Ocean/Wind Power Ecological Baseline Studies

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF SCIENCE, RESEARCH, & TECHNOLOGY

Ocean/Wind Power Ecological Baseline Studies

Gary A. Buchanan, Ph.D.
Bureau of Natural Resources Science
Division of Science, Research & Technology
NJDEP

STATE OF NEW JERSEY

Blue Ribbon Panel on Development of Wind Turbine Facilities in Coastal Waters

FINAL REPORT

TO

GOVERNOR JON S. CORZINE

APRIL 2006

Background

- New Jersey's Blue Ribbon Panel on Development of Wind Turbine Facilities in Coastal Waters
- Recommendations
  - Natural Resources
  - Economics, Tourism
  - Ocean Uses

Project Objectives

- Address Natural Resource portion of Blue Ribbon Panel Recommendation No. 4:
  - "Baseline data should be collected regarding the distribution, abundance, and migratory patterns of avian species, fish, marine mammals and turtles in the offshore area where development may be feasible."

Project Design

- Blue Ribbon Panel
- European Studies
- Technical Review Committee
  - USFWS, NMFS, MMS, NJDEP
  - North American Methods

Horns Rev Offshore Wind Farm

Environmental Impact Assessment
Summary of EIA Report

Maj 2000

Ministry of Environment and Energy
National Environmental Research Institute

Base-line investigations of birds in relation to an offshore wind farm at Horns Rev: results and conclusions 2000/2001

NERI Report
Commissioned by Tech-wise A/S

Towards standardised seabirds at sea census techniques in connection with environmental impact assessments for offshore wind farms in the U.K.

A COMPARISON OF SHIP AND AERIAL SAMPLING METHODS FOR MARINE BIRDS, AND THEIR APPLICABILITY TO OFFSHORE WIND FARM ASSESSMENTS

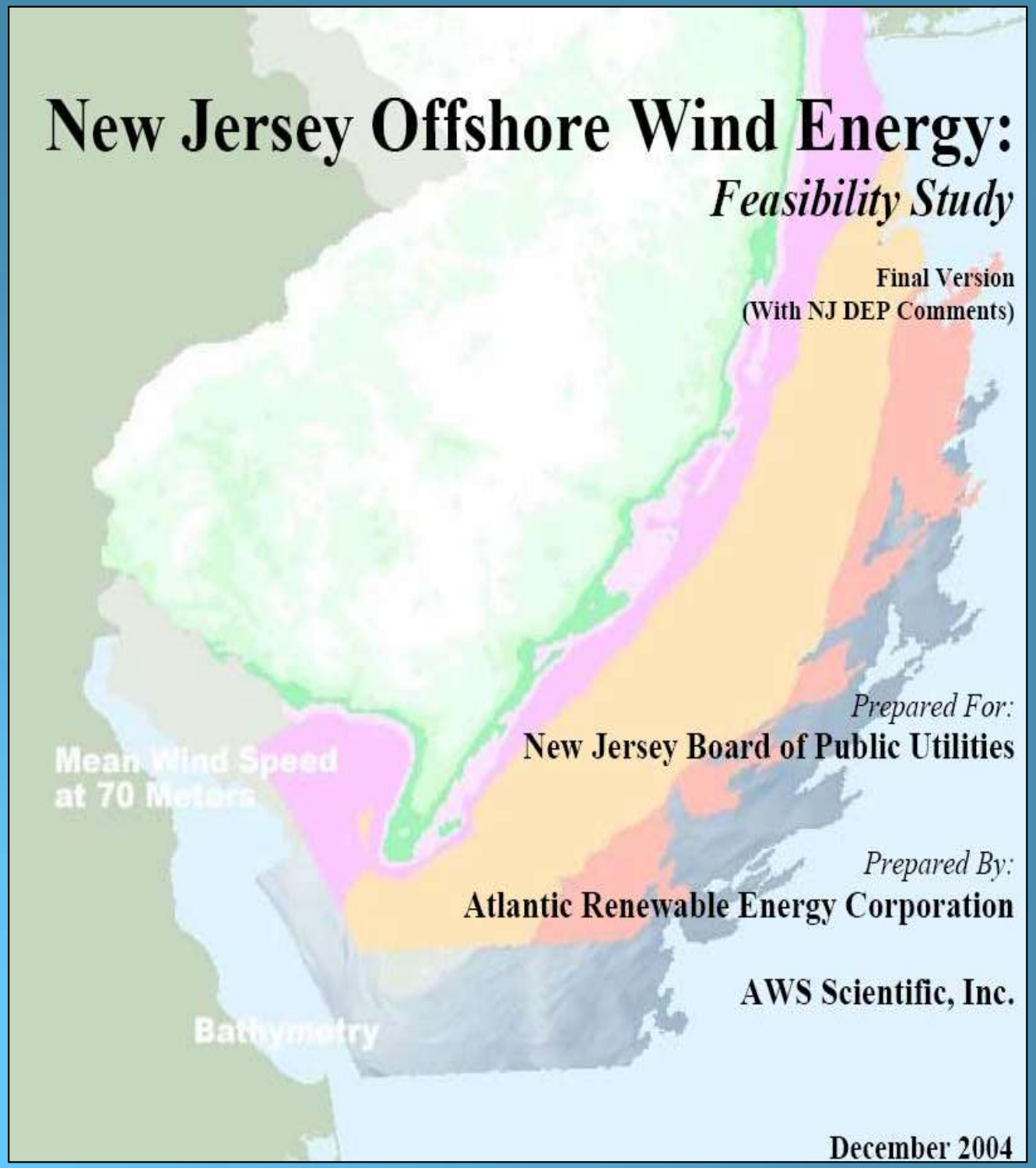
Kees (C.J.) Camphuysen[1], Tony (A.D.) Fox[2], Mardik (M.F.) Leopold[3] & Ib Krag Petersen

[1]Koninklijk Nederlands Instituut Voor Onderzoek Der Zee (Royal NIOZ), The Netherlands
[2]National Environmental Research Institute, Denmark
[3]Alterra, The Netherlands

Final version: April 2004

COWRIE

This report was commissioned by COWRIE



New Jersey Offshore Wind Energy:

Feasibility Study

Final Version
(With NJ DEP Comments)

Prepared For:
New Jersey Board of Public Utilities

Prepared By:
Atlantic Renewable Energy Corporation

AWS Scientific, Inc.

December 2004

Study Area

Specific Objectives

- What are the abundance, distribution, flight behavior (i.e., height and regular pathways), and utilization (e.g., feeding, breeding) of bird species in the Study Area?
- What are the abundance, utilization, and distribution (e.g., feeding, breeding) of marine mammals in the Study Area?
- What are the abundance, utilization, and distribution (e.g., feeding, breeding) of sea turtles in the Study Area?

Specific Objectives

- What are the abundance, utilization, and distribution of other marine biota (e.g., fish, shellfish) in the Study Area?
- What is the distribution of other existing natural resources, including, but not limited to, shoals, sand borrow areas, artificial reef sites, and other pre-existing resources in the Study Area?
- Using predictive modeling, mapping, and environmental assessment methodologies what portions of the study area are more or less suitable for wind/alternative energy power facilities based on potential ecological impacts?

Field Studies

- Three Primary Surveys:
  - Avian
  - Marine Mammal
  - Sea Turtle
- Supporting Studies:
  - Oceanographic

Other Studies

- Literature Review
- Data Compilation (digital and historical)
- Model Development
- Impact Assessment
- GIS
- Reporting

Budget

- $4.5 million
- Baseline Surveys: >80% of budget
- Remaining Budget:
  - Literature Review/Data Compilation
  - Predictive Modeling
  - Impact Assessment
  - Reporting

Schedule

- Solicitation for Research Proposals (SRP) issued March 19, 2007
- Proposals received May 2007
- Proposals reviewed by TRC, followed by Oral Presentations
- Bidder selection in June 2007
- Award: September to Geo-Marine, Inc.

Schedule

- 18-month study
- Start January 2008
- Field Work: 2008 – 2009
- Interim Report – January 2009
- Draft Final Report – September 2009

Overall Process

- Technical Review Committee – State & Federal Agencies
- Interested Party Group
- Peer Review Group – Independent Review

Interested Party Group (IPG)

- Organizations that have an interest in offshore power (e.g., environmental, natural resource or development standpoint)

- DEP outreach
  - Updates on the project's progress and results

Challenges

- NOAA Permit – Marine Mammal Protection Act & Endangered Species Act
  - Need due to “take” of protected species
- Weather – Visual surveys need to be conducted under good conditions
- Vessels – Limitations on operation (e.g., storms, availability)
- Budget

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new jersey department of environmental protection

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Related Sites

Blue Ribbon Panel on Development of Wind Turbine Facilities in Coastal Waters

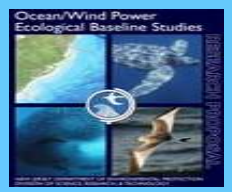
The New Jersey Department of Environmental Protection (NJDEP), Division of Science, Research & Technology (DSRT) issued a Solicitation for Research Proposals (SRP) in order to address the need for baseline ecological/natural resource data as recommended by the State of New Jersey Blue Ribbon Panel on Development of Wind Turbine Facilities in Coastal Waters.

The objective of this study is to conduct baseline studies in waters off New Jersey's coast to determine the current distribution and usage of this area by ecological resources. The scope of work includes the collection of data on the distribution, abundance and migratory patterns of avian, marine mammal, sea turtle and other species in the study area over an 18-month period.

- Agenda - Interested Party Group Meeting, November 9, 2007
- Response to Bidders Questions (May 11, 2007)
- Addendum (May 11, 2007)
- Solicitation of Proposal - Ocean/Wind Power Ecological Baseline Studies (April 19, 2007)

For more information regarding this project, please contact Gary A. Buchanan, Ph.D., Bureau of Natural Resources Science Division of Science, Research & Technology, NJDEP.

http://www.nj.gov/dep/dsr/ocean-wind/



Geo-Marine Inc. (GMI)

- Strong Proposal and Plan
- Experienced Team
  - Staff
  - Projects
  - Management
- Dan Wilkinson, Ph.D. – GMI Project Manager

Ocean/Wind Power Ecological Baseline Studies

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
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Interested Party Group Meeting Presentation

09 November 2007

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GEO-MARINE INCORPORATED

GMI Overview

- Founded in 1972 in Dallas, Texas Diversified environmental planning, cultural resource, engineering design, construction management, & technology company
  - 140 scientists, planners, engineers, & managers
  - 6 U.S. office locations
- Commercial and State experience since 1972:
  - Oil & Gas companies
  - Utilities & Energy Companies
  - Telecommunications Companies
  - Departments of Transportation and Port Authorities
  - Cities, Counties, State Governments
  - Commonwealths (Puerto Rico, Guam, Virgin Islands)
- Department of Defense experience since 1985:
  - US Navy and US Marine Corps
  - US Air Force and UK Royal Air Force
  - US Army and National Guard Bureau
  - Air National Guard, NASA
- Federal Government
  - USDA and USDOI
  - USDOS, USDOJ
  - GSA, NOAA/NMFS, EPA

GMI Project Experience

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GMI Service Categories

Natural Resources

- Biological Studies
- T&E Studies
- Habitat Surveys
- Ecosystem Restoration
- Wetland Studies
- Marine & Aquatic Sciences
- Biological Assessments
- Wildlife Mgt
- Radar Surveys
- Thermal Imaging
- GIS and Support Technologies

Planning & Analysis

- NEPA Analysis & Documentation
- Public Involvement
- Administrative Record
- Noise Studies
- Land Use Planning
- Socioeconomic Analysis
- Environmental Justice
- Water Quality
- Noise Studies

Environmental Services

- Storm Water Plans
- Spill Prevention
- Air Quality
- Clean Water
- RCRA
- CERCLA
- EPCRA
- UXO
- Lead-Based Paint
- Asbestos
- Demilitarization
- Risk Assessment

Cultural Resources

- Archaeology
- Native American Consultation
- Historic Architecture
- Ethnography
- Historical Research
- Osteology
- Section 106 Compliance
- Public Outreach
- Visualization Technologies

Engineering & Construction

- Condition Assessment Surveys
- Engineering Design
- Construction
- Design-Build
- Commissioning
- Retro-commissioning
- Monitoring & Operations

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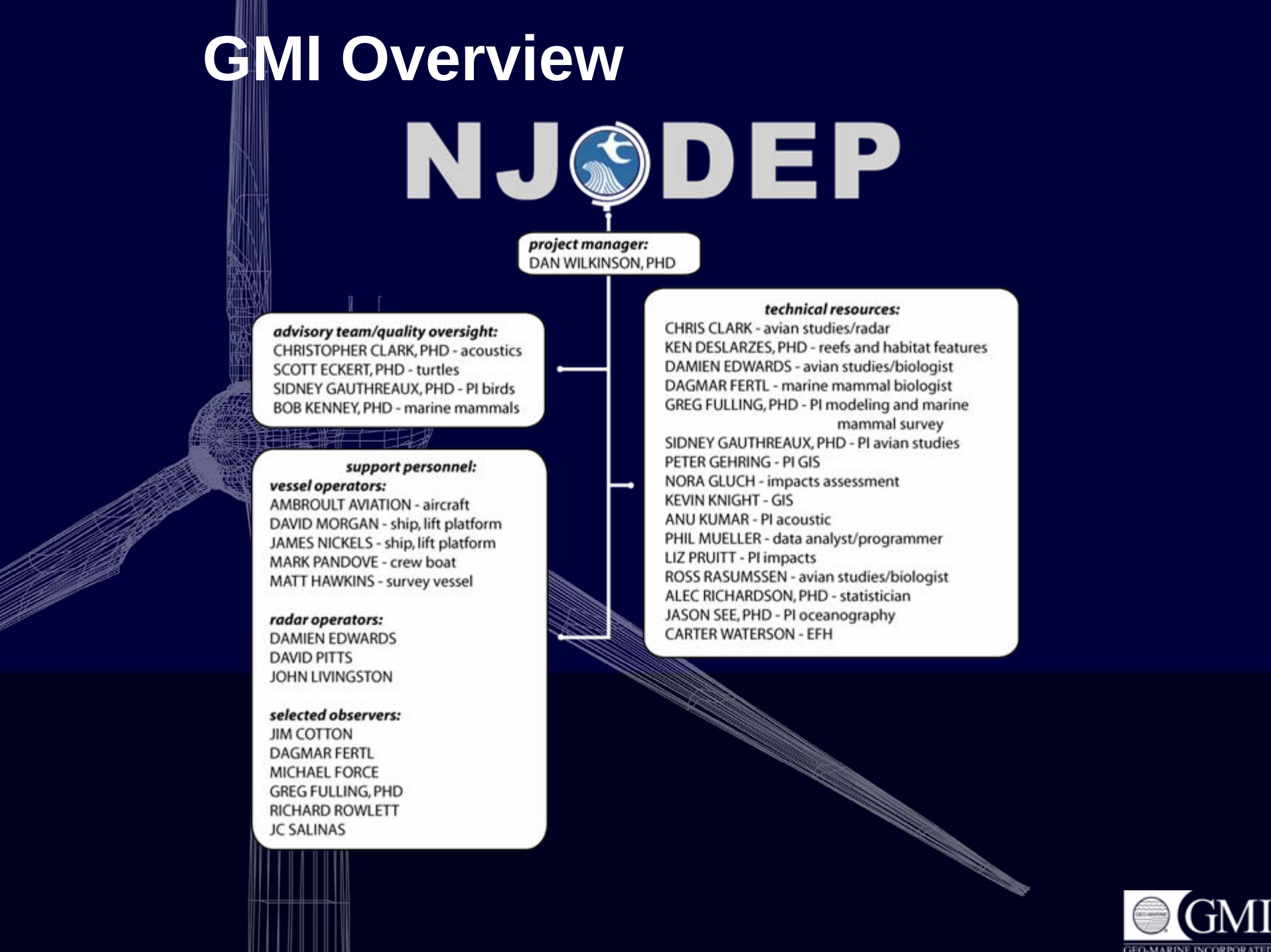
GMI Overview



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Ecological Baseline Study Components

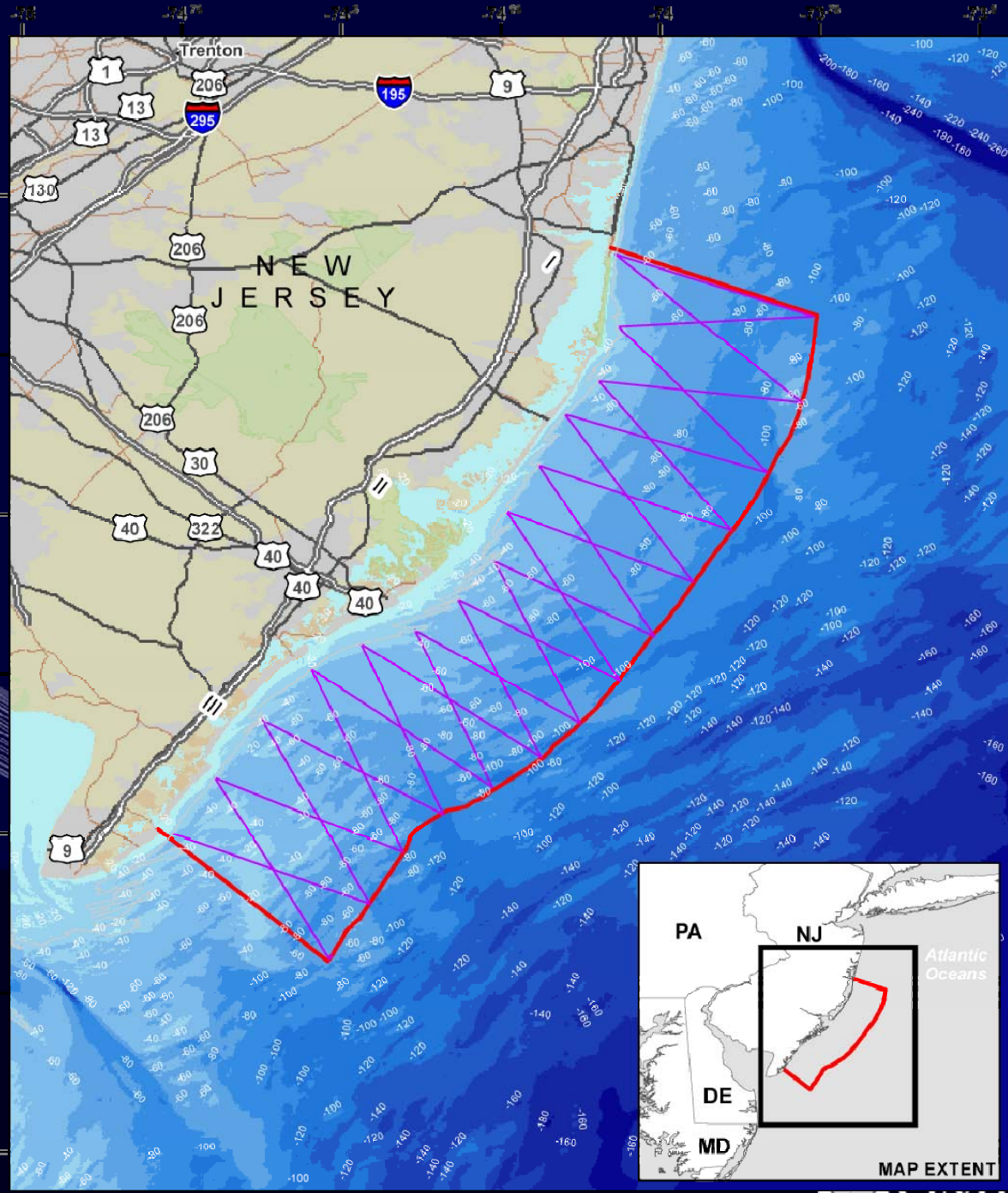
- Ship Board Avian, Marine Mammal, and Sea Turtle Surveys
- Aerial Marine Mammal, Sea Turtle
- Small Vessel Coastal Avian Surveys
- Acoustical Surveys
- Oceanographic Surveys
- Offshore Radar Surveys
- Thermal Imaging-Vertically Pointed Radar Surveys

Marine Mammal/Sea Turtle and Avian Studies

- Ship/aerial surveys will be designed to maximize coverage of the study area
- Extensive experience in survey design and data analysis:
  - Guam (MISTCS, Fulling et al. 2007 in preparation)
  - Gulf of Mexico (Fulling et al. 2004; Mullin and Fulling 2004)
  - US Atlantic Coast (Mullin and Fulling 2003; MATS 2004)

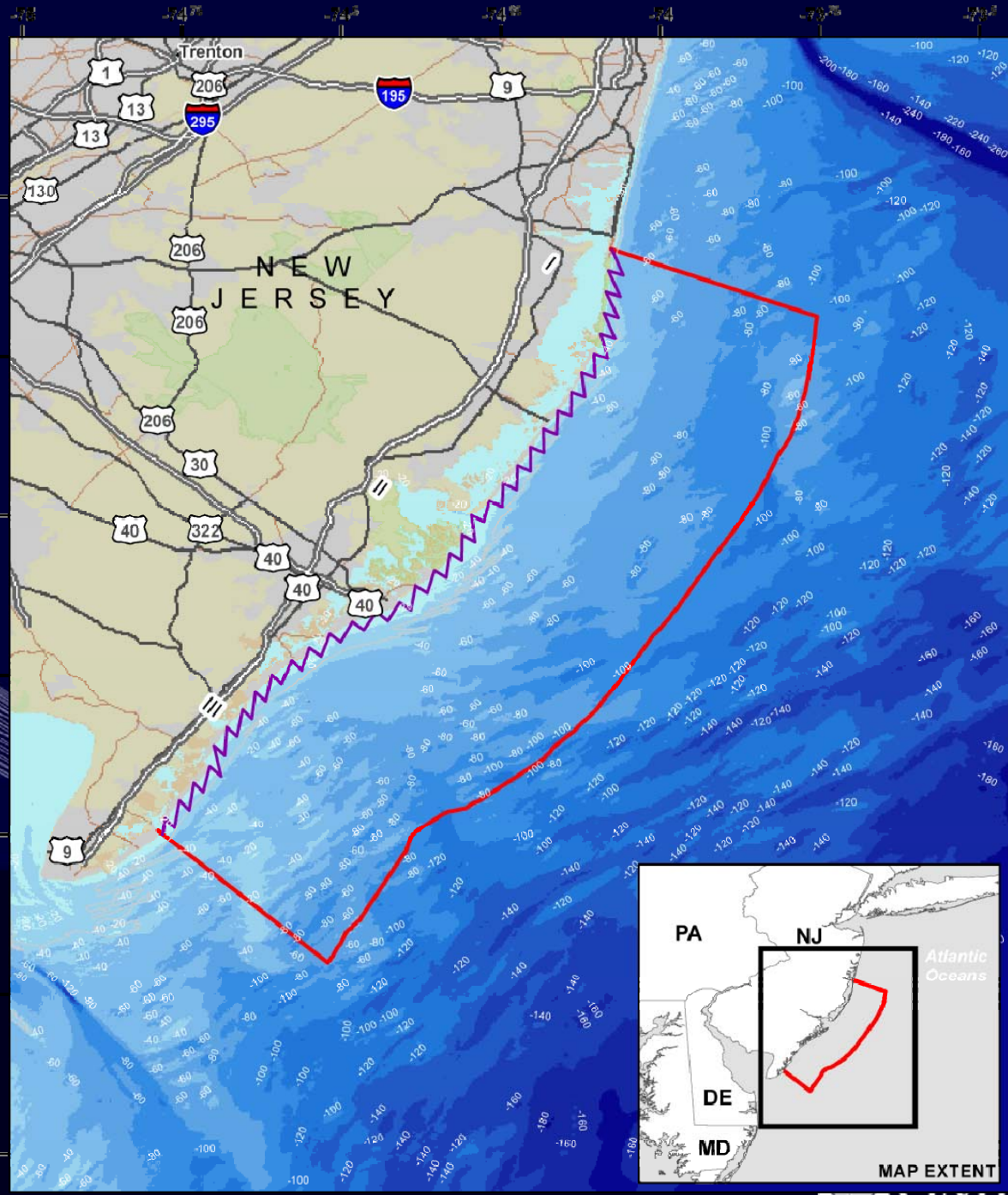
Shipboard Survey Tracklines

- 18 monthly surveys
- Double saw-tooth sample design
- Random start location



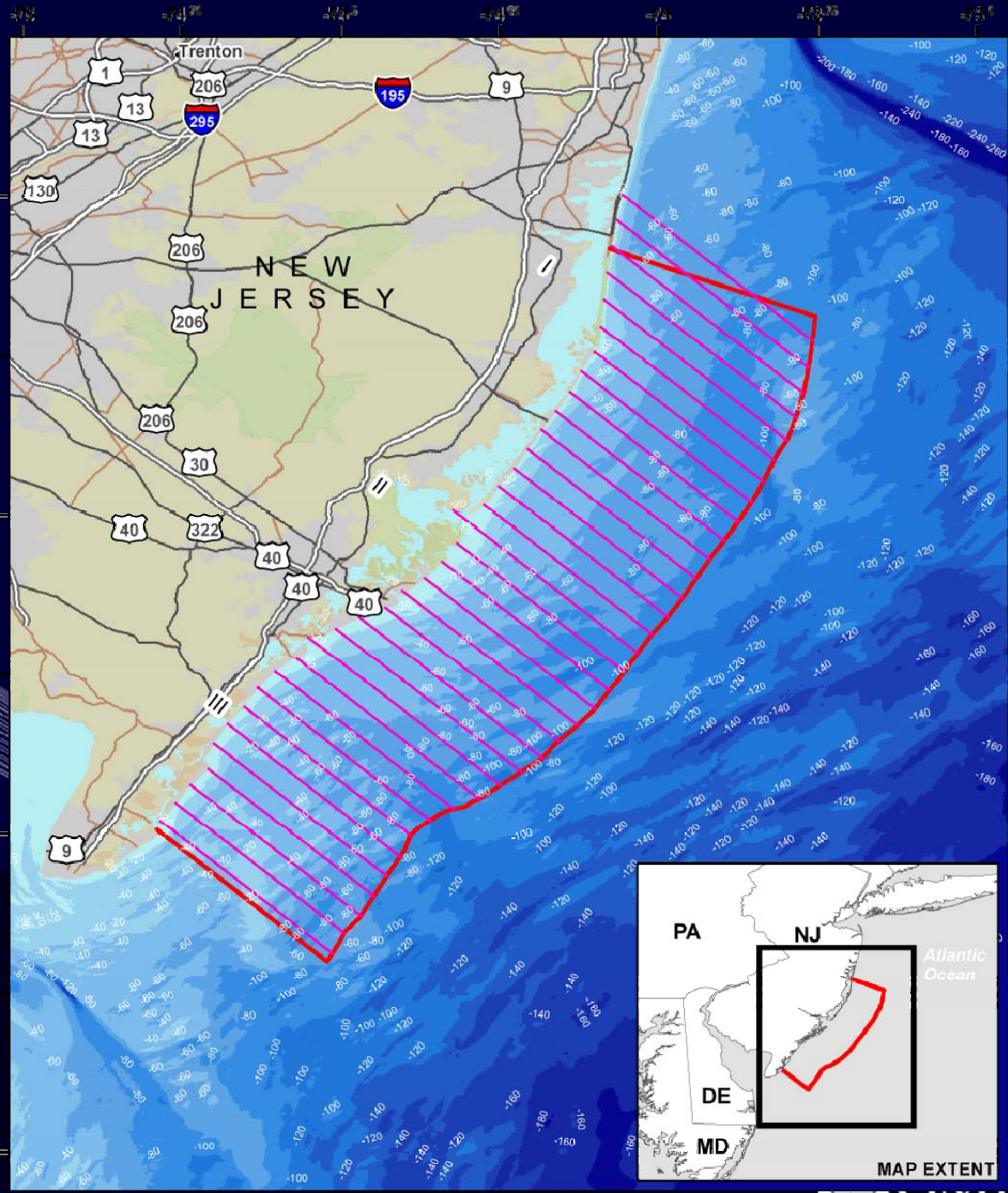
Small Vessel Coastal Avian Surveys

- Line-transect survey method (single saw-tooth)
- Extending to 10 meter isobath



Aerial Survey Tracklines

- 34 tracklines
- 2 nautical mile separation
- Random start location



Aircraft Cessna 337 Skymaster

Density Estimation

- Spatial modeling requires “hands-on” experience
  - We have learned from the leader’s in this field
    - Centre for Research in Environmental and Ecological Modeling (CREEM), University of St. Andrew’s, UK; Buckland, Borchers, Thomas, et al.
  - Two year working relationship
  - Numerous training workshop in DISTANCE
  - Combine ship and aerial surveys
- Recently completed projects
  - Guam Density Estimation (using traditional approach)
  - Navy OPAREA Density Estimation (NODE) projects – spatial modeling for the Navy
  - Gulf of Mexico, Southeast US Atlantic coast and the Northeast US Atlantic coast

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Aquatic Baseline Studies

- GMI scientists have:
  - Collected oceanographic data from shipboard surveys (Atlantic, Pacific, and Gulf of Mexico)
  - Collected data remotely from in situ instrumentation (Indian Ocean, Caribbean and Gulf of Mexico).
  - Performed post collection analysis of oceanographic parameters.

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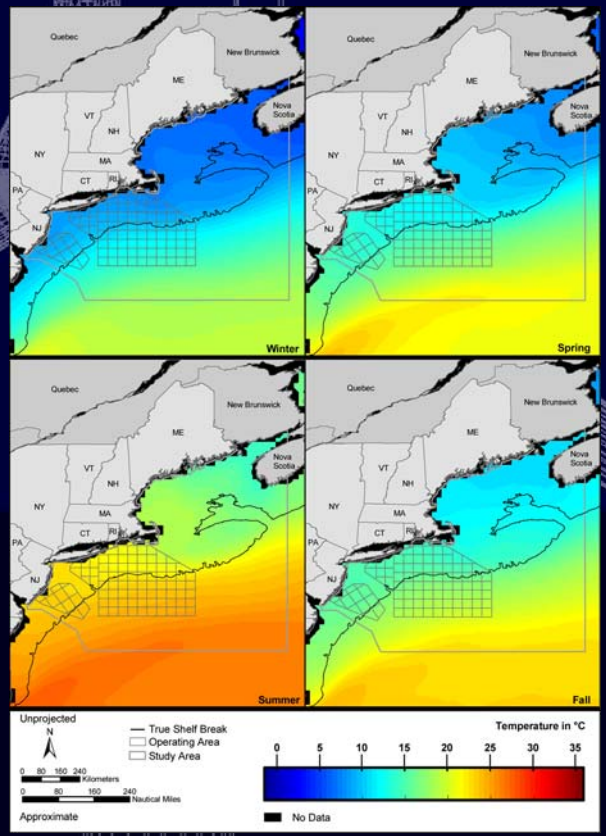
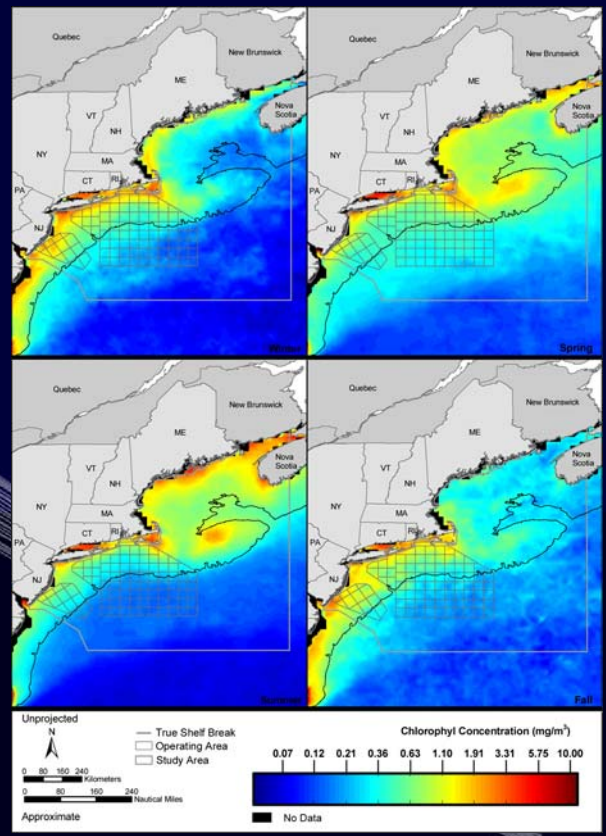
Aquatic Baseline Studies

GMI scientists have used satellite data (Sea Surface Temperature [SST] and chlorophyll) to create seasonal GIS maps of a region. These “layers” will be used for modeling animal densities.



SST



CHLOROPHYLL a

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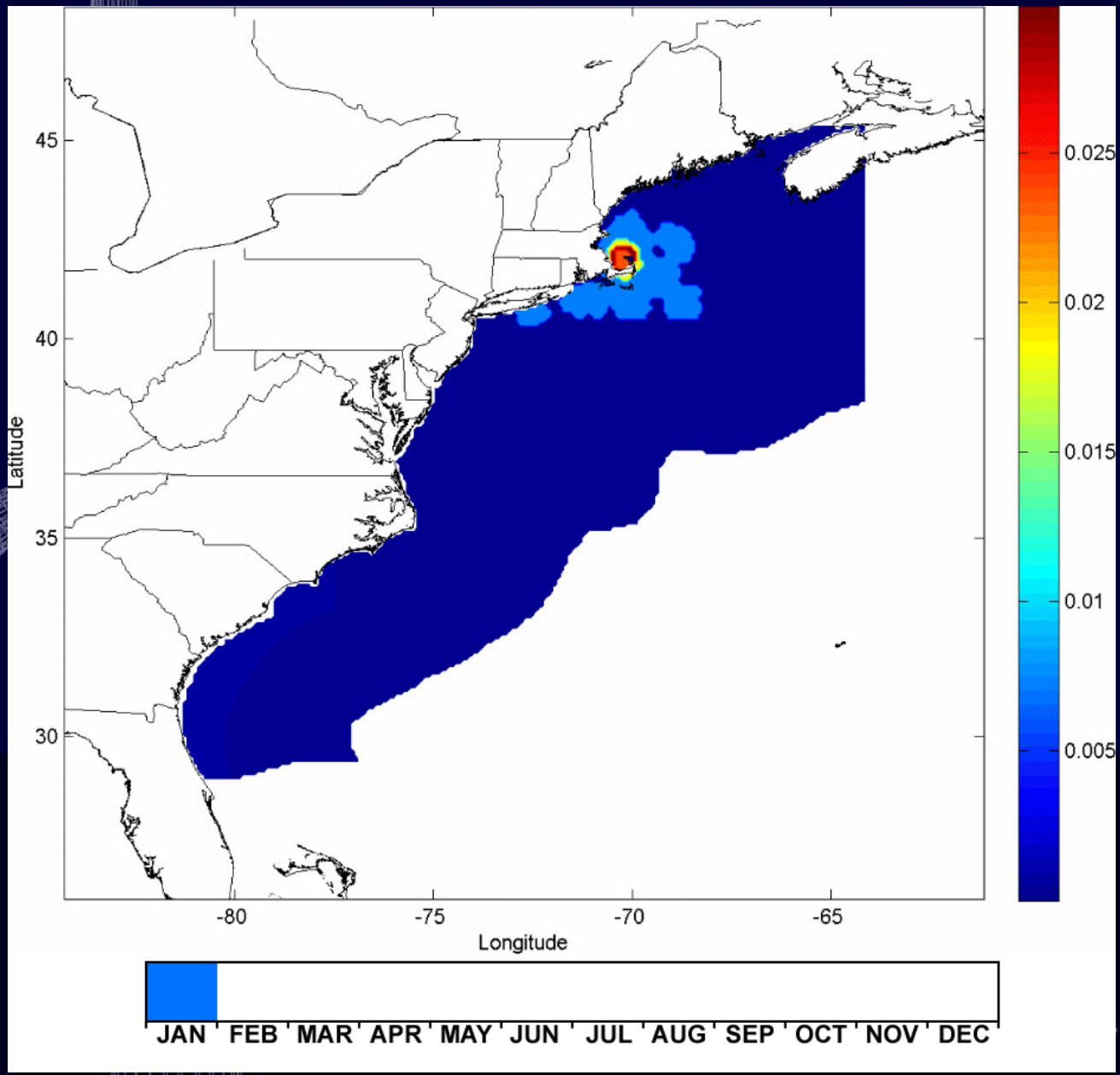
Steps in Modeling Line Transect Data

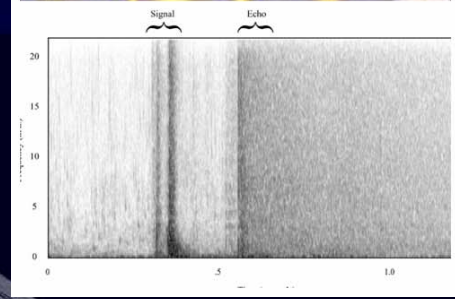
I. Survey data segmentation (program SAS®)
II. Detection function modeling (program DISTANCE)
    a. Diagnostics and model selection
    b. Interpretation of program DISTANCE output
III. Data preparation of covariates for the DSM (program MATLAB®)
    a. Import of dynamic variables (SST and chl)
    b. Import of static variables (bottom depth, bottom slope, distance from shelf break, latitude, and longitude)
    c. Define study area boundaries
IV. DSM modeling (GAM; programs R and MATLAB®)
    a. Diagnostics and model selection
    b. Significance of covariates
    c. Deviance explained
    d. Generalized Cross Validation (GCV) score
    e. Density estimate evaluation
V. DSM prediction (programs DISTANCE and R)
    a. Density estimation at the study area level
    b. Extrapolate to areas/seasons where survey data were not collected
VI. Density estimation at smaller scales
    a. Seasonal estimates
    b. Area specific estimates
VII. Measures of precision
    a. Variance estimation
    b. Bootstrap samples

Density Results – North Atlantic Right Whale



Underwater Acoustic Survey

- Deploy 5 pop-up buoys in study area
- Cornell University Bioacoustics Laboratory – Dr. C. Clark
  - 3 months life
  - 10-1000 Hz
  - ~10 km listening range
  - Quantify abundance of marine mammal vocalizations



Photos: Cornell, NOAA

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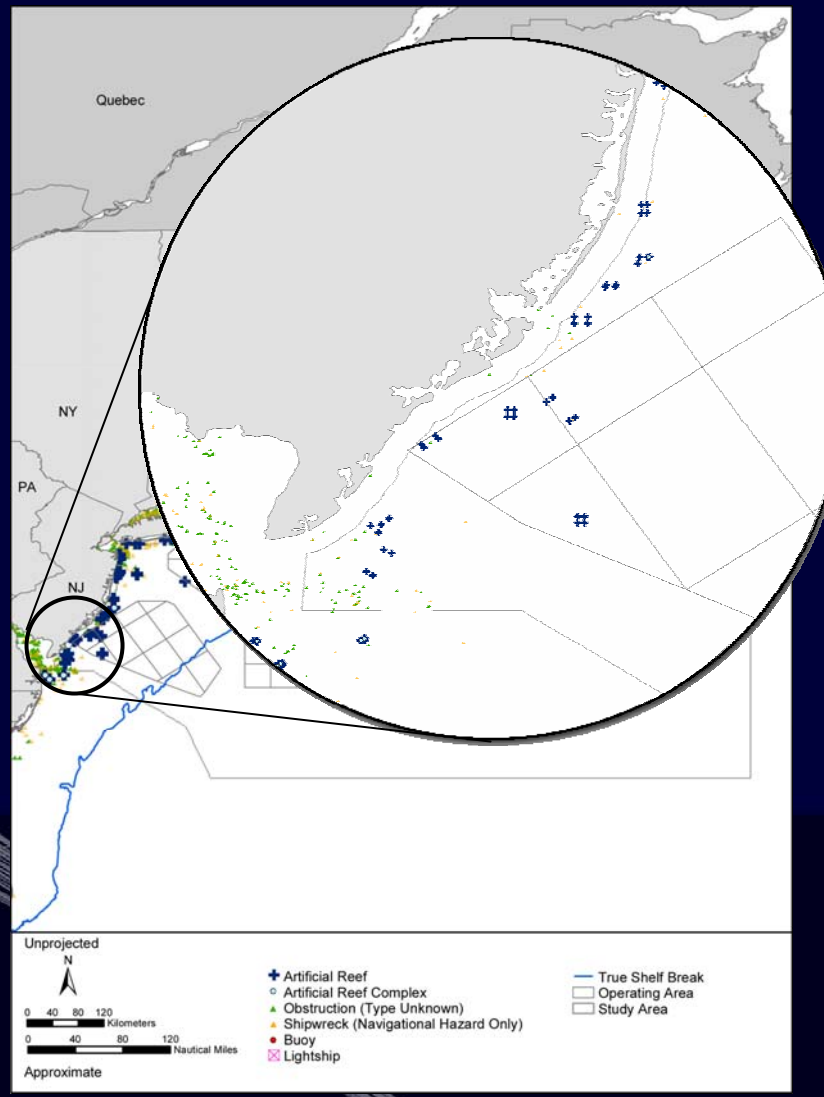
Aquatic Baseline Studies

Data fields in house for Aquatic Baseline Studies:

- ***Oceanography/Geology***
  Bathymetry, Sediments, SST, chlorophyll
- ***Human Activities***
  Artificial Reefs, Shipwrecks, Dive Sites, Navigable Waterways
- ***Habitats***

  Seagrass beds, live/hard bottom communities, coastal marsh



ARTIFICIAL REEFS

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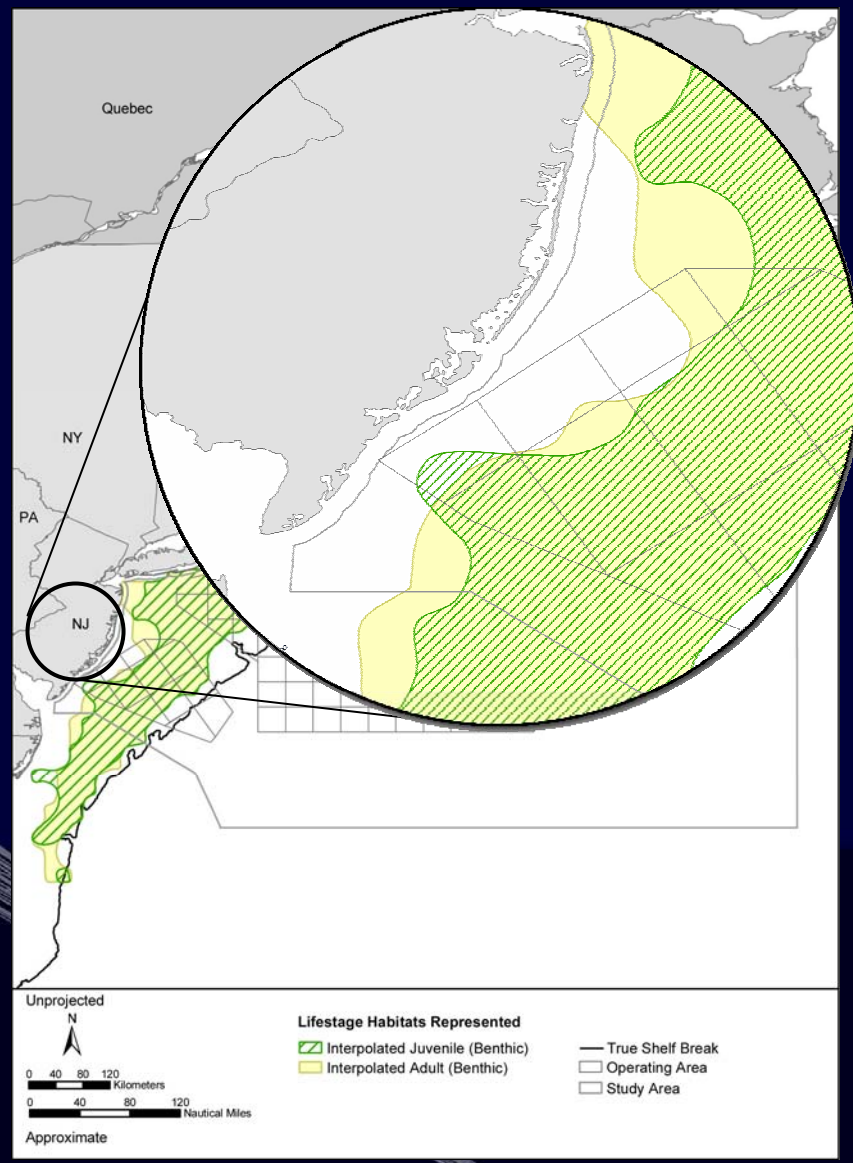
Aquatic Baseline Studies

Data fields in house for Aquatic Baseline Studies:

- ***Fishing Activities***
  Sink Gillnets, Clam Dredges, Pots, Recreational Fishing Spots/ local tournaments
- ***Fishery Landings for 36 species including:***
  Atlantic Cod, Atlantic Surfclam, Ocean Quahog, Red Hake, Flounder (summer windowpane, winter, witch, and yellowtail), King Mackerel/ Spanish Mackerel/Cobia, Bluefin Tuna, and swordfish.



EFH FOR OCEAN QUOHOG

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Marine Radar Sensing

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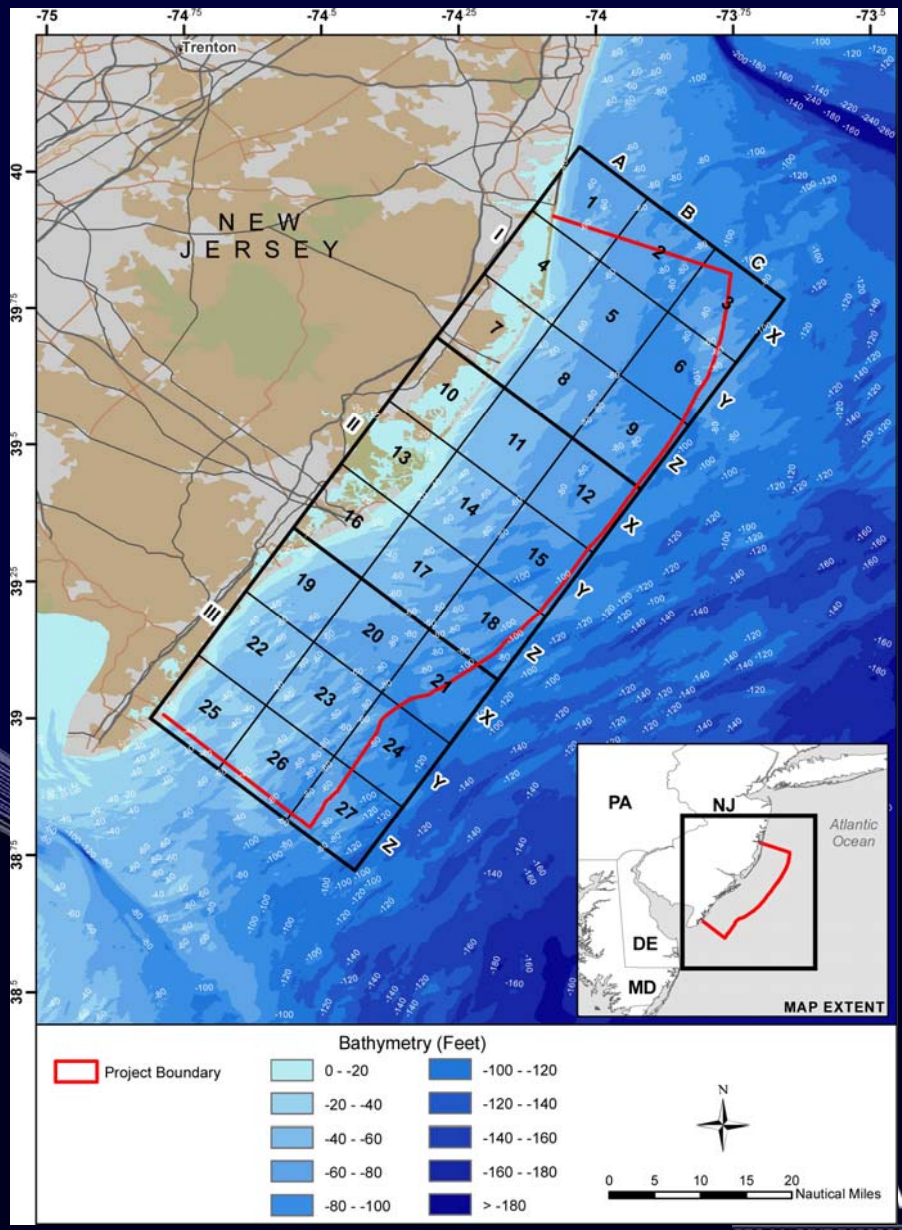
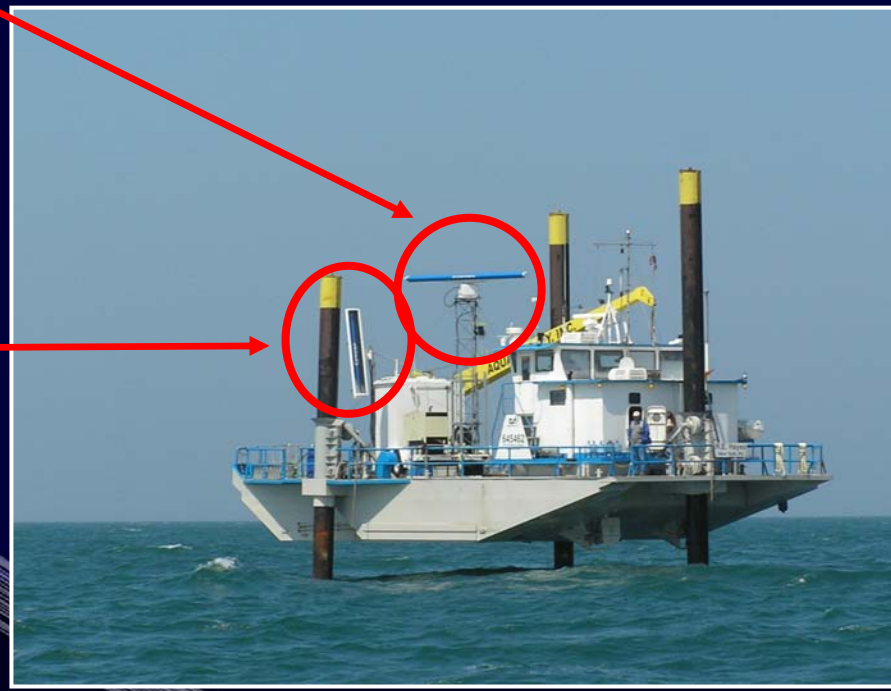
Radar Survey Sampling Design

- Fixed and randomly sampled sites
- Divided into 3 latitude strata of equal area
- 3 zones aligned by offshore distance
- Each strata consists of 9 grid cells
- Each grid cell represents 8nm X 8nm square grid (twice the 4nm radius radar coverage area)



Mobile Avian Radar System (MARS®)

- Dual Radar Bird Detection System
  - TracScan provides horizontal surveillance and tracks targets reporting:
    - position, speed, direction, and echo strength
    - S-band for “seeing beyond” precipitation and provides maximum range coverage
  - VerCat provides vertical surveillance and records:
    - Altitude, size of echo
    - X-band, finer altitude resolution
  - On-board weather station
- Automated, Digital signal capture
- 24/7 Radar Operations
- De-cluttering, target tracking software, data archiving for post-study analysis



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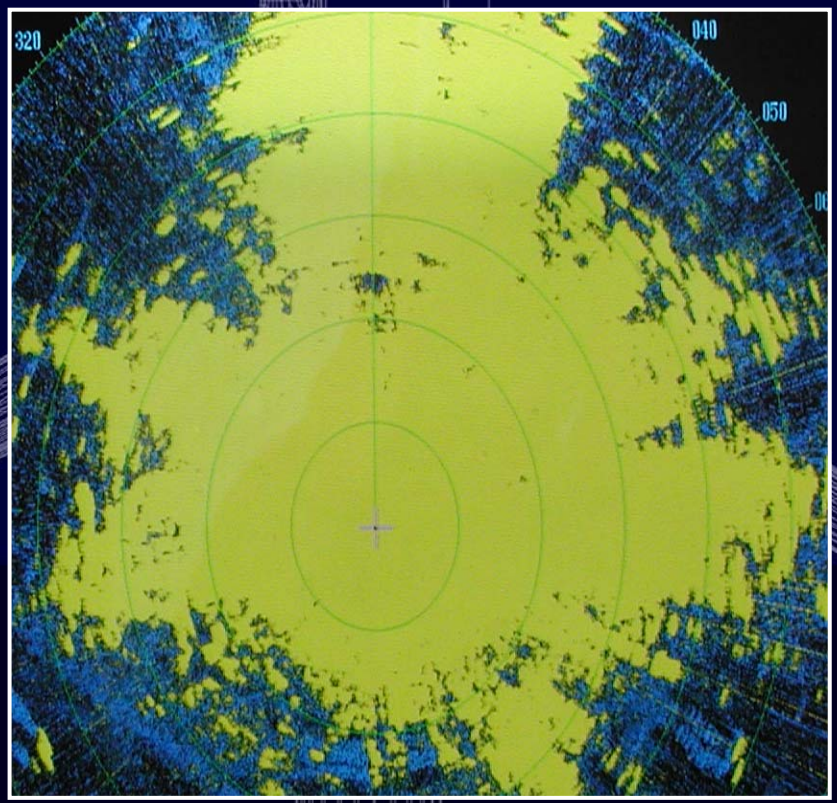
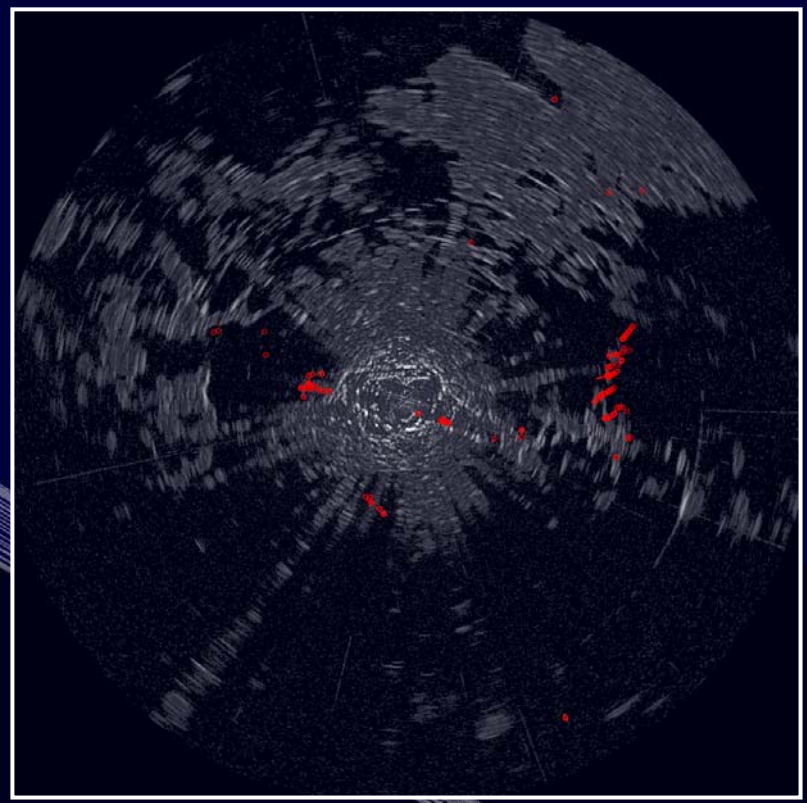
MARS® Processing Effect

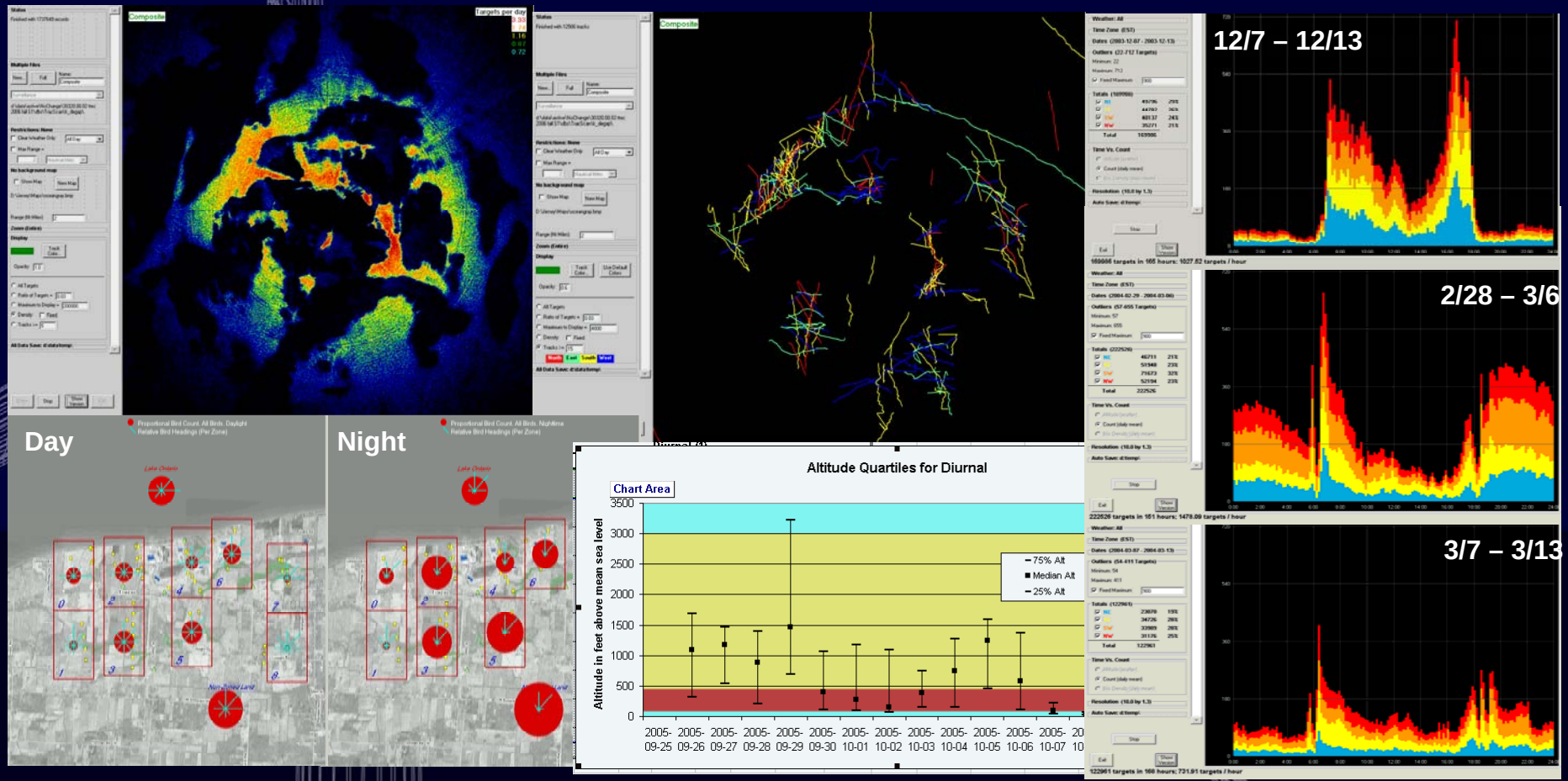
- Sample Raw image:



- Sample Processed image:



Radar Data Outputs



Visual Vessel Survey/Ground Truthing

- Provide validation of the marine radar data
- Ground truthing once per sample location each season
- Recorded data
  - Targets crossing the transect (vessel bow)
  - Select individual birds and different sized flocks (small, medium, large) of birds
  - Record: observation time, target identity, number, flight direction, estimated distance to bird, and estimated flight altitude

Thermal Imaging and Vertically Pointing Radar (TI-VPR)

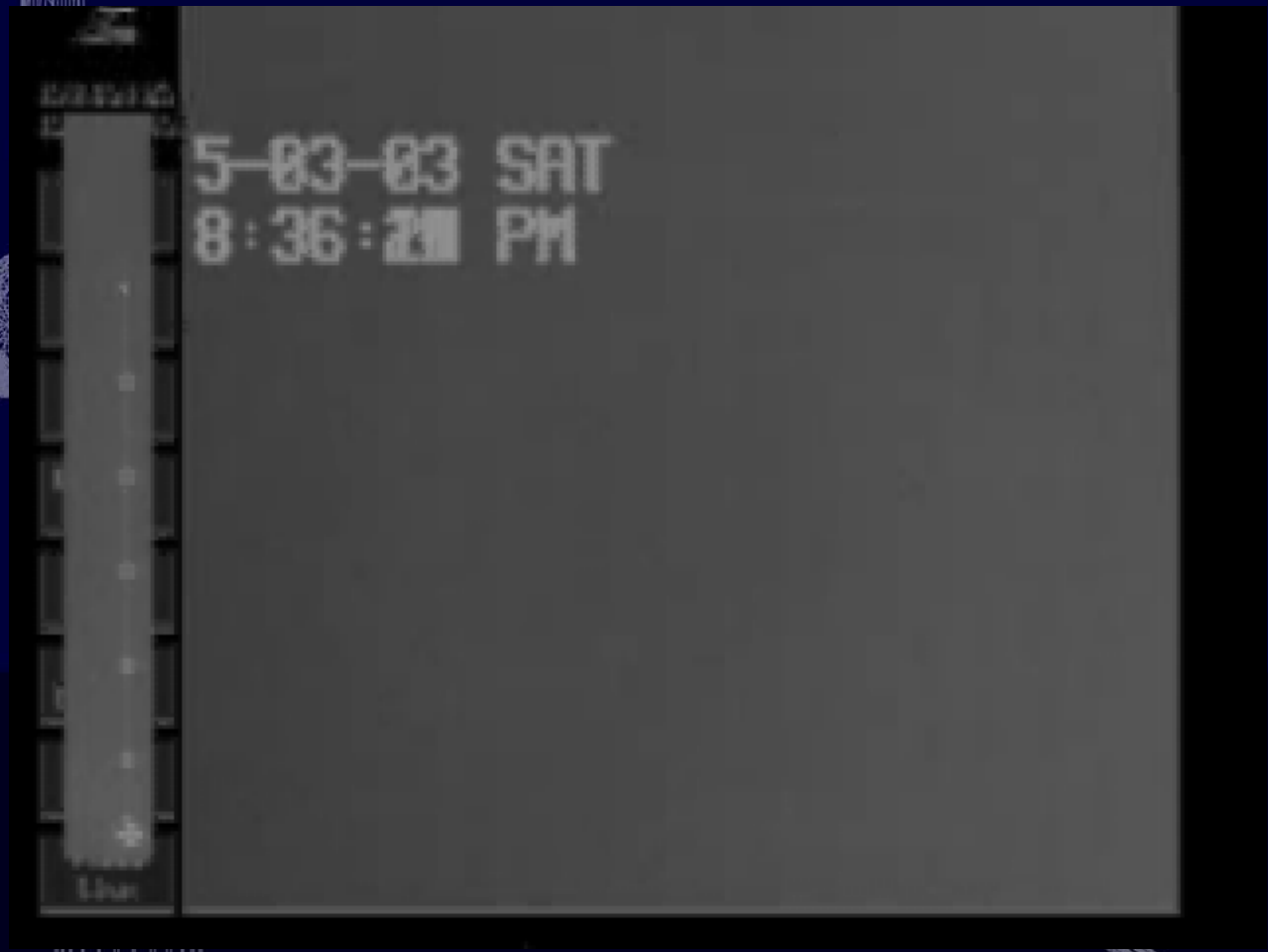
- Thermal imaging can detect individual birds/bats out to a maximum range of 2 km.

A **TI camera** **TI-VPR antenna**

The combination of thermal imaging (TI) and vertically pointing radar (VPR) enables the determination of:

- Altitude of target(s)
- Direction of target(s)
- Target identification and flock size

Thermal imager/vertical radar showing two flocks of birds flying overhead, a single migrating bird, and a foraging bat



Environmental Impacts Analysis Process

- Ensure a thorough understanding of proposed activities
- Define the potential impacts
- Determine methods for assessing impacts
- Gather data and assess impacts
- Coordinating and consulting with regulators
- Determine significance of impacts

Schedule

- Ship Board Avian, Marine Mammal, and Sea Turtle Surveys
  - Start date Jan 2008
- Aerial Marine Mammal, Sea Turtle, and Avian Surveys
  - Start date Jan 2008
- Small Vessel Coastal Avian Surveys
  - Start date Jan 2008

Schedule (cont'd.)

- Acoustical Surveys for Marine Mammals
  - Start date Mar 2008
- Oceanographic Surveys
  - Start date Jan 2008
- Offshore Radar Surveys
  - Start date Mar 2008
- Thermal Imaging-Vertically Pointed Radar Surveys
  - Start date Mar 2008