Atlantic States Marine Fisheries Commission
Habitat Management Series #11
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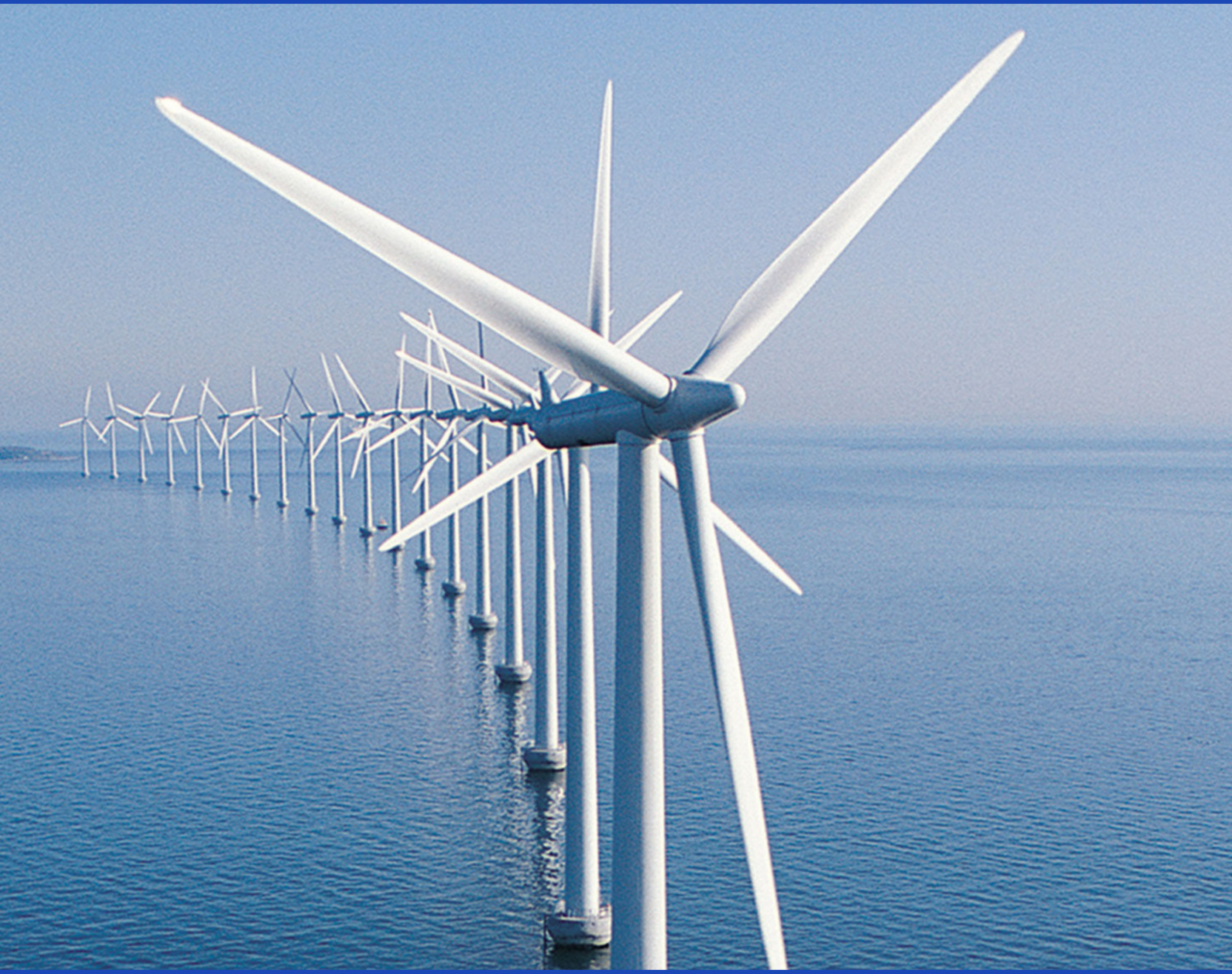

Offshore Wind in My Backyard?

Working towards healthy, self-sustaining populations for all Atlantic coast fish species or successful restoration well in progress by the year 2015

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Offshore Wind In My Backyard

prepared by the
ASMFC Habitat Committee

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Offshore Wind in My Backyard

Introduction

On February 7, 2011, the Department of Energy and the U.S. Department of the Interior's Bureau of Ocean Energy Management (BOEM) released National Offshore Wind Strategy: Creating an Offshore Wind Industry in the United States, a strategic plan to accelerate development of offshore wind energy. This plan sets a goal of deploying 10 gigawatts of offshore wind generating capacity by 2020 and 54 gigawatts by 2030, enough energy to power 2.8 million and 15.2 million American homes, respectively. Although offshore wind is a prevalent energy source in Europe, a commercial wind facility has yet to be built in U.S. waters. This brief report focuses on habitat issues that are broadly applicable along the Atlantic seaboard for the siting, construction, and monitoring of wind facilities. Because the focus of this document is on broadly applicable issues, some concerns important to a particular state or facility may not be covered. This absence does not suggest these concerns issues are unimportant for a particular project.

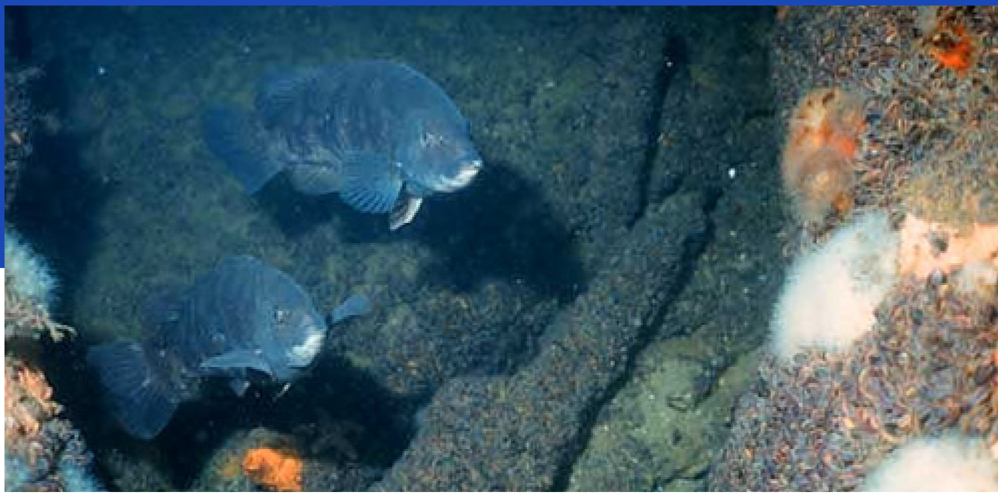
There are a number of social and environmental factors and issues to consider when evaluating impacts from development and operation of a wind facility, including:

- Offshore Geology
- Physical Oceanography
- Benthic Habitats, Invertebrates and Finfish
- Commercial and Recreational Fisheries
- Protected Marine Species
- Birds
- Coastal and Wetland Resources
- Sensitive Upland Habitats

For example, pile driving and the trenching or dredging for cable installation could cause suffocation, burial, or mortality of benthic communities, decrease community diversity and abundance (thereby affecting the rest of the food chain), decrease water quality, increase sedimentation, increase water turbidity, and permanently alter water flow around turbine

Top: http://www.windenergyplanning.com
Middle: Mattias Rust/http://www.iucn.org
Bottom: http://www1.eere.energy.gov/wind/pdfs/national_offshore_wind_strategy.pdf

[1]Decommissioning of wind facilities also is important to regulatory agencies, but lack of experience with this phase precludes conveying lessons learned at this time.



Chris Laporta, NYSDEC

foundations. Gravity-based foundations and scour controls (e.g., riprap) can affect even greater areas of bottom habitat than a single monopole. Heat exposure and electromagnetic radiation from electrical transmission cables placed through dredging and not yet fully covered in sediment could also negatively affect benthic communities. Noise during construction and operation could alter species migratory routes or other behaviors. Turbine foundations will likely act as artificial reefs, attracting fish or creating new benthic communities that use the hard substrate as spawning habitat; this could yield a net beneficial outcome if noise does not inhibit spawning. Herein, we have outlined environmental issues associated with wind facility development processes and offer recommendations on how to offset identified impacts.

Data Needs for Siting

Determining the location, configuration, and spacing of wind turbines within a facility is critical at both pilot and commercial scales. States vary with respect to their guidance on where wind facilities should be located. Coastal Marine Spatial Planning (CMSP) may be useful for informing siting decisions because it provides a means to integrate information on the locations of natural resources and human uses and to identify compatibilities and conflicts. CMSP can also help to identify unforeseen use conflicts with, for example, military training areas or highly utilized fishing sites. If baseline studies are not completed before siting decisions are made, there should be clear points in the early post-siting decision-making process where the information is available. The categories given below have proven useful in siting discussions for both the wind facility site and any transmission corridor:

Offshore Geology

- Side-scan SONAR, multi-beam SONAR, and sub-bottom profiling can be critical to mapping locations of hard bottom and better understanding the bathymetry and sediment layers in the area of the proposed project and distribution cables.

Benthic Habitats and Associated Communities

- Characterization and mapping of reef habitats and hard bottom communities in the region.
- Collection and synthesis of existing data on benthic invertebrate and shellfish communities.

Demersal and pelagic finfish and invertebrates

- Information on fish and invertebrate distributions and abundances is critical and may already be available in a format suitable for siting decisions and establishing a project baseline.
- Maps and inventories (locations, species use, landing data) of existing artificial habitats; existing information needs to be collected and synthesized.
- Mapping/inventorying essential fish habitat (EFH) and marine protected areas (MPAs).

Loren Coen, South Carolina Department of Natural Resources

Protected Marine Species (distribution, abundances, key prey species)

- Temporal and spatial distribution, abundance, movement and habitat use of marine mammals, sea turtles, protected fish species, and species of concern.
- Marine mammal surveillance during construction activities using passive acoustic monitoring and aerial surveys in addition to shipboard surveys to detect the presence of marine mammals and sea turtles. Passive acoustic monitoring is more reliable for detecting right whales which are difficult to spot when surfacing due to their black color. For surveys of large areas, passive acoustic monitoring ensures better coverage and higher confidence levels of detection than accomplished with shipboard observers. Aerial surveys should be used when feasible to improve observer detection efficiency and accuracy of identifications within the larger exclusion zones.
- The potential for ship strikes from crew and work vessels involved in construction and maintenance as well as all vessels transiting the site must be taken into account. Rerouting of ships to avoid the wind facility may increase the probability of encounters between ships and protected species.

Birds

- Data on the distribution, movement, abundance, and behavior of shorebirds; migratory seabirds; sea ducks and passerines (nocturnal and diurnal behavior); piscivorous birds and species of threatened, endangered, and state status must be synthesized. For a list of federally protected species, please see www.fws.gov/endangered/.
- Migratory flyways and flight heights must be determined.

Coastal and Wetland Resources

- Mapping of critical habitats, including wetlands, shellfish beds, protected areas, uplands, and land use and change over time. Effects of sea level rise on the location and distributions of these habitats should also be considered to ensure the wetlands, shellfish beds, and protected areas do not shift into areas used by wind facilities or their power distribution system.

Fisheries and Other Human Uses

- Spatial data and information on the distribution and intensity of recreational and commercial fishery effort and landings; distribution, timing, and intensity of vessel traffic; archaeological resources; and cultural resources.
- Other human uses may need to be considered depending on location of proposed projects.

Lessons Learned & Recommendations for Siting

- Avoid placing foundations on or within 1,000 feet of hard bottom or other sensitive benthic habitat (such as shellfish beds). This recommendation considers the likelihood of altered currents or sediment deposition patterns resulting from ambient currents intersecting with the wind facility and creating downstream eddies. Depending on the likelihood of hard bottom habitat in an area, a tiered approach to surveys may be useful and include side-scan SONAR, multi-beam SONAR (with backscatter), and sub-bottom profiling. Survey tracks and data processing should be done in a manner to achieve a verified minimum mapping unit of 0.01 acres or smaller. Facilities within nearshore waters may require smaller minimum mapping units to adequately characterize seagrass, oyster reefs, coral patch reefs, and similar habitats.

- Until more information is available, large wind facilities should be sited and configured to minimize encounters with marine mammals, migrating fish, and sea turtles. For example, when it is unclear how to do this, wind facilities that are mostly oriented parallel to the migration routes appear preferable to wind facilities with mostly perpendicular orientations. If sea turtle nesting beaches are nearby, the orientation with least impacts to migrating routes may be difficult to discern.
- While detailed discussion of how wind facilities may affect fishermen is outside the scope of this short report, avoiding siting in traditional fishing areas may have a collateral habitat implication since fishermen often fish in areas where fronts and eddies occur, and these pelagic habitat features may require protection.
- Cable termini and transmission corridors should not be within or cross salt marsh, submerged aquatic vegetation, or shellfish areas. Directional drilling can route all cables well below these areas.
- Based on existing knowledge cable corridors should be buried at least 6 feet into the sediment. This recommendation considers the probability of cables emerging due to shifting sediments and the need to shield marine organisms from heat and electromagnetic fields emanating from the cable; new information may result in a deeper or shallower recommendation. Studies of past cabling or trenching in an area may be available from projects unrelated to wind facilities. When this is the case, it may be economical to couple a synthesis of past benthic studies with a similar synthesis of sediment studies.

Design, Construction and Operation

Turbine Installation: The installation of turbines and auxiliary components is typically done by staging the equipment on barges and assembling in open water. Construction activities may result in loud noises, especially from impact pile driving, which can cause hearing loss (permanent or temporary threshold shift), non-auditory physical injury (e.g., barotrauma), and behavioral disruptions (e.g., communication, predation, predator avoidance, and navigation). The National Oceanic and Atmospheric Administration (NOAA)is developing comprehensive guidance on sound characteristics likely to cause injury and behavioral disruption in the context of the Marine Mammal Protection Act (MMPA), Endangered Species Act (ESA), and other statutes. Until formal guidance is available, NOAA Fisheries Service uses conservative thresholds of received sound pressure levels from broadband sounds that may cause behavioral disturbance and injury. These conservative thresholds are applied in MMPA permits and ESA Section 7 consultations for marine mammals to evaluate the potential for sound effects. The interim guidelines are available at www.nwr.noaa.gov/Marine-Mammals/MM-sound-thrshld.cfm.


http://www.wspenvironmental.com/

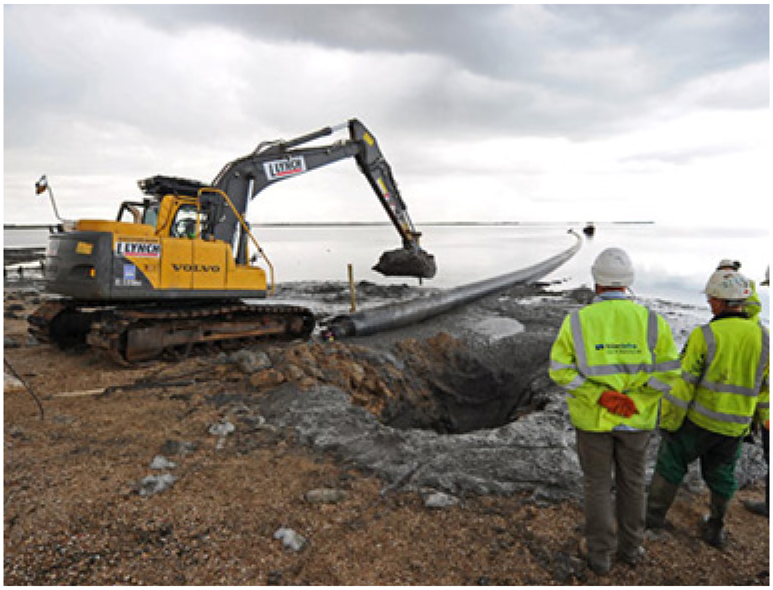
Factors that affect sound intensity include source level, pile size and material, sediment type, water depth, and bottom topography. Ideally, impact pile driving should be avoided, but if proposed should be implemented with robust marine mammal survey methods coupled with mitigation measures such as pile-driving, soft-starts, shut-downs, pile caps, bubble curtains, cushion blocks, and coffer dams, and use of vibratory hammers instead of impact-pile driving methods when practicable. Many of the noise problems can be avoided by utilizing other turbine support systems, such as pads buried into the sediments. For meteorological towers, vibratory hammers are the preferred pile driving technique where the underlying geology allows because vibratory hammers significantly reduce peak sound pressure levels compared to conventional impactpile driving techniques.

Turbine Operation: Noise and vibrations emanating from turbines during operation remain a concern and require further research.

Electromagnetism: Cables connecting turbines to transformers, substations, and other turbines produce electromagnetic fields that some fish (e.g., sharks) and sea turtles may perceive.To neutralize the electromagnetic field created by a single DC cable, European wind facilities install forward and return conductors parallel and close to each other, known as a bipolar system of transmission. Offshore wind facilities in Europe either have three-conductor AC cable systems or two-conductor bipolar DC cable systems to offset electromagnetic fields. Cables buried deep into sediments will have less of an impact in terms of emitted electromagnetic fields and heat than cables at or near the sediment surface.

Cable Burying: For environmental and safety reasons, cables are often buried several feet under the seabed. Cables can emit heat when transporting energy and European standards require cables to be buried at least one meter deep to avoid a rise in temperature in the surrounding seafloor. Burial also protects the equipment from bottom trawl nets and anchors and keeps cables out of sight from marine animals. The depth of a cable, sometimes up to15 feet, and habitat features, such as the type of seabed (e.g., hard rock vs. sand), are important factors in deciding which method is used to bury sea cables, such as hydro-plowing or dredging.

- A hydro-plow is typically fitted with hydraulic high pressure nozzles that create a direct downward and backward "swept flow" force inside the trench. This provides a downward and backward flow of re-suspended sediments within the trench, thereby "fluidizing" the sediments in situ as the plow progresses along the predetermined submarine cable route. This allows the cable to settle into the trench under its own weight to the planned depth of burial. Based on experience with other projects that involve laying cable, state and federal regulatory agencies often prefer this installation method.
- Dredging creates a much larger disturbance footprint than a hydro-plow, removes sediment from the seabed, and deposits sediments either alongside the trench or in a different



http://www.londonarray.com/the-project/offshore/cables/

area. Depending on the dredging method, the process can form trenches 50 feet wide with gradual slopes and an additional 30-foot width per foot of depth. After the trench creation, the cable is lowered onto the seabed. Natural settling of displaced sediments slowly fills the excavated area; if necessary, filling the trench can be a permit condition.

Lessons Learned & Recommendations for Construction and Operation

- Avoid using impact pile driving and other construction methods that produce loud underwater sounds with rapid rise times. Drilled shaft or press-in piling methods generate less noise than impact pile driving. Gravity pilings, while having a larger on-bottom footprint than driven pilings, may present a more manageable set of impacts.
- Bury transmission lines at least 6 feet to minimize thermal and electromagnetic interference. Investigate European methods of offsetting electromagnetic fields.
- Special procedures many be necessary to protect sensitive habitats from discharges that may occur when coolants or lubricants are replaced during maintenance of cables, turbines, or transformers.
- Avoid impacts to salt marsh, submerged aquatic vegetation, or shellfish areas by using horizontal directional drilling to cross sensitive habitats. Proposals to use horizontal directional drilling should include a plan for continuous monitoring for frac-outs as well as remediation measures should a frac-out occur.
- Consultation under ESA or MMPA may result in a requirement for ship speeds of 10 knots or less to reduce the probability of collision between protected species and ships constructing or servicing wind facilities.

Monitoring and Information Needs

Environmental monitoring of the topics described in detail above should continue through construction and operation of the wind facility. Long-term monitoring will likely be part of any BOEM lease agreement but should also be conducted for facilities in state waters.

Lessons Learned and Recommendations for Monitoring

- Conduct benthic mapping and side-scan SONAR to evaluate scouring around turbine foundations and effectiveness of buffers between facilities and sensitive habitats.
- Monitor changes in fish species, abundance, and distribution around wind facility foundations.
- Monitor abundance, distribution, and behavior of protected species and sea birds during construction and operation (ESA and MMPA incidental take authorizations will often require marine mammal and sea turtle monitoring by approved protected species observers).
- Monitor coastal habitat impacts from staging and transmission route activities.
- At the time this report was written, BOEM was developing a report on monitoring plans for wind facilities. Readers should check BOEM for updates on this effort.

ADDITIONAL INFORMATION

updated 11/9/2012

https://secure.sierraclub.org/images/content/pagebuilder/windenergy_offshore.jpg

Federal agencies involved in siting wind facilities:

Bureau of Ocean Energy Management (BOEM):
http://ocsenergy.anl.gov/guide/wind/index.cfm

Department of Energy (DOE):
http://www.windpoweringamerica.gov/

Fish and Wildlife Service (FWS):
http://www.fws.gov/midwest/wind/resources/index.html

Multipurpose Marine Cadastre:
http://www.marinecadastre.gov/default.aspx

State agencies involved in siting wind facilities:

MA Clean Energy Center:
http://www.masscec.com/
MA Office of Coastal Zone Management:
http://www.mass.gov/czm/
MD Department of Natural Resources Coastal Atlas:
http://dnr.maryland.gov/ccp/coastalatlas/
MD Department of Natural Resources Coastal Atlas:
http://dnr.maryland.gov/ccp/coastalatlas/
MD Energy Administration:
http://energy.maryland.gov/wind.html
ME State Planning Office:
http://www.maine.gov/spo
NJ Offshore Wind Studies:
http://www.nj.gov/dep/dsr/ocean-wind/
NY State Department of Environmental Conservation:
http://www.dec.ny.gov/energy/40966.html
RI Coastal Resources Management Council:
http://www.crmc.ri.gov/
SC Department of Natural Resources GIS Data Resources:
http://www.dnr.sc.gov/GIS/gisenergy.html
SC Energy Office:
http://www.energy.sc.gov/index.aspx?m=6&t=85
VA Marine Resources Commission:
http://leg2.state.va.us/dls/h&sdocs.nsf/By+Year/SD102010/$file/SD10.pdf
VA Offshore Wind Development Authority:
http://wind.jmu.edu/offshore/vowda/index.html

Other groups involved in siting wind facilities or are valuable data sources:

American Wind Energy Association:
http://www.awea.org/learnabout/offshore/wildlife.cfm
Clemson University Restoration Institute:
http://www.clemson.edu/restoration/focus_areas/renewable_energy/wind/
Collaborative Offshore Wind Research Into the Environment (COWIRE):
http://www.subacoustech.com/information/downloads/reports/544R0308.pdf
Georgia Wind Working Group:
http://www.gawwg.org/
Integrated Ocean Observing System (IOOS) Data Catalog and Asset Viewer:
http://www.ioos.gov/catalog/
Mid-Atlantic Regional Council on the Ocean (MARCO) Data Portal:
http://www.midatlanticocean.org/map_portal.html
National Wildlife Federation:
http://www.nwf.org/global-warming/policy-solutions/renewable-energy/offshore-wind.aspx
North America Offshore Wind Project:
http://offshorewind.net/
Northeast Ocean Data Portal:
http://northeastoceandata.org/
Offshore Wind NC:
http://offshorewindnc.org/resources/
Offshore Wind Energy Europe:
http://www.offshorewindenergy.org/
University of North Carolina Energy Services:
http://www.climate.unc.edu/coastal-wind
U.S. Offshore Wind Collaborative:
http://www.usowc.org/
SC Wind Collaborative (Clemson Univ.):
www.clemson.edu/restoration/focus_areas/renewable_energy/wind/
GA Wind Working Group:
www.gawwg.org/