

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

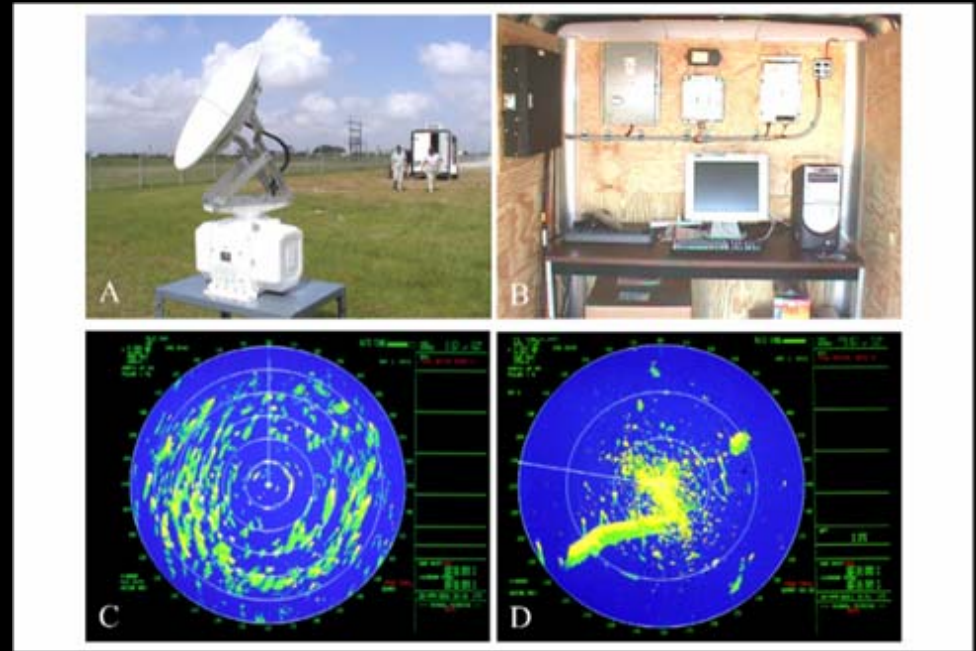
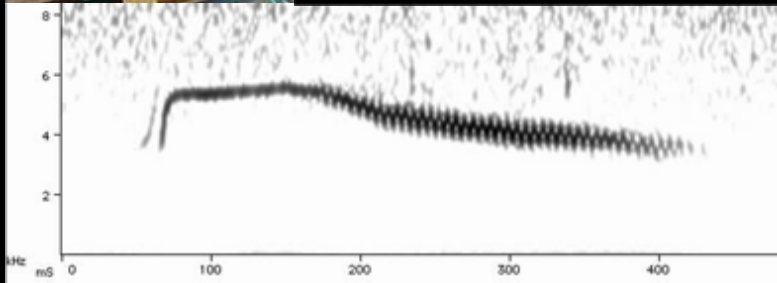


# The many names of migration. . .

- 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.

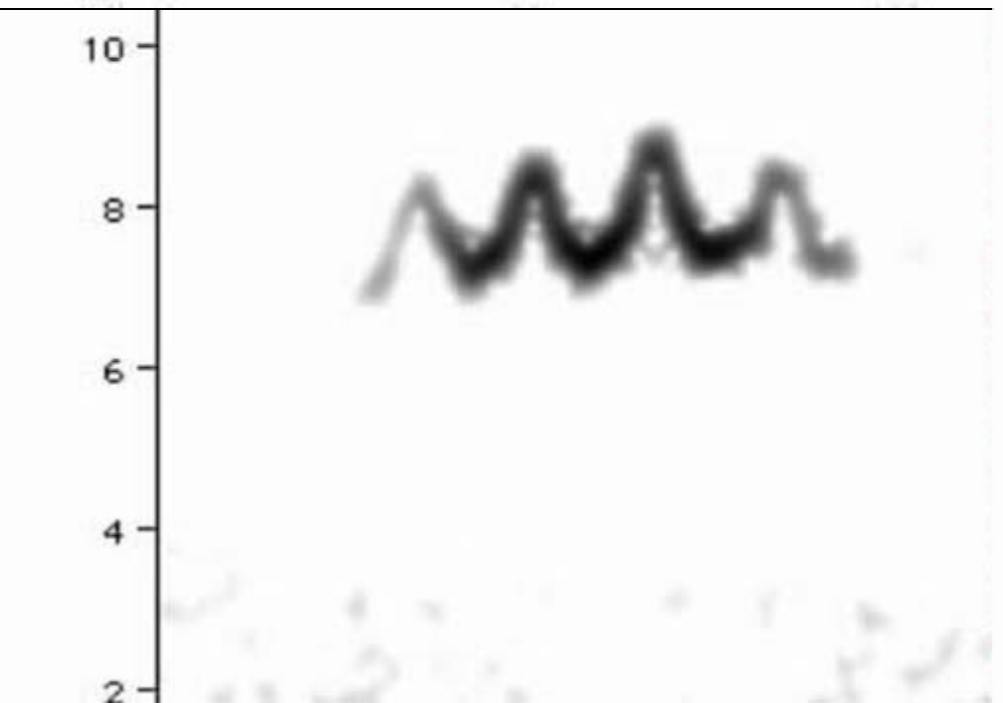
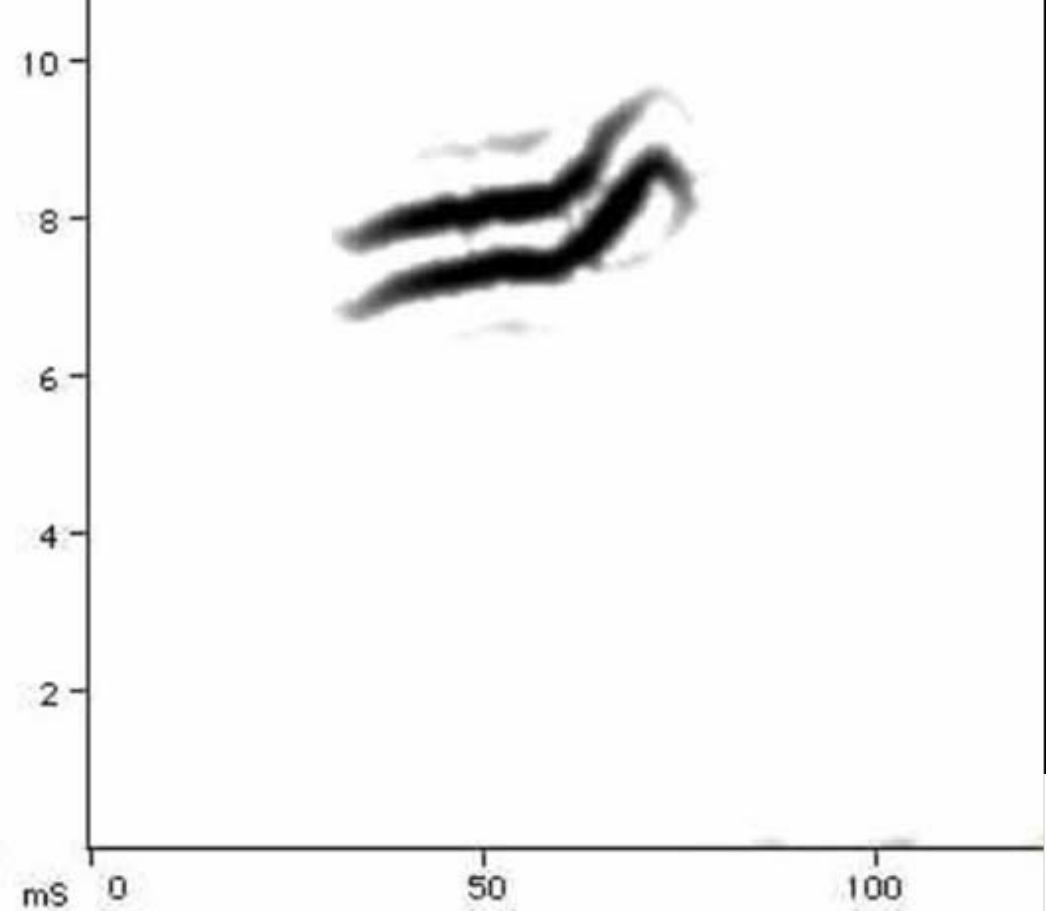
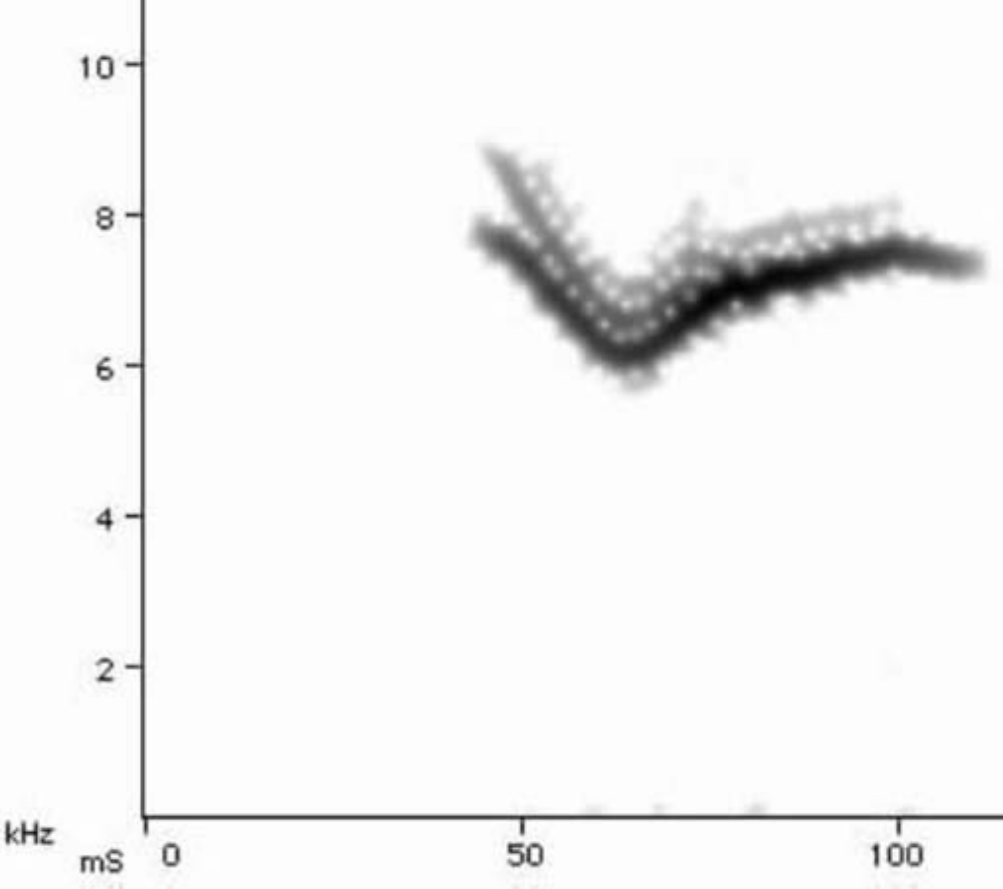


# Many birds migrate at night











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 📣



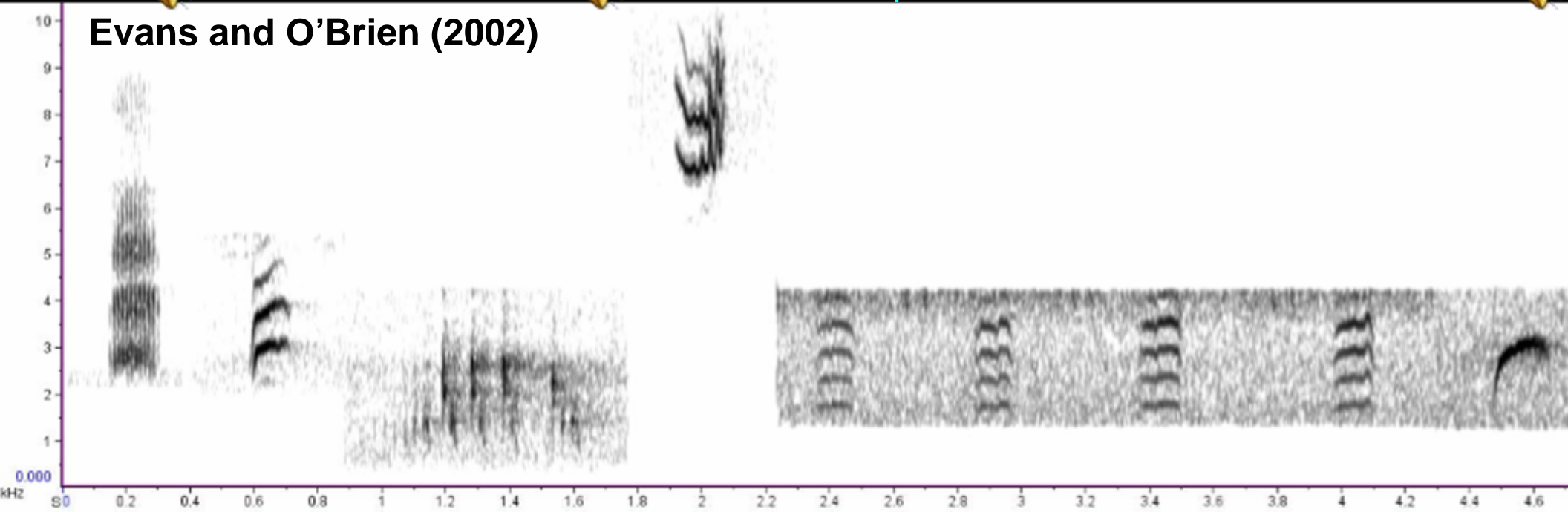
Bobolink 📣



White-throated Sparrow 📣

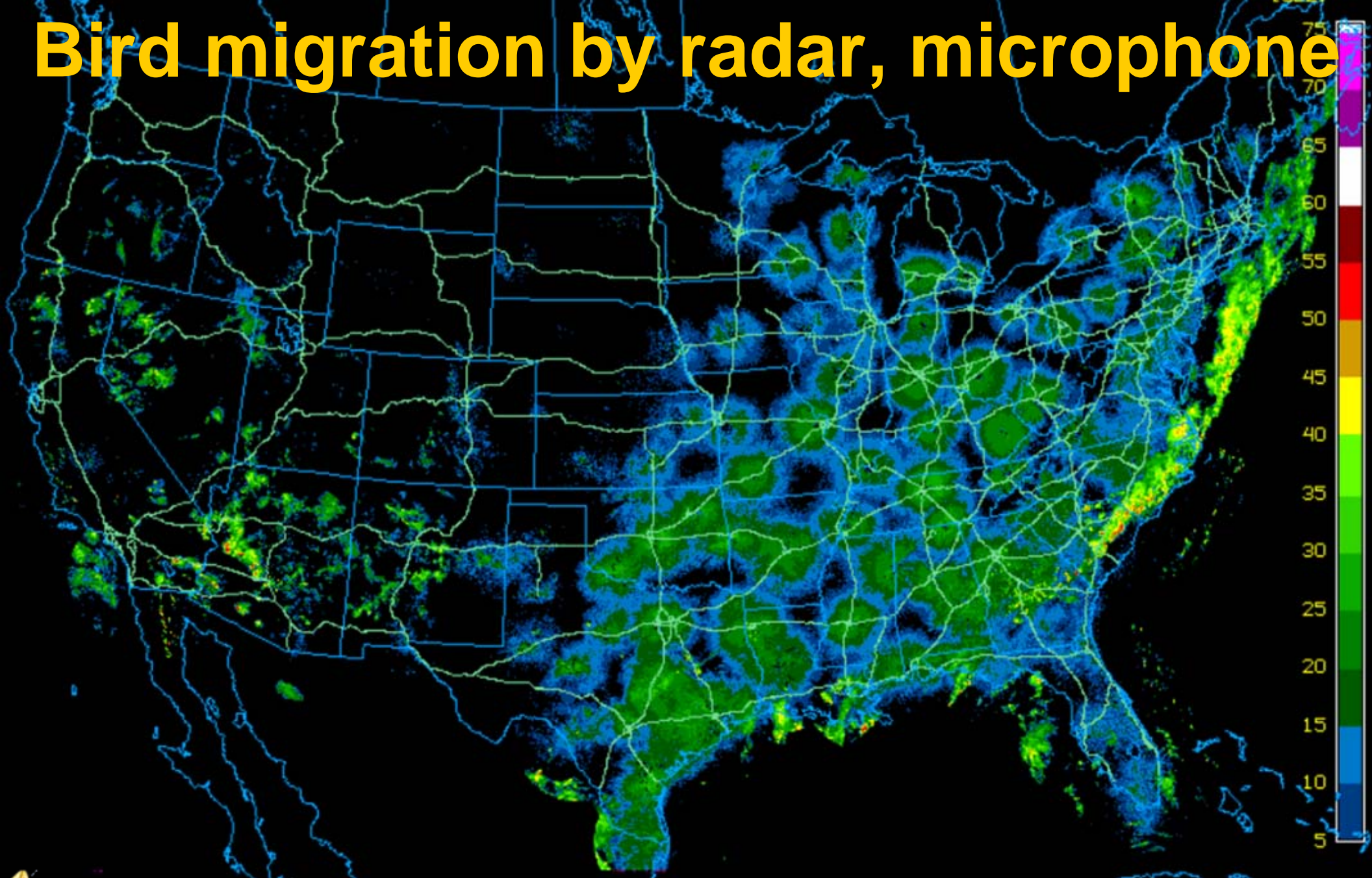


Swainson's Thrush 📣

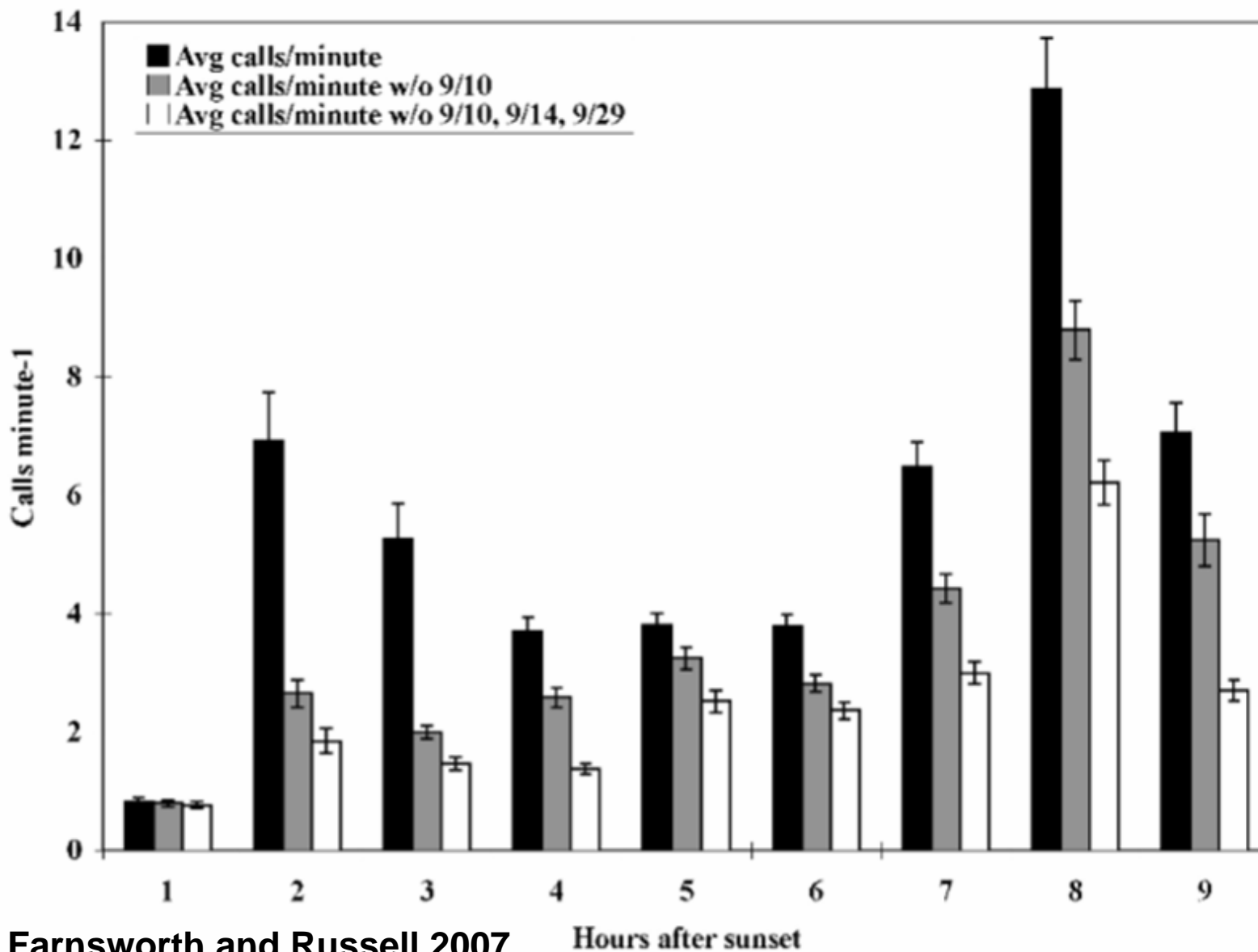




# Bird migration by radar, microphone



# Temporal patterns

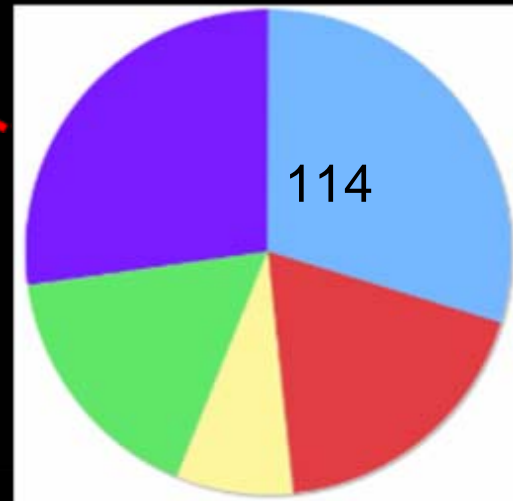
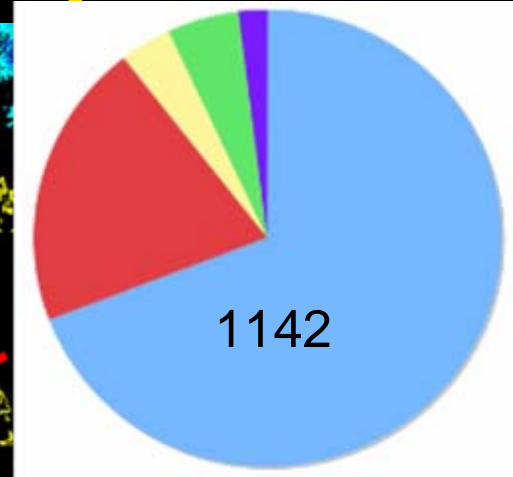
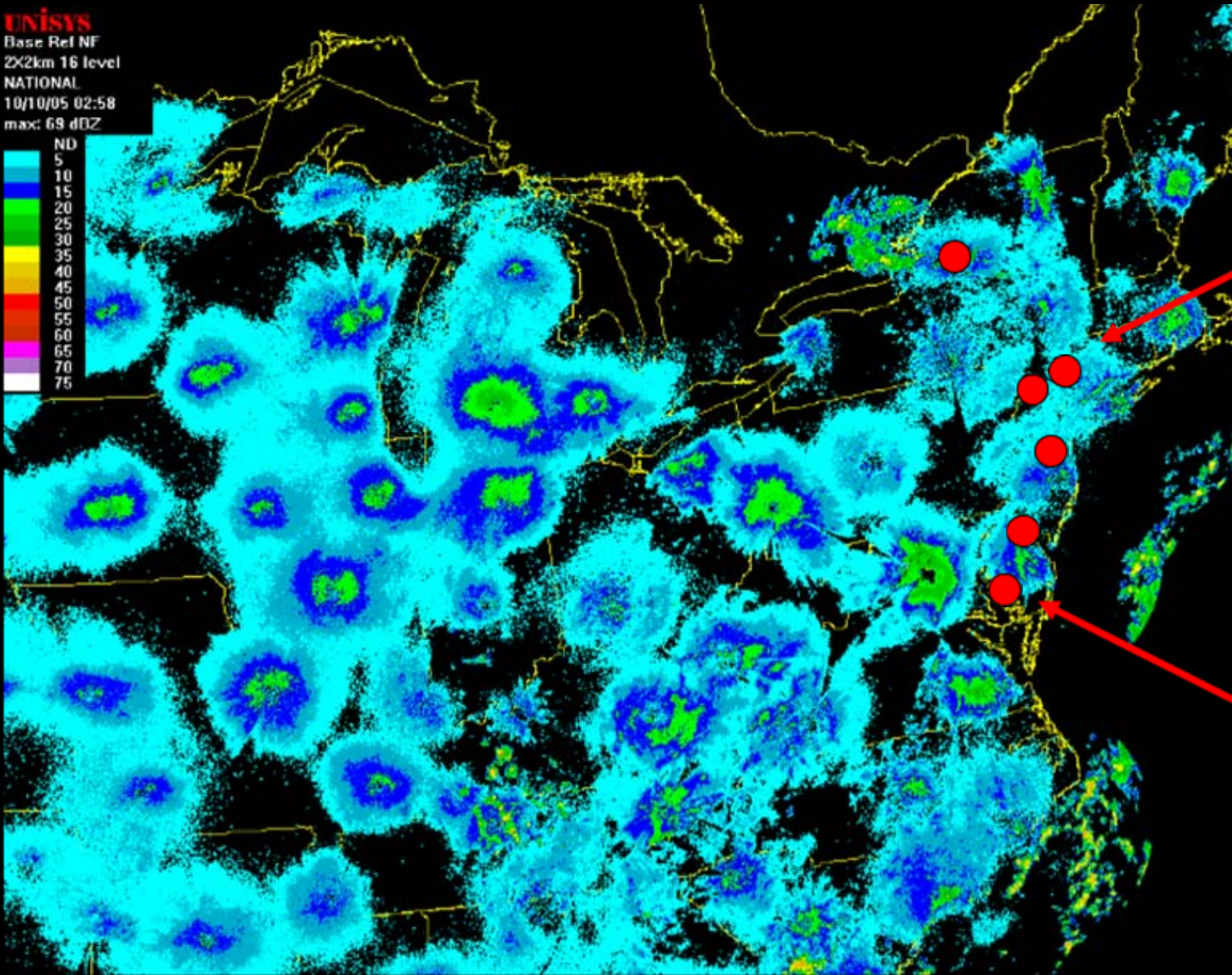


Farnsworth and Russell 2007



# Composition across time and space

UNISYS  
Base Ref NF  
2X2km 16 level  
NATIONAL  
10/10/05 02:58  
max: 69 dBZ



# Why study migrants and migration using acoustic technology?

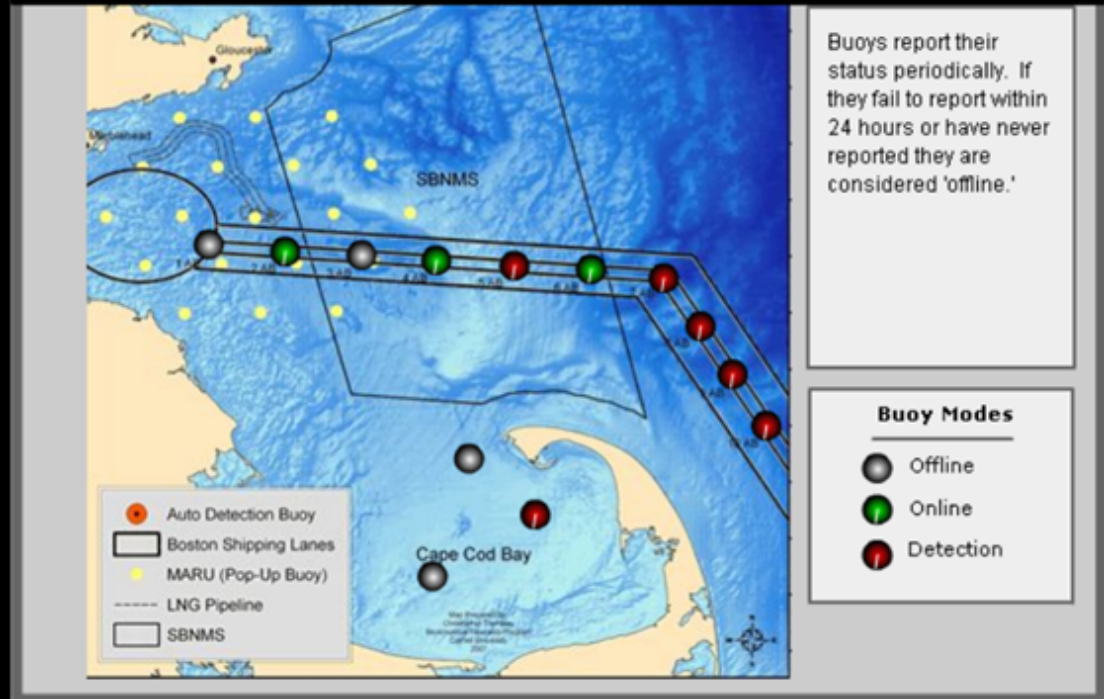
- collecting for extended periods at difficult-to-access sites;
- recording secretive species that vocalize infrequently;
- generating permanent record for repeated sampling;
- estimating variation in probabilities of detection

## Real-time Auto-detection Network: Boston Shipping Lane

### Whales Detected

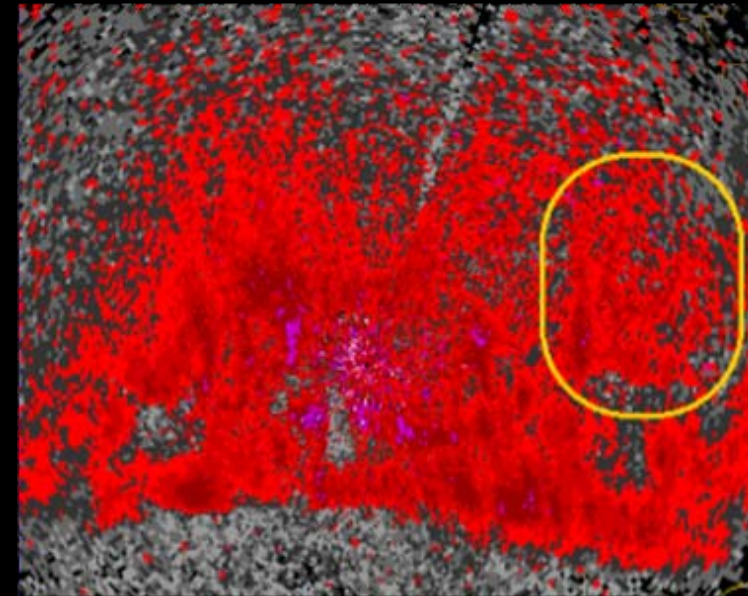
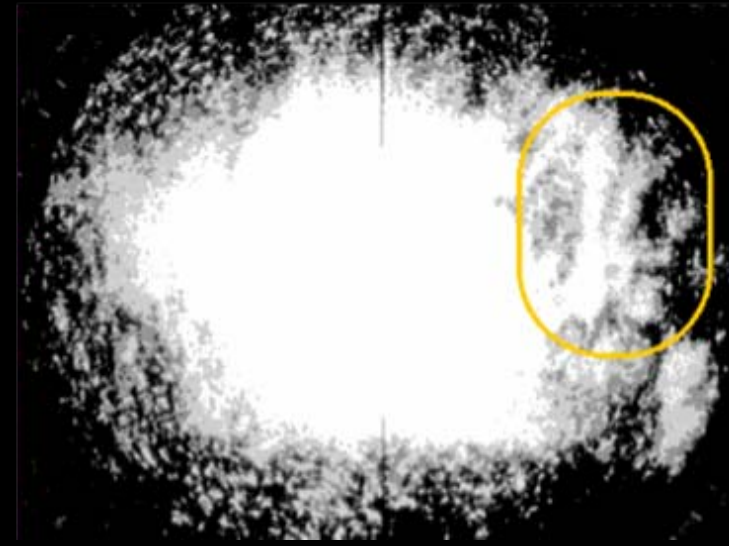
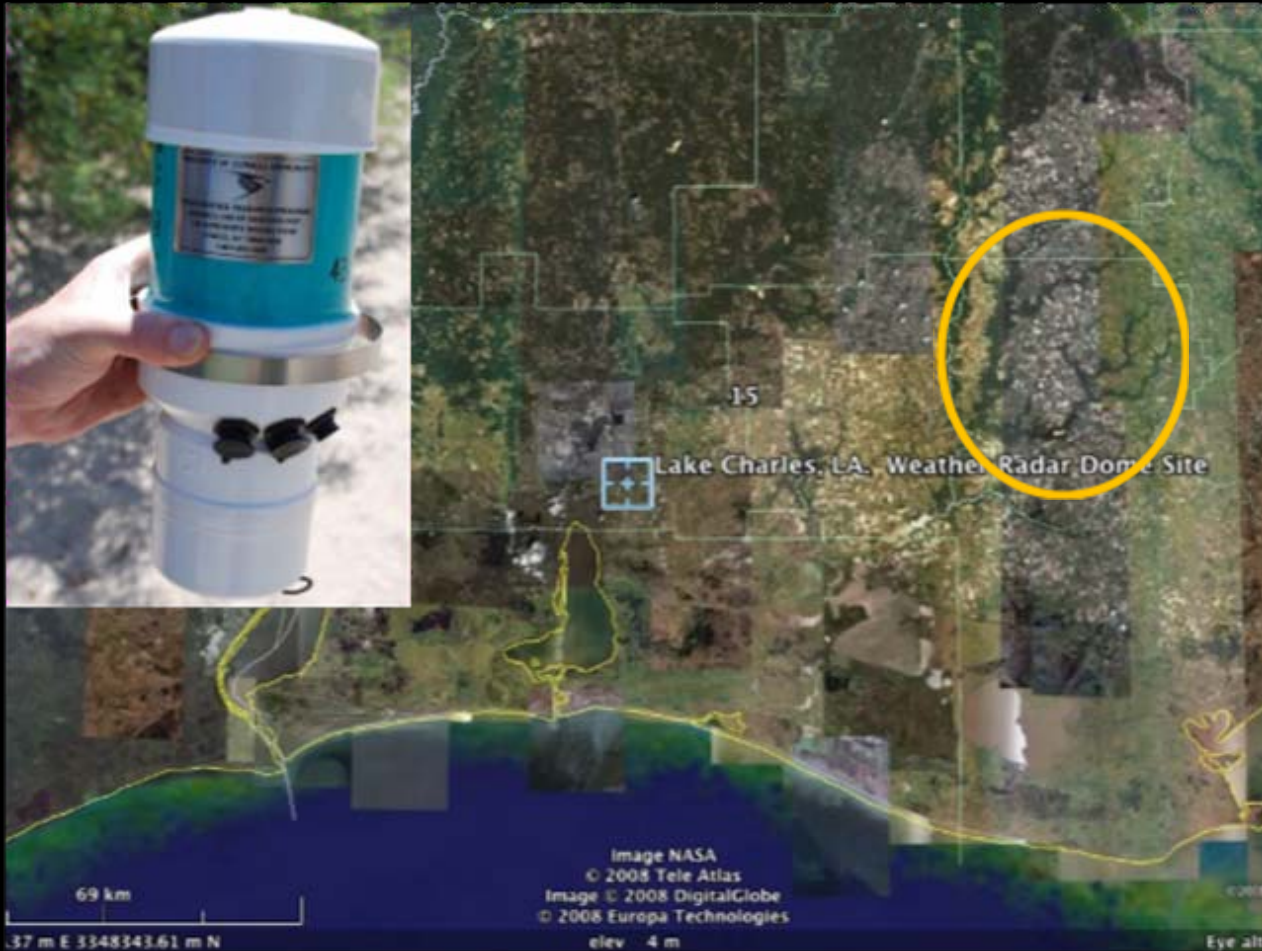
Last Whale Heard: 2008-01-30 09:08:23 GMT on Buoy DMF1

Current time: 2008-01-30 16:30:25 GMT





# 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 human activities that create new hazards





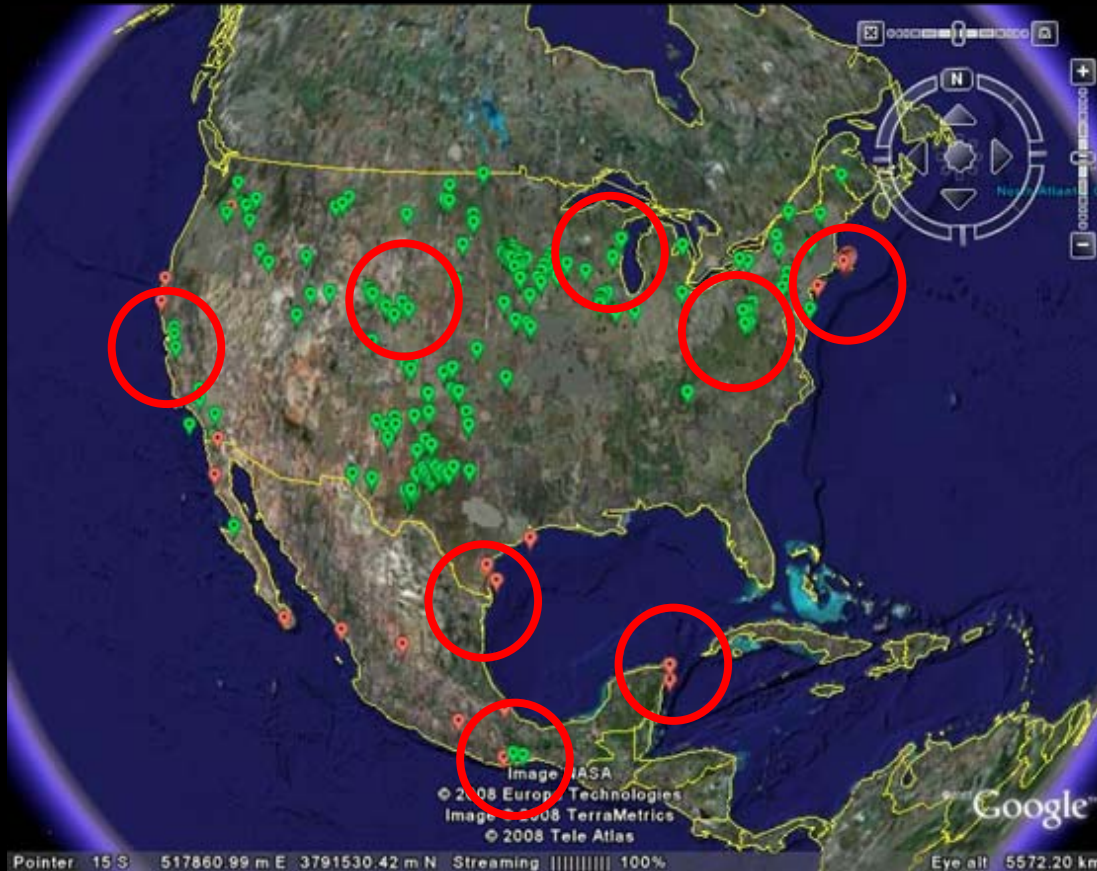
# Challenges of applying acoustic technology for monitoring migrant birds

- 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



# Wind Energy and Bird Conservation

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



# Wind Energy and Bird Conservation

- Airspace as bird habitat
- Rotor-swept area = 4 acres



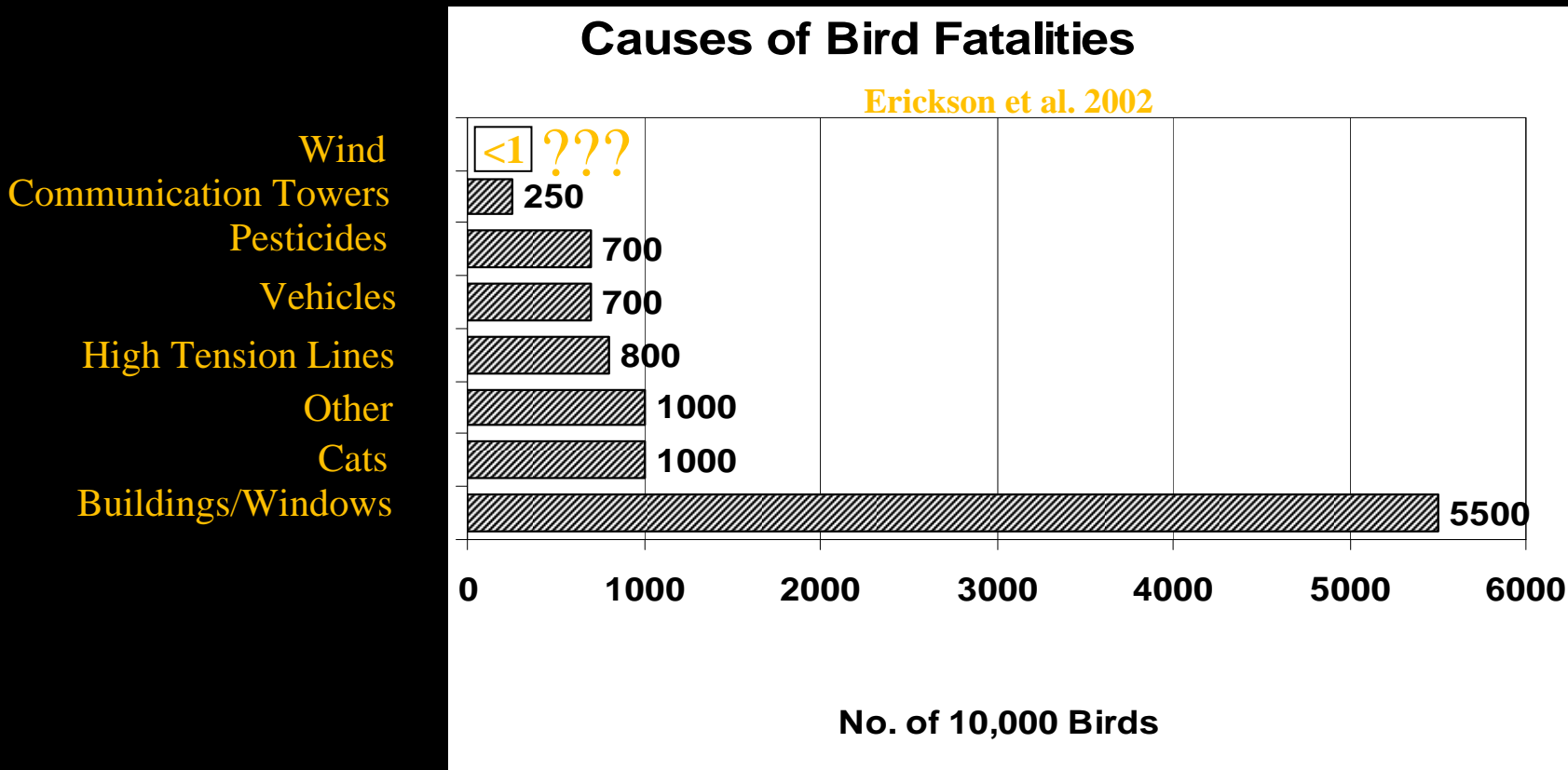
# Offshore Wind Development





# Wind Energy and Bird Conservation

“conventional wisdom”



**BUT, data from few sites with few turbines, using inconsistent methodologies**

# Wind Energy and Bird Conservation

## 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

# Wind Energy and Bird Conservation

**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”

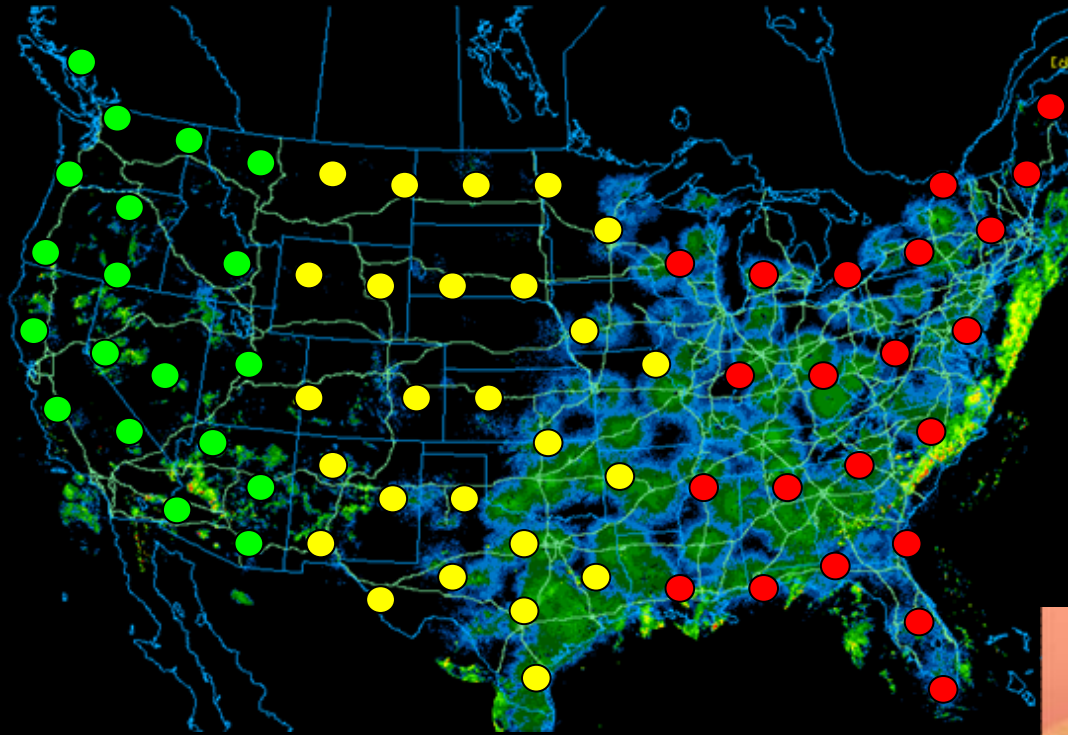


# *Future plans for conserving migrants*

Combine different monitoring technologies



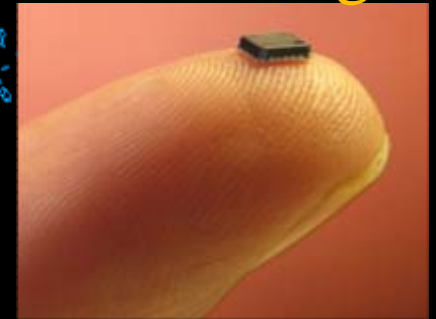
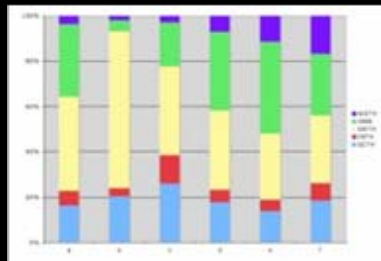
acoustics



radar

tracking

eBird



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