Annual Summary Compilation:

New or ongoing studies of Alaska shorebirds

November 2013

One of Cape Krusenstern's successful Semipalmated Sandpiper nests: four chicks!
Photo by Fang-Yee Lin.

Alaska Shorebird Group

EXECUTIVE SUMMARY

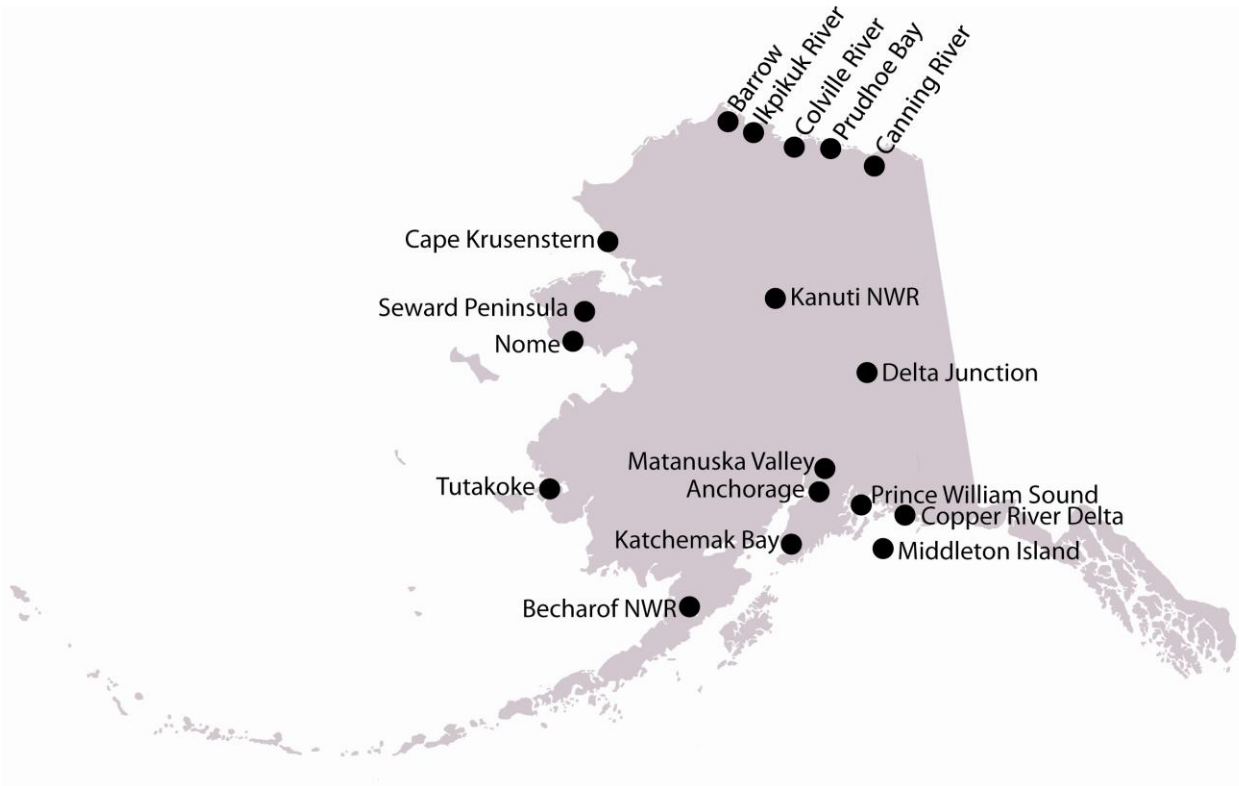
Erin Cooper, Alaska Shorebird Group Secretary

Welcome to the 2013 summary report of ongoing or new studies of Alaska shorebirds. This is the twelfth consecutive report put together by the Alaska Shorebird Group. In this document members of the Alaska Shorebird Group compiled annual summaries for 38 studies highlighting many interesting projects investigating Alaska shorebirds. 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 90 investigators, 30 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 22 of the projects (58%). Universities took the lead (co-lead) in the most projects (15) with 39% of the total projects including University of Alaska Fairbanks, Kansas State University, University of Alaska Anchorage, Simon Fraser University, University of Missouri, Université du Québec à Rimouski, University of Florida, and the University of Connecticut. Non-government organizations (NGO) included the Manomet Center for Conservation Sciences (n = 4), Wildlife Conservation Society (n = 4), Prince William Sound Science Center (n = 2) and Audubon Alaska ($n=1$). The U.S. Fish and Wildlife Service (n = 10) spearheaded a number of projects and led the way for government agencies. The Katchamak Bay Birders were the lead for the only project entry from a local birding group.

The map of our study site locations within Alaska (next page) shows the statewide distribution of projects from this summary where these locations could be gleaned from the summary. Much of the work in Alaska was conducted in arctic breeding sites with the second area of concentration in south central Alaska. Western Alaska had the next highest concentrations of projects. Two projects were located in the interior of the State (an increase from one project in 2012). I would like to thank all of the talented photographers who submitted their images for use in this document. Photo credits (when given) and a brief caption are listed for each photo. This year we added a list of peer-reviewed publications to our annual summary (see last section of document).

Thank you to the principal investigators for making contributions to this year's annual summary report. Big thanks to the field biologists for their valiant efforts in conducting these important field studies in Alaska. We look forward to many more years of fruitful research and conservation of Alaska's breeding and migratory shorebirds.



Dispersal of 2013 Alaska Shorebird Group Project throughout Alaska. Locations may represent more than one project.

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#1 AN ARTIFICIAL NEST EXPERIMENT TO ASSESS DEVELOPMENT IMPACT ON NESTING BIRDS

Investigators: Rebecca Bentzen, Martin Robards, Joe Liebezeit, Stephen Dinsmore, and Steve Zack, Wildlife Conservation Society

Attraction of predators to centers of human activity on the Arctic Coastal Plain of Alaska may result in increased nest predation rates closer to infrastructure. In 2012, we initiated a project to refine our understanding of this issue by conducting a multi-year artificial nest experiment. In June/July of 2013 we set out surrogate shorebird and duck nests on 4 transects for a total of 212 nests. Surrogate nests consisted of 3 domestic duck eggs (simulating Northern Pintail nests) or 4 Japanese Quail eggs (simulating *Calidris* shorebird nests) placed in ground scrapes. Artificial nests (60 per transect) were placed approximately every 170 meters along each transect emanating from Group I and II infrastructure (infrastructure that provides high food potential and/or high structural value to potential subsidized predators; Liebezeit et al. 2009) alternating placement of shorebird and duck nests. We are currently performing preliminary nest survivorship analyses with the 2013 data. Results will be used to inform study design adjustments for the 2014 field season.

#2 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: Rebecca Bentzen, Martin Robards, Joe Liebezeit, and Steve Zack, Wildlife Conservation Society

The Wildlife Conservation Society is completing an assessment of the importance of the northeast National Petroleum Reserve-Alaska 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. We compare these results with other sites on the North Slope to help evaluate the importance of this region for breeding birds.

In 2013, we continued work on two large plots (58 and 72 ha, respectively) the east side of the Ikpikpuk River approximately 30km south of the river mouth (70.55242° N; 154.73222°). We detected 54 bird species at the site during daily species surveys. On or near our study plots, we discovered and monitored 157 nests of 10 shorebird species from 4 June to 19 July using both rope drag and behavioral nest search techniques. Semipalmated Sandpiper (n = 64), Red-necked Phalarope (n = 18), and Red Phalarope (n = 23) nests accounted for the majority (67%) of those found. Among all species, 17 nests successfully hatched/fledged, 124 failed, and nest fate was not determined for 16. 5 geolocators were placed on American Golden Plovers and 29 on Semipalmated Sandpipers.

Fourteen species of potential nest predators were detected during timed surveys with the most common being Glaucous Gulls and Parasitic Jaegers.

Arctic Shorebird Demographic Network – Ikpikpuk River site

We also established Ikpikpuk as an Arctic Shorebird Demography Network (ASDN) site in 2010. In 2013, we continued 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 2013:

Data measure	**SESA**	**DUNL**	**REPH**	**RNPH**	**TOTAL**
Number of nests found	64	16	23	18	**121**
Number of birds banded[1]	31	7	13	15	**66**
Number of resights	45	17	7	2	**71**
Genetic blood samples	45	11	16	16	**88**
Avian malaria samples	42	11	16	15	**84**
Mercury blood samples	35	11	16	15	**77**
Fecal samples	13	4	10	10	**37**
Feather samples	45	11	16	16	**88**

[1] Number of birds banded is the total of newly banded birds for 2012, excluding recaptured birds. However, blood, fecal, and feather samples were taken from all birds captured this year (n = 93).

We collected blood for avian disease and mercury contaminants studies. 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).

#3 MIGRATORY BREEDING BIRDS USE OF RE-VEGETATED OIL PLATFORMS

Investigators: Rebecca Bentzen, Martin Robards, Joe Liebezeit and Steve Zack, Wildlife Conservation Society

Over the past 15 years BP Exploration (Alaska), Inc. and others have begun efforts to rehabilitate abandoned exploratory oil drilling pads. Despite intensive rehabilitation involving gravel removal, reintroduction of native vegetation, and reshaping topography, no follow-up studies have been performed to assess the wildlife response to these efforts. In 2013, we continued a project to determine bird nesting, feeding, and brood rearing use at rehabilitated oil pad sites that was initiated in 2012. The findings from this study will enable us to develop specific recommendations that will provide land managers and industry with new information to assist in site rehabilitation providing the highest quality reclaimed habitat for nesting birds.

In June/July we conducted three point count and three line-transect bird count replicates, and two nest searches at 10 rehabilitated pads (and 10 paired plots on undisturbed tundra). We collected over 1000 detections of 30 bird species during the count surveys. We also sampled microhabitat usage at 69 sites and paired random sites for 16 species on 10 of the rehabilitated pads. We are currently performing preliminary nest survivorship analyses with the 2013 data. Results will be used to inform study design adjustments for the 2014 field season.

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

Investigators: Rebecca Bentzen, Martin Robards, 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 2013, we discovered and monitored 68 nests of 10 shorebird species from 3 June to 22 July on (or near) 12 10-ha study plots using both rope drag and behavioral nest search techniques. Semipalmated Sandpiper, Pectoral Sandpiper, and Red-necked Phalarope nests accounted for the majority (75%) of those found. Among all species, 42 nests successfully hatched/fledged, 13 failed, and 13 nests were of unknown or undetermined fate. Nest predation was determined to be the cause of nest failure for all failed nests.

Overall, 19 species of potential nest predators were detected during timed surveys with the most common being Glaucous Gulls, Parasitic Jaegers, and Common Ravens.

Arctic Shorebird Demographic Network – Prudhoe Bay site

Within the framework of our pre-existing breeding bird studies, we also established Prudhoe Bay as an Arctic Shorebird Demography Network (ASDN) site in 2010. In 2013, we continued the ASDN adult survivorship component for four of the ASDN target species (Semipalmated Sandpiper, Dunlin, Red and Red-necked Phalarope). These involved monitoring nests but no banding activities in 2013. Data collected as part of our separate nest monitoring efforts, including predator activity, and snow cover will be contributed toward the ASDN effort.

Of the target species, 26 SESA, 2 DUNL, 3 REPH, and 12 RNPH nests were found (total 43).

#5 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 stable. 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. Between 1-8 June 2013, we located 20 nests, including 17 with full clutches. In all, we banded eight adult Semipalmated plovers and resighted 16 plovers banded previously on Egg Island. Additional field work is planned for Egg Island in 2014.

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#6 BREEDING ECOLOGY OF SHOREBIRDS AND SURVEY OF OTHER BIRDS AT CAPE KRUSENSTERN NATIONAL MONUMENT, ALASKA

Investigators: Megan Boldenow, University of Alaska Fairbanks and U.S. Fish and Wildlife Service; Richard Lanctot, U.S. Fish and Wildlife Service; Abby Powell, U.S. Geological Survey, Alaska Fish and Wildlife Cooperative Research Unit; H. River Gates, ABR, Inc.; Stephen Brown, Manomet Center for Conservation Sciences.

In 2013, we undertook the third year of study for the Arctic Shorebird Demographics Network (ASDN) at Cape Krusenstern National Monument in western Alaska. This was the fourth year of shorebird-related work at our site, which is located adjacent to Krusenstern Lagoon, approximately 30 miles northwest of Kotzebue, Alaska. In 2013, we conducted nest searching, banding and biological sample collection, and environmental monitoring activities between 24 May and 10 July. Over the course of our field season, we located 146 nests of 6 shorebird species, including Black-Bellied Plover, Black Turnstone, Dunlin, Semipalmated Sandpiper, Western Sandpiper, and Red-necked Phalarope.

We determined nest initiation dates for shorebird nests by observing clutch completion, using egg flotation regression equations, and/or back-calculating from hatch date. Mean nest initiation dates, standard deviation from the mean, and sample size for our focal species (Dunlin, Semipalmated and Western Sandpiper, Red-necked Phalarope, and Black Turnstone) are reported in Table 1. Additionally, we found one nest of Black-bellied Plover (found just outside the plot boundary, nest initiated 9 June). Average initiation dates were later for all *Calidrids* (i.e. sandpipers) in 2013, compared to 2011, and similar to initiation dates in 2012. For Red-necked Phalarope, average initiation date was slightly later in 2013 than in 2012 but slightly earlier than in 2011. Average initiation was 15 days later for Black Turnstone in 2013 relative to 2012; but this difference may have been influenced, in part, by the smaller sample size in 2013.

Table 1. Average nest initiation dates for focal shorebird species breeding at Cape Krusenstern, Alaska, 2011-2013.

	2011	2012	2013
Dunlin	3 Jun ± 5.2 d, n=14	6 Jun ± 5.0 d, n=22	7 Jun ± 6.8 d, n=22
Semipalmated Sandpiper	2 Jun ± 5.7 d, n=36	8 Jun ± 3.6 d, n=55	6 Jun ± 6.5 d, n=40
Western Sandpiper	7 Jun ± 10.5 d, n=10	10 Jun ± 5.2 d, n=35	8 Jun ± 7.3 d, n=65
Red-necked Phalarope	14 Jun ± 7.9 d, n=12	11 Jun ± 4.0 d, n=18	12 Jun ± 5.0 d, n=13
Black Turnstone	-	2 Jun ± 3.5 d, n=14	17 Jun ± 10.0 d, n=5

Fate of approximately 12% of the nests was unknown or undetermined. These consisted largely of Black Turnstones, which nested away from our main study area. Apparent nest success for those nests for which fate was determined is shown in Table 2. Red-necked Phalarope showed the highest apparent success in 2013, followed by Dunlin, Western Sandpiper, and Semipalmated Sandpiper. Overall, apparent nest success declined in 2013 when compared to both 2012 and

2011. Apparent nest success, for purposes of this summary, means that one or more chicks hatched.

Table 2. Apparent nest success for focal shorebird species breeding at Cape Krusenstern, Alaska, 2011-2013.

	2011	2012	2013
Dunlin	100%, n=12	75%, n=22	27%, n=22
Semipalmated Sandpiper	85%, n=30	69%, n=51	7%, n=40
Western Sandpiper	85%, n=6	74%, n=31	12%, n=65
Red-necked Phalarope	85%, n=6	50%, n=18	31%, n=13
Black Turnstone	-	undetermined	undetermined

We captured and uniquely marked 159 individual shorebirds (100 adults and 59 chicks). Adults were marked with engraved flags and/or color bands and included 21 Dunlin, 41 Western Sandpiper, 27 Semipalmated Sandpiper, 6 Red-necked Phalarope, and 5 Black Turnstone. Chicks were marked with a single aluminum band and included 23 Dunlin, 21 Western Sandpiper, 5 Semipalmated Sandpiper, and 10 Red-necked Phalarope. We measured morphological characteristics of each bird and collected genetic, feather, fecal, and avian health samples.

In addition to the above shorebird work, we conducted frequent (every 1-3 days) predator surveys, monitored surface water conditions, collected hourly weather conditions, and documented nesting habitat types. We participated in a number of ASDN side projects, including methyl mercury exposure in shorebirds, avian malaria, and gut microbiota. We also participated in the first year of two broad scale migratory connectivities for Semipalmated Sandpipers and Black Turnstones. We captured individuals and equipped them with light-level geolocators, deploying 18 geolocators on Semipalmated Sandpipers and 5 geolocators on Black Turnstones. Summaries of these side projects are found elsewhere in this document.

We tallied the numbers of birds of all species observed by researchers each day. In total we documented 61 species of birds in the study area, comprised of 11,535 individuals. Our most abundant observations (>500 observations over the season) included Red-necked Phalarope, Lapland Longspur, Glaucous Gull, Dunlin, Arctic Tern, Semipalmated Sandpiper, and Western Sandpiper. Our most common (>150 individuals/season, with approximately 5-10 individuals sighted per day) migrants or local breeders included Tundra Swan, Sandhill Crane, Northern Pintail, Parasitic Jaeger, Snow Goose, Long-tailed Duck, Red Phalarope, Greater White-fronted Goose, Pectoral Sandpiper, Mew Gull, Pacific Loon, Willow Ptarmigan, and Brant. Our most uncommon observations (<5 observations) included Wilson's Snipe (25 May), Red Knot (30 May), Buff-Breasted Sandpiper (29 May), Canada Goose (30 and 31 May), Common Merganser

(26 June), Northern Harrier (8 July), Rough-legged Hawk (1 June), Golden Eagle (1 and 12 June), Pomarine Jaeger (1 June), Common Redpoll (30 May), Arctic Warbler (29 May and 10 June), Dark-eyed Junco (25 May), Short-eared Owl (29 and 30 May), and Garganey (3 June).

Besides the breeding shorebirds, we confirmed the breeding status of an additional 12 bird species, including Mew Gull, Glaucous Gull, Sabine Gull, Arctic Tern, Parasitic Jaeger, Long-tailed Duck, Tundra Swan, Red-throated Loon, Pacific Loon, Lapland Longspur, Savannah Sparrow, and Willow Ptarmigan.

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Jennifer Kardiak releasing a geolocatored Semipalmated Sandpiper at the Cape Krusenstern site. Photo by M. Boldenow.
Up close and personal with a Red-necked Phalarope, in all its lobed-toe glory. Photo by Jennifer Kardiak.

#7 MIGRATORY CONNECTIVITY OF SEMIPALMATED SANDPIPERS

Investigators: Stephen Brown, Manomet Center for Conservation Sciences; Richard Lanctot and David Payer, U.S. Fish and Wildlife Service; Stephen Yezerinac, Mount Allison University; David Mizrahi, New Jersey Audubon Society; Megan Boldenow, University of Alaska Fairbanks; Joe Liebezeit, Audubon Society of Portland; Rebecca Bentzen and Martin Robards, Wildlife Conservation Society; Jennie Rausch, Grant Gilchrist and Paul Smith, Environment Canada; David Lank and Willow English, Simon Fraser University; Brett Sandercock and Eunbi Kwon, Kansas State University; Nicolas Lecomte, Université de Moncton.

Semipalmated Sandpipers (SESA) were historically one of the most widespread and numerous shorebird species in the Western Hemisphere. However, the species appears to have experienced significant declines on core wintering areas in recent years. Counts of SESA from the breeding areas have shown different results, with declines at some sites in the eastern arctic, and generally stable or increasing trends in the central and western arctic. These different survey results create a conservation challenge, because we need to respond to the apparent large decline in the wintering areas, while at the same time learning what caused it and how it can best be addressed. Simply put, we don't know if a decline is occurring range-wide or only in some regions, and we don't know what may be causing the decline observed in the core wintering areas, although hunting and conditions at major migration staging areas have been suggested.

Taking advantage of existing field camps in key SESA breeding areas, we deployed 194 geolocators on adult SESA at five sites in Alaska and three sites in Canada in 2013. Collectively, we were able to capture and deploy geolocators on 29 birds at Nome, 18 at Cape Krusenstern, 28 birds at Barrow, 29 birds at the Ikpikpuk River, 29 birds at the Canning River, 14 birds at the Mackenzie Delta, 12 birds at Igloolik, and 35 birds at Coats Island. These birds will be targeted for recapture in the 2014 breeding season. Results of this project will provide critical insight into the spatial connectivity of SESA across their annual cycle. The data will include temporal and spatial information on where breeding birds from throughout the Arctic migrate and winter, which will help determine whether the declines observed in the wintering areas are range-wide or regional. Furthermore, knowing the timing of movements for different populations could improve the design and interpretation of surveys for population monitoring. Finally, these data will support the development of sound conservation strategies to support recovery of populations by targeting efforts where they are most needed.

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#8 ARCTIC SHOREBIRD DEMOGRAPHICS NETWORK: OVERVIEW

Investigators: Stephen Brown, Manomet Center for Conservation Sciences, Richard Lanctot, U.S. Fish and Wildlife Service, and Brett Sandercock, Kansas State University

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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 and state/provincial agencies (USFWS, USGS, Environment Canada, Ontario Ministry of Natural Resources), academic institutions (University of Alaska Fairbanks, Cornell Lab of Ornithology, Kansas State University, Simon Fraser University, Mount Allison University, University of Florida, Moscow State University, Lomonosov, University of Quebec, Rimouski and Trent University) and non-profit organizations (Manomet Inc., Wildlife Conservation Society). All are actively conducting Arctic shorebird research and can implement similar protocols at their study sites. In addition, the Network relies on partners across the range of the target species for resighting efforts of banded birds. Current participants include 16 breeding season study sites spanning the entire Alaskan (*n* = 7), Canadian Arctic (*n* = 7) and Russian Arctic (*n* = 2, Fig. 1). Project summaries are available for the following Alaska sites: Nome (# 21), Cape Krusenstern (# 6), Barrow (# 24), the Ikpikpuk River (# 2), Canning River (# 9), Colville River (# 37), and Prudhoe Bay (# 4). Sites in Canada include Mackenzie Delta, Churchill, Bylot Island, East Bay, Burntpoint Creek, Coats Island and Igloolik, (the last two are new in 2013). Sites is Russia include Chaun Delta and Lower Khatanga River that began in 2012.

Fourth Year Completed

2013 marked the fourth year (of 5 years) where data were collected in the field. In preparation for this work, the protocol subcommittee revised the 2012 field protocols (based on feedback from the third year). 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 American Golden-Plover, Western Sandpiper, Pectoral Sandpiper, and Red-necked and Red Phalarope at several sites. Other species are banded as well, depending on the particular focus of a site. In 2013, personnel from the Network located ca. 2000 nests belonging to 32 species, and banded > 1200 individuals belonging to 18 species. In addition, as part of an effort to understand how local conditions influence nest success and adult survival, we collected data on weather, invertebrate abundance, predators, and lemmings.

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 have been implemented by Network Collaborators: Dunlin migratory connectivity, pond hydrology and insect emergence, Semipalmated Sandpiper migratory connectivity (# 7), dispersal of bryophyte diaspores (#23), prey and shorebird hatch mismatch (# 17), spring phenology and timing of nesting (#20), and avian health studies (#38 [avian malaria], # 16 [gut microbiota] and [methyl mercury]).

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..

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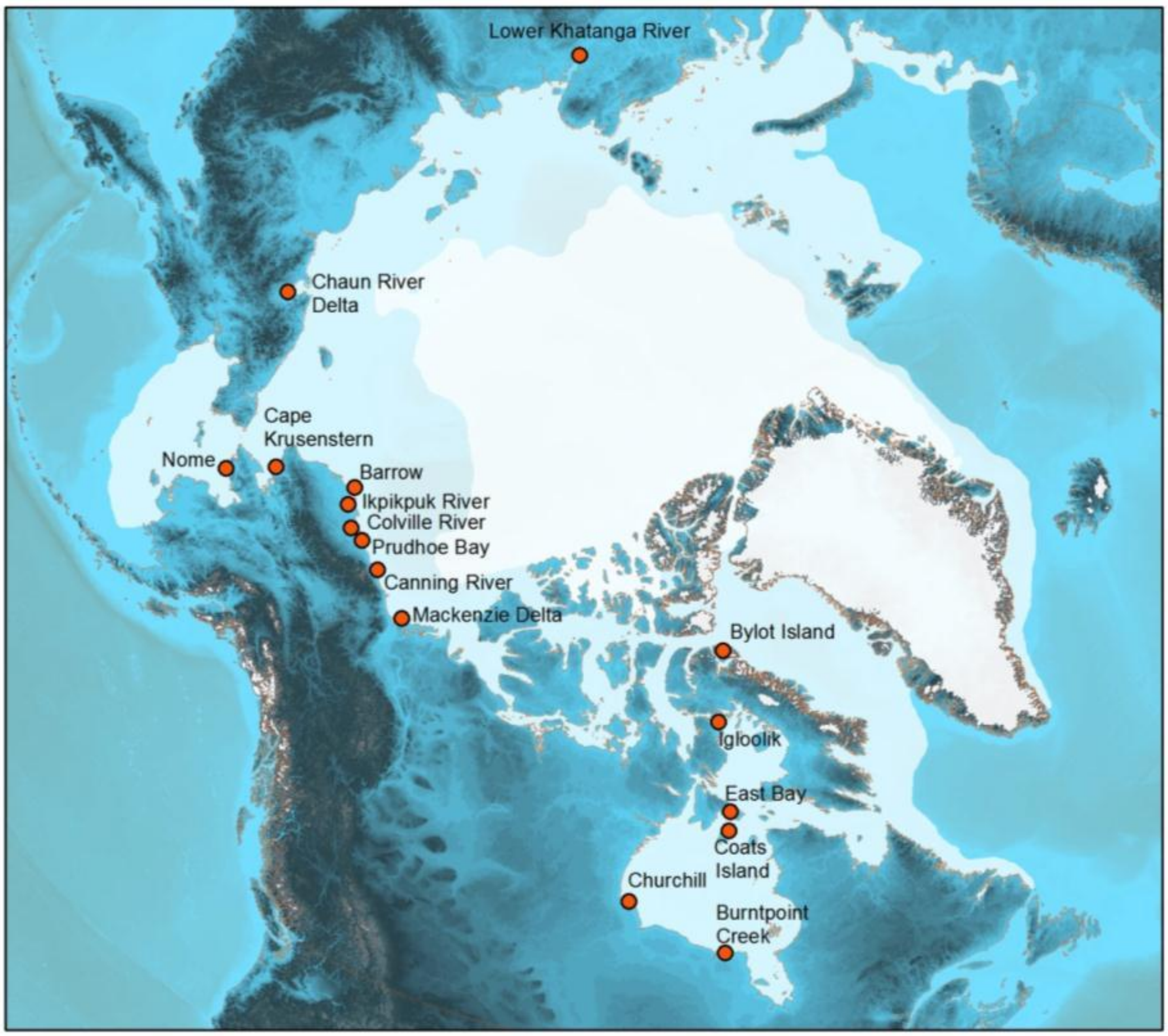

Figure 1. Arctic Shorebird Demographics Network sites in 2013.

#9 CANNING RIVER DELTA

Investigators: Stephen Brown, Manomet Center for Conservation Sciences, Dave Payer, USFWS, Scott Freeman, USFWS, and Brad Winn, Manomet Center for Conservation Sciences.

In 2013, we conducted field studies at the Canning River Delta as a partner in the Arctic Shorebird Demographics Network (ASDN; see project summary #8). At the Canning River Delta in 2013, after the slow start to nesting, nest numbers picked up rapidly, reaching an active nest peak of 191 shorebirds on June 27. A total of 279 nests of 10 species were found, including a record 11 BBSA nests. A total of 105 birds were captured this year. Geolocators were deployed on 29 SESA (1 instrument failed) including both pair members on 14 nests.

A total of 202 resights of banded DUNL, RNPH, and SESA were recorded, documenting 72 individuals banded between 2010 and 2012. Some birds banded prior to 2010 were also recorded including 2 DUNL and 3 SESA. Of the 77 total individuals resighted, 63 are documented by photos. In addition, one bird banded in Brazil was resighted nesting in the study area. This is the second resight of a Brazil bird at the Canning River.

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#10 LONG-TERM DIET PATTERNS OF BLACK OYSTERCATCHERS (*HAEMATOPUS BACHMANI*) IN THE GULF OF ALASKA AS DETERMINED THROUGH STABLE ISOTOPE ANALYSES

Investigators: Brooke Carney, Douglas Causey and Jeffry Welker, University of Alaska Anchorage; David F. Tessler, Alaska Department of Fish and Game; Heather Coletti, National Park Service

Black oystercatchers (*Haematopus bachmani*) are a species of concern throughout their range because of their specialized habitat and small population size. The prey base of black oystercatchers, which consists of animals found in the intertidal zone, may shift in unknown ways as a result of climate change. To better understand the intra-season and long-term diet patterns of black oystercatchers, we analyzed whole blood and feathers of black oystercatchers as well as several species of potential prey items using carbon (13C) and nitrogen (15N) stable isotopes. Blood and feather samples were collected from several field locations in the northern Gulf of Alaska in 2012 and 2013. Additionally, archived blood collected in the early 2000s and archived feathers collected throughout the 1900s in the same locations were also analyzed. Potential prey items were collected during 2012 and 2013 field efforts. Mixing models suggest that the diet of individuals sampled in 2012 and 2013 is approximately 52% mussels or other filter feeders, 41% limpets or other grazers, and approximately 5% dogwinkles or other secondary consumers, which is consistent with previous assessments of diet. There was little variation in the intra-season 13C and 15N signatures of feathers and of blood among individuals, suggesting the sampled individuals share a similar, specialized diet throughout the spring and summer seasons. Additionally, initial results of archived feathers show similar 15N values as those of recently sampled individuals, suggesting a long-term pattern of feeding at the same trophic level. Our results indicate that black oystercatchers may be susceptible to changes in the species composition of the intertidal zone.

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#11 BLACK OYSTERCATCHER SURVEYS IN PRINCE WILLIAM SOUND – 2013 FOREST PLAN MONITORING

Investigator: Erin Cooper, Chugach National Forest

Black Oystercatchers (*Haematopus bachmani*) are listed as a "species of high concern" in the U.S. National Shorebird Conservation Plan, a Focal Species for the U.S. Fish & Wildlife Service (USFWS), a Chugach National Forest (CNF) Management Indicator Species (MIS) and a US Forest Service Alaska Region Sensitive Species. Approximately 800-1200 individuals inhabit the shoreline and rocky islets of Prince William Sound, an area primarily managed by the Chugach National Forest. The Chugach Forest Plan calls for monitoring population trends, habitat relationships, and habitat change for nesting black oystercatchers in Prince William Sound. The Chugach National Forest has been monitoring black oystercatcher nest locations since 1999. These data has been used to analyze interactions between oystercatchers and human use and have been integrated into a sensitive species analysis for Prince William Sound..

The sampling design was developed in an attempt to retain the historically important survey regions of Harriman Fjord, Green Island, Montague Island, and the Dutch group, while supplementing this sample with shoreline segments from the entire Prince William Sound. In order to minimize travel time and expense to visit other sampled shorelines we took a regional approach to sampling, and developed a split-panel rotating design to provide a balance between estimation of trend and estimation of yearly status. This design designates some areas with high historic concentrations of oystercatchers to be visited every other year and other less populated areas to be visited less frequently. A split-panel rotating design also has the advantage of allowing more shorelines to be visited during the life of the monitoring program, which provides more opportunity to detect changes in the spatial distribution of nesting oystercatchers in Prince William Sound.

In early June 2013, we surveyed areas in Prince William Sound including: Harriman Fiord, the Dutch Group, Montague Island, Blackstone Bay, Ingot Island, and Port Etches. A total of twenty six active oystercatcher nesting territories were identified during the survey and an additional eleven sites were identified with non-breeding oystercatchers.. The greatest densities of active oystercatcher territories were located in the Dutch Group (6) and Montague Island (6). Data from the 2013 survey will be entered into the Chugach National Forest black oystercatcher GIS database. Future analysis will continue to compare populations and human use effects across Prince William Sound.

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Kate Mohatt collects oystercatcher nest data in Rocky Bay

#12 RED KNOT SURVEY ON THE COPPER RIVER DELTA

Investigators: Erin Cooper, Chugach National Forest and Pete Mickelson, Alaska WildWings

In May 2013 the Copper River International Migratory Bird Initiative funded a small survey of the red knot (*Calidris canutus*) migration on the Copper River Delta, Alaska. Other studies along the flyway have indicated that this species may be in decline but little is known about its current status and use on the Copper River Delta. Past work on the Delta by Pete Isleib in the 1970's counted flocks up to 40,000 birds in the spring migration. This project was initiated to acquire a current snapshot of spring migration timing and pulses on the Copper River Delta. Red knots have been observed most frequently on the northwest shores (lagoon side) of western Egg Island and Little (west) Egg Island. These beaches are a mix of about 40% mud and 60% (or more) of sand. Surveys were conducted by a single observer at Goose Cove, Egg Island and Little Egg Island on the Copper River Delta from May 7 through May 28th, 2013. When these areas were inaccessible due to the weather, the observer identified flocks through a spotting scope on the barrier islands from Goose Cove. Small flocks of knots were observed at the start of the survey on May 7th (26) and steadily increased up until May 14th (9,000-12,000). After the 14th, flocks dramatically decreased with the last bird sighted on May 24th (1). Knots were consistently spotted in the presence of dunlin (*Calidris alpina*), black-bellied plover (*Pluvialis squatarola*) and short-billed dowitchers (*Limnodromus griseus*). Results will inform land managers on the continued use of this species in land management planning efforts as well as assist in planning future surveys for habitat use and migration.

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#13 HABITAT, SOCIAL FACTORS, AND EXPERIENCE INFLUENCE NEST SITE SELECTION IN ARCTIC-BREEDING SHOREBIRDS

Investigators: Jenny Cunningham and Dylan Kesler, University of Missouri Columbia; Richard Lanctot, U.S. Fish and Wildlife Service

Theory predicts that nest site selection in birds is not random, but driven by proximate and ultimate factors that maximize survival and fitness. These factors may include habitat characteristics that offer a safe and thermodynamically efficient nest environment, proximity to foraging resources, and social organizations with other nesting birds that regulate resource security or cue habitat suitability. We are investigating the simultaneous influences of these factors on nest site selection by shorebirds breeding on the Arctic tundra around Barrow, AK. Our objectives are to develop a better understanding of how shorebirds use this environment, and how they may be affected by climate-mediated landscape changes. Additionally, we hope to use this information to advise land management and resource development decisions in the region.\

A total of 1,407 shorebird nests, including 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 located on six 36-ha study plots in Barrow, Alaska between 2005 and 2012. We used satellite-derived landcover imagery and conducted ground surveys of study plots to attribute habitat information to nest site coordinates. Habitat variables included tundra moisture level at micro- and macro- scales (within 3 m and 50 m buffers of the nest, respectively), which describe tundra moistness and associated vegetation communities along a gradient of wet to dry. Degree of microrelief is a variable describing the intensity of depth and spacing of mounds and troughs on the tundra, with the lowest value indicating completely flat terrain, and increasing values indicating increasing degree of microrelief. Distance from each nest to the nearest wetland was also included as a habitat variable. Social variables included distances from nests to nearest nesting conspecific and heterospecific shorebird neighbors. To evaluate nest site selection, we developed candidate sets of binomial-response mixed models comprised of explanatory variables of these habitat and social features. We ranked model sets for each shorebird species using an information theoretic approach.

We found that nest site selection was not random for any species, and all null models ranked low in candidate sets (Table 1). Micro-scale tundra moisture level was associated with nest site selection for all species except Long-billed Dowitchers, with birds selecting drier habitat than available (Figure 1). Macro-scale tundra moisture level ranked in top models for Long-billed Dowitchers, with birds selecting wetter habitat than random. Increasing tundra microrelief increased probability of nest site selection for American Golden Plovers, Long-billed Dowitchers, Pectoral Sandpipers, and Semipalmated Sandpipers. Distance to nearest wetland was associated with selection for Dunlin, Long-billed Dowitchers, and Red Phalaropes. Dunlin and Red Phalaropes nested closer to wetlands than random, but Long-billed Dowitchers nested farther from wetland areas. Distance to nearest conspecific was an important variable for American Golden Plovers, Dunlin, Pectoral Sandpipers, and Semipalmated Sandpipers, with these species nesting farther from conspecifics than expected. Conversely, distance to nearest heterospecific was associated with selection in Long-billed Dowitchers, with Dowitchers nesting closer to heterospecifics than expected. These models may be used to develop predicted probabilities of nest-site selection for each species at any given area of tundra, and can be a valuable management tool in informing anthropogenic land use decisions.

In a separate analysis, we examined a marked population of Dunlin on the study plots to determine how mate fidelity and sex influence how far an individual moves its nest-site from year to year. Between 2003 and 2011, 481 Dunlin that nested on or near the study plots were banded with unique color combinations, and then sexed by genetics, size, and behavior. A portion of these were re-sighted in subsequent years. Records of individuals that nested in years i and $i + 1$were compiled, with individuals assigned a class of 'faithful' or 'divorced,' depending on whether or not they reunited with their mate of the previous year. Distances between the nests of each individual in years i and $i + 1$ were measured in a geographic information system. Divorced females moved farther to their new nest location in the subsequent year than both divorced males ($t = 2.00$, $df = 32$, $P = 0.027$) and faithful females ($t = 4.19$, $df = 38$, $P < 0.001$), and divorced males moved farther than faithful males ($t = 2.12$, $df = 37$, $P = 0.021$; Figure 2). Future analyses will account for the effects of reproductive experience on movement, and will also be applied to Semipalmated Sandpipers.

Weighing a red phalarope. Photo by J. Cunninham

Table 1. AIC_c rankings of model sets for selected species. Rankings include models within 2 AIC_c units of the top model and the null model. All models include random effects for plot and year.

American Golden

Model	ΔAIC$_c$	w$_i$
MoistureLevel + Microrelief + Conspecific	0.00	0.28
MoistureLevel + Microrelief + Conspecific + Heterospecific	1.13	0.16
MoistureLevel + Microrelief + Conspecific + WtlndDist	1.51	0.13
Null	36.12	0.00

Semipalmated

Model	ΔAIC$_c$	w$_i$
MoistureLevel + Microrelief + WtlndDist + Conspecific	0.00	0.32
MoistureLevel + Microrelief + Conspecific	0.71	0.22
MoistureLevel + Microrelief + WtlndDist + Conspecific + Heterospecific	1.49	0.15
Null	41.91	0.00

Long-billed

Model	ΔAIC$_c$	w$_i$
MoistureLevel50 + Microrelief + WtlndDist + Heterospecific	0.00	0.40
MoistureLevel50 + Microrelief + WtlndDist	1.23	0.22
MoistureLevel50 + Microrelief + WtlndDist + Conspecific + Heterospecific	1.80	0.16
Null	52.48	0.00

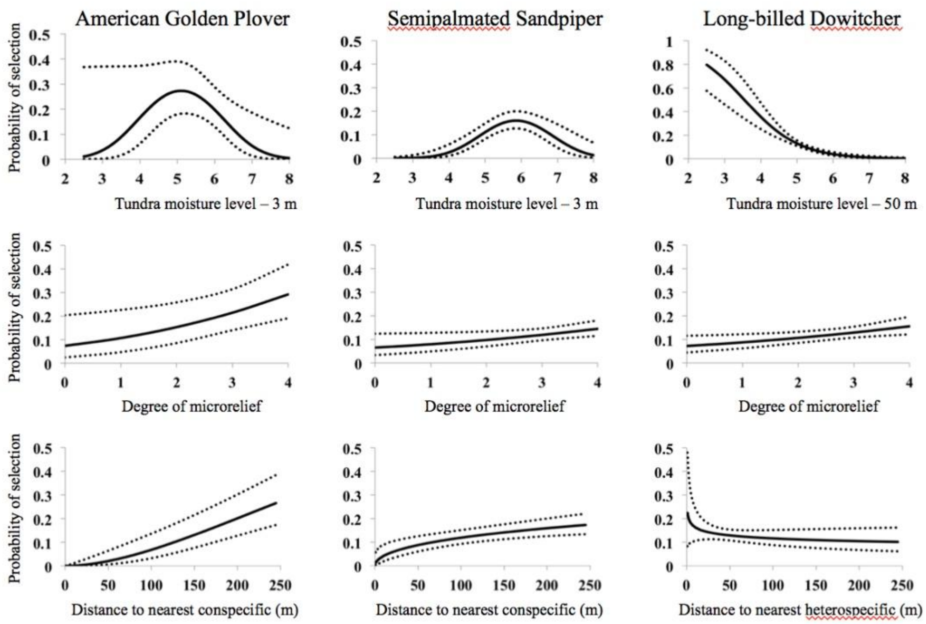

Figure 1. Predicted probability of nest site selection for three species with selected variables from averaged models. We used the range of values present at the study site for each variable while holding other covariates in the model at their respective median values. Presented with 95% confidence intervals.

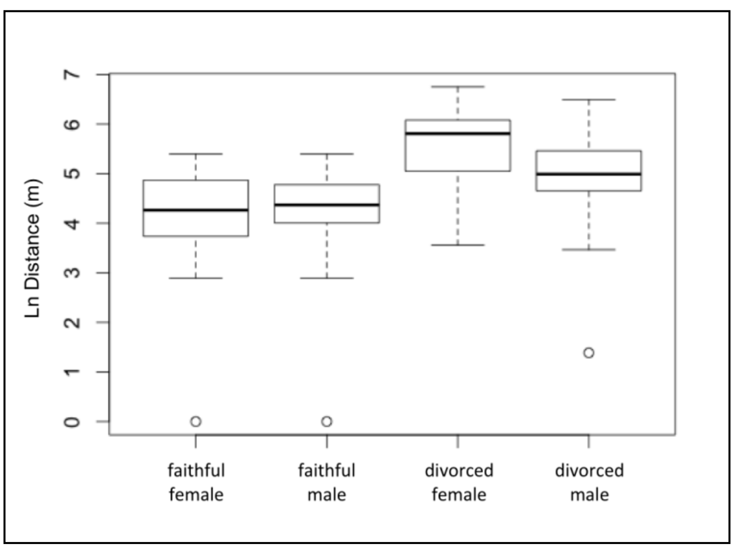

Figure 2. Natural log of distance moved from previous year's nest-site by each class of Dunlin. Whiskers represent ranges and boxes are quartiles and medians.

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#14 SHOREBIRDS OBSERVED ON MIDDLETON ISLAND, GULF OF ALASKA, DURING AUTUMN 2013

Investigators: Lucas DeCicco, Nicholas Hajdukovich, Jim Johnson, Steve Matsuoka, Rebecca Windsor, and Charles Wright' U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, Alaska

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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. In autumn 2013, we conducted a third consecutive season of migration monitoring on this island. Personnel were present from 15 Aug to 1 Oct, unfortunately cut short due to the government shutdown. Our primary focus was on passerine migration, but we also dedicated a substantial effort to monitoring all migratory birds. The information on shorebirds presented here is based on daily incidental observations, daily surveys of focal habitat types (e.g., freshwater marsh, estuarine meadows, saltwater marsh, saltwater lagoon), and coastal surveys. During five complete coastal surveys (20 Aug, 28 Aug, 4 Sep, 8 Sep, and 19 Sep, the entire perimeter of Middleton Island was covered (ca. 25km) in approximately 5 hours. Because of our arrival in mid-Aug, it is likely that information on early migrants is lacking. Nonetheless, these data constitute the most comprehensive autumn inventory of migratory shorebirds on Middleton Island completed to date.

Thirty-seven species of shorebirds were detected on Middleton Island during autumn 2013, bringing the island's shorebird list to 40 species. Least, Western, and Pectoral sandpipers, and Wilson's Snipe were the most numerous migrants, occurring in the hundreds to over a thousand per day during peak migration in suitable habitat. Below are species accounts summarizing the occurrence of all shorebird species recorded on Middleton Island during autumn 2013, habitat and age information is included when relevant.

Species Accounts:

Pluvialis squatarola. Black-bellied Plover. Historical early autumn records occurred on 1 Sep (2011), 9 Sep (1981) and 14 Sep (2012), while we observed this species 18 and 23 Aug (1; adult), and 27 and 28 Aug (1; juv.). More typically, one was seen on 7 and 8 Sep and six were seen on 19 Sep, all juveniles. This species prefers intertidal flats and rocky shoreline, rarely if ever observed in freshwater habitat.

Pluvialis dominica. American Golden-Plover. Consistent with the previous two years, this species was observed regularly in small numbers from 18 Aug to 16 Sep with two individuals on

24 Sep representing our latest detection of this species. A high count of seven individuals was made on 28 Aug. This species was observed both in association with *P. fulva* but more commonly separately in coastal habitat showing more of a propensity to tidal mudflats than *P. fulva*. All observations were of juveniles, however; we assume that adults of this species, if present, would be extremely difficult to separate from *P. fulva* during heavy molt.

Pluvialis fulva. Pacific Golden-Plover. This species was less abundant than in previous years (2011 and 2012). Large (50+) roosting flocks on the runway or north point were not noted this season. Despite reduced numbers, this species was detected from 17 Aug through 29 Sep. As would be expected, daily counts varied greatly with coverage; up to 40 individuals were observed on multiple occasions from 20 Aug through 4 Sep, after-which numbers diminished to daily maxima of 10 to 15 individuals with the exception of 25 on 9 Sep and 20 on 22 Sep. Adults dominated upon our arrival (e.g. 33 of 34 on 20 Aug), an approximate 1:1 ratio was noted on 25 Aug, juveniles dominated shortly after this (e.g. 25 of 30 individuals on 1 Sep) and our last observation of an adult was when two were noted on 20 Sep.

Charadrius hiaticula. Common Ringed Plover. On 25 Aug a single juvenile was identified by voice (recordings obtained) and tentatively supported by brief observations of a bird matching, in facial pattern, descriptions of this species. This constitutes the first observation of this species for Middleton Island and the first for the Pacific Coast of Alaska outside the Aleutian Islands.

Charadrius semipalmatus. Semipalmated Plover. This species was present on the island upon our arrival on 15 Aug including a family group with two young that were mostly feathered but flightless on 16 Aug. Migrant numbers were highest in Aug with peak observed from 18 through 28 Aug, maxima include: 80 (18 Aug), 126 (20 Aug; full coastal survey), 226 (22 Aug; including single flock of 80), and 106 (28 Aug; full coastal survey). Numbers dropped noticeably after this date, e.g. 23 individuals observed on the next full coastal survey (4 Sep) and 14 on 8 Sep, the species was present regularly through 14 Sep providing our last record of the species apart from an exceptionally late observation of three birds on 27 Sep.

Haematopus bachmani. Black Oystercatcher. Based on our full coastal survey data, numbers of this species remained relatively consistent throughout our survey period with 459 to 609 birds detected. The vast majority of birds throughout the season were adults (e.g. 115 of 120 on 8 Sep), adults in active wing molt were noted through at least early Sep.

Actitis macularius. Spotted Sandpiper. Information obtained through the full coastal surveys suggest that minimal change in abundance occurred from mid-Aug through early Sep with 56 birds on 20 Aug, 59 on 28 Aug, and 36 on 4 Sep. After early Sep, numbers diminished to 23 birds on 8 Sep and our last detection of this species was of one individual on 11 Sep. Age ratios were difficult to determine for this species, but what we noted suggest that the majority of birds on the island during this period were juveniles.

Tringa solitaria. Solitary Sandpiper. As in 2012, we found this species to be an uncommon migrant during the month of Aug. Small numbers were observed consistently from 18 Aug through 6 Sep, maxima include: three together on 19 Aug, six on 23 Aug, three on 24 Aug, and four on 28 Aug. A late individual was detected on 16 Sep. All birds seen well were juveniles. This species had a propensity for freshwater marsh habitat, often within, or on the edge of, *Salix* spp. thickets. Very few individuals were observed in coastal habitat.

Tringa incana. Wandering Tattler. Peak in occurrence of this species was noted during early Sep (e.g. 82 on 4 Sep), information obtained through the full coastal surveys suggest that numbers remained relatively high (>40) from mid-Aug through 19 Sep (52 on 20 Aug, 46 on 28 Aug, 68 on 8 Sep, and 44 on 19 Sep). Numbers decreased after the 19th with only single birds seen on 25 and 27 Sep.

Tringa melanoleuca. Greater Yellowlegs. Daily counts of >40 individuals were made consistently from mid-Aug through the end of Sep; daily maxima include 82 on 28 Aug, 85 on 7 Sep, 71 on 19 Sep, and 123 on 22 Sep. Adults were in the minority upon our arrival becoming less abundant through the end of Aug (e.g. one of 33 on 22 Aug, two of 29 on 23 Aug, two of 14 on 28 Aug), after the end of Aug only juveniles were noted. This species was most abundant in freshwater marsh habitat and in intertidal mudflats.

Tringa flavipes. Lesser Yellowlegs. Detected from mid-Aug through 22 Sep with highest numbers observed through early Sep, daily maxima include 35 on 22 and 23 Aug, 40 on 31 Aug and 80 on 1 Sep. After this date, fewer than 10 individuals were observed per day through 22 Sep when our last detection was made.

Bartramia longicauda. Upland Sandpiper. We observed similar patterns in occurrence of this species in 2013 as in 2012 when seven individuals were detected between 12 Aug and 2 Sep. In 2013 we observed this species from 16 to 26 Aug with a late individual occurring on 7 and 8 Sep. A remarkable six birds were noted on 16 Aug and one to two birds were observed nearly daily through 26 Aug. Recent information suggests that this species occurs regularly on Middleton Island in small numbers during the last half of Aug and likely earlier.

Numenius phaeopus. Whimbrel. Small numbers of this species were observed throughout our stay with daily counts not exceeding 10 individuals. Most individuals observed were juveniles with single adults noted on 28 Aug, 2 Sep, and 19 Sep. All birds observed were the expected subspecies *hudsonicus*.

Limosa haemastica. Hudsonian Godwit. This species was detected on three occasions during autumn 2013, one on 18 Aug, five on 20 Aug, and one on 28 Aug. All these individuals were identified as juveniles.

Limosa lapponica. Bar-tailed Godwit. A single juvenile of this species was documented on 3 Sep, representing the first occurrence for Middleton Island. This bird exhibited the uniform rump and back of the expected subspecies *baueri*.

Arenaria interpres. Ruddy Turnstone. This species occurred consistently in small numbers throughout our stay. Most individuals detected were associated with concentrations of other shorebird species in particularly productive rotting kelp wrack. On full coastal surveys six birds were seen on 20 Aug, 17 (our maximum count) on 28 Aug, 12 on 4 Sep, seven on 8 Sep, and six on 19 Sep. A mix of adults and juveniles were observed on most occasions with no obvious pattern being apparent.

Arenaria melanocephala. Black Turnstone. Numbers of this species increased consistently throughout our stay from 745 individuals on 20 Aug to 1057 on 19 Sep. Due to difficulties we experienced in determining age in the field no information on this subject was collected. This species was most commonly observed in large flocks along the eastern and southern rocky coastlines.

Calidris virgata. Surfbird. Numbers of this species on the island, based on full coastal survey data, ranged from 112 (20 Aug) to 492 (4 Sep), this apparently represents a peak in occurrence during early Sep. Proportion of juveniles was low with peak numbers of this age-class occurring during Aug.

Calidris canutus. Red Knot. We first observed this species on 18 Aug when four adults, all in breeding plumage were found, these birds remained through 22 Aug when they were joined by a single juvenile. This immature bird was again seen on 23 Aug. A juvenile and adult were seen not associated with one another on 4 Sep representing our last detection of this species. These observations support what we have seen in the previous two seasons suggesting that this species is a rare autumn migrant on Middleton Island.

Calidris alba. Sanderling. Up to 350 (20 Aug) individuals of this species were detected during full coastal surveys, 108 were noted on 4 Sep, 114 on 8 Sep, and 251 on 19 Sep. Low numbers of juveniles were observed with the peak count on 20 Aug being all adults, fewer than 10 juveniles were noted in later surveys.

Calidris pusilla. Semipalmated Sandpiper. Juveniles of this species were observed regularly in small numbers from 18 Aug through 5 Sep, generally in daily totals of less than five birds. Peak numbers occurred between 20 and 28 Aug when maxima of 11 on 20 Aug, 13 on 22 Aug, and seven on 24 Aug were recorded. No adults of this species were detected.

Calidris mauri. Western Sandpiper. The highest abundance of this species was noted early on in our stay with the peak count resulting from our first full coastal survey, 1221 individuals on 20 Aug. Subsequent surveys resulted in 315 on 28 Aug, 148 on 4 Sep, 173 on 8 Sep, and two on 19 Sep. Four birds were seen on 22 Sep representing our last detection of this species for the season. The vast majority of birds observed were juveniles with the exception of one to two adults detected on 15, 18, and 20 Aug, after this date only one adult was observed (5 Sep).

Calidris minutilla. Least Sandpiper. Based on our full coastal survey data, we found this species to be most abundant early in our stay, with peak counts occurring on 20 Aug (our first coastal survey; 1560 individuals), numbers consistently decreased with 671 on 28 Aug, 178 on 4 Sep, 77 on 8 Sep and 10 on 19 Sep. The vast majority of birds observed were juveniles with the exception of three adults on 18 Aug, three on 20 Aug (of 1560 birds), two on 27 Aug (of 220 birds), one on 1 Sep, and one of 54 on 8 Sep. The species was not detected after 19 Sep.

Calidris bairdii. Baird's Sandpiper. In comparison with previous autumn seasons, this species occurred in abnormally large numbers during 2013. Juveniles only were observed consistently from 20 Aug through 8 Sep with maxima of 11 on 20 Aug and 14 on 28 Aug (both during full coastal surveys). Most daily counts were of one to three birds. Individuals of this species were generally not associated with one another but were often observed in association with foraging flocks of *C. melanotos* and *C. minutilla* in rotting kelp wrack.

Calidris melanotos. Pectoral Sandpiper. This species was detected consistently from our arrival (when 80 birds were estimated on 18 Aug) through our departure. No obvious peak in occurrence was noted but highest numbers came from end of Aug through mid-Sep. Full coastal survey results are as follows: 589 on 20 Aug, 793 on 28 Aug, 643 on 4 Sep, 708 on 8 Sep, and 594 on 19 Sep. Ratio of adults to juveniles remained relatively consistent throughout Aug and early- to mid-Sep being approximately 1:50, after mid-Sep no adults were noted.

Calidris acuminata. Sharp-tailed Sandpiper. First detected on 20 Aug (single juvenile), representing the earliest autumn arrival of this species on Middleton, this species remained in small numbers through 29 Sep. Peak numbers occurred between 4 and 8 Sep with daily maxima of seven on 4 Sep (including a single flock of six), nine on 5 Sep (including flock of eight), and 11 on 7 Sep. Away from these dates all observations were of one to two individuals. No adults were seen.

Calidris ptilocnemis. Rock Sandpiper. This tightly flocking shorebird was detected in varying numbers during the full coastal surveys: 228 were observed on 20 Aug, 90 on 28 Aug, 608 on 4 Sep, 361 on 8 Sep, and 409 on 19 Sep. Adults in heavy molt were observed exclusively through 3 Sep when small numbers of juveniles began to appear. No peak in juvenile numbers was observed with our maximum count occurring on 7 Sep when five individuals were observed. All birds seen were either *C. p. couesi* or *C. p. tschuktschorum*.

Calidris alpina. Dunlin. A single juvenile (in full juvenal plumage) was seen on 28 Aug and again on 4 Sep; this represents the earliest autumn arrival date for Middleton Island. One to two birds were again detected on 18, 19, 21, 22, and 28 Sep.

Calidris ferruginea. Curlew Sandpiper. A single juvenile was briefly observed and photographed on 27 Aug, this constitutes the first record of the species on Middleton Island and fourth in Southcentral and Southeast Alaska.

Calidris himantopus. Stilt Sandpiper. Up to three juveniles of this species were seen from 27 Aug through 1 Sep. As in 2012, these birds preferred intertidal mudflats.

Calidris subruficollis. Buff-breasted Sandpiper. Four individuals of this species were detected during autumn 2013 (all juveniles), single birds were seen on 20, 23, and 28 Aug and on 7 and 8 Sep. This species was observed in coastal kelp wrack habitat and along the runway.

Calidris pugnax. Ruff. A single juvenile, likely a male due to its large size, was observed from 20 to 27 Aug. This individual was generally associated with foraging flocks of *C. melanotos* in rotting kelp wrack or in intertidal mudflat.

Limnodromus griseus. Short-billed Dowitcher. Peak numbers of this species were observed early in the season with 10 being seen on 22 Aug (all juveniles), the species was detected through 8 Sep with all other daily counts being of one to three individuals. Coastal rotting kelp wrack was preferred by this species.

Limnodromus scolopaceus. Long-billed Dowitcher. This species was much more common than *L. griseus* being detected from 15 Aug through 29 Sep. Peak in abundance occurred between 7 and 19 Sep when daily counts commonly reached 80+ birds, daily maximum was 290 on 7 Sep. Adults dominated during the early period, e.g. 30 of 32 on 20 Aug and 13 of 15 on 23 Aug, ratios reached approximately 1:1 in late Aug (27 and 28 Aug) and by 8 Sep, through our departure, all birds observed were juveniles.

Gallinago delicata. Wilson's Snipe. This species was abundant throughout our stay (15 Aug to 1 Oct) with detections of 20 to 60 birds per day being normal. Largest numbers were observed during particularly poor weather, peaks occurred from 1 to 3 Sep when up to 250 were estimated daily and on 7 Sep when 178 were estimated. A few individuals were heard winnowing during calm nights and mornings. This species was most common in freshwater marshes. Juveniles of this local breeding species retaining downy feathers on their heads were noted early in the season.

Phalaropus lobatus. Red-necked Phalarope. This pelagic shorebird was observed primarily from the north point during surveys focused on seabirds. Peak in abundance occurred from 18 Aug through 7 Sep when daily estimates commonly ranged from 100 to 1000 individuals. The species was not detected after 17 Sep.

Phalaropus fulicarius. Red Phalarope. The rarer of the two phalaropes, this species was detected occasionally with small numbers (<5 individuals) being seen on 18 and 20 Aug and 3 and 16 Sep. Peak in abundance occurred late with over 20 birds being seen on both 17 and 20 Sep.

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

Investigators: Willow English and David B. Lank, Simon Fraser University

2013 was the third and final year of a study on the evolution and ecology of reproductive traits in the Red-necked Phalarope. Despite a limited field season, we followed 80 nests, banded 51 new adults and 63 chicks, and recaught 34 individuals banded in previous years. Of these 34 recaps, 7 (6 M, 1 F) were second year birds banded as chicks in 2012. This represents a return rate of 4% (7/182 banded chicks). We collected blood and feather samples for ASDN side projects as well as for chick molecular sexing.

In previous years we used predator exclosures as part of another experiment, but this year nests were not protected. This allowed us to document natural nest survival and productivity. Of 74 nests where fate was determined, 29 hatched, 43 were depredated and one flooded.
The data from this project are currently being written up as a Master's thesis focusing on 1) Sex ratios and sex-biased maternal allocation, 2) the effect of weather on incubation patterns and extended incubation, 3) the evolution of small egg size in multiclutching shorebirds, and how this related to uniparental incubation ability. We look forward to publishing our first manuscript from this work in the near future.

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#16 LINKING GUT MICROBIOTA TO DEVELOPMENT AND LIFE-HISTORY TRAITS IN MIGRATORY SHOREBIRDS

Investigators: Kirsten Grond and Brett K. Sandercock, Kansas State University; Richard B. Lanctot, U.S. Fish and Wildlife Service, Jorge Santo Domingo and Hodon Ryu, U.S. Environmental Protection Agency; Arctic Shorebird Demographics Network collaborators

Migratory shorebirds travel long distances throughout their annual cycle and subsequently are exposed to a diverse array of microbial communities at their different breeding, staging and wintering sites. Migration movements span a large latitudinal range and seasonal changes in habitat use by shorebirds may alter their gut microbial community. Gut microbiota are important in maintaining health in mammals through interactions with the immune system and nutrient uptake. To date, composition and function of the shorebird gut microbiota remains largely unknown despite their putative role in long-distance transport of pathogens. Due to wide-spread variation in life history characteristics, shorebirds are an especially suitable group to examine for possible effects of environment and migration behavior on gut microbial composition. Climate change has been shown to have the largest impact in arctic regions, and environmental microbial communities are changing at high latitudes with regard to species composition and abundance. Understanding dynamics of gut microbiota is relevant for the potential changes that shorebirds face from climate-associated shifts in microbial communities along their migration pathways.

In our study we aim to investigate gut microbiota of migratory shorebirds by addressing the following objectives: 1) investigate inter- and intraspecific variation in gut microbiota diversity and abundance in relation to life-history characteristics of shorebirds, 2) assess the extent of transovarian vertical transmission of gut microbiota between mother and offspring, and 3) identify bacterial profiles associated with development and body condition of shorebird chicks.

In 2011-2013, over 1400 fecal samples were collected from 17 shorebird species at 12 Arctic Shorebird Demographics Network field sites. In 2013, we also collected fecal samples from adults and the guts from embryos collected from their near-hatching eggs at the Barrow field site to investigate maternal bacterial transmission during the egg formation stage. For this project, we collected 40 and 20 viable eggs from Dunlin and Semipalmated Sandpipers, respectively, 3 days before the estimated hatch date. We collected fecal samples from the attending female and extracted the embryonic gut. We will compare (anaerobic) fecal communities between mother and their embryos to investigate the potential for females to transmit bacteria to their offspring prior to hatch. To investigate gut microbial colonization and succession early in a chick's life, we collected fecal samples from chicks every few days wherever possible. Chicks were relocated after hatch by following adults equipped with radio transmitters. For this study, we followed 15

Dunlin and 15 Red Phalarope broods. With our samples, we aim to study the link between gut microbial composition and chick growth. We will continue chick sampling in 2014 with new methods that should allow us to increase our sample sizes. Of the 630 fecal samples collected in 2011, 550 samples were selected based on DNA yield and 16S bacterial rRNA was sequenced using the Illumina MiSeq platform. We generated a higher number of sequences per sample than we estimated in last year's report, with ~40 million sequences opposed to the expected 2.5 million. Our sequences are currently being analyzed with bioinformatics techniques and will be used to describe the bacterial profiles associated with each shorebird species. Our data will also be used to look at intra-individual gut microbial changes over time when 2012-2013 samples are sequenced. We plan to collect a final year of fecal samples in 2014, with special focus on sampling recaptured birds. These procedures will provide us with 4 years of fecal sampling, which will allow us to look at temporal changes on a population and individual level. Our project is the largest and most in-depth study of temporal and spatial variation in the gut microbiota of migratory birds.

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#17 EFFECTS OF SPRING PHENOLOGY ON TIMING OF BREEDING IN ARCTIC-NESTING SHOREBIRDS

Investigators: Kirsty E. Gurney, University of Alaska Fairbanks; David Ward, USGS Alaska Science Center; Michael Budde, USGS Center for Earth Resources Observation and Science

How large-scale changes in soil freeze-thaw cycles and associated changes in vegetation (i.e., spring phenology) will affect arctic-breeding shorebirds will vary among species and populations. Species that do not express phenotypic plasticity are most likely to be affected negatively – reduced reproductive success and population declines have been observed in long-distance avian migrants and in those whose breeding phenology is dependent on non-climatic cues. Conversely, species that migrate over shorter distances and those that advance the onset of breeding to keep pace with advancing spring phenology may benefit from predicted changes in climate. The proximate cues that arctic-nesting shorebirds use to determine timing of breeding, however, have not been examined across a broad taxonomic scale and remain poorly quantified for many species. The objective of our study is thus to evaluate hypotheses about processes that influence timing of breeding across a range of taxa, thereby providing ecological insights and facilitating accurate predictions of how shorebird populations will respond to changing environmental conditions on their Alaskan breeding grounds. We have acquired ASDN nesting data from 12 Arctic sites (2010 – 2012), including historical data from 7 sites (1990 – 2009), and the support of ASDN has resulted in a pan-Arctic collaboration with researchers at Zackenberg, Greenland also contributing data for multiple species (1995 – 2011).

Table 1: Historical and pan-Arctic data acquired that describe timing of nesting in arctic-breeding shorebirds.

Species	Total number of nests
American golden-plover	139
black-bellied plover	146
dunlin	551
long-billed dowitcher	211
pectoral sandpiper	749
red phalarope	744
red-necked phalarope	234
ruddy turnstone	392
semipalmated sandpiper	867
white-rumped sandpiper	118

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#18 BREEDING-SEASON RECONNAISSANCE OF WHIMBRELS ALONG INTERIOR ALASKA HIGHWAYS, 2013

Investigators: Christopher Harwood, U.S. Fish and Wildlife Service and University of Alaska Fairbanks; Abby Powell, U.S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit and University of Alaska Fairbanks

From 2009–2012, we studied the breeding ecology of a small population of Whimbrels (*Numenius phaeopus*) at Kanuti National Wildlife Refuge (NWR) in north-central Alaska. In Spring 2013, we initiated a reconnaissance of the distribution of Whimbrels in interior Alaska, an area essentially extending east to the Canadian border, north and south to the continental divides of the Brooks and Alaska Ranges, respectively, and west to treeline. We developed a GIS-based analysis of potential breeding locations for Whimbrels throughout this region using habitat associations derived from the earlier breeding study, as well as those compiled from the relatively scarce historical breeding locations in interior Alaska. Limited funding for logistical support restricted potential survey locations to a 20-km buffer of highways and improved roads within the Interior.

Surveys were originally scheduled to start the first week of May based on Whimbrel arrival dates for Kanuti NWR; however, a severely cold, snowy, and late spring delayed access to targeted areas until 23 May. The weather may have also delayed the arrival of Whimbrels to their interior breeding areas. In addition to the paid crew, two other volunteer crews participated. Crews visited survey locations along the Dalton, Richardson, Taylor, Steese, and Elliot Highways, as well as Stampede, Nabesna, and Denali Park Roads. We completed approximately 300 10-min point counts (with 500-m spacing within transects) by 20 June, with Whimbrels being detected on 42 (14%) of these. Confirmed Whimbrel nesting occurred along Stampede Road and near Donnelly Dome, two areas of well-documented Whimbrel presence, as well as Chandalar Shelf (just south of Atigun Pass on the Dalton Highway), a new breeding location. Despite the late spring conditions, nesting initiation at these locations was within the range of variation observed at Kanuti NWR during 2009–2012. Based on observations of territorial and/or defensive displays, we suspect breeding also occurred along the Elliot Highway (a new location) and near Finger Mountain on the Dalton Highway (known area). Despite multiple historical reports of Whimbrel presence in the White Mountains along the Steese Highway (mostly between Twelvemile and Eagle Summits) and the upper Kanuti River (aka "Old Man") along the Dalton Highway, we did not detect Whimbrels on multiple visits; in fact very few shorebirds species were detected there. Additionally, we did not detect Whimbrels along the Taylor Highway, despite considerable coverage there; however, there are no historical records for this area and based on our observations, suitable breeding habitat there may be more limited than GIS landcover data suggested.

The effort afforded us an opportunity to broaden our perspective of Whimbrel breeding ecology, particularly regarding habitat use, beyond that suggested during the prior four years at a small study area. The need for a more finely-scaled and more accurate landcover layer for interior Alaska was evident in the frequency at which initially identified potential breeding areas were deemed "unsuitable" or incorrectly identified upon actual inspection. While several new breeding areas were indeed identified during the survey, we cannot confirm if the still-patchy (both spatially and possibly even temporally) pattern of confirmed breeding locations for interior Alaska is simply a result of insufficient survey coverage, an inherent characteristic of this population, and/or a dynamic landscape shaped by landscape-level disturbances like wildland fire, flooding, etc. As this survey was restricted to access via the road system, certainly a greater effort is required to better describe the species' distribution in this sizeable bioregion.

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#19 BREEDING ECOLOGY, MIGRATORY CONNECTIVITY, AND AVIAN INFLUENZA VIRUS INFECTION RATES OF ALASKAN RED KNOTS (CALIDRIS CANUTUS ROSELAARI), 2013

Investigators: Jim Johnson, Lucas Decicco, Nicholas Hajdukovich, and Rick Lanctot, U.S. Fish and Wildlife Service, Migratory Bird Management; Jeff Hall, U.S. Geological Survey; and Scott Krauss, St. Jude's Childrens Hospital

The 2013 field season marked our fourth consecutive year of studying aspects of Red Knot (*Calidris canutus roselaari*) ecology on the Seward Peninsula. This year we conducted fieldwork during a 14-day period (23 June – 6 July) planned to coincide with estimated peak hatch.

Our primary objectives were to: 1) attach an additional 10 light-level geolocators to adults; 2) retrieve geolocators attached to adults during 2010 and 2011; 3) individually mark birds so that adult survival could be ascertained and they were available for resighting at non-breeding areas; and 4) collect biosamples to assess prevalence of active avian influenza virus (AIV) infection and determine AIV exposure history.

Geolocator retrieval, Resighting, and Banding:

We resighted 23 of 54 (43%) adults in 2013 that were marked on the Seward Peninsula in a prior year. We have recorded only one bird banded as a chick that returned to its natal area as an adult, which indicates either poor survival, low natal fidelity, or both. We attached an additional 9 geolocators to adults; to examine inter-annual variability in migratory timing and routes, five geolocators were attached to birds for which we have an annual track. We recovered one geolocator during 2103, increasing the total number of retrieved units to 48% (15/31).

Of the 63 adults banded during 2010–2012 (includes Seward Peninsula and Cape Krusenstern), seven were resighted during Jan 2013 at Guerrero Negro Lagoon complex; four were resighted at the Gulf of Santa Clara, Mexico in April; and four were resighted during May at Grays Harbor, WA. One male, 6LX, was observed at each of these three sites before we resighted him on his nesting territory on the Seward Peninsula.

No chick banded during this project has been resighted at a non-breeding site.

We individually banded (metal band and/or lime green flags with unique three-character alpha-numeric codes) an additional six adults and 11 chicks, which increased the total number of banded birds over the 4-year study to 74 adults and 88 chicks.

Breeding Ecology: We opportunistically and with assistance from the USGS plover crew found three nests. Observed and estimated (i.e., backdating chick age) hatch dates of these nests and 10 broods ranged from 22 June to 4 July (median = 28 June). Weather conditions during our visit were unseasonably cold and rainy compared to previous years, which took their toll on both adults and their chicks. For example, average mass of males captured this year was 108.5 g (n = 7) compared to 139.7 (n = 25) during 2010–2012 breeding seasons — a 22% reduction. Poor weather also appeared to adversely affect chick/brood survival. Repeated observations during a 14-day period indicated that brood size declined by 39% — an average reduction of 1.1 chicks / brood.

Frequency of AIV infection: Results from 2012 indicated that no chicks (n = 16) or adults (n = 20) sampled were actively shedding AIV during the breeding season on the Seward Peninsula. Furthermore, we did not detect AIV antibodies in chicks, but 18 of 20 adults sampled had detectible antibodies ($\bar{x}$ = 90%, 95% CI = 68.3–98.9%). This proportion of adults that had been previously exposed to AIV exceeds the highest value for the *rufa* subspecies sampled across the Atlantic Coast of North and South America (0–59%; D'Amico et al. 2007; Maxted et al. 2012) and five shorebird species sampled during autumn migration in western Alaska (0–14%, $\bar{x}$ = 4%; Pearce et al. 2012). These results imply that the period of adult exposure to AIV occurred outside of our brief sampling period. During the 2013 breeding season, we collected additional biosamples that will supplement a flyway scale sampling effort that aims to determine the temporal and spatial window of infection in *roselaari* Red Knots throughout the annual cycle.

We are grateful to K. Matsuoka and S. Matsuoka for their assistance with fieldwork. This project was supported by the USFWS Avian Health Program and Migratory bird Management.

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Red knot photo by Luke DeCicco

#20 TEMPORAL GRADIENT OF PREY AVAILABILITY AND SHOREBIRD BREEDING PHENOLOGY IN THE ARCTIC

INVESTIGATORS: Eunbi Kwon, Brett K. Sandercock, Kansas State University; David B. Lank, Simon Fraser University; Richard B. Lanctot and David Payer, U.S. Fish and Wildlife Service; River Gates, Alaska Biological Research; David Ward, USGS – Alaska Science Center; Stephen Brown, Manomet Center for Conservation Sciences; Steve Kendall, Canning River, Arctic NWR; Jennie Rausch, Environment Canada; Erica Nol and Laura McKinnon, Trent University; Nathan Senner, University of Groningen; Grant Gilchrist, Environment Canada; Paul Smith, Smith and Associates Ecological Research Ltd.; Joe Liebezeit, Audubon Society of Portland; Daniel Rinella, University of Alaska; Robert Wisseman, Aquatic Biology Associates, Inc.

Responses to climate change have been shown to vary across functional groups and trophic levels, which can cause decoupling of biological interactions or a ‘phenological mismatch’. Recent studies that have tested the phenological mismatch hypothesis are limited to 1) model systems, 2) small spatial scales with a single breeding population, and 3) simple comparative analyses. Thus the goal of our study is (1) to quantify the occurrence and geographic extent of phenological mismatches between breeding shorebirds and their invertebrate prey, and (2) to evaluate the geographic variation in the frequency and extent of phenological mismatches over ten Arctic coastal sites and among six shorebird species.

Six target shorebird species have been selected based on their breeding distributions (found in > 5 ASDN sites) and relative abundance (> 20 nesting pairs at each site), including Semipalmated Sandpiper (*Calidris pusilla*), Western Sandpiper (*C. mauri*), Dunlin (*C. alpina*), Pectoral Sandpiper (*C. melanotos*), Red Phalarope (*Phalaropus fulicarius*), and Red-necked Phalarope (*P. lobatus*). Breeding timing of shorebirds and seasonal change in the invertebrate abundance have been monitored in ten sites (part of the Arctic Shorebird Demographics Network) during 2010 – 2012; Nome, Cape Krusenstern, Barrow, Ikpikpuk, Colville Delta, Canning River, Prudhoe Bay, Mackenzie Delta, East Bay and Churchill. A total of 1,928 nests were monitored over three years in six sites (data collection is in process for the remaining four sites) for the before mentioned species; Nome, N=544 nests, Cape Krusenstern, N=257, Barrow, N=916, Mackenzie Delta, N=68, Churchill, N=107, East Bay, N=36. Semipalmated Sandpiper had the highest number of nests monitored across sites (N=426 for 2010-2012) and Pectoral Sandpiper had the least number monitored (N=245).

Here we are summarizing our preliminary results from five of ten sites for the spring phenology of the year 2010. First, we selected 11 invertebrate taxa to be our focal group based on their absolute abundance across five sites. The 11 taxa include Araneae, Brachycera, Carabidae, Chironomidae, Hymenoptera, Collembola, Staphylinidae, Sciaridae, Mycetophilidae, Tipulidae, and Ceratopogonidae. Eight of these taxa have been previously identified in the gut contents of six shorebird species. Ordination analysis showed that the invertebrate community compositions were similar among the five sites, although the timing of emergence differed. The timing of peak invertebrate biomass differed by 33 days among sites ranging from Jun 21 in Nome to Jul 24 in Barrow.

In all five sites, the onset of shorebird hatching coincided with the initial increase in the abundance of Chironomidae (midges) which was the most abundant prey source in all sites. However, the mean hatching of each shorebird species preceded the peak prey biomass in most of the sites by up to 15 days. We defined the 'degree of mismatch' as the temporal difference between the date of food peak and five days after the estimated hatch date (when the food requirement of the shorebird chicks to be the maximum), and estimated the degree of mismatch for each nest. The degree of mismatch varied significantly among sites, but without clear trend over latitudinal/longitudinal location of the sites. The degree of mismatch was also significantly variable among species; some species (such as Western Sandpiper) matched their timing of hatching to the local food peak better than others (such as Dunlin).

When data are acquired from all 10 Arctic sites, we plan to more fully address the two objectives described above. Fieldwork in 2010-2012 was supported through the NSF Polar Program and the Alaska Fish and Game Non-Game program for Nome and through various sources for nine other sites.

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#21 MONITORING BREEDING ECOLOGY OF SHOREBIRDS AND MIGRATION ROUTES OF WESTERN SANDPIPER AND SEMIPALMATED SANDPIPER

Investigators: Eunbi Kwon and Brett K. Sandercock, Kansas State University; Stephen Yezerinac, Mount Allison University; Willow English and David B. Lank, Simon Fraser University.

Investigating potential impacts of environmental factors on the breeding ecology of Arctic shorebirds is often constrained with lack of knowledge on their life cycle outside of the breeding period. We have been banding and monitoring the breeding ecology of Western Sandpiper (*Calidris mauri*), Semipalmated Sandpiper (*C. pusilla*), and Red-necked Phalarope (*Phalaropus* *lobatus*) in Nome, Alaska since 2008, and have part of the Arctic Shorebird Demographics Network since 2010. Our field work involves migratory connectivity of Western and Semipalmated Sandpipers, and conducting a breeding ecology study of shorebirds at Nome.

2013 field report: The duration of field work was a 2-month period between May 12 and July 17, 2013. We resighted 156 unique individuals, including 77 Western Sandpipers, 70 Semipalmated Sandpipers, and 9 Red-necked Phalaropes. Resightings not matched to birds in our previous banding efforts were excluded from summary. During nest searching, we located a total of 206 nests of arctic-breeding shorebirds, including Western Sandpipers (n = 50 nests), Semipalmated Sandpipers (n = 70), Red-necked Phalaropes (n = 80), Dunlin (n = 3), Wilson's Snipe (n = 2), and Long-billed Dowitcher (n = 1). Of the 120 sandpiper nests, 31% hatched young, 51% were depredated, 8% had unknown fate and 3% were abandoned. Of the 80 Red-necked Phalarope nests, 36% hatched young, 54% were depredated, 4% had unknown fate. We captured and banded a total of 382 shorebirds, including 104 Western Sandpipers (42 adults and 62 chicks on the nests), 130 Semipalmated Sandpipers (70 adults and 60 chicks) and 148 Red-necked Phalaropes (85 adults and 63 chicks). Monitoring of environmental conditions included setting up a weather station for climatic conditions, surveys of seasonal snowmelt, sampling of invertebrates in terrestrial 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). To monitor the density of small mammals on the study plot, we conducted live-trapping sessions for three days at the beginning and at the end of the season with a total 200 Sherman live-traps located along transects, providing a total of 2,412 trap checks. From this, we captured 67 individual tundra voles; 54 other captures were recaptures of the same individuals.

Migratory movement of sandpipers: Western and Semipalmated Sandpipers are long-distance migratory shorebirds that migrate between breeding areas in the low arctic of North America and to nonbreeding areas in Central and South America. Previous studies on the migration ecology of the two species are restricted to the reports from occasional resighting or recaptures, and local radio-telemetry studies. In a pilot study in 2011, we deployed geolocators on five Western Sandpipers and nine Semipalmated Sandpipers, the first time this new technology has been used on small-bodied species of shorebirds. In 2012, we successfully retrieved four geolocators, including one Western Sandpiper and three Semipalmated Sandpipers. The tracks successfully recovered from the geolocators showed that one female Western Sandpiper departed Seward Peninsula on 29 June, 13 days after it hatched three chicks. The Western Sandpiper then staged in southwest Alaska during 1-14 July and then flew non-stop from Alaska to the Fraser River Delta where it wintered. In the following spring, the bird made three coastal stops during northward migration and reunited with its mate to lay its first egg on 22 May, 2012. We recovered geolocators from three Semipalmated Sandpipers in 2012. These birds migrated along mid-continent flyway and stopped at several locations during the southward migration. Stop-over sites included sites in Alaska, Alberta, Saskatchewan, North Dakota, Oklahoma, and Texas. Two of the Semipalmated Sandpipers spent the nonbreeding season in Panama while a third overwintered in Colombia. Northward migration in spring 2012 involved similar migration routes from the previous southward migration. Building on our pilot study, we deployed 39 new geolocator tags on both species of sandpipers in the 2012 field season. We successfully retrieved 8 out of 39 geolocators in 2013, including 5 Western Sandpipers and 3 Semipalmated Sandpipers. Migration tracks from newly retrieved geolocators are currently being analyzed and will contribute to identify the migration routes as well as to generate research questions involving environmental impacts on the migration ecology of these sandpipers.

Field monitoring and biological sampling will continue through 2014 in pursuit of testing the impacts of climate change on reproductive performance and population demography of two sandpiper species. Fieldwork in 2013 was supported through the NSF Polar Program and the Alaska Fish and Game Non-Game program, with matching funds from Simon Fraser University and Kansas State University. We thank the Sitnasauk Native Corporation for their cooperation.

On the lookout for shorebirds in Nome. Photo Eunbi Kwon

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#22 MIGRATORY CONNECTIVITY OF AMERICAN-GOLDEN PLOVER

Investigators : Jean-François Lamarre and Joël Bêty, Université du Québec à Rimouski et Centre D'Études Nordiques (CEN); Gilles Gauthier, Université Laval et Centre D'Études Nordiques (CEN).

Collaborators: Wally Johnson, Kelly Overduijn, Richard Lanctot, Joe Liebezeit, Rebecca Bentzen, Mike Russell, Erica Nol, Laura McKinnon, Laura Koloski, Nicolas Lecomte, Marie-Andrée Giroux, Oliver Love and Eric Reed.

This field season (2013) was the third consecutive year of this broad effort to document **migratory connectivity** and **seasonal interactions** in American Golden-Plovers (*Pluvialis dominica*). Following previous work at Barrow (Rick Lanctot) and at Nome (Wally Johnson) we are currently working as a team with other sites since 2010 (principal site: Bylot Island; other sites: Nome, Barrow, Caw ridge, Churchill). This year, we added 2 new sites (Igloolik and Ikpikpuk River).

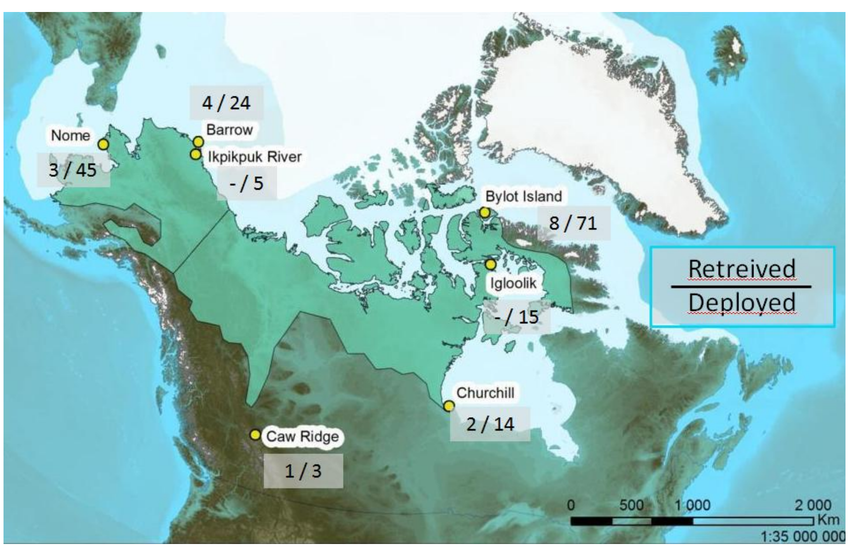
Our goals for 2013 were to:

1- Resight as many tagged plovers as possible,
2- trap them,
3- retrieve their data logger (geolocator)
4- and replace it with a new one

OR, if being a new site

1- Find as many nests as possible and deploy as much tags as possible.

Although some information is missing from some sites, we currently have data for 18 geolocators retrieved from Nome (3), Barrow (4), Caw ridge (1), Churchill (2) and Bylot (8). The following figure is presenting the overall deployment effort



Breeding range (in green) and location of the research sites (yellow dots) with respective amount of retrieved vs. deployed loggers since 2009

We intend to provide geolocators to field sites P.I. again in 2014. We will encourage all site leaders to retrieve as much data loggers as possible to maximize our dataset.

We will start to work on the geolocator-light leveled data in the next winter. We intend to define migratory stopovers and wintering sites with kernels. They will then be compared to look at the level of segregation of plovers nesting at different locations. Linear and logistic mixed models will be used to investigate the individual relationships between migratory path parameters (phenology, speed, and distance of the migration).

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Bylot Field crew 2013 (up front- JF Lamarre, on the back, left to right: Fanny Senez-Gagnon, Don-Jean Léandri-Breton and Pascal Royer-Boutin (with bug net on).

#23 DO MIGRATORY SHOREBIRDS DISPERSE BRYOPHYTE DIASPORES

INVESTIGATORS: Lily R. Lewis, Emily Behling, Hannah Gousse, Emily Qian and Bernard Goffinet, University of Connecticut Department of Ecology and Evolutionary Biology; Arctic Shorebird Demographics Network collaborators.

Long distance dispersal of plant diaspores shapes the distributions of many plants. Unlike seed plants where intercontinental disjunctions occur predominantly above the species level, bryophytes (including liverworts, mosses, and hornworts) typically display disjunctions below the species level. Bryophyte diaspores, including sexually produced spores and asexual units ranging from specialized structures such as gemmae to gametophyte (leafy plant) fragments, are typically small and thus well suited to becoming airborne and transported via wind currents.

Wind paths do not connect all intercontinental disjunctions, and thus not all disjunctions may be explained by wind dispersal. The amphitropical or bipolar disjunction pattern represents an extreme yet recurrent example, with at least 66 moss species and at least 120 higher rank seed plant taxa. In lieu of wind as an explanation for amphitropical dispersal, biotic dispersal agents have been predominantly invoked, primarily migratory shorebirds. Evidence used to support the hypothesis that migratory shore birds disperse bryophyte diaspores, and plant diaspores in general, is circumstantial, relying on correlations between bird migration path and plant distribution.

Breast feathers sampled by ASDN researchers during the 2013 field season are being screened. Each feather or set of feathers from an individual bird is rigorously screened using a novel protocol developed by the side project team. Briefly, feathers are washed in autoclaved deionized water, vortexed, centrifuged, and the feather(s) is removed and the wash water is screened under a light microscope at 40x magnification. If putative diaspores are found, the complete slide is placed on a sterile growth media and stored in a growth chamber. All steps where the feather may be exposed to contaminants is completed in a chemically and UV sterilized laminar flow hood in a lab where no bryophyte materials are handled or present.

Eighty-eight samples have been screened, representing 29 individual birds. Putative diaspores (Figure 1) have been recovered from twenty-two of these samples, representing three American Golden Plovers, two Semipalmated Sandpipers, and one Red Phalarope.

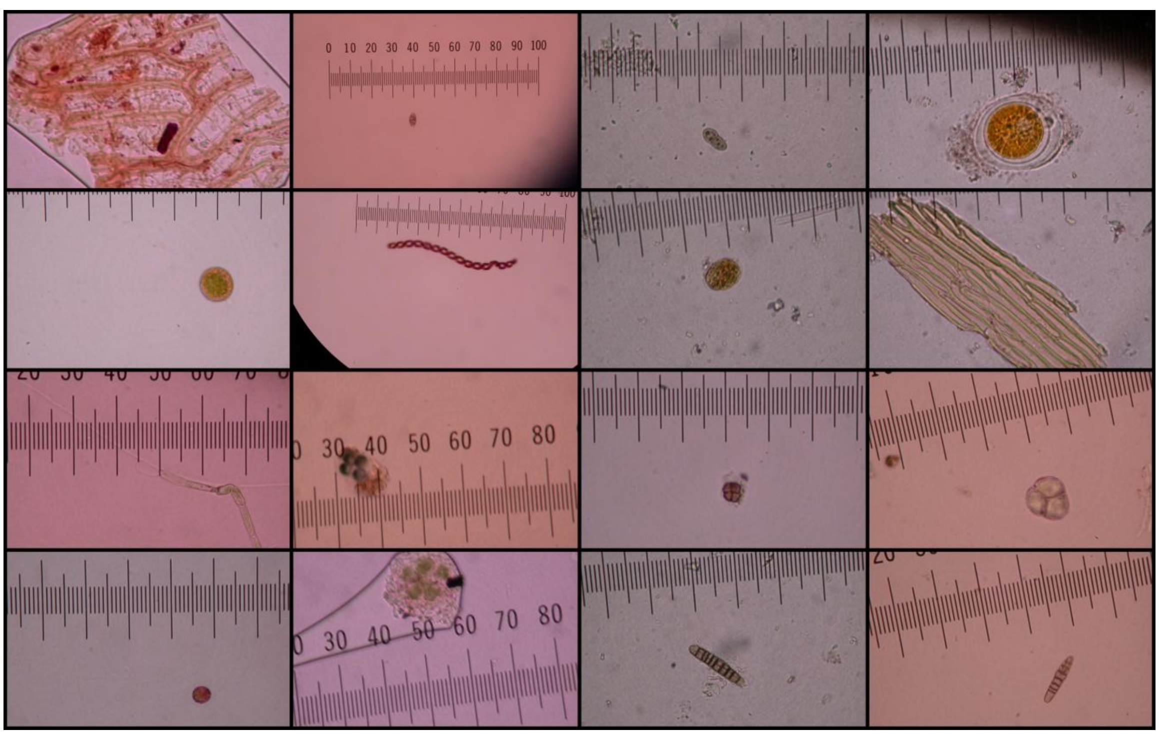

Figure 1. A sampling of the putative diaspores recovered from screened feathers. All photos were taken at 40x magnification.

#24 REPRODUCTIVE ECOLOGY OF SHOREBIRDS: STUDIES AT BARROW, ALASKA, IN 2013

Investigators: Richard Lanctot, U.S. Fish and Wildlife Service; Sarah Saalfeld, Manomet Center for Conservation Sciences and U.S. Fish and Wildlife Service; Jenny Cunningham, University of Missouri–Columbia, and Kirsten Grond, Kansas State University.

In 2013, we conducted the 11th 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) nest initiation and effort, replacement clutch laying, clutch and egg size, nest 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 will 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 fourth year of data collection as part of the Arctic Shorebird Demographics Network (ASDN) in 2013 (see the overall summary for objectives of the ASDN).

We located and monitored nests in six 36-ha plots in 2013. Five of the six plots are the same as those sampled in 2005-2012 and one new plot was established on top of Matthew Sturm's long-term snow monitoring site; all plots were searched with the same intensity as in past years. A total of 363 nests were located on our plots and an additional 40 nests were found outside the plot boundaries. Our total number of nests located on plots was the 3rd highest in this 11-year study (below the previous highs of 396 and 407 recorded in 2012 and 2011, respectively). Nests on plots included 105 Red Phalaropes, 64 Pectoral Sandpipers, 60 Semipalmated Sandpipers, 54 Dunlin, 44 Western Sandpipers, 15 Long-billed Dowitchers, 14 American Golden-plovers, and 7 Red-necked Phalaropes. No Ruddy Turnstone, nor Baird's, White-rumped, or Buff-breasted sandpiper nests were found on the plots in 2013. The breeding density of all shorebird species on our study area was 168.1 nests/km^2 in 2013; this was almost 1.45 times larger than our long-term average of 115.7 nests/km^2. In 2013, six species nested in higher densities than the 11-year average (American Golden-Plover, Dunlin, Pectoral Sandpiper, Red Phalarope, Semipalmated and Western Sandpipers) and six nested at densities below the 11-year average (Baird's, Buff-breasted and White-rumped Sandpipers; as well as Long-billed Dowitchers, Red-necked Phalarope, and Ruddy Turnstones).

The first shorebird clutch was initiated on 31 May – 1 day earlier than the long-term average of 1 June. Peak initiation date was 12 June and the median initiation date was 11 June; these dates were on the same day and 2 days earlier, respectively, than the long-term average. Median nest initiation dates for the more abundant species were 7 June for Dunlin, 9 June for Semipalmated

Sandpiper, 11 June for Red Phalarope, and 13 June for Pectoral Sandpiper. Median initiation dates were earlier for all species (compared to their respective 11-year averages), except for American Golden-Plover, whose median initiation date was 3 days later than the 11-year average.

Predators destroyed 16.5% of the known-fate nests (*N* = 345) in 2013. This is much less than the 11-year average of 29.2% and about 5% below the long-term average for other years with fox control (2005-2012). Across the more abundant species, apparent hatching success (# hatching at least one young/total number of known-fate nests) was highest in Red Phalarope (89.9%, *N* = 99), Dunlin (82.5%, *N* = 57), Pectoral Sandpiper (81.7%, *N* = 60) and Semipalmated Sandpiper (70.9%, *N* = 55). We suspect the high nesting success in 2013 was due to vegetation continuing to grow back since lemmings decimated several of the plots in 2009, providing concealment to nests from avian predators. The enhanced fox trapping efforts (i.e., trapping over an enlarged spatial area and with high intensity) also likely helped. In contrast to 2012, lemming numbers were very low in 2013; this may have resulted in the slight increase in predation rates in 2013 compared to 2012 (16.5 compared to 7.8%).

In 2013 we captured and color-marked 367 adults located both on and off plots. This was the second highest number of birds captured in any year, and was 1.3 times higher than the 11-year average of 288. Fifty of these adults (20 Dunlin, 19 Semipalmated Sandpipers, 8 Red Phalarope, 1 Long-billed Dowitcher, 1 Western Sandpiper, and 1 American Golden-plover) had been banded as adults in a prior year, and two Semipalmated Sandpiper adults had been banded as a chick in a prior year. We also captured one Dunlin adult that had been banded in Japan. Adults captured included 97 Semipalmated Sandpipers, 89 Dunlin, 73 Red Phalaropes, 39 Western Sandpipers, 34 Pectoral Sandpipers, 16 American Golden-plovers,14 Long-billed Dowitchers, and 5 Red-necked Phalaropes. We also re-sighted 33 previously banded adults on plots in 2013 (a small number of birds were resighted off plot but are not listed here). This included 14 Dunlin, 10 Semipalmated Sandpiper, 6 Red Phalarope, 1American Golden-Plover, 1 Western Sandpiper, and 1 Pectoral Sandpiper. We captured and color marked 713 chicks. This was 1.4x more than the 11-year average of 499, but lower than our previous highs of 1012 and 848 in 2012 and 2011, respectively.

In regard to other environmental features at Barrow, the summer of 2013 was an early snow melt year with 50% of the snow absent from the tundra on 2 June (average long-term date is 7 June). However, shorebirds initiated nests close to the long-term average, including first, peak and median nest initiation dates. Lemmings crashed in 2013, with numbers similar to the extremely low levels found in 2009. These levels were far below that experienced in 2006 and 2008. Despite the lack of lemmings, a few Parasitic Jaegers nested but no Snowy Owl and Pomarine Jaegers nested in the Barrow area.

We continue to conduct ancillary studies as time allows at Barrow. As part of the ASDN, we collected one geolocator from an American Golden-Plover (see 22) and deployed 28 on

Semipalmated Sandpipers (see 7) to assess migratory connectivity. We also collected samples from a variety of shorebirds to assess the presence of avian malaria (see 38) and levels of methyl mercury, and potential for bryosphore transmission across continents (see 23). We also continue to collect feathers and blood samples for archiving and other isotope/genetic collaborations. There are two graduate students working at the site. Jenny Cunningham (MS candidate, Univ Missouri-Columbia) completed her third and final field season investigating habitat selection by shorebirds (see 13). Kirsten Grond (PhD candidate, Kansas State University) conducted her second field season investigating gut microbiota in shorebirds in relation to immunity (see 16).

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#25 EFFECTS OF FOX REMOVAL AND OTHER FACTORS ON ARCTIC SHOREBIRD NEST SURVIVAL

Investigators: Richard Lanctot, U.S. Fish and Wildlife Service; Sarah Saalfeld, Manomet Center for Conservation Sciences and U.S. Fish and Wildlife Service; Brooke Hill, U.S. Geological Survey; H. River Gates, ABR, Inc.; Audrey Taylor, University of Alaska Anchorage; Jenny Cunningham, University of Missouri Columbia; Andy Doll, University of Colorado Denver; Kirsten Grond, Kansas State University; Michael Budde, U.S. Geological Survey; Stephen Brown, Manomet Center for Conservation Sciences

Removal or addition of apex predators may have profound effects on an ecosystem, resulting in loss of some species, enhancement of others, and changes in trophic interactions. In Arctic and Subarctic environments, Arctic fox (*Alopex lagopus*) have been shown to have dramatic effects on waterbird populations through loss in productivity (i.e., lower nest success and hatchling survival). However, other factors such as the availability of alternative prey (i.e., lemming), number and type of avian predators, weather, nest concealment, timing of nesting, as well as the behavior (e.g., incubation strategy, site fidelity) and density of the shorebird species themselves are likely to be important. We investigated these relationships by documenting shorebird nest survival as it relates to environmental and social factors near Barrow, Alaska, between 2003 and 2004, when no fox control was implemented, and 2005–2012 when foxes were removed at variable levels of intensity to benefit nesting eiders.

From 2003–2012, we located 1,925 shorebird nests, representing 8 species. Apparent nest survival was generally high throughout the study, with lowest survival occurring in 2004, prior to fox removal, and 2009, after fox removal was implemented. We estimated survival rates over a

58-day nesting season from 4 June–31 July (i.e., day first nest discovered to day last nest hatched or failed). Using nest survival models in Program MARK, we found a positive relationship between fox removal effort and shorebird nest survival. However, within fox removal categories yearly variation still existed, warranting the inclusion of a parameter for each year separately. In addition, we found strong support for a time effect, with nest survival rates exhibiting a quadratic seasonal response, with nest survival peaking in the middle of the season in all years but 2004 and 2009. In 2004, nest survival was greatest in the early part of the year and declined thereafter, whereas in 2009, nest survival was lowest in the middle of the season. Yearly variation in seasonal responses may have been at least partially related to timing of fox removal. For example, in 2009, increases in nest survival following low survival in the middle of the season corresponded to the removal of several foxes following a 20-day lag in which no foxes were removed. We also found a strong species effect; this model was not improved by grouping species based on incubation behavior or site fidelity. Based on estimates from the top-ranked model, Western Sandpiper, Long-billed Dowitcher, and American Golden-Plover had the lowest survival, while Red-necked Phalarope had the greatest survival. We also found strong support for the inclusion of early season integrated NDVI, a proxy for vegetation cover. Here, daily nest survival rates were positively related to early season integrated NDVI, indicating greater nest survival with more cover.

These results suggest that greater fox removal effort increased shorebird nest survival; however, other factors may have been more important. For example, yearly differences, not explained by predator or alternative prey levels, as well as time during the nesting season, species, and nest concealment were identified as the most important factors explaining daily survival rates of shorebirds. Surprisingly, we failed to find any effect of weather, overall nest abundance, or species-specific traits such as incubation behavior or site fidelity as in other studies. Thus, additional years of study under different ecological conditions are needed to better understand these relationships. Because nest survival is only one component of the overall recruitment rate, future studies should also investigate how brood survival is influenced by environmental and social conditions, and whether lowered perceived predation risk when foxes are removed leads to other benefits, such as greater parental investment and elevated body reserves. For example, reduced adult vigilance towards predation risks may result in better nest and chick attendance and more time for adults to forage. Such benefits could enhance adult and chick condition, potentially increasing their likelihood of surviving the summer, fall migration and the nonbreeding season.

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#26 MIGRATORY CONNECTIVITY OF BUFF-BREASTED SANDPIPERS

Investigators: Richard Lanctot, U.S. Fish and Wildlife Service; Stephen Yezerinac, Mount Allison University; Joaquin Aldabe, Aves Uruguay and Universidad de la República; Juliana Bosi de Almeida, Brasilia, Brazil; Gabriel Castresana, Reserva Natural Bahía Samborombón, Argentina; Stephen Brown, Manomet Center for Conservation Sciences.

Buff-breasted Sandpipers have a small and apparently declining population, and face threats during both migration and while wintering. Authors of the conservation plan for the species listed their number one range-wide priority as ascertaining migration patterns and concentration areas and linking breeding and nonbreeding locations. To do this, we equipped Buff-breasted Sandpipers with geolocators at three key wintering sites in South America, where the species is known to have relatively high levels of site fidelity. These devices collect light intensity information as the bird travels during its annual cycle, and when the bird is recaptured the downloaded data provides the times of sunrise and sunset, which allows the geographical location of the bird to be determined on a daily basis. Teams of four to six people conducted field work in Bahía Samborombón, Argentina; Lagoa do Peixe, Brazil; and Laguna de Rocha, Uruguay for about two weeks each during mid-December 2012 to mid-January 2013. Efforts were made to capture Buff-breasted Sandpipers with net guns, cannon nets, wilsternets, and with bright lights and fishing nets at night. Capturing birds proved difficult due to 1) tall grass that made birds avoid pastures used in prior years in Uruguay (due to wetter than normal conditions), 2) our inability to locate dependable roosting areas where stationary traps could be deployed in all three countries, and 3) the failure of the net guns to function properly due to excessive air temperatures. The bright lights and fish net approach proved very successful although this technique prevented targeted capture of specific individuals – a necessary requirement for the recapture of previously geolocator-equipped birds in year 2 of the study. Collectively, we were able to capture and deploy geolocators on 21 birds (13 females, 8 males) in Argentina, 26 birds in Brazil (16 females, 10 males), and 15 birds (9 females, 6 males) in Uruguay. One of the birds in Argentina was later found dead and the geolocator was removed. Efforts are currently underway to have field personnel recapture or lethally collect previously equipped geolocator birds at all three wintering sites during November 2013 through January 2014.

The Buff-breasted Sandpiper geolocation data will provide valuable information during all stages of their annual cycle and lead to more focused and effective conservation actions. We will be able for the first time to track the movements of this small sandpiper while it travels between wintering and breeding areas, providing insight to the number of stopover sites, the dates birds spend at these sites, and the proportion of birds stopping at distinct locales. This information is needed to focus conservation efforts but also to assess current estimates of the species population size. We will also be able to assess how any hurricanes and other severe storms influence migration behavior. On the wintering grounds, we will be able to assess site fidelity and movement among key wintering sites, and confirm whether males and females segregate. This information is useful for determining the number and location of sites to be protected in the future. A You Tube video describing the project can be seen by searching tnu.com.uy and the "Ciencia Salvaje" (Wild Science) section.

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#27 KACHEMAK BAY SHOREBIRD MONITORING PROJECT: 2013 REPORT

Investigators: George Matz and the Kachemak Bay Birders

Purpose

In May 2013, Kachemak Bay Birders (based in Homer, Alaska) completed its fifth consecutive shorebird monitoring project. The main purpose of this citizen science project is to attain a better understanding of the status of shorebird populations in the Kachemak Bay area, particularly during spring migration. This year we extended our efforts to include monitoring at nearby Anchor Point/River and the Kasilof River. Secondary purposes for this project are: 1) to contribute information that might be useful to others assessing shorebird populations across the entire Pacific Flyway: and 2) to use the monitoring data to help protect Kachemak Bay/Homer Spit shorebird habitat.

Results

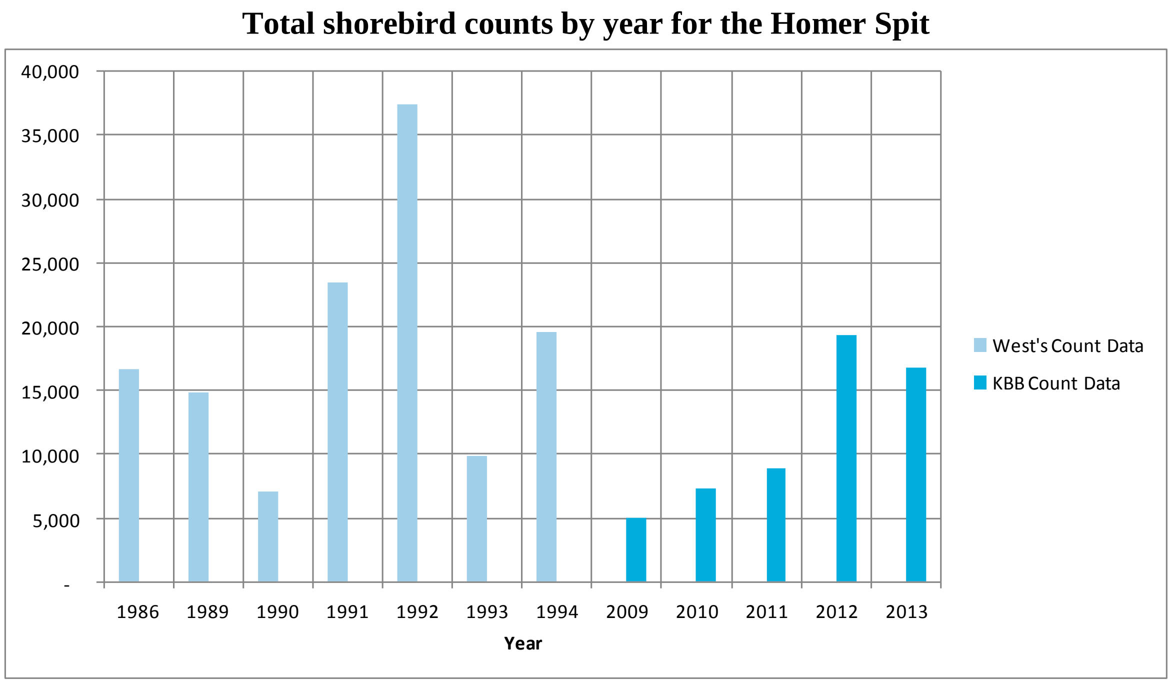
Between April 13, 2013 and May 23, 2013 a total of 33 volunteers (including 9 teenagers) monitored four sites on the Homer Spit, one site at nearby Beluga Slough, and by boat the islands and islets on the south side of the Bay. The protocol we followed is a modification of the International Shorebird Survey (ISS) protocol. We simultaneously monitor for two hours once every five days when the outgoing tide reached 15.0 feet (or at high tide if less). These tidal conditions optimize shorebird viewing opportunity for this area. In nine monitoring sessions we observed 23 species of shorebirds and counted a total of approximately 18,623 individual shorebirds. Top ten taxa seen include Western Sandpiper (7,964), LESA/WESA/SESA which is a lumping of *Calidris* species (5,305), Dunlin (2,548), Surfbird (748), Red-necked Phalarope (703 with all but three seen by boat), Dowitcher *sp*. (344 of which most were probably Short-billed), Black-bellied Plover (221), Pectoral Sandpiper (146), Least Sandpiper (128), and Pacific

Golden Plover (96). We noted some minor disturbances of shorebird flocks from loose dogs and low-flying aircraft.

The number of shorebird species we counted this year (23) was less than most previous years; 24 in 2009, 23 in 2010, 25 in 2011, and 27 in 2012. However, this year for the first time we saw Bristle-thighed Curlew, which is considered accidental for Kachemak Bay, on two successive monitoring sessions. The total number of individual shorebirds counted this year (18,623) was above average (15,171) for our five years of effort: 7,406 in 2009, 9,845 in 2010, 16,007 in 2011, and 23,972 in 2012. But it seemed like there were about as many shorebirds this year as last year. A review of our daily spot check data taken at prime sites during the peak of migration revealed that unlike 2012, when three of our scheduled monitoring dates happened to coincide with the peak of a pulse of shorebird arrivals, this year only the shoulder, not the peak, of the largest pulse was during a scheduled monitoring date.

Comparison to past surveys

As in previous years, we compared our data to George West's seven years of shorebird monitoring data (1986, 1989-1994). West saw a total of 23 shorebird species. Over the past five years of monitoring we have seen 30 species. Perhaps our more intense coverage explains our higher number of species. West's average annual count was 90,326 shorebirds. But comparison of this data with ours requires some adjustment. West monitored daily and our protocol calls for monitoring once every five days. Consequently, for the comparison we included only every fifth day of West's data. Also, since West's observations were only on the Homer Spit, we needed to exclude data from the Beluga Slough and Islands and Islets sites. Based on these adjustments, West's average shorebird count was 18,436. Our average for five years was 11,458 shorebirds; or 62% of West's.



New areas

In addition to the Homer Spit area we also conducted shorebird monitoring for the first time at the mouths of the Anchor and Kasilof Rivers. The Anchor River is located at the northern edge of Kachemak Bay about 15 miles north of Homer. The four volunteers that monitored here followed the same protocol used at the Homer Spit. They reported seeing a total of 21 species of shorebirds and counted 1,065 individual birds. The top ten taxa for this site were: Western Sandpiper (606), Whimbrel (75), Dunlin (67), yellowlegs sp. (45), Greater Yellowlegs (44), Black-bellied Plover (40), LESA/WESA/SESA (29), Lesser Yellowlegs (20), Dowitcher sp. (19), and Long-billed Dowitcher (18). Although several Bristle-thighed Curlews were frequently seen at the Anchor River this spring, none were observed during monitoring.

The Kasilof River empties into Cook Inlet about 40 miles north of the Anchor River. Five volunteers there followed a different protocol. They monitored the incoming tide and not necessarily on the same days as our effort at the Homer Spit. Nevertheless, with nine monitoring sessions, they had about the same level of effort. They saw a total of 18 species of shorebirds and counted approximately 21,363 individuals. The count for the Kasilof River is high enough to be considered a Western Hemisphere Shorebird Reserve Network Site of regional importance. The top ten taxa seen were Western Sandpiper (16,950), Dunlin (3,338), Short-biller Dowitcher (620), Least Sandpiper (209), Black-bellied Plover (59), Whimbrel (43), Long-billed Dowitcher (42), Greater Yellowlegs (34), Hudsonian Godwit (25), and Lesser Yellowlegs (8).

Many thanks to all the volunteers who made this happen. This project will continue next year. A full report of this year's project can be viewed at http://kachemakbaybirders.org.

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#28 MONITORING A SUBALPINE WHIMBREL COLONY ON DONNELLY TRAINING AREA IN INTERIOR ALASKA

Elizabeth Neipert and Matt Cameron, US Army Garrison Fort Wainwright-Donnelly Training Area; Colorado State University-Center for Environmental Management of Military Lands

In 2000, a road accessible colony of whimbrels (*Numenius phaeopus)* was discovered near Donnelly Dome approximately 18 miles south of Delta Junction, AK. At an elevation of 900 meters, the colony covers approximately 48 hectares in subalpine scrub habitat. Weekly surveys began in 2009. The colony has consistently occupied the area from early May to early July each season. However nesting was not documented until 2012, when four nests were found and monitored to determine nest fate, approximate hatch date, and dispersal date. Nests contained 2 - 4 eggs and hatched between 20 June and 25 June. All nests appeared to have successful hatchings and the last detection of whimbrels was 2 July.

In 2013, the first detection of whimbrels at the nesting area occurred on 23 May, roughly 2 weeks later than past seasons. This appeared to be due to the late snow cover on the site. On the dates of normal arrival, whimbrels were detected at lower elevations lacking snow cover. Seven nests were found with two more pairs suspected of nesting, but nests for them could not be detected. Nests were discovered ranging from 65 - 121 meters from 2012 nests, but without marked individuals there was no way to determine if these were returning individuals to the same territory. The nearest 2013 nests were 168 meters apart. All 7 nests had 4-egg clutches. The highest count during a visit was 21 individuals (18 birds from inferred pairs and 3 "interlopers").

While the birds arrived later than normal, they resumed normal phenology. Hatch dates were estimated with weekly checks and with motion sensor cameras mounted on posts near 3 nests. Hatching occurred between 24 June and 27 June, with some eggs pipping on the 27 June visit. Backdating using a 26-day incubation (C. Harwood, personal communication), nest initiation was estimated to occur between 29 May and 1 June. All nests showed evidence of hatching, but hatchling survival is unknown. Broods were observed to remain in the nest area as late as 8 July, after which broods are believed to have moved to lower elevations. The last whimbrel detection of 2013 was on 24 July and was a solitary individual flying around the area.

In 2013, we recorded the greatest number of nests in this whimbrel colony. This is likely due to improved nest-searching techniques rather than increased colony use. While we have monitored this site for five years, this year marks the first year we feel confident in our pair and nest data. Future monitoring focusing on pair abundance and nest success will continue in 2014.

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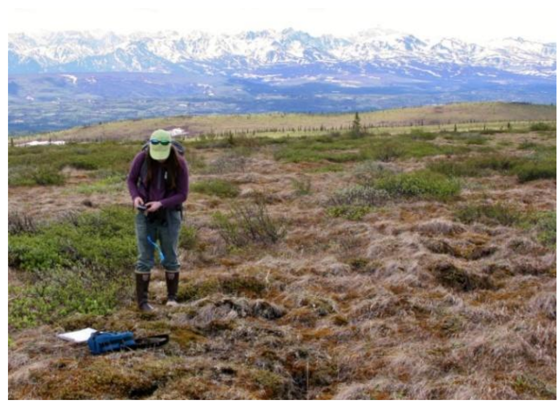

Whimbrel nest in subalpine scrub habitat. DTA Biologist recording a new nest with the Granite Mountains in the background.

#29 ARCTIC-BREEDING SHOREBIRDS IN A CHANGING CLIMATE: AN EVALUATION OF REPRODUCTIVE SUCCESS IN RELATION TO SHRUB PRESENCE, PHENOLOGY, AND FOOD ABUNDANCE ACROSS AN ELEVATIONAL GRADIENT

Investigators: Kelly Overduijn, University of Alaska, Fairbanks; Abby Powell, U. S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit and University of Alaska, Fairbanks; Colleen Handel, U.S. Geological Survey, Alaska Science Center, Anchorage

Justification and Objectives

On the Arctic breeding grounds, projected changes in climate are expected to benefit shorebirds in the short-term by increasing reproductive success and survival rates, primarily through amelioration of harsh weather and prolongation of summer. However, over time it is expected that climate change will lead to a reduction in the quantity and quality of open tundra habitat, which may adversely affect shorebird reproduction and exacerbate population declines.

Our study is motivated by concerns about declines in shorebird populations worldwide and aims to evaluate how shrub increase on the Arctic tundra, as a result of climate change, may affect the reproductive success of shorebird species. In particular, we are focusing on two sympatrically nesting shorebirds, the American Golden-Plover (*Pluvialis dominica*; AMGP) and the Pacific Golden-Plover (*P. fulva*; PAGP). These species were once considered subspecies of the Lesser Golden-Plover and are thought to have speciated through allopatry during the Last Maximum Glaciation of the Pleistocene.

AMGP and PAGP use broadly similar habitats composed of abundant low vegetation and lichen. However, distinct differences in the nest microhabitat between species are evident. AMGP typically nest on xeric sites that are located on higher slopes with little vegetation and a rocky substrate, whereas PAGP generally nest in mesic areas with a dense vegetative substrate. Hatch dates also differ between the two species with AMGP typically hatching before PAGP. Differences in habitat use and breeding phenology between these species provide an elegant model system for evaluating the breeding ecology of shorebirds in relation to shrub extent and invertebrate abundance.

The objectives of this research are to: (1) evaluate how reproductive success of AMGP and PAGP is influenced by climate-mediated effects on habitat availability, habitat structure, prey availability, and prey abundance along an elevational gradient, and (2) evaluate growth rates of AMGP and PAGP chicks relative to temporal and spatial availability of invertebrate prey.

Through this study, we hope to provide baseline data that could be used to make more informed hypotheses about ecological effects of climate change and to guide decisions about long-term management of migratory birds and their habitats. In particular, this research will elucidate the associations between shrub extent, shorebird habitat use, food availability, and the effects of seasonal phenology on shorebird reproductive success. Evaluating macro-scale relationships between shorebird species and their environment will help us to predict how populations might be affected by climate-induced habitat change.

2012 and 2013 Field Seasons

Our fieldwork began in the summer of 2012 and was completed in the summer of 2013 on the Seward Peninsula, Alaska. This region, located in northwestern Alaska, has pronounced longitudinal and elevational gradients of habitat. Local-scale changes in habitat types associated with elevational gradients on the Seward Peninsula are analogous to broad-scale changes in habitat associated with warming-driven shrub expansion across the Arctic. Thus, elevational gradients can function as proxies for climate warming-related habitat change.

We conducted fieldwork on the southern portion of the Seward Peninsula along the road system leaving Nome, Alaska (64.5° N 165.4° W). Elevations on the Seward Peninsula range from sea level to ~700 m; intermediate elevations are used by both species. Previous studies suggest that the lower elevational zone is used exclusively by PAGP and higher elevations by AMGP. We established five study sites during the 2012 field season. Two of these sites correspond with work by Oscar W. Johnson and Peter G. Connors during the 1980s and 1990s near Feather River and Nugget Creek. In 2013, we added one additional study site at Woolley Lagoon. Our study sites ranged from 26–418 m in elevation: Kougarok (64.9° N 165.2° W, 183–418 m), Feather River (64.8° N 166.03° W, 128–367 m), Blume Creek (64.8° N 166.06° W, 124–296 m), and Mile 16 (64.6° N 165.7° W,144–244 m). Woolley Lagoon (64.9° N 166.3° W) encompassed lower elevations (26–210 m).

In both seasons, we located nests and monitored nest success, banded incubating adults and newly hatched chicks, recorded movements of broods, recaptured chicks for growth measurements, classified habitat in brood-rearing areas, deployed geolocators, and collected invertebrates using pitfall traps throughout the brood-rearing period (Table 1). In 2013, we also collected invertebrates using pitfall traps from June through August across an elevational gradient.

Table 1. Sample sizes for breeding biology study of American and Pacific Golden-Plovers on the Seward Peninsula, Alaska, 2012-2013.

	AMGP		PAGP	
	2012	2013	2012	2013
Nests	25	29	17	42
Adults Banded	20	17	10	20
Chicks Banded	33	46	23	62
Broods Followed	9	17	8	20
Geolocators	6	10	-	10

Preliminary results from the 2012 field season indicated that nest initiation and subsequent hatch dates of AMGP were earlier on average than those of PAGP. We also found that both species used open habitats with few tall shrubs and there was more overlap between nesting and brood-rearing sites than previously documented. Apparent nest success was 44% for AMGP and 47% for PAGP. Apparent brood survival for both species combined was high (88%) and most pairs moved broods <1 km from nest sites to brood-rearing habitats.

Currently, invertebrate samples are being processed, data from the 2013 field season are being proofed, and data from both field seasons are being prepared for analysis.

This study was funded by the USGS Alaska Science Center Changing Arctic Ecosystems Initiative.

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#30 EFFECTS OF DIET AND PROVISIONING RATES ON PRODUCTIVITY OF BLACK OYSTERCATCHERS IN KENAI FJORDS NATIONAL PARK

Investigators: Brian Robinson, University Of Alaska, Fairbanks; Abby Powell, U. S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit and University of Alaska, Fairbanks; Laura Phillips, Kenai Fjords National Park; Heather Coletti, Southwest Alaska Network, National Park Service

Justification and Objectives

The Black Oystercatcher (*Haematopus bachmani*) is an important member of the rocky and gravel intertidal communities of eastern Pacific shorelines. As a top-level consumer in the intertidal food web, it can produce effects that cascade down trophic levels and influence the structure of nearshore marine systems. Black Oystercatchers are completely dependent on nearshore marine habitats for all critical life history components including foraging, breeding, chick-rearing, and resting and are therefore vulnerable to natural and human-caused disturbance that occurs within nearshore systems. For these reasons, in addition to a small estimated population size and uncertainty in population trends, Black Oystercatchers have been recognized as a species of conservation and management concern by regional and federal agencies.

The Nearshore Monitoring Protocol, under the National Park Service Southwest Alaska Network Inventory and Monitoring Program, incorporates annual monitoring of Black Oystercatcher population abundance, nest density and productivity, and prey species and sizes provided to chicks. However, each of these metrics is estimated from a single visit to Kenai Fjords and Katmai National Parks annually. Estimates obtained from a single observation may be subject to potential biases; data resulting from a single observation are recognized as potentially influenced by events that occur both prior to and following the visit, including breeding failure, and egg and chick mortality. Additionally, estimates of chick provisioning and diet based on the collection of prey remains brought to nest sites to provision chicks only reflect shelled prey provided to chicks prior to the collection date. Soft-bodied prey lacking shells, such as marine worms, and prey brought to chicks away from the nest site will not be detected. Further, prey remains left near the nest site by other animals such as gulls and crows may be mistaken for oystercatcher prey.

To address these issues, we initiated a two-year study examining Black Oystercatcher productivity, diet, and chick provisioning to ensure robust interpretation of trends observed in long term monitoring data collected for this species. The main objectives of this study are to: (1) estimate overall productivity of Black Oystercatchers breeding at Kenai Fjords National Park, (2) identify sources of disturbance and morality to adults, eggs, and chicks prior to fledging using remote video surveillance, (3) identify prey items comprising chick diet via direct observation and stable isotope analysis, (4) determine the rates of provisioning of food by adults to chicks, (5) estimate the caloric and nutritional content of main prey items, and (6) examine the influence of chick provisioning and diet on growth rate, body condition, fledging success and chick survival. Our findings will highlight important trophic linkages within nearshore marine systems in south-central Alaska and identify factors influencing breeding productivity of Black Oystercatchers. Results of this study will inform and improve long term monitoring studies and management of black oystercatchers at Kenai Fjords and Katmai National Parks. Similar monitoring efforts are being conducted in Prince William Sound, AK under Exxon Valdez Oil Spill Trustee Council funding and we anticipate these results will inform those monitoring efforts as well.

1st Field Season

From late-May to late-August 2013, we conducted fieldwork in Aialik Bay located within Kenai Fjords National Park. We conducted systematic boat-based surveys of historically known nesting sites to locate active breeding territories. Upon detecting a territorial pair, we searched the surrounding area extensively on foot to locate the nest. We monitored all active nests every three days throughout the nesting period, weather and logistics permitting. We deployed six Reconyx digital infrared remote-cameras at a sub-set of nests, moving them to new nest sites when nests ceased to be active. Throughout the course of the breeding season we periodically revisited sites where nests had failed and sites where territorial pairs were observed but had yet to lay a clutch in order to detect new nests.

We captured chicks to determine growth rates and body condition and collect blood plasma for stable isotope analysis of diet. Young chicks were marked with colored tape until their tarsi were large enough to be banded with a USGS metal band and two plastic alpha-numeric bands. We captured chicks every three days during high tide when intertidal feeding areas were submerged for several hours, which reduced the contribution of a recently filled crop to body mass and minimized disturbance to foraging.

Observations of chick provisioning were conducted to determine the rate of provisioning (defined as number of prey items fed by parent to offspring per unit time) and the type and size class of items provisioned. Observations were conducted in a camouflaged blind during low tide when feeding grounds became exposed. One observer, while looking though a 20-60x spotting scope, communicated the actions of adults and chicks and the type and size class of prey provisioned while a second researcher recorded the actions and time at which they occurred.

We collected intertidal invertebrates to estimate the energetic and nutritional values of the invertebrate prey provisioned to chicks and provide a reference for stable isotope analysis. We sampled during low tide at three oystercatcher feeding territories during late July/early August. We collected invertebrate samples that represented the taxa and size class of prey items observed during provisioning events.

We monitored a total of 15 nests throughout the breeding season and deployed remote cameras at 11 nests. Throughout the brood-rearing period, we conducted 123 hours of behavioral observations of five broods. We caught 11 individual chicks repeatedly for a total of 86 captures. Of 15 occupied nests, 40% hatched at least one chick. Of the nests that failed, 33% were depredated, 33% were flooded, and 33% were abandoned, addled, or lost to unknown causes. Of the 12 eggs that hatched chicks, only two survived to fledge.

This winter we will analyze our data and complete necessary lab work. Blood samples and a subset of prey samples will be processed at the Stable Isotope Facility at the University of Alaska Fairbanks for analysis of stable isotopes of 15N and 13C. Remaining prey samples will be analyzed at the University of Alaska Fairbanks to determine caloric and nutritional content. Next May we will return to Aialik Bay for a second season of fieldwork. We hope to expand our study site to monitor more breeding pairs. We will also deploy additional remote cameras. In addition to nest monitoring, we plan on utilizing the cameras during the brood-rearing period to detect sources of chick mortality.

This study was funded by the National Park Service. We are grateful to S. Stark for his assistance in the field and M. Kansteiner for the logistical support he provided.

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#31 CONSERVATIVE AND OPPORTUNISTIC SETTLEMENT STRATEGIES IN ARCTIC-BREEDING SHOREBIRDS

Investigators: Sarah Saalfeld, Manomet Center for Conservation Sciences, U.S. Fish and Wildlife Service; Richard Lanctot, U.S. Fish and Wildlife Service

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Long-distance migrations to Arctic regions are thought to benefit shorebirds through lower predation rates, reduced risk of diseases and parasites, increased food availability, and longer day light hours that promote growth of offspring. However, shorebirds breeding in the Arctic must also cope with unfavorable weather that can be energetically taxing, short breeding seasons, unpredictable breeding environments, and hazards of undergoing annual long-distance migrations. Because of these challenges, shorebirds appear to have evolved a number of strategies for adapting to and exploiting the Arctic environment. Two such strategies, put forth by Holmes (1966, 1971b) and Pitelka et al. (1974), suggest that species either conservatively or opportunistically select breeding locations based on local environmental conditions. "Conservative" species were characterized by strong site fidelity and territoriality, consistent population densities, relatively even spacing of individuals, and monogamous mating systems, while "opportunistic" species exhibited opposite traits and were polygamous. However, within the 40+ years since this hypothesis was put forth, little effort has been made to support or refute it, with validation of these settlement strategies being primarily restricted to studies on single species over short time periods, and with few studies attempting to identify the local cues species use when making settlement decisions.

We assessed whether 10 shorebird species consistently exhibited these settlement strategies over a 10-year period (2003–2012) near Barrow, Alaska by comparing annual estimates of site fidelity, territoriality, and population density. Additionally, we determined the relative importance of past and current environmental and social conditions in predicting annual breeding densities of these same species. Data from 1,413 captured adults and 1,946 shorebird nests indicated that most species (e.g., Semipalmated Sandpiper, Dunlin, Buff-breasted Sandpiper, Red Phalarope, White-rumped Sandpiper, Pectoral Sandpiper) conformed to one of the two settlement strategies, while others (e.g., American Golden-Plover, Western Sandpiper, Red-necked Phalarope) exhibited traits of both strategies, and a few (e.g., Long-billed Dowitcher) had settlement patterns inconsistent with that predicted for their mating system. We suggest that deviations from these strategies may occur depending on an individual's location within its breeding range, with individuals breeding at more northern latitudes or on the fringe of its breeding range exhibiting more opportunistic traits than individuals in southern latitudes or within core areas. However, for some species, such as Long-billed Dowitcher, described settlement patterns may be just too simplistic. We found some support indicating that food availability or lemming abundance predicted the nest density of 4 of the 10 species investigated, while other local conditions such as timing of snow melt, predator abundance, and prior reproductive success appeared to be unrelated to annual nest density. Results from this study indicate that understanding how species settle may have important consequences for implementing monitoring or conservation actions. For example, because individuals of some species may breed in different areas each year depending on their suitability, designating sites for protection may be difficult, and at a minimum, need to be sufficiently large to provide suitable habitat in all years.

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#32 TESTING A RECONYX CAMERA TO COLLECT SHOREBIRD ABUNDANCE WITH REGARD TO TIDE AND SEASON

Investigators: Susan E. Savage and Jonelle Johnson, Alaska Peninsula/Becharof NWR

In 2011 the Ecological Services branch of USFWS Region 7 prepared part of the Bristol Bay Watershed Assessment that was subsequently presented to the Environmental Protection Agency. This action was in response to a request from Bristol Bay Native organizations to assess the impact of heavy metal mining in the upper Kvichak and Nushugak drainages, especially to salmon resources and to species that were heavily dependent on Marine Derived Nutrients. One group that was identified was shorebirds. To better quantify shorebird use patterns along the Bristol Bay marine coast, the Alaska Peninsula/Becharof is testing the value of using a Reconyx camera to collecting shorebird abundance data with regard to tide and season. We located just one camera on the bank by Monsen Creek on Kvichak Bay near Naknek, Alaska on 30 April. The camera is scheduled to take one photo every 15 minutes from 0400 to 2245; camera SD cards are changed approximately every two weeks. We are still collecting data and plan to do so through early November or until shore ice begins accumulating. Wildlife Intern Johnson began preliminary screening of images in July. The resolution of the images is quite poor. We are able to make out a general impression of shorebird and gull abundance from the photos in addition to the level of the tide. We are quantifying the abundance of birds using the following categories: 1-10, 10-50, 50-100, 100-500, >500. The final results will be presented in a progress report available from the PIs.

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#33 BLACK TURNSTONE BREEDING ECOLOGY STUDIES AT TUTAKOKE, CENTRAL YUKON-KUSKOKWIN DELTA, ALASKA

Investigators: Audrey Taylor, University of Alaska Anchorage; Mary Anne Bishop, Prince William Sound Science Center; Kristine Sowl, Yukon Delta National Wildlife Refuge; Jessica Stocking, Prince William Sound Science Center

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Counts of Black Turnstones stopping at Prince William Sound's Montague Island during spring migration have declined dramatically in the last 15 years. The overall goal of this project is to understand if the decrease in observed numbers of birds stopping at Montague Island (which has traditionally been the principle spring staging site for this species) represents a true population decline due to climate-change impacts on the breeding grounds, or if the reduced numbers reflect a shift in the migration route and stopover sites used in Prince William Sound. To address the breeding population decline aspect of our hypotheses, we initiated Black Turnstone studies at the Tutakoke Brant Camp, located on the central Yukon-Kuskowkim Delta in western Alaska and operated by faculty and graduate students of the University of Nevada Reno. Tutakoke provided a major advantage for this project in that it is the site of Black Turnstone breeding ecology studies conducted from 1977-1982 by C. Handel and B. Gill; these studies will provide valuable comparative data for assessing breeding density or habitat changes that may have occurred between the 1970's and present day.

In early June 2013 A. Taylor, K. Sowl, and J. Stocking flew to Tutakoke and identified Handel and Gill's historical turnstone plots, located on either side of the Tutakoke River near the brant camp. We used behavioral cues from individual Black Turnstones to find and mark as many nests as possible on each of these plots. We also captured (using bownets), banded, and deployed light-level geolocators on adult Black Turnstones, floated and measured eggs, and assessed habitat surrounding each nest.

Between 12 and 26 June 2013 we found 72 Black Turnstone nests, banded 80 adults, and deployed 32 geolocators for future retrieval. The larger of the historical plots (19.5 ha) was primarily comprised of mixed graminoid/dwarf shrub mat tundra; nest density on this plot was 1.54 nests/ha. The smaller of the historical plots (7.7 ha) was comprised of low-lying salt grass meadow and had a nest density of 4.42 nests/ha. We noted that particularly in the salt grass meadow plot, Black Turnstones tended to nest in close association with Brant, Sabine's Gulls, Glaucous Gulls, and Arctic Terns.

Interestingly, we recaptured three Black Turnstones that had been previously marked at Tutakoke by B. Gill and P. Tomkovich in 2006 or 2007. Recaptures of these individuals indicate that Black Turnstones live to at least eight years of age (2005-2013). One of the recaptured individuals has been a faithful "camp bird" (nicknamed Piggy) since it was first banded as a nesting adult in 2007. It had a nest right behind camp in 2013, and regularly visited the camp vicinity to snack on dishwater remains. Another Black Turnstone nesting in the vicinity of camp was captured off its nest by baiting a bownet with noodles. This demonstrates the flexibility of feeding habits and sources employed by this species.

Also in 2013, we deployed seven geolocators on wintering Black Turnstones in Oak Harbor (Puget Sound), WA, and plan to attempt to retrieve these during March 2014. We plan to return to Tutakoke in June 2014 to retrieve geolocators and replicate Handel and Gill's density transects for Black Turnstones on the central Yukon-Kuskokwim Delta.

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#34 BIRDS 'N' BOGS CITIZEN SCIENCE PROJECT IN ANCHORAGE AND THE MATANUSKA VALLEY, ALASKA

Investigators: Audrey Taylor and Tess Forstner, University of Alaska Anchorage; Nils Warnock and Beth Peluso, Audubon Alaska

In the spring of 2013, Audubon Alaska and the Geography and Environmental Studies Department at the University of Alaska Anchorage initiated a new citizen science program called "Birds 'n' Bogs." The goal of this program is to document spring distribution of boreal birds—primarily Lesser Yellowlegs (*Tringa flavipes)*, Greater Yellowlegs (*Tringa melanoleuca*), Solitary Sandpiper (*Tringa solitaria*), Rusty Blackbirds (*Euphagus carolinus*), Olive-Sided Flycatchers (*Contopus cooperi*), Tree Swallows (*Tachycineta bicolor*) and Violet-Green Swallows (*Tachycineta thalassina*) —in wetland habitats of Anchorage and the Matanuska Valley. This citizen science program represents an important effort because boreal wetland birds are among North America's most rapidly declining avifauna. The Birds 'n' Bogs program relied on citizen scientists to perform surveys for target species across a set of predetermined wetlands in Anchorage and the Matanuska Valley to monitor distribution and abundance of boreal birds. Survey locations in Anchorage were based on the historical presence of Lesser Yellowlegs in bogs within the Anchorage area (Lee Tibbitt's work over the last several decades). In 2013, twenty-five participants surveyed thirty-two wetlands totaling over fifty-seven person-hours. These data were compiled using ArcGIS to create maps showing locations of the target species between 15-25 May (the spring "settling" period).

As this was the first year for this citizen science program, we will use this information as a baseline for future surveys, the results of which will enable us to assess preferred wetlands and distribution patterns for each target species within the Anchorage Bowl. This year gave us much insight into ways to improve survey protocols and select locations for future efforts. We also learned that shorebird habitat in the Matanuska Valley is abundant and diverse and would require substantial additional effort to survey as thoroughly as participants accomplished in the Anchorage area. However, because we did observe a number of our target species, we believe a systematic survey of all wetlands in the Matanuska Valley (as was done for Anchorage) would yield valuable data on boreal species in these habitats, which could then be compared over time and with Anchorage data. The 2013 Birds 'n' Bogs surveys represented a commendable effort by all participants and we anticipate repeating and expanding the effort in 2014, with the goal of establishing a long-standing monitoring program for declining boreal bird species in southcentral Alaska.

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#35 THE CUMULATIVE EFFECTS OF HIGH TIDES AND WAVE EVENTS, SUCH AS BOAT WAKES, ON THE PRODUCTIVITY OF BLACK OYSTERCATCHERS IN SOUTHCENTRAL ALASKA

Investigator: David F. Tessler, Alaska Department of Fish and Game

Flooding of black oystercatcher nests has been documented as an important cause of nest failure in Prince William Sound, Kenai Fjords National Park, and Glacier Bay National Park. The majority of nest failures due to flooding generally occur in synchrony during the peak of the lunar tide cycle. Within a local breeding area many nests may be lost on the same day, or within days of one another due to sea water inundation. The nests at greatest risk of flooding appear to be beach nests. Nests on cliffs or rocky islets appear to be less prone to loss from flooding.

To test the hypothesis that boat wakes (either from large vessels or small craft) might contribute significantly to nest loss should they coincide with periods of particularly high tides, we developed a salt water data logger with Advanced Telemetry Systems (ATS) that records the date, time, and duration of sea water immersion. The loggers make conductivity measurements at 0.25 second intervals and are thus capable of differentiating between a sustained period of tidal flooding and an overwash from a wave or boat wake.

In 2008 we monitored productivity and causes of loss at 23 black oystercatcher territories in Harriman Fjord, Prince William Sound, an area of particular importance to breeding black oystercatchers that experiences relatively high volumes of recreational and tour boat traffic.

Only 16 of 23 traditionally occupied territories were defended by breeding pairs in 2008. We installed salt water data loggers adjacent to each nest and conducted nest visits at four to five day intervals. If a nest was lost, we continued to monitor the territory to determine if the pair would attempt to renest, and all subsequent nests were paired with salt water loggers. We instrumented 22 nests in all. Nineteen nests were located on low sloping gravel beaches; the remaining 4 nests were on isolated rocky islets, cliffs, or glacial moraines. High spring tides swept the Harriman Fjord from June 2-6 and again July 3-5 2008. Only 5 of the 22 nests were successful fledging at least one chick; the remaining 17 nests failed, yet productivity was at the higher end of ranges observed using the same monitoring protocols in previous years. In 2008 hatching success (hatched eggs * total eggs laid^{-1}) was 25%, nest success (proportion of nests fledging at least one chick) was 23%, and overall productivity (fledged chicks * breeding female^{-1}) was 0.62, while the ranges for these values from 2003-2006 were 13-25%, 6-28%, and 0.2-0.89 respectively. Three of four (75%) non-beach nests were successful, with the only loss due to depredation. Only 2 (10%) beach nests were successful, with flooding accounting for 55% of losses and depredation the remaining 45%. Overall, flooding accounted for 53% of nest losses (n=9), while predation accounted for the remainder (n=8). However, regardless of the direct cause of loss, 16 of the 22 nests flooded at some point. Twelve of 16 first clutches were lost, and while flooding was the direct cause of loss for just 7 of these clutches, 4 of 5 depredated nests were also flooded prior to the predation event. Of the 6 renesting attempts, only 1 was successful: flooding took 2 nests, predation 3. However, again regardless of cause of loss, all but one of the lost second clutches flooded, and the only successful re-nest also flooded over a period of 2 nights but survived. The only second clutch that did not flood was eventually depredated. All 2nd nests in which the 1st nest was flooded, were also flooded, suggesting that heavy shoreline snowpack at the onset of breeding is not the driving cause for oystercatchers placing nests below the spring high tide line. Data from the salt water loggers indicates that all flooding events occurred at night between the hours of 23:00 and 04:30 when tour boats are not operating and when recreational boat activity is the least likely. Logger data also demonstrated that all flooding events were long duration tidal inundation, and were synchronized among territories – none were of a short period typical for waves of any kind. The results indicate that tidal flooding remains an important force influencing black oystercatcher productivity, however there was no evidence that boat wakes contributed to the flooding losses in Harriman Fjord in 2008.

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#36 POPULATION DEMOGRAPHY AND MOVEMENTS OF BRISTLE-THIGHED CURLEWS (*NUMENIUS TAHITIENSIS*) ON THE JAMES CAMPBELL NATIONAL WILDLIFE REFUGE, OAHU, HAWAII

Investigators: Lee Tibbitts and Dan Ruthrauff, US Geological Survey - Alaska Science Center; Jared Underwood, US Fish and Wildlife Service - Hawaiian and Pacific Islands NWR Complex

Bristle-thighed Curlews nest in two relatively small areas in western Alaska and winter exclusively on low-lying atolls and islands in Oceania. A recent influx of curlews onto James Campbell National Wildlife Refuge (4.5 km^2) on Oahu, Hawaii, provided us with an opportunity to investigate the dynamics of this expanding population and to assess its habitat needs on 'high' islands. In the past 12 years, wintering numbers on the refuge have increased from just a few sightings per year to peak counts at winter roosts of about 65 birds. We initiated a study in October 2012 with three main objectives: determine the number of curlews using the refuge, describe their movement patterns, and measure demographic parameters (e.g., age structure and breeding origin). As of October 2013 we have color-marked and flagged 33 birds to allow a mark-recapture approach to estimating population size and have conducted 25 refuge-wide surveys to assess numbers and habitat use. Satellite-tagged curlews (*n* = 6) spent most of their time on the refuge, but some regularly used private lands within ~5 km of the refuge for feeding and roosting during the day. Birds also occasionally made brief trips to the adjacent Hawaiian Islands of Kauai, Hawaii, and Molokai. Four satellite-tagged curlews migrated to Alaska in mid-May in non-stop flights that took about 3 days. Upon arrival in Alaska, birds staged near the coast of the Togiak National Wildlife Refuge and near the mouth of the Kuskokwim River before heading to breeding grounds on the Andreafsky Wilderness (*n* = 2 individuals) and Seward Peninsula (*n* = 2). Fall departure dates ranged from 12–22 August, and southbound flights were also direct and fast taking 3–4 days. The 2 satellite-tagged individuals that did not migrate were both sub-adults that remained on the refuge throughout the summer. Current work involves deploying more satellite tags, retrieving geolocators, and further assessing the characteristics of the refuge that promote its use by nonbreeding curlews.

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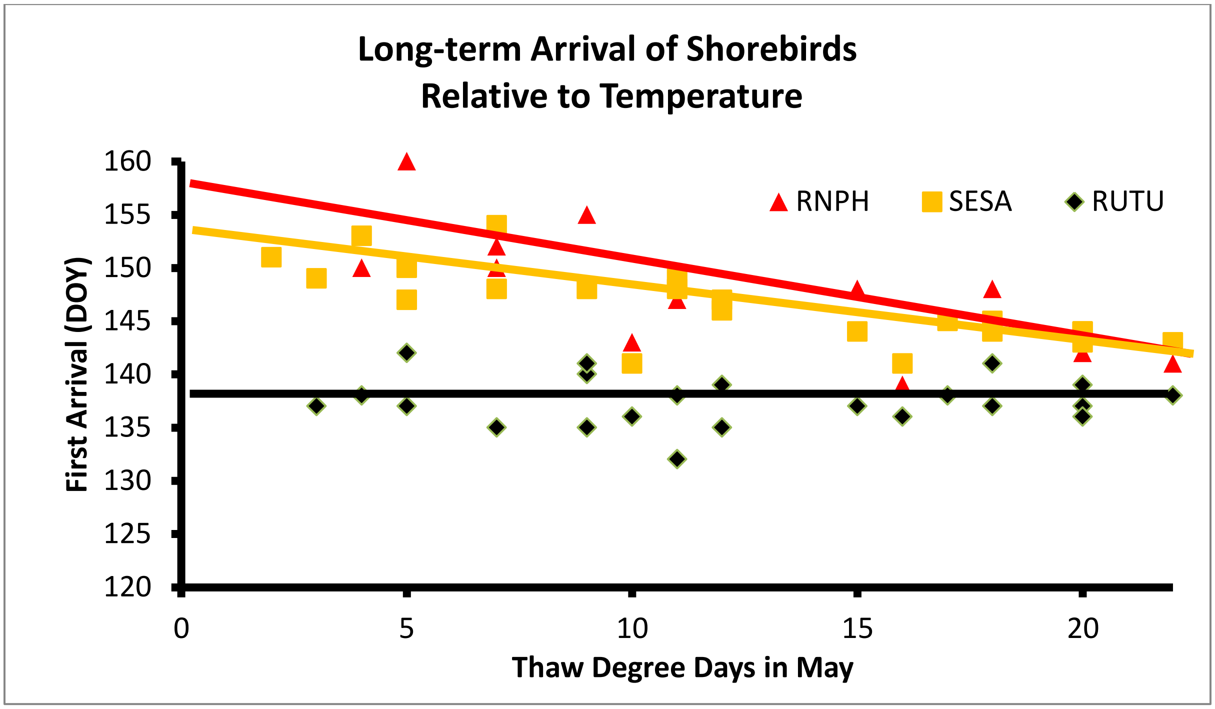
Curlews captured in James Campbell National Wildlife Refuge, Hawaii

#37 COLVILLE ASDN PROJECT- EFFECTS OF CHANGING PHENOLOGY ON SHOREBIRD MIGRATION AND REPRODUCTION ON THE COLVILLE RIVER DELTA

Investigators: David Ward and Jerry Hupp U.S. Geological Survey- Alaska Science Center

This study is investigating the impacts of climate change on timing of migration and breeding of avian migrants to understand whether these migrants are keeping pace with advancing trends in the phenology of resource availability in the Arctic. 2013 marked the third year for field research on shorebird nesting ecology in the Colville River Delta using Alaska Shorebird Demographic Network (ASDN) protocols. Data were collected on timing of arrival, nest initiation and hatch on 6 focal species of shorebirds (and several other species). In general, the timing of nesting and hatch of shorebirds in 2013 fell between 2011 (early) and 2012 (late). In 2013, we resighted 29 previously marked shorebirds (8 Dunlin, 3 Red Phalarope, 3 Ruddy Turnstone, and 15 Semipalmated Sandpiper), and captured and banded 62 new adults (18 Dunlin, 9 Red-necked Phalaropes, 19 Ruddy Turnstones, and 16 Semipalmated Sandpiper). Extra effort was placed on capturing and banding Ruddy Turnstones to deploy geolocators on breeding adults to better understand their migration patterns. Twenty-two birds were captured: 19 were previously unmarked and received geolocator-attached bands while the other 3 were recaptures of birds carrying geolocators deployed in 2012. A preliminary review of the geolocator data indicated that these 3 Ruddy Turnstones wintered in Mexico and migrated along Pacific and Bering Sea coasts. We are also working with Jim and Teena Helmericks to assess their many years of observations of avian arrivals to the Colville River Delta. Below is a graph of trends in the timing of arrival of 3 shorebird species relative to temperature (Thaw-degree days) in May, illustrating the variation in how avian migrants are responding to climate warming in the Arctic.



#38 AVIAN MALARIA SURVEILLANCE IN ARCTIC BREEDING SHOREBIRDS

Investigators: Samantha Wisely and Claudia Ganser, University of Florida
Co-investigators: Richard Lanctot, David Lank, Brett Sandercock, River Gates, Joe Liebezeit, Steve Zack, David Ward, Dave Payer, Stephen Brown, Paul Smith, Grant Gilchrist, Joel Bety, Jean Francois Lamarre, Erica Nol, Nathan Senner and Jennie Rausch

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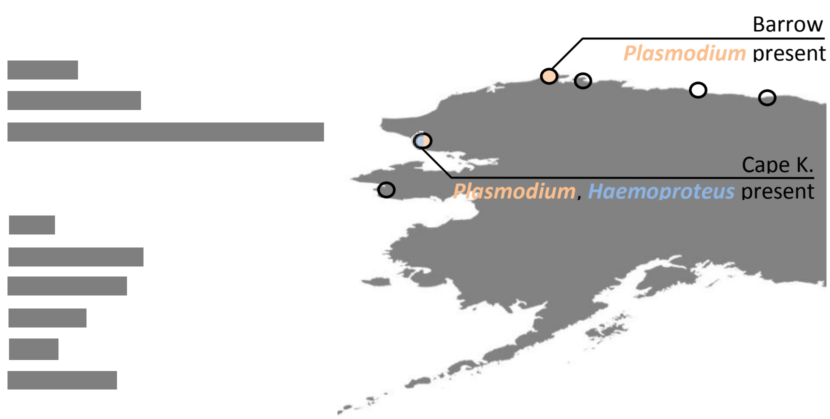
Avian malaria is an extensively studied disease system due to the diversity of host species and a nearly global distribution (Valkiunas 2005). The disease agent is comprised of a paraphyletic group of haematozoa in three families (Plasmodidae, Haemoproteidae, and Leucocytozoidae) which are spread via dipteran vectors (Bensch et al. 2000). Migrating species are most vulnerable to infection with haematozoa due to their global distribution and utilization of a wide range of habitats. Hence, parasite burden in migrants may be significantly increased which has implication for the global spread of infectious disease. To date most studies of the avian malaria causing haematozoa and their diversity in migratory species has been focused on passerines, nearly 87% of the reported haematozoa parasites were obtained from this order (MalAvi database). Little is known about the haemoatozoa diversity in Charadriiformes. Only about 0.6% of the reported haemoatozoa parasites were obtain from this order (MalAvi databases). Thus, to understand the diversity of avian malarial parasites we examined the geographic distribution and host breadth of haematozoa species recovered from Arctic-breeding shorebirds.

We screened all 419 blood samples for avian malaria using polymerase chain reaction to amplify DNA of haematozoa, and found 10 (2.39%) positive for haematozoa, which is consistent with previous studies that observed low parasite prevalence in the high Palearctic (Pierce 1981, Earle et al. 1993, Mendes et al. 2005) and Nearctic (Yohannes et al. 2009, Loiseau et al. 2012). A comparative study on the differences between avian malaria infections in wintering grounds (Tropics) and breeding grounds (Arctic) found that prevalence was higher in the wintering grounds of most migratory species, with the exception of species relevant for this study (Dunlin, Eurasian and Pacific Golden Plover, Pectoral Sandpiper and Red-necked Phalarope; Mendes et al. 2005). Hence, low haematozoa prevalence could be due a variety of factors such as few parasite vectors across migratory routes, annual fluctuations in epidemiological cycles, or immunological fitness of host species (Cardona et al. 2002, Garvin et al. 1997).

Prevalence was variable across shorebird species (American Golden Plover=0%, Common Snipe=0%, Dunlin=1.03%, Long-billed Dowitcher=4.76%, Pectoral Sandpiper=4.35%, Red Phalarope=0%, Red-necked Phalarope=2.86%, Ruddy Turnstone=0%, Semipalmated Sandpiper=2.00%, Western Sandpiper=4.17%, White-rumped Sandpiper=0%). Contrary to the general rule of low haematozoa prevalence in coastal and marine habitats (Valkiunas 2005) and findings by Mendes et al. (2005) and Yohannes et al. (2009), we did not find higher prevalence in species associated with freshwater inland habitats. Prevalence was also variable across sampling sites (Barrow=2.80%, Canning River=0%, Cape Krusenstern=4.76%, Colville River Delta=12.5%, Ikpikpuk=0%, Nome=0%).

We detected two *Plasmodium* species in two shorebird samples. One species (ASDN197100785) that we detected in Semipalmated Sandpiper from Cape Krusenstern (Alaska) was also found in Pectoral Sandpiper from Barrow (Alaska; Yohannes et al. 2009). This *Plasmodium* species has a narrow geographic range and is currently only found in North America and Asia. The host breadth spans across 10 species from 4 Orders including Charadriiformes, Passeriformes, Piciformes and Strigiformes. We detected another *Plasmodium* species (ASDN245116072) in Pectoral Sandpiper from Barrow that is currently found in 31 countries across both the Eastern and Western Hemisphere. In addition to the broad geographic range of this *Plasmodium* species, it exhibited an equally broad host range of 107 species from 5 Orders including Anseriformes, Charadriiformes, Falconiformes, Passeriformes and Strigiformes. We also detected a *Haemoproteus* species (ASDN197100714/715) in Semipalmated Sandpiper and Western Sandpiper from Cape Krusenstern with a geographic range of 25 counties across the Eastern and Western Hemisphere. Although this *Haemoproteus* species was only found in 57 species, it had the largest breadth of host species, infecting avian species within 9 Orders including Anseriformes, Charadriiformes, Columbiformes, Coraciiformes, Cuculiformes, Passeriformes, Piciformes, Psittaciformes and Strigiformes.



Site	Prevalence/individuals screened ($n_{screened}/n_{positive}$)		
Barrow	2.80%	(179/5)	
Cape K.	4.76%	(63/3)	
Colville	12.50%	(16/2)	

Species	Prevalence/individuals screened ($n_{screened}/n_{positive}$)		
DUNL	1.03%	(97/1)	
LBDO	4.76%	(42/2)	
PESA	4.35%	(46/2)	
RNPH	2.86%	(35/1)	
SESA	2.00%	(100/2)	
WESA	4.17%	(48/2)	

Figure 1. Avian malaria prevalence by sampling site (Barrow, Cape Krusenstern, Colville River Delta) and species (DUNL=Dunlin, LBDO=Long-billed Dowitcher, PESA=Pectoral Sandpiper, RNPH=Red-necked Phalarope, SESA=Semipalmated Sandpiper, WESA=Western Sandpiper).

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