Wind Energy and Bird Conservation: Acoustic Technologies for the Assessment of Risks to Migratory Birds

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The many names of migration. . .

• Many birds engage in “directed” movements, often involving a return to origin, to escape adversity and to exploit seasonal resources.

• Many internal and external factors govern migration.
Many birds migrate at night
Many species produce flight calls: unique vocalizations, varying in frequency, duration, and pattern; primarily given in sustained flight, presumably for communication.

Dickcissel  Black-billed Cuckoo  Red-breasted Nuthatch  
Bobolink  White-throated Sparrow  Swainson’s Thrush

Evans and O’Brien (2002)
Bird migration by radar, microphone
Temporal patterns

Farnsworth and Russell 2007

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Composition across time and space
Why study migrants and migration using acoustic technology?

- collecting for extended periods at difficult-to-access sites;
- recording secretive species that vocalize infrequently;
- generating permanent record for repeated sampling;
- estimating variation in probabilities of detection
Identifying key stopover habitats

Images from Gauthreaux, Clemson University Radar Ornithology Laboratory
Why study migrants and migration using acoustic technology?

Sample beyond the range of traditional protocols

Monitor humans activities that create new hazards
Challenges of applying acoustic technology for monitoring migrant birds

- Massive amounts of data to analyze
- Accelerating pace of automated software development needed for detection and classification
- Understanding detectability, localization, calling-rates, and quantification
- Continued identification challenges
- Species groups that don’t call
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Existing and proposed wind farms in US and MX (2008)

- 26,000+ turbines
- 1.5% of potential

Wind resources overlap with significant bird migration corridors

“Build-out” to reach potential would require 1.7 million turbines
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- Airspace as bird habitat
- Rotor-swept area = 4 acres
Offshore Wind Development

Middelgrunden, Denmark

3 km (1.86 mi)
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“conventional wisdom”

**Causes of Bird Fatalities**

Erickson et al. 2002

- Wind
- Communication Towers
- Pesticides
- Vehicles
- High Tension Lines
- Other
- Cats
- Buildings/Windows

BUT, data from few sites with few turbines, using inconsistent methodologies
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What we know:

Areas with most favorable winds are also often associated with migratory pathways.

Birds and bats do collide with turbines causing mortality, especially during migration.

Population level effects are unknown because of a lack of standardized research.

No mandatory environmental impact guidelines.

Need *coordinated research* to assess risk and establish guidelines for siting and operation of turbines based on science.

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17-19 June 2009, Racine WI - Wind and Wildlife Workshop

What knowledge gaps constrain our ability to assess risk and predict impacts?

What primary research is needed to reduce uncertainties and point to wildlife-compatible solutions?

What data are required for accurate predictive models to forecast migration and assess risk at wind facilities?

Identify topographic, seasonal, and climatic variables

Criteria for identifying “red zones”
Future plans for conserving migrants

Combine different monitoring technologies

acoustics

eBird

radar

tracking
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