A *Challenge* Proposal
Regarding
The Cape Wind Energy Project

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We need to minimize the impact of wind energy on wildlife while maximizing the opportunities for the development of wind energy.
- Benjamin Tuggle, Chief of Federal Program Activities, US Fish & Wildlife Service (AWEA Symposium, September 2005)

Mass Audubon is the largest conservation organization in New England, concentrating its efforts on protecting the nature of Massachusetts. Mass Audubon protects more than 30,000 acres of conservation land, conducts nature education programs for 250,000 children and adults annually, and advocates for sound environmental policies at the local, state, and federal levels. Established in 1896 and supported by over 65,000 member households, Mass Audubon maintains 43 wildlife sanctuaries that are open to the public and serve as the base for its conservation, education, and advocacy programs. For more information or to support its important work by becoming a member, call 1-800-AUDUBON or visit www.massaudubon.org.

Executive Summary

Mass Audubon presents a proposal to the developer of the Cape Wind Energy Project and its permitting agencies to adopt comprehensive and rigorous monitoring and mitigation conditions that will reduce the threat to birds and other wildlife. If Cape Wind Associates and the agencies accept this proposal, and remaining data gaps are filled with a finding of no ecologically significant threat, Mass Audubon will support the Cape Wind Project, the largest clean renewable energy project in the Northeast.

The Cape Wind Energy Project consists of 130 wind turbines arrayed over 25 square miles of Horseshoe Shoal in Nantucket Sound. It also includes a platform for gathering the generated electricity and two underwater cables to transmit power to Cape Cod. The project is expected to provide the equivalent of 75 percent of the electricity consumed on the Cape.

We review the Cape Wind Project in the context of the threat of rapid climate warming, oil spills, strip mining, air pollution, and the push for nuclear power as a clean energy source. We know that the combustion of fossil fuels releases greenhouse gases including carbon dioxide and methane that accumulate in the lower atmosphere and rapidly heat the earth. Combustion of fossil fuels also results in the release of mercury that bioaccumulates in the environment, causing health problems for humans, especially pregnant women and children. Rising sea levels caused by warming flood low-lying barrier beaches and islands that serve as critical habitat for coastal birds including the endangered Roseate Tern and threatened Piping Plover.

To combat the threat of climate change, increases in energy conservation and efficiency are a first priority. The clean renewable energy industry also needs to grow as quickly as possible to mitigate the effects associated with rapid climate change. Of all the renewable energy technologies available today, wind energy is the fastest growing, most successful, and most readily available.

Mass Audubon's technical review and assessment of the Cape Wind Draft Environmental Impact Statement/Report (DEIS/R) is focused primarily on the project's impacts on birds and their habitat. Our review standard is that the project pose no ecologically significant threat to living resources. This does not mean zero impact on those resources because the production of energy always entails some level of environmental impact.

Mass Audubon proposes this *Challenge* after five years of project review, including three years of ornithological fieldwork, our assessment of the DEIS/R, literature review, consultation with ornithologists, scientists, and engineers, and a visit to Denmark's offshore wind farms during the 2005 spring bird migration.

Based on our assessment of field data and the relevant literature, Mass Audubon has tentatively concluded that the project does not pose an ecologically significant threat to birds and the associated marine habitat. We have, however, identified data gaps in the DEIS/R that should be filled before a permitting decision is reached. Our support for the Cape Wind Energy Project is contingent upon these gaps being addressed with a finding of no ecologically significant threat. These gaps are:

- Nighttime distribution and behavior of hundreds of thousands of Long-tailed Ducks in and around Horseshoe Shoal;
- Movement of endangered Roseate Terns and threatened Piping Plovers during the late-summer to early-fall migration; and
- Abundance and distribution of migrating songbirds.

Work on filling some of these gaps has begun or will begin shortly.

We also propose adoption of an *Adaptive Management Plan* that includes a comprehensive and rigorous three-year monitoring program beginning at the construction phase; mitigation measures in the event that the project results in unanticipated ecologically significant adverse impacts; compensation for the use of public lands and waters; and enforceable procedures for decommissioning any abandoned turbines.

An independent review panel should be responsible for analyzing data collected during monitoring, and preparing reports for peer review and dissemination to relevant agencies, Cape Wind Associates, and the public. Finally, a mitigation fund should be established for conservation of bird habitat in and around Nantucket Sound. Monitoring and mitigation would be funded by Cape Wind Associates, supplemented with contributions from independent institutions and government agencies as appropriate. The fund should be administered by an independent third party.

Part I: Background

On February 23, 2004 Mass Audubon submitted a 37-page public comment letter[1] to the US Army Corps of Engineers, Massachusetts Executive Office of Environmental Affairs (EOEA), and Cape Cod Commission in response to the 4,000 page Draft Environmental Impact Statement/Report (DEIS/R)[2] for Cape Wind Associates' (Cape Wind) proposed Cape Wind Energy Project.

The Cape Wind Energy Project consists of 130 tower-mounted wind turbines arrayed in a grid over 25 square nautical miles of Horseshoe Shoals in Nantucket Sound. The project also includes a platform for gathering the generated electricity and two underwater cables to transmit power to Cape Cod. The proposed turbines will be spaced approximately one-third to one-half mile apart. The maximum height of the structures (tip of turbine blade) would be 425 feet above mean sea level. The project is expected to provide as much as 75% of the electricity consumed on Cape Cod.

The next steps in the environmental review process include the issuance of a new and revised DEIS/R by the US Department of the Interiors' Minerals Management Service (MMS). MMS is the federal oversight agency since recent passage of *The US Energy Policy Act of 2005*[3]. In its comments on the DEIS/R, Mass Audubon called upon the federal government to require a Supplemental DEIS.

The revised DEIS is expected to supplement the previous Draft's data with information obtained since the Draft's first release. The revised DEIS will also include the identification and review of new issues as a result of *Energy Act* amendments (*Section 388: Alternate Energy-Related Uses on the Outer Continental Shelf*) to *The US Outer Continental Shelf Lands Act for purposes of Leases, Easements, or Rights-of-Ways for Energy and Related Purposes*.

Following public comment on the new DEIS, options for federal officials under the *National Environmental Policy Act*[4] (NEPA) are either to require a Supplemental DEIS, or issue a Final EIS. According to NEPA regulations[5], this action is then followed by a Record of Decision that identifies alternatives considered and means adopted to avoid or minimize environmental harm from the project.

The Commonwealth's next step is to oversee the review of the Final EIR, as the environmental impact analysis coordination separates at the state and federal levels during the next phase of public review.

Mass Audubon is one of many who have and will continue to comment on one of the most important, precedent-setting renewable energy projects in the nation. As one of the largest conservation NGO's in the Northeast, Mass Audubon will continue to be involved in the public environmental review of this project, especially its avian aspects.

Through this *Challenge*, Mass Audubon offers terms for permitting mitigation and long-term environmental oversight on the critical avian issues associated with the project. Mass Audubon proposes this *Challenge* after five years of project review, including three years of ornithological fieldwork, our assessment of the DEIS/R, literature review, consultations with ornithologists, scientists, and engineers, and a visit to Denmark's offshore wind farms during the 2005 spring bird migration. Now is the time to challenge the permitting agencies and project applicant to address these issues upfront and prior to any final decisions.

Part II. *The Challenge*

Mass Audubon challenges the state and federal permitting agencies, and Cape Wind to meet the following conditions for the proposed Cape Wind Energy Project.

Mass Audubon will draft an *Adaptive Management Plan* with partner conservation organizations, and state and federal agencies, as appropriate, subject to peer-review. The *Plan* will include[6]:

A. Appropriate planning and siting criteria, and monitoring protocols for assessing potential ecological impact of the wind farm to the marine environment, including avian species using the Sound, during and post-construction/operational phases.
B. Adequate, well-defined, and enforceable mitigation measures spelled out in detail for implementation in the event that the project results in unanticipated and ecologically significant adverse impacts.[7]
C. Adequate compensation for the use of public lands and waters by Cape Wind Associates to be paid to the US Government with revenue sharing to Commonwealth of Massachusetts under the recently required provisions of *Section 388(2)* of *The US Energy Policy Act of 2005*.
D. Enforceable procedures and bonding authority for decommissioning abandoned facilities in accordance with regulatory approval for the wind farm project.

The *Plan* will be offered to:

1. Cape Wind Associates for their review and acceptance;
2. US Army Corps of Engineers, and Minerals Management Service as a permit condition; and
3. Massachusetts Executive Office of Environmental Affairs.

Plan specifics.

A. Monitoring of Marine Environment
   1. Protocols for monitoring impact of the wind farm on the marine environment should be comprehensive including study of seabed, fisheries, marine mammals and reptiles, and avian activity.[8]
   2. Duration of monitoring:

a. Monitoring of avian activity should include the period during construction and at least three years of monitoring during the post-construction or operational phase.
b. The ultimate duration of monitoring for assessing environmental impact will be modified in accordance with the implementation and evaluation of the *Adaptive Management Plan*.

3. The monitoring protocol should assess the overall avian impact of the project including collision mortality and changes in habitat use.
    a. Studies will be designed to address specific questions, such as the impact and potential impact of the project on birds.
    b. Monitoring protocols will follow those developed for wind farms at Nysted and Horns Rev off the coast of Denmark and comparable protocols as may be devised through the contribution of experts.
4. The monitoring program should utilize Mass Audubon's baseline data along with that produced for the DEIS/R as reference points for comparison to data obtained during the construction and post-construction periods.
5. The monitoring program should determine whether potential shifts in avian distribution following construction of the project are due to avoidance of the wind farm versus annual and seasonal shifts in food supply.
6. Studies should include
    a. Aerial surveys along Mass Audubon's established flight grid
    b. Radar monitoring from the Electric Service Platform (ESP)
        1.) Radar should be operated during peak movement of terns, sea ducks, and migratory songbirds, especially April through June and August through November.
        2.) Radar should be installed and maintained under guidance from Mass Audubon.
        3.) Ground truthing of radar observations by technicians hired by Mass Audubon should be conducted regularly from the ESP using spotting scopes fitted with a range finder.
        4.) Radar monitoring should begin as soon as the ESP is constructed.
        5.) Bird collisions should be documented with emerging technology such as infrared cameras with digital recording triggered by a collision impact. This is especially critical given the lack of information on the impact of offshore wind farms on avian species in the Northwest Atlantic Ocean.
7. Review Panel: Third party consultants should be responsible for collecting, analyzing, and disseminating the data.
    a. An independent review panel should be established by Cape Wind Associates, Mass Audubon, MMS, and the US Fish & Wildlife Service (USFWS) to peer review methods, data analysis, and reports. Mass Audubon will excuse itself from certain aspects of the review panel when and if it participates directly in conducting field research related to the project that will be subject to the Review Panel's review.

b. The panel's findings should be reported directly to the permitting, cooperating agencies, Cape Wind Associates, and be made available to the public.
c. If the Review Panel determines that there is unanticipated and ecologically significant avian mortality documented during any monitoring period, Cape Wind Associates should implement and permitting agencies should enforce programs to reduce avian mortality.

8. Such programs may include:
    a. Reduction in avian mortality implemented over a three-year period.
    b. Implementation schedule for seasonal shutdown of turbines during migration periods for certain species that are documented though previous monitoring to be adversely effected by certain turbines.
    c. Establishment of a mitigation fund for the protection of coastal waterbird habitat in and around Nantucket Sound (e.g. endangered and threatened tern species, and threatened Piping Plovers).
9. Funding: an independent fund should be established and funded by Cape Wind Associates with contributions from independent foundations, institutions and government agencies as available and appropriate. The fund should be administered at the applicant's expense by an independent third-party chosen by the applicant and the independent review panel.

Part III. Data Gaps

This *Challenge* is predicated on the collection of additional data to fill specific gaps in our knowledge of avian activity in and around the project area and a finding that this activity does not pose an ecologically significant threat to birds.

Mass Audubon, in its comments on the DEIS/R and other communications with the Army Corps of Engineers, has highlighted specific gaps in our knowledge of avian activity in and around the proposed project area. Mass Audubon's issuance of this *Challenge* is based on the premise that these gaps will be satisfactorily addressed during the environmental review process and that the results will indicate no ecologically significant threat to birds.

In response to a request from the Army Corps of Engineers, Mass Audubon identified three avian data gaps that should be addressed prior to the issuing of a permit. These are:

4. Observation and analysis of the distribution of Long-tailed Ducks in Nantucket Sound, especially in and around the proposed project area, Horseshoe Shoal.

Long-tailed Ducks reportedly number in the 100,000's in Nantucket Sound during the months of November through March. Each day at dawn, these ducks exit the

Sound traveling to feeding sites, returning to the Sound at dusk. Both the applicant and Mass Audubon have conducted extensive aerial surveys of Nantucket Sound during daylight hours when Long-tailed Ducks are largely absent from the Sound. We have, however, no information on the nighttime roosting locations of this species. In particular, we need to know whether Horseshoe Shoal is used by Long-tailed Ducks as a nighttime roosting site. If the answer to this question is yes, then the Long-tailed Ducks are potentially at risk to collision with the wind turbines when they enter, exit, or otherwise move within the project area.

As of late winter 2006, Mass Audubon staff are conducting preliminary research with the goal to fill this data gap in our collaborative project with U.S. Geological Survey staff with funding from MMS.

5. Radar or radio telemetry study of movement of Roseate Terns and Piping Plovers during the late summer and early fall staging and migration period.

Beginning in late July and continuing through August, thousands of Roseate Terns make their way from nesting sites west of Nantucket Sound to their staging areas on Monomoy Island and South Beach. Mass Audubon has detected a substantial west to east shift across Nantucket Sound in the number of tern sightings between aerial surveys conducted during daylight hours. The routes taken by terns across the Sound to Monomoy and South Beach, however, may not be captured by our surveys or the surveys conducted for the DEIS/R. Mass Audubon surveys do indicate a low level of activity of terns on Horseshoe Shoal; the surveys tend to register a low level of tern activity throughout the Sound, with the exception of the buildup of terns along Monomoy in late August and early September.

The survey coverage that Mass Audubon and the applicant did achieve was time-consuming and expensive, but still represented a very small fraction of the total amount of time when terns could have been active and moving across the Sound. For example, we did not determine if terns were moving at dawn and dusk or during the night as our flights did not cover these times. Overnight observations from South Monomoy Island have suggested that terns, at least during part of the year, did go to sea at night, and were seen returning and/or foraging during the dawn. We have requested more information on the number of transits by terns across Horseshoe Shoal during their movement to Monomoy and South Beach from their nesting areas to the west.

There is little information on the use of Horseshoe Shoal by Piping Plovers. This species was not observed in our aerial or boat surveys over a three-year period.

6. One additional season of radar study of spring and fall passerine (songbird) migration. The applicant completed one month of radar survey for spring migration of passerines in May 2002 and an additional month of radar data were collected in September 2002.

The bulk of passerine migration covers a much broader period than originally surveyed for the DEIS/R. For example, fall migration begins in August and continues through October. In addition, there was insufficient ground-truthing and analysis of the radar data collected in 2002. We strongly encourage re-analysis of both spring and fall 2002 radar data. Fall migration is more significant in terms of numbers of birds as this period includes first-year birds. Spring migration is also important, however, as most of the birds migrating during this period are breeders. EOEA has required that the applicant fill this data gap. We look forward to reviewing the results.

Part IV. Premises upon which *The Challenge* is offered

1. Combustion of fossil fuels results in increased releases of greenhouse gases including carbon dioxide and methane that are accumulating in the lower atmosphere resulting in a significant and measurable increase in the surface temperatures on earth. Fossil fuel combustion also results in the release of heavy metals including mercury and other byproducts that bio-accumulate in avian and marine life causing disruption of natural processes and health problems for humans, especially for pregnant women and children.
2. Mass Audubon practices and promotes energy conservation, increases in energy efficiency, and the development of renewable energy sources to offset the effects of rapid climate warming produced by the burning of fossil fuels.
3. *The Massachusetts Climate Protection Plan* (2004)[9] advances the New England Governors and Eastern Canadian Premier's goals of reducing carbon emissions by 20% by 2025. This reduction will be accomplished by promoting energy conservation and efficiency and expanding renewable energy.
4. The Cape Wind Energy Project is expected to produce annually 170 megawatts of renewable electricity in average wind conditions. This output is equivalent to approximately three-quarters of the 230 megawatt average electric demand of the Cape Cod & Islands. At peak output, the Cape Wind Project will produce 420 megawatts of clean, green electricity. This project is a step toward Massachusetts developing a diversified portfolio of clean renewable energy sources that will help address the problem of rapid climate change.
5. No significant impact on living resources does not mean zero impact on those resources. The production of energy for human consumption always entails some level of environmental impact.
6. Although most wind farms appear to pose little threat to avian and marine species, poorly sited wind farms can cause unacceptable mortality.[10]

7. Mass Audubon's technical review and assessment of the Cape Wind Energy Project DEIS/R is focused primarily on this project's environmental impacts on avian species and their habitat.[11]

Part V: Other Factors on which the Challenge is offered

This *Challenge* derives in part from five years of Mass Audubon review of the Cape Wind Energy Project. This includes an assessment of the DEIS/DEIR, three years of on-site avian research, review of the relevant literature, consultation with ornithologists, other scientists, and engineers, and a Spring 2005 avian migration season visit to Denmark's marine wind farms at Horns Rev and Nysted. This *Challenge* is also predicated upon the design and implementation of an *Adaptive Management Plan* that is supported by rigorous monitoring and mitigation measures.

Mass Audubon's review of this project has focused on birds because that is our primary area of expertise. However, we also believe that there may be other potential impacts to marine life that should not be ignored. We have relied on the evaluation of our own staff and the expertise of other organizations in assessing the threat of this project on the sea floor, fisheries, sea turtles, and marine mammals. Our current understanding of this impact suggests that the proposed wind farm will have short-term and local impact during the construction phase. If the construction phase is conducted responsibly, this impact can be minimized. Long-term impacts are anticipated to be minimal. We do recommend rigorous monitoring of these marine species. Denmark's Horns Rev and Nysted offshore wind farms provide appropriate models for devising such monitoring protocols.

Part VII. The Context – Rapid Climate Change

This *Challenge* is also based on the weighing of the environmental benefits and detriments of the project against the documented and substantial impacts associated with the extraction, transportation, use, and disposal of fossil and nuclear fuels including, but not limited to, the deleterious effects of rapid climate change.

Rapid climate change will result in sea level rise that will inundate the low lying barrier beaches and islands of Eastern Massachusetts that serve as critical habitat for the federally listed endangered Roseate Tern and threatened Piping Plover, along with other coastal water birds. The arctic breeding grounds of wintering sea ducks may also degrade as climate rapidly warms.

Rapid climate change demands both increases in energy conservation and efficiency and the rapid growth and development of new energy industries — not just limits on old ones. The clean renewable energy industry needs to grow as quickly as possible to mitigate the effects associated with rapid climate change. Of all the renewable energy technologies

available today, wind energy is the fastest growing, most successful, and readily available. Mass Audubon views this technology and other renewable energy initiatives as mitigation measures that can eventually offset the destructive impacts associated with fossil fuel use.[12]

Part VIII. Summary of Current Knowledge of Avian Activity in Nantucket Sound and the Horseshoe Shoal Project Area as of January 25, 2006.

The following summary is based on data independently collected by Mass Audubon staff and the consultants for Cape Wind Associates in the preparation of the DEIS/R[13] for the US Army Corps of Engineers, and EOEA. Mass Audubon has recommended that pre-construction avian threat assessment focus on three broad areas of avian activity in or over Nantucket Sound:

1) Abundance, distribution, and behavior of Roseate Tern and other tern species, including Common Tern and Least Tern
2) Abundance, distribution, and behavior of wintering waterfowl, such as, Common Eider, Long-tailed Duck, Surf Scoter, Black Scoter, White-winged Scoter, and Common and Red-throated Loons
3) Abundance and flight height of migratory songbirds, especially during peak spring and fall migrations

This summary discusses what we know and don't know regarding the above areas of avian activity and the resulting ecological threat based on an assessment of Mass Audubon studies and data provided in the DEIS/R[14]. Finally, we connect this state of knowledge to an assessment of potential avian mortality should the Cape Wind Project, as proposed, be constructed on Horseshoe Shoal. The latter assessment includes a brief discussion of known avian mortality and behavioral response from similar wind farms in Europe and North America. This report is not intended to repeat or revise the 4,000+ page DEIS/R. Neither is it intended to be an exhaustive review of existing information. Instead, we summarize our assessment of threat to avian species based on existing data, and we highlight areas where conclusions are limited by lack of information. Readers are encouraged to consult the Notes at the end of this document for additional supporting information.

Available Data on Avian Activity in Nantucket Sound

Data on which the avian summary is based are presented in Appendix I below[15]. For four years, and most recently and formally in Mass Audubon's public comments on the DEIS/R, Mass Audubon has called for a minimum of three years of data to adequately assess the avian resources of Nantucket Sound and the project area. Three years is necessary for a minimally accurate description of annual variation and trends in activity, distribution and abundance. As the Appendix I shows, the three-year minimum sampling

period has been met for studies of terns and will be met for studies of wintering waterfowl. Minimum data requirements will not be met for migratory songbirds. In addition, there remain potentially important gaps in the data on Long-tailed Duck and Roseate Tern movements within the project area, despite three years of field survey data on winter waterfowl and tern activity in Nantucket Sound. Recent and proposed studies may fill some of these gaps, but results were not available at the time this report was produced.[16]

Roseate Tern

Mass Audubon surveys of Roseate Tern activity focused on two time periods:

1) Nesting season (May – July) and
2) Pre-migratory staging period (August – mid-September).

Distribution, abundance, and behavioral data of Roseate Terns and other bird species were collected from aerial and boat surveys along pre-determined transects that were established throughout Nantucket Sound and included the proposed project area.

Breeding Season

Based on two years of Mass Audubon collecting data and interpretation of relevant data in the DEIS/R, Mass Audubon concludes that Roseate Tern, and tern activity in general, during daylight hours is relatively low in the project area during the breeding season.[17] Results from our boat surveys suggest that there is a spike in tern activity on the Shoal during early to mid-May, which may represent the arrival of migrants. The vast majority of terns recorded within Horseshoe Shoal during boat surveys (95+%) were flying below rotor-swept height. Limited aerial surveys of the entire Sound during the nesting season indicate most tern activity during daylight hours is in the eastern third of Nantucket Sound near Monomoy National Wildlife Refuge (NWR) where a large Common Tern breeding colony is located.[18] Boat and plane surveys were only conducted during daylight hours under good weather conditions and Mass Audubon does not know the pattern of tern activity at other times including, dawn, dusk, or at night. For example, there is some evidence that terns fly to nocturnal roosting sights on water prior to nesting, but little if anything is known about the location of these roosting sites.

Premigratory Staging Period

Three years of aerial survey data indicate that diurnal tern activity is relatively low on Horseshoe Shoal; the Shoal may have the lowest level of activity of any comparable area in Nantucket Sound.[19] Our survey results show a buildup of tern activity from August to September in the eastern edge of Nantucket Sound reflecting the increase in tern abundance on and around Monomoy NWR as terns gather for fall migration and feed in the shallow waters around Monomoy and South Beach in Chatham.[20]

In general, the frequency of tern sightings within Horseshoe Shoal was significantly less than compared to the rest of Nantucket Sound.[21] The survey data are subject to the criticism that they underestimate absolute tern activity in the project area. Nevertheless, Mass Audubon concludes that the data accurately represent relative diurnal activity of terns on Horseshoe Shoal in the context of foraging conditions and proximity of nesting and staging sites present during 2002 - 2004.

Winter Waterfowl and Loons

Between November and the end of March, Nantucket Sound provides habitat for hundreds of thousands of winter waterfowl, and this area may be a primary wintering habitat for Atlantic populations of Long-tailed Ducks, all three species of scoter, and Common Eider. Portions of Horseshoe Shoal contained dense concentrations (1,000s) of these duck species throughout the winter. During Mass Audubon conducted field studies of winter waterfowl in 2003-04 and 2004-05, spatial distribution of ducks in the Sound shifted between years, but remained relatively constant within years.[22] Common Eiders were observed more than expected within the Shoal, whereas Scoters were observed less than expected in the Shoal in both years. Gulls were also observed less than expected within the Shoal in the first year of surveys, and Gannets were observed more than expected in the 2nd year. Distribution of other species, including Loons, Long-tailed Ducks, and Razorbills showed no significant pattern of distribution in the Shoal relative to the rest of Nantucket Sound.[23] These patterns may shift over time, as waterfowl are believed to change feeding areas to utilize the shifting availability of food resources.

These conclusions are based on only two years of data, and a third year of surveys, currently underway, will provide additional insight. The survey data are important for providing a baseline for comparison of use of the Sound by these species should the wind farm be constructed, both during and post-construction. Mass Audubon surveys were conducted during daytime hours, and it is highly likely that Mass Audubon staff underestimated abundance of Long-tailed Ducks, which exit the Sound in the early morning and return at dusk.

Mass Audubon observations of waterfowl flight behavior are very limited. Mass Audubon field staff found that ducks were disturbed by their presence during boat surveys, severely limiting the boat surveys' value. The limited observations of duck flight height by Mass Audubon field staff indicated that ducks disturbed by boat traffic fly well below the rotor swept zone. Information on flight heights during migration at Nantucket Sound is lacking; ducks have been documented anecdotally at higher altitudes. Patterns in distribution of ducks in Mass Audubon's data are similar to the results presented in the DEIS/R. Mass Audubon field staff counted substantially more ducks during their aerial surveys, and it seems likely that methodological differences contributed to the discrepancy; further analysis is necessary to understand why Mass Audubon counted more ducks than the consultants who provided the data for the DEIS/R.

Mass Audubon believes that it has accurately estimated the distribution and relative abundance of most winter waterfowl species during daylight hours and under good weather conditions with the exception of Long-tailed Ducks. The results are repeatable, with some seasonal shifts in abundance and distribution. Further information on the location and relative abundance of Long-tailed Ducks in Nantucket Sound and the proposed project area during the night is necessary.

Songbird Migration

Mass Audubon did not conduct any studies of songbird migration because of lack of funding. The applicant completed two seasons of data collection using radar – one each in portions of the spring and fall migration periods in 2002. Summaries of results from radar studies on this key category of avian activity are provided in the DEIS/R. The summaries as presented are of limited value due to flaws in the analysis, and because there was no replication by season.[24] The fall migration data were collected from Cape Pogue on Martha's Vineyard, which resulted in incomplete coverage of the project area and a missed opportunity for collecting data on tern movements during the important premigratory staging period.[25]

According to the summary of radar data in the DEIS/R most birds, or targets, (74%) are observed above the rotor swept zone, but large numbers (120,000+) were observed flying at a height that was within the range of the rotor swept zone. The geographic areas covered by both horizontal and vertically scanning radar were not identical in the spring and fall sampling seasons. Both horizontal radar surveys overlapped at least a portion of the proposed project area. The coverage of the project area by vertical scanning radar on Cape Pogue is unclear; therefore, the height distribution of birds captured by this radar during the fall migration may not reflect flight patterns across the Shoal. Not all of the birds that entered the project area would be at risk to collision given the substantial spacing between turbines. The percentage of birds recorded flying within or below the rotor swept zone decreased at night, i.e., on average, migrating birds were recorded flying higher at night.

Assessment of Potential Impacts to Avian Species

Likely impact to avian species if the wind farm is constructed in Horseshoe Shoal falls into two broad categories:

1) Ecologically significant collision mortality; and
2) Ecologically significant loss of habitat due to avoidance of the wind farm.

The phrase "ecologically significant" is the operative phrase in these concerns. Mass Audubon assumes that an unknown number of birds passing through the project area will strike and be killed by the wind turbines, and some species will change their behavior and habitat use in response to the presence of the wind turbines. The primary concern is whether these impacts will result in ecologically significant population reductions.[26]

Evaluating avian collision studies at wind farms is difficult as most results are presented in non peer-reviewed technical or consultant's reports, are sensitive to field data collection techniques, and involve substantial extrapolations of mortality based on correction factors for search efficiency and scavenger removal rates. Studies at several wind farms, notably Altamont, California[27], Tarifa, Spain[28], Zeerbrugge, Belgium[29], and Backbone Mountain, West Virginia, have reported high avian and bat mortality. Studies showing both high and low avian and bat mortality have been criticized for a variety of methodological flaws that would undermine their conclusions.[30],[31]

Post-construction studies directly relevant to the proposed Cape Wind Project Energy Project are particularly rare. For example, the Belgium site provides mortality and collision probability estimates for Common Tern, but this facility is located nearshore, is adjacent to a Common Tern nesting colony (within 100s of meters), and the turbines are substantially closer together than they would be on Horseshoe Shoal. Thus, the relevance of these mortality estimates to the proposed Horseshoe Shoal wind farm is not known. The distance between Horseshoe Shoal and the current major colony at Monomoy NWR is outside the documented average foraging range of Common Terns (~20 km). Although terns could rapidly shift location of this and other nesting colonies in response to disturbance, nest failure, or changes in food supply, potential new colony sites (i.e., Muskeget Island) would still be about 10-15 km from the project area.

Different bird species can be expected to change their behavior in different ways in response to the presence of wind turbines. The results of the Belgian study referenced earlier suggest that bird species vary substantially in their probability of collision mortality.[32] Data available from offshore wind farms in Denmark indicate that waterfowl, such as eiders and scoters, will change flight direction during migration to avoid wind turbines and will relocate wintering congregations away from wind farms. In the latter case, it is not yet clear whether these location shifts are due to the presence of the wind farm or shifts in food supply.[33]

If these patterns hold, these changes in behavior would presumably reduce avian collision risk, although the changes may limit sea duck use of important foraging and resting grounds, which could affect overall survival. Alternatively, turbine monopiles could alter the abundance of some invertebrate and fish populations, which may increase attraction of certain bird species to the area; this could increase collision risk. For example, these same studies indicate that gulls and terns may increase activity in the vicinity of the Horns Rev wind farm when compared to pre-construction studies, although sample sizes are limited.[34]

There is currently not enough information to determine whether altered flight distances necessary to avoid turbines, or whether the changes in distribution of feeding and resting habitat, or changes in migration routes are ecologically significant impacts. To date, no collision mortality has been reported at the Danish offshore wind farms, although measuring mortality in the offshore environment is difficult.[35] Finally, the effects of collision mortality and habitat loss will vary from species to species. Loss of a few birds could be devastating to the endangered Roseate Tern[36], while sea ducks could experience loss of hundreds of birds without significant impact to the overall regional population.[37]

Given the difficulties in drawing conclusions about avian mortality at comparable wind projects, we make the following statements regarding threats to avian species at the proposed Horseshoe Shoal wind farm based on an analysis of available survey data and studies conducted on comparable wind farms:

1) Horseshoe Shoal is currently a relatively low risk site for collision mortality for Roseate Terns and tern species, in general, when compared to other potential site locations in Nantucket Sound (but see below).
2) Tern activity is closely tied to food availability. Establishment of colonies within 20 km of Horseshoe Shoal, or a change in distribution and abundance of forage fish could result in an increase in tern activity over the Shoal. Such a distributional shift could increase collision risk.
3) Danish studies suggest that tern activity in Horseshoe Shoal may increase with the construction of the wind farm[38], but colonies would still be too distant for any increase in high-risk activity, such as defending nesting territories.
4) At least one more spring and fall season of radar data, accurately interpreted, is necessary for a proper assessment of spring and fall songbird migration through the proposed project area.
5) Radar operation should be timed and located to provide more comprehensive information on tern activity in the project area as well, particularly at key periods when terns arrive in Nantucket Sound in the Spring and during the Fall pre-migratory staging period, when the Roseate Tern population in Buzzards Bay is known to move eastward across the Sound to South Beach, Chatham.
6) Winter waterfowl likely will adjust their roosting and feeding sites away from Horseshoe Shoal to avoid the wind farm and increased boat traffic, and this shift should reduce collision risk.[39]
7) If there is a shift in waterfowl distribution in Nantucket Sound after construction of the wind farm, we cannot say whether a potential loss of feeding habitat is ecologically significant or trivial when compared to the entire wintering range of these species. On the Atlantic Coast, the winter range for Scoters stretches from the waters off Atlantic Canada to northern Florida and the Gulf Coast of the United States. We do not know if access to winter foraging and/or resting habitat are limiting factors for waterfowl.[40]
8) Behavior of all birds, especially Long-tailed Ducks, at dawn, dusk, nighttime and during storms remains a major question, and data need to be collected to provide a more accurate threat assessment.[41]

9) Results to date from post-construction studies of two offshore wind farms in Denmark and smaller wind farms in Sweden lead to the preliminary conclusion that such wind farms do not pose an ecologically significant threat to sea ducks. More studies are needed to confirm this conclusion.
10) Accurate and additional preconstruction data are necessary to adequately evaluate changes in avian activity in Nantucket Sound if the wind farm is constructed.
11) Detailed post-construction protocols and mitigation measures should be implemented to determine if this particular wind farm causes unacceptable levels of avian mortality. Mass Audubon believes that the Danish studies at Horns Rev and Nysted offshore wind farms should serve as a model for post-construction studies at the Horseshoe Shoal wind farm if the latter is constructed.

Appendix I
Avian Data Summary
February 21, 2006

Avian Activity Category	Status of 3-year recommendation for avian studies	Mass Audubon provided studies (submitted and posted on MAS web site)	Mass Audubon will provide	Date of aerial and boat surveys conducted by Applicant (not sorted in DEIS by activity category)
Roseate Terns Staging Period (Aug. – Sept.)	Yes, combination of Mass Audubon and applicant data	2002[1] 2003[1] 2004[1]	All studies provided	March 17 – April 18, 2002 May 1 – August 30, 2002 September 25, 2002 – February 21, 2003 March 19 – June 2, 2003 June 16 – August 29, 2003 September 15, 2003 – February 27, 2004
Roseate Terns – Nesting Season (May – July)	Yes, combination of Mass Audubon and applicant data	2003[1] 2004[1]	All studies provided	
Winter Waterfowl (Dec. – Mar.)	Not met yet. Mass Audubon began third year of surveys in November 2005 Daytime surveys only; need to be supplemented with nighttime surveys.	Winter 2003-2004[2]	Winter 2004 – 2005[2] study in October 2005 Winter 2005 – 2006 study in June 2006	
Migratory Passerines	No, and no indication the applicant will meet this standard	None[3]	None[3]	Radar studies May 2002 September 2002 September 15, 2005

[1] Funded by the Massachusetts Technology Collaborative and the Island Foundation
[2] Funded by the Island Foundation, Foundation M, and USFWS Sea Duck Joint Venture Program
[3] No funding available

Notes

[1] http://www.massaudubon.org/news/index.php?id=140&type=news
[2] http://www.nae.usace.army.mil/projects/ma/ccwf/deis.htm
[3] Public Law 109-58.
[4] 1970, as amended at 42 U.S.C. 4371 et seq.), sec. 309 of the Clean Air Act, as amended (42 U.S.C. 7609) and E.O. 11514 (Mar. 5, 1970, as amended by E.O. 11991, May 24, 1977)
[5] 43 FR 55997, Nov. 29, 1978, Sec 1505.2
[6] Such organizations include the Conservation Law Foundation and Union Concerned Scientists, and Mass Wildlife and Minerals Management Service
[7] This approach is consistent with the recommendations of the US Fish and Wildlife Service, Region 5 as contained in a February 28, 2006 memorandum to the Rules Processing Team, Minerals Management Service in response to the *Advance Notice of Proposed Rulemaking (ANOPR) for Alternate Energy-Related Uses on the Outer Continental Shelf Regulation Identification Number 1010-AD30 published in the Federal Register (FR) (70 FR 77345).*
[8] We focus on birds because it is our primary area of expertise. This does not discount the importance of bats, sea turtles, fish and benthic species, which is why we recommend comprehensive monitoring. Denmark's Horns Rev and Nysted are appropriate models for devising such monitoring protocols.
[9] http://www.massclimateaction.org/pdf/MAClimateProtPlan0504.pdf
[10] Most land-based wind farms apparently cause low avian mortality, averaging 1-2 birds per turbine per year (2004 AWEA review). Wind farms in Altamont, California, Tarifa, Spain, the Netherlands, and Norway have caused high and unacceptable avian mortality, particularly of raptors (see references below).
[11] Bats and marine life are important and should be part of a monitoring program. We have focused on birds because it is our primary area of expertise. This does not discount the importance of bats, sea turtles, fish and benthic species, which is why we recommend further monitoring. Denmark's Horns Rev and Nysted may be appropriate models for devising such monitoring protocols.
[12] In September 2005, the Offshore Wind Energy Collaborative, established by the U.S. Department of Energy, Massachusetts Technology Collaborative, and GE Energy issued *A Framework for Offshore Wind Energy Development in the United States*. Mass Audubon participated in its development. It is available at: www.masstech.org/offshore/final_09_20.pdf
[13] USACE *op cit*
[14] All Mass Audubon reports are available on the Mass Audubon website at http://www.massaudubon.org/news/index.php?id=114&type=news
[15] Because of differences in methodology (the applicant had fewer flights, lower survey altitude, and survey periods do not match MAS survey periods) and the way data were reported in the DEIS, it is difficult to make direct comparisons between our results and the applicant's data. General trends in the data appear to be the same, based on our visual examination of the relevant figures contained in the DEIS.
[16] In September 2005 the applicant established avian radar on Cape Pogue, Martha's Vineyard to collect additional data on fall songbird migration. The radar was operational for an eight-week period ending November 14th. This survey could produce at least a portion of a 2nd season during the crucial fall songbird migration. We are hopeful that the radar will be operational for the spring migration in April and May.
[17] See Perkins, S., T. Allison, A. Jones, and G. Sadoti. 2004. A survey of tern activity with Nantucket Sound, Massachusetts, during the 2003 Breeding Season. Final Report for the Massachusetts Technology Collaborative, 18 pages; Sadoti, G., T. Allison, S. Perkins, A. Jones. 2005. A survey of tern activity within Nantucket Sound, Massachusetts during the 2004 Breeding Period. Final Report for Massachusetts Technology Collaborative, 22 pages.
[18] Blodget, B. G. 2001. Massachusetts Tern Inventory. Massachusetts Division of Fisheries and Wildlife, Westborough, MA. Unpublished report and personal communication.
[19] Perkins, S., A. Jones, and T. Allison. 2003. Survey of Tern Activity Within Nantucket Sound, Massachusetts, During Pre-Migratory Fall Staging. Final Report for Massachusetts Technology Collaborative, 18 pages; Perkins, S., T. Allison, A. Jones, G. Sadoti. 2004. A survey of tern activity within Nantucket Sound, Massachusetts, during the 2003 fall staging season. Final Report to the Massachusetts Technology Collaborative, Massachusetts Audubon Society, 22 pages; Sadoti, G., T. Allison, S. Perkins,

and A. Jones. 2005. A survey of tern activity within Nantucket Sound, Massachusetts, during the fall 2004 staging season. Final Report to the Massachusetts Technology Collaborative. 25 pp. The Massachusetts Technology Collaborative coordinated a peer-review of these reports, and reviewers' comments were incorporated in the final drafts.

[20] This area is well known as a major staging area for terns that collect from throughout the northwest Atlantic prior to departure to southern wintering areas. See, for example, Trull P., S. Hecker, M. J. Watson & I.C.T. Nisbet. 1999. Staging of Roseate Terns *Sterna dougallii* in post-breeding period around Cape Cod, Massachusetts, USA. Atlantic Seabirds 1(4): 145-158.

[21] These conclusions are based on the calculation of Jacob's selectivity index (D) using clusters of observations. The index, ranging from –1.0 to 1.0, compares the percentage of observations in the Shoal with the percentage of the survey area comprising the Shoal (11.4%). For example, a significant, negative index indicates that a species was observed less than expected in Horseshoe Shoal based on its distribution throughout Nantucket Sound. The significance of the index is tested with a one-sample Chi-square test using observed and expected values for the Shoal and the rest of the Sound. The conclusions of this test are sensitive to whether one uses observations (clusters ranging from 1 to 1000's) or numbers of individuals. The chi-square test requires independence amongst observations, and we assume that birds within clusters are not distributed independently. Significance levels were adjusted for the number of tests to $p < 0.002$. For additional details on the index, see Petersen, I. K. 2005. Bird numbers and distributions in the Horns Rev offshore wind farm area Subtitle: Annual status report 2004. National Environmental Research Institute Ministry of Environment, 38 pp. The results of our calculations indicated in the table below:

Horseshoe Shoal D-index - Terns

	% HS	D	N	X^2	P
Breeding Season - all years	4.1%	-0.508	195	9.97	**
Staging Period 2002	2.6%	-0.666	468	36.39	****
Staging Period 2003	2.1%	-0.714	748	64.38	****
Staging Period 2004	6.8%	-0.285	191	3.54	0.06
Staging Period Combined	2.9%	-0.628	1,407	102.67	****
Breeding Season minus Monomoy	12.9%	-0.004	62	0.00	n.s.
Staging Period 2002 minus Monomoy	4.5%	-0.524	269	16.60	****
Staging Period 2003 minus Monomoy	4.0%	-0.565	401	27.99	****
Staging Period 2004 minus Monomoy	12.1%	-0.039	107	0.01	n.s
Staging Period Combined minus Monomoy	5.3%	-0.457	777	40.30	****

n.s. - not significant
**** - p <.002**
**** p < .0001**

[22] Perkins, S., G. Sadoti, T. Allison, and A. Jones. 2005. Results of winter waterfowl surveys on Nantucket Sound, 2003–2004. Final Unpublished Report. 24 pp; Perkins, S., G. Sadoti, T. Allison, E. Jedrey, and A. Jones. 2006. Relative waterfowl abundance within Nantucket Sound, Massachusetts during the 2004-2005-winter season. Final Unpublished Report, 28 pages.

[23] These conclusions are based on the calculation of Jacob's selectivity index (D) as described earlier. As before we based our results on clusters of observations. This index estimates the preference of a species for the Shoal by comparing the percentage of observations in the Shoal with the percentage of the survey area comprising the Shoal. The significance of the index is tested with a one-sample Chi-square test using observed and expected values for the Shoal and the rest of the Sound. The significance level was adjusted for the number of tests (16) to $p < 0.003$. The results are indicated in the table below:

Horseshoe Shoal D-index	Clusters/observations									
Survey Year	2003-2004					2004-2005				
	% HS	**D**	**N**	**X^2**	**P**	**% HS**	**D**	**N**	**X^2**	**P**
Melanitta spp.	7.7%	*-0.212*	3,430	45.47	***	7.5%	*-0.227*	3,081	46.07	***
Common Eider	21.2%	**0.354**	1,526	145.08	***	19.5%	**0.306**	1,467	94.39	***
Long-tailed Duck	12.0%	0.030	2,397	0.84	n.s.	12.5%	0.054	2,951	3.76	0.06
Gavia spp.	11.1%	-0.016	920	0.06	n.s.	9.8%	-0.085	2,236	5.55	0.02
Larus spp.	8.7%	*-0.148*	1,376	9.51	**	13.3%	0.086	1,380	4.55	0.03
Northern Gannet	10.8%	-0.030	185	0.02	n.s.	19.3%	**0.300**	482	28.96	***
Razorbill	8.9%	-0.139	429	2.49	n.s.	15.4%	0.174	246	3.60	0.06
Grand Total	11.3%	-0.006	10,263	0.15	n.s.	12.0%	0.029	11,843	4.03	0.04

n. s. - not significant
**** p < .003**
***** p < .001**

[24]See detailed technical comments in: Comments on the Cape Wind Energy DEIS-DEIR: Assessment of potential effects on birds. USACE NAE-20040338-1, Submitted by Ian C.T. Nisbet, Ph.D., 150 Alder Lane, North Falmouth, MA 02556, icnisbet@cape.com, Submitted 29 January, 2005. Dr. Nisbet is one of the pioneers in the use of radar to study bird migration.

[25] Mass Audubon's concerns with the analysis of radar data are described in more detail in our comments on the DEIS/R (http://www.massaudubon.org/PDF/CapeWindDEISTechCom.pdf).

[26] Unfortunately, answering many of these questions with the desired scientific rigor is beyond the scope of the Environmental Review for this project. Determining population-level impacts for sea ducks for example, is hampered because we do not know which breeding populations winter in the Sound. Neither do we know whether the availability and quality of winter range limits sea duck populations. Although the answers to these questions are of primary concern to agencies charged with managing these species (i.e., see the Sea Duck Joint Venture website at http://seaduckjv.org/index.html), lack of funding slows their ability to conduct the necessary studies.

[27] Orloff S. and A. Flannery, 'Wind turbine effects on avian activity, habitat use, and mortality in Altamont Pass and Solano County wind resource areas', CEC report, 1992; Orloff, S. and A. Flannery, 'A continued examination of avian mortality in the Altamont Pass wind resource area', CEC report 1996; Thelander, C. G., K.S. Smallwood, and L. Rugge. 2003. Bird Risk Behaviors and Fatalities at the Altamont Pass Wind Resource Area" by, NREL/SR-500-33829, www.nrel.gov/docs/fy04osti/33829.pdf; Smallwood K.S. and C.G. Thelander, 'Bird mortality in the Altamont Pass wind resource area', NREL report NREL/SR-500-36973, in press.

[28] Janss, G. 2000. Bird behavior in and near a wind farm at Tarifa, Spain: Management Considerations. In: Proceedings of the National Avian-Wind Power Planning Meeting III, pp. 110-114, www.nrel.gov.

[29] Everaert, J. 2003. Wind turbines and birds in Flanders: Preliminary study results and recommendations. Natuur. Oriolus 69(4): 145-155.

[30] See, for example, Weisskopf, C. P. 2005. A review of avian fatality data in the Altamont Pass Wind Resource Area. Pilz and Co., LLC, 7 pages.

[31] The issue of avian mortality at wind farms has become a lightning rod for opposition to specific wind farms as well as to the widespread development of wind farms in the United States and Europe. Proponents of wind power development frequently cite statistics suggesting that the avian collision deaths at wind turbines is dwarfed by avian mortality from other sources, such as collisions with communications towers, buildings, including skyscrapers and homes, cars, utility wires, predation by cats, and hunting. Total estimated mortality from each of these sources typically number in the millions, while estimated mortality from wind turbines is in the range of the tens of thousands. The latter numbers would certainly increase as

the number of wind turbines increases worldwide. There is heated argument from some quarters about the validity of the numbers of deaths from wind turbines, but little of this discussion has taken place in the peer-reviewed literature. All estimates of avian mortality are subject to large error terms because of limited sample sizes, and correction factors adjusting for search area, scavenging of corpses and searcher efficiency. Although the validity of these correction factors can be tested by putting out known numbers of bird corpses and measuring recovery after certain time periods, the correction factors add substantial error to the calculation of estimates.

[32] Everaert op cit

[33] Dozens of reports have been prepared on the offshore wind farms located at Horns Rev and Nysted, Denmark. Web sites where these reports can be found are: Horns Rev (http://www.hornsrev.dk/Engelsk/Miljoeforhold/uk-rapporter.htm) and Nysted (http://www.nysted-havmollepark.dk/frames.asp). Results of response of migrating birds at the Nysted wind farm have been published in a peer-reviewed journal: Desholm, M. and J. Kahlert. 2005. Avian collision risk at an offshore wind farm. Biology Letters DOI: 10.1098/rsbl.2005.0336, 3 pages.

[34] Petersen op cit

[35] Petersen op cit; Danish investigators have been experimenting with infrared technology (Thermal Animal Detection System, TADS) to record avian behavior in and near the rotor swept zone (e.g., Desholm, M. 2005. TADS investigations of avian collision risk at Nysted offshore wind farm, autumn 2004. National Environmental Research Institute, Ministry of Environment, 31 pages. As quoted from this report: "No birds were recorded as passing the sweep area of the rotor-blades nor colliding with any part of the turbine during the 28,571 minutes…of monitoring."

[36] Mass Audubon submitted an estimate of tern mortality from the Cape Wind project in its comments on the DEIS. These estimates were based on the probability of collision mortality published in Everaert, op.cit and Mass Audubon's survey data. The latter were extrapolated to number of tern transits per day. These mortality estimates were intended to be illustrative of the kind of modeling that could be done with existing data, but not definitive. For example, our estimates did not take into account the probability of an individual tern encountering a turbine as it crossed Horseshoe Shoal, and, therefore, we assume that our results overestimated potential tern mortality. We continue to work on refining this model.

[37] Such mortality for waterfowl can also be taken in the context of hunting regulations. Current Massachusetts regulations allow a bag limit of seven birds per day and a possession limit of 14 birds during a 93-day season. A relatively small percentage (27%) of duck hunters hunt specifically for sea ducks and most hunt 3-days or less, but the potential annual winter kill of sea ducks in Nantucket Sound could number in the hundreds or more. H. Heusmann, MassWildlife, pers. comm.

[38] Petersen op cit

[39] Petersen op cit

[40] del Hoyo, J. A. Elliott, and J. Sargatal. 1992. Handbook of the Birds of the World. Vol. 1. Lynx Edicions, Barcelona, 696 pages.

[41] Mass Audubon recently received a grant from Minerals Management Service, USDOI, to conduct radio telemetry of Long-tailed Ducks in collaboration with Patuxent Wildlife Research Center. This project is currently underway. Our goal is to radio tag up to 25 ducks and to locate each duck at least ten times from the air. Aerial tracking of tagged ducks will be supplemented with boat tracking and point counts conducted at dusk on Horseshoe Shoal.