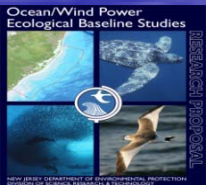


NJDEP Ocean/Wind Power Ecological Baseline Studies

USOWC & CESA
Joint Webinar Series
June 8, 2011

Gary A. Buchanan, Ph.D.
Office of Science, NJDEP
Jason See, Ph.D.
Geo-Marine, Inc.



Ocean/Wind Power Ecological Baseline Studies

January 2008 – December 2009

Volume I: Overview, Summary, and Application



NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
OFFICE OF SCIENCE

FINAL REPORT

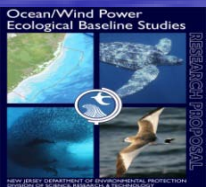
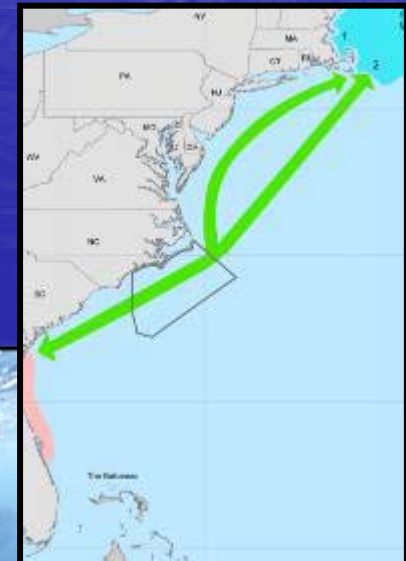
Prepared by:
Geo-Marine, Inc.
2201 K Avenue, Suite A2
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Phone: 972.423.5480
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Web: www.geo-marine.com

July 2010



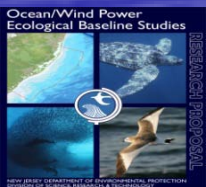
Geo-Marine, Inc.

- Natural Resources
- Marine Science
- Cultural Resources
- Remote Sensing Technologies
- Planning and Analysis



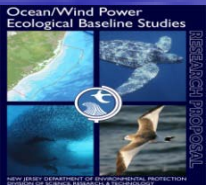
Project Significance and Issues

- DATA, DATA, DATA, DATA!!!!
- 1 project in state waters; 4 in federal waters
- \$3-4+ Billion investment
- Data will help support the development of renewable energy projects
- Help assess potential impacts
- Inform NEPA & Federal Consultation process (e.g., ESA)



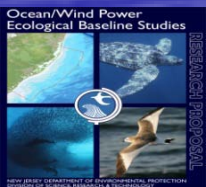
Ocean/Wind Power Ecological Baseline Studies Project Objectives

- 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 Objectives (cont.)

- “These data may be gathered variously by physical counts by boat and airplane, remote sensing by radar and sonar applications, and historic record reviews. Data collection should be designed to answer fundamental questions regarding which species use what areas and to what degree, and collected data should be made available to inform risk assessment and cumulative impact modeling.”

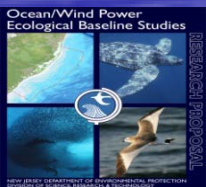


Specific Objectives – Fill Data Gaps

- In the Study Area, what are the abundance, distribution, and utilization of:
 - Bird Species (flight behavior)
 - Marine Mammals
 - Sea Turtles

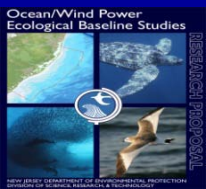
Specific Objectives

- 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/environmental impacts?



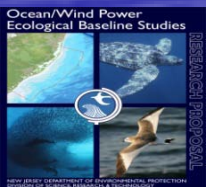
STUDY AREA

New Jersey



Field Studies

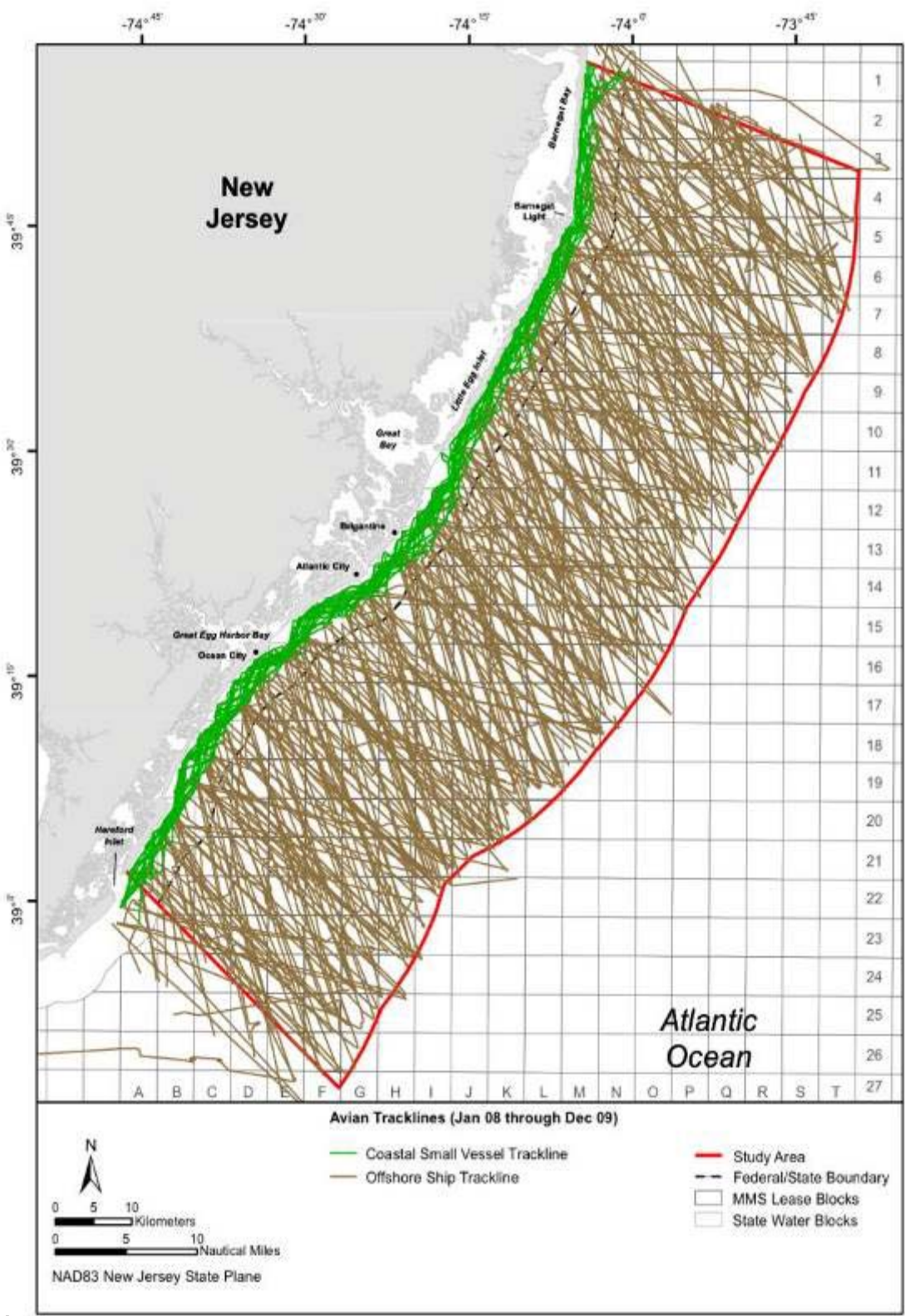
- Three Primary Targets:
 - Avian
 - Marine Mammal
 - Sea Turtle
- Supporting Studies:
 - Oceanographic
 - Fish and Fisheries
 - Benthic Mapping



Shipboard Surveys







**TOTAL SURVEY EFFORT
2008-2009**

**Bimonthly coastal and
offshore surveys**

Total km 18,183

Total species:

153 (avian)

8 (marine mammals)

2 (sea turtles)



Activity conducted pursuant to NOAA Permit No. 10014-02

Photo by Tony Leukering, GMI

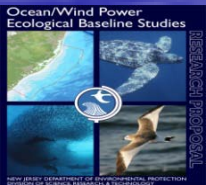
Detected species

Five federally threatened or endangered species:

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

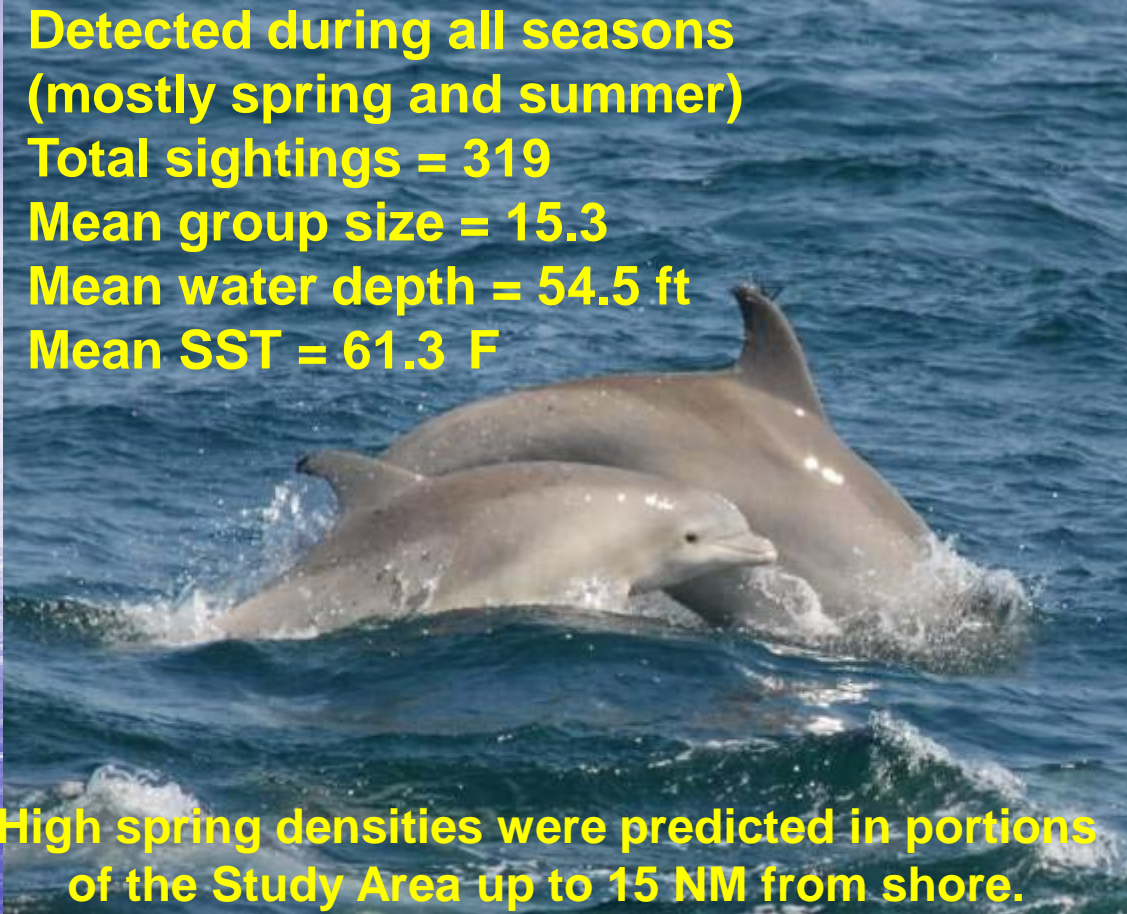
Also:

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



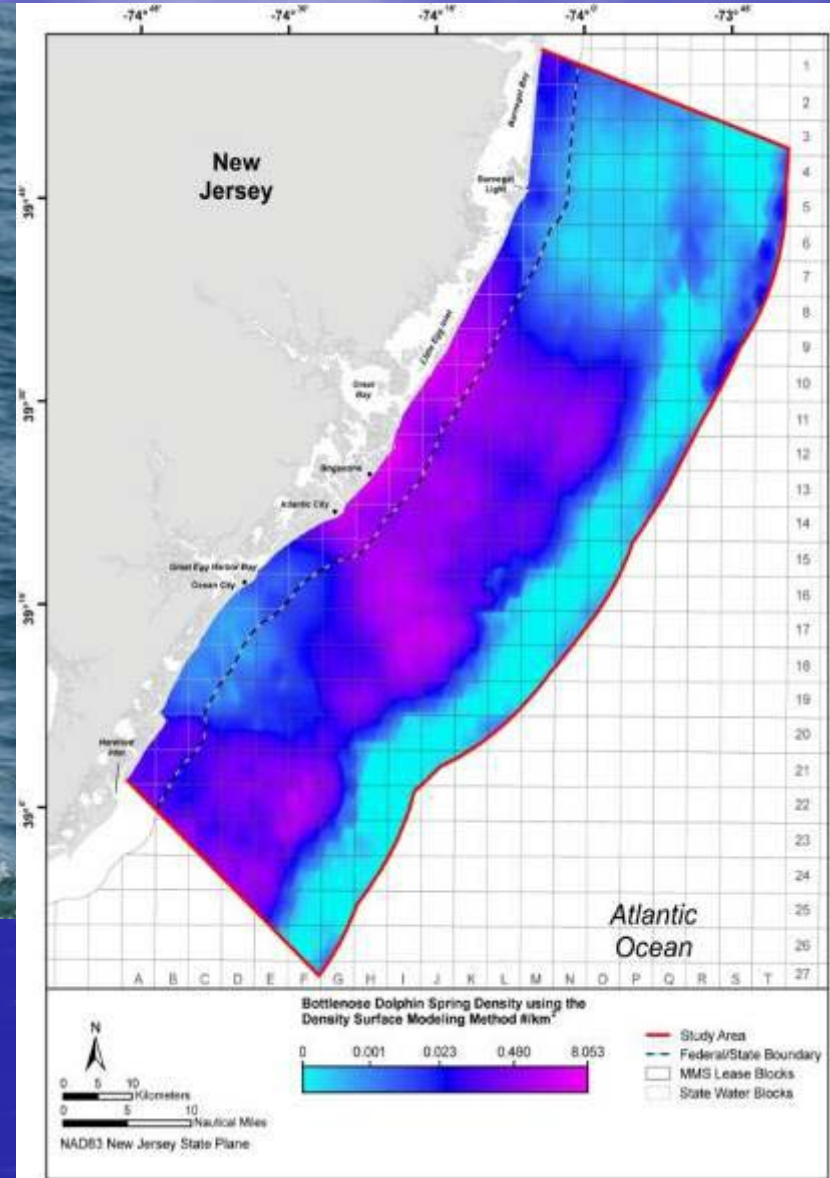
Bottlenose Dolphin

- 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

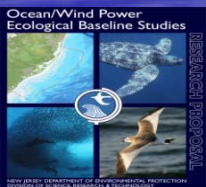


High spring densities were predicted in portions of the Study Area up to 15 NM from shore.

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



Spring abundance = 722 animals



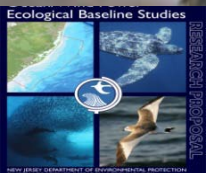
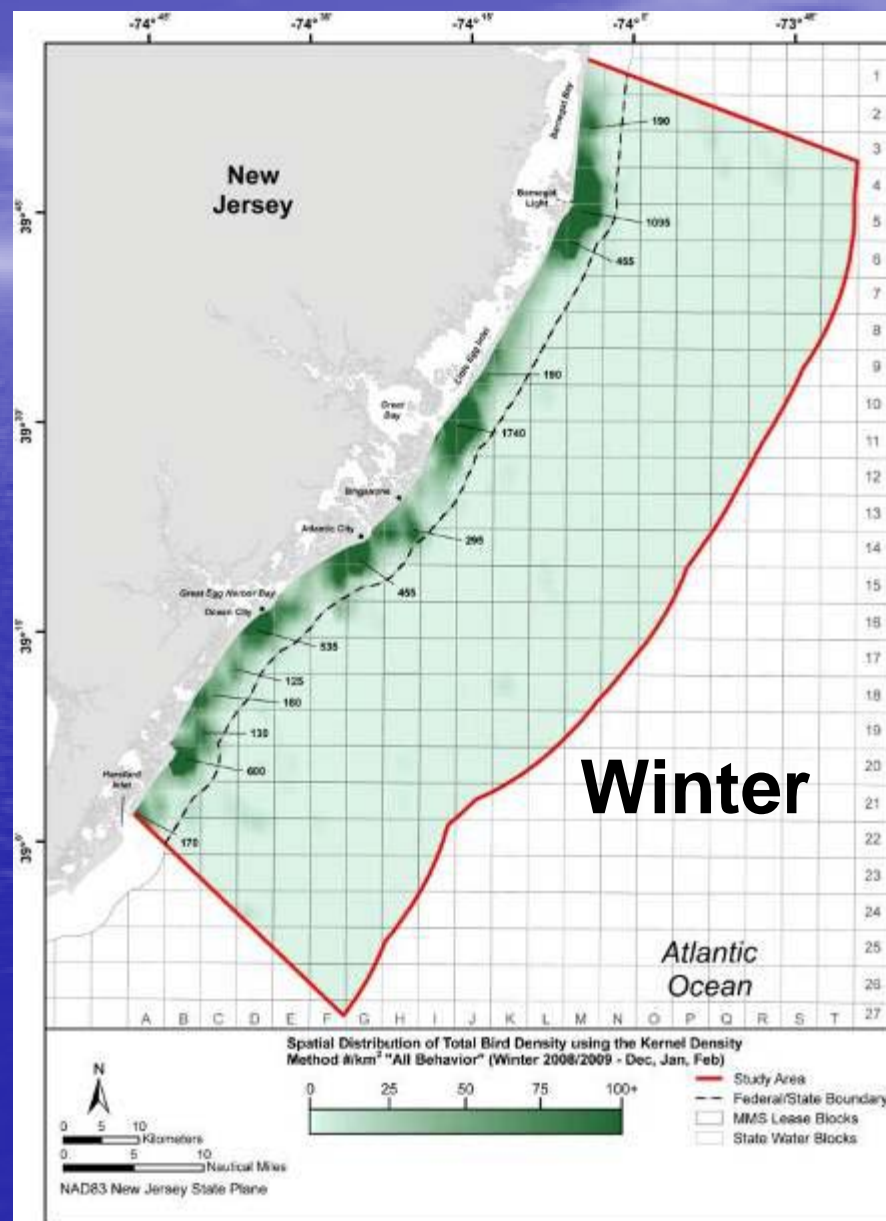
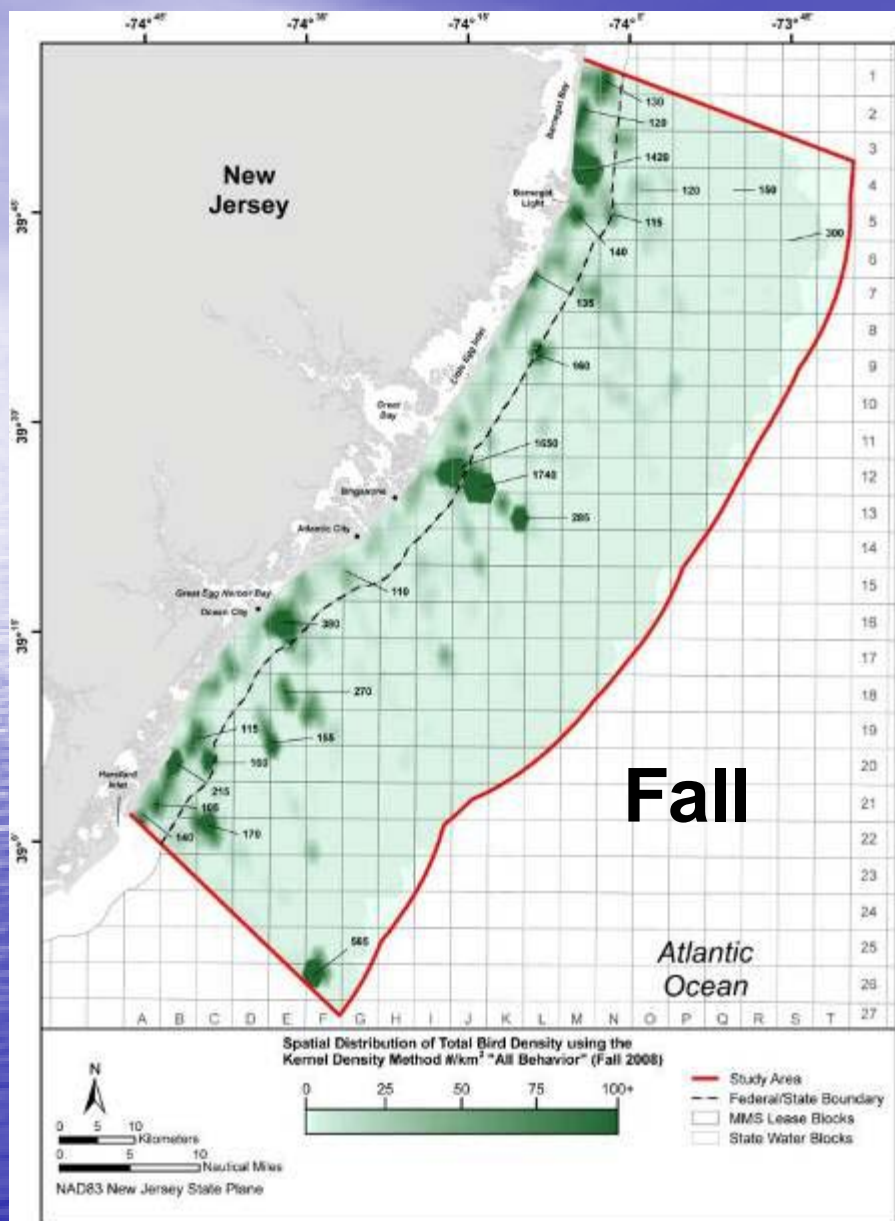




Photo by Tony Leukering, GMI

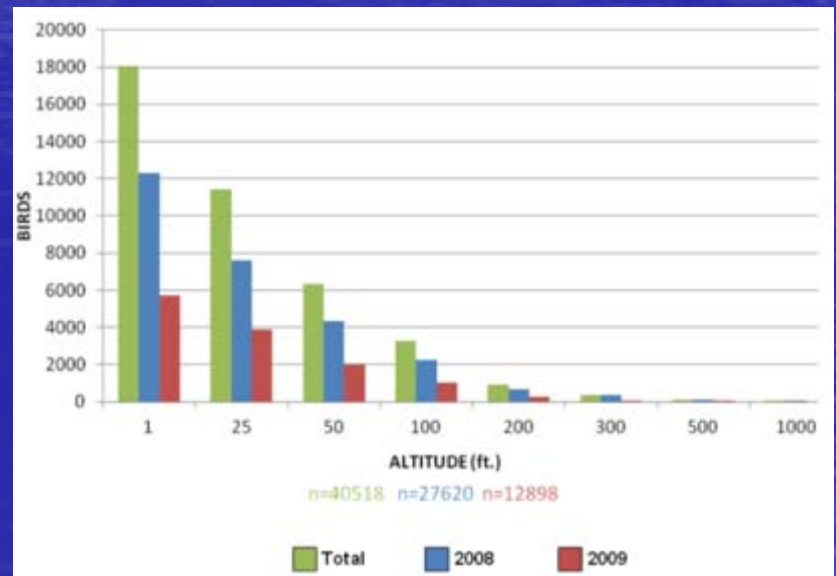
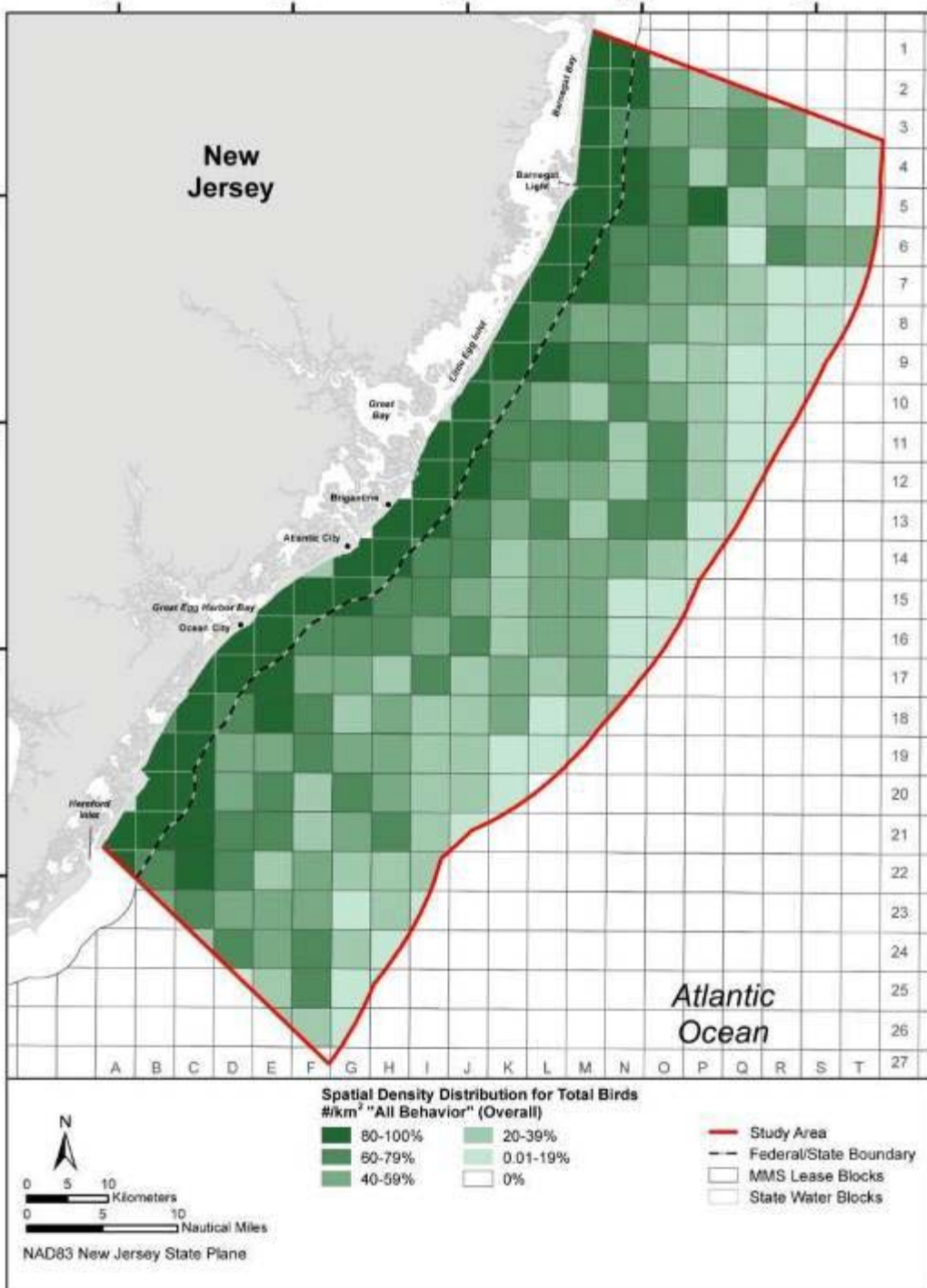
Seasonal Variability: Total bird density

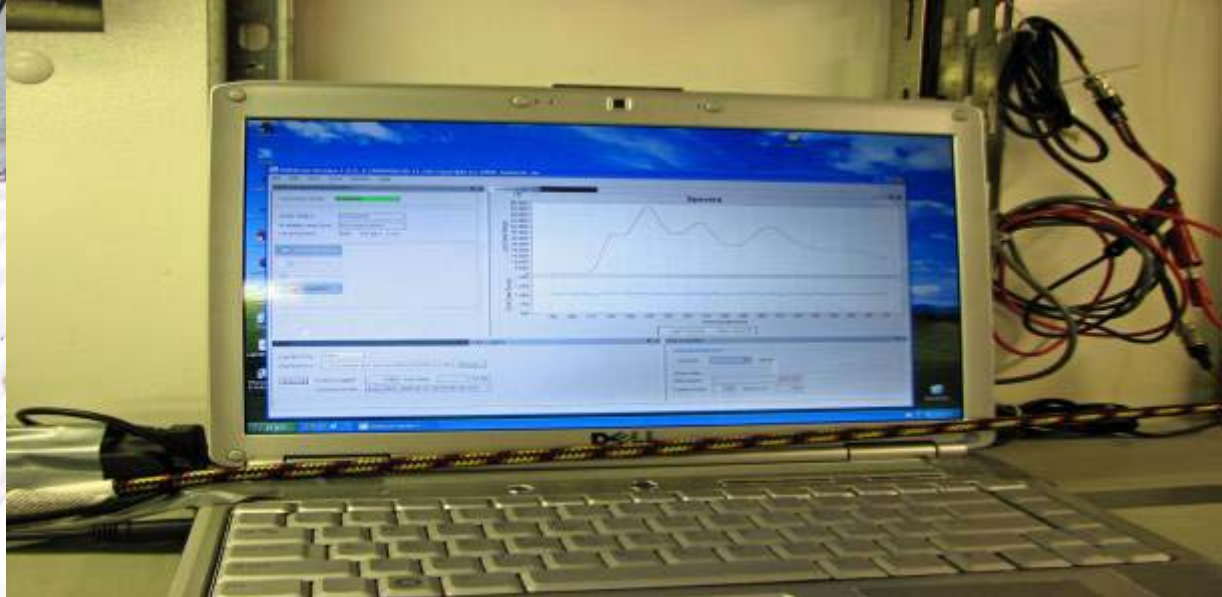


Avian Cumulative Daytime Abundance 2008-2009

Areas of highest avian abundance were mostly within state waters (3 NM from the coast)

Altitude Distribution

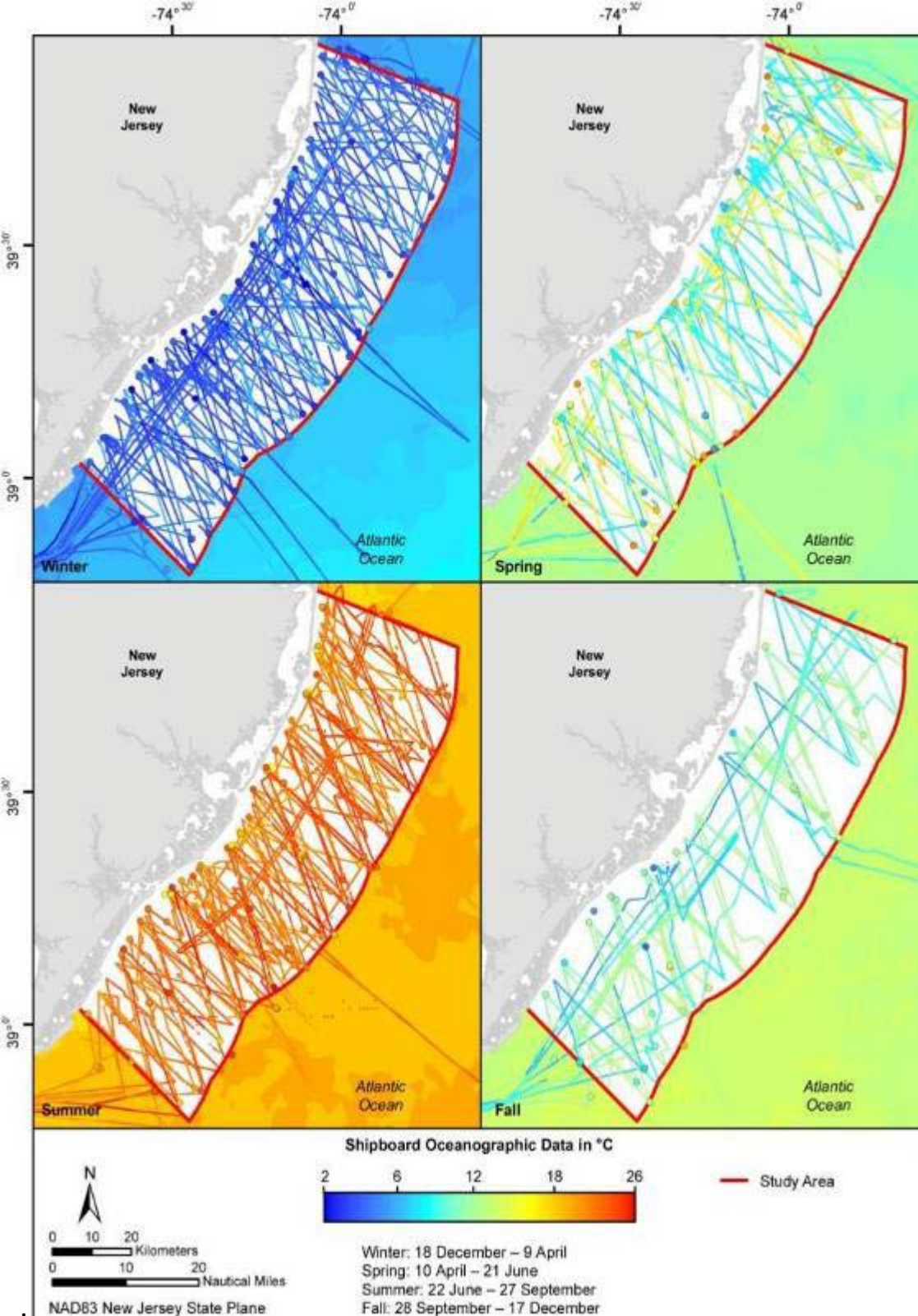




Sea Surface Temperature

Mean seasonal SST

- SST data collected via the Surface Mapping System (SMS) and CTD casts on-board the *R/V Hugh R. Sharp* between 2008 and 2009
- During winter, horizontal temperature gradients dominate; with colder water close to the coast and warmer water near the shelfbreak
- Temperature variations in the surface layer (the upper 30 m [98.4 ft]) are related to surface heating
- Thermal stratification begins in spring and persists until early fall when normal seasonal mixing occurs and homogenizes the water column



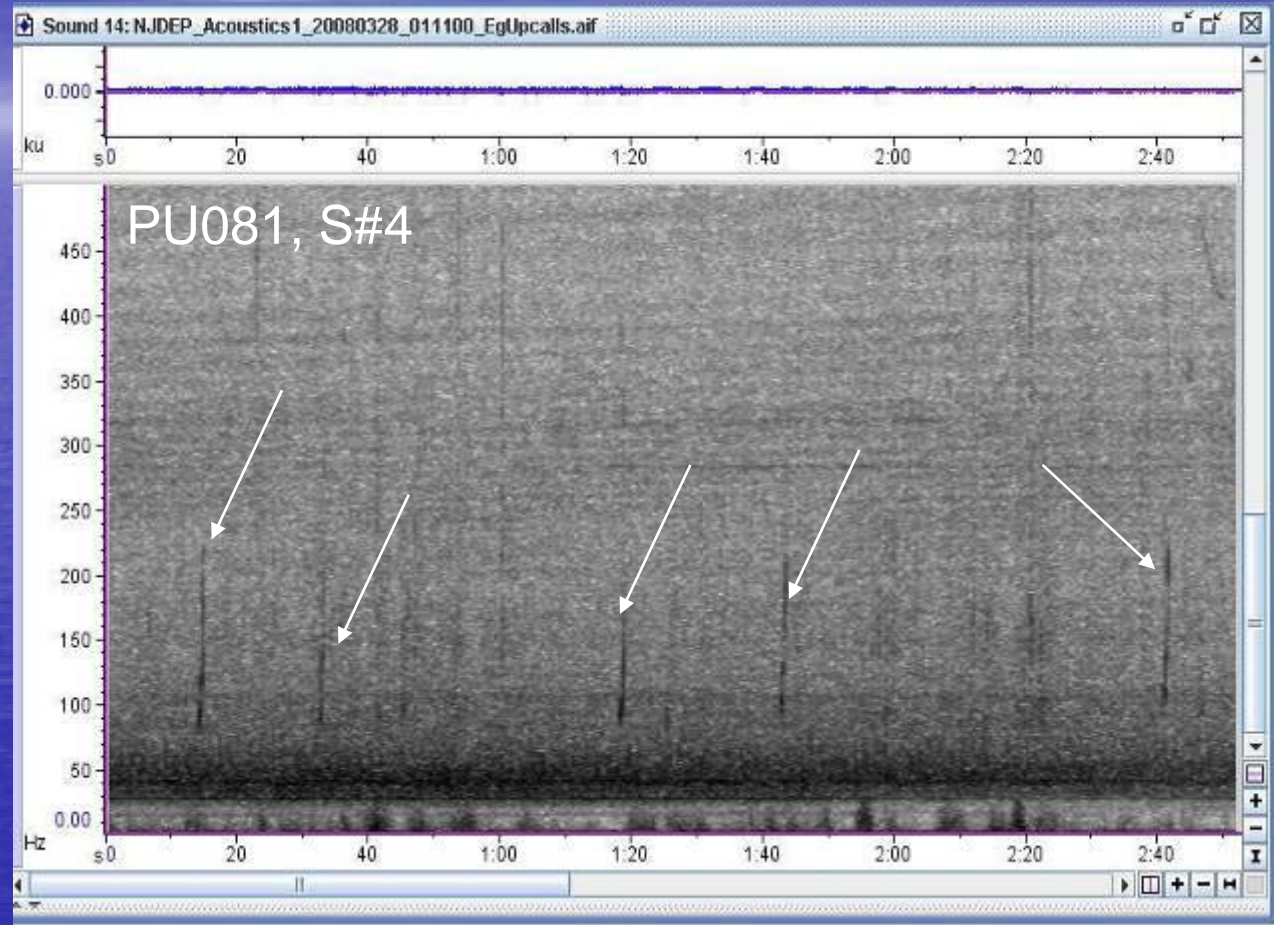
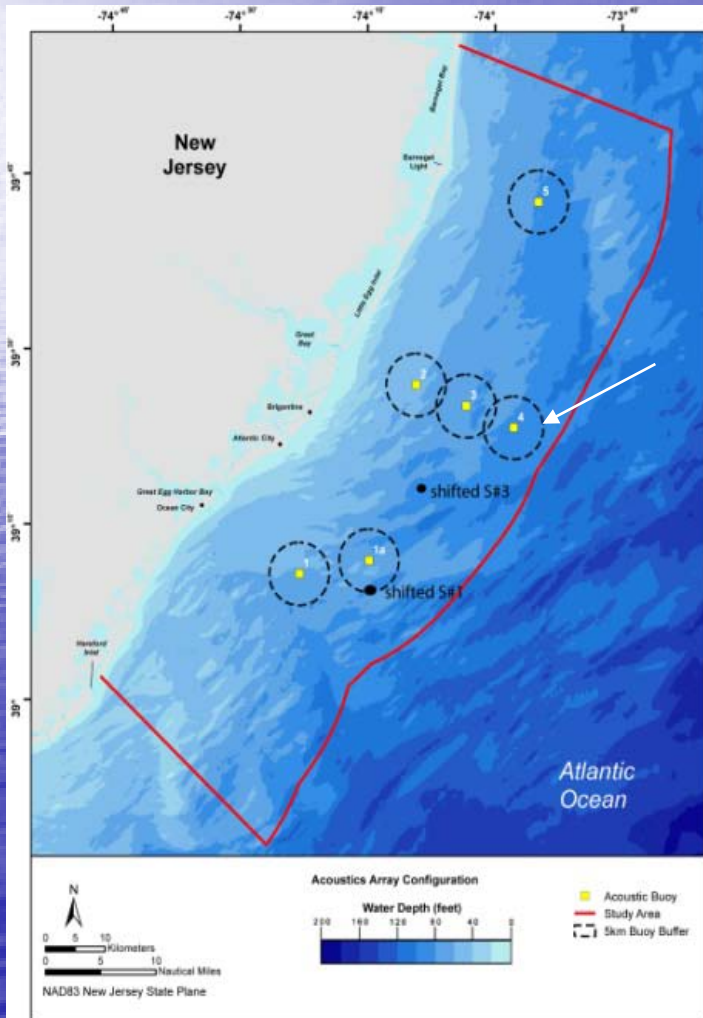
Acoustics

- Marine Mammal Acoustics
- Bat Acoustics



North Atlantic Right Whale

Upcalls 15 Apr 08



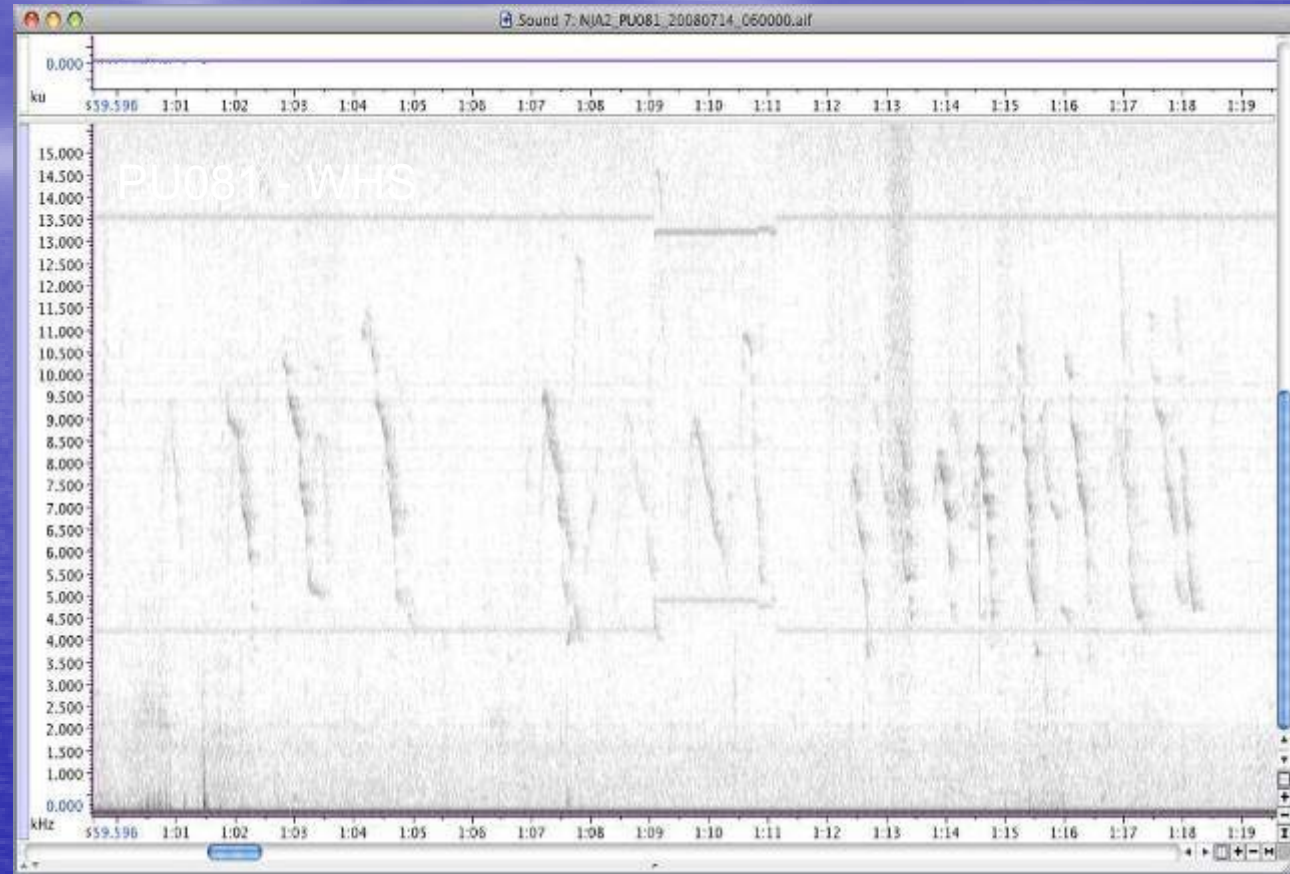
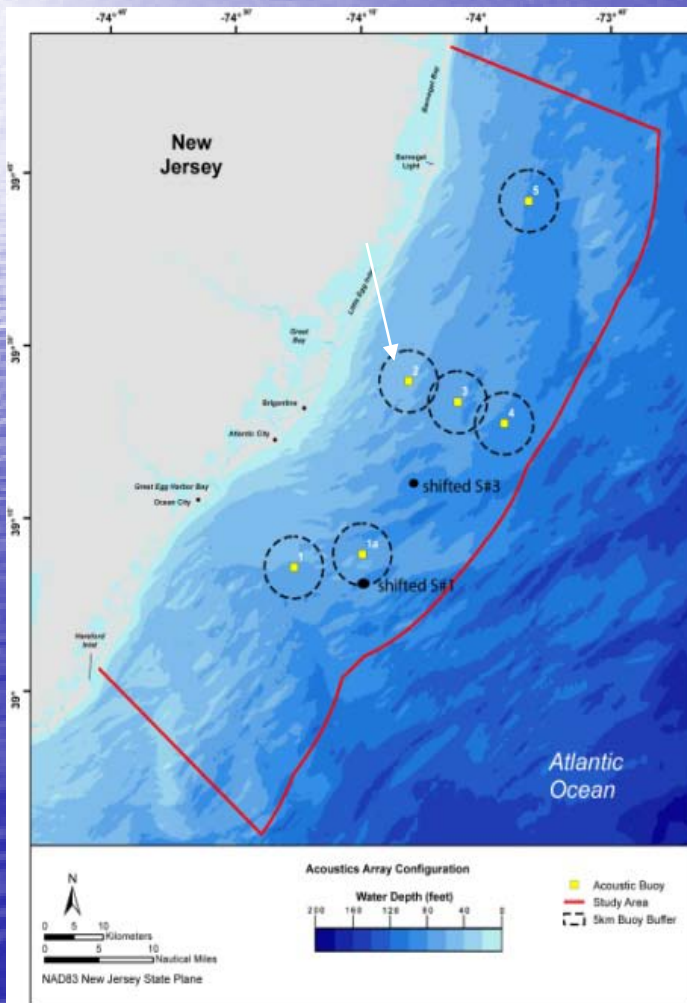
2x rate, amplified 4x



Bottlenose Dolphin

Delphinid
whistles, clicks,
claps, pulses,
squawks

14 July 08



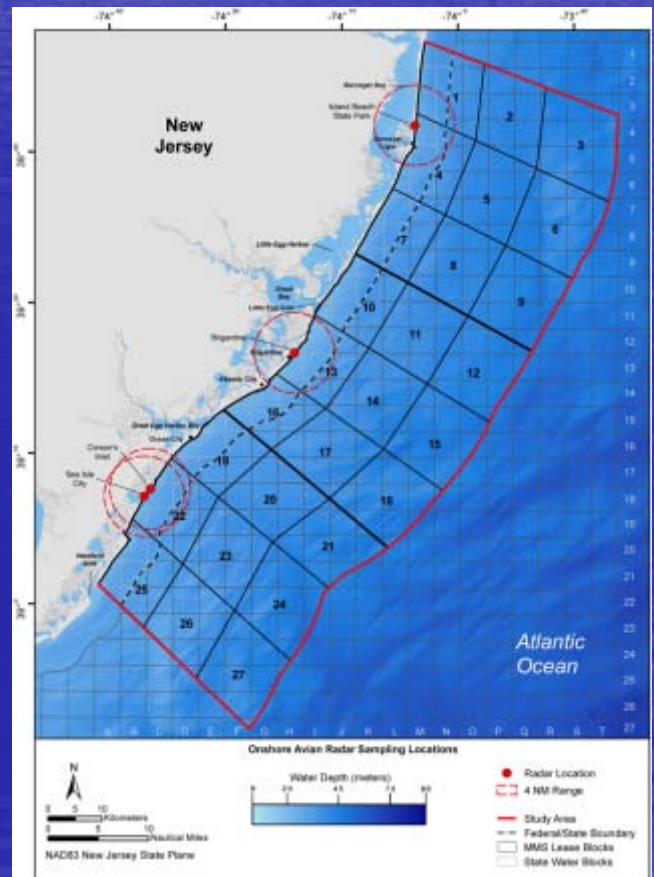
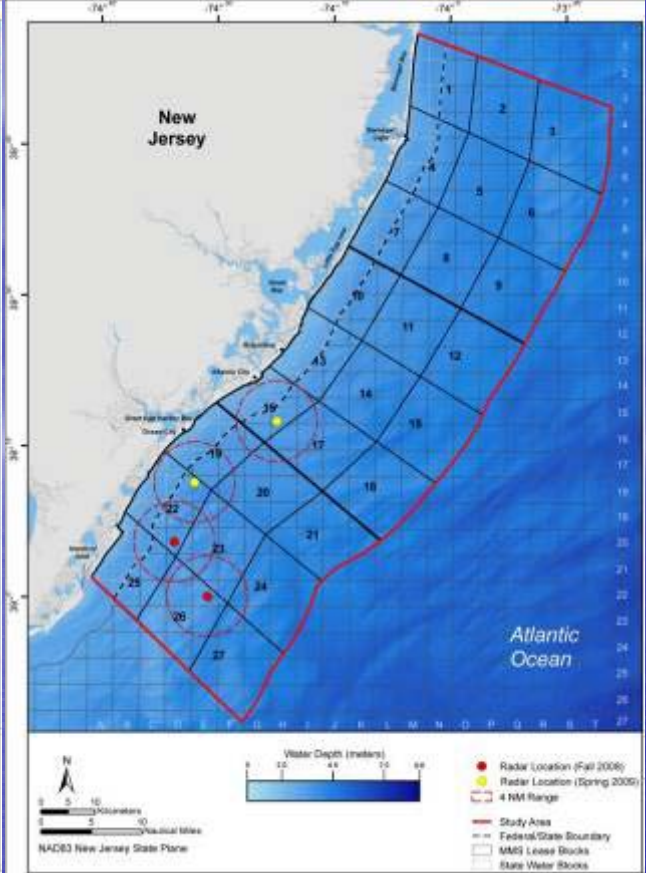
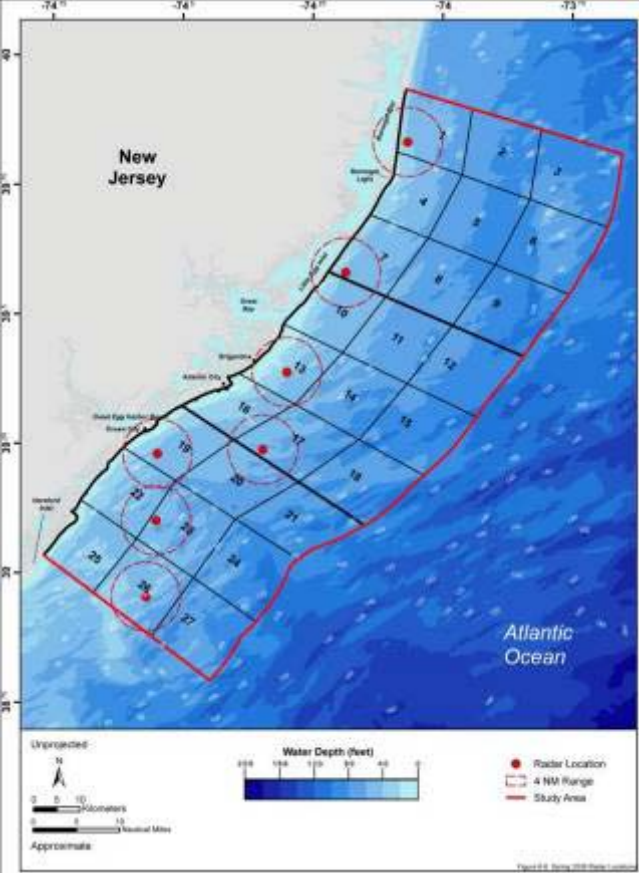
July 14, 2008 @ ~6:00 AM

Avian Radar









Spring 2008

Fall 2008 and Spring 2009

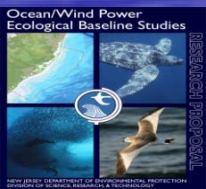


Figure 4-3. Number of individuals of all species and of scoters and Northern Gannet relative to distance from shore, Barnegat Inlet and Avalon, New Jersey, October-December 2009.

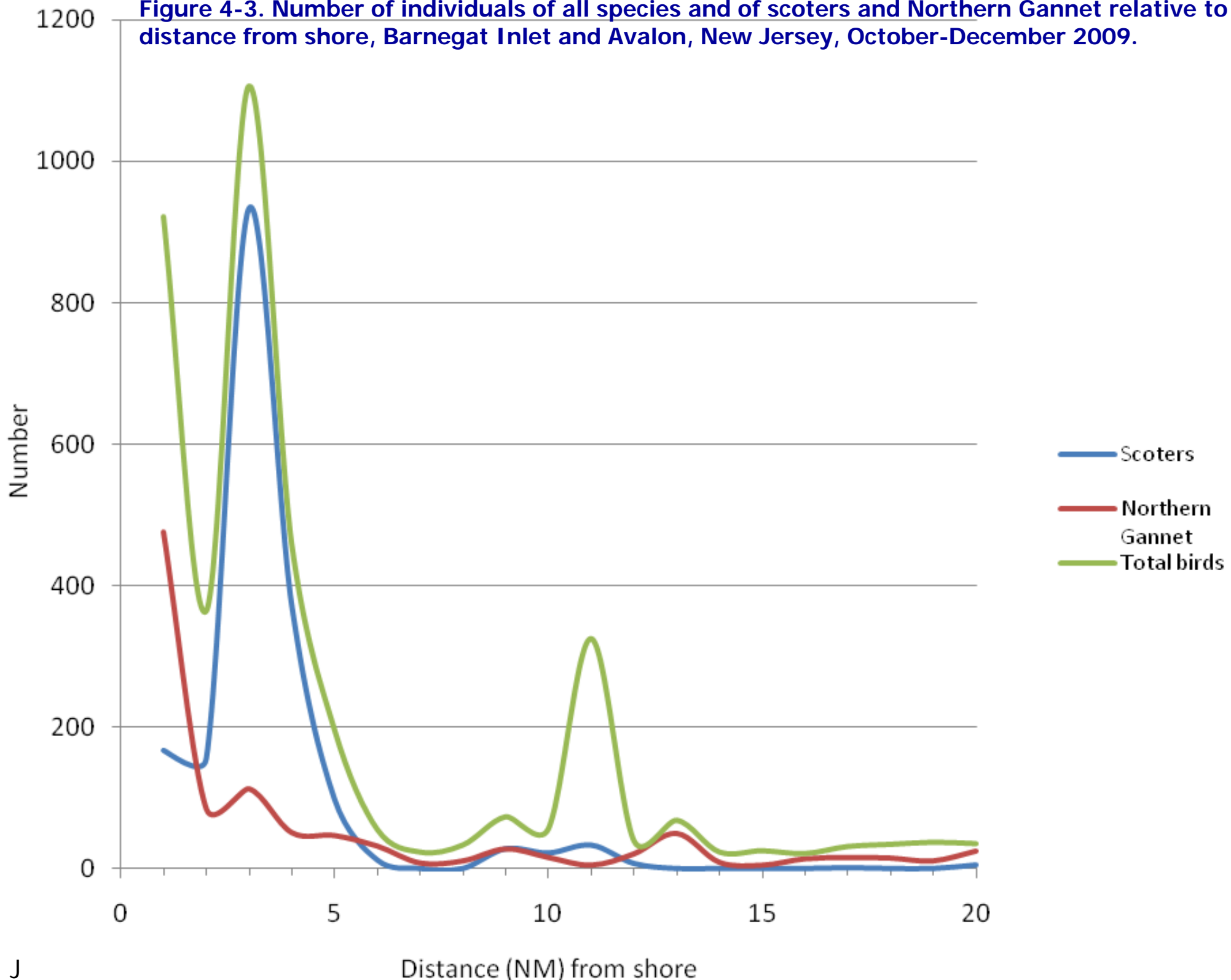


Figure 6-16. Altitudinal distribution of birds (TCC and CAC) aloft over Island Beach State Park, New Jersey, from 21-22 and 27 March 2009.

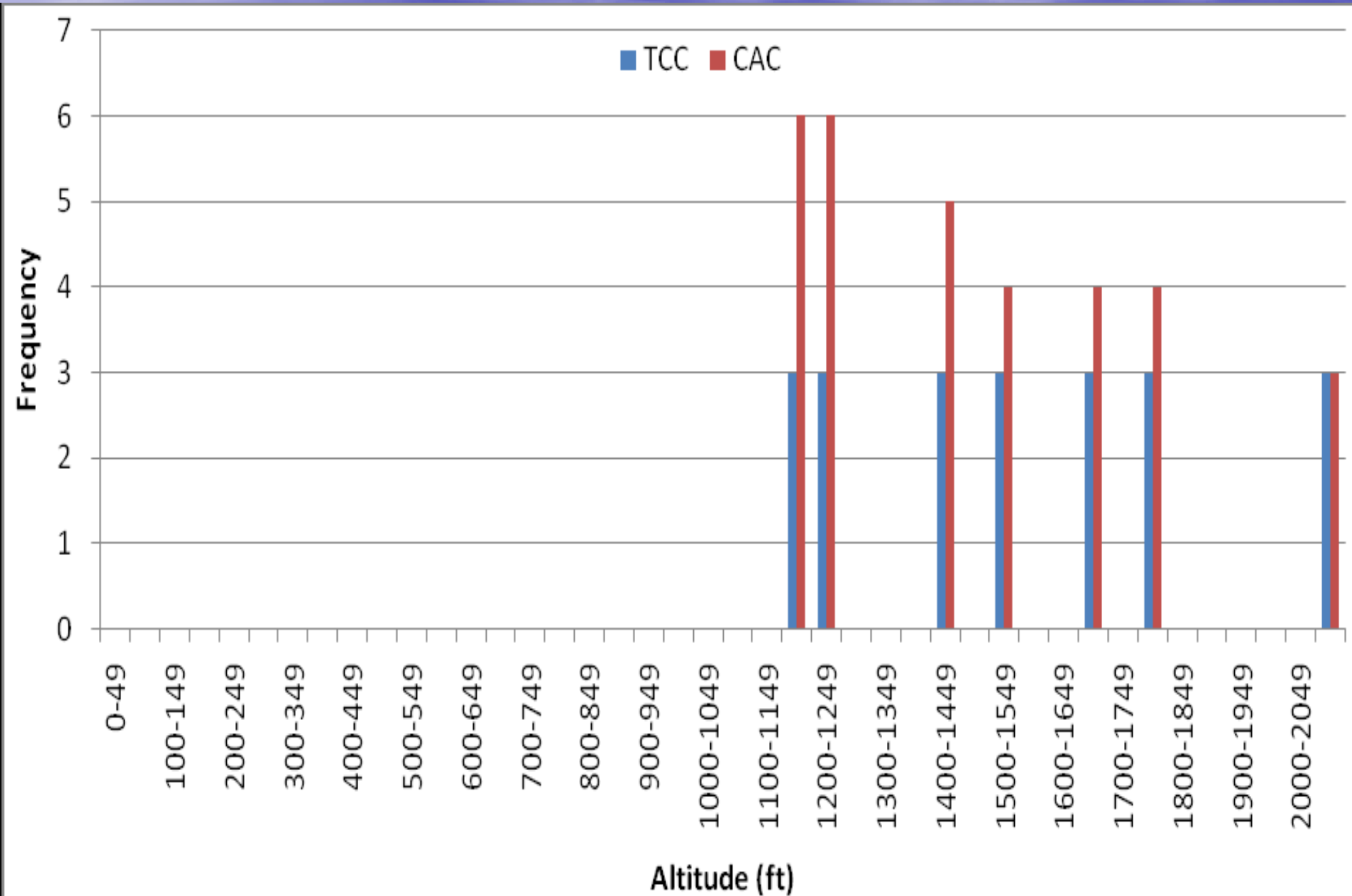
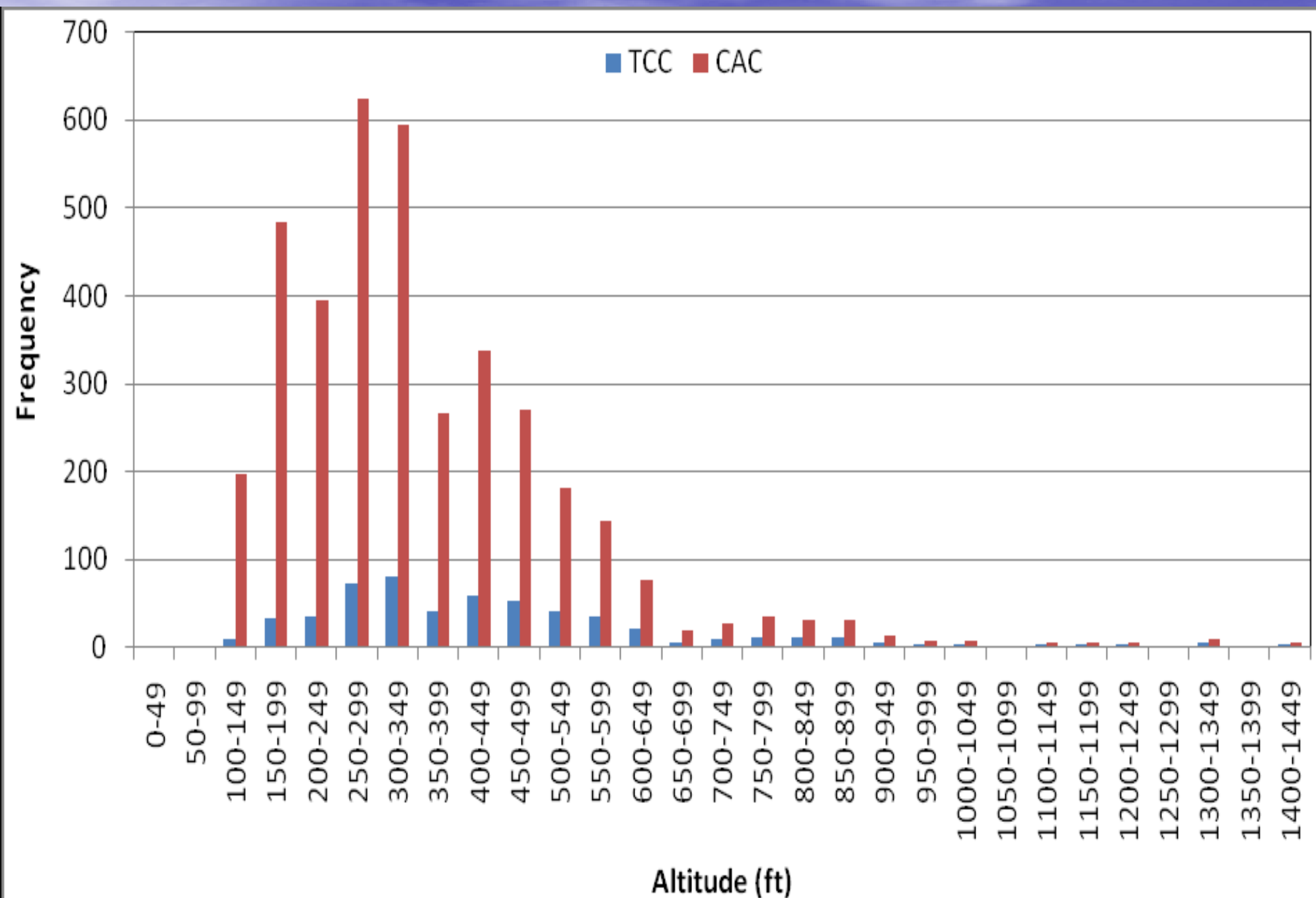
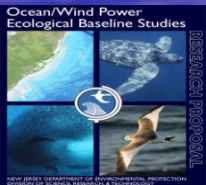


Figure 6-5. Altitudinal distribution of birds (TCC and CAC) aloft over Grid 23 from 01-07 May 2008.



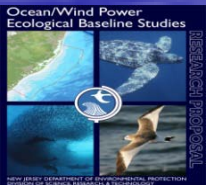
Other Studies

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



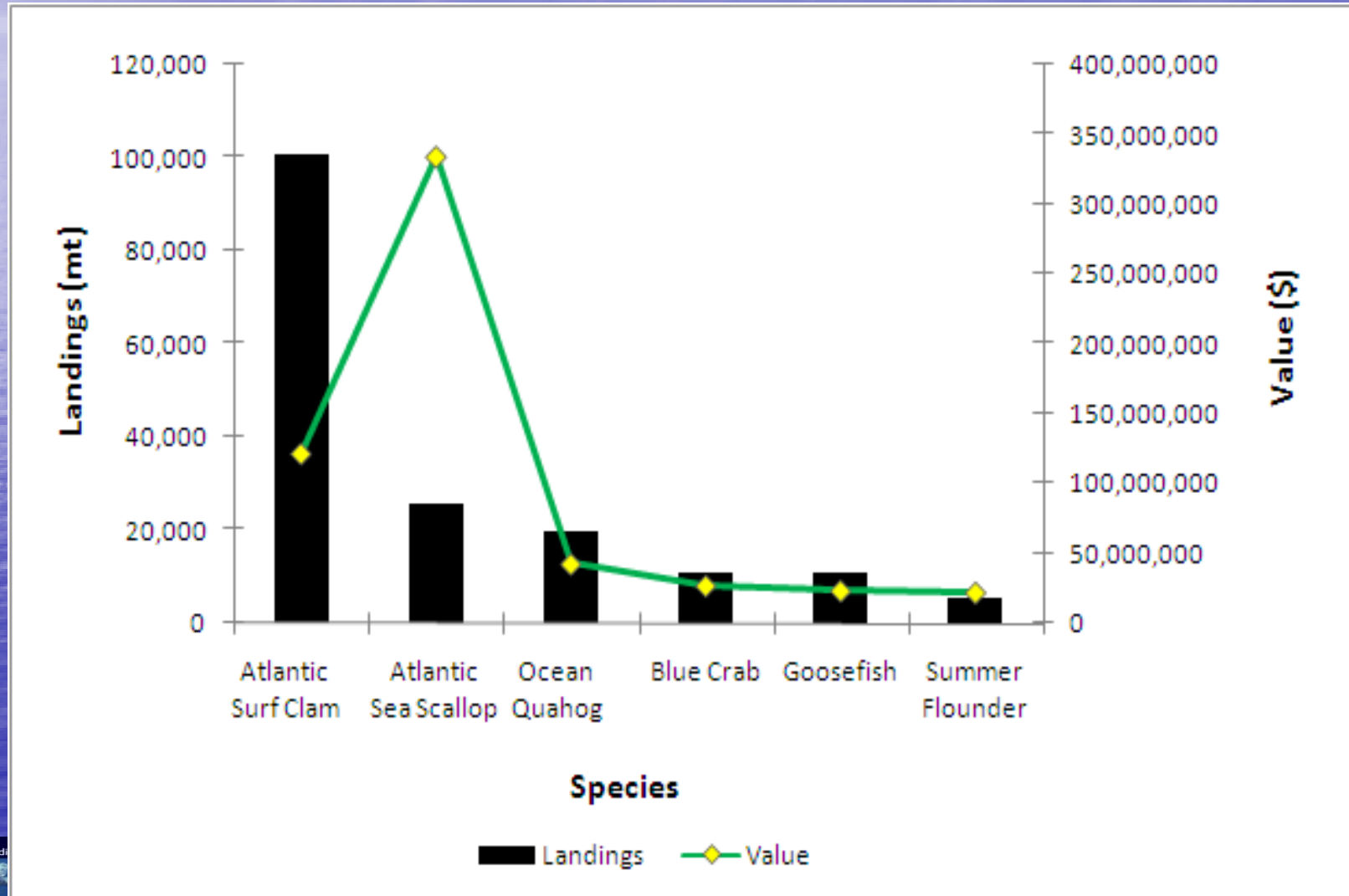
Data Analysis

- 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.

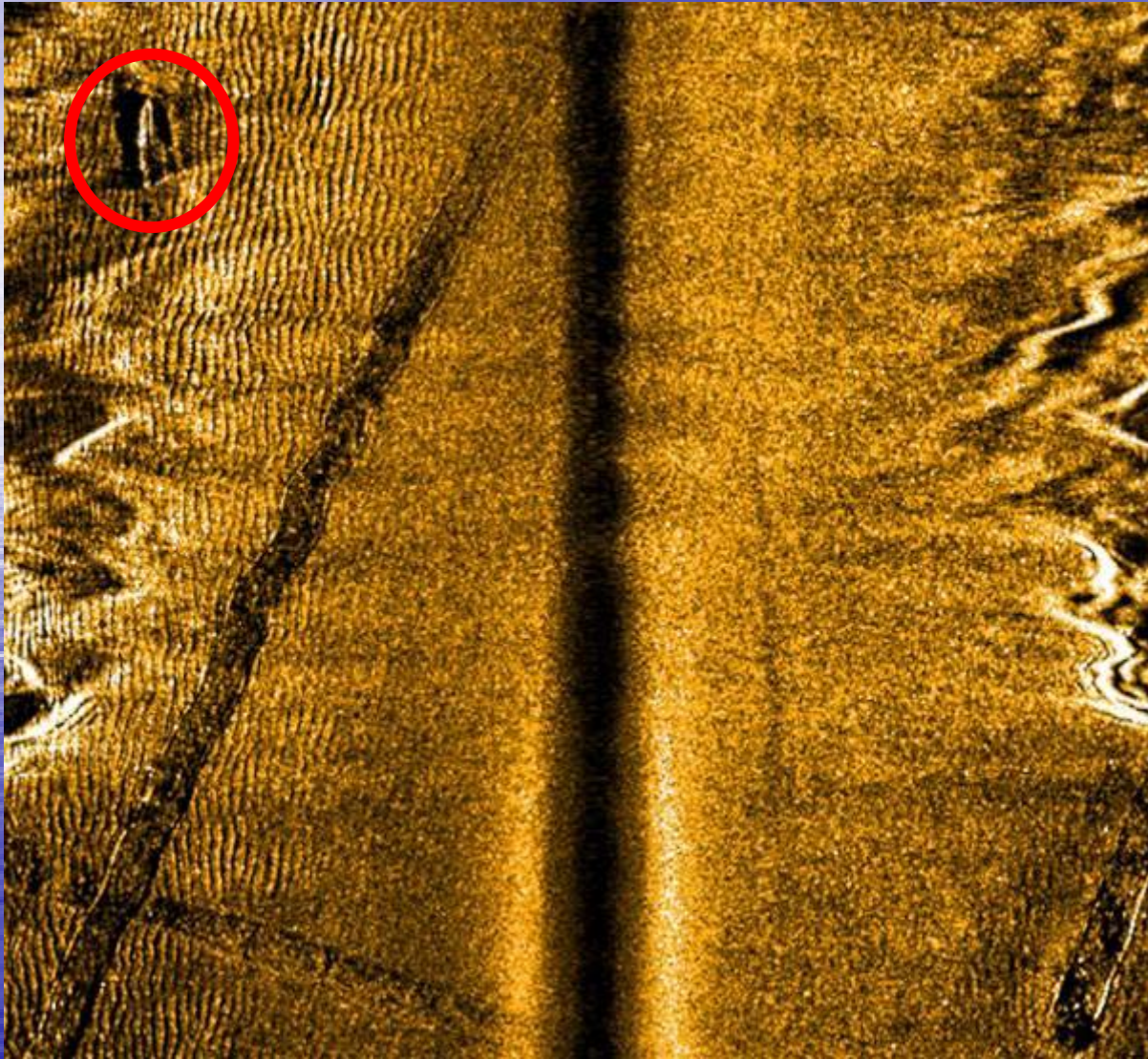


Fish and Fisheries

Commercial Fisheries (2003-2007)



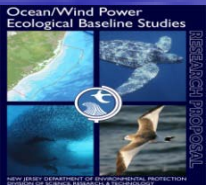
Benthic Mapping



- Two complementary tools: side scan sonar and magnetometer
- Relatively uniform sand bottom with four bottom types: sand plains, sand ripples, sand waves, and areas of mud and silt deposits
- Seabed morphology consists of relatively flat, migrating sand waves and ripples with occasional larger sand ridges
- Sonar targets include fish traps, debris probably associated with commercial shipping traffic, ship wrecks, and possibly cement structure debris.

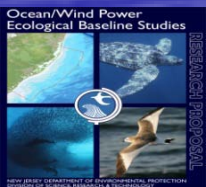
Schedule

- 24-month study
- Field Work: Jan 2008 – Dec 2009
- Interim Report – March 2009
- Draft Final Report – April 2010
- Final Report – July 2010



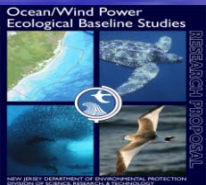
Overall Process

- Technical Review Committee – State & Federal Agencies
- Peer Review Group – Independent Review
- Interested Party Group (stakeholders)
 - Periodic informational meetings



Final Report Summary

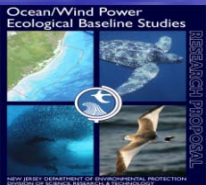
- Multiple Volumes
 - Birds
 - Marine Mammals & Sea Turtles
 - Fisheries
- Spatiotemporal Modeling
- Sensitivity Index Map
- Data fulfilled Project Objectives!



Findings

Influence on Siting Decisions

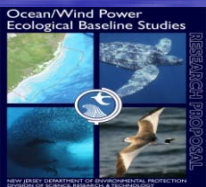
- Information and data can be used for:
 - Baseline data for projects in study area (NEPA)
 - Design of future monitoring
 - Screening of potential sites
 - ID Areas for BOEMRE Request for Interest & Phase II Wind Facilities



Findings

Influence on Siting Decisions (cont)

- Estimate of potential impacts on natural resources
- Listing of species that may be impacted esp. T&E species
- Estimate of relative scale of potential mitigation



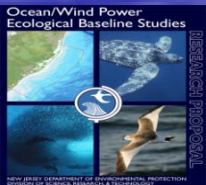
Findings

Influence on Siting Decisions (cont)

- Indication of areas that have limited potential for impacts
- Areas that have greater potential for impacts
- Site-specific information is still needed for planned projects

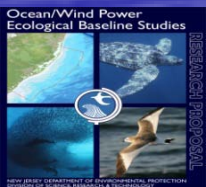
Sensitivity Map

- Simple weighting of GIS layers by natural & physical resources
- More heavily shaded areas indicate greater potential
- Does not mean can not develop area, but may indicate greater mitigation &/or other costs (e.g., monitoring, construction \$ due to avoidance).

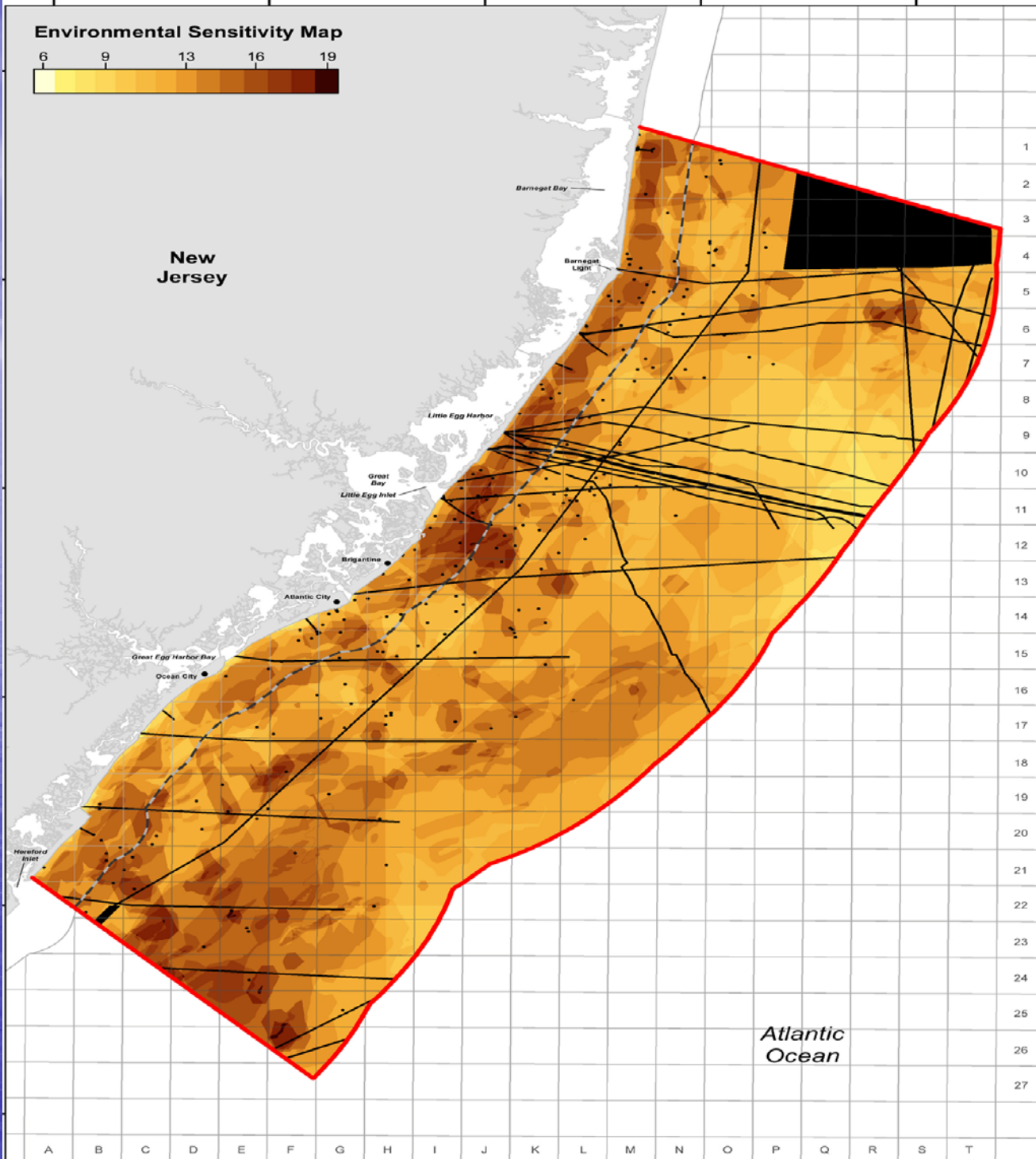
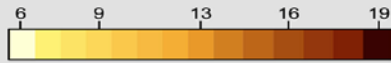


Sensitivity Map (cont)

- Tabular listing of all GIS layers by grid block
- Easy ID of sensitive 'layers'
- Additional site-specific information and risk assessment will be needed to better define risks and mitigation



Environmental Sensitivity Map



A B C D E F G H I J K L M N O P Q R S T



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)
 0.00000001 - 0.0162 #/km² = 1
 0.0163 - 0.1342 #/km² = 2
 0.1343 - 0.9871 #/km² = 3

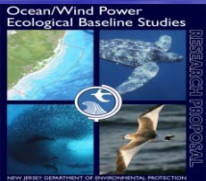
Marine Mammal Density (T and E Species)
 0.000001 - 0.000008 #/km² = 1
 0.000009 - 0.0004 #/km² = 2
 0.0005 - 0.0165 #/km² = 3

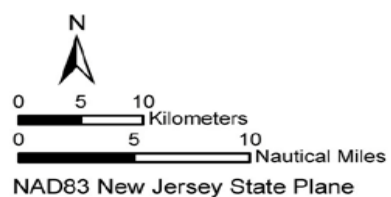
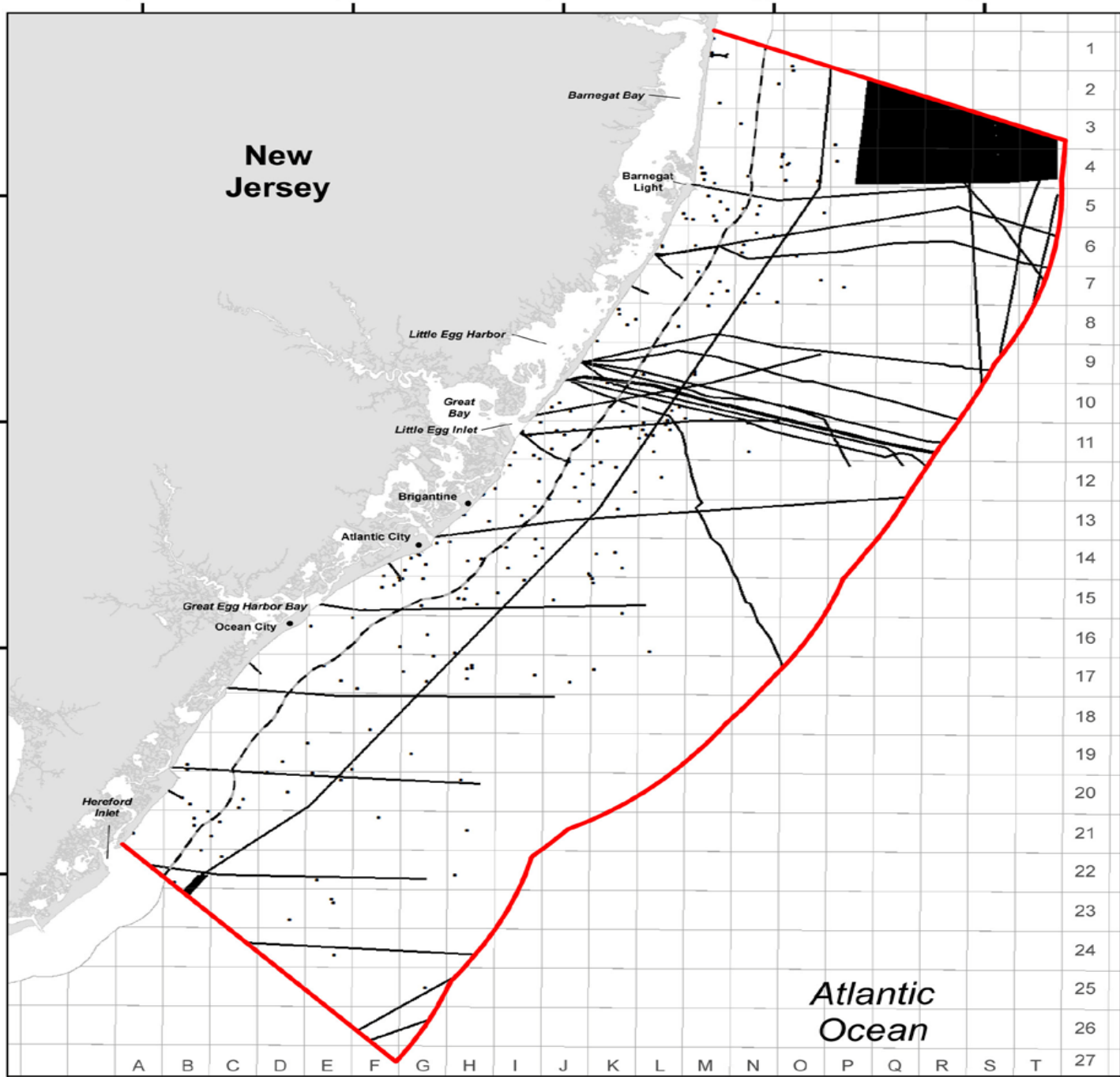
Sea Turtle (Sightings per km)
 0.0039 - 0.0059 #/km = 1
 0.0060 - 0.0073 #/km = 2
 0.0074 - 0.0261 #/km = 3

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
 25-38 = 3

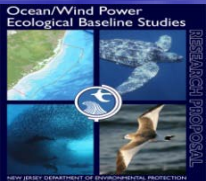
Prohibited Development Areas
 • Obstructions/Shipwrecks
 — Pipelines/Shipping Lanes/
 Tug Barge Transit Route/
 Utility Cables
 ■ Traffic Separation Zone
 — Study Area
 — Federal/State Boundary
 □ MMS Lease Blocks
 □ State Water Blocks

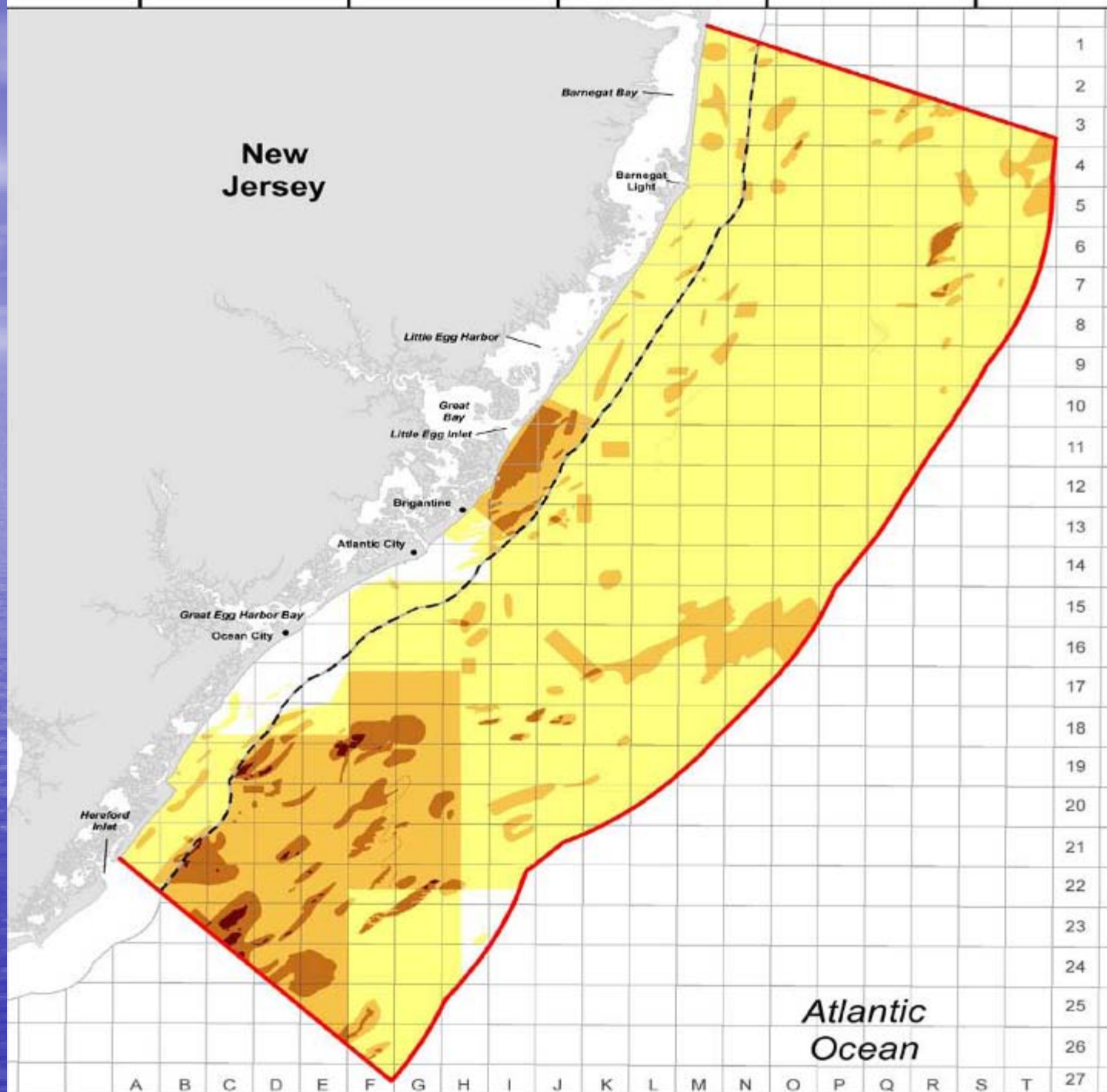




Prohibited Development Areas

- 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





Environmental Sensitivity

Yellow	1
Light Orange	2
Orange	3
Dark Orange/Brown	4

Categories:

- Artificial Reef Areas =1
- Commercial Fisheries =1
- Marine Protected Areas (MPA) =1
- Recreational Fishing Hotspots/Grounds =1
- Shoals =1

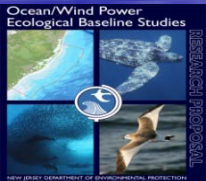
Legend:

- Study Area
- Federal/State Boundary
- MMS Lease Blocks
- State Water Blocks

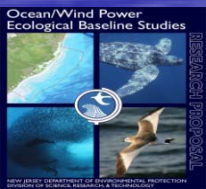
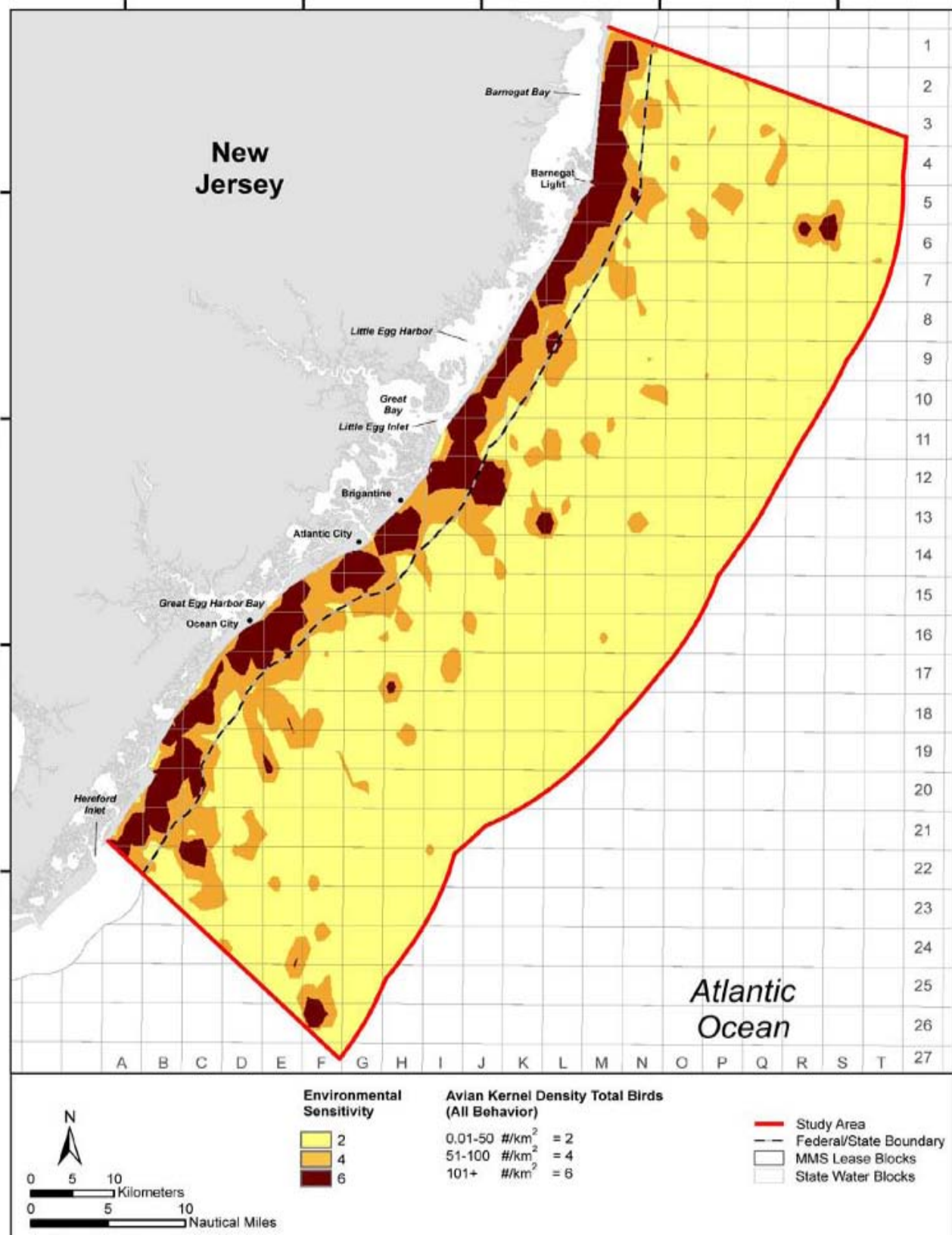
Scale:

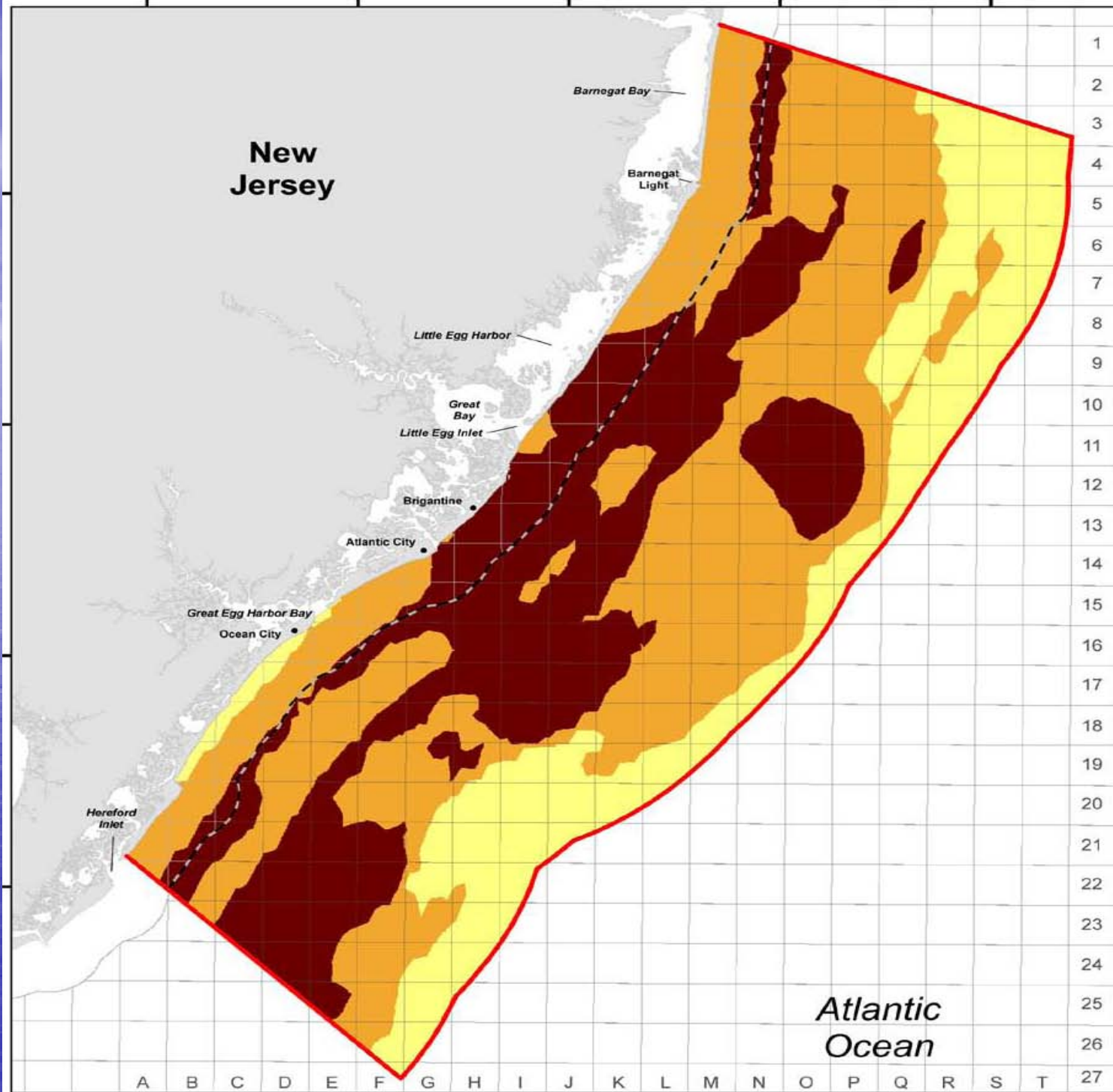
0 5 10 Kilometers

0 5 10 Nautical Miles



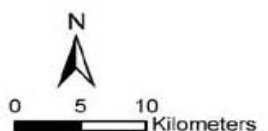
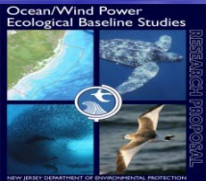
Depth, distance to shoreline and nearest shoal are significant predictors of bird spatial distribution.





New Jersey

Atlantic Ocean



Environmental Sensitivity



Marine Mammal Density (All Species)

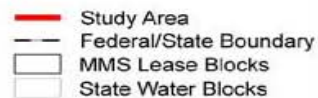
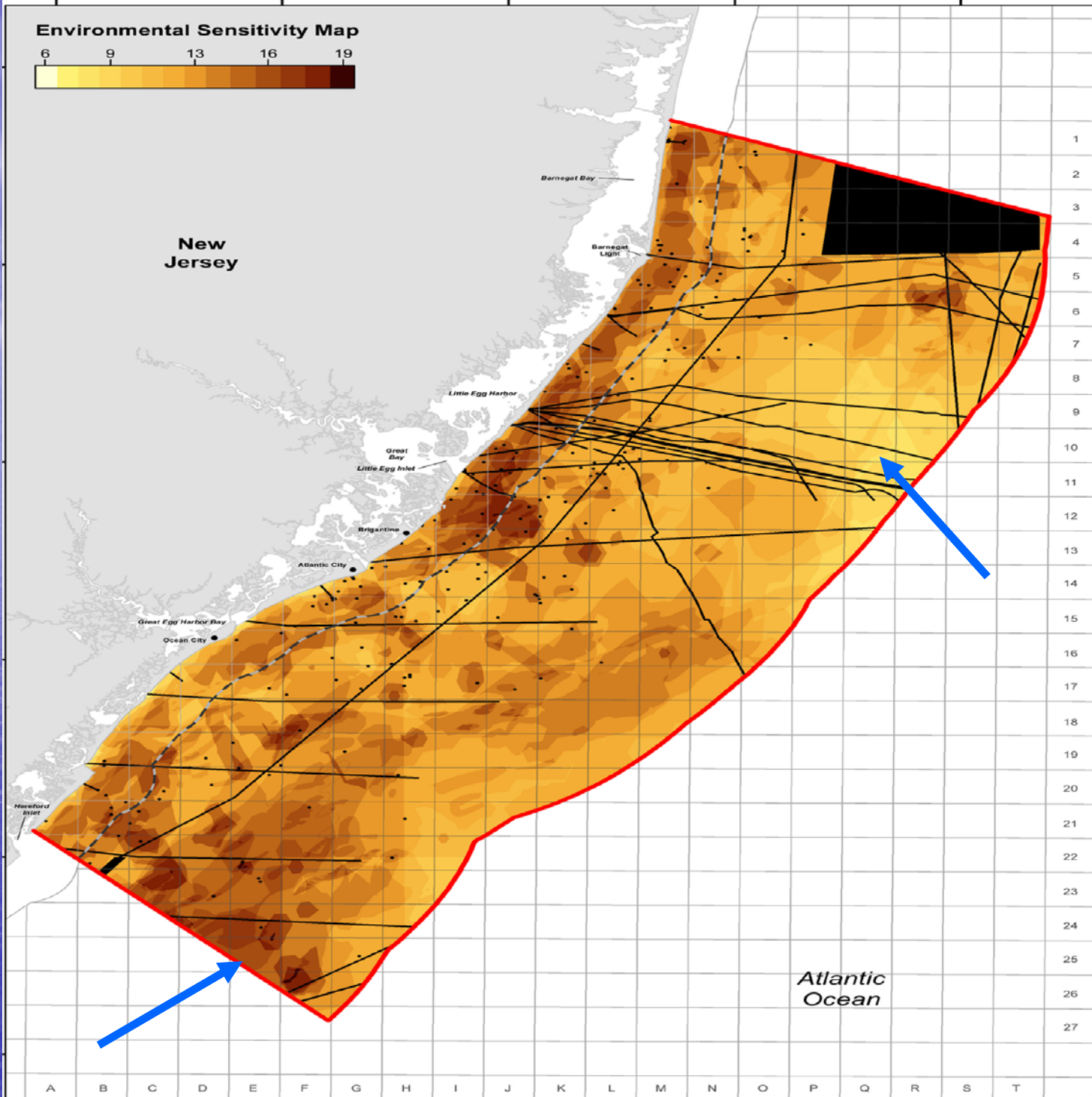
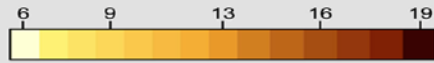


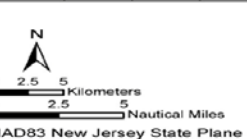
Table C-1. Physical and biological features found within each grid cell in the environmental sensitivity index.

Column	Row	Avian Kernel Density - Rank 1	Avian Kernel Density - Rank 2	Avian Kernel Density - Rank 3	Marine Mammal Density (All Species) - Rank 1	Marine Mammal Density (All Species) - Rank 2	Marine Mammal Density (All Species) - Rank 3	Marine Mammal Density (T & E Species) - Rank 1	Marine Mammal Density (T & E Species) - Rank 2	Marine Mammal Density (T & E Species) - Rank 3	Sea Turtle - Rank 1	Sea Turtle - Rank 2	Sea Turtle - Rank 3	Essential Fish Habitat - Rank 1	Essential Fish Habitat - Rank 2	Essential Fish Habitat - Rank 3	Marine Protected Areas (MPA)	Shoals	Commercial Fisheries	Recreational Fishing Hotspots/Grounds	Shipping Lanes	Obstructions	Pipelines	Shipwrecks	Traffic Separation Zone	Tug Barge Transit Route	Utility Cables
A	20	✓	✓			✓		✓					✓	✓					✓								
A	21	✓	✓	✓		✓	✓	✓				✓	✓	✓					✓	✓		✓					
A	22	✓	✓	✓		✓	✓	✓	✓				✓	✓				✓	✓		✓						
B	18		✓	✓	✓	✓		✓					✓	✓					✓	✓							
B	19	✓	✓	✓	✓	✓		✓	✓		✓		✓	✓					✓	✓	✓	✓		✓			
B	20	✓	✓	✓		✓	✓	✓					✓	✓					✓	✓		✓					
B	21	✓	✓	✓		✓		✓	✓				✓	✓			✓	✓	✓	✓		✓					
B	22	✓	✓	✓		✓	✓	✓					✓	✓			✓	✓	✓	✓	✓				✓	✓	
B	23	✓				✓		✓	✓				✓	✓			✓	✓	✓	✓				✓	✓		
C	16		✓		✓			✓					✓														
C	17	✓	✓	✓	✓	✓		✓	✓				✓	✓					✓	✓	✓		✓				
C	18	✓	✓	✓	✓	✓		✓	✓				✓	✓				✓	✓	✓	✓						
C	19	✓	✓	✓	✓	✓		✓	✓				✓	✓			✓	✓	✓	✓	✓						
C	20	✓	✓	✓		✓		✓	✓				✓	✓			✓	✓	✓	✓	✓						
C	21	✓	✓	✓		✓	✓	✓					✓	✓			✓	✓	✓	✓	✓				✓	✓	
C	22	✓	✓	✓		✓	✓	✓					✓	✓			✓	✓	✓	✓	✓				✓	✓	
C	23	✓	✓			✓		✓	✓				✓	✓			✓	✓	✓	✓	✓						
C	24	✓	✓			✓		✓	✓			✓	✓			✓	✓	✓	✓	✓	✓						
D	16	✓	✓	✓	✓	✓		✓	✓				✓	✓													
D	17	✓	✓	✓	✓	✓	✓	✓					✓	✓						✓	✓		✓				
D	18	✓	✓	✓	✓	✓		✓	✓				✓	✓					✓	✓	✓						
D	19	✓	✓	✓	✓	✓		✓	✓				✓	✓			✓	✓	✓	✓	✓			✓			
D	20	✓	✓			✓		✓	✓				✓	✓			✓	✓	✓	✓	✓	✓			✓	✓	
D	21	✓	✓			✓	✓	✓					✓	✓			✓	✓	✓	✓	✓				✓	✓	
D	22	✓	✓			✓	✓	✓				✓	✓				✓	✓	✓	✓	✓						
D	23	✓	✓			✓	✓	✓					✓	✓			✓	✓	✓	✓	✓	✓					
D	24	✓	✓			✓	✓	✓					✓	✓			✓	✓	✓	✓	✓						
D	25	✓				✓	✓	✓					✓	✓			✓	✓	✓	✓	✓						
E	15	✓	✓	✓	✓	✓		✓	✓				✓	✓					✓	✓	✓						
E	16		✓	✓	✓	✓		✓	✓				✓	✓					✓	✓		✓					
E	17	✓	✓	✓		✓	✓	✓					✓	✓			✓	✓	✓	✓	✓						
E	18	✓	✓	✓		✓	✓	✓					✓	✓			✓	✓	✓	✓	✓						
E	19	✓	✓	✓		✓		✓	✓				✓	✓			✓	✓	✓	✓	✓				✓	✓	

Environmental Sensitivity Map



A B C D E F G H I J K L M N O P Q R S T



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)
 0.00000001 - 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

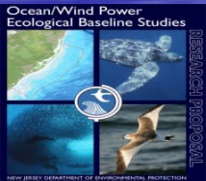
Sea Turtle (Sightings per km)
 0.0039 - 0.0059 #/km = 1
 0.0060 - 0.0073 #/km = 2
 0.0074 - 0.0261 #/km = 3

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
 25-38 = 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



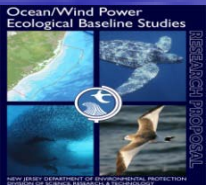
NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
 DIVISION OF OCEAN MANAGEMENT & RECREATION

Block E 25 - Layers & Ranks

- Avian Density – 1, 2, & 3
- Marine Mammal Density– 2 & 3
- MM T&E – 2 & 3
- Sea Turtle – 3
- Essential Fish Habitat - 3
- Marine Protected Area
- Commercial Fisheries
- Recreational Fishing Hotspot/Grounds

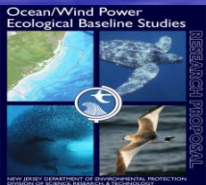
Block Q10 – Layers & Ranks

- Avian Density – 1
- Marine Mammal – 1
- MM T&E – 1 & 2
- Sea Turtle – 1
- Essential Fish Habitat - 2
- Commercial Fisheries
- Utility Cables



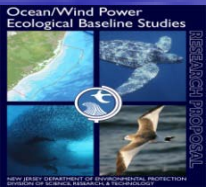
Terrestrial Turbine Impacts

- Low Frequency Sound
- Flicker (blades)
- Vibration
- Birds
- Bats
- Aesthetics (NIMBY)
- Health Effects??



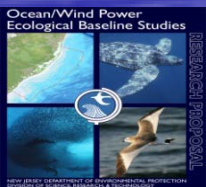
Potential Offshore Impacts

- Pre-construction
- Construction
- Operation
- Decommissioning



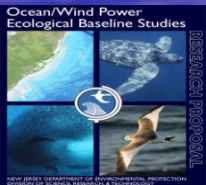
Potential Offshore Impacts

- Noise
- Lighting
- Vessel Disturbance (birds, mammals)
- Vessel Collision (mammals)
- Seafloor Disturbance

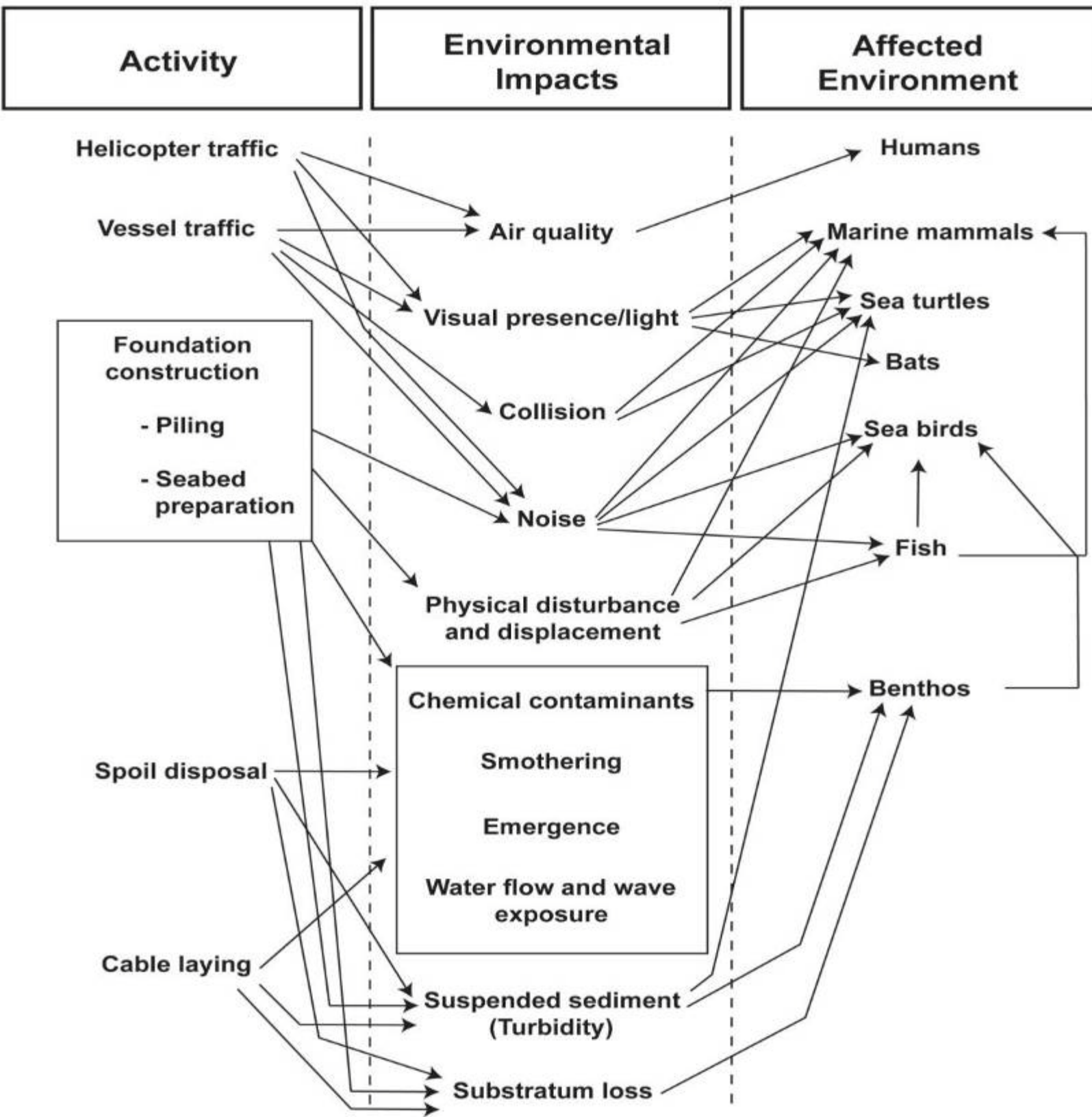


Potential Offshore Impacts

- Air Quality (pre-construction/construction)
- Vessel Traffic (Air & spills)
- Habitat Loss
- Water Quality – turbidity, contaminants
- Wetlands & Uplands (cable)
- Electromagnetic Fields (EMF)

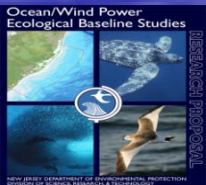


Construction Impacts



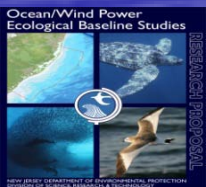
Construction vs. mitigation costs: Mitigation

- Construction:
 - Schedule (closed periods)
 - Lighting
 - Color
 - Marine Mammal observers
 - Construction techniques (e.g., slow start)
 - Location (offset by greater wind resource?)
 - Habitat enhancement (e.g., artificial reefs)



Construction vs. mitigation costs: Mitigation

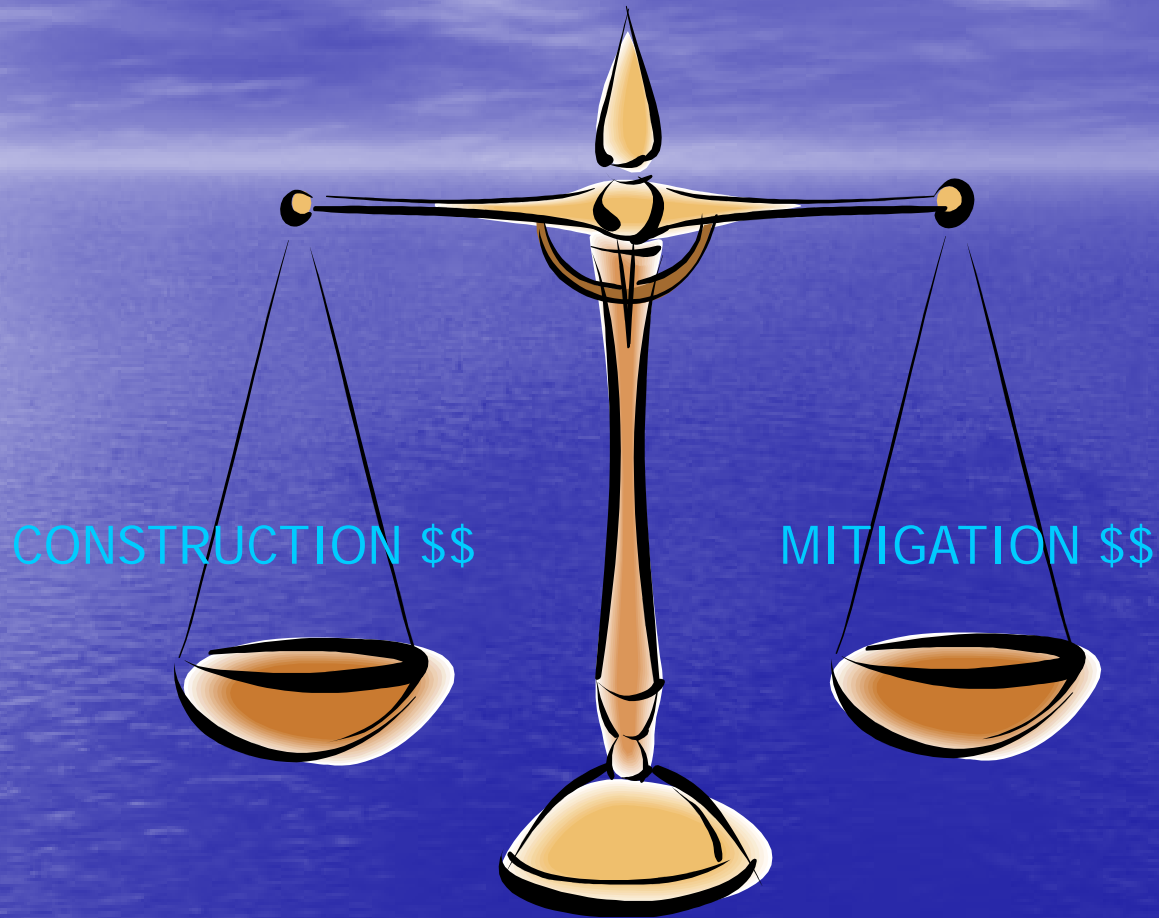
- Operation:
 - Curtailment (high migratory periods/weather conditions); Currently in NJ permit for State waters (up to 360 hours/year)
 - Monitoring of impacts
 - Reporting



Construction vs. mitigation costs: Construction

- Location
 - Additional cable length
 - Change in turbine configuration &/or design
- Additional construction costs due to extra distance to travel
- Deeper water (or shallower)

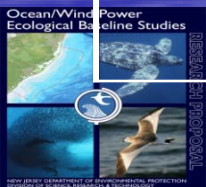
Balancing costs



Example: Annual Curtailment

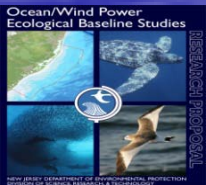
3.6 MW Turbines w/0.35 capacity factor @ 18.7¢/kWh

# Days (%)	Cost/Year	Cumulative (25 years)	50 Turbines	100 Turbines
1 (0.3)	\$5,655	\$141,400	\$7,069,000	\$14,137,000
5 (1.4)	\$28,270	\$706,800	\$35,343,000	\$70,685,000
10 (2.7)	\$56,550	\$1,414,000	\$70,686,000	\$141,371,000
20 (5.5)	\$113,100	\$2,827,000	\$141,372,000	\$282,744,000
30 (8.2)	\$169,600	\$4,241,000	\$212,057,000	\$424,116,000



Location vs. Construction

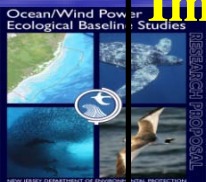
- Construction ~\$10M per mile of cable
- 20 days → 10 days
- Move 1-14 miles and save \$
- Simplified example (e.g., other costs not considered; may have no wind on curtailment days anyway e.g., fog)



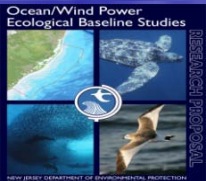
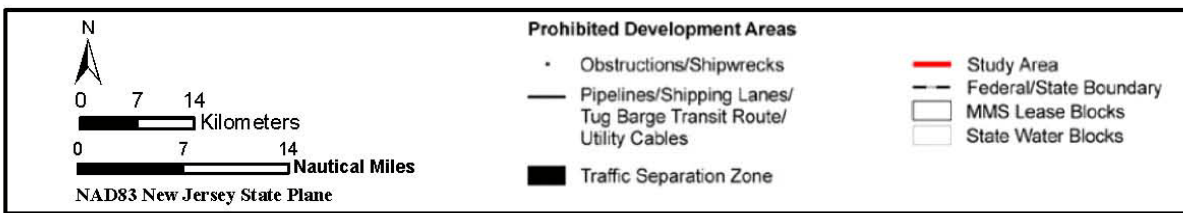
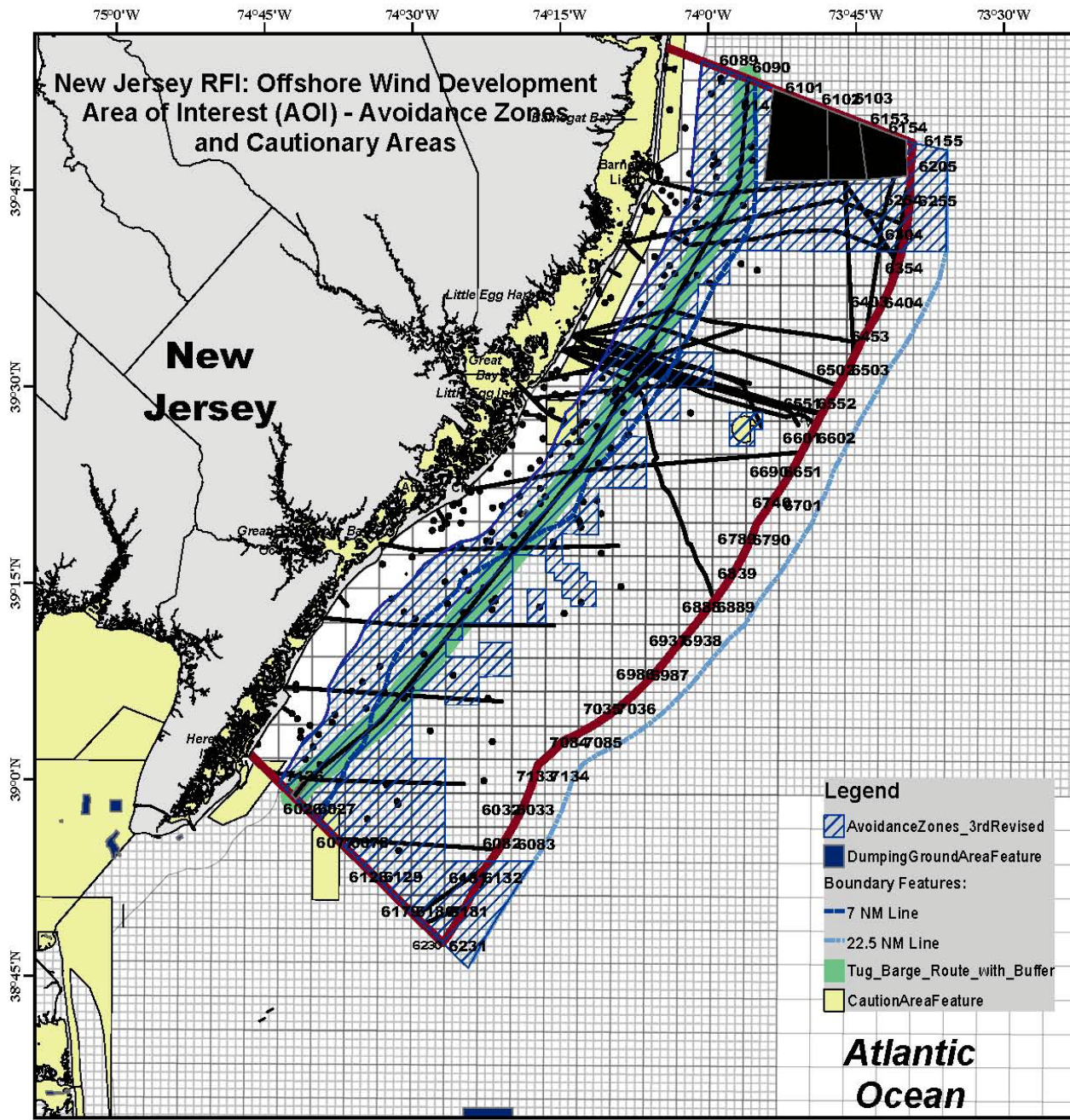
BOEMRE Requirements

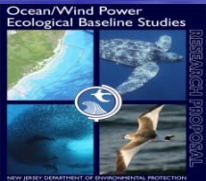
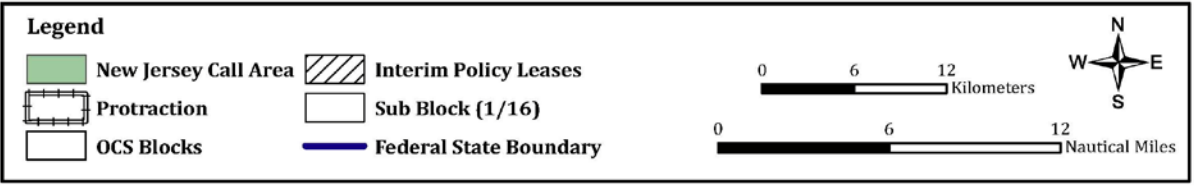
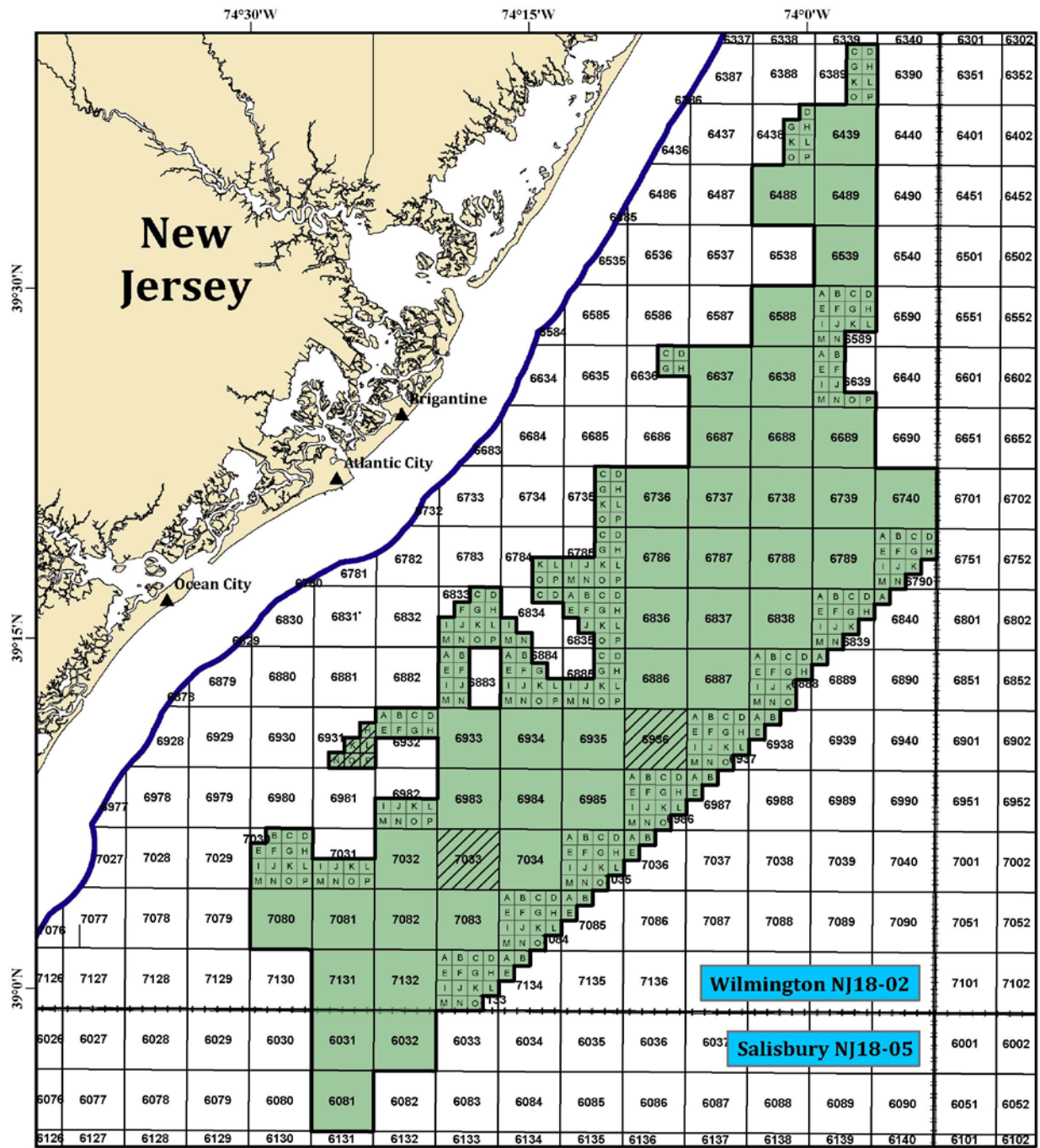
Environmental MMS Required Project Information for the Site Assessment Plan (SAP)
 - 30 CFR 285.601

Project Information	Description
Archaeological Resources	Details on survey; historic & prehistoric arch. resources
Geological	Details on survey (e.g., methods); seismic activity, fault zones, seabed subsidence & extent and geometry of faulting attenuation effects of geologic conditions near the site.
Biological	Survey details; determine presence of live bottoms, hard bottoms, topographic features, and surveys of other marine resources incl. fish populations (inc. migratory), marine mammals, sea turtles, sea birds and bats.
Socio-economic	Details on analyses to be conducted to determine visual impacts, competing uses (e.g., commercial fishing, recreation, tourism, military, oil and gas activities, sand and gravel activities), and other impacts as determined by MMS on a case-by-case basis.
Environmental Impacts	Measures to be used to avoid or minimize adverse effects and any potential incidental take, before you conduct activities on your lease and how you will mitigate environmental impacts from your proposed activities, including a description of the measures you will use as required by subpart H of this part.



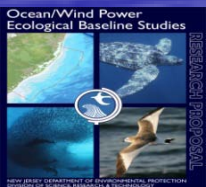
- Call for Information and Nominations for Commercial Leasing for Wind Power on the Outer Continental Shelf Offshore New Jersey was published in the Federal Register on April, 20, 2011
- ...to gauge specific interest in acquiring commercial wind lease(s) in some or all of the area, and
- to determine whether competitive interest exists in any particular area as required by 43 U.S.C. 1337(p)(3).
- 418 square nmi
- Nominations due June 6, 2011





Future Studies

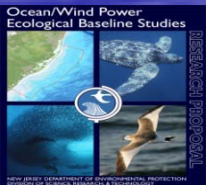
- OWPEBS - template to build upon or copy
- U.S. accepted techniques/methods – allows comparison between studies and for comprehensive geospatial analysis
- Migratory nature of protected species indicates the need for regional or coast-wide studies



Acknowledgments –

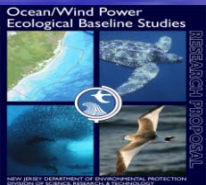
Technical Review Committee - NJDEP

- Coastal Management – Kevin Hassel
- Fish & Wildlife – 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 (cont)

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- NOAA/NMFS
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 - Debra Palka, Ph.D.
 - Karen Greene
- Minerals Management Service - Will Waskes

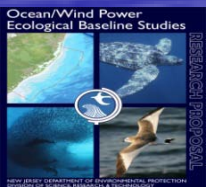


Acknowledgements – Project Team

Geo-Marine, Inc.

- Dan Wilkinson, Ph.D.
- Jason See, Ph.D.
- Sid Gauthreaux, Ph.D.
- Jarrod Santora, Ph.D.
- Chris Clark
- Amy Whitt, M.S.
- Kathleen Dudzinski, Ph.D.
- Suzanne Bates, M.S.
- Charles DeCurtis, Ph.D.

- Rutgers University
- Aqua Survey Inc.





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

QUESTIONS?

- NJDEP Office of Science website:

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

- Geo-Marine, Inc.:

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jsee@geo-marine.com

- BOEMRE:

www.boemre.gov/offshore/RenewableEnergy/index.htm

