Development of Bioacoustic Tools for Long-Term, Non-Invasive Monitoring of Threatened and Endangered Birds

Conservation
CS-1392

Background:

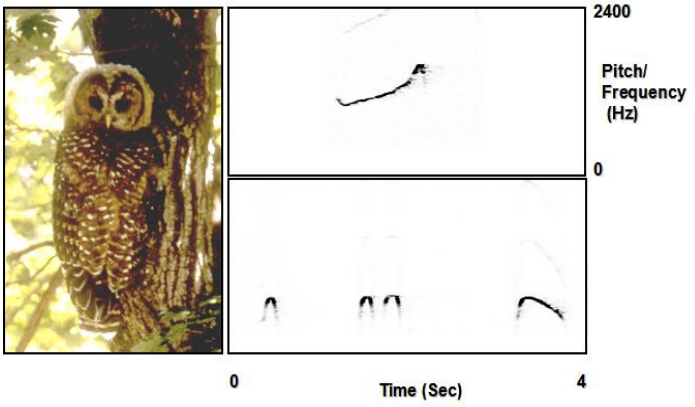
Birds that are nocturnal or live within visually obscured environments (e.g., aquatic or arboreal) depend on acoustic communication to locate mates, care for their young, maintain territories, and defend themselves from predators. Such species are inherently difficult to observe and monitor visually, but they may be studied acoustically. While acoustic surveys have been conducted for many years to obtain estimates of bird density, long-term population trends and life-history parameters could not be collected because individual identities of calling birds were unknown. However, for some species, individual recognition by voice is feasible and could be an efficient and non-invasive tool for tracking population trends. Quantitative bioacoustic techniques can determine whether individuals' vocalizations can be used to obtain individual signature information. These "acoustic fingerprints" already have been identified in several avian and mammalian species, but they have not yet been applied as a long-term censusing tool. Advances in computing hardware and signal processing have made the approach feasible. This project will apply these techniques to the Mexican Spotted Owl (*Strix occidentalis lucida*), one of the Department of Defense's priority species.

Objective:

The objective of this project is to develop quantitative bioacoustic techniques that can be used to monitor population densities and trends as well as to assess the effect of military training and other anthropogenic activities on the population dynamics of threatened and endangered birds, specifically the Mexican Spotted Owl.

Process/Technology Description:

Vocal recordings collected as part of an ongoing study led by Dr. Ann Bowles of Hubbs-Sea World Research Institute on the Mexican Spotted Owl will be used to demonstrate the effectiveness of acoustic techniques as an alternative, non-invasive, and efficient method for tracking owl movements, measuring population densities, and conducting long-term monitoring of individuals. This information ultimately will be used to obtain Mexican Spotted Owl population parameters. Recordings will be digitized, and each vocalization type will be analyzed quantitatively using sophisticated automated techniques for individual, sex, age-related, and geographical acoustic differences. Several statistical clustering techniques will be tested for use in identifying callers based on the acoustic properties of calls to assess the age-sex demographics of the population. Results from these tests will be compared to the original dataset of known call membership to validate the bioacoustic assessment algorithms.



Mexican Spotted Owl and spectrograms (pictoral representation) of vocalizations that female (top: whistle) and male (bottom: hoot series) owls make.

Expected Benefits:

This project will lead to the development of an innovative set of bioacoustic assessment tools as an alternative, cost-effective, and non-invasive method for monitoring population densities and trends in species for which vocalizations play a primary role in social communication and territory maintenance. This research also has broad implications for studying the effects of military habitat alternation on threatened and endangered wildlife health and conservation. These techniques could be used to assess the effects of noise from military activities on wildlife distribution and behavior. The tools developed from this project will allow future investigations to address important conservation questions pertaining to military training activities more comprehensively and efficiently. (Anticipated Project Completion - 2006)

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