Common Loon investigations related to Great Lakes botulism E outbreaks on Lake Michigan.

Purpose of the study

Recent die-off of loons along the Lake Michigan shoreline at Sleeping Bear Dunes National Lakeshore from botulism E outbreaks presents a unique opportunity to investigate aspects of Common Loon population ecology and contaminants levels and would provide an understanding of what portion of the loon population (i.e. age class, sex, and geographic area) is most vulnerable from botulism E outbreaks on the Great Lakes. This proposed research will contribute to a long-term investigation of the population ecology, behavior, and contaminant levels in Common Loons nesting in the North America.

Migration chronology

Very little is known about the migration chronology of common loons. Not only do adult loons depart breeding lakes before their offspring, but female adults generally leave ahead of their mates; thus the timing of botulism E outbreaks along loon flyways may be important in determining the age and/or sex class most vulnerable to this pathogen. It is interesting to note that the 136 loons examined from previous botulism E outbreaks (n=106 at Ipperwash Beach, Lake Huron 1999, and n=30 at Sleeping Bear National Lakeshore, Lake Michigan 2006) consisted of 130 adults, six sub-adults (second year birds), and zero fledged juveniles. The absence of hatch-year individuals in these die-offs was unexpected, as was the presence of second-year birds. Second year loons, have not yet acquired the definitive (breeding) plumage of their forth (or in rare cases third) calendar year, and typically remain on their oceanic wintering areas.

Sex-biased dispersal vs. sex-biased survival

Our twenty-year study of color-marked loons indicates that juvenile recruitment into natal breeding populations is heavily dominated by male birds. However, this finding has largely been based upon the close monitoring of these color-marked populations, and not upon a commensurate degree of surveying in the regions that surround them. Thus, while we believe that the dispersal mechanism in loons may involve the local recruitment of male loons into their frequently-observed natal areas and the long-distance dispersal of females into unmonitored neighboring populations, we should consider the possibility that mortality events (such as botulism E outbreaks) exert an uneven influence on the survivorship of male and female sub-adult loons.

Population origin

Breeding and wintering linkages for loon populations remain incompletely understood. Band recoveries for loons breeding in Michigan include 18 recoveries from wintering areas (Florida 11, North Carolina 5, New York 1, Georgia 1) and 7 from migration pathways (Lake Michigan 4, Lake Huron 2, Lake Erie 1). Recent advances in stable isotope techniques (such as using deuterium, the stable isotope of hydrogen) show promise for determining the geographic origins of birds, and may be applicable for loons recovered during botulism E outbreaks.

Mercury Sampling

Sampling of breeding loons for contaminants has revealed elevated mercury levels in

birds breeding on low pH lakes, reservoirs, and lakes with large wetland areas. Since we have focused our efforts on identifying those individuals most at risk to elevated mercury exposure, and our current capture and sampling technique relies largely on the successful reproduction of sampled birds, it not well understood if this non-random approach provides an accurate profile of mercury exposure across the entire population (i.e. non-breeding birds). Mortality events such as those associated with botulism E outbreaks on the Great Lakes provide an excellent opportunity to establish a broader picture of average mercury expose beyond the scope of current monitoring in selected breeding populations. Used in conjunction with stable isotopes this approach may provide the basis for further differentiating mercury burdens in loons across their North American breeding range.

Summary of proposed field methods and activities

Migration chronology & sex-biased dispersal would require the determination of age and sex for loons associated with die-off events throughout the migration period (from mid-August through late December, with the peak of migration expected in mid-to-late October). Age class can be assigned by noting (and possibly photographing) plumage characteristics, and sex can be determined by examining the sex organs through an incision in the abdominal cavity. We would recommend collection of any bird that was not clearly an adult or juvenile for closer examination. Other useful but not critical data include bill measurements and weight, both of which can easily be done in the field and may also yield important information about body condition at time of death.

Population origin. The stable isotope of hydrogen (deuterium) used to determine geographic origin in birds requires the collection of feathers that were grown at the site of interest. As adult loons often undergo body molt during migration, the isotope ratio of flight feathers – which are molted simultaneously on the wintering area prior to body molt and migration – would offer the most reliable estimation of wintering location. Determining breeding origins in adult loons may be more problematic, as post-nuptial molt in loons is variable and may occur during migration. The feathers at the base of the lower mandible are the first to be molted in the fall, often on breeding territories, and would show the most promise for pinpointing breeding region for adult birds. In juveniles, as some individuals molt throughout winter, collection of feathers for stable isotope analysis should include a flight feather (other than the second secondary use for mercury analysis).

Hg sampling would require collection of the dead loon's secondary flight feathers, breast, and belly feathers. Specifically, both second secondary feathers are clipped from the wing on the shaft below the barbs, and belly/breast feathers are pulled by hand. Feathers are stored in a sealable plastic bag. Age and sex both have an important influence on Hg levels: Juveniles (excepting those from highly acidic lakes) generally have much lower Hg levels than adults, while females typically have moderately lower Hg levels than males.