Alaska Shorebird Group

Annual Summary Compilation:

New or ongoing studies of Alaska shorebirds

December 2016

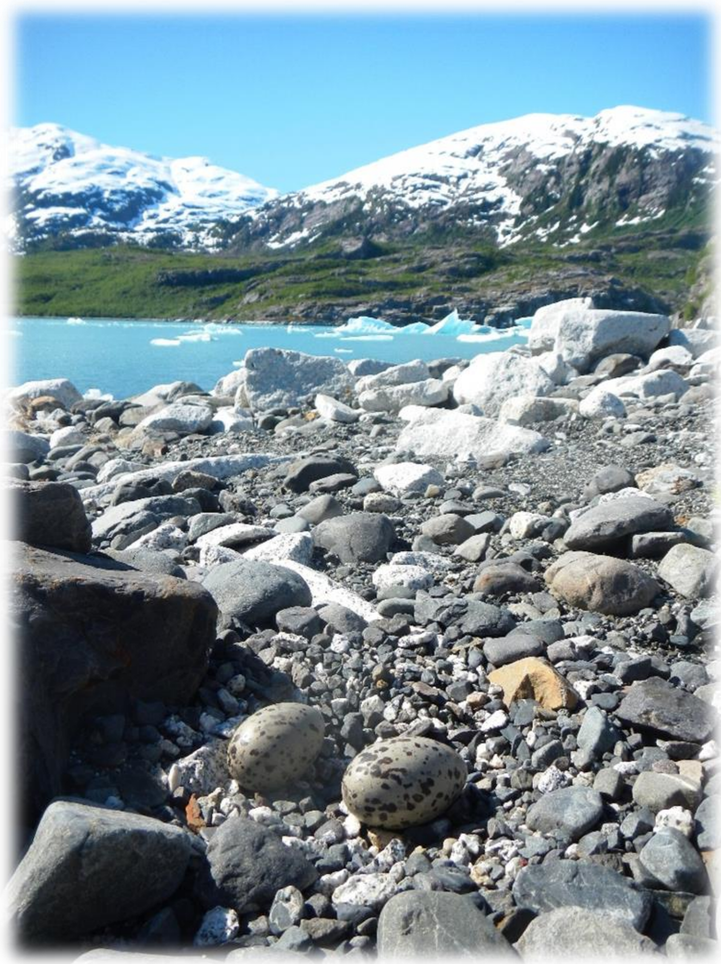

Figure 5.1. Black oystercatcher nest found during 2016 surveys in Prince William Sound.
Photo Credit: Melissa Gabrielson, USFS

EXECUTIVE SUMMARY

Welcome to the 2016 summary report of ongoing or new studies of Alaska shorebirds. This is the sixteenth consecutive report put together by the Alaska Shorebird Group. In this document, members of the Alaska Shorebird Group compiled annual summaries for 19 studies, highlighting many interesting projects investigating Alaska shorebirds. The Alaska Shorebird Group continues to be a highly collaborative organization with a member with the state government, the federal government, universities and the private sector. This annual compilation is the only written record of shorebird projects in the state of Alaska and provides a valuable timeline of shorebird science activities for the Alaska region and landscape scale projects spearheaded by Alaskan' efforts.

A map of study site locations (next page) shows the Alaska statewide distribution of projects described in this summary. More detail to each study design and layout is provided within project descriptions or can be gained by contacting the project contact. Most of the 2016 projects in Alaska were conducted at arctic breeding sites and in south central Alaska, with one additional study conducted in the Alaskan interior.

Thank you to the principal investigators for making contributions to this year's annual summary report, and especially to the field biologists for their valiant efforts in conducting these important field studies throughout Alaska and beyond. Further thanks I extend to all of the talented photographers who submitted their images for use in this document. Photo credits and a brief caption are listed for each photo, where provided by PIs. We look forward to many more years of fruitful research and conservation of Alaska's breeding and migratory shorebirds.

Kim Jochum Ph.D.
Alaska Shorebird Group Secretary

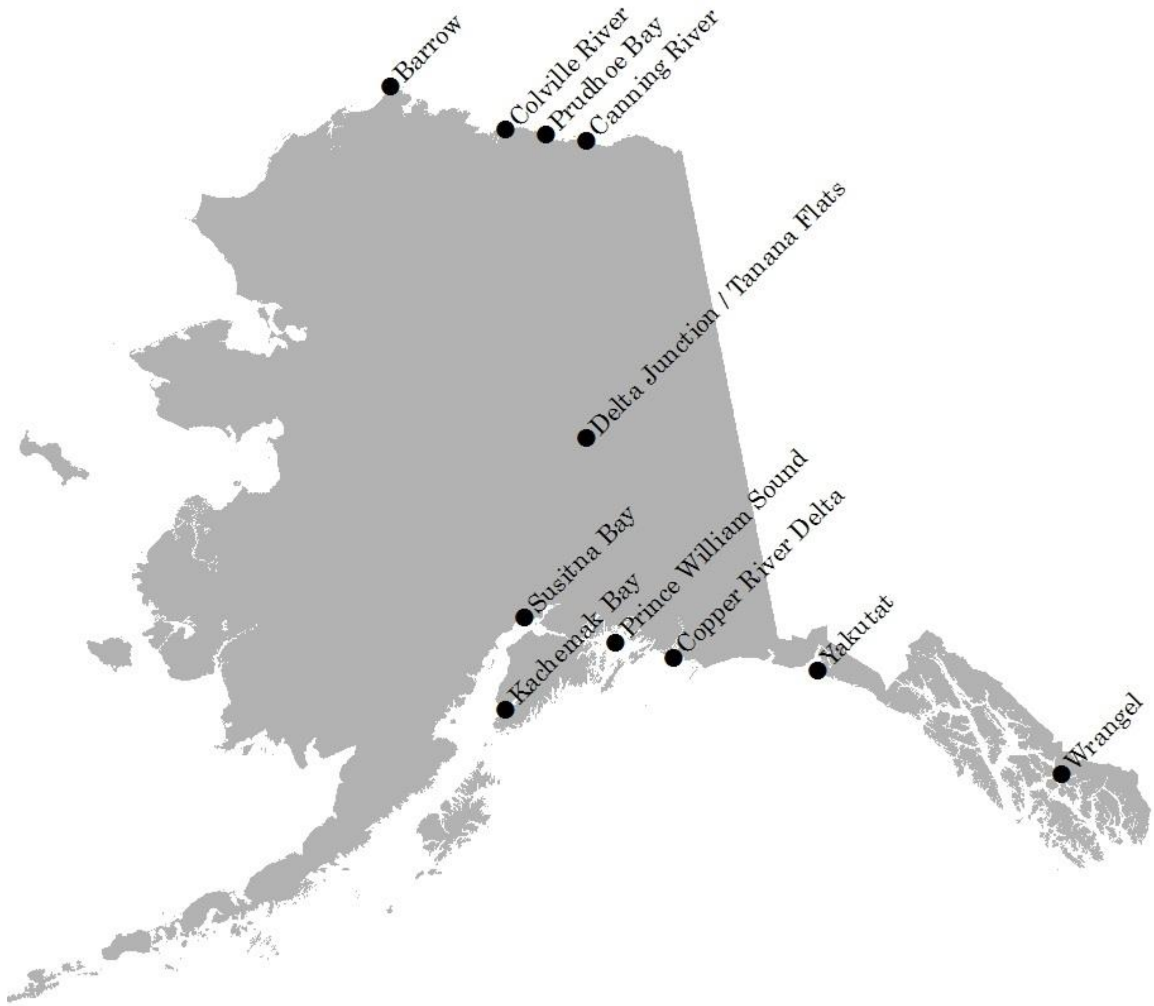

Figure 0.1. Dispersal of 2016 Alaska Shorebird Group Projects throughout Alaska. Locations may represent more than one project.

- Specific project sites/areas throughout Alaska
  - North Slope: 4, 8, 13, 17
  - Interior Alaska: 11
  - Susitna Bay: 3
  - Kachemak Bay: 9
  - Prince William Sound: 5
  - Copper River Delta: 12, 19
  - Southeast Alaska: 18

- Cross-Arctic projects with multiple study sites: 1, 2, 10, 14

- Landscape scale projects: 6, 7, 15, 16

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#1— KEEPING UP WITH CLIMATE CHANGE? SPRING PHENOLOGY AND ARCTIC-NESTING SHOREBIRDS

Investigators: Kristy E. Gurney, Environment and Climate Change Canada, David Ward and David Douglas, USGS Alaska Science Center, Michael Budde, USGS Center for Earth Resources Observation and Science

How large-scale changes in soil freeze-thaw cycles and associated changes in vegetation (i.e., spring phenology) will affect arctic-breeding shorebirds will vary among species and populations. Species that do not express phenotypic plasticity are most likely to be affected negatively – reduced reproductive success and population declines have been observed in long-distance avian migrants and in those whose breeding phenology is dependent on non-climatic cues. Conversely, species that migrate over shorter distances and those that advance the onset of breeding to keep pace with advancing spring phenology may benefit from predicted changes in climate. The proximate cues that arctic-nesting shorebirds use to determine timing of breeding, however, have not been examined across a broad taxonomic scale and remain poorly quantified for many species. The objective of our study is thus to evaluate hypotheses about processes that influence timing of breeding across a range of taxa, thereby providing ecological insights and facilitating accurate predictions of how shorebird populations will respond to changing environmental conditions on their Alaskan breeding grounds. Working with the Arctic Shorebird Demographics Network and using nesting data acquired from 17 Arctic sites, including 7 in Alaska, we evaluated (i) whether nesting phenology of Arctic-nesting shorebirds is responding to climate change and (ii) whether life-history traits explained differences among species. Initial assessments suggest substantial variation in species-specific responses and that timing of nesting might be an important predictor of flexibility in breeding dates.

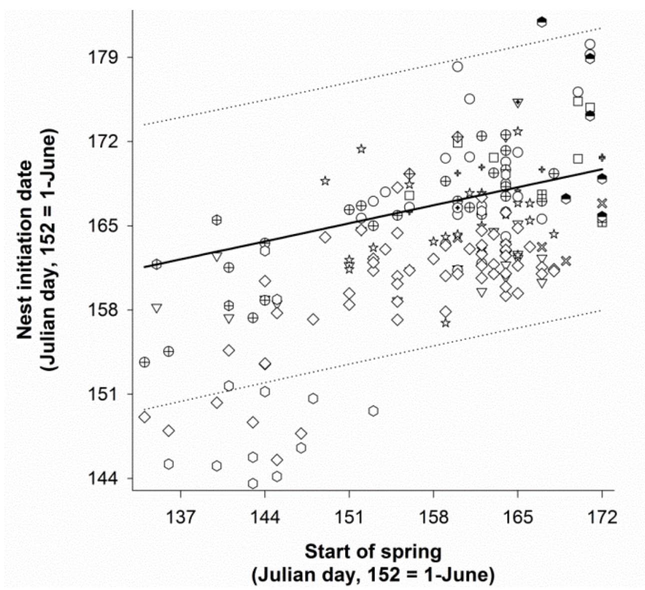

Figure 1.1. Shorebirds are nesting earlier with advancing spring phenology, and the strength of the response varies among species, as indicated by different symbols.

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#2— ARCTIC SHOREBIRD DEMOGRAPHICS NETWORK: OVERVIEW

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

To better understand how shorebirds will respond to climate-mediated changes in the Arctic's morphology and ecology, we established a network of field sites across Alaska, Canada, and Russia, known as the Arctic Shorebird Demographics Network (ASDN). Our field work was conducted over five years (2010-2014) at 16 sites by 32 principal investigators and 11 graduate students (4 PhD, 7 M.Sc.) from 15 institutions. We used standardized field protocols to collect information on shorebird ecology and demography, as well as a suite of predictor variables related to demographic parameters and climate change. Here we present a summary of results from our analysis, which are at various stages of the publication process.

The first major goal of our network was to develop range-wide estimates of apparent survival rates for six species of shorebirds. Annual estimates of apparent survival were low for American Golden-Plovers (0.22), Western Sandpipers (0.27), Red-necked Phalaropes (0.27), and Red Phalaropes (0.28), but moderate for Semipalmated Sandpipers (0.64) and three subspecies of Dunlin (0.64–0.71). Low rates of apparent survival likely indicate high rates of dispersal from the study areas. Apparent survival of three species varied by up to 70% depending on sex and nest fate, suggesting that nest failure coincided with adult mortality or increased the chance of breeding dispersal, especially for males. Apparent survival of four species was affected by annual variation in abundance of lemmings and voles, but the nature of the effect varied among species, with apparent survival being either highest or lowest in years of moderate rodent abundance. For one species (Red Phalaropes), apparent survival was lowest in years with high fox abundance. We found no effects of timing of snowmelt or summer temperature on apparent survival. Apparent survival of adult shorebirds may be relatively robust to environmental and ecological conditions at Arctic breeding sites, but breeding success may affect site fidelity more than previously thought.

Our second goal was to quantify patterns in reproductive success, specifically clutch size, egg volume, incubation duration, and nest success for 21 species of shorebirds. We also examined cause-specific rates of nest failure to predation, abandonment, and other causes. We found strong seasonal declines in at least one reproductive trait in a majority of species: up to 78% in the probability of laying a full four-egg clutch, 13% in incubation duration, 12% in daily survival rate of nests, and 5% in mean egg volume. Seasonal trends in clutch size and nest survival were observed within as well as among individuals, so temporal changes were not fully explained by among-individual variation. Seasonal changes in daily nest survival translated into a 24–89% reduction in expected nest success, indicating a large fitness cost of nesting late in the season. The proportion of failed nests that were depredated declined over the season from 0.98 to 0.60, while the proportion abandoned increased from 0.01 to 0.35 and drove the seasonal declines in nest survival. We have some evidence (analyses ongoing) that nest abandonment typically corresponds with mortality of the attending parent(s), suggesting that the risk of adult mortality increases sharply at the end of the nesting period. We also found effects of environmental covariates on reproductive investment and nesting success. Earlier snowmelt increased the probability of laying a full four-egg clutch for Western Sandpipers (range 0.61-0.91), and shortened incubation time for Dunlin (range 17-23 days) and Red Phalaropes (range 17-21 days). Warmer ambient temperatures increased the probability of laying a four-egg clutch for Western Sandpipers (range 0.60-0.93) and Red-necked Phalaropes (range 0.76-0.97), and increased daily survival rates of nests for Semipalmated Sandpipers (range 0.9634-0.9890) and Western Sandpipers (range 0.9546-0.9880). Abundance of lemmings and voles was associated with variation in the probability of laying a four-egg clutch for Semipalmated Sandpipers (range 0.83-0.90), and abundance of predators (foxes) was negatively correlated with daily nest survival rates for Western Sandpipers (range 0.9031-0.9821). Overall, our findings suggest that climate change may typically have neutral or positive effects during the nesting cycle of Arctic-breeding shorebirds in the short term.

Our last goal was to incorporate the above results into population models to evaluate how the sometimes contrasting effects of covariates on demographic rates would influence net population trends for five species of shorebirds. Based on expected climate change and the effects of covariates on adult survival and reproductive success, only one of our study species (Red Phalarope) was expected to experience a depressed population trajectory (up to 50% decline from the current population size) as a direct result of expected climate change. In contrast, we predicted no net effect on population size of Red-necked Phalaropes, and positive effects on populations of *arcticola* Dunlin (up to a 50% increase), Semipalmated Sandpipers (up to 2-fold increase), and Western Sandpipers (up to 3-fold increase). Thus, in the short term, we expect that climate change in the Arctic will not further endanger most shorebirds, aside from negative effects of increasing predator numbers or activity on species such as Red Phalaropes. However, future research should focus on key vital rates that have been understudied and may affect population projections, including chick survival, juvenile survival, and overwinter adult survival and the factors that affect those rates. Perhaps most importantly, climate change is expected to generate major changes in availability of breeding habitat that are likely to limit shorebird populations to much smaller breeding ranges. Future studies should examine breeding habitat associations, connectivity, and density dependence to better evaluate the potential effects of expected changes in arctic habitat.

As indicated above, data collected throughout the network has been used by a number of collaborators and students to investigate a variety of shorebird-related issues over large geographic and temporal scales. As of the fall of 2015, project investigators collectively produced 28 peer-reviewed publications, 2 PhD theses, 5 Master’s thesis, 3 popular articles, 34 reports, and 94 presentations. Many additional papers are in the process of being written and reviewed. Our work also formed the core of a worldwide collaboration that found that leg-mounted geolocators sometimes reduce return rates and nest success for small Arctic-breeding shorebirds (Open Access: Weiser et al. 2016, Movement Ecology 4:12, doi: 10.1186/s40462-016-0077-6).

This study included four priority species identified in the Alaska Shorebird Conservation Plan (2008), including the American Golden-Plover, Western Sandpiper, Dunlin, and Buff-breasted Sandpiper. The study also fulfills three Alaska-wide research objectives, including to: "investigate causes of shorebird population declines", "encourage long-term studies synthesizing measures of shorebird breeding phenology and environmental conditions", and "develop quantitative population models, measure key demographic parameters, and analyze population dynamics to estimate the long-term effects of subsistence harvest, depressed productivity, and other factors that may affect viability of shorebird populations" (Alaska Shorebird Conservation Plan 2008). Finally, the study fulfills one Alaska-wide monitoring objective that is to "monitor demographic parameters and use demographic models to better understand limiting factors at the population level" (Alaska Shorebird Conservation Plan 2008).

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#3— 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

In the final year of field work for my dissertation, we again monitored Hudsonian Godwits in Beluga, Alaska and on Isla Chiloé. 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, the relative influence of within breeding season vs. non-breeding season factors on reproductive performance, 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 influence breeding success? My work examines 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.

During this field season, we continued monitoring Hudsonian Godwits, other shorebirds, and predators in two study plots of ~700 ha. We monitored prey availability in the bogs as well as habitat variability. It was another poor year for Hudsonian Godwits, with lower adult return rates, a smaller breeding population, and poor chick survival (~5%). We monitored over 100 nests found in the bog of all waterbird species including 37 shorebird nests. We continued monitoring species arrival and abundance and entered all data into eBird.

In addition to work in Alaska, 2016 marked another year of monitoring Hudsonian Godwits on Chiloé Island in Chile. Surveys took place between January 1st – March 9th, 2016. Thirty Susitna Flats banded individuals were seen, one from Churchill, MB, as well as number of Chilean banded birds.

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Figure 3.1 Hudsonian Godwit chicks on hatch day. Photo credit: Rose Swift

#4— 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 2016 we discovered and monitored 123 nests of 13 tundra-nesting species (8 shorebird species) from 12 June to 9 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 (60%) of those found. Of the 123 nests found, 65 were successful, 42 were predated, 2 were abandoned, 1 failed due to a researcher, and 13 were unknown (Table 2). One nest's fate could not be determined. Apparent nest survival was 60.7% (65 successful, 42 predated) in 2016, 76% in 2015 (83 successful/26 depredated), and 50.5% in 2014 (56 nests hatched/55 depredated). Overall, 9 species of potential nest predators were detected during timed surveys with the most common being Glaucous Gulls, Parasitic Jaegers, and Long-tailed Jaegers.

Figure 4.1. Semipalmated Sandpiper, Prudhoe Bay Alaska. Photo credit Zak Pohlen.

Figure 4.2. Red-necked Phalarope, Prudhoe Bay, Alaska, 2015. Photo credit Zak Pohlen.

#5— BLACK OYSTERCATCHER SURVEYS IN PRINCE WILLIAM SOUND – 2016 FOREST PLAN MONITORING

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

Black oystercatchers 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 "management indicator species" for the Chugach National Forest (CNF), and a "sensitive species" for the US Forest Service Alaska Region. The Chugach Forest Plan (2002) advises monitoring population trends, habitat relationships, and habitat changes for nesting black oystercatchers in PWS. The Chugach National Forest has been monitoring black oystercatcher nest locations in PWS since 1999.

The sampling design for this survey was developed in an attempt to retain the historically important survey regions of Harriman Fjord, Green Island, Montague Island, and the Dutch group, while incorporating shoreline segments from the entire PWS. A regional sampling approach was used to minimize travel time and expenses. In addition, a split-panel rotating design was developed to provide a balance between estimation of trend and estimation of yearly status. 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 black oystercatchers in PWS.

In June 2016, the following areas were surveyed in Prince William Sound: Simpson Bay, Gravina Bay, Green Island, Herring Bay (Knight Island), Lower Herring Bay (Knight Island), Derickson Bay (Port Nellie Juan), Eaglek, Heather Bay, and Galena Bay (Figure 1).

A total of 17 active Black Oystercatcher nesting territories were identified during the survey and an additional 23 sites were identified with non-breeding Black Oystercatchers. The greatest densities of active Black Oystercatcher territories were located in Galena Bay (n =6). However, the greatest number of black oystercatcher encounters (n=12, breeding and nonbreeding) occurred in Heather Bay.

Overall, 9 active nests, 17 total eggs, 13 chicks, and 121 (breeding and non-breeding) adults were observed during the 2016 survey. Data from the 2016 survey will be entered into the CNF Black Oystercatcher GIS database. Future analysis will continue to compare Black Oystercatcher populations and human use effects across Prince William Sound.

This project will help address multiple actions in BCR 5 within the 2008 Alaska Shorebird Conservation Plan.

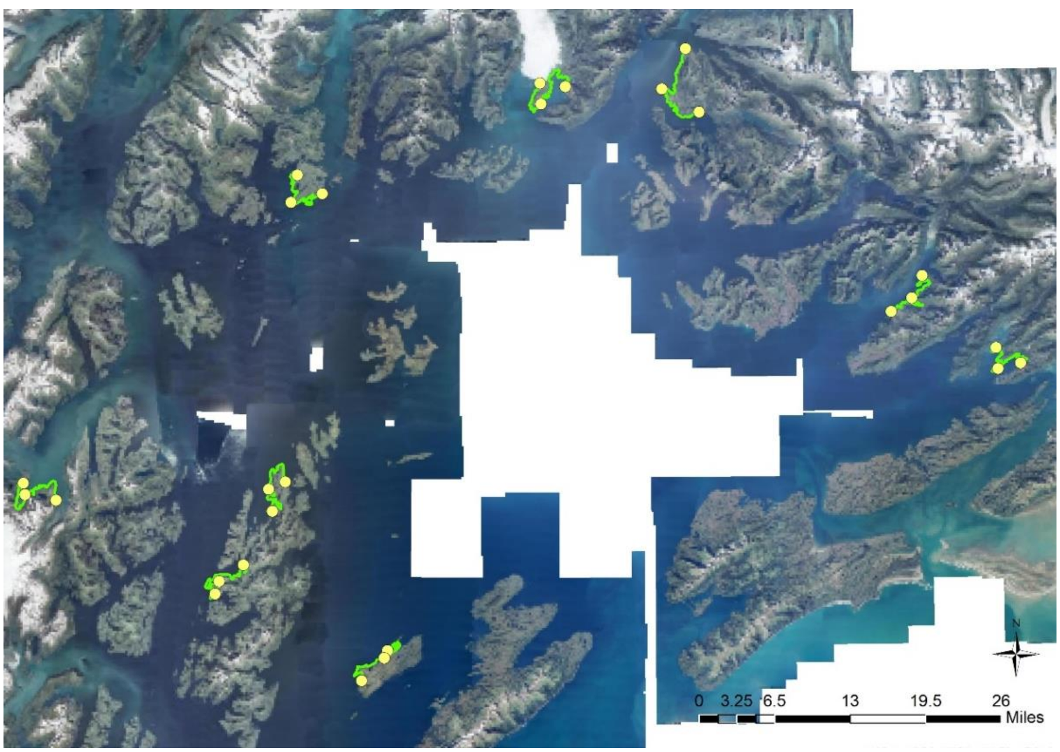

Figure 5.2. Black oystercatcher transects (with associated endpoints and center points) monitored in PWS during 2016 survey.

Figure 5.3. Black oystercatcher nest with eggs and chick found during 2016 surveys in Prince William Sound. Photo Credit: Matthew Prinzing, SCA Intern, USFS.

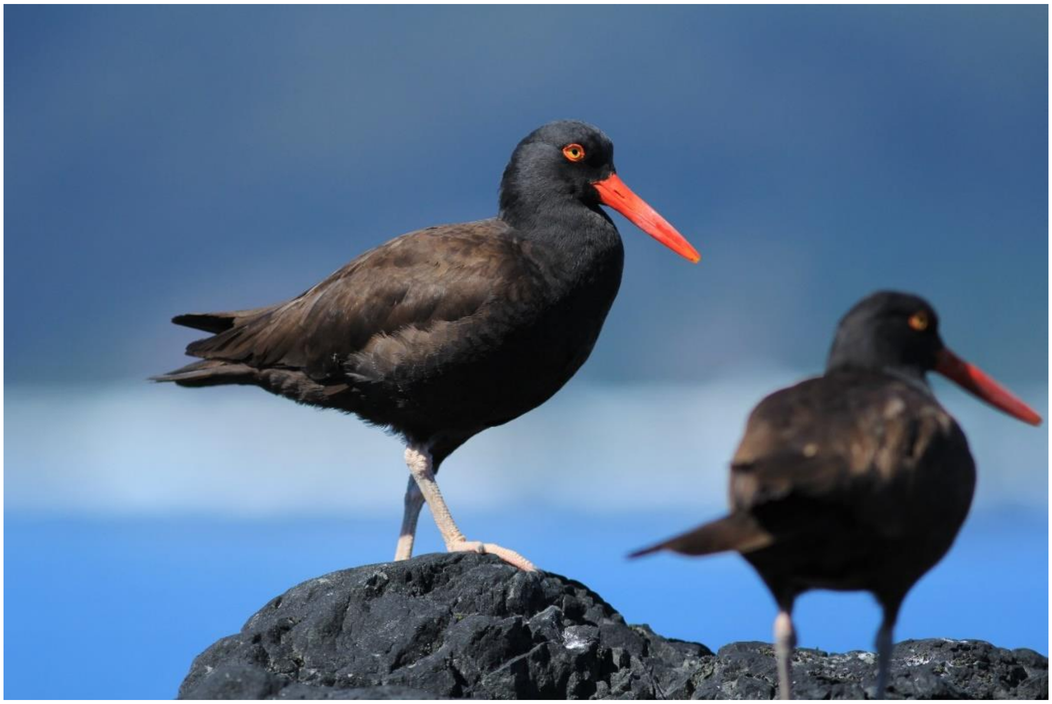

Figure 5.4. Black oystercatchers observed during 2016 surreys in Prince William Sound. Photo Credit: Matthew Prinzing, SCA Intern, USFS.

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#6— PACIFIC AMERICAS SHOREBIRD CONSERVATION STRATEGY

Investigators: Stan Senner, National Audubon Society, Brad Andres, U.S. Fish and Wildlife Service and River Gates, Pacifica Ecological Services

The Pacific Americas Shorebird Conservation Strategy is an international effort to identify priority threats and develop coordinated conservation action necessary to maintain and restore populations of shorebirds and their habitats across the entire Pacific Americas Flyway. Shorebirds are faced with many challenges due to their often long-distance migrations, reliance on coastal and wetlands habitats and vulnerability to environmental and anthropogenic perturbations. The Strategy focuses primarily on the Pacific coasts of the Americas and spans 120 degrees of latitude from northeastern Russia to southern Chile. During 2013–2016, more than 90 participants from 17 countries, representing 54 institutions participated in a series of four workshops at which the scope and contents of the Strategy were developed. We used the *Open Standards for the Practice of Conservation* to identify 21 target species, 7 major threats and 6 key action strategies across the project area. Thirteen target species occur within Alaska, where climate change, energy production and mining, and oil spills were identified as important regional threats. We aggregated a series of regional activities into a portfolio of actions that can be implemented to conserve shorebirds throughout the Flyway. The very process of developing the Strategy has already enabled partners to work together throughout the Flyway on a more coordinated basis.

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#7— SUBSPECIFIC MIGRATION ECOLOGY AND LANDSCAPE-SCALE CONSERVATION PRIORITIES FOR AN ARCTIC BREEDING SHOREBIRD, THE DUNLIN (*CALIDRIS ALPINA*)

Investigators: Ben Lagasse and Mike Wunder, University of Colorado Denver; Richard Lanctot, Chris Latty, Sarah Saalfeld, and Kristine Sowl, U.S. Fish and Wildlife Service; S.Brown, Manomet Center for Conservation Science; Rebecca Bentzen and Martin Robards, Wildlife Conservation Society; Olivier Gilg, University of Burgundy, Groupe de Recherche en Ecologie Arctique, Frencheville, France; Rob van Bemmelen, Wageningen University, Netherlands; Aleksandr Sokolov, Russian Academy of Sciences; Jannik Hansen, Aarhus University, Denmark; Pavel Tomkovich, Lomonosov Moscow State University, Russia; Velli-Matti Pakanen, University of Oulu, Finland; Laura McKinnon and Leah Wright, York University, Canada; Barbara Ganter and Hans-Ulrich Rosner, Husum, Germany; Olga Valchuk, Centre for Avian Biodiversity, Vladivostok, Russia; Alexei Dondua, Beringia National Park, Providenia, Russia.

Understanding the spatiotemporal connectivity of migratory populations is essential for developing landscape-scale conservation plans. The Dunlin is a migratory shorebird with 10 subspecies that breed throughout the circumpolar arctic and subarctic (Figures 1, 2). These subspecies migrate south, sometimes with other subspecies and sometimes alone, along most of the eight flyways emanating from the arctic. Understanding the spatiotemporal extent that subspecies segregate or mix while migrating together is important for directing conservation efforts in the appropriate locations. This is particularly true along the East Asian-Australasian Flyway given the extensive alteration and loss of habitat (e.g., intertidal habitats around the Yellow Sea have declined by >65%), and large differences in population sizes of the four subspecies that use this area (*actites* number <1000 and the others are <550,000).

The primary objectives of this study are to generate spatiotemporally explicit migratory tracks for Dunlin from 19 breeding sites throughout the circumpolar arctic using archival light-level geolocators (Figures 1, 2). With this information we plan to identify 1) migratory bottlenecks and subspecific sites of conservation priority at the flyway level, 2) the extent different subspecies mix during migration and on terminal wintering grounds, and 3) possible sex-specific differences in distribution and migratory timing.

Between 2010 and 2015, a total of 160 geolocators were deployed and recovered from tagging efforts focused on 5 subspecies at 11 breeding sites throughout North America, Finland, and eastern Russia (Figure 2). This past summer an additional 184 geolocators were deployed at 13 sites (Figure 2). Within Alaska, 15 geolocators were deployed at Kanaryarmiut on the Yukon-Kuskokwim Delta, 13 at the Canning River, and 46 near the town of Barrow (Figure 2). Field biologists will attempt to relocate and capture these 184 Dunlin in 2017 to retrieve migration tracks. Once these data are available, we will use FLightR and other software to determine movements of 8 of the 10 subspecies of Dunlin. The information from this study will help inform international efforts to develop effective landscape-scale conservation plans for the Dunlin, and other sympatric migratory shorebirds throughout the Northern

Hemisphere, many of which are showing long-term declines. We are very excited about this international collaboration and look forward to keeping the Alaska shorebird community updated as things progress.

This study is focused on the Dunlin, one of the priority shorebird species identified in the Alaska Shorebird Conservation Plan (Alaska Shorebird Group 2008). The study also fulfills action items identified in the Alaska Shorebird Conservation Plan under the Research section (i.e., "develop and implement contemporary research techniques (e.g., geolocators) to identify unique populations of shorebirds that reside in Alaska and to link sites used throughout their annual cycles"), and the International Collaborations section (i.e., "foster cooperative research efforts throughout the Western Hemisphere, Asia, and elsewhere along migratory flyways", AND "participate in species-specific conservation planning efforts").

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Figure 7.1. Dunlin equipped with a geolocator at Barrow, Alaska. Photo by Ben Lagasse.

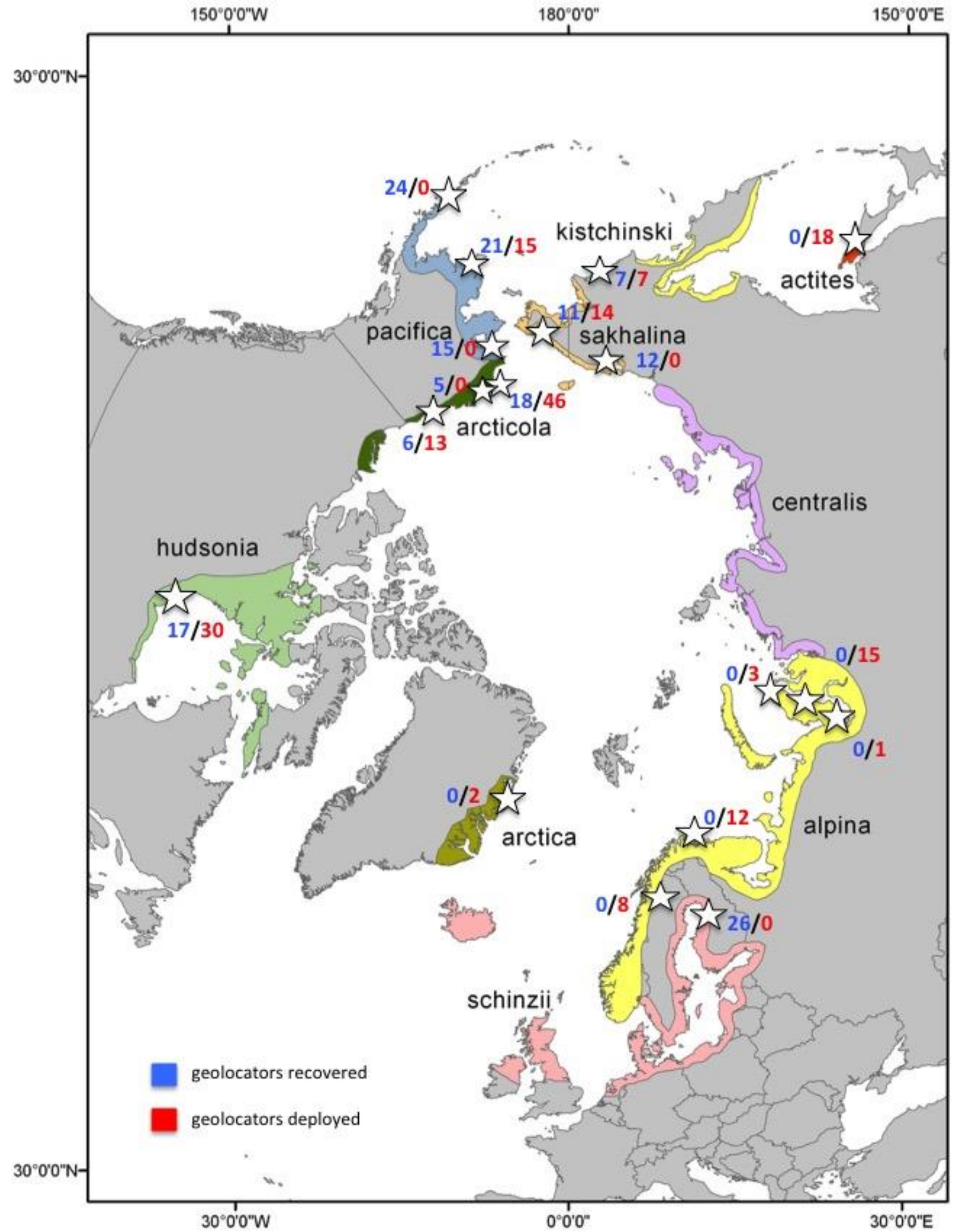

Figure 7.2. Location where light-level geolocators were deployed and recovered throughout the breeding range of the Dunlin.

#8— REPRODUCTIVE ECOLOGY OF SHOREBIRDS: STUDIES AT BARROW, ALASKA, IN 2016

Investigators: Richard Lanctot, U.S. Fish and Wildlife Service; Sarah Saalfeld, U.S. Fish and Wildlife Service

In 2016, we conducted the 14th 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.

We located and monitored nests in six 36-ha plots in 2016. All six plots were the same as those sampled in 2015, with five of the six plots sampled since 2005; all plots were searched with the same intensity as in past years. A total of 337 nests were located on our plots and an additional 24 nests were found outside the plot boundaries. Our total number of nests located on plots was lower than the past five years (total number of nests ranged from 358–506 in the past five years), but higher than the first eight years of this study (i.e., 2003–2010 where number of nests ranged from 75-318). Nests on plots included 121 Red Phalaropes, 71 Pectoral Sandpipers, 31 Dunlin, 31 Western Sandpipers, 28 Long-billed Dowitchers, 28 Semipalmated Sandpipers, 18 Red-necked Phalaropes, and 9 American Golden-plovers. No Ruddy Turnstone, White-rumped, Baird's, or Buff-breasted sandpiper nests were found on the plots in 2016. The breeding density of all shorebird species on our study area was 156.0 nests/km^2 in 2016; this was about 1.19 times larger than our long-term average of 130.6 nests/km^2. In 2016, five species nested in higher densities than the 14-year average (Long-billed Dowitcher, Pectoral Sandpiper, Red Phalarope, Red-necked Phalarope, and Western Sandpiper) and seven nested at densities below the 14-year average (American Golden-plover, Dunlin, Baird's Sandpiper, Buff-breasted Sandpipers, Ruddy Turnstone, Semipalmated Sandpiper, and White-rumped Sandpiper).

The first shorebird clutch was initiated on 24 May – 8 days earlier than the long-term average of 1 June. Median initiation date was 8 June; this date was 6 days earlier than the long-term average. Median nest initiation dates for the more abundant species were 4 June for Red Phalarope, 6 June for Semipalmated Sandpiper, 8 June for Dunlin, and 10 June for Pectoral Sandpiper. Median initiation dates were earlier for all species (compared to their respective 14-year averages), except for Red-necked Phalarope and American Golden-Plover, whose median initiation dates were 1–2 days later than the 14-year average, respectively.

Predators destroyed 22.1% of the known-fate nests in 2016 (excluding human-caused mortalities). This is less than the long-term average of 27.4%, but similar to the 21.6% average for other years with fox control (2005–2016). Apparent hatching success (# hatching at least one young/total number of known-fate nests) was highest in Western Sandpiper (83.9%, N = 32), Dunlin (82.8%, N = 45), Red Phalarope (77.5%, N =

121), and Semipalmated Sandpiper (71.4%, *N* = 34), and lowest in Red-necked Phalarope (66.7%, *N* = 18), Pectoral Sandpiper (60.6%, *N* = 71), American Golden-Plover (55.6%, *N* = 9), and Long-billed Dowitcher (48.0%, *N* = 27).

In 2016, we captured and color-marked 308 adults located both on and off plots. This was more than the 242 banded in 2015 and the 14-year average of 295. Fifty-one of these adults (36 Dunlin, 3 Red Phalarope, 1 Red-necked Phalarope, and 11 Semipalmated Sandpipers) had been banded as adults in a prior year. Adults captured included 73 Dunlin, 48 Red Phalarope, 44 Western Sandpiper, 41 Semipalmated Sandpiper, 40 Pectoral Sandpiper, 38 Long-billed Dowitcher, 13 American Golden-plover, and 11 Red-necked Phalarope. We also re-sighted 18 adults banded in prior years nesting on our plots in 2016. This included 5 Dunlin, 7 Semipalmated Sandpiper, 2 American Golden-Plover, and 4 Western Sandpiper. We captured and color marked 673 chicks. This was 1.19 times more than the 14-year average of 567, but lower than our previous highs of 1,014 in 2012 and 1,001 in 2015.

In regards to other environmental features at Barrow, lemming numbers in 2016 were similar as 2015, being 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. The summer of 2016 was the second earliest snow melt recorded in the past 14 years, with 20% snow cover remaining on the tundra on 30 May (average long-term date is 9 June).

When combining data across the 14-year study, we have seen a significant advancement in the timing of snow melt, with date of 20% snow cover now occurring 11 days earlier than just 14 years ago, an advancement rate of 0.8 days/year. This drastic change in the start of summer is likely to have large consequences on the shorebirds inhabiting this region. For example, to keep pace with advancing snow melt, shorebirds have advanced their nesting phenology, although the adaptability to adjust to earlier summers was very different among species. For example, Western Sandpiper, Pectoral Sandpiper, and Red Phalarope advanced laying dates by 0.3–0.9 days/year, while Long-billed Dowitcher, Semipalmated Sandpiper, and Dunlin showed advancement of just 0.1–0.2 days/year, and American Golden-Plover and Red-necked Phalarope showed no significant advancement. As species that failed to advance egg laying are more likely to have reduced recruitment, these species are most at risk to long-term population declines.

Field assistance for conducting this work was provided by Willow English (crew leader), Ben Lagasse, Danielle Gerik, Sara Hoepfner, Wyatt Engelhoff, Emilia Lai, and Nicole Orchard. Funding was provided by the Arctic Landscape Conservation Cooperative, National Fish and Wildlife Foundation, and USFWS Migratory Bird Management division.

This study fulfills two primary objectives for Bird Conservation Region 3 as outlined in the Alaska Shorebird Conservation Plan (2008), which are to "develop models to predict the effects of long-term climate change on shorebird populations" and "study breeding ecology to identify factors limiting population size."

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#9 — KACHEMAK BAY SHOREBIRD MONITORING PROJECT: 2016 REPORT

Investigators: George Matz and Kachemak Bay Birders

Purpose: In May 2016, Kachemak Bay Birders (based in Homer, Alaska) completed its eighth 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. We continued to include monitoring at Anchor Point/River and the Kasilof River, which now includes four years of data. By comparing our current Homer Spit data to monitoring data collected by the late George West, who conducted counts of Homer Spit shorebirds during the 1980s and 1990s, we are able to get a better understanding of population trends. Secondary purposes for this project are: 1) to contribute information that might be useful to others assessing shorebird populations across the entire Pacific Flyway: and 2) to use the monitoring data to help protect Kachemak Bay/Homer Spit shorebird habitat.

Protocol: The monitoring protocol we used was identical to previous years. Between April 16, 2016 and May 26, 2016 we had nine monitoring sessions. In the Homer Spit area we simultaneously monitored five sites for two hours once every five days when the outgoing tide reached 15.0 feet (or at high tide if less). Using these tide conditions provided consistency and optimized shorebird viewing conditions. We also recorded any disturbance to shorebirds. In addition, we received observations from a boat on the south side of Kachemak Bay about the same time. All the data was entered on eBird.

Again, a record number of 51volunteers participated: 43 in the Homer Spit area, 8 at Anchor Point, and 8 at the Kasilof River. This amounted to 500 hours of volunteer effort at the Homer Spit and Anchor River sites. This does not include travel time or time spent caucusing.

Results: This year in the Homer area we observed a total of 23 species of shorebirds and counted a total of approximately 10,477 individual shorebirds. The number of shorebird species counted this year was less than our eight year average (24). There were no new species. The total number of individual shorebirds counted this year was also less than average (13,470).

The top ten taxa seen this year include LESA/WESA/SESA which is a lumping of *Calidris* species (6,269), Western Sandpiper (1,403), Surfbird (1,335), Dunlin (508), Semipalmated Plover (270), Least Sandpiper (245), Black-bellied Plover (107), Wandering Tattler (58), Black Turnstone (55), and Greater Yellowlegs (44). We noted some minor disturbances of shorebird flocks by loose dogs, low-flying aircraft (particularly helicopters).

Comparison to past surveys: The table below provides the number of species seen each year of this project and its count. Spreadsheets, available at http://kachemakbaybirders.org/, provide much more detail, including breakdown by site.

2009-2016 Kachemak Bay Shorebird Count
Sorted by average abundance

# of Sp.	Species	2009	2010	2011	2012	2013	2014	2015	2016	**Average**
1	Western Sandpiper	3,229	4,996	4,100	16,375	7,964	4,000	2,267	1,403	5,542
2	Red-necked Phalarope	1,630	1,500	5,152	1,501	703	3,006	1,503	39	1,879
	LESA/WESA/SESA	104	803	3,336	844	5,305	987	306	6,269	2,244
3	Surfbird	292	110	574	2,919	748	2,644	2,111	1,335	1,342
4	Dunlin	1,097	561	1,283	1,205	2,548	1,530	826	508	1,195
5	Black-bellied Plover	179	315	282	354	221	114	210	107	223
6	Semipalmated Plover	194	203	197	142	92	251	273	270	203
7	Least Sandpiper	136	245	219	103	128	195	168	245	180
8	Black Turnstone	81	373	121	71	21	56	352	55	141
9	Rock Sandpiper	141	405	482	6	4	6	6	4	132
	Dowitcher sp.	99	82	57	76	344	49	65	17	99
10	Greater Yellowlegs	24	36	59	68	90	24	39	44	48
11	Short-billed Dowitcher	125	-	33	76	18	15	-	20	36
12	Pacific Golden Plover	5	42	5	95	96	17	4	23	36
13	Pectoral Sandpiper	-	7	-	1	146	98	11	-	33
14	Wandering Tattler	13	56	30	18	62	39	39	58	39
15	Whimbrel	10	22	27	28	65	26	28	43	31
16	Semipalmated Sandpiper	1	5	3	34	-	13	33	3	12
17	Long-billed Dowitcher	-	-	15	1	22	36	-	1	9
18	Black Oystercatcher	11	11	13	8	2	8	18	15	11
19	Lesser Yellowlegs	-	26	3	15	9	4	11	1	9
20	Marbled Godwit	3	12	1	7	-	8	5	5	5
21	Ruddy Turnstone	1	10	1	2	9	2	6	9	5
	Yellowlegs sp.	2	18	-	2	2	-	5	-	4
22	Hudsonian Godwit	18	-	2	-	3	3	-	-	3
23	Sanderling	-	1	8	8	-	2	-	-	2
24	American Golden-Plover	3	1	1	1	10	-	-	-	2
25	Bar-tailed Godwit	3	-	-	4	6	-	-	1	2
26	Wilson's Snipe	1	5	1	1	-	-	-	-	1
27	Baird's Sandpiper	1	-	-	6	-	-	-	1	1
28	Bristle-thighed Curlew	-	-	-	-	5	-	-	-	1
29	Red Phalarope	-	-	-	-	-	5	-	-	1
30	Spotted Sandpiper	3	-	-	1	-	-	-	1	1
31	Red Knot	-	-	2	-	-	1	1	-	1
	Total Individuals	7,406	9,845	16,007	23,972	18,623	13,139	8,287	10,477	13,470
	Total Species	24	23	25	27	23	25	21	23	24

Figure 9.1.

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 eight 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 to ours requires some adjustment. West monitored daily and our protocol calls for monitoring once every five days. Consequently, this comparison is based on every fifth day of West's data. Also, because West's observations were only on the Homer Spit, we need 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 8,932 shorebirds. Our average for six years was 10,175 shorebirds; or 55% of West's.

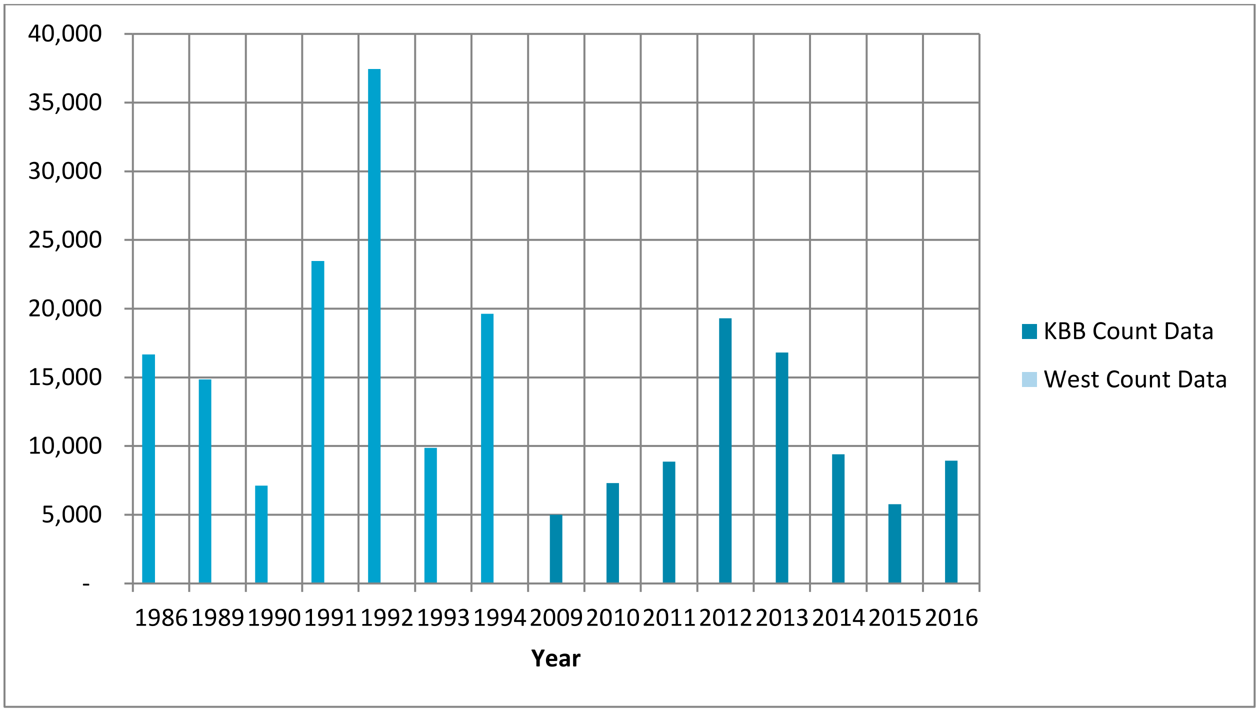

Figure 9.2.

Our shorebird monitoring data played a key part in the nomination that Kachemak Bay Birders submitted to expand the Kachemak Bay Western Hemisphere Shorebird Reserve Network to include City of Homer and Alaska Maritime NWR parcels in Beluga Slough as well as the State of Alaska's Kachemak Bay Critical Habitat Area. This nomination was approved in May 2016.

Anchor and Kasilof Rivers - 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 that was used at Homer Spit. They reported seeing a total of 15 species of shorebirds. The count this year (212) was less the lowest of the four years of data averaging 1,893 shorebirds.

The Kasilof River empties into Cook Inlet about 60 miles north of Homer. The protocol for this site is to monitor the incoming tide starting when it is about half-way between low and high tide. Monitors at the Kasilof River saw 20 species of shorebirds. The total count for the nine scheduled monitoring days was 3,876 shorebirds.

Many thanks to all the volunteers who made this happen. This project will continue next year.
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#10— SHOREBIRDS IN ALASKA NATIVE CULTURES: SUBSISTENCE HARVEST ESTIMATES AND LOCAL AND TRADITIONAL KNOWLEDGE

Investigators: Principal Investigator: Liliana C. Naves, Ph.D. and Jeff Park, Alaska Department of Fish and Game, T. Lee Tibbitts and Daniel R. Ruthrauff, Ph.D., U.S. Geological Survey, Alaska Science Center

Although shorebirds represent less than 1% of the Alaska subsistence bird harvest, information is needed to clarify potential harvest effects on populations and to involve subsistence users in management and conservation. This study proposes to (1) compile and summarize available Alaska shorebird harvest data so data are accessible and usable; (2) gather shorebird local and traditional knowledge (LTK); and (3) conduct outreach activities promoting communication and collaboration among stakeholders. Data analysis will summarize harvest data for all shorebird species, better account for local species identification systems (ethnotaxonomy), and identify considerations necessary for data interpretation. Harvest estimates will be produced for each of Alaska's regions and for the whole state (currently unavailable). Based on community and individual consent, key respondent interviews will be conducted in five communities in the Yukon-Kuskokwim Delta region to document shorebird LTK, clarify ethnotaxonomy, and provide better understanding of shorebirds as cultural and subsistence resources. Communication and outreach materials referring to shorebird ecology, migratory connectivity, and conservation will be produced in English and Yup'ik and distributed in western Alaska communities. One manuscript will be produced for publication as peer-reviewed article and one flyer will be produced to summarize project results' to communities participating in key respondent interviews.

Funding: National Fish and Wildlife Foundation, Alaska Fish and Wildlife Fund; Alaska Department of Fish and Game, Division of Wildlife Conservation; U.S. Geological Survey, Alaska Science Center

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#11— SHOREBIRD USE OF MILITARY LANDS IN INTERIOR ALASKA

Investigators: Ellen Martin, Paul F. Doherty, Jr., Kim Jochum, Calvin Bagley, Colorado State University

Shorebird populations are declining globally and little is known about the use and distribution of breeding species in interior Alaska. The Program for Regional and International Shorebird Monitoring (PRISM) has developed shorebird survey methodology, with most effort in the Arctic and less effort in the boreal forest region. We fill this information void by using PRISM methods to estimate shorebird use of military lands in interior Alaska on Tanana Flats Training Area and Donnelley Training Areas (Fairbanks and Delta Junction, Alaska). Our objectives were to: (1) identify shorebird species using military lands by using a modified PRISM approach, (2) create occupancy/use models for these species and determine associated habitat covariates, and (3) estimate abundance of shorebirds using military lands.

In general, we predict that shorebirds would more likely use open shrub and wet grassland habitat. We based our stratified random sampling design on anticipated species-specific covariate relationships (e.g., elevation, shrub height, and distance to water). We surveyed 78 plots (400x400 m) twice in our first field season (2016) with dependent-double observers to calculate species specific detection probabilities.

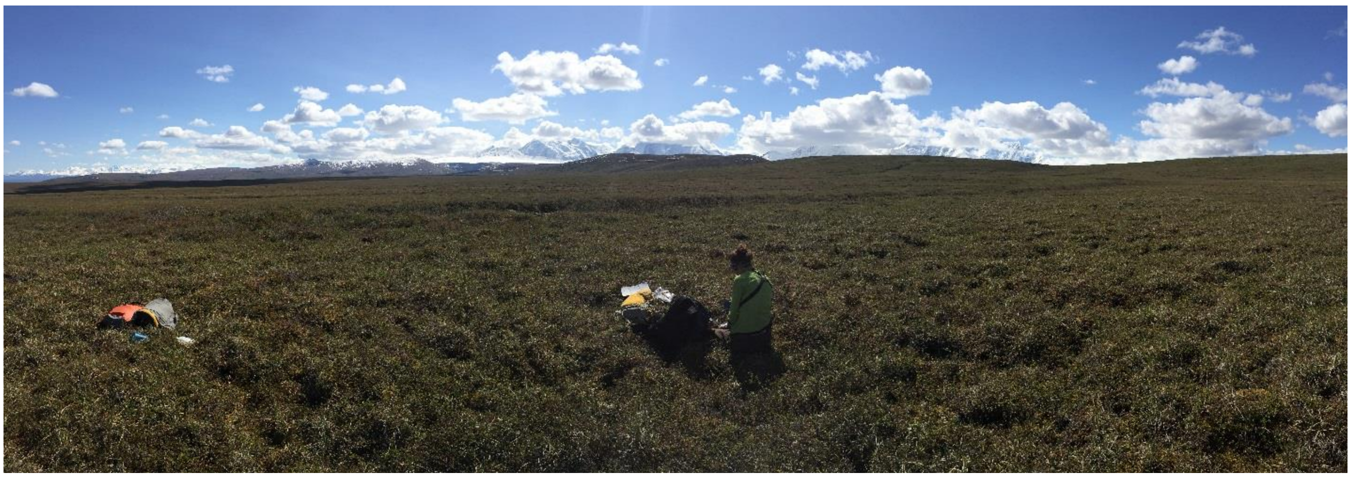

Figure 11.1. Typical upland plot habitat. Technician takes habitat data in Donnelly Training Area West.

We observed eight species of shorebirds on plot during surveys in 2016 (169 individuals):

43 Lesser Yellowlegs **
40 Wilson's Snipe *
10 Spotted Sandpiper
5 Whimbrel **
4 Solitary Sandpiper **
2 Black-bellied Plover *
1 Upland Sandpiper **
1 Dunlin
120 incidental observations

* = listed as species of moderate to high concern by the Alaska Shorebird Conservation Plan
** = listed as a species of moderate to high concern by Alaska Shorebird Conservation Plan and US Fish & Wildlife Service

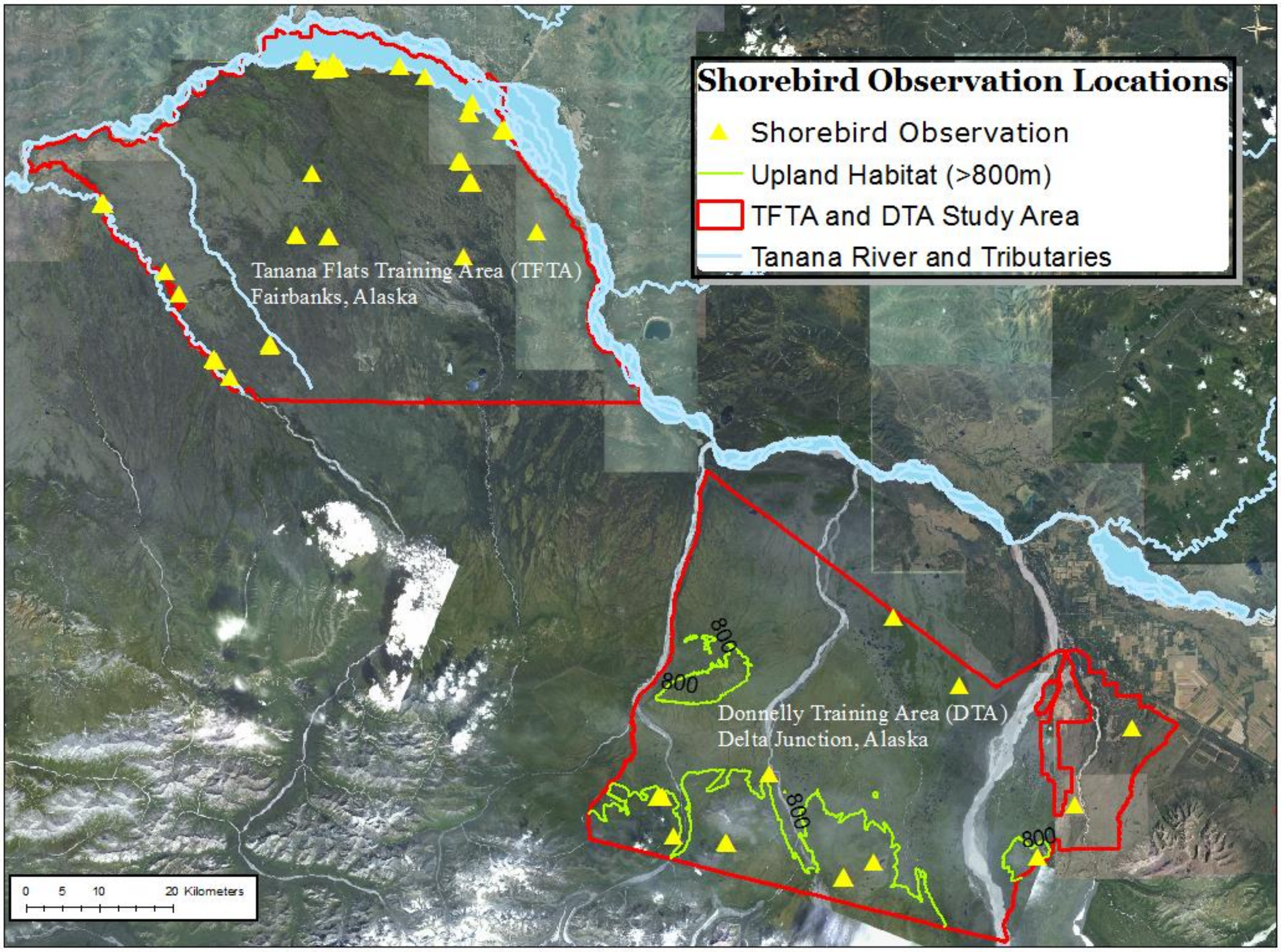

Figure 11.2. Stratified Random Sample of Shorebird Observation Locations, 2016.

We surveyed 48 upland plots in the Donnelly Training Areas East and West and 30 lowland plots in Tanana Flats Training Area (Figure 2). The project will continue during field season 2017.

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Figure 11.3. Lesser Yellowlegs on plot in Donnelly Training Area, Delta Junction, Alaska.

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

Investigators: Mary Anne Bishop, Prince William Sound Science Center and Erica Nol, Trent University

North American shorebirds have experienced population declines over the last several decades. Semipalmated Plover, however, are one shorebird species whose numbers are apparently stable. Building on research conducted in 2006 and 2008, we began a study in 2011 on a breeding population of Semipalmated Plovers at Egg Island, a barrier island on Alaska's Copper River Delta. The objectives of our study are to monitor breeding phenology and to determine survivorship based on return rates of banded breeders. Between 1- 5 and 14-15 June 2016 we located 12 plover nests. In all, we banded three Semipalmated plover adults and resighted 14 birds banded previously on Egg Island. Additional field work is planned for Egg Island in 2017.

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

Investigators: Dan Ruthrauff, US Geological Survey; Aaron Gottesman and Deven Kammerichs-Berke, Humboldt State University

2016 marked the sixth year of monitoring the reproductive output of shorebirds at the Colville River Delta (70.437°N, 150.677°W) under the Alaska Science Center's Changing Arctic Ecosystems initiative. We monitored the seasonal timing and outcomes of reproductive events of the nine most-common species of shorebirds at the site, and documented seasonal trends of their invertebrate prey resources following Arctic Shorebird Demographic Network protocols. As in 2015, we arrived at the study site on 20 May to warm, sunny conditions and a near lack of snow cover. Black-bellied Plovers, Bar-tailed Godwits, Ruddy Turnstones, Semipalmated Sandpipers, and Red-necked Phalaropes were present at the site upon arrival, and individuals of the seven other breeding shorebird species arrived within the next five days. Nests of multiple species were initiated soon after our arrival; the earliest estimated nest initiation that we detected was 22 May (Semipalmated Sandpiper), and the average nest initiation date across all species was 9 June.

We monitored 269 nests of nine shorebird species across each of two ~1.5 km^2 study plots. The observed hatching success across all species was 41%, considerably lower than 2015's rate of 66%. Predation was the cause of most nest failures, attributable primarily to Arctic and Red Foxes. Our study site typically supports a Red Fox den, but the den was unoccupied in 2016. As such, we noted numerous individual foxes on our study plots, and surmised that a lack of territorial, breeding foxes permitted access by a relatively high number of transient foxes to the area. As in 2015, we again monitored chicks of Semipalmated Sandpipers (n=70 broods) to better understand potential impacts of food availability and climatic conditions on chick growth and survival. In contrast to 2015 when unusually cold weather in mid-July negatively affected chick growth, weather conditions were mild across most of the brood-rearing period and rates of chick growth were consistently high across the breeding season. Chicks attained body mass values of ~20 g after about 10 days, a more rapid rate than we observed in 2015. In addition to these inquiries, we completed field collections for a habitat selection modeling project. This study combines WorldView-2 satellite imagery (sub-2-m resolution) with ground-based information on floristics, soil moisture, and habitat cover to map species-specific habitat types. These studies relate to conservation issues identified for BCR 3 in the Alaska Shorebird Conservation Plan relating to Energy Production and Mining as well as Climate Change and Severe Weather. Specifically, we are developing habitat-based models using remote imagery to better predict the probability of occurrence of breeding shorebirds, and we are monitoring the timing of shorebird hatch and chick growth in relation to the timing and abundance of their insect prey.

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Figure 13.1. REPH nest. Photo Credit: Dan Ruthrauff.

Figure 13.2. RNPH. Photo Credit: Dan Ruthrauff.

#14— DNA BARCODING ANALYSIS OF SHOREBIRD CHICK FECES: PROVIDING INSIGHTS INTO TROPHIC MISMATCH

Investigators: Danielle Gerik, University of Alaska Fairbanks; Richard Lanctot & Sarah Saalfeld, U.S. Fish and Wildlife Service; Andrés López, University of Alaska Fairbanks; Kirsty E. Gurney, Environment Canada

Whether Arctic breeding shorebird declines can be traced to changes on the breeding grounds, migration corridors, or wintering areas remains to be determined for many shorebird species. Assessing threats to shorebirds on breeding grounds where climate is rapidly changing ecosystems can provide crucial information to identify factors limiting population size. Climate driven shifts in the Arctic are underway and may have both short-term and long-term implications for shorebirds as a result of changes in the phenology and availability of arthropod prey for nesting adults and their young. The advancement of spring is shifting temperature dependent pulses of arthropods emergence to earlier dates. Whether earlier and possibly more variable emergence of arthropods may impact shorebird chick growth as a result of trophic mismatch is unclear. Understanding chick diets in terms of size, type, and dietary plasticity through development is important for evaluating whether a trophic mismatch exists and assessing its impact.

Shorebird chick diets will be characterized through this study by recovering prey DNA from shorebird feces and identifying prey with reference 'barcodes', which are unique genetic signatures that can be used to delineate taxon based on their DNA. Gene sequence based techniques for studying avian diets have the potential to provide fine scale taxonomic resolution, and coverage of avian diets. This non-lethal method may reduce biases associated with the visual examination of invertebrates found in the upper gastrointestinal tract. In this study, we describe our efforts to use fecal DNA metabarcoding technique with mitochondrial markers (CO1 and 16s) and next generation sequencing to characterize diets of pre-fledged shorebirds. We aim to examine dietary plasticity of chicks by relating chick diet to environmental background levels of invertebrates on breeding grounds in Barrow, Alaska.

We first developed a reference library of invertebrate DNA barcodes to represent arthropods collected in Barrow with genetic signatures. The reference library currently includes 80 unique CO1 barcodes, representing 5 classes, 10 orders, 22 families, 37 genera, and 26 species. These sequences serve to supplement existing public database coverage of arthropods inhabiting the Arctic Coastal Plain.

We evaluated the potential biases of a gene sequence based technique to recover prey DNA from shorebird feces by conducting a captive diet study during the summer of 2015 with pre-fledged Pectoral Sandpiper (*Calidris melanotos*) and Red Phalarope (*Phalaropus fulicarius*) chicks. During these experiments, chicks were fed arthropods (*chironomidae, coleoptera, muscidae, plecoptera, culicidae, trichopteran)* and their subsequent fecal samples were systematically collected. A total of 400 fecal samples were collected from captive Red Phalarope and Pectoral Sandpipers during these trials. These experiments will allow us to assess how chick age, prey type (hard vs. soft bodied), prey size, and presence of uric acid affect the recovery of DNA, PCR amplification and sequence read recovery. Fecal samples were collected over a range of time following consumption of prey to determine the window of time post consumption when prey DNA is detectable in shorebird feces. In addition, we measured the size of arthropods that chicks ate as they grew to determine if chicks were limited in the size of prey they could ingest – a potential issue frequently ignored when determining prey availability. Captive studies will be informative for evaluating the extent to which fecal DNA metabarcoding is able to recover prey in wild shorebird feces.

Next, we examined the degree to which pre-fledged shorebird young track the environmental availability of arthropods by relating chick diet to the abundance of arthropods in the environment. A total of 138 shorebird chick fecal samples were collected during the summers of 2014, 2015, and 2016 from Red Phalarope (53, *Phalaropus fulicarius*), Dunlin (39, *Calidris alpina)*, and Pectoral Sandpipers (45, *Calidris melanotos*) from known-aged chicks. We will compare prey found in these samples with prey sampled from the environment (in coordination with the larger Barrow study) to determine if shorebird chicks have age and interspecific prey preferences. If preferences exist, our prior assessments of food availability may need to be revised.

Currently, we are testing and refining genetic techniques through PCR optimization for our project engineered primers which allow for multiplexing samples in a parallel sequencing run on an Illumina MiSeq. Additionally, we are testing the viability of using additional library preparation steps to filter out PCR artifacts prior to next generation sequencing. Once the technique is refined, we will process and analyze the available captive and wild-caught chick fecal samples to evaluate potential biases in the gene sequence based approach and assess whether chicks have diet preferences. This information will be beneficial to the scope of a larger trophic mismatch study. This study fulfills one primary objective for Bird Conservation Region 3 to "develop models to predict the effects of long-term climate change on shorebird populations," as outlined in the Alaska Shorebird Conservation Plan (2008).

Thanks goes out to the volunteers, technicians and collaborators on this project. External funding was provided by the Arctic Landscape Conservation Cooperative, Audubon Society, U.S. Geological Survey, and the National Fish and Wildlife Foundation.

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Figure 14.1.

#15— MIGRATION OF BUFF-BREASTED SANDPIPERS

Investigators: Lee Tibbitts, U.S. Geological Survey and Rick Lanctot, U.S. Fish and Wildlife Service

In collaboration with Charlie Brower, Lindsay Brown, Bob Friedrichs, Susan Hearth, David Newstead, Brent Ortego, Kelli Stone, Jennifer Wilson, and Woody Woodrow

We initiated a satellite telemetry study in 2016 to determine range-wide migratory routes, migratory timing, and stopover habitats of Buff-breasted Sandpipers (*Calidris subruficollis*). This species of conservation concern breeds in low densities across the High Arctic in Alaska and Canada, and is thought to winter primarily in the pampas grasslands of Brazil, Uruguay, and Argentina. We captured birds on irrigated turf farms in coastal Texas in April and August and tagged them with 3.5–4.0 gram GPS Argos Pinpoint tags manufactured by Lotek Wireless. Tags were programmed to collect 30 GPS-quality locations at daily or multi-day intervals as birds migrated north (n = 15 birds tagged in April) and south (n = 25 birds in August). Once data collection was complete, tags were set to transmit the GPS data up to the Argos satellite system.

We received location data from 14 of the 15 northbound birds that indicated the birds departed Texas the second week of April and hopped north along a narrow corridor in the Central Flyway to arrive in late May at a pre-breeding stopover area in southern Saskatchewan. Total distance travelled was about 2,500 km and birds made one or more stops in Oklahoma, Kansas, Nebraska, South Dakota, or North Dakota. Birds continued north the first week of June and arrived near potential breeding sites on Victoria Island, Nunavut (n = 3 birds), coastal Northwest Territories (n = 2), and the North Slope of Alaska (n = 1). These sites required an additional 1,800 km to 3,200 km of flight; however it was unclear if these were their final breeding destinations since data collection stopped by 6 June.

We received only partial data from 7 of the 12 southbound birds that were due to report in November; the remaining 13 tags are programmed to report next year. The available data suggests that the 7 birds left Texas in late August and probably spent several days in Colombia, Peru, Bolivia and/or Paraguay in September and October before heading southeast to wintering areas in Uruguay, Brazil, and Argentina. Unfortunately, it is not possible to determine exact routes and timing from this incomplete dataset.

Scientists and citizen scientists have assessed habitat at the majority of the sites used by the northbound birds based on the highly-accurate GPS locations. These assessments are currently being analyzed, but do show birds predominantly used agriculture fields on their way north. Habitat assessments at sites used by the southbound birds will be made in the coming weeks. Timing information from the northbound migration (i.e., turnover rate) will also be used to help estimate population size in companion studies that were conducted in Texas and Nebraska.

This study is focused on the Buff-breasted Sandpiper, one of the priority shorebird species identified in the Alaska Shorebird Conservation Plan (Alaska Shorebird Group 2008). The study also fulfills action items identified in the Alaska Shorebird Conservation Plan under the Research section (i.e., "develop and implement contemporary research techniques (e.g., GPS tags) to identify unique populations of shorebirds that reside in Alaska and to link sites used throughout their annual cycles"), and the International Collaborations section (i.e., "foster cooperative research efforts throughout the Western Hemisphere, Asia, and elsewhere along migratory flyways", AND "participate in species-specific conservation planning efforts").

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*Figure 15.1.*Cannon net deploying during capture of Buff-breasted Sandpipers on a turf farm in Texas, 13 August 2016. Photo by Loren Gallo.

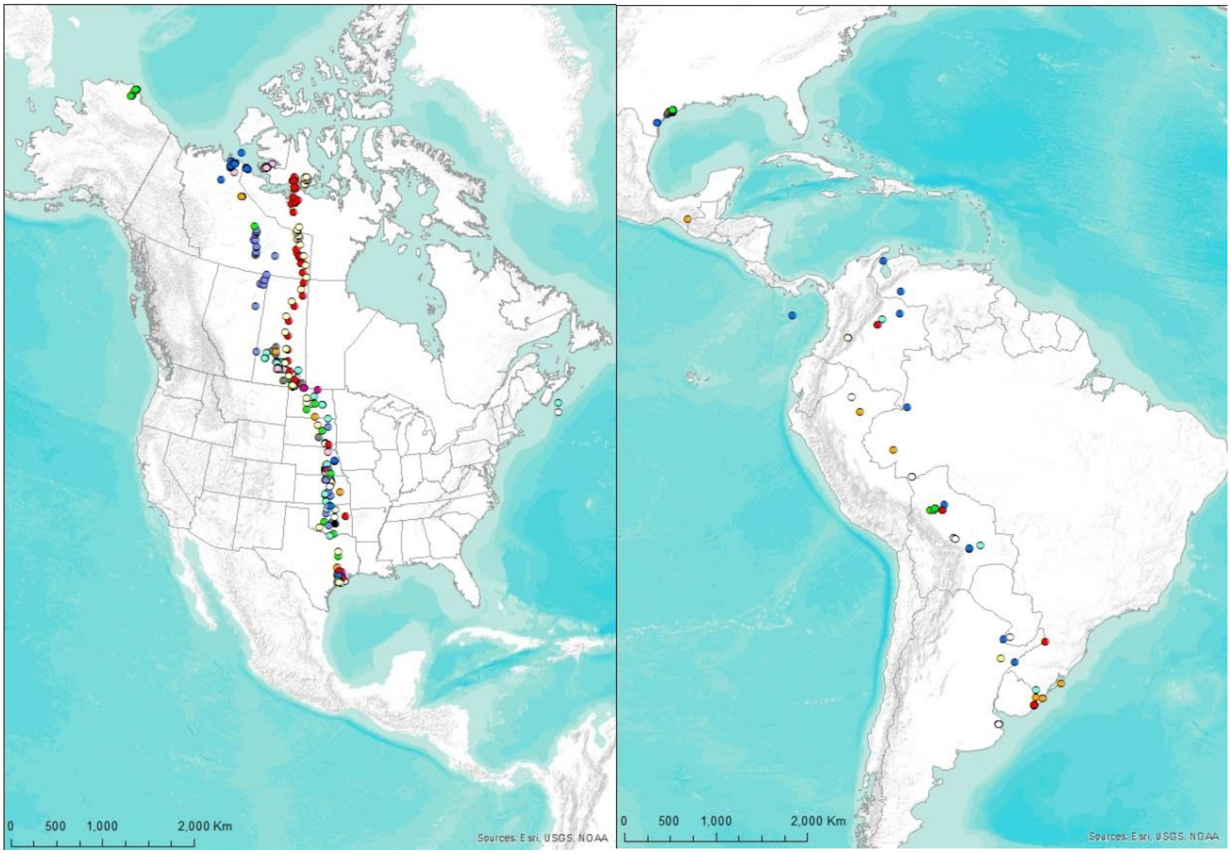

Figure 15.2. Locations of GPS-tagged Buff-breasted Sandpipers traveling to their breeding grounds and wintering areas from turf farms located south of Houston, Texas in April-early June (north) and September-November 2016 (south). Individual birds depicted by different colors.

#16— MIGRATORY CONNECTIVITY OF LESSER YELLOWLEGS (*TRINGA FLAVIPES*) AND SOLITARY SANDPIPERS (*TRINGA SOLITARIA*) BREEDING IN SOUTH-CENTRAL ALASKA

Investigators: Lucas H. DeCicco, Jim A. Johnson, Laura McDuffie and Richard Lanctot, U.S. Fish and Wildlife Service, and Kristy Craig, U.S. Air Force

In 2016 we investigated the migratory connectivity of two boreal nesting shorebirds, Lesser Yellowlegs (*Tringa flavipes*) and Solitary Sandpipers (*Tringa solitaria*), on Joint Base Elmendorf-Richardson, south-central Alaska. Migration of these species is either poorly understood or nearly unknown. We used the same banding scheme for both species: USGS metal band on right tarsus, yellow cohort below geolocator (if deployed) on right tibia, and green two-letter engraved flag on left tibia. We captured all individuals with mist nets and playback of chick alarm calls early in the brooding stage. Both species became progressively less responsive as chicks developed. We captured and banded 12 adult Lesser Yellowlegs (1–14 June) and 12 adult Solitary Sandpipers (8–16 June). We deployed 12 geolocators on yellowlegs and 4 geolocators on Solitary Sandpipers. Depending on return rates, we hope to continue these efforts in 2017. We thank Nick Jensen, David Loomis, Bryce Robinson, and Marian Snively for their help in the field.

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#17 — CANNING RIVER DELTA, ARCTIC NATIONAL WILDLIFE REFUGE 2016 SUMMARY

Investigators: Christopher Latty, USFWS-Arctic National Wildlife Refuge, Stephen Brown, Manomet, Inc., Scott Freeman, USFWS-Arctic National Wildlife Refuge

The study site at the Canning River Delta in Arctic Refuge was established in the late 1970s and has since become the primary breeding shorebird research location for the refuge. Work at this location is a collaboration between Arctic National Wildlife Refuge and Manomet, Inc. In 2016, a crew of 4 traveled to the camp by small wheel plane on 6 June; a few days later than usual due to early breakup. The first nest was found on 7 June and nest numbers picked up rapidly. We located a total of 253 nests, 160 of which were shorebirds. This is below average compared to previous years, but was not unexpected due to a smaller crew size in 2016. Estimated nest survival for all shorebirds was 43%, which is similar to the historic average. Lemming abundance (based on incidental sightings) was low and correspondingly, local Arctic fox did not appear to successfully reproduce. We captured 44 birds and reencountered 23 individuals banded between 2008 and 2013. We also collected cloacal swabs and serum for disease analyses and attached geolocators to 13 Dunlin. As part of a pilot to more accurately identify causes of nest failure, we placed cameras at 32 nests. Of the 16 camera-monitored nests that failed, 75% were depredated by Arctic fox, 19% were depredated by jaeger species, and 6% (n = 1) abandoned.

Figure 17.1.

Figure 17.2.

Contact: Christopher Latty, USFWS-Arctic National Wildlife Refuge

#18 — TONGASS NATIONAL FOREST SUMMARY OF 2016 SHOREBIRD WORK

Investigators: Bonnie Bennetsen, Joe Delabrue, and Susan Oehlers, US Forest Service

In 2016, the Tongass National Forest collaborated with the Environment for the Americas Latino Science Internship Program to host intern Janelle Lopez. Janelle worked on numerous bird and other fisheries and wildlife projects on multiple districts across the Tongass. Specific shorebird work was focused on the Wrangell and Yakutat Ranger Districts. While in Wrangell, Janelle conducted 20 shorebird surveys, developed educational posts on birds for the Forest Service Facebook page, and delivered bird focused outreach programs to local elementary school students. In Yakutat, Janelle conducted a total of 14 shorebird surveys, delivered bird focused outreach programs to local students (elementary and high school), and assisted with student programs during the Yakutat Tern Festival. Shorebird survey data followed protocol developed by Point Blue Conservation Science. Janelle entered all of the data into the Alaska Shorebird Survey Project database housed within the California Avian Data Center (CADC), a regional node of the Avian Knowledge Network (AKN) hosted by Point Blue Conservation Science.

Contact: Bonnie Bennetsen, US Forest Service

#19 — FACTORS INFLUENCING WATERBIRD ABUNDANCE AND DISTRIBUTION ON THE COPPER RIVER DELTA, ALASKA

Investigators: Jillian Jablonski and Audrey Taylor, Department of Geography & Environmental Studies, University of Alaska Anchorage, Erin Cooper, Chugach National Forest, Martin B. Berg and Jennifer Piacente, Loyola University Chicago, Gary A. Lamberti and Amelia McReynolds, University of Notre Dame

The Copper River Delta, Alaska is a highly productive coastal wetland and an important breeding ground for waterbirds. We are investigating a suite of biological, chemical, and physical factors to understand what drives waterbird distribution and breeding chronology on the Delta, and how pond temperatures and the presence of the aquatic invasive plant *Elodea canadensis* may influence the aquatic food web supporting the waterbird community. This research is ongoing, with the first season of data collection in 2016. From May 24 to July 29, 2016, we recorded a total of 738 birds and 42 nests across eighteen study ponds. The most abundant species observed were the Red-necked Phalarope, Ring-necked Duck, Mallard, and Dusky Canada Goose. In addition to the Red-necked Phalarope, other observed shorebirds include the Short-billed Dowitcher, Wilson's Snipe, Lesser Yellowlegs, Spotted

Sandpiper, and Western Sandpiper. Other ecosystem variables measured at each pond consist of aquatic and terrestrial vegetation, water quality parameters, water column dissolved nutrients, physical pond characteristics, and aquatic invertebrate community structure. Five of the ponds were infested with *Elodea*. Water temperatures across the survey period ranged from 14.4°C to 22.9°C. Our preliminary analyses indicate no statistically significant differences in waterbird abundance or densities between ponds with *Elodea* and ponds without *Elodea*. We identified a significant relationship between pond temperature and relative waterbird abundance based on breeding chronology. Fewer early nesting waterbirds were observed on cold ponds than would be expected by chance, but more late nesting waterbirds were on cold ponds than expected ($p<0.001$). Data processing for aquatic invertebrates and water chemistry is ongoing, and these results will be incorporated into further multivariate analyses to evaluate the relative importance of potential biotic and abiotic drivers of waterbird distribution and breeding chronology on the Copper River Delta.

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Figure 13.3. SESA. Photo Credit: Dan Ruthrauff.