6th International Sea Duck Conference

6 – 9 February 2017
San Francisco, CA

WELCOME TO TIBURON!

6th International Sea Duck Conference
Corinthian Yacht Club & the Lodge at Tiburon
6–9 February 2017

Dear Colleagues,

We warmly welcome you to the 6th International Sea Duck Conference on San Francisco Bay! Following the tradition of the previous five conferences, our goal is to provide a forum to discuss science, management, and conservation of these unique species and the threats facing their populations. We will provide opportunities for professionals and students to interact and network with their peers from around the world.

San Francisco Bay is a major migration and wintering area on the Pacific Flyway for waterbirds including numerous sea ducks. At the same time, it is a highly urbanized area that embodies many of the issues confronting sea duck populations. We face significant challenges in understanding the primary drivers and threats affecting sea duck populations in the rapidly changing environments that they use throughout their annual cycle. Thus, we have chosen "*From Bay to Boreal: the challenges of full-annual cycle management*" as the theme for this year's conference.

We have planned a full itinerary for your visit, including free time to interact with your colleagues. The conference setting in Tiburon will be at two venues within walking distance from each other; the **Corinthian Yacht Club** and the **Lodge at Tiburon**. On Monday, please come to the registration desk (12:00 – 20:00), just off the main lobby at the **Lodge**. On Monday night, we will gather for the **Welcome Reception** in the **Lodge's Main Sail Ballroom** (19:30 – 22:30) for light food and beer hosted by California Waterfowl Association. On Tuesday morning, we will begin the scientific program and oral presentations at the **Corinthian Yacht Club**, which is just a short walk to the marina. Breakfast will be served daily at 07:30 upstairs on the **Corinthian's** Sunset Porch, and plenary presentations will begin at 08:45 followed by science sessions.

We are especially excited to host our Thursday evening Banquet and Awards Dinner (18:30 – 22:30) aboard the Hornblower Spirit Yacht for a dinner cruise around San Francisco Bay! The bus departs the **Lodge** (18:30 sharp). Those staying for our Friday Field Trip will depart from the **Lodge** to experience a boat ride through the Sacramento-San Joaquin River Delta, one of the world's most complex water delivery projects.

We hope you enjoy your stay with us on San Francisco Bay and that our gathering leads to new ideas for sea duck conservation across the annual cycle and through the 21st Century!

Susan, Fritz, and John

Susan De La Cruz, USGS Western Ecological Research Center
Fritz Reid, Ducks Unlimited, Inc.
John Takekawa, Audubon California

PROGRAM AT A GLANCE

6th International Sea Duck Conference 2017

TIME	MONDAY 6-Feb-17	TUESDAY 7-Feb-17	WEDNESDAY 8-Feb-17	THURSDAY 9-Feb-17	FRIDAY 10-Feb-17
07:30 - 08:30		*Breakfast, Grand Ballroom, upstairs @ Corinthian Yacht Club, included*			
08:30 - 08:45		*Welcome*	*Announcements*	*Announcements*	**Field Trip: Delta Birding** with Dolphin Charters Depart Lodge at Tiburon at 06:30 am
08:45 - 09:45		**Plenary:** Dr. Paul Flint	**Plenary:** Dr. Jean-Pierre Savard	**Plenary:** Dr. Ray Alisauskas	
09:45 - 10:15		*Coffee break*			
10:15- 12:00		**Special Session:** Restoration of Sea Duck Populations Injured in Coastal Oil Spills	**Population Delineation**	**Annual Cycle**	
12:00 - 13:30	***Registration open*** *12 - 19:30 pm Lobby, Chart room @ Lodge at Tiburon*	***Lunch*** *(Corinthian, included)* **Panel:** Restoration of Sea Duck Populations	***Lunch*** *(on your own)*	***Lunch*** *(on your own)*	***Lunch*** *(provided)*
13:30 - 15:15		**Population Ecology & Trends**	**Disease & Mortality**	**Foraging & Energetics**	Return from Delta Birding by 17:00, dinner on your own
14:45 - 15:15			**Workshop II:** Telemetry Data Storage		
15:15 - 15:45		*Coffee break*			
15:45 - 17:00		**Distribution & Abundance**	**Conservation & Management**	**Breeding Ecology**	
17:00 - 17:30		**Dinner** *(on your own)*	**Dinner** *(on your own)*	***Break***	
17:30 - 18:30					
18:30 -19:30		**Workshop I:** Long-tailed Ducks *Spinnaker room @ Lodge at Tiburon*		*Board bus @ Lodge at Tiburon for Sausalito Marina* ***18:30 sharp***	
19:30 - 22:30	**Welcome Reception** *Mail Sail Ballroom @ Lodge at Tiburon*	**Poster Session** *Main Sail Ballroom @ Lodge at Tiburon*	**Workshop III:** Population Delineation *Spinnaker room @ Lodge at Tiburon*	**Banquet & Awards Dinner** *San Francisco Bay Cruise*	

Mon, 6 Feb	12:00 - 20:00	**Registration open,** *lobby of Chart room @ Lodge at Tiburon*
	19:30 - 22:30	**Welcome Reception,** *Main Sail Ballroom @ Lodge at Tiburon*
Tues, 7 Feb	07:30 - 08:30	**Breakfast served daily**, *Grand Ballroom, upstairs @ Corinthian Yacht Club (included)*
	08:00 - 17:30	**Registration open daily**, *upstairs @ Corinthian Yacht Club*
	12:00 - 13:30	**Lunch & Panel Discussion,** *Grand Ballroom @ Corinthian Yacht Club (included)*
	17:30 - 20:30	**Workshop I:** Long-tailed Ducks, *Spinnaker Room @ Lodge at Tiburon*
	19:30 - 22:30	**Poster Session**, *Main Sail Ballroom @ Lodge at Tiburon*
Wed, 8 Feb	07:30 - 08:30	**Breakfast** served daily, *Grand Ballroom, upstairs @ Corinthian Yacht Club (included)*
	08:00 - 17:30	**Registration open daily**, *upstairs @ Corinthian Yacht Club*
	14:45 - 15:15	**Workshop II:** Telemetry Data Storage, *Grand Ballroom, upstairs @ Corinthian Yacht Club*
	19:30 - 22:30	**Workshop III:** Population Delineation, *Spinnaker Room @ Lodge at Tiburon*
Thurs, 9 Feb	07:30 - 08:30	**Breakfast** served daily, *Grand Ballroom, upstairs @ Corinthian Yacht Club (included)*
	08:00 - 17:30	**Registration open daily**, *upstairs @ Corinthian Yacht Club*
	18:30 sharp	**Board bus** *@ Lodge at Tiburon for Sausalito Marina*
	19:30-22:30	**Banquet & Awards Dinner,** *Hornblower Spirit Yacht @ Sausalito Marina*
	22:30 - 23:00	**Board bus** *to return to Lodge at Tiburon*
Fri, 10 Feb	06:30 - 17:30	**Field Trip: Delta Birding with Dolphin Charters**, *lobby @ Lodge at Tiburon, lunch provided*

CONFERENCE SPONSORS

Patuxent Wildlife Research Center
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ACKNOWLEDGMENTS

The 6th International Sea Duck Conference was made possible by a Local and International Steering committee.

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Ornithologist, Artist, & Author

http://www.sophiewebb.com/

ACKNOWLEDGMENTS

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Jean Pierre Savard
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SPECIAL SESSION:
Planning Restoration of Sea Duck Populations Injured in Coastal Oil Spills

Carolyn Marn
US Fish and Wildlife Service

Susan De La Cruz
US Geological Survey

Dan Esler
US Geological Survey

Abby Powell
Florida Cooperative Fish and Wildlife Research Unit
University of Florida

Samantha Richman
US Geological Survey

Stuart Slattery
Ducks Unlimited Canada

Ramunas Žydelis
Ecology and Environment Department, DHI

TABLE OF CONTENTS

MEETING ROOMS
LODGE AT TIBURON &
CORINTHIAN YACHT CLUB

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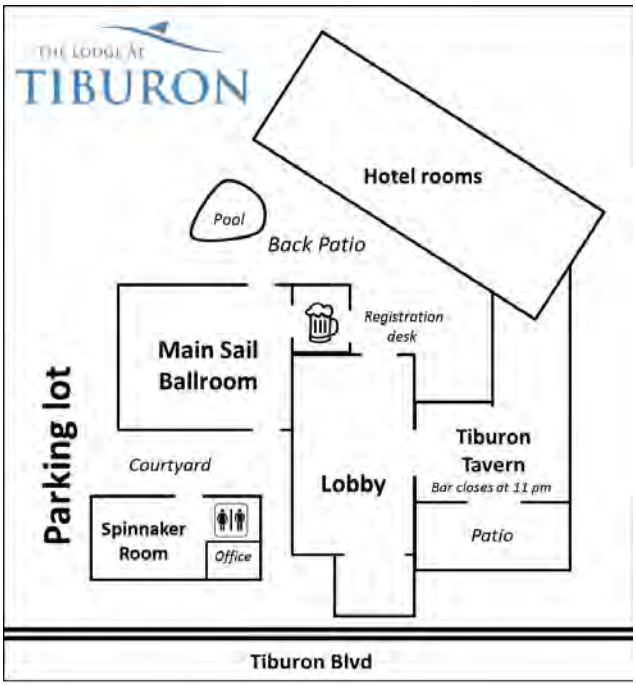
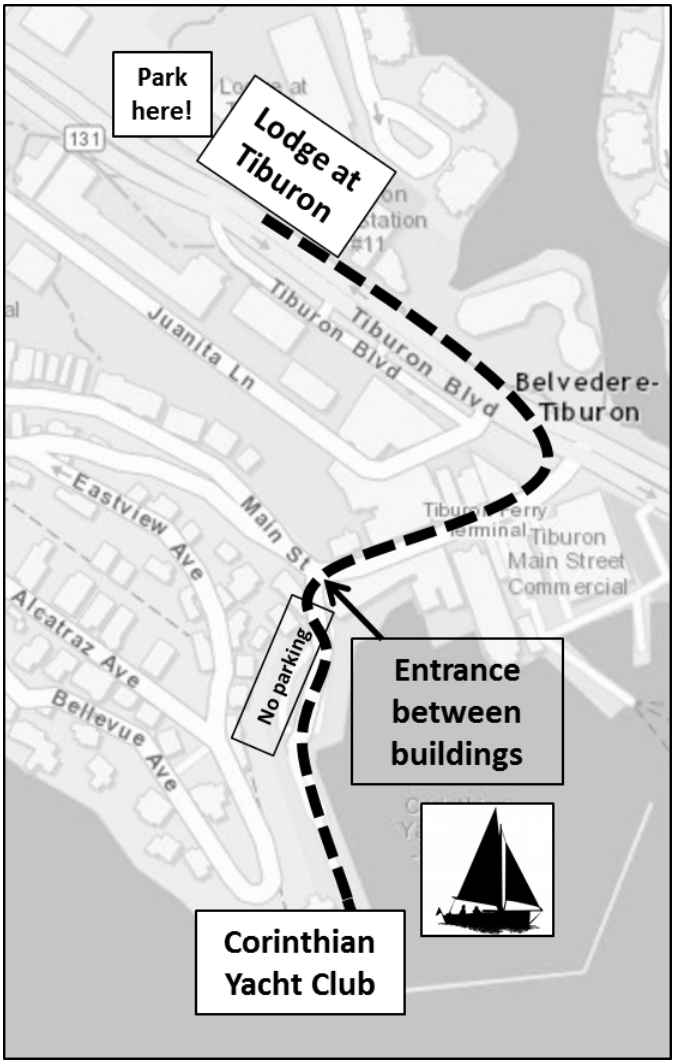
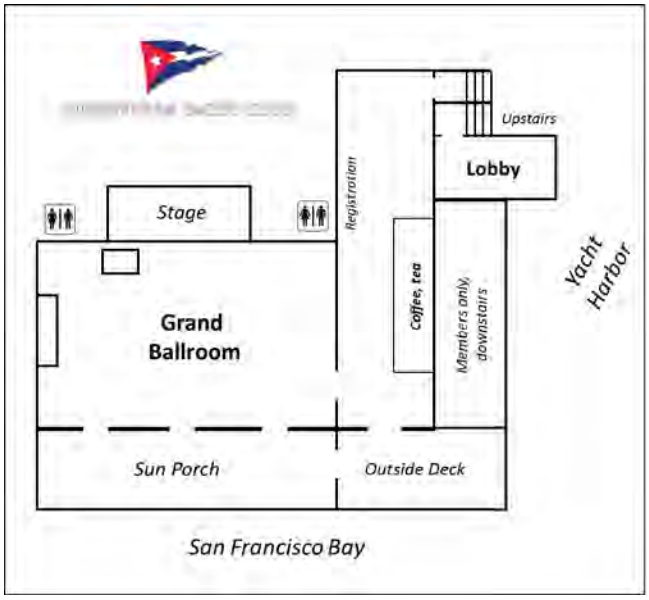
Call John @ (530) 219-8117 or Sam (307) 760-7108



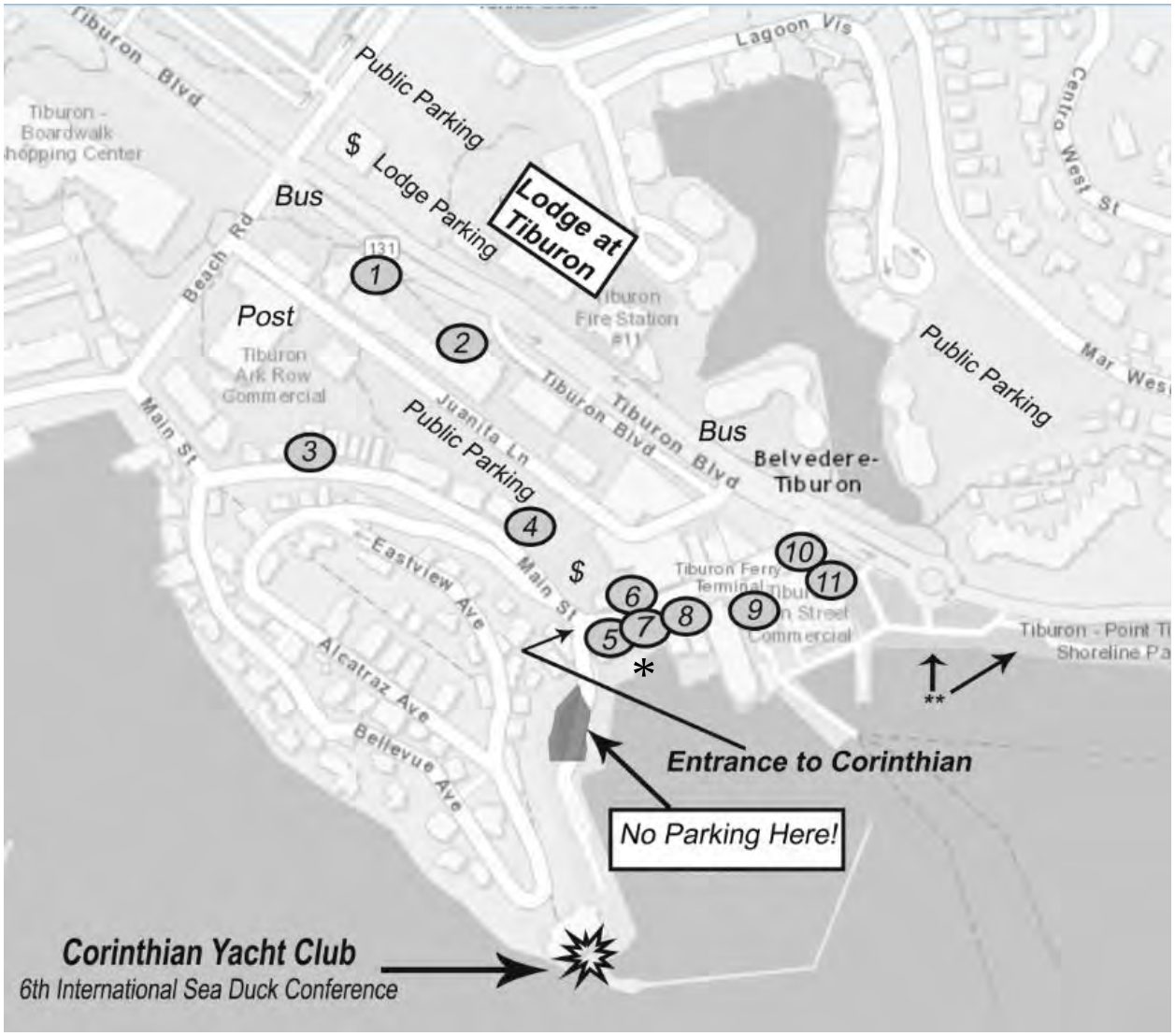
Lodge at Tiburon
1651 Tiburon Blvd
Tiburon, CA 94920





Corinthian Yacht Club
43 Main Street
Tiburon, CA 94920

LOCAL AREA AND RESTAURANTS



1) Tiburon Diner $
2) Dave and Mikes
3) Don Antonio Trattoria $$$
   (Café Renzo is two houses east)
4) Couloir Wines: Tasting Room
5) Tanoshi Sushi $$
6) Salt and Pepper $$$
7) Luna Blue $$
8) Sam's Anchor Café*
9) Waypoint Pizza $
10) Servino Ristorante $$$
11) Guaymas (Mexican) $$

Cross-shaded = No Parking!
*Tideline Watertaxi pick-up area
(415) 339-0196
** Tiburon Historic Peninsula Trail
$ = ATM or Bank
Bus = bus stop

NOTE: Tiburon Tavern (@ Lodge at Tiburon) closes at 11 pm, but the bar at Sam's Café will stay open until midnight for us!

CONFERENCE MENUS

Welcome Reception

Monday, 7 February, 19:30 – 22:30

Main Sail Ballroom @ Lodge at Tiburon

Selection of local cheese, crudité, and fruit.
Beer hosted by California Waterfowl Association

Breakfast served daily

Tuesday - Thursday, 7-9 February, 07:30 – 08:30

Grand Ballroom @ Corinthian Yacht Club

Scrambled eggs with green onions, breakfast pastries, Danish,
and croissants along with fresh fruit.

Lunch served TUESDAY only

Tuesday, 8 February, 12:00 – 13:30

Grand Ballroom @ Corinthian Yacht Club

Chef's Seasonal Salads, Cedar Plank Roasted Scottish Salmon with Pomegranate Glaze Chicken Breast Stuffed with Portobello's and Gruyere, Butternut Squash Ravioli with Venetian Style Duck Ragout, Roasted Root Vegetables and Buttery Broccolini. Warm Berry Cobbler with Honey Cream, Chocolate Kahlua Mousse Cups

Poster Presentations

Tuesday, 7 February, 19:30 – 22:30

Main Sail Ballroom @ Lodge at Tiburon

Selection of gourmet appetizers and starters.
Beer hosted by California Waterfowl Association

Banquet & Awards Dinner

Thursday, 9 February, 18:30 sharp (bus)

Hornblower Spirit Yacht
Sausalito Ferry Terminal
Beer hosted by California Waterfowl Association

Baby spinach salad with pine nuts, mushrooms, goat cheese and red wine vinaigrette.
Grilled marinated flat iron steak in a pan reduction peppercorn sauce.
Oven roasted Atlantic salmon w/ charred tomato vinaigrette.
Served with roasted red potatoes and baby carrots.
Fresh berry tart with lemon crème anglaise
and a chocolate dipped strawberry.

FIELD TRIP

Delta Birding with Dolphin Charters

Boat tour through the Sacramento – San Joaquin River Delta

Overview: *This all-day excursion brings us into the inland Delta which comprises one of the largest wetland restoration efforts in western North America. We will tour the inland waterways at a time when bird life is abundant with overwintering flocks of Lesser Snow Geese, Tundra Swans, Sandhill Cranes, Greater White-fronted Geese, Grebes, Surf Scoters, as well as numerous shorebirds and a few seabirds too! We will depart the Lodge at Tiburon at 6:30 am by bus to Antioch Harbor (about 1.5 h) and board the Dolphin Charter boat. Boat tours last about 5 hours and a boxed lunch will be provided along with coffee, tea, and water.*

Depart: Friday, 10 February 2017, 6:30 am, meet in the lobby @ Lodge at Tiburon
Return: Friday, 10 February 2017, 5 pm

ANNOUNCEMENT

Ecology and Conservation of North American Sea Ducks

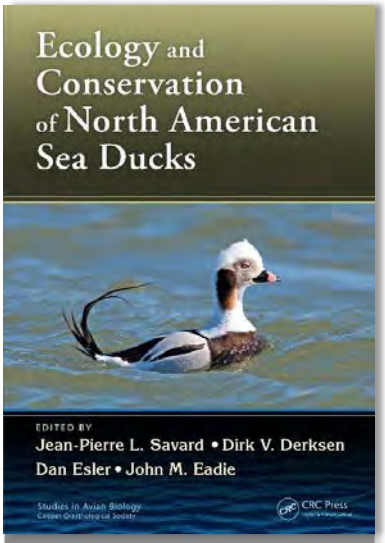
Volume in the *Studies in Avian Biology* series published on behalf of the Cooper Ornithological Society

Editors/Affiliations

Jean-Pierre L. Savard, Scientist Emeritus Environment Canada, Quebec
Dirk V. Derksen, U. S. Geological Survey, Anchorage, AK USA
Dan Esler, U. S. Geological Survey, Anchorage, AK USA **John M. Eadie,** University of California, Davis, USA

SAVE 20%

Sea duck research and management is important for understanding marine bird ecology and conservation as well as the health of marine ecosystems. This book is a synthesis of all that has been learned about sea ducks, highlighting data gaps, and directing future research and conservation efforts. An edited volume prepared by leading experts in the field, it addresses specific issues by drawing on all available information on sea ducks (and other waterfowl and avian taxa where this contrast is informative).



Key Features

- Provides an up-to-date synthesis of all that is known of an important group of diverse marine birds
- Presents collections of articles by leading experts on sea duck biology, ecology, and conservation
- Reports on an active area of ornithological research
- Offers an authoritative reference on sea duck ecology, behavior, and population dynamics

Selected Contents

Introduction. North American Status and Trends. Phylogeography. Population Dynamics/Demography. Diseases. Reproductive Energetics and Cross-Seasonal Effects. Contaminants. Foraging Energetics and Behavior. Migration Strategies. Molt Strategies. Reproductive Strategies. Reproductive Behavior. Population Delineation. Harvest. Important Habitats. Conservation Issues. Conclusions and Future Challenges.

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CONFERENCE SCIENCE PROGRAM

PLENARY SPEAKER

TUESDAY, 7 February 2017, 08:45 – 09:45

Dr. Paul Flint

Research Wildlife Biologist
US Geological Survey
Alaska Science Center

Paul Flint is a research biologist with the USGS Alaska Science Center where he has frittered away the majority of his career studying demographics of various waterfowl populations. Paul's work on sea ducks focused on breeding ecology of birds nesting on the Yukon-Kuskokwim Delta and along the Arctic Coastal Plain. He has also spent time studying molting and winter ecology of multiple sea duck species including work on contaminants and effects of localized oil spills. Because of the nature of funding most work is focused on specific management objectives or needs, with an emphasis towards acquiring the essential pieces to build population models for multiple species.

POPULATION ECOLOGY OF SEA DUCKS: WHAT DEFINES THE POPULATION "BUS," WHO'S DRIVING IT, AND WHERE'S IT GOING?

Population dynamics is a complex subject that incorporates the concepts of population delineation, drivers of population dynamics and environmental variation. Importantly, these three concepts are not independent and population delineation may change based on environmental conditions. As expected, population models suggest the main driver of dynamics is adult female survival. However, this conclusion is not overly useful in most situations. I suggest the real driver of population dynamics is environmental conditions. Many sea duck populations may be at or near a stochastically varying carrying capacity. As such, historic changes in population size would indicate changes in environmental carrying capacity. Under these conditions, management focused on life history characteristics has little utility. Understanding the effects of density dependence on sea duck populations needs to be a focus of future research. Population objectives may need to be revised and goals redefined in terms of population size or maximum sustained yield.

PLENARY SPEAKER

WEDNESDAY, 8 FEBRUARY 2017, 08:45 – 09:45

Dr. Jean-Pierre L. Savard

Scientist Emeritus
Canadian Wildlife Service

Dr. Savard obtained his MSc from the University of Toronto on urban birds and his PhD from the University of British Columbia on the spacing behavior of Barrow's Goldeneye. He has worked for 35 years for Environment Canada as a Population Biologist (13 years) and as a Research Scientist (22 years). He has held adjunct status at several Canadian Universities and co-supervised a number of graduate students. He has worked on seabirds, forest birds, peatland birds, urban birds, waterfowl and sea ducks both on the eastern, western and northern coasts of Canada. Most of his research however focused on sea ducks and he has published on goldeneyes, scoters, eiders, Harlequin ducks as well as on sea ducks in general. He is currently Scientist Emeritus for Environment and Climate Change Canada. Dr. Savard was also the recipient of our "Founding Father" award at the 5th International Sea Duck Conference in Iceland.

POPULATION DELINEATION IN SEA DUCKS: WHAT? WHERE? WHY? (WHAT WE KNOW AND BEYOND)

Populations appear at first glance as a simple concept, but when we try to define it, it becomes very slippery and multi-faceted. Definitions range from: number of species x in area y to more comprehensive definitions with spatial, temporal, genetic and ecological components. With the increase in species at risk, legislations and management needs, population delineation leads to better and more efficient resource allocations. I will briefly examine how the concept has evolved in sea ducks, how useful it has been, and what is the origin of various sea duck populations.

PLENARY SPEAKER

THURSDAY, 9 FEBRUARY 2017, 08:45 – 09:45

Dr. Ray Alisauskas

Research Scientist
Environment and Climate Change Canada

Ray Alisauskas grew up in Montreal by the St. Lawrence River, where he fished and watched ducks as a little kid. After a diploma course in wildlife management in 1976, he received a BSc in Renewable Resources from Macdonald College of McGill University. He studied energy and nutrition of birds with Dave Ankney at the University of Western Ontario, where he completed an MSc (1982) about American coots (not quite a Sea Duck) at Delta Marsh. That same year he embarked on a PhD about nutrition of midcontinent snow geese during spring migration. After a postdoc at Delta Waterfowl and University of Manitoba, he was employed as a Research Scientist with Canadian Wildlife Service in Saskatoon (1989). Ray initiated long-term research on population biology of Ross's and snow geese at Karrak Lake in Canada's central arctic (1990), and expanded research there to include long-term population studies of King Eiders (1995) and Long-tailed Ducks (1998). In 1991, he joined the Department of Biology, University of Saskatchewan, as adjunct professor. Research by seven of his 21 graduate students has been directed at Sea Duck population ecology. He is indebted to Dana Kellett for coordinating all arctic fieldwork at Karrak Lake. He continues to retain a focus on population biology of White-winged Scoters in Saskatchewan.

ANNUAL CYCLE OF SEA DUCKS

As for other migratory species, the timing of major events during annual cycles of sea ducks is governed by the seasonality of resources. This availability of food is characterized by some uncertainty and incomplete predictability of nutrient availability as these birds move through habitats between breeding, molting and winter. Some arctic species face predictable negative energy and nutrient deficits at a time of increased nutritional demand leading up to and during the egg-laying phase. All species face time constraints for feeding during incubation. An evolved hedge against such deficits includes the storage of nutrient or energy reserves; this sets the stage for carry-over effects (COE) of environmental variability during part of the annual cycle on individual performance during subsequent phases separated by many months and thousands of kilometers. COEs can induce individual variability in fitness. At the population level, COEs can translate to cross-seasonal effects (CSEs) on major population processes of survival probability, breeding probability and breeding performance. These, in turn, govern changes in abundance from one annual cycle to the next. Understanding ecological links between resource availability and subsequent vital rates is key to offering prescriptions for sea duck conservation and management. I discuss the annual cycle of sea ducks as it relates to their variability in vital rates. In addition to a general review of the ecological links between resource productivity, climate and population processes, I provide examples from long-term studies of female sea ducks that I have been involved with focusing solely on mark recapture of nesting females. Our abilities to progress scientifically have been rewarded by continuing developments of mark recapture for inferences about population processes and the use of stable isotopes; this has been backed up by a basic understanding of distribution of sea ducks during the annual cycle with satellite telemetry. Continued development of smaller, less intrusive and cost-effective transmitters may eventually further complement or even replace mark-recapture methods. Nevertheless, I suggest that the key to understanding population dynamics and various influences over the annual cycle requires the long-term view.

SPECIAL SESSION

TUESDAY, 7 February 2017, 10:15 – 13:30

Grand Ballroom, Corinthian Yacht Club, Tiburon, CA

PLANNING RESTORATION OF SEA DUCK POPULATIONS INJURED IN COASTAL OIL SPILLS

Oil spills in coastal areas impact sea duck populations via direct loss of birds or indirectly through impacts to habitats and food resources. However, very few restoration actions have been identified for sea duck populations. In the wake of the 2007 Cosco Busan oil spill in San Francisco and other major coastal spills, we have a pressing need to develop effective post-spill restoration actions that specifically benefit sea ducks.

PLANNING RESTORATIONS FOR SEA DUCK POPULATIONS INJURED IN COASTAL OIL SPILLS: INFORMATION NEEDS AND LESSONS LEARNED

Carolyn Marn, US Fish and Wildlife Service, San Francisco Bay-Delta Fish and Wildlife Office, Carolyn_Marn@fws.gov , **Susan De La Cruz**, USGS Western Ecological Research Center, sdelacruz@usgs.gov

Sea ducks are frequently injured by coastal oil spills, however little is known about effective restoration actions that benefit sea duck populations. Unlike restoration for many seabirds, restoration of breeding habitat is usually not cost effective or feasible for most sea ducks. This Symposium, attended by the world's sea duck experts, provides a rare opportunity to address the unique issues and restoration challenges for sea duck species. This introductory presentation will provide background on the Natural Resource Damage Assessment and Restoration process and give examples of restoration projects, including results from a pilot study on prey augmentation for surf scoters injured by the 2007 Cosco Busan oil spill in San Francisco Bay.

SEA DUCK TRAITS: THEIR INFLUENCE ON OIL SPILL VULNERABILITY AND RESTORATION POTENTIAL

***Dan Esler**, USGS Alaska Science Center, desler@usgs.gov*

When oil spills occur in areas occupied by sea ducks, they tend to be among the most-affected wildlife, due to vulnerabilities stemming from their habitat selection, diet, and metabolic attributes. The ability to restore or mitigate oil spill injury depends on the natural history and life history traits of the injured species; these vary widely across the sea duck tribe. This presentation reviews the attributes of sea ducks that influence susceptibility to oil spills and options for restoration, drawing from previous oil spills and considering implications for restoration of surf scoters injured by the Cosco Busan spill.

SPECIAL SESSION

CHALLENGES AND OPPORTUNITIES IN THE WESTERN BOREAL FOREST FOR RESTORING DAMAGED SEA DUCK POPULATIONS

***Stuart Slattery**, Ducks Unlimited Canada, s_slattery@duck.ca*

The Western Boreal Forest of North America is a vast, remote landscape undergoing substantial alteration from industrialization and climate change. While many conservation opportunities exist, these characteristics limit options for restoring damaged sea duck populations using National Resource Damage Assessment and Restoration Program (NRDAR) funds. This presentation will focus on scoters and review how they use this landscape, challenges to restoration, and potential opportunities to accomplish NRDAR objectives through longer range investments.

THE CHALLENGES RESTORING POPULATIONS OF ARCTIC-BREEDING EIDERS

***Abby Powell,** USGS Florida Cooperative Fish and Wildlife Research Unit, abbypowell@ufl.edu*

Arctic-breeding sea ducks include all of the eiders and Long-tailed Duck. Within the Bering, Chukchi, and Beaufort seas and the Gulf of Alaska, there are some common areas offshore used by all of the species for molting, staging, and/or overwintering. Threats to these marine habitats from oil spills vary both spatially and temporally and may best be addressed through preventative measures. Because these species nest primarily in remote tundra habitats, and (except for Common Eiders) are widely dispersed in low densities, actions to improve productivity and/or adult survival on the breeding grounds would be challenging logistically and economically.

EUROPEAN PERSPECTIVES ON RESTORATION AND RECOVERY OF SEA DUCK POPULATIONS

***Ramūnas Žydelis,** DHI, Agern Alle 5, 2970 Horsholm, Denmark, rzy@dhigroup.com*

Increasing survival of adult birds or reducing their mortality is likely an efficient way to achieve measureable restoration/recovery action. Known current mortality sources could be tackled, for example bycatch, hunting, chronic oil pollution and shellfish harvest. Also, investment in marine spatial planning today may become beneficial for sea duck populations in the long term. Mapping of important habitats and migrations routes, and designation of marine protected areas may serve as a knowledge base and planning tools that help avoiding conflicts with future developments in marine environment, e.g. offshore wind energy facilities, oil & gas extraction, port expansion, shipping routes, aquaculture, etc.

SPECIAL SESSION

Pre-Conference Survey

SPECIAL SESSION: PLANNING RESTORATION FOR SEA DUCK POPULATIONS INJURED IN COASTAL OIL SPILLS

On Tuesday, 7 February 2017, we will convene the 6th International Sea Duck Conference at the Corinthian Yacht Club in Tiburon, CA. As the largest gathering of sea duck ecologist in the world, we have proposed a Special Session on ***Planning Restoration for Sea Duck Populations Injured in Coastal Oil Spills***.

Please help us by responding to a few quick questions below to improve the session and generate ideas for potential restorations that would benefit sea ducks. We plan to publish the findings to help catalyze restoration projects that implement appropriate actions for sea duck recovery.

(Please note: projects are not limited to the United States, can include conservation easements for habitats in imminent danger, and should focus on post-spill restoration.)

If you had substantial funding for several years…

1. **What actions would you take to restore or offset losses to sea duck populations?** *Specifically for eiders and scoters, but also open to other species like long-tails, goldeneyes, buffleheads, harlequins that are also injured in coastal oil spills.*

2. **When and where do you think restoration activities would be most effective and have the greatest impact on increasing populations?** Consider factors such as demographic bottlenecks, differences in life history strategies and limiting habitats, density dependence and benefits to survival and body condition.

3. **What restoration actions have you seen implemented that benefit sea ducks? Why do you think these actions were successful?**
   Include factors that contributed to success.

4. **What indicators could be used to monitor success of sea duck restoration activities?** *Ex: Population level responses, linkages between habitat improvements and demographics or indicators (e.g. body condition).*

Click here to use the Online Form

WORKSHOP I

TUESDAY, 7 FEBRUARY 2017, 17:30 – 20:30

Spinnaker Room @ Lodge at Tiburon

LONG-TAILED DUCK – STATE OF KNOWLEDGE AND INFORMATION NEEDS

(Organizers: Tim Bowman, Ramunas Zydelis, Kevin Kenow)

17:30 Overview of status and distribution and key conservation concerns in North America *(Tim Bowman)*

17:50 Overview of status and distribution and key conservation concerns in Eurasia *(Ramunus Zydelis)*

18:10 Harvest assessment model (specifically focused on LTDU) *(Mark Koneff)*

18:30 Open discussion on what are the most important information gaps for LTDU in North America and in Eurasia. Do we know enough about LTDU to identify conservation measures we should be pursuing now? *(Discussion led by Bowman, Zydelis, Koneff)*

10-minute break

19:10 Panel Discussion: Improving survival of radio-marked long-tailed ducks
Brief introduction of topic and panelists *(Kevin Kenow)*

19:20 Interactive discussion of potential variables affecting survival identified from the survey, mitigation, recommendations *(moderated by Scott Ford)*

20:20 Additional discussion items and closing remarks

Scott Ford, Avian Specialty Veterinary Services, Milwaukee, WI, USA
Michelle Kneeland, Biodiversity Research Institute, Portland, ME, USA
Stephane Lair, University of Montreal, Montreal, Quebec, Canada
Malcolm McAdie, Marmot Recovery Foundation, Nanaimo, British Columbia, Canada
Dan Mulcahy (remote), USGS, Alaska Science Center, Anchorage, AK, USA (retired)
Glenn Olsen, USGS Patuxent Wildlife Research Center, Laurel, MD, USA
Pam Tuomi, Alaska SeaLife Center, Seward, AK, USA

WORKSHOP II

WEDNESDAY, 8 FEBRUARY 2017, 14:45 – 15:15

Grand Ballroom @ Corinthian Yacht Club

MEETING: TELEMETRY DATA STORAGE AND ACCESS

(Organizers: Emily Silverman, Derek Maski)

An emerging effort to develop a web-accessible animal movement telemetry data platform, with an emphasis on marine bird data, is slated to begin in Q3 of FY2017. The initial collaborators include USGS, USFWS, BRI and Sea Duck Joint Venture members. The FY2017 primary task is to pilot the development of a system capable of storage, visualization, analysis, and dissemination of marine bird telemetry data.

Purpose

The scheduled workshop intends to bring together interested parties to gain consensus on the need, potential scope, and broad requirements for a telemetry data system. Access collective knowledge about current telemetry systems, establish desired functions, and elicit requirements.

Participants

Researchers with telemetry data and those with experience accessing and analyzing telemetry data, including scientists from the USGS Science Centers, USFWS Refuges & Migratory Bird programs, the Sea Duck Joint Venture, the Canadian Wildlife Service, Environment & Climate Change Canada's Science & Technology Program, state and provincial agencies, and academic institutions.

Principles

The proposed platform is constrained by current staff resources, funds already allocated or immediately available within FY17, and IT infrastructure in place or immediately available. Data for potential release must be in the public domain or imminently available for open public use and distribution. The FY17 focus is on publicly available sea duck telemetry datasets.

Workshop plan

We will review our understanding of how telemetry data are currently collected, managed, and used (existing use cases - A) and describe possible new ways of interacting with data under the proposed system (use case B). We will form break out groups to discuss (1) IT infrastructure & data management, and (2) data providers' and data users' requirements.

Outcome

Two or three users stories (B') describing the retrieval, visualization and analysis of data that capture the requirements and workflow under a fully implemented new system.

WORKSHOP III

WEDNESDAY, 8 FEBRUARY 2017, 19:30 – 22:30

Spinnaker Room @ Lodge at Tiburon

POPULATION DELINEATION – HOW TO DEFINE POPULATIONS

(Organizers: Sean Boyd, Dan Esler)

Since initiation of the Sea Duck Joint Venture, considerable effort has been devoted to describing population delineation of sea ducks, due to the relevance of understanding population structuring for both management and research. Studies have used genetics, satellite telemetry, stable isotopes, and band recoveries to graphically depict migratory movements and distinct or overlapping population segments, resulting in improved understanding of population delineation for many species.

Despite the effort and progress, some general questions remain:

- What does “population delineation” really mean?
- Does the definition of population delineation differ depending on management needs or methods used?
- How do resolution and inference differ among methods?
- Are there data analysis methods that can yield comparable results across studies?
- What have we learned about well-studied species?
- Where are most important data gaps?
- Are these studies contributing meaningfully to sea duck management?

ORAL PRESENTATIONS

MONDAY, 6 FEBRUARY 2017			
12:00 - 20:00		*Registration Open, lobby @ Lodge at Tiburon*	
19:30 - 22:30		**WELCOME RECEPTION,** *Main Sail Ballroom @ Lodge at Tiburon* *Light food and beer*	
TUESDAY, 7 FEBRUARY 2017			
07:30 - 08:30		*Breakfast, Grand Ballroom, upstairs @ Corinthian Yacht Club*	
08:30 - 08:45		Fritz Reid	**WELCOME TO SAN FRANCISCO 2017**
		Scott McWilliams	**INTRODUCTION TO THE SCIENCE PROGRAM**
8:45		Margaret Peterson	
		Plenary Paul L. Flint	**POPULATION ECOLOGY OF SEA DUCKS: WHAT DEFINES THE POPULATION "BUS," WHO'S DRIVING IT, AND WHERE'S IT GOING?**
09:45 - 10:15		*Coffee break*	
10:15 - 12:00	**1.0**	**SPECIAL SESSION: PLANNING RESTORATION OF SEA DUCK POPULATIONS INJURED IN COASTAL OIL SPILLS**	
10:15	1.1	Carolyn Marn & Susan De La Cruz	**INTRODUCTION TO THE SESSION, *Carolyn Marn and Susan De La Cruz***
10:35	1.2	Dan Esler	**SEA DUCK TRAITS: THEIR INFLUENCE ON OIL SPILL VULNERABILITY AND RESTORATION POTENTIAL, *Dan Esler***
10:50	1.3	Stuart Slattery	**CHALLENGES AND OPPORTUNITIES IN THE WESTERN BOREAL FOREST FOR RESTORING DAMAGED SEA DUCK POPULATIONS *, Stuart Slattery***
11:05	1.4	Abby Powell	**THE CHALLENGES RESTORING POPULATIONS OF ARCTIC-BREEDING EIDERS, *Abby Powell***
11:20	1.5	Ramunas Zydelis	**EUROPEAN PERSPECTIVES ON RESTORATION AND RECOVERY OF SEA DUCK POPULATIONS, *Ramunas Zydelis***
11:35	1.6	*Discussion*	
12:00 - 12:30		*Lunch @ Grand Ballroom, upstairs, Corinthian Yacht Club - Included in registration*	
12:30 - 13:30		**PANEL DISCUSSION: PLANNING RESTORATION OF SEA DUCK POPULATIONS INJURED IN COASTAL OIL SPILLS** *Panelists: Dan Esler, Ramunas Zydelis, Stu Slattery, Abby Powell, Carolyn Marn, Susan De La Cruz*	
13:30 - 15:15	**2.0**	**POPULATION ECOLOGY & TRENDS** Session chair: Dana Kellett	
13:30	2.1	Andre Breault	**USING GIS TOOLS TO MAP SEADUCK DISTRIBUTION IN BRITISH COLUMBIA, *Andre M. Breault****, Bruce Harrison, and Darryl W. Kroeker*
13:45	2.2	Kylee Dunham*	**POPULATION DYNAMICS OF ALASKAN BREEDING STELLER'S EIDERS, *Kylee D. Dunham**** *and James B. Grand*
14:00	2.3	Leigh Fredrickson	**FIFTY YEARS OF OBSERVATIONS ON HOODED MERGANSERS FROM A SOUTHERN SWAMP POPULATION, *Leigh H. Fredrickson*** *and Peter Blums*

14:15	2.4	Sean Boyd	**SURVIVAL RATES OF HARLEQUIN DUCKS IN THE SALISH SEA, BRITISH COLUMBIA, AND THE EFFECTS OF CLIMATE AND FOOD**, ***W. Sean Boyd,*** *Scott Wilson, Greg Robertson, Ian Goudie, and Connie Smith*
14:30	2.5	Eric Reed	**POPULATION TRENDS IN PACIFIC COMMON EIDERS IN RELATION TO ANNUAL VARIATION IN ICE BREAK-UP OVER A 20-YEAR PERIOD, *Eric T. Reed,*** *Cindy Wood, Danica Hogan, Christian Roy, Myra Robertson, and D. Lynne Dickson*
14:45	2.6	Dana Kellett	**APPARENT SURVIVAL OF ADULT FEMALE KING EIDERS WINTERING IN EASTERN AND WESTERN NORTH AMERICA, *Dana K. Kellett*** *and Ray T. Alisauskas*
15:00	2.7	*Break early*	
15:15 - 15:45		*Coffee break*	
15:45 - 17:15	**3.0**	**PATTERNS OF DISTRIBUTION & ABUNDANCE** Session chair: Kjell Larsson	
15:45	3.1	Joseph Evenson	**NOCTURNAL SPACE USE BY SURF SCOTERS (*MELANITTA PERSPICILLATA*) AND CRUDE OIL SPILL RESPONSE PLANNING IN THE SALISH SEA,** *Lindsey Hamilton,* ***Joseph R. Evenson****, and Dina Roberts*
16:00	3.2	Vasiliy Baranyuk	**EIDERS OF WRANGEL ISLAND, RUSSIA, *Vasiliy V. Baranyuk***
16:15	3.3	Jeffrey Ball	**DISTRIBUTION AND ABUNDANCE OF SEA DUCKS ALONG THE HUDSON BAY COAST OF NORTHERN MANITOBA**, ***Jeffrey R. Ball****, Frank B. Baldwin, Chris E. Smith, Stuart M. Slattery*
16:30	3.4	Scott Gilliland	**SOME HYPOTHESES BEHIND AN APPARENTLY COLLAPSING POPULATION OF COMMON EIDERS IN SW NEW BRUNSWICK, *Scott G. Gilliland****, Ray T. Alisauskas, Shawn M.C. Robinson, F. Patrick Kehoe, K. Conner, Peter W. Hicklin and C. Davison Ankney*
16:45	3.5	Kjell Larsson	**REPRODUCTIVE SUCCESS OF LONG-TAILED DUCKS WINTERING IN THE BALTIC SEA, *Kjell Larsson***
17:00		*Dinner, on your own*	
17:30 - 20:30		**WORKSHOP: LONG-TAILED DUCKS,** *Spinnaker Room @ Lodge at Tiburon*	
19:30 - 22:30		**POSTER SESSION,** *Main Sail Ballroom @ Lodge at Tiburon* *Light food and beer*	

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*	

THURSDAY, 9 FEBRUARY 17

07:30 - 08:30		*Breakfast, Grand Ballroom, upstairs @ Corinthian Yacht Club*	
08:30 - 08:45		**Announcements**	
08:45		**Stu Slattery**	
		Plenary Ray T. Alisauskas	**THE ANNUAL CYCLE OF SEA DUCKS**
09:45 - 10:15		*Coffee break*	
10:15 - 12:00	**7.0**	**ANNUAL CYCLE**	
		Session chair: Alicia Berlin	
10:15	7.1	Dustin Meattey*	**ANNUAL CYCLE MOVEMENTS AND WINTER HABITAT USE OF WHITE-WINGED SCOTERS IN SOUTHERN NEW ENGLAND,** *Dustin E. Meattey, Scott R. McWilliams, Peter W.C. Paton, Jason Osenkowski, Christine Lepage, Scott G. Gilliland and Glenn H. Olsen*
10:30	7.2	Rebecca Bentzen	**MIGRATION TRENDS FOR KING AND COMMON EIDERS PAST POINT BARROW, ALASKA, *Rebecca L. Bentzen,*** *Abby N. Powell, and Robert S. Suydam*
10:45	7.3	Johanna Kottsieper*	**SEASONAL AND ANNUAL DYNAMICS OF THE COMMON SCOTER *MELANITTA NIGRA* IN THE GERMAN NORTH AND THE BALTIC SEAS, *Johanna Kottsieper****, Nele Markones, Stefan Garthe*
11:00	7.4	Alicia Berlin	**SATELLITE TRACKING HIGHLIGHTS USE OF OCEAN HABITAT BY SURF SCOTERS IN FEDERAL WATERS OF THE US MID-ATLANTIC, *Alicia M. Wells-Berlin****, Jonathan L. Fiely, Suzanne J. Gifford, Andrew Gilbert, Lucas Savoy, Carrie E. Gray, Glenn H. Olsen, Caleb S. Spiegel*
11:15	7.5	Susan Ellis-Felege	**BEHAVIORAL RESPONSES OF COMMON EIDERS TO UNMANNED AIRCRAFT SURVEYS IN NORTHERN MANITOBA,** *Susan N. Ellis-Felege, Andrew F. Barnas, Christopher J. Felege, Tanner J. Stechmann, Samuel D. Hervey, and Robert F. Rockwell*
11:30 - 13:30		*Lunch (on your own)*	
13:30 - 15:15	**8.0**	**FORAGING & ENERGETICS**	
		Session chair: Jim Lovvorn	
13:30	8.1	Rolanda Steenweg*	**A TALE OF TWO OVERWINTERING SITES: INFERING OVERWINTERING ORIGINS OF A DIVING SEA DUCK USING STABLE ISOTOPES, *Rolanda J. Steenweg,*** *Glenn T. Crossin, T. Kurt Kyser, Flemming R. Merkel, Gregory J. Robertson, H. Grant Gilchrist, Joanna Mills-Flemming, and Oliver P. Love*
13:45	8.2	Bruce Harrison	**ASSOCIATING SEA DUCKS WITH COASTAL HABITATS IN BRITISH COLUMBIA, *Bruce Harrison****, Kathleen Moore, Dan Buffett, Danielle Morrison*

14:00	8.3	Shiway Wang	**THE IMPORTANCE OF MARINE RESOURCES FOR BREEDING SPECTACLED EIDERS: INSIGHTS FROM FATTY ACID ANALYSIS, *Shiway W. Wang***, *Tuula E. Hollmén, Margaret R. Petersen, Matthew G. Sexson, Suzanne M. Budge, Sara J. Iverson*
14:15	8.4	Hannah Robson	**DISENTANGLING DRIVERS OF DECLINE USING TIME TRAVELLING MUD; THE CASE OF THE COMMON SCOTER (*MELANITTA NIGRA*) BREEDING IN BRITAIN, *Hannah J. Robson,*** *Vivienne J. Jones, Steve Brooks, Andrew Douse, Carl D. Sayer, and Geoff M. Hilton*
14:30	8.5	James Lovvorn	**LIMITS TO BENTHIC FEEDING BY EIDERS IN A VITAL ARCTIC MIGRATION CORRIDOR DUE TO LOCALIZED PREY AND CHANGING SEA ICE, *James R. Lovvorn,*** *Aariel R. Rocha, Stephen C. Jewett, Douglas Dasher, Steffen Oppel, and Abby N. Powell*
14:45	8.6	Sam Iverson	**MARINE NUTRIENT SUBSIDIES TO THE TERRESTRIAL ENVIRONMENT OF COMMON EIDER NESTING COLONIES IN THE CANADIAN ARCTIC,** *Nikolas M.T. Clyde, Kathryn E. Hargan,* ***Samuel A. Iverson****, Mark R. Forbes and H. Grant Gilchrist*
15:00	8.7	*Break early*	
15:15 - 15:45		*Coffee break*	
15:45 - 17:30	**9.0**	**BREEDING ECOLOGY** Session chair: John Takekawa	
15:45	9.1	Holly Hennin	**PHYSIOLOGICAL MECHANISMS DRIVING FORAGING, FATTENING AND BREEDING PHENOLOGY IN AN ARCTIC SEADUCK, *Holly L. Hennin***, *Pierre Legagneux, H. Grant Gilchrist, Michael H. Janssen, Jöel Bêty, and Oliver P. Love*
16:00	9.2	Kim Jaatinen	**STATE-DEPENDENT ALLOCATION STRATEGIES IN COMMON EIDERS: AN EARLY WARNING SYSTEM FOR FOOD-WEB CHANGES? *Kim Jaatinen,*** *Markus Öst and Keith A. Hobson*
16:15	9.3	Jón Einar Jónsson	**NEST SITE SELECTION IN ICELANDIC COMMON EIDERS, *Jón Einar Jónsson,*** *Árni Ásgeirsson and Ellen Magnúsdóttir*
16:30	9.4	Micah W.C. Miller*	**SOURCES OF NUTRIENTS TO INCUBATING SEA DUCKS: THE ROLES OF MARINE AND FRESHWATER INPUTS, *Micah W.C. Miller*** *and James R. Lovvorn*
16:45	9.5	John Takekawa	**CLOSING REMARKS**
17:00		*Break*	
18:30		*Board bus @ Lodge at Tiburon for Sausalito Marina, 18:30 sharp*	
19:00 - 22:30		**BANQUET & AWARDS DINNER -** *San Francisco Bay Dinner Cruise, Hornblower Spirit Yacht*	

POSTER PRESENTATIONS

POSTER PRESENTATIONS

10.01	Ainars Aunins	**FACTORS AFFECTING THE DISTRIBUTION AND NUMBERS OF WINTERING SEA DUCKS IN THE EASTERN PART OF THE BALTIC SEA, *Ainars Aunins**, Leho Luigujõe, Antra Stīpniece*
10.02	Jeffrey R. Ball	**COMMUNITY-BASED MONITORING OF KING AND COMMON EIDER NEAR ULUKHAKTOK, NT, DURING SPRING MIGRATION, *Jeffrey R. Ball** and Kirsty E. B. Gurney*
10.03	Elizabeth S. Bonczek*	**IMPACT OF A MID-SUMMER STORM SURGE ON COMMON EIDERS NESTING ON BEAUFORT SEA BARRIER ISLANDS, *Elizabeth S. Bonczek,** Christopher J. Latty, Tuula E. Hollmen, and Peter Winsor*
10.04	Joshua I. Brown*	**INTER-SPECIFIC POPULATION DYNAMICS OF THE COMMON GOLDENEYE AND BARROW'S GOLDENEYE, *Joshua I. Brown,** Sarah Sonsthagen, Robert Wilson, Sean Boyd, Sandra Talbot, Philip Lavretsky*
10.05	Michael Casazza	**DABBLING DUCK MOVEMENTS: FROM SUISUN MARSH AND BEYOND, *Michael Casazza,** Joshua Ackerman, Joseph Fleskes, Susan De La Cruz, Cory Overton, Mark Herzog, Christopher Hartman, Cliff Feldheim, John Eadie, Caroline Brady, Jeffrey Kohl, Desmond Mackel, Mason Hill, Fiona McDuie*
10.06	Katrina Counihan	**CHARACTERIZATION OF IMMUNE FUNCTION IN STELLER'S EIDERS, *Katrina Counihan** and Tuula Hollmén*
10.07	Bryan L. Daniels	**CLUTCH SIZES OF THE SPECTACLED EIDER ON THE YUKON DELTA NATIONAL WILDLIFE REFUGE, ALASKA, *Bryan L. Daniels***
10.08	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 G. Randy Milton*
10.09	Luke J. Fara[1]*	**MIGRATION PATTERNS, HABITAT USE, FOOD HABITS, AND HARVEST CHARACTERISTICS OF LONG-TAILED DUCKS WINTERING ON LAKE MICHIGAN, *Luke J. Fara**, Kevin P. Kenow, Michael W. Eichholz, and Steven C. Houdek*
10.10	Luke J. Fara[2]	**USING THERMAL IMAGERY AND "JUDAS" BIRDS TO INCREASE CAPTURE OF LONG-TAILED DUCKS ON LAKE MICHIGAN, *Luke J. Fara**, Kevin P. Kenow, Michael W. Eichholz, Brian R. Lubinski, Larry R. Robinson, and Steven C. Houdek*
10.11	P-O. Fontaine	**CO-CULTURE OF BLUE MUSSEL (Mytilus edulis) AND SUGAR KELP (Saccharina latissima): EXPLORING THE POTENTIAL EFFECT OF SEAWEEDS IN DETERRING THE EFFECT OF DUCK PREDATION ON MUSSELS, CASCAPEDIA BAY (QC, CANADA), *P-O. Fontaine**, É. Tamigneaux*

POSTER PRESENTATIONS

10.12	Michele D. Goodman	**EVALUATION OF PRE- AND POST-SURGICAL LACTATE LEVELS IN LONG-TAILED DUCKS (CLANGULA HYEMALIS) AS AN INDICATOR OF HYPOXEMIA, *Michele D. Goodman,*** *Glenn H. Olsen, and Dustin E. Meattey*
10.13	Luke C. Hawk	**EVALUATING MOVEMENT PATTERNS AND HABITAT NUANCES OF WINTERING DIVING DUCKS, *Luke C. Hawk,*** *Mason A. Hill, Susan E.W. De La Cruz, Michael Casazza, Joshua Ackerman, Joseph Fleskes, Cory Overton, Cliff Feldheim, and Caroline Brady*
10.14	Richard Hearn	**CAUSES OF, AND RESPONSES TO, DECLINES IN EUROPEAN POPULATIONS OF LONG-TAILED DUCK AND VELVET SCOTER,** *Richard Hearn and Mindaugas Dagys*
10.15	Holly L. Hennin	**ENERGETIC PHYSIOLOGY MEDIATES INDIVIDUAL OPTIMIZATION OF BREEDING PHENOLOGY IN A MIGRATORY ARCTIC SEABIRD, *Holly L. Hennin****, Joël Bêty, Pierre Legagneux, H. Grant Gilchrist, Tony D. Williams, and Oliver P. Love*
10.16	Mason A. Hill	**ENHANCING PREY AVAILABILITY FOR SEA AND BAY DUCKS INJURED BY THE COSCO BUSAN OIL SPILL IN SAN FRANCISCO BAY, *Mason A. Hill,*** *Kyle A Spragens, John Y. Takekawa, Susan E.W. De La Cruz*
10.17	Kevin P. Kenow	**DISTRIBUTION OF WINTERING LONG-TAILED DUCKS ON LAKE MICHIGAN, *Kevin P. Kenow****, Steven C. Houdek, Brian R. Lubinski, Timothy J. Fox, Luke J. Fara*
10.18	Mark D. Koneff	**EVALUATING HARVEST POTENTIAL AND INFORMATION NEEDS FOR SEA DUCKS, *Mark D. Koneff****, Chris P. Dwyer, Guthrie S. Zimmerman, Kathleen K. Fleming, Paul I. Padding, Patrick K. Devers, Fred A. Johnson, Michael C. Runge and Anthony J Roberts*
10.19	Charlotte Kilchenstein	**A POTENTIAL TECHNIQUE FOR ATTACHMENT OF SOLAR GPS/GSM TRANSMITTERS ON SURF SCOTERS: SILICONE HARNESS, *Charlotte B. L. Kilchenstein****, Alicia M. Wells-Berlin, Jonathan L. Fiely, K. Mark McBride*
10.20	Stéphane Lair	**EFFECT OF INTRANASAL MIDAZOLAM HYDROCHLORIDE ADMINISTRATION ON SURVIVAL OF SURF SCOTERS (MELANITTA PERSPICILLATA) FOLLOWING INTRACOELOMIC IMPLANTATION OF SATELLITE TRANSMITTERS,** *Rozenn Le Net, Stéphane Lair, Scott G. Gilliland, Timothy D. Bowman, Christine Lepage, Ariane Santamaria-Bouvier, Daniel M. Mulcahy and Matthew G. Sexson*

POSTER PRESENTATIONS

10.21	Chris Latty	**DISEASE AS A POTENTIAL LIMITING FACTOR FOR COMMON EIDER BREEDING ON BEAUFORT SEA BARRIER ISLANDS, *Christopher J. Latty**, Tuula E. Hollmen, Katrina L. Counihan, Claire K. Montgomerie*
10.22	Christine Lepage	**RECOVERY DISTRIBUTION OF SURF AND WHITE-WINGED SCOTERS IN NORTHEASTERN NORTH AMERICA, *Christine Lepage,** Scott G. Gilliland, Eric T. Reed, Megan V. Ross, Jean-Pierre L. Savard*
10.23	Holly Hennin	**PRE-BREEDING FATTENING MEDIATES INVESTMENT IN CLUTCH SIZE IN A CAPITAL-INCOME BREEDING SEADUCK, *Holly L. Hennin**, Cody J. Dey, Joël Bêty, Pierre Legagneux, H. Grant Gilchrist, and Oliver P. Love*
10.24	Leho Luigujõe	**WINTER DISTRIBUTION AND TRENDS OF SEADUCKS IN ESTONIAN COASTAL WATERS IN THE PERIOD 1993 – 2016, *Leho Luigujõe***
10.25	Brian R. Lubinski	**AN AIRBORNE REMOTE SENSING ALTERNATIVE FOR CONDUCTING PELAGIC SURVEYS OF LONG-TAILED DUCKS, *Brian R. Lubinski,** Larry R. Robinson, Luke J. Fara, and Kevin P. Kenow*
10.26	Kate H. Martin	**SPECTACLED AND STELLER'S EIDER RECOVERY PROGRAM: CONSERVATION STRATEGY, Kate H. Martin,** Neesha C. Stellrecht, Ted R. Swem
10.27	Kathleen McGrew[1]*	**REDUCING GILLNET BYCATCH: SEADUCK UNDERWATER HEARING THRESHOLDS AND AUDITORY DETERRENT DEVICES, *Kathleen A. McGrew**, Christopher K. Williams, Alicia M. Wells-Berlin, Sara E. Crowell*
10.28	Kathleen McGrew[2]	**CAPTIVE RAISED GROWTH MODELS FOR SEADUCKS, *Kathleen A. McGrew,** Sarah Fitzgerald, and Alicia M. Wells-Berlin*
10.29	Nic McLellan	**IDENTIFYING AREAS OF IMPORTANCE FOR SEA DUCKS THROUGHOUT THEIR ANNUAL CYCLE, *Nic McLellan**, Tim Bowman, Sean Boyd, Shannon Badzinski, Christine Lepage Scott Gilliland, and James Churchill*
10.30	Jacob McPherson *(presented by Chris Williams)*	**ESTIMATING BEHAVIORAL MULITPLIERS TO RESTING METABOLIC RATE IN AMERICAN BLACK DUCK AND LESSER SCAUP, *Jacob W. McPherson**, Christopher K. Williams, Alicia M. Berlin, John M. Coluccy*
10.31	Micah W.C. Miller*	**ASSESSMENT OF BIOINDICATOR APPROACHES FOR TRACE ELEMENTS AND SUBLETHAL HEALTH EFFECTS IN SEA DUCKS BREEDING IN ARCTIC ALASKA, *Micah W.C. Miller,** James R. Lovvorn, Angela C. Matz, Robert J. Taylor, Christopher J. Latty, David E. Safine, Tuula E. Hollmén*

POSTER PRESENTATIONS

10.32	William P. Mueller	**LONG-TAILED DUCKS IN WESTERN LAKE MICHIGAN, *William P. Mueller***, *Bryan B. Lenz*
10.33	Glenn H. Olsen[1]	**USING I-STAT BLOOD RESULTSTO PREDICT P0ST PTT IMPLANT SURVIVAL IN LONG-TAILED DUCKS AND SCOTERS, *Glenn H. Olsen***, *Anand Krishnaswamy, Michael C. Runge, Alicia M. Wells-Berlin, Dustin E. Meattey*
10.34	Glenn H. Olsen[2]	**LONG-TAILED DUCK AND SCOTER HEMATOLOGY AND SERUM CHEMISTRY, *Glenn H. Olsen,*** *Alicia M. Wells-Berlin, Sara E. Crowell, Kathleen A. McGrew*
10.35	John Pearce	**VISUALIZING POPULATION DELINEATION AMONG NORTH AMERICAN SEA DUCKS: MAPS FOR FUTURE RESEARCH AND MANAGEMENT PLANNING, *John Pearce***, *Mary Whalen, and Josh Stiller*
10.36	Hannah M. Plumpton*	**ANNUAL FACTORS AFFECTING THE WINTERING DISTRIBUTION OF BLACK SCOTERS, *Hannah M. Plumpton***, *Emily D. Silverman, Beth E. Ross*
10.37	Carrick M. Rice*	**FORAGING DIVE TIMES OF DIVING DUCKS IN A FRESHWATER LAKE, *Carrick M. Rice,*** *Philipp N. Maleko, Tracey Rice, and Luke J. Matthews*
10.38	Lucas Savoy2	**TIMING, DURATION, AND PATHWAYS OF HARLEQUIN DUCK MIGRATION TO PACIFIC MOLTING AND WINTERING AREAS,** *Sean Boyd, Beth MacCallum, Malcolm McAdie, Lisa Bate, Chris Hammond, Matt Wilson, Joseph Evenson, Susan Patla,* ***Lucas Savoy***
10.39	Lucas Savoy3	**CONTAMINANT CONCENTRATIONS IN THE ENDANGERED SCALY-SIDED MERGANSER FROM RUSSIA,** *Diana V. Solovyeva,* ***Lucas Savoy,*** *Oksana Lane, Sergey L. Vartanayan, Christopher Perkins, and Kevin Regan*
10.40	Vera Y. Kokhanova *(presented by Diana Solovyeva)*	**SURVIVAL RATE OF SPECTACLED EIDERS ON AYOPECHAN ISLAND, CHUKOTKA, RUSSIA,** *Vera Y. Kokhanova and* ***Diana V. Solovyeva***
10.41	Diana V. Solovyeva	**WINTER DIVING ACTIVITY OF SPECTACLED EIDER SOMATERIA FISCHERI AS REVEALED BY PRESSURE TAG*, Diana V. Solovyeva***
10.42	Sarah A. Sonsthagen	**COAST TO COAST: ASSESSING MIGRATORY CONNECTIVITY OF NORTH AMERICAN SCOTERS, *Sarah A. Sonsthagen***, *Robert E. Wilson, Philip Lavretsky, and John M. Pearce*
10.43	Kyle A. Spragens	**A REVIEW OF SEA DUCK HARVEST IN WASHINGTON STATE: MONITORING HUNTER PARTICIPATION AND HARVEST TRENDS, *Kyle A. Spragens***, *Joseph R. Evenson, and Matthew T. Wilson*

POSTER PRESENTATIONS

10.44	Tanner J. Stechmann*	**NEST ATTENDANCE PATTERNS OF COMMON EIDERS AT WAPUSK NATIONAL PARK IN NORTHERN MANITOBA,** ***Tanner J. Stechmann,*** *David T. Iles, Andrew F. Barnas, Samuel D. Hervey, Robert F. Rockwell, and Susan N. Ellis-Felege*
10.45	Rolanda J. Steenweg*	**THE ENERGETIC COSTS AND REPRODUCTIVE BENEFITS OF MATE GUARDING IN A DIVING SEADUCK,** ***Rolanda J. Steenweg****, Holly L. Hennin, Pierre Legagneux, H. Grant Gilchrist, Glenn T. Crossin, and Oliver P. Love*
10.46	Rune S. Tjørnløv	**ASSESSING HUNTING SUSTAINABILITY IN A DECLINING FLYWAY POPULATION OF COMMON EIDERS,** ***SOMATERIA MOLLISSIMA****,* ***Rune S. Tjørnløv,*** *Morten Frederiksen, Roger Pradel and Rémi Choquet*
10.47	Sadie E.G. Ulman	**A SURVEY OF SEA DUCK PREY ITEMS ACROSS FOUR SITES ON THE YUKON-KUSKOKWIM DELTA, ALASKA,** ***Sadie E.G. Ulman****, Elizabeth A. Ruffman, and Tuula E. Hollmén*
10.48	David H. Ward	**BREEDING AND MIGRATION DELINEATION OF SURF SCOTERS WINTERING IN SOUTHEAST ALASKA,** ***David H. Ward****, Corey S. VanStratt, Daniel Esler, Katherine M. Brodhead, and Brian D. Uher-Koch*
10.49	Wilhelm L. Wiese	**WHAT'S EATING COMMON EIDER EGGS? NEST CAMERAS TELL THE REAL STORY,** ***Wilhelm L. Wiese****, Tuula E. Hollmen, Mark S. Lindberg, Christopher J. Latty*
10.50	Heather M. Wilson	**AERIAL SURVEY DETECTION FOR SPECTACLED EIDERS AND OTHER WATERBIRDS ON THE ARCTIC COASTAL PLAIN OF ALASKA,** ***Heather M. Wilson****, Robert A. Stehn, William W. Larned, Tamara K. Zeller, and Robert T. Platte*
10.51	Denny Zwiefelhofer	**KODIAK ISLAND COOPERATIVE BARROW'S GOLDENEYE NEST BOX PROJECT,** ***Denny Zwiefelhofer****, John Crye, and Robin Corcoran*

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ABSTRACTS FOR ORAL PRESENTATIONS

2.1: POPULATION ECOLOGY & TRENDS

USING GIS TOOLS TO MAP SEA DUCK DISTRIBUTION IN THE BRITISH COLUMBIA

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A landscape-level aerial survey of breeding waterfowl has been conducted annually from 2006 to 2016 in Central British Columbia. Approximately 3,000 geo-referenced duck sightings are collected each year using techniques outlined in the continental *Waterfowl Breeding Population and Habitat Survey.* Although the primary goal of the survey is to estimate population trends, we used GIS techniques to provide concise and powerful summaries of species abundance and distribution and how these change over time, at multiple spatial scales. This study reports on Barrow's Goldeneye, Bufflehead and Hooded Merganser at 3 different scales: the Interior B.C. (11 million ha), ecological units (ranging in size from 0.6 to 2 million ha, n = 8) and standardized 16x16 km squares (n = 468). Our results highlight differences in abundance and distribution at the three scales. This non-traditional reporting of population survey results aims at addressing environmental assessment and land use planning needs while paving the way for the web release of the data. Landscape-level GIS analyses also support the development of habitat-species and/or climate change models and guide habitat delivery for the Canadian Intermountain Joint Venture.

2.2: **POPULATION ECOLOGY & TRENDS**

POPULATION DYNAMICS OF ALASKAN BREEDING STELLER'S EIDERS

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The Alaskan breeding population of Steller's eiders *(Polysticta stelleri*) was listed as threatened under the Endangered Species Act in 1997 in response to perceived declines in abundance throughout their breeding and nesting range. Aerial surveys suggest the breeding population is small and breeds in highly variable numbers, with zero birds counted in 5 of the last 25 years. The primary objective of this research is to evaluate competing population process models of Alaskan-breeding Steller's eiders through comparison of model projections to aerial survey data. To evaluate model efficacy and estimate demographic parameters, we used a Bayesian state-space modelling framework and fit each model to counts from the annual aerial surveys using sequential importance sampling/resampling. The results strongly support that the Alaskan breeding population experiences population level non-breeding events, and is open to exchange with the larger Russian-Pacific breeding population. We estimated population viability using the open model with immigration and non-breeding, and a closed model to address beliefs of population closure. Closed model projections suggest this population has a 100% probability of extinction within 42 years. Projections from the open population model suggest that with immigration there is no probability of permanent extinction if the larger Russian population persists. Due to random immigration process and non-breeding behavior it is likely that this population will continue to be present in low and highly variable numbers on the breeding grounds in Alaska. However, monitoring the winter population, which contains both Russian and Alaskan breeding birds, may offer a more comprehensive indication of population viability.

2.3: POPULATION ECOLOGY & TRENDS

FIFTY YEARS OF OBSERVATIONS ON HOODED MERGANSERS FROM A SOUTHERN SWAMP

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Nesting hooded mergansers were first studied intensively beginning in 1962 in SE Missouri by banding nesting females and web-tagging newly hatched ducklings. The study shifted to the use of plasticine- filled leg bands in 1998 and continued through 1915. Plasticine bands enhanced information on homing, dispersal, and nesting behavior. The species is exceptionally secretive and only one brood has been observed in 54 years within this forested habitat. Males and females return to the swamp in November and remain throughout the winter when open water is available or return when wetlands are ice free. Males leave to move north before or soon after egg laying is complete. Nesting females depart northward after nest failure or with completion of brood rearing. Yearling females return and practice nesting skills following completion of active nesting by adults. Hooded mergansers select nest sites where boxes are over water or immediately adjacent to water. Eggs are laid at a rate of one egg every 1.5 days. Feces of hooded mergansers is more fluid than feces of wood ducks and is dominated by two colors, a coarse red solution suggesting a crayfish diet and a more viscous black foul smelling form suggesting fish consumption. About 2/3 of the population primarily feeds on crayfish based on red fecal material. Merganser homing is less precise than wood ducks with local movements among years of eight or more miles. Merganser nest box use has gradually increased from about 10% to 30% of box use from the 1960s to recent years. Hooded mergansers have conspecific and interspecific (with wood ducks) brood parasitism. Wood duck and hooded merganser ducklings from both wood ducks and hooded mergansers incubated clutches reach flight stage. About 13% of the annual production of mergansers came from nests incubated by wood ducks. During a recent 7 year period, 11,682 day old ducklings with plasticine-filled leg bands included 3,417 hooded mergansers. There were 130 (5.7%) hunting recoveries and 33 (25%) of these were long distance natal dispersal recoveries. We were successful in capturing 124 yearling female hooded mergansers in an especially designed capture box over 5 nesting seasons. Of these 54 had been marked as day old ducklings within 7 km of the capture box site. We determined the fate of 63 mergansers that were captured over a 3 year period. Of these 34 were not seen again, whereas 24 were recruited into the local population and 5 were recaptured in the special traps. The secretive nature of hooded mergansers in southern flooded forests makes them challenging study subjects but their apparent abundance in some narrow riparian corridors may offer opportunities to gain more insights into this cavity nesting specialist.

2.4: POPULATION ECOLOGY & TRENDS

SURVIVAL RATES OF HARLEQUIN DUCKS IN THE SALISH SEA, BRITISH COLUMBIA, AND THE EFFECTS OF CLIMATE AND FOOD

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Thousands of Harlequin Ducks (*Histrionicus histrionicus*) concentrate each spring over Pacific herring (*Clupea pacificus*) spawn at Hornby Island in the Salish Sea, British Columbia. We implemented a Bayesian capture-mark-resight (CMR) analysis to estimate apparent survival rates and re-sight probabilities of Harlequin Ducks marked and observed at least once in spring between 1993 and 2005 at Hornby Island. We incorporated a band wear (loss) function in the analyses to first correct for bias in apparent survival probabilities due to band wear. We then used the corrected estimates to examine how male and female apparent survival varied over time and in relation to banding location (Hornby, other coastal location, interior). We also tested whether apparent survival co-varied with several environmental indices including Pacific herring spawn, Pacific Decadal Oscillation (PDO), North Pacific Index (NPI) and sea surface temperature (SST).

Mean annual survival was 0.874 and 0.834, but declined by 1.4% and 0.7% annually for males and females, respectively. Survival was similar across banding locations and the only significant relationship between survival and the environmental indices tested was with PDO which was positively related to male apparent survival and explained 14% of the annual variance. While PDO was only influential for male survival, annual survival rates of males and females were correlated (r = 0.66) suggesting other factors influence the two sexes similarly across years.

Ecosystem management is an important approach for conservation of Harlequin Ducks in the Pacific Northwest because of the intense commercial fishery and history of stock collapses of Pacific herring. Demography and distribution of Harlequin Ducks, and likely other marine birds, are linked to this nutrient-rich food source, and vital demographic rates such as survival rate appear to be linked to climate, at least for males, and hence may be affected by climate change.

2.5: POPULATION ECOLOGY & TRENDS

POPULATION TRENDS IN PACIFIC COMMON EIDERS IN RELATION TO ANNUAL VARIATION IN ICE BREAK-UP OVER A 20-YEAR PERIOD

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The majority of Pacific Common Eiders breed in Western Canada, mostly in Amundsen Gulf, Dolphin and Union Strait, Coronation Gulf, and Queen Maud Gulf. Population and distribution data are sparse for this population with infrequent surveys conducted at Point Barrow, AK, and the central Canadian Arctic. This population was monitored on its main breeding sites in Bathurst Inlet and Queen Maud Gulf in 1995 and 2007-08 by Dickson and collaborators, and a reduction of approximately 50% of breeding pairs was noted between these two periods. We conducted aerial surveys within the Bathurst Inlet and Queen Maud Gulf areas during the egg laying period between 2014 and 2016 using methodology comparable to that used in previous surveys. The number of eiders detected was relatively stable over this period in Bathurst Inlet but they were more variable in Queen Maud Gulf, where ice conditions were also more variable. Long-term trends indicate that declines observed between 1995 and 2007-08 (approx. 50% decline) have not reversed but that the population may have stabilized. Declines appear to be more important within the Queen Maud Gulf area, which may be subject to more variable ice conditions that may limit its potential as breeding habitat. This area is predicted to undergo important reductions in ice thickness under current climate change models which could have impacts on breeding eiders. Short- and long-term trends will be discussed in relation to annual variation in ice break-up as well as long-term trends and projections related to climate change.

2.6: POPULATION ECOLOGY & TRENDS

APPARENT SURVIVAL OF ADULT FEMALE KING EIDERS WINTERING IN EASTERN AND WESTERN NORTH AMERICA

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King Eiders in North America winter either in Pacific waters in the northern Bering Sea and coastal regions of southern Alaska, or in Atlantic waters in coastal regions of southern Greenland, Newfoundland, and Labrador. Overlap in breeding distribution between winter populations occurs in the central Canadian arctic. We estimated apparent survival and encounter probability of adult females nesting at Karrak Lake, Nunavut (67º 14' N, 100º 15' W) south of Queen Maud Gulf, 2001-2012. We captured 358 unique breeding female king eiders on 847 occasions, and used a discriminant function with stable isotopic 15N and 13C ratios in head feathers to assign individuals to Pacific and Atlantic winter regions, with classification accuracy of 99% and 94%, respectively. We used inferred winter area as an effect on variation in apparent survival and encounter probability. Although 95% confidence intervals often included zero, apparent survival increased linearly over time in the first-ranked model (model weight, w = 0.41, B_{Time}=0.010 (95% CI: -0.003, 0.022)), remained constant in the second-ranked model (w = 0.22, intercept=0.873 (0.849, 0.897)), and increased over time (w = 0.18, B_{Time} = 0.009 (-0.003, 0.021)) with an additive effect of winter area (Pacific > Atlantic, effect size = -0.024 (-0.089, 0.040)) in the third-ranked model. Encounter probability was best modeled as annually variable with an additive effect of winter area (Pacific > Atlantic, effect size = -0.136 (-0.204, -0.068)). Assumptions inherent in Cormack-Jolly-Seber models support use of encounter probability as an index of breeding probability in this system. Weak evidence for lower apparent survival for the Atlantic population may be explained by higher harvest pressure in Greenland. Substantial support for lower encounter probability (i.e., breeding probability) for the Atlantic population may also be a result of harvest pressure that disturbs birds, or less favorable environmental conditions during winter, both of which may impede females from storing nutrient and energy reserves required for breeding.

3.1: PATTERNS OF DISTRIBUTION & ABUNDANCE

NOCTURNAL SPACE USE BY SURF SCOTERS (MELANITTA PERSPICILLATA) AND CRUDE OIL SPILL RESPONSE PLANNING IN THE SALISH SEA

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Sea duck movement, habitat use and population data are primarily collected during diurnal periods, constructing a biased understanding of their ecology and distribution. Diurnal distribution data currently guide conservation and management decisions regarding the recently declined population of surf scoters (*Melanitta perspicillata)* wintering in Puget Sound. To understand nocturnal distributions of surf scoters, our study 1) determined habitat characteristics of nocturnal use areas in the Salish Sea, 2) determined influencing factors of selection of nocturnal use, and 3) developed a predictive model to estimate likely nocturnal use areas across the Salish Sea and assess vulnerabilities to potential oils spills. We used surf scoter location data collected from Platform Terminal Transmitter (PTT) and various spatial layers in a GIS to identify habitat characteristics of nocturnal locations and to measure distances traveled between diurnal and nocturnal use areas. We developed a use versus pseudo-non-use resource selection design, using logistic regression, and Akaike's information criterion (AIC) to create a predictive model for nocturnal scoter presence in the Salish Sea. We found that distance to shore, water depth, tidal current and vessel traffic were strong predictors of nocturnal presence. In the Salish Sea, surf scoters will travel an average of 3,967 m between diurnal and nocturnal habitats, and mean distance traveled varied depending on local geography. Nocturnal use sites were characterized by greater distances from shore and deeper water; scoters avoided areas with strong tidal currents and heavy shipping traffic. These newly identified nocturnal habitat requirements expand on the knowledge of surf scoter winter ecology and provide sea duck management guidance in the Salish Sea, including information to improve oil spill response preparedness. These findings also highlight the need for a better understanding of the variation between nocturnal and diurnal habitat selection of other sea ducks to better inform management decisions for all sea ducks.

3.2: POPULATION ECOLOGY & TRENDS

EIDERS OF WRANGEL ISLAND, RUSSIA

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Several species of eiders nest on Wrangel Island, Russia. Spectacled and Siberian (Steller's) Eiders are rare species on Wrangel Island, but King and Common Eiders are common breeding species. King Eiders breed mainly on the lakes in the coastal plains of Wrangel Island and do not occur in the interior mountainous areas. Common Eiders nest everywhere throughout the island. Common Eiders are less numerous than King Eiders in the lake areas, but they occur frequently along rivers and streams into the mountainous areas, and can nest as far as 50 km from the sea coast. Common Eider nests can be solitary or in colonies containing hundreds of nests. Common Eiders favor nest locations near the nests of Snowy Owls. On Wrangel Island, no habitats are inaccessible to Arctic Foxes. Snowy Owls nest on the ground and defend their territories from terrestrial predators such as the Arctic Fox. Snow Geese, Black Brant, and Common Eiders are often found nesting colonially in these protected areas around Snowy Owl nests. Although waterfowl benefit by this protection from Arctic Fox, Snowy Owls prey on waterfowl and waterfowl nesting near them are sometimes in danger of being eaten by their protectors. This happens with Common Eiders in the years with a deficit of other prey for Snowy Owls, such as lemmings. The need for food by Snowy Owls sharply increases in early July after the young hatch. During this time, Snow Geese with their goslings are already leaving the nesting areas, but Common Eiders are usually still incubating. Common Eiders which nest earlier have higher survival. In years with low lemming numbers, Snowy Owls near nesting Common Eiders gain an advantage by using the Eiders and ducklings for food. Because of these factors, survival of Common Eiders nesting in colonies, as well as solitary nesters, is dependent on lemming numbers on Wrangel Island.

3.3: POPULATION ECOLOGY & TRENDS

DISTRIBUTION AND ABUNDANCE OF SEA DUCKS ALONG THE HUDSON BAY COAST OF NORTHERN MANITOBA

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Sea duck conservation is challenged with limited information on distribution, abundance and habitat use, particularly during the breeding, molt and migration periods. Recent research has highlighted the coastal waters of southern Hudson Bay and James Bay as important habitat for sea ducks. The Government of Manitoba identified the Seal River estuary on the Hudson Bay coast of Manitoba as an Area of Special Interest and a priority for protection based on an enduring features analysis. The Seal River is a designated Canadian Heritage River recognizing its natural, cultural and recreational values, and the estuary is an Important Bird Area based on a large number of Black Scoter recorded during spring migration. However, neither designation provides long-term protection. Our objective was to assess waterfowl use of this region to support designation of the Seal River estuary as a protected area and promote expansion of the boundary to include the adjacent Knife River delta and adjoining marine waters. During 2013 to 2015, we conducted aerial surveys of breeding waterfowl in coastal and adjacent terrestrial habitats surrounding Churchill. Survey coverage was approximately 4% of the region. We counted 22,617 total indicated birds over three years representing 25 species or species groups. Geese were most abundant (57%) followed by ducks (41%), nearly half (48%) of which were sea ducks (10 species). In 2015, we conducted additional surveys of near shore marine waters during the molt and migration periods. More than 6000 birds were recorded during 865 km of flying, approximately half of which were sea ducks. During all three sampling periods, sea duck density tended to be higher near the outlets of the Seal and Knife Rivers, particularly during the non-breeding period. Our results contribute to a growing understanding of this coastal region as an important area of biodiversity that merits designation as protected area.

3.4: POPULATION ECOLOGY & TRENDS

SOME HYPOTHESES BEHIND AN APPARENTLY COLLAPSING POPULATION OF COMMON EIDERS IN SW NEW BRUNSWICK

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Common Eiders wintering in Maritime Canada have declined from 45,000 in 2006, to 25,000 and 26,000 birds in 2012 and 2016, respectively. Breeding pairs in southwestern New Brunswick were stable between 8,000 to 11,000 from 1984 to 2005. However, declines of 3%/yr since 2005 resulted in only 3,500 pairs by 2014. Here we review data on nutrient dynamics, and prey densities collected during the non-breeding period in southwestern New Brunswick in the mid-1980s compared to information available today. Adult females were relatively fatter than adult males over the entire period. Size-corrected lipid mass of adult females increased from ~100 g in September to ~335 g in February, but then declined to ~ 185 g by March. Females caught during the pre-RFG period at a local colony had average lipid mass of ~ 360 g. In contrast, juvenile females had ~60 g more lipid than adult females in September, but were similar by December. Lipid of adult females continued to increase until February, while lipid in juveniles declined to about half that of adults. As well, no juveniles could be collected after February despite them being up to 5 times more vulnerable to the gun than adults, suggesting absence of juveniles from the study area. During the winter of 1986, there 35 million blue mussels estimated on a study area of 11,000 m^2. Fewer than 10 mussels were detected in the same area in 2016. We used a drone in summer, 2016, to assess mussel beds over a much larger areas but none were found. Adult females may no longer be able to acquire adequate resources to breed; or, juveniles to survive through winter. We speculate that lowered breeding probability and lowered juvenile survival are behind declines in recruitment responsible for the decline of eiders breeding and wintering in southwestern New Brunswick.

3.5: POPULATION ECOLOGY & TRENDS

REPRODUCTIVE SUCCESS OF LONG-TAILED DUCKS WINTERING IN THE BALTIC SEA

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Aerial and ship-based winter surveys have shown that the North European / West Siberian population of long-tailed duck, which mainly winters in the Baltic Sea, has decreased dramatically in numbers during the past 20 years. The decrease is most likely a result of extra anthropogenic mortality in combination with low reproductive success. Measures of juvenile proportions of wintering long-tailed ducks between 2008 and 2016 were obtained from analyses of photos of flying flocks. By this photo method, thousands of birds were sampled from boats in different parts of the wintering range each year. Three categories of birds were identified, i.e. adult males, juvenile males and females. The sex ratio of juveniles was assumed to be equal. The juvenile proportions varied between 4 and 25 % among years. The average level during the nine year period was too low to support a stable population. During five winters when comparisons were possible, the juvenile proportions were considerably lower in the southern than in the central Baltic Sea. The sex ratio of adult birds was also more male skewed in the southern part.

The main food of long-tailed ducks in winter and spring in the central Baltic Sea is blue mussels. The soft body content (condition) of blue mussels in spring was analysed. The condition of blue mussels varied greatly between years and sites but no clear relationship was found between the condition of blue mussels in spring and the reproductive success of long-tailed duck, measured as the juvenile proportion in the subsequent winter. To reverse the population trend one must reduce the known extra anthropogenic mortality, i.e. reduce operational oil pollution and modify ship routes, reduce bycatch in fishery and hunting mortality, as well as increase our understanding of large scale processes affecting the breeding sites in the Arctic.

4.1: POPULATION DELINEATION

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

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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

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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

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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

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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

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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

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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

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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

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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

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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

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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

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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

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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

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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.

7.1: ANNUAL CYCLE

ANNUAL CYCLE MOVEMENTS AND WINTER HABITAT USE OF WHITE-WINGED SCOTERS IN SOUTHERN NEW ENGLAND

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Migration phenology and the distribution of key breeding, molting and staging areas are poorly understood facets of sea duck biology. Additionally, concerns over the potential impacts of offshore wind energy on sea duck populations has led to an immediate need to better describe their distributions, habitat use and site fidelity, as well as develop spatial models that describe the relationships between environmental factors and sea duck habitat use in the offshore environment. The US government has established nine Wind Energy Area (WEA) lease blocks covering 4,724 km^2 along the Atlantic Outer Continental Shelf from Massachusetts to Virginia. These blocks are in areas that may provide important staging and wintering habitat for several sea duck species. We used satellite telemetry to determine the population linkages between wintering, breeding, and molting areas for White-winged Scoters (*Melanitta fusca*), as well as their resource selection and habitat use during winter in southern New England. In 2015 and 2016, 52 female White-winged Scoters were instrumented at wintering areas in Cape Cod, MA and Long Island, NY, and a molting location in Forestville, Quebec. Tagged birds migrated to breeding sites from eastern Manitoba to the Yukon, Canada, representing the westernmost breeding location from Atlantic wintering grounds. Wintering White-wings used four distinct pathways during their spring migration to breeding areas. Preliminary estimates suggest highly variable home range sizes during winter (31.9 to 4219.5 km^2) with little to no overlap with current offshore WEA lease blocks. This differs from Black Scoters (*Melanitta americana*) and Common Eiders (*Somateria mollissima*) in southern New England, which consistently utilized larger core-use areas during winter that overlapped with some WEAs. Ongoing analyses will focus on modeling probability of use and resource selection during winter in relation to important environmental parameters.

7.2: ANNUAL CYCLE

MIGRATION TRENDS FOR KING AND COMMON EIDERS PAST POINT BARROW, ALASKA

***Rebecca L. Bentzen**, Abby N. Powell, and Robert S. Suydam*

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Most of the king (*Somateria spectabilis*) and common eiders (*S. mollissima v-nigra*) nesting in northern Alaska and northwestern Canada migrate past Point Barrow, Alaska, during spring and fall migration. Spring migration counts have been conducted approximately every ten years at Point Barrow since 1976, and indicated that both eider species experienced population declines of approximately 50% between 1976 and 1996, and that the declines had stabilized by 2004. We conducted spring counts in 2015 and 2016 to obtain population estimates that can be compared with those from 1970s, 1996, and the early 2000s in order to evaluate long-term and current trends. Preliminary analyses indicate that 787,277 ± 49,750 (estimates ± 95% confidence intervals) and 322,292 ± 23,657 king eiders migrated past Point Barrow in 2015 and 2016, respectively. We estimate 98,121 ± 6,985 and 130,027 ± 5,601 common eiders migrated past in 2015 and 2016. Our estimates of the population of king eiders were very different (>50% difference) between the two years of the study, possibly due to a very short and intense migration peak in 2016 resulting in population count that is biased low due to sampling periods not adequately capturing the peak of migration. Spring counts of king eiders were also variable between years in the previous count (2003, 2004) and estimated numbers overlapped those estimated in this study. The numbers of common eiders were similar between the two years, as well as for the 12 years since the previous count. Such data are critically needed in order to assess conservation needs of these species, especially in the face of a changing climate and potential shifts in the timing of migration and impacts to populations of eiders.

7.3: ANNUAL CYCLE

SEASONAL AND ANNUAL DYNAMICS OF THE COMMON SCOTER *MELANITTA NIGRA* IN THE GERMAN NORTH AND THE BALTIC SEAS

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Up to a quarter of the Western Palearctic Common Scoter (*Melanitta nigra*) flyway population occur in the German waters of the North Sea as well as the Baltic Sea throughout the entire year, with both areas constituting important moulting and wintering grounds. The Research and Technology Centre (FTZ) has performed ship and aircraft based Seabirds at Sea (SAS) surveys in both areas since the 1990s and thus holds a comprehensive database with detailed information on the year-round distribution patterns of this species over several years. These distribution patterns revealed not only seasonal differences but also the occurrence of distinct concentration areas during specific periods (e.g. during the moulting season). As a result, we were able to derive detailed insights into temporal dynamics of this species in the SE North Sea, demonstrating a particular consistency for some regions. Recently, changes in the distribution in the SE North Sea could be observed with Common Scoters occurring further offshore and in deeper waters than earlier. These changes might have been caused by the ice winter in 2009/10 since several areas were ice covered and prey resources were not available anymore. Furthermore, a first analysis of selected environmental parameters such as sediment characteristics, water depth, and benthos community showed that there seems to be a strong connection between these factors and the distribution patterns. In this talk, we will demonstrate to what extent the species distribution can be explained by environmental factors.

7.4: ANNUAL CYCLE

SATELLITE TRACKING HIGHLIGHTS USE OF OCEAN HABITAT BY SURF SCOTERS IN FEDERAL WATERS OF THE US MID-ATLANTIC

***Alicia M. Wells-Berlin**, Jonathan L. Fiely, Suzanne J. Gifford, Andrew Gilbert, Lucas Savoy, Carrie E. Gray, Glenn H. Olsen, Caleb S. Spiegel*

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Offshore wind energy is one of the fastest-growing sectors of world energy development, offering a clean abundant source of electricity to meet demands. Offshore wind facilities may however impact many bird species, exposing them to increased mortality through turbine collisions, and by altering behavior and flight pathways. Several wind energy facilities are currently being planned for offshore U.S. Atlantic waters. To evaluate the potential impact on marine birds by wind turbines in Federal waters (>5.6 km from shore), there is a need to collect information on the distribution, seasonal occupancy and behavior (e.g., flight pathways timing, etc.) of a broad suite of birds in these areas. Our project evaluated the fine-scale occurrence and movement patterns of surf scoters (*Melanitta perspicillata*) in the near-coastal federal waters of the U.S. mid-Atlantic area (North Carolina to Long Island, New York). Kernel density estimations for both sexes of scoters showed that core-use areas during the wintering period encompassed the majority of both Chesapeake Bay and Delaware Bay, with additional smaller core-use areas occurring south of Cape Cod near Nantucket Shoals, in Long Island Sound, and in Pamlico Sound, NC. During migration scoters followed a route within 18.5 km of the Atlantic coastline to staging areas near the Gulf of St. Lawrence. Although surf scoters are not likely to be as heavily impacted by federally-managed wind facilities as other marine bird species, concurrent state-managed leases (<5.6 km offshore) may directly impact surf scoters through mortality and/or alter bird movements further offshore or in-land.

7.5: ANNUAL CYCLE

BEHAVIORAL RESPONSES OF COMMON EIDERS TO UNMANNED AIRCRAFT SURVEYS IN NORTHERN MANITOBA

Susan N. Ellis-Felege, *Andrew F. Barnas, Christopher J. Felege, Tanner J. Stechmann, Samuel D. Hervey, and Robert F. Rockwell*

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Unmanned aircraft vehicles (UAVs) are relatively new technologies gaining popularity among wildlife biologists. As with any new tool in wildlife science, operating protocols must be developed through rigorous impact testing to avoid potential biases. Some studies have anecdotally characterized behavioral responses of birds to UAV surveys, but a robust quantification of any such impacts is lacking in the literature. We evaluated UAV-induced behavioral responses of nesting common eiders (*Somateria mollissima*) in Wapusk National Park, Manitoba, Canada. Using a Trimble UX5 fixed wing aircraft in 2016 we flew over 7 nests and did not fly over 2 control nests. We recorded eider behaviors using miniature 24-hour video surveillance cameras. Video was reviewed 30 minutes before a UAV flight, during a flight, and 30 minutes after landing to fully capture procedures associated with a flight period. We quantified behaviors as bird on or off the nest, and if the bird was on the nest as vigilant, sleeping, or engaging in nest. At an additional 5 nests we used trail cameras and time-lapse photography to determine if eiders were in attendance during overhead UAV flights and compared attendance patterns to 5 nests without UAV flights. Our results suggest birds notice the UAV flying over, but this does not appear to influence rates of nest attendance or more importantly nest success. We found no influence of altitude at 75 m, 100 m or 120 m above ground level. Results from this study can be used to inform best practices for unmanned aircraft surveys, and highlight the need for species-specific impact assessments before using a UAV for wildlife studies.

8.1: FORAGING & ENERGETICS

A TALE OF TWO OVERWINTERING SITES: INFERING OVERWINTERING ORIGINS OF A DIVING SEA DUCK USING STABLE ISOTOPES

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It is well-appreciated that the outcome of one life history stage can impact investment or state during subsequent life history stages. However, the ability to follow individuals from one life history stage to another to measure these impacts can often be difficult. Although advances in tracking technologies (Satellite, GPS) can allow for the spatial monitoring of individuals across time, less invasive and less expensive techniques which do not require the recapture of individuals may be preferable. In this study, we aimed to investigate the effectiveness of measuring the stable isotopes of carbon, nitrogen and hydrogen in blood and claw tissue to assign overwintering location for common eiders breeding at East Bay Island, NU. Eiders breeding at East Bay are an ideal system to test these analytical questions because they have been shown to overwinter in two geographically distinct locations; approximately two-thirds of the breeding population overwinter near Nuuk, Greenland and one-third overwinter near Newfoundland and Labrador, Canada. We took a multi-isotope approach to best characterize and distinguish between the two overwintering groups using blood and claw samples from eiders overwintering near Newfoundland and Nuuk during the winter of 2014. We predicted that we would be able to differentiate between our two groups of birds based on geographically distinct differences in freshwater run-off (hydrogen-2), nutrient deposits (nitrogen-15), plant species and diversity (carbon-13). The two overwintering groups indeed exhibit distinct stable isotopic signatures of carbon, nitrogen and hydrogen, consistent with our predictions. To our knowledge this is the first instance of this technique being effectively used on a sea duck at this scale. Our research demonstrates that it is possible to assign sea ducks to their overwintering grounds upon arrival to their breeding colony.

8.2: FORAGING & ENERGETICS

ASSOCIATING SEA DUCKS WITH COASTAL HABITATS IN BRITISH COLUMBIA

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The Canadian Wildlife Service and Ducks Unlimited Canada have been collaborating to produce models to define and predict the habitat use of sea ducks along the British Columbia (BC) coast, an ecologically diverse area which supports significant numbers of at least 10 sea duck species. Several of these species are of conservation concern, but we still lack knowledge of their distributions and important habitat attributes.

Each constructed model has three components:

1. 'ShoreZone' habitat mapping dataset, consisting of physical and biological mapping systems, collected by the Province of BC. This dataset has near complete coverage for BC.
2. BC Coastal Waterbird Survey (BCCWS) dataset collected by Bird Studies Canada for a limited portion of the coastline that provides waterbird abundance.
3. Supplementary habitat datasets collected from other sources, with variable coverages.

We built habitat use models for four species in the "R" statistical modeling environment, using mixed-effects compound Poisson models with cross-random effects. Bufflehead, Red-breasted Merganser, White-winged Scoter and Surf Scoter were chosen to cover a range of habitat use patterns. Fifty-five potential models were generated using combinations of predictor variables representing food, shelter and safety, and best models were selected using an AIC Approach. The best models included information from a range of characteristics, including physical substrate type, food sources, magnitude of freshwater input, bathymetry, and shelter-associated features. Explanatory formulae were then used to predict the abundance of those four species in BC coastal areas not covered by the BCCWS surveys, to help prioritize areas for conservation actions. Predictions are being validated through comparisons to other independent datasets. There is potential to expand this approach to Alaska, Washington and Oregon, which also have ShoreZone data, and to collaborate with other west coast modeling efforts to improve management of sea ducks at a larger scale.

8.3: FORAGING & ENERGETICS

THE IMPORTANCE OF MARINE RESOURCES FOR BREEDING SPECTACLED EIDERS: INSIGHTS FROM FATTY ACID ANALYSIS

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Spectacled eiders winter and stage in marine habitats, and their breeding outcome likely depends on the availability of adequate prey resources. However, information about timing and sources of critical nutrient acquisition to reproduction is lacking for this threatened eider species. We used quantitative fatty acid signature analysis (QFASA) to estimate the diets of spectacled eiders breeding on the Yukon Delta, Alaska in 2008, and on the Arctic Coastal Plain, Alaska in 2009 and 2010. As expected, diet upon arrival to breeding grounds and through the early breeding season comprised of marine food items consistent with prey found at their wintering area in the Bering Sea (amphipods, *Macoma spp., Nereis. spp., Nuculana belloti* and *N. radiata*). The proportions of these diet items varied between years, which likely reflected the interannual variability in the availability of these marine food items. As the breeding season progressed (3-4 weeks later) marine fatty acids from the wintering grounds continued to dominate in adult eider adipose tissue (89%-92%) along with smaller proportions of freshwater and terrestrial food items in their diets (8%-11%). These results indicate that nesting adult eiders used mainly endogenous reserves acquired from their marine wintering grounds but also foraged at their breeding sites. In contrast, 64% of duckling diets in 2010 consisted primarily of freshwater food items. The remaining 36% of duckling FAs came from marine sources, likely from maternal input during embryo development. We provide the first empirical evidence suggesting the predominate use of capital breeding strategies in spectacled eiders in Alaska, thus furthering the importance of marine non-breeding areas as critical habitat for reproduction.

8.4: FORAGING & ENERGETICS

DISENTANGLING DRIVERS OF DECLINE USING TIME TRAVELLING MUD; THE CASE OF THE COMMON SCOTER (MELANITTA NIGRA) BREEDING IN BRITAIN

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Common scoter (*Melanitta nigra*) breeding in the UK have declined by approximately 50% in the last 20 years making it a priority species for conservation. However, competing hypotheses for the decline are impossible to disentangle without an understanding of long term environmental change. Breeding at isolated, oligotrophic lakes, there is a paucity of long term environmental monitoring data available. This study utilises lake sediment cores to fill this gap in knowledge by reconstructing decadal-scale environmental change at 18 breeding lakes in the Flow Country, Scotland, an important stronghold for common scoter in Britain. Set in a mixture of landscape settings, half of the 18 sites continue to support breeding scoters whilst the remainder demonstrates significant reductions or total losses of breeding populations. Multi-proxy analysis of the dated sediment cores included diatoms, chironomid and macrofossil remains; these remains provide both direct evidence of the communities present and can also be used to establish water chemistry and climate related changes using well established transfer functions. Top-bottom analysis of the 18 cores demonstrate that communities inhabiting these lakes have changed dramatically in recent times; resulting in divergence of community structure, suggesting a range of drivers impacting these systems, which were originally relatively homogeneous. Analysis of wide-bore cores from four of these lakes provides a fine resolution view of ecological change suggesting major changes in scoter habitat over the last 20-50 years, potentially linked to anthropogenic pressures including afforestation, fishery management and climate change. This study demonstrates that the conservation management of rare and declining duck species, such as Common Scoter, can be greatly assisted by a long-term palaeolimnological perspective.

8.5: FORAGING & ENERGETICS

LIMITS TO BENTHIC FEEDING BY EIDERS IN A VITAL ARCTIC MIGRATION CORRIDOR DUE TO LOCALIZED PREY AND CHANGING SEA ICE

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Four species of threatened or declining eider ducks that nest in the Arctic migrate through the northeast Chukchi Sea, where anticipated industrial development may require prioritizing areas for conservation. In this nearshore corridor (10 to 40 m depth), the eiders' access to benthic prey is restricted to variable areas of open water within sea ice. For the most abundant species, the king eider (*Somateria spectabilis*), stable isotopes in blood cells, muscle, and potential prey indicate that these eiders ate mainly bivalves when traversing this corridor. Bivalves there were much smaller than the same taxa in deeper areas of the northern Bering Sea, likely due to higher mortality rates caused by ice scour in shallow water; future decrease in seasonal duration of fast ice may increase this effect. Computer simulations suggested that if these eiders forage for >15 h/day, they can feed profitably at bivalve densities >200 m^{-2} regardless of water depth or availability of ice for resting. Sampling in 2010–2012 showed that large areas of profitable prey densities occurred only in certain locations throughout the migration corridor. Satellite data in April–May over 13 years (2001–2013) indicated that access to major feeding areas through sea ice in different segments of the corridor can vary from 0–100% between months and years. In a warming and increasingly variable climate, unpredictability of access may be enhanced by greater effects of shifting winds on unconsolidated ice. Our results indicate the importance of maintaining a range of potential feeding areas throughout the migration corridor to ensure prey availability in all years. Spatial planning of nearshore industrial development in the Arctic, including commercial shipping, pipeline construction, and the risk of released oil, should consider these effects of high environmental variability on the adequacy of habitats targeted for conservation.

8.6: FORAGING & ENERGETICS

MARINE NUTRIENT SUBSIDIES TO THE TERRESTRIAL ENVIRONMENT OF COMMON EIDER NESTING COLONIES IN THE CANADIAN ARCTIC

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Nutrient fluxes across ecosystem boundaries can have pronounced effects on ecosystem dynamics, but these interactions can be difficult to untangle in complex systems. Island systems are ideal places to study nutrient subsidies as they have finite bounds and are separated by physical space. In particular, the arctic island archipelagos of Hudson Strait are severely nutrient limited, mostly undisturbed, and have been surveyed historically since the 1950's. This area harbors many species of seabird, including the Common Eider (*Somateria mollissima*), which nests in large colonies on offshore islands in this region. Through foraging on benthic invertebrates and returning to these colonies, these birds may be providing marine nutrients to the terrestrial environment of their nesting islands through excretion, with possible large-scale bottom-up consequences on primary productivity, trophic structure, and overall biodiversity. Using freighter canoes and local Inuit guides we sampled vegetation, soil, and invertebrates on 25 islands and 6 mainland sites in the areas near Cape Dorset, Nunavut and Ivujivik, Quebec over two summers (2014-15). Using stable isotope techniques, transect data, and paleolimnological records, we show the extent and level of nutrient subsidies to these colony islands is substantial, and has the potential to have ecosystem-level effects. The Common Eider is a local and internationally relevant species that is harvested across the Canadian Arctic that is facing increasing predation pressure from Polar Bears (*Ursus maritimus*) due to cascading effects of climate change. This increase in predation has the potential to reduce or interrupt this transfer of nutrient rich material from ocean to land, with possible landscape-scale effects on ecosystem function and structure.

9.1: BREEDING ECOLOGY

PHYSIOLOGICAL MECHANISMS DRIVING FORAGING, FATTENING AND BREEDING PHENOLOGY IN AN ARCTIC SEADUCK

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Reproduction is an energetically demanding life history stage in which individuals must carefully manage energetic resources to maximise their reproductive success. Species reliant on capital stores for reproduction are under a unique set of energetic constraints because they must accumulate substantial fat stores prior to reproducing; however, the underlying mechanisms influencing the accumulation of resources are currently poorly understood. Corticosterone (CORT) is an energetic hormone that influences resource acquisition and management, making it a strong candidate mechanism linking foraging behaviour, resource acquisition, and reproductive decisions. We manipulated baseline CORT or implanted females with a control while simultaneously deploying GPS units in free-living Arctic-nesting common eiders (*Somateria mollissima*), a mixed capital-income breeding strategy species. Using these GPS units we were able to quantify foraging behaviour (i.e., diving rate, average dive duration) and follow our hens through to reproduction to determine the indirect, reproductive effects of baseline CORT elevations on reproductive phenology. Results from this study combined with previous work in seaducks suggests that elevated baseline corticosterone prior to investment in reproduction has a direct positive impact on resource acquisition and play a strong mechanistic role in driving variation in key life history decisions *via* influences on foraging in diving seaduck species. Additionally, testing these mechanistic relationships will provide researchers with the predictive capacity to understand how physiology may affect adaptability of Arctic-breeding species, particularly those facing increasing climatic variability in polar regions.

9.2: BREEDING ECOLOGY

STATE-DEPENDENT ALLOCATION STRATEGIES IN COMMON EIDERS: AN EARLY WARNING SYSTEM FOR FOOD-WEB CHANGES?

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To predict how the breeding success of migrating birds responds to changes in food availability during any part of their annual cycle it is crucial to understand the relative importance of nutrients derived from feeding on breeding vs. nonbreeding grounds to the formation of eggs. Species-specific strategies for financing the costs of reproduction are well understood, forming a continuum ranging from high to low reliance on stored nutrients. The role and adaptive value of individual variation in these strategies remain elusive. Life-history theory posits that capital breeding should be favored when offspring reproductive value peaks, typically early in the season, and that current income should increasingly be used with progressing season. Because resource limitation may hamper flexible resource allocation, a corollary prediction is that only good-condition individuals may show the expected seasonal shift in resource use. We set out to clarify i) the contribution of endogenous and exogenous nutrients to yolk and albumen of eider eggs, and ii) the role of individual variation in the use of endogenous and exogenous protein when producing eggs. Our results show that egg albumen is produced almost solely from local diet whereas yolk is produced from a varying mixture of endogenous and exogenous nutrients. Studying the mixed origins of yolks revealed, for the first time, that individuals from a single population differ in their utilization of stored reserves and concurrent intake to finance the costs of reproduction. Heavy females predominantly used stored reserves for producing egg yolks early in the season, increasingly relying on local feeding with later onset of breeding, whereas light females showed no seasonal change in allocation strategy. Stable isotope profiling at the individual level is a powerful tool for monitoring relative changes in investment strategies through time, showing promise as an early warning indicator of ecological change in food webs.

9.3: BREEDING ECOLOGY

NEST SITE SELECTION IN ICELANDIC COMMON EIDERS

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A long-term banding project on breeding common eiders (hereafter eider; *Somateria mollissima*), in Breiðafjörður, West Iceland began in 2015. This project is collaboration with local eiderdown farmers, some of which participate in the banding effort. Objectives are to quantify individual variation in nest site selection and faithfulness, phenotypic variation, and to evaluate interrelationships of these parameters. The project includes 7 nesting islands, which vary in landscape, and avian/mammalian predator presence/absence. Eiders are caught with pole-nooses, weighted, and measured for body size with a caliper (head length, wing length, tarsus and culmen). Photographs of females are used to classify plumage color variation. There are at least 5 nest habitat types in the study area, each of which differs with respect to camouflage background coloration: 1) Shoreline; 2) Adjacent to rocks; 3) Hilltops with vegetation (sedges, grass, forbs or crowberry), common but the only nest sites in the islands which are inhabited by American mink. 4) Marshes, on tussocks or under willow brushes. 5) Hidden nests. In 2016, 204 females were color-banded and 46 of those with geolocators from the SEATRACK project. In 2015, 200 females were banded with color markers and 32 of those with geolocators. In 2014, 37 females were banded with geolocation devices. Recovery rates of geolocators were 63% in 2016 and 57% in 2015. Of 109 recovered or resighted (55%) females in 2016, only 3 females (3%) switched nesting islands but within-island relocations were common. Although females generally were nest site-faithful, nest movements up to 921 meters were observed between years, with much variation among islands: the smallest and largest island-specific medians were 7 m and 72 m, respectively. Two females were caught on second nests following nest depredation. In 2017, we plan to add four islands to the banding effort for improved coverage of the study population.

9.3: BREEDING ECOLOGY

SOURCES OF NUTRIENTS TO INCUBATING SEA DUCKS: THE ROLES OF MARINE AND FRESHWATER INPUTS

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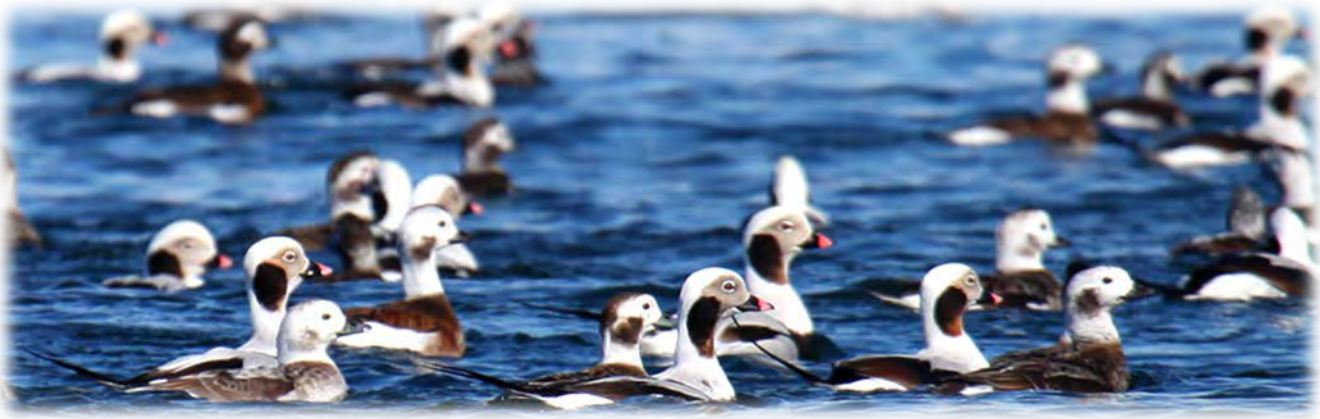
Waterfowl have varying breeding strategies related to body mass, from income breeding to capital breeding. In smaller species, females are expected to rely heavily upon locally available nutrients to produce eggs as well as sustain themselves through incubation. In larger species, nutrients used for egg production may be of varying local and non-local sources, with females sustaining themselves largely on stored reserves. The sources and quality of nutrients, therefore, may have important impacts on productivity of some species. Sea ducks may rely on both marine foods via stored reserves, or on freshwater foods from breeding areas, but the relative contributions of these sources may vary with body size. We measured carbon and nitrogen isotope ratios of egg membranes of long-tailed ducks and Steller's, spectacled, and king eiders at Barrow, Alaska in 2013 and 2014. We compared those ratios using linear mixing models to those of potential marine and freshwater prey in a variety of habitat types. Isotope ratios differed among species, and were closely associated with marine sources in larger spectacled and king eiders, and with freshwater sources in smaller long-tailed ducks and Steller's eiders. However, differences were apparent in the types of prey used, and their relative contributions to nutrients used for egg production. These data demonstrate differential use of habitat in sympatric species, as well as provide a framework for prioritizing conservation of l foods needed for successful reproduction. Changing climate in the Arctic may cause preferred prey groups to decline, potentially limiting forage quality for some sea duck species.

POSTER ABSTRACTS



10.01: POSTER PRESENTATION

FACTORS AFFECTING THE DISTRIBUTION AND NUMBERS OF WINTERING SEA DUCKS IN THE EASTERN PART OF THE BALTIC SEA

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The Baltic Sea is one of the largest brackish water bodies in the world, which is known to be supporting nearly three million sea ducks during the non-breeding season. This study focuses on the less known eastern part of the Baltic – marine waters of Latvia and Estonia. Previous surveys indicated that large numbers of Long-tailed Ducks *Clangula hyemalis* as well as Velvet Scoters *Melanitta fusca* and Black Scoters *M. nigra* use these areas for wintering, however, none of these earlier surveys covered the whole area. The survey took place in February 2016. Field transects were chosen so that they would cover the whole study area – every 3km in the shallow parts and every 6 or 8 km in the deepest parts. Line transect plane surveys with distance sampling were used for data collection. The total length of transects was more than 11,500 km. Eco-geographical variables such as depth, water temperature, salinity, water velocity, availability of different bottom substrates, shipping intensity and others were collected both for the transect segments and cells of the 1-km prediction grid. Different combinations of the variables were tried in the GAM models to explain the recorded distribution of the seaduck species. The obtained GAM models allowed describing habitat preferences and were used for prediction to create density distribution maps and estimate population size for analyzed species and species groups. The abundance of seaducks in winter 2016 was lower than before in most of the sites, however, new concentration hotspots were discovered in previously surveyed areas. The obtained distribution maps were used to identify potential gaps in the current network of Marine protected Areas.

10.02: POSTER PRESENTATION

COMMUNITY-BASED MONITORING OF KING AND COMMON EIDER NEAR ULUKHAKTOK, NT, DURING SPRING MIGRATION

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Climate change is having widespread impacts on natural and human systems. These impacts are most acute in the Arctic, and marine and freshwater ecosystems are predicted to be the two systems most affected by climate warming in this region. Inuit are experiencing these changes first hand and they are concerned about the effects these changes will have on their subsistence culture. Eiders are more closely associated with the arctic and with sea ice than most other avian taxa. Numbers of King and Common Eider have declined substantially in recent decades. Loss of sea ice, altered foraging conditions, overharvesting, and accumulation of heavy metals are suggested potential mechanisms. We partnered with the community of Ulukhaktok, NT, in 2016 to survey eider passing the community during spring migration, and to quantify the level of mercury contamination in King Eider. Large numbers of eider, particularly King Eider, pass Ulukhaktok during spring migration and significant numbers are harvested annually. Community members are concerned about the availability of eider and what contaminants they may contain. Our goals are to 1) estimate numbers of King and Common Eider passing Ulukhaktok during spring migration, 2) compare current abundance and phenology to a previous survey conducted in the mid-1990's, 3) quantify mercury levels in King Eider, and 4) evaluate wintering location factors contributing to variation in mercury levels within the local southwestern Victoria Island population, and within a regional/continental population by comparing results from a concurrent study at Karrak Lake, NU, where the local King Eider population winters in both Pacific and Atlantic water. This study will provide information on the numbers of eider available to local harvesters, and insights into variation in contaminant exposure that should prove useful in evaluating potential risk factors to eider populations and subsistence hunters.

10.03: POSTER PRESENTATION

IMPACT OF A MID-SUMMER STORM SURGE ON COMMON EIDERS NESTING ON BEAUFORT SEA BARRIER ISLANDS

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In a recent climate change vulnerability assessment of birds breeding on Alaska's North Slope, Pacific common eider (*Somateria mollissima v-nigrum*) were reported to be the highest-risk waterbird, largely due to potential overwash of nests from forecasted sea-level rise and increases in storm surges. To address this risk, the Arctic National Wildlife Refuge and the University of Alaska Fairbanks began a study in 2014 to determine how flooding may impact the population breeding on the Beaufort Sea barrier islands along 120 miles of the Arctic Refuge coastline. We located nests by visiting the islands by boat, then monitored nests with time-lapse cameras and revisited nests to determine fate. We also used high resolution GPSs to determine the height of nests relative to mean sea-level. Summer 2016 was characterized by unusually low snow extent and record low Arctic sea ice in mid-June. On July 18, 2016, a storm lasting 36 hours with winds building to 39 mph led to a surge that brought water levels 1.12 m above mean sea-level and resulted in the inundation of most common eider nests on the islands. Although storm surges have been observed in the region during late summer and fall, we are unaware of an event of this magnitude occurring in mid-July, a period when most common eiders are still incubating. Model predictions suggest that wave heights and storm surges will continue to increase as the sea ice retreats in response to a warming Arctic, placing the barrier island nesting population of eiders at an increasing risk in the future.

10.04: POSTER PRESENTATION

INTER-SPECIFIC POPULATION DYNAMICS OF THE COMMON GOLDENEYE AND BARROW'S GOLDENEYE

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Some of the highest rates of hybridization occur in waterfowl (Order *Anatidae*). Within sea ducks, interspecific gene flow is thought to be most prevalent within the goldeneyes (*Bucephala spp.)* as hybrids have been described from all areas of contact. Barrow's (*B. islandica*) and Common (*B. clangula*) goldeneyes engage in reciprocal nest parasitism, resulting in nests containing eggs of both species. Social ontogeny has been shown to constrain species-recognition abilities, potentially leading to misdirected mating efforts (i.e. hybridization) and interspecific gene flow. Common Goldeneye has a Holarctic distribution and Barrow's Goldeneye is primarily restricted to western North America, but they occur sympatrically in the boreal forest of British Columbia. These species' reciprocal nest parasitism, coupled with the general observation of male biased sex ratios within waterfowl (i.e. unpaired males will be present), led us to hypothesize that gene flow, if any, should occur symmetrically in areas where the two species are codistributed. Using ddRAD-seq data, we examined inter-specific genetic variation between Barrow's (n = 30) and Common (n =34) goldeneyes. Based on 4315 autosomal and 232 Z-linked loci, we uncovered strong differentiation between species (global autosomal Φ_{st} = 0.53; global Z-linked loci Φ_{st} = 0.67) and identified one putative male F1 hybrid captured in British Columbia with assignment probability of 55% as Barrow's and 45% Common goldeneye. Detection of a F1 hybrid in this locale verifies that cross-species gene flow does occur, although given the high level of differentiation observed between species it is likely relatively uncommon. Alternatively, F1 hybrids may suffer some reduction in fitness (e.g. via sexual selection).

10.05: POSTER PRESENTATION

DABBLING DUCK MOVEMENTS: FROM SUISUN MARSH AND BEYOND

***Michael Casazza**, Joshua Ackerman, Joseph Fleskes, Susan De La Cruz, Cory Overton, Mark Herzog, Christopher Hartman, Cliff Feldheim, John Eadie, Caroline Brady, Jeffrey Kohl, Desmond Mackel, Mason Hill, Fiona McDuie*

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Suisun Marsh is the largest estuarine marsh (48,000 ha) on the Pacific Coast of the coterminous United States and offers an unparalleled opportunity to observe the movements and resource use of sympatric dabbling and diving duck species. Beginning in 2015, we have tracked 5 species of waterfowl in Suisun Marsh using 17 gram Ecotone® GPS transmitters that communicate using the cellular (GSM) network. To date we have marked 268 individuals including five dabbling duck species; Mallard (*Anas platyrhynchos)*, Northern Pintail (*Anas acutas*), Gadwal (*Anas strepera*), Northern Shoveler (*Anas clypeata*), and American Wigeon (*Anas Americana)*. To date we have collected over a half million locations and followed individuals as they move within California during the winter, and in North America through both spring and fall migrations. Three individuals have been tracked for more than 500 days and the longest movement track is over 18,000 kilometers. Each species generally demonstrates specific movement processes. Locally breeding Mallards and Gadwall typically complete a post-breeding migration to molt in the Klamath Basin. Northern Pintail emigrate north, mostly to the Prairie Pothole region of the north-central US and south-central Canada. The varied habitats present Suisun Marsh during the winter create a hub of co-occurring species that serves as the terminus of autumnal migration.

10.06: POSTER PRESENTATION

CHARACTERIZATION OF IMMUNE FUNCTION IN STELLER'S EIDERS

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The Alaska breeding population of Steller's eiders (*Polysticta stelleri*) was listed as threatened under the Endangered Species Act due to declines in their numbers and nesting habitat. The Alaska SeaLife Center maintains a captive population of Steller's eiders and their offspring are being used by USFWS to reintroduce the species to the Yukon Kuskokwim Delta. It is important that the immunocompetence of captive bred eiders is similar to wild eiders; therefore, this study compared the immune function of captive and wild bred eiders that are housed at ASLC. Twenty males from four different age classes were included in the study. This project had three objectives: 1) measure various immune biomarkers to assess immune function, 2) compare immune function among the different age classes, and 3) determine if immune function varied between captive and wild eiders. We hypothesized that immunocompetence would vary among age classes, but not between wild and captive bred birds. Multiple biomarkers were used to characterize immune function including: total and differential white blood cell count, immunoglobulin G and total protein content of serum, T and B cell immunoreactivity and glutathione levels. Nine year old and second year male eiders had significantly higher immune activity than hatch year and males older than 13 years. Immune function appeared to be influenced primarily by age and not whether the eider was captive or wild bred. This study provided a baseline of the immunocompetence of captive male Steller's eiders at ASLC by evaluating various aspects of their immune function.

10.07: POSTER PRESENTATION

CLUTCH SIZES OF THE SPECTACLED EIDER ON THE YUKON DELTA NATIONAL WILDLIFE REFUGE, ALASKA

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The spectacled eider (*Somateria fischeri*) breeds along the coasts of the Bering and Chukchi seas in western and northern Alaska and northern and eastern Russia. Spectacled eiders nesting on the Yukon-Kuskokwim Delta have been in decline since the 1970s (Stehn et al. 1993, Arctic 46:264) and were listed by the U. S. Fish and Wildlife Service as a threatened species in 1993. Listing prompted basic biological research and systematic surveys in Alaska to monitor Yukon-Kuskokwim Delta spectacled eider subpopulations. Recent survey results indicate that the Yukon-Kuskokwim Delta subpopulation may be close to meeting the minimum population benchmark of ≥ 6,000 breeding pairs to be de-listed. Dau (1976, Wildfowl 27:111) noted that nesting patterns of spectacled eiders on the Yukon-Kuskokwim Delta appeared to be dictated by the timing and duration of the spring break-up period. Dau reported a reduction in mean clutch size in females who initiated later within the same season. Stehn et al. (1993) provided information on clutch sizes from random plots throughout the Yukon-Kuskokwim Delta from 1965-1992 while the population was in decline. We plan to look at clutch sizes of spectacled eiders nesting on Kigigak Island on the Yukon-Kuskokwim Delta, Alaska from 1991- 2012 while the subpopulation was beginning to increase. Our objectives were: 1) to compare clutch sizes within and between years, and 2) to compare effects of laying date on clutch sizes.

10.08: POSTER PRESENTATION

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

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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 die-off 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.

10.09: POSTER PRESENTATION

MIGRATION PATTERNS, HABITAT USE, FOOD HABITS, AND HARVEST CHARACTERISTICS OF LONG-TAILED DUCKS WINTERING ON LAKE MICHIGAN

Luke J. Fara*, *Kevin P. Kenow, Michael W. Eichholz, and Steven C. Houdek*

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Recent aerial surveys indicate that Lake Michigan supports a considerable number of wintering long-tailed ducks (*Clangula hyemalis*). For example, a December 2013 survey tallied over 18,000 long-tailed ducks (LTDUs) along 2,400 km of transects. Ranking high in priority with the Sea Duck Joint Venture, LTDUs have been a focal species in a large-scale wintering telemetry project in the Atlantic and Great Lakes regions to address information needs concerning population delineation, migration, and ecology. While a large effort has been placed on radio-marking LTDUs during 2007-2013 on the Atlantic coast and Lake Ontario, the effort has not yet included Lake Michigan. Additionally, hunter harvest of LTDUs has increased since 2002, and forage base has likely changed due to invasive species. We will implant adult female LTDUs wintering on Lake Michigan with satellite transmitters to determine temporal and spatial patterns of migration, breeding ground affiliations, and site fidelity. We will conduct a voluntary boat launch survey on Lake Michigan to assess LTDU harvest, determine harvest rates, species composition, and sex ratios. We will use a combination of hunter harvested LTDUs and Next Generation Sequencing of fecal DNA to determine and assess changes in LTDU diet. Results of the study will aid managers as they deal with outbreaks of type-E avian botulism, near and off-shore wind energy development, and assessment of hunter regulations. Preliminary results of one or more of these will be presented.

10.10: POSTER PRESENTATION

USING THERMAL IMAGERY AND "JUDAS" BIRDS TO INCREASE CAPTURE OF LONG-TAILED DUCKS ON LAKE MICHIGAN

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Locating and capturing long-tailed ducks (*Clangula hyemalis*) and other pelagic waterbirds at night is difficult on large bodies of water, such as the Great Lakes, particularly when there is little knowledge on the locations of night-time distributions. To increase capture opportunities, two approaches were utilized to supplement our knowledge of LTDU distribution on Lake Michigan. Aerial thermal imagery was used to locate flocks at night and guide capture crews on the water. Additionally, a subset of transmitters (n = 5) programmed to transmit at noon and midnight, were deployed on males, termed "Judas" birds, to document diel movements. By utilizing these methods, capture was increased from 0.16 birds per hour (0.83 birds per night) to 0.42 birds per hour (2.10 birds per night).

10.11: POSTER PRESENTATION

CO-CULTURE OF BLUE MUSSEL (*Mytilus edulis)* AND SUGAR KELP (*Saccharina latissima)*: EXPLORING THE POTENTIAL EFFECT OF SEAWEEDS IN DETERRING THE EFFECT OF DUCK PREDATION ON MUSSELS, CASCAPEDIA BAY (QC, CANADA)

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In Europe and Canada the economic losses in blue mussels (*Mytilus edulis*) farms due to duck predation represent a major problem. In this project, an alternative approach will be presented to reduce duck predation passively in mussel farms as traditional techniques are generally neither effective, cost efficient nor without any impact on ducks. These methods are generally focusing on protecting mussels by isolating them (net, protective socks, cages…), using passive repellent (mannequins, mirrors, corpses…) or active repelling techniques (sound, light, chase, lethal force…). These techniques were found to be generally expensive, prone to habituation, potentially stressful to duck populations and often do not take in consideration ice cover. To solve this problem, the presented project intends to introduce sugar kelp (*Saccharina latissima*) in co-culture over a mussel floating line, to visually shield the mussels. We hypothesize that by hiding the mussels from the ducks vision field, it will protect the mussels without imposing further stress on the ducks. Additionally, it is expected that the sugar kelp and blue mussels could benefit from the spatial proximity in terms of production, consumption and excretion. On the farm production, such design, allowing a circular economy where the repellent is also a product, could ease the losses recovery while developing a polyculture model for the farmers. During spring, visual observation of the migrating flock will be made to insure the validity of the test based on the occurrence, the length of stay, the species present as well as duck general behavior around the experimental design. Between April and May 2017, the resulting growth (biomass \ meter), survival rate (density \ meter) and overall quality (Body condition Index) of the mussel will be assessed and compared to a neighbouring empty line without kelp and to another line carrying artificial kelp made of polypropylene sheets.

10.12: POSTER PRESENTATION

EVALUATION OF PRE- AND POST-SURGICAL LACTATE LEVELS IN LONG-TAILED DUCKS (*CLANGULA HYEMALIS*) AS AN INDICATOR OF HYPOXEMIA

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Blood lactate is a biochemical parameter that is known to increase when an organism undergoes anaerobic metabolism, which can be seen in cases of exertional myopathy, mechanical obstruction as well as in other stressful events. During a recent field capture event of long-tailed ducks (*Clangula hyemalis*) in Nantucket Sound, MA, blood lactate levels were assessed using a point-of care analyzer both prior to surgery and prior to release. Results from this study can be utilized to develop novel balanced anesthesia protocols to mitigate the adverse effects associated with field surgery and improve survival outcomes post release and can also direct future research into the value of lactate as a marker of organism stress.

10.13: POSTER PRESENTATION

EVALUATING MOVEMENT PATTERNS AND HABITAT NUANCES OF WINTERING DIVING DUCKS

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Methods to evaluate habitat use and localized movements by diving ducks is complicated by concerns over adverse effects of externally-mounted tracking devices, thus limiting the spatial resolution of inference for these species. However, regional and sub-bay connectivity within the San Francisco Bay-Delta system is presently undocumented, but represents a region of species-specific ecological needs occurring within a mosaic of habitats. The goal of this project was to test emerging technologies for evaluating wintering diving duck movements and habitat associations in the San Francisco Bay-Delta region. During the winter 2015-2016, we deployed 14 solar-powered GPS-GSM backpack transmitters using custom molded silicone harnesses developed to facilitate transmitter attachment to diving ducks. Three species were marked in this pilot year: Canvasback (n = 12), Greater Scaup (n = 2), and Lesser Scaup (n = 1). A total of 4,148 GPS-quality (<20 m) locations were obtained from marked individuals between December 2015 and May 2016. Individuals used a full spectrum of habitats from shallow shoals, tidal marsh, managed marsh, and static deep-water ponds within the Bay sites and transitioned inland towards freshwater habitats during spring months. We describe general movement patterns and habitat nuances highlighted by this methodology, as well as study design considerations for broader application of this marking scheme. Given climate change and cyclical drought conditions the importance of describing key habitat features, spatio-temporal patterns of distribution, and landscape connectivity for these unique-niche species in this ecosystem is critical.

10.14: POSTER PRESENTATION

CAUSES OF, AND RESPONSES TO, DECLINES IN EUROPEAN POPULATIONS OF LONG-TAILED DUCK AND VELVET SCOTER

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Large declines in some populations of European seaduck were first detected in 2011. Of particular concern are Long-tailed Duck (*Clangula hyemalis*) and Velvet Scoter (*Melanittta fusca*), both of which are thought to have declined by around two thirds since the early 1990s and are now listed as Vulnerable on the IUCN Red List.

Action planning workshops carried out for the African-Eurasian Migratory Waterbird Agreement (AEWA) in 2014 (Long-tailed Duck) and 2016 (Velvet Scoter) identified a number of potential threats. Of primary concern are: (i) small scale oil discharges in non-breeding areas and (ii) accidental bycatch in static fishing nets in wintering and staging areas. Other possible contributing factors include: (i) hunting, (ii) development of offshore infrastructure, (iii) large scale accidental oil spills, (iv) competition with non-native Round Goby *Neogobius melanostomus*, (v) disturbance from shipping, (vi) dredging and dumping of aggregates, (vii) human disturbance, and (viii) habitat degradation in breeding areas.

Crucially, data to causally link seaduck declines to most of these factors are lacking, limiting immediate conservation responses. Furthermore, demographic data with which to understand population responses are also lacking. However, some evidence from wing surveys of hunters bags, birds caught as bycatch and ratios of juvenile:adult males in winter flocks suggests that the productivity of Long-tailed Duck has decreased significantly in the last 30 years. This suggests that in addition to the above threats, most of which are thought to be impacting over-winter survival rates, factors affecting breeding success in the Arctic could also be important, at least for Long-tailed Duck.

For an effective conservation response, huge improvements are needed in baseline monitoring and research of European seaducks, including in the remote breeding grounds. In particular, this requires the development of well-resourced research programmes, linked to other established marine and Arctic biological research, aimed at understanding seaduck declines.

10.15: POSTER PRESENTATION

ENERGETIC PHYSIOLOGY MEDIATES INDIVIDUAL OPTIMIZATION OF BREEDING PHENOLOGY IN A MIGRATORY ARCTIC SEABIRD

***Holly L. Hennin**, Joël Bêty, Pierre Legagneux, H. Grant Gilchrist, Tony D. Williams, and Oliver P. Love*

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The reproductive phenology of migratory species breeding in seasonal environments is predicted to be impacted by a combination of arrival condition, arrival date and the ability to gain in condition once on the breeding grounds. While empirical studies have confirmed that greater arrival body mass and earlier arrival dates result in earlier investment in reproduction, no study has yet been able to assess whether individual variation in energetic management of condition gain impacts this key, fitness-related breeding decision. Using an 8-year dataset from over 350 pre-breeding female Arctic common eiders (*Somateria mollissima*), we tested whether individual variation in two physiological traits influencing energetic management (plasma triglycerides: physiological fattening rate, and baseline corticosterone: energetic demand) predicted individual variation in breeding phenology after controlling for arrival date and body mass. Individuals with higher physiological fattening rates combined with lower energetic demand had the earliest breeding phenology (shortest delays between arrival at the breeding grounds and laying, and earliest laying dates). Our results are the first to determine empirically that individual flexibility in pre-breeding energetic management influences key fitness-related reproductive decisions, suggesting that individuals have the capacity to optimally manage reproductive investment.

10.16: POSTER PRESENTATION

ENHANCING PREY AVAILABILITY FOR SEA AND BAY DUCKS: RESULTS OF A POST OIL SPILL RESTORATION PILOT PROJECT

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The November 2007 M/V Cosco Busan oil spill resulted in significant injury to wintering waterfowl, especially surf scoters (*Melanitta perspicillata*) and greater scaup (*Aythya marila*) in San Francisco Bay (SFB). To assess the restoration potential of habitat augmentations, we deployed two types of prey enhancement treatments in SFB: 1) spawning substrates for Pacific Herring (*Clupea harengus pallasi*) Eggs on Kelp (HEOK), a significant waterfowl prey item, and 2) substrates for natural mussel recruitment to increase availability and quality of prey. Three HEOK rafts were deployed in Richardson Bay Audubon Sanctuary from October 2014 to April 2015. Of the 12 separate kelp deployments, spawn was recorded on 4 deployments, but recorded 3 times on one particular raft. The total number of herring eggs deposited upon deployed kelp over study duration was estimated at just over 3,210,000 eggs, equating to a potential caloric energy of 15,185 – 26,003 kJ. A number of bivalve species readily colonized deployed substrates. Present in this "fouling community" were: California lyonsia (*Lyonsia californica*) at 52 individuals per m^2, invasive Asian Mussel (*Musculista senhousia*), which averaged 14 individuals per m^2, the Blue or Bay Mussel comprising multiple species of the Mytilius sp. complex, which averaged 135 individuals per m^2 and the Carinate dove shell (*Alia carinata*) which had an average of 5 individuals per m^2. Bufflehead (*Bucephala albeola*) and scaup showed a dramatic increase of individuals during the spawn period compared to the pre-spawn period and a substantial decline in the post spawn time period. While restoration of eelgrass as a spawning substrate is planned to benefit herring damaged by the Cosco Busan spill, the HEOK rafts and bivalve recruitment methodologies may provide unique benefits to scoters, scaup and other wintering migratory waterbirds that utilize this food source.

10.17: POSTER PRESENTATION

DISTRIBUTION OF WINTERING LONG-TAILED DUCKS ON LAKE MICHIGAN

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While the Great Lakes are recognized as an important resource to migrating and wintering waterbirds, information on the distribution and abundance of long-tailed ducks (LTDUs; *Clangula hyemalis*) is limited, especially in the western Great Lakes. Information on Great Lakes sea duck concentrations is of interest to resource managers as they deal with several important conservation issues. For example, impact assessment of near-shore and off-shore wind turbine placement and elucidating factors that influence the outbreak of type-E avian botulism require better understanding of the distribution, abundance, and temporal use patterns of waterbirds. We conducted low-level aerial surveys of northern, southern, and eastern Lake Michigan during migration and winter periods of autumn 2010 through spring 2014 along fixed-width transects. Transects were spaced at 3.2 to 4.8-km intervals, and extended up to 32 km offshore.

Long-tailed ducks were among the most abundant species observed during our surveys. The distribution of LTDUs on Lake Michigan was widespread throughout survey areas in northern Lake Michigan during autumn. During winter months, up to 74% of the number of waterbirds tallied along survey transects were LTDUs, when largest concentrations were observed along the Michigan coast from Ludington Bay to Benton Harbor, MI, where water depths ranged between 10-40 m. A peak count of 17,803 LTDUs was tallied on 18-19 December 2013 during a survey of 1,129 km of transects. An extensive portion of waters up to 30 km offshore and 50 m deep in the south end of Lake Michigan was also frequently used by wintering LTDUs. Lake Michigan ice cover extent varied among years, and at times impacted LTDU distribution. The survey data are useful in delineating areas of conservation concern for LTDUs. We plan to model the association of LTDU abundance to a suite of environmental covariates using a hierarchical Bayesian spatial count model.

10.18: POSTER PRESENTATION

EVALUATING HARVEST POTENTIAL AND INFORMATION NEEDS FOR SEA DUCKS

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In 2012, the Sea Duck Joint Venture (SDJV) created a Harvest Management Subcommittee (hereafter we) and initiated an effort to determine the priority information needs to support harvest management decisions for 5 focal species: American common eider, surf scoter, white-winged scoter, black scoter and long-tailed duck. To prioritize information needs, we assessed the influence of uncertainty in individual reproductive and survival parameters on the capacity to determine whether contemporary harvest levels exceeded an assumed management objective of maximum sustained yield (MSY). We compiled estimates from published and unpublished literature and used them to develop probability distributions for each parameter that reflected uncertainty about true mean values for each population. Available field data for these species frequently were collected at small spatial scales (i.e., local sub-population), and may not be representative of mean values for the populations of interest. Therefore, we conducted an expert elicitation to supplement available empirical data. We used Monte Carlo simulation to propagate uncertainty in demographic parameters into probability distributions describing uncertainty in the intrinsic rate of increase (r_{max}), population size, and harvest (harvest rate for common eider) for each population. We used the Prescribed Take Level framework to contrast contemporary harvest levels with allowable harvest levels (i.e., MSY). We assessed the sensitivity of comparisons of contemporary and allowable harvest levels to uncertainty in each of the demographic parameters, Finally, we summarized priority information needs for the SDJV by identifying parameters which were both highly uncertain and had the most influence on the comparison of contemporary and allowable harvest levels. We present the results of the harvest potential assessment and a summary of priority information needs for each of the five species.

10.19: POSTER PRESENTATION

A POTENTIAL TECHNIQUE FOR ATTACHMENT OF SOLAR GPS/GSM TRANSMITTERS ON SURF SCOTERS: SILICONE HARNESS

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The effects of climate change and additive stressors from anthropogenic disturbance have negatively impacted sea-duck populations across North America. To evaluate these impacts, coelomically implanted PTT transmitters have been used to track sea-ducks, but implanting tags in the field is logistically challenging, costly, and invasive. No proven technique currently exists to attach devices externally for long-term tracking of sea-ducks. Compared to surgical techniques, the ability to externally attach tracking devices reduces handling time and stress to tagged birds. Additionally, solar-rechargeable GPS/GSM transmitters provide longer tag-life, a better relocation rate, and data of higher precision than PTT devices. At Patuxent Wildlife Research Center, we developed a silicone-based back-pack style harness for use on surf scoters (*Melanitta perspicillata*). Diving and behavioral studies conducted with captive surf scoters provide evidence that these birds can tolerate external devices attached with flexible, durable silicone, but that we have not yet optimized the design of the equipment including tag design. A more flexible type of silicone, light-weight attachment materials, reduced thickness and weight of harness straps, and improvements in fit and positioning of the device on the dorsal surface of the birds, saw improved results in the second of two pilot field studies conducted on the Atlantic coast in 2015 and 2016. We recommend conducting further dive studies to optimize device position to reduce hydrodynamic drag, and improving transmitter case design so that externally attached equipment can more closely mimic the streamlined body shape seaducks have evolved to support underwater foraging.

10.20: POSTER PRESENTATION

EFFECT OF INTRANASAL MIDAZOLAM HYDROCHLORIDE ADMINISTRATION ON SURVIVAL OF SURF SCOTERS (*MELANITTA PERSPICILLATA*) FOLLOWING INTRACOELOMIC IMPLANTATION OF SATELLITE TRANSMITTERS

Rozenn Le Net, ***Stéphane Lair,*** *Scott G. Gilliland, Timothy D. Bowman, Christine Lepage, Ariane Santamaria-Bouvier, Daniel M. Mulcahy and Matthew G. Sexson*

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Intracoelomic implantations of satellite transmitters have been associated with suboptimal survival rates in surf scoters (*Melanitta perspicillata*), especially when compared to other species of sea ducks. It has been proposed that physical exertion and stress associated with capture, handling, and confinement of these birds results in physiological alterations that could impact post-surgical survival. The objective of this study was to evaluate if the intranasal administration of a sedative (midazolam) could improve the survival rate of surf scoters implanted with intracoelomic transmitters. Midazolam hydrochloride (5 mg) was administered intranasally to 26 randomly selected female adult surf scoters shortly after their capture in Forestville (October 2013, Quebec, Canada). The same volume of saline was given to 26 surf scoters of the same sex and age for comparison. All birds were surgically implanted with an intracoelomic transmitter equipped with a percutaneous antenna by the same surgeon. To assess the effect of the treatment, transmitters were programmed to transmit 2h each day for 30 days post-implantation and survival rate was estimated for each group using the telemetry data. The association between the administration of midazolam and survival was assessed while controlling for other factors such as body mass, hematocrit, plasma total solids, duration of surgery, anesthesia and confinement. Death odds at 30 days for the midazolam group (23%) was significantly lower than those for the saline group (61%) ($p = 0.004$). No other variable was significantly associated with survival. This result indicates that sedation with midazolam following the capture might increase post-surgical survival in surf scoters.

10.21: POSTER PRESENTATION

DISEASE AS A POTENTIAL LIMITING FACTOR FOR COMMON EIDER BREEDING ON BEAUFORT SEA BARRIER ISLANDS

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The Pacific common eider (*Somateria mollissima v-nigrum*; COEI) population declined by 50–90% between 1957 to 1992, and the species is listed as a U.S. Fish and Wildlife Service Bird of Management Concern and an Audubon WatchList species. Although Pacific common eiders have declined throughout their range, those breeding on barrier islands in the Beaufort Sea are considered particularly vulnerable due to small population size, genetic and physical segregation, and rapid environmental change. These factors may place the population vulnerable to disease, and disease may be limiting population recovery. Infectious and parasitic diseases have been documented to cause both mortality and reduced productivity in COEI across the circumpolar region. In previous studies, evidence of disease exposure has been detected in COEI in the Beaufort Sea and a novel adenovirus was reported as a cause of mortality in other sea ducks in the same area. However, the ecology and role of disease as a limiting factor in COEI in arctic Alaska has not been systematically studied. To address this, we collected blood and cloacal swabs from nesting and post-breeding COEI hens across 120 miles of barrier islands in the Eastern Beaufort Sea in 2015 and 2016 and screened samples for evidence of exposure to avian pathogens. Our results are compared to previous data collected 15 years ago in the same region.

10.22: POSTER PRESENTATION

RECOVERY DISTRIBUTION OF SURF AND WHITE-WINGED SCOTERS IN NORTHEASTERN NORTH AMERICA

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Conservation of North American sea ducks is challenging due to considerable knowledge gaps surrounding key demographic parameters. Scoter demography and harvest are poorly understood despite undergoing apparent long-term population declines. The objective of our study was to determine the distribution and level of harvest of Surf and White-winged scoters (*Melanitta perspicillata* and *M. fusca*) banded during the molting period in eastern Canada from 2004–2013. Estimates of harvest rate were 0.5%–2.4% for Surf Scoters and 0.9%–3.6% for White-winged Scoters banded in Labrador and Quebec. Harvest rates thus appear to be relatively low for these species compared to other waterfowl. The harvest locations for Quebec-banded Surf Scoters occurred mostly in Maryland (27%) and North Carolina (27%) followed by Quebec (19%), while Labrador-banded birds were recovered in Maryland (40%), Quebec (11%), North Carolina (10%) and Virginia (10%). For White-winged Scoters, half of the recoveries of Quebec-banded birds were made in Massachusetts (50%), followed by Quebec (21%) and Nova Scotia (14%), while recoveries of Labrador-banded birds were split equally among Massachusetts (20%), Maine (20%), Quebec (20%), Nova Scotia (20%) and New Brunswick (20%). Surf scoters were recovered in Quebec and Nova Scotia in September and October, and gradually recovered in U.S. from November through January, when most of the harvest occurred in Maryland, North Carolina and Virginia. White-winged Scoter harvest occurred in Quebec in October, progressing towards Massachusetts by January, where most birds were recovered. The harvest distribution results were consistent with both species' wintering distribution as recently identified from satellite telemetry. These results represent the first direct measures of harvest rate and harvest distribution for Surf and White-winged scoters. This information will be useful to support harvest management decisions, clarify migratory pathways, and help decision making for resource development (e.g., offshore wind energy).

10.23: POSTER PRESENTATION

PRE-BREEDING FATTENING MEDIATES INVESTMENT IN CLUTCH SIZE IN A CAPITAL-INCOME BREEDING SEADUCK

Holly L. Hennin, Cody J. Dey, Joël Bêty, Pierre Legagneux, H. Grant Gilchrist, and ***Oliver P. Love***

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Many species experience a seasonal decline in clutch size, but few mechanisms have been tested to account for this relationship. Theoretical models predict two possible, non-exclusive pathways: poor condition at arrival on the breeding grounds may delay laying and thereby reduce investment in the clutch, or later arriving females may have reduced resource availability to support the formation of a large clutch. As such, if lower condition or later-arriving females can gain in condition at a faster rate they may be able to lay larger than expected, earlier clutches. Energetic metabolites are useful metrics used by physiologists to estimate an individual's current energetic state, and elevated plasma triglycerides (TRIG) in particular are useful for estimating fattening rate during hyperphagic life history stages. Lipid accumulation and management is critical prior to laying in common eiders (*Somateria mollissima*), which must accumulate significant fat stores prior to laying to both fuel follicle growth and deposit the fat stores needed to successfully complete their 24-day incubation fast. Here we use an 11-year data set collected from East Bay Island, NU, Canada, in pre-recruiting, Arctic-nesting female eiders to examine the potential indirect effect that fattening rate may have on clutch size. Path analytical methods revealed that fattening rate had an indirect effect on clutch size *via* a direct influence on the timing of laying: females with higher fattening rates (TRIG) laid earlier and produced larger clutch sizes. Our results are the first to provide mechanisms underlying the well-documented seasonal decline in clutch size across species, namely that fattening prior to breeding indirectly influences reproductive investment *via* changes to breeding phenology. Further, this work illustrates that flexibility within physiological traits can overcome poor arrival condition or late arrival to positively influence reproductive investment.

10.24: POSTER PRESENTATION

WINTER DISTRIBUTION AND TRENDS OF SEADUCKS IN ESTONIAN COASTAL WATERS IN THE PERIOD 1993 – 2016.

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The present report gives an overview of the land-based counts of waterfowl in Estonia. The counts were made in mid-January and the counts were organized by the Estonian Ornithological Society since 1966. The Estonia waters were divided into 7 major-sections, 20 sub-sections and 338 count areas. The land-based survey was based mainly on fixed routes or observation points at the coast. The wide network of the Estonian Ornithological Society (150-200) observers covered 80% of Estonian coastline. The key areas of important coastal wintering sites were visited by professional ornithologist. From the coast, birds were recorded to a distance up to 2 km, depends the weather condition.

Main results:

- Stellers Eider was increasing up to 1994. After that these species have a decreasing trend.
- Smew, Goosander and Goldeneye have shown increase.
- Numbers of Mallard, Red-breasted Merganser and Cormorant are stable.

10.25: POSTER PRESENTATION

AN AIRBORNE REMOTE SENSING ALTERNATIVE FOR CONDUCTING PELAGIC SURVEYS OF LONG-TAILED DUCKS

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Traditional low-level aerial surveys have been used recently to determine waterbird distribution and relative density on Lake Michigan. Surveys were flown in a fixed-wing aircraft at an average speed of 200 km/h at about 61 m above the water. Observers tallied waterbirds within 200 m-wide transects on each side of the plane, although only the outside 165 m were observable. Each observation was recorded using an integrated GPS voice recording system.

Airborne remote sensing surveys reduce risk to aircrew and eliminate human factors, such as observer fatigue, effecting target detection. In 2016, the FWS acquired an 80 megapixel metric grade aerial camera with a 70 mm lens and added a medium wavelength cooled thermal camera integrated into a direct georeferencing system. This system produces imagery that can be georeferenced without the need for discernable features within the imagery, providing a tool to survey pelagic waterbirds during the day and at night. In October 2016, the system was used to locate long-tailed ducks (LTDUs) at night from 610 m above the water at 230 km/h ground speeds and the location information relayed to capture crews on the water. In addition, daytime missions were flown to evaluate the efficacy of replacing traditional low-level surveys with an airborne remote sensing alternative. These daytime flights were flown at 305 m above the water, and produced 234 m-wide images that were georeferenced, mosaicked and used to manually count LTDUs with encouraging results. Thermal imagery collected at night from 610 m above the water produced a 218 m-wide image (0.17 m ground sample distance) that suggested night time surveys of waterbirds was possible for certain applications under certain environmental conditions. Efforts are now underway to develop an automated tool to identify LTDUs within the visible imagery, necessary to make this remote sensing technique operational.

10.26: POSTER PRESENTATION

SPECTACLED AND STELLER'S EIDER RECOVERY PROGRAM: CONSERVATION STRATEGY

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The range-wide population of spectacled eiders and the Alaska-breeding population of Steller's eiders are listed as Threatened under the Endangered Species Act (ESA). Region 7 (Alaska) Fairbanks Fish and Wildlife Field Office, which leads recovery programs for both species, coordinates management actions that are guided by a broad conservation strategy and conducted by a suite of partners. For spectacled eiders, three breeding populations are recognized: Yukon-Kuskokwim Delta (YKD), Arctic Coastal Plain (ACP), and Arctic Russia (AR). Monitoring data indicates that the status of the YKD population has improved since listing, the ACP population has remained stable, and the AR population meets recovery criteria based on its abundance. The most important element of the spectacled eider conservation strategy is monitoring population abundance and trend needed to evaluate status in relation to recovery criteria. For Steller's eiders, viable populations on both the ACP and YKD are required to meet recovery criteria established in the species' recovery plan. Aerial surveys indicate that roughly a few hundred individuals occur on the ACP although abundance and reproductive effort appear to vary across the region and among years. The YKD population is considered essentially extirpated, with only one nest found in the last decade. The Steller's eider conservation strategy includes increasing adult female survival and breeding success of the extant ACP population, and possibly re-establishment of a viable population on the YKD through reintroduction. Management actions being implemented on the ACP include: research and monitoring, outreach and law enforcement to reduce shooting mortality and use of lead shot, arctic fox and raven control near Barrow to increase nest and brood success, and reducing habitat loss and disturbance through the ESA Section 7 consultation process. The feasibility of reintroduction of Steller's eiders to the YKD is being evaluated through an experimental pilot project begun in 2015.

10.27: POSTER PRESENTATION

REDUCING GILLNET BYCATCH: SEADUCK UNDERWATER HEARING THRESHOLDS AND AUDITORY DETERRENT DEVICES

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AMW and SEC: United States Geological Survey, Patuxent Wildlife Research Center, Laurel MD

As diving foragers, seaducks are vulnerable to underwater human activities, including naval sonar activity, seismic surveys, construction, and gillnet fisheries. Bycatch in gillnets is an important source of mortality for seaducks and other marine birds, killing hundreds of thousands of seabirds annually. While several studies have looked at the potential of acoustic deterrents to lower bycatch risk for marine mammals, sea turtles, and some species of seabirds, there has been very little work done to determine the potential for these types of devices to reduce seaduck bycatch. Understanding of underwater acoustic sensitivity in diving birds is important for the design of acoustic deterrent devices and evaluation of their effects on reducing bycatch. In addition, hearing sensitivity measurements provide information on possible behavioral and physiological impacts of man-made noise sources in aquatic environments. We are investigating underwater hearing in captive seaduck species in order to determine the efficacy of commercially available auditory deterrents, such as pingers, to specifically reduce seaduck bycatch. We hand-raised long-tailed ducks (*Clangula hyemalis*), surf scoters (*Melanitta perspicillata*), lesser scaup (*Aythya affinis*), and harlequin ducks (*Histrionicus histrionicus*) at Patuxent Wildlife Research Center's (PWRC) captive sea duck facility. We used psychoacoustic techniques to train the ducks to respond to sound stimuli underwater in PWRC's dive-tanks. Trials are underway in order to obtain underwater auditory thresholds for these bycatch-sensitive species. Preliminary threshold data suggest that long-tailed ducks may have less sensitive underwater hearing than marine mammals, which are the target for most commercial pingers today. In the coming months we will gather more threshold data from our captive seaducks in order to be able to recommend appropriate specifications for seaduck targeted acoustic deterrents.

10.28: POSTER PRESENTATION

CAPTIVE RAISED GROWTH MODELS FOR SEADUCKS

Kathleen A. McGrew[2], *Sarah Fitzgerald, and Alicia M. Wells-Berlin*

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The establishment of Patuxent Wildlife Research Center's breeding captive colony has enabled us to collect duckling growth data on multiple species of seaducks and dabbling ducks, including surf scoters (*Melanitta perspicillata)*, white-winged scoters (*Melanitta fusca)*, long-tailed ducks (*Clangula hyemalis)*, lesser scaup (*Aythya affinis*), and harlequin ducks (*Histrionicus histrionicus*), and American black ducks (*Anas rubripes*). Daily weights and biweekly tarsus and culmen measurements were obtained on ducklings from day of hatch up to 100 days of maturity for two years, with the objective of developing models that predicted each respective species' growth trend. We preliminarily present key parameters of the Gompertz growth model, including growth rate constants, total growth, and the growth asymptote, for multiple species. Overall, seaducks had higher growth rates than dabbling ducks and larger ducks had older ages of peak growth than smaller individuals. These baseline data could be used as model growth curves of ontogenetic development and peak growth for individuals encountered in the field, allowing field biologists to use these measurements to potentially estimate age.

10.29: POSTER PRESENTATION

IDENTIFYING AREAS OF IMPORTANCE FOR SEA DUCKS THROUGHOUT THEIR ANNUAL CYCLE

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Studies supported by the North American Sea Duck Joint Venture (SDJV) partnership have helped improve our understanding of important sea duck habitats across the continent and beyond. This work has involved a variety of techniques including satellite telemetry, and new or improved waterfowl surveys. The SDJV's goal is to make information on habitat use available to decision makers and ultimately improve the conservation and management of these species. Currently, we are developing an atlas that identifies key sites for sea ducks throughout North America and documents their seasonal importance, current protection or designations, and potential threats. Our next step is to make accessible spatially explicit sea duck data through one or more existing geospatial database hosts that can be queried by interested folks, along with other environmental parameter data. We envision these products will be used to: 1) provide justification for protecting areas of importance to sea ducks, 2) improve decision making for resource development in key areas, 3) direct research investigating biotic and abiotic features that characterize sea duck habitats, and 4) predict how habitat conditions may change and potentially impact populations. In this poster we highlight some of the most important habitats/areas for sea ducks in North America.

10.30: POSTER PRESENTATION

ESTIMATING BEHAVIORAL MULITPLIERS TO RESTING METABOLIC RATE IN AMERICAN BLACK DUCK AND LESSER SCAUP

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American black duck (*Anas rubripes*) and lesser scaup (*Aythya affinis*) populations have experienced continual declines over recent decades. Research suggests that these declines may be the result of a complex of factors including resource availability on non-breeding landscapes. In an attempt to quantify the ability of a landscape to support migrating and wintering waterfowl populations, many studies have begun using bioenergetics modeling to calculate energetic carrying capacity by estimating energy demand and energy supply. Estimates for many of the physiologic parameters required in calculating energetic demand (i.e. resting metabolic rates, time-activity budgets, etc.) have been explored, yet estimates of other critical parameters are still lacking. The objective of this project is to produce estimates of behavior specific multipliers to resting metabolic rate (RMR) in American black ducks and lesser scaup. These species were chosen as focal species due to their current population status and their representation of both the diving and dabbling duck guilds, which allows for reasonable extrapolation to additional species. We used open-flow respirometry techniques to estimate RMR and to isolate behavior specific factorial increases to RMR in captive American black ducks and lesser scaup. Respirometry trials were performed between September, 2015 and March, 2016 at Patuxent Wildlife Research Center, Laurel, MD. Results presented will provide more accurate estimates of daily energetic expenditure for these species and will ultimately contribute to refined landscape carrying capacity estimates for waterfowl during the non-breeding period.

10.31: POSTER PRESENTATION

ASSESSMENT OF BIOINDICATOR APPROACHES FOR TRACE ELEMENTS AND SUBLETHAL HEALTH EFFECTS IN SEA DUCKS BREEDING IN ARCTIC ALASKA

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As industrial development, thawing permafrost, and aerial deposition of pollutants increase in the Arctic, bioindicators to monitor contaminants exposure in a range of community components are increasingly important. However, indicators are seldom compared to similar species to verify their relevance. For example, female common eiders (*Somateria mollissima*) are widely used indicators of species that use marine habitats for much or all of the year. However, they are but one of a number of related species found in the Arctic, with varying migration, diet, and body size which may influence contaminant exposure. Contaminants may induce a suite of physiological responses, but typically contaminants are regressed against single markers independently. We examined blood levels of multiple trace elements, and effects on blood-based biomarkers, in long-tailed ducks (*Clangula hyemalis*), Steller's eiders (*Polysticta stelleri*), spectacled eiders (*Somateria fischeri*), king eiders (*Somateria spectabilis*), and common eiders nesting in Arctic Alaska. We also assessed element levels in feathers of king and spectacled eiders. Blood concentrations of elements varied widely among species, and among ages and sexes within species. Comparisons among species indicate that element concentrations in blood of common eiders may yield very different toxicity and biomarker responses than in other species. For all species, concentrations in feathers ranged from ~6 to over 900 times those in blood, and did not demonstrate the same relative patterns. Future biomonitoring efforts must consider the potential variation in metals concentrations among species. Moreover, use of bioindicator species to infer concentrations and their effects in other species may not always be suitable, even in closely-related taxa.

10.32: POSTER PRESENTATION

LONG-TAILED DUCKS IN WESTERN LAKE MICHIGAN

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As part of a group of research entities studying pelagic waterfowl in the Great Lakes, WGLBBO observers surveyed the waters of western Lake Michigan during Phase 1 and 2 of the Great Lakes Commission's pelagic waterfowl/waterbird monitoring in 2012-2014. Our mapped data portray examples of temporal and geographic distribution of Long-tailed Ducks (LTDU) in the offshore waters of western Lake Michigan, in a zone covering survey blocks 1.6-16.0 km from shore, from Door Co. WI to the WI/IL border, plus additional observations in the 0-1.6 km zone. LTDU consistently occupy an offshore zone in deeper water and consistently further from shore than most other diving duck species, with many data records as far as 16.0 km from shore not uncommon. In both migration seasons, LTDU arrive later than most other divers, in spring have often migrated out of this zone by early April, and are replaced there by other, later-migrating species.

10.33: POSTER PRESENTATION

USING I-STAT BLOOD RESULTSTO PREDICT P0ST PTT IMPLANT SURVIVAL IN LONG-TAILED DUCKS AND SCOTERS

***Glenn H. Olsen[1]**, Anand Krishnaswamy, Michael C. Runge, Alicia M. Wells-Berlin, Dustin E. Meattey*

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We obtained blood samples from Long-tailed Ducks (*Clangula hyemalis*), Surf Scoters (*Melanitta perspicillata*), and White-winged Scoters*(Melanitta fusca*), after capture and before surgically implanting the ducks with satellite transmitters (PTTs).The blood samples were immediately analyzed using an I-Stat blood analysis unit. We followed the ducks post-release until they died, the battery on the PTT died, or the signal was otherwise lost. Using a Weibull analysis of the survival data, we are seeking to determine whether any factors available on the I-Stat cartridge help predict long-term (1-2 years) post-implant survival in these three species. The I-Stat blood analysis unit is portable, battery operated, and easily taken into most field conditions where surgery would be performed to implant PTTs. Using predictive pre-surgical blood screening techniques would enable wildlife biologists and wildlife veterinarians to better choose the sea ducks to implant with satellite transmitters. Initial results with a small sample of ducks suggest that the heterophil to eosinophil ratio is a weak predictor of long-term survival, but none of the I-Stat metrics showed a significant effect.

Mention of commercial products does not imply US Government endorsement.

10.34: POSTER PRESENTATION

LONG-TAILED DUCK AND SCOTER HEMATOLOGY AND SERUM CHEMISTRY

***Glenn H. Olsen[2]**, Alicia M. Wells-Berlin, Sara E. Crowell, Kathleen A. McGrew*

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Starting in 2006 as part of Sea Duck Joint Venture and Bureau of Ocean and Energy Management Projects, we collected blood from healthy surf scoters (*Melanitta perspicillata*), black scoters (*Melanitta americana*), white-winged scoters *(Melanitta fusca*), and long-tailed ducks (*Clangula hyemalis*) being banded and receiving satellite transmitter implants. We report the clinical blood results including white blood cell counts, red blood cell counts, hematocrits, and serum chemistry results, creating baseline results for each species.

10.35: POSTER PRESENTATION

VISUALIZING POPULATION DELINEATION AMONG NORTH AMERICAN SEA DUCKS: MAPS FOR FUTURE RESEARCH AND MANAGEMENT PLANNING

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Most sea duck species remained poorly-studied up until the mid-twentieth century and population declines were noted in many species beginning in the 1990s. In 1998, the North American Sea Duck Joint Venture (SDJV) was established to promote "the conservation of all North American sea ducks through partnerships by providing greater knowledge and understanding for effective management." A priority of the SDJV has been to complete assessments of migratory connectivity to inform population delineation of sea duck species across North America. The U.S. Geological Survey (USGS) has participated on the Continental Technical Team and Management Board of the SDJV since its inception, and provides scientific information relevant to the mission and priorities of the SDJV. Continuing with that goal, here we provide an update on the status of current knowledge regarding geographic distribution, migratory connectivity, and population delineation of sea duck species in North America. We provide maps of all known band recovery, genetic, and telemetry data across the North American range of sea duck species and visually assess evidence for population delineation at the continental scale. Results from this exercise demonstrate consistency across different marker data sets in continental levels of population delineation for several species, a lack of basic information on population delineation for others, and evidence for where future research dollars would most efficiently be directed to enable hypothesis-driven research that addresses knowledge gaps.

10.36: POSTER PRESENTATION

ANNUAL FACTORS AFFECTING THE WINTERING DISTRIBUTION OF BLACK SCOTERS

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Along the Atlantic coast of the United States there has been an increase in human activity. These activities include energy production, sand mining, aquaculture, shipping, and coastal development that all have the potential to greatly impact sea ducks throughout their migratory cycle. Of the sea ducks wintering along the Atlantic coast the black scoter (*Melanitta americana*) has the largest and most variable range, encountering the effects of global change throughout migration. To better quantify the abundance and wintering distribution of black scoters and other sea ducks, the U.S. Fish and Wildlife Service conducted aerial surveys from 2009-2012 along the Atlantic coast. The initial results show that the core wintering areas used by black scoters varied each year and that black scoters could be found as far north as the U.S.-Canada border and as far south as the Georgia coast. We build on this work to further describe the species distribution during winter and assess the factors affecting their annual distribution using the data from the U.S. Fish and Wildlife Service winter surveys. We discuss and identify several key habitat variables including the ocean depth, substrate type, and the interpolated surface of slope. This study will increase knowledge on the wintering ecology of black scoters and aid in the development of future aerial surveys to better quantify abundance, as well as identifying areas of potential overlap with energy development.

10.37: POSTER PRESENTATION

FORAGING DIVE TIMES OF DIVING DUCKS IN A FRESHWATER LAKE

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Behavioral observations of wildlife can offer valuable information about species' life histories and ecological interactions. Due to the fact that waterfowl from both the Aythyini and Mergini forage by diving, investigating factors relating to dive duration could offer valuable insight into how this shared behavior differs among groups of ducks. Members of both of these tribes winter and forage at Lake Solano in the Central Valley of California. Observation of their foraging behavior was undertaken during the winter of 2016 to assess inter- and intra-specific differences, as well as to determine the influence of local environmental factors. Dive durations were recorded for individuals of each species present at the study site. Also noted for each dive was the gender of the individual, the location along the lake (water depth), the time of day, and whether or not the dive was synchronous with other individuals. Data was collected for seven species: five Mergini (*Bucephala albeola*, *B. clangula*, *B. islandica*, *Mergus merganser* and *Lophodytes cucullatus*) and two Aythyini (*Aythya collaris* and *A. affinis*). Results showed a correlation between species and dive times, as well as water depth and time of day. While these data are not conclusive owing to the small sample size and limited spacial scale, they suggest that future studies could focus on determining which factors are most influential on dive duration in a larger system.

10.38: POSTER PRESENTATION

TIMING, DURATION, AND PATHWAYS OF HARLEQUIN DUCK MIGRATION TO PACIFIC MOLTING AND WINTERING AREAS

Sean Boyd, Beth MacCallum, Malcolm McAdie, Lisa Bate, Chris Hammond, Matt Wilson, Joseph Evenson, Susan Patla, ***Lucas Savoy***

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The core breeding range for Harlequin Ducks (*Histrionicus histrionicus*) in western North America extends from Alaska, south through the Yukon, Northwest Territories, and British Columbia. Smaller, breeding populations exist in southwestern Alberta and the northwestern US and include areas of Washington, Idaho, Wyoming, and Montana. Each state and province has identified the Harlequin Duck as a species of conservation priority, given their small and isolated populations and specific nesting requirements for pristine mountain-streams. Conservation objectives for these areas have all identified the importance of mapping migration routes that connect breeding sites to Pacific coast molting and wintering locations, as well as determining migration timing, duration, habitat use, and stopover sites. In spring 2016, we captured Harlequin Duck pairs on breeding streams and surgically implanted satellite transmitters in the males and attached geolocators to the leg bands of females. We marked a total of 18 male harlequins (Alberta = 10, Montana = 5, Wyoming = 2, Washington = 1) and 17 females (Alberta = 8, Montana = 5, Wyoming = 2, Washington = 2). One Montana male was presumably predated shortly after capture; so 17 males successfully migrated from their breeding streams to their Pacific coast molting locations. Migration initiation dates for the 17 marked males varied by breeding areas and occurred between June 03 –July 10. Individual male migration lasted between 1-17 days and stopover sites were approximately half-way to the coast and included rivers, mountain streams and lakes. The males arrived at their molting areas between June 05-July 24 and these areas ranged from southeast Alaska to northwestern Washington. Satellite transmitters are programmed to provide location data until July 2017 so this will allow us to map their winter sites once they have completed molting. Efforts will be made to retrieve the geolocators from females in spring 2017.

10..39: POSTER PRESENTATION

CONTAMINANT CONCENTRATIONS IN THE ENDANGERED SCALY-SIDED MERGANSER FROM RUSSIA

*Diana V. Solovyeva, **Lucas Savoy**, Oksana Lane, Sergey L. Vartanayan, Christopher Perkins, and Kevin Regan*

The Scaly-sided Merganser (*Mergus squamatus*) is a highly endangered sea duck, and breeding exclusively in isolated areas in Far-East Russia, China, and Korea. The Scaly-sided Merganser's breeding habitat consists of freshwater rivers within wooded mountainous regions. Nesting occurs in natural tree cavities or artificial nest boxes erected near the river's edge. Post-breeding, the Scaly-sided Merganser migrates to wintering locations, consisting of river, pond, and ocean areas of central China and primarily in the Yangtze River Basin. In recent decades, this region has become highly polluted from rapidly increasing industrial development and agricultural runoff. From 2012-2015, we collected un-hatched or abandoned eggs, whole blood and feathers from breeding female Scaly-sided Mergansers in Russia. We also collected feathers from molting male mergansers in Primorye, Far East Russia. Samples were delivered to the United States for trace element and heavy metal analyses to determine contaminant exposure to the Scaly-sided Merganser. We analyzed a total of 53 samples for nine different contaminants and included: silver (Ag), Arsenic (As), cadmium (Cd), chromium (Cr), mercury (Hg), nickel (Ni), lead (Pb), selenium (Se), zinc (Zn). We compared results to published sea duck contaminant studies worldwide. The majority of the contaminants contained concentrations similar to those reported for other sea duck species, and considered non-harmful background levels. However, Hg and Cr frequently exceeded concentrations noted in other sea duck studies and may contain concentrations of concern for the Scaly-sided Merganser. We present the first Scaly-sided Merganser contaminant data and compare our findings to concentrations reported for several sea duck species worldwide.

10.40: POSTER PRESENTATION

SURVIVAL RATE OF SPECTACLED EIDERS ON AYOPECHAN ISLAND, CHUKOTKA, RUSSIA

Vera Y. Kokhanova *and Diana V. Solovyeva*

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Demography of Spectacled Eiders (*Somateria fischeri*) was investigated during 2002 – 2015, with breaks in 2006 and in 2014, on Ayopechan Island, Chaun Delta, Chukotka, Russia. 52 square nest search plots (1 km^2 each) set up in 2003 but these were reduced to 40 in 2007 as unsuitable plots were removed. At least 40 plots were in use annually after 2007. All active and depredated nests were recorded. All active nests were revisited in 10-day interval. We used water test for determined stages of incubation and captured females at their nests 0 to 5 days prior to predict hatch date using mechanical or automatic bow-trap, or a small net. In addition to nesting females we captured non of failure breeding females with mist-nets on their feeding lakes. Females were marked with Moscow standard bands and engraved plastic bands with alfa-numeric code. A total 135 adult females were marked between 2002 and 2015 and 22 ducklings were banded between 2003 and 2004. Females were resighted during nesting in the years following banding year by capturing or by use of camera-traps. Forty two females were recaptured in subsequent years. Comrack-Jolly-Seber maximum likelihood approach was used to estimate annual survival (φ) and resighting probabilities (p) from mark-resight data. Based on data, which were collected during field study on Ayopechan Island, we estimated recapture probabilities, median age of first reproduction, natal and breeding site fidelity of Spectacled Eider females.

10.41: POSTER PRESENTATION

WINTER DIVING ACTIVITY OF SPECTACLED EIDER *SOMATERIA FISCHERI* AS REVEALED BY PRESSURE TAG

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Four females Spectacled Eiders were equipped with pressure tags with three tags by Cefas Co, United Kingdom, and one tag by Lotek Co, Canada. Females were trapped at their nests in Chaun-Delta, Chukotka, Russia, in June 2010 and June 2012. Only females which showed site-fidelity to the same nest site were selected for tag deployment. Two females were recaptured after two years of tag wearing. One more female was recaptured after 3 years but tag wasn't retrieved. Among two tags retrieved one was recording diving depth and temperatures for 5 days between 1 and 5 of November 2010. Second tag was injected salt water and didn't provide a record. Diving tag recorded pressure and temperature data in one minute interval. Maximal diving depth averaged 43.05 m. Diving sessions timing and duration, dive and pause duration are discussed.

10.42: POSTER PRESENTATION

COAST TO COAST: ASSESSING MIGRATORY CONNECTIVITY OF NORTH AMERICAN SCOTERS

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Understanding how populations of migratory species are geographically linked throughout the annual cycle (i.e. migratory connectivity) is fundamental to understanding the genetic and demographic structure of populations, as well as where and when conservation measures should be implemented. Among North American seaducks, assessing connectivity is challenging as species have large distributions, varied migratory strategies and dispersal propensities. Many seaduck species exhibit some level of breeding and wintering site fidelity; though unless seasonal fidelity is accompanied by philopatry, it does not result in breeding population structure as young birds disperse among regions linking demographic parameters. Although scoters have similar life history characteristics, patterns in their breeding and wintering distributions are species-specific (based on banding and telemetry data), potentially influencing the degree of migratory connectivity. Black Scoters are highly segregated (east and west coast); coincident with their discontinuous breeding distribution. Surf Scoters have a continuous breeding distribution with limited overlap between eastern and western segments in winter. Despite a disjunct breeding distribution, White-winged Scoters are likely highly admixed in winter due to movement of central region birds to both coasts. Species, such as the scoters, with limited detailed data on migratory and dispersal patterns, genetic data can provide much needed insight into population connectivity and delineation. We used genome-wide scans (i.e., RadSeq) to assess population genetic structure of the three North American scoter species across four regions (Alaska, Pacific, Central, and Atlantic). This method allowed us to scan larger portions of the genome (> 3000 loci) than past efforts, enhancing our ability to uncover shallow genetic divergence (a general characteristic of high-latitude species) and detect loci promoting divergence among geographic regions. These data will provide additional information on where (or if) demographic breaks as evidenced by restricted dispersal among regions are occurring and aid managers in delineating populations.

10.43: POSTER PRESENTATION

A REVIEW OF SEA DUCK HARVEST IN WASHINGTON STATE: MONITORING HUNTER PARTICIPATION AND HARVEST TRENDS

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Substantial waterfowl populations in the Pacific Flyway over the last 15 years have allowed for liberal seasons and bag limits. Current regulations are among the most liberal ever offered in Washington and beginning with the 2014-15 season hunters could retain three times the daily bag in their possession for most waterfowl. The 2015-16 waterfowl harvest was regulated under Washington State regulations following federal framework recommendations and allowed the maximum (107 days) number of days under the Migratory Bird Treaty Act; by which, Washington's season length was 105 days statewide with two additional days for the statewide Youth Hunt. The daily bag-limit was 7 ducks, but Washington State elected to further restrict sea duck harvest to include not more than 1 harlequin (season limit), 2 scoter, 2 long-tailed duck, and 2 goldeneye in western Washington due to concerns over low recruitment in sea ducks and the potential for small harvest to be focused on a disproportionately high concentration of certain species relative to the rest of the Pacific Flyway winter distribution. Because statewide surveys are not accurate enough to measure harvest of several priority waterfowl species, special surveys have been developed that utilize written hunting authorizations and mandatory reporting. The sea duck (harlequin, scoter and long-tailed duck), brant, and snow goose harvest is estimated annually using a mandatory harvest report card for each species. Written authorization and harvest reports have been required of sea duck hunters in all of western Washington since 2004. The harvest survey indicated a total harvest of 737 scoters, 103 long-tailed ducks, 88 harlequin ducks and 451 goldeneyes. The reported goldeneye harvest included 60% common goldeneye. From 2,113 authorizations, an estimated 632 hunters were successful and hunted a total of 1,810 days. Primary harvest areas included Island, Mason, Skagit, Clallam, Pierce, and Whatcom counties. Patterns in harvest are consistent with distributional patterns detected during extensive annual aerial survey efforts of the Puget Sound region. Since adoption of the 2004 mandatory harvest card reporting requirement, harvest of the primary species, surf scoter, has been reduced by more than 50%, but some level of harvest has been maintained on the seven species of sea duck commonly sought after by the state's waterfowling community.

10.44: POSTER PRESENTATION

NEST ATTENDANCE PATTERNS OF COMMON EIDERS AT WAPUSK NATIONAL PARK IN NORTHERN MANITOBA

***Tanner J. Stechmann**, David T. Iles, Andrew F. Barnas, Samuel D. Hervey, Robert F. Rockwell, and Susan N. Ellis-Felege*

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Common eiders (*Somateria mollissima*) have been well studied because of their value to the down industry. However, little data is available regarding detailed nesting behaviors in areas where down is not commercially harvested. Nesting behaviors of incubating hens can be reflective of changing environmental conditions important to reproductive success. The objective of this study was to explore factors influencing nest attendance patterns of female common eiders breeding along the western Hudson Bay in Wapusk National Park, Manitoba, Canada. During 2014-2016 nests were located using systematic searches, and eggs were candled to determine incubation stage. Time-lapse photography was used to monitor a subset of common eider nests within the colony. Cameras were left at the nest until hatch or failure, and photographs were reviewed to record female attendance patterns. We examined the influence of covariates including nest location within the colony and incubation stage on the number and duration of daily recess events and overall incubation constancy. Preliminary results from 2014-2015 show female eiders took 2 recesses per day, each lasting an average of 29 minutes. Females spent approximately 97% of their time incubating which decreased slightly as incubation age progressed. We found little variation in incubation constancy regardless of distance to center of the colony or proximity to nearest neighboring nest. Changes in recess number and duration may indicate shifts in resource availability to eiders in this colony prior to breeding and may play a role in observed annual variation of reproductive success and overall colony dynamics.

10.45: POSTER PRESENTATION

THE ENERGETIC COSTS AND REPRODUCTIVE BENEFITS OF MATE GUARDING IN A DIVING SEADUCK

Rolanda J. Steenweg*, *Holly L. Hennin, Pierre Legagneux, H. Grant Gilchrist, Glenn T. Crossin, and Oliver P. Love*

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Reproduction is an energetically demanding life history stage, with males and females exhibiting different types of costs. In species with female-based, mono-parental care, male reproductive investment often comes in the form of mate or territorial defense, which can often impact the reproductive success of their mate. Although there are substantial energetic costs predicted to be associated with mate guarding in the pre-breeding period, the mechanisms regulating energetics at this stage, and the mechanisms linking male condition to female reproductive success, are currently poorly understood. Common eiders nesting at East Bay Island are a model species to explore the relationship between male and female state because of both members of each pair are captured simultaneously during the pre-breeding period. Male eiders are expected be decline in condition during the pre-breeding period compared to an increasing condition of their paired female because males must expend significant amounts of energy defending their mate from extra-pair copulations or defending her foraging territory. Consequently, there will be an increasing disparity in relative state across the pre-breeding period as male condition declines. Here we examine whether variation in male energetic physiology (corticosterone, triglycerides, beta-hyroxybutyrate, non-esterified fatty acids and immunoglobulin Y) is able to predict the subsequent condition of their paired female, and by extension her subsequent breeding decisions (likelihood of breeding). We hypothesize that males in lower relative condition — with higher baseline corticosterone and beta-hydroxybutyrate, and lower triglycerides, non-esterified fatty acids, and immunoglobulin Y — may ultimately benefit via their females laying earlier and successfully breeding. These results will be important in explaining indirect drivers of reproductive timing and success in Arctic-nesting common eiders, and identifying mechanisms underlying sex-specific, reproductive trade-offs.

10.46: POSTER PRESENTATION

ASSESSING HUNTING SUSTAINABILITY IN A DECLINING FLYWAY POPULATION OF COMMON EIDERS *Somateria mollissima*

***Rune S. Tjørnløv**, Morten Frederiksen, Roger Pradel and Rémi Choquet*

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For harvested species, management decisions have the power to greatly influence population dynamics. Therefore, managers must ensure that harvest is well balanced and does not remove more than a sustainable population surplus. Ideally, this assessment should investigate how much hunting harvest contributes to total mortality and ultimately how it affects population dynamics. We constructed ring-recovery and ring-recapture-recovery multistate models which account for cause-specific reporting probabilities to estimate unbiased proportions of the Baltic/Wadden Sea population of the Common Eider *Somateria mollissima* dying due to 1) hunting and 2) other causes. We first used a ring-recovery model and life histories of > 18.000 Eiders ringed at ten study sites to estimate annual proportions of adult female Eiders dying due to hunting (α_h) during 1971-2014. By means of a ring-recapture-recovery analytical framework we also estimated the proportion of ducklings (and adult females) dying due to hunting at two sites. We then extracted means of all available demographic data and specified population projection models that allowed us to investigate the effect of past and present hunting regulations on changes in population size at the flyway level. To account for uncertainties in flyway population size estimates, depending on the type of census, we modelled two scenarios. Our results indicate that even under a best case scenario a complete ban on shooting fecund females is not enough to stop the observed decline, because of increases in natural mortality of both adult females and immatures over the last 2 decades. Although, levels of natural mortality must decrease in order to fully halt the decline of the Baltic/Wadden Sea flyway population, we advocate to maintain and extent the current ban on hunting females to also apply to immature male age classes.

10.47: POSTER PRESENTATION

A SURVEY OF SEA DUCK PREY ITEMS ACROSS FOUR SITES ON THE YUKON-KUSKOKWIM DELTA, ALASKA

***Sadie E.G. Ulman**, Elizabeth A. Ruffman, and Tuula E. Hollmén*

SEGU and EAR: The Alaska SeaLife Center, Seward, AK, USA
TEU: The Alaska SeaLife Center, Seward, AK, USA and College of Fisheries and Ocean Sciences, University of Alaska, Fairbanks, AK, USA

The Yukon-Kuskokwim Delta is a globally important area for wildlife, and supports a high biodiversity and abundance of migrating and nesting marine birds and waterfowl. Changes in the environment due to climate change affect wetland ecology in this region. The objective of this project is to identify potential diet items for ground nesting waterfowl across coastal areas in the central Yukon-Kuskokwim Delta, and support planning for potential Steller's eider (*Polysticta stelleri*) reintroduction efforts. In 2014 and 2015, four wetland sites were selected and sampled including Kigigak Island and three sites along the Kashunuk river system, representing a gradient of locations from close to shore to 13 miles inland. Ponds were randomly selected within a 1km radius of each of four established sites, with additional criteria of >500 m from same community type and >100 m from border of an adjacent community type. Two benthic samples (125 ml) were collected from each pond using a 0.5L Van Veen grab. Samples were cleaned, stained with Rose Bengal to identify seeds and invertebrates, separated, identified to family or species when possible, and dried and weighed to obtain dry weight. In 2014, 67 ponds were sampled, and in 2015 an additional 16 ponds were added. One hundred and fifty samples were processed and from those, 47 total potential diet items (35 invertebrates and 12 seeds) were found. Mean biomass (g/ml) was summarized for each item across the four sites and years. Across all pond samples in 2014, invertebrates with highest biomass (g/ml) included: Gastropoda, Chironomidae, Cladocera, Ostracoda, and Copepoda, and in 2015 Hydrozetes, Isopoda, Ostracoda, Chironomidae, and Gastropoda. In both years, the seeds with highest mean biomass (g/ml) in ponds were *Carex* species, *Hippuris* species, *Potagometon* species, *Empetrum* species and an unknown seed species. This assessment provides information on prey biodiversity and biomass available during the waterfowl brood rearing period in locations on coastal Yukon-Kuskokwim Delta.

10.48: POSTER PRESENTATION

BREEDING AND MIGRATION DELINEATION OF SURF SCOTERS WINTERING IN SOUTHEAST ALASKA

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Declines in sea duck populations have highlighted the need for additional basic research across the life cycle of these long-distance migratory birds. A lack of basic ecological information on Surf Scoters (*Melanitta perspicillata*), including the linkage between wintering and breeding areas is a major impediment to determining factors contributing to their decline. Therefore we marked Surf Scoters with satellite transmitters near Juneau, Alaska in 2008-2010 to describe their nesting location in the boreal forest and migration chronology and locations during fall and spring. Surf Scoters initiated spring migration in late April and early May, staged on lakes of the south central Yukon in mid May and reached the nesting grounds of Great Slave Lake and northern Yukon in late May. After breeding, some birds migrated west along the Arctic coast of Alaska and staged in Norton Sound and Bristol Bay, Alaska between July and September, while others retraced their spring migration southward to winter in southeast Alaska and Washington.

10.49: POSTER PRESENTATION

WHAT'S EATING COMMON EIDER EGGS? NEST CAMERAS TELL THE REAL STORY

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Nest predation is a significant limiting factor to the reproductive success of Pacific common eiders (*Somateria mollissima v-nigrum*, COEI). COEIs nesting on barrier islands and spits in the Beaufort Sea may be at increased risk of predation due to changes in predator densities and distributions. Examples include reported increases of red fox (*Vulpes vulpes*) and polar bears (*Ursus maritimus*) on the coast during the nesting period. Observational studies of individual nesting colonies have identified arctic foxes (*Vulpes lagopus*) and glaucous gulls (*Larus hyperboreus*) as primary nest predators, but data on predator impacts at a larger scale is limited. Determination of nest predators at dispersed nest sites is traditionally accomplished by evaluating evidence left at the nest. However this method has been criticized for being subjective. Using quantitative analysis to evaluate predator evidence has been proposed as a more objective method and relies on development of predator-evidence profiles from observed depredation events. During June-July 2015 and 2016, we placed time-lapse cameras at approximately 150 COEI nest sites to record causes of nest fate. Glaucous gulls, arctic foxes, polar bears, grizzly bears (*Ursus arctos*), and golden eagles (*Aquila chrysaetos*), were the most common nest predators. In 2016, we also used both traditional and quantitative methods for evaluating evidence of nest predators and compared results to observations from time-lapse camera footage. Preliminary findings suggest that both the traditional and quantitative methods are unreliable for determining nest predators on the barrier islands. Flooding events, wind erosion, and multiple predators at individual nests lead to ambiguous or unclear evidence of nest fate.

10.50: POSTER PRESENTATION

AERIAL SURVEY DETECTION FOR SPECTACLED EIDERS AND OTHER WATERBIRDS ON THE ARCTIC COASTAL PLAIN OF ALASKA

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We estimated detection probability of spectacled eiders and other waterbird species on aerial transect surveys flown on the Arctic Coastal Plain, Alaska. Our primary goal was to adjust the population index towards a less-biased population estimate in order to better measure recovery criteria for the threatened spectacled eider. A secondary goal was to determine relative detection rates for all large waterbirds on the Arctic Coastal Plain, and identify important sources of variation in perception bias. We conducted aerial surveys in early June 2015 and 2016 using fixed-wing aircraft with independent, simultaneous observations by front and rear-seat observers; aka the double-observer technique. We reconciled matched-sightings of front- and rear-seat observations post-hoc, using time of observation as the primary matching criteria. We analyzed over 5000 sightings of more than 20 species, including 5 sea duck species: king, spectacled, and common eiders, long-tailed ducks, and white-winged scoters. Using RMARK, we examined a suite of mark-resight models of detection probability relative to species, species group, crew, day, group size, and year. Support was highest for models with differences in detection between species type (e.g., swan, loon, eider, goose, gull, duck), group size (singles, pairs, small and medium flocks), and observer crew (front and back seat observer pairings). Average front-observer detection rates ranged from 40-50% in ducks, 50-60% in gulls, and 60-70+% in swans, loons, eiders, and geese. Our results provide visibility detection estimates for adjustment of aerial survey indices to population estimates, while also elucidating the influence of important covariates. Admittedly, our estimated detection rates are maximum values, as the methods we employed only correct for elements of perception bias, not availability bias.

10.51: POSTER PRESENTATION

KODIAK ISLAND COOPERATIVE BARROW'S GOLDENEYE NEST BOX PROJECT

***Denny Zwiefelhofer**, John Crye, and Robin Corcoran*

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In 2010, a project was initiated to provide nesting habitat and collect basic productivity information for Barrow's goldeneye (*Bucephala islandica)* by placing nest boxes on lakes along the Kodiak road system and in a remote area, Karluk Lake. The number of nest boxes available for use varied in road system (range 22-26) and remote locations (range 20-21) with an annual project average of 45 boxes available from 2010-2016. This cooperative effort is supported by the Alaska Department of Fish and Game, Kodiak National Wildlife Refuge, Lesnoi Corporation, Koniag Corporation, U.S. Coast Guard - Integrated Support Command Kodiak, and private individuals. Annual box occupancy rates by goldeneye ranged from 19% in 2011 to 45% in 2016 with a mean occupancy of 33% over the period. Barrow's goldeneyes using project boxes had an estimated average clutch size ranging from 5.9 eggs in 2011 to 9.3 eggs in 2016 with a mean of 7.6 eggs/clutch for project boxes to date. Estimated nest box mean hatching success for known outcome clutches (N = 86) was 84% and ranged from 62% in 2014 to 96% in 2012. Unhatched eggs (N = 75) from abandoned clutches (N = 1) and non-incubated “dump” clutches (N = 8) accounted for 63% of all unhatched nest box eggs (N = 120). Road system nest boxes located on lakes <10 hectares in size have had the majority of use by goldeneye to date. Four road system nest boxes, (1 box - 2014; 3 boxes - 2016) were used by common mergansers (*Mergus merganser)* and had a 97% hatching success of an average clutch of 8.3 eggs per box. Red squirrels (*Tamiasciurus hudsonicus*) have dominated occupancy of road system boxes located on lakes >10 hectares. Project nest boxes have produced over 550 Barrow's goldeneye young since 2011.

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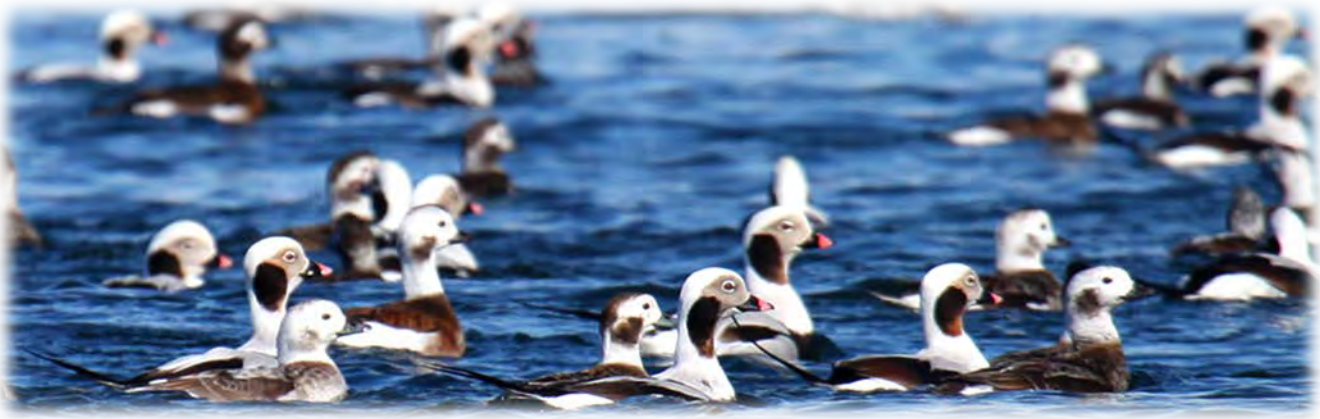
POSTER ABSTRACTS



10.01: POSTER PRESENTATION

FACTORS AFFECTING THE DISTRIBUTION AND NUMBERS OF WINTERING SEA DUCKS IN THE EASTERN PART OF THE BALTIC SEA

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The Baltic Sea is one of the largest brackish water bodies in the world, which is known to be supporting nearly three million sea ducks during the non-breeding season. This study focuses on the less known eastern part of the Baltic – marine waters of Latvia and Estonia. Previous surveys indicated that large numbers of Long-tailed Ducks *Clangula hyemalis* as well as Velvet Scoters *Melanitta fusca* and Black Scoters *M. nigra* use these areas for wintering, however, none of these earlier surveys covered the whole area. The survey took place in February 2016. Field transects were chosen so that they would cover the whole study area – every 3km in the shallow parts and every 6 or 8 km in the deepest parts. Line transect plane surveys with distance sampling were used for data collection. The total length of transects was more than 11,500 km. Eco-geographical variables such as depth, water temperature, salinity, water velocity, availability of different bottom substrates, shipping intensity and others were collected both for the transect segments and cells of the 1-km prediction grid. Different combinations of the variables were tried in the GAM models to explain the recorded distribution of the seaduck species. The obtained GAM models allowed describing habitat preferences and were used for prediction to create density distribution maps and estimate population size for analyzed species and species groups. The abundance of seaducks in winter 2016 was lower than before in most of the sites, however, new concentration hotspots were discovered in previously surveyed areas. The obtained distribution maps were used to identify potential gaps in the current network of Marine protected Areas.

10.02: POSTER PRESENTATION

COMMUNITY-BASED MONITORING OF KING AND COMMON EIDER NEAR ULUKHAKTOK, NT, DURING SPRING MIGRATION

Jeffrey R. Ball *and Kirsty E. B. Gurney*

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Climate change is having widespread impacts on natural and human systems. These impacts are most acute in the Arctic, and marine and freshwater ecosystems are predicted to be the two systems most affected by climate warming in this region. Inuit are experiencing these changes first hand and they are concerned about the effects these changes will have on their subsistence culture. Eiders are more closely associated with the arctic and with sea ice than most other avian taxa. Numbers of King and Common Eider have declined substantially in recent decades. Loss of sea ice, altered foraging conditions, overharvesting, and accumulation of heavy metals are suggested potential mechanisms. We partnered with the community of Ulukhaktok, NT, in 2016 to survey eider passing the community during spring migration, and to quantify the level of mercury contamination in King Eider. Large numbers of eider, particularly King Eider, pass Ulukhaktok during spring migration and significant numbers are harvested annually. Community members are concerned about the availability of eider and what contaminants they may contain. Our goals are to 1) estimate numbers of King and Common Eider passing Ulukhaktok during spring migration, 2) compare current abundance and phenology to a previous survey conducted in the mid-1990's, 3) quantify mercury levels in King Eider, and 4) evaluate wintering location factors contributing to variation in mercury levels within the local southwestern Victoria Island population, and within a regional/continental population by comparing results from a concurrent study at Karrak Lake, NU, where the local King Eider population winters in both Pacific and Atlantic water. This study will provide information on the numbers of eider available to local harvesters, and insights into variation in contaminant exposure that should prove useful in evaluating potential risk factors to eider populations and subsistence hunters.

10.03: POSTER PRESENTATION

IMPACT OF A MID-SUMMER STORM SURGE ON COMMON EIDERS NESTING ON BEAUFORT SEA BARRIER ISLANDS

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In a recent climate change vulnerability assessment of birds breeding on Alaska's North Slope, Pacific common eider (*Somateria mollissima v-nigrum*) were reported to be the highest-risk waterbird, largely due to potential overwash of nests from forecasted sea-level rise and increases in storm surges. To address this risk, the Arctic National Wildlife Refuge and the University of Alaska Fairbanks began a study in 2014 to determine how flooding may impact the population breeding on the Beaufort Sea barrier islands along 120 miles of the Arctic Refuge coastline. We located nests by visiting the islands by boat, then monitored nests with time-lapse cameras and revisited nests to determine fate. We also used high resolution GPSs to determine the height of nests relative to mean sea-level. Summer 2016 was characterized by unusually low snow extent and record low Arctic sea ice in mid-June. On July 18, 2016, a storm lasting 36 hours with winds building to 39 mph led to a surge that brought water levels 1.12 m above mean sea-level and resulted in the inundation of most common eider nests on the islands. Although storm surges have been observed in the region during late summer and fall, we are unaware of an event of this magnitude occurring in mid-July, a period when most common eiders are still incubating. Model predictions suggest that wave heights and storm surges will continue to increase as the sea ice retreats in response to a warming Arctic, placing the barrier island nesting population of eiders at an increasing risk in the future.

10.04: POSTER PRESENTATION

INTER-SPECIFIC POPULATION DYNAMICS OF THE COMMON GOLDENEYE AND BARROW'S GOLDENEYE

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Some of the highest rates of hybridization occur in waterfowl (Order *Anatidae*). Within sea ducks, interspecific gene flow is thought to be most prevalent within the goldeneyes (*Bucephala spp.)* as hybrids have been described from all areas of contact. Barrow's (*B. islandica*) and Common (*B. clangula*) goldeneyes engage in reciprocal nest parasitism, resulting in nests containing eggs of both species. Social ontogeny has been shown to constrain species-recognition abilities, potentially leading to misdirected mating efforts (i.e. hybridization) and interspecific gene flow. Common Goldeneye has a Holarctic distribution and Barrow's Goldeneye is primarily restricted to western North America, but they occur sympatrically in the boreal forest of British Columbia. These species' reciprocal nest parasitism, coupled with the general observation of male biased sex ratios within waterfowl (i.e. unpaired males will be present), led us to hypothesize that gene flow, if any, should occur symmetrically in areas where the two species are codistributed. Using ddRAD-seq data, we examined inter-specific genetic variation between Barrow's (n = 30) and Common (n =34) goldeneyes. Based on 4315 autosomal and 232 Z-linked loci, we uncovered strong differentiation between species (global autosomal Φ_{st} = 0.53; global Z-linked loci Φ_{st} = 0.67) and identified one putative male F1 hybrid captured in British Columbia with assignment probability of 55% as Barrow's and 45% Common goldeneye. Detection of a F1 hybrid in this locale verifies that cross-species gene flow does occur, although given the high level of differentiation observed between species it is likely relatively uncommon. Alternatively, F1 hybrids may suffer some reduction in fitness (e.g. via sexual selection).

10.05: POSTER PRESENTATION

DABBLING DUCK MOVEMENTS: FROM SUISUN MARSH AND BEYOND

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Suisun Marsh is the largest estuarine marsh (48,000 ha) on the Pacific Coast of the coterminous United States and offers an unparalleled opportunity to observe the movements and resource use of sympatric dabbling and diving duck species. Beginning in 2015, we have tracked 5 species of waterfowl in Suisun Marsh using 17 gram Ecotone® GPS transmitters that communicate using the cellular (GSM) network. To date we have marked 268 individuals including five dabbling duck species; Mallard (*Anas platyrhynchos)*, Northern Pintail (*Anas acutas*), Gadwal (*Anas strepera*), Northern Shoveler (*Anas clypeata*), and American Wigeon (*Anas Americana)*. To date we have collected over a half million locations and followed individuals as they move within California during the winter, and in North America through both spring and fall migrations. Three individuals have been tracked for more than 500 days and the longest movement track is over 18,000 kilometers. Each species generally demonstrates specific movement processes. Locally breeding Mallards and Gadwall typically complete a post-breeding migration to molt in the Klamath Basin. Northern Pintail emigrate north, mostly to the Prairie Pothole region of the north-central US and south-central Canada. The varied habitats present Suisun Marsh during the winter create a hub of co-occurring species that serves as the terminus of autumnal migration.

10.06: POSTER PRESENTATION

CHARACTERIZATION OF IMMUNE FUNCTION IN STELLER'S EIDERS

Katrina Counihan *and Tuula Hollmén*

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The Alaska breeding population of Steller's eiders (*Polysticta stelleri*) was listed as threatened under the Endangered Species Act due to declines in their numbers and nesting habitat. The Alaska SeaLife Center maintains a captive population of Steller's eiders and their offspring are being used by USFWS to reintroduce the species to the Yukon Kuskokwim Delta. It is important that the immunocompetence of captive bred eiders is similar to wild eiders; therefore, this study compared the immune function of captive and wild bred eiders that are housed at ASLC. Twenty males from four different age classes were included in the study. This project had three objectives: 1) measure various immune biomarkers to assess immune function, 2) compare immune function among the different age classes, and 3) determine if immune function varied between captive and wild eiders. We hypothesized that immunocompetence would vary among age classes, but not between wild and captive bred birds. Multiple biomarkers were used to characterize immune function including: total and differential white blood cell count, immunoglobulin G and total protein content of serum, T and B cell immunoreactivity and glutathione levels. Nine year old and second year male eiders had significantly higher immune activity than hatch year and males older than 13 years. Immune function appeared to be influenced primarily by age and not whether the eider was captive or wild bred. This study provided a baseline of the immunocompetence of captive male Steller's eiders at ASLC by evaluating various aspects of their immune function.

10.07: POSTER PRESENTATION

CLUTCH SIZES OF THE SPECTACLED EIDER ON THE YUKON DELTA NATIONAL WILDLIFE REFUGE, ALASKA

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The spectacled eider (*Somateria fischeri*) breeds along the coasts of the Bering and Chukchi seas in western and northern Alaska and northern and eastern Russia. Spectacled eiders nesting on the Yukon-Kuskokwim Delta have been in decline since the 1970s (Stehn et al. 1993, Arctic 46:264) and were listed by the U. S. Fish and Wildlife Service as a threatened species in 1993. Listing prompted basic biological research and systematic surveys in Alaska to monitor Yukon-Kuskokwim Delta spectacled eider subpopulations. Recent survey results indicate that the Yukon-Kuskokwim Delta subpopulation may be close to meeting the minimum population benchmark of ≥ 6,000 breeding pairs to be de-listed. Dau (1976, Wildfowl 27:111) noted that nesting patterns of spectacled eiders on the Yukon-Kuskokwim Delta appeared to be dictated by the timing and duration of the spring break-up period. Dau reported a reduction in mean clutch size in females who initiated later within the same season. Stehn et al. (1993) provided information on clutch sizes from random plots throughout the Yukon-Kuskokwim Delta from 1965-1992 while the population was in decline. We plan to look at clutch sizes of spectacled eiders nesting on Kigigak Island on the Yukon-Kuskokwim Delta, Alaska from 1991- 2012 while the subpopulation was beginning to increase. Our objectives were: 1) to compare clutch sizes within and between years, and 2) to compare effects of laying date on clutch sizes.

10.08: POSTER PRESENTATION

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

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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 die-off 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.

10.09: POSTER PRESENTATION

MIGRATION PATTERNS, HABITAT USE, FOOD HABITS, AND HARVEST CHARACTERISTICS OF LONG-TAILED DUCKS WINTERING ON LAKE MICHIGAN

Luke J. Fara*, *Kevin P. Kenow, Michael W. Eichholz, and Steven C. Houdek*

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Recent aerial surveys indicate that Lake Michigan supports a considerable number of wintering long-tailed ducks (*Clangula hyemalis*). For example, a December 2013 survey tallied over 18,000 long-tailed ducks (LTDUs) along 2,400 km of transects. Ranking high in priority with the Sea Duck Joint Venture, LTDUs have been a focal species in a large-scale wintering telemetry project in the Atlantic and Great Lakes regions to address information needs concerning population delineation, migration, and ecology. While a large effort has been placed on radio-marking LTDUs during 2007-2013 on the Atlantic coast and Lake Ontario, the effort has not yet included Lake Michigan. Additionally, hunter harvest of LTDUs has increased since 2002, and forage base has likely changed due to invasive species. We will implant adult female LTDUs wintering on Lake Michigan with satellite transmitters to determine temporal and spatial patterns of migration, breeding ground affiliations, and site fidelity. We will conduct a voluntary boat launch survey on Lake Michigan to assess LTDU harvest, determine harvest rates, species composition, and sex ratios. We will use a combination of hunter harvested LTDUs and Next Generation Sequencing of fecal DNA to determine and assess changes in LTDU diet. Results of the study will aid managers as they deal with outbreaks of type-E avian botulism, near and off-shore wind energy development, and assessment of hunter regulations. Preliminary results of one or more of these will be presented.

10.10: POSTER PRESENTATION

USING THERMAL IMAGERY AND "JUDAS" BIRDS TO INCREASE CAPTURE OF LONG-TAILED DUCKS ON LAKE MICHIGAN

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Locating and capturing long-tailed ducks (*Clangula hyemalis*) and other pelagic waterbirds at night is difficult on large bodies of water, such as the Great Lakes, particularly when there is little knowledge on the locations of night-time distributions. To increase capture opportunities, two approaches were utilized to supplement our knowledge of LTDU distribution on Lake Michigan. Aerial thermal imagery was used to locate flocks at night and guide capture crews on the water. Additionally, a subset of transmitters (n = 5) programmed to transmit at noon and midnight, were deployed on males, termed "Judas" birds, to document diel movements. By utilizing these methods, capture was increased from 0.16 birds per hour (0.83 birds per night) to 0.42 birds per hour (2.10 birds per night).

10.11: POSTER PRESENTATION

CO-CULTURE OF BLUE MUSSEL (*Mytilus edulis)* AND SUGAR KELP (*Saccharina latissima)*: EXPLORING THE POTENTIAL EFFECT OF SEAWEEDS IN DETERRING THE EFFECT OF DUCK PREDATION ON MUSSELS, CASCAPEDIA BAY (QC, CANADA)

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In Europe and Canada the economic losses in blue mussels (*Mytilus edulis*) farms due to duck predation represent a major problem. In this project, an alternative approach will be presented to reduce duck predation passively in mussel farms as traditional techniques are generally neither effective, cost efficient nor without any impact on ducks. These methods are generally focusing on protecting mussels by isolating them (net, protective socks, cages…), using passive repellent (mannequins, mirrors, corpses…) or active repelling techniques (sound, light, chase, lethal force…). These techniques were found to be generally expensive, prone to habituation, potentially stressful to duck populations and often do not take in consideration ice cover. To solve this problem, the presented project intends to introduce sugar kelp (*Saccharina latissima*) in co-culture over a mussel floating line, to visually shield the mussels. We hypothesize that by hiding the mussels from the ducks vision field, it will protect the mussels without imposing further stress on the ducks. Additionally, it is expected that the sugar kelp and blue mussels could benefit from the spatial proximity in terms of production, consumption and excretion. On the farm production, such design, allowing a circular economy where the repellent is also a product, could ease the losses recovery while developing a polyculture model for the farmers. During spring, visual observation of the migrating flock will be made to insure the validity of the test based on the occurrence, the length of stay, the species present as well as duck general behavior around the experimental design. Between April and May 2017, the resulting growth (biomass \ meter), survival rate (density \ meter) and overall quality (Body condition Index) of the mussel will be assessed and compared to a neighbouring empty line without kelp and to another line carrying artificial kelp made of polypropylene sheets.

10.12: POSTER PRESENTATION

EVALUATION OF PRE- AND POST-SURGICAL LACTATE LEVELS IN LONG-TAILED DUCKS (*CLANGULA HYEMALIS*) AS AN INDICATOR OF HYPOXEMIA

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Blood lactate is a biochemical parameter that is known to increase when an organism undergoes anaerobic metabolism, which can be seen in cases of exertional myopathy, mechanical obstruction as well as in other stressful events. During a recent field capture event of long-tailed ducks (*Clangula hyemalis*) in Nantucket Sound, MA, blood lactate levels were assessed using a point-of care analyzer both prior to surgery and prior to release. Results from this study can be utilized to develop novel balanced anesthesia protocols to mitigate the adverse effects associated with field surgery and improve survival outcomes post release and can also direct future research into the value of lactate as a marker of organism stress.

10.13: POSTER PRESENTATION

EVALUATING MOVEMENT PATTERNS AND HABITAT NUANCES OF WINTERING DIVING DUCKS

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Methods to evaluate habitat use and localized movements by diving ducks is complicated by concerns over adverse effects of externally-mounted tracking devices, thus limiting the spatial resolution of inference for these species. However, regional and sub-bay connectivity within the San Francisco Bay-Delta system is presently undocumented, but represents a region of species-specific ecological needs occurring within a mosaic of habitats. The goal of this project was to test emerging technologies for evaluating wintering diving duck movements and habitat associations in the San Francisco Bay-Delta region. During the winter 2015-2016, we deployed 14 solar-powered GPS-GSM backpack transmitters using custom molded silicone harnesses developed to facilitate transmitter attachment to diving ducks. Three species were marked in this pilot year: Canvasback (n = 12), Greater Scaup (n = 2), and Lesser Scaup (n = 1). A total of 4,148 GPS-quality (<20 m) locations were obtained from marked individuals between December 2015 and May 2016. Individuals used a full spectrum of habitats from shallow shoals, tidal marsh, managed marsh, and static deep-water ponds within the Bay sites and transitioned inland towards freshwater habitats during spring months. We describe general movement patterns and habitat nuances highlighted by this methodology, as well as study design considerations for broader application of this marking scheme. Given climate change and cyclical drought conditions the importance of describing key habitat features, spatio-temporal patterns of distribution, and landscape connectivity for these unique-niche species in this ecosystem is critical.

10.14: POSTER PRESENTATION

CAUSES OF, AND RESPONSES TO, DECLINES IN EUROPEAN POPULATIONS OF LONG-TAILED DUCK AND VELVET SCOTER

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Large declines in some populations of European seaduck were first detected in 2011. Of particular concern are Long-tailed Duck (*Clangula hyemalis*) and Velvet Scoter (*Melanittta fusca*), both of which are thought to have declined by around two thirds since the early 1990s and are now listed as Vulnerable on the IUCN Red List.

Action planning workshops carried out for the African-Eurasian Migratory Waterbird Agreement (AEWA) in 2014 (Long-tailed Duck) and 2016 (Velvet Scoter) identified a number of potential threats. Of primary concern are: (i) small scale oil discharges in non-breeding areas and (ii) accidental bycatch in static fishing nets in wintering and staging areas. Other possible contributing factors include: (i) hunting, (ii) development of offshore infrastructure, (iii) large scale accidental oil spills, (iv) competition with non-native Round Goby *Neogobius melanostomus*, (v) disturbance from shipping, (vi) dredging and dumping of aggregates, (vii) human disturbance, and (viii) habitat degradation in breeding areas.

Crucially, data to causally link seaduck declines to most of these factors are lacking, limiting immediate conservation responses. Furthermore, demographic data with which to understand population responses are also lacking. However, some evidence from wing surveys of hunters bags, birds caught as bycatch and ratios of juvenile:adult males in winter flocks suggests that the productivity of Long-tailed Duck has decreased significantly in the last 30 years. This suggests that in addition to the above threats, most of which are thought to be impacting over-winter survival rates, factors affecting breeding success in the Arctic could also be important, at least for Long-tailed Duck.

For an effective conservation response, huge improvements are needed in baseline monitoring and research of European seaducks, including in the remote breeding grounds. In particular, this requires the development of well-resourced research programmes, linked to other established marine and Arctic biological research, aimed at understanding seaduck declines.

10.15: POSTER PRESENTATION

ENERGETIC PHYSIOLOGY MEDIATES INDIVIDUAL OPTIMIZATION OF BREEDING PHENOLOGY IN A MIGRATORY ARCTIC SEABIRD

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The reproductive phenology of migratory species breeding in seasonal environments is predicted to be impacted by a combination of arrival condition, arrival date and the ability to gain in condition once on the breeding grounds. While empirical studies have confirmed that greater arrival body mass and earlier arrival dates result in earlier investment in reproduction, no study has yet been able to assess whether individual variation in energetic management of condition gain impacts this key, fitness-related breeding decision. Using an 8-year dataset from over 350 pre-breeding female Arctic common eiders (*Somateria mollissima*), we tested whether individual variation in two physiological traits influencing energetic management (plasma triglycerides: physiological fattening rate, and baseline corticosterone: energetic demand) predicted individual variation in breeding phenology after controlling for arrival date and body mass. Individuals with higher physiological fattening rates combined with lower energetic demand had the earliest breeding phenology (shortest delays between arrival at the breeding grounds and laying, and earliest laying dates). Our results are the first to determine empirically that individual flexibility in pre-breeding energetic management influences key fitness-related reproductive decisions, suggesting that individuals have the capacity to optimally manage reproductive investment.

10.16: POSTER PRESENTATION

ENHANCING PREY AVAILABILITY FOR SEA AND BAY DUCKS: RESULTS OF A POST OIL SPILL RESTORATION PILOT PROJECT

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The November 2007 M/V Cosco Busan oil spill resulted in significant injury to wintering waterfowl, especially surf scoters (*Melanitta perspicillata*) and greater scaup (*Aythya marila*) in San Francisco Bay (SFB). To assess the restoration potential of habitat augmentations, we deployed two types of prey enhancement treatments in SFB: 1) spawning substrates for Pacific Herring (*Clupea harengus pallasi*) Eggs on Kelp (HEOK), a significant waterfowl prey item, and 2) substrates for natural mussel recruitment to increase availability and quality of prey. Three HEOK rafts were deployed in Richardson Bay Audubon Sanctuary from October 2014 to April 2015. Of the 12 separate kelp deployments, spawn was recorded on 4 deployments, but recorded 3 times on one particular raft. The total number of herring eggs deposited upon deployed kelp over study duration was estimated at just over 3,210,000 eggs, equating to a potential caloric energy of 15,185 – 26,003 kJ. A number of bivalve species readily colonized deployed substrates. Present in this "fouling community" were: California lyonsia (*Lyonsia californica*) at 52 individuals per m^2, invasive Asian Mussel (*Musculista senhousia*), which averaged 14 individuals per m^2, the Blue or Bay Mussel comprising multiple species of the Mytilius sp. complex, which averaged 135 individuals per m^2 and the Carinate dove shell (*Alia carinata*) which had an average of 5 individuals per m^2. Bufflehead (*Bucephala albeola*) and scaup showed a dramatic increase of individuals during the spawn period compared to the pre-spawn period and a substantial decline in the post spawn time period. While restoration of eelgrass as a spawning substrate is planned to benefit herring damaged by the Cosco Busan spill, the HEOK rafts and bivalve recruitment methodologies may provide unique benefits to scoters, scaup and other wintering migratory waterbirds that utilize this food source.

10.17: POSTER PRESENTATION

DISTRIBUTION OF WINTERING LONG-TAILED DUCKS ON LAKE MICHIGAN

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While the Great Lakes are recognized as an important resource to migrating and wintering waterbirds, information on the distribution and abundance of long-tailed ducks (LTDUs; *Clangula hyemalis*) is limited, especially in the western Great Lakes. Information on Great Lakes sea duck concentrations is of interest to resource managers as they deal with several important conservation issues. For example, impact assessment of near-shore and off-shore wind turbine placement and elucidating factors that influence the outbreak of type-E avian botulism require better understanding of the distribution, abundance, and temporal use patterns of waterbirds. We conducted low-level aerial surveys of northern, southern, and eastern Lake Michigan during migration and winter periods of autumn 2010 through spring 2014 along fixed-width transects. Transects were spaced at 3.2 to 4.8-km intervals, and extended up to 32 km offshore.

Long-tailed ducks were among the most abundant species observed during our surveys. The distribution of LTDUs on Lake Michigan was widespread throughout survey areas in northern Lake Michigan during autumn. During winter months, up to 74% of the number of waterbirds tallied along survey transects were LTDUs, when largest concentrations were observed along the Michigan coast from Ludington Bay to Benton Harbor, MI, where water depths ranged between 10-40 m. A peak count of 17,803 LTDUs was tallied on 18-19 December 2013 during a survey of 1,129 km of transects. An extensive portion of waters up to 30 km offshore and 50 m deep in the south end of Lake Michigan was also frequently used by wintering LTDUs. Lake Michigan ice cover extent varied among years, and at times impacted LTDU distribution. The survey data are useful in delineating areas of conservation concern for LTDUs. We plan to model the association of LTDU abundance to a suite of environmental covariates using a hierarchical Bayesian spatial count model.

10.18: POSTER PRESENTATION

EVALUATING HARVEST POTENTIAL AND INFORMATION NEEDS FOR SEA DUCKS

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In 2012, the Sea Duck Joint Venture (SDJV) created a Harvest Management Subcommittee (hereafter we) and initiated an effort to determine the priority information needs to support harvest management decisions for 5 focal species: American common eider, surf scoter, white-winged scoter, black scoter and long-tailed duck. To prioritize information needs, we assessed the influence of uncertainty in individual reproductive and survival parameters on the capacity to determine whether contemporary harvest levels exceeded an assumed management objective of maximum sustained yield (MSY). We compiled estimates from published and unpublished literature and used them to develop probability distributions for each parameter that reflected uncertainty about true mean values for each population. Available field data for these species frequently were collected at small spatial scales (i.e., local sub-population), and may not be representative of mean values for the populations of interest. Therefore, we conducted an expert elicitation to supplement available empirical data. We used Monte Carlo simulation to propagate uncertainty in demographic parameters into probability distributions describing uncertainty in the intrinsic rate of increase (r_{max}), population size, and harvest (harvest rate for common eider) for each population. We used the Prescribed Take Level framework to contrast contemporary harvest levels with allowable harvest levels (i.e., MSY). We assessed the sensitivity of comparisons of contemporary and allowable harvest levels to uncertainty in each of the demographic parameters, Finally, we summarized priority information needs for the SDJV by identifying parameters which were both highly uncertain and had the most influence on the comparison of contemporary and allowable harvest levels. We present the results of the harvest potential assessment and a summary of priority information needs for each of the five species.

10.19: POSTER PRESENTATION

A POTENTIAL TECHNIQUE FOR ATTACHMENT OF SOLAR GPS/GSM TRANSMITTERS ON SURF SCOTERS: SILICONE HARNESS

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The effects of climate change and additive stressors from anthropogenic disturbance have negatively impacted sea-duck populations across North America. To evaluate these impacts, coelomically implanted PTT transmitters have been used to track sea-ducks, but implanting tags in the field is logistically challenging, costly, and invasive. No proven technique currently exists to attach devices externally for long-term tracking of sea-ducks. Compared to surgical techniques, the ability to externally attach tracking devices reduces handling time and stress to tagged birds. Additionally, solar-rechargeable GPS/GSM transmitters provide longer tag-life, a better relocation rate, and data of higher precision than PTT devices. At Patuxent Wildlife Research Center, we developed a silicone-based back-pack style harness for use on surf scoters (*Melanitta perspicillata*). Diving and behavioral studies conducted with captive surf scoters provide evidence that these birds can tolerate external devices attached with flexible, durable silicone, but that we have not yet optimized the design of the equipment including tag design. A more flexible type of silicone, light-weight attachment materials, reduced thickness and weight of harness straps, and improvements in fit and positioning of the device on the dorsal surface of the birds, saw improved results in the second of two pilot field studies conducted on the Atlantic coast in 2015 and 2016. We recommend conducting further dive studies to optimize device position to reduce hydrodynamic drag, and improving transmitter case design so that externally attached equipment can more closely mimic the streamlined body shape seaducks have evolved to support underwater foraging.

10.20: POSTER PRESENTATION

EFFECT OF INTRANASAL MIDAZOLAM HYDROCHLORIDE ADMINISTRATION ON SURVIVAL OF SURF SCOTERS (*MELANITTA PERSPICILLATA*) FOLLOWING INTRACOELOMIC IMPLANTATION OF SATELLITE TRANSMITTERS

Rozenn Le Net, ***Stéphane Lair,*** *Scott G. Gilliland, Timothy D. Bowman, Christine Lepage, Ariane Santamaria-Bouvier, Daniel M. Mulcahy and Matthew G. Sexson*

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Intracoelomic implantations of satellite transmitters have been associated with suboptimal survival rates in surf scoters (*Melanitta perspicillata*), especially when compared to other species of sea ducks. It has been proposed that physical exertion and stress associated with capture, handling, and confinement of these birds results in physiological alterations that could impact post-surgical survival. The objective of this study was to evaluate if the intranasal administration of a sedative (midazolam) could improve the survival rate of surf scoters implanted with intracoelomic transmitters. Midazolam hydrochloride (5 mg) was administered intranasally to 26 randomly selected female adult surf scoters shortly after their capture in Forestville (October 2013, Quebec, Canada). The same volume of saline was given to 26 surf scoters of the same sex and age for comparison. All birds were surgically implanted with an intracoelomic transmitter equipped with a percutaneous antenna by the same surgeon. To assess the effect of the treatment, transmitters were programmed to transmit 2h each day for 30 days post-implantation and survival rate was estimated for each group using the telemetry data. The association between the administration of midazolam and survival was assessed while controlling for other factors such as body mass, hematocrit, plasma total solids, duration of surgery, anesthesia and confinement. Death odds at 30 days for the midazolam group (23%) was significantly lower than those for the saline group (61%) ($p = 0.004$). No other variable was significantly associated with survival. This result indicates that sedation with midazolam following the capture might increase post-surgical survival in surf scoters.

10.21: POSTER PRESENTATION

DISEASE AS A POTENTIAL LIMITING FACTOR FOR COMMON EIDER BREEDING ON BEAUFORT SEA BARRIER ISLANDS

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The Pacific common eider (*Somateria mollissima v-nigrum*; COEI) population declined by 50–90% between 1957 to 1992, and the species is listed as a U.S. Fish and Wildlife Service Bird of Management Concern and an Audubon WatchList species. Although Pacific common eiders have declined throughout their range, those breeding on barrier islands in the Beaufort Sea are considered particularly vulnerable due to small population size, genetic and physical segregation, and rapid environmental change. These factors may place the population vulnerable to disease, and disease may be limiting population recovery. Infectious and parasitic diseases have been documented to cause both mortality and reduced productivity in COEI across the circumpolar region. In previous studies, evidence of disease exposure has been detected in COEI in the Beaufort Sea and a novel adenovirus was reported as a cause of mortality in other sea ducks in the same area. However, the ecology and role of disease as a limiting factor in COEI in arctic Alaska has not been systematically studied. To address this, we collected blood and cloacal swabs from nesting and post-breeding COEI hens across 120 miles of barrier islands in the Eastern Beaufort Sea in 2015 and 2016 and screened samples for evidence of exposure to avian pathogens. Our results are compared to previous data collected 15 years ago in the same region.

10.22: POSTER PRESENTATION

RECOVERY DISTRIBUTION OF SURF AND WHITE-WINGED SCOTERS IN NORTHEASTERN NORTH AMERICA

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Conservation of North American sea ducks is challenging due to considerable knowledge gaps surrounding key demographic parameters. Scoter demography and harvest are poorly understood despite undergoing apparent long-term population declines. The objective of our study was to determine the distribution and level of harvest of Surf and White-winged scoters (*Melanitta perspicillata* and *M. fusca*) banded during the molting period in eastern Canada from 2004–2013. Estimates of harvest rate were 0.5%–2.4% for Surf Scoters and 0.9%–3.6% for White-winged Scoters banded in Labrador and Quebec. Harvest rates thus appear to be relatively low for these species compared to other waterfowl. The harvest locations for Quebec-banded Surf Scoters occurred mostly in Maryland (27%) and North Carolina (27%) followed by Quebec (19%), while Labrador-banded birds were recovered in Maryland (40%), Quebec (11%), North Carolina (10%) and Virginia (10%). For White-winged Scoters, half of the recoveries of Quebec-banded birds were made in Massachusetts (50%), followed by Quebec (21%) and Nova Scotia (14%), while recoveries of Labrador-banded birds were split equally among Massachusetts (20%), Maine (20%), Quebec (20%), Nova Scotia (20%) and New Brunswick (20%). Surf scoters were recovered in Quebec and Nova Scotia in September and October, and gradually recovered in U.S. from November through January, when most of the harvest occurred in Maryland, North Carolina and Virginia. White-winged Scoter harvest occurred in Quebec in October, progressing towards Massachusetts by January, where most birds were recovered. The harvest distribution results were consistent with both species' wintering distribution as recently identified from satellite telemetry. These results represent the first direct measures of harvest rate and harvest distribution for Surf and White-winged scoters. This information will be useful to support harvest management decisions, clarify migratory pathways, and help decision making for resource development (e.g., offshore wind energy).

10.23: POSTER PRESENTATION

PRE-BREEDING FATTENING MEDIATES INVESTMENT IN CLUTCH SIZE IN A CAPITAL-INCOME BREEDING SEADUCK

Holly L. Hennin, Cody J. Dey, Joël Bêty, Pierre Legagneux, H. Grant Gilchrist, and ***Oliver P. Love***

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Many species experience a seasonal decline in clutch size, but few mechanisms have been tested to account for this relationship. Theoretical models predict two possible, non-exclusive pathways: poor condition at arrival on the breeding grounds may delay laying and thereby reduce investment in the clutch, or later arriving females may have reduced resource availability to support the formation of a large clutch. As such, if lower condition or later-arriving females can gain in condition at a faster rate they may be able to lay larger than expected, earlier clutches. Energetic metabolites are useful metrics used by physiologists to estimate an individual's current energetic state, and elevated plasma triglycerides (TRIG) in particular are useful for estimating fattening rate during hyperphagic life history stages. Lipid accumulation and management is critical prior to laying in common eiders (*Somateria mollissima*), which must accumulate significant fat stores prior to laying to both fuel follicle growth and deposit the fat stores needed to successfully complete their 24-day incubation fast. Here we use an 11-year data set collected from East Bay Island, NU, Canada, in pre-recruiting, Arctic-nesting female eiders to examine the potential indirect effect that fattening rate may have on clutch size. Path analytical methods revealed that fattening rate had an indirect effect on clutch size *via* a direct influence on the timing of laying: females with higher fattening rates (TRIG) laid earlier and produced larger clutch sizes. Our results are the first to provide mechanisms underlying the well-documented seasonal decline in clutch size across species, namely that fattening prior to breeding indirectly influences reproductive investment *via* changes to breeding phenology. Further, this work illustrates that flexibility within physiological traits can overcome poor arrival condition or late arrival to positively influence reproductive investment.

10.24: POSTER PRESENTATION

WINTER DISTRIBUTION AND TRENDS OF SEADUCKS IN ESTONIAN COASTAL WATERS IN THE PERIOD 1993 – 2016.

Leho Luigujõe

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The present report gives an overview of the land-based counts of waterfowl in Estonia. The counts were made in mid-January and the counts were organized by the Estonian Ornithological Society since 1966. The Estonia waters were divided into 7 major-sections, 20 sub-sections and 338 count areas. The land-based survey was based mainly on fixed routes or observation points at the coast. The wide network of the Estonian Ornithological Society (150-200) observers covered 80% of Estonian coastline. The key areas of important coastal wintering sites were visited by professional ornithologist. From the coast, birds were recorded to a distance up to 2 km, depends the weather condition.

Main results:

- Stellers Eider was increasing up to 1994. After that these species have a decreasing trend.
- Smew, Goosander and Goldeneye have shown increase.
- Numbers of Mallard, Red-breasted Merganser and Cormorant are stable.

10.25: POSTER PRESENTATION

AN AIRBORNE REMOTE SENSING ALTERNATIVE FOR CONDUCTING PELAGIC SURVEYS OF LONG-TAILED DUCKS

***Brian R. Lubinski**, Larry R. Robinson, Luke J. Fara, and Kevin P. Kenow*

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Traditional low-level aerial surveys have been used recently to determine waterbird distribution and relative density on Lake Michigan. Surveys were flown in a fixed-wing aircraft at an average speed of 200 km/h at about 61 m above the water. Observers tallied waterbirds within 200 m-wide transects on each side of the plane, although only the outside 165 m were observable. Each observation was recorded using an integrated GPS voice recording system.

Airborne remote sensing surveys reduce risk to aircrew and eliminate human factors, such as observer fatigue, effecting target detection. In 2016, the FWS acquired an 80 megapixel metric grade aerial camera with a 70 mm lens and added a medium wavelength cooled thermal camera integrated into a direct georeferencing system. This system produces imagery that can be georeferenced without the need for discernable features within the imagery, providing a tool to survey pelagic waterbirds during the day and at night. In October 2016, the system was used to locate long-tailed ducks (LTDUs) at night from 610 m above the water at 230 km/h ground speeds and the location information relayed to capture crews on the water. In addition, daytime missions were flown to evaluate the efficacy of replacing traditional low-level surveys with an airborne remote sensing alternative. These daytime flights were flown at 305 m above the water, and produced 234 m-wide images that were georeferenced, mosaicked and used to manually count LTDUs with encouraging results. Thermal imagery collected at night from 610 m above the water produced a 218 m-wide image (0.17 m ground sample distance) that suggested night time surveys of waterbirds was possible for certain applications under certain environmental conditions. Efforts are now underway to develop an automated tool to identify LTDUs within the visible imagery, necessary to make this remote sensing technique operational.

10.26: POSTER PRESENTATION

SPECTACLED AND STELLER'S EIDER RECOVERY PROGRAM: CONSERVATION STRATEGY

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The range-wide population of spectacled eiders and the Alaska-breeding population of Steller's eiders are listed as Threatened under the Endangered Species Act (ESA). Region 7 (Alaska) Fairbanks Fish and Wildlife Field Office, which leads recovery programs for both species, coordinates management actions that are guided by a broad conservation strategy and conducted by a suite of partners. For spectacled eiders, three breeding populations are recognized: Yukon-Kuskokwim Delta (YKD), Arctic Coastal Plain (ACP), and Arctic Russia (AR). Monitoring data indicates that the status of the YKD population has improved since listing, the ACP population has remained stable, and the AR population meets recovery criteria based on its abundance. The most important element of the spectacled eider conservation strategy is monitoring population abundance and trend needed to evaluate status in relation to recovery criteria. For Steller's eiders, viable populations on both the ACP and YKD are required to meet recovery criteria established in the species' recovery plan. Aerial surveys indicate that roughly a few hundred individuals occur on the ACP although abundance and reproductive effort appear to vary across the region and among years. The YKD population is considered essentially extirpated, with only one nest found in the last decade. The Steller's eider conservation strategy includes increasing adult female survival and breeding success of the extant ACP population, and possibly re-establishment of a viable population on the YKD through reintroduction. Management actions being implemented on the ACP include: research and monitoring, outreach and law enforcement to reduce shooting mortality and use of lead shot, arctic fox and raven control near Barrow to increase nest and brood success, and reducing habitat loss and disturbance through the ESA Section 7 consultation process. The feasibility of reintroduction of Steller's eiders to the YKD is being evaluated through an experimental pilot project begun in 2015.

10.27: POSTER PRESENTATION

REDUCING GILLNET BYCATCH: SEADUCK UNDERWATER HEARING THRESHOLDS AND AUDITORY DETERRENT DEVICES

Kathleen A. McGrew[1], *Christopher K. Williams, Alicia M. Wells-Berlin, Sara E. Crowell*

KAM and CKW: University of Delaware, Department of Entomology and Wildlife Ecology, Newark DE
AMW and SEC: United States Geological Survey, Patuxent Wildlife Research Center, Laurel MD

As diving foragers, seaducks are vulnerable to underwater human activities, including naval sonar activity, seismic surveys, construction, and gillnet fisheries. Bycatch in gillnets is an important source of mortality for seaducks and other marine birds, killing hundreds of thousands of seabirds annually. While several studies have looked at the potential of acoustic deterrents to lower bycatch risk for marine mammals, sea turtles, and some species of seabirds, there has been very little work done to determine the potential for these types of devices to reduce seaduck bycatch. Understanding of underwater acoustic sensitivity in diving birds is important for the design of acoustic deterrent devices and evaluation of their effects on reducing bycatch. In addition, hearing sensitivity measurements provide information on possible behavioral and physiological impacts of man-made noise sources in aquatic environments. We are investigating underwater hearing in captive seaduck species in order to determine the efficacy of commercially available auditory deterrents, such as pingers, to specifically reduce seaduck bycatch. We hand-raised long-tailed ducks (*Clangula hyemalis*), surf scoters (*Melanitta perspicillata*), lesser scaup (*Aythya affinis*), and harlequin ducks (*Histrionicus histrionicus*) at Patuxent Wildlife Research Center's (PWRC) captive sea duck facility. We used psychoacoustic techniques to train the ducks to respond to sound stimuli underwater in PWRC's dive-tanks. Trials are underway in order to obtain underwater auditory thresholds for these bycatch-sensitive species. Preliminary threshold data suggest that long-tailed ducks may have less sensitive underwater hearing than marine mammals, which are the target for most commercial pingers today. In the coming months we will gather more threshold data from our captive seaducks in order to be able to recommend appropriate specifications for seaduck targeted acoustic deterrents.

10.28: POSTER PRESENTATION

CAPTIVE RAISED GROWTH MODELS FOR SEADUCKS

Kathleen A. McGrew[2], *Sarah Fitzgerald, and Alicia M. Wells-Berlin*

KAM, SF, AMW: USGS, Patuxent Wildlife Research Center, Laurel, MD, USA

The establishment of Patuxent Wildlife Research Center's breeding captive colony has enabled us to collect duckling growth data on multiple species of seaducks and dabbling ducks, including surf scoters (*Melanitta perspicillata)*, white-winged scoters (*Melanitta fusca)*, long-tailed ducks (*Clangula hyemalis)*, lesser scaup (*Aythya affinis*), and harlequin ducks (*Histrionicus histrionicus*), and American black ducks (*Anas rubripes*). Daily weights and biweekly tarsus and culmen measurements were obtained on ducklings from day of hatch up to 100 days of maturity for two years, with the objective of developing models that predicted each respective species' growth trend. We preliminarily present key parameters of the Gompertz growth model, including growth rate constants, total growth, and the growth asymptote, for multiple species. Overall, seaducks had higher growth rates than dabbling ducks and larger ducks had older ages of peak growth than smaller individuals. These baseline data could be used as model growth curves of ontogenetic development and peak growth for individuals encountered in the field, allowing field biologists to use these measurements to potentially estimate age.

10.29: POSTER PRESENTATION

IDENTIFYING AREAS OF IMPORTANCE FOR SEA DUCKS THROUGHOUT THEIR ANNUAL CYCLE

***Nic McLellan**, Tim Bowman, Sean Boyd, Shannon Badzinski, Christine Lepage Scott Gilliland, James Churchill*

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Studies supported by the North American Sea Duck Joint Venture (SDJV) partnership have helped improve our understanding of important sea duck habitats across the continent and beyond. This work has involved a variety of techniques including satellite telemetry, and new or improved waterfowl surveys. The SDJV's goal is to make information on habitat use available to decision makers and ultimately improve the conservation and management of these species. Currently, we are developing an atlas that identifies key sites for sea ducks throughout North America and documents their seasonal importance, current protection or designations, and potential threats. Our next step is to make accessible spatially explicit sea duck data through one or more existing geospatial database hosts that can be queried by interested folks, along with other environmental parameter data. We envision these products will be used to: 1) provide justification for protecting areas of importance to sea ducks, 2) improve decision making for resource development in key areas, 3) direct research investigating biotic and abiotic features that characterize sea duck habitats, and 4) predict how habitat conditions may change and potentially impact populations. In this poster we highlight some of the most important habitats/areas for sea ducks in North America.

10.30: POSTER PRESENTATION

ESTIMATING BEHAVIORAL MULITPLIERS TO RESTING METABOLIC RATE IN AMERICAN BLACK DUCK AND LESSER SCAUP

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American black duck (*Anas rubripes*) and lesser scaup (*Aythya affinis*) populations have experienced continual declines over recent decades. Research suggests that these declines may be the result of a complex of factors including resource availability on non-breeding landscapes. In an attempt to quantify the ability of a landscape to support migrating and wintering waterfowl populations, many studies have begun using bioenergetics modeling to calculate energetic carrying capacity by estimating energy demand and energy supply. Estimates for many of the physiologic parameters required in calculating energetic demand (i.e. resting metabolic rates, time-activity budgets, etc.) have been explored, yet estimates of other critical parameters are still lacking. The objective of this project is to produce estimates of behavior specific multipliers to resting metabolic rate (RMR) in American black ducks and lesser scaup. These species were chosen as focal species due to their current population status and their representation of both the diving and dabbling duck guilds, which allows for reasonable extrapolation to additional species. We used open-flow respirometry techniques to estimate RMR and to isolate behavior specific factorial increases to RMR in captive American black ducks and lesser scaup. Respirometry trials were performed between September, 2015 and March, 2016 at Patuxent Wildlife Research Center, Laurel, MD. Results presented will provide more accurate estimates of daily energetic expenditure for these species and will ultimately contribute to refined landscape carrying capacity estimates for waterfowl during the non-breeding period.

10.31: POSTER PRESENTATION

ASSESSMENT OF BIOINDICATOR APPROACHES FOR TRACE ELEMENTS AND SUBLETHAL HEALTH EFFECTS IN SEA DUCKS BREEDING IN ARCTIC ALASKA

***Micah W.C. Miller**, James R. Lovvorn, Angela C. Matz, Robert J. Taylor, Christopher J. Latty, David E. Safine, Tuula E. Hollmén*

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As industrial development, thawing permafrost, and aerial deposition of pollutants increase in the Arctic, bioindicators to monitor contaminants exposure in a range of community components are increasingly important. However, indicators are seldom compared to similar species to verify their relevance. For example, female common eiders (*Somateria mollissima*) are widely used indicators of species that use marine habitats for much or all of the year. However, they are but one of a number of related species found in the Arctic, with varying migration, diet, and body size which may influence contaminant exposure. Contaminants may induce a suite of physiological responses, but typically contaminants are regressed against single markers independently. We examined blood levels of multiple trace elements, and effects on blood-based biomarkers, in long-tailed ducks (*Clangula hyemalis*), Steller's eiders (*Polysticta stelleri*), spectacled eiders (*Somateria fischeri*), king eiders (*Somateria spectabilis*), and common eiders nesting in Arctic Alaska. We also assessed element levels in feathers of king and spectacled eiders. Blood concentrations of elements varied widely among species, and among ages and sexes within species. Comparisons among species indicate that element concentrations in blood of common eiders may yield very different toxicity and biomarker responses than in other species. For all species, concentrations in feathers ranged from ~6 to over 900 times those in blood, and did not demonstrate the same relative patterns. Future biomonitoring efforts must consider the potential variation in metals concentrations among species. Moreover, use of bioindicator species to infer concentrations and their effects in other species may not always be suitable, even in closely-related taxa.

10.32: POSTER PRESENTATION

LONG-TAILED DUCKS IN WESTERN LAKE MICHIGAN

***William P. Mueller**, Bryan B. Lenz*

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As part of a group of research entities studying pelagic waterfowl in the Great Lakes, WGLBBO observers surveyed the waters of western Lake Michigan during Phase 1 and 2 of the Great Lakes Commission's pelagic waterfowl/waterbird monitoring in 2012-2014. Our mapped data portray examples of temporal and geographic distribution of Long-tailed Ducks (LTDU) in the offshore waters of western Lake Michigan, in a zone covering survey blocks 1.6-16.0 km from shore, from Door Co. WI to the WI/IL border, plus additional observations in the 0-1.6 km zone. LTDU consistently occupy an offshore zone in deeper water and consistently further from shore than most other diving duck species, with many data records as far as 16.0 km from shore not uncommon. In both migration seasons, LTDU arrive later than most other divers, in spring have often migrated out of this zone by early April, and are replaced there by other, later-migrating species.

10.33: POSTER PRESENTATION

USING I-STAT BLOOD RESULTSTO PREDICT P0ST PTT IMPLANT SURVIVAL IN LONG-TAILED DUCKS AND SCOTERS

***Glenn H. Olsen[1]**, Anand Krishnaswamy, Michael C. Runge, Alicia M. Wells-Berlin, Dustin E. Meattey*

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AK: Veterinary Medicine Student, Sri Lanka
DEM: University of Rhode Island and Biodiversity Research Institute

We obtained blood samples from Long-tailed Ducks (*Clangula hyemalis*), Surf Scoters (*Melanitta perspicillata*), and White-winged Scoters*(Melanitta fusca*), after capture and before surgically implanting the ducks with satellite transmitters (PTTs).The blood samples were immediately analyzed using an I-Stat blood analysis unit. We followed the ducks post-release until they died, the battery on the PTT died, or the signal was otherwise lost. Using a Weibull analysis of the survival data, we are seeking to determine whether any factors available on the I-Stat cartridge help predict long-term (1-2 years) post-implant survival in these three species. The I-Stat blood analysis unit is portable, battery operated, and easily taken into most field conditions where surgery would be performed to implant PTTs. Using predictive pre-surgical blood screening techniques would enable wildlife biologists and wildlife veterinarians to better choose the sea ducks to implant with satellite transmitters. Initial results with a small sample of ducks suggest that the heterophil to eosinophil ratio is a weak predictor of long-term survival, but none of the I-Stat metrics showed a significant effect.

Mention of commercial products does not imply US Government endorsement.

10.34: POSTER PRESENTATION

LONG-TAILED DUCK AND SCOTER HEMATOLOGY AND SERUM CHEMISTRY

***Glenn H. Olsen[2]**, Alicia M. Wells-Berlin, Sara E. Crowell, Kathleen A. McGrew*

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Starting in 2006 as part of Sea Duck Joint Venture and Bureau of Ocean and Energy Management Projects, we collected blood from healthy surf scoters (*Melanitta perspicillata*), black scoters (*Melanitta americana*), white-winged scoters *(Melanitta fusca*), and long-tailed ducks (*Clangula hyemalis*) being banded and receiving satellite transmitter implants. We report the clinical blood results including white blood cell counts, red blood cell counts, hematocrits, and serum chemistry results, creating baseline results for each species.

10.35: POSTER PRESENTATION

VISUALIZING POPULATION DELINEATION AMONG NORTH AMERICAN SEA DUCKS: MAPS FOR FUTURE RESEARCH AND MANAGEMENT PLANNING

***John Pearce**, Mary Whalen, and Josh Stiller*

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JS: New York State Department of Environmental Conservation, 625 Broadway, Albany, New York, 12233, USA

Most sea duck species remained poorly-studied up until the mid-twentieth century and population declines were noted in many species beginning in the 1990s. In 1998, the North American Sea Duck Joint Venture (SDJV) was established to promote "the conservation of all North American sea ducks through partnerships by providing greater knowledge and understanding for effective management." A priority of the SDJV has been to complete assessments of migratory connectivity to inform population delineation of sea duck species across North America. The U.S. Geological Survey (USGS) has participated on the Continental Technical Team and Management Board of the SDJV since its inception, and provides scientific information relevant to the mission and priorities of the SDJV. Continuing with that goal, here we provide an update on the status of current knowledge regarding geographic distribution, migratory connectivity, and population delineation of sea duck species in North America. We provide maps of all known band recovery, genetic, and telemetry data across the North American range of sea duck species and visually assess evidence for population delineation at the continental scale. Results from this exercise demonstrate consistency across different marker data sets in continental levels of population delineation for several species, a lack of basic information on population delineation for others, and evidence for where future research dollars would most efficiently be directed to enable hypothesis-driven research that addresses knowledge gaps.

10.36: POSTER PRESENTATION

ANNUAL FACTORS AFFECTING THE WINTERING DISTRIBUTION OF BLACK SCOTERS

Hannah M. Plumpton*, *Emily D. Silverman, Beth E. Ross*

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BER: U.S. Geological Survey, South Carolina Cooperative Fish and Wildlife Research Unit, Clemson, SC, USA
EDS: U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Laurel, MD, USA

Along the Atlantic coast of the United States there has been an increase in human activity. These activities include energy production, sand mining, aquaculture, shipping, and coastal development that all have the potential to greatly impact sea ducks throughout their migratory cycle. Of the sea ducks wintering along the Atlantic coast the black scoter (*Melanitta americana*) has the largest and most variable range, encountering the effects of global change throughout migration. To better quantify the abundance and wintering distribution of black scoters and other sea ducks, the U.S. Fish and Wildlife Service conducted aerial surveys from 2009-2012 along the Atlantic coast. The initial results show that the core wintering areas used by black scoters varied each year and that black scoters could be found as far north as the U.S.-Canada border and as far south as the Georgia coast. We build on this work to further describe the species distribution during winter and assess the factors affecting their annual distribution using the data from the U.S. Fish and Wildlife Service winter surveys. We discuss and identify several key habitat variables including the ocean depth, substrate type, and the interpolated surface of slope. This study will increase knowledge on the wintering ecology of black scoters and aid in the development of future aerial surveys to better quantify abundance, as well as identifying areas of potential overlap with energy development.

10.37: POSTER PRESENTATION

FORAGING DIVE TIMES OF DIVING DUCKS IN A FRESHWATER LAKE

Carrick M. Rice**, *Philipp N. Maleko, Tracey Rice, and Luke J. Matthews*

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Behavioral observations of wildlife can offer valuable information about species' life histories and ecological interactions. Due to the fact that waterfowl from both the Aythyini and Mergini forage by diving, investigating factors relating to dive duration could offer valuable insight into how this shared behavior differs among groups of ducks. Members of both of these tribes winter and forage at Lake Solano in the Central Valley of California. Observation of their foraging behavior was undertaken during the winter of 2016 to assess inter- and intra-specific differences, as well as to determine the influence of local environmental factors. Dive durations were recorded for individuals of each species present at the study site. Also noted for each dive was the gender of the individual, the location along the lake (water depth), the time of day, and whether or not the dive was synchronous with other individuals. Data was collected for seven species: five Mergini (*Bucephala albeola*, *B. clangula*, *B. islandica*, *Mergus merganser* and *Lophodytes cucullatus*) and two Aythyini (*Aythya collaris* and *A. affinis*). Results showed a correlation between species and dive times, as well as water depth and time of day. While these data are not conclusive owing to the small sample size and limited spacial scale, they suggest that future studies could focus on determining which factors are most influential on dive duration in a larger system.

10.38: POSTER PRESENTATION

TIMING, DURATION, AND PATHWAYS OF HARLEQUIN DUCK MIGRATION TO PACIFIC MOLTING AND WINTERING AREAS

Sean Boyd, Beth MacCallum, Malcolm McAdie, Lisa Bate, Chris Hammond, Matt Wilson, Joseph Evenson, Susan Patla, ***Lucas Savoy***

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The core breeding range for Harlequin Ducks (*Histrionicus histrionicus*) in western North America extends from Alaska, south through the Yukon, Northwest Territories, and British Columbia. Smaller, breeding populations exist in southwestern Alberta and the northwestern US and include areas of Washington, Idaho, Wyoming, and Montana. Each state and province has identified the Harlequin Duck as a species of conservation priority, given their small and isolated populations and specific nesting requirements for pristine mountain-streams. Conservation objectives for these areas have all identified the importance of mapping migration routes that connect breeding sites to Pacific coast molting and wintering locations, as well as determining migration timing, duration, habitat use, and stopover sites. In spring 2016, we captured Harlequin Duck pairs on breeding streams and surgically implanted satellite transmitters in the males and attached geolocators to the leg bands of females. We marked a total of 18 male harlequins (Alberta = 10, Montana = 5, Wyoming = 2, Washington = 1) and 17 females (Alberta = 8, Montana = 5, Wyoming = 2, Washington = 2). One Montana male was presumably predated shortly after capture; so 17 males successfully migrated from their breeding streams to their Pacific coast molting locations. Migration initiation dates for the 17 marked males varied by breeding areas and occurred between June 03 –July 10. Individual male migration lasted between 1-17 days and stopover sites were approximately half-way to the coast and included rivers, mountain streams and lakes. The males arrived at their molting areas between June 05-July 24 and these areas ranged from southeast Alaska to northwestern Washington. Satellite transmitters are programmed to provide location data until July 2017 so this will allow us to map their winter sites once they have completed molting. Efforts will be made to retrieve the geolocators from females in spring 2017.

10..39: POSTER PRESENTATION

CONTAMINANT CONCENTRATIONS IN THE ENDANGERED SCALY-SIDED MERGANSER FROM RUSSIA

*Diana V. Solovyeva, **Lucas Savoy**, Oksana Lane, Sergey L. Vartanayan, Christopher Perkins, and Kevin Regan*

The Scaly-sided Merganser (*Mergus squamatus*) is a highly endangered sea duck, and breeding exclusively in isolated areas in Far-East Russia, China, and Korea. The Scaly-sided Merganser's breeding habitat consists of freshwater rivers within wooded mountainous regions. Nesting occurs in natural tree cavities or artificial nest boxes erected near the river's edge. Post-breeding, the Scaly-sided Merganser migrates to wintering locations, consisting of river, pond, and ocean areas of central China and primarily in the Yangtze River Basin. In recent decades, this region has become highly polluted from rapidly increasing industrial development and agricultural runoff. From 2012-2015, we collected un-hatched or abandoned eggs, whole blood and feathers from breeding female Scaly-sided Mergansers in Russia. We also collected feathers from molting male mergansers in Primorye, Far East Russia. Samples were delivered to the United States for trace element and heavy metal analyses to determine contaminant exposure to the Scaly-sided Merganser. We analyzed a total of 53 samples for nine different contaminants and included: silver (Ag), Arsenic (As), cadmium (Cd), chromium (Cr), mercury (Hg), nickel (Ni), lead (Pb), selenium (Se), zinc (Zn). We compared results to published sea duck contaminant studies worldwide. The majority of the contaminants contained concentrations similar to those reported for other sea duck species, and considered non-harmful background levels. However, Hg and Cr frequently exceeded concentrations noted in other sea duck studies and may contain concentrations of concern for the Scaly-sided Merganser. We present the first Scaly-sided Merganser contaminant data and compare our findings to concentrations reported for several sea duck species worldwide.

10.40: POSTER PRESENTATION

SURVIVAL RATE OF SPECTACLED EIDERS ON AYOPECHAN ISLAND, CHUKOTKA, RUSSIA

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Demography of Spectacled Eiders (*Somateria fischeri*) was investigated during 2002 – 2015, with breaks in 2006 and in 2014, on Ayopechan Island, Chaun Delta, Chukotka, Russia. 52 square nest search plots (1 km^2 each) set up in 2003 but these were reduced to 40 in 2007 as unsuitable plots were removed. At least 40 plots were in use annually after 2007. All active and depredated nests were recorded. All active nests were revisited in 10-day interval. We used water test for determined stages of incubation and captured females at their nests 0 to 5 days prior to predict hatch date using mechanical or automatic bow-trap, or a small net. In addition to nesting females we captured non of failure breeding females with mist-nets on their feeding lakes. Females were marked with Moscow standard bands and engraved plastic bands with alfa-numeric code. A total 135 adult females were marked between 2002 and 2015 and 22 ducklings were banded between 2003 and 2004. Females were resighted during nesting in the years following banding year by capturing or by use of camera-traps. Forty two females were recaptured in subsequent years. Comrack-Jolly-Seber maximum likelihood approach was used to estimate annual survival (φ) and resighting probabilities (p) from mark-resight data. Based on data, which were collected during field study on Ayopechan Island, we estimated recapture probabilities, median age of first reproduction, natal and breeding site fidelity of Spectacled Eider females.

10.41: POSTER PRESENTATION

WINTER DIVING ACTIVITY OF SPECTACLED EIDER *SOMATERIA FISCHERI* AS REVEALED BY PRESSURE TAG

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Four females Spectacled Eiders were equipped with pressure tags with three tags by Cefas Co, United Kingdom, and one tag by Lotek Co, Canada. Females were trapped at their nests in Chaun-Delta, Chukotka, Russia, in June 2010 and June 2012. Only females which showed site-fidelity to the same nest site were selected for tag deployment. Two females were recaptured after two years of tag wearing. One more female was recaptured after 3 years but tag wasn't retrieved. Among two tags retrieved one was recording diving depth and temperatures for 5 days between 1 and 5 of November 2010. Second tag was injected salt water and didn't provide a record. Diving tag recorded pressure and temperature data in one minute interval. Maximal diving depth averaged 43.05 m. Diving sessions timing and duration, dive and pause duration are discussed.

10.42: POSTER PRESENTATION

COAST TO COAST: ASSESSING MIGRATORY CONNECTIVITY OF NORTH AMERICAN SCOTERS

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Understanding how populations of migratory species are geographically linked throughout the annual cycle (i.e. migratory connectivity) is fundamental to understanding the genetic and demographic structure of populations, as well as where and when conservation measures should be implemented. Among North American seaducks, assessing connectivity is challenging as species have large distributions, varied migratory strategies and dispersal propensities. Many seaduck species exhibit some level of breeding and wintering site fidelity; though unless seasonal fidelity is accompanied by philopatry, it does not result in breeding population structure as young birds disperse among regions linking demographic parameters. Although scoters have similar life history characteristics, patterns in their breeding and wintering distributions are species-specific (based on banding and telemetry data), potentially influencing the degree of migratory connectivity. Black Scoters are highly segregated (east and west coast); coincident with their discontinuous breeding distribution. Surf Scoters have a continuous breeding distribution with limited overlap between eastern and western segments in winter. Despite a disjunct breeding distribution, White-winged Scoters are likely highly admixed in winter due to movement of central region birds to both coasts. Species, such as the scoters, with limited detailed data on migratory and dispersal patterns, genetic data can provide much needed insight into population connectivity and delineation. We used genome-wide scans (i.e., RadSeq) to assess population genetic structure of the three North American scoter species across four regions (Alaska, Pacific, Central, and Atlantic). This method allowed us to scan larger portions of the genome (> 3000 loci) than past efforts, enhancing our ability to uncover shallow genetic divergence (a general characteristic of high-latitude species) and detect loci promoting divergence among geographic regions. These data will provide additional information on where (or if) demographic breaks as evidenced by restricted dispersal among regions are occurring and aid managers in delineating populations.

10.43: POSTER PRESENTATION

A REVIEW OF SEA DUCK HARVEST IN WASHINGTON STATE: MONITORING HUNTER PARTICIPATION AND HARVEST TRENDS

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Substantial waterfowl populations in the Pacific Flyway over the last 15 years have allowed for liberal seasons and bag limits. Current regulations are among the most liberal ever offered in Washington and beginning with the 2014-15 season hunters could retain three times the daily bag in their possession for most waterfowl. The 2015-16 waterfowl harvest was regulated under Washington State regulations following federal framework recommendations and allowed the maximum (107 days) number of days under the Migratory Bird Treaty Act; by which, Washington's season length was 105 days statewide with two additional days for the statewide Youth Hunt. The daily bag-limit was 7 ducks, but Washington State elected to further restrict sea duck harvest to include not more than 1 harlequin (season limit), 2 scoter, 2 long-tailed duck, and 2 goldeneye in western Washington due to concerns over low recruitment in sea ducks and the potential for small harvest to be focused on a disproportionately high concentration of certain species relative to the rest of the Pacific Flyway winter distribution. Because statewide surveys are not accurate enough to measure harvest of several priority waterfowl species, special surveys have been developed that utilize written hunting authorizations and mandatory reporting. The sea duck (harlequin, scoter and long-tailed duck), brant, and snow goose harvest is estimated annually using a mandatory harvest report card for each species. Written authorization and harvest reports have been required of sea duck hunters in all of western Washington since 2004. The harvest survey indicated a total harvest of 737 scoters, 103 long-tailed ducks, 88 harlequin ducks and 451 goldeneyes. The reported goldeneye harvest included 60% common goldeneye. From 2,113 authorizations, an estimated 632 hunters were successful and hunted a total of 1,810 days. Primary harvest areas included Island, Mason, Skagit, Clallam, Pierce, and Whatcom counties. Patterns in harvest are consistent with distributional patterns detected during extensive annual aerial survey efforts of the Puget Sound region. Since adoption of the 2004 mandatory harvest card reporting requirement, harvest of the primary species, surf scoter, has been reduced by more than 50%, but some level of harvest has been maintained on the seven species of sea duck commonly sought after by the state's waterfowling community.

10.44: POSTER PRESENTATION

NEST ATTENDANCE PATTERNS OF COMMON EIDERS AT WAPUSK NATIONAL PARK IN NORTHERN MANITOBA

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Common eiders (*Somateria mollissima*) have been well studied because of their value to the down industry. However, little data is available regarding detailed nesting behaviors in areas where down is not commercially harvested. Nesting behaviors of incubating hens can be reflective of changing environmental conditions important to reproductive success. The objective of this study was to explore factors influencing nest attendance patterns of female common eiders breeding along the western Hudson Bay in Wapusk National Park, Manitoba, Canada. During 2014-2016 nests were located using systematic searches, and eggs were candled to determine incubation stage. Time-lapse photography was used to monitor a subset of common eider nests within the colony. Cameras were left at the nest until hatch or failure, and photographs were reviewed to record female attendance patterns. We examined the influence of covariates including nest location within the colony and incubation stage on the number and duration of daily recess events and overall incubation constancy. Preliminary results from 2014-2015 show female eiders took 2 recesses per day, each lasting an average of 29 minutes. Females spent approximately 97% of their time incubating which decreased slightly as incubation age progressed. We found little variation in incubation constancy regardless of distance to center of the colony or proximity to nearest neighboring nest. Changes in recess number and duration may indicate shifts in resource availability to eiders in this colony prior to breeding and may play a role in observed annual variation of reproductive success and overall colony dynamics.

10.45: POSTER PRESENTATION

THE ENERGETIC COSTS AND REPRODUCTIVE BENEFITS OF MATE GUARDING IN A DIVING SEADUCK

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Reproduction is an energetically demanding life history stage, with males and females exhibiting different types of costs. In species with female-based, mono-parental care, male reproductive investment often comes in the form of mate or territorial defense, which can often impact the reproductive success of their mate. Although there are substantial energetic costs predicted to be associated with mate guarding in the pre-breeding period, the mechanisms regulating energetics at this stage, and the mechanisms linking male condition to female reproductive success, are currently poorly understood. Common eiders nesting at East Bay Island are a model species to explore the relationship between male and female state because of both members of each pair are captured simultaneously during the pre-breeding period. Male eiders are expected be decline in condition during the pre-breeding period compared to an increasing condition of their paired female because males must expend significant amounts of energy defending their mate from extra-pair copulations or defending her foraging territory. Consequently, there will be an increasing disparity in relative state across the pre-breeding period as male condition declines. Here we examine whether variation in male energetic physiology (corticosterone, triglycerides, beta-hyroxybutyrate, non-esterified fatty acids and immunoglobulin Y) is able to predict the subsequent condition of their paired female, and by extension her subsequent breeding decisions (likelihood of breeding). We hypothesize that males in lower relative condition — with higher baseline corticosterone and beta-hydroxybutyrate, and lower triglycerides, non-esterified fatty acids, and immunoglobulin Y — may ultimately benefit via their females laying earlier and successfully breeding. These results will be important in explaining indirect drivers of reproductive timing and success in Arctic-nesting common eiders, and identifying mechanisms underlying sex-specific, reproductive trade-offs.

10.46: POSTER PRESENTATION

ASSESSING HUNTING SUSTAINABILITY IN A DECLINING FLYWAY POPULATION OF COMMON EIDERS *Somateria mollissima*

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For harvested species, management decisions have the power to greatly influence population dynamics. Therefore, managers must ensure that harvest is well balanced and does not remove more than a sustainable population surplus. Ideally, this assessment should investigate how much hunting harvest contributes to total mortality and ultimately how it affects population dynamics. We constructed ring-recovery and ring-recapture-recovery multistate models which account for cause-specific reporting probabilities to estimate unbiased proportions of the Baltic/Wadden Sea population of the Common Eider *Somateria mollissima* dying due to 1) hunting and 2) other causes. We first used a ring-recovery model and life histories of > 18.000 Eiders ringed at ten study sites to estimate annual proportions of adult female Eiders dying due to hunting (α_h) during 1971-2014. By means of a ring-recapture-recovery analytical framework we also estimated the proportion of ducklings (and adult females) dying due to hunting at two sites. We then extracted means of all available demographic data and specified population projection models that allowed us to investigate the effect of past and present hunting regulations on changes in population size at the flyway level. To account for uncertainties in flyway population size estimates, depending on the type of census, we modelled two scenarios. Our results indicate that even under a best case scenario a complete ban on shooting fecund females is not enough to stop the observed decline, because of increases in natural mortality of both adult females and immatures over the last 2 decades. Although, levels of natural mortality must decrease in order to fully halt the decline of the Baltic/Wadden Sea flyway population, we advocate to maintain and extent the current ban on hunting females to also apply to immature male age classes.

10.47: POSTER PRESENTATION

A SURVEY OF SEA DUCK PREY ITEMS ACROSS FOUR SITES ON THE YUKON-KUSKOKWIM DELTA, ALASKA

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The Yukon-Kuskokwim Delta is a globally important area for wildlife, and supports a high biodiversity and abundance of migrating and nesting marine birds and waterfowl. Changes in the environment due to climate change affect wetland ecology in this region. The objective of this project is to identify potential diet items for ground nesting waterfowl across coastal areas in the central Yukon-Kuskokwim Delta, and support planning for potential Steller's eider (*Polysticta stelleri*) reintroduction efforts. In 2014 and 2015, four wetland sites were selected and sampled including Kigigak Island and three sites along the Kashunuk river system, representing a gradient of locations from close to shore to 13 miles inland. Ponds were randomly selected within a 1km radius of each of four established sites, with additional criteria of >500 m from same community type and >100 m from border of an adjacent community type. Two benthic samples (125 ml) were collected from each pond using a 0.5L Van Veen grab. Samples were cleaned, stained with Rose Bengal to identify seeds and invertebrates, separated, identified to family or species when possible, and dried and weighed to obtain dry weight. In 2014, 67 ponds were sampled, and in 2015 an additional 16 ponds were added. One hundred and fifty samples were processed and from those, 47 total potential diet items (35 invertebrates and 12 seeds) were found. Mean biomass (g/ml) was summarized for each item across the four sites and years. Across all pond samples in 2014, invertebrates with highest biomass (g/ml) included: Gastropoda, Chironomidae, Cladocera, Ostracoda, and Copepoda, and in 2015 Hydrozetes, Isopoda, Ostracoda, Chironomidae, and Gastropoda. In both years, the seeds with highest mean biomass (g/ml) in ponds were *Carex* species, *Hippuris* species, *Potagometon* species, *Empetrum* species and an unknown seed species. This assessment provides information on prey biodiversity and biomass available during the waterfowl brood rearing period in locations on coastal Yukon-Kuskokwim Delta.

10.48: POSTER PRESENTATION

BREEDING AND MIGRATION DELINEATION OF SURF SCOTERS WINTERING IN SOUTHEAST ALASKA

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Declines in sea duck populations have highlighted the need for additional basic research across the life cycle of these long-distance migratory birds. A lack of basic ecological information on Surf Scoters (*Melanitta perspicillata*), including the linkage between wintering and breeding areas is a major impediment to determining factors contributing to their decline. Therefore we marked Surf Scoters with satellite transmitters near Juneau, Alaska in 2008-2010 to describe their nesting location in the boreal forest and migration chronology and locations during fall and spring. Surf Scoters initiated spring migration in late April and early May, staged on lakes of the south central Yukon in mid May and reached the nesting grounds of Great Slave Lake and northern Yukon in late May. After breeding, some birds migrated west along the Arctic coast of Alaska and staged in Norton Sound and Bristol Bay, Alaska between July and September, while others retraced their spring migration southward to winter in southeast Alaska and Washington.

10.49: POSTER PRESENTATION

WHAT'S EATING COMMON EIDER EGGS? NEST CAMERAS TELL THE REAL STORY

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Nest predation is a significant limiting factor to the reproductive success of Pacific common eiders (*Somateria mollissima v-nigrum*, COEI). COEIs nesting on barrier islands and spits in the Beaufort Sea may be at increased risk of predation due to changes in predator densities and distributions. Examples include reported increases of red fox (*Vulpes vulpes*) and polar bears (*Ursus maritimus*) on the coast during the nesting period. Observational studies of individual nesting colonies have identified arctic foxes (*Vulpes lagopus*) and glaucous gulls (*Larus hyperboreus*) as primary nest predators, but data on predator impacts at a larger scale is limited. Determination of nest predators at dispersed nest sites is traditionally accomplished by evaluating evidence left at the nest. However this method has been criticized for being subjective. Using quantitative analysis to evaluate predator evidence has been proposed as a more objective method and relies on development of predator-evidence profiles from observed depredation events. During June-July 2015 and 2016, we placed time-lapse cameras at approximately 150 COEI nest sites to record causes of nest fate. Glaucous gulls, arctic foxes, polar bears, grizzly bears (*Ursus arctos*), and golden eagles (*Aquila chrysaetos*), were the most common nest predators. In 2016, we also used both traditional and quantitative methods for evaluating evidence of nest predators and compared results to observations from time-lapse camera footage. Preliminary findings suggest that both the traditional and quantitative methods are unreliable for determining nest predators on the barrier islands. Flooding events, wind erosion, and multiple predators at individual nests lead to ambiguous or unclear evidence of nest fate.

10.50: POSTER PRESENTATION

AERIAL SURVEY DETECTION FOR SPECTACLED EIDERS AND OTHER WATERBIRDS ON THE ARCTIC COASTAL PLAIN OF ALASKA

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We estimated detection probability of spectacled eiders and other waterbird species on aerial transect surveys flown on the Arctic Coastal Plain, Alaska. Our primary goal was to adjust the population index towards a less-biased population estimate in order to better measure recovery criteria for the threatened spectacled eider. A secondary goal was to determine relative detection rates for all large waterbirds on the Arctic Coastal Plain, and identify important sources of variation in perception bias. We conducted aerial surveys in early June 2015 and 2016 using fixed-wing aircraft with independent, simultaneous observations by front and rear-seat observers; aka the double-observer technique. We reconciled matched-sightings of front- and rear-seat observations post-hoc, using time of observation as the primary matching criteria. We analyzed over 5000 sightings of more than 20 species, including 5 sea duck species: king, spectacled, and common eiders, long-tailed ducks, and white-winged scoters. Using RMARK, we examined a suite of mark-resight models of detection probability relative to species, species group, crew, day, group size, and year. Support was highest for models with differences in detection between species type (e.g., swan, loon, eider, goose, gull, duck), group size (singles, pairs, small and medium flocks), and observer crew (front and back seat observer pairings). Average front-observer detection rates ranged from 40-50% in ducks, 50-60% in gulls, and 60-70+% in swans, loons, eiders, and geese. Our results provide visibility detection estimates for adjustment of aerial survey indices to population estimates, while also elucidating the influence of important covariates. Admittedly, our estimated detection rates are maximum values, as the methods we employed only correct for elements of perception bias, not availability bias.

10.51: POSTER PRESENTATION

KODIAK ISLAND COOPERATIVE BARROW'S GOLDENEYE NEST BOX PROJECT

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In 2010, a project was initiated to provide nesting habitat and collect basic productivity information for Barrow's goldeneye (*Bucephala islandica)* by placing nest boxes on lakes along the Kodiak road system and in a remote area, Karluk Lake. The number of nest boxes available for use varied in road system (range 22-26) and remote locations (range 20-21) with an annual project average of 45 boxes available from 2010-2016. This cooperative effort is supported by the Alaska Department of Fish and Game, Kodiak National Wildlife Refuge, Lesnoi Corporation, Koniag Corporation, U.S. Coast Guard - Integrated Support Command Kodiak, and private individuals. Annual box occupancy rates by goldeneye ranged from 19% in 2011 to 45% in 2016 with a mean occupancy of 33% over the period. Barrow's goldeneyes using project boxes had an estimated average clutch size ranging from 5.9 eggs in 2011 to 9.3 eggs in 2016 with a mean of 7.6 eggs/clutch for project boxes to date. Estimated nest box mean hatching success for known outcome clutches (N = 86) was 84% and ranged from 62% in 2014 to 96% in 2012. Unhatched eggs (N = 75) from abandoned clutches (N = 1) and non-incubated “dump” clutches (N = 8) accounted for 63% of all unhatched nest box eggs (N = 120). Road system nest boxes located on lakes <10 hectares in size have had the majority of use by goldeneye to date. Four road system nest boxes, (1 box - 2014; 3 boxes - 2016) were used by common mergansers (*Mergus merganser)* and had a 97% hatching success of an average clutch of 8.3 eggs per box. Red squirrels (*Tamiasciurus hudsonicus*) have dominated occupancy of road system boxes located on lakes >10 hectares. Project nest boxes have produced over 550 Barrow's goldeneye young since 2011.

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TIME	TUESDAY 7-Feb-17	WEDNESDAY 8-Feb-17	THURSDAY 9-Feb-17
07:30 - 08:30	*Breakfast, Grand Ballroom, upstairs @ Corinthian Yacht Club*		
08:30 - 08:45	*Welcome*	*Announcements*	*Announcements*
08:45 - 09:45	**Plenary: Dr. Paul Flint**	**Plenary: Dr. JP Savard**	**Plenary: Dr. Ray Alisauskas**
09:45 - 10:15	*Coffee break*		
10:15- 12:00	**Special Session: 1.0** *Restoration & Recovery of Sea Duck Populations*	**4.0 Population Delineation**	**7.0 Annual cycles**
10:15	1.1 Carolyn Marn &	4.1 David Safine	7.1 Dustin Meattey*
10:30	Susan De La Cruz	4.2 Emily Silverman	7.2 Rebecca Bentzen
10:45	1.2 Dan Esler	4.3 Diana Solovyeva	7.3 Johanna Kottsieper*
11:00	1.3 Stu Slattery	4.4 Walt E. Rhodes	7.4 Alicia Berlin
11:15	1.4 Abby Powell	4.5 Jean-François Giroux	7.5 Susan Ellis-Felege
11:30	1.5 Ramunas Zydelis	4.6 Derek Masaki	7.6 *Break early*
11:45	1.6 *Discussion*		
12:00 - 13:30	**Lunch** *(Corinthian, included)* **Panel Discussion:** *Restoration & Recovery of Sea Duck Populations*	**Lunch** *(on your own)*	**Lunch** *(on your own)*
13:30 - 15:15	**2.0 Population Ecology & Trends**	**5.0 Disease & Mortality**	**8.0 Foraging & Energetics**
13:30	2.1 Andre Breault	5.1 Chris Dwyer	8.1 Rolanda Steenweg*
13:45	2.2 Kylee Dunham*	5.2 Lucas Savoy	8.2 Bruce Harrison
14:00	2.3 Leigh Fredrickson	5.3 Sam Iverson	8.3 Shiway Wang
14:15	2.4 Sean Boyd	5.4 Nathan R. Graff	8.4 Hannah Robson
14:30	2.5 Eric Reed	5.6 *Call for hosting 2020*	8.5 James Lovvorn
14:45	2.6 Dana Kellett	**Workshop II:** Telemetry Data Storage	8.6 Sam Iverson
15:00	2.7 *Break early*		8.7 *Break early*
15:15 - 15:45	*Coffee break*		
15:45 - 17:30	**3.0 Patterns in Distribution & Abundance**	**6.0 Conservation & Management**	**9.0 Breeding Ecology**
15:45	3.1 Joseph Evenson	6.1 Dan Esler	9.1 Holly Hennin
16:00	3.2 Vasiliy Baranyuk	6.2 Gregory Soulliere	9.2 Kim Jaatinen
16:15	3.3 Jeffrey Ball	6.3 Fritz Reid	9.3 Jón Einar Jónsson
16:30	3.4 Scott Gilliland	6.4 Max Goldman	9.4 Micah W.C. Miller*
16:45	3.5 Kjell Larsson	6.5 John Takekawa	9.5 *Closing remarks*
17:00	**Dinner** *(on your own)*	**Dinner** *(on your own)*	***Break***
17:15			
17:30 - 18:30			
18:30 - 19:30	**Workshop I:** Long-tail Ducks *Spinnaker @ Lodge at Tiburon*		*Board bus @ Lodge at Tiburon for Sausalito Marina (18:30 sharp)*
19:30 - 22:30	**Poster Session** *Main Sail Ballroom @ Lodge at Tiburon*	**Workshop III:** Population Delineation *Main Sail Ballroom @ Lodge at Tiburon*	**Banquet & Awards Dinner** *Hornblower Spirit Yacht (bus back to Tiburon @ 22:30)*

** Student presenter; All day activities @ Corinthian Yacht Club. All evening activities @ Lodge at Tiburon.*