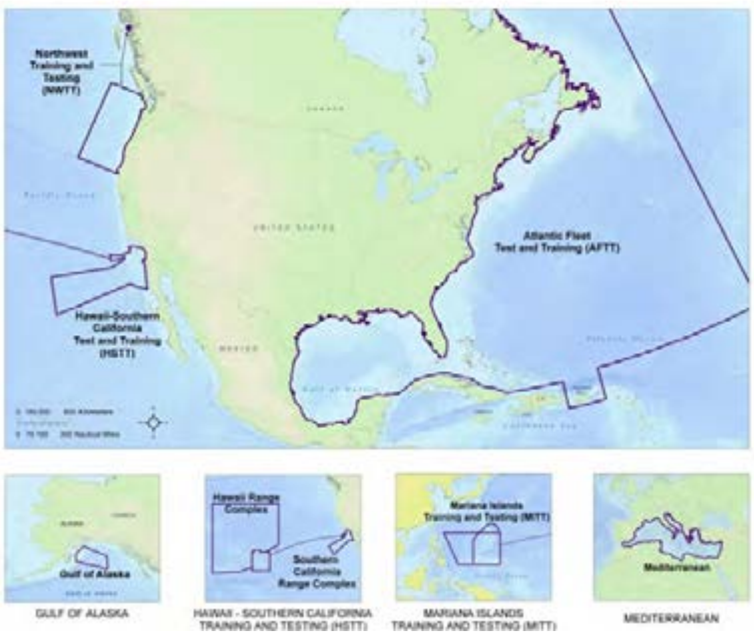
NAVFAC Atlantic

25 July 2012

anurag.kumar@navy.mil

Consistent Navy Approach To Include Density Data

Navy's Study Areas

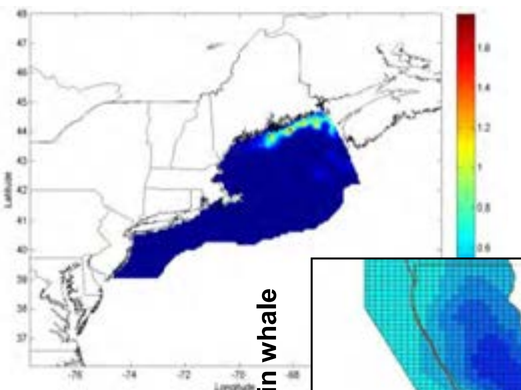


- **Need - NMSDD:**
  - Navy covering broader geographic area of Phase II 2014
  - Needs to estimate density to quantify impacts to species
  - Existing density data to come from variety of sources to characterize species abundance and distribution for both surveyed and un-surveyed areas within Navy's study areas
  - Approach needs to guide implementation of density data from various sources, ensuring that best available science (quality/detail of data) is used

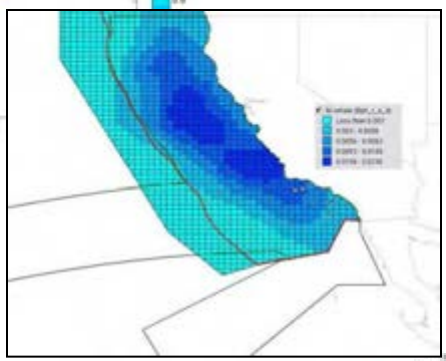
Spatial Models & Stratified Density

Density Spatial Model

Example: NODES harbor porpoise

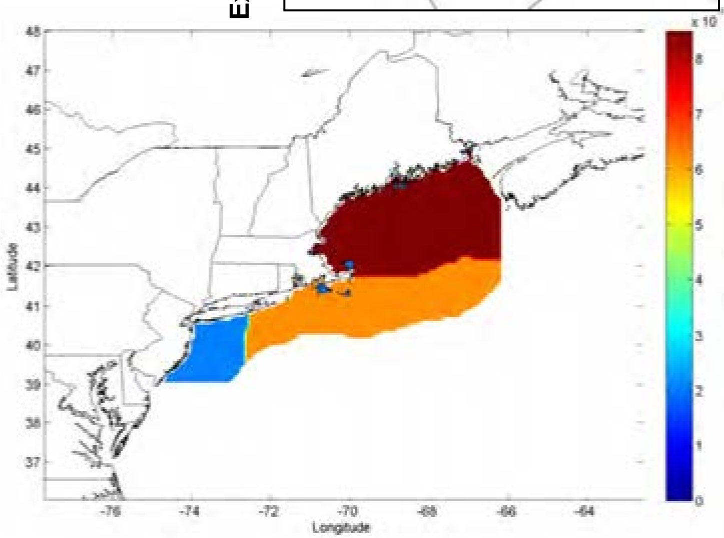


Example: SDSS fin whale



Stratified

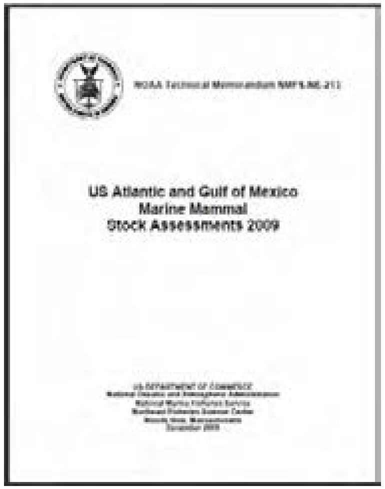
Example: bottlenose



- **Density spatial models (Habitat-based)**
  - Spatial models based on survey data and environmental parameters used as predictors (SDSS and some species in NODES)
  - Line-transect survey coverage needed throughout the modeled area
  - Most data-intensive survey method, but provides the greatest quality of spatial detail
- **Stratified design-based density estimates**
  - NMFS post-stratification of survey to spatially characterize areas of density
  - Method parses survey data, possibly increasing uncertainty

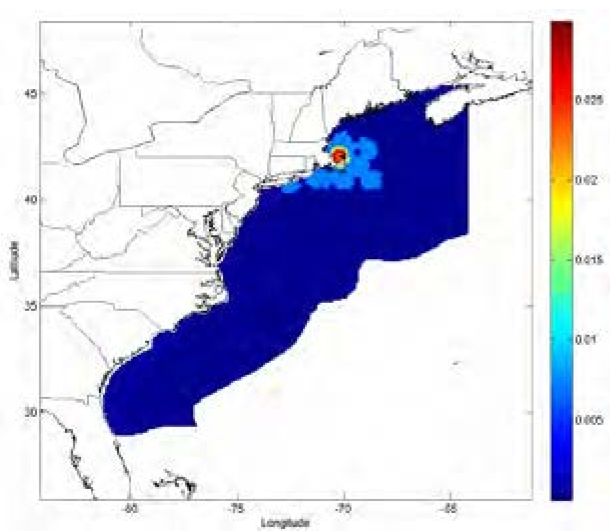
Other Sources

Sock Assessment Based
Example: North Atlantic right whale


NOAA Technical Memorandum NMFS-NE-213

US Atlantic and Gulf of Mexico
Marine Mammal
Stock Assessments 2009

Peer Reviewed Model
Example: North Atlantic right whale



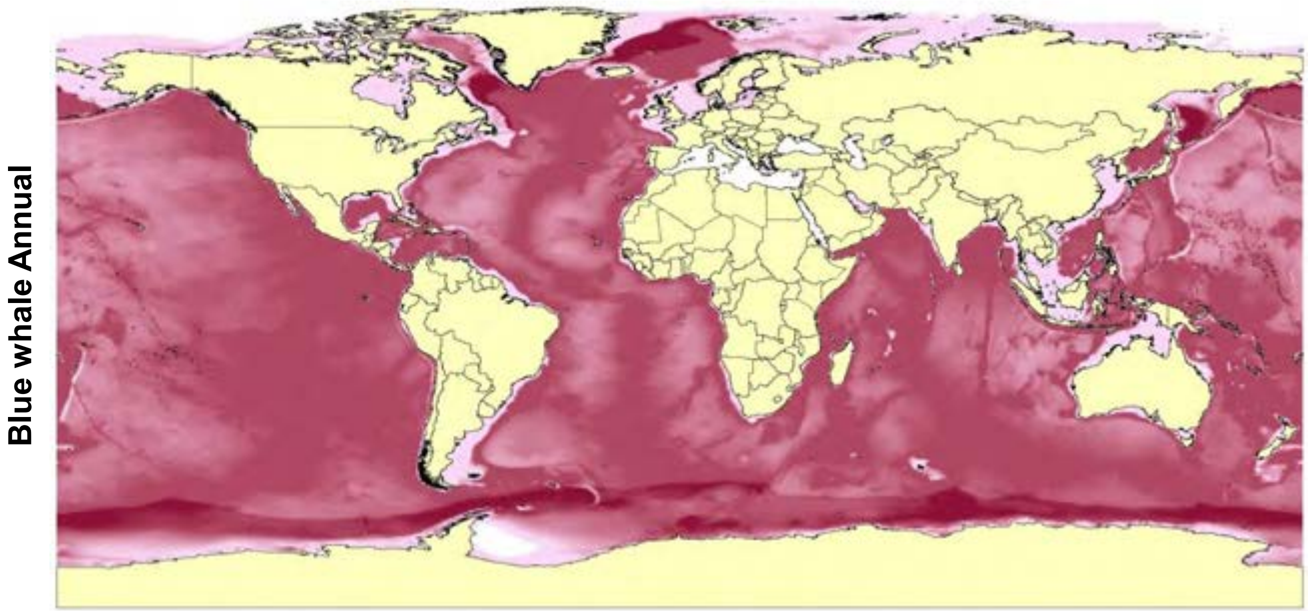
- **NMFS Stock Assessment Report**
  – Available for the proportion of the species population occurring within the U.S. EEZ

- **Literature derived estimates and peer-reviewed recommendations from independent experts**
  – Density data derived from literature who's purpose was to characterize species abundance for a specific area.
  – Peer reviewed recommendations from scientists conducting the survey

Global Sources of Density Data

- Kaschner© Global data
  - Annual estimates available for 70 species to 3 nm boundary
  - Distribute average published population abundance estimates over habitat model to estimate density in each grid

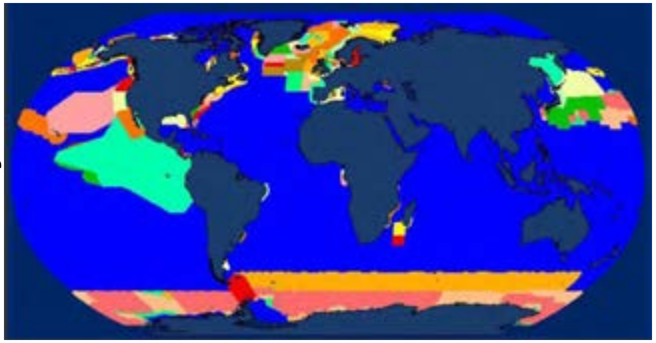
- Visit: www.seaaroundus.org



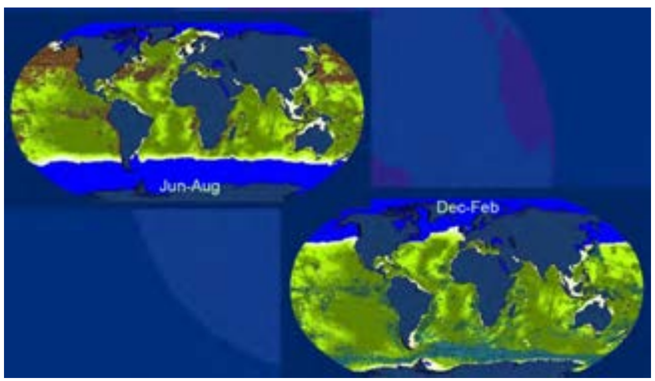
Global Sources of Density Data

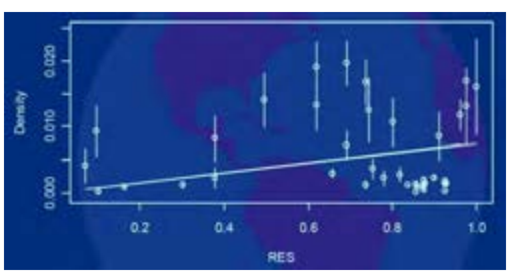
- **SMRU Ltd. Global Density Data©**
  - 45 species available
  - Four seasons
  - Used Kashner's Relative Environmental Suitability (RES) model in conjunction with results from line-transect survey data from 315 sources from (1978-2006)
  - Developed regressions of available density in relation to habitat to predict density beyond survey coverage

Survey Data



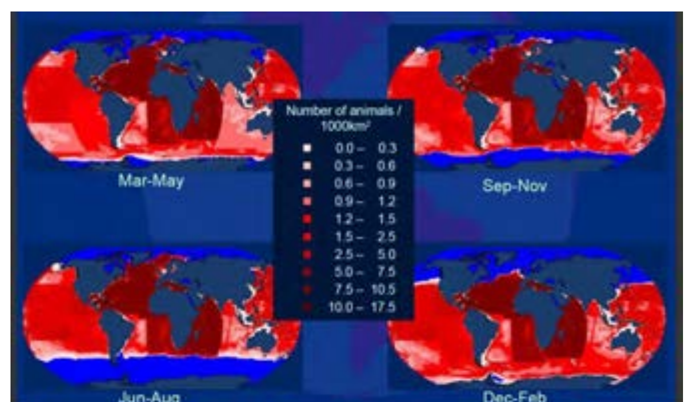
RES



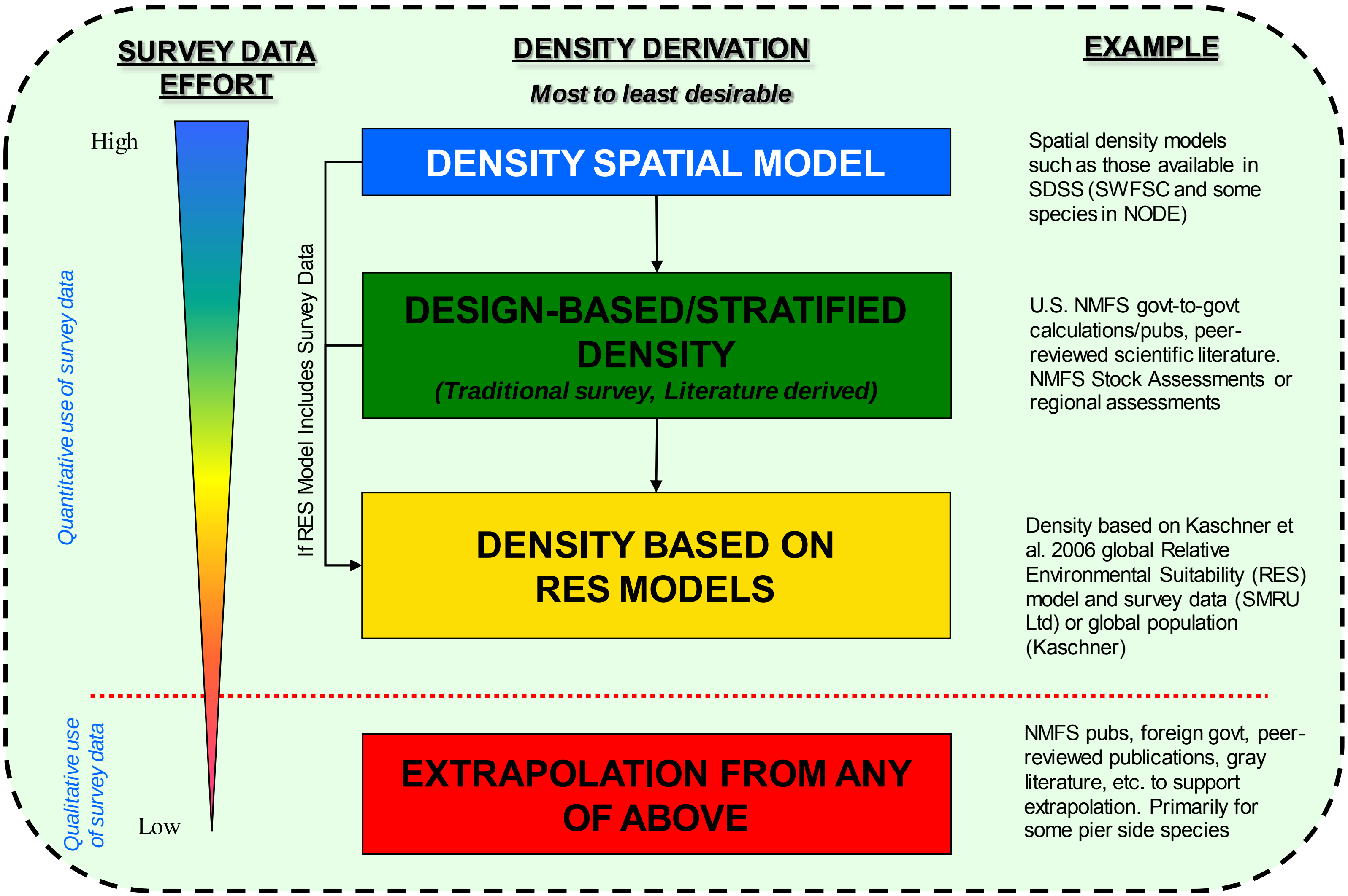


Regression/Prediction

Sperm Whale

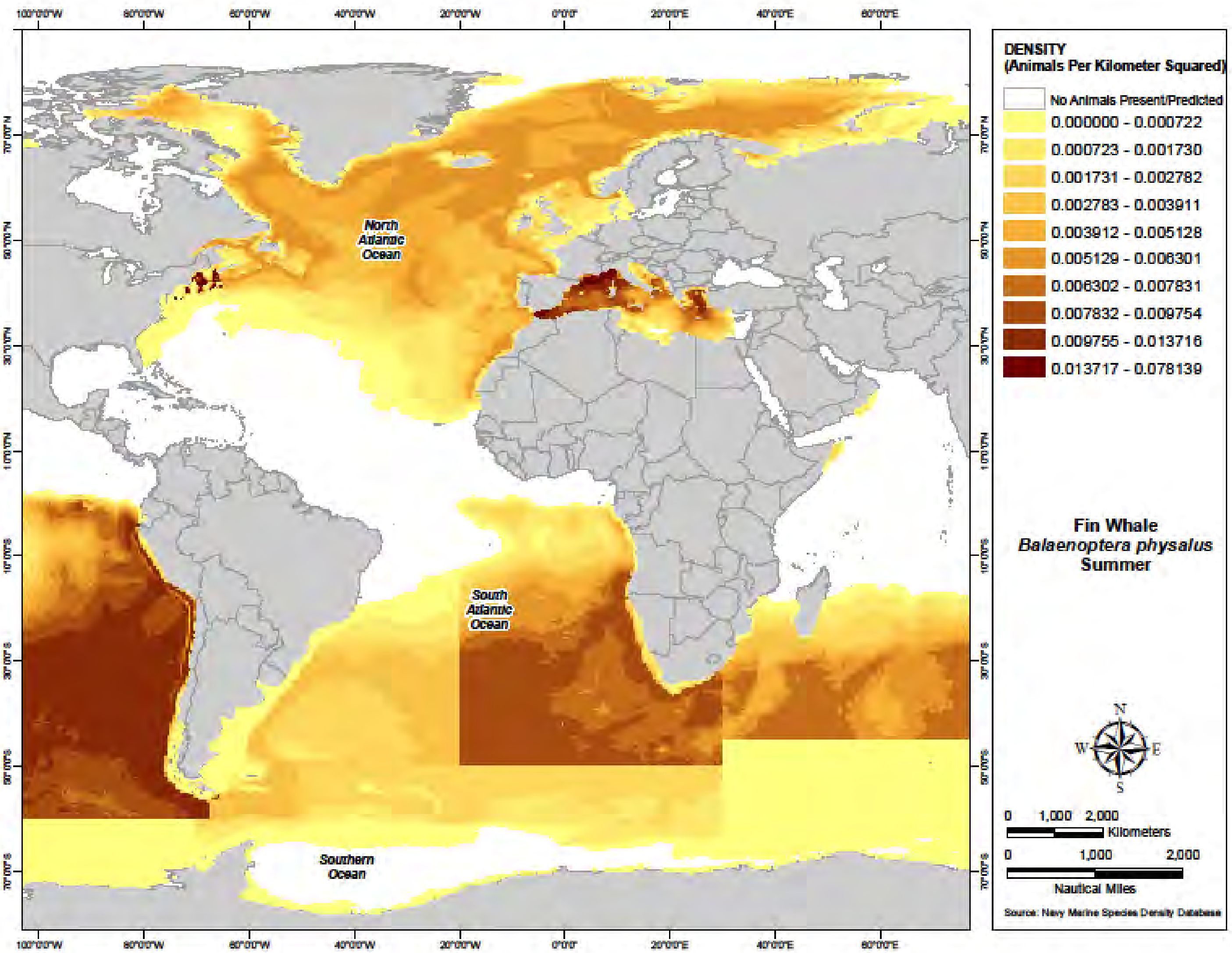


Density Estimation



Example of Combined Density

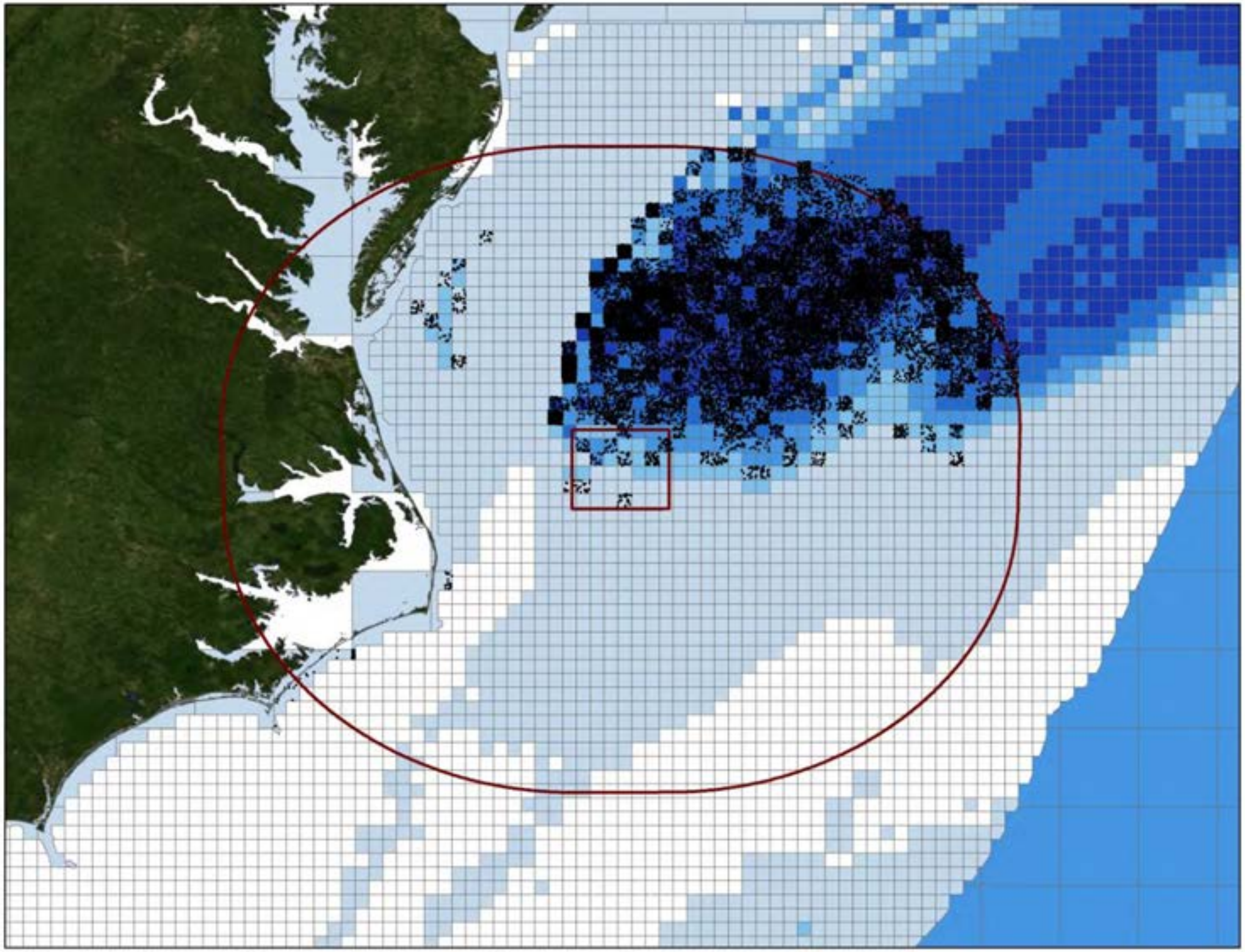
Fin whale Summer composite of SMRUL, and NODES data



Data Format

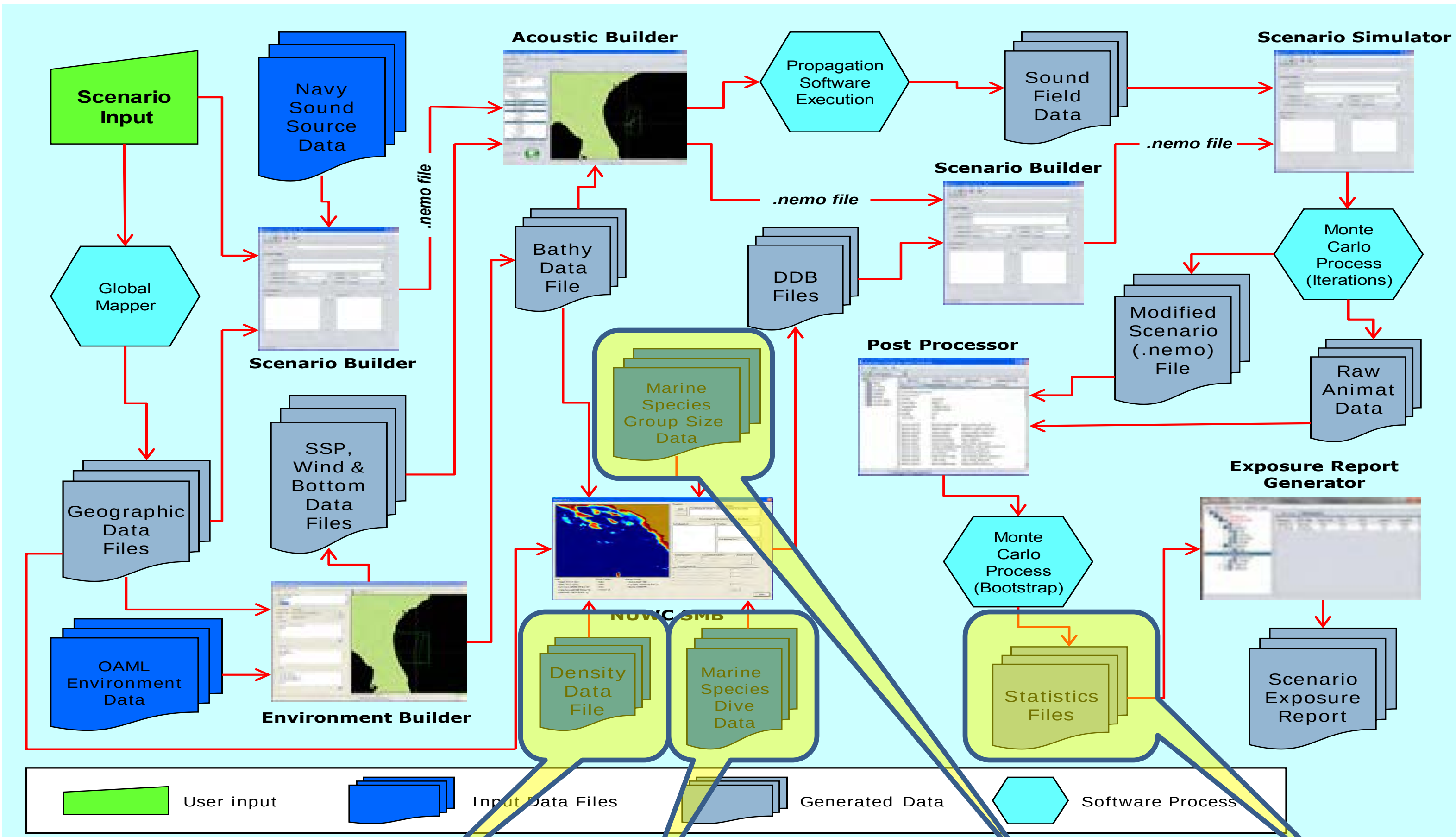
- All merged species/season datasets are in ArcGIS compatible format
- No density values provided were manipulated
- Number of seasonal files are broken up by the most temporally parsimonious data source used
- Within each season, for a given species, beginning and ending timeframes are for each density value
- Files were broken up by Atlantic, Pacific, and working on combining these.
- Metadata included for all density values

Density in NAEMO to Quantify Risk



Striped dolphins Summer Density

NAEMO Model



Density - Visual Survey, other methods

Depth - Tagged Animal Data

Group Size - Visual Survey

Risk Threshold Criteria

NMSDD Future

- Incorporate new data from CetMap, AMAPPs, Etc.
- Duke revisit at the SMRUL/Kaschner density data for AFTT
- Update the database management system for future upgradeability, version control, and deployment
- Make the results available to the public
- Collaborate with other modelers

Current technical reports:

www.aftteis.com and www.hstteis.com

anurag.kumar@nav.mil

Presentation #27

AMAPPS Modeling

Northeast Fisheries Science Center
Southeast Fisheries Science Center
By
Dr. Debi Palka

Objectives

- Develop spatial-temporal fine scale density maps of cetaceans, sea turtles, and sea birds within US Atlantic waters that function of habitat and detection factors.
- Investigate trends, hot spots, potential climate efforts
- Investigate trophic ecosystem relationships

Types of models

- **Density maps that account for:**
  - Seasonal-temporal patterns and variability
  - Probability of detection given appropriate covariates
  - Group size given appropriate covariates
  - Encounter rates given appropriate covariates
  - g(0) – probability of detection on track line
  - Availability – dive and surface times given appropriate covariates
  - Spatial autocorrelation, if present

Specifics

- Will need to pool some species
- Probably use Bayesian Hierarchical framework to put all parts together
- Spatial Resolution: Ideally 4 km, but will need to also use 10 or 20 km resolution depending on sample sizes
- Temporal resolution : season or month

Type	Source	Extent / Resolution
depth	ETOPO5 and coastal relief model	3 arc-minute and 3 arc-second
distance to shore and various depth contours	in-house	variable vector resolution
Sediment type	200m isobath of GEBCO	
sea surface temperature	SST since 1991, available from various sources (MODIS, Pathfinder, GOES) merged, and interpolated by Narragansett lab staff	1991 – 2010; hourly; 1 – 9 km resolution
chlorophyll	SeaWiFS and MODIS processed by Narragansett lab staff	1997 – 2011; hourly; 1 – 4 km resolution
SST and chlorophyll fronts intensity and distance to	Above processed in-house	1997 – 2010 (or 2011); 5-day averages; 4 km resolution
Mixed layer depth and salinity or density at depth	Ocean Model output	1997 – 2010; daily; 4 – 10 km resolution

Wind and Water Power Technologies Office
Wind Program
wind.energy.gov
DOE/EE-0925

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy