Wednesday, 8 February 2017

07:30 - 08:30			*Breakfast, Grand Ballroom, upstairs @ Corinthian Yacht Club*	
08:30 - 08:45			**Announcements**	
	08:45		**Scott Gilliland**	
			Plenary Jean-Pierre L. Savard	**POPULATION DELINEATION OF SEA DUCKS: WHAT? WHERE? WHEN? WHY?**
09:45 - 10:15			*Coffee Break*	
10:15 - 12:00	**4.0**		**POPULATION DELINEATION** Session chair: Emily Silverman	
10:15		4.1	David Safine	**ESTIMATING BREEDING SITE FIDELITY FOR ADULT FEMALE STELLER'S EIDERS NEAR BARROW, ALASKA, *David E. Safine,*** *Kate H. Martin, Ted R. Swem, Neesha C. Stellrecht, John M. Pearce, Sandra L. Talbot, George K. Sage, Ann E. Riddle, Tuula E. Hollmen, and Mark S. Lindberg*
10:30		4.2	Emily Silverman	**IDENTIFICATION OF KEY SITES FOR SEA DUCKS ALONG THE ATLANTIC COAST OF THE U.S., *Emily D. Silverman*** *and Kyle E. Dettloff*
10:45		4.3	Diana Solovyeva	**SEADUCKS IN ASIA: OVERVIEW OF THE SPECIES DISTRIBUTION, TRENDS, AND LEVEL OF KNOWLEDGE*, Diana V. Solovyeva***
11:00		4.4	Walt E. Rhodes	**DEVELOPMENT OF A SURVEY FOR BREEDING SEA DUCKS ACROSS THE CANADIAN BARRENLANDS, *Walt E. Rhodes*,** *Emily D. Silverman and Scott G. Gilliland*
11:15		4.5	Jean-François Giroux	**ESTIMATING POPULATION GROWTH AND RECRUITMENT RATES OF AMERICAN COMMON EIDERS, *Jean-François Giroux*,** *Martin Patenaude-Monette, Brad Allen, Dan G. McAuley, G. Randy Milton, Mark L. Gloutney, Glen J. Parsons, Scott G. Gilliland, Nic R. McLellan, and Eric T. Reed*
11:30		4.6	Derek Masaki	**DEVELOPMENT OF A SYSTEM FOR STORAGE, ACCESS, AND DISPLAY OF TELEMETRY DATA, *Derek T. Masaki,*** *Suzanne J. Gifford, Emily D. Silverman, and Timothy D. Bowman*
12:00 - 13:30			*Lunch, on your own*	
13:30 - 15:15	**5.0**		**DISEASE & MORTALITY** Session chair: Lucas Savoy	
13:30		5.1	Chris Dwyer	**DETERMINING THE SOURCE POPULATIONS OF COMMON EIDERS IMPACTED BY WELLFLEET BAY VIRUS USING MITOCHONDRIAL DNA, *Chris Dwyer,*** *Sarah Sonsthagen, Randall M. Mickley, Samantha E. J. Gibbs, Jean-Francois Giroux, Brad Allen and Randy Milton*
13:45		5.2	Lucas Savoy	**NARROWING THE FOCUS OF THE WELLFLEET BAY VIRUS INVESTIGATION: ANNUAL MOVEMENT PATTERNS OF SATELLITE-MARKED COMMON EIDERS BREEDING IN BOSTON HARBOR, MASSACHUSETTS, USA, *Lucas Savoy*,** *Chris Dwyer, Brad Allen, Randall M. Mickley, Samantha E.J. Gibbs, Glenn H. Olsen, H Heusmann, Susannah Corona, Jorge Ayub, Darryl Heard, and Dan McAuley*

14:00	5.3	Sam Iverson	**DEMOGRAPHIC PERTURBATION AND RECOVERY DYNAMICS FOLLOWING THE EMERGENCE OF AVIAN CHOERA OUTBREAKS AT AN ARCTIC COMMON EIDER BREEDING COLONY,** ***Samuel A. Iverson****, Mark R. Forbes, and H. Grant Gilchrist*
14:15	5.4	Nathan R. Graff	**A METHOD TO REDUCE AVIAN PREDATION OF SEA DUCK NESTS,** ***Nathan R. Graff,*** *David E. Safine, and Ted Swem*
14:30	5.5	Call for hosting 2020	
14:45	**Workshop:** Telemetry Data Storage		
15:15 - 15:45		*Coffee Break*	
15:45 - 17:15	**6.0**	**CONSERVATION & MANAGEMENT** Session chair: Fritz Reid	
15:45	6.1	Dan Esler	**SEA DUCKS AS INDICATORS OF NEARSHORE MARINE CONDITIONS,** ***Dan Esler***
16:00	6.2	Gregory Soulliere	**DERIVING CONSERVATION OBJECTIVES FOR NON-BREEDING SEA DUCKS IN THE UPPER MISSISSIPPI RIVER AND GREAT LAKES JOINT VENTURE REGION,** ***Gregory J. Soulliere,*** *John M. Coluccy, and Mohammed Al Saffar*
16:15	6.3	Frederic Reid	**LARGEST TERRESTRIAL CONSERVATION CAMPAIGN ON THE GLOBE: NORTH AMERICA'S BOREAL BIOME,** *Frederic A. Reid, Gary R. Stewart, Les Bogdan, Jeff Wells*
16:30	6.4	Max Goldman	**BUILDING A BETTER BIRD MAP: AUDUBON ALASKA'S 2017 ECOLOGICAL ATLAS OF THE BERING, CHUKCHI, AND BEAUFORT SEAS,** ***Max S. Goldman****, Erika J. Knight, and Melanie A. Smith*
16:45	6.5	John Takekawa	**UNRAVELING THE EELGRASS-HERRING-SCOTER FOOD WEB IN THE SAN FRANCISCO BAY ESTUARY: APPLYING SCIENCE-BASED CONSERVATION TO DRIVE COMMUNITY INVOLVEMENT**, ***John Y. Takekawa,*** *Kerry W. Wilcox, Anna Weinstein, Andrea Jones, and Susan W. De La Cruz*
17:00 - 19:30		*Dinner, on your own*	
19:30 - 20:30		**WORKSHOP: POPULATION DELINEATION** (Organizers: Sean Boyd, Dan Esler) *Spinnaker room @ Lodge at Tiburon*	

4.1: POPULATION DELINEATION

ESTIMATING BREEDING SITE FIDELITY FOR ADULT FEMALE STELLER'S EIDERS NEAR BARROW, ALASKA

David E. Safine*, Kate H. Martin, Ted R. Swem, Neesha C. Stellrecht, John M. Pearce, Sandra L. Talbot, George K. Sage, Ann E. Riddle, Tuula E. Hollmen, and Mark S. Lindberg*

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Pacific Steller's eiders (*Polysticta stelleri*) primarily nest in Arctic Russia and winter on the Alaska Peninsula and Aleutian Islands of Alaska, but a small proportion nest in Alaska (~1%). Only the Alaska-breeding population of Steller's eiders was listed as Threatened under the US Endangered Species Act, but understanding of the connectivity between Russian and Alaskan breeding populations is limited. Our previous genetic studies uncovered low levels of population differentiation between the two breeding populations, leading to questions about the level of breeding site fidelity in females. The goal of this study was to estimate breeding site fidelity of adult female Steller's eiders near Barrow, Alaska. We used genetic analyses to identify individuals from nest feathers and a Cormack-Jolly-Seber analysis to estimate apparent survival, a product of true survival and fidelity (or 1-permanent emigration). We identified 17 birds that nested at least twice near Barrow (N = 214 nests; 1995 - 2014). Apparent survival was 0.81 (SE 0.06) and apparent capture probability was 0.07 (SE 0.02). Assuming true survival of 0.86 (based on a recent study), we estimated breeding site fidelity to be 0.94 (0.81/0.86). If nest detection rates (true capture probability) in our study area ranged from 25-50%, then temporary emigration probability was high (0.72 – 0.86; 1-[0.07/detection rate]). This study suggests that female Steller's eiders nesting near Barrow have a high probability of returning to nest over the long-term, however, females are often absent from the study area in a given year. Temporary emigrants may be nesting outside the study area but within Alaska, nesting in Arctic Russia, or at either location but not nesting. These results show some level of separation between the Alaskan and Russian breeding populations, but highlight the need to investigate temporary emigration to better evaluate the degree of separation.

4.2: POPULATION DELINEATION

IDENTIFICATION OF KEY SITES FOR SEA DUCKS ALONG THE ATLANTIC COAST OF THE US

Emily D. Silverman *and Kyle E. Dettloff*

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To advance conservation and habitat protection, the Sea Duck Joint Venture (SDJV) is developing an atlas of key sites for sea ducks. We used data from five Atlantic Wintering Sea Duck and the Atlantic Marine Assessment Program for Protected Species surveys conducted between 2008 and 2013 to identify the boundaries of key areas for sea ducks wintering along the eastern coast of the United States. We calculated sea duck densities for square kilometer survey segments and classified the segments as “key” if observed counts within the segments were 10 or higher (a SDJV criterion for key status). Using the identified segments, we estimated a coastline-constrained kernel density, and identified the core areas defined by the resulting isopleth boundaries. We calculated key site boundaries for all sea ducks, American common eider (*Somateria mollissima dresseri*), long-tailed duck (*Clangula hyemalis*), and scoter (*Melanitta* spp.) and compare the resulting areas to areas of importance indicated from satellite telemetry.

4.3: POPULATION DELINEATION

SEADUCKS IN ASIA: OVERVIEW OF THE SPECIES DISTRIBUTION, TRENDS, AND LEVEL OF KNOWLEDGE

Diana V Solovyeva

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There are fifteen seaduck species regularly occurring in Asia during breeding and wintering and during migrations. Among those eleven species are shared with Europe and ten species are shared with North America. Scaly-sided Merganser and Siberian Scoter are endemic Asian species. Three more species are vagrants. Among Asian states Russia and China are playing a key role for sea ducks and followed by both Koreas and Japan. Russia is hosting 15 breeding species and 10 wintering species and China is hosting 4 and 9 species accordingly. Single sea duck species occurred in southern Asian countries (Uzbekistan, Kirgizstan, Iran, Pakistan, India, Burma, Turkey) and sea ducks are absent in South-East Asia. Boreal Pacific waters are the most important sea duck wintering area in Asia and followed by the Caspian Sea. Common Merganser has the largest breeding range in Asia while the Scaly-sided Merganser and the Spectacled Eider have the smallest ranges. Trends of Asian sea ducks are discussed. Twenty percent of species are declining, 33 % are increasing, 14 % are stable and for 33 % trends are unknown. The paper presents sites of regular seaduck monitoring in Asia and current seaduck projects in the region. Level of knowledge is estimated for each species as a number of papers published. Scaly-sided Merganser is the most well studied sea duck species while four scoters and the Smew are the most poor studied there.

4.4: POPULATION DELINEATION

DEVELOPMENT OF A SURVEY FOR BREEDING SEA DUCKS ACROSS THE CANADIAN BARRENLANDS

Walt E. Rhodes, Emily D. Silverman, and Scott G. Gilliland

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Priority information needs for sea ducks include population delineation and development of survey techniques of breeding areas over a large geographic scale. The May Waterfowl Breeding Population and Habitat Survey (WBPHS) is currently the only large-scale monitoring survey for breeding sea ducks, however, that survey is of limited value for monitoring breeding sea duck populations due to transect locations and timing of the survey. Recent research has demonstrated that females of several sea duck species migrated to breeding locations just outside of the WBPHS area in an unsurveyed region known as the Canadian Barrenlands, which is located in the Northwest Territories and Nunavut between Hudson Bay and Great Slave Lake and south of Queen Maud Gulf. We described the results of an experimental survey conducted by the U.S. Fish & Wildlife Service in 2014 and 2015. Objectives were to determine if the survey was achievable due to region's remoteness, determine the density and distribution of breeding sea duck species, and verify results from the Atlantic and Great Lakes Migration Study (AGLMS). We flew 2,592 and 2,763 miles of transects within a 203,000 sq. mi. area in 2014 and 2015, respectively, demonstrating that with appropriate pre-flight planning the region can be safely surveyed by fixed-wing aircraft. Breeding scoter (*Melanitta perspicillata*, *M. fusca deglandi*, *M.nigra americana*) and long-tailed duck (*Clangula hyemalis*) densities equaled or exceeded same- and multi-year (2005-14) densities of the WBPHS, Central Arctic, and Ungava Atlantic Goose surveys, indicating the importance of this region to those species. Distribution of breeding sea ducks within the Barrenlands mirrored those found in the AGLMS. Additional research is needed to determine detection rates and scoter species composition within these important habitats.

4.5: POPULATION DELINEATION

ESTIMATING POPULATION GROWTH AND RECRUITMENT RATES OF AMERICAN COMMON EIDERS

Jean-François Giroux, Martin Patenaude-Monette, Brad Allen, Dan G. McAuley, G. Randy Milton, Mark L. Gloutney, Glen J. Parsons, Scott G. Gilliland, Nic R. McLellan, and Eric T. Reed

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Sound management of bird populations rests upon an adequate understanding of their dynamics. The aim of our study was to evaluate population growth rates of more than 30 Common eider (*Somateria mollissima dresseri*) colonies in Newfoundland and Labrador, New Brunswick, Nova Scotia, Quebec, and Maine. We used Pradel mark-recapture models to estimate colony-specific growth rates and the relative contributions of survival and recruitment on growth. We first validated this approach using annual nest counts conducted between 2003 and 2016 during down harvest operations in four colonies located in the St-Lawrence estuary in Quebec and totalling about 13,000 pairs. There was very close agreement of the estimates derived using the two approaches for two colonies. The breeding population of Common eiders increased on Île Blanche (λ = 1.04 based on recaptures and 1.06 based on nest counts) and decreased on Île Bicquette (0.95 and 0.94, respectively). There was less agreement in the other colonies where numbers were more stable (Île aux Fraises: 1.00 and 1.04, respectively; Île aux Pommes: 0.96 and 1.01, respectively). Nevertheless, we consider that capture-recapture data are suitable to estimate population trends of Common eiders, and that it can be used in colonies for which no nest monitoring occurs. Results from this study will allow the identification of the life stages that have the greatest influence on eider population growth, which can in turn inform the development of more efficient management actions.

4.6: POPULATION DELINEATION

DEVELOPMENT OF A SYSTEM FOR STORAGE, ACCESS, AND DISPLAY OF TELEMETRY DATA

Derek T. Masaki, Suzanne J. Gifford, Emily D. Silverman, and Timothy D. Bowman

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Data gathered from sea ducks outfitted with satellite transmitters have provided invaluable insight into the breeding, molting, and wintering locations of sea ducks, as well as information about within season movements and site fidelity. Telemetry data can be hard to manage, store, and share, however, for three principle reasons: (1) raw data require processing to be converted into a usable format for analysis, (2) recorded locations are of inconsistent quality and necessitate filtering , which is dependent on intended data use, and (3) there is no integrated, interactive system for public data sharing and display. We describe a joint USGS-USFWS-SDJV project to develop a platform for filtering, sharing, and interacting with satellite telemetry data. The pilot data platform will be developed with USGS IT resources utilizing open source software (Apache, PostgreSQL, OpenLayers, R) extending and re-using modules derived from existing biodiversity information systems (BISON, Atlas of Living Australia). The effort will leverage existing collaborative relationships between USGS, USFWS, Smithsonian Institution, and University partners, each bringing domain expertise and years of experience in developing biological information systems. When fully developed, the system will allow access to a large volume of sea duck telemetry data and should spur research into habitat use, migration, behavior, and population structure.

5.1: DISEASE & MORTALITY

DETERMINING THE SOURCE POPULATIONS OF COMMON EIDERS IMPACTED BY WELLFLEET BAY VIRUS USING MITOCHONDRIAL DNA

Chris Dwyer, *Sarah Sonsthagen, Randall M. Mickley, Samantha E. J. Gibbs, Jean-Francois Giroux, Brad Allen and Randy Milton*

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Continued annual mortality events of American common eiders (*Somateria mollissima dresseri*) during the fall migration on Cape Cod, MA, USA associated with the Wellfleet Bay virus (WFBV) have led to questions regarding the geographic origin and potential impacts (if any) of this disease on various population segments of common eiders. The relatively few band recoveries of eiders found dead on Cape Cod has included birds that were previously banded in Maine, Nova Scotia and Quebec. However, there continues to be insufficient numbers of band recoveries for use in identifying the source population(s) of eiders affected, and likely many areas across the breeding range of common eiders where banding is not occurring. Gaining a better understanding of the source population(s) of common eiders involved in these mortality events has become increasingly important given the growing concern over population trends in various portions of their range.

Common eiders are unique among sea ducks as they exhibit fine scale spatial genetic structure at both mitochondrial and nuclear markers. Therefore, it is possible to assign birds collected during these fall mortality events to geographic breeding areas based on their genetic signature. This study is designed to develop a multi-locus data matrix containing reference samples from breeding colonies within the Gulf of St. Lawrence, Nova Scotia, Maine and Massachusetts. Under a scenario of genetic structure among breeding colonies, we are working toward probabilistically assigning common eiders involved in these annual mortality events back to their natal breeding areas. This has enabled us to examine the spatial distribution and proportion of migrant vs. local common eiders that have been involved in dieoff events on Cape Cod, and could be used to support information needs of managers and decision-makers beyond these annual mortality events where the source population is of interest.

5.2: DISEASE & MORTALITY

NARROWING THE FOCUS OF THE WELLFLEET BAY VIRUS INVESTIGATION: ANNUAL MOVEMENT PATTERNS OF SATELLITE-MARKED COMMON EIDERS BREEDING IN BOSTON HARBOR, MASSACHUSETTS, USA

Lucas Savoy*, Chris Dwyer, Brad Allen, Randall M. Mickley, Samantha E.J. Gibbs, Glenn H. Olsen, H. Heusmann, Susannah Corona, Jorge Ayub, Darryl Heard, Dan McAuley*

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Between 1998 and 2015, 14 recognized mortality events of the American Common Eider (*Somateria mollissima dresseri*) have occurred along the coast of Cape Cod, Massachusetts, USA, with estimated total losses exceeding 6,000 birds. In 2010, a novel orthomyxovirus named Wellfleet Bay Virus (WFBV) was isolated in the tissues of eiders. From 2011-2014, biologists collected blood samples from nesting hens at colonies in the Gulf of St. Lawrence and Nova Scotia, Canada, and Maine and Massachusetts, USA. Screenings for the virus determined that one nesting colony in Boston Harbor contained the majority of eiders which tested positive for WFBV antibodies. During 2013-2015, we implanted 47 Common Eiders (female = 23, male=24) with satellite transmitters at the Boston Harbor breeding colony, in an effort to identify potential areas of concern for exposure or transmission of the WFBV. The transmitter duty cycles were programmed to last up to 2.5 years. Each marked eider was sampled to test for the presence/absence of WFBV antibodies. We mapped individual eider movements to identify their molting, wintering, and migration pathways. Thirty-seven eiders provided movement data. Molting locations varied, including areas of Massachusetts, Maine, Quebec, and Labrador. Wintering areas ranged from Maine to Long Island, New York. One of the marked birds died in November 2013, at the same location and time period as the eider WFBV die-off that season. We also compared the movement patterns of eiders marked in Boston Harbor with eiders marked at breeding colonies in Maine (n=8) during 2010 and 2012. Data collected from this study provides a better understanding of the annual movements of eiders from a high virus exposure area and their potential interactions with other Atlantic populations of eiders.

5.3: DISEASE & MORTALITY

DEMOGRAPHIC PERTURBATION AND RECOVERY DYNAMICS FOLLOWING THE EMERGENCE OF AVIAN CHOERA OUTBREAKS AT AN ARCTIC COMMON EIDER BREEDING COLONY

Samuel A. Iverson*, Mark R. Forbes, and H. Grant Gilchrist*

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Emerging infectious diseases are on the rise globally; however, determining the acute and long-term conservation impacts of disease epidemics on wildlife population dynamics remains a significant challenge. In this study, we take advantage of a unique opportunity to examine the transmission dynamics and the demographic impact of a new series of avian cholera outbreaks on a marked population of northern common eiders (*Somateria mollissima borealis*) at a breeding colony in the Canadian Arctic subject to long-term monitoring (1997-2016) . Consistent with expectations for a novel pathogen invasion, case incidence increased exponentially during the initial wave of exposure (R_0 = 2.5). Disease conditions gradually abated, but only after several years of smouldering infection. In total, >6000 eider deaths were recorded during outbreaks spanning eight consecutive breeding seasons. Breeding pair abundance declined by 56% from the pre-outbreak peak; however, a robust population pairs remained intact upon final epidemic fade-out. While the arrival of avian cholera coincided with in a precipitous decline in the survival rates of both male and female eiders, the disease did not have an appreciable influence on eider nest success. Rather, nest success was most strongly influenced by clutch initiation date, weather conditions, and the frequency of polar bear (*Ursus maritimus*) incursions onto the colony. The latter has exhibited a directional increase in association anthropogenically-driven climate change and as such constitutes a shift beyond the normal scope of annual variability that potentially constrains to population recovery. The results of our research constitute a step forward in determining disease impacts in a free-ranging population subject to a variety of limiting factors and for which basic epidemiological information has been lacking.

5.4: DISEASE & MORTALITY

A METHOD TO REDUCE AVIAN PREDATION OF SEA DUCK NESTS

***Nathan R. Graff**, David E. Safine, and Ted Swem*

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Steller's eiders (*Polysticta stelleri*) nest in very low densities across the Arctic Coastal Plain of Alaska with the highest breeding pair density occurring near Barrow. Annual ground-based surveys have been conducted to monitor breeding pair numbers and nest survival in the Barrow area since 1991. Overall, annual nest success ranged from 0-88% with 0-78 nests found per year in the study area. Common predators include arctic fox (*Vulpes lagopus*), pomarine jaeger (*Stercorarius pomarinus*), parasitic jaeger (*Stercorarius parasiticus*), and glaucous gull (*Larus hyperboreus*). Despite fox control efforts within the study area, nest success often remains low due to avian predation. To evaluate the potential to reduce avian nest predation, we designed an experiment to test the effectiveness of non-lethal avian predation deterrents. In 2015, four deterrent treatments and a control (no treatment) were placed at artificially created nests. All nests were monitored with time-lapse cameras to record avian predator behavior at the nest site. The most effective treatment was an overhead cover that provided concealment of the nest from predators flying overhead. In the second year (2016), we tested the behavioral effects of the overhead cover on nesting hens. We selected king eiders (*Somateria spectabilis*) and long-tailed ducks (*Clangula hyemalis*) as surrogate, non-threatened, sea duck species to test the design. Nearly all hens (11 of 12; 92%) returned to the nest to incubate following cover deployment during mid to late incubation, and a high proportion of those nests hatched (10 of 12; 83%). Although sample sizes remain small, preliminary results suggest that this method may reduce nest predation by avian predators without causing nest abandonment or other negative reactions by the hen. We plan to continue modifying the cover size and timing of deployment, and with continued encouraging results, may apply the method to threatened sea duck nests in the future.

6.1: CONSERVATION & MANAGEMENT

SEA DUCKS AS INDICATORS OF NEARSHORE MARINE CONDITIONS

Daniel Esler

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During the period when the Sea Duck Joint Venture was established (1999) and the first Sea Duck Conference was held (2002), a common refrain in the field was that we knew very little about the biology of sea ducks. Since then, the huge research effort directed at sea ducks has yielded a wealth of information that allows us to pose a different kind of question: can we apply our new-found understanding of sea ducks to use them as indicators of the health and status of the nearshore marine ecosystems that they inhabit for most of the annual cycle? Nearshore marine systems are subject to natural and anthropogenic perturbations originating in both terrestrial and oceanic biomes. Sea ducks are predators in food webs that are distinct from those of most other marine birds, being based around benthic invertebrates that serve as intermediary consumers and, subsequently, as sea duck prey. Sea ducks have been shown to have a multitude of responses to changes in prey availability, including distributional, behavioral (through foraging effort), physiological (through mass optimization), and demographic. I argue that our understanding of these relationships can be used by managers to gauge habitat status, and to forecast effects of changing ocean conditions on prey fields and upper-level consumers. Sea ducks also are good indicators of coastal contamination, consuming prey (filter-feeding invertebrates) and using habitats where contaminants tend to concentrate. I will present several examples of responses of sea ducks to many forms of habitat change and contamination, providing evidence that sea ducks can be useful indicators of change in nearshore marine ecosystems.

6.2: CONSERVATION & MANAGEMENT

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

Gregory J. Soulliere, *John M. Coluccy, and Mohammed Al Saffar*

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Bird habitat Joint Ventures (JVs) employ explicit population and habitat objectives in combination with spatially-defined decision tools to guide conservation delivery. Waterfowl scientists have generally lead in this strategic conservation approach, except habitat planning for non-breeding (migration and wintering) sea ducks is relatively less advanced in most JV regions. Unbiased surveys of sea duck abundance and distribution during the non-breeding period are uncommon, thus generating meaningful sea duck population and habitat conservation targets may be unrealistic. Yet the exercise is necessary and instructive, yielding explicit testable assumptions and monitoring needs. We describe the approach used by the Upper Mississippi River and Great Lakes Region JV to develop regional population and habitat objectives for non-breeding sea ducks. We began with continental breeding population abundance objectives from the 2012 North American Waterfowl Management Plan (NAWMP). We then determined the proportional harvest of each sea duck species occurring in the JV region relative to total U.S. harvest for each species. We assumed the proportion harvested in the JV region multiplied by the NAWMP continental abundance objective reflected a reasonable foundation for determining carrying capacity needs during peak abundance periods occurring during the autumn-winter harvest season. Using the estimate of peak abundance, and migration chronology curves generated from regional e-Bird data, we were able to predict the number of duck-energy-days (DEDs) occurring in the JV region when sea duck populations are at NAWMP objective levels – this served as a carrying-capacity goal. Species-specific DED targets during the complete non-breeding period, combined with predicted energy needs and estimated forage-energy values for sea duck habitats, were used to quantify regional habitat objectives for non-breeding sea ducks. County-level harvest data coupled with digital spatial data (National Wetland Inventory) were used to identify regional areas of importance to seas ducks and the hunter-stakeholders pursuing them. Recommendations for applying results along with uncertainties and probable short-comings to this methodology were identified.

6.3: CONSERVATION & MANAGEMENT

LARGEST TERRESTRIAL CONSERVATION CAMPAIGN ON THE GLOBE: NORTH AMERICA'S BOREAL BIOME

***Frederic A. Reid**, Gary R. Stewart, Les Bogdan, Jeff Wells*

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LB: Ducks Unlimited Canada, Surrey, BC, Canada
JW: Boreal Songbird Initiative, Orono, ME, USA

At 1.5 Billion acres, North America's Boreal Forest stretches from western Alaska to eastern Labrador, accounting for 25% of the Earth's remaining intact forests. Over thirty percent of the Boreal is covered by wetlands, an estimated 1.5 million lakes and some of the world's largest river systems. Wetlands make up 6% of the Earth's landcover, yet Canada alone has 25% of the World's wetlands. Most of Canada's wetlands (>85%) rest in the Boreal Forest. The Boreal provides breeding habitat for 13-16 million waterfowl and molting/migration habitat for millions more. More than 15 species of waterfowl have 50% or greater of their continental breeding population in the Boreal, and of these species, eight are Mergini and three are Bay ducks. Indigenous peoples have reported dramatic declines in Scoters and Long-tailed Ducks, while traditional surveys indicate increases in Bufflehead and Goldeneyes.

Until recently, conservation in the Boreal was viewed as unnecessary relative to other priorities facing the continent and the high degree of isolation in this vast ecosystem. This perception has rapidly changed with climate change and expansion of anthropogenic extraction industries. Beginning in 2000, a collaborative conservation campaign of Indigenous people, NGOs, and proactive industries pushed governments for conservation gains in North America's Boreal. This International Boreal Conservation Campaign found success in creating a Boreal Framework of 50% protection from any extraction and 50% sustainable development on the landscape. Conservation efforts were reached because of Indigenous land planning, forestry certification, and provincial-wide Boreal commitments. To date over 860 million acres is protected (under OIC) or committed sustainable development, either by law or provincial pledge. Further efforts will focus on moving pledged acres to permanent, provincial and territorial wetland policies, carbon protection, and further recognition of Indigenous and provincial land planning. Specific examples of conservation successes will be discussed.

6.4: CONSERVATION & MANAGEMENT

BUILDING A BETTER BIRD MAP: AUDUBON ALASKA'S 2017 ECOLOGICAL ATLAS OF THE BERING, CHUKCHI, AND BEAUFORT SEAS

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As the breadth of knowledge regarding sea duck ecology continues to grow, there is a need to synthesize and disseminate this wealth of information to lay people, policy makers, and scientists alike in a format that is accessible and representative of current knowledge or lack thereof. The goal of Audubon Alaska's ***Ecological Atlas of the Bering, Chukchi, and Beaufort Seas*** is to create a comprehensive, trans-boundary atlas that represents the current state of knowledge on a wide array of relevant Arctic subjects. Our process involves intensive research and consultation with experts in order to gather and analyze the most recent and robust data available. The resulting maps integrate disparate datasets of points, tracks, or polygons into a few cohesive and complementary data layers that serve to visually describe a particular species' activity and movements through the project area over the course of a year. We will introduce some of our sea duck maps and discuss our process from identifying our audience, to intensive data gathering and syntheses, through the cartographic process where the story is solidified and visualized.

6.5: CONSERVATION & MANAGEMENT

UNRAVELING THE EELGRASS-HERRING-SCOTER FOOD WEB IN THE SAN FRANCISCO BAY ESTUARY: APPLYING SCIENCE-BASED CONSERVATION TO DRIVE COMMUNITY INVOLVEMENT

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In the highly urbanized estuary of San Francisco Bay, the Richardson Bay Audubon Center and Sanctuary provides the only large open-water area where boats are prohibited during the winter. This 369-ha sanctuary provides a natural laboratory where trophic relationships among the critical intertidal and subtidal shoal habitats of the estuary are less affected by human disturbance. The Richardson Bay shoals support dense eelgrass beds (*Zostera marina*) that provide structure and habitat for spawning Pacific herring (*Clupea pallasii*). Adult herring and their roe contribute to the diet of many wintering waterbirds in the estuary including the largest southernmost concentration of surf scoters (*Melanitta perspicillata*) in the Pacific Flyway. However, over the past 3 decades, the extent of historic eelgrass beds have decreased, the herring spawn and its fishery has declined, and the midwinter index for scoters has plummeted 90% from 30,000 to 3,000 birds in the estuary. Threats associated with growth of the human population have included increasing disturbance, contaminants, and oil spills (including the 2007 Cosco-Busan spill when a large number of scoters were killed). Yet, the Bay Area and its conservation community have had little direct response to these alarming declines, primarily because there is a lack of understanding of the underlying ecology of these species and their shoal habitats, including the critical contribution of the shoals to the overall biodiversity of the estuary. Here we will introduce how we are seeking to motivate actions to benefit wintering scoters and other sea ducks by recruiting grassroots community involvement through participation in science-based conservation efforts. We will present the information needed to better understand the eelgrass-herring-scoter relationships, the importance of the shoals, and the potential effects of emerging threats. Finally, we will discuss the challenges of integrating participation by community members in science-based conservation and the critical role participation serves in leading to conservation action.