Research Directions and Mitigation

With continued data collection and mapping of areas used by birds and bats in the GoM, the risk of mortality from collisions, stress and habitat destruction may be minimized through appropriate site selection for offshore wind development (USFWS 2011).

There is some evidence that birds become accustomed to turbine arrays and develop avoidance behaviors, but long-term impacts of these changes are unknown (Kahlert et al. 2004 in Drewitt and Langston 2006).

Different paints or acoustic deterrents on turbine towers and blades may be developed to reduce interactions.

Bat fatality can be dramatically reduced in some instances by raising the cut-in speed (the speed at which turbines begin rotating and generating energy) with only marginal power loss to the facility (≤1% total annual output) (Arnett et al. 2011).

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Founded in 1983, the Island Institute is a membership-based nonprofit organization headquartered in Rockland, Maine, focused on helping to sustain the year-round island and remote coastal communities of the Gulf of Maine. As the Gulf of Maine increasingly attracts attention for its robust offshore wind resource, the Institute is working with island communities, fishermen, regulators, researchers, developers, manufacturers and others to enable them to effectively share information on ocean energy development with each other.

For more information on the Island Institute's ocean renewable energy efforts, please contact Heather Deese, vice president of programs, at hdeese@islandinstitute.org, (207) 594-9209 x 112 or Suzanne MacDonald, community energy director, at smacdonald@islandinstitute.org, (207) 594-9209 x 144.
The following web resources are also available:
http://www.islandinstitute.org/oceanrenewableenergy.php • http://www.islandinstitute.org/mappingworkingwaters.php

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Interactions with Offshore Wind Energy: Birds and Bats

The Gulf of Maine (GoM) has been identified by the U.S. Department of Energy and the wind energy industry as an "outstanding" location for offshore wind energy development because of its strong, consistent winds (Schwartz et al. 2010). The GoM is an important area for bird and bat species due to its location on the Atlantic Migration Flyway and its abundance of habitat for nesting seabirds. The area is also a major overwintering area for several seabird species that breed in the southern hemisphere but "winter" in the GoM during the summer months.

This fact sheet provides a summary of potential direct and indirect interactions of birds and bats with offshore wind energy developments, with a focus on potential interactions along the Maine coast and in the northern GoM. Direct impacts include physical interactions with the turbine itself, such as collisions, while indirect impacts are related to factors such as the effects on prey behavior, changes in migration routes and loss of quality habitat. Both direct and indirect impacts can have immediate and cumulative effects on bird and bat populations.

While there are currently no wind turbines installed at sea in the United States, research on wildlife interactions with terrestrial wind turbines and the hundreds of ocean wind turbines in European waters, as well as ongoing impact assessment studies at planned offshore wind energy sites in the U.S., provide the basis for this fact sheet.

Some of the bird and bat species found in the Gulf of Maine

American Black Duck	Black Guillemot	Dark-eyed Junco	Northern Gannet	Roseate Tern
American Kestrel	Black Scoter	Eastern Red Bat	Northern Goshawk	Silver-haired Bat
American Oystercatcher	Black-capped Chickadee	Great Blue Heron	Northern Saw-whet Owl	Spotted Sandpiper
Atlantic Puffin	Blue Jay	Great Cormorant	Osprey	Tree Swallow
Bald Eagle	Blue-headed Vireo	Greater Shearwater	Peregrine Falcon	Wilson's Storm Petrel
Bicknell's Thrush	Cedar Waxwing	Hoary Bat	Red Bat	Winter Wren
Big Brown Bat	Common Loon	Horned Grebe	Red-breasted Nuthatch	Yellow-rumped Warbler

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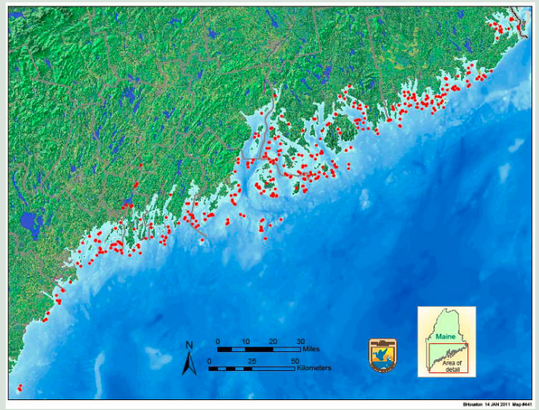
Birds

Habitat Use

The Gulf of Maine (GoM) is used by millions of migrating and breeding birds. More than a half-million songbirds move over the Midcoast Maine region, using islands and coastal areas as they head south during the fall migration and return on the same route in the spring months (Holberton 2010).

The National Marine Fisheries Service has designated the GoM as a critical breeding and wintering area for a variety of bird species, including terns, puffins, eagles, gulls, gannets, grebes, loons, eiders and shorebirds. Seabirds breed on hundreds of islands in the GoM, many of which are more than 10 nautical miles offshore. The GoM has also been recognized as a major flyway corridor for migrating species of shorebirds, waterfowl and seabirds, and is considered to be the most important migration staging area in the Northeast for southward migration. Large numbers of migratory songbirds fly over the GoM to and from the boreal forests and Atlantic Canada.



Seabirds and common eiders breed on over 320 Maine islands

Currently there are 22 designated Important Bird Areas (IBAs) in Maine (Gallo et al. 2008). An IBA is designated as a location that offers important habitat for species of breeding, wintering or migrating birds, and is considered vital to bird populations on a world or regional scale. Generally, these are sites connected with species of conservation concern (or threatened/endangered) and with high concentrations or species diversity.

Interactions with Offshore Wind Energy

Areas of high use by birds are of particular interest as they often translate into areas of high risk for collision with man-made structures. State and federal agencies maintain detailed datasets of seabird and waterbird distribution in the region, but little information is available on the locations of songbirds and other migrant species.

While collision mortality is frequently correlated with bird abundance (Drewitt and Langston 2006), several other factors also appear to play a role. The vortex caused by rotating wind turbine blades creates unstable air, which makes it more difficult for birds to avoid wind turbine interactions even if they miss the structure itself (Desholm 2006). Of particular concern are species with low maneuverability that are less suited to avoiding the pressure changes (University of Maine 2011). Direct impacts with wind turbines—primarily collisions—are known to occur more often in foggy and poor weather conditions (University of Maine 2011). High headwinds and precipitation may cause birds to alter their flight altitude while tidal and offshore currents affect prey availability for seabirds (Ferrer et al. 2011). Songbirds have been observed to fly lower over the water surface during poor weather conditions and may be attracted to illuminated offshore wind turbines in poor visibility conditions (Hüppop 2006).

Summary of Predicted Annual Avian Mortality

Mortality Source	Annual Mortality Estimate	Percent Composition
Buildings	550 million	58.2 %
Power Lines	130 million	13.7%
Cats	100 million	10.6 %
Automobiles	80 million	8.5 %
Pesticides	67 million	7.1 %
Communication Towers	4.5 million	0.5 %
Terrestrial Wind Turbines	28.5 thousand	<0.01 %
Airplanes	25 thousand	<0.01 %
Other Sources	not calculated	not calculated

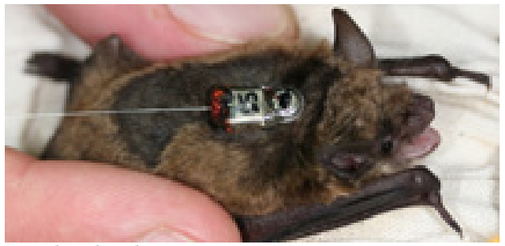
Adapted from Erickson et al. 2005

The number of birds that collide with turbines is expected to be much lower than those that die due to other man-made causes, such as collisions with windows, communication towers, and cats (Erickson et al. 2005). The American Bird Conservancy (ABC), however, considers a previous measure of one million bird mortalities per year to be an underestimate given expectations that the number of operating turbines will continue to increase (ABC 2010). Indirect effects, such as displacement from foraging areas and avoidance behavior, can have impacts that are difficult to quantify.

Bats

Habitat Use

Bats inhabit islands in the GoM corridor and use it when commuting, foraging and migrating. Several species of bats migrate across the GoM from Nova Scotia and mate on islands along the migration corridor. Because bats have long life spans and low reproductive rates, they are slow to recover from population-wide impacts.


Bat with tracking device

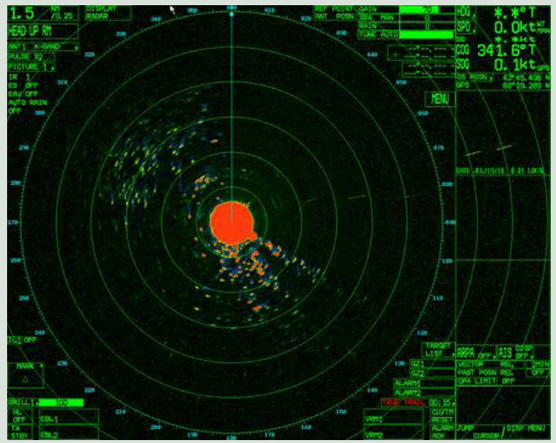
Interactions with Offshore Wind Energy

Migrating, tree-roosting bats (e.g., the hoary bat, red bat and silver-haired bat) are vulnerable to terrestrial wind development, either through collision with spinning turbine blades or barotrauma, a phenomenon caused by the change in pressure near turbine blades causing bat organs and blood vessels to rupture. Why bats interact with turbines is poorly understood, but there are a number of hypotheses, including: attraction to turbines as potential roosting or mating structures; siting of turbines along migratory corridors; disorientation from electromagnetic fields created by the wind farms; and attraction to insects that gather around the lights on turbines. Like birds, poor weather conditions also have been associated with a higher incidence of bat deaths at terrestrial wind projects.

Research methods being used to understand locations and movements of birds and bats

Research methods currently in use or under development include: shore-based radar to identify bird and bat numbers and flight patterns; thermal (infrared) animal detection systems; visual studies; and recording of acoustic signals produced by bats and birds.

- Maine Coastal Island National Wildlife Refuge (NWR), managed by U.S. Fish and Wildlife Service (USFWS), is using satellite tags (devices that track the movement of individual birds) on shearwaters to begin identifying foraging areas and migration corridors for pelagic seabirds.
- University of Maine-led DeepCwind research along the Maine coast includes continuous radar data from Monhegan island for twelve months (July 2010-July 2011) and contextual studies based on tagging and other ornithological studies on Maine coastal islands.
- The USFWS, Maine Coastal Islands NWR, National Park Service and the University of Maine have been monitoring flight and feeding habitats of birds and bats in the GoM to gather information on migratory patterns, habitat use and species composition of flocks through the use of radio telemetry, satellite transmitters, GPS loggers and geolocators.
- Biodiversity Research Institute (BRI) researchers have been monitoring falcon and owl movements along the Maine coast and its islands in order to aid in the wind-energy selection process by delineating migration routes (BRI 2011).
- Scientists at Stantec are working to collect baseline data on bird and bat movements along the coast and on the GoM's islands using radar and acoustic data from bat echolocation calls (Stantec 2010).
- In Europe, techniques such as radar and thermal imaging combined with visual and acoustic observations have been used to track bird movements offshore in preparation for wind-energy installations and for post-construction monitoring (Hüppop et al. 2006).


This radar data was collected from a horizontally-oriented unit deployed by New Jersey Audubon Society on the south end of Monhegan island as part of the University of Maine-led DeepCwind environmental monitoring. The data are processed with purpose-built software to remove wave-induced back-scatter, precipitation and other small objects (insects), and then analyzed along with data from a vertically-oriented radar unit to calculate the number, height, direction and speed of birds and bats passing through the area.