Maine Research Array: Bird and Bat Data

Wing Goodale
Senior Science Director
Biodiversity Research Institute

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BRI
wing_goodale@briloong.org

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Impacts to birds and bats

Collision
Birds and bats are at risk of colliding with offshore wind turbines resulting in injury or mortality.

Displacement/Barrier Effects
Species may avoid wind farms, resulting in displacement from areas previously used for activities such as foraging. Wind farms can also act as barriers to movement such as migration.

Habitat Change
Introduction of hard structures into marine environment can alter ecosystem structure, creating “artificial reefs”.

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What are Adverse Effects?

- **Hazards**: physical changes to the environment
- **Vulnerability**: documented sensitivity to hazards
- **Exposure**: present in a development area
- **Adverse effects**
  - **Direct**: mortality and injury; Direct effects are the result of a stimulus response relationship
  - **Indirect**: a chain of effects pathways that can lead to adverse effects

Figure 3: The Risk Triangle

Crichton 1999
Effects are going to be variable by species and development phase.
Data on Hazards

- Existing data from fixed bottom turbines
- Hazards from floating are likely similar to fixed bottom
- Potential differences
  - Reef effect, currents, upwelling, and micro habitat changes
  - More perching opportunities
  - Avoidance of large turbines
- Unique aspects of GOM
  - Species
  - Geography
Avian Data on Exposure: Surveys

Regional

- Gulf of Maine lacks large-scale high-density surveys
- AMMAPS
- 1970s/80s Manomet/CSAP
- NOAA EcoMon
- NOAA Herring Acoustic
- Waterfowl (not offshore)
- Colonial seabird (not offshore)

Small Scale

- Bold
- GOMCES
- Sea floor mapping

What’s missing?

What can you learn?

- Spatiotemporal use patterns
- Local abundance (density)
- Local distribution
- Local seasonal changes

Allyn et al. 2017

Veit et al. 2015

BRI 2012

BRI 2016

Figure 1: Map of cruise track over the survey period. Date of survey point is indicated by different colored dots.

Figure 2. The Gulf of Maine Coastal Ecosystem Survey. Surveyed transects (black lines) and fixed cast stations (red circles) during the 2014, 2015, and 2016 summer surveys overlaid on bottom depth layer (darker blue = deeper waters).

Bird and marine mammal observations

Across the three survey years, we observed 23 species of bird, seven species of marine mammal, and two species of large pelagic fish (Table 2). The number of bird species observed was relatively consistent across years; most species were encountered each year. The number of observations of individual species, however, varied across years, especially for SGCN. This variability in abundance may be attributable to foraging flocks. For example, in 2014, we observed a large (100+ individuals) foraging flock of terns (Sterna spp.), and in 2015 we observed a foraging flock (50-100 individuals) of Atlantic Puffins, however, in 2016 we did not observe any large foraging flocks of any species.

Marine mammals and pelagic fish observations were more variable. Humpback whales were observed only during the summer of 2015. Additionally, we observed ocean sunfish (Mola mola) regularly on the southern transects and while transiting throughout the southern region during the summer 2014 and 2015 surveys. Yet, we did not observe any ocean sunfish during the summer 2016 survey.
Avian Data on Exposure: Survey Models

- MDAT Marine Bird Abundance and Occurrence Models
  - Regional-scale seasonal predictions of relative density for 47 avian species
  - Developed to support marine spatial planning on the Atlantic OCS (FL to ME)
  - Provides excellent regional context

What can you learn?
- Regional spatiotemporal use patterns
- Relative abundance
- Regional distribution
- Regional seasonal changes
Avian Data on Exposure: Tracking Data

Many types
• Geolocators
• Motus tags
• Cellular GPS (GSM) tags
• Satellite GPS tags

Species
• Non-marine migratory
  • Songbirds
  • Raptors
  • Wading birds
• Marine
  • Colonial nesters
  • Migratory

Data source
• MoveBank
• Researchers

What can you learn?
• Migration routes
• Foraging areas, distance
• Phenology
• Spatial resolution and sample size limitations
Avian Data on Exposure: Tracking Models

Movement Models
- Aggregate positions
- Account for direction of movement
- Account for time
- Model over space

What can you learn?
- Migration routes
- Core use areas

Northeast Ocean Data

Spiegel et al. 2017
Breeding data
- Seabird colonies (some managed)
- Wading bird rookeries

General knowledge on migratory staging areas and routes
- Seabirds
- Shorebirds
- Songbirds: NEXRAD

Bird banding stations
- Species composition
- Body condition
- Phenology

What can you learn?
- Primary seabird breeding locations
- Listed species breeding sites
- Potential foraging areas and migration routes based upon ecology

What are key sources?
- Avian Data on Exposure: Coastal Use

[Map of Maine with marked seabird colonies and water bodies]
We recorded site location using GPS, and calculated area, distance to the nearest mainland for each island, as well as percent land area within 4.8 km of each site based on the Medium Resolution Shoreline datalayer of the National Oceanic and Atmospheric Administration.

The percentage of land within a 4.8-km radius ranged from 0% to 100%, with an average of 50%. The highest percentages were observed on islands located closer to the mainland, while islands further away had lower percentages of land within the 4.8-km radius.

The single buoy (Gloucester Buoy) was southeast of the study area, near the mouth of the Penobscot River. The buoy was used to collect acoustic data, which was analyzed to identify bats.

We used various acoustic detection/recording units, including Anabat SD1, Anabat SD2, and Anabat SD3. The data collected was used to determine the presence of bats in the study area.

Collection and analysis of data

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Types of data

- Acoustic
- Mist-netting
- Tracking
- Maternity roosts and hibernacula

Acoustics offshore

- Islands
- Buoys
- Boats

Key data sources?

- Bat Data on Exposure
- Peterson et al. 2014

What can you learn?

- Species composition
- Timing
- Movement related to weather
Data on Vulnerability

Vulnerable to seabird species
- **Collision**: Gulls, cormorants, kittiwake
- **Displacement**: loons, auks, sea ducks, gannets

**Collision vulnerability ranking**
- Density (exposure), flight height, sitting/flying, flight speed, nocturnal activity, avoidance (macro, meso, micro)
- Flight height: North Atlantic Seabird Catalog & Loring et al. 2019
- Literature

**Displacement vulnerability ranking**
- Avoidance (macro, meso): European studies
- Habitat flexibility: Literature

**Population vulnerability ranking**
- Conservation status and trends: State Status & Partners in Flight
- Vital rates (reproductive success and adult survivorship): Adult Survivorship score from Willmott et al. 2013

Desholm & Kahlert. 2005
How do you use the data?

**Exposure marine birds**
- MDAT: Spatiotemporal variation in planning area
- MDAT: Regional context
- Tracking: migration routes
- Bats and terrestrial: qualitative
How do you use the data?

Relative Vulnerability Rankings
- Wade et al. 2016
- Kelsey et al. 2018

Collision Risk Models
- Band et al. 2012
- Stochastic European Model

Bats and terrestrial birds
- Literature
- Weight of evidence

Recognize Uncertainty!

Species | Disturbance by ship and helicopter traffic | Habitat use flexibility | Conservation importance score | Species concern index value
---|---|---|---|---
Black-throated diver | 5 | 4 | 16 | 32
Red-throated diver | 5 | 4 | 16 | 32
Great northern diver | 5 | 3 | 18 | 27
Common scoter | 5 | 4 | 12 | 24
Common goldeneye | 4 | 4 | 12 | 19
Great cormorant | 4 | 4 | 11 | 18
Velvet scoter | 5 | 3 | 11 | 16
Common eider | 3 | 4 | 13 | 16
Black guillemot | 3 | 4 | 13 | 16
Slavonian grebe | 3 | 4 | 16 | 13
Common guillemot | 3 | 3 | 16 | 14
Razorbill | 3 | 3 | 16 | 14
Shag | 3 | 3 | 15 | 14
Great cormorant | 4 | 3 | 11 | 13
Little tern | 2 | 4 | 13 | 10
Arctic tern | 2 | 3 | 17 | 10
Atlantic puffin | 2 | 3 | 16 | 10
Long-tailed duck | 3 | 4 | 8 | 10
Rose-ate tern | 2 | 3 | 15 | 9
Sandwich tern | 2 | 3 | 15 | 9
Common tern | 2 | 3 | 14 | 8
Great-crested grebe | 3 | 4 | 7 | 8
Great black-backed gull | 2 | 2 | 15 | 6
Black-legged kittiwake | 2 | 2 | 14 | 6
Common gull | 2 | 2 | 13 | 5
Black-headed gull | 2 | 2 | 12 | 5
Little auk | 2 | 2 | 9 | 4
Northern gannet | 2 | 1 | 17 | 3
Herring gull | 2 | 1 | 16 | 3
Great skua | 1 | 2 | 16 | 3
Lesser black-backed gull | 2 | 1 | 16 | 3
Arctic skua | 1 | 2 | 14 | 3
White-tailed eagle | 1 | 2 | 12 | 2
Manx shearwater | 1 | 1 | 17 | 2
European storm-petrel | 1 | 1 | 17 | 2
Leach's storm-petrel | 1 | 1 | 16 | 2
Northern fulmar | 1 | 1 | 16 | 2
Sooty shearwater | 1 | 1 | 12 | 1
What does MDAT tell us?

State Listed
Collision Risk
Displacement Risk
Roseate Tern
What data is missing?

Survey data
- Are there any local surveys available

Local knowledge
- Fishing community
- Whale watching and birding trips

Tracking data
- GPS and satellite tracking studies not available on MoveBank

Behavioral vulnerability data
- Flight heights

Population vulnerability data
- State conservation status

Coastal concentration areas
- Colonial breeding sites
- Migratory staging
- Winter surveys
Thanks!

Questions?

Wing Goodale
Biodiversity Research Institute
wing_goodale@briloon.org