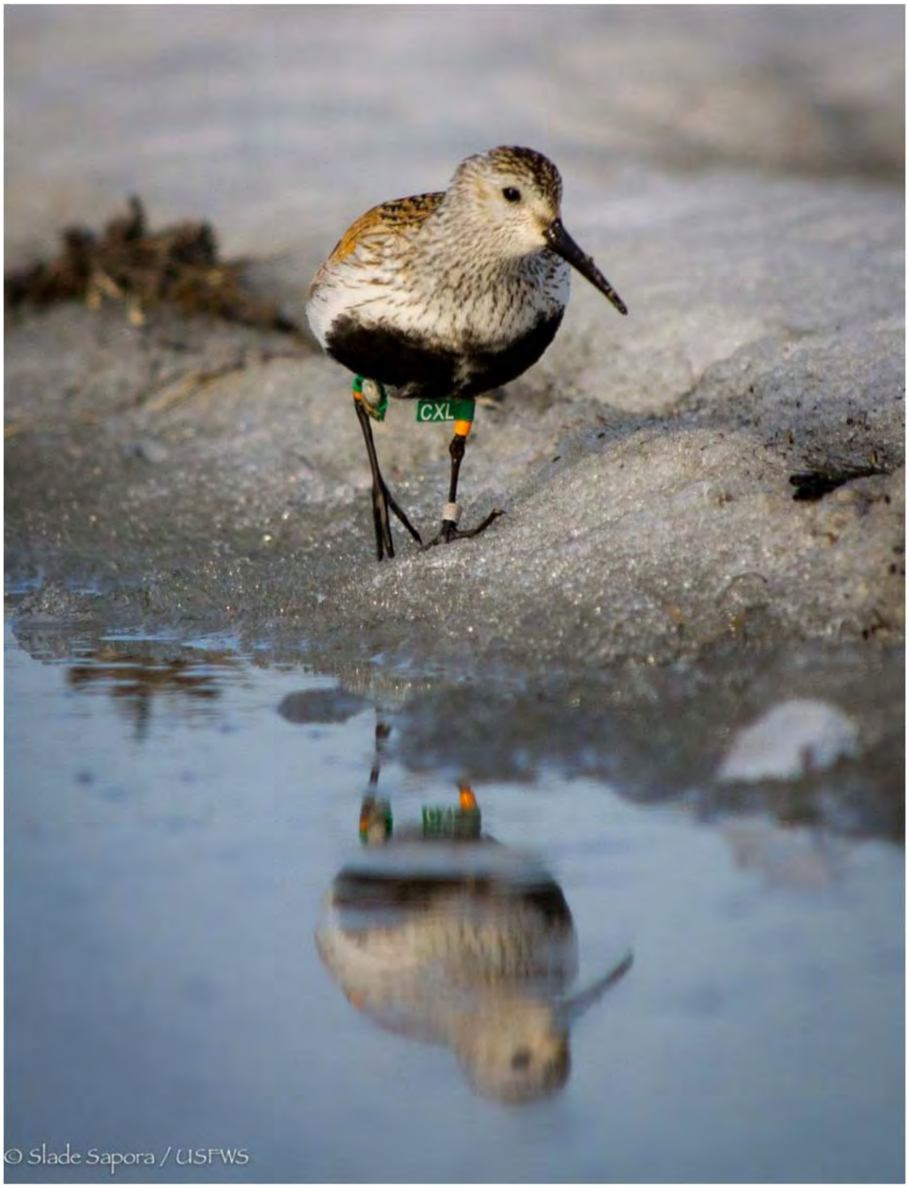
Alaska Shorebird Group

Ongoing or new studies of Alaska shorebirds

Annual Summary Compilation



December 2011

No. 10

Compiled and edited by River Gates for the Alaska Shorebird Group. Anyone wanting additional information about these studies should contact the individual(s) noted at the end of each project summary. Data provided within annual summaries should not be cited or used for any purpose without prior approval from the responsible contact person

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EXECUTIVE SUMMARY

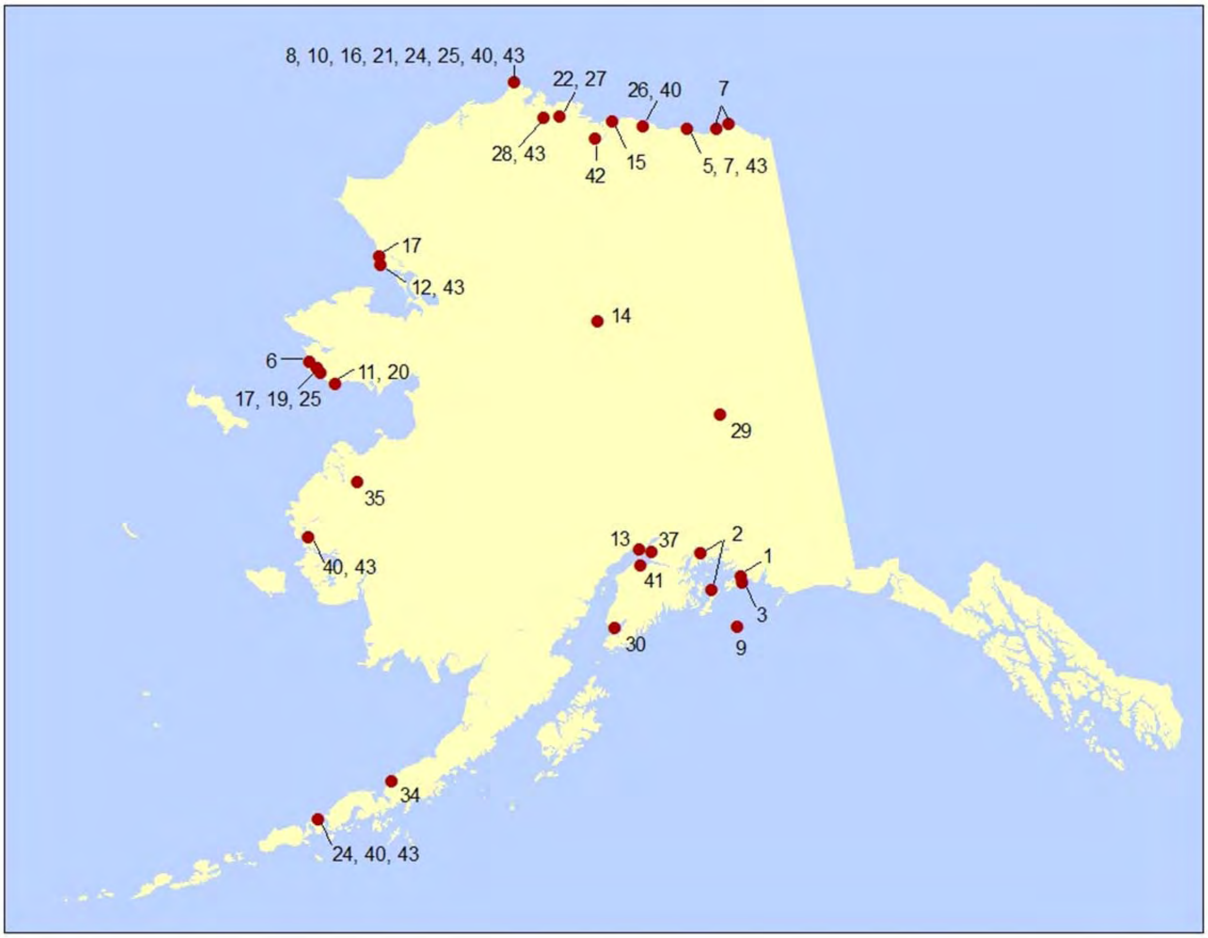
RIVER GATES, ALASKA SHOREBIRD GROUP SECRETARY

Welcome to the 2011 summary report of ongoing or new studies of Alaska shorebirds. This is the eleventh consecutive report put together by the Alaska Shorebird Group. In this document members of the Alaska Shorebird Group compiled annual summaries for 43 studies highlighting many interesting projects investigating Alaska shorebirds. The number of studies reported here is up by 12% from 38 contributed summaries in 2010. This annual compilation is the only written record we have of shorebird projects in the state of Alaska and provides a valuable timeline of shorebird science activities for this region.

Among the 38 unique projects there were a total of 105 investigators involved in these projects, 28 of which participated in more than one project. The Alaska Shorebird Group continues to be a highly collaborative organization with a large membership of productive principal investigators. Women led 15 of the total studies (35%) and accounted for 32% of the total investigators. Academic institutions and federal government agencies shared the responsibility of leading the most projects including 16 projects per type of institution and 74% of the total projects. For government agencies this included the U.S. Fish and Wildlife Service (*n*= 11), and the U.S. Geological Survey – Alaska Science Center (*n* = 5). A diversity of American, Canadian and Chinese academic institutions led projects including Kansas State University (*n* = 3), University of Colorado Denver (*n* = 2), University of Alaska Fairbanks (*n* = 2) and Anchorage, Colorado State University, Montana State University, Brigham Young University, Simon Fraser University, Bishop's University, University of Delaware, University of Missouri, and Nanchang University. The remaining five principal investigators represented non-government organizations (NGO) including the Manomet Center for Conservation Sciences (*n* = 2), Wildlife Conservation Society, Prince William Sound Science Center, and Katchemak Bay Birders.

The map of our study site locations within Alaska (below) clearly shows that shorebirds live up to their name, with all study sites, except for two, located relatively close to the coastline. The two interior Alaska shorebird projects are shedding light on a poorly studied aspect of Alaskan shorebird ecology. Six studies were conducted entirely or partially overseas at Alaskan shorebird's wintering grounds or at stopover points along their migration routes. These studies ranged far and wide including four different countries (e.g. Russia, Canada, China, and Taiwan) and include Hawaii. Sarah Saalfield kindly prepared the state of Alaska map detailing the primary study locations. I would like to acknowledge the talented photographers who submitted their superb images for use in this document. Shorebirds and the people who study them are apparently very photogenic. Photo credits and a brief caption are listed for each photo.

Finally, thanks to everyone who made contributions to this year's annual summary compilations and the field staff whose valiant efforts implementing these important studies does not go unnoticed. We look forward to many more years of fruitful research on Alaska's shorebirds.



This map displays the location of shorebird study sites summarized in this report. Each site is represented with a red dot and an accompanying number. The number corresponds to the numbered project title for each summary in the report. In some cases, the study site covered a relatively large region and included many field locations. In these cases, a subset of the more important sites within the larger study region is displayed. This map *does not* display sites where field work was conducted solely outside of Alaska (Project summaries 18, 36), studies that had no field data collection in 2011 (Project summary 33), and studies that had no field component and/or relied on data from other sources (Project summary 39). Projects 4, 23, 32 and 38 were conducted at the Arctic Shorebird Demographics Network study sites (see page 13 for map).

#1 SITE FIDELITY WITHIN THE COPPER RIVER DELTA, ALASKA BY MIGRANT SHOREBIRDS

INVESTIGATOR: MARY ANNE BISHOP, PRINCE WILLIAM SOUND SCIENCE CENTER

Migrant shorebirds are likely to exhibit fidelity in stopover site selection between years because coastal stopover sites are often widely spaced and limited in number. In 2008, I began a study at Hartney Bay on the western Copper River Delta to determine if site fidelity between years and to a specific location is a common behavior during spring migration. During May 2008 and 2009 a combined total of 297 Western Sandpiper, 142 Least Sandpiper, and 13 Semipalmated Plover were mist-netted and color-banded at Hartney Bay. In 2011, an additional 130 Western Sandpiper, 43 Least Sandpiper and 4 Semipalmated Sandpiper were color-banded. All birds received a green flag on the lower right and a USFWS band on the upper left leg. Color bands on the lower left leg were used to distinguish year cohort (red for 2008, light blue for 2009, orange for 2011) and age (adults = 1 band, juveniles = 2 bands). On 4 May, and again from 6-17 May 2011 an observer spent 2-3 hours daily at high tide scanning flocks for banded birds. Three Western Sandpipers previously banded at Hartney Bay were resighted. In addition, a fourth Western Sandpiper was resighted at Hartney Bay that had been banded at Barrow Alaska in July 2008. In 2012 we plan to tag shorebirds with alpha-numeric bands.

Contact: Mary Anne Bishop, Prince William Sound Science Center, PO Box 705, Cordova, AK 99574. Phone: 907-424-5800 x 228; email: mbishop@pwssc.org.

#2 SHIFTS IN SPRING STOPOVERS FOR SURFBIRDS AND BLACK TURNSTONES

INVESTIGATORS: MARY ANNE BISHOP, PRINCE WILLIAM SOUND SCIENCE CENTER AND AUDREY R. TAYLOR, WINDBIRD RESOURCES

Currently, little is known about how Black Turnstone and Surfbird populations migrate up the Pacific Coast to their Alaska breeding grounds. In spring 2010 we captured, banded and radio-tagged 45 birds total (10 Surfbirds and 35 Black Turnstones) at Barkley Sound (Pacific Rim National Park) and Oak Harbor Washington. To facilitate identification in the field, bands consisted a yellow darvic band on both lower legs as well as a USFWS or CWS band on the upper-left leg. None of the birds were resighted nor radio transmitters detected during spring 2010 boat surveys at Montague Island or during ground surveys at Unakwik Inlet, two important stopover areas in Alaska’s Prince William Sound. However, at the Oak Harbor Marina, we resighted 10 banded birds in October 2010, 11 banded birds during April 2011, and 3 banded birds during a July 2011 visit. These results suggest that mortality during migration was not a factor in the lack of sightings and radio transmitter detections during the 2010 Prince William Sound surveys. As a follow-up, from 7-30 April 2011 we put geolocators on 13 Black Turnstones captured at Oak Harbor and resighted 4 of these individuals in July 2011. Later this 2011 fall and again in 2012 spring we will attempt to recapture these birds using noose mats and a non-lethal net gun.

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#3 MONITORING SEMIPALMATED PLOVERS BREEDING AT EGG ISLAND, COPPER RIVER DELTA

INVESTIGATORS: MARY ANNE BISHOP, PRINCE WILLIAM SOUND SCIENCE CENTER AND ERICA NOL, TRENT UNIVERSITY

North American shorebirds have experienced population declines over the last several decades. Semipalmated Plover, however, are one shorebird species whose numbers are apparently increasing. Building on research conducted in 2006 and 2008, we began a study in 2011 on a breeding population of Semipalmated Plovers at Egg Island, a barrier island on Alaska's Copper River Delta. The objectives of our study are to monitor breeding phenology and to determine survivorship based on return rates of banded breeders. During the first week of June, we located 15 nests and captured and banded 22 adult Semipalmated plovers. We also recaptured three plovers previously banded in 2008. In addition we resighted a plover initially banded as a chick in 2006, as well as two other banded birds that could not be positively identified. One of the 2011 banded birds was resighted at Willapa Bay Washington in July 2011. Additional field work is planned for Egg Island in 2012.

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#4 ARCTIC SHOREBIRD DEMOGRAPHICS NETWORK: OVERVIEW

INVESTIGATORS: STEPHEN BROWN, MANOMET CENTER FOR CONSERVATION SCIENCE, RICK LANCTOT, USFWS, BRETT SANDERCOCK, KANSAS STATE UNIVERSITY AND RIVER GATES, USFWS AND MANOMET CENTER FOR CONSERVATION SCIENCES.

Project Goals and Approach

Recent shorebird trend analyses indicate that many North American shorebird species are declining, but we do not know why. The overall goal of the Arctic Shorebird Demographics Network (Network) is to conduct demographic analyses for several target species that will help determine factors limiting population size. The Network measures demographic rates such as adult and juvenile survival, productivity, and other demographic parameters at various life history stages. In addition, the power of the Network will substantially increase our ability to address a wide variety of other science and conservation goals that can only be studied at a regional or global level, such as migratory connectivity studies that require work across the entire range of a species. Multiple study years are needed to accurately measure survivorship of marked individuals, and also because significant year to year variation occurs in the demographic rates of shorebirds. We anticipate that the Network will provide data critical to conservation planning for shorebirds through its planned completion in 2015.

Network Collaborators

The Network involves participation of collaborators from federal agencies (USFWS, USGS Environment Canada), academic institutions (University of Alaska Fairbanks, Kansas State University, Simon Fraser University and Trent University) and non-profit organizations (Manomet Inc., Wildlife Conservation Society) who are actively conducting Arctic shorebird research and can implement similar protocols at their study sites (see map below). In addition, the Network relies on partners across the range of the target species for resighting efforts of banded birds. Current participants include 11 breeding season study sites spanning the entire Alaskan (n = 7) and Canadian Arctic (n = 4) (Figure 1), and include study sites underway including Nome (see project summary #20), Cape Krusenstern (see project summary #12), Barrow (see project summary #21), the Ikpikpuk River (see project summary #28), the Colville River (see project summary #42) the Canning River (see project summary #5), Prudhoe Bay (no ASDN participation in 2011), and in Alaska; as well as at the Mackenzie River Delta, Bylot Island, East Bay, and Churchill sites in Canada.

Second Year Completed

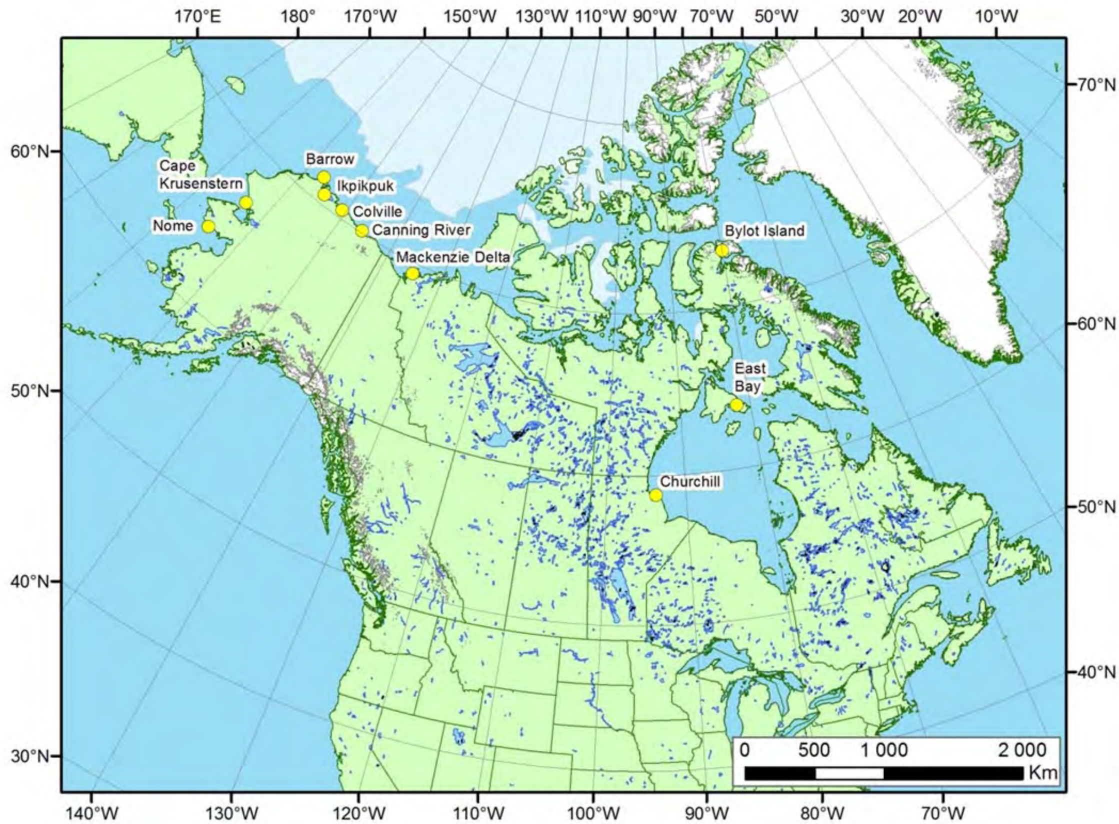
2011 marked the second year (of 5 years) where data were collected in the field. In preparation for this work, the protocol subcommittee revised the 2010 field protocols (based on feedback from the pilot year) and developed new field components. The predator index and aquatic invertebrate food resources components were revised while avian heath sampling, pond hydrology and a re-sighting protocol were newly developed components for 2011. A major portion of our field work involves locating nests and banding of our target species, including Semipalmated Sandpiper and Dunlin at most sites, and Western Sandpiper, Pectoral Sandpiper, and Whimbrel, at several sites. Other species are banded as well, depending on the particular focus of a site. In 2011, personnel from the Network located 1420 nests belonging to 17 species, and banded 1289 individuals belonging to 15 species. In addition, as part of the Arctic Landscape Conservation Cooperative, we collected data on weather, invertebrate abundance, predators, lemmings, and other environmental data to help determine causes of variations in nest survival over time.

Network Side Projects

Network side projects are investigations that are conducted at the Network study sites that are outside the framework of the core demographic study objectives. The following side projects were implemented by Network Collaborators: Dunlin migratory connectivity (see project summary #43), pond hydrology (see project summary #32) and avian health studies (see project summaries #23 and #38).

Lead Organizational Roles

Stephen Brown at Manomet Center for Conservation Sciences is the overall coordinator for the project, and supports group planning, communication, and group funding. Rick Lanctot of USFWS is the Science Coordinator, and leads the design and development of field protocols, side-project coordination, and group funding. Brett Sandercock of Kansas State University leads the group on study design issues and will lead the demographic analyses. River Gates works for both Manomet and USFWS and focuses her efforts on protocol development, data sheet and electronic file construction, data compilation and summaries, general Network coordination. Joe Liebezeit of the Wildlife Conservation Society, Paul Smith of Environment Canada and Brooke Hill of USFWS and UAF serve on the protocol development committee.



Contact: Stephen Brown, Manomet Center for Conservation Sciences, P.O. Box 565, Manomet, MA 0234. Phone: 508-224-6521; Email: sbrown@manomet.org

#5 ARCTIC SHOREBIRD DEMOGRAPHICS NETWORK: CANNING RIVER SITE

INVESTIGATORS: STEPHEN BROWN, MANOMET CENTER FOR CONSERVATION SCIENCES, DAVE PAYER, USFWS, SCOTT FREEMAN, USFWS, AND BRAD WINN, MANOMET CENTER FOR CONSERVATION SCIENCES.

In 2011, we conducted field studies at the Canning River Delta as a partner in the Arctic Shorebird Demographics Network (ASDN; see project summary #4). We had previously conducted studies on breeding shorebirds at this site in 1979-80, 2002-07, and during surveys of the Arctic Refuge Coastal Plain. All these previous efforts indicated that the highest densities of breeding shorebirds occurred in the Canning River Delta region. The ASDN was established to collect scientific data to determine, for several shorebird species, which life history stage is limiting population growth: nesting success or adult survival. The network consists of several sites across the North American Arctic at which coordinated, intensive studies of shorebird demographics will be conducted over five years. Arctic-breeding shorebirds disperse widely during the non-breeding season, making them very difficult to study at that time, so life history information is therefore best obtained when shorebirds are congregated on their breeding grounds.

At the Canning River Delta in 2011, we found and monitored 234 shorebird nests, including five target species for the Network, SESA, DUNL, PESA, RNPH, and REPH. We captured and color banded 125 individuals of these same species. We resighted 50 unique individual shorebirds banded in previous years, mostly the previous season during the first year of the Network. In addition, we followed all of the Network protocols for environmental variables that may influence nest success and survival such as availability of food sources (260 total samples of aquatic and terrestrial invertebrates), weather, snow melt chronology, habitat, predator abundance, and small mammal abundance. We also monitored nests of all other bird species except LALO, and measured activity of avian predators. We participated in the shorebird disease study being led by Rick Lanctot, and provided a total of 162 blood samples, and 54 fecal samples. We also recovered 5 geolocators of 22 placed on adult Dunlin last season as part of a partnership to determine migration stopover locations and wintering sites for the *arcticola* subspecies that breeds on the Arctic Refuge. Determining migration connectivity will provide additional information on factors that may be limiting population size of this species. We plan to continue field work at the Canning for the remaining three years of ASDN effort.

Contacts: For more information, please contact Stephen Brown, Manomet Center for Conservation Sciences, P.O. Box 565, Manomet, MA 0234, Phone: 508-224-6521; Email: sbrown@manomet.org; or Dave Payer, Arctic National Wildlife Refuge, 101 12th Ave., Room 236, Fairbanks, AK 99701. Phone: 907-455-1830; Email: David_Payer@fws.gov.

#6 EXTRA-PAIR PATERNITY IN BLACK-BELLIED PLOVER AND OTHER OBSERVATIONS AT WOOLLEY LAGOON, SEWARD PENINSULA

INVESTIGATORS: PHIL BRUNER, ANDREA BRUNER, DEPARTMENT OF BIOLOGY BRIGHAM YOUNG UNIVERSITY HAWAII, AND JANITA VERDEILLES, TAHITI, FRENCH POLYNESIA.

Our 2011 field season (6-17 June) focused primarily on collecting our third and final DNA samples for our extra-pair paternity (EPP) study from our small insular population of Black-bellied Plover. The three year (2009-2011) study sampled 55 chicks and 14 adults (eight pairs of which four were sampled in two or more seasons). These data represent approximately 90% of all the Black-bellied Plover at our study site. DNA analysis found no EPP. This was in marked contrast to the 33% EPP we found in our Ruddy Turnstone population which nests together with our Black-bellied Plover at Woolley Lagoon. Our study site is restricted to a narrow 200m wide by 1.5 km patch of suitable nesting habitat. The nests of these two species are intermixed and distances between nests are often less than 100m. One hypothesis in the literature predicts that colonial or semi colonial nesting provides greater access to other potential mates resulting in an expected increase in EPP. This may explain our high rate of EPP in Ruddy Turnstones but apparently did not encourage EPP in our Black-bellied Plover.

We have documented only two examples of mate retention in Ruddy Turnstones. By marked contrast mate retention by our Black-bellied Plover is the norm. Our most striking example is one pair that was together nine consecutive seasons (1993-2001). In 2002 the male of this pair failed to return to Woolley Lagoon. The only example of mate switching to date has been where the female of one pair and the male of another failed to return in 2011. The surviving mates formed a pair. If persistent mate retention discourages EPP this might off set the potential for EPP opportunities in colonial or semi colonial birds.

We have marked nearly all of the nest cups of Pacific and American Golden-Plover as well as Black-bellied Plover and Ruddy Turnstones at Nome from 1988 to the present. Each year we check these nest cups to determine if they are still intact and if they are being reused. We have documented reuse of nest cups in all four species. In one exceptional example the nest cup was used four times by three different males, twice by the original male (an American Golden-Plover), and once each by another American Golden-Plover and Pacific Golden- Plover. This past field season we once again found a Pacific Golden-Plover using an American Golden-Plover nest cup (not the same one previously noted). This example was exceptionally remarkable due the fact this nest cup was last used in 1998! For 13 seasons this nest cup and territory was vacant. The fact that the 2011 Pacific Golden-Plover even found the nest cup was amazing. Some nets cups remain visible for many years. The first Pacific Golden-Plover nest cup we marked in 1988 can still be clearly distinguished.

Our 2012 field season will focus on documenting the percent cover of biotic and abiotic components in our Ruddy Turnstone nesting territories at Woolley lagoon. These data will be compared with previously (2009) obtained percent cover data for the area immediately around the nest cup. The purpose of this work is to address the question of whether-or-not Ruddy Turnstones randomly select the location of the nest cup. We will be assisted in this effort by Sheila Conant, Department of Zoology, University of Hawaii at Manoa and an undergraduate biology student from Brigham Young University Hawaii.

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#7 RESOURCE AVAILABILITY FOR SHOREBIRDS AT DELTA MUDFLATS DURING THE POST-BREEDING PERIOD IN THE ARCTIC NATIONAL WILDLIFE REFUGE

INVESTIGATORS: ROY CHURCHWELL, UNIVERSITY OF ALASKA, FAIRBANKS; ABBY POWELL, U. S. GEOLOGICAL SURVEY, ALASKA; STEVE KENDALL, USFWS; STEPHEN BROWN, MANOMET CENTER FOR CONSERVATION SCIENCES.

Studies have established that several species of shorebirds congregate along the coast of the Arctic National Wildlife Refuge during the post-breeding period. It is thought these birds are staging in preparation for a southern migration; however, it is possible they are already migrating when they reach Refuge coastal areas. Our project was initiated to investigate shorebird use of Refuge delta mudflats during the post-breeding period.

We conducted pilot studies in the summer of 2009 on the Jago River Delta to develop methods that were then expanded to two other deltas in summers (July 15 – August 31) 2010 and 2011, including the Canning, and Okpilak/Hulahula. We collected core samples to look at invertebrates and sediment characteristics across each delta within 250-m grid cells during three time periods: early, mid, and late season. We also counted shorebirds across the mudflat within 100-m grid cells every 3 days during the study period. We collected blood samples from shorebirds to investigate correlations between triglyceride levels and available resources. Blood samples were collected both early and late during the study period, to investigate temporal differences in shorebird fattening rates. Finally, we also collected weather data (temperature, wind speed, and wind direction) and water depth at each camp to investigate the role of environmental factors on use of coastal habitats by shorebirds.

We are currently processing invertebrate and soil samples from 2011, and have not completed any analyses of 2011 data. For 2010, we found the three most abundant shorebird species were semipalmated sandpiper, pectoral sandpiper, and red-necked phalarope (3,502, 1,608, and 484 average total number of birds for each species observed per mudflat respectively), and the three most frequently observed species were semipalmated sandpiper, dunlin, and black-bellied plover (observed 95%, 79%, and 74% of survey days respectively). The largest numbers of birds on the Jago mudflat were found around the 1st of August. At the Jago in 2009 we observed the highest densities of birds early in the season (just before 1 August), but in 2010 the peak in abundance was during mid-season (just after 1 August). The greatest abundance of birds coincides with the peak of semipalmated sandpiper migration. We observed a similar pattern at the Okpliak/Hulahula. However, at the Canning, the greatest number of birds was observed late in the season. We believe this was due to interactions between water levels and food availability that coincided with a large number of pectoral sandpiper migrants late in the season.

The 2010 data revealed differences among the mudflat invertebrate communities. The Jago had an extensive freshwater invertebrate community (Tupulidae, Chironomidae, and

Oligochaeta), and much of the biomass was made up of these three taxa. Although we also found saltwater taxa at the Jago, including Amphipoda and Chaetiliidae, they were minor contributors to biomass until later in the season. The availability of saltwater taxa was dependent on water levels, while the availability of freshwater taxa was not; this can lead to unpredictable changes in biomass of saltwater taxa. The Okpilak/Hulahula site showed similar trends, but had a large increase in biomass of the saltwater taxa Chaetiliidae late in the season. The invertebrate community at the Canning was different from the other two sites in several ways. Chironomidae was not found at the Canning, but it was the only site where we found the polycheate worm Spionidae. Late in the season the biomass of Amphipoda and Chaetiliidae increased due to a low water event that exposed mudflat previously inundated by saltwater, but overall the Canning seemed to support more of a saltwater invertebrate community. Lastly, sediment characteristics were relatively similar between the three study areas except at the Canning, where we observed higher carbon (about 4 times greater) and lower silt/clay values (about 10% lower).

We are still working on the statistical methods to correlate the distribution of invertebrates and birds as well as the role of environmental conditions. We were able to partially investigate this relationship from early-season triglyceride samples we collected at each site in 2010. However, we were unable to collect enough late-season samples for analysis. In the early season we found birds at the Canning Delta had significantly lower triglyceride levels compared to the other two sites, which supports the lower invertebrate and shorebird abundance we observed during that period.

Analyses of the 2011 data will be completed by spring 2012, and we hope to provide more insights to shorebird use of mudflats along the Arctic Refuge coast at that time.

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#8 NEST SITE SELECTION IN NORTH SLOPE SHOREBIRDS: RELATIVE IMPACT OF ECOLOGICAL AND BEHAVIORAL FACTORS

INVESTIGATORS: JENNY CUNNINGHAM AND DYLAN KESLER, UNIVERSITY OF MISSOURI – COLUMBIA; AND RICHARD B. LANCTOT, USFWS

Ecological and behavioral factors have the potential to influence nest-site selection in arctic breeding shorebirds. We are using historic and contemporary data collected in Barrow, Alaska, to model nest-site selection and better understand how shorebirds may react to a changing Arctic landscape. Nest locations of Dunlin (*Calidris alpina*), Red Phalarope (*Phalaropus fulicarius*), Pectoral Sandpiper (*Calidris melanotos*), Semipalmated Sandpiper (*Calidris pusilla*), Long-billed Dowitcher (*Limnodromus scolopaceus*), and American Golden Plover (*Pluvialis dominica*) were documented over eight field seasons at six fixed study plots. Mixed effects generalized linear models will be developed to represent alternative hypotheses affecting nest site selection in shorebirds. Models will be comprised of combinations of explanatory variables associated with landform, vegetation, snow cover, and conspecific and heterospecific social and population characteristics. Nest site data will be fitted to the models, which will then be compared in an information theoretic framework.

To explore the dynamics of conspecific and heterospecific attraction and avoidance in shorebird nest-site selection, we will compare the annual spatial distributions of shorebirds to time-related population parameters. We predict that if individual birds respond to conspecific or heterospecific pressures, nest site selection will be altered by variance in population densities across years. Past breeding experiences likely also affect nest site selection so these factors will be simultaneously evaluated. Our intent is to develop a synthetic shorebird nest site selection model that incorporates the range of affecting parameters.

During 2011, we groomed previously collected nest site data, which include geographic coordinates for 2,290 nest sites, classifications of vegetation and habitat types around nests, and dates associated with nest initiation and fate. Ground surveys were conducted and detailed landform and habitat maps were composed for each of the six fixed study plots. The full extent of each plot was systematically documented in 864 geographically referenced photographs. Additionally, we obtained visual spectrum satellite photographs and a geographically referenced digital vegetation classification map of the area (courtesy of Craig Tweedie, University of Texas at El Paso) to further substantiate vegetation and habitat classifications of nests. Foundational approaches were defined for the study, and we intend to continue data collection during the 2012 and 2013 breeding seasons to document the progression of snow-melt patterns and expand shorebird nest site data.

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#9 SHOREBIRDS OBSERVED ON MIDDLETON ISLAND: NOTES ON SPECIES COMPOSITION ABUNDANCE, AND TIMING DURING AUTUMN MIGRATION

INVESTIGATORS: LUCAS DECICCO, NIELS DAU, CHARLIE WRIGHT, RIVER GATES, AND JIM JOHNSON, U.S. FISH AND WILDLIFE SERVICE

Located in the Gulf of Alaska, Middleton Island is 80 km south of the nearest point of land and represents a unique site to study the extent of trans-Gulf migration in many avian taxa. From 24 August to 27 September 2011, we conducted a pilot study aimed at assessing the potential for monitoring trans-Gulf passerine migration on the island. Although our primary focus was on passerines, we also conducted periodic shorebird surveys of coastal, terrestrial, and near-shore habitats, which were supplemented by daily incidental observations. Our month long visit did not by any means encompass the entirety of shorebird migration on Middleton Island. Nevertheless, we provide one of the few thorough descriptions of the composition, timing, abundance, and habitat use for shorebirds on Middleton Island.

Preliminary results and species accounts: We detected shorebirds in nearly all available habitats, including: near-shore waters, rocky and cobble beaches, intertidal mudflats, freshwater marshes, upland wet tundra, and graminoid meadows. We recorded a total of 6,534 individuals comprised of 31 species. The majority of species were infrequently detected; only nine species (Pacific Golden-Plover, Black Oystercatcher, Wandering Tattler, Greater Yellowlegs, Whimbrel, Black Turnstone, Pectoral Sandpiper, Wilson's Snipe, and Red-necked Phalarope) were recorded on ≥50% of field days. Seven species, (Pacific Golden-Plover, Black Oystercatcher, Wandering Tattler, Greater Yellowlegs, Black Turnstone, Wilson's Snipe, and Red-necked Phalarope) comprised ≥80% of all individuals observed on Middleton Island. We recorded a few notable species including the island's first records of Red Knot and Marbled Godwit, as well as the Hudsonian Godwit, Dunlin, and Sharp-tailed, Baird's, Solitary and Stilt sandpipers.

Black-bellied Plover. We observed this species as singles or in flocks of up to five individuals on 12% of field days. We did not regularly detect Black-bellied Plovers until the end of September, when they were observed along rocky shorelines.

American Golden-Plover. Singles observed on 6% of field days. We detected three individuals between 31 August and 14 September. The occurrence of this species on Middleton Island is notable based on the dearth of south-coastal Alaska fall records. All detections occurred in intertidal and rocky shoreline habitats.

Pacific Golden-Plover. Flocks of four to 50 birds were observed on 79% of field days. We noted peak numbers between 24 August and 8 September. Numbers declined markedly after this date when, with few exceptions, we observed ≤ 10 birds daily. This species was associated with dry coastal meadows.

Semipalmated Plover. Small groups of two to 4 birds were observed on 12% of field days. We did not observed Semipalmated Plovers after 7 September. All individuals were seen on rocky or intertidal shoreline habitats.

Black Oystercatcher. Flocks of three to 80 birds were observed on 82% of field days. We noticed no appreciable change in abundance during our stay. We observed this species along rocky or cobble shorelines.

Spotted Sandpiper. Singles and flocks of up to eight birds were observed on 39% of field days. We noted this species between 24 August and 9 September, with a high count of 15 birds on 1 September. After this date numbers declined noticeably and we did not detected Spotted Sandpipers after 16 September. Cobble shoreline was the favored habitat of this species.

Solitary Sandpiper. We observed singles in freshwater seeps at the edges of willow thickets on 24 and 26 August.

Wandering Tattler. We saw five to 30 individuals daily between 24 August and 21 September, with a maximum count of 45 on 1 September. Wandering Tattlers occurred along rocky shorelines.

Greater Yellowlegs. We observed Greater Yellowlegs on 88% of field days throughout our stay in numbers typically ≤20. Our maximum daily count of 55 birds occurred on 17 September which included a single flock comprised of 42 individuals. This species was associated with freshwater wetlands.

Lesser Yellowlegs. We observed this species on 33% of field days with no apparent temporal pattern, most individuals were associated with intertidal shoreline habitat. We observed a maximum of eight birds on 6 September.

Whimbrel. We recorded Whimbrels on 67% of field days generally in numbers ≤10. Peak numbers were observed between 6 and 13 September. Most birds occurred along rocky shorelines and adjacent dry meadows.

Hudsonian Godwit. We observed a single juvenile in intertidal shoreline habitat on 8 September.

Marbled Godwit. We detected a single individual on 20 September flying south over rocky shoreline habitat.

Ruddy Turnstone. We encountered Ruddy Turnstones on 18% of field days throughout our visit; most observations were of single birds on rocky shorelines.

Black Turnstone. We observed this species on 67% of field days exclusively along rocky shorelines. We generally encountered numbers between one and 25 individuals with an exceptionally large count of 300+ made on 1 September.

Surfbird. Surfbirds occurred along the rocky shorelines on 18% of field days with numbers reaching 30 individuals on 31 August, most individuals were adults.

Red Knot. We observed two juveniles along rocky shorelines on 4 September.

Sanderling. Sanderlings were detected on 18% of field days throughout our stay, with numbers increasing towards the end of September. We observed a maximum of 110 birds on 14 September. Rocky shoreline was the favored habitat of this species.

Western Sandpiper. We observed this species on 24% of field days, in flocks of five-15 individuals primarily in intertidal and rocky shoreline habitats. The majority of our observations fell between 24 August and 14 September with a maximum count of 40 birds made on 14 September.

Least Sandpiper. We recorded Least Sandpipers on 46% of field days in numbers generally ≤ 15. The majority of observations fell between 24 August and 11 September, after this date the species was observed on three additional days. Our maximum count was of 40 birds on 31 August. This species was associated with freshwater marshes.

Baird's Sandpiper. We detected a single bird on 3 September

Pectoral Sandpiper. We observed no appreciable change in the abundance of Pectoral Sandpipers during our stay. Numbers generally ≤ 15 birds were noted on 73% of field days, our high count of 25 individuals was made on 7 September.

Sharp-tailed Sandpiper. We recorded a single juvenile foraging in a kelp wrack line on 25 and 26 September.

Rock Sandpiper. We observed flocks of >500 individuals along rocky shorelines. On 31 August the majority of birds were adults. All individuals observed well appeared to be one of the non-nominate subspecies.

Dunlin. We encountered a single individual on 21 September in rocky shoreline habitat.

Stilt Sandpiper. We observed a single birds on 21 September in intertidal shoreline habitat.

Short-billed Dowitcher. We detected two individuals on 7 September and a single on 13 September. Many dowitchers (n = 36) were not identified to species, therefore Short-billed Dowitchers may be more common than reflected by our detections. All individuals were observed in freshwater marsh habitat.

Long-billed Dowitcher. We observed Long-billed Dowitchers on 33% of all field days in numbers typically ≤15, with the exceptions of 35 and 30 on 7 and 17 September respectively. Freshwater marsh habitat was preferred.

Wilson's Snipe. The Wilson's Snipe was the most abundant non-marine shorebird we detected, being observed on 94% of field days. Daily totals were typically 20-60 birds, with >100 counted on 31 August and 25 September. A single flock of 80 individuals was flushed on 31 August. We noticed no appreciable change in abundance during our stay. This species was associated with freshwater wetlands.

Red-necked Phalarope. The Red-necked Phalarope was the most abundant shorebird we encountered being observed in large numbers on 67% of field days. Abundance of this species increased during late-September and flocks of <60 birds were the norm. A maximum count of >800 birds feeding in the surf occurred on 6 September.

Red Phalarope. We observed single birds in near-shore waters on 6 and 24 September.

This year, we developed and tested survey methods that could be employed during future years to systematically monitor abundance and timing of shorebirds on Middleton Island. This effort would be improved by lengthening the duration of our stay to better encompass the protracted fall migration.

We would like to thank the Federal Aviation Administration and Scott Hatch for providing transportation to and from Middleton Island and invaluable logistical support.

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Mudflat and wrack line habitat on Middleton Island’s northeastern shore.

#10 INVESTIGATING ARRIVAL DATES AND ALLOCATION OF RESOURCES IN BREEDING DUNLIN USING STABLE ISOTOPES

INVESTIGATORS: ANDREW DOLL AND MICHAEL WUNDER, UNIVERSITY OF COLORADO – DENVER; RICHARD B. LANCTOT, U.S. FISH AND WILDLIFE SERVICE; CRAIG STRICKER, U.S. GEOLOGICAL SURVEY

Stable isotopes are a useful tool for analyzing avian migration and reproduction. In this study, the isotope values of tissue material obtained from dunlin (*Calidris alpina arcticola*) were used to make inferences about their resource allocation process. In the spring, Dunlin migrate from the coastal areas of Southeast Asia to their terrestrial breeding grounds on the arctic tundra of Alaska (Figure 1). These areas are isotopically distinct environments; the coastal environments are relatively enriched in $\delta^{13}C$, $\delta^{15}N$, $\delta^{34}S$, and δD values and the breeding grounds generally have lower values. As dunlin consume prey, they incorporate these isotopes into their tissues at levels reflective of the environments in which they forage. By analyzing the isotope signatures of dunlin captured on the tundra, we see a transition from high to low isotope values as they equilibrate to the terrestrial isotope signature of the tundra (Figure 2).

The primary tissue source for this study are blood samples collected from breeding birds in the Barrow area. Blood has been shown to have a relatively quick isotope turnover rate after a diet shift occurs. By sampling blood from dunlin throughout the season we are able to estimate the rate of this transition at a population level. Our working estimate of this turnover rate was derived from initial captures of 99 individuals in 2010 and is similar to what was reported in a captive study of this species (~0.0619: Evans-Ogden, et al., 2004). A subset of individuals (n=33) were recaptured and re-sampled to investigate individual variation in turnover rate within the population. The turnover rates from these individuals appeared higher and more variable than that determined in the captive study (mean=0.1062, 95%CI: 0.035-0.197). We are continuing to refine our models to either resolve or validate these differences. The final estimates of turnover rates will be used to estimate arrival dates for each individual, which in turn will be related to snowmelt dates as well as nest initiation dates and nesting success.

A comparison between primary feathers (grown in the arctic) and breast covert feathers (grown prior to arrival in the arctic) will further support the change in isotope values that occurs with their diet shift. Blood samples from brooding chicks display distinctly terrestrial isotope signatures and will be compared with the isotope values of the mothers. Abandoned eggs and chick carcasses were also collected, which may shed some light on the strategy of resource allocation with respect to reproduction. Finally, dunlin were collected upon arrival to the arctic and just prior to migrating at the end of summer in each year. Analysis of muscle, liver, blood, and feather tissue from these birds provides information about the endpoints in our transition curve and fractionation differences between these tissues.

During the 2011 breeding season, 124 dunlin were captured and 24 of these were recaptured and resampled. Blood samples were collected from 17 successful chick broods. Twelve abandoned or partially depredated eggs and four chick carcasses were collected. Five dunlin were collected in early June and 5 dunlin were collected in the latter half of July. Isotope analysis of 2011 samples is ongoing.

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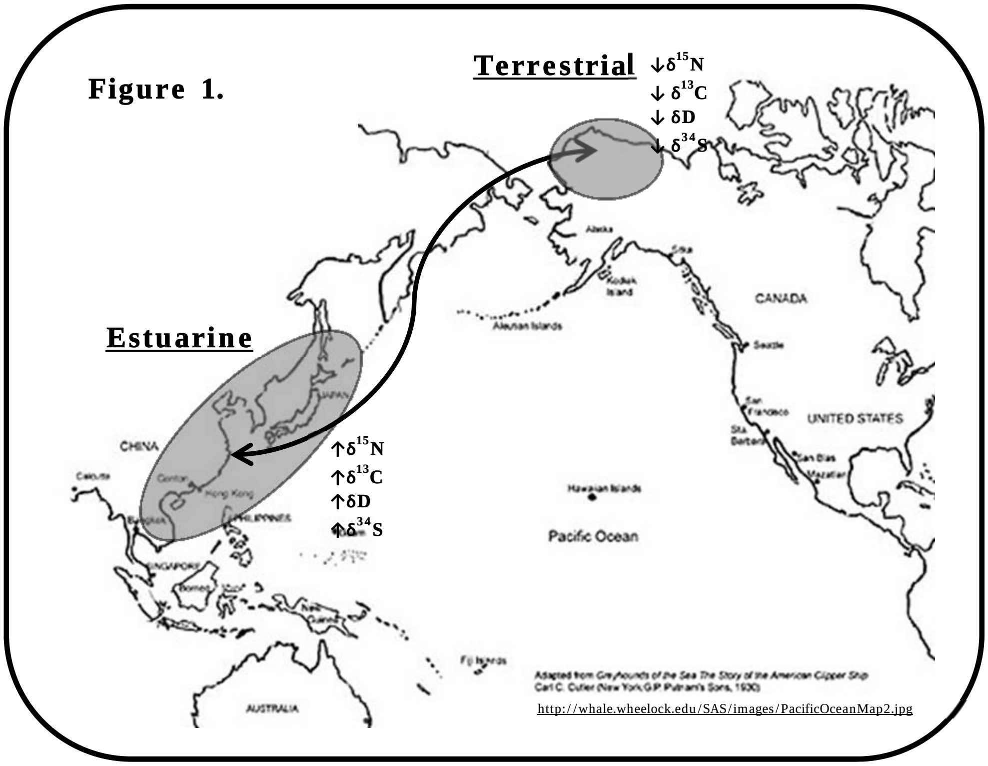
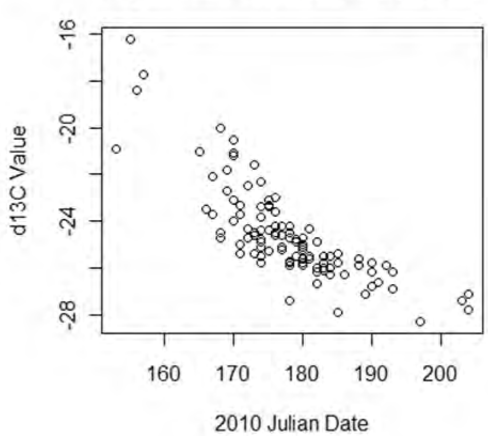


Figure 1.

Figure 2: 2010 d13C Transition



#11 ECOLOGY AND EVOLUTION OF REPRODUCTIVE TACTICS IN RED-NECKED PHALAROPES.

INVESTIGATORS: WILLOW ENGLISH, DAVID B. LANK, SIMON FRASER UNIVERSITY

2011 marked the first year of a study on the evolution and ecology of reproduction in Red-necked Phalaropes. Starting in mid-May, we worked an approximately 2 km^2 plot near Nome, AK. This site is also the Arctic Shorebird Demographic Network (ASDN) site for Nome, and much of the data we obtained were also submitted to the ASDN for demographic studies.

In 2011, we found 50 Red-necked Phalarope nests, more than double the number that were found in this area by the ASDN crew in 2010. We banded 56 adults, including the males from 40 nests. Blood samples were taken from 42 birds, feathers from 48 and fecal samples from 14. We floated and collected egg size data from 169 eggs. A single fresh egg was taken from nests where it could be determined that incubation had not begun; these eggs will be sectioned and dyed to determine the period of rapid yolk deposition. We monitored incubation on 44 nests by installing HOBO temperature data loggers. The loggers measure temperature in the nest cup every 30 seconds, and in uniparental species these records can be analyzed to determine length, frequency and duration of incubation bouts and off-bouts. Despite losing many flooded nests to one of the wettest summers on record, 30 nests successfully hatched with the use of predator exclosures. From these we obtained blood samples and morphometric data from 67 chicks. As part of the ASDN protocol, 16 nesting adult males were banded and colour banded in 2010, and in 2011 four of these birds were found nesting on the plot. In addition, one of the two juveniles banded in 2010 was resighted with a newly hatched brood in 2011.

With the data collected in 2010 and in subsequent years, we hope to answer questions about the evolution and ecology of reproductive tactics in this sex-role reversed species. Specifically, we intend to test hypotheses about: 1) trends in egg size relative to body size between different mating systems, 2) possible biases in sex ratio and sex-dependant investment in offspring, and 3) the timing of rapid yolk deposition and clutch production in multi-clutching and single-clutching shorebirds.

Many thanks to the NSF, Alaska Department of Fish and Game, NSERC, Simon Fraser University and NSTP (Canada) for funds allowing this project to take place.

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#12 SURVEY OF BREEDING SHOREBIRDS AT CAPE KRUSENSTERN NATIONAL MONUMENT, ALASKA

RIVER GATES, U.S. FISH AND WILDLIFE SERVICE AND MANOMET CENTER FOR CONSERVATION SCIENCES, SLADE SAPORA, MANOMET CENTER FOR CONSERVATION SCIENCES, MADELEINE VANDER HEYDEN AND RICK LANCTOT, U.S. FISH AND WILDLIFE SERVICE, AND STEPHEN BROWN, MANOMET CENTER FOR CONSERVATION SCIENCES

In 2011, we increased our efforts at Cape Krusenstern National Monument in northwestern Alaska and became a fully operational Arctic Shorebird Demographics Network site. We conducted nest searching, banding and environmental monitoring activities between 27 May and 3 July 2011 during which time we found 72 nests of 4 species of shorebirds (Western Sandpiper, Semipalmated Sandpiper, Dunlin, Red-necked Phalarope). Additionally we confirmed the breeding status of an additional 15 bird species including Black Turnstone, Tundra Swan, American Widgeon, Northern Pintail, Common Eider, Long-tailed Duck, Pacific Loon, Mew and Glaucous Gull, Arctic Tern, Sandhill Crane, Parasitic Jaeger, Willow Ptarmagin, Lapland Longspur, and Savannah Sparrow.

We documented 62 species of birds in the study area including 15,630 individuals. Our most common observations included (>1,000 observations): Glaucous Gull, Tundra Swan, Semipalmated Sandpiper, Lapland Longspur, Arctic Tern, Red-necked Phalarope and Northern Pintail. Our most uncommon observations included (< 5 observations): Buff-breasted Sandpiper (4 June), Golden Eagle (9 June), Ross's Gull (7 June),Tree Swallow (4 June) Peregrine Falcon (28 June), Bristle-thighed Curlew (31 May and 1 June), Yellow-billed Loon (11 and 12 June), Red-necked Grebe (15 June), Slaty-backed Gull (28 and 30 May) and Red Phalarope (29 and 31 May).

We determined nest initiation dates for shorebird nests by observing clutch completion, by using egg floatation regression equations or hatch date to calculate initiation dates. Mean initiation date for Dunlin was 3 June ± 9.2d (n = 14, 26 May- 25 June); Semipalmated Sandpiper 2 June ± 5.7d (n = 36, 26 May – 21 June); Western Sandpiper 7 June ± 10.5d (n = 10, 20 May – 21 June) and Red-necked Phalarope 14 June ± 7.9d (n = 12, 1 June- 27 June). Average initiation dates were earlier for all study species this year when compared with 2010 monitoring data. Further, initiation dates were earlier by 4 days for Dunlin, 5 days for Semipalmated Sandpiper, 8 days for Western Sandpiper and 2 days for Red-necked Phalarope. We were unable to determine the fate of approximately 15% of the monitored nests mostly Western Sandpiper and Red-necked Phalarope. For nests where fate was determined, Dunlin showed the highest apparent hatch success of 100% (n = 12), followed by the remaining 3 species having high apparent nest success of 85%, (Semipalmated Sandpiper, n=30; Western Sandpiper, n=6; Red-necked Phalarope, n = 6). We captured and uniquely marked 115 individuals with engraved flags and color bands, including 26 Dunlin, 19 Western Sandpiper, 58 Semipalmated Sandpiper and 12 Red-necked Phalarope. We also participated in a broad scale migratory connectivity study by recapturing 12

Dunlin (40% recovery rate) with light-level geolocators (see Yezerinac et al. summary). All captured birds were morphologically measured and had genetic, feather, and avian health samples collected. We also participated in side projects including a Network-wide pond hydrology study (see Rinella et al. summary) and a National Park Service native bee sampling study, in addition to conducting frequent predator surveys, terrestrial and aquatic food resource collections, surface cover and hourly weather conditions.

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2011 field crew for the Cape Krusenstern shorebird breeding project including (left to right): River Gates, Slade Sapora, Madeleine Vander Heyden and Lukas Padegimas

#13 PACIFIC SHOREBIRD MIGRATION PROJECT

INVESTIGATORS (IN 2011): BOB GILL, LEE TIBBITTS, DAN RUTHRAUFF, AND DAVE DOUGLAS U.S. GEOLOGICAL SURVEY; NILS WARNOCK, AUDUBON ALASKA; GARY PAGE, PRBO CONSERVATION SCIENCE; NATHAN SENNER, CORNELL UNIVERSITY.

In 2011, the Pacific Shorebird Migration Project (PSMP) continued its studies into the movement ecology of members of the tribe Numeniini (curlews and godwits). For the first time in seven years, we did not tag any new birds with satellite transmitters, but did continue to monitor solar transmitters deployed in previous years. In addition, Nathan Senner continued to assess the migration ecology of Hudsonian Godwits using geolocator technology at his study sites in Churchill, Manitoba and Beluga, Alaska.

Species-specific highlights:

Numenius phaeopus: We tracked nine adult Whimbrels (3 females, 6 males) of the original 11 that had been tagged with solar transmitters last year on the Colville River breeding grounds. The birds spent winter 2010–2011 at embayments scattered along the Pacific Coast from Mexico to Chile. The first northward movement occurred in mid-March when a bird in Chile flew up to a staging site in Sinaloa. All other birds hopped north about a month later to stage in northern Mexico and southern California. In mid-May, 7 birds flew to Alaska along coastal and trans-Gulf of Alaska routes; one bird made a late migration to the Colville breeding grounds in mid-June and one bird spent June at the Salton Sea in California before returning to its wintering site. Much like last year, post-breeding Whimbrels staged in western Alaska about 200 km from the coast although one male deviated from this pattern and stopped briefly on the north slope of the Alaska range about 100 km west of Mt. McKinley. In late July – early August, birds embarked on direct, nonstop flights from Alaska to either southern California or northern Mexico and by late October they arrived at the same wintering sites used the previous winter.

Numenius americanus: We tracked 12 Long-billed Curlews (5 females, 7 males) that had been marked as adults on breeding grounds in Oregon and Montana 2–4 years ago. The majority of birds departed breeding areas 15–30 June and either flew nonstop (Oregon birds) or made several short stops (Montana) *en route* to their wintering sites of previous years. Oregon birds winter in agricultural lands in the Central Valley of California and Montana breeders use agricultural and natural lands from northern Texas east to Tamaulipas and south to Aquascalientes, Mexico. Oregon birds arrived on breeding grounds about two weeks earlier than Montana birds (late March vs. mid April) and males preceded females by a few days. As of this writing, nine transmitters are still on the air including one on a male tagged in 2007 who enters his fifth winter as a tracked bird.

Limosa haemastica: We finished up the final the year of the initial component of our study of the effects of global climate change on Hudsonian Godwits by returning for a fourth season to Churchill, Manitoba and a third season to Susitna Flats, Alaska. Circumstances continue to differ greatly between the two field sites. This year saw the return of nearly 90% of our marked birds to Susitna Flats, which allowed the recovery of 60% (17) of our data loggers. Churchill had its highest return rate yet, with nearly 70% of adult godwits returning, but that only resulted in the recovery of two data loggers due to the incredibly high rate of nest depredation (15/16 nests) and low re-nesting probability. The second year of migration tracks from Susitna Flats showed that individuals largely repeat their overall route between years, but change some of the details of that route, such as their exact choice of stopover sites. The same remains true for the Churchill birds that we have now tracked over the course of three migrations. The largest difference, however, between the two study sites continues to be the relative timing of breeding efforts for the two populations: Susitna Flats birds are largely synchronized with local phenology, while Churchill birds are mismatched by one-two weeks each year. This discrepancy has resulted in dramatically different rates of breeding success for the two sites. In the past four years, the highest rate of fledging success in Churchill has been 8%, while birds at Susitna Flats have enjoyed rates as high as 26%. Moving forward, work on Hudsonian Godwits will continue in 2012 at Susitna Flats, hopefully for the long term, but work at Churchill will transition to a focus on Whimbrels.

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#14 WHIMBREL BREEDING ECOLOGY NEAR KANUTI LAKE, KANUTI NATIONAL WILDLIFE REFUGE, 2011.

INVESTIGATORS: CHRISTOPHER HARWOOD, USFWS AND UNIVERSITY OF ALASKA FAIRBANKS AND ABBY POWELL, U. S. GEOLOGICAL SURVEY

For the fourth consecutive year, Kanuti National Wildlife Refuge (NWR) staff documented the breeding of Whimbrels (*Numenius phaeopus*) in and near tundra within 5 km of the refuge's administrative cabin at Kanuti Lake. The project, originally begun in 2008 as a general avian reconnaissance of the area and season (pre-breakup through summer), has since evolved into a Master's project investigating Whimbrel breeding biology in the Interior; 2011 was the first year of data collection under the full auspices of the thesis.

Kanuti NWR personnel returned to the Kanuti Lake site on 1 May 2011, eventually departing 13 July. The first Whimbrels were detected on 6 May. The first returning marked bird was resighted on 13 May, while the latest resighted marked bird was located on 28 May. We resighted six of 12 adults marked in 2010 and just 1 of 21 marked in 2009. Only 3 of these 7 known returning birds were documented nesting.

Nesting propensity declined for the second straight year, with only 6 nests found in the traditional study area (compared to ≥19 and 14 nests in 2009 and 2010, respectively). Although greater effort was expended spatially and temporally beyond and within the study area, all 6 nests were located <500m from any nests found in 2009 and 2010. Only 2 of the 6 nests hatched (4 were depredated), including none within the historically most productive area.

The first nest was located on 23 May with three eggs, suggesting this likely earliest nest was initiated on 21 May. The two successfully hatched nests were found during laying and later observed star-piped near hatch (22 May and 18 June surmised for initiation and hatch dates, respectively, for both nests). Based on observed incubation starting with the third egg, an incubation period of 24 days was derived, agreeing with Skeel's traditionally used estimate from Whimbrels at Churchill, MB.

Given the paucity of nesting pairs observed by the end of May, we reconnoitered a sizeable patch of tundra approximately 15 km east (and 3–5 hr away by boat/canoe/hike) of the camp. Although no Whimbrels were detected in this tundra patch during helicopter surveys in mid-June 2009 and mid-May 2010, 11 nests were located here between 2 and 16 June 2011. A twelfth pair with a brood was confirmed, and additional nesting pairs were suspected. All 11 nests were discovered during incubation and were confirmed hatching between 16–19 June. Overall nesting success (based on daily survival rates) for the combined traditional and new areas was 60%.

Twenty adult Whimbrels were captured and newly marked (uniquely coded green flags) during incubation and immediately post-hatch, from 11–18 June. Of the confirmed 18 pairs that nested in 2011, 8 pairs had both members eventually marked, 7 had 1 member eventually marked (including 6 males), and no adults were marked for 2 pairs.

Decent nest success (especially at the new site) and amply marked birds permitted greater tracking of known broods. As in studies at Churchill, females departed within 1 week of hatch, leaving the males to attend broods thereafter. There were numerous occasions of ≥2 broods together (or with Hudsonian Godwit broods nearby) suggesting possible joint brood defense strategies. A ≤2 wk-old brood was confirmed travelling approximately 3,200 m in ≤ 5 days.

Multiple habitat features of varying spatial scale around Whimbrel nests and random non-nest sites were collected to later explore the relationship of nest site selection and habitat associations. The possibly confounding nature of measuring certain habitat features (e.g., percent cover) at potentially suboptimal times (e.g., post-fate) will be assessed. A second year of data collection under the auspices of the graduate project resumes May 2012.

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Whimbrel perched on top of spruce tree in Kanuti National Wildlife Refuge contemplating if she can out smart Harwood again this year

Chris Harwood dutifully collecting detailed nest habitat data despite the challenging conditions of a territorial Whimbrel.

#15 BANDING AND MONITORING STUDY OF RUDDY TURNSTONES ON THE COLVILLE RIVER DELTA, ALASKA: 1964 TO PRESENT.

INVESTIGATOR: JAMES HELMERICKS, GOLDEN PLOVER GUIDING CO.

Spring migration data on Ruddy Turnstones (*Arenaria interpres*) have been recorded at the Helmericks' Colville River Delta, Alaska Banding Station from 1964 to 2011. In 1983 the monitoring program was expanded to include banding birds with USFWS bands. In 1987 the banding program was changed to include a color banding system to allow for individual color codes. Study objectives include attempting to determine where North Slope Ruddy turnstones migrate for winter, summer and wintering site fidelity, age data, and the timing of spring arrivals in relation to snow conditions and breakup dates for the Colville Delta.

1987, 510 ruddy turnstones have been banded with color codes. Celluloid and darvic color bands were deployed until 2011, but it was determined that identifications of banded birds were hindered by rapid fading and frequent loss of the bands. Therefore, in 2011 a more robust engraved tarsus band was substituted. These bands are expected to have a lifespan of at least 20 years, and allow for easier and more accurate identification in the field.

The data collected shows that populations of turnstones using the habitat around the Colville River Delta, AK banding station winter in Southern CA (most sightings), Baja California Sur, Mexico, and one bird from French Guiana. The most recent sighting was a bird banded in 2011 with the new engraved tarsus band. It was seen in Puerto Viejo, Mexico, the same location as the first returned code from that country, in 1998. The data suggests that some birds winter in the same location, sometimes even the same beach, in successive winters.

Data sets of at least 10 years duration on turnstones returning to the Colville Delta breeding grounds have been collected on over 30 individuals. The current age record is 17 years. Spring migration arrival times have been remarkably consistent over the past 47 years, and do not appear to correlate with documented changes in the timing of breakup or snowmelt.

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#16 FACTORS AFFECTING APPARENT ANNUAL SURVIVAL RATES OF ARCTICOLA DUNLIN BREEDING AT BARROW, ALASKA

INVESTIGATORS: BROOKE HILL, UNIVERSITY OF ALASKA FAIRBANKS/USFWS; RICHARD B. LANCTOT, USFWS; CHRISTINE HUNTER, UNIVERSITY OF ALASKA FAIRBANKS

The objective of our study was to determine what factors affect apparent survival probabilities of *arcticola* Dunlin breeding at Barrow, Alaska. Dunlin have high breeding site fidelity at our site, allowing us to use a capture-mark-recapture analysis to estimate apparent survival rates and determine which factors affect those rates. Because we capture Dunlin at their nesting site, we were able to incorporate additional individual covariates into our analyses. We determined whether sex, individual nest success, individual initiation date, and the presence of a radio transmitter affected recapture and survival probabilities. Further, we investigated the affect of site parameters on apparent annual survival, including the influence of artificial fox control, general nest success, the timing of spring, and the completion of the Saemangeum Dike in South Korea.

We marked a total of 208 adult Dunlin on six long-term monitoring plots between 2003 and 2009. Of these, 99 were male and 109 were female. Most were sexed using genetic testing. Re-sightings were made between 2004 and 2010. Of all individuals banded, 50% returned to the study area at least once, with males returning at a higher rate (56%) than females (44%). Our analysis indicated that the sex of an adult explained the most variation in recapture probability, while sex, year, and individual initiation date explained most of the variation for apparent survival. Recapture rates were lower for females (0.73; 95% CI: 0.61 – 0.81) than for males (0.87; 95% CI: 0.80 – 0.92). Survival rates varied by year but were higher for males than females (Figure 1), and were higher for birds that initiated nests early rather than later (Figure 2). This difference in survival rates is likely an artifact of lower site fidelity by females. However, if that is not the case, these results are troubling since most demographic studies have shown that adult female survival rate is a driving factor in population regulation.

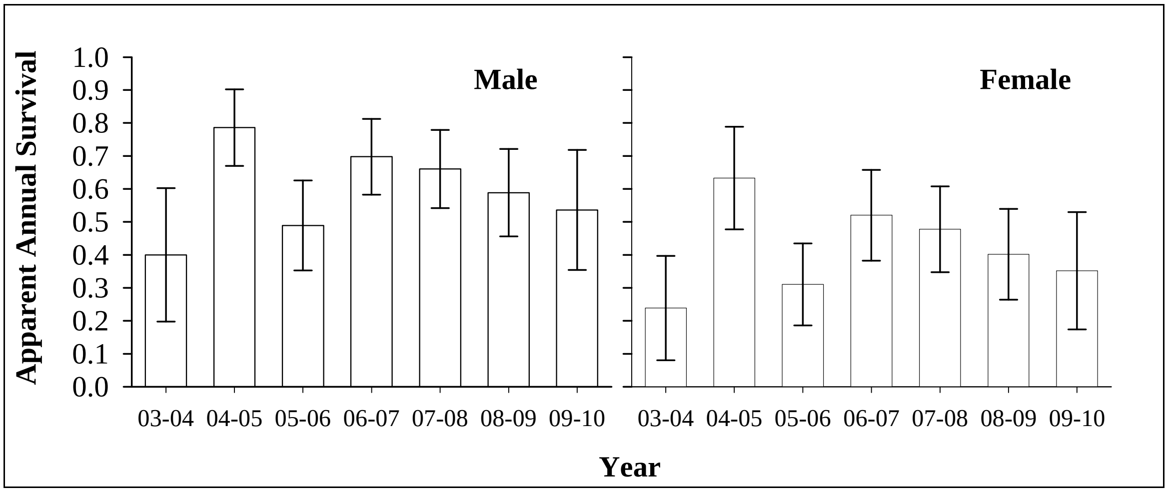

Figure 1. Estimates of apparent annual survival of male and female Dunlin breeding at Barrow, Alaska, between 2003 and 2010. Estimates were derived from our top model, where survival varied by year and sex, and had an additive effect of individual initiation date. Upper and lower 95% confidence intervals are shown.

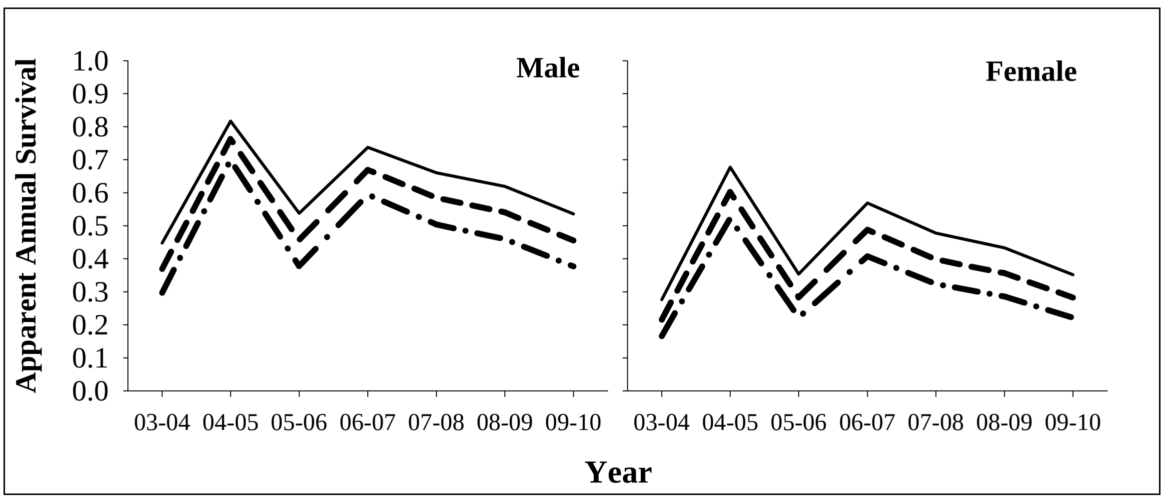

Figure 2. Estimates of apparent annual survival of Dunlin breeding at Barrow, Alaska, USA, from 2003 – 2010 in relation to initiation date (black line = 9 June, short dashed line = 14 June, dashed and dotted line = 19 June). Estimates were derived from our top model, where survival varied by year and sex, and had an additive effect of individual initiation date.

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#17 SURVEYS, BREEDING ECOLOGY, AND MIGRATORY CONNECTIVITY OF ALASKAN RED KNOTS (CALIDRIS CANUTUS ROSELAARI), 2011

INVESTIGATORS: JIM JOHNSON, LUKE DECICCO, NICK HAJDUKOVICH, JESSE CONKLIN, RICK LANCTOT, AND BRAD ANDRES U.S. FISH AND WILDLIFE SERVICE, MIGRATORY BIRD MANAGEMENT

During 2011, we continued our studies of Red Knots (*C. c. roselaari*) in northwestern Alaska. Objectives were to: 1) obtain additional genetic samples for an analysis of population structure of *C. c. roselaari* and *C. c. rufa*, 2) estimate Red Knot occupancy and habitat associations during the breeding season on the Seward Peninsula (as opposed to the Cape Krusenstern region surveyed in 2010), 3) describe breeding ecology of Red Knots, 4) individually mark Red Knots so they are available for resighting on the nonbreeding grounds, and 4) determine migratory timing and routes as well as non-breeding locations of *roselaari* using light-level geolocators.

Red Knot Surveys: Between 25 May and 3 June, we surveyed 106 polygons (10–338 ha, *mean* = 50.5 ha) on the Seward Peninsula that met our selection criteria. We recorded a total of 91 Red Knots, including an estimated 57 pairs, on 29 of 106 (27%) polygons. Knots were associated with large, broad-topped domes, terraces, and ridgelines comprised of rocky, sparsely vegetated habitats predominately comprised of dwarf shrub tundra and lichen. We detected knots 2–65 km (*mean* = 26 km) from the coast and >100 m (111–693, *mean*= 361 m) above sea level. Although knots were encountered across the Seward Peninsula, the frequency of detections was highest in the western Kigluiak and York mountains. Uncorrected densities on plots surveyed more than once ranged from two to five pairs on plots 0.11–0.4 km^2 in size. At one of our highest nest density areas, we recorded 10–12 pairs and subsequently detected nine broods on a single 2.8 km^2 ridgeline. In contrast to the Cape Krusenstern region (see ASG summary for 2010), where the majority of knot detections were <20 km from the coast, presence of knots on the Seward Peninsula was not correlated with proximity to the coast. Furthermore, the proportion of occupied plots and the number of pairs recorded were two times higher on the Seward Peninsula than the Cape Krusenstern region. Uncorrected pair densities were also higher on the Seward Peninsula and surpassed published densities for any other breeding population throughout the species’ global range.

Breeding Ecology: We found 10 Red Knot nests. Average cover characteristics within a 10-m radius centered on the nest were 6% lichen (2–20%), 51% dwarf shrub tundra (28–75%), 3% graminoid (0–10%), 38% bare rock (15–60%), and <1% bare soil (0%–2%). Nests were on flat to slightly sloped terrain (*mean* = 7.5°) at 200–372 m (*mean* = 290 m) above sea level.

Initiation of laying, based on lay and hatch dates as well as estimates from floating eggs and plumage of chicks, ranged from 23 May to 9 June (median = 30 May, *n* = 15). Based on five nests found with ≤2 eggs, incubation begins with the laying of the second egg. Assuming incubation lasted 24 days, from the laying of the second egg to when the first egg hatched, estimated hatch dates ranged from 18 June to 5 July (median = 25 June, $n = 15$).

Apparent nest success (≥1 egg hatched) of the 10 nests located in our study was 40%. Failure of five nests was a result of predation and one was abandoned, possibly because of human disturbance. At our primary study site where five nests were found there were several factors that likely increased nest loss. First, there were three winter-killed musk oxen and we observed on several occasions red foxes and common ravens in the vicinity of three failed nests. Second, one nest was <25 m from occupied Arctic ground-squirrel burrows and squirrel feces were in and around the nest cup. Finally, 75% of this site was snow-covered in late-May, which may have concentrated knot nests allowing predators to find them more easily. At a second site where a single knot nest was found, a reindeer carcass was present and this nest was later depredated. Abandonment of the last nest, which was a re-nest attempt, likely occurred as a result of one too many monitoring visits.

We observed banded knots attempting to re-nest following the loss of their initial clutches on 31 May. Replacement clutch size appears to be limited. For example, 4 nests initiated between 24 to 26 May contained four eggs whereas four probable re-nests started between 2 and 9 June contained three eggs.

Brood survival information was based on a few nests that hatched and others found while repeatedly surveying our primary study sites. On 8 July, we observed four males who had lost their 8–13 day old broods to a 4-day storm of snow, heavy rain and 50 kph winds. However, following the storm we observed two males with younger chicks. One plausible explanation for the apparent higher survival of younger chicks was that they were small enough for the male to brood whereas older chicks were too large and succumbed after being exposed to multiple days of wet, cold conditions.

During the 2011 breeding season, we captured and banded 19 adults (14 males and 5 females) and 20 chicks, which increased the total number banded birds over the 2-year study to 44 adults (34 males and 10 females) and 45 chicks. Also, we obtained an additional 15 genetic samples.

Adult and natal site fidelity was observed during our study. Initial evidence of adult site fidelity was based on a male banded in July 2009, which was subsequently recaptured in July 2010. This male's two chicks were also banded. We resighted one of these chicks in 2011, a two-year old female that successfully nested approximately 2 km from its natal site. Nearly 80% of males (11 of 14) and 33% of females (one of three) banded on the Seward Peninsula in 2010 returned to either a previous nest site or the location where a male was captured with a brood.

Migratory Connectivity: We resighted two single displaying knots banded in Baja; there is one previous record from Cape Krusenstern and four previous records from the Yukon-Kuskokwim Delta of knots banded in Mexico. Furthermore, three knots that we banded in 2010 were resighted away from the breeding grounds: one bird was observed at Mission Bay, CA on 19 November 2010 and two birds were found at Grays Harbor, WA on 13 May 2011.

We resighted 12 of 17 birds (71%) equipped with geolocators on the Seward Peninsula in 2010 and we retrieved six geolocators (35%) in 2011 – five from males and one from a female. In general, geolocators did not have noticeable adverse effects on birds, but there were small callouses on the right tarsi where the lower end of the geolocator rubbed. We attached geolocators to an additional 14 adults. Descriptions of migratory timing and routes are forthcoming.

Future Research: In 2012, we will continue our efforts to describe breeding ecology and individually mark birds so that they are available for resighting during the non-breeding season. We will also attempt to recapture 25 adults carrying geolocators.

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Red Knot and chick shortly after nest began hatching its young.

#18 RESEARCH AND CONSERVATION OF HUDSONIAN GODWITS AND WHIMBRELS ON CHILOÉ ISLAND, CHILE, 2011

INVESTIGATORS: JIM JOHNSON, BRAD ANDRES, U.S. FISH AND WILDLIFE SERVICE, MIGRATORY BIRD

Introduction: The fundamental elements of the shorebird project on Chiloé Island focus on: 1) conducting research and monitoring to identify important resource requirements, geographic areas supporting concentrations of birds, and mechanisms limiting populations; 2) acquiring support for conservation efforts by publicizing the species' conservation concerns to the local inhabitants, natural resource agencies, and the conservation community; and 3) implementing a full array of conservation actions to sustain populations of Hudsonian Godwits and Whimbrels.

Objectives for the 2011 field season were to: 1) resight individually marked godwits and Whimbrels, 2) capture and individually mark a new cohort of godwits and Whimbrels, and 3) design a regional monitoring program to determine population trends and site use patterns of shorebirds and other waterbird species.

Resighting and Survivorship: During 5–16 January 2011, we resighted godwits and Whimbrels at primary capture sites in the Castro region: Putemun, Pullao, Rilan, Curaco de Velez, and Chullec. We observed 310 of 665 (47%) banded godwits and 168 of 315 (53%) banded Whimbrels. In total, we recorded nearly 1,300 detections of banded birds. In addition to our efforts near Castro, we surveyed 20 secondary sites and recorded an additional 39 banded godwits; however, we did not observe any banded Whimbrels. We have observed this pattern of godwit dispersal from capture sites and the high site propensity of Whimbrels during previous years. Factors influencing godwit movement patterns are unstudied, but likely include the species' higher sensitivity to disturbance, particularly during high tides when suitable roost sites are limited, and the species' specificity for foraging conditions and prey. In contrast, Whimbrels appear more flexible in their use of roost sites; they have been observed roosting in a variety of terrestrial, intertidal, and marine (e.g., aquaculture floats) habitats. Also, Whimbrels' preference for crabs—a resource that is concentrated in discrete patches of algae available during a short time during the tide cycle—may favor higher territoriality and familiarity with specific bays.

Observers recorded seven godwits banded at Susitna Flats, Alaska and one godwit banded at Churchill Bay, Manitoba (N. Senner, unpub. data). These records, combined with observations of 12 godwits banded at Susitna Flats and no birds banded at Churchill during our 2010 visit, add support to an ongoing study of godwit migration ecology using geolocators. Preliminary results from geolocators indicate that breeding populations are highly segregated during the nonbreeding season with Alaska's godwits overwintering on Chiloé Island and Churchill's godwits migrating to the Atlantic coast of southern South America (N. Senner, unpub. data). Resightings of godwits and Whimbrels banded on Chiloé Island in North America also aid our general understanding of the timing and routes of migratory movements and provide refinements to relatively inaccurate locations derived from geolocators. For example, during 2011 godwits banded on Chiloé were observed during spring migration in Missouri, Iowa, Colorado, South Dakota, Yukon Territory, and Alaska.

Captures: Following our resighting efforts, we focused on capturing and individually marking additional godwits and Whimbrels. During 17–24 January, we caught 125 godwits and 40 Whimbrels during four cannon netting attempts. To date, we have banded 790 godwits and 355 Whimbrels on Chiloé Island.

Monitoring Program: Monitoring godwit and Whimbrel population trends and site-use patterns on Chiloé Island was identified as a primary action item in the Chiloé Island Shorebird Conservation Plan (CISCP). We developed a monitoring strategy to accomplish the following immediate objectives: 1) provide an annual assessment of the numbers of godwits and Whimbrels on Chiloé Island to determine any consistent change in their population levels, and target additional effort during October to determine the importance of Chiloé Island to migrant godwits; 2) train local observers in shorebird identification, survey techniques, and data management, which leads to their participation and management of count and resighting surveys; and 3) conduct resighting surveys of marked birds at sites where godwits and Whimbrels were banded from 2007 to 2011, other nearby sites, and sites covered during the assessment survey. Resighting information will be used to estimate survival and to determine consistency of use of important sites.

Some of the long-term objectives met by monitoring include: 1) determine if sites important to godwits and Whimbrels provide environmental conditions adequate to maximize over-winter survival and spring migration readiness, and 2) determine if actions undertaken on Chiloé Island as part of local conservation strategies or CISCP enhance the population status of godwits and Whimbrels.

The program was successfully implemented during our visit and will be repeated by Chilean colleagues during the austral summer (June), winter (January), and fall migration (October).

Additional Accomplishments: In 2011, the eastern wetlands of Chiloé Island were established as a WHSRN site of Hemispheric Importance, which is the third WHSRN designation and second site of Hemispheric Importance in Chile. Also, through WHSRN's leadership, Chile's Ministry of the Environment signed a landmark agreement for the conservation of wetlands and migratory shorebirds on Chiloé Island.

Summary: Our work on Chiloé Island during 2011 successfully added to ongoing efforts to provide estimates of adult annual survival and determine population trends for godwits and Whimbrels. Additionally, one of the understated benefits of our study has been to foster collaborations among an international group of students and biologists; this year our team included three students and 9 biologists from Canada, Chile, United Kingdom, and the U.S. We also continued to initiate new and maintain existing relationships with local communities and citizens; their appreciation and awareness of the shorebirds they interact with on a daily basis is the key to successful conservation efforts in the region.

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Chilean students assist in releasing a color-marked Hudsonian Godwit on Chiloé Island, Chile.

#19 GEOLOCATOR STUDIES OF PACIFIC GOLDEN-PLOVERS: PART II

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We used geolocators (data loggers) to define previously unknown routes of Pacific Golden-Plovers (*Pluvialis fulva*) migrating between wintering and breeding grounds. Logger-equipped birds wintering on Oahu (north Pacific), followed direct north-south transpacific pathways linking Hawaii with southerly regions of the Alaska breeding range, primarily on the Alaska Peninsula. Elsewhere on the winter range, pathways were more complex. Plovers wintering in the central Pacific (Marshall Is. and Christmas Is.), south Pacific (American Samoa, Gilbert Is., and Fiji), and western Pacific (Saipan) all converged on Japan during spring migration lingering there for up to a month. After departing Japan, all central and south Pacific plovers traveled eastward to Alaska nesting grounds that were mostly farther north (Y-K Delta and Seward Peninsula) than those of Oahu birds. One of five Saipan plovers also migrated to Alaska and may have nested at Nelson Is., the others continued northward and nested on the Kamchatka Peninsula and in Chukotka. In fall, Alaska plovers not bound for Hawaii (i.e., those nesting on the Y-K Delta and Seward Peninsula) tracked southward on lengthy mid-Pacific pathways. The longest migration was that of an individual nesting near Nome and wintering in Queensland, Australia. Autumn flights of some Saipan birds were transoceanic across the western Pacific, others tracked through Japan. The foregoing constitute three migratory patterns: 1) direct flights between Hawaii and Alaska; 2) lengthy clockwise movements leading from Alaska to insular wintering grounds south of Hawaii in fall, thence in spring back to Alaska via Japan; 3) pathways from Saipan via Japan to Siberia and Alaska in spring, fall return routes variable some traversing Japan. With the exception of Hawaii birds (pattern 1), our findings suggest that Japan is a vital spring stopover for plovers wintering across a wide area of the Pacific.

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#20 CHANGES IN BREEDING PHENOLOGY OF ARCTIC-BREEDING SHOREBIRDS: COMPARATIVE STUDY OVER TWO DECADES

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Changes in breeding phenology are often the first indicator of biological response to modern climate change. Birds migrating long distances to the breeding ground are especially vulnerable to environmental changes such as global warming, and are showing advances in their timing of breeding. However, testing such temporal shifts in migration and reproduction requires long-term monitoring on the study system. In 2011, we revisited a breeding site for Western Sandpiper, Semipalmated Sandpiper, and Red-necked Phalaropes near Cape Nome, 13 miles east of Nome on the Seward Peninsula of Alaska, where Brett K. Sandercock first initiated the field monitoring in 1993. Since the initiation, breeding performance of three focal species has been monitored for total 11 years (1993-1999 and 2010-2011) in collaboration with David B. Lank and recently with Arctic Shorebird Demographics Network.

2011 field report: The duration of field work was from May 12 to July 25, 2011. We resighted 98 unique individuals, including 52 Western Sandpipers, 43 Semipalmated Sandpipers, and three Red-necked Phalaropes. Resightings included birds marked in 2008 (n = 7), 2009 (n = 10) and 2010 (n = 31). We located nest sites for 68% of the resighted sandpipers, demonstrating that both species have strong site fidelity to their arctic breeding territories. During nest searching, we located a total of 204 nests of arctic-breeding shorebirds, including Western Sandpipers (n = 88 nests), Semipalmated Sandpipers (n = 64), and Red-necked Phalaropes (n = 52). Of the 152 sandpiper nests, 47% hatched young, 28% were depredated, 11% were abandoned (likely due to mortality of an incubating parent), and 14% had an unknown fate. We captured and banded a total of 341 shorebirds, including 184 Western Sandpipers, 104 Semipalmated Sandpipers and 53 Red-necked Phalaropes. As a pilot study, we deployed geolocators on a small sample of sandpipers (five Western and nine Semipalmated Sandpipers; all newly marked adult breeders). Monitoring of environmental conditions included setting up a weather station for climatic conditions, surveys of seasonal snowmelt, measurement of water levels in tundra ponds, sampling of invertebrates in terrestrial and aquatic habitats, live trapping of lemmings and other small mammals, and daily counts of predators encountered during field activities (primarily jaegers, falcons, arctic and red fox). In order to monitor the density of small mammals on the study plot, we conducted a live-trapping for three days at the beginning of the season, with total 20 sherman traps in two separate transects. However, due to the low population density, we did not capture any small mammal this year.

Comparative analysis on breeding timing: For the summary report, we limited our analysis to Western (N=469 nests) and Semipalmated Sandpiper (N=345 nests). For earlier monitoring during 1993 – 1999, the mean date of clutch initiation (DCI) was 25th May (144.66 ± 0.364) for Western Sandpipers and 28th May (148.48 ± 0.397) for Semipalmated Sandpipers. After 7 years later, during 2010 – 2011, DCI was 28th May (147.89 ± 0.570) for Western Sandpipers and 29th May (149.16 ± 0.693) for Semipalmated Sandpipers. In both species, the date of clutch initiation and hatching showed significant inter-annual variation, and were negatively correlated with the daily mean temperature (regression coefficients were -1.738 and -2.113 for Western and Semipalmated Sandpipers respectively). Hatching success for both species decreased by 9% during the study period (mean hatching success: 58% during 1993 – 1999, 49% during 2010 – 2011). Inter-annual variation in hatching success was not explained by laying date, clutch size or daily mean temperature. Future analysis will include some other important environmental factors such as seasonal change in food availability, snow cover and precipitation.

Field monitoring and biological sampling will continue through 2013 in pursuit of testing the impacts of climate change on reproductive performance and population demography of two sandpiper species. Fieldwork in 2011 was supported through the NSF' Polar Program and the Alaska Fish and Game Non-Game program, with matching funds from Simon Fraser and Kansas State. We thank the Sitnasauk Native Corporation for their cooperation.

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#21 REPRODUCTIVE ECOLOGY OF SHOREBIRDS: STUDIES AT BARROW, ALASKA, IN 2011

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In 2011, we conducted the ninth year of a long-term shorebird study at Barrow, Alaska (71.29°N, 156.64°W). The objectives of this study are to collect baseline data on (1) temporal and spatial variability of shorebird diversity and abundance, (2) arrival date, nest initiation and effort, replacement clutch laying, clutch and egg size, hatching success and chick survival, and other demographic traits of arctic-breeding shorebirds, (3) to establish a marked population of as many shorebird species as possible that would allow us to estimate adult survival, mate and site fidelity, and natal philopatry, and (4) to relate weather, food availability, and predator and prey abundances to shorebird productivity. In addition to these objectives, Barrow conducted a second year of data collection as part of the Arctic Shorebird Demographics Network (ASDN) in 2011 (see the overall summary for objectives of the ASDN).

We located and monitored nests in six 36-ha plots in 2011. All six plots are the same as those sampled in 2005-2010 and were searched with the same intensity as in past years. A total of 407 nests were located on our plots and another 48 nests (39 of which were Dunlin) were found outside the plot boundaries. Our total nest number exceeded any other year in this study. Nests on plots included 159 Red Phalaropes, 109 Pectoral Sandpipers, 42 Semipalmated Sandpipers, 35 Long-billed Dowitchers, 31 Dunlin, 12 Red-necked Phalaropes, 9 American Golden-plovers, 9 Western Sandpipers, and 1 White-rumped Sandpiper. No Baird's or Buff-breasted Sandpipers were found on the plots in 2011. The breeding density of all shorebird species on our study area was 188.4 nests / km^2 in 2011; this exceeded all previous nesting densities during the 9-year study, and was substantially higher than the previous highs (150.5 in 2006 and 107.9 in 2008) and was nearly twice as high as our long-term average of 102.4. In 2011, seven species nested in higher densities than in an average year (Long-billed Dowitcher, Pectoral Sandpiper, Red Phalarope, Red-necked Phalarope, Semipalmated Sandpiper, White-rumped Sandpiper, and Western Sandpiper), two nested at densities below the 9-year average (Baird's Sandpiper and Buff-breasted Sandpiper), and two nested at densities similar to the 9-year average (American Golden-Plover and Dunlin).

The first shorebird clutch was initiated on 29 May 2011 – 5 days earlier than the long-term average. Peak initiation date was the 18 June and median initiation date was the 16 June; these dates were 6 and 2 days later, respectively, than the long-term average. Median nest initiation dates for the more abundant species were the 12 June for Dunlin, 9 June for Semipalmated Sandpiper, 17 June for Red Phalarope, and 16 June for Pectoral Sandpiper. These dates were later for most species than our 9-year average, but earlier for Pectoral Sandpiper, Semipalmated Sandpiper, and White-rumped Sandpiper.

Predators destroyed 10.7% of the known-fate nests in 2011. This is much less than the 9-year average of 32.9% and similar to other years with fox control (2005-2011, except for 2009 which had 68.8% predation). Across the more abundant species, apparent hatching success (# hatching at least one young/total number of nests) was highest in Semipalmated Sandpiper (97.6%, N = 42), Dunlin (91.20%, N = 57), American Golden-plover (91.1%, N = 11), Red Phalarope (84.1%, N = 157), Pectoral Sandpiper (78.5%, N = 107), and Long-billed Dowitcher (61.8%, N = 34). We suspect the high nesting success in 2011 was similar to reasons stated for 2010 (especially when compared to 2009). First, lemming numbers had increased again in 2011 compared to the very low levels in 2009, possibly providing an alternative food source for fox and other predators. Second, vegetation has continued to grow back since lemmings decimated several of the plots in 2009, providing concealment to nests from avian predators. Third, fox trapping efforts continue to be very effective and successful in 2011 due to increased trapping intensity and efficacy by the USDA Wildlife Services-employed trappers.

In 2011 we captured and color-marked 360 adults. This was the highest number of birds banded in any year, was similar to the number banded in 2006 (342) and 2008 (358), but was much higher than the 9-year average of 264. Sixty-nine of these adults (50 Dunlin, 13 Semipalmated Sandpipers, 3 Red Phalarope, and 3 American Golden-plover) had been banded in a prior year. Adults captured included 121 Dunlin, 48 Long-billed Dowitchers, 60 Semipalmated Sandpipers, 50 Pectoral Sandpipers, 44 Red Phalaropes, 15 American Golden-plovers, 10 Western Sandpipers, 9 Red-necked Phalaropes, 2 Ruddy Turnstones, and 1 White-rumped

Sandpiper. We captured and color marked 848 chicks in 2011. This was much higher than the 9-year average of 418 and close to the number banded in 2006 (707).

In regard to other environmental features at Barrow, the summer of 2011 appeared to be an early year with the date where 50% of the snow being absent from the tundra on the 5 June (substantially earlier than 16 June 2010). Shorebirds responded by initiating nests early but the bulk of nests were initiated later than average – producing a more long-drawn out nesting season. Lemming numbers continued to increase in 2011, following the increase experienced in 2010, and there were low numbers of Snowy Owls and Pomarine Jaegers nesting in the Barrow area.

We continue to conduct ancillary studies as time allows at Barrow. As part of the ASDN, we collected samples to assess avian malaria (see summary by Wisely et al.) and gut microbiota (see summary by Lanctot et al.). We also collected pond hydrology data for use in an invertebrate emergence modeling exercise (see summary by Dan Rinella, Univ. of Alaska Anchorage). Brooke Hill (MS candidate, UAF) analyzed data and wrote a paper on the survival of Dunlin adults from un-manipulated, and early and late replacement clutches (see her summary). Andy Doll (MS candidate, Univ Colorado Denver) completed his second field season investigating turnover rates in stable isotopes as an index of arrival time (see his summary), and Jenny Cunningham (MS candidate, Univ Missouri-Columbia) completed her first field season investigating habitat selection by shorebirds (see her summary).

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Female Pectoral Sandpiper at the Colville River Arctic Shorebird Demographics Network site.

#22 EVALUATING THE IMPORTANCE OF THE TESHEKPUK LAKE SPECIAL AREA WITHIN THE NATIONAL PETROLEUM RESERVE—ALASKA TO SHOREBIRDS

INVESTIGATORS: RICHARD LANCTOT, BRAD ANDRES, U.S. FISH AND WILDLIFE SERVICE; STEPHEN BROWN, MANOMET CENTER FOR CONSERVATION SCIENCES; AND JIM JOHNSON, U.S. FISH AND WILDLIFE SERVICE

The Teshekpuk Lake Special Area (TLSA) is located in the northeast corner of the National Petroleum Reserve—Alaska. Special restrictions limiting oil and gas development in TLSA are currently in place, but this area is undergoing an environmental planning review and long-term land-use status is uncertain. To evaluate the importance of the TLSA to shorebirds, we surveyed 167 randomly selected 16-ha plots between 2006 and 2008 using single-visit rapid searches when shorebirds were establishing territories and beginning to incubate nests. Counts of monogamous species were adjusted based on the assumption that all individuals were paired, and then by detection probabilities developed within the Arctic PRISM. Counts of polygamous species were adjusted based on their behavior (i.e., adults at or suspected to have nests were assumed to be paired, and then single birds were added to this total). We did not adjust counts of polygamous species by detection probabilities because it was unclear what a single bird meant (i.e., was it unpaired or paired with numerous individuals). Models were developed using classification and regression tree analyses and validated with data collected in the same area between 1999 and 2001 for the Outer Coastal Plain (OCP) and Inner Coastal Plain (ICP) regions. The overall density (mean ± SE) combined across regions was 127 ± 9 shorebirds/km^2, with the highest densities on the OCP (156 ± 13 shorebirds/km^2) followed by the ICP (81 ± 12 shorebirds/km^2). The most abundant species was the Semipalmated Sandpiper (33 ± 5 shorebirds/km^2), followed by the Red Phalarope (23 ± 4 shorebirds/km^2), Dunlin (21 ± 4 shorebirds/km^2), Red-necked Phalarope (15 ± 2 shorebirds/km^2), and Pectoral Sandpiper (15 ± 2 shorebirds/km^2). For the entire area of the TLSA, we estimated a total breeding season population of 576,914 ± 41,462 shorebirds, which meets the biological criterion for a Western Hemisphere Shorebird Reserve Network site of Hemispheric Importance. Relative to density estimates in the Arctic National Wildlife Refuge (Brown et al. 2007), density estimates on the TLSA were orders of magnitude higher for American Golden-Plover (2x), Semipalmated Sandpiper (6x), Pectoral Sandpiper (2.5x), Dunlin (17.5x), Long-billed Dowitcher (9x), Red-necked Phalarope (3x) and Red Phalarope (8x). Similar densities were estimated for the two portions of the North Slope for the Ruddy Turnstone and Stilt Sandpiper.

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#23 PHYLOGENETIC ANALYSIS OF MICROBIOTA INHABITING THE GUT OF SHOREBIRDS

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Accurate description of the gut microbiota via molecular techniques has proven critical due to the role commensals and pathogens play in shaping the immune systems in free-living animals. Very little is known about the gut microbiota of avian species; such information is important in the field of ecological immunology, understanding the rise in emerging infectious diseases, and determining whether birds are important zoonotic reservoirs. Like diseases, an individual's gut microbiota is likely to vary with many factors, some of which are intrinsic to the areas they breed, migrate and winter, and at these locations, the prevalent environmental conditions of the habitats that they occupy. Because arctic-breeding shorebirds migrate to different latitudes to winter, use different habitats while migrating and wintering, and use different migratory routes, they are an especially good group of birds to investigate how gut microbiota varies with these factors. In doing so, we can also gain a better understanding of how gut microbiota may correlate with the recently documented declines in shorebird species.

In 2011, personnel at Arctic Shorebird Demographics Network sites (see this summary) and two other sites in Alaska (Izembek and Yukon Delta NWR) captured a variety of shorebirds using bow nets or walk-in traps. As part of this sampling, we investigated gut microbiota in three subspecies of Dunlin that were equipped with light-level geolocators in the summer of 2010 and retrieved in 2011 (see Yezerinac et al. summary). Altogether, 630 samples belonging to 12 species were gathered (48 were from Dunlin equipped with geolocators). To date, DNA has been extracted from 588 fecal samples belonging to 10 species of shorebirds using MoBio PowerLyzer kits. DNA levels in extracts were measured using Picogreen kits and showed that low but high quality DNA was successfully extracted. Next we plan to use the DNA extracts in PCR and qPCR assays to determine the presence and quantity of fecal bacteria (i.e., E. coli and total enterococci) and opportunistic pathogens such as *Campylocabter*, *E. coli* O157, and *Salmonella*. Pathogen-specific PCR products will be sequenced using conventional Sanger chemistry to further confirm the presence of pathogenic groups. Selected fecal DNA extracts will be used to describe the composition of eukaryotic and prokaryotic communities using universal regions of the 16S rRNA and the 18S rRNA gene (rDNA) and high throughput sequencing. To our knowledge this will represent the largest gut microbial community project for shorebirds world-wide. Once microbiota laboratory analyses are complete, we will correlate these findings with the life history characteristics of the different shorebird species and the specific migration tracks of the Dunlin equipped with geolocators.

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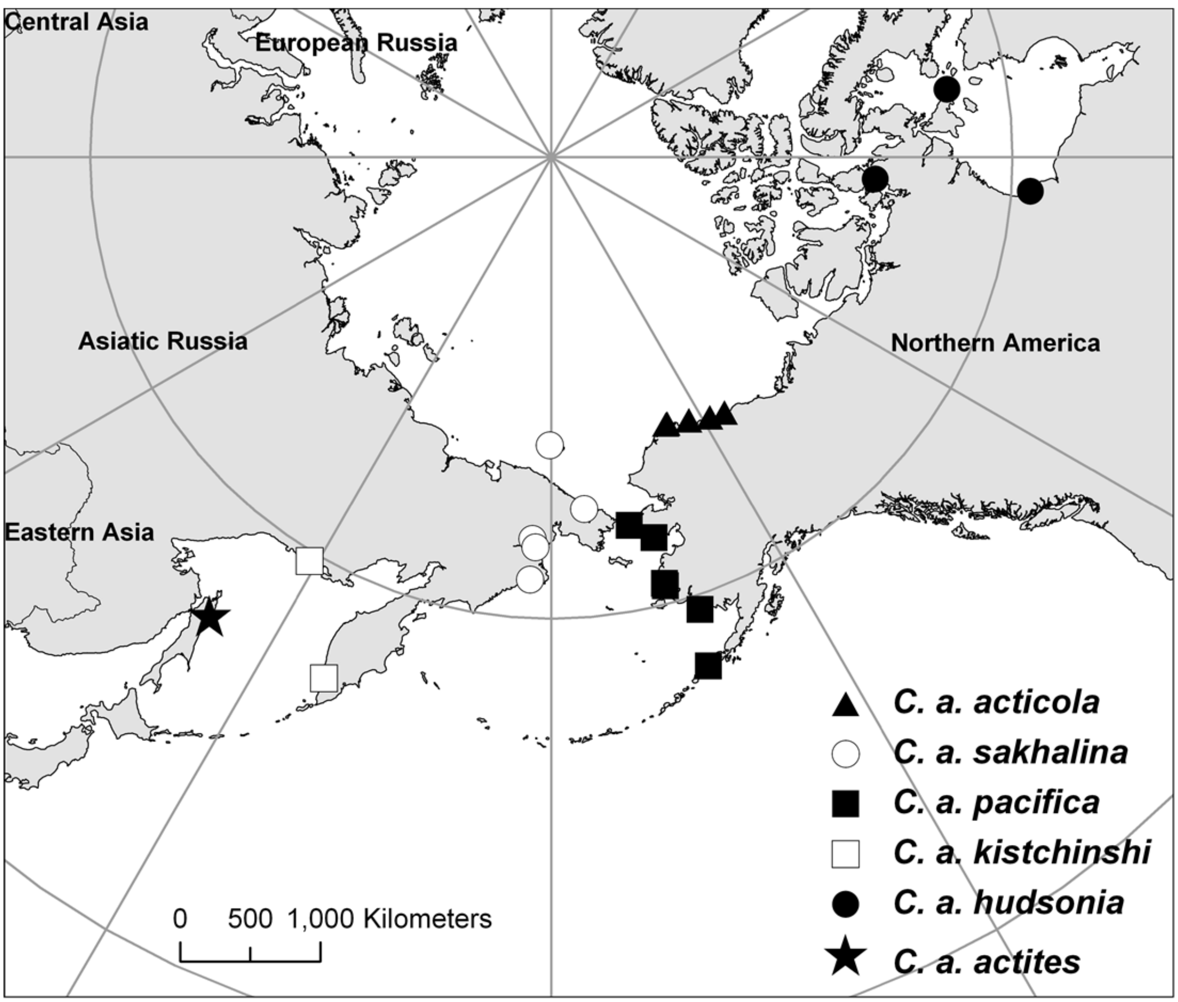
#24 GENETIC STRUCTURE OF DUNLIN BREEDING IN NORTH AMERICA AND EAST ASIA

INVESTIGATORS: LUZHANG RUAN, NANCHANG UNIVERSITY, NANCHANG, CHINA; MARK MILLER, TOM MULLINS, AND SUSAN HAIG, U.S. GEOLOGICAL SURVEY, FOREST AND RANGELAND ECOSYSTEM SCIENCE CENTER; RICHARD LANCTOT, USFWS, AND MANY OTHER COLLABORATORS.

Understanding the migratory connectivity of Dunlin breeding in the Arctic is important for identifying and protecting migration and wintering areas, and for understanding the potential for transmission of avian influenza and other diseases between wintering areas and Arctic regions. Unfortunately in many cases different Dunlin subspecies are thought to use the same sites during migration and wintering. Thus development of methods for differentiating Dunlin subspecies is essential to fully understand whether and how Dunlin segregate away from the breeding grounds. This project explored the feasibility of using genetic techniques to differentiate Dunlin breeding in North America and East Asia, and compliments other studies that used morphometrics (see Gates et al. in 2010 Alaska Shorebird Group annual document) and stable isotopes (see Wunder et al. summary) to separate subspecies. We studied three subspecies of Dunlin that breed in the Russian Far East (*Calidris alpina actites*, *C. a. kistchinski*, and *C. a. sakhalina*), two in Alaska (*C. a. arcticola*, *C. a. pacifica*) and one in eastern Canada (*C. a. hudsonia*). The subspecies *C. a. arcticola* and *pacifica* breed in northern and western Alaska, respectively, and intermix during migration in western Alaska. *C. a. pacifica* continues its migration along the Pacific Coast of North America while *C. a. arcticola* crosses the Bering Strait and stages and winters with the three subspecies that breed in the Russian Far East. *C. a. hudsonia* breeds in central Canada and winters along the Atlantic Coast of North America.

We collected 370 Dunlin blood samples from 22 breeding areas between 2003 and 2009. DNA was extracted from all samples using conventional techniques. Mitochondrial DNA were evaluated for 125 individual samples. PCR was used to amplify a portion of the mitochondrial cytochrome b gene (cyt*b*, 635 bp) and a primer pair (L14996 and H15646) was used to amplify the mitochondrial cytochrome b sequences. Twenty-five unique cytochrome *b* haplotypes were identified. The haplotype network generated from these sequences showed some subspecies phylogenetic structure, especially for *C. a. actites* and *C. a. hudsonia*. Both of these subspecies had their own separate haplotypes. In contrast, the other four subspecies shared between one and three haplotypes. It is unknown if the shared haplotypes reflect ongoing gene flow among subspecies or if the pattern instead reflects incomplete linage sorting among isolated groups. Nuclear microsatellite genotypes were obtained at 8 loci for 370 individuals. In contrast to the mitochondrial data, the microsatellites did not show consistent genetic structure among subspecies. Genetic analyses also provided limited evidence for recent population size reductions. A test to determine if individuals could be correctly assigned to their respective subspecies using microsatellite data was poor, with only 128 (34.6%) out of 370 individuals successfully assigned to the correct subspecies. Taken together, the mitochondria and microsatellite genetic analyses suggest greater breeding dispersal among male individuals relative to female individuals. This interpretation contrasts with local observations that suggest males have higher site fidelity (see Hill et al summary), and conflicts with the general consensus of most shorebird dispersal studies, whereby female dispersal tends to be more common.

Genetic data and the limited geographic distribution suggest that *C. a. actites* is an important conserved subspecies: the subspecies is restricted to a small area on Sakhalin Island, Russia, the mitochondrial haplotypes are very unique, and the microsatellite data indicate this subspecies has the most genetic differentiation of all the subspecies. This subspecies also has the smallest estimated population size. We suggest intensive sampling of Dunlin be conducted to determine where this subspecies stages and winters, and once determined, efforts should be made to protect these areas.



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#25 USE OF LIGHT-LEVEL GEOLOCATORS TO STUDY THE MIGRATION CONNECTIVITY OF AMERICAN GOLDEN-PLOVERS BREEDING ON THE SEWARD PENINSULA AND NEAR BARROW, ALASKA

INVESTIGATORS: RICHARD LANCTOT, BROOKE HILL, AND JIM JOHNSON, USFWS; SHANE GOLD, BRIGHAM YOUNG UNIVERSITY – HAWAII; AND STEPHEN YEZERINAC, MOUNT ALLISON UNIVERSITY

To unveil the migratory pathways of American Golden-plovers, we equipped adults that nest along the road systems of the Seward Peninsula and at Barrow, Alaska, with light-level geolocators. Seventeen (14 male, 3 female) and 15 geolocators (14 male, 1 unknown) were attached to adults nesting on the Seward Peninsula and near one of the six long-term USFWS study plots at Barrow during the 2009 and 2010 field seasons. Each bird was equipped with a 1.4 g light-level geolocator (British Antarctic Survey model MK-14) attached to a leg band. To date we have captured three birds from each site, although additional birds have been seen but not captured. We plan to continue trying to recapture birds in the summer of 2012. Because the Mk-14 will record data for up to two years, it is possible we could learn how individuals vary their migration pathways from year-to-year. Analyses of the light intensity data are on-going. In an independent study, researchers (Jean-François Lamarre and Joel Bety at the University of Quebec at Rimouski) studying shorebirds at Bylot Island, Canada, have also equipped American Golden-Plovers with geolocators and we have established a collaboration to compare migration routes of these two populations. American Golden-Plovers are among the world's longest-distance migrants, and we hope our efforts will significantly advance current knowledge of their migratory routes, wintering ground connectivity, and potential for climate to change to affect this species.

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#26 LONG-TERM MONITORING OF TUNDRA-NESTING BIRDS IN THE PRUDHOE BAY OILFIELD, NORTH SLOPE, ALASKA

INVESTIGATORS: JOE LIEBEZEIT AND STEVE ZACK, WILDLIFE CONSERVATION SOCIETY

Since 2003, the Wildlife Conservation Society, in cooperation with BP Exploration [Alaska], Inc., has monitored nest survivorship, nest predator abundances, predator identity, and other parameters that may influence nesting success in the Prudhoe Bay Oilfield. This on-going monitoring effort is allowing a better understanding of potential impacts from industry, climate change, and other factors on breeding birds.

In 2011, we discovered and monitored 130 nests of 13 species from 3 June to 18 July on (or near) 12 10-ha study plots using both rope drag and behavioral nest search techniques. Semipalmated Sandpiper, Pectoral Sandpiper, and Lapland Longspur nests accounted for the majority (66%) of those found. Among all species, 76 nests successfully hatched/fledged, 41 failed, and 13 nests were of unknown or undetermined fate. Nest predation was the most important cause of nest failure (85%). Other sources of nest failure were abandonment for unknown reasons (n = 4), trampling by caribou (n = 1), and observer-caused failure (n = 1). Overall nest density was 98.3 nests / km^2, very similar to last year (93.3 nests / km^2) and within the overall range of other years monitored. Mayfield estimates of nesting success ranged from 49 to 78%, for the four most common breeding species (n >10) with Greater White-fronted Geese having the lowest survivorship and Semipalmated Sandpipers the highest.

Overall, 11 species of potential nest predators were detected during timed surveys with the most common being Glaucous Gulls and Long-tailed Jaegers. Pomarine Jaeger and Snowy Owl detections were up significantly this year as well and we documented at least one pair of nesting Pomarine Jaegers. Lemming activity at this site was the second highest documented at this site since 2003 with 0.069 lemmings observed / 30 min. survey (2006 was the highest lemming year with 0.085 lemmings observed / 30 min. survey).

Temperatures were unseasonably high in late May and during the first few days of June before a cold snap hit which lasted much of June. We had evidence that at least some of the birds that started nesting during the early season warmth had to renest after early season failure. Snow melt and tundra exposure were similarly timed to the previous few years with snow cover between 35-40% on June 4^{th} but down to <10% by June 9th. Over the past nine years we have documented an earlier trend in nest initiation dates for the three most common species. We identified 11 predation events using remote camera systems at active nests including five red fox, three arctic fox and one each of Common Raven, Snowy Owl, and Parasitic Jaeger.

A comprehensive annual report will be available in the spring of 2012 at http://www.wcsnorthamerica.org/.

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Wildlife Conservation Society's field biologist watching a female Pectoral Sandpiper return to the nest and reveal its location at Prudhoe Bay, Alaska.

#27 BREEDING BIRD DIVERSITY, DENSITY, NESTING SUCCESS AND NEST PREDATORS AT A STUDY SITE ON THE IKPIKPUK RIVER IN THE TESHEKPUK LAKE SPECIAL AREA, NORTH SLOPE, ALASKA

INVESTIGATORS: JOE LIEBEZEIT AND STEVE ZACK, WILDLIFE CONSERVATION SOCIETY

The Wildlife Conservation Society is assessing the importance of the northeast National as a breeding ground for migratory birds since this region is challenged by increasing interest in oil development yet little is known about the breeding parameters for most nesting bird species in this region. In 2010, we established a new site along the Ikpikpuk River. Our objective is to collect baseline information on diversity of tundra-nesting birds, breeding biology (most importantly nest density and survivorship), nesting habitat preference, nest predator abundance, nest predator identity, and other factors known to influence nest survivorship. After, three years of data collection, we will compare these results with other sites on the North Slope to help evaluate the importance of this region for breeding birds.

In 2011, we re-established 12 10-ha study plots on the east side of the Ikpikpuk River approximately 30km south of the river mouth (70.55242° N; 154.73222°W). We detected 56 bird species at the site during informal surveys and 34 of these species we directly observed nesting or discovered other evidence indicating they likely nest at the site. On or near our study plots, we discovered and monitored 196 nests of 19 species from 5 June to 16 July using both rope drag and behavioral nest search techniques. Semipalmated Sandpiper (*n* = 52), Lapland Longspur (*n* = 34), Pectoral Sandpiper (*n* = 22), and Greater White-fronted Geese (*n* = 22) nests accounted for the majority (66%) of those found. Among all species, 131 nests successfully hatched/fledged and 58 failed. We were unable to reliably assess the fate of seven nests because of inconclusive evidence at the nest sites or because the nests were still active when the field season ended. Nest predation was the most important cause of nest failure accounting for 52 of 58 (90%) of failed nests. Other sources of nest failure were abandonment (*n* = 3), and failure for unknown reasons (*n* = 3).

Mayfield estimates of nesting success ranged from 46.6 to 85.8% for the six species with sample sizes >10 with Greater white-fronted Geese having the lowest survivorship and Red-necked Phalarope the highest. Overall nest density was the same as 2010 (125.8 nests / km^2).

Lemming detections increased dramatically from 2010 to 2011 (0.003 to 0.086 detections / 30 min. survey) matching the highest lemming detection rate recorded at Prudhoe Bay (in the "high lemming" year of 2006). However, this detection rate was still considerably lower than that observed at a site near Teshekpuk Lake in 2006 (0.334 lemmings / 30 min. survey). Ten species of potential nest predators were detected during timed surveys with the most common being Glaucous Gulls, Parasitic Jaegers, Long-tailed Jaegers, and arctic ground squirrels. Pomarine Jaeger and Snowy Owl activity was up from 2010 but these species were detected significantly less compared to the Prudhoe Bay site. We identified eight nest predator events using remote camera systems at active nests including three arctic fox, two arctic ground squirrel, two red fox, and one Parasitic Jaeger event.

Temperatures were unseasonably high in late May and during the first few days of June before a cold snap hit which lasted much of June. We had evidence that at least some of the birds that started nesting during the early season warmth had to renest after early season failure. Snow melt and tundra exposure were slightly delayed compared to 2010 but in both years snow cover was <10% by June 5th.

A comprehensive annual report will be available in the spring of 2012 at http://www.wcsnorthamerica.org/.

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#28 ARCTIC SHOREBIRD DEMOGRAPHICS NETWORK – IKPIKPUK RIVER SITE

INVESTIGATORS: JOE LIEBEZEIT AND STEVE ZACK, WILDLIFE CONSERVATION SOCIETY

Within the framework of our pre-existing breeding bird studies, we also established Ikpikpuk as an Arctic Shorebird Demographics Network (ASDN) site in 2010. In 2011, we re-established two large plots (58 and 72 ha, respectively) where we focused on the ASDN adult survivorship component for four of the ASDN target species (Semipalmated Sandpiper, Dunlin, Red and Red-necked Phalarope). These involved finding nests, trapping the birds with bow nets and mist nets, color banding the captured birds, and collecting morphometric data. Data collected as part of our separate nest monitoring efforts, including predator activity, lemming abundance, and snow cover will be contributed toward the ASDN effort.

The following table contains a summary of target species discovered nests, birds captured and banded, and samples taken on the ASDN adult survivorship plots at Ikpikpuk in 2011:

Data measure	**SESA**	**DUNL**	**REPH**	**RNPH**	**TOTAL**
Number of nests found	52	18	8	9	**87**
Number of birds banded	68	31	9	10	**118**
Number of resights	30	15	2	1	**48**
Genetic blood samples	46	11	2	0	**59**
RNA later samples	20	20	6	9	**55**
Avian malaria samples	20	20	7	9	**56**
Fecal samples	56	28	9	6	**99**
Feather samples	66	31	9	9	**115**

[1] Some phalaropes were captured with mist nets on the ASDN plots while foraging explaining why "number birds banded" total exceeds "nests found" for these uniparental nesting species.

We also continued terrestrial and aquatic insect sampling and monitoring climatic conditions using a HOBO weather station.

As part of an ancillary study, we also recaptured 4 of 35 geolocator-equipped Dunlin and removed the geolocators (see Lanctot et al summary). We will attempt to retrap more geolocator-equipped Dunlin to remove geolocators in 2012. We also collected blood for an avian disease study. Additional blood and feather samples were collected and are to be used in on-going and potential future genetic, hormone, and stable isotope studies (see table above).

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#29 STATUS OF SURVEYS FOR BREEDING SHOREBIRDS ON US ARMY LANDS IN EASTERN INTERIOR ALAKSA

INVESTIGATORS: JEFF MASON, ELIZABETH NEIPERT. COLORADO STATE UNIVERSITY

Limited formal surveys and anecdotal observations of shorebirds have been recorded for the last 12 years by ecologists working with the US Army's natural resources program. A bird list for the 660,000 acre Donnelly Training Area (DTA) south of Delta Junction includes 18 shorebird species, the majority locally uncommon migrants. This region of the eastern interior is relatively dry (~12" annual rainfall) and consists of boreal forest, including regenerating burns and subalpine shrublands with abundant kettle lakes and is traversed by broad, braided glacial rivers. Breeding and staging habitat is virtually nonexistent for shorebirds with a few rare exceptions.

Confirmed and implied breeding (displaying adults) has been documented for Spotted Sandpiper, Solitary Sandpiper, Lesser and Greater Yellowlegs, Wilson's Snipe, Whimbrel and Upland Sandpiper. Although boreal wetland habitat is common, documented breeding by *Tringa* sandpipers is relatively rare with the bulk of our observations being Lesser Yellowlegs. Habitat partitioning between these species is poorly understood but would provide insight into the apparent low numbers of Greater Yellowlegs and Solitary Sandpipers. Even Wilson's Snipe, likely one of the more common AK breeding shorebirds away from the coast, are relatively uncommon on Donnelly Training Area.

A road accessible Whimbrel colony was discovered in 2000 at 900 meters elevation in subalpine scrub habitat. Weekly surveys beginning in 2009 have documented as many as 31 individuals with peak numbers occurring in mid June. To date no nests have been found (1 eggshell) and no young have been observed. The actual size of this breeding colony and causes for the apparent lack of productivity are unknown.

Upland Sandpipers are relatively widespread on the installation and occur in a variety of habitats from human maintained clearings and regenerating burns to subalpine scrub. Periodic surveys for territorial birds and broods have been conducted for several years to determine distribution and habitat use on DTA. One four-egg nest was found in a 25 acre human modified clearing in 2009. The nest was apparently depredated a week later. We estimate as many as 2 dozen breeding pairs may occur on the installation in any given year.

Both Whimbrels and Upland Sandpipers have been documented on a local BBS route established in 2000 and both species have declined markedly during the last 12 years.

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#30 KACHEMAK BAY SHOREBIRD MONITORING PROJECT:2011 SURVEY REPORT

INVESTIGATORS: GEORGE MATZ AND THE KACHEMACK BAY BIRDERS

The general belief among birders who have a long history with Alaska's Kachemak Bay is that spring shorebird concentrations are not what they use to be. But, it would be useful to have some sort of monitoring data to verify that perception. Hence the origin of this citizen science project which was conceived in the winter of 2008-2009 by members of the newly organized Kachemak Bay Birders based in Homer, Alaska.

In May 2011, the Kachemak Bay Birders completed its third consecutive shorebird monitoring project. The main purpose of this project is to gain a better understanding of shorebird populations that stopover at Kachemak Bay, particularly the Homer Spit area, during spring migration. Fortunately, we are able to compare our results to the shorebird surveys done at the Homer Spit by George West from 1986-1994. This comparison provides some historical insight into shorebird population trends over the past couple of decades. Secondary purposes of this project are; 1) to contribute information that might be useful to others who are assessing shorebird populations across the entire Pacific Flyway, and 2) to use, when needed, the monitoring data to help protect Kachemak Bay/Homer Spit shorebird habitat.

In 2011, between April 14 and May 24, a total of 18 volunteers participated in monitoring four sites on Homer Spit, nearby Beluga Slough, and by boat the Islands and Islets on the south side of the Bay. Weather conditions were typical for the season; lows near freezing in April and warming up to 50°F in May. The protocol we followed is a modification of the International Shorebird Survey (ISS) protocol. We monitored two hours once every five days when the outgoing tide reached 15.0 feet (or at high tide if less). We observed 25 species of shorebirds and counted a total of approximately 16,007 individual birds. Fifty four percent of the birds counted were mixed flocks of Western Sandpipers and Dunlin, mostly at the Mud Bay site. Thirty two percent of the count was Red-necked Phalaropes seen by boat on the open waters of Kachemak Bay. There were no significant disturbances from either humans or predators.

The number of shorebird species seen in 2011 (25) was higher than 2009 (24) or 2010 (23). The total number of individual shorebirds counted in 2011 (16,007) was also higher than in 2009 (7,406) or 2010 (9,845). The biggest increase was Western Sandpipers and Dunlin, as well as Red-necked Phalarope, Surfbirds, and Rock Sandpipers (which overwinter at Kachemak Bay). Despite the increase, the 2011 count was still substantially less than that observed by West. Adjusting West's daily counts to match our five day counts, he saw an average of 18,436 individual shorebirds during his seven years of survey. Including only the Homer Spit sites and matching dates, we counted 8,858 individual shorebirds in 2011. The adjusted count for 2009 was 4,994 individual birds and in 2010 it was 7,314.

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#31 AVIAN INFLUENZA PREVALENCE IN ALASKA SHOREBIRDS REVISITED

INVESTIGATORS: JOHN M. PEARCE, DANIEL R. RUTHRAUFF, AND JEFFREY S. HALL. ALASKA SCIENCE CENTER AND NATIONAL WILDLIFE HEALTH CENTER, U.S. GEOLOGICAL SURVEY.

Shorebirds are considered a reservoir of avian influenza virus (AIV). However, recent surveillance around the world revealed low (<1%) prevalence of AIV in shorebird species with the notable exception of Ruddy Turnstones (*Arenaria interpres*) during spring migration in Delaware Bay on the Atlantic coast of North America. To further assess if AIV in shorebirds is species- and location-dependent, we examined the presence of AIV in standard cloacal/oral swabs paired with serological tests of 263 blood samples from five species of shorebirds in Alaska. Similar to previous results in Alaska and elsewhere along the Pacific Coast, prevalence of AIV in swab samples was low (0.4%), but the seroprevalence was higher (4.2%). Ruddy Turnstones exhibited the highest prevalence for infection and antibodies (2.0% virus prevalence via rRT-PCR, 13.7% seroprevalence). These levels are lower than recorded on the Atlantic coast of North America and further demonstrate the site- and species-specific nature of AIV infection in North American shorebirds.

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#32 CLIMATE EFFECTS ON ARCTIC FOOD RESOURCES: MODELING THE TIMING AND DURATION OF AQUATIC AND TERRESTRIAL INSECT AVAILABILITY

INVESTIGATORS: DANIEL RINELLA, ALASKA NATURAL HERITAGE PROGRAM, UNIVERSITY OF ALASKA ANCHORAGE; MATTHEW RINELLA, AGRICULTURAL RESEARCH SERVICE, DEPARTMENT OF AGRICULTURE, AND ARCTIC SHOREBIRD DEMOGRAPHICS NETWORK COOPERATORS

Among birds, the effects of climate change appear to be greatest for long-distance migrants that breed in seasonally productive habitats. This pattern may be due to the lack of a mechanism for synchronizing their breeding migrations with the advancing phenology of key food sources on the breeding grounds. The Arctic is warming faster than any other climate zone on earth, likely leading to mismatches between breeding birds and the annual pulse of emerging insects they depend on. Working closely with the Arctic Shorebird Demographics Network (ASDN) at sites across arctic Alaska and Canada, we will develop models to predict the effect of climate change on the timing of aquatic insect emergence from tundra ponds.

ASDN collaborators monitor the emergence of aquatic insects by sampling exuviae from the downwind margin of tundra ponds (2011, 9 camps, 5 ponds per camp, 3-day intervals). Identification and enumeration of insect samples and management of climate and other data are ongoing. Ultimately, we will develop models that relate the timing and duration of pulses in aquatic insect emergence to climate variables and select covariates. Environmental variables will include accumulated water temperature, threshold water temperatures, timing of snow and ice melt, pond morphology, and pond substrate quality. Accumulated temperature will likely be an important predictor, and we anticipate substantial variation in thermal regime across the ASDN sites. We will use preexisting data, as appropriate, to validate model performance over longer time scales. The models will be used to predict future changes in the timing and duration of arctic insect availability based on climate change projections and to identify geographic areas and pond types where phenological changes in insect availability are expected to be greatest.

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Wildlife Conservation Society's biologist, skimming the water surface to collect aquatic invertebrate samples at the Ikpikpuk River Arctic Shorebird Demographics Network camp.

#33 PREDICTING SHOREBIRD HABITAT ON THE ARCTIC COASTAL PLAIN OF ALASKA

INVESTIGATORS: SARAH SAALFELD, MANOMET CENTER FOR CONSERVATION SCIENCES, USFWS; RICHARD LANCTOT, USFWS; STEPHEN BROWN, MANOMET CENTER FOR CONSERVATION SCIENCES; JAMES JOHNSON, USFWS; BRAD ANDRES, USFWS; JONATHAN BART, U.S. GEOLOGICAL SURVEY

More so than any other region, the Arctic has experienced the effects of climate change in recent years, with warming rates almost twice the global average. Climate-mediated changes have the potential to dramatically shape shorebird habitats and ultimately population distributions. Along with climate-mediated effects on shorebirds, increased human development could have a direct negative impact on shorebird populations and breeding habitat within the Coastal Plain of Alaska in the near future. The first step to evaluating the potential impacts of climate-mediated changes and development on shorebird species within the Coastal Plain of Alaska is to document the current distribution of shorebirds and determine habitat selection patterns of shorebirds within this region. Unfortunately, the contemporary distribution as well as habitat associations of shorebirds on the Coastal Plain of Alaska is poorly known and only coarsely defined.

During 9 years between 1998 – 2008 (surveys were not conducted in 2003 and 2005; Figure 1), ground surveys were conducted on the Arctic Coastal Plain of Alaska as part of the Program for Regional and International Shorebird Monitoring (PRISM). During this time, > 760 plots were surveyed using a single-visit rapid area search technique when shorebirds were establishing territories and incubating nests (8 June – 1 July). Currently, we are using these surveys to develop geospatial predictive models for eight species of breeding shorebirds (Black-bellied Plover [*Pluvialis squatarola*], American Golden-Plover [*Pluvialis dominica*], Semipalmated Sandpiper [*Calidris pusilla*], Pectoral Sandpiper [*Calidris melanotos*], Dunlin [*Calidris alpina*], Long-billed Dowitcher [*Limnodromus scolopaceus*], Red-necked Phalarope [*Phalaropus lobatus*], Red Phalarope [*Phalaropus fulicarius*]). We are generating species-specific predictive models using presence-only modeling techniques and remotely sensed physical and ecological variables hypothesized to influence the current distribution of shorebirds within this region. These spatial models will predict preferred shorebird habitats across the Arctic Coastal Plain of Alaska, allowing us to identify critical conservation areas based both on the presence of species of conservation concern and species richness. These baseline distribution maps also will allow range changes to be discerned and related to natural and anthropogenic impacts on the landscape.

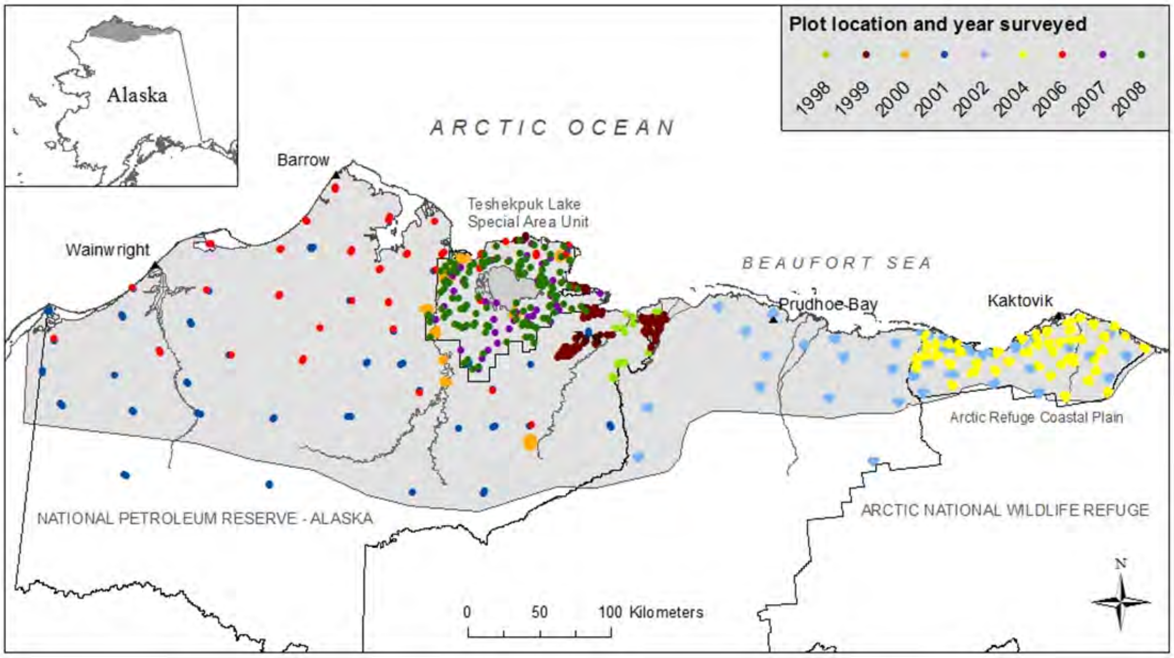

Figure 1. Location of the study area (shaded), major administrative boundaries, major rivers, and plots surveyed between 1998 and 2008.

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Adult Snowy Owl captured on video consuming a freshly hatched Semipalmated Sandpiper chick.

#34 BREEDING RANGE OF THE PACIFIC GOLDEN-PLOVER ON THE ALASKA PENINSULA

INVESTIGATORS: SUSAN SAVAGE, USFWS

Prior to 2004 the Pacific Golden-Plover (*Pluvialis fulva*) breeding range was documented to extend only as far south as an area northwest of Lake Iliamna (area just south of the Koktuli and Stuyahok rivers). Breeding birds were unknown to use the Alaska Peninsula. Beginning in 2004 Alaska Peninsula/Becharof NWR (Refuge) worked with USGS to determine distribution and abundance of Alaska Peninsula shorebirds and with Dr. O.W. Johnson specifically on Plover distribution, finding Pacific Golden-Plover nesting to the Big Sandy River (56.22°N, -160.25°E). In 2009 Refuge staff revisited Big Sandy River and further confirmed this southern extent of breeding. In 2011 Refuge staff traveled to David River on the southern Alaska Peninsula from 27-29 May and found at one or more pairs and one nest. Pacific Golden-Plovers were uncommon in the area; however Rock Sandpipers were very common.

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#35 UPDATE ON ASSESSING THE POPULATION STATUS OF BRISTLE-THIGHED CURLEWS (*NUMENIUS TAHITIENSIS*) BREEDING IN THE SOUTHERN NULATO HILLS, ALASKA

INVESTIGATORS: KRISTINE M. SOWL, USFWS AND JAKE F. JUNG, TENNESSEE TECH UNIVERSITY

The Bristle-thighed Curlew (*Numenius tahitiensis*) is a rare species with a limited breeding range restricted to two areas in Western Alaska. It winters exclusively on islands and atolls in the central and southern Pacific Ocean. The population faces potential threats in its non-breeding areas from introduced predators, sea level rise due to climate change, and an unknown level of human harvest. The Southern Nulato Hills on the Yukon Delta National Wildlife Refuge hosts approximately 60% of the global breeding population. In 2010, we initiated a 3-year study to assess the current population status of the Bristle-thighed Curlew breeding in this area using the methods of territory mapping, mark-resight techniques, and point count surveys. A field camp was established at Allen Creek approximately 40 kilometers north of St Mary's, Alaska. Within our 45-km^2 study area, we mapped at least 36 breeding territories, found eight nests, recorded curlew activity budgets, counted curlews and other shorebirds at 180 count points, and captured and banded 36 adults and 6 chicks. In addition to a standard metal leg band, adults were given a green leg flag with a unique code (either two letters or two numbers) to aid in recognition of individuals in subsequent years. We also captured an adult female that was originally banded in 1992; we replaced her single surviving color band with a leg flag. We did not resight any other curlews that had been marked prior to 2010 (four previously marked individuals were observed in 2010). The region-wide population count is scheduled for May 2012.

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Bristle-thighed Curlew on the breeding grounds in the Nulato Hills, Western Alaska.

#36 EXPERIMENTAL INVESTIGATIONS OF THE WINTER ECOLOGY OF ROCK SANDPIPERS

INVESTIGATORS: DAN RUTHRAUFF AND BOB GILL, U.S. GEOLOGICAL SURVEY; THEUNIS PIERSMA AND ANNE DEKINGA, ROYAL NETHERLANDS INSTITUTE FOR SEA RESEARCH (NIOZ)

Two subspecies of Rock Sandpiper (*Calidris p. ptilocnemis* and *C. p. tschuktschorum*) winter in the North Gulf of Alaska and Cook Inlet, with the nominate form having the more restricted and northerly distribution. Indeed, Cook Inlet represents the most northerly non-breeding range of any North Pacific shorebird. To better understand the species' non-breeding ecology and to investigate potential physiological and behavioral differences that might account for subspecific differences in the non-breeding distributions, we initiated a study based primarily around captive birds. We did this by transporting 30 adult Rock Sandpipers from Alaska to the aviary complex at the Royal Netherlands Institute for Sea Research (NIOZ) in September 2009. Among the 30 birds were about equal numbers of the two subspecies and about equal numbers of males and females within each subspecies. In 2009 and 2010, we conducted respirometry trials to determine each subspecies' basal metabolic rate and metabolic response to temperature. Despite the vastly different thermal environments of their non-breeding ranges, we detected no subspecific differences in metabolic rates. Also in 2010, we performed *ad libitum* foraging trials using un-buried *Macoma balthica*, a preferred bivalve prey item, to determine prey-size selection preferences and maximum intake rates. In January and February 2011, we conducted lipid extraction analysis on a collection of capture mortalities to assess how Rock Sandpipers seasonally regulate their body composition. In October and November of 2011, we continued experimental investigations of Rock Sandpiper foraging ecology by conducting trials to determine each subspecies' functional response to variation in the density of buried prey (*Macoma balthica*). These results will be forthcoming, but when combined with previous results should allow us to assess the energetic thresholds and physiological constraints of both subspecies and how these factors interact with biotic and abiotic environmental factors to determine their winter ecologies.

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Rock Sandpiper (*Calidris ptilocnemis ptilocnemis*) looking pretty spiffy in basic plumage in March at Homer, Alaska.

#37 A PILOT STUDY EMPLOYING GEOLOCATORS TO ASSESS MIGRATORY MOVEMENTS OF LESSER YELLOWLEGS

INVESTIGATORS: LEE TIBBITTS U.S. GEOLOGICAL SURVEY; RICK LANCTOT U.S. FISH AND WILDLIFE SERVICE; AND STEPHEN YEZERINAC, MOUNT ALLISON UNIVERSITY

In an effort to determine if we could use geolocators to track the migratory movements of Lesser Yellowlegs (*Tringa flavipes*), we tagged 20 individuals (along with one Short-billed Dowitcher, *Limnodromous griseus*) with flag-mounted geolocators (0.8g MK-12 BAS units) in June 2010. This past June, we recaptured only two of the Lesser Yellowlegs and the single Short-billed Dowitcher. We focused this pilot effort on birds breeding in Anchorage because field logistics are relatively simple in town and, based on previous studies, we know that birds in this population return at high rates and can be recaptured. However, despite regular searches of breeding and foraging territories in May and June, only five tagged yellowlegs were detected. This return rate (25%) is three times lower than return rates recorded for this population during the late 1990s. It is unclear whether this difference represents an effect due to the tag itself, an overall recent decrease in survival in this population, or behavioral changes related to the urbanization of Anchorage's open spaces. The tagged yellowlegs appeared to behave normally except when they waded in tibo-tarsus-deep water where they would pause during each step to shake the tagged leg (geolocators were attached to the tibo-tarsus). In addition, the captured birds (including the dowitcher) all had calluses on their tarsi that may have been healed wounds at the site where the outer edge of the geolocator made contact with the tarsus as a bird lifted its leg. Preliminary examination of the light-level data suggests that the dowitcher migrated on or near the Pacific Coast. In contrast, the yellowlegs used the Central Flyway during both north and south migrations. Our preliminary analyses have not yet determined where these three individuals spent the non-breeding season last year. Hopefully these data will provide insight into the relatively unknown migratory behavior of yellowlegs.

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#38 AVIAN MALARIA SURVEILLANCE IN ARCTIC BREEDING SHOREBIRDS

INVESTIGATORS: SAMANTHA WISELY AND CLAUDIA GANSER, KANSAS STATE UNIVERSITY; AND ARCTIC SHOREBIRD DEMOGRAPHICS NETWORK COOPERATORS

Avian malaria is a well-studied disease system in birds due to advances in molecular screening techniques of segments of the parasite genome. The disease agent is comprised of a paraphyletic group of haematozoa in three families (Plasmodidae, Haemoproteidae, and

Leucocytozoidae) with an intermediate dipteran vector (Bensch et *al.* 2000). Avian malaria has been implicated in the extinction of avian species, and threatens the entire avian community of the Hawaiian Island ecosystem (van Riper *et al.* 1986). Some species may succumb directly to the disease (Jarvi *et al.* 2001), while in other species reproductive output is reduced (Ortego et al. 2008) making the population more vulnerable to extinction. Migrating species are exposed to multiple habitats often on different continents which can affect a host's parasite burden and has implications for the global spread of infectious diseases. Migratory birds have been implicated in the transmission and spread of infectious diseases such as avian influenza virus, West Nile virus and blood parasites (Rappole *et al*. 2000) and can potentially transmit these pathogens to naïve host populations. Thus understanding host specificity of *Plasmodium* and its allies, and interspecies transmission can help elucidate routes and rates of vector-borne disease transmission in globally migrating avian species.

Samples were screened for haematozoans (*Plasmodium, Haemoproteus and Leucozytocoon*) using two primer pairs developed for the amplification of a 153 nucleotide segment of the RNA-coding mitochondrial DNA (343F 5'-GCT CAC GCA TCG CTT CT-3' and 496 5'-GAC CGG TCA TTT TCT TTG-3', Fallon *et al.* 2003) and a 159 nucleotide segment of cytochrome b mitochondrial DNA (213F 5' GAG CTA TGA CGC TAT CGA-3' and 372 5' GGA ATG AGA GTT CAC CGT TA-3', Beadell *et al*. 2005). Polymerase Chain Reaction was conducted in an Eppendorf Epgradient Thermocycler (Brinkman Inc. Westbury, NY, USA) in 20 µL PCR cocktails containing 1.5µL of extracted template DNA, 1X QIAGEN buffer, 2-2.5 µM MgCl, 0-0.8mg/ml of bovine serum albumin (BSA) 0.2-0.8µM dNTP's, 0.4-0.6µmol/L of each primer and 0.25-0.5 units of Taq polymerase (Go Taq Flexi, Promega, Madison, WI, USA). Thermocycling conditions followed the protocol described by Fallon *et al.* (2003) and Beadell *et al.* (2005). Each PCR reaction was run with both positive and negative controls. Parasite genome segments were visualized using gel electrophoresis.

We extracted DNA from 200 of the 419 red blood cell samples sent to Kansas State University on 6 September 2011 by the Arctic Shorebird Demographics Network. Samples were collected from shorebirds during the breeding season of 2011. We determined quality and quantity of DNA from the extracted samples. DNA quality is measured as the ratio of absorption of light at wavelengths of 260nm and 280 nm. Our samples had an average ratio of 1.9±0.02 (Mean±SD). A ratio of 1.8 suggests pure DNA uncontaminated by organic molecules, and our samples are well within acceptable, useable values. The concentration of DNA in our samples averaged 85.1±6.8 ng/ul; we thus extracted ample DNA of high quality from all samples handled thus far. Of the 200 extracted blood samples we screened n=188 for avian malaria using polymerase chain reaction to amplify DNA of haematozoans. We found a prevalence of 4.79% (n=9, Table 1).

Table 1. Species and locations that screened positive for avian malaria. Relative values will likely not reflect prevalence rates since only a portion of the samples have been screened.

Species	**Common Name**	**Positives**
Calidris pusilla	Semipalmated Sandpiper	4
Limnodromus scolopaceus	Long-billed Dowitcher	2
Pluvialis dominica	American Golden Plover	1
Phalaropus lobatus	Red-necked Phalarope	1
Gallinago delicata	Wilson's Snipe	1
Total		**9**

Location		
Nome, Alaska		3
Barrow, Alaska		4
Cape Krusenstern, Alaska		2
Total		**9**

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#39 CONSERVATION STATUS OF BUFF-BREASTED SANDPIPERS: A CONSERVATION GENETICS APPROACH

INVESTIGATORS: SAMANTHA WISELY, BRETT SANDERCOCK AND ZACHARY LOUNSBERRY, KANSAS STATE UNIVERSITY; JULIANA BOSI DE ALMEIDA, BRASILIA, BRAZIL; RICHARD B. LANCTOT, U.S. FISH AND WILDLIFE SERVICE

Long-term monitoring programs indicate that populations of migratory shorebirds are declining in many regions. The Buff-breasted Sandpiper (BBSA) is designated as a Highly Imperiled Global Species, the highest category of conservation concern. BBSA breed in the high arctic, migrate through the Great Plains, and travel to nonbreeding sites on the east coast of South America. Estimation of population size from visual counts of BBSA have been hampered by a lack of data on site fidelity and turnover rates. As part of a large-scale conservation genetic analysis of Buff-breasted Sandpipers (*Tryngites subruficollis*), we are analyzing contemporary and historical samples to address three objectives: 1) to assess connectivity among breeding, stopover and nonbreeding sites, 2) to evaluate the demographic independence of breeding and nonbreeding sites, and 3) to determine the population trend of BBSA over the last century and a half.

We developed 9 microsatellite markers to assess genomic diversity and designed primers to assess 1070 bp of the cytochrome b gene and 576 bp of the control region of the mitochondrial genome. We have screened all contemporary samples with all markers, including 235 samples from wintering areas in South America, 68 samples from migration sites, and 192 samples from breeding areas in the Arctic. We have finished collecting specimens from natural history collections and now have 257 specimens from 11 museums (Table 1). 41 samples were collected prior to 1900 and 210 samples were collected from 1901-1970. We have optimized internal primers to amplify the low yield and low quality DNA retrieved from museum specimens and have begun screening. We have had good success in amplifying DNA from samples collected prior to 1900 (Table 2).

Microsatellite data suggest that contemporary populations have maintained connectivity among wintering and breeding grounds (Figure 1). We did not find differential clustering of genetic diversity among breeding, stop over and overwintering samples, suggesting that connectivity remains among these migratory groupings. The mitochondrial data suggest that the contemporary global population experienced a bottleneck followed by a population expansion, as suggested by the star-shaped haplotype network (Figure 2).

Analyses of the contemporary data are ongoing. In the coming months we will be calculating the effective population size of breeding and overwintering populations. We will also conduct a molecular clock analysis to understand the timing of the bottleneck, and help us determine if the bottleneck is a recent, anthropogenic disturbance or the signal of Pleistocene refugial dynamics. These questions will help elucidate Objective 2.

To achieve Objective 3, we will create haplotype networks incorporating both historical and contemporary haplotypes to determine if major lineages have been lost over time. We will also estimate the effective population size prior to 1910, from 1911-1970 and from 1971-present.

Figure 1. Principle component analysis of microsatellite genotype variation among all contemporary sampled individuals. 20.42% of variation is explained by Principal component 1 and 18.73% by PC 2. ◆ = breeding sites, ■ = stopover sites, and ▲ = overwintering sites.

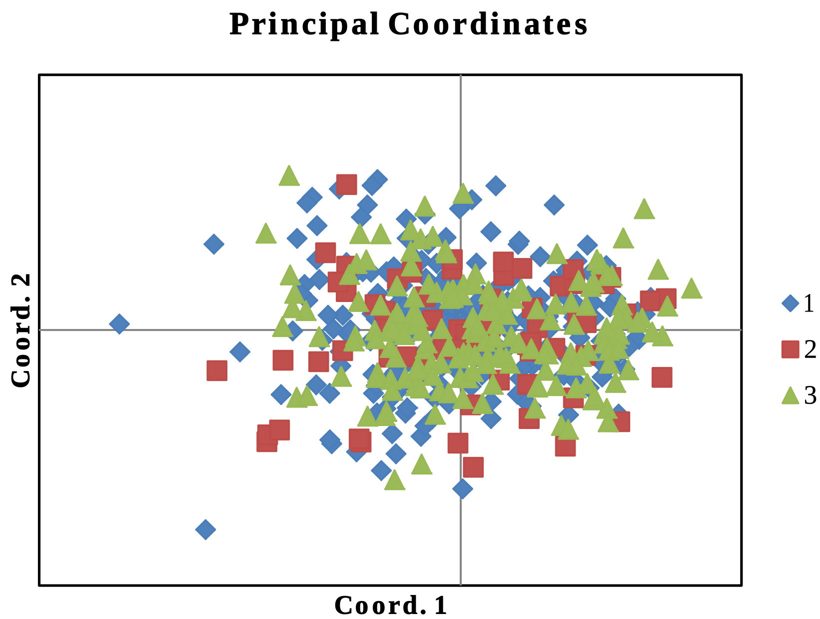

Figure 2. Minimum-spanning haplotype network for a 967-bp region of the cytochrome *b* gene in 438 contemporary samples of Buff-breasted Sandpiper. Node size indicates relative size of each haplogroup and branch length indicates number of mutations (standard branch length is one mutation). Circles are color-coded to correspond with the proportion of sampling locations that share the same haplotype (white = breeding, black = stopover, and gray = overwintering).

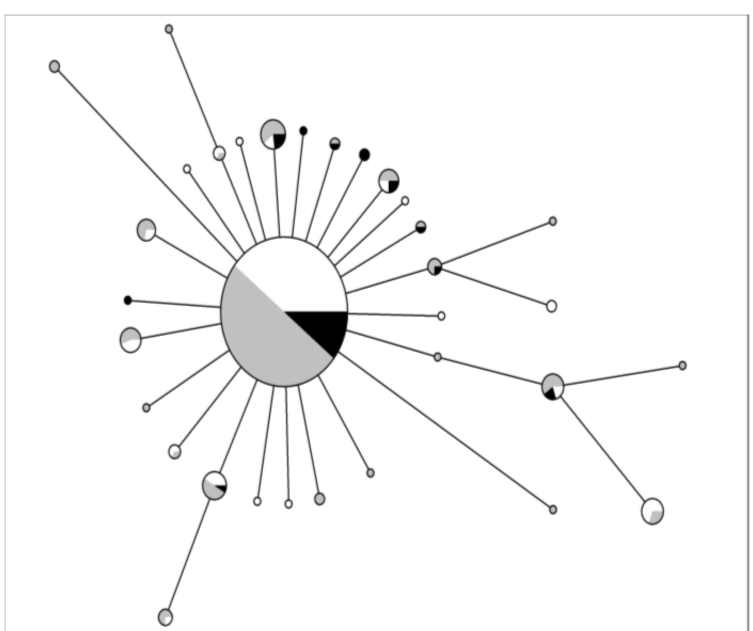

Table 1. Buff-breasted Sandpiper samples received from museum collections.

ORNIS Museum Code	Museum Name	Number of Specimens
UNSM	University of Nebraska State Museum	8
LACM	Los Angeles County Museum of Natural History	13
DMNH	Delaware Museum of Natural History Bird Collection	16
ANSP	Academy of Natural Sciences, Philadelphia's Natural History Museum	9
YPM	Yale University Peabody Museum	16
OMNH	Oklahoma Museum of Natural History	25
KU	University of Kansas Biodiversity Institute - Bird Collection	24
MCZ	MCZ Ornithology Collection – Harvard University	51
USNM	National Museum of Natural History, Smithsonian Institution	20
UMMZ	University of Michigan Museum of Zoology	51
MVZ	Museum of Vertebrate Zoology – UC Berkeley	24

Table 2. Preliminary sequencing of historic Buff-breasted Sandpiper samples. These data represent one attempt at sequencing. More attempts will be made. For toe pads, we had a 75% success rate of DNA amplification and sequencing. The vast majority of our oldest samples are toe pads.

Sample Name	Source	Type	Year	Bands on gel	Sequence
MUS24	KU71775	Feather	1879	No	No
MUS25	KU71776	Feather	1879	No	No
MUS57	UMMZ99973	Toe pad	1882	No	No
MUS58	UMMZ99974	Toe pad	1882	No	Yes
MUS60	UMMZ30228	Toe pad	1875	Yes	Yes
MUS73	UMMZ99975	Toe pad	1882	Yes	Yes

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#40 USING STABLE ISOTOPES IN PRIMARY FEATHERS TO CLASSIFY DUNLIN SUBSPECIES

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We measured stable carbon, hydrogen and nitrogen in primary feathers (which are grown on the breeding grounds) sampled from 277 individual birds representing six recognized subspecies of dunlin (*Caldris alpina*). Samples collected and analyzed in 2009 included 19 *actities* sampled in Sakhalin, Russia; 25 *arcticola* sampled in Barrow and Prudhoe Bay, Alaska; 97 *hudsonia* sampled in Michigan, Maine, Nunavat, New Jersey, and North Carolina; 30 *kitchinski* sampled in Kamchatka, Russia; 76 *pacifica* sampled in the Yukon Delta, and the Alaska and Seward peninsulas; and 30 *sakhalina* sampled from Chukotka, Russia. Two different nominal assignment frameworks, a likelihood-based assignment test and a classification tree, performed similarly for classifying individual birds to subspecies using information from all three isotopes. Cross validation of the likelihood-based assignment test yielded an overall correct assignment rate of 56%, with correct assignment percentages to individual subspecies ranging from 26% to 76%. We evaluated the performance of the classification tree using a bootstrap-based random forest algorithm. This yielded an overall correct assignment rate of 62%, with correct assignment rates for individual subspecies ranging from 32% to 74%. We used a k-means cluster analysis to evaluate the congruency between isotopic and taxonomic groupings. Based on this, between 3-5 clusters were most optimally supported by the isotope data. These clusters did not separate out along taxonomic lines, with most subspecies represented in each of the isotope-based clusters. This suggests that the physical biogeochemistry of the regions supporting recognized subspecies does not vary sharply across the breeding range for dunlin, or that additional variance was introduced by sampling feathers that were grown in the previous year (i.e. not freshly grown on site) and that birds were moving between years, or that birds were growing their primary feathers away from their breeding grounds – possibly on southward migration where they overlapped with other subspecies. Using isotope information from feathers to assort subspecies is better than random guessing and we suggest that isotope data from feathers in dunlin can be used conservatively in conjunction with additional lines of evidence to improve the ability to determine subspecies of dunlin that are sampled during winter.

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#41 STABLE ISOTOPES INFER GEOGRAPHIC ORIGINS OF SHOREBIRDS UTILIZING AN ALASKAN ESTUARY DURING MIGRATION

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Chickaloon Flats, Kenai National Wildlife Refuge, is a 10,974 ha tidal mudflats located along the northern part of the Kenai Peninsula in upper Cook Inlet, Alaska. It is a protected coastal estuary stopover site along the Pacific Flyway, consisting of 7% of total estuarine intertidal area of Cook Inlet and Prince William Sound.

We observed a total of 95 avian species throughout the spring and fall of 2009 and 2010, with 26 of those species breeding on Chickaloon. Avian surveys showed several pulses of total birds during spring migration, and a more protracted fall migration with variable smaller pulses of birds. Almost one third (23 of 73) of shorebird species recorded in Alaska utilize this stopover during spring and/or fall migrations. Estimated maximum daily shorebird numbers from ground-based surveys were 5,638 during spring migration, and 20,297 during fall migration.

The objectives of this study were to utilize stable isotope (δD and $\delta^{13}C$) analyses of six shorebird species to provide large spatial scale breeding and wintering origins of migrating shorebirds using Chickaloon Flats as a stopover site. We analyzed stable isotopes in six shorebird species that migrate through Chickaloon during both spring and fall including greater yellowlegs (*Tringa melanoleuca*), lesser yellowlegs (*Tringa flavipes*), least sandpiper (*Calidris minutilla*), pectoral sandpiper (*Calidris melanotos*), short-billed dowitcher (*Limnodromus griseus caurinus*), and long-billed dowitcher (*Limnodromus scolopaceus*). We performed a likelihood-based assignment to inform on probable geographic origins. If samples were classified as marine in origin ($\delta^{13}C$ values >-20‰), they were not assigned to origins using deuterium (δD).

Stable hydrogen analyses of first primary feather of migrating hatch year (HY) greater yellowlegs (n=66) examined on Chickaloon Flats during fall migration indicated that migrant greater yellowlegs were born in southwestern Alaska. The highest numbers of probable origins lie in Western Alaska Bird Conservation Region (BCR) 2 and to a lesser extent in the Northwestern Interior Forest BCR4 and North Pacific Rainforest BCR5.

Analyses of first primary feathers of migrating HY lesser yellowlegs (n=28) indicated they were born in highest numbers in the western portion of the Northwestern Interior Forest BCR4, while smaller numbers show probable origins in the northeastern portion of Western Alaska BCR2, the southern portion of Arctic Plains and Mountains BCR3, and the northern portion of North Pacific Rainforest BCR5. Analyses of primary feathers of after hatch year (AHY) birds indicated that migrant lesser yellowlegs (n=4) had various wintering origins ranging from southeastern North America through South America. North American probable origins include the Florida peninsula, most of the Caribbean Islands, and coastal Texas and Louisiana. Locations in South America include: northeastern Venezuela, almost all of Guyana, Suriname and French Guiana, northeastern Brazil, western Peru into Bolivia around Lake Titicaca, along the border of Chile and Argentina, and the southern tips of Chile and Argentina.

Stable hydrogen analyses of first primary feather of migrating least sandpipers (N=13) during spring and fall migration indicated that migrant least sandpipers wintered throughout most of the range. The highest numbers of birds show probable North American origins in southwestern Oregon, western California, and central Arizona and New Mexico. However moderate probability of origins occur in Central and South America including Belize, northern Guatemala, eastern Honduras and Nicaragua, Costa Rica, Panama, central Ecuador, and Colombia.

Analysis of the first primary feather of spring migrating pectoral sandpipers (N=11) indicated that they wintered in northern coastal South America. More specifically, birds originated in northeast Venezuela, northern Guyana and Suriname, most of French Guiana, north central interior Brazil, and an isolated area in southeast Peru. Analyses of first primary feathers of migrating HY birds indicated that migrant short-billed dowitchers (N=26) were born in Northwestern Interior Forest (BCR4) and North Pacific Rainforest (BCR5).

Stable hydrogen analyses of first primary feathers indicated that migrant AHY long-billed dowitchers (N=8) molted primaries at a variety of possible stopovers across western United States and Canada. Analyses of alternate tertial feathers indicate various wintering origins of the same individuals, from central California along the western portion of Lake Tahoe, southern Baja California, both coasts of Mexico, southern Texas east through southeastern North Carolina, and southern Guatemala and El Salvador.

The use of stable isotopes to infer molt origins of birds has proven to be a useful and important tool in migration and conservation studies. This study has shown probable origins of long-distance shorebird migrants, some of high conservation concern, utilizing an Alaskan stopover site, and has helped in identifying habitats and previously unknown areas used by Alaskan breeding shorebirds. This research has shown the overall importance and value of Chickaloon Flats as a stopover and breeding grounds for a diversity of avian species, and long-distance migrant shorebirds in particular.

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#42 COLVILLE RIVER DELTA - SHOREBIRD PROJECT

INVESTIGATORS: DAVID WARD, DAVID PAVLIK, BRAD WILKINSON, TYRONE DONNELLY, ERIC PALM, AND KYLE HOGREFE, US GEOLOGICAL SURVEY-ALASKA SCIENCE CENTER

Introduction The 2011 field season on the Colville River Delta was a pilot year for a shorebird monitoring project following protocol from the Arctic Shorebird Demographic Network (ASDN) and the United States Geological Survey (USGS). The project adopted a similar study area to the previous shorebird work that had been conducted quite a few years before. All species nests, not just shorebirds, were monitored for nest fate.

The 2011 Colville River Delta field season started on May 18th, 2011. Upon arrival, the ground and entire camp area was covered in heavy snow and only the very top of the river bank edge was snow free. Bird activity was limited to a pair of Snow Buntings at camp, Rock and Willow Ptarmigan, two Ruddy Turnstone, one Tundra Swan, Greater White-fronted, Snow and Canada Geese, and Glaucous Gulls. Shorebirds diversity and numbers rose from mid to late-May through early June (see table 1 below).

Table 1: Arrival dates of breeding or suspected breeders on the Colville River Delta

Species:	Date:
American Golden-Plover	21-May-11
Black-bellied Plover	23-May-11
Semipalmated Plover	24-May-11
Bar-tailed Godwit	23-May-11
Ruddy Turnstone	18-May-11
Red-necked Phalarope	23-May-11
Red Phalarope	2-Jun-11
Long-billed Dowitcher	21-May-11
Semipalmated Sandpiper	19-May-11
Pectoral Sandpiper	21-May-11
Dunlin	28-May-11
Stilt Sandpiper	23-May-11

Numbers of birds were recorded in the daily species log to monitor fluctuations in migration timing and arrival/departure. Nests of all species found throughout the season were monitored for nest fate. Most non-species nests were visited on a 10-day schedule, while shorebirds were monitored more intensely on a 5-day schedule. As many adult shorebirds were banded as possible with emphasis on Ruddy Turnstones and Semipalmated Sandpipers due to their high site fidelity. Invertebrate samples were collected on a three day schedule throughout the season. Snow surveys were done every other day until 90% snow cover was gone. We then switched to a weekly schedule to monitor fluctuating water and land cover. Daily predator surveys will provide information on the abundant avian nest predators.

Nest Survival Two shorebird plots were initiated, one north of camp and one south of camp, to serve as boundaries for nest searching efforts. These areas combine the previous shorebird monitoring plots used years ago. Each site was visited on a daily basis starting on May 20, 2011 in order to maximize the number of nests found. Nests of all species, not just shorebirds, were flagged and monitored for nest fate. Shorebird nests were monitored on a 5-day interval and eggs were measured when possible. Nests found during incubation were floated for age estimates.

A total of 143 shorebird nests were found and monitored on the two plots. Semipalmated Sandpipers were the most numerous, followed by Red-necked Phalarope, Dunlin and Red Phalarope. Black-bellied Plover, Ruddy Turnstone and Pectoral Sandpiper nests were relatively sparse, while only single nests of Semipalmated Plover, Bar-tailed Godwit, Long-billed Dowitcher and American Golden-Plover were found. See table 2 and table 3 below for first nest initiation dates and shorebird nest numbers by species. Initiation date is defined as the day the first egg is laid in the nest. The first Red-necked Phalarope nest was found very early in the season after a span of unusually warm weather. It was abandoned and the next phalarope nest wasn't found until quite a bit later in the season. June 1, 2011 is probably quite early for this species to initiate, and should be compared to future or previous years data.

Table 2: Dates for earliest nest initiation by species using lay/float/hatch data

Species	**Date**
Semipalmated Sandpiper	31-May-11
Dunlin	4-Jun-11
Pectoral Sandpiper	1-Jun-11
Red-necked Phalarope	1-Jun-11
Red Phalarope	13-Jun-11
Ruddy Turnstone	9-Jun-11
Black-bellied Plover	7-Jun-11
Semipalmated Plover	17-Jun-11
Bar-tailed Godwit	7-Jun-11
American Golden-Plover	1-Jun-11
Long-billed Dowitcher	4-Jun-11

Table 3: Number of shorebird nests by species on the Colville River Delta in 2011

Species:	Number:
Semipalmated Sandpiper	77
Red-necked Phalarope	19
Dunlin	14
Red Phalarope	13
Ruddy Turnstone	7
Pectoral Sandpiper	5
Black-bellied Plover	4
Bar-tailed Godwit	1
Semipalmated Plover	1
Long-billed Dowitcher	1
American Golden-Plover	1

South plot had a slightly higher diversity of shorebird species nesting, while north plot had a higher number of shorebird nests overall. Shorebird nests were monitored until nest fate could be determined. Nests were monitored every 5 days until close to hatch. When eggs had stars or pips, nests were re-checked every day until completion. Nest fate was broken down into 5 categories; hatch, fail, abandon, unknown and undetermined

Banding Adult shorebirds were banded on both north and south plot when time allowed. Banding started on June 11, 2011 and ended on July 12, 2011. Semipalmated Sandpipers and Ruddy Turnstones were focal species for banding because of their high site fidelity. Dunlin would have also been a good focal species if time had allowed. 53 birds were color-banded on both plots, providing a base sample for re-sighting in future years.

Higher numbers of shorebirds were banded on north plot than on south, although similar numbers of Semipalmated Sandpipers were banded on both. A slightly higher diversity of birds was banded on north plot because of the few phalaropes banded.

A unique color-band combination was used on each bird of the same species so individuals will be identifiable. Color-bands were originally placed on the upper-right tarsus of Semipalmated Sandpipers, but were changed to the lower-right tarsus on future birds because of the difficulty of re-sighting multiple bands on a small upper-tarsus. Therefore, a small number of Semipalmated Sandpipers have color-bands on their upper-right tarsus. Certain color combinations may be used more than once as long as they are on different species, so it is important to note the species when re-sightings birds. See table 6 below for color-combinations applied to shorebirds during the 2011 field season.

Predator Surveys Predator surveys were conducted on a daily basis for the duration of the observers time spent in the field starting on May 30, 2011 and ending on July 13, 2011. This sampling technique results in predator surveys for both north and south plot on a given day. The number of individual predators were counted and marked on the predator sheets as an exact number. The most common predators were Arctic Ground Squirrels, Parasitic and Long-tailed

Jaegers and Glaucous Gulls. Glaucous Gulls and the Jaegers were seen predating geese nests on several occasions, and it is not a stretch to assume they do the same to shorebirds.

During the peak of the breeding season, multiple fox sightings on plot probably explain a portion of the shorebird nest predations. An Arctic Fox was seen on multiple days on north plot. At least 2 Red Foxes were seen, mainly on south plot but occasionally on north plot. Foxes have a very sharp sense of smell and can follow observers scent right to marked shorebird nests.

Lemming winter nest transects were also walked once during the field season to gain an idea of the abundance of lemmings in the area. The surveys were performed on June 2, 2011 on north and south plot. A total of 2km on each plot was walked and no lemming nests were found. Only a few lemmings were seen incidentally throughout the season, making 2011 a poor year for lemmings in the Colville River Delta area.

Future Recommendations The pilot year for the 2011 Colville River Delta shorebird project went very well given the circumstances. We were able to gather important data on arrival dates, nest survival and a handful of blood and feather samples for the ASDN. A decent number of birds were banded, although more would certainly help re-sights in the future to better understand adult survival rates. Because only 2 people were full-time shorebird researchers, banding took a lower priority to the nest finding and monitoring. With just one or two more full-time shorebird researchers, one researcher could be used specifically to band and a much higher number of color-banded birds would be present on the plots. The other researchers could do nest checks and search for nests while one person bands. Banding was much more efficient with 2 people, but was possible as a solo operation. Banding should focus on Semipalmated Sandpipers, Dunlin and Ruddy Turnstones as they have high site fidelity. All in all, the field season went very smoothly for a pilot project.

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#43 LINKING DUNLIN BREEDING SITES WITH MIGRATORY STOPOVER AND WINTERING LOCATIONS USING LIGHT-LEVEL GEOLOCATORS

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Many shorebirds breed in tundra regions that are relatively free of development, yet during the non-breeding season they move in migratory flyways to areas where development is common and widely distributed. Given that many shorebird species have experienced substantial population declines over the past several decades and that species that use particular migration routes are more prone to decline, knowledge of the timing and geographic links between migratory populations throughout their annual cycle can aid wildlife monitoring and conservation. Knowledge of the variability in migratory strategies would also help model potential effects of climate change on migratory populations. The objectives of this project are to identify migratory routes and stopover areas for three subspecies of Dunlin, *Calidris alpina arcticola*, *pacifica* and *hudsonia*. In 2010, between 22 and 51 Dunlin at each of seven breeding populations were equipped with light-level loggers (aka geolocators). In 2011 we recovered loggers: 21 from Izembek National Wildlife Refuge, 21 from Yukon Delta National Wildlife Refuge, 12 from Cape Krusenstern National Monument, 16 from Barrow, 4 from Ikpikpuk River, 5 from Arctic National Wildlife Refuge, and 17 from Churchill, Manitoba. 55% of the loggers (BAS Model MK12) had dead batteries upon recovery. On average, these logged 312 days, though the range was large 6-376 days. The others provide complete yearly tracks. Thus, we have records of southward migration and wintering sites from almost all recovered loggers, but have a reduced number of records of northward migration. All *arcticola* were found to migrate to Asia, all *pacifica* went to the west coast of North America (including those at Cape Krusenstern–a site where the subspecies identification was unknown), and all *hudsonia* wintered along the east coast or Gulf coast of North America. More precise analyses are ongoing, focusing on (i) distributions and the connectivity of separate breeding populations throughout the annual cycle and (ii) individual differences in migration in relation to individual attributes (e.g. sex and breeding success) and environmental conditions (e.g. weather fronts).

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