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*	

7.1: ANNUAL CYCLE

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*

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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

***Johanna Kottsieper**, Nele Markones, Stefan Garthe*

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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

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*

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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

***Bruce Harrison**, Kathleen Moore, Dan Buffett, Danielle Morrison*

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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

***Shiway W. Wang**, Tuula E. Hollmén, Margaret R. Petersen, Matthew G. Sexson, Suzanne M. Budge, Sara J. Iverson*

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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

***Hannah J. Robson**, Vivienne J. Jones, Steve Brooks, Andrew Douse, Carl D. Sayer, and Geoff M. Hilton*

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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

***James R. Lovvorn**, Aariel R. Rocha, Stephen C. Jewett, Douglas Dasher, Steffen Oppel, and Abby N. Powell*

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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

Nikolas M.T. Clyde, Kathryn E. Hargan, ***Samuel A. Iverson,*** *Mark R. Forbes and H. Grant Gilchrist*

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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

***Holly L. Hennin**, Pierre Legagneux, H. Grant Gilchrist, Michael H. Janssen, Jöel Bêty, and Oliver P. Love*

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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.