



Alaska Shorebird Group

Annual Summary Compilation:
New or ongoing studies
of Alaska shorebirds

December 2014



A red knot on the Seward Peninsula. Photo by L. DeCicco.

EXECUTIVE SUMMARY

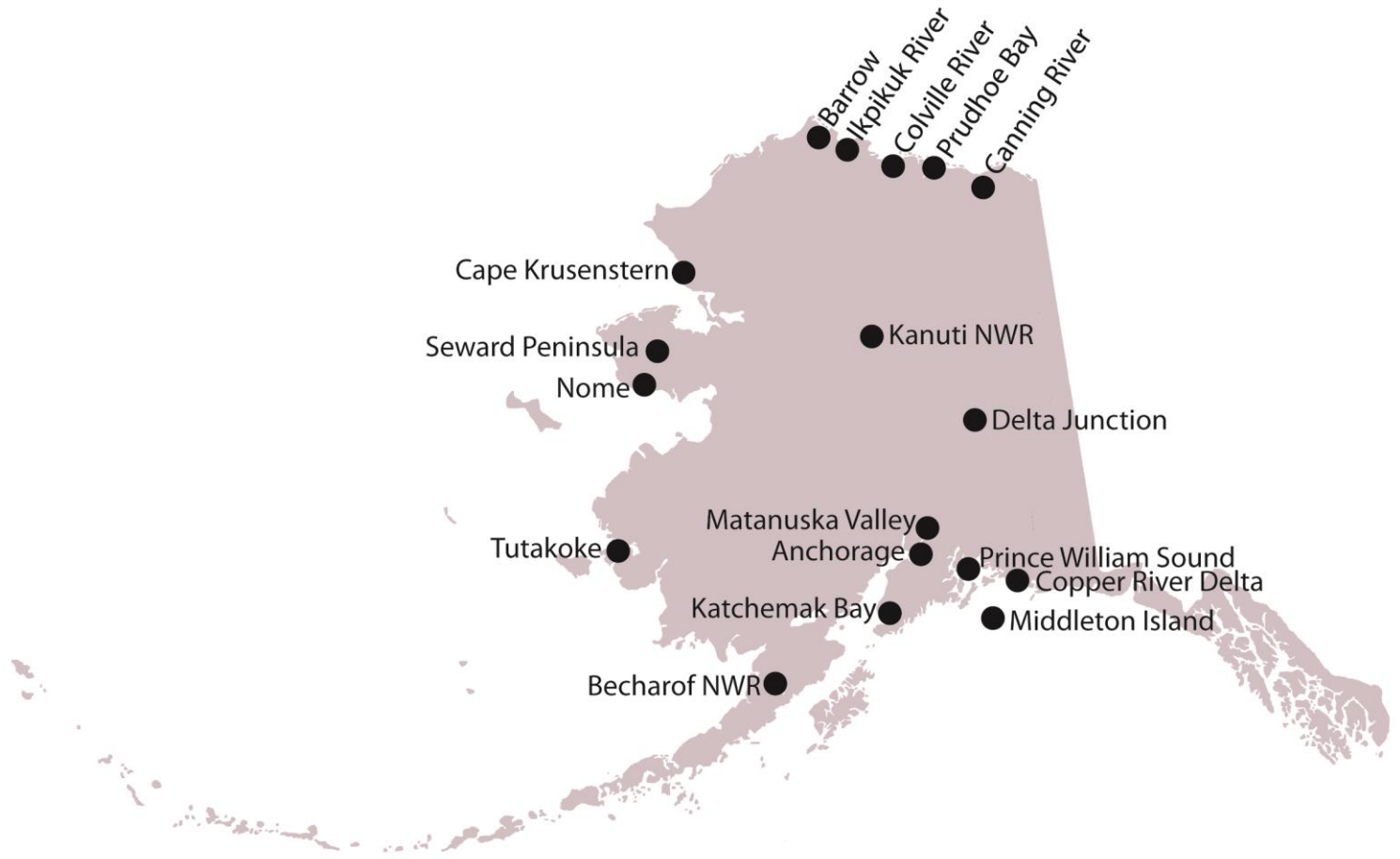
Erin Cooper, Alaska Shorebird Group Secretary

Welcome to the 2014 summary report of ongoing or new studies of Alaska shorebirds. This is the fourteenth consecutive report put together by the Alaska Shorebird Group. In this document members of the Alaska Shorebird Group compiled annual summaries for 31 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 32 unique projects there were a total of 78 investigators, 25 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. Universities took the lead (co-lead) in the most projects (12) with 38% of the total projects including University of Alaska Fairbanks, Kansas State University, University of Alaska Anchorage, Simon Fraser University, Cornell, and the University of Florida. Non-government organizations (NGO) included the Wildlife Conservation Society ($n = 3$), Alaska Biological Research Inc. ($n=2$), Manomet Center for Conservation Sciences ($n = 2$) and Prince William Sound Science Center ($n = 2$). The U.S. Fish and Wildlife Service ($n = 5$) spearheaded a number of projects and led the way for government agencies. The Katchamak Bay Birders were once again 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. This statewide distribution is a duplicate of the 2013 project distribution. 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.

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 2014 Alaska Shorebird Group Projects throughout Alaska. Locations may represent more than one project.

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

Investigators: Rebecca Bentzen and Martin Robards, 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 2014, we discovered and monitored 135 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 Lapland Longspur nests accounted for the majority (61%) of those found. Among all species, 56 nests successfully hatched/fledged, 63 failed, and 16 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

Within the framework of our pre-existing breeding bird studies, we established Prudhoe Bay as an Arctic Shorebird Demography Network (ASDN) site in 2010. In 2014, we continued this partial-ASDN effort. This involved monitoring nests but no banding activities in 2014. 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, 28 SESA, 1 DUNL, 7 REPH, and 14 RNPH nests were found (total 50).

We also established Ikpikpuk as an Arctic Shorebird Demography Network (ASDN) site in 2010. In 2014, 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. Nest monitoring, including predator activity, lemming abundance, and snow cover, was also collected and contributed toward the ASDN effort (see following Table).

Species	# nests	# successful	# failed	# unknown fate	% success
AMGP	1	1	0	0	1.00
ARTE	7	2	4	1	0.33
BBPL	4	0	3	1	0.00
BRAN	1	1	0	0	1.00

BTGO	1	0	1	0	0.00
DUNL	17	3	11	3	0.21
GWFG	20	12	8	0	0.60
LBDO	1	0	1	0	0.00
LTDU	1	0	1	0	0.00
PALO	4	2	2	0	0.50
PESA	14	4	7	3	0.36
REPH	22	14	6	2	0.70
RNPH	27	15	10	2	0.60
SESA	58	19	27	12	0.41

*% success based on percentage of nests successfully hatching one or more chicks and not based on exposure days

The following table contains a summary of target species captured and banded, and samples taken on the ASDN adult survivorship plots at Ikpikpuk in 2014. 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.

Species	# captured	# recaptures	# feather	# genetic	# malaria	# fecal	# geolocator
DUNL	4	2	3	4	4	1	0
REPH	4	1	3	4	4	1	0
RNPH	5	2	3	5	5	1	0
SESA	17	9	15	15	15	2	3

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

Investigators: Rebecca Bentzen, Martin Robards, Joe Liebezeit, and Stephen Dinsmore

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 2014 we completed the 3rd and last year of the study. We set out surrogate shorebird and duck nests on 4 transects for a total of 228 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.

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

Investigators: Rebecca Bentzen, Martin Robards, and Joe Liebezeit

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 2014, we continued a project (3rd and final year) 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. In 2014, we had 491 detections of a total of 622 individuals. 251 of those detections and 326 of those individuals were detected on rehab plots. 240 of those detections and 296 of those individuals were detected on paired undisturbed plots. 12 nests were discovered on the rehabilitated plots. 4 nests were located off of the gravel pad and were in the buffer zone, or within an area of gravel spillover into the tundra. The vegetation associated with these 4 nests was more closely related to natural tundra than to the rehabilitated pad, but still were influenced by the pad. Of the 12 nests, 4 fledged young, 7 failed, and 1 is unknown. 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 and bird density analyses.

#4—A PILOT STUDY TO IDENTIFY RED KNOT STOPOVER AREAS ON THE COPPER AND BERING RIVER DELTAS

Investigators: Mary Anne Bishop, Prince William Sound Science Center, Joseph Buchanan, Washington Department of Fish and Wildlife, and Jim Johnson, US Fish and Wildlife Service, Migratory Bird Management

With an estimated population of 22,000 individuals, the Red Knot (*Calidris canutus roselaari*) is one of the smallest and least studied shorebird populations in North America. Since 2011, resightings of Mexico-banded *roselaari* as well as US Forest Service surveys have shown that Alaska's Copper River Delta is a major Red Knot stopover area during spring. On 13 May we captured and radiotagged 20 Red Knots at Grays Harbor, Washington, the most important stopover north of the wintering grounds in northwestern Mexico. Our objective was to identify stopover areas on the Copper River Delta and the adjacent Bering River Delta. On seven consecutive days between 15 and 21 May, aerial telemetry surveys covered both deltas. In all, 12 of the 20 radiotagged knots were detected. First detections (n = 3 knots) occurred on 17 May and peak detections occurred on 19 and 20 May when 11 radiotagged knots were detected. Our monitoring concluded at a time when knots, including additional marked birds, were likely still migrating north from Washington. Controller Bay (Bering River Delta) was the most important stopover area during our surveys with 10 of the 12 knots detected there while two knots stopped over on the Copper River Delta. These results are in stark contrast to previous ground surveys that identified the western edge of the Copper River Delta as an important stopover area. We suggest that different subpopulations of Red Knots are using different stopover areas within the Copper and Bering River deltas.

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

#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 31 May and 6 June 2014, we located 21 nests, including 19 with full clutches. In all, we banded seven adult Semipalmated plovers and resighted 19 plovers banded previously on Egg Island. Additional field work is planned for Egg Island in 2015.

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

#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.; and Stephen Brown, Manomet Center for Conservation Sciences

In 2014, we undertook the fourth year of study for the Arctic Shorebird Demographics Network (ASDN) at Cape Krusenstern National Monument in western Alaska. This was the fifth year of shorebird-related work at our site, which is located adjacent to Krusenstern Lagoon, approximately 30 miles northwest of Kotzebue, Alaska. We conducted nest searching, banding and biological sample collection, and environmental monitoring activities between 23 May and 7 July. Over the course of our field season, we located 133 nests of 6 shorebird species, including Black Turnstone, Dunlin, Semipalmated Sandpiper, Western Sandpiper, Red-necked Phalarope, and Red 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 (Table 1). Average initiation dates were variable among species and years. Notably, this season marked the first known breeding Red Phalarope (nest initiated 9 June) over the past five years of data collection at Cape Krusenstern.

Table 1. Average (± 1 SD) nest initiation dates for focal shorebird species breeding at Cape Krusenstern, Alaska, 2011-2014.

	2011	2012	2013	2014
Dunlin	3 Jun \pm 5.2 d n = 14	6 Jun \pm 5.0 d n = 22	7 Jun \pm 6.8 d n = 22	5 Jun \pm 11.2 d n = 16
Semipalmated Sandpiper	2 Jun \pm 5.7 d n = 36	8 Jun \pm 3.6 d n = 55	6 Jun \pm 6.5 d n = 40	5 Jun \pm 5.3 d n = 34

Western Sandpiper	7 Jun \pm 10.5 d n = 10	10 Jun \pm 5.2 d n = 35	8 Jun \pm 7.3 d n = 65	5 Jun \pm 7.0 d n = 53
Red-necked Phalarope	14 Jun \pm 7.9 d n = 12	11 Jun \pm 4.0 d n = 18	12 Jun \pm 5.0 d n = 13	11 Jun \pm 6.3 d n = 26
Black Turnstone	-	2 Jun \pm 3.5 d n = 14	17 Jun \pm 10.0 d n = 5	3 Jun \pm 4.2 d n = 3

Fate of approximately 29% of the nests was unknown or undetermined, which was higher than in previous years. We observed depredation of adult sandpipers by Parasitic Jaegers in 2014; and it is likely they presented a predation risk for newly-hatched chicks, although this was not documented. Some of the nests with unknown fate may have hatched, but predation of chicks took place before chicks could be observed during routine nest monitoring. Dunlin showed the highest apparent success in 2014, followed by Semipalmated Sandpiper, Western Sandpiper, and Red-necked Phalarope (Table 2). We did not monitor hatching success of Black Turnstones since they were located too far from our main study plots. Overall, apparent nest success was higher in 2014 than in 2013, but it was much lower than in 2012 and 2011.

Table 2. Apparent nest success (percentage of nests that hatched one or more chicks) for focal shorebird species breeding at Cape Krusenstern, Alaska, 2011-2014.

	2011	2012	2013	2014
Dunlin	100% n = 12	75% n = 22	27% n = 22	42% n = 12
Semipalmated Sandpiper	85% n = 30	69% n = 51	7% n = 40	31% n = 29
Western Sandpiper	85% n = 6	74% n = 31	12% n = 65	23% n = 39
Red-necked Phalarope	85% n = 6	50% n = 18	31% n = 13	11% n = 19

Captured adults were marked with engraved flags and/or colored darvic bands and metal bands. We banded a total of 161 adults, including 24 Dunlin, 70 Western Sandpiper, 45 Semipalmated Sandpiper, 17 Red-necked Phalarope, 1 Red Phalarope, and 4 Black Turnstone. We measured morphological characteristics of adult birds and collected feather, fecal, and blood samples. We weighed and banded 54 chicks, including 13 Dunlin, 21 Western Sandpiper, 16 Semipalmated Sandpiper, and 4 Red-necked Phalarope.

In addition to the above shorebird work, we conducted frequent (every 1-3 days) predator surveys, monitored surface water and weather conditions, and documented nesting habitat types. We participated in a number of collaborative projects, including avian malaria and gut microbiota of a variety of adult shorebirds, and two broad-scale migratory connectivity studies for Semipalmated Sandpipers and Black Turnstones. We recaptured individuals equipped the previous year with light-level geolocators, recovering 7/18 geolocators on Semipalmated Sandpipers and 2/5 on Black Turnstones. Summaries of collaborative 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 81 species of birds in the study area, comprised of 26,412 individual observations over the season. Our most abundant observations (>500 observations over the season) were Pacific Loon, Tundra Swan, Black Brant, Northern Pintail, Long-tailed Duck, Red-breasted Merganser, Sandhill Crane, Dunlin, Pectoral Sandpiper, Semipalmated Sandpiper, Western Sandpiper, Red-necked Phalarope, Long-tailed Jaeger, Glaucous Gull, Mew Gull, Arctic Tern, and Lapland Longspur. Our most common (>150 individuals/season, with approximately 5-10 individuals sighted per day) migrants or local breeders included Greater White-fronted Goose, Greater Scaup, Bar-tailed Godwit, Long-billed Dowitcher, Sabine's Gull, Parasitic Jaeger, Savannah Sparrow, and Redpoll species. Our most uncommon observations (<5 observations) included Short-eared Owl (21, 27, 31 May), Slaty-backed Gull (21 May; 4, 8, 29 June), Bald Eagle (21 May & 27 June), Surf Scoter (24 May), Wilson's Snipe (25-27 May), Bristle-thighed Curlew (26 May), Wandering Tattler (26 May), White-crowned Sparrow (26 May), Buff-breasted Sandpiper (28 May), Semipalmated Plover (29 May), Horned Lark (30 May), Ruddy Turnstone (30 May), Osprey (31 May & 4 June), Red-necked Stint (4 June), Falcated Duck (10 June), Peregrine Falcon (20 June & 6 July), Eurasian Wigeon (21, 23, 24 June), Hudsonian Godwit (29 June), and Caspian Tern (3 July).

Besides the breeding shorebirds noted above, we confirmed the breeding status of an additional 22 bird species in areas within and adjacent to our study plots. These were Red-throated and Pacific Loons, Tundra Swan, Greater White-fronted Goose, Green-winged Teal, Northern Pintail, Greater Scaup, Common Eider, Long-tailed Duck, Sandhill Crane, Willow Ptarmigan, Long-billed Dowitcher, Mew Gull, Glaucous Gull, Sabine Gull, Arctic Tern, Parasitic Jaeger, Common Raven, Lapland Longspur, Eastern Yellow Wagtail, Savannah Sparrow, and Redpoll species.

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#7—ASSESSING SHOREBIRD USE OF LAGOONS IN CAPE KRUSENSTERN NATIONAL MONUMENT, 2014

Investigators: Megan Boldenow and Jared Hughey, University of Alaska Fairbanks; Stacia Backensto and Jeremy Mizel, National Park Service; and Abby Powell, U.S. Geological Survey Alaska Fish and Wildlife Cooperative Research Unit

Purpose

Habitats along the coastline of Cape Krusenstern National Monument (CAKR) include lagoons and estuaries, areas known to be important for waterbirds during spring and fall migration. These habitats are vulnerable to potential impacts from climate change, offshore energy development, and increased arctic shipping. There is relatively little information regarding the use of specific coastal habitats by migrating waterbirds, including their distribution within CAKR. Anecdotal and historic information suggest that the coastline of CAKR may be important to a number of shorebird species that congregate there in large numbers prior to fall migration.

To document contemporary use, we conducted post-breeding surveys of shorebirds at Sisualik Spit, including Sisualik Lagoon and adjacent areas. This work will contribute to an updated assessment of waterbird use of coastal habitats at Western Arctic Parks generally, and at CAKR and the Sisualik Lagoon area more specifically. Surveys conducted in 2014 give an indication of shorebird abundance and community composition at Sisualik Spit during the post-breeding season, as well as timing of use. Incidental observations of other birds were also recorded.

Results

Between 23 July and 9 August, 2-3 observers surveyed habitats at Sisualik Spit for use by shorebirds. A total of 19 shorebird species were observed during the study period, out of a total bird species count of 70; on average, 11 (range 7-16) species of shorebirds were seen per day. These species were comprised of approximately 10,300 individual shorebirds, out of a total count of 14,482 individual birds.

Our most abundant shorebird observations (>500 observations over the season) were Western Sandpiper, Semipalmated Sandpiper, Dunlin, and Red-necked Phalarope. Our most common (>100 individuals/season, with approximately 5-10 individuals sighted per day) migrants or local breeders included Least Sandpiper, Pectoral Sandpiper, and Long-billed Dowitcher. Our most uncommon observations (<5 observations) included Stilt Sandpiper.



The Cape Krusenstern crew with a geocator SESA, captured using recorded SESA calls and a mistnet. Proud moment! Photo by Jared Hughey.

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#8 ARCTIC SHOREBIRD DEMOGRAPHICS NETWORK: OVERVIEW

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

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, Cape Krusenstern, Barrow, the Ikpikuk River, Canning River, Colville River, and Prudhoe Bay. Sites in Canada include Mackenzie Delta, Churchill, Bylot Island, East Bay, Burntpoint Creek, Coats Island and Igloolik, whereas sites in Russia include Chaun Delta and Lower Khatanga River (none are described in this annual summary).

Fifth Year Completed

2014 marked the fifth of five years where data were collected in the field. In preparation for this work, the protocol subcommittee revised the 2013 field protocols (based on feedback from the fourth year and changes in side-project participants). 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 2014, personnel from the 16-site Network located ca. 2300 nests belonging to 34 species, and banded > 1800 individuals belonging to 18 species. Throughout the entire 5-year study, field personnel at the 16 sites located >8,800 nests belonging to 37 species, and banded >11,300 birds belonging to 29 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 projects are some examples of side projects that have been implemented by Network Collaborators: Dunlin migratory connectivity, pond hydrology and insect emergence, Semipalmated Sandpiper migratory connectivity (# xx), American Golden-Plover migratory connectivity, invertebrate prey and shorebird hatch mismatch (# xx), spring phenology and timing of nesting (# xx), and avian health studies (#31 [avian malaria], #12 [gut microbiota]).

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. Finally Emily Weiser is the research associate primarily focused on data analysis related to adult and nest survival, as well as other data analysis projects.

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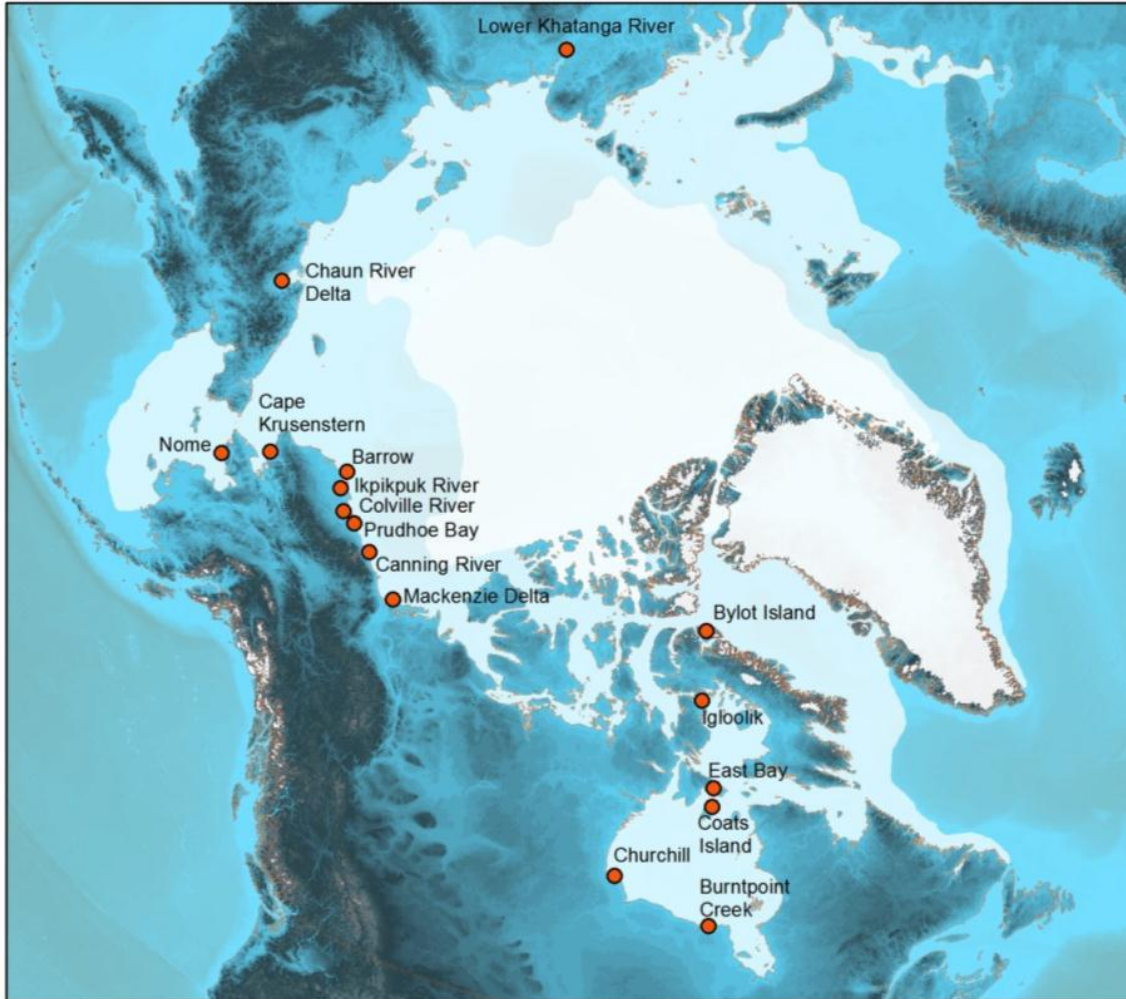


Figure 1. Arctic Shorebird Demographics Network sites in 2014.

#9—CANNING RIVER DELTA, ARCTIC NATIONAL WILDLIFE REFUGE 2014 SUMMARY

Investigators: Stephen Brown, Manomet Center for Conservation Sciences; Dave Payer, USFWS-Arctic National Wildlife Refuge; Scott Freeman, USFWS-Arctic National Wildlife Refuge; Ian Davies, Manomet Center for Conservation Sciences .

This was the fifth and final season for field studies at the Arctic Shorebird Demographic Network (ASDN) site at the Canning River Delta, Arctic National Wildlife Refuge. Work at this site is a collaboration between Manomet Center for Conservation Sciences and the US Fish & Wildlife Service-Arctic National Wildlife Refuge.

A field camp was established on 3 June. The first nests were found on 7 June and nest numbers picked up rapidly, reaching a peak of 222 active shorebird nests on 26 June. Overall, we encountered 485 nests representing 28 species, of which 405 were shorebird nests. This exceeded the previous record of 280

nests in 2013. The high nest numbers were driven primarily by Pectoral Sandpipers, with 209 nests, more than 10 times the number of nests for this site and species compared to their lowest-density year (2012). Red Phalaropes also had their highest year (N=69 nests). Nesting statistics by species are given in Table 1.

Nest success was relatively high this year, i.e., 50% for all shorebirds combined. This was not surprising given declining lemming numbers over the previous 3 seasons (based on incidental sightings), and the likely concurrent decline in fox abundance (Table 2).

We recorded 184 resights of banded birds, including 60 individuals banded between 2010 and 2013. Resighted individuals by species are reported in Table 1. Some birds banded prior to 2010 were also recorded, including 1 Dunlin and 1 Semipalmated Sandpiper. Of the 62 individuals resighted, all but 5 were documented by photos. We captured 92 birds this year (Table 1). Geolocators were recovered from 13 of 29 Semipalmated Sandpipers that received instruments in 2013. Only 1 bird with a geolocator was observed but not caught, a female that probably nested with an unbanded male, and whose nest was never located.

Another noteworthy phenomenon was a high abundance of avian predators, including Short-eared Owls, Rough-legged Hawks, and Northern Harriers. These birds are usually only seen in small numbers. In combination with the usual early-season abundance of Pomarine Jaegers, as well as some Snowy Owls and other jaeger species, the air was usually filled with predators. Shorebird nest success was high in spite of this, although it may have caused some species, particularly Semipalmated Sandpipers, to alter their predator avoidance strategies.



Banded Sandpiper on the Canning River Delta

Table 1. 2013 Shorebird nests, nesting success, resights of banded birds, and captures at Canning River Delta, Arctic National Wildlife Refuge, 2014.

Species	Nests (N)	Success (%)	Resights (N)	Captures (N)
AMGP	2	50		
BBSA	5	20		
DUNL	11	64	8 (13%)	9
LBDO	2	100		
PESA	209	48		24
REPH	69	39		21
RNPH	34	53	6 (12%)	11
RUTU	3	67		
SESA	67	63	46 (18%)	27
STSA	3	100		
Total	405	50	60	92

Table 2. Incidental sightings of lemmings and arctic foxes, and SESA nest success at the Canning River Delta, Arctic National Wildlife Refuge, 2014.

Year	Lemmings (N)	Arctic Foxes (N)	SESA Nest Success (%)
2010	14	16	79
2011	197	48	65
2012	116	78	14
2013	26	46	34
2014	61	55	63

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#10—BLACK OYSTERCATCHER SURVEYS IN PRINCE WILLIAM SOUND – 2014 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 2014, we surveyed areas in Prince William Sound including: College Fjord, Green Island, Eleanor Island, Port Gravina, Knight Island, Rocky Point, Simpson Bay, and Unakwik Inlet. A total of twelve active oystercatcher nesting territories were identified during the survey and an additional four sites were identified with non-breeding oystercatchers. The greatest densities of active oystercatcher territories were located in the College Fjord (5) and Green Island (5). Data from the 2014 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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#11—RED KNOT (*CALIDRIS CANUTUS ROSELARRI*) SURVEYS ON THE COPPER RIVER DELTA DURING SPRING MIGRATION

Investigators: Erin Cooper, U.S. Forest Service, Cordova, AK; Melissa Gabrielson, U.S. Forest Service, Cordova, AK

Little is known about the current status of the Red Knot (*Calidris canutus roselarri*). The Copper River Delta in south-central Alaska is one of the Western Hemisphere's most important shorebird stopover sites. Recently (2012 and 2013), thousands of Red Knots were observed on one of the more western barrier islands on the Copper River Delta (i.e. Little Egg Island). This led to questions about the Copper River Delta's importance as a stopover site for Red Knots. In 2013, the Copper River International Migratory Bird Initiative funded a small survey that documented the timing of the Red Knot migration and use of the Copper River Delta. In an effort to increase the knowledge about Red Knot stopover sites and use on the Copper River Delta, 2 observers were stationed on Little Egg Island from 7 – 16 May in 2014 to document Red Knot numbers, behavior, arrival times, departures, and document flagged individuals. This project was an extension of the survey that was conducted in 2013. The information collected from this effort will be tied in with other surveys that are being conducted to determine the interconnectedness of the Red Knot and its use of stopover sites along its migration pathway.

Results:

Total shorebird numbers were the largest on 8 May when approximately 13,288 were observed on Little Egg Island. The largest number of Red Knots was observed on 10 May (n ~ 4250). Total shorebird numbers and total Red Knot numbers began to decrease after 10 May. Red knots were consistently observed in the presence of Dunlin (*Calidris alpina*), Black-bellied Plover (*Pluvialis squatarola*), Short-billed Dowitchers (*Limnodromus griseus*), Western Sandpiper (*Calidris mauri*), and Ruddy Turnstones (*Arenaria interpres*). Whimbrels (*Numenius phaeopus*) and Marbled godwits (*Limosa fedoa*) were also observed during surveys.

Additional effort was put into resighting flagged Red Knots. Flagged Red Knots were first observed on 8 May. All of the flagged birds had a metal band on the lower right leg and a yellow flag over a red flag on the left leg (Guerrero Negro, Mexico). All flagged shorebirds observed were turned into bandingbirds.org for documentation. One of the flagged Red Knots was identified as 701. This bird was banded in Guerrero Negro, Baja California Sur. on October 17, 2009 as an adult. Flagged birds were observed until 11 May when they dispersed from Little Egg Island.



Melissa Gabrielson searches the flock for flagged birds. Photo Mike Aussman.

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#12—SHOREBIRDS OBSERVED DURING AUTUMN 2014 ON MIDDLETON ISLAND, GULF OF ALASKA

Investigators: Lucas DeCicco and Nicholas Hajdukovich, Jim Johnson, Steve Matsuoka, and Charles Wright, U.S. Fish and Wildlife Service; David Tessler, Alaska Department of Fish and Game

Species diversity and timing of autumn migrant shorebirds over the northern Gulf of Alaska has been studied from Middleton Island during the past four fall seasons. 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. Our dataset from Middleton Island gives us an insight in to the timing and species composition of shorebirds departing Alaska over the Gulf of Alaska.

In autumn 2014 we conducted our fourth and final season of migration monitoring on Middleton Island. Data were collected from 11 August to 16 October 2014. This was our longest season to date, successfully covering the latter portions of the migratory period for most shorebird species and the arrival of some wintering species. The information on shorebirds presented here is based on daily surveys of focal habitat types as well as complete coastal surveys. During five complete coastal surveys (13 August, 27 August, 6 September, 25 September, and 11 October) the entire perimeter of Middleton Island (ca. 30km) was surveyed in approximately 5 hours, centered about high-tide. This survey, focused

on the coastal obligate species, provided us with what we consider to be good estimates of the total population utilizing the Island at those times.

Our mid-August arrival, although early for passerine migrants (the main focus of this project) coincided with the highest number of Western, Least, and Semipalmated sandpipers we observed, suggesting that there is much to be learned of the migratory occurrence of these species in July and the first half of August in the northern Gulf of Alaska. These data complement those of two of our previous three seasons with similar temporal spans and as a whole represent a significant increase in knowledge of timing and species diversity of off-shore migratory shorebirds in the northern Gulf of Alaska.

Species diversity in 2014 was slightly lower than in the previous two comparable years (34 in 2014 cf. 37 in 2013 and 35 in 2012). The most common migrants—Least and Western sandpipers, and Wilson’s Snipe—occurred in similar numbers and temporal patterns as in previous years. Of note were the decreased numbers of Pectoral Sandpipers compared to previous years (see species account); complete lack of Red Knots (cf. small numbers in 2011, 2012, and 2013); higher than normal numbers of Lesser Yellowlegs and Semipalmated and Baird’s sandpipers; and the occurrence of a juvenile Red-necked Stint and an adult Gray-tailed Tattler. American Golden-Plovers and Upland, Stilt, Solitary, and Buff-breasted sandpipers—all previously considered to be unusual migrants in the region—were confirmed to occur annually in small numbers (corroborating previous seasons’ observations). Coverage during Jul and the first half of Aug would provide valuable insight into timing of the earlier migrants and would complement the information we have collected over the past four years. Below are species accounts summarizing the occurrence of all shorebirds recorded on Middleton Island during autumn 2014; habitat and age information, as well as comments on historical perspective are included when relevant.

Species Accounts:

Pluvialis squatarola. Black-bellied Plover. Single individuals of this uncommon and late migrant were observed from 1 September through 16 October. No adults were identified. This pattern of occurrence is not abnormal compared to our previous seasons. Little association with other *Pluvialis* plovers was noted.

Pluvialis dominica. American Golden-Plover. Single juveniles were identified on five occasions from 26 August through 6 September. Our observations over the past three seasons suggest that this primarily interior migrant occurs coastally on Middleton Island annually in small numbers during autumn. This species was only occasionally noted in association with *P. fulva*, generally preferring mud-dominated coastal bays and rotting kelp wrack.

Pluvialis fulva. Pacific Golden-Plover. This species was present throughout our stay. Age ratios were difficult to determine but adults, in low proportions, were noted through 14 September. After this date, only juveniles were observed. Daily counts were generally 20 or fewer throughout the season, with an increase in numbers from 25 September through 11 October when 30-40 birds were seen daily. Our peak count was 55 birds on 25 September.

Charadrius semipalmatus. Semipalmated Plover. This species was observed regularly from our arrival through 6 September. Strangling single juveniles were noted intermittently through 15 October with the exception of eight on 25 September. Numbers were highest through 18 August with daily counts of over 100 individuals not being uncommon; peak was 230 on 14 August. After 18 August numbers began to decline with high counts of 50-80 individuals through the end of August; up to 25 individuals were noted through 6 September. Juveniles dominated throughout the season with adults being present only during the last half of August. Of note was a single leucistic adult on 14 August.

Haematopus bachmani. Black Oystercatcher. This locally common breeder was observed throughout our stay with 600-800 individuals noted during the full coastal surveys between 13 August and 6 September. We observed a major exodus of this species at some point between 6 and 25 September—when numbers decreased from 599 to 133 on the full coastal surveys. Based on our incidental observations, this exodus likely occurred between 19 and 25 September. Our last full coastal survey (11 October) resulted in 90 individuals. We had not observed this departure during previous years. Both juveniles and adults were identified with adults outnumbering juveniles 5:1.

Actitis macularius. Spotted Sandpiper. This species is a common early migrant on Middleton Island. Our full coastal surveys noted 42 on 13 August, 38 on 27 August, and seven on 6 September. After this date we observed only two single juveniles: one on 16 September and a very late individual on 3 October. All birds seen well were identified as juveniles with the exception of one adult on 20 August. These data suggest that most migrants have moved out of the region by early September.

Tringa solitaria. Solitary Sandpiper. One to two individuals were noted routinely from our arrival on 11 August through 29 August with a peak of three on 27 August. This pattern agrees what we have observed in previous years. All birds seen well were juveniles.

Tringa brevipes. Gray-tailed Tattler. A single adult of this Asiatic species was documented on 18 August, loosely associated with Wandering Tattlers and Black Turnstones. This is the third record of the species for Middleton Island and the first adult.

Tringa incana. Wandering Tattler. This species slowly decreased in abundance throughout the season. Based on full coastal survey data, 168 were present on 13 August, 102 on 27 August, 65 on 6 September, 11 on 25 September, and 2 on 11 October (our last observation of the species). Adults dominated upon our arrival (e.g. of 60, 59 were adults on 12 August); the ratio changed to ca. 1:1 by 25 August then quickly swung to ca. 1:10 by the end of August. Adult numbers continued to decline with the last adult being observed on 14 September.

Tringa melanoleuca. Greater Yellowlegs. Peak of abundance in this species occurred from the end of August (e.g. 130 on 27 August) through mid-September (e.g. 179 on 11 September). Prior to this period we detected ca. 20 individuals per day. Daily numbers between 50 and 100 were noted from mid-September through 1 October, after which all daily totals were below 50 individuals. Few adults were observed and all during August; presumably there is an earlier migratory peak composed primarily of adults.

Tringa flavipes. Lesser Yellowlegs. Higher than normal numbers of this species were observed this season with the largest numbers noted upon our arrival (e.g. 156 on 12 August and 194 on 13 August). Numbers slowly decreased to ca. 60 individuals by 30 August, 12 were noted on 7 September, and our last observation was of eight individuals on 14 September. This species was exclusively observed in the brackish lagoon at the NE corner of the island and for this reason we were easily able to estimate numbers throughout the season. One to three adults were noted from our arrival through 26 August.

Bartramia longicauda. Upland Sandpiper. One to two individuals of this species were noted on five days between 20 and 31 August. This information supports our conclusion from previous years that this species is an annual migrant in small numbers through the region.

Numenius phaeopus. Whimbrel. Typically small numbers of this species were observed during autumn 2014. High daily counts of 10-15 individuals occurred from our arrival through 6 September; after this date numbers declined. With the exception of seven on 15 September, between one and three per day were found intermittently through 25 September. A single late individual was found on 11 October. Both adults and juveniles were observed, with juveniles outnumbering adults and the last adult being noted on 16 September. Adults were observed in active symmetrical wing molt.

Limosa haemastica. Hudsonian Godwit. Three juveniles of this species were observed, two on 12 August (with one continuing to 13 August) and one from 1-6 September. Small numbers of this species have been observed annually during autumn on Middleton Island.

Arenaria interpres. Ruddy Turnstone. This species was most abundant during August with 18 detected on the full coastal survey on 13 August and 19 on the same survey on 27 August. Numbers then decreased to seven on 6 September, 5 on 25 September, and 2 on 11 October (our last observation of the species). Adults dominated upon our arrival but this ratio slowly switched and juveniles dominating by the end of August. Adults remained in small numbers through the end of the species' duration.

Arenaria melanocephala. Black Turnstone. Numbers of this wintering species increased over the course of the fall season with 900-1000 observed during the first two full coastal surveys and nearly 1200 on our last full coastal survey (11 October). This species does not breed on the island and it is unknown when the majority of birds arrive.

Calidris virgata. Surfbird. This species was observed in varying numbers with no obvious temporal pattern. Our full coastal surveys detected 137 individuals on 13 August, 85 on 27 August, 305 on 6 September, 169 on 25 September, and 111 on 11 October. It is unknown what the normal wintering population of this species is on Middleton Island. Adults dominated the age ratio upon our arrival with an estimated 1:30 ratio (juvenile:adult) on 13 August. The ratio switched to approximately 1:1 from 18-25 August and juveniles dominated at a ratio of 5:1 by 27 August. Both adults and juveniles were present after this date with juveniles dominating through our departure. During later dates it was difficult to determine age ratios due to increase wear of juvenal plumage and completion of basic plumage molt in both adults and juveniles. Adults were all in primarily breeding plumage upon our arrival.

Calidris alba. Sanderling. A general increase in abundance was noted for this species with 115 estimated during our first coastal survey on 13 August and 250 estimated on the 11 October coastal survey. Peak count was 340 on the 25 September coastal survey. Adults dominated over juveniles upon our arrival with only one juvenile identified in the 115 individuals observed on 13 August. An estimated ratio of 1:1 was noted during mid-September and both adults and juveniles remained through our departure.

Calidris pusilla. Semipalmated Sandpiper. This species was present from 12 August to 1 September with notably larger numbers than in previous years. Peak observed numbers occurring during 12-16 August (e.g. 32 on 12 August and 36 on 13 August). Since our largest observed numbers were at the beginning of our stay the true peak of migration in this species is unknown. Numbers decreased after the 16th with one to five individuals observed from 18 August through 1 September. Only juveniles were observed.

Calidris mauri. Western Sandpiper. An early migrant, observed peak abundance was noted within the first week of our arrival when 1103 birds were estimated on the full coastal survey of 13 August. Numbers precipitously declined to 163 on the 27 August coastal survey, 15 on the 6 September survey, seven on the 25 September. The last individual, a one-legged adult, was observed on 3 October. Our survey window was too late during 2014 to define the true migratory peak in this species.

Calidris ruficollis. Red-necked Stint. A single juvenile of this Asiatic species was observed on 29 and 30 August.

Calidris minutilla. Least Sandpiper. This species was most abundant upon our arrival, with nearly 2000 individuals counted on the 13 August survey. Numbers decreased drastically to 186 on the 27 August survey and 13 were observed on 6 September. After this date we detected this species intermittently; our last observations occurred on 28 September and 5 October. Juveniles dominated the age ratio throughout our stay with a ratio of 1:40 (adult to juvenile) noted on 13 August and only juveniles were noted from 27 August on.

Calidris bairdii. Baird's Sandpiper. This species was observed from our arrival through 6 September with unusually large numbers detected. Peak counts were 33 individuals on 13 August, 20 on 25 August, and 19 on 27 August. All birds were identified as juveniles.

Calidris melanotos. Pectoral Sandpiper. Notably few individuals of this species were observed this fall with eight on the 13 August coastal survey, 24 on 27 August, 81 on 6 September, 132 on 25 September, and 19 on 11 October. Adults and juveniles occurred in approximately equal numbers through 20 August; after this date only one adult was observed. To compare, the largest numbers during 2013 occurred from 20 August to 19 September when 500-800 individuals were estimated during the same coastal surveys.

Calidris acuminata. Sharp-tailed Sandpiper. With the exception of two on 18 September, single juveniles of this Asiatic species were observed on five days from 5 September through 13 October.

Calidris ptilocnemis. Rock Sandpiper. Between 250 and over 500 individuals of this species were detected during our full coastal surveys: 260 on 13 August, 323 on 27 August, 276 on 6 September, 516 on 25 September, and 358 on 11 October. Only adults were noted during the 13 August survey, the first juvenile was identified on 18 August, and adults continued to dominate through 25 September. After this date, age ratios became difficult to determine due to the attainment of basic plumage in both age classes. Adults arrived on Middleton Island in breeding plumage and completed their molt into basic plumage on the island.

Calidris alpina. Dunlin. This late visitant was observed on 3 September (one individual) and 25 September (two birds); after this date one to three individuals were observed on five occasions through 15 October. It is possible that small numbers of this species winter on Middleton Island. The later birds were observed associated with flocks of Black Turnstones.

Calidris himantopus. Stilt Sandpiper. Small numbers of this species were observed from 15 August through 5 September with a peak of five birds seen on 20 August. All were juveniles.

Calidris subruficollis. Buff-breasted Sandpiper. Four juveniles of this species were detected between 20 August and 6 September (two on 20 August, one on 22-23 August, and one on 5-6 September). This species has occurred in similarly low numbers during previous years.

Limnodromus griseus. Short-billed Dowitcher. A single juvenile on 1 September was our only observation of this species. This is an abnormally low number compared to previous fall seasons, when we have typically observed small numbers (5-10 individuals) on multiple occasions.

Limnodromus scolopaceus. Long-billed Dowitcher. Between 15 and 30 individuals were noted from our arrival through 21 September and the peak in occurrence fell between 24 September and 3 October with 45-75 individuals observed. Numbers decreased after this date and our last observation occurred on 13 October. Adults occurred at an approximate 1:1 ratio during the first week of our stay, after this date juveniles dominated.

Gallinago delicata. Wilson's Snipe. An abundant fall migrant on Middleton Island, this species was detected throughout our stay with no notable temporal peak. Over 100 individuals were estimated on 21 August, 6 October, and 10-12 October, while 300 were estimated on 5 September.

Phalaropus lobatus. Red-necked Phalarope. This pelagic shorebird was observed from the northwestern point of the island from 15 August to 27 September with a peak occurring from 29 August to 1 September when 200-300 individuals were estimated.

Phalaropus fulicarius. Red Phalarope. This species was detected on three occasions during fall 2014: two were noted on 14 September, one on 24 September, and five (including two juveniles) on 12 October.

We thank Scott and Martha Hatch, Institute of Seabird Research and Conservation, for logistical support and the Federal Aviation Administration for ongoing support of our travel between Anchorage and

Middleton Island. The field assistance provided by Jordan Buetow, Marty Reedy, Rachel Richardson, and Karen Sinclair was greatly appreciated, as was the logistical support of Francisca Gutierrez. This project was funded by the U. S. Fish and Wildlife Service, Migratory Bird Management and the Alaska Department of Fish and Game, Wildlife Diversity Program.

#13—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, and Arctic Shorebird Demographics Network Collaborators.

Gut microbiota play an important role in organism health, through facilitating nutrient uptake, detoxification of secondary metabolites and interactions with the immune system. The avian gut microbiota has not been studied in depth, despite its potential importance to influence avian health. To assess the role of gut microbiota in wild birds, the first step is to determine gut microbial composition and what factors influence these communities. 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. 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.

A total of 1835 fecal samples were collected in 2011-2014 from 11 shorebird species at 11 arctic breeding sites across Alaska and Canada. Sites are part of the Arctic Shorebird Demographics Network. Our study species include one plover and ten scolopacid shorebirds that differ extensively in migratory behavior, habitat preferences and mating system, and are representative of the arctic-breeding shorebird

community. A wide variation in life-history traits will allow us to investigate the role of phylogeny and environment in microbiota community formation, as well as how different life-history characteristics influence microbiota diversity and abundance. In addition to fecal samples from adult shorebirds across the Arctic, we collected ~200 fecal samples from Dunlin and Red Phalarope chicks between hatch and fledging. In the upcoming year, we will investigate initial microbial colonization of the chicks' gastrointestinal tract and relate microbial succession to chick growth and development. Lastly, in 2013 we collected 48 eggs of Dunlin and Semipalmated Sandpiper close to hatch, to investigate the presence and diversity of gut microbiota of embryos prior to hatch. We dissected out the gut from these embryos and are currently sequencing the microbial communities from these samples. After sequencing, we will compare embryonic gut microbiota to the maternal gut microbiota, to assess potential vertical transovarian transfer of microbiota.

Up to present, we sequenced bacterial communities of all fecal samples collected in 2011, which resulted in a total of 59 million bacterial sequences from 530 fecal samples. We have analyzed these sequences to determine the influence of environment and host species identity on gut microbiota composition, and found that both environmental and genetic factors (host species) influence gut microbiota. In the coming time, we aim to assess the influence of different environmental factors, such as migration route, staging/non-breeding habitats and social behavior on gut microbiota composition. Also, we will tie microbial composition to breeding success and body condition of shorebirds, as a measure of individual quality and health.

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

Investigators: Kirsty E. Gurney, Environment Canada, David Ward, USGS Alaska Science Center and 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.

<u>Species</u>	<u>Total number of nests</u>
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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#15—KANUTI NWR 2014: ANNUAL REMINDER TO ASG THAT THERE ARE SHOREBIRDS, AND STUDIES THEREOF, IN INTERIOR ALASKA.

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

For the sixth time in seven years, Kanuti National Wildlife Refuge staff “sprung out” at our administrative cabin at Kanuti Lake (N 66.18° x W 151.74°) and documented first detections for all bird species observed, including shorebirds (Table 1). We arrived pre-breakup via skiplane on 15 April, preceding the area’s breeding and migrant shorebirds, and remained through 2 July.

While shorebird study in 2014 was largely incidental to other work (e.g., landbird surveys, plant phenology monitoring, trail camera traps), we did revisit the area’s local Whimbrel populations, focus of

intensive study from 2009–2014, to glean minimal phenology data and document resightings of previously marked individuals. We incidentally located 8 Whimbrel nests, 5 of them during laying, which allowed for a modest documentation of initiation, despite the small sample size and limited effort. The estimated earliest initiation dates for the Kanuti Lake and the more distant “Everglades” populations (i.e., 15 km east of Kanuti Lake) were 19 and 14 May, respectively. The former date likely represented the beginning of peak initiation in both areas, and the latter was the earliest initiation date recorded (by 3 days) among all years. We resighted 11 of 60 individuals marked since 2009 (3 of 60 are confirmed dead). One female, marked in 2009, was resighted again, marking at least the fifth year she has nested; she successfully nested four times. We observed 3 individuals each from the 2010 and 2011 marked cohorts, and 4 from 2012; we deemed that 6 of these 10 nested, 2 likely did not nest, and of 2 we were unsure. We again confirmed Hudsonian Godwit breeding (i.e., 2 nests found) in the area.



Hudsonian Godwit nesting at Kanuti Lake. Photo Chris Harwood.

Table 1. Date of first detections for shorebird species at Kanuti Lake, Kanuti NWR, 2008–2014. Confirmed local breeders are bolded. Latest arrival date for personnel was 1 May (2011, 2012). No work was conducted there in 2013.

	2008	2009	2010	2011	2012	2014
American Golden-Plover	19-May	12-May			14-May	
Semipalmated Plover		15-May	1-May			
Spotted Sandpiper	20-May	26-May	18-May	19-May	22-May	23-May

Solitary Sandpiper	8-May	18-May	13-May	14-May	9-May	12-May
Lesser Yellowlegs	5-May	5-May	1-May	8-May	4-May	10-May
Upland Sandpiper		25-May			23-May	23-May
Whimbrel	6-May	4-May	8-May	6-May	7-May	6-May
Hudsonian Godwit	8-May	4-May	10-May	8-May	7-May	9-May
Semipalmated Sandpiper		18-May	17-May		1-Jun	
Least Sandpiper	9-May	4-May	8-May	14-May	12-May	9-May
Pectoral Sandpiper	17-May	18-May	17-May	14-May	12-May	21-May
Long-billed Dowitcher	18-May	15-May	15-May	14-May	16-May	
Wilson's Snipe	5-May	8-May	1-May	7-May	3-May	10-May
Red-necked Phalarope	19-May	4-May	27-May	14-May	15-May	6-May

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#16—BREEDING ECOLOGY, MIGRATORY CONNECTIVITY, AND AVIAN INFLUENZA VIRUS INFECTION RATES OF RED KNOTS (*CALIDRIS CANUTUS ROSELAARI*), 2014

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

The 2014 field season marked the fifth consecutive year of studying aspects of Alaska-breeding Red Knot (*Calidris canutus roselaari*) ecology at the Seward Peninsula. In contrast to an abbreviated 2013 field season that coincided with the brood-rearing period, our 2014 field season spanned the majority of the breeding period (21 May–7 July). This year we also participated in fieldwork at Grays Harbor, WA, during spring migration (9–17 May).

Objectives of the Washington fieldwork were to: 1) sample 100 adult Red Knots to determine active and past avian influenza virus (AIV) infection rates, and blood-borne pathogen infection rates; 2) assist J. Buchanan's long-term knot resighting effort and mark additional birds so that they are available for

resighting; and 3) deploy VHF radio transmitters on 20 adults to determine timing and distribution of knots on the Copper River Delta, AK, during spring migration (see summary by Mary Anne Bishop for details).

Primary objectives at the Seward Peninsula were to: 1) retrieve up to 9 geolocators deployed on adults in 2013; 2) sample up to 30 adults and chicks to determine active and past AIV infection rates, and blood-borne infection rates; and 3) resight previously marked birds to estimate apparent adult survival and mark additional birds so that they are available for resighting at breeding and non-breeding areas.

Grays Harbor Banding, Biosampling, and Resighting:

We captured and individually marked >350 adult Red Knots and collected 100 DNA samples, 100 feather isotope samples, and 103 AIV and blood-borne pathogen samples. The resighting effort was also productive: we recorded >300 individually marked knots including birds banded in Russia, Alaska, Baja California, and Padre Island, TX.

Seward Peninsula Geolocator Retrieval, Resighting, and Banding:

We resighted 23 of 67 (34%) adults that were marked on the Seward Peninsula in a prior year: six originally banded in 2013, four in 2012, six in 2011, and seven in 2010. In all years combined, we have recorded two birds banded as chicks that returned to their natal area as adults, which indicates either poor survival, low natal fidelity, or both. We retrieved 5 of 9 geolocators deployed in 2013. We also recovered a geolocator deployed in 2011, which increased the percentage of retrieved geos to 53% (21/40). We deployed no new geolocators on adults this year.

Of the 74 adults banded during 2010–2013 (67 at Seward Peninsula and 7 at Cape Krusenstern in 2010), 1 was resighted in the Gulf of Santa Clara, Mexico in March 2014 (banded in 2011) and 15 were resighted in Grays Harbor, WA in May 2014 (3 banded in 2010, 3 in 2011, 4 in 2012, and 5 in 2013).

No chicks banded during this project have been resighted at a non-breeding site.

We individually marked (metal band and/or unique alpha-numeric lime green flag) 22 new adults and 29 chicks in 2014, which increased the total number of Red Knots banded over the 5-year study to 96 adults and 117 chicks.

Breeding Ecology:

Despite significant effort over the first three weeks of our Seward Peninsula field season we were only able to locate four Red Knot nests. Unseasonably cold and foggy conditions through the majority of this period reduced our ability to detect and follow birds. We deployed nest-monitoring cameras at two nests and both were depredated (one by a red fox and the other by a wolverine). The remaining two nests were successful.

Below-freezing temperatures and multiple snow events during the incubation period did not negatively affect breeding success of Red Knots. We found 27 broods (2010–2013 ave. = 14 broods) comprised of

70 chicks. Estimated (i.e., backdating based on apparent chick age) hatch dates of these broods ranged from 17–30 June (median = 23 June). This was the earliest hatching period recorded during our 5 year study (cf. median of 28 June in 2013, 3 July in 2012, 25 June in 2011, and 27 June in 2010). In contrast to previous breeding seasons, we did not observe major brood reduction, which is likely a result of the absence of prolonged precipitation events that can substantially reduce chick survival and increase male abandonment. The slightly advanced nesting period in 2014 resulted in our first observations of volant chicks.

Frequency of AIV infection:

ELISA assays indicated that 26 of 29 (90%) adult Red Knots sampled at the Seward Peninsula in 2014 had previously been exposed to AIV (i.e., seropositive). This result is identical to our 2012 finding that 18 of 20 (90%) breeding adults were seropositive¹. RT-PCR results combined from 2013–2014 indicate that no individuals were actively shedding AIV. In contrast, 44 of 103 (43%) adults sampled at Grays Harbor during spring migration were seropositive; no birds were actively shedding AIV. The lack of active shedding but evidence of prior infection indicate that the period of adult exposure to AIV occurred outside of our brief sampling periods in AK and WA. Causes for the discrepancy in seroprevalence rates within the subspecies are currently unknown, but a contributing factor may include population segregation during the winter and latter stages of spring migration that make the Seward Peninsula birds more likely to be exposed to the disease. Blood-borne pathogen results are pending.

We are grateful to W. Holman and the staff of Washington Department of Fish and Wildlife for their assistance with fieldwork. This project was supported by the USFWS Avian Health Program and Migratory bird Management.

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¹Johnson et al. 2014. Avian influenza virus antibodies in Pacific Coast Red Knots (*Calidris canutus roselaari*). *Journal of Wildlife Diseases* 50:671–675.



Figure 1. Red Knots flock flying to their roost site at Grays Harbor, WA. N. Hajdukovich

#17—MONITORING BREEDING ECOLOGY OF SHOREBIRDS IN NOME, ALASKA

Investigators: Eunbi Kwon, Brett K. Sandercock, Division of Biology, Kansas State University; David B. Lank, Center for Wildlife Ecology, Simon Fraser University

In pursuit of testing the impacts of climate change on reproductive performance and population demography of Arctic breeding shorebirds, 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 been part of the Arctic Shorebird Demographics Network since 2010. We finalized our planned 4-year study in Nome in 2014.

2014 field report: The duration of field work was a 2-month period between May 13 and July 5, 2014. We resighted 162 unique individuals, including 65 Western Sandpipers, 62 Semipalmated Sandpipers, and 35 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 192 nests of arctic-breeding shorebirds, including Western Sandpipers (n = 84 nests), Semipalmated Sandpipers (n = 47), Red-

necked Phalaropes (n = 56), Dunlin (n = 4), and Least Sandpiper (n = 1). Of the 131 sandpiper nests, only 9% hatched young, 73% were depredated, 11% had unknown fate and 3% were abandoned. Of the 56 Red-necked Phalarope nests, 18% hatched young, 46% were depredated, 1% had unknown fate. We captured and banded a total of 78 shorebirds, including 42 Western Sandpipers, 35 Semipalmated Sandpipers, and 1 Red-necked Phalarope. Monitoring of environmental conditions included setting up a weather station for climatic conditions, surveys of seasonal snowmelt, and daily counts of predators encountered during field activities (primarily jaegers, falcons, arctic and red fox).

Foreign resight: In 2014, we resighted one Western Sandpiper and one Semipalmated Sandpiper both of which have been banded on Paracas National Reserve, Ica (southern Peru) in 2014. Both sandpipers were observed while feeding on the pond margin during early stage of breeding season, and never found on a nest.

Return of Red-necked Phalaropes: Red-necked phalaropes are known for low site fidelity comparing to other shorebird species of similar body size. However, in Nome, we have observed high number of Red-necked Phalaropes that have been captured on the site in previous years returned. Banding and resighting effort on the species has been maintained similar across study years (2011-2013), and we found five times greater the number of returned phalaropes in 2014 (N=35) than previous years (N=7 in 2012 and N=9 in 2013).

Field monitoring and biological sampling is concluded and we are currently testing suite of environmental variables against the changes in breeding phenology, reproductive output as well as demographic rates of two sandpiper species that have been monitored on site on and off since 1993. Fieldwork in 2014 was supported through the NSF Polar Program with matching funds from Simon Fraser University and Kansas State University. We thank the Sitnasauk Native Corporation for their cooperation.

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#18—TEST OF ECOLOGICAL MISMATCH IN AN ARCTIC NETWORK

Investigators: Eunbi Kwon, Brett K. Sandercock, Kansas State University. David B. Lank, Simon Fraser University. Richard B. Lanctot, David Payer, US Fish and Wildlife Service. River Gates, Alaska Biological Research. David Ward, USGS-Alaska Science Center. Stephen Brown, MANOMET. Steve Kendall, Canning River, Arctic NWR. Jennie Rausch, Environment Canada. Erica Nol, 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.

Modern climate change has been shifting spring phenology of biological systems. Responses to climate change however can vary across functional groups and trophic levels, which can cause decoupling of biological interactions or a ‘phenological mismatch’. Recent studies showed that phenological mismatch decreases individual fitness and annual survival rate of organisms. As long-distance migrants, Arctic-breeding shorebirds are at greater risk of facing such problem. Thus the objective of our study was (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 extent of phenological mismatches over ten Arctic coastal sites and among six shorebird species.

Breeding timing of six target shorebird species and seasonal change in the invertebrate abundance have been monitored in ten sites (part of the Arctic Shorebird Demographics Network) during 2010 – 2012.

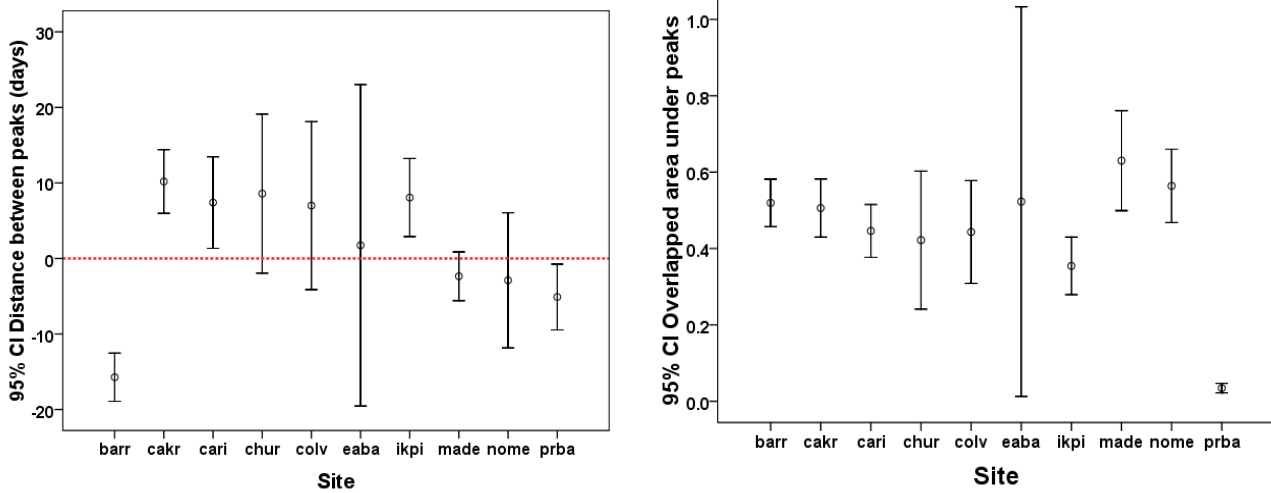
Table 1. Number of shorebird nests monitored during 2010-2012.

Site	Dunlin	Pectoral Sandpiper	Red Phalarope	Red-necked Phalarope	Semipalmated Sandpiper	Western Sandpiper	Total
Barrow	99	234	376	43	133	31	916
Canning River	54	211	103	152	385	-	905
Cape Krusenstern	57	-	-	37	108	55	257
Churchill	87	-	-	20	-	-	107
Colville River	25	-	27	40	178	-	270
East Bay	-	-	42	-	-	-	42
Ikpikpuk River	87	73	74	59	322	-	615
Mackenzie River Delta	-	-	-	61	43	-	104
Nome	-	-	-	170	159	209	538
Prudhoe Bay	-	50	-	21	115	-	198
Grand Total	421	568	622	603	1443	295	3,952

We defined the ‘degree of match’ between shorebirds and their prey invertebrate as 1) the temporal distance between the Julian date of peak hatching of shorebirds and the date of peak biomass of collected invertebrates as well as 2) the overlapped area under two peaks. Although different species showed varying amount of overlap with their food peak (39% overlap for Red Phalarope to 55% for Western Sandpiper) the degree of match varied the most among ten study sites (Figure 1). We are currently testing various aspects of site-specific conditions such as both long-term and present climatic conditions, geographical locations, absolute timing of breeding, and the amount of prey invertebrate available to shorebirds in order to understand how the geographic variation of phenological mismatch may arise.

Figure 1. Degree of phenological match between hatching of shorebirds and peak of invertebrate biomass in ten sites. (a) Distance between the peaks; negative value indicates earlier hatching than peak

biomass, and positive value indicates later hatching than peak biomass. (b) Overlapped area under the two peaks; ‘0-1’ scale indicates ‘no overlap – complete overlap’ between the peaks.



Fieldwork in 2010-2014 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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#19—MIGRATORY CONNECTIVITY OF THE BUFF-BREASTED SANDPIPER

Investigators: Richard Lanctot and Sarah Saalfeld, U.S. Fish and Wildlife Service; Joaquin Aldabe, Universidad de la Republica, Uruguay; Juliana Bosi de Almeida, Brasilia, Brazil; Gabriel Castresana, Reserva Natural Bahia Samborombon, Argentina; Stephen Brown, Manomet Center for Conservation Sciences; and Stephen Yezerinac, Surrey, British Columbia.

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, teams of four to six people conducted field work in Laguna de Rocha in Uruguay, Lagoa do Peixe in Brazil and Bahía San Borombón in Argentina in December 2012 and January 2013. Teams captured and deployed geolocators on a total of 62 birds, including 21 birds in Argentina, 26 birds in Brazil, and 15 birds in Uruguay. Each individual was equipped with a Intigeo-W65/55 geocator from Migrate Technology that was attached to custom-made, dark green leg flag (Figure 1). 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.

In December 2013 and January 2014, teams of 2-3 people searched for geolocator-equipped Buff-breasted Sandpipers in fields where birds were captured in the first year of the study. People used spotting scopes and binoculars to search for birds, visiting fields repeatedly for 3-4 weeks. A total of three Buff-breasted Sandpipers were collected with pellet guns: two in Argentina and one in Brazil. We know of at least one and two other geolocator-equipped birds that were present in Argentina and Brazil, respectively, that were not captured. Our inability to find many individuals equipped with light-level geolocators suggests that most birds move to new areas between years, or possibly only visit areas for short periods of time each year. This conclusion, however, should be tempered by several factors. First, we may have encountered more birds had our field season been longer or for more years. Second, inappropriate habitat conditions during this study, especially in Uruguay, may have decreased the between-year site fidelity. Third, birds with geolocators may have had higher over-summer mortality than others, depressing their return rates. Fourth, it is possible that equipping birds captured earlier in the winter season may have increased return rates. The collection of three geolocator-equipped birds and the observations of at least three others indicate that some birds do return from the breeding grounds to winter in the same location where they were initially captured. Geolocator data from the two females collected indicated these birds used the same wintering site exclusively throughout the study, spending 164 and 192 days at their capture locations, respectively. The single male used two wintering sites: his original capture site where he spent 125 days and a second site in Central Argentina for 63 days.

Despite having a limited number of tracked birds, we were able to identify the migration route and pattern of this species for the first time. *It is important to note that the geolocator data provide imprecise estimates of location.* All stopover and breeding locations are approximate, particularly in regard to the latitude during the few weeks surrounding the spring and fall equinoxes and when birds migrate north of the Arctic Circle. In contrast, longitudinal data tends to be more accurate (typically within 2-4 degrees of depicted sites). All three birds migrated north through the central region of South America then through the Great Plains of North America, and finally north to the arctic breeding areas. A similar route was used on the way south. Birds took about 1 and ½ months to reach the breeding grounds after leaving their wintering sites, 2 to 2 and ½ months to reach the wintering grounds after leaving their breeding sites, and had between 4 and 7 and 4 and 6 stops during north and southbound migrations, respectively. During their annual cycle, the two females traveled about 33,000 kilometers each and the single male traveled about 41,000 kilometers. All three birds used parts of Colombia, coastal Texas, and various regions of the Great Plains during northbound migration. Similar areas, but frequently different sites, were used during southbound migration, except additional sites were used in central South America that were not present during northbound migration. Areas in Iowa, South Dakota and North Dakota were found to be important despite the rarity of this species in these states. This suggests the species disperses broadly on the landscape and uses suitable habitats opportunistically to refuel as they migrate over the Great Plains. Finally, we observed a difference in site fidelity to both breeding and wintering areas for the two females and the one male tracked during this study. The male

spent time in at least two distinct breeding areas (possibly 3, including Alaska) and two wintering areas. In contrast, the females appeared to use a single breeding and wintering area.

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Figure 1. Buff-breasted Sandpiper with engraved flag on right leg and geolocator on left leg. Close up of light-level geolocator attached to leg flag shown in lower right. This bird was equipped with a geolocator at Lagoa do Peixe, Brazil in early January and resighted in March in the same area. Photo of bird by C. Alves da Silva.

#20—REPRODUCTIVE ECOLOGY OF SHOREBIRDS: STUDIES AT BARROW, ALASKA, IN 2014

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

In 2014, we conducted the 12th year of a long-term shorebird study at Barrow, Alaska (71.29°N, 156.64°W). The objectives of this study are to (1) collect baseline data on temporal and spatial variability of shorebird diversity and abundance, (2) collect information on nest initiation and effort, replacement clutch laying, clutch and egg size, nest and chick survival, and other demographic traits of arctic-breeding shorebirds, (3) 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) relate weather, food availability, and predator and prey abundances to shorebird productivity. In addition to these objectives, Barrow conducted a fifth year of data collection as part of the Arctic Shorebird Demographics Network (ASDN) in 2014 (see the overall summary for objectives of the ASDN) and began an interdisciplinary study investigating climate change effects on shorebirds.

We located and monitored nests in six 36-ha plots in 2014. All six plots were the same as those sampled in 2013 and five of the six plots were the same as those sampled in 2005-2012; all plots were searched with the same intensity as in past years. A total of 401 nests were located on our plots and an additional 28 nests were found outside the plot boundaries. Our total number of nests located on plots was the second highest in this 12-year study (above a previous high of 396 in 2012 but below the 406 recorded in 2011). Nests on plots included 167 Red Phalaropes, 117 Pectoral Sandpipers, 47 Dunlin, 37 Semipalmated Sandpipers, 9 American Golden-plovers, 9 Red-necked Phalaropes, 7 Long-billed Dowitchers, 5 Western Sandpipers, 2 White-rumped Sandpipers, and 1 Ruddy Turnstone. No Baird's or Buff-breasted sandpiper nests were found on the plots in 2014. The breeding density of all shorebird species on our study area was 185.6 nests/km² in 2014; this was the second highest ever recorded and about 1.55 times larger than our long-term average of 119.8 nests/km². In 2014, seven species nested in higher densities than the 12-year average (Dunlin, Pectoral Sandpiper, Red Phalarope, Red-necked Phalarope, Ruddy Turnstone, Semipalmated and White-rumped Sandpipers) and five nested at densities below the 12-year average (American Golden-Plover, Baird's and Buff-breasted sandpipers; as well as Long-billed Dowitchers, and Western Sandpipers).

The first shorebird clutch was initiated on 6 June —4 days later than the long-term average of 2 June and 5 days later than in 2013. Median initiation date was 19 June; this date was 4 days later than the long-term average, reflective of a much more protracted breeding period. Median nest initiation dates for the more abundant species were 9 June for Dunlin, 10 June for Semipalmated Sandpiper, 20 June for Red Phalarope, and 19 June for Pectoral Sandpiper. Median initiation dates were later for all species (compared to their respective 12-year averages), except for Dunlin and White-rumped Sandpiper, whose median initiation dates were 1 day and 2 days earlier than the 12-year average, respectively.

Predators destroyed 26.3% of the known-fate nests ($N = 393$) in 2014 (excluding human-caused mortalities). This is slightly less than the long-term average of 28.3% and slightly more than the 21.6% average for other years with fox control (2005-2014). However, it was a substantial increase relative to 2012 when only 7.8% of nests were depredated. Across the more abundant species, apparent hatching success (# hatching at least one young/total number of known-fate nests) was highest in American Golden-Plover (100%, $N = 9$), followed by Dunlin (76.9%, $N = 47$), Semipalmated Sandpiper (67.6%, $N = 47$), Pectoral Sandpiper (63.1%, $N = 116$), and Red Phalarope (63.8%, $N = 160$). We suspect the higher predation rates in 2014 were due to 1) avian predators such as Snowy Owls, Pomarine Jaegers, and Parasitic Jaegers that nested on and near our study plots, and 2) relatively low numbers of lemmings (although higher than reported in 2013). It seems unlikely this uptake in predation was due to Arctic Fox since the enhanced fox trapping efforts (i.e., trapping over an enlarged spatial area and with high intensity) continued in 2014.

In 2014, we captured and color-marked 399 adults located both on and off plots. This was close to the 421 banded in 2012, and was 1.34 times higher than the 12-year average of 298. Seventy-seven of these adults (38 Semipalmated Sandpipers, 30 Dunlin, 6 Red Phalarope, 1 Western Sandpiper, 1 Red-necked Phalarope, and 1 American Golden-plover) had been banded as adults in a prior year, and one Semipalmated Sandpiper and three Dunlin adults had been banded as chicks in a prior year. These returns, combined with those recorded in 2013, represent some of the first evidence of natal philopatry at our site. Adults captured included 122 Red Phalaropes, 88 Pectoral Sandpipers, 79 Semipalmated Sandpipers, 72 Dunlin, 12 American Golden-plovers, 12 Red-necked Phalaropes, 7 Western Sandpipers, 4 Long-billed Dowitchers, 2 Ruddy Turnstones, and 1 White-rumped Sandpiper. We also re-sighted 34 adults banded in prior years on our plots in 2014 (5 other birds were resighted off plot, including our first returning Long-billed Dowitcher, but are not listed here). This included 25 Dunlin, 8 Semipalmated Sandpiper, 1 American Golden-Plover. One of the dunlin resighted was previously banded in Japan and also seen on a different plot in 2013. We captured and color marked 664 chicks. This was 1.27 times more than the 12-year average of 522, but lower than our previous highs of 1014, 872, and 724 in 2012, 2011, and 2013, respectively.

In regard to other environmental features at Barrow, the summer of 2014 was a late snow melt year with 50% of the snow absent from the tundra on 11 June (average long-term date is 8 June). The entire summer was also cold and relatively wet. Lemmings increased in numbers in 2014 relative to the extreme low in 2013, but never reached numbers expected based on regular observations of winter nests throughout many of the plots. Several plots had been grazed quite heavily by caribou, and to some extent lemmings, who resided in the area over the winter months. Overall lemmings were low to moderately available. However, these levels were far below that experienced in 2006 and 2008. Despite the lack of lemmings, a few Snowy Owls, Pomarine and Parasitic jaegers nested in the Barrow area.

We continue to conduct ancillary studies as time allows at Barrow. As part of an ASDN-wide study, Vanessa Loverti from Region 1 FWS joined our team and helped recover 11 of 28 geolocators deployed on Semipalmated Sandpipers in 2013 to assess migratory connectivity (see ##). We also collected samples from a variety of shorebirds to assess the presence of avian malaria (see ##), for archiving, and for other isotope/genetic collaborations. There was one graduate student working at the site. Kirsten Grond (PhD candidate, Kansas State University) conducted her third and final field season investigating gut microbiota in shorebirds in relation to immunity (see ##). Terry Doyle also helped assess the use of area searches and line transect techniques to estimate bird numbers on our plots.

Finally, we began an interdisciplinary study whose goal was to investigate how climate-mediated changes in weather (precipitation, temperature) affects snow and hydrology conditions, which in turn affect invertebrate emergence and indirectly shorebirds (through timing of nest initiation and hatch; as well as brood survival and growth rates). Shorebird related field components included assessing whether a trophic mismatch currently exists between invertebrate emergence and chick hatch; and experimentally creating a mismatch by delaying shorebird hatching date and assessing how this affects growth and survival of young.

Field assistance for conducting this work was provided by Jenny Cunningham and Kirsten Grond (crew leaders), Willow English, Abby Sterling, Sydney Sheedy, Javi Marin, Mike Allen, Terry Doyle, Vanessa Lovern and Michelangelo Ball Van Zee. Guest field techs included Dylan Kesler, Kevin Kalasz, David Hodgkinson, Eunbi Kwon, and Nathaniel Wilder. Funding was provided by the Arctic Landscape Conservation Cooperative, National Fish and Wildlife Foundation, USFWS Migratory Bird Management division, University of Missouri Columbia, Kansas State University, and Princeton University.

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#21—KACHEMAK BAY SHOREBIRD MONITORING PROJECT: 2014 REPORT

Investigators: George Matz and Kachemak Bay Birders

Purpose

In May 2014, Kachemak Bay Birders (based in Homer, Alaska) completed its sixth 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. Again, 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



Joanne Thordarson, BJ Hitchcock, and Stan White checking an identification while shorebird monitoring.

Spit shorebird habitat.

Results

Between April 17, 2014 and May 27, 2014 a total of 45 individuals participated in one or more of the year's nine shorebird monitoring sessions. The protocol we follow is a modification of the International Shorebird Survey (ISS) protocol. At the Homer Spit, we simultaneously monitor for two hours once every five days when the outgoing tide reaches 15.0 feet (or at high tide if less). These tidal conditions optimize shorebird viewing opportunity for this area. This year we observed a total of 25 species of shorebirds and counted a total of approximately 13,319 individual shorebirds. Top ten taxa seen include Western Sandpiper (4,000), Red-necked Phalarope (3,006 of which 3,000 were seen by boat), Surfbird (2,644), Dunlin (1,530), LESA/WESA/SESA which is a lumping of *Calidris* species (987), Semipalmated Plover (251), Least Sandpiper (195), Black-bellied Plover (114), Pectoral Sandpiper (98),

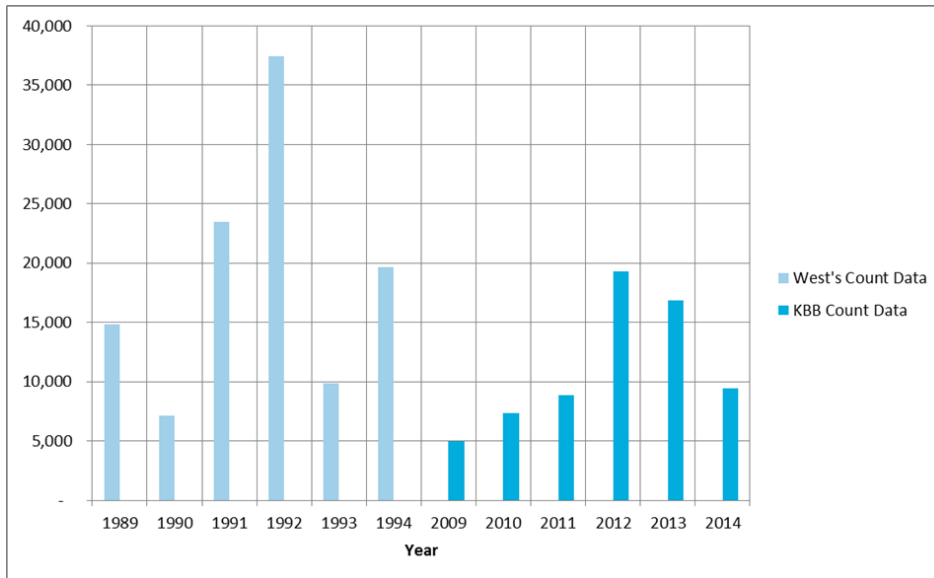
and Black Turnstone (56). We noted some minor disturbances of shorebird flocks from loose dogs and low-flying aircraft, particularly helicopters.

The number of shorebird species we counted this year (25) is the same as the average for all six years of monitoring. One new species seen this year were four Red Phalarope mixed in with a large flock of Red-necked Phalarope at the mouth of the Bay. We also saw a Red Knot, which is only the second time we've observed this late migrant during monitoring. The number of Surfbirds this year was about twice our average. A flock of about 1,500 was seen separate from our monitoring. The total number of individual shorebirds counted this year (13,139) was about average for our six years of effort (14,832). Unlike previous years, which had a couple of pulses of migrating shorebirds arrive at Kachemak Bay, this year there was just one continuous pulse. It appears that the weather, which was benign throughout the migration, may have been a primary factor. Since there was no need for shorebirds to wait out a storm, their stopover seemed to be for no more than a tide or two.

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 six years of monitoring we have seen 31 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 adjusted count for this year was 9,402 shorebirds. Our average for six years was 11,115 shorebirds; or 60% of West's

Total shorebird counts by year for the Homer Spit



Anchor and Kasilof River

In addition to the Homer Spit area we also continued shorebird monitoring 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 volunteers that monitored here followed the same protocol as that used for the Homer Spit. They reported seeing a total of 19 species of shorebirds. The count this year for the Anchor River amounted 5,476. However, this includes a flock of about 5,000 Red-necked Phalarope that were seen offshore on May 12th.

The Kasilof River empties into Cook Inlet about 40 miles north of the Anchor River. The protocol for this site was to monitor the incoming tide starting when it was about half-way between low and high tide. Monitors at the Kasilof River saw 15 species of shorebirds. On May 16, which was a supplemental day, they saw a Baird's Sandpiper. The total count for the nine scheduled monitoring days was 958 shorebirds. This is considerably less than last year, due primarily to not seeing as many sandpipers. It is speculated that because of the mild weather, many shorebirds did not bother to stopover at the Kasilof River this year. Observations for the Kasilof River were not that much different than the Anchor River if you deduct out the large flock of Red-necked Phalarope seen off-shore of the Anchor River.

Many thanks to all the volunteers who made this happen. This project will continue next year.

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#22—UPDATE: 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, Department of Biology and Wildlife, 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. Local-scale changes in habitat types associated with elevational gradients 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 along the road system leaving Nome, Alaska. Elevations ranged from sea level to ~700 m. Previous studies suggested 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 sites corresponded 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, while in 2013 there was a high level of synchrony in both nest initiation and hatch of these species. There was broad overlap between species in use of habitat types, but there was a significant difference in elevation, with AMGP nesting at higher elevations (265 ± 10 m, $n = 53$) than PAGP (206 ± 11 m, $n = 54$). 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. Both species exhibited high apparent nest success and estimates were marginally greater in 2013 (AMGP = 44%, 2012; 55%, 2013; PAGP = 47%, 2012; 49%, 2013). Apparent brood survival for both species combined varied between years (2012 = 88%; 2013 = 32%) and most pairs moved broods <1 km from nest sites to brood-rearing habitats. Currently, invertebrate samples are being processed 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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#23—EFFECTS OF DIET AND PROVISIONING RATES ON PRODUCTIVITY OF BLACK OYSTERCATCHERS IN KENAI FJORDS NATIONAL PARK

Investigators: Brian Robinson, Department of Biology and Wildlife, 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 mortality of 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.

2014 Field Season

From mid-May to late-August 2014, we conducted our second and final season of fieldwork in Aialik Bay and Northwestern Fjord of Kenai Fjords National Park and the Chiswell Islands and Granite Island of the Alaska Maritime National Wildlife Refuge. We conducted systematic boat-based surveys to locate active nests. We deployed 13 digital infrared remote-cameras at a sub-set of nests, moving them to new nest sites when nests ceased to be active.

We captured and banded chicks to determine growth rates and body condition and collect blood plasma for stable isotope analysis of diet. 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. We collected intertidal invertebrates at five oystercatcher feeding territories during late July to provide a reference for stable isotope analysis. We sampled during low tide.

Preliminary Results

We monitored 25 nests at 23 occupied territories. Black Oystercatchers at two sites renested after original nest failure. Average clutch size was 2.6 eggs (SD \pm 0.78) with a range of 1-3 eggs per nest. Fifteen of 25 nests hatched at least one chick (apparent nest success of 60%) with peak hatch taking

place on 10 June (SD \pm 4.9 days). These nests produced 34 chicks with an average of 2.3 (SD \pm 0.75) chicks per nest hatched. Nest cameras identified depredation of nests by black bear (*Ursus americanus*) and fledglings by Peregrine Falcon (*Falco peregrinus pealei*) (see photo below). Of 15 nests which hatched, 9 fledged young (60%). Sixteen young survived to fledge with peak fledging taking place on 17 July (SD \pm 3.5 days).

In order to determine growth rates, we captured 30 chicks from 14 nesting territories 1-7 times each for 104 total captures. In addition to morphometric data, we also collected 38 blood samples from chicks at 12 nest sites. We conducted 88 hours of provisioning observations between 6 June and 29 July at 10 nesting territories. We observed adult Black Oystercatchers delivering a wide variety of invertebrate prey to chicks including Pacific blue mussels (*Mytilus trossulus*), black katey chitons (*Katharina tunicata*), limpets (*Lottia spp.*), rock louse (*Ligia pallasii*), Aleutian moonsnails (*Cryptonatica aleutica*), thatched barnacles (*Semibalanus cariosus*), Alaska jingles (*Pododesmus macrochisma*) and dogwinkles (*Nucella spp.*).

This winter we will continue to analyze our data and complete lab work. Blood samples and a subset of prey samples will be processed at the Alaska Stable Isotope Facility for analysis of stable isotopes of ^{15}N and ^{13}C . Prey remains collected will be analyzed to provide additional information on species composition and size distribution of black oystercatcher prey.

This study was funded by the National Park Service.

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Nest camera captures a black bear depredating a Black Oystercatcher nest in Kenai Fjords National Park.

#24—TESTING A TWO CAMERA MODELS TO COLLECT SHOREBIRD ABUNDANCE WITH REGARD TO TIDE AND SEASON

Investigators: Susan E. Savage and Jessica Howell, 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 Nushagak 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, in 2013 the Alaska Peninsula/Becharof tested the value of using a Reconyx camera to collecting shorebird abundance data with regard to tide and season. This camera provided poor resolution for the size of the birds and the distance of the birds from the camera. In 2014 we employed a StealthCam G42NG at three locations: near Monsen Creek on Kvichak Bay near Naknek, Alaska (same location as the Reconyx in 2013); Big Creek, north of Egegik; Halfmoon Bay, on the west side of Kvichak Bay southwest of Levelock. These cameras were deployed at the end of April 2014. After the first cards were retrieved in June, we were

still dissatisfied with the resolution, so a Wingscapes BirdCampPro was ordered and installed at the Monsen Creek site in July. The cameras are scheduled to take one photo every 30 minutes from 0400 to 2245; camera SD cards are changed approximately every two months. We are collecting data through late October. Wildlife Intern Howell began preliminary screening of images in July. Work is still in progress reviewing the photos. The final results will be presented in a progress report available from the PIs.

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#25—SHOREBIRD DISTRIBUTION, ABUNDANCE, AND HABITAT ASSOCIATIONS IN THE PROPOSED SUSITNA-WATANA HYDROELECTRIC PROJECT AREA, INTERIOR ALASKA, SUMMARY OF 2013 RESULTS (BCR 4)

Investigators: Terry Schick, River Gates, Nathan Jones, Ashley Hovis, and Tawna Morgan; ABR Inc.—Environmental Research & Services.

In 2013, the Alaska Energy Authority initiated a three-year study of the breeding shorebirds that occur in the proposed Suistna-Watana Hydroelectric project area in the middle and upper Susitna River basin. Two survey methods were employed including ground-based point-count surveys for breeding birds (focusing on landbirds and shorebirds) in all available habitats, and ground-based point-count and transect surveys focused in riverine and lacustrine habitats. The study was designed to provide data on the distribution and abundance and habitat associations for all shorebird species, including species of conservation concern. We used a two-stage, stratified random/systematic sampling design, stratifying by vegetation type, to allocate transects (grids) of point-count locations in the study area. The plot allocation procedure mirrors that used by the Alaska Landbird Monitoring Survey (ALMS), but is used at a more localized scale (project level as opposed to state-wide level). ArcGIS Version 10.1 software was used for all plot allocation procedures.

Point-count Plots

Point-count field surveys were conducted following standard protocols for point-count surveys for breeding birds in Alaska (ALMS 2010). At each point-count plot, observers recorded the primary habitat type sampled, adjacent habitat types, and the individual habitat being used by each bird observed whenever possible. Habitat types were defined as the Alaska Vegetation Classification (AVC) Level-III, or Level-IV when possible, vegetation types of Viereck et al. (1992).

In 2013, the start date for the field surveys was delayed 8 days because abnormally cold spring weather and deep snowpack in the study area resulted in the late arrival of most migratory birds. We conducted 1,364 point-count surveys along 113 transects in the study area between 23 May and 20 June 2013, for a total of 28 survey days. We recorded 11 shorebird species in the study area in 2013 and calculated

means of 0.4 ± 0.6 shorebird species (range 0–4) and 0.6 ± 1.0 individual shorebirds (range 0–12) per point-count plot. Most shorebirds were assumed to be nesting in the area, based on observations of nests or repeated observations of aerial display activities and territorial behavior, or alarm and mobbing reactions typical of nesting birds.

Due to the low detection rate of shorebirds in the study area, insufficient data were available to estimate densities for shorebirds using Program DISTANCE. Based on the raw point-count data (uncorrected for detectability), Wilson's Snipe was the most common shorebird species in the project area, accounting for 61% of all shorebird observations. Seven shorebird species (American Golden-Plover, Lesser Yellowlegs, Spotted Sandpiper, Least Sandpiper, Red-necked Phalarope, Semipalmated Plover, and Solitary Sandpiper) were much less common, together accounting for less than 10% of all shorebird point-count observations in the project area. Three other species (Wandering Tattler, Whimbrel, and Greater Yellowlegs) were rarely encountered, together accounting for less than 1% of all shorebird point-count observations in the project area.

Shorebirds were observed in 22 of the 24 habitat types sampled in the project area in 2013, but they were most common in the open habitats. Shorebird abundance metrics uncorrected for detectability (average-occurrence values) were highest in Wet Graminoid Meadows, where an average occurrence of 0.90 shorebirds (of all species) per point-count was recorded ($n = 20$ plots). Riverine habitats, Closed Mixed Forest, and Moist Graminoid Meadows also had relatively high shorebird abundance (total average-occurrence values for shorebirds of all species of 0.87, 0.57, and 0.54; $n = 52, 14,$ and 42 plots, respectively). Species richness of shorebirds was highest in Open Needleleaf Forest and Ericaceous Dwarf Shrub, where 7 and 6 shorebird species were recorded, respectively. No shorebirds were detected in two habitats (Barrens and Broadleaf Woodland). Of the individual species, Wilson's Snipe was observed in the greatest number of habitat types ($n = 18$). All other shorebird species were found in nine or fewer habitats; Wandering Tattler, Greater Yellowlegs, and Red-necked Phalarope, which were found in only one habitat type each.

Riverine Transects and Point-count Plots

Focused surveys in riverine habitats were conducted because riverine habitats are often undersampled in standard point-count surveys. During the riverine-focused surveys, observers walked along transects that followed riverine corridors, that is generally the larger, named tributary streams to the Susitna River and the Susitna River itself. Point-count plots were interspersed along transects to increase the number of point-counts conducted in riverine habitats. The point-counts and transect surveys in riverine corridors generally were conducted later in the sampling period (15–19 June 2013), after shorefast ice had melted and high water from spring flooding had subsided. In addition to the point-counts conducted in riverine corridors, researchers walked slowly along each stream course as they moved between point-count locations and recorded all birds observed, as well as the AVC Level-III or IV vegetation type being used at the time of observation. Bird activity in riverine waters and along stream shorelines was recorded, as well as activity in riparian and upland habitats when those habitats occurred adjacent to the sampled streams. To provide a standardized relative measure of abundance for all species recorded during the 13

riverine-focused transect surveys, the resulting data are presented as the number of observations of each species per unit time spent in transit (following methods used by Andres et al. 1999 and Boisvert and Schick 2007).

In all, 692 individual birds of 44 different species were recorded during the riverine-focused surveys, including 28 landbird, 11 waterbird, 3 shorebird, and 2 raptor species. Means of 12.7 ± 4.5 species (range 7–21) and 53.2 ± 36.6 individual birds (range 7–137) were recorded per transect. For shorebirds, across all 13 transects a mean of 2.3 birds per hour was recorded during the riverine-focused transect surveys. Spotted Sandpiper was by far the most abundant shorebird species and accounted for 98% of the shorebird observations and 17% of all bird observations made. Spotted Sandpipers were observed most frequently using riverine littoral habitats, but they were also found in low riparian shrub habitats located along tributary streams and the Susitna River.

Lacustrine- focused Surveys

As with riverine habitats, focused surveys in lacustrine habitats were conducted because lacustrine habitats also are often undersampled in standard point-count surveys. The lacustrine-focused surveys ($n = 59$) were transect surveys, which were conducted concurrently with the transect-based point-counts in all available habitats described above. Lacustrine waterbodies were surveyed when a waterbody was located within approximately 250 m of any preselected point-count in terrestrial habitats. During the lacustrine-focused surveys, researchers walked the perimeter of each waterbody or, for small ponds, selected a vantage point from which the entire waterbody and shoreline were visible. All birds seen or heard using lacustrine habitats and adjacent vegetated habitats were recorded, as was the AVC Level-III or IV vegetation type being used at the time of observation.

Overall, 435 individual birds of 50 different species were recorded during the lacustrine-focused surveys, including 21 waterbird, 11 shorebird, and 18 landbird species. Means of 2.9 ± 2.8 species (range 0–13) and 7.5 ± 10.0 individual birds (range 0–46) were recorded per survey, although 10 locations (17%) had zero detections. Waterbirds were the most abundant species group observed, and comprised 55% ($n = 235$) of all observations. Shorebirds and landbirds were less abundant, accounting for 31% ($n = 132$) and 15% ($n = 63$) of all observations, respectively.

Red-Necked Phalarope was the most abundant shorebird species observed on the lacustrine-focused surveys, composing 25% of all shorebird observations. Other common shorebird species included Wilson's Snipe, Lesser Yellowlegs, and Least Sandpiper, which together accounted for 55% of all shorebird detections. Shorebirds were found in lacustrine habitats 70% of the time and in adjacent Moist Graminoid Meadow habitats 24% of the time.

In 2014, a second year of surveys was conducted and a final year of surveys will be completed in 2015. A report on the first year of study is located on the project's website: <http://www.susitna-watanahydro.org/type/documents> (see Initial Study Report, Study 10.16 Breed, Parts A, B and C).

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Ashley Hovis during 2014 point counts.

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#26—ECO-EVOLUTIONARY CONSEQUENCES OF REPRODUCTIVE INVESTMENT OF HUDSONIAN GODWITS IN A CHANGING WORLD

Investigators: Rose Swift, Cornell University; Amanda Rodewald, Cornell University; Nathan Senner, University of Groningen

After a year hiatus in 2013, we're monitoring the population of Hudsonian Godwits in the Beluga, Alaska area again. Building on work done by former Lab of Ornithology graduate student Nathan Senner, I began a focused effort to better understand the drivers and consequences of different reproductive investments and the impacts of global climate change in a long-distance migratory bird of conservation concern, the Hudsonian Godwit (*Limosa haemastica*). My research on reproductive investment is centered on one central driving force, predation, from which derive the following question. How does the trade-offs in nest site selection between microhabitat, thermal preferences, community composition, and predation risk influences breeding success? My work will be one of the few studies to examine parental investment throughout the full breeding season – from incubation through post-hatching stages to get a complete view of reproductive investment. In addition, I aim to take an annual cycle approach to fully understand the constraints of their migratory path on their reproductive investments. By building our knowledge of nest site selection, seasonal carry-over effects, and breeding success, I will aid conservation and management efforts by developing a habitat suitability map for potential breeding areas. This could be especially useful, since the population appears to disperse across the landscape for breeding and much of the census population is not represented by breeding-bird population surveys.

During my pilot field season, we reinitiated an invertebrate sampling design with 40 traps covering two study plots of ~700 ha. We resighted 34 birds banded by Nathan between 2009-2012. We monitored 64 nests found in the bogs of all waterbird species including 21 shorebird nests. We developed protocols for monitoring species arrival and abundance and entered all data into eBird. Additionally, we had a female Bar-tailed Godwit and adult male Black-tailed Godwit seen on the tidal mudflats during the onset of fall migration.



Least sandpiper chicks in Beluga, Alaska July 2014. Photo by: Garrett MacDonald

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#27—BLACK TURNSTONE: A POPULATION DECLINE OR SHIFTING MIGRATION PATTERNS?

Audrey Taylor, Department of Geography and Environmental Studies, UAA; Mary Anne Bishop, Prince William Sound Science Center; and Kristine Sowl, Yukon Delta National Wildlife Refuge

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 principal spring staging site for this species) represents a true population decline (possibly 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 Research Camp, located on the central Yukon-Kuskowkim Delta in western. 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.

2014 represented our second field season at Tutakoke. Similar to 2013, we located and monitored nests on historic turnstone plots along the Tutakoke River (originally established in 1977 by C. Handel and B. Gill) and marked individuals to assist with estimating nest density. We also recaptured 18 of the 30 individuals that had been fitted with geolocators in 2013, assessed habitat surrounding each nest, and conducted distance sampling-based surveys along historic transects to estimate local densities of breeding Black Turnstones.

Between 22 May and 14 June 2014, we located 90 Black Turnstone nests on our two plots and banded 32 new adults. Nesting chronology at Tutakoke was much earlier in 2014 than in 2013, when nests were found between 12 and 26 June. Nest density on Plot 1 (mixed graminoid/dwarf shrub mat tundra) was 2.15 nests/ha; nest density on Plot 2 (low-lying salt grass meadow) was 4.81 nests/ha. These densities are similar to those estimated for the same plots in 2013 (1.54 nests/ha and 4.42 nests/ha, respectively). Plot search effort in 2014 was 129 person-hours on Plot 1, and 80 person-hours on the smaller Plot 2, compared to 37 person-hours and 34 person-hours in 2013, respectively. Much of our time on the plots this year was spent searching for geocator-equipped individuals, hence the vastly larger number of person-hours in 2014 compared to 2013.

We were unsuccessful at recapturing any Black Turnstones fitted with geolocators in Oak Harbor, Washington during our March 2014 attempt, but Megan Boldenow and the crew of the Cape Krusenstern ASDN camp successfully retrieved 2 geolocators during June 2014 from returning Black Turnstones initially tagged in 2013.

We have just completed analysis of the Tutakoke transect data using Program DISTANCE to estimate density of Black Turnstones at varying distances from the coast and in three different habitats, and will compare current densities with those calculated by Handel and Gill. Analyses are ongoing to examine how the coastal landscape on the Yukon-Kuskokwim Delta in general and nesting habitat at Tutakoke in specific may have changed in the last 40 years, and of the geocator data retrieved in 2014. We are also starting stable isotope analyses of Black Turnstone feathers collected at breeding and wintering areas for comparison of isotope-derived migration patterns with geocator data.

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#28—AERIAL INVENTORY OF STAGING SHOREBIRDS ON THE BERING LAND BRIDGE NATIONAL PRESERVE COASTLINE

Audrey Taylor, Department of Geography & Environmental Studies, UAA; Jeremy Mizel and Stacia Backensto, Arctic Inventory and Monitoring Network, National Park Service

Shorebirds are an important component of the avifauna of the Western Arctic National Parklands, yet are typically understudied compared to more easily surveyed waterfowl or seabirds. Anecdotal evidence suggests that a number of shorebird species congregate in large numbers prior to fall migration along the coastline of Bering Land Bridge (BELA) National Preserve. Despite the vulnerability of these areas to effects of offshore energy development, little is known regarding abundance, species composition, or distribution of shorebirds prior to fall migration. Furthermore, protecting habitat for internationally significant populations of migratory birds is a mandate for Western Arctic Parklands. Our goal for this project was to describe the spatial variation in shorebird use along the BELA coastline prior to fall migration, and to identify potential hotspots for staging/migrating shorebirds. We conducted replicate aerial surveys in late July and early August along a random sample of transects in mudflat habitat. Preliminary results from these surveys indicated over 26,000 shorebirds were counted from the aircraft between 28 July and 13 August, the majority of which were found at Cape Espenberg, Cowpack Lagoon, and Arctic and Ikpek Lagoons. From here, we plan to use Bayesian hierarchical models to estimate spatial variation in shorebird use of mudflat habitat along the BELA coast.

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#29—BIRDS ‘N’ BOGS CITIZEN SCIENCE PROGRAM UPDATE

Audrey Taylor, Lindsay Hermanns, and McKenna Hanson, Department of Geography and Environmental Studies, UAA; Beth Peluso and Nils Warnock, Audubon Alaska

2014 represented the second year of Birds ‘n’ Bogs, a citizen science program initiated through Audubon Alaska and University of Alaska’s Department of Geography and Environmental Studies. The goal of this program is to document spring distribution of boreal birds in wetland habitats of Anchorage and the Matanuska Valley, as well as to foster communication and collaboration between university

students and long-term Anchorage residents, two populations for whom contact is limited. The 2014 Birds ‘n’ Bogs program recruited 32 volunteers from the Municipality of Anchorage as well as 4 volunteers from the Matanuska Valley. These participants chose to survey one or more predetermined wetlands to collect data on the distribution of the following target boreal bird species: Lesser Yellowlegs, Greater Yellowlegs, Solitary Sandpipers, Rusty Blackbirds, Olive-Sided Flycatchers, Tree Swallows, and Violet-Green Swallows. To conduct their surveys, participants listened and watched for target species in and near their chosen wetland; surveys were repeated 3-4 times over the period 10 May to 1 June 2014 (the spring “settling” period). Observations were compiled using ArcGIS to create maps showing locations of the target species throughout the survey period.

Anchorage participants surveyed 20 sites totaling approximately 65 person-hours of effort while the Matanuska Valley participants surveyed 4 sites totaling approximately 17 person-hours of effort. Across all sites, participants observed at least 63 Lesser Yellowlegs, 82 Greater Yellowlegs, 7 Solitary Sandpipers, 3 Rusty Blackbirds, 186 Tree Swallows, and 43 Violet-Green Swallows. Fewer species and fewer individuals of each species were observed this year compared to our 2013 season. We speculate this may have been due to the comparatively late and cold winter experienced by birds wintering in the lower 48, which may have had an impact on the success and timing of birds migrating to Alaska. Additionally, we had a number of volunteers this year that chose to survey wetlands in pairs or groups, which may have led to reduced effort compared to 2013.

We plan to continue this effort in 2015 with additional recruiting of participants in the Matanuska Valley and additional focus on recording all bird species observed in addition to the seven target species.

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#30—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

We continued our study of the Bristle-thighed Curlews on James Campbell National Wildlife Refuge (4.5 km²) using satellite telemetry to measure local and migratory movements, ground surveys to assess age structure, population size and habitat use, and genetic analysis to determine breeding origin of the

wintering birds. To date we have color-marked 46 individuals, satellite-tagged 12 of them, and conducted 28 repeat refuge-wide surveys. Satellite-tagged birds spent most of their time on the refuge, but some regularly used private lands within ~5 km of the refuge for feeding during the day and some visited offshore rocks for roosting at night. Birds occasionally made brief trips to the adjacent Hawaiian Islands of Kauai, Hawaii, and Molokai in 2013, but not in 2014. Satellite-tagged birds departed Oahu on 5–10 May in 2014 ($n = 10$) and arrived 2.3–3.8 days later on breeding areas in the Andreafsky Wilderness ($n = 8$ birds) and the Seward Peninsula ($n = 2$). In contrast to last year, birds flew straight to breeding areas without stopping at Togiak NWR, most likely because breeding habitats were snow-free in early May this year. Fall departure dates ranged from 31 July to 15 August, and southbound flights took slightly longer than northbound at an estimated 3.7–4.8 days. Genetic analysis confirmed that the larger James Campbell population also consisted of birds from both breeding areas. Current work involves data analysis and write-up.

#31—POTENTIAL CLIMATE-MEDIATED IMPACTS ON THE REPRODUCTIVE ECOLOGY OF SHOREBIRDS AT THE COLVILLE RIVER, ALASKA

Investigators: David Ward, Tyrone Donnelly, Aaron Gottesman, and Dan Ruthrauff, US Geological Survey

2014 marked the 4th year during which we monitored the reproductive output of shorebirds at the Colville River Delta following Arctic Shorebird Demographic Network protocols. Upon arrival to the study site on 24 May, surrounding terrain was mostly covered in snow (45%) or water (27%) with only river bank edges free of snow and standing water. Snow and water cover dropped below 50% cover on 2 June and 4 June, respectively. There were only 12 bird species present at the study site upon our arrival, a total that rose to 29 species by 28 May, dropped to a low of 15 at the end of May during a 3-day cold snap, and then steadily rose to a peak on 5 June. Arrival dates for the most common breeding shorebirds were 24 May for Red-necked Phalarope, 25 May for Black-bellied Plover, 26 May for Dunlin, Semipalmated Sandpiper, American Golden-Plover, Bar-tailed Godwit and Pectoral Sandpiper, and 28 May for Long-billed Dowitcher and Stilt Sandpiper.

We monitored 169 shorebird and 164 non-shorebird nests across each of two ~1.5 km² study plots. The most abundant shorebird species were Semipalmated Sandpipers ($n=79$ nests), Red Phalaropes ($n=33$), Dunlin ($n=15$), and Ruddy Turnstones ($n=13$). Red-necked Phalarope ($n=10$), Black-bellied Plover ($n=8$), and Pectoral Sandpiper ($n=5$) nests were relatively uncommon, and only one American Golden-Plover nest was found. The most common non-shorebird nests were Greater White-fronted Goose ($n=57$), Lapland Longspur ($n=34$), Black Brant ($n=17$), and Snow Goose ($n=15$). The mean date of nest initiation for Semipalmated Sandpipers (range =14 days) and Ruddy Turnstones (range=14 days) was 10 June, 14 June for Dunlins (range= 30 days) and Red Phalaropes (range= 20 days), and 17 June for Red-necked Phalaropes (range=20 days). Observed nest success of known-fate nests for all shorebird species

was 63% (range = 0–91%) and varied across the five most common species (Semipalmated Sandpipers: 67%; Dunlin: 91%; Ruddy Turnstone: 10%; Red Phalarope: 62%; Red-necked Phalarope: 75%).

In addition to monitoring seasonal trends in reproductive output, we initiated a pilot study to experimentally assess potential effects of delayed hatching on the growth and survival of Semipalmated Sandpiper chicks. A key prediction regarding climate change impacts to wildlife concerns the occurrence of phenological mismatches between resources at lower trophic levels and consumers at higher trophic levels, a concept termed the ‘mismatch hypothesis’. We maintained a sample ($n=5$ clutches) of freshly-laid eggs in cool, sterile conditions for 5 days whereupon we returned these eggs to active nests, thus artificially delaying their hatch. In subsequent years we will employ this approach to assess whether chicks from delayed nests grow and survive at the same rate as those from control nests. We will also measure the seasonal abundance of the chicks’ arthropod prey base to determine the relative importance of intrinsic versus seasonal factors in regulating chick growth and survival, allowing us to assess potential vulnerability to climate-mediated mismatch scenarios.

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#32—BIOGEOGRAPHY OF TRANSMISSION DYNAMICS FOR A VECTOR-BORNE PATHOGEN RECENTLY FOUND IN ARCTIC-BREEDING SHOREBIRDS

Investigators: Samantha Wisely and Claudia Ganser, University Of Florida, Gainesville, and The Arctic Shorebird Demographics Network Cooperators

Co-Investigators: Rick Lanctot, Dov Lank, Brett Sandercock, River Gates, Joe Liebezeit, Steve Zack, David Ward, David Payer, Stephan Brown, Paul Smith, Grant Gilchrist, Joel Bety, Jean Francois Lamarre, Erica Nol, Nathan Senner, and Jennie Rauch

Globally, shorebirds are declining at a precipitous rate. Although the exact causes are unclear and likely complex, habitat loss and degradation in addition to climate change are likely at the root of their decline. Indirect effects of these changes, such as increased infectious disease transmission, have largely been ignored in the literature. Our study addresses the role of avian malaria – a vector-borne infectious disease caused by *Plasmodium*, *Haemoproteus* and *Leucocytozoon* – in the conservation of Neotropical migrants and establishes the global context of their transmission dynamics. From 2011 – 2014 we collected over 3100 blood samples from 14 shorebird species. These samples were collected from 14 Arctic breeding sites across the Alaskan, Canadian and Russian Arctic.

Utilizing molecular techniques, we screened shorebird samples from 2011 – 2012 ($n=1219$ samples) for malaria parasites. The overall prevalence of avian malaria at Arctic breeding grounds was 2.21%, with slight annual variations between the years. In 2011 we found 10 (2.39%) positive for malarial parasites, and 17 (2.13%) in 2012. These estimates are consistent with previous studies that found low parasite

prevalence at Nearctic breeding sites. Low prevalence of infectious disease agents are indicative of a high pathogenic potentially.

The biogeographic analysis indicated that one *Plasmodium* strain (recovered from a Semipalmated Sandpiper) had a narrow geographic range occurring in only 4 counties within two geographic regions (Asia, North America) and an equally narrow host range occurring in only 9 host species, while the other strain (recovered from a Pectoral Sandpiper) had a nearly panglobal distribution occurring across 31 countries within five geographic regions. This *Plasmodium* strain had a broad host range, occurring in 106 host species that belong to 5 orders. The *Haemoproteus* strain (recovered from a Western and Semipalmated Sandpiper) had a global distribution (occurring in 25 countries) and broad host range of 56 species that belong to 9 orders. Up to date we have only been able to amplify 4 out of the 10 positive shorebird samples. We are in the process of obtaining additional sequences to be able to draw a detailed comparisons between lineages found in other bird species along migratory routes and construct a more comprehensive biogeographic analysis of haematozoa .

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Lee Tibbitts and Wally Johnson working on Pacific Golden Plovers up in Nome this summer. Photo Nils Warnock.