4th INTERNATIONAL SEA DUCK CONFERENCE
SEWARD, ALASKA
SEPTEMBER 12-16, 2011

ABSTRACTS

www.seaduckconference.com

Organizing Committee

SPONSORS

COMMON EIDER LEVEL

USGS Alaska Science Center

Environment Canada

Environnement Canada

SCALY-SIDED MERGANSER LEVEL

National

USGS Western Ecological Research Center

Migratory Bird Management and National Office

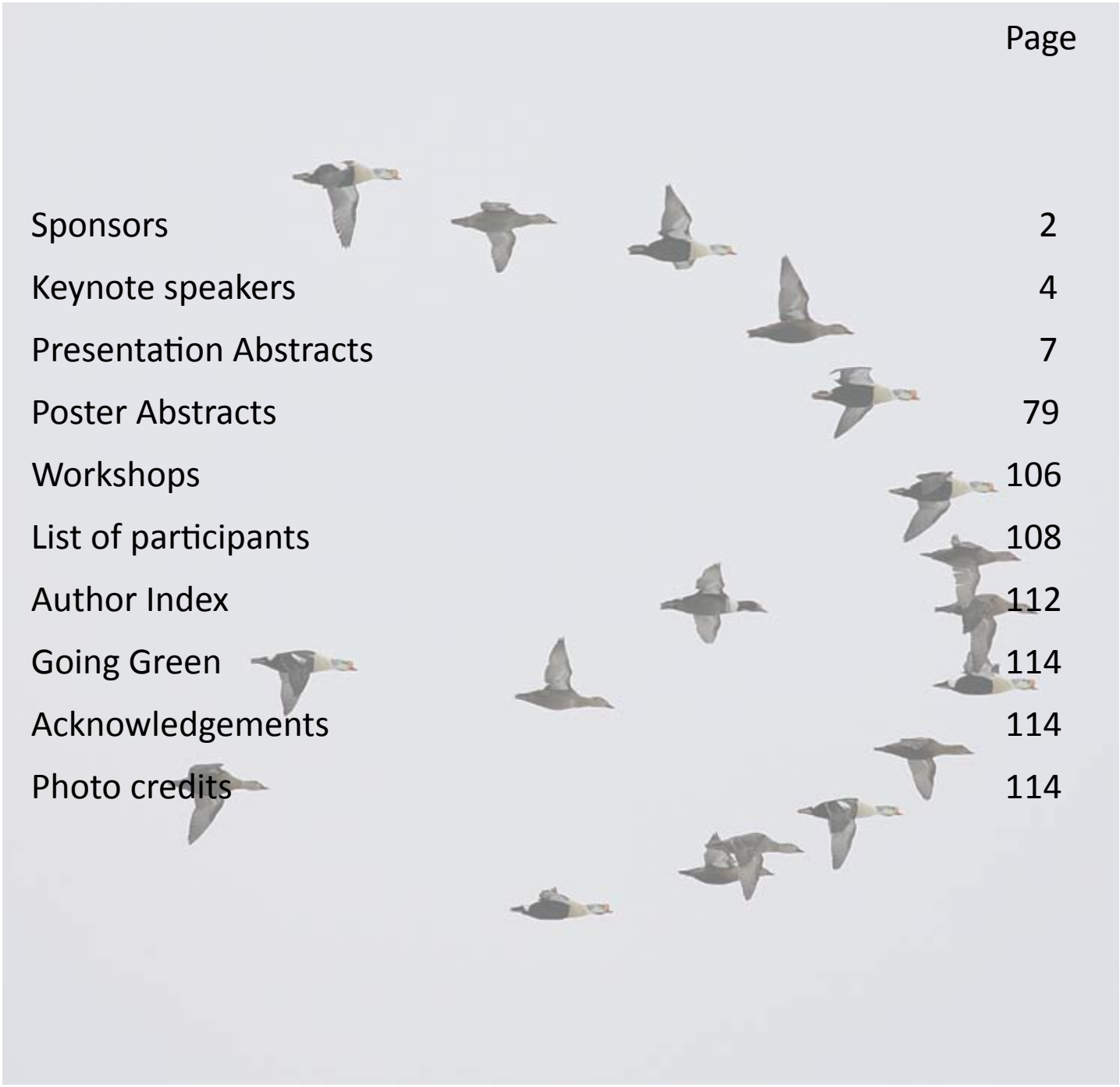
Shell Oil

HARLEQUIN DUCK LEVEL

Microwave Telemetry

BOEMRE

Table of Contents



KEYNOTE SPEAKERS

Keynote speaker # 1:

H. Grant GILCHRIST

Research Scientist with Environment Canada and an Adjunct Professor at Carleton University (Ottawa, Canada)

Biography: *His scientific program has been designed to respond to Environment Canada responsibilities and priorities for the conservation of sea ducks and pelagic seabirds in Arctic Canada and Greenland.He has initiated original studies to obtain the information required for their conservation and management. He often works in collaboration with Universities to provide deeper fundamental insights into the processes of marine bird ecology and population demography. Several of his studies also focus on the harvest of marine bird species by Aboriginal Peoples. Recently his research program was awarded a Natural Sciences and Engineering Research Council (NSERC) Strategic Operating Grant to study the ecology and demographic impact of Avian Cholera on Common Eider ducks. Dr. Gilchrist currently sits on the Sea Duck Joint Venture Continental Technical Team, is a Principal Investigator in the ArcticNet NSERC Centres of Excellence Program, and was elected Chair of the international Circumpolar Seabird Working Group in 2010.*

Abstract: Conservation Biology of the Northern Common Eider Duck: Exploring the Art of Delivering Science in Canada's Arctic
The Northern Common eider duck nests in the Eastern Canadian Arctic and west Greenland, and concern was growing in the mid-1990s that northern eiders were being over-harvested in winter. In response, an international research program was initiated in 1996 to assess the winter eider harvest and to help identify possible conservation measures. The overall methods of the program, which required new international collaborations, field studies and funding sources will be discussed in the context of the Sea Duck Joint Venture; one of the key supporters of the Northern Common Eider duck Conservation Program. Information derived from banding studies, satellite telemetry, and mark-re-sighting efforts were integrated in a demographic model which estimated that the harvest was indeed, not sustainable. Based upon these findings, more conservative hunting regulations were successfully introduced in west Greenland in 2002 and presented through public education and outreach programs. Since then, higher female survival rates detected in Canada as well as impressive colony growth at colonies in both west Greenland and Arctic Canada suggested that the new hunting regulations were having the desired positive impact. More recently, Inuit hunters detected mass eider die-offs at some Canadian breeding colonies, and this mortality was later confirmed as multi-year outbreaks of avian cholera; a new disease among marine bird populations in eastern Arctic Canada. The current demographic impacts of avian cholera on northern eiders, as well as our expanded research program to quantify the geographic spread of the disease will also be presented.

Keynote speaker # 2:

Mikael KILPI

Aronia Research at Novia University of Applied Sciences and Åbo Akademi University (Ekenäs, Finland)

Biography: *I´m a long-term seabird naturalist, trained at the University of Helsinki where I did my PhD-thesis on the breeding ecology of the herring gull in 1988. After having spent several years at Helsinki, I left for the Novia University of Applied Sciences in 2000, where I have worked as research manager of a then small – now larger – research institute, Aronia, specializing on coastal ecology. I have always worked with seabirds, herring gulls and then eider ducks, one side of me focusing on the fascinating social behavior of gulls and eiders, the other side of me involved in more hands-on management issues of either problematic increases of gulls and cormorants, or declining eiders. I live in Hanko, by the sea at the very SW-tip of the Finnish mainland.*

Abstract: The Large-scale Decline of the Baltic Eider Population, and Can We Deduce Reasons For It From Data On Smaller Scales?

The majority of the breeding eiders (Somateria mollissima) in the Baltic Sea nest on the east coast of Sweden and on the west coast of Finland. The birds winter in the southern part of the Baltic. Monitoring efforts on wintering birds in Denmark and Sweden have yielded an estimate of about 1.2 million birds wintering in the early 1990´s, an update of the wintering population in 2000 landed on 760 000 birds, which was not mirrored in a corresponding decrease in the number of breeding birds (1990; 480 000 pairs, 2000; 560 000 breeding pairs). The estimated figures for 976 000 wintering birds in 2009 is tied to a steep decrease in breeding bird numbers, the breeding estimate is now 263 000 pairs. Monitoring of breeding birds in Finland and Sweden suggest a decrease by 40–60% in the last ten years. Using Danish hunting bag statistics, this decrease is paralleled by a long-term decline in first-year birds from c. 70% to c. 30% from 1982 up to the present, and a change in the population sex-ratio of adult birds from 45% females (1982) to only about 25% in 2009. Thus, the decline is followed by dramatic changes in both structure of the adult population and an indication of reduced productivity. Although European Union legislation clearly demands that seabird population status in the Baltic should be documented properly, national measures to this end are not satisfactory, and up until now there has been no real effort to take a flyway approach to manage the eider population of the Baltic.
Current national census schemes do suggest a steep recent decline, but the reasons behind the large-scale trends have only been looked at on smaller scales, and hence data on productivity and possible reasons for an increase in female mortality are not properly known. A few major hypotheses have emerged;

1. The thiamine deficiency hypothesis; Balk et al. (2009) identified a general deficiency of thiamine causing a paralytic fatal disease in nesting females and a lowered productivity due to deficiency induced high egg- and nestling mortality.
2. The food quality hypothesis; Recently – in conjunction with the large decline in the number of wintering long-tailed ducks (*Clangula hyemalis*) in the Baltic – the quality of the staple food, the blue mussel (*Mytilus edulis*) seems to have deteriorated (Larsson, in progress).
3. The disease hypothesis ; On smaller scales, studies on the Finnish coast (Hario & Rintala 2006) identify low productivity as the main cause for the population trend, and the lowered productivity may be tied to documented disease-related mass-mortality of ducklings.
4. The predation increase hypothesis; Other studies on the Finnish coast find no systematic change in duckling production, but rather a dramatic increase in breeding mortality of females due to altered predation regimes in the archipelagoes (Ekroos et al. 2011 in review).

None of the hypotheses alone unequivocally explain the current trends in Baltic eiders. Studies done on the Finnish coast have mainly looked at one population close to the range boundary of the eider in the Gulf of Finland (Hario & Rintala 2006), and one population (Hanko) closer to the core distributional area. In the marginal population, production figures have been very low (1990-2005 mean 0.17±0.17) for many years, while female survival has been high (c. 90 % apparent yearly survival, Hario et al. 2009). The population development is likely best explained by the number of new recruits produced. Circumstances for successful breeding have deteriorated in the area, in terms of blue mussel biomass and density. Here, the decline of the population started in the mid-1980s. Low reproductive rate may also have been seriously affected by new, emerging disease. The study on this population was terminated in 2007. In the more westerly site at Hanko, reproduction of young has been variable, but during 1990-2005 the mean value was much higher than in the more eastern population (mean 0.69±0.45). Over the period 1990-2011, there was no trend in reproductive success, no trend in clutch size, and no trend in female body condition over the years. In the Hanko study area, circumstances for eider breeding in terms of mussel abundance have remained good. The only significant change in the area is an increase in predators (mainly white-tailed sea eagle *Haliaeetus albicilla*). The change in predation regime is reflected in a change in brood care behavior of the eiders in that area. The decrease in the core breeding area in Finland began only after the mid-1990s, escalating in very recent years. Monitoring of migrating birds in spring into the Gulf of Finland, reveals a decrease in the number of females compared with males, mirroring the trend of a more skewed sex-ratio in the wintering area. Local studies so far find support for effects of depressed duckling production, but reasons need to be further clarified. Local studies also find effects mediated on ducklings and females via blue mussels, and an increase in female mortality. Local studies on the Swedish coast also give some support to alleged food-web changes and die-offs associated with these. The four proposed major hypotheses are likely not mutually exclusive, but may act in consort. To get to the causative agent best explaining local variation and the large-scale combined effect of local variation on the entire Baltic eider population will yet require intensified and strictly coordinated work.

Keynote speaker # 3:

Daniel ESLER

Simon Fraser University, Centre for Wildlife Ecology, 5421 Robertson Road, Delta, BC, V4K 3N2, Canada

Biography: *Dan Esler is a researcher with the Centre for Wildlife Ecology, Simon Fraser University in British Columbia, and formerly with the Alaska Science Center, USGS. He has worked with sea ducks for 17 years on a variety of applied research projects in Canada, the U.S., Mexico, and Russia. Dan and his students consider a wide range of factors that may influence population dynamics of sea ducks throughout the annual cycle. He has worked with most sea duck species, but is particularly fond of harlequin ducks, Barrow's goldeneyes, and surf scoters.*

Abstract: Sea Duck Research in the SDJV Era: Advances and Challenges

One of the primary goals of the Sea Duck Joint Venture (SDJV) is to foster research to address data gaps, which in turn should lead to more effective conservation. Therefore, I (1) determined whether the volume of research has increased in conjunction with SDJV activities, (2) documented the historical and SDJV-era research species and topics; (3) identified areas where significant advances have been made; (4) evaluate whether sea duck management has been improved by recent research; and (5) offer my opinion on future research that will best contribute to sea duck conservation.

I conducted a thorough review of published literature in peer-reviewed journals with English-language text or summaries, which revealed 1,547 papers with sea ducks as a primary topic since 1926. Research focused on sea ducks has seen tremendous increases since initiation of SDJV (1999 to present), constituting more than half (53%) of the published sea duck literature.

Numbers of publications varied considerably by species, with Common Eiders (COEI) as a topic of >25% of the total, whereas Steller's and Spectacled Eiders have been subjects of roughly 3% each (the lowest among all species), despite significant conservation concerns for these species. The seasons to which studies pertained was roughly evenly split between breeding (57%) and non-breeding. Topics receiving a high degree of attention in the literature included behavior (18%), particularly studies of brood amalgamation in COEI and goldeneyes, and contaminants studies (13%), although many of these constitute only descriptions of chemical occurrence in sea ducks. Conversely, studies addressing population dynamics (2%), population delineation (3%), and construction of population models (<0.5%) were quite rare, relative to their value for conservation.

Research during the SDJV era has led to a number of advances in knowledge with relevance to conservation, including: identification of important habitat attributes and specific sites; details of energetics and trophic interactions; effects of contaminants; population delineation for some species (e.g., King Eiders); and effects of some anthropogenic influences at local or regional scales (e.g., wind farms, shellfish aquaculture, harvest). However, some of the bigger questions facing sea duck conservation (mechanisms underlying continental-scale declines in many species; population bottlenecks through the annual cycle) remain unanswered. I suggest that the most productive research foci for promoting sea duck conservation include: continued efforts at population delineation for priority populations, quantification of vital rates and variation in relation to underlying causes (habitat, climate, contaminants, energetics, harvest, etc), and incorporation of vital rates into population models.

ABSTRACTS

"*" after the title indicates this is a student abstract considered for an award

SESSION 1: TROPHIC INTERACTIONS AND ENERGETICS

SESSION CHAIR: JAMES R. LOVVORN

PRESENTATION # 1

EFFECTS OF AIR AND WATER TEMPERATURE ON RESTING METABOLISM IN DIVING BIRDS

Samantha E. Richman[1] and James R. Lovvorn[2]

[1] Biology, Chemisty and Geography Department, Quebec University at Rimouski, Rimouski, QC G5L 6Y7, Canada; Tel. : US cell (307) 760-7108; Canada office (418) 775-0853; email: cruciger7@gmail.com
[2] Department of Zoology, Southern Illinois University, Carbondale, Illinois 62901, U.S.A.

To assess the energy requirements of free-ranging birds, we often estimate daily energy expenditure (DEE) based on laboratory and field measurements. A common approach is to construct time-energy budgets in which durations of daily activities (eg. resting, preening, swimming, diving, flying) are multiplied by their respective costs and summed. While many studies focus on activities with high cost, such as flying or diving, these activities can occupy a relatively small fraction of the diel period. Marine diving birds can spend 40–80% of a day floating on the water surface, and for some species resting costs are a large portion of DEE (40–60%). Thus, resting metabolic rate (RMR) while floating on water at varying temperatures, which includes both basal metabolism and thermoregulation, becomes a critical variable. We conducted a comprehensive review of the literature on published data of RMR in air and while floating on water for diving birds of diverse taxa and body sizes. In our review, we compared RMR for four groups of diving birds (alcids, diving ducks, cormorants, penguins) while resting in air and on water at a range of ambient temperatures measured by open-flow respirometry on unrestrained, post-absorptive adults. RMR (W kg^{-1}) was substantially higher on water than in air at all temperatures for all species except the sea ducks, which showed little difference at temperatures >10°C. At lower temperatures on water, the rate of increase in RMR as temperature decreased was also less in the sea ducks than in other species. For Common Eider (*Somateria mollissima*), there was no clear lower critical temperature (T_{LC}) either in air or on water; and on water, RMR showed relatively little increase with decreasing temperatures compared to other species. These patterns held even when comparing Long-tailed Duck (*Clangula hyemalis*) to an alcid and a penguin of similar body size. Further, metabolic measurements of Common Eiders varied greatly among studies. For example, RMR while floating on water measured by Hawkins et al. (2000, JEB v200) of 10.10 W kg^{-1} was 164% higher than measurements by Jenssen et al. (1989, CJZ v67) of 3.83 W kg^{-1} at similar water temperatures (16–20°C). If an eider floated on the water for a conservative estimate of 17 hours a day (~70% of a 24-h period), the total cost of resting extrapolated from Jenssen would yield ~457 kJ, but ~1107 kJ from Hawkins; nearly 2.5 times higher. Such an increase would double the estimate of required food intake. Differing experimental conditions and especially behavioral state of the birds can cause large variation in results among studies, and these aspects should be carefully considered when choosing values for energetics models. Valid estimates of RMR on water are critical to models of energy costs, and to resulting estimates of the extent and quality of habitat needed to support them. The often large energetic effects of time spent floating on water can differ substantially among major taxa of diving birds, so that relevant estimates are critical to understanding their patterns of daily energy use.

PRESENTATION # 2

FORAGING PATTERNS AND ENERGY BUDGETS OF COMMON EIDERS AND LONG-TAILED DUCKS WINTERING IN THE SOUTHERN BALTIC SEA

Monika Dorsch[1], Ramūnas Žydelis[2], and Georg Nehls[1]

[1] BioConsult SH, Brinckmannstr. 31, D-25813 Husum, Germany; Tel.: +49-4841-66329-18;
e-mail: m.dorsch@bioconsult-sh.de

[2] DHI, Agern Allé 5, DK-2970 Hørsholm, Denmark

The southern Baltic Sea is of major importance to wintering sea ducks which breed in the boreal and arctic zone of Northern Europe and Siberia. The purpose of this study was to evaluate foraging patterns and energy expenditures of two abundant sea duck species during their wintering season in the Fehmarn Belt area, a 20 km strait between Germany and Denmark. We used VHF radio telemetry to record activity budgets of Common Eider (*Somateria mollissima*) and Long-tailed Duck (*Clangula hyemalis*). We subsequently calculated energy expenditures of these species using literature and empirical data aiming to use this information in the assessment of species susceptibility to possible habitat change and disturbances due to a planned fixed link construction across the Fehmarn Belt.

Our study site lies within the core wintering range of the Common Eider, but the area represents the westernmost edge of the Long-tailed Duck winter distribution in the Baltic. We observed highly differing foraging patterns between the two studied species. Both species foraged almost exclusively during the daylight hours. In mid-winter Common Eiders were engaged in foraging behavior on average 4.5 hours per day, whereas Long-tailed Ducks spent on average 8.5 hours per day foraging, which comprises most of daylight time. Individual Long-tailed Ducks were even recorded to spend up to 66 % of the daylight time under water. This difference in necessary diving effort to meet the daily energy demand was also reflected in calculated energy budgets: surface behavior of Common Eiders constituted 70 % of the total daily energy expenditure, and diving costs were one of the major energy expenditures for Long-tailed Ducks. The total daily energy demand of each species and time spent foraging implies that Common Eiders are more efficient foragers than Long-tailed Ducks, despite known flexibility of the latter species in utilizing different food resources. Observed activity budgets also suggest that Long-tailed Ducks probably have little capacity to cope with impacts of disturbance.

PRESENTATION # 3

INTAKE RATES AND PREY-SIZE SELECTION OF CAPTIVE COMMON EIDERS FORAGING ON BLUE MUSSELS*

Elisabeth Varennes[1], Samantha E. Richman[1], and Magella Guillemette[1]

[1] Biology, Chemistry and Geography Department, Quebec University at Rimouski, 300 allée des Ursulines, Rimouski, QC G5L 6Y7, Canada; Tel. : (418) 775-0813; email: varenneselisabeth@yahoo.fr

The intake rate of a predator or number of prey consumed per unit of time spent foraging as a function of the density is known as a predator's functional response. Measures of functional response curves can be converted to energy intake (kJ per unit of time spent foraging) by knowing the energy content of prey which provides important information on the amount and quality of habitats required to support bird populations. However, different sized prey may vary in their energy yield because of differences in gain/cost ratios. Hence, a predator's ability to select the most profitable prey sizes may influence their functional response and energy intake. The Blue Mussel (*Mytilus edulis*) is a common prey item for sea ducks feeding in intertidal and subtidal habitats. The objectives of our study were to quantify prey-size selection of Common Eiders (*Somateria mollissima*) foraging on mussels and measure their intake rates for different mussel sizes and densities. Our experiments used captive Common Eiders (n = 10), maintained at the Maurice Lamontagne Institute, Fisheries and Ocean Canada in Mont Joli, Québec. Captive Eiders were housed in an isolated room with two diving tanks (6 m x 4 m x 2 m, water depth 1.5 m). We recorded with an underwater camera the foraging behavior of our birds feeding on mussels naturally attached to slate tiles in a tray at the bottom of the tank. One week before the experiments, mussels were placed on slate tiles in small tanks in order to let them grow byssal threads, which allowed us to simulate natural conditions found on the sea floor. Shell and flesh mass (wet, dry and ash free dry mass), energy and nutrient content were measured for different mussel sizes. Captive eiders showed a type II functional response curve and higher intake rates for smaller mussels. Eiders showed a strong preference for small and medium mussels, ignoring larger mussels when smaller mussels were available at similar densities. However, eiders were able to consume larger mussels when smaller ones were in very low densities. The selection of smaller mussels can be explained by their higher intake rate and lower shell-tissue ratio. Hence, different sizes of prey do not represent equivalent energy yields for predators who need to adjust their foraging behavior according to these size differences in order to maximize energetic gain. However, we do not know yet what are the mussel characteristics that elicit the highest profitability for sea ducks.

PRESENTATION # 4

THE ROLE OF BODY MASS IN DIET COMPOSITION OF SEA DUCKS IN WINTER*

Jean-François Ouellet[1] and Magella Guillemette[1]

[1] Biology, Chemistry and Geography Department, Quebec University at Rimouski, 300 allée des Ursulines, Rimouski, Québec, Canada G5L 3A1; office (home): (418) 739-5751 / office: (418) 723-1986 ext.1968; e-mail: jean-francois_ouellet03@uqar.qc.ca

The goal of this study was to investigate the role of body size in diet composition of sea ducks in winter. Mass-specific energy requirements scale inversely with body mass and smaller animals have greater energy and nutrient requirements relative to their body mass than larger ones. Sea ducks wintering in northern environments must reconcile high energy expenditures with limited energy income within a short time period. Also, they should avoid gorging with food and gaining extra weight in accordance with their poor take-off aptitudes, and should avoid dietary overlap according to the competitive exclusion principle. Winter conditions probably challenge more severely the daily energy budget of smaller species than that of larger ones. According to the energy budget rule, smaller species can be expected to forage in a risk-prone fashion and rely more on high quality prey than larger species. This study compiled three data sets taken from the literature for sea ducks wintering in North America: their body mass, their winter diet and the energy value of their invertebrate prey. Analyses were conducted in parallel at two taxonomic levels. The main prey in sea duck winter diet were bivalves, malacostraca and gastropods. Malacostraca dominated the diet of smaller species and bivalves dominated the diet of larger ones. Lowest energy values were found in slow moving and hard shelled prey and highly mobile prey had the highest energy values. Correlation analyses revealed a negative relationship between the body mass of sea ducks with the relative energy value of their winter diet. There seemed to be a limit to the amount of low quality prey the sea ducks can include in their diet. We concluded that diet composition was driven by physiological constraints and avoidance of competition.

PRESENTATION # 5

ENVIRONMENTALLY-MEDIATED ENERGY MANAGEMENT AND PHYSIOLOGY OF WINTERING WHITE-WINGED SCOTERS*

Eric Palm[1], Daniel Esler[2], Eric Anderson[2], and Sean Boyd[3]

[1] Centre for Wildlife Ecology, Department of Biological Sciences, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada; Tel.: (503) 944-9729; e-mail: epalm@sfu.ca
[2] Centre for Wildlife Ecology, Simon Fraser University, 5421 Robertson Road, Delta, BC, V4K 3N2, Canada
[3] Science and Technology Branch, Environment Canada, 5421 Robertson Road, Delta, BC, V4K 3N2, Canada

Although White-Winged Scoters (*Melanitta fusca)* and Surf Scoters (*M. perspicillata)* are often combined in population estimates, trends in wintering numbers at sites along the Pacific coast differ markedly between the two species, indicating different ecologies and a need for separate management strategies. Compared to Surf Scoters, White-Winged Scoters inhabit far fewer wintering sites in appreciable numbers, yet few studies have specifically addressed factors underlying habitat needs of White-Winged Scoters during the non-breeding period. Our objectives were to determine the relative influences of climate, predation risk, and food availability on the energetics and physiology of wintering White-Winged Scoters, and to use this information to clarify functional values of different marine habitats. In particular, we assessed the value of Dogfish Banks off the northeast coast of Haida Gwaii (formerly the Queen Charlotte Islands) in British Columbia. The Banks are somewhat of an anomaly among White-Winged Scoter wintering areas because it is an offshore, deeper-water site offering little protection from adverse weather conditions; it also is a proposed site for offshore wind energy development. We collected adult male White-Winged Scoters during mid and late winter at Dogfish Banks and four other sites along the Pacific coast of British Columbia and Washington and analyzed for differences in diet composition and numerous indices of body condition and physiological state. Scoters foraging at Dogfish Banks consumed a wider variety of foods and were heavier than birds wintering in the other areas which included protected bays and estuaries. In addition, diets at Dogfish Banks were highly variable between years. Our results suggest that White-Winged Scoters adjust their prey consumption in response to seasonal and inter-annual changes in prey abundance. Birds at Dogfish Banks may have required increased lipid reserves as an insurance policy against unfavorable foraging conditions during unpredictable bouts of harsh weather. In addition, a lack of natural predators at Dogfish Banks compared to sites closer to shore may have reduced the risk of predation that is often associated with increased body mass. These findings suggest that White-Winged Scoters employ different energy management strategies depending on site-specific habitat attributes.

PRESENTATION # 6

THE ROLE OF A DOMINANT INVASIVE SPECIES IN THE DIET AND BODY CONDITION OF WINTERING SURF SCOTERS (*MELANITTA PERSPICILLATA*) IN SAN FRANCISCO BAY

Susan E. W. De La Cruz[1], John M. Eadie[2], A. Keith Miles[3], and John Y. Takekawa[1]

[1] U.S. Geological Survey, Western Ecological Research Center, San Francisco Bay Estuary Field Station, 505 Azuar Dr., Vallejo, CA 94592 U.S.A.; Tel.: (707) 562-2004; e-mail: sdelacruz@usgs.gov
[2] Department of Wildlife, Fish and Conservation Biology, 1 Shields Avenue, University of California, Davis, CA 95616 U.S.A.
[3] U.S. Geological Survey, Western Ecological Research Center, 3020 State University Drive East, 3006 Modoc Hall, Sacramento, California 95819 U.S.A.

The San Francisco Bay estuary, an important wintering area for Pacific Flyway Surf Scoters (*Melanitta perspicillata*), is highly urbanized and known for its abundant invasive species. Such species can have profound negative effects on native avifauna; however, they may sometimes create superabundant food resources exploited by avian predators. The invasive over-bite clam (*Corbula amurensis*), which now dominates the benthos in the northern reach of the estuary, has greatly altered the ecology of the Bay and has increased contaminant risks for predators. Nutritional content of *Corbula* is high and thus it represents a potentially profitable prey source for benthivores such as Scoters; however, the role of *Corbula* in the diet and winter conditioning of Scoters is unknown. Our objectives were to 1) determine the temporal and spatial differences in Scoter diets, and 2) evaluate the relationship between Corbula use and seasonal body condition. We collected 139 Scoters, used a combination of traditional esophageal and stable isotope analyses to determine their seasonal diets in distinct foraging areas within the estuary, and examined proximate measures of body condition. We found that Scoter diets were spatially distinct along a salinity gradient and dominated by *Corbula* in the northern reach of the estuary (San Pablo and Suisun Bays), while the Japanese littleneck clam (*Venerupis philipinparium*) and Pacific herring (*Clupea pallasii*) roe were the most important food items in the more marine influenced Central Bay. Scoter protein content showed little temporal or spatial variability, but lipids were highly variable across locations, seasons and years. Lipids were negatively correlated to $\delta^{15}N$ and positively correlated to $\delta^{13}C$ in plasma and muscle, indicating bivalves contributed more to lipid acquisition than other diet items and that Scoters foraging in areas of higher salinity put on more lipids. Our results suggest Scoters foraging on bivalves (mainly *Venerupis*) in the Central Bay, were able to attain higher lipid content than scoters foraging on bivalves (mainly *Corbula)* in San Pablo and Suisun Bays. Efforts to understand the energetic value of changing prey populations in the marine and estuarine habitats of Scoters are necessary to assist in the identification of areas for conservation as well as management efforts that may benefit the species.

PRESENTATION # 7

NICHE PARTITIONING, THRESHOLD FOOD DENSITIES, AND SPECIES ABUNDANCE IN DIMINISHING HABITATS FOR DIVING DUCKS

James R. Lovvorn[1], Susan E. W. De La Cruz[2], John Y. Takekawa[2], Laura E. Shaskey[2], Victoria K. Poulton[1], and Samantha E. Richman[1]

[1] Department of Zoology, Southern Illinois University, Carbondale, Illinois 62901 U.S.A.; Tel.: (307) 399-7441; e-mail: lovvorn@siu.edu
[2] U.S. Geological Survey, Western Ecological Research Center, San Francisco Bay Estuary Field Station, 505 Azuar Drive, Vallejo, California, 94592 U.S.A.

When important habitats are threatened by climatic shifts or human alterations, conservation planning can be aided by estimating the extent and quality of habitat needed to sustain certain numbers of different species. In some cases, multiple species depend on a single prey taxon that comprises most available prey. If so, relative population trajectories of those predators as the prey becomes limiting are expected to depend on how their foraging niches are partitioned. Alternatively, if several predator species consume common prey indiscriminately, their relative persistence may depend on differing prey densities that each predator requires for profitable foraging. In the San Pablo Bay subunit of San Francisco Bay, California, the three main diving duck species are Lesser Scaup (LESC, *Aythya affinis*), Greater Scaup (GRSC, *A. marila*), and Surf Scoter (SUSC, *Melanitta perspicillata*). On the extensive subtidal shoals, all these ducks feed almost entirely on the same bivalve species (*Corbula amurensis*) which constitutes most available prey. Although declines in body mass, increased foraging effort, and major departures of these birds in January appear to result from food limitation, we found no strong niche partitioning by prey size, water depth, or location within the bay. However, a simulation model indicated that energy costs associated with differing body size (LESC are smaller), locomotor mode (SUSC swim with wings as well as feet), and dive behavior result in gradations of prey density required for profitable foraging in the order SUSC > GRSC > LESC. Thus, on average, each species will become limited at differing stages of prey depletion, despite their feeding on the same prey of the same size at the same sites. The model indicated that, depending on year, 30 to 70% of *Corbula* standing stocks can be below threshold densities and thus effectively unavailable to diving ducks. Moreover, a substantial fraction of prey above absolute thresholds was not exploited before most ducks left the area, perhaps because many viable patches could not be readily located. Ectotherm predators on the same prey, especially starry flounders (*Platichthys stellata*), white sturgeon (*Acipenser transmontanus*), and bat rays (*Myliobatis californica*) can increase the total standing stock required to support given numbers of diving ducks. As shown for these ducks, lack of clear niche partitioning can prevent the targeting of habitat conservation at particular declining species (SUSC). However, modeling profitability thresholds can suggest absolute minimum prey stocks needed to support sensitive species with a given mix of endotherm and ectotherm competitors, and can identify the species most vulnerable to declines in a common prey base.

SESSION 2: BREEDING ECOLOGY

SESSION CHAIR: MARKUS ŐST

PRESENTATION # 8

ESTIMATING RECRUITMENT AGE OF FEMALE KING EIDERS USING REVERSE-TIME CAPTURE HISTORIES

Ray T. Alisauskas[1] and Dana K. Kellett[2]

[1] Prairie and Northern Wildlife Research Centre, Science and Technology Branch, Environment Canada, 115 Perimeter Road, Saskatoon, Saskatchewan, S7N 0X4, Canada; and Department of Biology, University of Saskatchewan, 112 Science Place, Saskatoon, Saskatchewan S7N 5E2, Canada. Tel: (306) 975-4556; e-mail: Ray.Alisauskas@ec.gc.ca.
[2] Prairie and Northern Wildlife Research Centre, Science and Technology Branch, Environment Canada, 115 Perimeter Road, Saskatoon, Saskatchewan, S7N 0X4, Canada. e-mail: Dana.Kellett@ec.gc.ca

We determined age-specific probabilities of first-time nesting from estimates of seniority from reverse-time capture histories following Pradel et al. (1997). Of 1,739 ducklings of either sex marked from 1996 to 2006, only 42 had been subsequently captured as females nesting on the study area from 1997 to 2007. No ducklings from any cohort were captured as nesting hens before 3 years of age. As well, none were found to have nested for the first time after 7 years of age, although only cohorts of ducklings marked before 2001 were at least 7 years old by 2007. Ninety-five % CL of mean age of first detected nesting was 4.36 ± 0.36 years if all ducklings were considered (n = 42), and 4.40 ± 0.42 if only ducklings marked before 2001 were considered (n = 35). Compared to these naïve estimates based on return rates, mean recruitment age estimated from mark recapture that accounted for detection was 3.57 ± 0.15. Naïve estimates of recruitment age based on return rates erroneously implied a population decline of 6%/year, whereas population projection using unbiased estimates of recruitment age suggested a 6% annual increase and local population health.

PRESENTATION # 9

SURVEY DESIGN FOR BREEDING SCOTERS: HELICOPTER VS. FIXED-WING

Scott G. Gilliland[1], Eric Reed[2], Christine Lepage[3], Jean-Pierre L. Savard[4], Daniel Bordage[3], Greg Robertson[1], Jean Rodrigue[3], John Bidwell[4] and Bill Harvey[5]

[1] Environment Canada, 6 Bruce St., Mount Pearl, NL, Canada A1N 4T3; Tel.: (709) 772-2013; e-mail: scott.gilliland@ec.gc.ca
[2] Canadian Wildlife Service, 351 St. Joseph Blvd, Gatineau, QC, Canada K1A 0H3
[3] Canadian Wildlife Service, 1141 route de l'Église, Québec, QC, Canada G1V 3W5
[4] Environment Canada, Science and Technology, 1141 route de l'Église, Québec, QC, Canada G1V 3W5
[5] U.S. Fish & Wildlife Service, Old town, Maine, 04468

Most of the breeding ranges of the scoters are not captured in the traditional Waterfowl Breeding Population and Habitat Survey in North America. Development of monitoring programs for scoter breeding populations presents unique challenges because scoters breed in low densities in remote northern areas and species are difficult to differentiate from aircraft. In this study, we assessed the probability of detection of scoters from fixed-wing aircraft and helicopter, and evaluated the observer's ability to identify scoter species from fixed-wing aircraft. Surveys were performed on a 22,000 km^2 study area in Labrador and Québec. Thirty-three 25 km^2 plots were surveyed by helicopter using a dependant double-observer approach. An additional thirteen line transects, each 100 km long, were surveyed by fixed-wing using distance sampling techniques. Overall sampling intensity was about 3% for both platforms. Detection probabilities were high and precise for the helicopter (0.99; 95% CI: 0.98-1.0), and there was little effect of observer experience on detection probability. In contrast, detection probability for the fixed-wing was low (0.31; 95% CI: 0.27-0.36). Pair density estimates, corrected for incomplete detection, were similar between the two platforms for Black Scoters (~0.8 pr/km^2), however the density for Surf Scoters estimated from the fixed-wing (0.05 pr/km^2; 95% CI: 0.03-0.10) was less then half that estimated from the helicopter (0.11± pr/km^2; 95% CI: 0.02-0.21). The observer's ability to identify scoters varied with distance from the fixed-wing. About 12% of the scoters were recorded as unknown scoter species within the 100 m and 200 m distance bands. The species composition derived within the first 100 m distance band from the fixed-wing (46% Surf Scoter; 42% Black Scoters and 12% unknown) contrasted with that recorded from the helicopter (69% Surf Scoters, 23% Black Scoters and 7% White-winged Scoters). These results suggest that Surf Scoters were often miss-classified as Black Scoters from the fixed-wing. This likely resulted in overestimates of Black Scoter and under estimates of Surf Scoter densities for the fixed-wing surveys. Density estimates, corrected for detection for scoters were 1.4 times greater when measured from the helicopter (0.23 pr/km^2; 95% CI: 0.22-0.24) than from the fixed-wing (0.16 pr/km^2; 95% CI: 0.11-0.22), which suggests that a larger proportion of the population was detectable from the helicopter than from the fixed-wing. Detection probability may vary among observers, habitats and weather conditions. Given the low detection probabilities from the fixed-wing, we suggest that procedures to estimate detection probability be included in survey designs for these species to ensure consistency in resulting breeding indices. Our results also show that species identification from fixed-wing aircraft may not be reliable and we suggest that estimation of detection probability and independent assessments of species composition are necessary if species-specific population indices are required from fixed-wing survey programs.

PRESENTATION # 10

NEST SITE SWITCHING IN AN INCREASING COLONY OF COMMON EIDER, IN RELATION TO NEST DENSITIES AND WINTER WEATHER

Jón Einar Jónsson[1] and Smári J. Lúðvíksson[2]

[1] University of Iceland, Snæfellsnes Research Centre, Hafnargata 3, IS 340, Stykkishólmur, Iceland; Tel.: +354-433-811; e-mail joneinar@hi.is
[2] Háarifi 33, IS-360 Hellissandur, Iceland.

Birds can change nest sites between years in response to number of breeders at a colony. Furthermore, environmental factors, such as winter conditions, can influence breeding condition and breeding decisions in capital-breeding species. We used 16 years of banding data and nest counts of Common Eider *Somateria mollissima*, from Rif, west Iceland, to estimate whether nest numbers or weather were related to the probability of females switching between two nearby nesting islands. The islands have different microclimate properties (grass vs. rock) as nest sites, i.e. they differ in area, nest substrate, general shape, wind exposure, and adjacent bathymetry and water depths. There is no vegetation to shelter the females and windy conditions coupled with high water levels spray water over females and nests. The colony was established for down collection in 1972 by creation of a nesting island made of boulders. This island filled up with Common Eider nests until 1990, when a second nesting island, with a grass substrate, was created and was settled by females shortly thereafter. The banding study presented here began in 1993. Thus, effects of crowding were reduced three years before the study began in 1993. Crowding gradually increased until 2008 because of increased nest numbers at the colony. Time-series analysis reported that nest numbers were not related to weather. Weather variables and nest numbers were used as linear constraints in a multi-site analysis in MARK. Apparent survival (S=0.87) was constant over the study period and not related to weather or nest numbers. Probability of switching islands (Ψ) was plausibly constrained in time by three parameters; (1) winter with high precipitation lowered the probability of moving unidirectionally from the grass island to the rock island; (2) milder winters in 2001-2008 than in 1993-2000 coincided with lowered overall probability of switching islands; and (3) population growth (200-300 nests in 1993-2000, increasing to 600 during 2001-2008) was accompanied by lowered overall probability of switching islands. We attribute the effects of winter weather on nest switching as high levels of precipitation, which increased water levels surrounding the two islands, influencing the decision to switch islands. Effects of nest numbers indicate that switching becomes less probable when nest densities increased, indicating competition for suitable nest sites. The trend in nest numbers is atypical for Icelandic common eider colonies, which is related to the intense management of this particular colony. Such dense colonies occur when nest sites are a limiting factor at a given eiderdown farm. Our findings on weather being related with switching islands indicate that winter conditions can influence the decision to switch nest sites throughout the species' range, particularly where Common Eiders nest close to shores of lakes or even the ocean.

PRESENTATION # 11

FEMALE EIDERS SHOW HIGH REPEATABILITY IN NEST COVER REGARDLESS OF PREVIOUS NEST SUCCESS

Benjamin Steele[1], Markus Öst[2], Aleksi Lehikoinen[3], and Kim Jaatinen[2]

[1] Colby-Sawyer College, New London, NH 03257. U.S.A. Tel.: (603) 526-3677;
e-mail: bsteele@colby-sawyer.edu
[2] ARONIA Coastal Zone Research Team, Åbo Akademi University and Novia University of Applied Sciences, Raseborgsvägen 9, FI-10600 Ekenäs, Finland
[3] Finnish Museum of Natural History, P.O. Box 17, FI-00014 University of Helsinki, Finland

Common Eider (*Somateria mollissima*) nests range from 90% covered by vegetation to 100% open to the sky. Previous studies suggest that this is a tradeoff between higher egg predation risk in open nests and higher adult predation risk in covered nests. This result predicts that egg predation should cause females to move to a more covered nest in subsequent years. We tested this hypothesis in a Common Eider population breeding in southwestern Finland, Baltic Sea, in 2007-2010. Contrary to our hypothesis, females showed significant nest cover repeatability (10%) between years, regardless of nest success in the previous year. In fact, even females that moved between islands still selected a nest site with similar cover (57% repeatability). However, females do respond to nest success, moving further from the previous nest when they were unsuccessful. In contrast to breeding dispersal, which is flexibly adjusted to prevailing nest predation risk, nest-site selection on the microhabitat scale seems to be a fairly constant trait, resulting from either imprinting at hatching or from some genetic effect, and is perhaps related to personality as indicated by stress hormones.

PRESENTATION # 12

NEST SURVIVAL OF KING EIDERS IN A LESSER SNOW AND ROSS'S GOOSE COLONY

Dana K. Kellett[1] and **Ray T. Alisauskas**[2]

[1] Prairie and Northern Wildlife Research Centre, Science and Technology Branch, Environment Canada, 115 Perimeter Road, Saskatoon, Saskatchewan, S7N 0X4, Canada; Tel.: (306) 975-5509; e-mail: Dana.Kellett@ec.gc.ca
[2] Prairie and Northern Wildlife Research Centre, Science and Technology Branch, Environment Canada, 115 Perimeter Road, Saskatoon, Saskatchewan, S7N 0X4, Canada; and Department of Biology, University of Saskatchewan, 112 Science Place, Saskatoon, Saskatchewan S7N 5E2, Canada. e-mail: Ray.Alisauskas@ec.gc.ca

We estimated nest survival of King Eiders (*Somateria spectabilis*) in the Lesser Snow and Ross's Goose (*Chen caerulescens* and *C. rossii*, respectively) colony at Karrak Lake, Nunavut, in Canada's central arctic, during 1995-2010. Compared to the surrounding mainland, King Eiders preferentially nested on islands of two large lakes within the study area apparently because islands are less accessible to mammalian predators. Annual nest survival varied between 50.4 – 86.4% during egg-laying and 30.9 – 76.0% during incubation. Daily nest survival rate (DSR) varied in response to an interaction between year and nest age; in most years, DSR increased through egg-laying, was highest during early and mid incubation, but then declined in late incubation. Within years, nest survival additionally declined with nest initiation date (b_{NID} = -0.453 (95% CI: -0.519, -0.386)), but was not influenced by variation in spring chronology (lateness of snow melt). We will also discuss DSR relative to: (1) disturbance by observers, (2) vegetation at nest sites, (3) interspecific relationships (proximity, density, and chronological overlap with geese (*Chen* and *Branta* spp.), gulls (*Larus* spp.), and Arctic Terns (*Sterna paradisaea*), (4) island size and distance to mainland, and (5) weather during nesting.

PRESENTATION # 13

USE OF VIDEO AND TIME-LAPSE CAMERAS TO MONITOR NEST FATE OF STELLER'S EIDERS NEAR BARROW, ALASKA, 2005-2008

Nora A. Rojek[1,2], Philip D. Martin[1], and Ted R. Swem[1]

[1] U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office, 101 12th Avenue, Room 110, Fairbanks, Alaska 99701, U.S.A.; Tel.: (907) 226-4616; e-mail: nora_rojek@fws.gov
[2] Alaska Maritime National Wildlife Refuge, 95 Sterling Highway, Suite 1, Homer, Alaska 99603, U.S.A.; e-mail: nora_rojek@fws.gov

Breeding effort and success of Steller's Eiders (*Polysticta stelleri*) and their predators near Barrow, Alaska are positively correlated with Brown Lemming (*Lemmus trimucronatus*) density. Predation is believed to be the main cause of low eider nest success (averaging 27% 1991-2008). Understanding causes of nest failure is important to recovery efforts for the threatened Alaska-breeding Steller's Eider population. From 2005-2008, we monitored 25 Steller's Eider nests using video and time-lapse digital cameras. Seven nests (28%) failed due to predation or partial predation prior to nest abandonment: 4 by Pomarine Jaegers (*Stercorarius pomarinus*), 1 by Arctic Fox (*Alopex lagopus*), 1 by combination of fox and jaeger, and 1 by Common Raven (*Corvus corax*). Two additional nests were partially depredated by jaegers, but hens successfully resumed incubation. A Glaucous Gull (*Larus hyperboreus*) visited the vicinity of one nest, but no depredation occurred. Hens had no defense against fox and raven, but did attempt to defend nests from jaegers. In general, Pomarine Jaeger depredation occurred during hen recesses; however, in 2005 we documented, for the first time, Pomarine Jaeger attacks on two incubating hens. The study was confounded by fox control in all years. With fox control, small numbers of nesting jaegers were an important predator in years with moderate lemming numbers (2005 and 2007). In high lemming years (2006 and 2008), no camera-monitored nests failed despite the presence of several hundred nesting jaegers. Camera images revealed that for incubation recesses, Steller's Eider hens typically depart their nests by taking flight but usually return by walking back to nest sites. We suspect the hens' sudden departures and stealthy returns reduce the likelihood of predators locating nests, and this behavior may be a hen's optimal method of avoiding detection and predation. We documented predators removing whole eggs from nests and scavenging nest bowl contents after hens successfully departed with broods. Cause of nest failure, therefore, cannot be determined with certainty based on nest remains.

PRESENTATION # 14

PATTERNS IN NEST SURVIVAL AND INCUBATION BEHAVIOR AMONG SEA DUCKS AND GEESE NEAR BARROW, ALASKA: HOW DO STELLER'S EIDERS FIT?

David E. Safine[1], Nora A. Rojek[1, 2], Ted R. Swem[1], and Jewel K. Bennett[1]

[1] U.S. Fish and Wildlife Service, 101 12th Avenue, Room 110, Fairbanks, Alaska 99701, U.S.A;
Tel.: 907-456-0354; e-mail David_Safine@fws.gov
[2] Alaska Maritime National Wildlife Refuge, 95 Sterling Highway, Suite 1, Homer, Alaska 99603, U.S.A

The Alaska-breeding population of Steller's Eiders (*Polysticta stelleri*) numbers in the hundreds and is listed as a threatened species under the United States Endangered Species Act. The nesting strategy of this sea duck is unique as its nesting effort varies greatly among years. Near Barrow, Alaska (the only known concentration of nesting Steller's Eiders in North America), Steller's Eider nests have been found in 12 (60%) of the last 20 years, while other sea ducks have been observed nesting every year. Given concerns about recruitment in Steller's Eiders, understanding factors affecting nest survival is a management priority. Estimating nest survival for sea duck and waterfowl species (in additional to Steller's Eiders) across years near Barrow will help build an understanding of the nesting strategy of Steller's Eiders. We located and monitored fate of nests of sea ducks (N = 50; Steller's, Spectacled [*Somateria fischeri*], and King [*S. spectabilis*] Eider, and Long-tailed Duck [*Clangula hyemalis*]), dabbling ducks (N = 19; Northern Pintail [*Anas acuta*] and American Green-winged Teal [*A. crecca*]), and Greater White-fronted goose (N = 152; *Anser albifrons*) during summers of 2009 and 2010. At a sample of sea duck nests (2008 - 2010; N = 19), we used time-lapse digital cameras to record incubation constancy. We estimated nest survival and its sources of variation using the nest survival model in Program MARK. We built plausible models including taxonomic group, year, and day of nesting season (relative to first day a nest was found in all years). The best approximating model indicated that nest survival varied by taxonomic group and day of nesting season. Greater White-fronted Geese had the highest nest survival probability (0.78; 95% C.I. 0.69 - 0.85), followed by sea ducks (0.21; 95% C.I. 0.11 - 0.33), and then dabbling ducks (0.04; 95% C.I. 0.00 - 0.15). Season day had a positive effect on daily survival rate ($\beta = 0.03$, 95% C.I. 0.00 - 0.07). Incubation constancy was highest for Spectacled and King Eiders (97 and 96%, respectively; SE 1%), lower for Steller's Eiders (83%, SE 2%), and lowest for Long-tailed Ducks (72%, SE 8%). Patterns in incubation constancy, body size, and number of adults at the nest for waterfowl species nesting near Barrow appears to be related to differences in daily nest survival rates. Species with higher incubation constancy, larger body size, and bi-parental care have the highest nest survival rates (White-fronted Geese), followed by high incubation constancy and moderate body size (Spectacled and King Eiders), and the lowest nest survival rates are associated with lower incubation constancy and small body size (Northern Pintail). Steller's Eiders fit into this pattern at the lower end of the spectrum, with nest survival rates relatively low for a sea duck, similar to Long-tailed Ducks.

PRESENTATION # 15

NEST SURVIVAL, PRODUCTIVITY, AND MASS LOSS OF BREEDING COMMON GOLDENEYES IN SUBARCTIC ALASKA

Eric J. Taylor[1], James S. Sedinger[2], and Abigail J. Lawson[2]

[1] U.S. Fish and Wildlife Service, Migratory Bird Management, 1011 East Tudor Road, Anchorage, Alaska, 99503, U.S.A. Tel.: (907) 786-3446; e-mail: eric_taylor@fws.gov

[2] Natural Resources and Environmental Science, University of Nevada-Reno, MS 186, 1000 Valley Road, Reno, Nevada 89512, U.S.A.

Common Goldeneyes (*Bucephala clangula*) in interior Alaska are at the northern edge of their breeding range, and are likely limited in their reproductive output relative to temperate populations by a shorter reproductive season. In 1993, the University of Alaska-Fairbanks Student Chapter of The Wildlife Society gained funding from Ducks Unlimited to install 150 nest boxes on the 1,028 km^2 Chena River State Recreation Area, located approximately 30 km east of Fairbanks, Alaska. We estimated nest survival for Common Goldeneyes for 12 breeding seasons between 1997 and 2010 (2006, 2007 excluded) using the nest success module of Program Mark. The best performing model allowed daily nest survival to vary among years, as a quadratic function of nest age, and as linear functions of nest initiation date, clutch size and presence of parasitism. Daily nest survival declined until the 30th day nests were active, then increased. Nest success varied from 91 ± 1% in 2002 to 63 ± 2% in 2000. Later initiated nests had lower daily survival than those initiated earlier (β = -0.38 ± 0.11). Females producing larger clutches had higher daily nest survival (β = 0.36 ± 0.16). Nests parasitized by conspecifics tended to survive at higher rates (β = 0.21 ± 0.12), although 95% confidence intervals for this effect overlapped 0. To better understand breeding ecology, demographics, and physiology of Common Goldeneyes nesting in subarctic Alaska, we evaluated the importance of condition on reproductive fitness. Because incubation is an important reproductive investment in nesting sea ducks, hens must balance demands of maintaining adequate body condition while caring for developing eggs. Incubation costs may limit current and future reproductive success, particularly in cold environments. Here, we report how female body mass is influenced by nest initiation date, spring phenology, reproductive history, stage of nesting, reproductive investment (clutch size), incubation length, and degree of nest parasitism. A total of 276 Common Goldeneye hens was captured in nest boxes during egg laying, incubation, and at hatch. Hens were banded, measured, and weighed to the nearest 5g. We used mixed models in SAS to assess dynamics of body mass and treated an individual female as a random effect to account for repeated sampling of some females. Candidate models included female structural size (PC1 score), year, modal nest initiation date for each year, nest initiation date relative to the mode, nest age and nest age^2, clutch size, female age (first time nesting versus experienced) and individual female. The best performing model contained structural size, modal nest initiation date, relative nest initiation date, nest age and nest age^2, female age, and an effect of individual female. A model replacing modal hatch date with annual variation in mass did not perform as well, suggesting that most annual variation in female mass was associated with factors related to nesting phenology (e.g., timing of spring thaw). First-time nesting females weighed 12 g less than experienced breeders. Females weighed less in years when nesting was delayed (2 ± 0.4g for each day of delay). Within years, females that nested relatively later also weighed less (2 ± 0.2g for each day of delay). Females lost 7.5 g per day during early egg laying but the quadratic relationship between nest age and female mass resulted in stable mass during the last 10 days of incubation.

PRESENTATION # 16

DIFFERENTIAL RESPONSES TO HOST RELATEDNESS BY NESTING AND NON-NESTING PARASITES IN A BROOD-PARASITIC DUCK

Kim Jaatinen[1], **Markus Öst[1]**, Phillip Gienapp[2], and Juha Merilä[2]

[1] ARONIA Coastal Zone Research Team Åbo Akademi Univ. & Novia Univ. of Applied Sciences, FI-10600 Ekenäs, Finland; Tel.: +358 40 594 5186; e-mail kim.jaatinen@gmail.com

[2] Ecological Genetics Research Unit, Department of Biosciences, University of Helsinki, P.O. Box 65, FI-00014, Helsinki, Finland

Whereas interspecific brood parasitism is always detrimental to the host, conspecific brood parasitism (CBP), where individuals from a single species parasitize each others' nests, may theoretically benefit the recipient through the inclusive fitness benefits of kin-biased egg donation. Empirical studies confirming the presence of kin biased egg donation often indicate that the pattern is only evident if host and primary parasite (laying most parasitic eggs) are compared. These observations suggest that secondary and tertiary parasites may be less related or unrelated to the host. Little is known about the strategies employed by non-nesting parasites and whether a parasite's own nesting affects the number of eggs laid per host also remain largely unexplored. Using high-resolution molecular tools we were able to assign parasitic offspring to non-nesting and nesting females in a Canadian population of Barrow's goldeneyes (*Bucephala islandica*). The aim of this paper is threefold. Firstly, we studied how the presence or absence of a nest affected the probability of female Barrow's goldeneyes (*Bucephala islandica)* to parasitize others and the relatedness to the host, while correcting for spatial proximity. Secondly, we investigated how the number of eggs donated was related to whether the parasite had a nest of her own, correcting for spatial proximity and relatedness. Lastly, we compared the quality of nesting and non-nesting parasites, based on their age, size and body condition.

The results of this study revealed that nesting parasites were more likely to engage in parasitism than non-nesting females, and that the probability of engaging in parasitism increased with relatedness and spatial proximity to the host. Females that did employ a parasitic egg-laying tactic laid more eggs in nests close to their own home range. Interestingly, our results revealed, for the first time, a differential response to host-parasite relatedness by nesting and non-nesting females. The number of parasitic eggs laid by nesting parasites clearly increased with relatedness to the host, whereas that of non-nesting parasites did not. This result indicates that the potential for inclusive fitness is much greater for hosts when parasitized by nesting parasites than when parasitized by non-nesting parasites. We found no indications of a quality difference between nesting and non-nesting females as indicated by age, size or body condition, although non-nesting parasites tended to lay fewer parasitic eggs in total.

Our study supports the possibility for the presence of kin-selected brood parasitism and shows that nesting parasites did indeed lay more parasitic eggs as host-parasite relatedness increases. Parasites without nests, on the other hand, did not respond to relatedness. Our findings may thus help reconcile the disparate views on the role of relatedness in CBP, since parasites even in the same population may differ widely in their host selection criteria, depending on whether primary parasites or secondary or tertiary ones are in focus.

PRESENTATION # 17

PERSONALITIES AND COOPERATIVE BROOD CARE IN FEMALE COMMON EIDERS*

Martin W. Seltmann[1], Tuula E. Hollmén[2], Kendall Mashburn[3], Kim Jaatinen[1] and Markus Öst[1]

[1] ARONIA Coastal Zone Research Team, Novia University of Applied Sciences & Åbo Akademi University, Ekenäs, Finland; Tel.: +358 442043454; e-mail: martin.seltmann@novia.fi
[2] Alaska SeaLife Center, Seward, AK, U.S.A.
[3] University of Alaska Fairbanks, Fisheries Division, Juneau, AK, U.S.A.

Individual variation in animal behavior is increasingly reported to have important ecological and evolutionary consequences. A major component of personality is the shyness-boldness continuum. However, very little is known about the relationship between personality and the tendency to engage in reproductive cooperation with conspecifics. In our study we investigated the personalities and brood-rearing strategies of female common eiders (*Somateria mollissima*) from a population in southwestern Finland, Baltic Sea, during 2008-2010. Personalities were defined based on endocrine, physiological, behavioral and state-dependent traits. We measured baseline levels of corticosterone in fecal samples and the increase of corticosterone concentrations as a stress response to handling in blood serums samples, using a radioimmunoassay. Breathing rate and rectal temperature were measured as physiological traits. The behavioral traits included flight initiation distance, aggression against conspecifics, and spatial centrality in brood-rearing coalitions which measured boldness, and female dive duration during brood-rearing which was considered a measure of exploratory behavior. Additionally, we included nest cover as a further explorative behavioral trait in our analyses. Age and body condition represented state-dependent traits. We found that several of our measured traits were correlated, and both intra- and inter-individual consistency in behavior was generally high. These results are consistent with the classification of individuals into proactive and reactive individuals along the shyness-boldness continuum. We will also show the relative frequency of different personality types in our study population. Finally, our study revealed that eider personalities were non-randomly distributed with respect to the choice of brood-rearing strategies. Brood rearing strategies range from solo care to shared care in large multi-female brood-rearing coalitions and individual variation and consistency in personality seem to be important factors in the partner choice among females forming brood-rearing coalitions.

SESSION 3: PHYSIOLOGY, DISEASES, CONTAMINANTS AND PARASITES

SESSION CHAIR: SHIWAY W. WANG

PRESENTATION # 18

COMPARISON OF TRENDS IN PHYSIOLOGICAL PARAMETERS OF LONG-TAILED DUCKS UNDERGOING INTRACOELOMIC SATELLITE TRANSMITTER IMPLANTATION AND TWO DIFFERENT POST-OPERATIVE CARE PROTOCOLS

Scott L. Ford[1], Glenn H. Olsen[2] and Matthew C. Perry[2]

[1] Avian Specialty Veterinary Services, 13861 Hillcrest Dr NW, Poulsbo, WA 98370; Tel.: (360) 271-7000; e-mail: akeaglevet@yahoo.com
[2] U.S. Geological Survey, Patuxent Wildlife Research Center, 12302 Beech Forest Road, Laurel, MD 20708, U.S.A.

As indicated in the Sea Duck Joint Venture (SDJV) Strategic Plan, there are ongoing questions about the effects of implanted satellite transmitters on behavior, reproduction, and survival of sea ducks. Post-surgical discomfort and loss of waterproofing could leave ducks more prone to predation, hypothermia, or depletion of critical energy reserves. This could be particularly important to consider when ducks undergo surgery during molting or early wintering periods. To address these concerns, SDJV funded a study to provide additional data about the physiologic effects of capture, surgical implantation of intracoelomic platform transmitting terminals (PTTs), and various perioperative care techniques. Fifty-one (31 M, 20 F) Long-tailed Ducks (Clangula hyemalis) were captured in winter in Nantucket Sound, MA, USA and assigned to one of four study groups. Group A received PTTs and subcutaneous (SC) fluids. Group B received PTTs, SC fluids, and gavage feeding. Group C were not implanted, but received SC fluids. Group D were not implanted, but received SC fluids and gavage feeding. SC fluids consisted of Lactated Ringer's Solution administered into the crural patagium ("inguinal web") at 50 mls/kg body weight (BW) twice daily. Gavage feeding consisted of an elemental diet (Emeraid Exotic Carnivore, Lafeber Co., Cornell, IL, USA, mention of trade names does not imply federal government endorsement) at 50 mls/kg BW, three times daily. No significant differences between sexes at capture were found for serum corticosterone (sC), fecal corticosterone (fC), packed cell volume (PCV), total white blood count (TWBC), or heterophil:lymphocyte ratio (H:L). Mean (and standard deviation), genders combined, at capture: sC: 29.0(23.2) ; fC: 53.8 (48.5), PCV: 56.3(10.5), TWBC: 14.2(4.6) k/dl, H:L: 0.30(0.19). Mean body mass change (gm/hr) post capture was significantly different between groups A (mean -1.81, SD: 0.53) and B (mean 0.94, SD: 1.01) A comparison of study groups by slopes of BW, TWBC, and H:L over time revealed no statistically significant differences. Subjectively, there was a positive correlation in TWBC for birds receiving PTTs. sC trends were statistically different between each of the groups showing negative trends over time in ducks receiving gavage feeding and positive trends in birds not gavage fed. Mean (and SD) for sC change over time by group: A: 0.94 (0.48); B: -0.42 (0.19); C: 2.67 (1.41); D: -1.07 (0.20). fC could not be compared due to lack of sufficient samples. We recommend researchers administer SC fluids every 12 hours until surgery. Surgery should be performed within 12-18 hours post-capture to avoid prolonged periods without alimentation. After surgery, seaducks should receive gavage feeding three times daily until release. Unless a pool with constant inflow of clean water is available, ducks should be bathed only briefly in clean water twice daily and allowed to dry prior to release. Wherever possible, seaducks should be housed in groups or pairs on net-bottomed cages wide enough to allow extension of the wings. Covers should be used on the cage fronts to limit visual contact with people and noise should be minimized. Small pet carriers are adequate for transporting ducks, in pairs, from and to the field, but not for captivity longer than a few hours. Extended post-operative care may have benefits for ducks undergoing surgery during migration or wintering, but further research is needed to develop practical means of providing portable, clean housing and bathing and preening opportunities for restoration of waterproofing.

PRESENTATION # 19

FOUR YEARS OF TESTING SURGICALLY IMPLANTED TRANSMITTERS IN CAPTIVE SEADUCKS

Glenn H. Olsen[1], Alicia M. Wells-Berlin[2], and Matthew C. Perry[2]

[1] U.S. Geological Survey, Patuxent Wildlife Research Center, 12302 Beech Forest Road, Laurel, Maryland 20708, U.S.A.; Tel.: (301) 497-5603; e-mail: golsen@usgs.gov
[2] U.S. Geological Survey, Patuxent Wildlife Research Center, 12100 Beech Forest Road, Laurel, Maryland 20708, U.S.A.

In April 2007, we implanted 4 captive diving ducks (Lesser Scaup, *Aythya affinis*) with non-functional (dummy) satellite transmitters that were externally exact duplicates of the PTT 100 (Microwave Telemetry, Columbia, Maryland, U.S.A., mention of trade name does not imply U.S. government endorsement). This was done as a test for implanting dummy PTTs in seaducks. In November 2007, we implanted dummy PTTs in 4 captive White-winged Scoters (*Melanitta fusca*). We followed this with 2 implants in captive Surf Scoters (*Melanitta perspicillata*) and 2 captive Long-tailed Ducks (*Clangula hyemalis*) in April 2008, and 3 Harlequin Ducks (*Histrionicus histrionicus*) in May 2009. We have seen changes in the hematological and serum chemistry values in the ducks with implants as compared to control ducks kept under the same conditions in our captive seaduck colony. Mean hematocrit values for White-winged Scoters were 44.1% for scoters with implants, 50.0% for control scoters (F=34.5, P=0.0000) and mean aspartate aminotransferase (AST) values for White-winged Scoters were 77 IU/L for scoters with implants, 23 IU/L for control scoters (F=12.6, P=0.0013), mean alanine aminotransferase (ALT) values were 29 IU/L for implant scoters and 20 IU/L for control scoters (F=5.39, P= 0.0275), mean total protein values were 5.50 g/dl for implant scoters and 4.83 g/dl for control scoters (F=3.79, P=0.0616), with the largest change being in the globulin fraction of total protein, 3.94 g/dl in implant scoters and 3.30 in control scoters (F=5.26, P=0.0296) and in the Albumin/Globulin Ratio, 0.39 in implant scoters and 0.50 in control scoters (F=4.37, P=0.0458). Initially we obtained hematological samples from the seaducks at 3 month intervals and saw a spike in some values, such as AST, in the first six months post-surgery, with values gradually returning to the baseline established before surgery. After the first year, sampling was done twice yearly. Although other seaduck species were monitored for blood values, sample sizes were smaller and values are not reported here. Survival has been high for all captive duck species. Of the original seaducks implanted with the dummy PTTs, we have had only one loss, a White-winged Scoter that died 6 months post implant. We have also lost one control duck, a Long-tailed Duck that died 8+ months after the start of the study. This long-term captive study shows that implant surgery alone, in field situations, is not a cause of mortality in seaducks.

PRESENTATION # 20

GENETIC DIVERSITY OF AVIAN INFLUENZA IN ALASKA SEA DUCKS

Andrew B. Reeves[1], Andrew M. Ramey[1], J. Christian Franson[2], Hon S. Ip[2]

[1] U.S. Geological Survey, Alaska Science Center, 4210 University Dr. Anchorage, AK 99508, U.S.A.; Tel.: (907) 786-7172; e-mail: areeves@usgs.gov
[2] U.S. Geological Survey, National Wildlife Health Center, 6006 Schroeder Road, Madison, Wisconsin 53711, U.S.A.

In 2006, a multi-agency plan for detecting highly pathogenic avian influenza (HPAI) identified and ranked wild birds based on their potential to introduce the H5N1 Asian-origin virus to North America. Five sea ducks were included in the list of "priority species" to be monitored: Steller's Eider (*Polysticta stelleri*), Spectacled Eider (*Somateria fischeri*), Common Eider (*S. mollisima*), King Eider (*S. spectabilis*), and Long-tailed Duck (*Clangula hyemalis*). Results from five years of surveillance sampling found no evidence of HPAI in these or any other avian species. However, numerous low pathogenic avian influenza (LPAI) viruses were detected via surveillance and genetic analyses of these isolates enhanced our ability to study sea ducks as an important influenza reservoir. We sequenced the RNA genomes of LPAI viruses in Alaska sea ducks and compared them to samples collected from other avian species in North America and Asia using phylogenetic techniques. Mixed-origin lineages (i.e. viruses with genes from both North America and Eurasia) were observed in at least three species: Steller's Eider, King Eider, and Harlequin Duck (*Histrionicus histrionicus*). The presence of Eurasian genes suggests these species have either migratory connectivity to regions within the Asiatic influenza gene pool and/or secondary contact with other host species that do. Preliminary analyses suggest that, when considered separately, the hemagglutinin (HA) and neuraminidase (NA) surface glycoproteins found in sea ducks are similar to those found in Alaska dabbling ducks. In contrast, the combination of HA and NA subtypes in sea ducks appear different to dabbling ducks. Despite a much smaller sample size, several of the subtype combinations observed in sea ducks had not been previously reported in Alaska dabbling ducks sampled over the same time period (2006-2010). These data suggest that influenza diversity may differ between some waterfowl families, marine and freshwater environments, or both. If confirmed, such findings would have important implications to how sea duck species are evaluated as reservoirs of avian influenza.

PRESENTATION # 21

EVIDENCE FOR SEGREGATION OF AVIAN INFLUENZA RESERVOIRS IN STELLER'S EIDERS AND NORTHERN PINTAILS USING ALASKA PENINSULA COASTAL LAGOONS

Andrew M. Ramey[1], John M. Pearce[1], Andrew B. Reeves[1], J. Christian Franson[2], Timothy D. Bowman[3], Margaret R. Petersen[1], and Hon S. Ip[2]

[1] U.S. Geological Survey, Alaska Science Center, 4210 University Drive, Anchorage, Alaska 99508, U.S.A.; Tel.: (907) 786-7174; e-mail: aramey@usgs.gov
[2] U.S. Geological Survey, National Wildlife Health Center, 6006 Schroeder Road, Madison, Wisconsin 53711, U.S.A.
[3] U.S. Fish and Wildlife Service, Migratory Bird Management, 1011 East Tudor Road, Anchorage, Alaska 99503, U.S.A.

Phylogenetic analyses and comparisons of genomic homology can be useful for resolving the role of migratory birds in the maintenance and spread of avian influenza viruses (AIVs). In this study, we analyzed epidemiological and sequence data for AIVs from Steller's Eiders (*Polysticta stelleri*) sampled at coastal lagoons along the Alaska Peninsula from 2006 through 2008 to asses the role of this species in transporting viruses between continents and maintaining a regional viral reservoir with sympatric Northern Pintails (*Anas acuta*). The overall AIV prevalence in Steller's Eiders was 2.5% as detected by real time RT-PCR, however, the prevalence rate varied between sample locations at Izembek Lagoon (0.2%) and Nelson Lagoon (3.9%). Genetic sequencing of 13 AIVs isolated from Steller's Eiders sampled at Nelson Lagoon revealed 4.9% of gene segments as being of Eurasian origin or 7.9% after removing highly homologous isolates to correct for non-independence of samples. Seven different AIV subtypes were detected in Steller's Eiders across three sample years, however only two of these subtypes were shared with viruses isolated from Northern Pintails sampled at Izembek Lagoon during the same sample years. No AIV strain isolated from Steller's Eiders was > 99% homologous at all eight gene segments to viruses obtained from Northern Pintails during the course of this study. Highly homologous comparisons (i.e. > 99%) for individual gene segments were detected between AIVs isolated from Steller's Eiders and Northern Pintails. The frequency of highly homologous gene segments was greater for AIVs sampled from the same species than between species for all eight influenza genes. Based on previous band-recovery data at Izembek Lagoon, Steller's Eiders likely transport AIVs of Asian origin between continents through long distance migratory movements. Comparisons of virus prevalence, distribution of viral subtypes, and genomic homology do not support the transmission of AIVs between Steller's Eiders and Northern Pintails at Alaska Peninsula coastal lagoons. However, high levels of homology of some internal gene segments provide evidence for overlapping AIV gene pools. Incomplete segregation of AIV reservoirs at Alaska Peninsula coastal lagoons could be due to physical or ecological barriers to virus transmission between Steller's Eiders and Northern Pintails or combinations thereof.

PRESENTATION # 22

PREVALENCE OF AVIAN INFLUENZA ANTIBODIES AMONG SEA DUCKS IN ALASKA

Heather M. Wilson[1], Jeffrey S. Hall[2], Paul L. Flint[3], and J. Christian Franson[2]

[1] U.S. Fish and Wildlife Service, Migratory Bird Management, 1011 E. Tudor Road., Anchorage, Alaska, 99503, U.S.A. Tel.: (907) 786-3831; e-mail heather_wilson@fws.gov
[2] U.S. Geological Survey, National Wildlife Health Center, 6006 Schroeder Road., Madison, Wisconsin 53711, U.S.A.
[3] U.S. Geological Survey, Alaska Science Center, 4210 University Drive., Anchorage, Alaska, 99508, U.S.A.

We examined seroprevalence of avian influenza (AI) antibodies in more than 4400 birds, from 13 species of wild waterfowl in Alaska (2001-2010). Prevalence of antibodies was highest in sea ducks, particularly Steller's Eiders (*Polysticta stelleri*) 80%, Common Eiders (*Somateria mollissima*) 85%, and Spectacled Eiders 92% (*S. fischeri*), than all other waterfowl sampled. However, several species of sea ducks had substantially lower seroprevalence rates than the eiders (e.g., Long-tailed Ducks *Clangula hyemalis* 51% and American Scoters *Melanitta americana* 69%). Seroprevalence was higher in adults than juveniles and varied with year of sampling. High seroprevalence in sea duck species with low active exposure rates suggests influenza exposure is occurring during periods in the annual cycle largely outside of our sampling frame (e.g., over-winter) and that testing for virus alone may be inefficient in determining risk of transmission and/or exposure to AI virus for all species. Previous studies noting poor survival of AI virus in saline environments suggested that marine birds, such as sea ducks, would have lower exposure rates. However, our results indicate quite the opposite, with >80% of eiders having been previously exposed to AI. High prevalences in eiders may be related to overall life history. Highly flocked, northern-wintering, marine waterfowl may have more opportunity for exposure, particularly during highly aggregated periods in the annual cycle (e.g., spring/fall molting/staging and wintering). Finally, given recent studies suggesting that pre-existing low pathogenic AI antibodies can infer some protection against highly pathogenic AI (HPAI H5N1), our results also suggest that wild sea duck populations in Alaska could be a key group of unapparent carriers of HPAI viruses. We advocate future sampling which would expand priority species to include those with elevated low pathogenic avian influenza seroprevalences (such as all sea duck species), in addition to those with high active-exposure rates.

PRESENTATION # 23

LEVELS OF HEAVY METAL, PCBS, PESTICIDES AND FLAME RETARDANTS IN TISSUES OF BARROW'S GOLDENEYES WINTERING IN THE ST. LAWRENCE MARINE SYSTEM*

Jean-François Ouellet[1,3], Louise Champoux[2] and Michel Robert[1]

[1] Environment Canada, Canadian Wildlife Service, Quebec region, 1141 route de l'Église, Sainte-Foy, Québec, Canada G1V 4H5; Tel.: office (home): (418) 739-5751 / office: (418) 723-1986 ext.1968.
[2] Environment Canada, Science and Technology, 1141 route de l'Église, Sainte-Foy, Québec, Canada G1V 4H5
[3] present address : Biology, Chemistry and Geography Department, Quebec University at Rimouski, 300 allée des Ursulines, Rimouski, Québec, Canada G5L 3A1; e-mail: jean-francois_ouellet03@uqar.qc.ca

The eastern North American population of Barrow's Goldeneye (*Bucephala islandica*) is designated "of special concern" by the Committee on the status of Endangered Wildlife in Canada. During six months per year the majority of this population at risk winters within only 300 km of non contiguous coastline in the St. Lawrence marine system. Large numbers of individuals congregate for prolonged periods of time in severely contaminated areas where they feed on benthic invertebrates, mostly molluscs. Obviously, this clustered distribution pattern and the feeding habits of the species make this small population highly vulnerable to contamination. Our objective was to determine the level of contaminants in tissues of Barrow's Goldeneyes wintering in the St. Lawrence marine system. Specimens were collected in the regions of Charlevoix (Upper Estuary), Manicouagan (Lower Estuary) and Chaleur Bay and were analyzed for hepatic PCBs, chlorinated pesticides, brominated flame retardants, and hepatic and renal Hg, Cd, Se, As, and Pb. Metals were detected in most of the specimens. Pesticide and flame retardant levels were generally low. DDE contributed most of the total DDT detected. Specimens from Chaleur showed the highest Se (mean±SD: 37.7±15.4 mg/kg hepatic dw) and total DDT (65.9±15.8 ng/g hepatic ww) levels. Specimens from Charlevoix had highest pesticides (other than DDT) and Cd (5.15±1.7 mg/kg hepatic dw) levels, and specimens from Manicouagan had highest PCBs (261±132 ng/g hepatic ww) and Hg (4.33±1.47 mg/kg hepatic dw) levels. Baie-des-Anglais in Manicouagan is known to be heavily contaminated by PCBs and juveniles collected there showed similar PCB levels as adults from the same region.

PRESENTATION # 24

VALIDATING STABLE CARBON ISOTOPE ANALYSIS OF FATTY ACIDS TO ESTIMATE DIETS OF THREATENED EIDERS*

Shiway W. Wang[1,2], Suzanne M. Budge[3], Tuula E. Hollmén[4,5] and Matthew J. Wooller[2,4]

[1] Sedna Ecological, Inc., Fairbanks, Alaska 99707 U.S.A.
[2] Alaska Stable Isotope Facility, Water and Environmental Research Center, University of Alaska Fairbanks, Fairbanks Alaska 99775 U.S.A.; Tel.: (907) 460 2496; e-mail: shiway@gmail.com
[3] Department of Process Engineering and Applied Science, Dalhousie University, Halifax, Nova Scotia B3J 2X4
[4] School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, Alaska 99664 U.S.A.
[5] Alaska SeaLife Center, Seward, Alaska 99664 U.S.A.

The Spectacled Eider (*Somateria fischeri*) and Steller's Eider (*Polysticta stelleri*) winter and stage in marine habitats, and their breeding outcome likely depends on availability of adequate marine resources. Determining the diet preferences and foraging habitat associations of these eiders in relation to seasonal and life history stages will provide information to help identify and characterize important habitats of these threatened breeding populations. Given limitations of traditional methods of diet analyses, such as stomach contents analysis, our overall goal was to develop non-invasive methods to study diets of threatened eiders. In this study, we validated the use of stable carbon isotope analyses of specific fatty acids to estimate diets of captive eiders. Similar to bulk isotopes, stable carbon isotopes of fatty acids deposited in animal tissues can serve as markers of their source but could be fractionated to some extent during digestion, assimilation and mobilization. Assessing the amount of isotopic modification is critical in developing this approach. In this study, captive eiders were fed a known constant diet for 180 days with blood serum sampled at 60, 120 and 180 days immediately after a 12 hr fast; adipose tissue was collected at 180 days. $\delta^{13}C$ values of 20:5n-3 and 22:6n-3 in adipose tissue did not differ from diet, while 18:2n-6 and 18:3n-3 showed a ~2‰ enrichment compared to diet. Discrimination factors were used in combination with a mixing model incorporating fatty acids and lipid concentrations to estimate diet of eiders fed a binary mixture with contrasting isotopic signatures. Diet estimates varied with fatty acid structure but mean values closely approximated the actual proportions consumed. These results demonstrate the utility of this method in tracing dietary input in eiders.

PRESENTATION # 25

IN-AIR AND UNDERWATER HEARING OF SEA DUCKS*

Sara C. Therrien[1], Catherine E. Carr[1], Ronald E. Therrien[2], Robert J. Dooling[1], Arthur N. Popper[1], Elizabeth F. Brittan-Powell[1], and Alicia M. Wells-Berlin[2]

[1] University of Maryland, College Park, MD 20742, U.S.A.; Tel.: (443) 996-1008; e-mail: therrien@umd.edu
[2] U.S. Geological Survey, Patuxent Wildlife Research Center, 12100 Beech Forest Rd., Laurel, MD 20708, U.S.A.

Construction and maintenance of alternative energy sources, such as wind farms, can dramatically increase in-air and underwater noise levels in local areas. Introduction of anthropogenic noise sources can mask communication, displace animals from preferred foraging or breeding habitat, disrupt predator-prey interactions, and cause physiological damage ranging from hearing impairment to tissue hemorrhaging. However, it is impossible to determine the effects that increased noise levels can have on an aquatic animal without first knowing its auditory sensitivity and how it uses sound. This study investigates the in-air and underwater hearing abilities of several sea duck and a diving duck species. Hearing tests are conducted using both electrophysiological and behavioral methods. The auditory brainstem response (ABR) is a valuable physiological technique used to test a bird's hearing in a minimally invasive and time-efficient manner. The ABR is a scalp-recorded potential resulting from synchronized neural discharge (population response) following an auditory stimulus. This synchronized response is manifested as a series of four or more waves occurring within the first 10 ms following stimulation and represents the progressive propagation of auditory neural activity through the ascending auditory pathway. To date, we have used the ABR to test hearing in one species of diving duck (Lesser Scaup, *Aythya affinis*), as well as Long-tailed Ducks (*Clangula hyemalis*), and Surf Scoters (*Melanitta perspicillata*). The typical duck ABR waveform showed two to three prominent peaks that occurred within the first 5 ms after onset of the stimulus. Peak amplitude of the response increased and peak latency of the response decreased with increasing stimulus sound pressure level (SPL). Threshold was defined as 2.5 dB below the lowest SPL that evoked a visual response (visual detection method). The best range of hearing for all three species was from 1000 Hz to 4000 Hz, with sensitivity peaking between 1500 Hz and 3000 Hz. Both the waveform morphology and response characteristics of the peaks to changing stimulus intensity are similar to those found in other avian species, such as screech owls (*Megascops asio*) and budgerigars (*Melopsittacus undulatus*). These results represent the first measurement of auditory sensitivity of any sea duck. In addition to the ABR tests, we are currently conducting behavioral hearing tests, in which the ducks have to respond to an auditory stimulus by pecking a specific target, to determine hearing thresholds while diving underwater. Many sea ducks spend a significant portion of their lives under the water, and most likely have sensory adaptations to facilitate their aquatic lifestyles. Because acoustic energy is so efficient underwater, it would be an effective mode of communication, navigation and/or foraging for sea ducks. However, without any measurements of in-air or underwater hearing abilities it is impossible to explore the role of acoustics in the lives of sea ducks. In addition, this study represents the first attempt to test any bird species' hearing underwater.

SESSION 4: NON-BREEDING ECOLOGY

SESSION CHAIR: DIRK V. DERKSEN

PRESENTATION # 26

THEN AND NOW: A COMPARISON OF THE DISTRIBUTION OF SPECTACLED EIDERS AT NON-BREEDING AREAS IN THE PAST 15 YEARS*

Matthew G. Sexson[1,2], Margaret R. Petersen[1], and Abby N. Powell[3]

[1] U.S. Geological Survey, Alaska Science Center, 4210 University Drive, Anchorage, Alaska 99508, U.S.A.; Tel.: (907) 786-7177; e-mail: msexson@usgs.gov
[2] Department of Biology and Wildlife, University of Alaska Fairbanks, 211 Irving 1, Fairbanks, Alaska 99775, U.S.A.
[3] U.S. Geological Survey, Alaska Cooperative Fish & Wildlife Research Unit, University of Alaska Fairbanks, 211 Irving 1, Fairbanks, Alaska 99775, U.S.A.

Threatened Spectacled Eiders (*Somateria fischeri*) spend 9 – 12 months of the year at sea, where the distribution of sea ice and benthic prey likely influence the species' non-breeding distribution. Among other aspects of arctic marine ecosystems, sea ice and benthic communities have changed in response to rapid climate warming. If environmental conditions at non-breeding areas have changed and eider distribution is responsive to those conditions, we would expect to see shifts in spatial distribution over time. We compared molting and wintering location data collected from adult eiders with implanted satellite transmitters from 1993 - 1997 (n = 53) and 2008 - 2010 (n = 79) to determine if non-breeding distribution changed between the two periods. We compared distributions from each time period using several spatial tools including multi-response permutation procedures, percent overlap of home ranges (95% kernel) and core use areas (50% kernel), and distance between mean centers. Overlap of home ranges between the two time periods at four distinct molting areas ranged from 25 to 75%. The distribution of eiders molting in eastern Norton Sound, the eastern Chukchi Sea, and on the arctic coast of Russia were different between periods in each area ($p < 0.01$), but not on the east coast of the Chukotka Peninsula ($p = 0.4$). Overlap of core molting areas ranged from 0 to 73%; areas in eastern Norton Sound did not overlap. Eiders used a single wintering area south of St. Lawrence Island in the northern Bering Sea in all years. Overlap of wintering home range and core area were 47 and 26%, respectively. Winter distribution was different between periods ($p = 0.01$). Mean centers from each winter distribution were only 7 km apart; and the 95% kernel home range during the earlier time period fit within the more recent home range, suggesting a difference in spatial dispersion as opposed to central tendency. We did not detect gross departure from traditionally used non-breeding areas nor from designated critical habitat. However, data from our ongoing study suggest that the spatial distribution of Spectacled Eiders at 3 out of 4 primary molting areas and the single known wintering area has changed in the past 15 years.

PRESENTATION # 27

DISTRIBUTION, ABUNDANCE, AND MOVEMENTS OF BLACK SCOTERS (*MELANITTA AMERICANA*) WINTERING ALONG THE SOUTHERN ATLANTIC COAST OF THE UNITED STATES: HABITAT ASSOCIATIONS AND LESSONS FOR MONITORING

Emily Silverman[1], Walt Rhodes[1], Scott Gilliland[2]

[1] U.S. Fish & Wildlife Service, Migratory Bird Management, 11510 American Holly Drive, Laurel, MD 20708; Tel.: (301) 497-5801; e-mail: emily_silverman@fws.gov, walt_rhodes@fws.gov
[2] Environment Canada, 6 Bruce St., Mount Pearl, NL, Canada A1N 4T3; scott.gilliland@ec.gc.ca

Black Scoters (*Melanitta americana*) are the most southerly distributed sea duck along the Atlantic coast of the U.S., wintering as far south as the Georgia-Florida border (30° 42'N). They are found in large numbers from North Carolina to Florida: current estimates suggest 40-77% of all Atlantic coast birds winter in this region, and are especially concentrated near Savannah, GA and Charleston, SC, two cities with growing port traffic (Silverman *et al.* 2010). These areas are under consideration for offshore energy development and, at the southern edge of the Black scoter wintering range, represent critical habitats that may be particularly impacted by environmental alterations linked to climate change. Black scoter occurrence along this section of the coast is not well characterized and highly variable, but recent intensive winter surveys and a satellite tagging provide data that offer insights into the abundance, distribution, and movement patterns of birds wintering in this area. We present analysis of (i) the satellite locations of 15 Black Scoters outfitted in May 2010 and wintering south of Chesapeake Bay, (ii) the 2008-11 Atlantic coast winter sea duck survey, which consists of east-west transects spaced every 5 NM of latitude, extending to over 20 NM offshore, and (iii) the historic Atlantic coast winter aerial survey, conducted for 10 years in the 1990s and early 2000s, which ran parallel to the coast at ¼ mile offshore. We discuss the relationship of scoter distribution to habitat features including bathymetry, shoreline characteristics, sea surface temperature, winter weather conditions, and exposure to hunting. Preliminary data and previous modeling results (Zipkin *et al*. 2010) suggest that Black Scoters concentrate at the mouths of rivers and bays, and their abundance is strongly related to annual climate cycles and sea depth, habitat characteristics that are likely to be affected by sea level change and port dredging. We quantify the frequency, distance, and nature of winter movements of Scoters over the winter and during the aerial survey period. Overall, Black Scoters along the coast shifted south from October through January, but moved little during the course of the 2011 survey flights. Using extra replicated transects and additional 2.5 NM-spaced transects flown in 2011, we explore the adequacy of the current Atlantic coast winter survey design to estimate sea duck numbers in areas where sea ducks are abundant, but patchily distributed.

PRESENTATION # 28

MOLTING, WINTERING GROUNDS AND MIGRATION PATTERNS OF SCALY-SIDED MERGANSERS *MERGUS SQUAMATUS* FROM GEOLOCATOR AND STABLE ISOTOPE ANALYSIS

Diana V. Solovyeva[1] (corresponding author), Jason Newton[2], Tony (A.D.) Fox[3,4] and Vsevolod Afanasyev[4]

[1] Zoological Institute RAS, 1 Universitetskaya Emb., St-Petersburg, 199034, Russia; tel/fax: +7 812 2306712; e-mail: diana_solovyeva@mail.ru
[2] NERC Life Sciences Mass Spectrometry Facility, SUERC, Rankine Avenue, East Kilbride, G75 0QF, UK e-mail: Jason.Newton@glasgow.ac.uk
[3] Department of Wildlife Ecology and Biodiversity, National Environmental Research Institute, University of Aarhus, Kalø, Grenåvej 14, DK-8410 Rønde, Denmark; e-mail: tfo@dmu.dk and jwf@bas.ac.uk
[4] British Antarctic Survey, High Cross, Madingley Road, Cambridge, CB3 0ET, United Kingdom; e-mail: vaf@bas.ac.uk

The scaly-sided merganser is a globally threatened species, known only to breed in Far East Russia, North China and probably in DPR Korea. The moulting locations, habitats, timing and strategies are hitherto completely unknown. In spring 2006-2009 twenty nine females Scaly-sided Mergansers were captured on their nests in the Avvakumovka, Kievka, Margaritovka and Pavlovka river basins in Primorye, Russia, and fitted with British Antarctic Survey geolocating data loggers. Fifteen females were recaptured in the years following the year of initial catching including two females recaptured after two years. All the retrieved loggers provided daily data on the times of sunrise and sunset experienced by the birds throughout the annual cycle which enabled calculation of their movements through the seasons. Flight feather samples from 17 females and 8 males in 2007-2008 were analysed for deuterium stable isotope ratios to determine moulting habitats and potential moulting areas. Fourteen merganser feather samples were analysed for carbon and nitrogen stable isotopes in feathers. Seven among 17 females analysed for deuterium stable isotope ratios were tracked using geolocators for the period of feather growth. We here present the first data ever describing the moult locations and migration patterns of Scaly-sided Mergansers en route to their ultimate wintering quarters in China. Males moulting areas differed from those of females and young birds differed from adults.

PRESENTATION # 29

IMPORTANCE OF THE BOREAL TRANSITION ZONE OF NORTHERN ALBERTA FOR POSTBREEDING BARROW'S GOLDENEYES

Jonathan E. Thompson[1], Danica Hogan[2], Daniel Esler[3] and Sean Boyd[4]

[1] Ducks Unlimited Canada, #200, 10720 - 178 Street, Edmonton, AB, T5S 1J3, Canada; Tel.: (780) 930-1249; e-mail: j_thompson@ducks.ca
[2] Centre for Wildlife Ecology, Department of Biological Sciences, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada
[3] Centre for Wildlife Ecology, Simon Fraser University, 5421 Robertson Road, Delta, BC, V4K 3N2, Canada
[4] Science & Technology Branch, Environment Canada, 5421 Robertson Road, Delta, BC, V4K 3N2, Canada

Satellite telemetry and fixed-winged aerial surveys of wetlands in the Boreal Transition Zone of northern Alberta have revealed that this region is important to Barrow's Goldeneyes (*Bucephala islandica*) during remigial molt and fall staging. Males begin arriving on postbreeding sites in early to mid June with some birds remaining until freeze-up in early November; this period encompasses approximately 5 months or 40% of their annual cycle. Two adjacent sites in northwestern Alberta, Cardinal and Leddy Lakes, cumulatively host up to 7000 postbreeding Barrow's Goldeneyes annually. Aerial surveys in other parts of the Boreal Transition Zone of Alberta indicate that at least 12 additional sites host annual concentrations of ≥ 100 postbreeding goldeneyes, but ground surveys are still required to confirm species composition. Satellite telemetry data suggest that many of the birds migrating to molting sites in northern Alberta are from breeding sites in the intermountain region of British Columbia. Specifically, of 20 breeding male Barrow's Goldeneyes marked with satellite transmitters in south-central British Columbia, 6 (30%) ultimately molted on Cardinal Lake. Similarly, 2 of 3 wintering males (66%) marked with satellite transmitters along the southern coast of British Columbia molted on Cardinal Lake. Over the last two years, we have captured and banded approximately 1200 Barrow's Goldeneyes during remigial molt on Cardinal and Leddy Lakes. The main cohort captured was After-Second-Year males representing from 78 to 85% of the birds at Cardinal Lake and 83 to 85 % of the birds at Leddy Lake. We also marked 100 flightless male Barrow's Goldeneyes with subcutaneous prong-mounted VHF radios to monitor survival and local movements and 38 males with satellite transmitters to track longer range movements throughout their annual cycle. Preliminary analyses suggest that survival of radio and satellite marked birds during remigial molt was relatively high, while mortality rates increased during fall staging and winter due primarily to hunting on Cardinal Lake and in Puget Sound, Washington. Given that few sites are currently recognized to provide significant molting and fall staging habitat for Barrow's Goldeneyes, our study suggests that protection of these sites should be a conservation priority. This recommendation is particularly true for sites in northern Alberta that could be at more immediate risk from expansion of energy developments and other industrial activities.

PRESENTATION # 30

PREDICTING SEA DUCK DISTRIBUTIONS FROM SURVEYS AND TELEMETRY DATA

Stefan Heinänen[1], Henrik Skov[1] and Ramūnas Žydelis[1]

[1] DHI, Agern Allé 5, DK-2970 Hørsholm, Denmark; Tel.: +45 4516 9352; e-mail: she@dhigroup.com

Species distribution models describing relationships between observed species and environmental variables are becoming inevitable in conservation planning and management. Although we have quite good knowledge of the habitat preferences of sea ducks there are few examples of distribution models capable of quantitatively predicting the numbers and distribution patterns of sea ducks at sea. In this study, we explore the usefulness of different data sets, collected in different manners for predictive modeling. Our objective was to investigate the use of data from ship and aerial surveys as well as telemetry data for predicting the density and probability of presence of several sea duck species on a broad, Baltic Sea wide extent, as well as on a small local scale. We used ship and aerial survey data from national monitoring programs to describe wintering distribution patterns and mean densities of sea ducks in the whole Baltic Sea. On the regional scale we used aerial surveys to predict densities, and telemetry data to predict probability of occurrence in a region between Denmark and Germany. As sea duck survey data typically is zero-inflated, we have used a two-part so-called delta-gamma generalized additive model to predict the density of sea ducks. The first part of the model predicts if the model species is present or absent (fitted with a binomial distribution) whereas in the second part the density is predicted (fitted with a gamma distribution and log link). All zeros are excluded in the density part and the predictions of both parts are finally combined. We also utilized satellite telemetry data to predict the probability of occurrence of sea ducks. Because telemetry data represent only bird presence points, we tested habitat predictions applying MaxEnt and generalized additive models including pseudo-absences. We also accounted for biases in telemetry position recording by implementing an iterative re-sampling procedure. All modeling approaches yielded satisfactory and comparable results. Depth, geographic coordinates and food resources were generally the most important predictors, variables describing disturbance were often also influential. The modeled distribution patterns obtained by telemetry data agreed well with the modeling results based on survey data. Despite of statistical challenges inherent to many bird datasets, such as zero inflation, non-linearity and temporal and spatial autocorrelation we show that different kinds of data can be utilized for obtaining ecologically interpretable predictions of distribution and numbers of sea ducks at different scales. Predictive modeling of sea duck distribution offers a toolbox for better utilization of available data. Distribution models enhances our understanding of which factors are important in shaping the distribution patterns of birds and can be used to address an array of different management and conservation issues.

PRESENTATION # 31

USING DENSITY SURFACE MODELS TO ASSESS THE SPATIAL DISTRIBUTION AND ABUNDANCE OF SEADUCKS USING RHODE ISLAND'S OFFSHORE WATERS

Peter W.C. Paton[1], Kristopher Winiarski[1], Carol L. Trocki[1], Pamela H. Loring[1], Jason E. Osenkowski[2], and Scott R. McWilliams[1]

[1] Department of Natural Resources Science, University of Rhode Island, Kingston, Rhode Island 02881, U.S.A.; Tel.: (401) 874-2986; e-mail: ppaton@mail.uri.edu
[2] Rhode Island Department of Environmental Management, Division of Fish & Wildlife, 277 Great Neck Road, West Kingston, RI 02892, U.S.A.

The Rhode Island Ocean Special Area Management Plan (Ocean SAMP) was initiated in 2008 to zone offshore waters in anticipation of the construction of two offshore wind facilities, with 5-8 wind turbines off of Block Island and up to 200 wind turbines in Rhode Island Sound. The Ocean SAMP characterized abiotic and biotic resources in a spatially-explicit context to facilitate the appropriate placement of offshore developments including wind facilities. Baseline information on avian use of the area was one of the critical components of the Ocean SAMP. We conducted a systematic series of land-based seawatches, ship-based line transect surveys, and aerial strip transects to assess the spatial distribution, abundance, and flight ecology of birds. In addition, an Black Scoter (*Melanitta americana*) satellite-telemetry project was initiated in the winter of 2010-2011 to provide us with more insight into movement and habitat use patterns of seaducks. We detected 560,466 individuals of 128 avian species during 1,098 1-2 hr land-based seawatches at 11 sites from January 2009 to August 2010. The most commonly detected birds were scoters (*Melanitta* spp., 31% of detections), Common Eiders (*Somateria mollissima,* 18%), and gulls (*Larus* spp., 27%). We also conducted ship-based line transect surveys on 46 days over the 18-month survey period, and aerial strip-transect surveys on 29 days between 18 Nov 2009 and 31 Aug 2010 to cover the entire 3,800 km^2 study area. We used seawatches to quantify the migration chronology, flight directions, flight altitudes and spatial distribution of seaducks using nearshore areas. We used the ship-based and aerial surveys to develop Density Surface Models (DSM) in Program DISTANCE to estimate the spatial distribution and abundance of birds in offshore areas, as well as to develop bathymetry profiles for select species. We documented substantial interannual variation in scoter and eider abundance during land-based seawatches. Based on DSM models from aerial surveys, we estimated daily eider abundance in winter at 19,343 individuals (95% CI = 15,827 to 23,641) and in spring at 2,862 individuals (95% CI = 2,505 to 3,268). Common Eider densities during winter were highest (ca. 300 individuals per km^2) in waters along the south coast of Rhode Island, Block Island, Montauk and the shallower waters in the northeastern corner of the study area, whereas during spring, seaduck densities decreased to ca. 54 individuals per km^2 in nearshore waters. DSM suggested that Common Eiders were farther offshore in spring than in winter. The Ocean SAMP study area is characterized by waters averaging 35 ± 10 m deep, with 8% of the study area <20 m and 86% between 20-50 m deep. Seaducks were usually detected in waters <25 m deep, with most detected in areas <20 m. Transmittered Black Scoter also primarily used nearshore, shallow habitats (on average within 600 m of shore, <10 m depths) throughout the day and night during winter, although some large movements were observed. As a result of this research, the Rhode Island Ocean SAMP has proposed no developments, including offshore wind facilities, should occur in waters <20 m deep.

PRESENTATION # 32

CONSISTENCY IN THE DISTRIBUTION OF MOLTING SCOTERS AND COMMON EIDERS IN THE ESTUARY AND GULF OF ST. LAWRENCE IN 1998 AND 2010

François Bolduc[1] and **Jean-Pierre L. Savard**[2]

[1] Environment Canada, Canadian Wildlife Service, 1141 rte de l'Église, Québec City, QC, Canada, G1V 3W5; Tel. : (418) 640-2910; e-mail: François.bolduc@ec.gc.ca
[2] Environment Canada, Science and Technology, 1141 rte de l'Église, Québec City, QC, Canada, G1V 3W5

We compared results of aerial surveys conducted in late July and early August in the Estuary and the northern Gulf of St. Lawrence in 1998 and 2010 to investigate whether common molting sites could be identified between decades and species. In July or August, between 10,000 and 20,000 molting scoters gathered along a 55 km stretch on the south shore of the Estuary (between Trois-Pistoles and Rimouski), and between 10,000 and 24,000 along 90 km of coastline on the north shore of the Estuary (Between Forestville and Baie-Comeau) in 1998 and 2010. Based on our visual estimates, between 24,000 and 45,000 scoters, mostly Surf Scoters (*Melanitta perspicillata*) and some White-winged Scoters (*M. fusca*), can be observed in this area at this time of the year. In July and August, three to ten thousand molting Common Eiders (*Somateria mollissima*) were scattered along 75 km of coastline on the south shore of the Estuary between Bic and Saint-Ulric, and along 75 km on the north shore between Forestville and Baie-Comeau. Areas associated with the greatest concentrations of eiders (3,000-15,000) were found close to Les Escoumins on the southwest coast of Anticosti Island (22,000-40,000). We observed a maximum of 54,000 to 62,000 molting eiders in our study area in a given year. Visual estimates will be corrected using stratified ratio estimators and, as the ratio photo/visual estimates most often is between 1.2 and 2.0, results suggest that between 100,000-200,000 molting sea ducks can be found at a given time in our study area. Scoters and eiders appear to use the same areas for molting every year, but they rarely molt in mixed flocks; Common Eiders are mostly found over rocky substrates and scoters over sandy substrates. Such consistency in location of molting sites within species offers potential for monitoring changes in the population among years. The survey technique would benefit from a high-end photographic apparatus to reliably differentiate scoter species and adults from immature individuals. Our results point to potential conservation issues for sea ducks in this area, such as oil pollution due to high shipping traffic, disturbance from ferries and recreationists, and mollusk harvesting and farming.

PRESENTATION # 33

DISTRIBUTION PATTERNS OF WINTERING SEA DUCKS ALONG THE ATLANTIC COAST IN RELATION TO LOCAL ENVIRONMENTAL CHARACTERISTICS AND THE NORTH ATLANTIC OSCILLATION*

Elise E. Zipkin[1,2], Beth Gardner[2], Andrew T. Gilbert[3], Allan F. O'Connell, Jr.[4], J. Andrew Royle[2] and Emily D. Silverman[5]

[1] University of Maryland – College Park, Biology-psychology Building, College Park, MD 20742, U.S.A.. Tel.: (301) 497-5810; e-mail: ezipkin@umd.edu
[2] U.S. Geological Survey, Patuxent Wildlife Research Center, 12100 Beech Forest Rd., Laurel, MD 20708, U.S.A..
[3] U.S. Geological Survey, Patuxent Wildlife Research Center, 196 Whitten Rd. Augusta, ME, 04330, U.S.A..
[4] U.S. Geological Survey, Patuxent Wildlife Research Center, BARC East, Bldg. 308, 10300 Baltimore Ave, Beltsville, MD 20705, U.S.A..
[5] U.S. Fish and Wildlife Service, Migratory Bird Management, 11510 American Holly Drive, Laurel, Maryland 20708, U.S.A..

Twelve species of North American sea ducks winter off the eastern coast of the United States and Canada. Yet, despite their seasonal proximity to urbanized areas in this region, there is limited information on patterns of wintering sea duck habitat use. It is difficult to gather information on sea ducks because of the relative inaccessibility of their offshore locations, their high degree of mobility, and their aggregated distributions. To characterize environmental conditions that affect wintering distributions, as well as their geographic ranges, we analyzed count data of sea ducks that were collected during the Atlantic Flyway Sea Duck Survey for ten years starting in the early 1990s. We included five species in our analyses: Black Scoters (*Melanitta americana)*, Surf Scoters (*Melanitta perspicillata)*, White-winged Scoters (*Melanitta fusca)*, Common Eiders (*Somateria mollissima)*, and Long-tailed Ducks (*Clangula hyemalis*). We modeled count data for each species within 10 nautical mile segments using a zero-inflated negative binomial model that included four local-scale habitat covariates, (sea surface temperature, mean bottom depth, maximum bottom slope, and a variable to indicate if the segment was in a bay or not), one broad-scale covariate (the North Atlantic Oscillation), and a temporal correlation component. Our results indicate that species distributions have strong latitudinal gradients and consistency in local habitat use. The North Atlantic Oscillation was the only environmental covariate that had a significant (but variable) effect on the expected count for all five species, suggesting that broad-scale climatic conditions may be directly or indirectly important to the distributions of wintering sea ducks. Our results provide critical information on species-habitat associations, elucidate the complicated relationship between the North Atlantic Oscillation, sea surface temperature, and local sea duck abundances, and should be useful in assessing the impacts of climate change on seabirds.

PRESENTATION # 34

RELATIONSHIP BETWEEN MOLTING, WINTERING AND BREEDING AREAS FOR THE EASTERN POPULATION OF BARROW'S GOLDENEYES

Jean-Pierre L. Savard[1] and Michel Robert[2]

[1] Environment Canada, Science and Technology, Wildlife Research, 1141 Route de l'Église, P.O. Box 10 100, Québec, Québec, G1V 3W5; Tel. : (418) 648-3500; e-mail: jean-pierre.savard@ec.gc.ca
[2] Environment Canada, Canadian Wildlife Service, 1141 Route de l'Église, P.O. Box 10100, Québec, Québec, G1V 3W5.

The eastern population of Barrow's Goldeneyes (*Bucephala islandica*) is listed as "of special concern" in Canada with probably less than 2500 adult females in the population. While breeding and wintering ranges are known, molting locations and links between breeding, molting, and wintering areas are unclear. In this study, we wanted to determine the location of molting sites of adult females, whether females breeding in a given area molted and/or wintered together, and whether females molted at the same locations as males. Incubating females were equipped with satellite transmitters in June 2009, and their movements followed until fall 2010. All implanted females abandoned their clutch and remained several weeks on the breeding areas. They undertook their molt migration in late July-early August. We identified 4 molting sites: an inlet in Ungava Bay 1100 km from the breeding area (BA), an inland lake 100 km south of Ungava Bay (880 km from BA), an inland lake near Hudson Bay (910 km from BA) and the St. Lawrence Estuary (165 km from BA). Females from the same breeding area did not molt together but in very distant locations (average distance between molting females = 755 km). Although not directly in any previously known male molting sites, two females were in areas where males are known to molt. Females left their molting areas at different times between mid October and early November, returning directly to the St. Lawrence Estuary. They wintered in different locations within the St. Lawrence estuary and were quite mobile throughout the winter. Although females moved several hundred km during winter they stayed within the St. Lawrence Estuary suggesting little or no movements between wintering populations of the St. Lawrence Estuary and Gulf. The south coast of the St. Lawrence was used during spring and fall staging, and the north coast during winter. These movements have implications for the design and interpretation of winter surveys. Selection of a molting location in the eastern Barrow's Goldeneye population as well as relationships between breeding, molting and wintering areas appear quite complex. There are apparently no direct relationships between breeding, molting and wintering sites. This means that birds from a given breeding area winter and molt in a variety of areas. Selection of a molting area in this population appears independent of the breeding or wintering areas.

PRESENTATION # 35

SEA DUCKS OF THE LOWER GREAT LAKES: CURRENT STATE OF KNOWLEDGE, RESEARCH NEEDS, AND THREATS

Scott A. Petrie[1], Philip Wilson[1], Shawn Meyer[2], Shannon Badzinski[2], Ted Barney[1], and **Michael Schummer**[1]

[1] Long Point Waterfowl, P. O. Box 160, Port Rowan, Ontario N0E 1M0, Canada;
Tel.: (888) 448-2473 x 118; e-mail: spetrie@bsc-eoc.org
[2] Canadian Wildlife Service, 335 River Road, Ottawa, Ontario, K1A 0H3, Canada

The lower Great Lakes (hereafter LGL) are an important freshwater resource used by sea ducks staging and wintering in eastern North America, but few studies have adequately investigated these populations. A substantial increase in abundances of sea ducks wintering at the LGL followed the introduction of zebra (*Dreissena polymorpha*) and quagga (*D. burgensis*) mussels. At that time, increased abundances of sea ducks, the potential for birds to acquire unhealthy contaminant burdens, and limited knowledge regarding breeding affiliations prompted increased interest in research, surveys and conservation of sea ducks staging and wintering at the LGL. Contemporary mid-winter abundance estimates at Lake Ontario alone often exceed 100,000 sea ducks (primarily Long-tailed Ducks [*Clangula hyemalis*], Buffleheads [*Bucephala albeola*], Common Goldeneyes [*B. clangula*], White-winged Scoters [*Melanitta fusca*], and Mergansers [*Mergus* spp.]). Common research objectives for sea ducks staging and wintering at the LGL include determining factors potentially limiting abundances, development of surveys to better estimate populations , determining breeding ground affiliations, understanding habitat use and selection, and determining potential impacts of industrial wind turbines. Recent interest in the development of thousands of off-shore industrial wind turbines has potential to reduce foraging habitat availability and provide barriers to sea duck movements on the LGL. Therefore, information on habitat and resource selection by sea ducks is needed to guide conservation planning (e.g., wind turbine placement or restrictions). A satellite telemetry study (collaboration between the Canadian Wildlife Service, US Fish and Wildlife Service, and Long Point Waterfowl) was initiated in winter 2010/11 to determine habitat use and selection at Lake Ontario, as well as breeding ground affiliations of Long-tailed Ducks that winter on Lake Ontario. We will provide a review of LGL sea duck research, including movements obtained from Long-tailed Ducks implanted with satellite transmitters in winter 2010/11. The potential implications of off-shore wind turbine development will also be discussed.

PRESENTATION # 36

ASSESSING EFFECTS OF SEA DUCK HABITAT LOSS BY USING INDIVIDUAL-BASED MODELS

Ramūnas Žydelis[1], Monika Dorsch[2], and Georg Nehls[2]

[1] DHI, Agern Allé 5, DK-2970 Hørsholm, Denmark; Tel.: +45-4516-902; e-mail: rzy@dhi.dk
[2] BioConsult SH, Brinckmannstr. 31, D-25813 Husum, Germany

With increasing human encroachment into marine environment unbiased assessments are increasingly needed to understand potential impacts on wildlife, including sea ducks. One of the most commonly asked questions is how habitat change or destruction might affect animals using the resources. As it goes for sea ducks, the problem often distils to a question whether habitat or food resources remaining after habitat alteration are sufficient to support a population using the study area. One of the approaches to answer such a question is applying individual based modeling.
The objective of our study was to predict potential impacts of a fixed link construction across Fehmarn Belt, Southern Baltic, on Common Eiders (*Somateria mollissima*) wintering in the study area. We used individual-based modeling to evaluate habitat carrying capacity and make predictions about Common Eider responses to habitat change. Individual-based models predict how animal populations are affected by environmental change by modeling the responses of the individuals to change. We created the baseline model using literature information and empirical study area- specific data on eider food resources and functional relationships between birds and their habitats. The calibrated baseline model predicted bird distribution, time spent foraging, daily energy balance, bird body mass and other parameters well corresponding to those observed in the study area. We assessed habitat carrying capacity by 'allowing' varying number of birds to enter the model system and then measuring the fitness of these virtual birds at the end of modeled wintering season. Anticipated impact scenario of habitat change was tested by running the baseline model of altered food resources. The degree of habitat loss described in the impact scenario did not appear to cause food limitation for wintering Common Eiders in our study area. With this case study we demonstrate that individual-based modeling could be an efficient tool to measure effects of habitat change on staging sea ducks. Wintering sea ducks are a particularly suitable object for applying individual-based modeling due to typically high site fidelity of these birds and dependence on sessile food resources.

PRESENTATION # 37

SITTING DUCKS? WING MOULT IN SURF AND WHITE-WINGED SCOTERS*

***Rian Dickson**[1], Daniel Esler[1], Jerry Hupp[2], Eric Anderson[1], Joseph Evenson[3], Jennifer Barrett[1]

[1] Centre for Wildlife Ecology, Simon Fraser University, Burnaby, BC, Canada; Tel.: (778) 782-5618
e-mail: rdd@sfu.ca
[2] U.S. Geological Survey, Alaska Science Center, Anchorage, AK 99508, U.S.A.
[3] Washington Department of Fish and Wildlife, Olympia, WA, U.S.A.

Sea ducks, like other waterfowl, moult their remiges simultaneously, rendering them flightless while wing feathers re-grow. Flightlessness may increase vulnerability to predators and/or decrease foraging abilities, while growth of new remiges may result in increased energetic costs. Waterfowl display a wide range of strategies to accommodate these potential constraints during this annual cycle stage, although these are not well-studied in sea ducks. We examined strategies used by White-winged Scoters (*Melanitta fusca*) and Surf Scoters (*M. perspicillata*) to meet demands of the wing moult period at two widely separated study sites in Southeast Alaska and the Salish Sea that support large numbers of moulting scoters. Scoters were captured during wing moult (n=3316) and VHF transmitters (n=162) were deployed to allow monitoring of foraging effort and survival. We found that during wing moult, scoters showed no decreases in body mass and mass was high relative to other stages of the annual cycle. Further, overall foraging effort was relatively low. Similar patterns were found at both study sites despite very different habitats and levels of human disturbance. These observations indicate that scoters are not nutritionally or energetically constrained during wing moult and that they do not rely on reserves acquired prior to initiating wing moult to fuel feather growth. We also documented high survival rates of both species during remigial moult. White-winged and Surf Scoters apparently select productive coastal habitats where they can avoid energetic or demographic constraints during the post-breeding wing moult period. Considerations of bottlenecks in the annual cycle that limit continental population dynamics of scoters should be directed at other stages.

PRESENTATION # 38

REMIGIAL MOLT OF BARROW'S GOLDENEYES: IS THIS A PERIOD OF NUTRITIONAL OR POPULATION CONSTRAINT?*

Danica Hogan[1], Daniel Esler[2] and Jonathan Thompson[3]

[1] Centre for Wildlife Ecology, Department of Biological Sciences, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada; Tel.: (778) 782-5618; email: danicah@sfu.ca
[2] Centre for Wildlife Ecology, Simon Fraser University, 5421 Robertson Road, Delta, BC, V4K 3N2, Canada
[3] Ducks Unlimited Canada, #200, 10720 - 178 Street, Edmonton, AB, T5S 1J3, Canada

Remigial molt may be challenging for waterfowl, as the loss and subsequent replacement of flight feathers may induce nutritional constraints or increase the risk of mortality. We quantified phenology of remigial molt, body mass dynamics, foraging effort, and survival of molting Barrow's Goldeneyes (*Bucephala islandica*) at newly discovered post-breeding sites in the Boreal Transition Zone of northwestern Alberta. Our objective was to determine whether remigial molt constituted an energetic or demographic constraint within the annual cycle of Barrow's Goldeneyes and subsequently draw inference about influences on population dynamics. We captured birds during remigial molt over two molting seasons using drive trapping techniques, and fitted a subset of 100 adult males with VHF radio transmitters to monitor foraging efforts and survival. Remigial molt began in late July and ended in early September for the dominant cohorts using the lakes (after-second-year and second-year males). Molt initiation dates were generally earlier for second-year males than after-second-year males and earlier for males than females. Initiation dates varied widely within cohorts, suggesting a lack of time constraints or selective pressure for specific phenologies. Average body mass of all cohorts did not decline through remigial molt. In addition, foraging effort was very low (< 10% of available time was spent foraging). Body mass and foraging effort results suggest that Barrow's Goldeneyes were able to meet nutritional and energetic costs of remigial molt without using stored reserves or foraging excessively. Finally, survival during remigial molt was high compared to other stages of the annual cycle. Overall, our findings suggest that Barrow's Goldeneyes molting in northwestern Alberta are not currently constrained by nutritional demands or high mortality risks, and thus remigial molt is unlikely to be constraining population dynamics of this subpopulation. This underscores the importance of identifying and protecting molting sites before they are significantly degraded, as these low-stress environments may be integral to maintaining sea duck populations.

PRESENTATION # 39

WILL WORK FOR FOOD: LATITUDINAL VARIATION IN FORAGING EFFORT BY WINTERING SURF SCOTERS FROM MEXICO TO ALASKA*

Corey S. VanStratt[1], Daniel Esler[2], David Ward[3], Jerry Hupp[3], Katherine Brodhead[1], and Brian Uher-Koch[1]

[1] Centre for Wildlife Ecology, Department of Biological Sciences, Simon Fraser University, 8888 University Drive, Burnaby, B.C. Canada V5A 1S6; Tel.: (517) 410-9295; e-mail: csv5@sfu.ca
[2] Centre for Wildlife Ecology, Simon Fraser University, 5421 Robertson Road, Delta, B.C. Canada V4K 3N2
[3] U.S. Geological Survey, Alaska Science Center, 4210 University Drive, Anchorage, AK 99508, U.S.A.

Distributions of sea ducks are influenced by many factors. Understanding these underlying influences is complicated when considering migratory animals, as different mechanisms may be acting at different annual cycle stages. One factor that may be driving winter distribution of Surf Scoters (*Melanitta perspicillata*) along their Pacific range is foraging opportunity, defined as the abundance, quality, and accessibility of food resources. To evaluate whether foraging opportunity varied latitudinally and might constrain winter distributions, we affixed 69 Surf Scoters with VHF radio transmitters during 2006 and 2007 in Baja California, Mexico, and 110 Surf Scoters during 2008 and 2009 in Juneau, Alaska. We monitored their diving behavior and calculated foraging effort at the southern and northern peripheries of their winter distribution (Baja California, Mexico, and Juneau, Alaska, respectively). We compared this effort to published findings of effort at high quality foraging habitats at the core of their winter range (Strait of Georgia, British Columbia, Canada). We predicted that if foraging opportunity limited their winter distribution, foraging effort would be higher at the peripheries of the distribution and that scoters, which are typically obligate diurnal foragers, may be forced to extend their foraging effort into nocturnal periods to compensate for reduced day length during mid-winter at higher latitudes. Results indicated that foraging effort was highest at the southern periphery but lowest at the northern periphery. Overall, scoters at the southern sites foraged over twice as much as scoters at the northern site, with intermediate foraging effort at the range core. Likewise, scoters foraged nocturnally at the southern periphery, while very few nocturnal dives were detected at the northern periphery. Detailed evaluation of variation in foraging effort in Alaska indicated effects of date and cohort (age and sex class). Most cohorts had higher foraging effort during mid-winter, suggesting that scoters at the northern periphery adjust foraging effort in response to seasonal demands. However, juvenile females showed highest foraging rates towards the end of winter, suggesting different constraints by cohort. In contrast, foraging effort did not vary in relation to date, cohort, or year in Baja California, but was stable and relatively high throughout the winter. We suggest that foraging opportunity may limit the southern distribution where high diurnal foraging rates and the presence of nocturnal foraging were observed, but that other factors such as climate or predation may be limiting the northern distribution. These findings have relevance for understanding observed differential migration among Surf Scoter cohorts, as well as implications for population conservation based on differential habitat use and threats faced by different cohorts.

PRESENTATION # 40

A HOTSPOT FOR DIVING DUCKS AND AMPHIPODS*

Timothy P. White[1] and Richard R Veit[2]

[1] Department of Biology, City University of New York, College of Staten Island, 2800 Victory Boulevard, Staten Island, New York, 10314; Tel.: (718) 213-1353; email: white.timothy.p@gmail.com
[2] Department of Biology, City University of New York, College of Staten Island, 2800 Victory Boulevard, Staten Island, New York, 10314; Tel.: (718) 213-1353; email: veitrr2003@yahoo.com

Nantucket Shoals is a winter foraging hotspot for sea ducks and their amphipod prey, as well as a region of abrupt topography, strong cross-isobath currents, and tidal mixing. Long-tailed Ducks target predictable amphipod swarms that serve as high quality prey on Nantucket Shoals. A narrow zone of strong hydrographic fronts and high primary production create a unique environment in which gammarid amphipods aggregate to graze, and, in turn, serves as a reliable feeding area for Long-tailed Ducks. The spatial distributions of Long-tailed Ducks and White-winged Scoters significantly overlap on the Shoals; both are associated with the frontal zone and the core pelagic amphipod swarm. The amphipod population on the Shoals is episodic, showing seasonal and interannual variability which may be associated with climatic forcing. Variation in amphipod abundance is likely a strong factor that influences sea duck distribution and abundance on Nantucket Shoals. This unique ecosystem is important to significant numbers of wintering diving ducks and has recently become attractive to industrial offshore development.

SESSION 5: MIGRATION AND POPULATION DELINEATION

SESSION CHAIR: SEAN BOYD

PRESENTATION # 41

ATLANTIC AND GREAT LAKES SEA DUCK MIGRATION STUDY

Timothy D. Bowman[1], Scott G. Gilliland[2], Matthew C. Perry[3], Jean-Pierre L. Savard[4], Alicia M. Wells-Berlin[5], Christine Lepage[6], Taber D. Allison[7], Keith McAloney[8]

[1] U.S. Fish and Wildlife Service, Migratory Bird Management,1011 East Tudor Road, Anchorage, Alaska 99503, U.S.A. Tel.: (907) 786-3569; e-mail: tim_bowman@fws.gov
[2] Environment Canada, Canadian Wildlife Service, 6 Bruce Street, Mount Pearl, Newfoundland A1N 4T3, Canada
[3] U.S. Geological Survey, Patuxent Wildlife Research Center, 12100 Beech Forest Road, Laurel, Maryland 20708, U.S.A.
[4] Environment Canada, Science and Technology, Wildlife Research, 1141 Route de l'Église, P.O. Box 10 100, Québec, Québec G1V 3W5, Canada
[5] U.S. Geological Survey, Patuxent Wildlife Research Center, 12100 Beech Forest Road, Laurel, Maryland 20708, U.S.A.
[6] Environment Canada, Science and Technology, Wildlife Research, 1141 Route de l'Église, P.O. Box 10 100, Québec, Québec G1V 3W5, Canada
[7] American Wind Wildlife Institute, 208 South Great Road, Lincoln, Massachusetts 01773, U.S.A.
[8] Environment Canada, Canadian Wildlife Service, 17 Waterfowl Lane, Sackville, New Brunswick E4L 1G6, Canada

In 2009, the Sea Duck Joint Venture (SDJV) partnership launched an ambitious, large-scale satellite telemetry study of sea ducks in the Atlantic Flyway to document sea duck distribution, migration patterns, and seasonal habitats used. By 2013, approximately 300 transmitters will be deployed in four species: Black Scoter (*Melanitta americana*), Surf Scoter (*M. perspicillata*), White-winged Scoter (*M. fusca)*, and Long-tailed Duck (*Clangula hyemalis*). The study is designed to: 1) identify important wintering, breeding, and staging areas, 2) identify important habitats within these areas, 3) investigate annual variability in migration patterns, 4) investigate site fidelity to seasonal habitats, and 5) investigate wintering ground movement patterns and variability of habitat use. These goals will aid in the management, monitoring, and conservation of these species. Black Scoters staging in Baie des Chaleurs in spring bred from Northern Quebec to the Northwest Territories, molted in James Bay, staged near Cape Cod in fall, wintered from Chesapeake Bay to South Carolina, and used different migration routes in spring and fall (~1000 km shorter in fall). Ducks migrating south in fall tended to fly over land areas more than ducks flying north in spring, perhaps to feed and accumulate energy reserves prior to breeding. Some ducks covered 9500 km in their annual migration cycle. Movements overland occurred at night. Surf Scoters molting along the Labrador coast migrated over or around the Gaspé Peninsula (Quebec), wintered from Cape Cod to North Carolina and staged in the St. Lawrence and near Cape Cod in fall. White-winged Scoters molting in the St. Lawrence Estuary, staged there and near Prince Edwards Island in fall, wintered in Lake Ontario, Newfoundland, Gulf of St. Lawrence (Québec), Cape Cod (Massachusetts) and Long Island (New York) suggesting that molting locations are selected independently of wintering areas. Some ducks migrated from the Great Lakes to the Atlantic coast during winter. Long-tailed Ducks traveled from wintering areas in Nantucket Sound, through eastern Hudson Bay area to breeding areas in the arctic, and returned via a similar route. Long-tailed Ducks instrumented on wintering areas in Chesapeake Bay apparently bred in arctic habitats but, unlike ducks marked at Nantucket, migrated through the Great Lakes and western Hudson Bay. Preliminary results suggest complex relationships between breeding, molting and wintering areas for scoters and Long-tailed Ducks in the Atlantic flyway. Most birds showed high fidelity to their breeding, molting, staging and wintering areas. The work plan for 2011-2013 includes marking ducks at additional sites and bolstering sample sizes. Maps illustrating migration patterns of marked birds and other information about this study can be found at http://seaduckjv.org/atlantic_migration_study.html

PRESENTATION # 42

SEASONAL MOVEMENTS AND DISTRIBUTION OF WINTERING PACIFIC STELLER'S EIDERS (*POLYSTICTA STELLERI*) DURING THE ANNUAL CYCLE

Daniel H. Rosenberg[1], Michael J. Petrula[1], Denny Zwiefelhofer[2,4], Tuula E. Hollmén[3,5], Douglas D. Hill[1] and Jason L. Schamber[1]

[1] Alaska Department of Fish and Game, 525 W. 67th Ave, Anchorage, Alaska, 99518, U.S.A.; Tel.: (907) 267-2453; e-mail: dan.rosenberg@alaska.gov
[2] U.S. Fish and Wildlife Service, Kodiak Island NWR, 1390 Buskin River Rd, Kodiak, Alaska, 99615, U.S.A.
[3] Alaska SeaLife Center, 301 Railway Ave, Seward, Alaska, 99664, U.S.A.
[4] Current address: P.O. Box 2100, Kodiak, Alaska, 99615, U.S.A.
[5] School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, P.O. Box 730, Seward, Alaska, 99664, U.S.A.

The Pacific population of Steller's Eiders (*Polysticta stelleri*) is recognized as having two distinct breeding populations: a large population (>100,000 birds) that breeds in Russia and another much smaller population (<1000 birds) that breeds in Alaska, USA. Both populations mix on non-breeding areas that are located primarily in Alaska. The Pacific population is thought to have declined by 50% in recent decades which prompted a listing of the species as rare in the Yakutsk Republic of Russia. In the USA, the Alaska breeding population was listed as *Threatened* in 1997 in response to the population decline and a severe reduction in their breeding distribution. As with many sea duck species, limited life-history information is available to identify population-limiting factors and develop conservation action plans. In particular, knowledge of cross-seasonal affiliations and temporal and spatial use of habitat are deficient. We used satellite telemetry to characterize the annual movements and habitat use of a small segment of the Pacific population of Steller's Eiders. We captured wintering birds at Chiniak Bay, Kodiak Island, Alaska in late-February and early-March (2004-2006) and monitored the movements of 24 satellite-tagged birds (16 ASY females, 1 SY female and 7 ASY males) that departed the study area. All birds used the same inter-continental migration corridor during spring, but fine-scale patterns and chronology of spring migration appeared to vary by year and among individuals. During spring migration, birds primarily followed the Alaskan coastline, but also used overland crossings of the Alaska Peninsula and offshore pathways across Bristol Bay and the Bering Sea south of St. Lawrence Island. In Russia, the migration corridor included an overland route from the Gulf of Anadyr, across the Chukotka Peninsula to the Russian arctic coast where final movements were over coastal tundra wetlands. In summer, thirteen females and 3 males used inland locations along the arctic coast of Russia; five birds spent the summer in near-shore waters of Russia and Alaska. Inland sites included those from the Chukotka Peninsula to the Taymyr Peninsula and the New Siberian Islands. However, half of the birds were located on the Indigirka-Yana lowlands, suggesting this may be a relatively high-density nesting area. In late summer, thirteen birds migrated from inland locations, along the northern coastline of Russia around the Chukotka Peninsula and across the Bering Sea to molting locations in Alaska. Molting areas were broadly distributed in coastal Alaska and included St Lawrence Island (n=1), Kuskokwim Shoals (n=1), Kamishak Bay (n=3) and three sites along the Alaska Peninsula (n=8). Three of 4 birds returned to the same molting location in a consecutive year. Following molt, most birds (12 of 13) returned to winter at Kodiak Island. Steller's eiders appear to lack strong connectivity between breeding and non-breeding areas, but results also suggest high fidelity to molting and wintering areas.

PRESENTATION # 43

DISPERSAL AND DIVERGENCE: COMPARATIVE MITOCHONDRIAL GENETICS OF CAVITY NESTING SEA DUCKS ACROSS PACIFIC AND ATLANTIC FLYWAYS

John M. Pearce[1], Jean-Pierre L. Savard[2], John M. Eadie[3], and Thomas K. Christensen[4]

[1] U.S. Geological Survey, Alaska Science Center, 4210 University Drive, Anchorage, Alaska 99508, U.S.A.; Tel.: (907) 786-7094; e-mail: jpearce@usgs.gov
[2] Environment Canada, Science and Technology, 1141 route de l'Eglise, P.O.Box 10100, Sainte-Foy, Quebec, Canada G1V 4H5
[3] University of California Davis, Davis, California 95616
[4] National Environmental Research Institute, Department of Wildlife Ecology and Biodiversity, Aarhus University, Rønde DK-8410, Denmark

Little is known about the linkages between Pacific and Atlantic populations–via individual movements and gene flow–of cavity nesting sea ducks in North America. Earlier telemetry and band-recovery data suggest these populations are fairly distinct throughout their annual cycles. Using mitochondrial (mt) DNA sequence information from Bufflehead (*Bucephala albeola*), Common Goldeneye (*B. clangula*), Barrow's Goldeneye (*B. islandica),* Hooded Merganser (*Lophodytes cucullatus*), and Common Merganser (*Mergus merganser*). We used various analytical methods to examine if Pacific and Atlantic populations emerged within similar timeframes, are connected by gene flow, and should be considered separate management units based on genetic information. Despite a reliance on nesting cavities and documented high levels of breeding site fidelity, we observed a range of genetic patterns, suggestive of gene flow that is limited in some species (Barrow's Goldeneye) and more pervasive in others (Bufflehead).

PRESENTATION # 44

TRACKING LONG-TAILED DUCKS FROM THE SOUTHERN EDGE OF THEIR DISTRIBUTION TO THE HIGH ARCTIC

Ramūnas Žydelis[1], Georg Nehls[2], and Monika Dorsch[2]

[1] DHI, Agern Allé 5, DK-2970 Hørsholm, Denmark; e-mail: rzy@dhi.dk
[2] BioConsult SH, Brinckmannstr. 31, D-25813 Husum, Germany

Long-tailed Duck (*Clangula hyemalis*) is the most abundant sea duck species in the Western Palearctic, with over 90% of the regional population wintering in the Baltic Sea. No information has been available allowing to link birds wintering in the Baltic with their breeding grounds, staging sites and migration routes, as very few ring recoveries exist and no telemetry studies were undertaken. The objective of our study was to start filling the knowledge gaps about the annual cycle of Long-tailed Ducks in the Western Palearctic and describe their winter habitat use and movements.
We equipped 10 wintering Long-tailed Ducks with implantable satellite transmitters in the southern Baltic and successfully tracked 6 of them to the breeding grounds. Tracked individuals showed different mobility patterns while on wintering quarters: some were very sedentary whereas others moved extensively and used several distinct wintering sites. Spring migration started in a step-wise pattern and birds staged for about a month in the NE Baltic before crossing land to the White Sea. Further, birds gradually moved north-eastwards trailing the edge of retrieving ice and utilizing offshore habitats. All tracked individuals eventually reached the Kara Sea, and some of them flew inland of Yamal and Gydan peninsulas for presumed breeding. Birds stayed in the Kara Sea until autumn migration and probably molted there. Return migration to the Baltic Sea did not follow the stepping pattern as in spring, and birds moved swiftly to the south until they reached the Gulf of Finland. This is the first study of tracking Baltic-wintering Long-tailed Ducks through the annual cycle, which provides empirical evidence of population origin and offers new knowledge about ecology and mobility of the species.

PRESENTATION # 45

MIGRATION OF LONG-TAILED DUCKS MOULTING IN THE WESTERN CANADIAN ARCTIC

Blake Bartzen[1], Lynne Dickson[2], and **Timothy D. Bowman**[3]

[1] Environment Canada, Canadian Wildlife Service, 301-125 Mackenzie Road, Inuvik, Northwest Territories, Canada X0E 0T0; Tel.: (867) 678-6431; e-mail: blake.bartzen@ec.gc.ca
[2] Environment Canada, Canadian Wildlife Service, Room 200, 4999-98 Avenue N.W., Edmonton, Alberta, Canada T6B 2X3
[3] U.S. Fish and Wildlife Service, Migratory Bird Management, 1011 East Tudor Road, Anchorage, Alaska 99503, U.S.A.

Offshore oil and gas exploration and development is currently underway in important sea duck habitats in the Beaufort and Chukchi seas. Because hundreds of thousands of sea ducks migrate through these areas, development activities could have a significant impact on population levels. We used satellite telemetry to identify key migration corridors and staging areas for Long-tailed Ducks (*Clangula hyemalis*) and to elucidate affiliations between breeding and wintering areas. In August 2009 and 2010, we captured and implanted satellite transmitters in 58 (45 females and 13 males) moulting Long-tailed Ducks at McKinley Bay, Northwest Territories. Most birds remained in or near McKinley Bay until mid-September when they began a westward migration along the northern coast through the Beaufort and eastern Chukchi Sea. Most birds arrived at wintering areas by mid-November. The main wintering locations were off the Russian and Alaskan coasts, and some birds migrated as far south as Queen Charlotte Islands, British Columbia and Kamchatka Peninsula, Russia; two ducks tagged in 2010 wintered off the coast of Japan. Many of the transmitters ceased functioning for unknown reasons prior to spring migration in 2010. Ducks began moving northward along the Alaskan and Russian coasts in late April 2010. Unexpectedly, two females migrated to potential breeding locations in northern Russia and are of interest because we had anticipated that females would display a high degree of site fidelity and would return to breeding and moulting locations in northern Canada. The remaining five birds with functioning transmitters bred relatively close to the moult site at McKinley Bay. During spring migration, the Long-tailed Ducks staged at several locations along the northern coast of Alaska, but they spent less time staging in the southeastern Beaufort Sea than King Eiders (*Somateria spectabilis*) and Pacific Common Eiders (*Somateria mollissima v-nigra*) also breeding in the western Canadian arctic. Data from Long-tailed Ducks captured in 2010 will help to further delineate spring migration and staging areas. However, the 2009 and 2010 data clearly indicate the importance of the southeastern Beaufort Sea to post-breeding Long-tailed Ducks as many of them stayed in the region until late September or early October. The relatively large concentrations and lengthy stays of post-breeding Long-tailed Ducks in the Beaufort region could place them at a higher risk of impact and susceptibility to offshore development activities than other marine bird populations using that region.

PRESENTATION # 46

LINKING BREEDING AND MOLTING SITES OF AMERICAN COMMON EIDERS

Jean-François Giroux[1], Shawn R. Craik[2], Jean-Pierre L. Savard[3], Keith A. Hobson[4], Mark L. Gloutney[5], and Brad Allen[6]

[1] Department of Biological Sciences, Quebec University in Montreal, P.O. Box 8888, Centre-ville, Montréal, Québec, Canada H3C 3P8; Tel.: (514) 987-3000 (3353#); e-mail: giroux.jean-francois@uqam.ca
[2] Science Department, University Sainte-Anne, Pointe-de-l'Église, Nova Scotia, Canada B0W 1M0
[3] Wildlife Research Division, Wildlife and Landscape Science Directorate, Environment Canada, P.O. Box 10100, 1141 Route de l'Église, Sainte-Foy, Québec, Canada G1V 4H5
[4] Wildlife Research Division, Wildlife and Landscape Science Directorate, Environment Canada, Saskatoon, Saskatchewan, Canada S7N 3H5
[5] Ducks Unlimited Canada, P.O. Box 430, Amherst, Nova Scotia, Canada B4H 3Y4
[6] Maine Department of Inland Fisheries and Wildlife, 650 State Street, Bangor, Maine 04401-5654 U.S.A.

The primary objective of our study was to determine molting regions of female Common Eiders breeding in different colonies across the range of *Somateria mollissima dresseri*. Specifically, we aimed to delineate molting regions in Labrador, St. Lawrence Estuary, Gulf of St. Lawrence, and Maine, and to determine variation in use of molting regions by females within and among breeding colonies in these four areas. This was accomplished in two steps: first, we isotopically defined molting regions by obtaining a sample of a growing ninth primary feather from AHY females in the four areas; second, we compared isotope signatures from primary feathers of breeding females in the four areas (17 colonies) with those associated with molting regions defined during the previous year. Molting regions were discriminated by values of $\delta^{13}C$ and $\delta^{15}N$ ($\chi^2_4 = 105.3$, $P < 0.001$). Values of $\delta^{13}C$ decreased with higher latitudes ($r^2 = 0.68$) and increased westward ($r^2 = 0.70$). We identified considerable overlap in $\delta^{13}C$ and $\delta^{15}N$ signatures among feathers of most females breeding in the Gulf of St. Lawrence and in Maine and from about 60% of birds breeding in the St. Lawrence Estuary, suggesting that at least some females breeding in these areas use common molting regions. Information from isotopes currently being analyzed will allow us to examine for sources of signature variation. We will also estimate rates of fidelity to molting regions by comparing signatures of females captured in successive years. Nevertheless, our results indicate that stable isotopes from developing ninth primary feathers are a potential tool for delineating female eider molting regions throughout the range of *S. m. dresseri*.

PRESENTATION # 47

ANNUAL MOVEMENTS, SITE FIDELITY, AND POPULATION DELINEATION OF BARROW'S GOLDENEYES IN WESTERN NORTH AMERICA

Sean Boyd[1], Daniel Esler[2], Timothy D. Bowman[3], Jonathan E. Thompson[4], and Malcolm McAdie[5]

[1] Science & Technology Branch, Environment Canada, 5421 Robertson Road, Delta, British Columbia, V4K 3N2, Canada; Tel.: (604) 940-4682; e-mail: sean.boyd@ec.gc.ca
[2] Centre for Wildlife Ecology, Department of Biological Sciences, Simon Fraser University, 5421 Robertson Road, Delta, British Columbia, V4K 3N2, Canada
[3] US Fish and Wildlife Service, Migratory Bird Management, 1011 East Tudor Road, Anchorage, Alaska, 90503,U.S.A.
[4] Ducks Unlimited Canada, #200, 10720 - 178 St., Edmonton, Alberta, T5S 1J3, Canada
[5] 5206 Burnham Cr., Nanaimo, British Columbia, V9T 2H9, Canada

We marked the following age and sex classes of Pacific Barrow's Goldeneyes (*Bucephala islandica*) with implanted satellite transmitters at four sites and during three major periods of the annual cycle: breeding males (May, 3 years) and females and their offspring (Aug, 2 years) in the Cariboo Plateau area of south-central British Columbia; molting males at Cardinal Lake in northwest Alberta (Aug, 2 years); and wintering males and females near Vancouver, British Columbia, and in Prince William Sound, Alaska (Feb-Mar, 1 year). Our objectives were to describe migration routes, affiliations among breeding, molting and wintering areas, and degree of site fidelity within and across years. We plan to use these data to help describe population structure and delineate appropriate management units. Males marked in the Cariboo Plateau molted over a large but annually consistent area from northern Alberta to northern Northwest Territories. ARGOS data showed an important connection between the Cariboo Plateau and Cardinal Lake Alberta; ca. 30% of the tagged males molted on this lake each year. Cariboo Plateau males and females and Cardinal Lake males consistently migrated to and wintered in the same region along the Pacific Coast, from southern Washington State to just north of Vancouver Island. This constitutes the southern portion of the species wintering range on the west coast. Most females breeding in the Cariboo Plateau migrated north to molt but they did not travel as far as males. Hatch year birds did not travel to the coast with their mothers or siblings but they overwintered in the same general region as their parents, i.e. from southern Washington State to just north of Vancouver Island. Adult males and females marked in late winter near Vancouver bred over a large area of south-central British Columbia and a few males even migrated to Cardinal Lake to molt. Finally, birds marked in Prince William Sound appear to constitute a separate population segment throughout the annual cycle; they showed a completely different migratory connectivity compared to birds marked in British Columbia and Alberta. Males and females migrated to interior Alaska to breed and the males subsequently flew to Old Crow Flats in the Yukon to molt. Almost all adult birds in the above capture events showed a high level of individual site fidelity to breeding, molting, and wintering sites, which has important management and conservation implications. Further deployments of satellite transmitters on Barrow's Goldeneyes are planned for other Pacific coastal areas to increase sample sizes and to complete a range-wide characterization of connectivity.

PRESENTATION # 48

INTERANNUAL WINTER SITE FIDELITY EVIDENT AMONG MOST PACIFIC COMMON EIDERS BREEDING IN NORTHWEST ALASKA

Margaret R. Petersen[1], David C. Douglas[2], Sarah McCloskey[1], and Heather Wilson[3]

[1] U.S. Geological Survey, Alaska Science Center, 4210 University Drive, Anchorage, Alaska 99508, U.S.A.; Tel.: (907) 786-7180; e-mail: mrpetersen@usgs.gov
[2] U.S. Geological Survey, Alaska Science Center, 3100 National Park Road, Juneau, Alaska 99801, U.S.A.
[3] U.S. Fish and Wildlife Service, Migratory Bird Management, 1011 East Tudor Road, Anchorage, Alaska 99503, U.S.A.

Many species that migrate return to the same breeding, wintering, and/or stopover location in successive years. This site fidelity is most common when habitats have predictable and abundant resources and provide safety from predators or weather. One species, the Common Eider, winters in extreme locations at the edge of the ice pack in northern latitudes. The ice varies markedly within and among years although it is generally predictable in its overall presence. Several shallow areas do not freeze completely during any part of the winter, and birds are commonly found within these polynyas. Eiders feed on benthic invertebrates whose species distribution likely changes little among years. Winter site fidelity would thus be advantageous since conditions that are conducive to winter survival are predictable. We used satellite transmitters to determine winter site fidelity of Pacific Common Eiders. Birds were marked on the breeding grounds in northwestern Alaska (2007) and spent two winters (2007/2008 and 2008/2009) in the coastal Bering Sea. We used the statistical package Blossom to determine if the distribution of individuals changed between winters. We used the Multiresponse Permutation Procedure (MRPP) to test if the locations between the two consecutive years were members of a similar spatial distribution. We used the kernelud function in the ADEHABIT library of R and prescribed the CVh smoothing parameter to determine the 95% and 50% (core) UD (utilization distribution) contours to examine variability among individuals and wintering regions. We then examined AVHR-R and EMRS-E data to determine the extent of ice within the 95% UDs area (winter range) in each polynya. Twenty-one of 22 (96%) of the eiders whose transmitters provided locations in both winters returned to the same polynya they used the previous year. The distributions of 63% of these individuals were similar among years. Birds returned to the same general area the subsequent year; 90% and 95% of individuals were relocated at least once within their core and 95% UD, respectively. Shorefast and sea ice within the winter range of individuals in each polynya varied among and within years and among polynyas although no area was completely covered with ice in any year. We suggest that as sea ice reaches its greatest extent in late winter (a time when few alternative areas of open-water exist), the cost of abandoning the winter range likely outweighs the benefits of prospecting for other open water. This could explain the limited movement among polynya between years. Shifts in distribution within polynya among years could be a result of changes in forage quality, quantity or availability or other environmental or behavioral factors. Although spatial distributions changed among a few birds, the vast majority (91%) were re-located within the entire or portions of their previous winter's 95% UD. Our data show that most birds have high fidelity to their wintering area, and ice, the most variable characteristic of their environment, did not negatively influence winter site fidelity during our study.

PRESENTATION # 49

SURF SCOTER (*MELANITTA PERSPICILLATA*) INTER-ANNUAL SITE FIDELITY TO WINTERING AREAS ALONG THE PACIFIC COAST

Joseph R. Evenson[1], David R. Nysewander[1], Bryan L. Murphie[1], Thomas A. Cyra[1], Don Kraege[1], John Y. Takekawa[2], Susan E. W. De La Cruz[2], David H. Ward[3], Daniel Esler[4] and Sean Boyd[5]

[1] Washington Department of Fish & Wildlife, 600 Capitol Way North, Olympia, Washington 98501, U.S.A.; Tel.: (360) 790-8691; e-mail: evensjre@dfw.wa.gov
[2] Western Ecological Research Center, U.S. Geological Survey, 505 Azuar Drive, Vallejo, California 94592, U.S.A.
[3] U.S. Geological Survey, Alaska Science Center, 4210 University Drive, Anchorage, Alaska 99508, U.S.A.
[4] Centre for Wildlife Ecology, Simon Fraser University, Delta, BC, V4K 3N2, Canada
[5] Pacific Wildlife Research Centre, Canadian Wildlife Service, RR#1 – 5421 Robertson Rd., Delta, BC, V4K 3N2, Canada

Satellite transmitters were implanted into after-third-year age class Surf Scoters (*Melanitta perspicillata*) from five wintering populations along the Pacific Coast of North America and tracked during six consecutive winters, 2004-2010. Inter-annual fidelity to wintering sites was examined for 61 Surf Scoters that transmitted over consecutive winters, with contributions from five capture regions: South East Alaska (n=8); Strait of Georgia, British Columbia (n=7); Puget Sound, Washington (n=27); San Francisco Bay, California (n=14); and Baja California, Mexico (n=5). Individual home ranges were compared across years and sorted by capture region and sex. The majority of scoters showed a high level of site loyalty to wintering areas. They returned to their general area of capture (< 75 km) and most of these birds returned to spend some time near their exact capture locations (< 10 km). Two of San Francisco birds were exceptions to this general pattern as they spent the following winter in Mexico. Movement patterns within the wintering range also varied; most scoters spent the majority of time near the capture location, while some moved within the capture region. Timing of return to wintering areas varied by capture region and sex. Some scoters returned to the winter capture region prior to the molt period, while others returned during the subsequent mid-winter period. Length of stay at wintering areas varied, but most scoters spent a significant portion of the year and this was influenced by sex and capture region. Some scoters utilized the capture region for moulting, wintering, and spring staging (up to an eight month period). This type of high site fidelity and low turnover for adults has important management implications.

SESSION 6: POPULATION DYNAMICS AND DEMOGRAPHICS

SESSION CHAIR: PAUL L. FLINT

PRESENTATION # 50

PHILOPATRY PREDISPOSES TO PREDATION-INDUCED ECOLOGICAL TRAPS: HABITAT- AND CONDITION-SPECIFIC MORTALITY OF BREEDING COMMON EIDERS

Johan Ekroos[1], **Markus Öst[1]**, Patrik Karell[2], Kim Jaatinen[1], and Mikael Kilpi[3]

[1] ARONIA Coastal Zone Research Team, Åbo Akademi University and Novia University of Applied Sciences, FI-10600 Ekenäs, Finland; Tel.: +358-19-2248414; e-mail markus.ost@novia.fi
[2] University of Helsinki, P.O. Box 65, FI-00014 Helsinki, Finland
[3] ARONIA Centre for Environmental Research, Åbo Akademi University and Novia University of Applied Sciences, FI-10600 Ekenäs, Finland

A decrease in adult survival should have strong detrimental effects on population growth in long-lived species. Philopatry to breeding habitats has been considered as an adaptation for responding to environmental change. However, in species with low behavioral plasticity in breeding habitat selection evolved in stable environments with low predation risk, such as in island-breeding birds, natal philopatry may become maladaptive under changing predation risk. Furthermore, predation risk often differs between habitats; in ground-nesters, predation risk may be higher in open than in forested habitat. External mortality factors may also be modified by a condition-dependent component. Common Eiders (*Somateria mollissima*) in our study area in Tvärminne, SW Finland, Baltic Sea, breed in two contrasting habitats: small, open islands and slightly larger forested islands. This species shows high breeding philopatry to nesting islands and the Baltic population has faced a rapid recent change in predation regime due to the recovery of the White-tailed Sea Eagle (*Haliaeetus albicilla*), concurrent with a large-scale population decline. Common Eiders use a capital breeding strategy, reaching a bottleneck in their annual condition during late incubation, and female condition has been proposed to indicate individual quality and hence positively affect survival. We analyzed the survival of breeding females during 1996-2010 using mark-recapture analysis in program MARK with respect to the type of breeding island, female body condition at her first known breeding event, an index of White-tailed Sea Eagle abundance, winter climate (NAO index), and possible time trends. Our results revealed the lowest apparent survival estimates ever recorded in this species (average φ = 0.72 ± 0.025 SE). Apparent survival differed significantly between habitats, with higher survival for eiders breeding on forested islands (average φ = 0.76 ± 0.017 SE) than on open islands (average φ = 0.68 ± 0.033 SE). As predicted, the body condition of females was positively related to annual survival. Annual survival was unrelated to eagle abundance and winter climate, and it was stable over time. The lack of effect of eagle abundance on survival may be due to resident eagles being present throughout most of the study period and high collinearity with habitat type, as open islands are preferred eagle hunting grounds, also exposing incubating females to predation. Our results provide compelling evidence of a predation-related survival cost of nesting in open habitat in the same population of the same species. Breeding philopatry may thus increase the risk of being caught in ‘ecological traps’, also helping to explain the population decline of Baltic Common Eiders.

PRESENTATION # 51

LIVE LONG AND PROSPER: LATITUDINAL AND SEASONAL VARIATION IN NONBREEDING SURVIVAL OF SURF AND WHITE-WINGED SCOTERS

Brian Uher-Koch[1], Daniel Esler[2], Jerry Hupp[3], David H. Ward[3], Corey S. VanStratt[1], Rian Dickson[1], Kathy Brodhead[1], Sean Boyd[2], Joseph R. Evenson[4], Samuel A. Iverson[1], Molly Kirk[1], Tyler Lewis[1], Eric M. Anderson[1] and Joel Schmutz[3]

[1] Centre for Wildlife Ecology, Department of Biological Sciences, Simon Fraser University, 8888 University Drive, Burnaby, B.C., V5A 1S6, Canada; Tel.: (778) 782-5618; e-mail: buherkoc@sfu.ca
[2] Centre for Wildlife Ecology, Simon Fraser University, 5421 Robertson Road, Delta, B.C., V4K 3N2, Canada
[3] U.S. Geological Survey, Alaska Science Center, 4210 University Drive, Anchorage AK, 99508, U.S.A.
[4] Washington Dept of Fish and Wildlife, 600 Capitol Way North, Olympia, WA, 98501-1091, U.S.A.

Surf Scoter (*Melanitta perspicillata*) and White-winged Scoter (*M. fusca*) numbers in North America have declined substantially over the past 50 years. Because population dynamics of scoters and other sea ducks are more sensitive to variation in adult survival than to productivity and survival of young, it is important to document variation in survival throughout the annual cycle to identify potential periods of demographic constraint. During nonbreeding periods of their annual cycle, including the remigial molt and wintering stages, scoters may be vulnerable to increased mortality risks. During remigial molt, scoters are flightless and occur in large aggregations making them susceptible to catastrophic events and possibly higher risk of predation. They also may incur energetic or nutritional costs associated with flight feather growth and higher foraging costs due to reduced wing area. Wintering scoters may be faced with depleted prey, increased thermoregulatory costs, decreased day-length, and increased predation. The challenges and constraints faced by nonbreeding scoters likely vary across a geographical gradient, and survival may vary as part of trade-offs balancing choice of molting and wintering sites. To identify spatial and seasonal variation in scoter survival rates, we conducted radio-telemetry studies to track fates of nonbreeding scoters over nearly their entire Pacific range. Between 2001–2010, we attached VHF transmitters to White-winged and Surf Scoters during wing molt in late summer, and the overwintering period in three areas: Puget Sound, Washington, Strait of Georgia, British Columbia, and southeast Alaska, and to Surf Scoters during early winter in Baja California. We found that survival of molting scoters was high across species, cohorts, and sites. We determined that survival of White-winged Scoters was greater for adults than for hatch-year individuals in the core of their wintering range in British Columbia. For Surf Scoters, we found that survival was lower at range peripheries (Southeast Alaska and Baja California) than at the wintering range core. In southeast Alaska, Surf Scoter survival was markedly lower for hatch year birds than for adults. Based on our results, we conclude that the period of remigial molt is a relatively safe time in the annual cycle of scoters. Winter survival is lower and varies markedly by location and cohort; these patterns may explain observed differential winter distributions by different age and sex cohorts. Also, winter survival may constitute a potential population constraint.

PRESENTATION # 52

SURVIVAL OF STELLER'S EIDERS MOLTING ALONG THE ALASKA PENINSULA, 1994-2007

Charles J. Frost[1], Tuula E. Hollmén[1, 2], and Joel Reynolds[3]

[1] Alaska SeaLife Center, 301 Railway Ave., Seward, AK, 99664, U.S.A; Tel,: (907) 224-6894; e-mail: charlesf@alaskasealife.org
[2] University of Alaska Fairbanks, School of Fisheries and Ocean Sciences, P.O. Box 730, Seward, Alaska 99664, U.S.A.
[3] U.S. Fish and Wildlife Service, Western Alaska Landscape Conservation Cooperative, 1011 East Tudor Road, Anchorage, AK, 99503, U.S.A.

Steller's eiders (*Polysticta stelleri*) breed, molt, and winter in parts of Alaska. The global population of Steller's eiders is thought to be in decline, and the Alaska breeding population was listed as threatened in 1997 under the Endangered Species Act. Izembek lagoon, along the Bering Sea side of the southern Alaska Peninsula, is an important molting area for the Pacific population and the site of banding efforts since 1961. Structured, consistent banding effort occurred during 1993-2006, and resulted in the capture or recapture of 44,925 Steller's eiders. We used Pradel mark-recapture models to estimate apparent annual survival and population growth rates for adult Steller's eiders molting at Izembek lagoon. We designed 32 models in Program MARK involving effects of sex and year on survival, recapture rate, and seniority, as well as potential trends in survival and seniority over periods of years. The top model (AICc weight = 1.0) incorporated a 2-phase trend (1993-1998, then 1999-2003) in survival and seniority for each sex and fully sex- and year-specific recapture rates. Average annual adult female survival was estimated at 0.86 (SE = 0.030), while average annual adult male survival was estimated at 0.87 (SE = 0.018). Average annual recapture rates were estimated at 0.16 (SE = 0.022) and 0.23 (SE = 0.080) for females and males, respectively. We found evidence of increasing annual survival rates for both sexes between 1999 and 2004, with fully sex- and time-specific recapture rates and sex-specific immigration rates. Average annual population growth rates (λ) for both sexes are approximately 1.0 since 1998, indicating potential recent population stability.

PRESENTATION # 53

ESTIMATING POPULATION SIZE, SEX RATIO AND ANNUAL RECRUITMENT OF WINTERING SPECTACLED EIDERS, USING OBLIQUE DIGITAL AERIAL PHOTOGRAPHY

William W. Larned[1], Robert A. Stehn[2], and Matt Sexson[3]

[1] U.S. Fish and Wildlife Service, Migratory Bird Management, 43655 Kalifornsky Beach Rd., Soldotna, Alaska 99669, U.S.A.; Tel.: (907) 260-0124; e-mail: william_larned@fws.gov
[2] U.S. Fish and Wildlife Service, Migratory Bird Management, 1011 East Tudor Rd., Anchorage, Alaska, 99503, U.S.A.
[3] U.S. Geological Survey, Alaska Science Center, 4210 University Drive, Anchorage, Alaska 99508, U.S.A.

Unbiased estimates of population size, trend, and sex and age ratios of wintering sea ducks are needed to measure status relative to population objectives, and to understand factors affecting population change. In particular, age ratio estimates provide data to index recruitment, a key component of population dynamics. Unfortunately, sex and age composition of some species varies considerably within and among wintering flocks, making unbiased samples difficult to obtain, as is the case for wintering Spectacled Eider (*Somateria fischeri*) flocks that exhibit sex/age segregation. However, recent satellite telemetry and survey data suggest that the entire global population of Spectacled Eiders winters together as a relatively small, sedentary cluster of monospecific flocks, providing a unique opportunity to obtain unbiased population parameters for this species. We used visual observations and oblique, high-resolution digital photographs obtained during 2009 and 2010 aerial surveys to estimate total population size, and sex and age ratios. The technique included contiguous rectangular-grid aerial coverage based on recent satellite telemetry data, GPS-linked aerial flight track and observational data logging, and GIS analysis to map flight tracks, visual eider estimates and photographic flock images. We analyzed photographs using a counting feature in image processing software. We used GIS analysis of telemetry and survey data to estimate and compensate for coverage error, and weighted extrapolation techniques within flocks to estimate flock and population-level parameters from photographic images that varied in quality. Results and recommendations on current and proposed techniques will be presented.

PRESENTATION # 54

REPRODUCTIVE SUCCESS: SEX RATIO AND ANTHROPOGENIC MORTALITY IN LONG-TAILED DUCKS WINTERING IN THE BALTIC SEA

Kjell Larsson[1]

[1] Gotland University, SE-621 67 Visby, Sweden. Tel.: +46 498 299839; e-mail: kjell.larsson@hgo.se

Recent aerial and ship-based surveys have shown that the arctic breeding Russian population of Long-tailed Duck (*Clangula hyemalis*), which winters in the Baltic Sea, has decreased dramatically in numbers in the past 15-20 years. The causes for the decline are not clear, but several non-exclusive hypotheses have been suggested addressing the effects of, (1) extra adult mortality due to oil spills from ships or to by-catches in fishery, (2) thiamine deficiency, (3) low reproductive success due to low availability of high quality food in winter and spring, and (4) low reproductive success due to climatic or other unknown factors at the Arctic breeding grounds.
Analyses of large number of photos of flying flocks of Long-tailed ducks at sea, and of several thousand birds killed in fish nets or by oil, at different sites within the Baltic Sea, show that the proportion of juveniles in wintering flocks has been very low, only a few percent, in recent winters. The sex ratio of adult birds is also heavily male biased at the major wintering sites in the central Baltic Sea suggesting a higher mortality of females than of males at the Arctic breeding grounds. The total number of birds killed by the many small illegal oil spills from ships has been very high during the 1990s and during the beginning of the 2000s. In some years more than 100 000 birds were killed by oil in the central Baltic Sea. Fewer birds have been killed by oil in the most recent years.
For successful breeding the Long-tailed Duck is considered to be dependent on the nutrient and energy reserves accumulated on the wintering and spring sites in the Baltic Sea. The blue mussel (*Mytilus edulis / M. trossulus*), which in the central Baltic Sea rarely exceeds 35 mm in length, is a very important food item for Long-tailed Ducks. An ongoing research project is analysing the spatial and temporal variation of the quality of blue mussels at important wintering and spring feeding sites. The quality measurements of blue mussels will be related to plankton densities and plankton species composition. The research on Long-tailed ducks has been financially supported by WWF Sweden and since 2008 by Nord Stream AG.

PRESENTATION # 55

APPARENT SURVIVAL AND RECRUITMENT IN A SUBARCTIC POPULATION OF COMMON GOLDENEYES*

Abigail J. Lawson[1], James S. Sedinger[1], and Eric J. Taylor[2]

[1] Natural Resources and Environmental Science, University of Nevada-Reno, MS 186, 1000 Valley Road, Reno, Nevada 89512, U.S.A. Tel.: (530) 304-5898; e-mail: alawson@cabnr.unr.edu
[2] U.S. Fish and Wildlife Service, Migratory Bird Management, 1011 East Tudor Road, Anchorage, Alaska 99503, U.S.A.

Historical volatility and decline of Alaska sea duck populations have been of primary conservation concern in the last half-century. Though Common Goldeneyes (*Bucephala clangula*; hereafter Goldeneye) are reasonably well-studied and are thought to be stable throughout their North American range, few estimates of demographic parameters exist for populations at northern latitudes. This study is the first to provide estimates of adult survival and recruitment for Goldeneyes in Alaska, an area for which the lack of demographic information is particularly acute. Our study has monitored a nest box (n=150) population of Goldeneyes within the 1028 km^2 Chena River State Recreation Area located approximately 30 kilometers east of Fairbanks, Alaska, near the northern limit of their breeding range. Nest box activity has been intensively monitored on the study area since 1997 (excluding 2006 and 2007). Hens were captured and marked on the nest (n=276) during the egg-laying period beginning in late April and were closely monitored through incubation. At hatch, nesting females were recaptured and ducklings marked (n=3663) using a combination of webtags and plasticine-filled metal leg bands. We used multistate models in Program Mark to estimate apparent adult female survival with nonbreeding as an unobservable state. We chose this method as our study design does not allow us to encounter nonbreeding females or those that may have temporarily or permanently emigrated from the study area. Transition probabilities (ψ) between observable (breeding) and unobservable (nonbreeding) states allowed us to estimate age-specific breeding probabilities conditioned on status the previous season. Using an information-theoretic approach, our most parsimonious model (AIC weight: 0.48) indicated apparent adult female survival rates exhibit substantial temporal variation that ranged between 0.64 (95% CI: 0.20-0.93) and 0.85 (95% CI: 0.73-0.92). Furthermore, probability of breeding conditioned on having bred the previous year (ψ^{BB}) was 0.96 (95% CI:0.67-0.99) which is consistent with earlier work that suggests females generally do not skip a year of breeding. Long-lived species, like Goldeneyes, typically exhibit life-history traits characteristic of K-selected species, such as low and variable levels of annual reproduction contrasted with high annual rates of adult survival. Though populations of long-lived species are generally most sensitive to changes in adult survival, recruitment is also thought to play a dominant role in population dynamics due to higher rates of variability under natural conditions (e.g., environmental factors). For our recruitment analyses we used Pradel models, also in Program Mark, to estimate the seniority parameter (γ), which was then used to derive recruitment rates (λ) from the estimates of adult survival in our population. Our top model (AIC weight: 0.86) suggested a time-dependent λ that ranged from 0.82 and 1.14, and a constant detection probability (p) of 0.95 (95% CI:0.91-0.97).

PRESENTATION # 56

A DRAMATIC DECLINE IN A MAJOR COMMON EIDER *SOMATERIA MOLLISSIMA* POPULATION WITHIN THE BRITISH ISLES: SEEKING THE CAUSES*

Christopher M. Waltho[1], Stephen R. Baillie[2], and Robert W. Furness[3]

[1] 73 Stewart Street, Carluke, Lanarkshire, ML8 5BY, Scotland, UK; Tel.: +44 1555750719;
e-mail: chris.waltho@eider.org.uk
[2] British Trust for Ornithology, The Nunnery, Thetford, Norfolk IP24 2PU, UK
[3] College of Medical, Veterinary and Life Sciences, Graham Kerr Building,University of Glasgow, Glasgow G12 8QQ, UK

The Common Eider *Somateria mollissima* population within the Firth of Clyde, western Scotland, UK has declined by 65% in 13 years. A decade ago, this was the largest population in the British Isles. The causes of this decline are unknown. Data on biometrics and clutch size have been collected at several colonies where females have been banded in large numbers. Using data collected over the last 15 years, from an annual post moult census together with nesting observations, mark-recapture and mark-recovery data from c1500 banded females from three major breeding colonies in the Clyde, we examine the demographic mechanisms and potential environmental causes of the decline. A suite of ca. 25 potential impacting environmental factors is considered, including predation, human disturbance, diseases, prey availability and pollution. We find little evidence for changes in pollution, prey availability or diseases. There does not appear to be a single factor or combination causing an acute effect. A chronic effect from a combination of factors is the most likely cause of the decline. There is evidence of increased human disturbance but it is unclear whether this affects eider productivity or survival. There is little evidence of reduced breeding productivity and the decline appears to be related, to increasing mortality. This mortality is likely to be due to a combination of factors, including increasing predation by American Mink *Mustela vison* and seals *Halichoerus grypus* and *Phoca vitulina*, together with possible unreported losses related to mussel farming. Sex ratio data from the fall census also provide a way to assess whether increased mortality is predominantly of females or of both sexes.

PRESENTATION # 57

EFFECTS OF BOOM-BUST NESTING SUCCESS ON COMMON EIDER POPULATION DYNAMICS: INFERENCES FROM A LONG-TERM STUDY IN LA PÉROUSE BAY, MANITOBA, CANADA

David T. Iles[1], David N. Koons[1], and Robert F. Rockwell[2]

[1] Department of Wildland Resources, Utah State University, 5230 Old Main Hill, Logan, UT, 84322-5230, U.S.A.; Tel.: (435) 760-3506; e-mail: david.iles@aggiemail.usu.edu
[2] Division of Vertebrate Zoology, The American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024, U.S.A..

Common eider (*Somateria mollissima*) populations have experienced long-term declines worldwide. Despite recent attention given to understanding the problems associated with sea duck population declines, little is known about the causes of catastrophic reproductive failure in common eider colonies and the associated consequences of these events on population dynamics. Previous research suggests that common eider nesting success and duckling survival are poor in most years, interrupted by occasional “boom” years, making both demographic parameters highly variable over time. Predators such as polar bears, arctic foxes, wolves, gulls, bald eagles, and jaegers have been known to decimate the annual reproductive output of eider populations. Furthermore, global climate change may be influencing predator phenology and thus altering the frequency of catastrophic predation events in eider colonies. The objective of this research was to estimate the impact of predation on ‘boom-bust’ nesting success and examine how changes in the frequency of “bust” years affect population dynamics. To address this objective, historical data collected at La Pérouse Bay, Manitoba were compiled into an electronic vital-rate database. We used Program Mark to estimate nesting success, as well as the influence of relative predator abundance and phenology on the temporal dynamics of reproductive success in the colony. Along with our nesting success estimates, additional vital rates from published studies on other common eider populations were incorporated into an age-structured stochastic population model that captures the general common eider life history. This allowed us to examine the influence of change in the frequency of bust years on short- and long-term population dynamics. This study provides valuable insight into the ongoing effects of changing environmental conditions on eider population dynamics, which could help direct management actions and policies.

PRESENTATION # 58

POPULATION DYNAMICS OF KING EIDERS BREEDING IN NORTHERN ALASKA

Rebecca L. Bentzen[1] and Abby N. Powell[2]

[1] Department of Biology and Wildlife, University of Alaska Fairbanks, Fairbanks, AK 99775–7220, U.S.A..; Tel.: (907) 883-1305; e-mail: rlmcguire@alaska.edu
[2] U. S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit, University of Alaska Fairbanks, Fairbanks, AK 99775–7020, U.S.A.

The North American population of King Eiders (*Somateria spectabilis*) has declined by more than 50% since the late 1970s for unknown reasons. King Eiders spend most of their lives in remote areas forcing managers to make regulatory and conservation decisions based on very little information. We incorporated available published estimates of vital rates with new estimates to build a female, stage-based matrix population model for King Eiders and examine the processes underlying population dynamics of king eiders breeding at two sites, Teshekpuk and Kuparuk, on the coastal plain of northern Alaska and wintering around the Bering Sea (2001-2010). Clutch size ranged from 2 to 8 eggs and averaged 4.4 eggs/nest. Estimated site year-specific process variation in clutch size was 0.07 (95% CI = 0.06–0.23). Adult annual survival rate was high (0.94, 95% CI: 0.90-0.96) and spatially and temporally invariant (σ^2 = 0.0002). First year survival was 0.65 (95% CI: 0.53-0.76) and more variable (σ^2 = 0.003) than that of adults. We predicted a stable to decreasing population (λ = 0.978, 95% CI: 0.938 – 1.140) and that population growth was most sensitive to changes in adult female survival (sensitivity = 0.93) but that low duckling survival may be a bottleneck to productivity (retrospective variation in λ was 65% due to variation in duckling survival). Although adult survival was high and invariant, catastrophic events could have a major impact and we need to consider how to mitigate and manage threats to adult survival. However, if vital rates remain stable, the more variable reproductive parameters (duckling and nest survival) may be more responsive to management actions such as predator control and limited anthropogenic disturbance in breeding areas. While we were limited in some aspects by sample size and missing parameters, our model is an important step in managing the population and mitigating future impacts.

PRESENTATION # 59

MODELLING THE EFFECTS OF DECLINING LEAD SHOT AVAILABILITY ON SPECTACLED EIDER POPULATION DYNAMICS

Paul L. Flint[1], Jason Schamber[1], Margaret R. Petersen[1], Sarah McCloskey[1] and Robert M. Platte[2]

[1] U.S. Geological Survey, Alaska Science Center, 4210 University Drive, Anchorage, Alaska 99508, U.S.A.
Tel.: (907) 786-7183; e-mail: pflint@usgs.gov
[2] U.S. Fish & Wildlife, Migratory Bird Management, 1011 East Tudor Road, Anchorage, Alaska 99503.

We examined the settlement rate of lead pellets in tundra wetlands over 10 years. In contrast to earlier work, we found that lead pellets progressively settle into sediments at a rate of about 1 cm per year. Accordingly we estimate that about 50% of lead pellets would reach a depth where they are unavailable to foraging eiders about 10 years after deposition. We determined lead exposure rates for nesting female Spectacled Eiders (*Somateria fischeri*) captured at hatch at seven study sites. Using these site specific lead exposure samples, we modeled the overall lead exposure for the entire Yukon Delta nesting population. At the population level we estimate that 11.5% of nesting females are exposed to lead at hatch. Using mark-recapture techniques, we estimated the annual survival rate for females that were exposed to lead (i.e., 48%) to be considerably lower than for females not exposed to lead (i.e., 88%). Active enforcement of the lead shot ban started in 1998 and use of lead shot may have diminished through time. Accordingly we modeled the potential increase in annual survival that would be expected under our estimates of lead shot settlement. As lead availability declines, we predict that annual survival will increase from 83 to 88%. Because population dynamics are highly sensitive changes in adult female survival, we predict that lamda will correspondingly increase from 1.016 to 1.05. In other words, during the period of our studies, the population was increasing at 1.6% per year and we would expect that rate to increase to 5% as lead shot availability declines. Thus, management actions designed to reduce lead shot introduction to the environment are expected to have substantial positive effects on eider population dynamics.

SESSION 7: HARVEST AND MANAGEMENT

SESSION CHAIR: STUART SLATTERY

PRESENTATION # 60

HARVEST AND SURVIVAL OF EASTERN NORTH AMERICAN SURF SCOTERS

Scott G. Gilliland[1], Eric Reed[2], Christine Lepage[3], Louis Lesage[3], Jean-Pierre L. Savard[4], and Keith McAloney[5]

[1] Environment Canada, Canadian Wildlife Service, 6 Bruce St., Mount Pearl, NL, Canada A1N 4T3;
Tel.: (709) 772-2013; e-mail: scott.gilliland@ec.gc.ca
[2] Environment Canada, Canadian Wildlife Service, 351 St. Joseph Blvd, Gatineau, QC, Canada K1A 0H3
[3] Environment Canada, Canadian Wildlife Service, 1141 Route de l'Église, Québec, QC, Canada G1V 3W5
[4] Environment Canada, Science and Technology, 1141 Route de l'Église, Québec, QC, Canada G1V 3W5
[5] Environment Canada, Canadian Wildlife Service, 17 Waterfowl Lane, Sackville, NB, Canada E4L 1G6

A long-term decline in continental populations of scoters was detected in the Waterfowl Breeding Population and Habitat Survey in North America in the late 1990s. Over the last 12 years several conservation agencies have developed research and monitoring programs to better track population trends and identify potential threats to populations. Although several potential threats have been eliminated, causes of the decline remain unknown. Good demographic information is key to understanding population dynamics, yet no estimates of survival exist for scoters, and estimates of harvest rates, population sizes and trends are very poor. We report here the results of recent Surf Scoter (*Melanitta perspicillata*) banding programs conducted in eastern Canada. Between 2004 and 2008, we banded 1876 adult male Surf Scoters at molting sites off the coast of Labrador, Newfoundland, and in the St. Lawrence Estuary, Quebec. There were 74 band recoveries from hunter-shot birds during the period 2004–2010. Survival analysis, based on dead recoveries, indicated that survival and recovery rates were constant through the period under study. Annual survival was estimated at 0.70 (95% CI: 0.58–0.79). There was some indication that survival in the year following initial release was lower than in subsequent years (ΔAIC = 0.97 between this model and a constant survival model), with survival in the year following initial capture estimated at 0.68 (0.55–0.80) and 0.76 (0.56–0.88) in subsequent years. Although there is uncertainty as to the presence of an effect of capture on survival, future work should consider this possibility when using floating gill nets for capture. Direct recovery rates varied between 0.012 and 0.019. Assuming a retrieval rate of 0.8 and reporting rates of either 1.0 or 0.71 (U.S. estimate from Black Duck reward banding), harvest rate estimates averaged either 0.020 (range: 0.016–0.024) or 0.028 (range: 0.022–0.034) between 2004 and 2007. These results indicate relatively low harvest pressure for male Surf Scoters. These estimates of survival and harvest rate are the first available for the species in North America. Although this is a great improvement in our ability to understand the dynamics of this population, there remains much uncertainty in the estimates. They are based on small sample sizes and a short period of time, both factors contributing to reduced power to detect changes in survival over time or the impact of capture on survival. Accurate survival and harvest rate estimates are central to understanding the dynamics of the population and as such in directing management or conservation efforts. Using the Lincoln-Peterson approach, we roughly estimate that there were about ½ million adult and sub-adult males in the Atlantic and Mississippi Flyways. We suggest that development of better banding programs and better estimates sea duck harvest could provide a practical approach monitoring eastern North American Surf Scoter population. Although large-scale banding programs in North America have historically focused on Mallard and Black Duck populations, it may now be appropriate to shift some of this effort towards declining sea duck populations.

PRESENTATION # 61

SPATIAL ECOLOGY OF LONG-TAILED DUCKS WINTERING IN NANTUCKET SOUND: PRE- CONSTRUCTION ANALYSIS OF CAPE WIND OFFSHORE WIND PROJECT

Alicia M. Wells-Berlin[1], Taber D. Allison[2], Matthew C. Perry[1], and Glenn H. Olsen[3], and Simon Perkins[4]

[1] U.Ss Geological Survey, Patuxent Wildlife Research Center, 12100 Beech Forest Road, Laurel, MD 20708; Tel.: (301) 497.5730; e-mail: aberlin@usgs.gov
[2] American Wind Wildlife Institute, 1110 Vermont Ave, NW, Washington, DC 20005
[3] U.S. Geological Survey Patuxent Wildlife Research Center, 12302 Beech Forest Road, Laurel, Maryland 20708
[4] 61 Elm Brook Road, Concord, MA 01742

Although no offshore wind turbines have been constructed in the United States, serious interest in offshore wind power began in 2001 with a proposal, now an approved plan, for an offshore wind project in Nantucket Sound off Cape Cod, Massachusetts. What remains unknown is the local distribution and movements of seaducks 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 seaducks. It is critical to identify the most important habitats for seaducks prior and post construction of turbines because their placement may not only impact the habitats where they are placed but also wildlife species utilizing these habitats. We have used satellite telemetry to track the movements of wintering Long-tailed Ducks (LTDUs, *Clangula hyemalis*) in the waters around Nantucket. 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, and then return to the Sound at dusk to unknown nocturnal locations. We wanted to determine the relationship of these nocturnal roosting sites to the proposed Cape Wind Energy Project (WEP). We captured and instrumented a total of 32 LTDUs ducks and tracked their movements within Nantucket Sound and to their breeding grounds beginning in winter 2007-08 (9 ducks), winter 2008-2009 (11 ducks), winter 2009-2010 (12 ducks). None of the instrumented ducks described above were recorded roosting on Horseshoe Shoal, the proposed project area, including the second winter of the five returning ducks. Of the LTDUs captured in the vicinity of Cape Cod and Monomoy Island in March 2010, 11 transmitted signals for one month or more, 6 of these demonstrated the commuting pattern, and none of these ducks provided satellite fixes in or near Horseshoe Shoal. The remaining five ducks did not commute prior to departure for their breeding areas in mid-April 2010; they remained in the area immediately adjacent to Harwich, Chatham and Monomoy Island. Many ducks demonstrated the pattern of diurnal migration so often observed on Nantucket Island, but ducks do not make this journey every night. Some ducks appeared not to”commute” but stayed in one area both day and night. Other ducks apparently 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. We are presently proposing to include other sea duck species wintering in Nantucket Sound, especially White-winged Scoter (*Melanitta fusca*) and Common Eider (*Somateria molissima*) to estimate the behavioral impact of construction and operation of the now approved Cape Wind energy project on sea ducks.

PRESENTATION # 62

SURF SCOTER (*MELANITTA PERSPICILLATA*) RESPONSE TO FERRY TRAFFIC IN SAN FRANCISCO BAY

John Y. Takekawa[1], Natalie R. Wilson[1], Susan E. W. De La Cruz[1], Jane O. Anfinson[1], and Tsewang Namgail[1]

[1] U.S. Geological Survey, Western Ecological Research Center, San Francisco Bay; Estuary Field Station, 505 Azuar Dr., Vallejo, CA 94592 U.S.A.; Tel.: (707) 562-2000; e-mail: sdelacruz@usgs.gov

The San Francisco Bay estuary supports some of the largest populations of diving waterbirds and shorebirds wintering on the Pacific Flyway, while simultaneously accommodating shipping ports, recreational and commercial boaters, and water transit year-round. The effect that human disturbances such as commuter ferries have on wildlife populations are not well understood, but such disturbances may alter behavior when animals encounter vessels or their wakes. Many existing and planned ferry routes in San Francisco Bay cross subtidal areas that are known to be used by substantial numbers of diving ducks and other waterbirds for foraging and roosting. Our study objectives were to: 1) conduct on-board ferry surveys in San Francisco Bay to assess species-specific "reaction" distances and calculate effect zones; 2) examine waterbird avoidance of watercraft in land-based surveys at selected areas; and 3) document distribution of waterbirds along ferry routes with aerial surveys. We found that Surf Scoters responded to ferries that were 30 – 900m away as follows: dive, 87.14 ± 5.79, n = 35; fly, 103.59 ± 3.39, n = 488; swim, 245.48 ± 3.94, n = 1630; alert, 231.83 ± 7.11, n = 112; no response, 363.70 ± 9.33, n = 247. Based on mean response distances, we calculated a mean effect zone of 300 m on each side of the ferry path plus 200 m to account for recorded path deviation followed during sampled routes. Existing ferry routes create an effect zone that equals approximately 106 km^2, or 11% of San Francisco Bay area, and proposed ferry routes would increase this zone by 126.05 km^2 to 23%. Ground survey results indicated that Scoter densities declined immediately after ferry passage and varied significantly from expected values. Diving ducks comprised the majority of waterbirds counted during early winter and accounted for > 95% birds in the North Bay through December. In light of increasing human population in the Bay Area, as well as recreational and commercial boating, additional attention should be placed on understanding waterbird responses to disturbance and identifying regions that should be considered for protection.

PRESENTATION # 63

SEA DUCK PREDATION ON MUSSEL FARMS: DEVELOPING CONSERVATION-FRIENDLY AND COST-EFFECTIVE SOLUTIONS FOR MUSSEL GROWERS

Samantha E. Richman[1], Elisabeth Varennes[1], Magella Guillemette[1], John C. Bonardelli[2] and Sveinn Are Hanssen[3]

[1] Biology, Chemistry and Geography Department, Quebec University at Rimouski, 300 Allee des Ursulines, Rimouski, QC G5L 6Y7, Canada; Tel. : Canada office: (418) 775-0853; US cell: (307) 760-7108; email: cruciger7@gmail.com
[2] Shellfish Solutions, Inc., Belvedere 45, Tronheim, Norway
[3] Norwegian Institute for Nature Research, Framsenteret, NO-9296 Tromsø, Norway

The cultivation of Blue Mussels (*Mytilus spp.*) is a growing industry world-wide. However, predation by migrating sea ducks has become a challenge to mussel growers causing extensive financial losses. Mussels are a principle prey item for sea ducks, like Common Eiders (*Somateria mollissima*) and Scoters (*Melanitta* spp.), which take advantage of mussel farms that provide a highly abundant and easily accessible food source. To reduce predation, mussel growers have adopted several frightening techniques including loud recordings, pyrotechnics, shooting, chemical deterrents, protective socking material or chasing with boats; all of which have had limited success and are often subject to habituation. The installation of exclusion nets to physically prevent sea ducks from entering mussel farms have been the most successful. However, nets are expensive to install and maintain, and can entangle fish, diving birds, and mammals; causing conflicts with conservation and fishery regulators. Our objectives for this study are to use captive sea ducks: (1) to quantify the number of cultivated mussels consumed and the amount of 'knock-off' caused by foraging activity; (2) to determine the size-age classes most vulnerable to predation; and (3) to test the behavior of sea ducks in response to the presence of exclusion nets. We used captive Common Eiders (N = 10) in dive tanks at the Maurice Lamontagne Institute, Fisheries and Oceans Canada, Mont-Joli, Quebec. Mussels of different size year stocks were obtained from local mussel farms and maintained in circulating unfiltered sea water tanks. Individual ducks were offered 2 m ropes of differing mean mussel size (seed <20 mm, socked 25–45, and commercial >45 mm) and we measured consumption rates by sub-sampling the rope (10 cm) before and after each experiment. We tested nylon and polyethylene nets suspended across the dive tank of varying mesh size, twine weight and color. Foraging behavior, preferred size, knock-off rates, and interactions with nets were recorded continuously by video cameras above and below the water surface. Eiders preferred the smallest mussels (seed <25 mm) which also had the highest 'knock-off' rates compared with socked (25-45 mm) or commercial sizes (>45 mm), likely due to lower byssal attachment strength. Video observations of the behavior of eiders in the presence of exclusion nets determined that smaller mesh sizes (<15 cm) had a lower potential for entanglement. As the conflict between mussel aquaculture and migrating sea ducks escalates, there is a pressing need to develop conservation-friendly and cost-effective solutions to protect mussel farms without interfering with international wildlife laws.

PRESENTATION # 64 - CLOSING REMARKS

What Current Sea Duck Research And Management Are Relevant And What's Esoteric? And Where Should We Go From Here?

Paul L. Flint, USGS, Alaska Science Center, 4210 University Drive, Anchorage, Alaska 99508; Tel.: (907) 786 7183; e-mail: paul_flint@usgs.gov

There is evidence that major changes in size and trajectory of sea duck populations are tied to oceanographic regime shifts. However, it is less clear exactly what aspects of sea duck ecology change in response to these environmental shifts (i.e., survival or recruitment). This issue is further complicated by the fact that oceanographic regime shifts are only detectable 5-10 years after they have occurred. We need to establish the linkages between at sea environmental conditions and sea duck population dynamics. To accomplish this we need 4 things (1) long term indices to population size (i.e., survey data), (2) long term studies of sea duck survival and recruitment, (3) metrics of at sea conditions sufficient to detect regime changes, and (4) a little luck (i.e., we need regime shifts to occurring during our studies). Satellite telemetry data is useful for linking breeding populations to appropriate oceanographic metrics. Identifying the specific effects of environmental variation on life history characteristics is critical for identifying potential management actions. The problem with this approach is that it's correlational and thus we cannot truly infer cause and effect relationships. Further this approach is retrospective and functionally assumes that what changed in the past will be what changes in the future. Nonetheless, in my opinion we need to focus on the long term ongoing work that can yield insights to these broad scale questions. Once we have that information, more detailed specific studies will logically follow.

"*" after the title indicates this is a student abstract considered for an award

POSTER # 1

HABITAT USE OF BARROW'S GOLDENEYE IN MAY AND AUGUST ON THE KODIAK ARCHIPELAGO, ALASKA

Robin Corcoran[1] and Denny Zwiefelhofer[1]

[1] U.S. Fish and Wildlife Service, Kodiak National Wildlife Refuge, 1390 Buskin River Rd., Kodiak, Alaska, 99615, U.S.A.; Tel.: (907) 487-0229 ; e-mail: robin_corcoran@fws.gov

Barrow's Goldeneye (*Bucephala islandica*) are common year round on the Kodiak Archipelago. Nearshore marine bird surveys were conducted at four sites on Kodiak in May and August between 1994 and 2010. At two of the four sites Barrow's Goldeneye densities were significantly higher in May than in August. Mean densities of Barrow's goldeneye at each site in May varied from 0.52 to 6.29 birds/km^2 and in August from 0.14 0.73 birds/km^2. A comparison of the occurrence of birds with habitat availability indicated a preference for protected shorelines with partially mobile substrate and estuary habitats. Broods, although not common on August surveys, were regularly seen (n=12) particularly on the western, more heavily forested end of the Archipelago. We also describe a molting concentration of between 60 and 100 primarily female Barrow's goldeneye in marine waters in Blue Fox Bay on Afognak Island. Seventy-five molting Barrow's goldeneye were captured and banded at this location in 2006, and 56 were captured in August 2010 with six recaptures of birds banded in 2006.

POSTER # 2

AVAILABILITY OF NESTING AND BROOD-REARING HABITAT FOR STELLER'S EIDERS IN THE YUKON-KUSKOKWIM DELTA OF SOUTHWESTERN ALASKA

Charles J. Frost[1] and Tuula E. Hollmén[1, 2]

[1] Alaska SeaLife Center, 301 Railway Ave., Seward, AK, 99664, U.S.A.; Tel.: (907) 224-6894; e-mail: charlesf@alaskasealife.org
[2] School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, P.O. Box 730, Seward, Alaska 99664, U.S.A.

The Alaska breeding population of Steller's Eiders (*Polysticta stelleri*) was listed as threatened under the US Endangered Species Act in 1997. The current breeding population in Alaska is estimated to number hundreds, with highest densities near Barrow on the North Slope. On the Yukon-Kuskokwim Delta in western Alaska, the breeding population has nearly disappeared, and reintroduction has been explored as a potential tool to restore this breeding population. An important consideration is if and where suitable habitat exists that would provide the resources necessary for both nesting and brood-rearing of Steller's Eiders. To develop tools to evaluate habitat availability and suitability, we constructed a 100x100m gridded map of the Yukon-Kuskokwim Delta in NetLogo. Each grid cell contained standardized values on a scale of [0, 1] for each classified layer of important habitat characteristics, including: historical sightings/reports, ecotype designation, pond availability, flooding probability, salinity range, lead distribution, predator presence, and biodiversity. We used a front-end input system to alter weights based on objective (published research) and subjective (expert opinion) reasoning and combined grid values to evaluate current habitat availability and suitability. We simulated a variety scenarios of predator removal and habitat change to evaluate future habitat suitability in the Yukon-Kuskokwim Delta.

POSTER # 3

ANNUAL VARIATION IN BODY MASS OF PRE-FLEDGING SPECTACLED EIDER DUCKLINGS ON KIGIGAK ISLAND, YUKON-KUSKOKWIM DELTA, ALASKA

Melissa Gabrielson[1], Bryce Lake[2], and **Nathan Graff**[3]

[1] U.S. Fish & Wildlife Service, Yukon Delta National Wildlife Refuge, P.O. Box 346, Bethel, AK 99559; Tel.: (907) 543-1043; e-mail: Melissa_Gabrielson@fws.gov
[2] U.S. Fish & Wildlife Service, Yukon Flats National Wildlife Refuge, 101 12th Avenue, Room 264, Fairbanks, Alaska 99701, U.S.A.
[3] School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, P.O. Box 757220, Fairbanks, Alaska 99775, U.S.A.

Duckling size is an important determinant of survival. Body mass of Spectacled Eider (*Somateria fischeri*) ducklings, just prior to fledging, is positively related to survival at age of first breeding (age two). From 1999 to 2008, 461 ducklings were captured, banded, and weighed on the spectacled eider breeding ground located on the coastal zone of the Yukon-Kuskokwim Delta, Alaska. Most individuals that returned as adults (n=59) were first observed nesting at age two or three. Recently, few ducklings (n=2) banded between 2005 and 2008 have been observed. One hypothesis for this change is that duckling mass has declined, and consequently ducklings were in poor body condition prior to fledging and did not survive. Body mass may have declined from elevated salinity in ponds, concomitant changes in wetland invertebrates that growing ducklings rely on, or changes in weather in brood rearing and wintering areas. The results from this study will summarize body mass of Spectacled Eider ducklings prior to fledging and evaluate a link between environmental conditions on the breeding grounds and recruitment of this population.

POSTER # 4

HABITAT FACTORS RELATED TO THE ABUNDANCE AND DISTRIBUTION OF SURF SCOTERS DURING THE BREEDING SEASON IN LABRADOR AND QUEBEC, CANADA

Scott G. Gilliland[1], Gregory J. Robertson[1], Jean-Pierre L. Savard[2], Christine Lepage[3] and Matthew Mahoney[4]

[1]Environment Canada, 6 Bruce St., Mount Pearl, NL, A1N 4T3; Tel.: (709) 772-2103; e-mail: scott.gilliland@ec.gc.ca
[2]Environment Canada, Science and Technology, Wildlife Research, 1141 Route de l'Église, P.O. Box 10100, Québec, Québec, G1V 3W5
[3]Environment Canada, Canadian Wildlife Service, 1141 Route de l'Église, P.O. Box 10100, Québec, Québec, G1V 3W5
[4]Environment Canada, 17 Waterfowl Lane, Sackville, NB, E4L 1G6

In North America, breeding habitat requirements of Surf Scoters (*Melanitta perspicillata*) are poorly understood, and quantitative assessments have yet to be made. Understanding these requirements is important to ensure that quality breeding habitat is available and protected. It will also allow a more precise assessment of the breeding range, and help in designing future monitoring programs. In this study, we assess breeding habitat preferences of Surf Scoter pairs based on extensive helicopter surveys flown in Labrador and Quebec. In 2008-09, 62 plots, each 25 km^2, were flown in a 42 000 km^2 study area using standard helicopter survey techniques. Using GIS, each scoter observation was joined to the nearest waterbody, and waterbody area, perimeter and elevation were extracted. Logistic regressions were used to assess the ability of waterbody characteristics to predict scoters presence or absence. The mean breeding density of Surf Scoters was 0.315 ± 0.039 pr/km^2 (SE) and ranged between 0 and 0.76 pr/km^2. A quadratic model of waterbody perimeter proved the best model in predicting scoter presence, with waterbody area also having some predictive power, but was closely correlated with perimeter. There was no apparent linear relationship with elevation of waterbody and scoter presence within the study area. Medium-size lakes with perimeter lengths between 1 to 10 km had higher occupancy rates than expected and these lakes were relatively rare within the study area. The occupancy rate for small ponds (<1 km perimeter length) was low, but due to their sheer numbers, were important habitat for Surf Scoters. Using this model, we map predicted pair densities across the entire study area.

POSTER # 5

FORAGING HABITAT AND FOOD AVAILABILITY FOR SPECTACLED EIDER BROODS ON THE YUKON-KUSKOKWIM DELTA, ALASKA*

Nathan Graff[1], Tuula E. Hollmén[1,2] and Melissa Gabrielson[3]

[1]School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, P.O. Box 757220, Fairbanks, Alaska 99775, U.S.A.; Tel.: (507) 440-0041; e-mail: nrgraff@alaska.edu
[2] Alaska SeaLife Center, P.O. Box 1329, Seward, AK 99664, U.S.A.
[3] U.S. Fish and Wildlife Service, P.O. Box 346, Bethel, AK 99559, U.S.A.

The Yukon-Kuskokwim Delta is an important breeding area for Spectacled Eiders (*Somateria fischerii*) in North America. From the1970s to 1990s, the population suffered a long term decline in the region, leading to the species being listed as 'Threatened' under the U.S. Endangered Species Act in 1993. Although the breeding ecology of the species on the Yukon-Kuskokwim Delta has been monitored closely, little is known about the foraging habitat or foods available to broods prior to fledging. In 2010, a 3-year study was initiated to characterize brood rearing habitats and habitat use by Spectacled Eiders on Kigigak Island on the Yukon-Kuskokwim Delta. A pilot study was conducted during the summer of 2010 to investigate food availability for spectacled eiders and characterize the habitat they use for feeding. Data collection will continue in 2011-2012. Preliminary data showed fluctuating conductivity levels between 3600 µs/cm and 16000 µs/cm throughout the summer. Peaks occurred around early August with the lowest levels occurring earlier and later in the year. Between June and September, water levels fluctuated slightly but remained less than 0.6 m in depth. Water chemistry likely contributes to invertebrate abundance and species composition within pond habitats, but aquatic invertebrate samples collected await further analysis. Additional sampling will occur along with brood observations to pattern foraging habitat use during the summers of 2011 and 2012.

POSTER # 6

COMMON EIDER IN THE NORTH-WESTERN RUSSIA

Alexander V. Kondratyev[1]

[1] St-Petersburg State University, Universitetskaya emb. 7/9, 199164, St-Petersburg, Russia, Tel.: +7-921-308-78-13; e-mail: akondratyev@mail.ru

In the North-Western Russia Common Eider is found breeding in two locations. First location represents the eastern-most edge of rather numerous Baltic breeding population. In Russian waters of the Gulf of Finland, Common Eiders inhabit only the most western islands. Recent breeding census held in May 2010 only reveal slightly more than 200 nests on remote and inaccessible rocky islands, washed by brackish waters. In the most westerly lying part of the Gulf Common Eiders are scarce and never recorded on breeding. Another isolated much smaller population is found on Lake Ladoga, which is the largest freshwater lake in Europe. Here Common Eiders breed on islands of rocky archipelagos in the north-western part of the lake, this population is much smaller, and does not exceed 35-40 nests. In both locations nest initiation starts by the end of April, with 10 May being the mean date. Hatching mostly occurs since end of May until 15-20 June. The most densely populated islands also support big colonies of Herring and Lesser Black-Backed Gulls, sometimes counting up to 250-300 nests. In all cases Eiders start nesting either simultaneously or a week later than gulls. Nests are well concealed among boulders, in tall grass tussocks and in dense low shrubs. Clutch size prior to hatching was 3,8±0,1 (N=156) eggs. Nest predation varied between the islands from 2 to 24 %, being 10,6 % at average among 9 surveyed islands in the Gulf of Finland. On Lake Ladoga in 2000 nest predation rate was estimated as 6%. Among 182 clutches only one contained more than 9 eggs, so was treated as a result of definite nest parasitism, in all others cases clutch size distribution was unimodal with the modal clutch of 4 eggs. Soon after hatching Common Eider broods move away from small breeding islands and stay closer to bigger islands with shallow bays and good shelter. Broods were never seen along the mainland coasts. On Lake Ladoga broods are easy to join, and joined broods were observed more often than single, the biggest creches comprised up to 20 ducklings with 4 accompanying females. Due to hard accessibility of brood-rearing areas the

overall breeding success of this eastern-most Baltic population still remains poorly known. This is even more true for the unique Ladoga breeding population, where overall breeding success seems to be extremely low, as autumn counts have never shown any good number of broods. Feeding ecology and trophic relations of this latter freshwater eider population also remains practically unknown.

POSTER # 7

EFFECTS OF THE *CHRYSOCHROMULINA POLYLEPIS* BLOOM IN THE BALTIC SEA IN 2008 ON THE BREEDING PERFORMANCE OF EIDERS

Kjell Larsson[1], Susanna Hajdu[2], Mikael Kilpi[3], Rolf Larsson[4], Aivar Leito[5], Peter Lyngs[6], and Peter Waldeck[1]

[1] Gotland University, SE-621 67 Visby, Sweden, Tel.: +46 498 299839; e-mail: kjell.larsson@hgo.se
[2] Marine Ecology, Stockholm University, 106 91 Stockholm, Sweden
[3] Aronia Research, Åbo Akademi University & Novia UAS, FI-10600 Ekenäs, Finland
[4] Flyet, Pl 680A, SE 373 00 Jämjö, Sweden
[5] Estonian University of Life Sciences, 51014 Tartu, Estonia
[6] Christiansø Feltstation, Christiansø 97, 3760 pr Gudhjem, Denmark

We studied the breeding performance of Eiders (*Somateria mollissima*) at 101 nesting island in Sweden, Finland, Estonia and Denmark between 2007 and 2010. The field work that was performed in the different regions were in most cases parts of other long-term research or monitoring projects on eiders and other waterbirds. In Swedish colonies on Gotland and at the Hanö Bay as well as in Danish colonies on Bornholm, i.e. in colonies in central and southern Baltic Sea, a highly synchronous dramatic decrease of the number of nesting females was observed from year 2007 to 2008. In the colonies on Gotland, the 70 % decrease was followed by increases in 2009 and 2010, although not up to numbers observed in 2007. At Hanö Bay and at Bornholm the observed decreases of 55 % and 36 %, respectively, between 2007 and 2008, were followed by increases in 2009 and 2010 up to the level observed in 2007. By contrast, no general drop of the number of nesting females was observed from 2007 to 2008 in the colonies in the Gulf of Finland or in western Estonia. The exceptional poor breeding performance and the high frequency of non-breeding female Eiders in the central and southern Baltic Sea in 2008, coincided temporally and spatially with an exceptional spring bloom of the potentially toxic haptophyte *Chrysochromulina polylepis*. We suggest that the intensive spring bloom of *Chrysochromulina polylepis* in 2008 in the central and southern, but not in the northeastern Baltic Sea, affected the quality of the main benthic food of Eiders, i.e. the Blue mussels (*Mytilus edulis / M. trossulus*), and, subsequently, the health status of adult female Eiders and their breeding propensity. From the results we also infer that the foraging opportunities prior to egg-laying at the vicinity of the breeding sites, and not only at the wintering sites, significantly affect breeding the propensity of Eiders. The research on Eiders has been financially supported several national research funds and since 2008 by Nord Stream AG (grant to Kjell Larsson).

POSTER # 8

BREEDING ECOLOGY OF LONG-TAILED DUCKS (*CLANGULA HYEMALIS*) IN CHURCHILL, MANITOBA

Matthew C. Perry[1] and Robert M. Alison[2]

[1] U.S. Geological Survey, Patuxent Wildlife Research Center, 12100 Beech Forest Road, Laurel, Maryland, 20708, U.S.A.; Tel.: (301) 497-5622; e-mail: mperry@usgs.gov
[2] 312-2757 Quadra Street, Victoria, BC V8T 4E5

The breeding ecology of Long-tailed Ducks (*Clangula hyemalis*) was studied in Churchill, Manitoba, from 2004-2010 and data are compared with data collected 40 years ago by Dr. Robert Alison. This area is unique in that there are numerous nesting ducks, is readily accessible to researchers, and represents the most southern known breeding population of Long-tailed Ducks. Ducks on the study site were captured with mist nets set over water during a 2-week period in mid-June. In addition, some females were captured with the use of a long-handled dip net while incubating eggs. Banding of 143 adult Long-tailed Ducks caught in mist nets revealed a skewed sex ratio favoring males (1.7M:1F). No second-year (subadults) males were captured in any years, although second-year females were commonly captured on breeding sites. During June, 107 nests were discovered and mean clutch size was 7 eggs. LTDU nests were located an average 2.2 m from the water edge and 31 cm above water surface. Mean bowl depth late in incubation was 5.9 cm. Mean date of the initiation of incubation was June 21, which was not different from that reported by Alison in the early 1970s. Some females used the same nest bowl for 2 consecutive years as indicated by the presence of year-old embryo sacs among the new un-hatched eggs. Site fidelity of long-tailed ducks to the Churchill breeding area was documented by the mist-net capture of 9 (7.5%) ducks banded the previous years and one banded female captured in the same nest bowl she used in previous year. A pair banded in June 2007 was caught in 2009 at the original capture site. Several nest starts (1-2 eggs) were discovered, but eggs disappeared within a few days apparently from Herring Gull (*Larus argentatus*) predation. This study revealed the close association of Long-tailed Ducks and Common Eiders (*Somateria mollissima*) with Arctic Terns (*Sterna paradisaea*), which nest simultaneously and in the same habitat. Both duck species seem to benefit from the presence of aggressive Arctic Terns by reducing predation by Herring Gulls, whose numbers are increasing in the study area. The use of islands or narrow peninsulas as nesting sites for ducks and terns was an important characteristic of nesting sites that has potential benefits from reduced predation. Avian predation was recorded by Herring Gulls, Common Ravens (*Corvus corax*), and Pacific Loon (*Gavia pacifica*). Mammalian predators included Red Fox (*Vulpes vulpes*) and American Mink (*Neovison vison*). Understanding the Churchill population of Long-tailed Ducks could have important implications in understanding populations in more remote areas, especially in regard to global climate change.

POSTER # 9

EFFECTS OF IMPLANTED TRANSMITTERS ON REPRODUCTIVE BEHAVIOR AND EGG PRODUCTION OF CAPTIVE SEADUCKS

Matthew C. Perry[1], Alicia M. Wells-Berlin[1], Glenn H. Olsen[1], Charlotte Kilchenstein[1]

[1] U.S. Geological Survey, Patuxent Wildlife Research Center, 12100 Beech Forest Road, Laurel, Maryland, 20708, U.S.A.; Tel.: (301) 497-5622; e-mail: mperry@usgs.gov

Before implanting transmitters in seaducks it is important to learn whether there are any adverse effects of the implants. To evaluate effects we instrumented 4 captive female White-winged Scoters (*Melanitta fusca*), 2 captive male Surf Scoters (*Melanitta perspicillata*), 2 captive female Long-tailed Ducks (*Clangula hyemalis*), and 3 captive female Harlequin Ducks (*Histrionicus histrionicus*) during 2007 to 2009. We used surgically implanted 39-g inactive (dummy) PTT-100 transmitters in both scoter species and 26-g dummy PTT-100 transmitters in Long-tailed Ducks and Harlequin Ducks. Foraging, inactive, locomotive, maintenance, and reproductive behaviors were recorded along with productivity during the breeding season. Differences occurred throughout the breeding season for most behaviors. The most notable difference was that control ducks engaged in higher reproductive behaviors in May and June than did instrumented ducks. We monitored egg production of instrumented females and egg production of the female Surf Scoters paired with instrumented males, along with non-instrumented control ducks for a 2- or 3- year period. All instrumented ducks were paired with non-instrumented ducks, which were also monitored and maintained in a captive colony at USGS Patuxent Wildlife Research Center (Patuxent), Laurel, Maryland, USA. Egg production was greater for control pairs than instrumented pairs of Surf Scoters and Long-tailed Ducks. Malformed and crushed eggs were laid by instrumented White-winged Scoters, whereas

none were laid among control ducks. No eggs were laid by Harlequin Ducks. We recommend the smaller transmitter (26-g PTT-100) be used for future studies with Long-tailed Ducks and Harlequin Ducks, and with White-winged Scoters and Surf Scoters if data dealing with breeding behavior are important. Researchers should recognize potential problem with atypical breeding behavior and with egg production for instrumented seaducks.

POSTER # 10

ACTIVITY RECORDS IN LAYING AND INCUBATING SCALY-SIDED MERGANSERS *MERGUS SQUAMATUS*: A COMPARISON OF 10MIN AND 2MIN INTERVAL LIGHT DATA RECORDING

Diana V. Solovyeva[1], James Fox[2], Vsevolod Afanasyev[2], and Valery Shokhrin[3]

[1] Zoological Institute RAS, 1 Universitetskaya Emb., St-Petersburg, 199034, Russia; e-mail: diana_solovyeva@mail.ru; tel/fax: +7 812 2306712;

[2] British Antarctic Survey, High Cross, Madingley Road, Cambridge, CB3 0ET, United Kingdom, jwf@bas.ac.uk & vaf@bas.ac.uk;

[3] Lazovskiy SNR, Lazo, Tsentral'naya Str., Lazo, Primorye, Russia, shokhrin@mail.ru

Breeding biology of endangered scaly-sided merganser was poorly known. In spring 2006-2009 twenty nine Scaly-sided Mergansers females were captured on their nests in South Primorye, Russia, and fitted with British Antarctic Survey geolocator data loggers. In 2006-8 we fitted twenty one females with the Mk9 model with a light recording interval of 10mins. We employed a new type of Mk11 logger with a 2min light recording interval and fitted them on eight females in 2009. Females were captured at nests in about mid-incubation and each logger record included late incubation period and hatch in the given year, and egg-laying and early incubation period in the following year. Eleven females with Mk9 were recaptured the year after deployment and two females were recaptured after two years. Four females with 2min loggers were recaptured a year after deployment. Female activity records during egg-laying and incubation were compared. Timing of egg-laying, egg-laying interval and related number of follicles per generation, incubation onset and rhythm, hatch and nest departure were investigated.

POSTER # 11

EIDER NEST SUCCESS IN EASTERN RUSSIAN ARCTIC

Diana V. Solovyeva[1]

[1] Zoological Institute RAS, 1 Universitetskaya Emb., St-Petersburg, 199034, Russia; Tel/fax: +7 812 2306712; e-mail: diana_solovyeva@mail.ru

Apparent nest success was investigated in Steller's and King eiders in 1993-2000 in the Lena delta, Northern Yakutia. Apparent and Mayfield nest success were investigated in Spectacled and King Eiders in 2002-2010 in the Chaun Delta, Chukotka. Deviation of Mayfield nest success from apparent nest success was resulted from high proportion of nests found already depredated and not involved in Mayfield nests success calculations. A hypothesis explaining large fluctuations of eider nest success in 1980-90's as compared to stable nest success in 2000's is suggested for eastern Russian Arctic.

POSTER # 12

DEVELOPMENT OF LONG-TAILED DUCK EGGS THROUGH THE INCUBATION PERIOD

Kristen B. Steinmetzer[1] and Tasha J. DiMarzio[1]

[1] Alaska SeaLife Center, P.O. BOX 1329 Seward, AK 99664; Tel.: (907) 224-6362; e-mail: kristens@alaskasealife.org

Currently, floating (suspending an egg in water to see how much it floats or sinks) is a technique used by many field biologists in Alaska to determine the viability and development of a clutch of eggs at a nest site. This technique, however, only shows what stage of growth the egg is at, not the health of the embryo inside. Candling (shining a bright light through the egg) can be a reliable way to judge the health of an egg through embryonic development. Candling shows the fertility of a clutch, what date an embryo died, whether or not the egg is on track with the expected hatch date of its species, and gives much more precise data than floating techniques. However, understanding the connection between the external visual results of egg candling and the internal morphological consequences can be quite difficult. Documenting the candling of Long-tailed Duck (*Clangula hyemalis*) eggs on a daily basis using a high-powered lighting device and camera shows both healthy (i.e. crisp, clear veins) and unhealthy (i.e. fuzzy appearance around embryo) embryonic development and shows what a healthy egg should look like at a given day of development. Dead embryos are both candled and dissected to show what the candled egg actually looks like at a given moment of development. This information is a valuable tool, allowing a person new to candling a reference to compare results to. Having this information available in a manual for field purposes would allow for the use of candling as a more functional field application in Alaska. These methods could be performed with various species housed at the ASLC to compare results and contrast differences between species.

POSTER # 13

INDETERMINATE LAYING AND FLEXIBLE CLUTCH SIZE IN A CAPITAL BREEDER, THE COMMON EIDER (*SOMATERIA MOLLISSIMA)*

Peter Waldeck[1,2], Sveinn Are Hanssen[3], Malte Andersson[1]

[1] Department of Zoology, University of Gothenburg,Box 463, 405 30 Gothenburg, Sweden; Tel.: +46 739068990; e-mail: peter.waldeck@hgo.se
[2] Department of Biology, University of Gotland, 621 67 Visby, Sweden
[3] Norwegian Institute for Nature Research, 9296 Tromsø, Norway

Clutch size control in capital breeders such as large waterfowl has been much debated. Some studies have concluded that clutch size in ducks is determined before the start of laying and does not change in response to egg additions or removals. The response, however, may depend on the timing of tests, and experiments may have been too late for females to alter the number of eggs. We here study clutch size responses to predation of first and second eggs in the common eider, using protein fingerprinting of egg albumen to verify that the same female continues laying in the nest after predation. Sixty of 79 females with early egg predation (one or both of the two first eggs) deserted the nest. Among the 19 females that stayed and continued laying, the mean number of eggs produced was 4.4, significantly higher than the 3.7 in non-predated nests. The staying females had similar egg size and clutch initiation date as females that deserted, and their body mass and clutch initiation date was similar to that of females whose clutches were not predated. Even capital-breeding common eiders may therefore be indeterminate layers, as many females in which early eggs are removed lay more eggs than others. A previous study has shown that they can reduce their laying if eggs are added. Our results add to increasing evidence that ducks have more flexible egg production than previously thought.

POSTER # 14

ESTABLISHING NON-BREEDING HABITAT OBJECTIVES FOR SEA DUCKS IN THE UPPER MISSISSIPPI RIVER AND GREAT LAKES JOINT VENTURE REGION

Gregory J. Soulliere[1], Bradly A. Potter[1], John M. Coluccy[2], and **Benjamin M. Kahler**[1]

[1] Upper Mississippi River and Great Lakes Region Joint Venture, U.S. Fish and Wildlife Service, 2651 Coolidge Road, Suite 101, East Lansing, MI 48823, U.S.A.; Tel.: (517) 351-8334; e-mail benjamin_kahler@fws.gov
[2] Great Lakes Atlantic Regional Office, Ducks Unlimited, 1220 Eisenhower Place, Ann Arbor, MI 48108, U.S.A

Joint Ventures (JVs) are employing science-based decision-making to quantify and target conservation actions through spatially precise, landscape oriented, decision tools in conjunction with explicit population and habitat objectives. Generating meaningful sea duck habitat protection and restoration targets for multiple species over large and diverse JV regions may be unfeasible. Yet the exercise is necessary and instructive, yielding explicit testable assumptions and monitoring needs. Migration and wintering habitat objectives were developed for sea ducks in the Upper Mississippi River and Great Lakes JV region using a bioenergetics model incorporating estimates of population size, harvest data, and winter distribution. Recent literature suggests spring migration habitat is likely more important than fall habitat. Thus, we made a critical planning assumption: habitat carrying capacity established to accommodate wintering and spring migrating duck populations also will suffice during fall migration. With foundational assumptions explicitly stated, a simple model with three components was developed: 1) regional population goal for each species, 2) energy demand/individual, and 3) energy supply/unit area. The North American Waterfowl Management Plan (NAWMP) goal of restoring duck populations to 1970s levels was adopted for six sea duck species common to the region (mergansers were excluded). Based on recent continental spring population estimates (NAWMP 2004), Bufflehead (*Bucephala albeola*) and Common Goldeneye (*Bucephala clangula*) populations were at goal levels. Surf, White-winged, and Black Scoters (*Melanitta perspicillata, M. fusca, and M. nigra*) and Long-tailed Duck (*Clangula hyemalis*) were below NAWMP goal and thus had a population "deficit." After apportioning continental population goals to the JV region, sea duck habitat maintenance and restoration objectives were derived using the energetic-model, converting use-day requirements into habitat objectives. Because factors outside the JV region significantly influence sea duck populations, habitat objectives are stated in terms of carrying capacity. Habitat "maintenance" objectives were established to accommodate current populations and "restoration" objectives are an estimate of additional habitat required to accommodate population deficits. Use days and habitat objectives are based on migration and winter periods combined. We estimated sea duck population goals during non-breeding periods can be attained with 89,500 ha of quality open water foraging sites. Our intent was to establish an initial process for generating explicit regional waterfowl population and habitat conservation objectives using available survey data and biological information from scientific literature. Sparse population and ecological information was a significant planning challenge for sea ducks. However, we used a scientific method for habitat objective-setting and identified testable assumptions and evaluation needs to improve subsequent iterations of this procedure. Information needs of greatest importance for model improvement include determining 1) duration of stay during migration and winter periods, 2) accessible energy available and food/feeding thresholds before area abandonment ("giving-up densities"), 3) ability to accommodate multiple species with varied diet preferences (e.g., Bufflehead and Common Goldeneye) on the same habitat areas, and 4) factors other than food potentially limiting habitat quality. An unbiased survey of sea duck abundance and distribution during non-breeding periods is also essential to refine population abundance objectives as well as effectively target derived habitat objectives.

POSTER # 15

ASSESSING GENETIC DIVERSITY IN CAPTIVE STELLER'S EIDERS (*POLYSTICTA STELLERI*) USING MICROSATELLITE MARKERS.

Ann E. Riddle[1], Tuula E. Hollmén[1,2], and John M. Pearce[3]

[1] Alaska SeaLife Center, P.O. Box 1329, Seward, Alaska 99664, U.S.A ; Tel.: (907) 224-6882; e-mail: annr@alaskasealife.org
[2] University of Alaska Fairbanks, School of Fisheries and Ocean Sciences, P.O. Box 730, Seward, Alaska 99664, U.S.A.
[3] U.S. Geological Survey, Alaska Science Center, 4210 University Dr., Anchorage, Alaska 99508, U.S.A.

In 1997 the Alaska-breeding population of Steller's Eiders (*Polysticta stelleri*) was listed as threatened under the U.S. Endangered Species Act. Currently, the Alaska SeaLife Center in Seward, Alaska maintains the only captive flock of

Steller's Eiders in North America. This captive flock was established with birds and eggs from different locations in Alaska. Quantifying the genetic diversity of these captive Steller's Eiders was deemed essential to support effective management of the Alaska SeaLife Center flock (i.e., avoid inbreeding), development of propagation techniques, and to compare the captive diversity to that of the larger wild population. Therefore, we genotyped the captive Steller's Eiders at the Alaska SeaLife Center with seven nuclear microsatellite loci that have been previously used to assess genetic diversity in free ranging Steller's Eider populations. For each locus, we determined allelic frequencies, expected and observed heterozygosity, probability of deviation from Hardy-Weinberg equilibrium, and the inbreeding coefficient and compared our results to those previously reported for free ranging Barrow breeding (n=49) and Alaska Peninsula molting (n=45) populations. The captive birds analyzed (n=35) showed a similar level of heterozygosity (0.60 observed, 0.59 expected) as the two free ranging groups (both populations 0.58 observed, 0.61 expected) suggesting that the genetic diversity of the captive flock at the seven loci examined is representative of larger, free ranging populations. While additional genetic markers may be examined in the future, our initial results here suggest that the captive flock at the Alaska SeaLife Center will be useful for future captive propagation and provide a unique tool for Steller's Eider research.

POSTER # 16

COMMON EIDER SEASONAL MOVEMENTS IN PROPOSED OFFSHORE WIND POWER TEST SITES

Lucas J. Savoy[1], Wing Goodale[1], Brad Allen[2], Darryl Heard[3], Dustin Meattey[1], and Ian Johnson[1]

[1] Biodiversity Research Institute, 19 Flaggy Meadow Road, Gorham, Maine 04038, U.S.A.; Tel.: (207) 839-5818, ext 104; e-mail: lucas.savoy@briloon.org
[2] Maine Department of Inland Fisheries and Wildlife, 650 State Street, Bangor, Maine 04401, U.S.A.
[3] College of Veterinarian Medicine, University of Florida, Gainesville, Florida 32610, U.S.A.

The state of Maine, U.S.A., has recently approved the development of three offshore wind power development testing sites, to begin construction within the next three years. State and federal agencies have maintained valuable long-term reproductive and population surveys of numerous species of breeding seabirds and wintering waterfowl in Maine. Critical information on the timing of migration, migratory pathways, wintering site fidelity, and daily and seasonal movements of avian species along coastal Maine is needed. We selected the Common Eider (*Somateria mollisima*) as an important species to gain further knowledge on their seasonal movements and the potential impacts to this species, through wind power development. Common Eiders were selected due to the: 1) significant North American breeding and wintering population in Maine; 2) species' susceptibility to the effects of wind power development in Europe; 3) bird's year-round utilization of nearshore marine resources along Maine's coastline; and 4) lack of information on eider migratory and seasonal movements in northeastern North America. Our primary objectives were to: 1) investigate the annual seasonal movements of eiders in Maine; and 2) determine the approximate distance traveled and locations of their daily flights between daytime feeding and evening roosting locations on their wintering areas. In May 2010, we captured four nesting females from a large eider nesting colony in Maine and implanted each with a Microwave Telemetry Inc. 38 gram abdominal implantable PTT 100 satellite transmitter. Following surgery and recovery, the hens were placed back on their nests. The transmitters were programmed with a multi-seasonal timer, to conserve battery life and maximize transmissions during the winter months, when eiders are more likely to move. From May through November (season 1), duty cycles were six hours on and 120 hours off. From December through the life of the transmitter (May) (season 2), eight hours on and 48 hours off. Three of the eiders remained within a four mile radius from their nesting island, from May through most of October. In late October, these three eiders migrated 150 miles south to Cape Cod area, Massachusetts, U.S.A. One of these eiders flew approximately 100 miles to Boston Harbor, and remained there for 6-10 days before departing to Cape Cod. The fourth eider departed its nesting area in late June and migrated 67 miles northward up the Maine coast to Penobscot Bay, Maine, U.S.A. This bird flew back to its nesting area in early October, remaining there for approximately 14 days, before flying back to its original northern area. Preliminary analysis shows these four eiders move minimally (~ 2 miles) between their feeding and roosting areas, while on their breeding grounds and wintering areas.

POSTER # 17

DISTRIBUTION AND DEMOGRAPHICS OF PACIFIC COMMON EIDERS IN WESTERN AND NORTHERN ALASKA

Karen S. Bollinger[1], Christian P. Dau[2], Robert M. Platte[2], and Robert Stehn[2]

[1] U.S. Fish and Wildlife Service, Migratory Bird Management, 1412 Airport Way, Fairbanks, Alaska 99701, U.S.A. Tel.: (907) 456-0427; E-mail: karen_bollinger@fws.gov
[2] U.S. Fish and Wildlife Service, Migratory Bird Management, 1011 East Tudor Road, Anchorage, Alaska 99503, U.S.A.

The North American population of Pacific Common Eiders (*Somateria mollissima*) is estimated to be 115,000-170,000 birds. Within Alaska, the largest breeding aggregations of Pacific Common Eiders occur along the coastlines of the Aleutian Islands, the Yukon-Kuskokwim Delta, and the barrier islands of the Bering, Chukchi, and Beaufort seas. Available data indicate sharp declines from the 1950's to the 1990's in numbers of Common Eiders on breeding grounds in both Alaska and Canada. Aerial survey data from the Waterfowl Breeding Population and Habitat Survey indicate a >90% local decline in breeding Eiders on the YKD over the last 40 years. Although annual estimates are highly variable, approximately 2800 Common Eiders (range: 1353-4449 total birds) occur along the Beaufort Sea coast. Coastal erosion has more than doubled in Alaska - up to 13 m per year between 2002 and 2007 along a 64 km stretch of the Beaufort Sea. Further loss of barrier islands along the Beaufort Sea coast will likely influence breeding populations of Common Eiders dependent upon this habitat. Because reliable information on abundance and trend is either nonexistent or available only for a few specific areas within the species range, the U.S. Fish and Wildlife Service is developing a comprehensive aerial survey for western and northern Alaska to monitor Pacific Common Eider distribution, abundance, and demographics. Here we describe results of Common Eider surveys along the coastline of the Alaskan Arctic Coastal Plain (1999-2009) and from the Yukon-Kuskokwim Delta of southwestern Alaska northward (2006-09). We summarize survey data on population size and trend, demographics, distribution, and nesting habitats.

POSTER # 18

TRADEOFFS IN DUTY-CYCLES FOR SATELLITE TRACKING PROGRAMS FOR SEA DUCKS

Scott G. Gilliland[1] and Sean Boyd[2]

[1]Environment Canada, 6 Bruce St., Mount Pearl, NL, Canada A1N 4T3; Tel.: (709) 772-2013; e-mail: scott.gilliland@ec.gc.ca
[2] Environment Canada, Science & Technology, Delta, BC V4K 3Y3

Satellite tracking studies for sea ducks have been limited to use of implantable radios. These radios have limited battery capacities and, to extend the life of the radio, a duty-cycle is used to switch the radio on and off for fixed periods of time. The duty-cycle is a tradeoff between maximizing the total life expectancy of the radio and having a reasonable expectation that a satellite will be in view while the radio is transmitting. The ARGOS system uses polar orbiting satellites, which result in better coverage near the poles and poorer coverage near the equator. The recommended duty-cycles used for sea ducks to provide position information across the entire life cycle has been 6 h on and 72 h off. This duty-cycle results in a life expectancy of 1.2 years ± 50 d (SD; n = 15). This duty-cycle has provided a high expectancy of acquiring position information each time the radio is on. However, this high frequency of location data is not required for population delineation studies, and the long transmission period limits our ability to track birds over multiple years. Here we present data from a Black Scoter telemetry project that show some of the limitations of the 6 h on 72 h off duty-cycle, and evaluate the performance of a 2 h on 72 h off duty-cycle. During their spring migration, we implanted 15 Black Scoter (*Melanitta Americana*) females with 6h on 72 h off duty-cycle in 2009 and an additional 15 females with 2 h on 72 h off duty-cycle in 2010. The average departure date from the spring staging area for both years was 8 June ± 15 d in the year of implementation. However, departure dates from spring staging sites for the 2010 migration for birds implemented in 2009 were 22 days earlier (16 May ± 3 d). This suggests that the chronology of migration, and likely breeding, was impacted by the capture and/or surgery, and underscores the need to track birds over multiple migration events to accurately describe migration. As of 1 Jan 2011, several of the 2010 marked birds have migrated to low latitudes wintering areas (between northern Florida and North Carolina) where the 2 h on duty-cycle was predicted to perform poorly due to poor

satellite coverage. Between early May and January, these birds have traveled between 31° and 67° N. Between 42° and 67° N we received and average of ~ 2 locations ≥ ARGOS Class 1 per duty-cycle. The average number of locations per cycle was slightly lower at the lower latitudes. However, even at the lowest ones (30°-35° N), we received and average of 1.6 locations ≥ ARGOS Class 1 per duty-cycle. To date, the 2 h on 72 h off duty-cycle has performed well at the lower latitudes, and are providing useful information for the design of winter monitoring programs. With a life expectancy of ~3 years, these radios have the potential to provide better information on site fidelity and migration chronology than duty-cycles with shorter life expectancies.

POSTER # 19

A NEW AERIAL SURVEY TO MONITOR SEA DUCKS AND OTHER MIGRATORY BIRDS IN THE CANADIAN ARCTIC

Deborah J. Groves[1], Timothy J. Moser[2], Edward J. Mallek[3], and D. Lynne Dickson[4]

[1] U.S. Fish and Wildlife Service, Migratory Bird Management, 3000 Vintage Boulevard, Suite 240, Juneau, Alaska 99801, U.S.A.; Tel.: (907) 780-1174; e-mail: debbie_groves@fws.gov
[2] U.S. Fish and Wildlife Service, Migratory Bird Management, Whipple Federal Building, Room 501, 1 Federal Drive, Fort Snelling, Minnesota 55111, U.S.A.
[3] U.S. Fish and Wildlife Service, Migratory Bird Management, 1412 Airport Way, Fairbanks, Alaska 99701, U.S.A.
[4] Canadian Wildlife Service, Room 200, 4999-98 Avenue, Edmonton, Alberta T6B 2X3, Canada

During the summers of 2005-2010, the Arctic Goose Joint Venture, Sea Duck Joint Venture, U.S. Fish and Wildlife Service (USFWS), Canadian Wildlife Service (CWS), Central and Mississippi Flyway Councils, and other partners conducted fixed-wing aerial surveys of migratory birds throughout a large expanse of important lowland habitats in Canada's Arctic. Our surveys had two main objectives: 1) obtain distribution information and indices of abundance of King Eiders (*Somateria spectabilis*), Long-tailed Ducks (*Clangula hyemalis*), Canada Geese (*Branta canadensis*), Greater White-fronted Geese (*Anser albifrons*), Tundra Swans (*Cygnus columbianus*), and others; and 2) assess the logistic feasibility of using turbine-powered, fixed-wing aircraft to conduct an annual bird survey in the region. We selected survey areas that were previously identified by CWS as important habitats for our highest-priority species (King Eider, Long-tailed Duck, Canada Goose, and Greater White-fronted Goose). We chose a survey window of 15 June to 3 July to coincide with the mid-incubation period for geese, as well as the period when King Eiders were paired. Depending on survey area and year, we flew systematic transects spaced 10- or 20 km apart, using a de Havilland Turbine Beaver or Quest Kodiak aircraft. Survey crews composed of a USFWS biologist-pilot and a right-seat observer recorded observations of all birds (excluding shorebirds and passerines) and large mammals within 200 m of the flight path. We surveyed varying portions of the total survey area each year. Annual population indices, densities, distribution, and estimates of variance are presented for King Eiders and Long-tailed Ducks. In all years, we successfully accomplished the survey within the planned survey window. Crews encountered relatively minor logistic challenges stemming from a combination of weather, aircraft mechanical problems, and long distances between airports; however, aircraft and crew safety were never compromised. The success of our 2005-2010 surveys in providing valuable data led to increased support to design and implement an annual multi-species bird survey in the Canadian Arctic. Although the survey does not encompass all King Eider and Long-tailed Duck breeding habitats, it will provide important annual population-size and distribution data over an extensive area. By 2011, we will have collected at least 2 years of data in all portions of the survey area. Using the 2005-2011 data and data from earlier CWS helicopter surveys, we will determine the final operational survey design.

POSTER # 20

WINTERING NORTHERN COMMON EIDER IN EASTERN CANADA

Christine Lepage[1], **Scott G. Gilliland**[2], Daniel Bordage[1], and Jean-Pierre L. Savard[3]

[1] Environment Canada, Canadian Wildlife Service, 1141 Route de l'Église, Québec, Québec, Canada G1V 3W5; Tel. : (418) 649-6506; e-mail: christine.lepage@ec.gc.ca
[2] Environment Canada, Canadian Wildlife Service, 6 Bruce Street, Mount Pearl, Newfoundland, Canada A1N 4T3
[3] Environment Canada, Science and Technology, Wildlife Research, 1141 Route de l'Église, Québec, Québec, Canada G1V 3W5

The northern Common Eider (*Somateria mollissima borealis*) provides a complex management challenge as it is harvested in Canada and Greenland throughout its entire annual cycle. Data from banding and satellite telemetry indicate that about 30% of the northern Common Eiders that breed in the eastern Canadian Arctic winter in Canada and 70% in Greenland. In this study, we present the first complete series of range-wide winter surveys of the Canadian component of this population conducted in 2003, 2006 and 2009. Population estimates were calculated using ratio estimators of visual estimates vs. photographic counts to correct for observer biases in flock estimation. A medium format camera was used in the 2003 survey and required high and low altitude photos to estimate flock size and ratio of brown to white birds. However, the use of high resolution digital cameras with image stabilized lenses in 2006 and 2009 required only high altitude photos of flocks to obtain photo counts and ratios of brown to white birds. Correction factors varied significantly among years and observers (range = 0.94–2.42). The 2003 *borealis* population estimate was 203 952 (188 474–219 430 CI; CV = 8%), the 2006 estimate, 175 835 (167 825–183 845; CV = 5%), and the 2009 estimate, 204 795 (182 383–227 207; CV = 11%). During these three surveys, largest numbers of wintering eiders were found on the Northeast Coast (46%, 22% and 33% in 2003, 2006 and 2009, respectively), in Bonavista (11%, 18% and 22%, respectively) and on the East Avalon (13%, 10% and 17%, respectively) of Newfoundland, and in the Mingan Archipelago (15%, 23%, and 7%, respectively) of Québec. Compared to 2003 and 2009 where 72% and 78% of the wintering eiders were counted in Newfoundland, the 2006 population estimate was split more equally between Newfoundland and Québec (53% and 44%, respectively). This suggests that individuals may not always winter in the same area each year as a result of variable ice coverage. The number of flocks was lower and their sizes larger in 2003 (178 flocks; mean = 1 146 eiders; heavy ice cover in the entire surveyed area) than in 2006 (334 flocks; mean = 512 eiders; below normal ice cover in the entire surveyed area) or 2009 (361 flocks; mean = 549 eiders; ice cover normal in the Gulf area but below normal in the east Newfoundland waters). Climate change should lead to milder winter conditions and reduced ice coverage, resulting in greater dispersion of wintering eiders. Monitoring the distribution and abundance of eiders wintering in eastern Canada will help us develop conservation actions such as marine protected areas in the face of increasing demand for offshore and coastal development. The use of model-based ratio estimators that combine visual estimates and photo counts is important to reduce observer biases in estimating the wintering population of northern Common Eider.

POSTER # 21

TRENDS IN WINTERING SEA DUCK DENSITY INDICES WITHIN THE INLAND MARINE WATERS OF WASHINGTON STATE, 1994 - 2010

Bryan L. Murphie[1], Joseph R. Evenson[2], David R. Nysewander[3], Thomas A. Cyra[4], Ignacio Vilchis[5], Shannon Knapp[3], Don Kraege[3]

[1]Washington Department of Fish & Wildlife, P.O. Box 1483, Shelton, WA 98584, USA; e-mail: bryan.murphie@dfw.wa.gov
[2]Washington Department of Fish & Wildlife, 7801 Phillips Rd, Lakewood, Washington 98498, U.S.A.
[3]Washington Department of Fish & Wildlife, 600 Capitol Way North, Olympia, Washington 98501, U.S.A.
[4]Washington Department of Fish & Wildlife, 16018 Mill Creek Blvd, Mill Creek, WA 98012, U.S.A.
[5]SeaDoc Society, UC Davis, 942 Deer Harbor Road, Eastsound, WA 98245, U.S.A.

Using aerial strip transects, we surveyed inland marine waters of Washington State for wintering (December – mid-February) sea duck abundance from 1994 – 2010. We sampled an average area of 640.3 km^2 (SD=35.0) annually, stratified within six depth bins (contours) (0-10 meter, 10-20m, 20-40m, 40-60m, 60-100m, and >100m isobaths). The annual range of effort per depth bin was 254-311 km^2 (0-10m), 59-77 km^2 (10-20m), 63-83 km^2 (20-40m), 35-51 km^2

(40-60m), 46-75 km^2 (60-100m), and 57-125 km^2 (>100m). Observers recorded species/species group, count and time of all sea ducks encountered within a fifty meter strip on each side of a DeHaviland DHC-2 “Beaver” floatplane flown at an altitude of 65 meters and speed of 80–90 knots (148-167 km/h). All sightings were spatially referenced. From 1994 to 1999, eight observers participated in surveying to varying degrees; however, since 2000 the same two observers have conducted all surveys.

We produced two indices of population viability from the 17-year dataset. First, annual abundance/density indices were generated using Waterbirds 1.20 (R.G.Ford Consulting). Second, using generalized linear models with poisson error distributions we modeled bird densities as a function of time (survey year), space (longitude and latitude), and habitat (water depth). Minimization of the Akaike Information Criterion (AIC) was the criteria used to select the combination of covariates that best describe historical bird densities within the study area.

Annual abundance indices, uncorrected for detectability, ranged from 3,325-7,780 Harlequin Duck (*Histrionicus histrionicus)*, 2,368-14,566 Long-tailed Duck (*Clangula hyemalis*), 46,347-143,659 Scoters combined (Surf, *Melanitta perspicullata*; Black, *M. niger*; and White-winged, *M. fusca,* comprised an average of 74%, 24%, and 2%, respectively, of all Scoters classified to species; an average of 33.4% of all Scoters were unclassified), 37,680-76,871 Goldeneye (on average 31% were Common, *Bucephala clangula*, 19% Barrow’s, *B. islandica*; and 50% were unclassified Goldeneye species), 41,772-99,677 Bufflehead (*B. albeola)*, 279-1,512 Hooded Mergansers (*Lophodytes cucullatus*), and 9,617-26,192 Common (*Mergus merganser*) and Red-breasted (*M. serrator*) Mergansers combined (on average 17% were Common, 41% Red-breasted, and 42% were unclassified Merganser species). Analysis of bird densities as a function of time showed declining trends for all sea duck species analyzed from 1994-2010 including Harlequin Ducks, -23.0% total at an average of -1.53% per year; Long-tailed Ducks, -57% at an average of -4.86% per year; all Scoters combined, -63% at an average of -5.72% per year; Goldeneye, -41% at an average of -3.05% per year; Bufflehead, -23% at an average of -1.53% per year; all Mergansers combined, -12% at an average of -0.72% per year. Continued monitoring efforts to document these trends are essential to the prioritization of management and research decisions, setting harvest levels, and evaluating the effectiveness of recovery efforts.

POSTER # 22

GENETIC STRUCTURE AND GENE FLOW IN A RECOVERING POPULATION OF COMMON EIDERS IN THE ALEUTIAN ARCHIPELAGO, ALASKA

Matthew G. Sexson[1], Sarah A. Sonsthagen[1], Margaret R. Petersen[1], and Sandy L. Talbot[1]

[1] U.S. Geological Survey, Alaska Science Center, 4210 University Drive, Anchorage, Alaska 99508, U.S.A.; Tel.: (907) 786-7177; e-mail: msexson@usgs.gov

Species occupying the Aleutian Islands in the Northern Bering Sea were heavily impacted by the introduction of fur bearing Arctic foxes (*Vulpes lagopus*) that began in 1750 and continued until 1930. Eradication efforts were initiated in 1949 to restore breeding populations of Aleutian Cackling Geese (*Branta hutchinsii leucopareia*). Among other species, Pacific Common Eiders (*Somateria mollissima v-nigrum*) re-colonized islands where foxes were removed. Recent satellite telemetry data showed that eiders breeding in the Central and Western Aleutian Islands are year round residents with limited dispersal in winter to nearby islands. However, the pattern of genetic structure among recently established colonies remains unknown. Therefore, we investigated the population genetic structure and gene flow of Common Eiders breeding in the Aleutian Islands in an effort to identify potential source populations. We collected genetic information from 14 microsatellite loci and the mitochondrial DNA (mtDNA) control region for female eiders (n = 149) breeding at Adak in the Andreanof Island group, Amchitka in the Rat Island group, and Agattu, Nizki, Alaid, and Attu islands in the Near Island group, in 2005 - 2008. We detected spatial variation in the distribution of mtDNA haplotypes with high levels of differentiation between most of the islands sampled (Φ_{ST} = 0.093–1.000). We did not detect differentiation between eiders sampled on Adak and Amchitka islands, and Agattu and Attu islands. In contrast, population genetic structure was not observed at microsatellite loci. This pattern is consistent with sexual differences in Common Eider behavior, where females are typically more philopatric than males which often demonstrate higher rates of dispersal. Gene flow along the Aleutian Archipelago was generally asymmetrical, following a westerly course. The directionality of gene flow estimates from mtDNA differed from microsatellite estimates, with Amchitka Island exhibiting evolutionary dispersal into most populations in the Western and Central Aleutian Islands, and Attu Island exhibiting gene flow to islands in close geographic proximity. The results of our study suggest that female philopatry contributes to genetic differentiation between islands, but male dispersal tends to homogenize allele frequencies across the Central and Western Aleutian Islands. Our data also suggest that islands once void of Common Eiders were re-colonized by source populations on islands in closest proximity.

POSTER # 23

SURVIVAL OF ATLANTIC COAST SEADUCKS WITHIN 2 WEEKS AND 2 MONTHS OF INSTRUMENTATION WITH IMPLANTABLE SATELLITE TRANSMITTERS

Matthew C. Perry[1], Glenn H. Olsen[1], Alicia M. Wells-Berlin[1], Scott G. Gilliland[2], Keith McAloney[3], Jean-Pierre L. Savard[4], Pamela Loring[5], and Taber D. Allison[6]

[1] U.S. Geological Survey, Patuxent Wildlife Research Center, 12100 Beech Forest Road, Laurel, Maryland, 20708, U.S.A.; Tel.: (301) 497-5622; e-mail: mperry@usgs.gov
[2] Environment Canada, Canadian Wildlife Service, 6 Bruce Street, Mount Pearl, Newfoundland, A1N 4T3, Canada.
[3] Environment Canada, Canadian Wildlife Service, 17 Waterfowl Lane, Sackville, New Brunswick E4L 1G6, Canada.
[4] Environment Canada, Science and Technology, Wildlife Research, 1141 Route de l'Église, P.O. Box 10 100, Québec, Québec, G1V 3W5, Canada
[5] Program in Wildlife & Conservation Biology, Department of Natural Resources Science, 105 Coastal Institute in Kingston, University of Rhode Island, Kingston, Rhode Island, 02881, U.S.A.
[6] American Wind Wildlife Institute, 208 South Great Road, Lincoln, Massachusetts 01773, U.S.A.

Four species of seaducks were instrumented (n = 235) with implantable transmitters at six locations along the Atlantic coast between 2001 and 2010. Surf Scoters (*Melanitta perspicillata*) were instrumented in Chesapeake Bay (n = 26), Quebec (n = 9), and in Labrador (n = 26), White-winged Scoters (*M. fusca*) in Quebec (n = 19), American Scoters (*M. americana*) in New Brunswick (n = 80) and Rhode Island (n = 20), and Long-tailed Ducks (*Clangula hyemalis*) in Nantucket Sound (n = 53) and Chesapeake Bay (n = 2). All scoters were instrumented with 39 g PTT100 transmitters, whereas Long-tailed Ducks were instrumented with 26 g PTT100 transmitters. Mortality during the first 2-week period and the 2-month period following surgery was variable by season and age of the ducks. Adults survived longer than subadults (second year), but no differences between sexes were detected. Although 80% of hatching years ducks (n = 5) survived past 2 weeks, mortality was 100% during the 2-month period. Ducks instrumented in late winter on wintering or staging areas had the least mortality. Ducks instrumented during molting or early in winter had the highest mortality. Holding ducks for 2-5 days to allow for recovery from surgery did not increase survival as initially suggested, but appeared to reduce survival. Body condition prior to surgery is considered the most important factor affecting initial survival. Body condition evaluation was based on weight, size of breast muscle, and amount of internal fat observed at initiation of surgery. However, in some areas, predation, especially by gulls (*Larus* spp.), was a major factor believed to be mostly caused by ducks having wet feathers following release and expending excessive times preening on shore. Feather wetting appeared to be related to ducks bathing in water with an oily scum from their feces prior to release. Post mortem examination of several recovered mortalities was equivocal, and in most cases mortalities are not recovered and we are forced to speculate based on several pre-release factors. We suggest that ducks with low fat levels in coelomic cavity should be rejected for surgery and that bathing of ducks following surgery only be conducted in clean flowing water. We recommend that ducks be released soon (1-3 hours) after surgery and no later than the following morning.

POSTER # 24

A SEA DUCK JOINT VENTURE MANAGEMENT BOARD PRIORITY: COMPILING AND ARCHIVING ALL SATELLITE TELEMETRY DATA FOR LANDSCAPE SCALE ANALYSES AND MONITORING

Alicia M. Wells-Berlin[1], Ronald E. Therrien[1], Timothy D. Bowman[2], and Keith McAloney[3]

[1] U.S. Geological Survey, Patuxent Wildlife Research Center, 12100 Beech Forest Road, Laurel, MD 20708; Tel.: (301) 497-5730; e-mail: aberlin@usgs.gov
[2] U.S. Fish & Wildlife Service, Migratory Bird Management, 1011 East Tudor Road, Anchorage, Alaska 99503
[3] Canadian Wildlife Service, 17 Waterfowl Lane, P.O. Box 6227, Sackville, NB, E4L 1G6

One of the primary goals of the Sea Duck Joint Venture is to delineate the populations of seaducks in North America. This goal has lead to number of satellite telemetry tracking projects all over North America. To this day this data has either been published in numerous different journals or not published at all. There is an increase interest into large landscape scale perspectives to manage species. If this data is compiled into one database then some of these pertinent continent wide issues can be addressed, such as effects of climate change and weather events on migrational pathways, home ranges, and timing; visualization of potential interactions between populations or designating potential subpopulations,

monitoring the potential spread of avian borne diseases such as west nile virus and potentially avian flu; and aiding in determining where more information is needed. The Sea Duck Joint Venture Management Board has made compiling all sea duck telemetry data into three separate databases, Movebank, wildlifetracking.org, and the sea duck data model a priority. The sea duck data model is being developed to archive both the detailed raw Argos data and filtered data points and geometry. The filter output includes good quality PTT data points and summarized data points by duty cycle. This data can be exported for additional analysis into external tools like Matlab, Google Earth, ArcView, Excel and others. The export can include both detailed PTT data or summarized geometry files. For example, polygons of population delineation areas by species for display in a mapping program could be exported. This is all wrapped in a security model that allows a program manager or owner to control the levels of access to a program or grouping of PTTs. For example, access could be granted to detailed PTT performance data, detailed PTT location information or summarized geometry/polygon data. Access could be limited to a specific period of time as well. There has been a significant time and money invested in collecting this valuable data on sea duck movement patterns from satellite transmitters. However, without the proper tools to manage, analyze, and disseminate the data, all potential benefits to sea duck management will not be realized.

POSTER # 25

DETERMINATION OF BIOME-LEVEL MOULT LOCATIONS OF WHITE-WINGED SCOTERS (MELANITTA FUSCA) USING STABLE ISOTOPE ANALYSIS

Rian Dickson[1], Daniel Esler[1], and Stuart Slattery[2]

[1] Centre for Wildlife Ecology, Department of Biological Sciences, Simon Fraser University, Burnaby, BC, Canada ; Tel.: (778) 782-5618; e-mail: rdd@sfu.ca;
[2] Institute for Wetland and Waterfowl Research, Ducks Unlimited Canada, Stonewall, MB, Canada

We used stable isotope analysis of primary feathers to estimate the relative numbers of White-winged Scoters (*Melanitta fusca*) that moult in freshwater versus marine environments. While it is generally thought that North American scoters undergo remigial moult in marine habitats, there is evidence from satellite telemetry and direct observations that some individuals moult in freshwater environments, although the relative frequency of this behaviour is unknown. Identification of alternate moulting habitats may be an important part of developing relevant management strategies for this declining species, and could also lead to increased understanding of cross-seasonal effects in migratory birds. Primary feather samples collected from hatch-year White-winged Scoters (n=24), which would have been grown on freshwater breeding areas, and adults moulting in coastal habitats of Southeast Alaska and the Salish Sea (n=40) were used to establish reference carbon/nitrogen signatures for freshwater and marine environments, respectively. Isotopic signatures of primary feather samples collected from scoters of unknown moult locations were then compared to the known references, to determine whether they were grown in marine or freshwater environments. The unknown moult location samples were collected during the breeding season, from males (n=58) and females (n=64) captured early in the breeding season at Cardinal Lake, NWT and from females (n=67) captured during incubation at Redberry Lake, SK. We found that most of these White-winged Scoters moulted in coastal environments (>90%). However, our results indicate that some adult females underwent remigial moult in freshwater environments, and a very small number of males may have done so as well. In addition, females that grew their remiges in coastal environments exhibited a slightly more freshwater signature than males that moulted on the coast, likely reflecting differing phenology of post-breeding migration relative to moult initiation between the sexes. While the majority of White-winged Scoters moult in coastal environments, freshwater moulting is not uncommon for females and likely is influenced by their breeding success. Strategies of moult and potential constraints for this important cohort merit further study.

POSTER # 26

WINTER HABITAT USE AND MOVEMENT PATTERNS OF SCOTERS IN RHODE ISLAND

Pamela H. Loring[1], Scott R. McWilliams[1], Peter W. C. Paton[1], Richard A. McKinney[2], and Jason Osenkowski[3]

[1] Department of Natural Resources Science, University of Rhode Island, Kingston, Rhode Island 02881, U.S.A. ; Tel.: (413) 237-1213; e-mail: pam_loring@my.uri.edu
[2] U.S. Environmental Protection Agency, Atlantic Ecology Division, 27 Tarzwell Drive, Narragansett, RI 02882, U.S.A.
[3] Rhode Island Department of Environmental Management, Division of Fish & Wildlife, 277 Great Neck Road, West Kingston, RI 02892, U.S.A.

The Rhode Island coast includes New England's largest estuary and provides diverse marine habitat for thousands of seaducks during winter and migratory staging periods. Black *(Melanitta americana),* Surf (*M. perspicillata*), and White-winged (*M. fusca*) scoters tend to concentrate at select coastal sites, likely in association with benthic prey. To investigate the relationship between scoter abundance and prey density, we collected benthic samples and underwater video using a Van Veen Grab (0.04 m^2) affixed with a planar-view camera at 0.5 km^2 estuarine sites representing a continuum of high-use to low-use by scoters. Weekly shore-based surveys were conducted to quantify numbers of feeding scoters at each site from December 2010 to April 2011. Highest mean numbers of feeding Surf Scoters (121 ± 47) and Black Scoters (62 ± 10) were associated with relatively high mean densities of potential prey, including bivalves (27 ± 6 individuals per m^2), gastropods (26 ± 10 individuals per m^2), polychaetes (22 ± 4 individuals per m^2), and tube-dwelling Amphipods of the genus *Ampelisca* (832 ± 225 individuals per m^2). Bivalve species consisted primarily of Atlantic jackknife (*Ensis directus*), dwarf surfclams (*Mulinia lateralis*), and northern dwarf tellin (*Tellina agilis*). Gastropods were dominated by dog whelks (*Nassarius* spp.*),* while polychaetes included blood worms (*Glycera* spp.*)* and clam worms (*Nereis* spp.). In addition to associating scoter abundance with prey availability on a local scale, we related winter movement patterns of scoters instrumented with satellite transmitters (n=18) to physical habitat characteristics (i.e., depth, distance to shore, slope, and benthic substrate) throughout the Rhode Island coast. Understanding habitat use and movement patterns of wintering scoters is important for modeling potential risks associated with development of offshore wind facilities in Rhode Island waters.

POSTER # 27

MOLT ECOLOGY OF SURF SCOTERS (*MELANITTA PERSPICILLATA*) ON THE PACIFIC COAST: MIGRATION, CHRONOLOGY AND LOCATIONS IDENTIFIED FROM SATELLITE TELEMETRY*

Joseph R. Evenson[1], David R. Nysewander[1], Bryan L. Murphie[1], Thomas A. Cyra[1], Don Kraege[1], John Y. Takekawa[2], Susan E. W. De La Cruz[2], David H. Ward[3], Daniel Esler[4], and Sean Boyd[5],

[1] Washington Department of Fish & Wildlife, 600 Capitol Way North, Olympia, Washington 98501, U.S.A.; Tel.: (360) 902-8137; e-mail: evensjre@dfw.wa.gov
[2] Western Ecological Research Center, U.S. Geological Survey, 505 Azuar Drive, Vallejo, California 94592, U.S.A.
[3] Alaska Science Center, U.S. Geological Survey, 4210 University Drive, Anchorage, Alaska 99508, U.S.A.
[4] Centre for Wildlife Ecology, Simon Fraser University, Delta, BC, V4K 3N2, Canada
[5] Pacific Wildlife Research Centre, Canadian Wildlife Service, RR#1 – 5421 Robertson Rd., Delta, BC, V4K 3N2, Canada

Satellite transmitters were implanted in after-third-year age class Surf Scoters (*Melanitta perspicillata*) at five wintering sites along the Pacific Coast from 2004-2010. ARGOS data from 78 scoters (63 females, 15 males) were used in these analyses (Southeast Alaska (n=9); Strait of Georgia, British Columbia (n=9); Puget Sound, Washington (n=30); San Francisco Bay, California (n=22); and Baja California, Mexico (n=8)). We examined variation in molt migration routes and distances traveled, rate of travel, chronology of molt migration, duration of stay at pre-molt stopover sites, length of stay at molt areas, and how these related to various factors such as wintering and nesting locations, latitude of molt area, spring migratory pathway used, and sex. Chronology of molt migration was different for males and females. Most males left nesting areas from mid-June through mid-July for marine pre-molt stopover areas, arriving at molting areas between mid-July through mid-August. Females predominantly left nesting areas by mid-July through early August to migrate to marine molting areas. A small proportion of females molted within the Canadian interior in close proximity to their respective nesting sites. Females that molted in marine areas arrived at the molt sites from mid-August through early September. The two primary molting areas observed on marine waters for females were northern Southeast Alaska and southern

British Columbia - Washington State. All males molted on marine areas but there was little overlap with females; most males molted at sites from Cook Inlet, Alaska, and north, with one exception in Oregon. By incorporating five concurrent studies examining Surf Scoter life history through satellite telemetry, we have been able to document, on a flyway scale, new insights into this crucial stage. These data are vital for effective management and research on this species.

POSTER # 28

THE SEABED HABITATS OF COMMON EIDER *SOMATERIA MOLLISSIMA* MOLT SITES IN THE BRITISH ISLES

Christopher M. Waltho[1]

[1] 73 Stewart Street, Carluke, Lanarkshire, ML8 5BY, Scotland, United Kingdom; Tel.: +44 1555750719;
e-mail: chris.waltho@eider.org.uk

Waterfowl molting sites are frequently spatially separate from either breeding or wintering grounds. A variety of characteristics may determine a suitable molting site. In general, seaducks require their molting sites to be safe from predators and with rich accessible (sublittoral) feeding.
This study investigates the seabed habitats of eider molting grounds in the British Isles. More than 90 molting sites were identified and mapped. These were compared with habitat data from the UKSeaMap – a GIS seabed classification. UKSeaMap uses the European Nature Information System (EUNIS) habitat classification.
Molt flocks were located across 7 seabed habitats (at EUNIS level 3). The primary habitats utilised were shallow plains with infralittoral coarse sediment (A5.1) or infralittoral fine sand/muddy sand (A5.23 & A5.24), and these were often located in shallow bays, sounds or sealochs. Low energy infralittoral rock (A3.3) was also used. However, improved resolution of the habitat data may show littoral/sublittoral rock to be an important component within these other habitat types, especially for loafing and preening activities.
A wider ranging multi factoral analysis of molting sites is required before site selection can be better understood.

POSTER # 29

CHARACTERIZATION OF SERUM PROTEIN PROFILES IN SEVEN SPECIES OF SEA DUCKS IN ALASKA

Ann E. Riddle[1], **January Frost**[1], Jennifer Curl[1], and Tuula E. Hollmén[1,2]

[1] Alaska SeaLife Center, P.O. Box 1329, Seward, Alaska 99664, U.S.A; Tel.: (907) 224-7902;
e-mail: januaryf@alaskasealife.org
[2] University of Alaska Fairbanks, School of Fisheries and Ocean Sciences, P.O. Box 730, Seward, Alaska 99664, U.S.A.

Population declines have been documented for several species of sea ducks in Alaska (tribe *Mergini*). Causes of declines are largely unknown, and limited information is available about physiological health of many populations. Serum protein profiles have been used to monitor general health in avian species and can indicate the presence of inflammatory and infectious processes. For birds, most methods separate serum proteins into pre-albumin, albumin, α-, β- and γ-globulin fractions. However, profiles vary among species and have not been characterized for most sea ducks. From 2004-2007, we collected samples from sea ducks in Alaska and characterized protein fractions for seven species using electrophoresis (Beckman Coulter, Inc., Paragon® Electrophoresis Systems): Steller's Eiders (*Polysticta stelleri*, n=77), Spectacled Eiders (*Somateria fischeri*, n=14), Harlequin Ducks (*Histrionicus histrionicus*, n=55), Common Eiders (*Somateria mollissima*, n=5), King Eiders (*Somateria spectabilis*, n=6), White-winged Scoters (*Melanitta fusca*, n=8), and Black Scoters (*Melanitta americana*, n=8). We also compared protein profiles between sexes for Steller's Eiders, Spectacled Eiders, and Harlequin Ducks during the winter season and observed no obvious difference in protein fractions. As reported in other avian species, albumin was found to be the largest protein fraction in all species. We found a total of seven to nine fractions in sea ducks, with notable protein pattern differences among species. All four Eider species showed a pre-albumin fraction while King Eiders, Harlequin Ducks, and both species of Scoters had two γ-globulin fractions. Understanding serum protein profiles will allow characterization of baseline values for each individual species, which further facilitates serum protein electrophoresis as a tool to assess general health, disease, and inflammatory processes in sea ducks.

POSTER # 30

SURVIVAL OF REHABILITATED SURF SCOTERS (*MELANITTA PERSPICILLATA*) OILED DURING THE COSCO BUSAN SPILL ON SAN FRANCISCO BAY COMPARED TO UNOILED CONTROL GROUPS

Susan E. W. De La Cruz[1], John Y. Takekawa[1], Kyle Spragens[1], Richard Golightly[2], Gregory Massey[3], Laird Henkel[4], R. Scott Larsen[3], and Michael Ziccardi[3]

[1] U.S. Geological Survey, Western Ecological Research Center, San Francisco Bay Estuary Field Station, 505 Azuar Dr., Vallejo, CA 94592 U.S.A., Tel.: (707) 562-2004; e-mail: sdelacruz@usgs.gov
[2] Department of Wildlife, Humboldt State University, Arcata, CA 95521 U.S.A.
[3] Wildlife Health Center, School of Veterinary Medicine, University of California, Davis, California 95616 U.S.A.
[4] Office of Spill Prevention and Response, California Dept. of Fish and Game, 20 Lower Ragsdale Drive, Suite 100, Monterey, CA 93940 U.S.A.

On 7 November 2007, the *M/V* Cosco Busan released approximately 58,000 gallons of bunker oil into the San Francisco Bay near the Oakland-San Francisco Bay Bridge. Surf Scoters (*Melanitta perspicillata*) were the most affected bird species in this incident, and more than one thousand Scoters were treated by the Oiled Wildlife Care Network in Cordelia, California. To evaluate post-release survival and the effects of rehabilitation on Scoters, we compared winter survival of oiled, rehabilitated birds to that of 2 control treatment groups: un-oiled, rehabilitated; and un-oiled, non-rehabilitated Scoters. Birds from each group were radio-marked and released in San Francisco Bay. We conducted aerial telemetry flights 2 to 3 times a week for a total of 31 flights between 16 December 2007 and 7 April 2008 to determine location and mortality status of all marked birds. We used a live encounter – dead recovery modeling procedure in Program MARK to model Surf Scoter winter survival and used Akaike's Information Criterion (AICc) to rank and compare candidate fate models. The best-fitting model indicated that the probability of survival differed among treatment groups and over time, and that detection and recovery differed among groups. We averaged across all models to determine cumulative winter survival estimates for each of the three treatment groups. The resulting estimates (± standard errors) were lowest for oiled, rehabilitated birds (0.138 ± 0.097), intermediate for un-oiled, non-rehabilitated birds (0.503 ± 0.160), and highest for un-oiled, rehabilitated Scoters (0.796 ± 0.197). Our results provide information needed to help improve wildlife recovery after oil spills and other disasters.

POSTER # 31

PREVALENCE OF LOW PATHOGENIC AVIAN INFLUENZA VIRUSES IN SEA DUCKS SAMPLED IN ALASKA, 2006-2010

J. Christian Franson[1], Paul L. Flint[2], Margaret R. Petersen[2], Kimberly A. Trust[3], Timothy D. Bowman[3], and Hon S. Ip[1]

[1] U.S. Geological Survey, National Wildlife Health Center, 6006 Schroeder Road, Madison, Wisconsin 53711, U.S.A.; Tel.: (608) 270-2444; e-mail: jfranson@usgs.gov
[2] U.S. Geological Survey, Alaska Science Center, 4210 University Drive, Anchorage, Alaska 99508, U.S.A.
[3] U.S. Fish and Wildlife Service, Migratory Bird Management, 1011 E. Tudor Road, Anchorage, Alaska 99503, U.S.A.

Waterfowl are an important reservoir of influenza viruses, often becoming infected but typically not developing overt clinical disease. As part of a program to monitor for the introduction of high pathogenic avian influenza (HPAI) into North America by migratory birds, more than 55,000 waterfowl sampled in Alaska from 2006 through 2010 were tested for influenza viruses. In Tribe *Mergini* this included a total of 6,339 individuals of 14 species, with Steller's Eider (*Polysticta stelleri*), Spectacled Eider (*Somateria fischeri*), King Eider (*S. spectabilis*), and Common Eider (*S. mollissima*) accounting for 90% of the samples. Cloacal and oropharhyngeal swabs were collected from sea ducks primarily on Alaska's North Slope, the Yukon-Kuskokwim Delta, and the Alaska Peninsula. The samples were screened for avian influenza viruses by real-time reverse transcriptase polymerase chain reaction (RRT-PCR). No HPAI viruses were found, but low pathogenic avian influenza (LPAI) viruses were detected in all four species of eiders, as well as Harlequin Duck (*Histrionicus histrionicus*), Long-tailed Duck, (*Clangula hyemalis*), and White-winged Scoter (*Melanitta fusca*). Among the eiders, Steller's Eider had the greatest frequency of LPAI at 2.1%, while Spectacled Eider had the lowest at 0.2%. When the

frequency of LPAI was evaluated on the basis of units consisting of individuals of the same species sampled in one year at each of several locations, the data generally followed a Poisson distribution, as the majority of positives came from a relatively small percentage of the sampling units. Laboratory studies have reported decreased persistence of avian influenza viruses at high salinity but, although the overall frequency (approximately 1%) of LPAI in sea ducks was lower than in other ducks (5.4%), it was similar to or greater than frequencies in geese (1%) and swans (0.6%) sampled in Alaska in 2006-2010. Evidence exists that waterbirds with overlapping migratory pathways between Asia and Alaska carry Asian LPAI lineages to Alaska. These findings suggest the possibility that some sea ducks, particularly Steller's Eiders that migrate between Russia and Alaska, could bring Asian origin influenza viruses to North America.

POSTER # 32

DISEASE SURVEILLANCE (AVIAN CHOLERA, AVIAN INFLUENZA, AND AVIAN MALARIA) IN LONG-TAILED DUCKS (*CLANGULA HYEMALIS*) AND COMMON EIDERS (*SOMATERIA MOLLISSIMA*) IN CHURCHILL, SUBARCTIC MANITOBA

Linda C. Lyon[1] and Matthew C. Perry[2]

[1] University of Wisconsin-Madison, Department of Forest and Wildlife Ecology, 1630 Linden Drive, Madison, Wisconsin 53706, U.S.A.; Tel.: (410) 952-6818 (cell); e-mail: Linda.C.Lyon@uwsp.edu
[2] U.S. Geological Survey, Patuxent Wildlife Research Center, 12100 Beech Forest Road, Laurel, Maryland 20708, U.S.A.

Due to the remote habitats of seaducks little is known about diseases affecting these waterfowl species. Surveillance for three potentially significant diseases of waterfowl (avian cholera, avian influenza, and avian malaria) was conducted in two species of seaduck, Long-tailed Duck (*Clangula hyemalis*) and Common Eider (*Somateria mollissima*), in Churchill, subarctic Manitoba. These species have been exhibiting long-term population declines in North America. Surveillance for avian disease has not been conducted in the Churchill region with these species. Knowledge of disease is becoming more important as the threat of climate change becomes more apparent in this subarctic region. Choanal and cloacal swabs were collected for avian cholera (n = 19) and avian influenza (n = 13) analysis and blood smears (n = 16) were evaluated for prevalence of avian malaria. Disease monitoring was conducted in collaboration with ongoing USGS research involving demographics and nesting ecology of seaducks. Coordination of all sampling and transfer of disease material was done with disease authorities in Canada and the United States. No evidence of avian influenza or avian malaria was found in these populations. Avian cholera results are pending. Avian Cholera samples are being tested in collaboration with Environment Canada and the University of Saskatchewan currently conducting avian cholera research in the Canadian Arctic. It is important to survey for diseases in declining populations as well as healthy populations as the climate changes. This study can serve as a negative baseline for continued surveillance in this region and with these species. The results of this study will give wildlife managers a better understanding of the incidence of disease in seaducks in the Churchill area, which is an important area for breeding seaducks as well as migrating ducks that come down the Churchill River on their way to molting areas in James Bay.

POSTER # 33

DO STATE-MEDIATED HORMONES PREDICT REPRODUCTIVE DECISIONS IN ARCTIC-NESTING COMMON EIDERS?*

Holly L. Hennin[1], Joël Bêty[2], H. Grant Gilchrist[3] and Oliver P. Love[1]

[1] Department of Biological Sciences, University of Windsor, Windsor, Ontario, Canada, N9B 3P4; Tel.: (519) 253-3000 x4754; e-mail: hennin@uwindsor.ca
[2] Biology Department and Northern Studies Center, Quebec University at Rimouski, Rimouski, Quebec, Canada, G5L 3A1
[3] National Wildlife Research Centre, Environment Canada, Ottawa, Ontario, Canada, K1S 5B6

Variation in individual state and the abiotic environment is predicted to influence the reproductive decisions and hence success of Arctic migratory species. Previous studies have indicated that body mass and arrival date on breeding grounds can explain some of the variation observed in the reproductive decisions individuals make; however we still observe a substantial amount of unexplained variation among individuals. Employing a state-dependent framework we

are using arrival physiology to enhance our ability to explain individual variation in reproductive decisions in a model migratory Arctic species. Our objective is to determine whether variation in state-dependent physiological traits combined with environmental context enhances our predictive ability to explain variation in reproductive decisions and how this variation influences reproductive success. We are studying Canada's largest colony of Arctic-breeding Common Eiders (*Somateria mollissima*; 4000 – 6000 pairs annually) at East Bay Island, Nunavut. From 2006-2009 we captured over 1000 pre-breeding females, collected baseline hormone (corticosterone and leptin), metabolite (triglycerides), and oxidative stress levels, and recorded both the reproductive decisions (e.g. whether to defer reproduction, when to reproduce) and reproductive success (e.g. ability to hatch ducklings) of these individuals. Since 2005 avian cholera (*Pasteurella multocida*) has spread through the colony, potentially creating strong selection pressure on individual physiological phenotypes. Furthermore, an increasingly variable spring climate in the Eastern Arctic is potentially selecting for individuals with physiologically plastic responses. We hope to use state-dependent physiological measures to i) predict variation in reproductive decisions, ii) relate individual physiological plasticity to reproductive success, and iii) better understand how individual state and the external environment interact to shape variation in life-history traits in this Arctic-breeding species of concern.

POSTER # 34

AVIAN CHOLERA EMERGENCE AT COMMON EIDER BREEDING COLONIES IN THE EASTERN CANADIAN ARCTIC*

Samuel A. Iverson[1,2], **H. Grant Gilchrist**[2], and Mark Forbes[1]

[1] National Wildlife Research Centre, Environment Canada, (on campus) Carleton University, 1125 Colonel By Drive, Ottawa, ON, Canada, K1S 5B6; Tel.: (613) 998 7294; e-mail: Samuel.Iverson@ec.gc.ca
[2] Department of Biology, Carleton University, 1125 Colonel By Drive, Ottawa, ON, Canada, K1S 5B6

Population level impacts of disease on free-ranging hosts have proven difficult to quantify; however the magnitude of losses from individual outbreak events and the frequency of outbreaks at some locations have raised concerns about biological costs. Since 2005, avian cholera outbreaks have been documented on an annual basis at a closely studied breeding colony for northern common eiders (*Somateria mollissima borealis*) in the East Bay Migratory Bird Sanctuary, Southampton Island, Nunavut. Avian cholera is caused by infection with the bacterium *Pasteurella multocida* and the disease is among the most lethal for birds in North America. Avian cholera has circulated in American common eider populations (*S. m. dresseri*) since at least the 1960s; however its appearance in Arctic-breeding eiders is a new phenomenon. Band recovery analysis and nest monitoring at East Bay indicate mortality rates for breeding females ranging from 5%-45% per year since the disease was first detected. In addition, there has been as a near total failure in duckling productivity. This has raised concerns over colony collapse and regional population declines if the disease persists in other areas. Traditional Ecological Knowledge interviews of Inuit harvesters combined with recently initiated boat-based surveys of colonies across the Hudson Strait region provide additional detail about transmission networks and the extent of the epizootic. We present a paradigm for integrating these data into a population model that considers both host demography and disease epidemiology. Our objective is to predict disease spread on the basis of population connectivity and assess potential population-level impacts.

POSTER # 35

METALS IN ALASKAN STELLER'S AND SPECTACLED EIDERS

Micah Miller[1], Christopher Latty[1], Angela Matz[1]

[1] U.S. Fish and Wildlife Service, 101 12th Avenue, Fairbanks, Alaska 99709, U.S.A. Tel.: (907) 455-1874; e-mail: micah_miller@fws.gov

North American breeding populations of Spectacled (*Somateria fischeri*) and Steller's (*Polysticta stelleri*) Eiders have suffered extreme declines in recent decades. Some Spectacled Eider populations have declined nearly 95% from historical numbers and the Steller's Eider has become functionally extirpated from parts of its historic breeding range,

warranting listing as threatened under the United States Endangered Species Act. Elemental metal contamination has been identified as a potential factor in the decline of these species. From 2003 to 2010, 18 Spectacled and 28 Steller's Eider carcasses were collected on Alaska's North Slope. We necropsied birds and removed liver and kidney samples using chemically-clean techniques. We analyzed tissue for a full range of elemental contaminants, especially lead, cadmium, and mercury. Our data expand upon prior research, identify current contaminant burdens of threatened eiders without the need for invasive procedures, and help managers define further research and monitoring needs for both species.

POSTER # 36

TECHNIQUES FOR IMPLANTING SATELLITE TRANSMITTERS IN SEADUCKS

Glenn H. Olsen[1], Alicia M. Wells-Berlin[2], Matthew C. Perry[2], Charlotte Kilchenstein[2], and Scott Ford[3]

[1] U.S. Geological Survey, Patuxent Wildlife Research Center, 12302 Beech Forest Road, Laurel, Maryland 20708, U.S.A.; Tel.: (301) 497-5603; e-mail golsen@usgs.gov
[2] U.S. Geological Survey, Patuxent Wildlife Research Center, 12100 Beech Forest Road, Laurel, Maryland 20708, U.S.A.
[3] Avian Specialty Veterinary Services of Alaska, 13861 Hillcrest Drive NW, Poulsbo, Washington 98370, U.S.A.

The USGS Patuxent Wildlife Research Center, Laurel, Maryland U.S.A. has a seaduck research colony including White-winged Scoters (*Melanitta fusca*), Surf Scoters (*Melanitta perspicillata*), Black Scoters (*Melanitta americana*), Long-tailed Ducks (*Clangula hyemalis*), and Harlequin Ducks (*Histrionicus histrionicus*). All but the Black Scoters have been used to test techniques for implanting satellite transmitters. In addition, we have field tested techniques in all of the above species except Harlequin Ducks. We implant non-functional (dummy) PTT 100 satellite transmitters (Microwave Telemetry, Inc., Columbia, Maryland, U.S.A., mention of product names does not imply U.S. government endorsement) in the captive research birds. We continue to develop and refine the techniques we use for these procedures. We use paper surgical gowns to maintain sterility. These gowns are light enough to easily be carried into the field. They can be purchased individually or in bulk and autoclaved prior to use. Carrying large quantities of sterile gowns or instruments into the field can be a problem at times due to weight and size restraints for luggage. We have tested using pressure cookers as portable autoclaves. There are several models made, we currently use WearEver Model W92160, 5.7 liter capacity (WearEver, Millville, New Jersey 08332, U.S.A.). A small wire rack constructed from hardware cloth is used to keep items to be sterilized above the water level. Usually 2-3 cm of water is sufficient for sterilization. We have used various ranges or stoves, including a small portable single-burner camp stove to sterilize wrapped gowns and instruments. Sterilization time is usually 20-30 minutes. Because it is preferable to not pluck birds during surgical preparation, we have tested several products for keeping feathers out of surgical incision areas. However some of these agents have been found to interfere with waterproofing, which could lead to hypothermia or excessive preening activity post-release. We tested 70% isopropyl alcohol, chlorhexidine diacetate disinfectant (Nolvasan, Fort Dodge Laboratories, Inc., Fort Dodge, Iowa 50501, U.S.A.), and a surgical lubricating jelly (H-R Lubricating Jelly, Carter-Wallace, Inc., New York, New York 10105, U.S.A.). Of these, the lubricating jelly caused the least wetting problems post-surgery. The jelly is water soluble and non-greasy. It is relatively inexpensive, and a 142 g tube lasts for many surgeries (20-30). One product we have recommended in the past, the Veterinary Transparent Surgical Drape, SKU#3274 (Veterinary Specialty Products, Inc., Mission, Kansas 66201, U.S.A.) has changed its formula and does not stick as well, or at all in some cases, to the surgical site. We also worked on post-surgical care of the seaducks, testing a new product for gavage feeding. This product, Emeraid Exotic Carnivore Diet, was useful for maintaining seaduck body weights when releases were done on the day following surgery. With Long-tailed Ducks we saw an average weight loss of 5 gm (SE=15.29, n=4) post-surgery and prior to release before trying this product, whereas, with the addition of gavage feeding Emeraid Exotic Carnivore diet once or twice prior to release, we had an average weight gain of 49 gm (SE=9.67, F=9.07, P=0.0108, n=10) for the same period.

POSTER # 37

DEVELOPING CELL CULTURE METHODS AND BIOASSAYS TO ASSESS TOXICOLOGICAL RESPONSES IN HARLEQUIN DUCKS (*HISTRIONICUS HISTRIONICUS*)

Ann E. Riddle[1], Tuula E. Hollmén[1,2], and Kathrine Springman[1,3]

[1] Alaska SeaLife Center, P.O. Box 1329, Seward, Alaska 99664, U.S.A.; Tel.: 907-224-6882; e-mail: annr@alaskasealife.org
[2] School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, P.O. Box 757220, Fairbanks, Alaska 99775
[3] Portland State University, Department of Chemistry, P.O. Box 751, Portland, Oregon 97207

Cell culture methods can provide high-throughput testing with replication, thus enabling species-specific testing under controlled laboratory conditions. Cell culture techniques have been used for a variety of purposes, such as investigations into possible injury or damage from toxic substances at the cellular level. We have established hepatocyte cell culture methods and bioassays for the Harlequin Duck (*Histrionicus histrionicus*), a species which has not fully recovered from the 1989 *Exxon Valdez* oil spill, to assess cellular level pathology and biochemistry in this species. Using Harlequin Duck, surrogate Mallard (*Anas platyrhynchos*) and Barrow's Goldeneye (*Bucephala islandica*) embryonic cell lines, we developed methods for hepatocyte cell extraction and culture. Hepatocyte cells were monitored for growth characteristics, health, and morphology using microscopy to validate extraction techniques and optimum time frames for bioassay testing. A panel of cellular bioassays is also being developed and validated to examine cellular, enzymatic, and genetic damage from hydrocarbon exposure. We have tested assay reagents (e.g. dimethyl sulfoxide) for non-specific toxicity and used positive control reagents (i.e., chrysene) to establish baseline responses for each cell line. In addition we have exposed cells to both neat and synthetically weathered Alaska North Slope crude oil to measure the response to oil. The use of Harlequin Duck cell lines for bioassays offers a novel technique to examine species-specific toxicological responses in affected populations.

POSTER # 38

MERCURY CONCENTRATIONS IN BLOOD OF MIGRATORY AND WINTERING SEA DUCKS FROM THE ATLANTIC AND GREAT LAKES REGIONS

Lucas J. Savoy[1], Timothy D. Bowman[2], Dustin Meattey[1], Oksana Lane[1], Jason E. Osenkowski[3], Scott G. Gilliland[4], Glenn H. Olsen[5], Nancy Pau[6], Kate O'Brien[7], Alicia M. Wells-Berlin[5], Philip Wilson[8], Shannon Badzinski[9], and Shawn Meyer[9]

[1] Biodiversity Research Institute, 19 Flaggy Meadow Road, Gorham, Maine 04038, U.S.A.; Tel.: (207) 839-5818, ext 104; e-mail: lucas.savoy@briloon.org
[2] U.S. Fish and Wildlife Service, Migratory Bird Management, 1011 East Tudor Road, Anchorage, Alaska 99503, U.S.A.
[3] Rhode Island Department of Environmental Management, 277 Great Neck Road, West Kingston, Rhode Island 02892, U.S.A.
[4] Canadian Wildlife Service, Mount Pearl, Newfoundland, A1N 4T3, Canada
[5] U.S. Geological Survey, Patuxent Wildlife Research Center, 11410 American Holly Drive, Laurel, Maryland 20708, U.S.A.
[6] U.S. Fish and Wildlife Service, Parker River National Wildlife Refuge, 6 Plum Island Turnpike, Newburyport, Massachusetts 01950, U.S.A.
[7] U.S. Fish and Wildlife Service, Rachel Carson National Wildlife Refuge, 321 Port Road, Wells, Maine 04090, U.S.A
[8] Long Point Waterfowl, 115 Front Street, Port Rowan, Ontario, N0E 1M0, Canada
[9] Canadian Wildlife Service, 335 River Road, Ottawa, Ontario, K1A 0H3, Canada

Determining mercury concentrations in sea ducks by analysis of whole blood is important in understanding contaminant accumulation through consumption of local food sources and is rarely studied in most sea duck species. Mercury is a persistent contaminant, and readily available to most fish and wildlife through atmospheric deposition and localized industrial point sources. Levels of methylmercury, the organic and highly toxic form of mercury, is bio-magnified through marine and freshwater food chains and at certain levels can be harmful to wildlife. Exposure to dietary mercury can be highly variable among species of sea ducks due to prey selection, foraging strategies, and the proximity of wintering and breeding locations to contaminated areas. A total of 161 combined blood samples were collected from Black Scoter

(*Melanitta americana*), Surf Scoter (*Melanitta perspicillata*), White-winged Scoter (*Melanitta deglandi*), and Long-tailed Duck (*Clangula hyemalis*) during capture efforts and handling of sea ducks, as part of the North American Sea Duck Joint Venture's Atlantic and Great Lakes Sea Duck Migration Study. Blood samples were also collected from 76 Atlantic wintering sea ducks, including Common Eider (*Somateria mollissima*), Black Scoter, and White-winged Scoter, as part of separate satellite telemetry and avian influenza studies. Sampling locations included New Brunswick and Lake Ontario, Canada, and Maine, Massachusetts, and Rhode Island, U.S.A. Mercury was detected in all samples. Concentrations ranged from 0.001 to 1.78 parts per million (ppm) wet weight in whole blood. Overall, Common Eider contained the highest Hg concentrations, followed by White-winged Scoter, Black Scoter, Long-tailed Duck, and Surf Scoter. Four species, the Black Scoter, White-winged Scoter, Common Eider, and Long-tailed Duck were sampled at multiple locations and provided site comparisons. Mercury concentrations were similar and were not significantly different among locations for the scoter species and Long-tailed Ducks. Common Eiders from Massachusetts contained significantly higher blood Hg levels than eiders from other locations.

POSTER # 39

A BEHAVIORAL AND ANATOMICAL STUDY OF ELECTRORECEPTION IN SEA DUCKS

Ronald E. Therrien[1], Andrew N. Iwaniuk[2], Helen F. James[3], Catherine E. Carr[4], Matthew C. Perry[1], and Alicia M. Wells-Berlin[1]

[1] U.S. Geological Survey, Patuxent Wildlife Research Center, 12100 Beech Forest Rd., Laurel, MD 20708, U.S.A.; Tel.: (443) 996-7000; e-mail: rtherrien@usgs.gov
[2] Department of Psychology and Neuroscience, University of Lethbridge, Lethbridge, Alberta, Canada
[3] National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560 U.S.A.
[4] Department of Biology, University of Maryland, College Park, MD 20742-4415, U.S.A

Electroreception, the ability to detect electrical fields by the nervous system, has evolved independently several times in aquatic vertebrates. In most species, electroreception is primarily used to detect prey. Given that sea ducks are aquatic and feed on the same prey items as paddlefish, platypus and other electroreceptive species, it is certainly possible that they could possess electroreceptive abilities. In addition, sea ducks have a dense array of pits on their bill that are superficially similar to the pits formed by electroreceptors in platypus, paddlefish and sharks. Whether these are simply touch receptors or they are electroreceptor has not been tested to date. Some sea duck species exhibit a significant expansion of the trigeminal nerve and brain regions processing trigeminal input compared to other avian orders, which may represent an adaptation of the trigeminal nerve and the brain for processing electroreceptor input. The objective of this study is therefore to test for electroreception in sea ducks. We are using the Ruddy Duck as a preliminary test, and then will go on to use all methods on the Long-tailed Duck, White-winged Scoter, and Surf Scoter. We will use a combination of behavioral and anatomical approaches. For thee behavioral task, an apparatus that emits a weak, variable AC electrical impulse, similar to that emitted by the muscle contractions of prey species, has been constructed. Four of these generators are placed at the bottom of a dive tank, one in each corner. Only one generator is active at a time, so that during trials, only one corner of the tank will be emitting an electrical current. A duck is then allowed to dive freely in the tank for two hours, while the electrical current is generated in one corner. After every ten-minute period, the corner that is electrified will be randomly rotated. An underwater video camera system will record all behavioral trials. After a trial, naïve observers will analyze the footage to look at the location of each dive by the duck during the trial period. This analysis will then be associated with the location of the emitted electrical current to see if the ducks are preferentially diving to the same location as the active electrical signal. Preliminary results suggest that Ruddy Ducks dive preferentially toward the "live" corner of the tank, and can therefore detect electrical fields, but their sensitivity in this task has yet to be tested. Anatomically, we will look for electroreceptor-like cells in the bill tissue of the sea ducks and compare them to other dabbling and diving ducks using both light and electron microscopy. If electroreceptive abilities are encountered, this would mark the fist discovery of this capability in any bird species.

POSTER # 40

SPECTACLED EIDER EGG YOLK FATTY ACIDS: IMPLICATIONS FOR DIET STUDIES

Shiway W. Wang[1], Tuula E. Hollmén[2,3], and Sara J. Iverson[4]

[1] Sedna Ecological, Inc., Fairbanks, Alaska 99707 U.S.A.; Tel.: (907) 460 2496; e-mail: shiway@gmail.com
[2] School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, Seward, Alaska 99664 U.S.A.
[3] Alaska SeaLife Center, Seward, Alaska 99664 U.S.A.
[4] Department of Biology, Dalhousie University, Halifax, Nova Scotia B3H 4J1

Fatty acid (FA) signature analysis has been used to study foraging ecology and food webs in marine ecosystems. Using consumer FA signatures, along with a comprehensive database of diet FA signatures, and accounting for consumer FA metabolism, it is possible to estimate the proportions of diet items in the consumer's diet using quantitative fatty acid signature analysis (QFASA). However, before applying QFASA to free-ranging populations, controlled feeding studies are performed to determine FA deposition and turnover characteristics. We conducted feeding experiments to validate the use of egg yolk FA as a proxy to infer diets of captive female Spectacled Eiders (*Somateria fischeri*). From February – July 2008, birds (n = 5) were fed a consistent diet of 85% Mazuri and 15% silverside. From February – July 2009, birds (n = 5) were fed on average a diet of 91% Mazuri, 3% silverside, 1% clam, 2% krill, and 2% mussel. Yolk samples were collected from fertile (2008 n = 37, 2009 n = 9) and infertile eggs (2008 n = 11, 2009 n = 12). From the long-term, known, consistent diet in 2008, we assessed the quantitative characteristics of FA deposition from diet to egg yolk and developed calibration coefficients (CCs) for individual FA. We found no differences in yolk FA signatures between infertile and fertile eggs in both years (ANOSIM $R < 0.1$, $P > 8.5$). Egg yolk FA signatures were 96% similar between infertile and fertile eggs for both years (Bray-Curtis similarity matrices, SIMPER). Using the CCs developed from 2008, QFASA estimated the 2009 diet composition of eiders to be 86 ± 4% Mazuri, 9 ± 3% silverside, 0 ± 1% clam, 1 ± 1% krill, and 4 ± 4% mussel (mean ± SD). These results were 92% similar (SIMPER) and not different from the actual diet fed to birds in 2009 (ANOSIM $R = 0.2$, $P = 0.08$). We conclude that the use of infertile eggs has potential to provide a non-invasive method to infer diets of breeding female eiders. Using yolk FA to determine diets may provide insight into understanding sources and timing of nutrient acquisition during reproduction, characterization of important marine and coastal habitats, and conservation of these threatened populations.

POSTER # 41

100 YEARS OF COMMON EIDER *SOMATERIA MOLLISSIMA* IN THE FIRTH OF CLYDE, WESTERN SCOTLAND, UK: 90 YEARS OF BOOM FOLLOWED BY 10 YEARS OF BUST

Christopher M. Waltho[1]

[1] 73 Stewart Street, Carluke, Lanarkshire, ML8 5BY, Scotland, United Kingdom; Tel.: +44 1555750719;
e-mail: chris.waltho@eider.org.uk

The Firth of Clyde is a partially enclosed area of sea totalling 3300 km^2 with approximately 1000km of coastline on the west coast of Scotland, UK.
Common Eider *Somateria mollissima* have colonised the Firth of Clyde from 1908. The breeding range expanded and the population grew at more than 8.5% p.a. for 90 years. At the end of the 20th century, the Clyde accounted for more than 20% of eider in the British Isles, becoming the primary site.
The Clyde population has been monitored annually since 1997. A post molt census is carried out each September, through a network of 35 volunteers. These counts are also coordinated with the British and Irish monthly Wetland Birds Survey. The counts are mainly from the shoreline; aerial surveys have found few birds beyond this range.
This study shows that, since 1997, the Clyde population has declined by more than 65% at approximately 7% p.a. The rate of decline is similar across all sectors of the Firth, and there is no evidence of any displacement beyond the study area.
The causes of this decline are currently under investigation.

POSTER # 42

PREY SELECTION OF COMMON EIDERS, *SOMATERIA MOLLISIMA* IN BREIDAFJÖRDUR, WEST ICELAND*

Thordur Orn Kristjánsson[1], **Jon Einar Jonsson**[2] and Jörundur Svavarsson[3]

[1] Institute of Biology, University of Iceland, Aragata 9, 101 Reykjavik, Iceland; Tel.: +354-5626532; e-mail: thok@hi.is
[2] University of Iceland, Snaefellsnes Research Centre, Hafnargata 3, Stykkishólmur, IS-340, Iceland.
[3] Marine Biology Centre, Faculty of Life and Environmental Sciences, University of Iceland, Aragata, 901 Reykjavík, Iceland

Food selection of the common eider was evaluated by studying the frequency of prey in stomachs of 28 drowned eiders (*Somateria mollissima*) from lumpfish nets in May 2009 in Breidafjördur, West Iceland. The eiders foraged on a variety of prey. Almost all common eiders investigated ate molluscs, including gastropod snails (93%) polyplacophora (64%) and bivalves (39%). Crustaceans were also quite common (57%). Twenty two species were observed, ranging from 2-10 in a single bird. The weight of total food items in the stomachs ranged from 10 - 100 gr (average 40 gr per bird). The most frequently occurring food species was the mottled red chiton (*Tonicella mormorea*) found in 18 birds (64%), the number of individuals ranging from 10 to over 100 in each bird. The second most frequent species was the great spider crab (*Hyas arenarius*) found in 16 birds. In each bird there were 1-4 specimens but with a head length ranging from 10-70 mm (30 mm average). Other species were found in fewer birds, but sometimes in great numbers. The blue mussel (*Mytilis edulis*) has frequently been reported as one of the most common food items for the eiders in northern hemisphere but we only found *M. edulis* in 6 birds., The shell length was always <10 mm except in one bird, which had five specimens from 40-50 mm in length. *Isopods* and *amphipods* (*Crustacea*) were only found in a single eider but have previously been reported as a very important prey for eiders and ducklings. This low frequency could be due to timing of the collection which was in May. The eider might prey on variety of food during this season but investigations have shown that they switch to crustaceans and blue mussel in more extent after fledging, a suggestion needing further studies.

POSTER # 43

PREY SELECTION AND ITS RELATIONSHIP TO HABITAT AND FORAGING STRATEGY OF REMIGIAL MOLTING WHITE-WINGED (*MELANITTA FUSCA*) AND SURF SCOTERS (*M. PERSPICILLATA*) IN PUGET SOUND, WASHINGTON, AND THE STRAIT OF GEORGIA, BRITISH COLUMBIA*

Heather J. Tschaekofske[1], **Joseph R. Evenson**[2], Eric M. Anderson[3], Thomas A. Cyra[2], Bryan L. Murphie[2], and Alison Styring[1]

[1] The Evergreen State College, 2700 Evergreen Parkway NW, Olympia, Washington 98505, U.S.A.; Tel.: (360) 915-7205; e-mail: heathertxx@hotmail.com
[2] Washington Department of Fish & Wildlife, 600 Capitol Way North, Olympia, Washington 98501, U.S.A.
[3] Centre for Wildlife Ecology, Simon Fraser University, Delta, BC, V4K 3N2, Canada

This study provides an initial examination of the diet of remigial molting scoters in the Puget Sound, Washington, and the southern Strait of Georgia, British Columbia region. Prey species consumption preferences may indicate specific benefits and foraging strategies sought by molting scoters. We examined fecal samples from 47 White-winged (*Melanitta fusca*) and 96 Surf Scoters (*M. perspicillata*) at both estuarine and non-estuarine sites. Diets differed by location and major taxonomic prey category. The dominant prey in most prior scoter dietary studies were bivalves, yet this study found that molting Surf Scoters consumed a significant amount of non-bivalve prey. Additionally, prey size was an important factor relating to habitat, and feeding technique, and small prey (< 5.0mm) were preferentially consumed by Surf Scoters, likely in accordance with scoter body size. Molting White-winged Scoters selected a diet of bivalves almost exclusively regardless of habitat; primarily mussels (*Mytilus trossulus*) and Varnish clams (*Nuttallia obscurata*). Molting Surf Scoters consumed bivalves primarily at the non-estuarine sites, while selecting for more gastropods, crustaceans, and polychaetes at the estuary sites dominated by eelgrass habitat. In conclusion, Surf Scoters consumed a more diverse diet than White-winged Scoters during the molt, and prey consumption was likely related to habitat and scoter body size.

POSTER # 44

SEAFOOD BUFFET: SPATIAL AND SEASONAL VARIATION IN NONBREEDING SCOTER DIET ALONG THE PACIFIC COAST

Eric M. Anderson[1], **Daniel Esler**[1], Jerry Hupp[2], David H. Ward[2], Katherine Brodhead[3], Rian Dickson[3], Eric Palm[3], Brian Uher-Koch[3], and Corey S. VanStratt[3]

[1] Centre for Wildlife Ecology, Simon Fraser University, 5421 Robertson Road, Delta, B.C. Canada V4K 3N2; Tel.: 206.999.8909; e-mail: eric_anderson@sfu.ca
[2] U.S. Geological Survey, Alaska Science Center, 4210 University Drive, Anchorage, AK 99508, U.S.A.
[3] Centre for Wildlife Ecology, Department of Biological Sciences, Simon Fraser University, 8888 University Drive, Burnaby, B.C. Canada V5A 1S6

In coastal environments, Surf Scoters (*Melanitta perspicillata*) and White-winged Scoters (*M. fusca*) have often been assumed to feed mainly on bivalves. At several sites along the Pacific Coast, we assessed scoter diets throughout the nonbreeding period (remigial molt, winter, and spring staging). We collected scoters, immediately preserved esophageal contents, excluded gizzard contents from analyses and converted prey wet mass to ash-free dry mass to achieve an unbiased description of diet. Diet of Surf Scoters in Southeast Alaska during the molt and winter periods consisted almost exclusively of mussels. In contrast, Surf Scoters wintering in three bays of Puget Sound consumed a more varied diet; 67% - 86% of the ash-free dry mass of esophageal contents from each bay consisted of nonbivalve prey. Likewise, Surf Scoter diet in Baja California, Mexico during the winter was quite varied; the most common prey were crustaceans, particularly Mud Shrimp (*Neotrypaea californiensis*) and crabs, which were often consumed during commensal foraging with Gray Whales (*Eschrichtius robustus*). Diet varied considerably for White-winged Scoters across different wintering areas in coastal Washington and British Columbia. At sites dominated by shallow subtidal zones or intertidal mudflats (Birch Bay, Puget Sound; Baynes Sound, Chatham Sound, and Fraser River Delta, B.C.), White-winged Scoters foraged primarily on bivalves. However, at offshore sites, such as Dogfish Banks in Hecate Strait, White-winged Scoters consumed a more varied diet while foraging in sand or sand-cobble bottom, including echinoderms, fish, and crustaceans.

POSTER # 45

NUTRIENT ALLOCATION TO EGG PRODUCTION BY BLACK SCOTERS (*MELANITTA AMERICANA*)

Jason L. Schamber[1,3], Daniel Esler[2], and Paul L. Flint[1]

[1] U.S. Geological Survey, Alaska Science Center, 4210 University Drive, Anchorage, Alaska 99508, U.S.A.; Tel.: (907) 267-2206; e-mail: jason.schamber@alaska.gov
[2] Centre for Wildlife Ecology, Simon Fraser University, 5421 Robertson Road, Delta, British Columbia V4K 3N2, Canada
[3] Current address: Alaska Department of Fish and Game, 525 W. 67th Ave, Anchorage, Alaska, 99518, U.S.A.

Nutrient demands for egg production in waterfowl are met by using a strategy that falls along a continuum between capital (endogenous reserves) and income (exogenous resources) breeding. A particular strategy reflects a species' general life-history and attributes of their local environments. Knowledge of this strategy may help identify when and where nutritional constraints occur and their influence on reproduction. Little is known about nutrient allocation to egg production in Black Scoters (*Melanitta americana*), a species that is among the latest nesting waterfowl. We collected female Black Scoters on the Yukon-Kuskokwim Delta, Alaska from arrival through laying in 2005-2006; and we collected eggs from nests in 2004. We examined the relationship between somatic and reproductive lipid, protein, and mineral using proximate composition analysis. As well, we assessed the importance of exogenous versus endogenous nutrient sources by examining stable isotope ratios of carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) in somatic tissues and eggs. Somatic lipid, protein and mineral levels did not decline during egg formation. In addition, reproductive females had higher endogenous lipid reserves than non-reproductive females. Further, $\delta^{13}C$ and $\delta^{15}N$ of non-lipid egg components were less enriched than $\delta^{13}C$ and $\delta^{15}N$ values of breast muscle and blood plasma. Similarly, $\delta^{13}C$ of egg lipid was less enriched than the $\delta^{13}C$ value for abdominal lipid and blood plasma. Black Scoters appear to rely on locally acquired exogenous reserves to meet the energetic and nutritional costs of egg production. However, females must reach a threshold body condition to initiate egg production; which may explain, in part, their relatively late nesting schedule.

Two workshops will be held simultaneously at the Alaska SeaLife Center on Wednesday, September 14th from 7.30 pm to 10.00 pm.
The hotel shuttle will be available to take the participants to the workshops and back.

WORKSHOP # 1
Bear Mountain Conference Room

Title: Assessing the Impact of Offshore Renewable Energy Devices on Sea Ducks: Pre- and Post-Construction Research Needs

Moderators: Alicia M. Wells-Berlin, Peter W.C. Paton, and Scott R. McWilliams

Although there are no offshore wind facilities in North America, there is an estimated 907 GW of potential wind energy off the coasts of the United States, which is enough energy to power about 700 million homes. This has catalyzed efforts by northeastern and mid-Atlantic states and the US federal government to develop offshore renewable energy sources in the western Atlantic Ocean. This has led to increased interest by biologists and regulators in the spatial and temporal distribution of sea ducks using nearshore and offshore waters in the region.

Boehlert and Gill (2010) recently described six distinct environmental stressors of Offshore Renewable Energy Developments (ORED) including (1) *static effects*: physical presence of device results in fundamental changes to the habitat both above and below the water surface, (2) *dynamic effects:* moving parts of marine renewable energy devices can impact receptors, for example the moving blade on wind turbines can collide with wildlife; (3) *energy removal effects:* localized changes in water movement energy and turbulence, (4) *chemical effects*: effects of chemicals used in marine renewable energy projects, including risks associated with vessels servicing the devices, (5) *acoustic effects:* sounds produced by ORED and their associated infrastructure, and (6) *electromagnetic effects:* effects of low-frequency electromagnetic fields associated with the transmission of energy produced by ORED.
Studies conducted in Europe suggest offshore wind facilities could impact sea duck populations. Birds avoided offshore wind facilities during daily foraging and migratory flights, which resulted in habitat displacement by scoters, at least in the short term. Although there is little evidence of direct mortality at offshore wind facilities to date, onshore wind facilities are estimated to kill 2.3 birds per wind turbine per year in the U.S. Therefore there is a pressing need to gather baseline monitoring information on the spatial distribution, abundance, movement and foraging ecology of sea ducks in the region prior to and following construction of offshore wind facilities.
Sea duck biologists have developed a number of survey techniques to assess the potential impact of ORED on avian populations in offshore areas. The primary methods used to quantify changes in the spatial distribution and abundance of birds over a variety of spatial scales are ship-based and aerial surveys. A robust BACI (Before- After Control- Impact) monitoring survey design is crucial to detecting static avian effects such as displacement or attraction due to the physical structure of ORED devices. Studies need to have enough statistical power to detect displacement or attraction for an avian guild or species given variability among samples and the degree of the displacement or attraction. This workshop will focus on pre- and post-construction research needs.

Two goals:

1. Summarize potential effects of offshore wind development on sea ducks.

2. Develop specific recommendations to USFWS and BOEMRE regarding pre- and post-construction research needs.

WORKSHOP # 2
Research Alcove

Title: Surgical and Husbandry Techniques for Radio-marked Sea Ducks

Moderators: Sean Boyd and Timothy D. Bowman

Up to 2000 sea ducks have been marked with implantable satellite transmitters over the past two decades. While these markings have amassed volumes of information on sea duck migration and connectivity, there remain concerns about survival of some species and/or cohorts. This workshop will provide a venue for veterinarians and biologists to share information and experiences with surgical and husbandry techniques, with a goal of increasing survival of PTT-marked birds, or identifying topics that should be further investigated to improve survival.

Potential questions/topics include:
- What is acceptable surgical and post-surgical mortality?
- Are there specific variables that affect survival?
- PTT configuration - what's important?
- To feed or not to feed?
- Pre- and post-surgical holding times?
- Is survival lower at certain times of the annual cycle?

LIST OF PARTICIPANTS

.

Last Name	First Name	Organization	Email
Alisauskas	Ray T.	Environment Canada, Prairie and Northern Wildlife Research Centre, Science and Technology Branch	ray.alisauskas@ec.gc.ca
Anderson	Paul D.	U.S. Fish and Wildlife Service, Migratory Bird Management, Alaska	paul_anderson@fws.gov
Bentzen	Rebecca L.	University of Alaska Fairbanks, Department of Biology and Wildlife, U.S.A.	rlmcguire@alaska.edu
Bollinger	Karen S.	U.S. Fish and Wildlife Service, Migratory Bird Management, Alaska	karen_bollinger@fws.gov
Bond	Jeanine	Ducks Unlimited Canada	j_bond@ducks.ca
Bowman	Timothy D.	U.S. Fish and Wildlife Service, Migratory Bird Management, Alaska	tim_bowman@fws.gov
Boyd	Sean	Environment Canada, Science & Technology Branch	sean.boyd@ec.gc.ca
Cerbini	Charles	Wildlife Conservation Society/Central Park Zoo, U.S.A	bmoss@wcs.org
Cline	Heidi	Alaska SeaLife Center, U.S.A.	heidic@alaskasealife.org
Corcoran	Robin	U.S. Fish and Wildlife Service, Kodiak National Wildlife Refuge, Alaska	robin_corcoran@fws.gov
De La Cruz	Susan E. W.	U.S. Geological Survey, Western Ecological Research Center, California	sdelacruz@usgs.gov
DeGange	Anthony	U.S. Geological Survey, Alaska Science Center	tdegange@usgs.gov
Derksen	Dirk V.	U.S. Geological Survey, Alaska Science Center	dirk_derksen@usgs.gov
Dickson	Rian	Simon Fraser University, Centre for Wildlife Ecology, British Columbia, Canada	riandel@gmail.com; rdd@sfu.ca
Dorsch	Monika	1BioConsult SH, Germany	m.dorsch@bioconsult-sh.de
Esler	Daniel	Simon Fraser University, Centre for Wildlife Ecology, British Columbia, Canada	desler@sfu.ca
Evenson	Joseph R.	Washington Department of Fish & Wildlife, U.S.A.	evensjre@dfw.wa.gov
Fischer	Julian	U.S. Fish and Wildlife Service, Migratory Bird Management, Alaska	julian_fischer@fws.gov
Flint	Paul L.	U.S. Geological Survey, Alaska Science Center	paul_flint@usgs.gov
Ford	Scott L.	Avian Specialty Veterinary Services, Poulsbo, Washington, U.S.A.	akeaglevet@yahoo.com
Franson	J. Christian	U.S. Geological Survey, National Wildlife Health Center, Wisconsin, U.S.A.	jfranson@usgs.gov
Frost	Charles J.	Alaska SeaLife Center, U.S.A.	charlesf@alaskasealife.org
Frost	January	Alaska SeaLife Center, U.S.A.	januaryf@alaskasealife.org
Gibbs	Samantha	U.S. Fish and Wildlife Service, Migratory Bird Management, Alaska	samantha_gibbs@fws.gov
Gilbert	Jean-Philippe	Hydro-Quebec, Canada	gilbert.jean-philippe@hydro.qc.ca
Gilchrist	H. Grant	Environment Canada	grant.gilchrist@ec.gc.ca
Gilliland	Scott G.	Environment Canada, Canadian Wildlife Service	scott.gilliland@ec.gc.ca
Giroux	Jean-François	University of Montreal at Quebec, Biological Science Department, , Canada	giroux.jean-francois@uqam.ca
Graff	Nathan	University of Alaska Fairbanks, School of Fisheries and Ocean Sciences, U.S.A.	nrgraff@alaska.edu
Groves	Debbie J.	U.S. Fish and Wildlife Service, Migratory Bird Management, Alaska	debbie_groves@fws.gov
Hearn	Richard	Wildfowl and Wetlands Trust, United Kingdom	richard.hearn@wwt.org.uk

Last Name	First Name	Organization	Email
Heath	Joel	University of British Columbia, Canada	heath.joel@gmail.com
Heinänen	Stefan	DHI, Denmark	she@dhigroup.com
Hennin	Holly L.	University of Windsor, Department of Biological Sciences, Canada	hennin@uwindsor.ca
Hillstrand	Nancy	Seaducks Unlimited, Inc., U.S.A.	barrowsgoldeneye@gmail.com
Hogan	Danica	Simon Fraser University, Centre for Wildlife Ecology, British Columbia, Canada	danicah@sfu.ca
Hollmén	Tuula E.	Alaska SeaLife Center, U.S.A.	tuula_hollmen@alaskasealife.org
Hupp	Jerry	U.S Geological Survey, Alaska Science Center	jhupp@usgs.gov
Iles	David T.	Utah State University, Department of Wildland Resources, U.S.A.	david.thomas.iles@gmail.com
Jacobs	Judy	U.S. Fish and Wildlife Service, Ecological Services, Endangered Species, Alaska	judy_jacobs@fws.gov
Jones	Tahzay	National Park Service, U.S.A.	tahzay_jones@nps.gov
Jónsson	Jón Einar	University of Iceland, Snæfellsnes Research Centre	joneinar@hi.is
Kilpi	Mikael (Tor)	Åbo Akademi University and Novia University of Applied Sciences, ARONIA Coastal Zone Research Team, Finland	mikael.kilpi@novia.fi
Klein	Kimberly	U.S. Fish and Wildlife Service, Ecological Services, Endangered Species, Alaska	kimberly_klein@fws.gov
Kochanny	Chris	Sirtrack Limited	kochannyc@sirtrack.com
Kondratyev	Alexander V.	St. Petersburg State University, Russia	akondratyev@mail.ru
Kraege	Don	Washington Department of Fish and Wildlife U.S.A.	don.kraege@dfw.wa.gov
Lance	Ellen	US Fish and Wildlife Service, Alaska	ellen_lance@fws.gov
Larned	William W.	U.S. Fish and Wildlife Service, Migratory Bird Management, Alaska	William_larned@fws.gov
Larsson	Kjell	Gotland University, Sweden	Kjell.Larsson@hgo.se
Lawson	Abigail J.	University of Nevada, Reno, U.S.A.	alawson@cabnr.unr.edu
Loring	Pamela H.	University of Rhode Island, Department of Natural Resources Science, U.S.A.	pam_loring@my.uri.edu
Lovvorn	James R.	Southern Illinois University, Department of Zoology,	lovvorn@siu.edu
Lyon	Linda C.	University of Wisconsin-Madison, U.S.A.	linda.c.lyon@vux.bos.netsolhost.com
Martin	Kate	U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office, Alaska	kate_martin@fws.gov
McAdie	Malcolm	Nanaimo, British Columbia, Canada	malcolm.mcadie@gov.bc.ca
McWilliams	Scott R.	University of Rhode Island, Department of Natural Resources Science, U.S.A.	srmcwilliams@uri.edu
Meattey	Dustin	Biodiversity Research Institute, Maine, U.S.A.	dustin.meattey@briloon.org
Miller	Micah	U.S. Fish and Wildlife Service, Ecological Services, Contaminants, Fairbanks, Alaska	micah_miller@fws.gov
Mulcahy	Daniel	U.S Geological Survey, Alaska Science Center	daniel_mulcahy@usgs.gov
Nigro	Debbie	U.S. Bureau of Land Management, Alaska	dnigro@blm.gov
Nilsson	Christina		christina.a.e.nilsson@telia.com
Nilsson	Leif	Lund University, Ecology Building, Department of Animal Ecology, Sweden	leif.nilsson@zooekol.lu.se
Olsen	Glenn H.	U.S. Geological Survey, Patuxent Wildlife Research Center, Maryland	golsen@usgs.gov
Osenkowski	Jason E.	Rhode Island Department of Environmental Management, Division of Fish and Wildlife, U.S.A.	jay.osenkowski@dem.ri.gov
Öst	Markus	Åbo Akademi University and Novia University of Applied Sciences, ARONIA Coastal Zone Research Team, Finland	markus.ost@novia.fi;
Ouellet	Jean-François	University of Québec at Rimouski, Department of Biology, Chemistry and Geography, Canada	jean-francois_ouellet03@uqar.qc.ca
Palm	Eric	Simon Fraser University, Centre for Wildlife Ecology, Department of Biological Sciences, Canada	epalm@sfu.ca
Paton	Peter W. C.	University of Rhode Island, Department of Natural Resources Science, U.S.A.	ppaton@mail.uri.edu
Pearce	John M.	U.S. Geological Survey, Alaska Science Center	jpearce@usgs.gov
Perry	Matthew C.	U.S. Geological Survey, Patuxent Wildlife Research Center, Maryland	mperry@usgs.gov
Petersen	Margaret R.	U.S. Geological Survey, Alaska Science Center	mrpetersen@usgs.gov

Last Name	First Name	Organization	Email
Petrula	Michael J.	Alaska Department of Fish and Game, U.S.A.	mike.petrula@alaska.gov
Phillips	Laura	National Park Service, Kenai Fjords National Park, U.S.A.	laura_phillips@nps.gov
Platte	Robert M.	U.S. Fish and Wildlife Service, Migratory Bird Management, Alaska	bob_platte@fws.gov
Powell	Abby N.	U.S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit, U.S.A.	ffanp@uaf.edu
Ramey	Andrew M.	U.S. Geological Survey, Alaska Science Center	aramey@usgs.gov
Reeves	Andrew B.	U.S. Geological Survey, Alaska Science Center	areeves@usgs.gov
Reid	Fritz	Ducks Unlimited, U.S.A.	freid@ducks.org
Richman	Samantha E.	Quebec University at Rimouski, Department of Biology, Chemistry and Geography, Canada	cruciger7@gmail.com;
Riddle	Ann E.	Alaska Sealife Center, U.S.A.	annr@alaskasealife.org
Robertson	Myra	Environment Canada, Canadian Wildlife Service	myra.robertson@ec.gc.ca
Rosenberg	Daniel H.	Alaska Department of Fish and Game, U.S.A.	dan.rosenberg@alaska.gov
Safine	David E.	U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office, Alaska	David_Safine@fws.gov
Sailer	Jeff	Wildlife Conservation Society, Central Park Zoo, U.S.A.	jsailer@wcs.org
Savard	Jean-Pierre L.	Environment Canada, Science and Technology, Wildlife Research, Quebec	jean-pierre.savard@ec.gc.ca
Savoy	Lucas	Biodiversity Research Institute, Maine, U.S.A.	lucas.savoy@briloon.org
Schamber	Jason L.	Alaska Department of Fish and Game, U.S.A.	jason.schamber@alaska.gov
Schouten	Arnold	Dry Creek Waterfowl, Washington, U.S.A.	arndeb@olypen.com
Schouten	Debbie	Dry Creek Waterfowl, Washington, U.S.A.	arndeb@olypen.com
Schummer	Michael	Long Point Waterfowl, Canada	mschummer@longpointwaterfowl.org
Schwarzbach	Steven	U.S. Geological Survey, California, U.S.A.	steven_schwarzbach@usgs.gov
Scott	Cheryl	University of California at Davis, U.S.A.	cascott@ucdavis.edu
Seltmann	Martin W.	Åbo Akademi University and Novia University of Applied Sciences, ARONIA Coastal Zone Research Team, , Finland	martin.seltmann@novia.fi
Sexson	Matthew G.	U.S. Geological Survey, Alaska Science Center	msexson@usgs.gov
Silverman	Emily D.	U.S. Fish and Wildlife Service, Migratory Bird Management, Maryland	emily_silverman@fws.gov
Slattery	Stuart	Ducks Unlimited, Canada	s_slattery@ducks.ca
Smith	Carey	U.S. Fish and Wildlife Service, Oregon, U.S.A.	Carey_Smith@fws.gov
Smith	Gregory	U.S. Geological Survey, Patuxent Wildlife Research Center, Maryland	smithg@usgs.gov
Solovyeva	Diana V.	Zoological Institute, Russian Academy of Sciences, Russia	diana_solovyova@mail.ru
Sonsthagen	Sarah A.	U.S. Geological Survey, Alaska Science Center	ssonsthagen@usgs.gov
Staab	Cara	U.S. Bureau of Land Management, Alaska	cstaab@blm.gov
Steele	Benjamin	Colby-Sawyer College Department of Natural Science, New Hampshire, U.S.A.	bsteele@colby-sawyer.edu
Swem	Ted R.	U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office, Alaska	ted_swem@fws.gov
Takekawa	John Y.	U.S. Geological Survey, Western Ecological Research Center, California	john_takekawa@usgs.gov
Talbot	Sandra L.	U.S. Geological Survey, Alaska Science Center	stalbot@usgs.gov
Taylor	Eric J.	U.S. Fish and Wildlife Service, Migratory Bird Management, Alaska	eric_taylor@fws.gov
Therrien	Ronald E.	U.S. Geological Survey, Patuxent Wildlife Research Center, Maryland	rtherrien@usgs.gov
Therrien	Sara C.	University of Maryland, U.S.A.	therrien@umd.edu
Thompson	Jonathan E.	Ducks Unlimited, Canada	j_thompson@ducks.ca
Torrence	Shannon	U.S. Fish and Wildlife Service, Ecological Services, Fairbanks, Alaska	shannon_torrence@fws.gov

Last Name	First Name	Organization	Email
Turner	Bruce	Institute for Environmental Monitoring and Research, Goose Bay, Newfoundland, Canada	bturner@nl.rogers.com
Uher-Koch	Brian	Simon Fraser University, Centre for Wildlife Ecology, British Columbia, Canada	buherkoc@sfu.ca
VanStratt	Corey S.	Simon Fraser University, Centre for Wildlife Ecology, British Columbia, Canada	csv5@sfu.ca
Varennes	Elisabeth	Quebec University at Rimouski, Department of Biology, Chemistry and Geography , Canada	varenneselisabeth@yahoo.fr
Waldeck	Peter	University of Gothenburg, Department of Zoology, Sweden	peter.waldeck@hgo.se
Walther	Denise	U.S. Fish and Wildlife Service, Ecological Services, Fairbanks, Alaska	denise_walther@fws.gov
Waltho	Christopher M.	Carluke, Scotland, U.K.	chris.waltho@eider.org.uk
Wang	Shiway W.	Sedna Ecological, Inc., Alaska, U.S.A.	shiway@gmail.com
Ward	David H.	U.S. Geological Survey, Alaska Science Center	dward@usgs.gov
Wells-Berlin	Alicia M.	U.S. Geological Survey, Patuxent Wildlife Research Center, Maryland	aberlin@usgs.gov
Wilson	Heather M.	U.S Fish and Wildlife Service, Migratory Bird Management, Alaska	heather_wilson@fws.gov
Wilson	Matthew	U.S. Fish and Wildlife Service, Nevada, U.S.A.	Matthew_Wilson@fws.gov
Wilson	Philip	Long Point Waterfowl, Ontario, Canada	philiplatifwilson@gmail.com
Wortham	James	U.S. Fish and Wildlife Service, Migratory Bird Management, Maryland	jim_wortham@fws.gov
Zipkin	Elise E.	University of Maryland - College Park, U.S.A.	ezipkin@umd.edu
Zwiefelhofer	Denny	U.S. Fish and Wildlife Service, Kodiak National Wildlife Refuge, Alaska	denny.zwiefelhofer@gmail.com
Žydelis	Ramūnas	DHI, Denmark	rzy@dhi.dk

Conference Secretariat

McCleskey	Bridget	The Northern Forum/Conference Coordinators, LLC	bridgetm@northernforum.org
Novik	Natalie	The Northern Forum	nnovik@northernforum.org
Wohl	Priscilla	The Northern Forum	pwohl@northernforum.org

AUTHOR INDEX

t

GOING GREEN

Go Zero for Sea Ducks!
The 4th Annual North American Sea Duck Conference has partnered with The Conservation Fund's Go Zero program to"zero out" the CO_2 emissions related with all of the **conference energy use and attendee travel.** Our donation will plant 260 trees at Lake Ophelia National Wildlife Refuge in northern Louisiana. As they grow, the trees will trap an estimated 312 tons of CO_2 equivalent from the atmosphere cleaning the air we breathe, filtering the water we drink, and creating new resting and foraging areas for tens of thousands of waterfowl. We encourage organizers of future conferences to consider offsetting their carbon footprint as well. The Conservation Fund has a carbon footprint calculator and offers several conservation programs to which you can donate. For more information, visit www.conservationfund.org/gozero.

The Windsong Lodge, the venue of the event, has agreed to use the mugs produced for the Conference instead of paper cups. The mugs will be washed and sanitized by the hotel every day and placed at the disposal of the participants, and then packed and given to each one as a memento of the Conference before departure. The hotel has also pledged to avoid using disposable ware, and will change towels in the rooms only upon request. The meal menus will also focus on local produce in order to boost local farming.

Local transportation is also geared at reducing the conference's carbon footprint: chartered shuttles will be available to take the participants from the airport and downtown Anchorage to Seward and back, and while in Seward, the hotel shuttle will be used to go around town, rather than cabs.

The participants will be given **thumb drives** with the conference information and the abstracts. **The program** will be printed partly in black and white and on recycled paper, and the organizing committee has a commitment to paper and cartridge recycling.

ACKNOWLEDGEMENTS

The 4th International Sea Duck Conference would like to acknowledge the hard work of the following individuals in organizing the conference:

Steering Committee:

- **Dirk Derksen** (U.S. Geological Survey)
- **Timothy Bowman** (U.S. Fish and Wildlife Service)
- **Tuula Hollmén** (Alaska SeaLife Center)

as well as the Chairs of the SubCommittees:

- **Paul Flint**, Scientific Committee
- **Abby Powell**, Awards and Student Travel Committee
- **Heather Wilson**, Carbon Footprint Committee
- **Tony DeGange**, Fundraising and Finance Committee
- **Nancy Anderson**, Local Organizing and Social Committee
- **Tamara Zeller**, Outreach Committee

PHOTO CREDITS

Ted Swem: Front cover, 2, 3, 107,
Tim Bowman: 4, 7, 8, 27, 73, 79, 106, 108, 112
Debbie Schouten: 2, 36, 62
Jeff Wasley: 16, 52
Jim Zelenak: 2