

Atlantic and Great Lakes Sea Duck Migration Study

Background and Study Plan

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(for most current version of Study Plan, go to http://seaduckjv.org/atlantic_migration_study.html)

Summary

The Sea Duck Joint Venture (SDJV) was formed in 2001 to address concerns about declines in sea duck populations and the paucity of information about their basic life history and limiting factors. An understanding of the links among breeding, wintering, staging, and molting areas is essential to understanding sea duck declines and limiting factors, and evaluating potential impacts from development, harvest, and climate change.

In addition to the basic needs for information on migration patterns and habitats used, demands for alternative energy are increasing and offshore wind projects are slated or proposed for several areas used by sea ducks in coastal areas of the Atlantic flyway and in the Great Lakes. Thus, there is an immediate need to identify the most important habitats and patterns of use for sea ducks prior to placement of turbines to minimize potential adverse effects on sea ducks and their habitats.

The SDJV and partners have embarked on a large scale, multi-year, collaborative project that will use satellite telemetry to document annual migration patterns, and to assess risk to sea ducks in specific areas in eastern North America where offshore wind projects are planned. Target species include black scoter, surf scoter, white-winged scoter, and long-tailed duck.

The SDJV has made this project its highest priority and is committing substantial resources for 2009-2013. In 2010, 48 black scoters were marked in New Brunswick/Quebec, and more than 30 long-tailed ducks were marked from Massachusetts to Maryland. Migration maps for these and previously marked birds, as well as summary reports, are available at <http://seaduckjv.org> . For 2011, the SDJV has proposed capturing and marking up to 78 surf scoter, white-winged scoter, and long-tailed duck wintering along on the Atlantic coast and in Lake Ontario. SDJV funding for FY2011 is about \$203,000, with at least that amount in matching contributions. Additional partners and funding are needed in 2011 and 2012 to ensure the project is executed at the appropriate scale and magnitude to meet objectives.

A web page has been established for the project at http://seaduckjv.org/atlantic_migration_study.html that includes tracking maps, a description of the project and trapping techniques, standard operating protocols, and study plan.

Introduction

The SDJV is a conservation partnership under the auspices of the North American Waterfowl Management Plan. The partnership was formed in 2001 to address concerns about declines in sea duck populations and the paucity of information about their basic life history and limiting factors. The SDJV mission is to improve our knowledge of sea ducks to better conserve and reverse population declines. SDJV partners include federal, state, provincial, academic, and NGO partners in the U.S. and Canada. The program is administered and coordinated through the U.S. Fish and Wildlife Service. The SDJV provides seed money for research and monitoring, coordination services, education and outreach (see www.seaduckjv.org), and sponsors an international sea duck conference every three years to facilitate information exchange among researchers and managers. An implementation plan was first developed

in 2010 (Sea Duck Joint Venture 2010) and will be revised annually to reflect progress toward addressing priorities, as well as emerging issues.

An understanding of the links among breeding, wintering, staging, and molting areas is essential to understanding sea duck declines and limiting factors. SDJV partners have a history of successful investigations of the type proposed here, yet there remain many information gaps, most notably in the Atlantic flyway. Previous studies in the Pacific flyway have documented large scale movements and characterized habitat use for sea ducks in coastal and offshore habitats (De La Cruz et al. 2009). This information has necessitated redrawing distribution maps for a few species and has even documented strong links beyond the borders of North America (e.g., Russia, Korea). We anticipate similar success in the Atlantic flyway.

Justification and Need

More than half of North American sea duck populations have apparently declined over the past 2-3 decades, although reasons for declines are unknown. Population delineation (i.e., the links among breeding, molting, wintering, and staging areas) is critical information needed to design and interpret monitoring surveys, to better understand population ecology and dynamics, and determine limiting factors and potential strategies to improve conservation status of sea ducks. Extensive satellite telemetry studies have been done on several sea duck species on the Pacific coast, but relatively little is known about population delineation for sea ducks in eastern North America, most notably for surf scoter, black scoter, white-winged scoter, and long-tailed duck (Mallory et al. 2006) – all of which are species of particular conservation concern (Sea Duck Joint Venture 2010). Sea ducks are one of the primary wildlife species utilizing coastal habitats in the Atlantic flyway during migration and winter, and can serve as good indicators of environmental health.

Monitoring efforts are especially dependent on being able to put target species into some kind of spatial perspective (e.g., geographic scale, connectivity) and temporal perspective (e.g., timing of spring and fall migration). Not only is delineation needed to define demographic units to be assessed, it is critical to the identification of factors limiting specific populations (e.g. harvest levels, amount or quality of habitat, pollution, etc.).

Traditionally, waterfowl populations have been delineated using large scale banding programs. Such programs can be very informative as they provide estimates of demographic rates (e.g., survival and harvest rates) and affiliations between banding and harvest areas. However, effective banding programs require long-term investments and representative coverage across the target population's range. There have been few effective banding programs for most North American sea duck populations due to the difficulty of capturing these birds in remote locations and therefore little information exists on population demography or affiliations.

The most promising and practical approaches for defining demographic units include satellite telemetry, stable isotope, and genetic techniques. Satellite telemetry has been the primary tool used to identify breeding ranges, migration routes, molting and wintering areas, and timing of bird movements among these areas. The constraints of this approach are the high costs and the limited sample sizes. However, when the cost of satellite telemetry is compared to other scientific approaches in remote northern locations, it is actually an efficient way to generate very detailed information, including specific movement and location data that cannot be obtained in any other way. Technological advances now allow for extended life of transmitters enabling researchers to track birds for more than one annual cycle and to potentially describe annual variability in habitat use patterns and document the extent of site fidelity.



Another compelling reason for a study of this nature is the growing demand for alternative energy, specifically offshore wind power. Offshore wind farms are currently proposed for Nantucket Sound (now approved), coastal areas of Maine, Delaware and Rhode Island, and the north shore of Lake Ontario, all of which harbor significant sea duck populations. It is critical to identify the most important habitats for sea ducks prior to construction of turbines because their placement may impact the habitats where they are placed and thus the wildlife species utilizing these habitats. For example, in Europe, offshore wind farms have been in use for years and researchers have demonstrated significant avoidance of wind farms by sea ducks. Because wind farms are usually situated on shallow-water shelves that harbor rich benthic communities (i.e., sea duck food), avoidance equates to loss of sea duck foraging habitat and possibly reduction in fitness of individuals. It will be important to consider the cumulative effects of numerous offshore wind farms placed throughout the Atlantic coast and Great Lakes.

What remains unknown relative to proposed wind farms is the local distribution and movements of sea ducks within these coastal areas during migration and winter, as well as the numbers of birds and species composition – information that would enable managers and developers to make informed decisions about site placement of wind farms that would minimize impacts to sea ducks.

The SDJV is advocating a large-scale, multi-year, coordinated satellite tracking program for sea ducks in the Atlantic flyway, including the Great Lakes, that will address information needs for both population delineation and monitoring, and provide information on habitat use to inform conservation planning. This broad scale, coordinated approach is not unprecedented – a similar effort and partnership was used to delineate the population of black scoter in the Pacific, which resulted in an understanding of links among different geographic areas and life stages, as well as an appropriately timed and geographically correct breeding ground survey.



Primary Objectives

- Fully describe the annual migration patterns for four species of sea ducks (surf scoter, black scoter, white-winged scoter, long-tailed duck) in the Atlantic flyway and Great Lakes by 2014.
- Map local movements and estimate length-of-stay during winter for individual radio-marked ducks in areas proposed for placement of wind turbines (e.g., Maine-Penobscot Bay, Nantucket Sound, and coastal Rhode Island).
- Identify near- and offshore areas of high significance to sea ducks to help inform habitat conservation efforts.
- Estimate rates of annual site fidelity to wintering areas, breeding areas, and molting areas for all four focal species in the Atlantic flyway.

Secondary Objectives and Benefits

1. Provide timely information to facilitate design and interpretation of monitoring surveys, particularly those currently under development. Information would include:
 - a. Timing of movements throughout annual cycle, especially during the survey “window” for various ongoing or proposed surveys (e.g., Atlantic Coast Winter Sea Duck Survey, scoter breeding and molting surveys, migration counts at Point Lepreau NB and Avalon NJ)
 - b. Identification of key habitat areas and length-of-stay data for sea ducks at known high use staging, molting, and wintering areas such as Chesapeake Bay, Delaware Bay, Nantucket Sound, James Bay, St. Lawrence estuary and gulf, and the Great Lakes.
 - c. Inter-annual site fidelity to specific breeding, molting and wintering sites.
 - d. Determination or validation of the outer offshore survey boundary and north-south delimiters for the Atlantic Coast Winter Sea Duck Survey currently under development.
2. Realize efficiencies due to quantity discounts on transmitters, reduction in travel and logistical expenses (i.e., one big project is more efficient than several smaller projects), and capitalize on related projects currently underway (e.g., offshore wind farm assessments) that can provide staff and logistical support.
3. Provide defensible data on habitat use at scales that will be useful for evaluating risk to sea ducks from proposed offshore energy projects.

Methodology

We will focus the study on four high priority sea duck species in the Atlantic flyway: black scoter, surf scoter, white-winged scoter, and long-tailed duck. In the Great Lakes, we will focus on at least one high priority species, long-tailed duck, and possibly white-winged scoter if adequate numbers are detected in accessible locations during surveys and trapping efforts in winter.

We will capture and mark with PTTs a representative and adequate sample to ensure that effective sample sizes are achieved for each species. By *representative sample*, we mean that each species will be sampled throughout its wintering or molting range (in approximate proportion to relative flyway abundance), or at “bottleneck” sites where the bulk the of the Atlantic flyway population passes during spring migration. By *adequate sample*, we mean at least 30 birds that survive post-surgery and provide information for at least one full year. A sample size of 30 is consistent with that recommended by Lindberg and Walker (2007) for satellite telemetry studies. To achieve that target sample size, we assume there will be 25% post-marking mortality and/or radio failure, thus we will strive to mark at least 40 birds per species over a 2-3 year period. Sample sizes for Great Lakes deployments would be in addition to Atlantic coast deployments (i.e., 40 additional long-tailed ducks and up to 40 additional white-winged scoters, if feasible).

Birds will be captured using whatever technique works for that species in that particular area. This may involve over-water mist nets, net-gunning from a boat, night-lighting, gill-netting, or drive trapping of

molting birds (http://seaduckjv.org/catch/to_catch_a_sea_duck.pdf) . Highest priority for marking is on adult females, and then on adult males, which are the most important cohorts for understanding population dynamics. SDJV resources will not be used to mark young (hatch-year) ducks because they are unlikely to breed within one or more years and therefore contribute little to our understanding of population delineation.

Age will be determined based on bursa depth, plumage characteristics, or both. For this study (versus for banding reports), age designations will be as follows: Hatch Year = less than 12 months old and bursa depth >15mm with immature plumage (e.g., light belly and notched tail feathers); Second Year = 12-24 months old and bursa depth >15mm; After Second Year = >24 months old and bursa depth <5mm or absent (Mather and Esler 1999, Peterson and Ellarson 1978, Hochbaum 1942). After Hatch Year designation would be used to describe a bird that is >1 year old, but for which more definitive age determination was not possible.

PTTs will be surgically implanted in the abdominal cavity of each duck by a qualified veterinarian following the technique described by Korschgen et al. (1996). We will use 38-42g PTTs with a battery life of approximately 800 hours for scoters, and 26-28 g PTTs with a battery life of approximately 400 h for long-tailed ducks to alleviate concerns about potential adverse physiological effects of large transmitters in small ducks (M. Perry, pers. comm.). All transmitters will be wrapped in a sterile mesh that promotes adhesion to the body wall, and provides additional anchoring points to stabilize the PTT within the bird (Fig. 1). The smaller PTTs that will be deployed in long-tailed ducks will be pressure-proofed to prevent crushing if ducks dive to great depth (>50 feet; long-tailed ducks are known to dive deeper than other sea ducks). Radio-tagged birds will be held in captivity for several hours post-surgery, hydrated subdermally, tube-fed a formulated elemental diet (Olsen et al. 2010), then released at the capture site.

All PTTs will be programmed with duty cycles that represent a compromise between PTT longevity and frequency of location data. For both the 26 g and 38-42 g transmitters, the duty cycle will be 4 hrs ON and 72 hrs OFF (i.e., one location every 3 days). This should allow PTTs to last at least one year, and possibly two years for the larger units. PTTs that last at least one, and ideally two, full annual cycles will enable an analysis of annual variation in timing of migration, habitat use, and site fidelity. The single duty cycle also enables “trading” PTTs among project elements as necessary to capitalize on opportunities to mark additional birds. Exceptions to these duty cycles will be made for partners with studies that require other duty cycles to meet specific local objectives (e.g., daily movements during winter to evaluate potential conflicts with proposed offshore wind projects). All partners will have an appropriately-tuned VHF receiver (401 MHz) that will enable testing of PTTs prior to implantation in ducks, and facilitate retrieval of PTTs from dead birds.

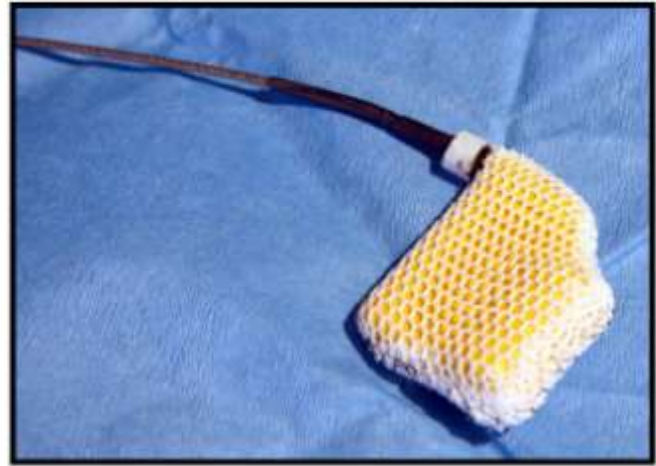


Figure 1. Implantable PTTs for use in sea ducks. 38-42 g type (left) and 26 g type with mesh (above).

Feather and blood samples will be obtained from all captured ducks and archived for genetic (see sampling protocol, Appendix A), stable isotope (see sampling protocol, Appendix B) and contaminant and disease screening (see sampling protocol, Appendix C). All SOPs can be accessed at http://seaduckjv.org/atlantic_migration_study.html. Most of these analyses are currently outside the scope of this study, but samples would be archived and made available for future analyses.

PTT Deployment schedule

The deployments will involve both new efforts as well as augmentation of several studies already planned in 2009- 2012. Existing or planned projects include:

1. Black scoters staging during spring in New Brunswick at Baie Chaleur (spring 2009 and 2010). This area represents a “bottleneck” for migrating black scoters throughout eastern North America. Canadian Wildlife Service, Atlantic region, with support from SDJV, marked about 70 black scoters during spring 2009 and 2010. The project built on marking efforts from previous years.
2. White-winged scoters molting in Quebec in the St. Lawrence estuary (summer 2010): Canadian Wildlife Service, Quebec region, marked 19 molting white-winged scoters in late summer 2010. These represent the first white-winged scoters marked with PTTs in eastern North America.
3. Long-tailed ducks wintering in Nantucket Sound, Cape Cod, and Chesapeake Bay (winter 2010): A joint project between Massachusetts Audubon, USGS, and SDJV that built on marking efforts in previous years. Nantucket Sound is the most important wintering areas

for long-tailed ducks on the Atlantic coast. In winter 2010, about 30 long-tailed ducks were marked in these three areas, mostly in Nantucket.

4. RI Department of Environmental Management and University of Rhode Island are preparing to deploy 20 PTTs in surf scoters during the fall 2010 to investigate movement patterns, migration, staging and breeding areas in conjunction with a study of the potential effects of offshore wind projects on sea ducks. A graduate student is in place for 2010 to help coordinate this element of the project.

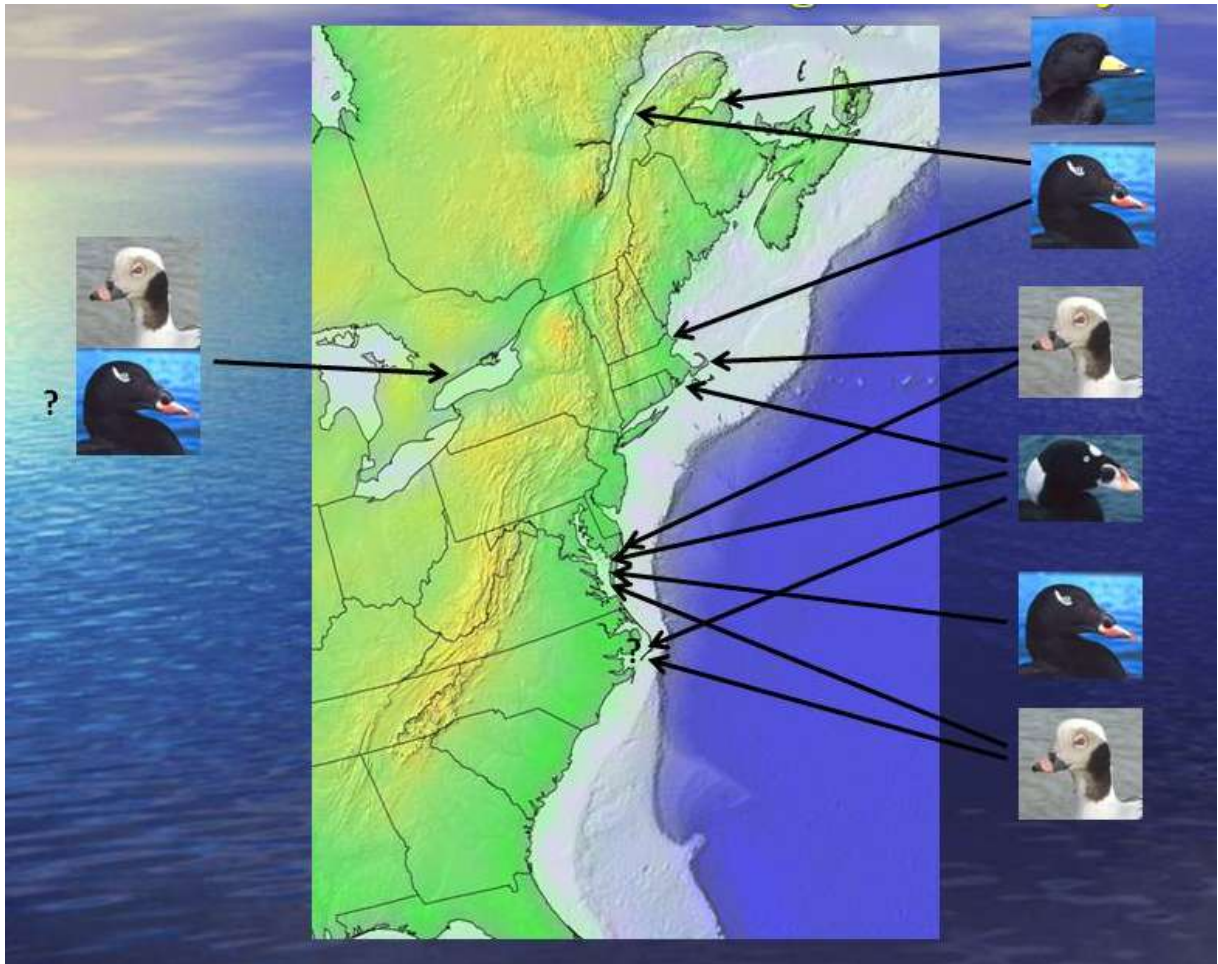


Figure 2. Proposed marking locations for sea ducks in the Atlantic and Great Lakes region.

Table 2. Tentative PTT Deployment Schedule for 2010-2012						Primary responsibility for project
Species and Location	Life stage / season	# PTTs previously deployed through SDJV-funded and independent partner projects	# additional PTT deployments			
			2010	2011	2012	
Black Scoter – Restigouche River, New Brunswick	Spring staging; early May	43	47 (completed May 2010)			
Long-tailed Duck – Nantucket Sound	Winter; November	10 ?	10 (completed Dec 2009)			
Long-tailed Duck – Cape Cod	Winter; Feb/ March	10	18 (completed Mar 2010)			
Long-tailed Duck – Chesapeake Bay	Winter; Feb/ March	0	2 (completed Mar 2010)	10	?	Alicia Berlin, Matt Perry
Long-tailed Duck – one wintering area in Maritimes or Maine	Winter; Dec -March	0			?	If feasible, Scott Gilliland
Long-tailed Duck – one wintering in south Atlantic coast	Winter; Dec -March				15	Currently unknown – Jay to contact flyway folks
Long-tailed Duck – Great Lakes	Winter; Feb -March	4		20	20	Shannon Badzinski
White-winged Scoter – St Lawrence estuary	Molting; August	0	19 (completed August 2010)			Jean-Pierre Savard, Christine Lepage
White-winged Scoter – Chesapeake Bay	Winter; Dec -March	0		?*	?	If feasible, Alicia Berlin, Matt Perry
White-winged Scoter – Great Lakes (if feasible based on 2010 reconnaissance)	Winter; Dec -March	0			20	Shawn Meyer
White-winged Scoter – Parker River NWR, Massachusetts	Winter; Dec -Jan			10*	10?	Lucas Savoy
White-winged Scoter – one other wintering site on Atlantic coast	Winter; Dec -March				10	Currently unknown
Surf Scoter – Chesapeake Bay	Winter; Dec -March	11?		10*	?	Alicia Berlin, Matt Perry
Surf Scoter – Rhode Island	Winter; Nov - Jan	0		20*	10?	Jay Osentowski
Surf Scoter – one other wintering or spring staging area on Atlantic coast	Winter/spring Dec -May				10-20	Currently unknown

- An additional eight PTTs are available for deployment in scoters on an opportunistic basis at any of the locations denoted with (*) ; 1st priority would be for WWSC, 2nd priority for SUSC.

Complementary studies to improve post-operative care and husbandry techniques

As indicated in the SDJV Strategic Plan, there are ongoing questions about the effects of implanted satellite transmitters on behavior, reproduction, and survival. We will use opportunities provided by the Atlantic and Great Lakes Sea Duck Migration Study to learn more about the physiologic effects of capture, surgical implantation, and post-operative care including tube-feeding (gavage) an elemental diet and determining optimal time for re-alignment and cleaning of plumage after surgery (Olsen et al. 2010). The expectation is that data from this and related studies will aid in the refinement of post-operative management techniques for field surgeries, which should help us improve post-implantation survival rates and decrease behavioral and reproductive bias induced by surgery. Initial investigations on post-surgical care techniques were accomplished in conjunction with long-tailed duck captures at Cape Cod in March 2010; a final report will be posted at <http://seaduckjv.org/ssna.html> (Project #128).

Products/Outreach

Products:

All data will be downloaded from Argos server and uploaded into two archival, web-based programs, www.wildlifetracking.org (a service of seaturtle.org that uses STAT as a mapping tool) and Movebank (www.movebank.org). A copy of all raw Argos files will also be archived on the network at USGS Patuxent Wildlife Research Center.

Data will be filtered to remove any inappropriate erroneous data points, and maps will be produced by STAT, the analysis tool used by seaturtle.org (www.wildlifetracking.org), and by custom analyses to portray seasonal summary maps and produce mapping products for specific purposes. Maps will be updated daily on www.wildlifetracking.org to enable quick views of bird movements.

A project web page has been created on the SDJV website, http://seaduckjv.org/atlantic_migration_study.html. The web page includes links to maps for all species and all elements of this study. The site also contains important information for partners, including the most updated study plan, SOPs, equipment lists, generic data recording forms, trapping techniques, and project task lists. The site will also eventually include video clips from various projects so the public can view the capture techniques and post-capture processing for birds captured as part of this project.

Annual reports summarizing the status and habitat use for each species will be submitted to the SDJV by individual PIs, and consolidated into an overall cohesive and comprehensive annual project report, with consistent mapping products, by the USGS data manager/contractor. Final reports, scientific publications, and possibly a monograph will be published as well as reports and publications by each individual principal investigator at their discretion.

Currently, two graduate students are involved in this study: Pam Loring (University of Rhode Island), and Phillip Wilson (University of Western Ontario).

Outreach:

Several programs will be implemented to enhance the outreach of this project to interested partners and the public. First, through the STAT program, partners and interested individuals will have the opportunity to participate in an *Adopt-an-Animal* program for individuals to follow adopted sea ducks along their migration. This feature is administered through seaturtle.org and all proceeds will go to the maintenance and expansion of the STAT program, which provides a valuable mapping and analysis tool to this project at no cost.

For educators and students we will incorporate telemetry data into the *Signals of Spring* program, a curriculum based middle and high school classroom program designed to increase student performance in science. Students use current Earth image data to explain the movement of animals tracked by satellites ([http://www.signalsofspring.net/](http://www.signalsofpring.net/)).

Other outreach products targeting specific audiences (e.g., habitat conservation community, wind energy-related groups and agencies) will be produced and distributed on an as-needed basis and will also be posted on the project web page.

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Partner Responsibilities

Project Task	Lead(s) and Affiliation	Timetable/Deadlines
Overall coordination and tracking of entire project	Tim Bowman, USFWS	ongoing
Purchasing of transmitters and liaison with transmitter manufacturer	individual PIs as appropriate	ongoing
Principal Investigator for PTT deployment in BLSC in New Brunswick and Quebec	Scott Gilliland, CWS	May 2010 (completed)
Principal Investigators for PTT deployment in LTDU in Nantucket Sound / Shoals	Taber Allison, Mass Audubon Matt Perry, USGS	Nov2009 Mar2010 (completed)
Principal Investigator for PTT deployment in LTDU in Great Lakes	Shannon Badzinski, CWS	Jan-March 2011
Principal Investigator for PTT deployment in molting WWSC in Quebec	Jean-Pierre Savard, CWS	Aug 2010 (completed)
Principal Investigator for PTT deployment in wintering WWSC at Parker River NWR, Mass.	Lucas Savoy, BioDiversity Research Institute, Maine.	December 2010 to March 2011
Principal Investigator for PTT deployment in LTDU and SUCS in Chesapeake Bay	Matt Perry and Alicia Berlin, USGS	Mar-Apr 2010 Feb-Apr 2011
Principal Investigators for PTT deployment in SUCS in Rhode Island	Jay Osenkowski, RI DNR Scott McWilliams, URI	Dec 2010 to Mar 2011
Investigate post-surgical operative care and husbandry techniques	Scott Ford, Avian Specialty Veterinary Services of Alaska	Initial work planned for winter 2009-2010; final report by 28 September 2010
Upload Argos data to a central repository and mapping and analysis tools, such as <i>Movebank</i> or <i>Wildlifetracking.org</i>	Alicia Berlin, USGS	On a once-weekly basis beginning Mar 2010
Archival of raw data at USGS Patuxent	Alicia Berlin, USGS	ongoing
Annual synthesis and analysis of all telemetry data including summary maps and annual report	Alicia Berlin, USGS (summary maps); annual narratives by respective PIs	Annual report due 29 September each year
Manuscript preparation and publication of results from specific elements (sites)	Individual PIs; co-authorship to be determined	ongoing
Manuscript preparation and publication of cumulative results from this study	Alicia Berlin, USGS Co-authorship to be determined	Probably about winter 2014 after all deployed PTTs have ceased transmissions.
Communicating results with various partners and other interested parties (e.g., Atlantic flyway, habitat joint ventures, Atlantic Marine Bird	Various	At regular annual meetings and opportunistically

Cooperative, NSST, etc.)		
Include Atlantic Sea Duck Study results in <i>Signals of Spring</i> curriculum	NASA initiative; Alicia Berlin, USGS to coordinate re: data needs	By March 2011
Coordination and development of outreach activities associated with the project to ensure consistent messages and accuracy of information	Debra Reynolds, USFWS Region 5	ongoing

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Potential Partners and Contacts:

(to request addition or edits to this list, please send an email to tim_bowman@fws.gov)

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