ACCESS NUMBER: 00050

STUDY TITLE: Determining Distribution & Movements of Long Tailed Ducks

REPORT TITLE: Determining nocturnal locations, breeding ground locations, and genetic structure of Long-Tailed Ducks wintering in Nantucket Sound

CONTRACT NUMBER: M09PX00050

SPONSORING OCS REGION: Gulf of Mexico

APPLICABLE PLANNING AREA(S): Outer Continental Shelf and coastal boundaries of North and Mid-Atlantic

FISCAL YEAR(S) OF PROJECT FUNDING: 2010 and 2011

COMPLETION DATE OF REPORT: September 12, 2011

COSTS: $76,340

PROJECT MANAGER(S): Dr. Taber D. Allison

AFFILIATION: Massachusetts Audubon Society

ADDRESS: 208 S. Great Road, Lincoln, MA 01773

PRINCIPAL INVESTIGATOR(S)*: Dr. Taber D. Allison

KEY WORDS: Satellite Telemetry, Offshore Wind Energy, Population Delineation, Molecular Genetics, Habitat Selection, Nantucket Sound, Cape Wind

BACKGROUND: The first offshore wind energy facility (Cape Wind) has been proposed in federal waters in Nantucket Sound of the coast of Massachusetts. The Sound is a prime location for large wintering congregations of sea ducks including Long-Tailed Duck (*Clangula hyemalis* - LTDU), a species that has experienced sharp population declines on a global scale. Potential impacts of Cape Wind on sea ducks include collision fatalities and loss of habitat due to displacement resulting from avoidance of the Cape Wind project area.

LTDUs have a circumpolar breeding distribution, but which of the possible breeding populations between arctic Alaska, Canada, Greenland, Iceland, Scandinavia, and Siberia are represented in the hundreds of thousands of ducks overwintering in the Sound? Answering this question is of general interest in understanding the ecological impact of changes in the quality of the LTDU wintering habitat of the Sound, but is specifically of interest in predicting the impact of Cape Wind on LTDU and other sea duck winter congregations. It is difficult to interpret the ecological significance of these impacts without accurate definition of the source breeding populations for LTDUs. For example, habitat quality of the wintering range may be a limiting factor for some breeding populations but not others.

In addition, LTDUs typically depart en masse (i.e., “commute”) from the Sound at dawn each day to feeding areas primarily in and around Nantucket Shoals southeast of Nantucket Island. Commuting LTDU return to the Sound at dusk to unknown nocturnal locations within the Sound, and in particular, proximity of nighttime roosting locations relative to the proposed Cape Wind site is not known.

OBJECTIVES: Our principal objective was to study the diurnal movements and commuting behavior of LTDU in the Sound and to determine the relationship of nocturnal roosting sites of commuting LTDU to the location of the proposed Cape Wind project using satellite telemetry.

A second and important objective was to delineate breeding populations of LTDU wintering in the Sound by tracking instrumented LTDU to their breeding grounds in the Arctic and sub-Arctic.

Finally, we conducted molecular genetics analyses of LTDU tissue samples and compared them with LTDU samples from other geographic locations, to determine if there was any genetic structuring of LTDU wintering in Nantucket Sound.

DESCRIPTION: The location of this study was Nantucket Sound off the coast of southern Massachusetts and adjacent to Martha’s Vineyard and Nantucket Island. We captured and surgically inserted satellite transmitters in 32 LTDU over a 3-year period between late fall 2007 and late fall 2009. Satellite transmitters were programmed to provide a location, or “fix” every 48 hours during the winter months, and every four days after mid-April. Location data were obtained from the Argos web site on a weekly basis; only locations with a margin of error less than 1000 m were saved and mapped.

In late fall 2009 we extracted genomic DNA from 42 blood and feather samples collected in Nantucket Sound, as well as from 34 tissue samples provided by the University of Washington Burke Museum from birds collected in Russia, Alaska, Nunavut, and New York. We analyzed mtDNA sequence data and sequence data from a panel of nine nuclear HapSTR loci to test for genetic differentiation between eastern and western wintering congregations of LTDU.

SIGNIFICANT CONCLUSIONS: Hundreds of nighttime satellite fixes were provided over three years, and none were located on within the Cape Wind project area. Breeding areas were consistently located in a relatively narrow region around the northern half of Hudson’s Bay, Canada. All instrumented ducks traveled to breeding areas along the eastern seaboard of the United States, and through the Gulf of St. Lawrence.

Preliminary analyses suggest little or no genetic structuring of long-tailed duck populations. Sampled birds shared a high level of both mitochondrial and nuclear genetic diversity, likely reflecting historically large effective population sizes and ongoing gene flow among populations.

STUDY RESULTS: Of the 32 instrumented ducks, 19 ducks transmitted locations for one month or more. Fifteen ducks made it to or near possible breeding locations, and

six ducks returned to Nantucket Sound and transmitted location signals for all or a portion of a second winter before apparent battery failure. Early in the study, there was high mortality of instrumented ducks, some of which we determined to be the result of predation by gulls of ducks shortly after instrumented ducks were released. Changes in release location reduced this predation essentially to zero.

Ducks tended to depart Nantucket Sound in the second to third week of April, spend 3-6 weeks in their "stopover" location in the Gulf of St. Lawrence, and arrive in apparent breeding locations in mid-June. LTDUs depart from their breeding grounds in late September and arrive at their Nantucket Sound wintering grounds in November.

The majority of apparent breeding locations were primarily in the Canadian province of Nunavut and Quebec near the coast along Hudson Bay, but some were up to 400 km from the Hudson Bay Coast or further north on the cluster of large islands bordering the Beaufort Sea and Baffin Bay (Figure 1). No detailed analysis of habitat use or gender differences in location has been attempted yet.

None of the instrumented ducks were recorded roosting at any time on the Cape Wind project area. Because the transmitters do not operate continuously, we can't eliminate the possibility that the instrumented ducks were on Horseshoe Shoal at times when the transmitters were in the "off" portion of the winter season duty cycle. Many ducks demonstrated the pattern of diurnal migration often observed by observers on Nantucket Island, but ducks do not make this journey every day. Some ducks appeared not to migrate but stay in one location both day and night for most of the winter. Other ducks occasionally spent the night on Nantucket Shoals, not returning to the Sound at night. Results suggest that instrumented LTDUs used a broad area of the Sound for nighttime roosting sites, and that the roosting locations changed, i.e., one site was not consistently used, even by individual ducks.

Mitochondrial control region sequences were obtained for 77 individuals, including 41 from Nantucket Sound. There were 68 unique haplotypes, only seven of which were shared by more than one individual bird. The mitochondrial tree reveals little or no phylogeographic structure. Birds from different regions are thoroughly mixed together in the tree and identical or closely related haplotypes are found in different regions. The nine HapSTR loci produced 155 SNPs, 92 of which were found in more than one individual, and a large number of alleles were recorded at each locus. The program STRUCTURE revealed no evidence of genetic structure among geographic regions, and did not group geographically clustered samples as genetic populations under any value of *k*.

STUDY PRODUCT(S): Allison, T.D., S. Perkins, K. F. Stryjewski and M. D. Sorenson. 2011. Determining Nocturnal Locations, Breeding Ground Locations, and Genetic Structure of Long-Tailed Ducks Wintering in Nantucket Sound. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Herndon VA. 21 pp.

---

* P.I.'s affiliation may be different than that listed for Project Manager(s).