NJDEP Ocean/Wind Power Ecological Baseline Studies

USOWC & CESA
Joint Webinar Series
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- Natural Resources
- Marine Science
- Cultural Resources
- Remote Sensing Technologies
- Planning and Analysis
Project Significance and Issues

- DATA, 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 to determine 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
Seasonal Variability: Total bird density

Fall

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

Altitude Distribution

Spatial Density Distribution for Total Birds

- 80-100%
- 60-79%
- 40-59%
- 0-20%
- 0.01-19%

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

NAD83 New Jersey State Plane
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
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)

![Graph showing landings and value of various species of fish and shellfish.]

- Atlantic Surf Clam
- Atlantic Sea Scallop
- Ocean Quahog
- Blue Crab
- Goosefish
- Summer Flounder

Species:
- Landings
- Value

Value $:
- 400,000,000
- 350,000,000
- 300,000,000
- 250,000,000
- 200,000,000
- 150,000,000
- 100,000,000
- 50,000,000
- 0

Landings (mt):
- 120,000
- 100,000
- 80,000
- 60,000
- 40,000
- 20,000
- 0
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 cannot 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
Depth, distance to shoreline and nearest shoal are significant predictors of bird spatial distribution.
Table C-1. Physical and biological features found within each grid cell in the environmental sensitivity index.

<table>
<thead>
<tr>
<th>Column</th>
<th>Row</th>
</tr>
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<tbody>
<tr>
<td>A</td>
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<td>18</td>
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<tr>
<td>E</td>
<td>19</td>
</tr>
</tbody>
</table>

Columns:
- 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
- Shipping Lanes
- Obstructions
- Pipelines
- Shipwrecks
- Traffic Separation Zone
- Tug Barge Transit Route
- Utility Cables
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 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

CONSTRUCTION $$

MITIGATION $$
### Example: Annual Curtailment

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

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

<table>
<thead>
<tr>
<th>Project Information</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Archaeological Resources</strong></td>
<td>Details on survey; historic &amp; prehistoric arch. resources</td>
</tr>
<tr>
<td><strong>Geological</strong></td>
<td>Details on survey (e.g., methods); seismic activity, fault zones, seabed subsidence &amp; extent and geometry of faulting attenuation effects of geologic conditions near the site.</td>
</tr>
<tr>
<td><strong>Biological</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Socio-economic</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Environmental Impacts</strong></td>
<td>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.</td>
</tr>
</tbody>
</table>
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
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- Kathleen Dudzinski, Ph.D.
- Suzanne Bates, M.S.
- Charles DeCurtis, Ph.D.

• Rutgers University
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Activity conducted pursuant to NOAA Permit No. 10014-02
Photo by Tony Leukering, GMI
QUESTIONS?

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

• Geo-Marine, Inc.:
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