Detection and Perception of Sound by Eagles and Surrogate Raptors

Topic Area 1: Eagle Physiology and Behavior

Lead Organization: University of Minnesota
Principal Investigator: Jeffrey Marr

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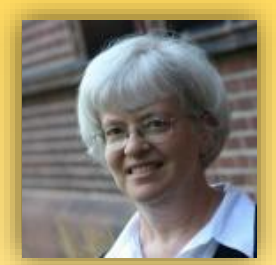
Project Team



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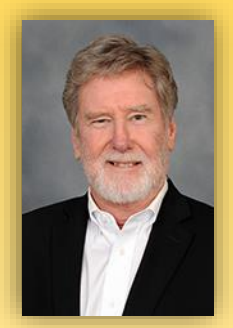

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Objectives

- Open up new opportunities for developing effective acoustic-based deterrent technologies for eagles

- Assess auditory function in bald and golden eagles
- Identify acoustic stimuli (e.g., frequencies, frequency modulations (FM) or amplitude modulations (AM)) that could be exploited to develop acoustic deterrents
- Identify vocalizations and other auditory stimuli that result in measurable behavioral responses in eagles
- Determine whether the red-tailed hawk has similar auditory characteristics such that it can be used as a surrogate
- Disseminate findings to industry

Methods

- Auditory Brainstem Response (ABR) to assess auditory function (e.g., sensitivity, input/output properties) in response to brief tone bursts and transient (e.g., click) stimulation in bald eagles, golden eagles and red-tailed hawks

- Auditory Steady State Response (ASSR) to assess auditory function in response to complex stimuli (e.g., AM and FM stimuli).

- Identify possible auditory deterrents by creating a library of recordings of eagle vocalizations at The Raptor Center

- Identify auditory stimuli that create a measurable behavioral response by installing a sound production system in the eagle rehabilitation facility at The Raptor Center and recording video of the response to different stimuli.

Surrogate Raptors

- In addition to evaluation of bald and golden eagles, auditory performance in red-tailed hawks (*Buteo jamaicensis*) will be evaluated to determine their potential value as a hearing surrogate.

- Comparison of hearing sensitivity curves will determine whether the red-tailed hawk can serve as a surrogate species for bald and golden eagles in future work.

- Red-tailed hawks are significantly easier to acquire and handle.

- Inclusion of red-tailed hawks could greatly increase the population size for the testing of deterrence technologies.

Facilities

The Raptor Center – University of Minnesota

- Part of the College of Veterinary Medicine
- Public spaces for outreach and education, as well as a lower floor dedicated to the medical care, surgical treatment and rehabilitation of wild raptors.
- The public spaces house 30 permanently injured education raptors that are used for live bird programming and environmental outreach.

- The Raptor Center has a number of different raptor enclosures including:
  - 9 indoor flight rooms for birds entering the reconditioning phase of their rehabilitation.
  - 11 outdoor flight pens, 4 of which have cameras installed for remote monitoring
- The Raptor Center has all state and federal permits necessary to work with raptors.

Facilities

Multi-Sensory Perceptional Lab– University of Minnesota

- The MSP Lab has two large sound-attenuating chambers for testing
- Specialized equipment for auditory, vision, and balance testing
- Bald eagles from The Raptor Center will be brought into one of the sound-attenuating chambers for ABR and ASSR testing.
- Results from the MSP will be compared to results from the Mobile Evoked Auditory Response Lab (MEARL) to validate the ambient sound-attenuation of the MEARL.

Facilities

Mobile Evoked Auditory Response Lab (MEARL)

- A mobile testing space that will be designed and fabricated specifically for this project
- MEARL will incorporate experience from past designs of similar spaces
- Lined with acoustic foam and electrically shielded
- Large enough to house an eagle and necessary components of the data acquisition system
- Easy to disassemble and transport to any location

Knowledge Transfer

- Industry contacts of the UMN Wind Energy Research Group will be leveraged to facilitate the transfer of project findings to stakeholders and innovators.
- A final report will be prepared summarizing all the findings of the project
- At least one peer-reviewed journal article will be submitted
- An information package will be developed and disseminated to wind industry stakeholders. This package will include:
  - 2 page fact sheet on the project
  - Power Point presentation summarizing the project
  - Poster that can be shared at professional conferences