Alaska Shorebird Group

Summaries of ongoing or new studies of Alaska shorebirds during 2010

November 2010

No. 9

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

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A note from the compiler:

Welcome to the 2010 summary report of ongoing or new studies of Alaska shorebirds. This is the ninth consecutive report put together by the Alaska Shorebird Group. In this document I compiled summaries for 38 studies highlighting many interesting projects investigating Alaska shorebirds. Projects reported here are in various stages of development from initial pilot season work to post-field work analysis. A few projects have been completed since last year but it is also possible that some projects were not reported here. Please spread the word about this summary to other biologists studying Alaska shorebirds who may be unfamiliar with this effort. This summary is the only written record we have of shorebird projects in the region and provides a valuable timeline of such activities.

Among the 38 projects there were a total of 80 investigators involved in these projects, 21 of which participated in more than one project. Women led 11 of the total studies (29%) and accounted for 31% of the total investigators. Government agencies led the highest proportion of studies (15 of the 38; 39%). Academic institutions came up second leading 14 of the 27 projects (37%). For government agencies this included the U.S. Fish and Wildlife Service (n = 11), the U.S. Geological Survey (n = 3), and the U.S. Forest Service (n = 1). Lead academic institutions included the University of Alaska – Fairbanks (n = 6), Kansas State University (n = 2), Bishop's University, Brigham Young University, Montana State University, Simon Fraser University, University of Colorado – Denver, and the University of Delaware. The remaining nine principal investigators represented non-government organizations including the Wildlife Conservation Society (n = 3), Prince of William Sound Science Center (n = 2), Audubon Alaska, Manomet Center for Conservation Sciences, Katchemak Bay Birders, and Cascadia Research Collective.

In 2010, the Arctic Shorebird Demographic Network, a new region-wide research effort was initiated with the overall goal to provide a better understanding of population trends for some key shorebird species. This past year, we also saw an increase in light-level geolocator studies (n = 6) as the technology for this type of work is becoming more suitable for smaller shorebird species. The map of our study site locations within Alaska (on the back page) clearly shows that shorebirds live up to their name, with all study sites, except for one, located relatively close to the coastline. Field work for seven studies were conducted entirely or partially outside Alaska along shorebird flyways including Russia, Chile, Mexico, Canada, and various places in the lower 48. Many of the projects, particularly the tracking studies, will provide information directly relevant to shorebird management and conservation for stakeholders across international boundaries.

I would like to acknowledge the photographers who graciously allowed the use of their superb images in this document. Photo credits and a brief caption are listed for each photo. I also thank Rick Lanctot for assisting me in obtaining many of the summaries for this report. Finally, thanks to all the hard efforts of everyone involved in these important studies. We look forward to many more years of fruitful research on Alaska's shorebirds.

Electronic copies of this report and all previous issues (back to 2002) are available at: http://alaska.fws.gov/mbsp/mbm/shorebirds/working_group.htm

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PROJECT SUMMARIES

1. ARCTIC SHOREBIRD DEMOGRAPHICS NETWORK: OVERVIEW

Project Goals

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 is to conduct demographic analyses for several target species that will help determine factors limiting population size. The Network will measure 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.

A Demographic Approach

The existing large scale monitoring efforts developed under the Program for Regional and International Shorebird Monitoring (PRISM) are aimed at providing population size and trend estimates, along with accompanying environmental data to interpret the estimates. However, the current PRISM program cannot provide information on the mechanisms behind declines, and when shorebird population sizes are likely to be limited (e.g., breeding, migration, non-breeding). Poor reproductive success or low juvenile or adult survival may be limiting populations, but population trends alone are not sufficient to determine which is most important to address to support population growth. Determining when shorebird populations are limited will have significant impacts on future conservation actions to address population declines.

Network Participants

The network is open to participation by any collaborators who are actively conducting arctic shorebird research and can include implementation of the protocols designed by the group at their study sites. In addition, the Network will rely on partners across the range of the target species for resighting efforts of banded birds. Current participants include breeding season study sites spanning the entire Alaskan and Canadian arctic (Figure 1), and include study sites underway or in development at the Yukon Delta, Nome (see project summary #33), Cape Krusenstern (see project summary #11), Barrow (see project summary #24), the Ikpikpuk River (see project summary #28), Prudhoe Bay (see project summary #27), and the Canning River (see project summary #18), in Alaska; as well as at the Mackenzie River Delta, East Bay, Coats Island, and Churchill in Canada.

Pilot Year Completed

The group developed detailed field protocols to investigate demographic parameters as well as environmental variables at all of the study sites and implemented them in 2010. We have completed the pilot study year at all of our current study sites, including intensive banding efforts for our target species, Semipalmated Sandpiper and Dunlin at most sites, and Western Sandpiper, Pectoral Sandpiper, Whimbrel, and Semipalmated Plover at several sites. In addition, as part of the Arctic Landscape Conservation Cooperative, we collected weather data, invertebrate abundance samples, and other environmental data to help determine causes of variations in nesting success over time.

Funding for site support will be critical to successfully implementing the project over the next four years. Multiple study years are needed to accurately measure survivorship of banded 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 four years.

Lead Organizational Roles

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

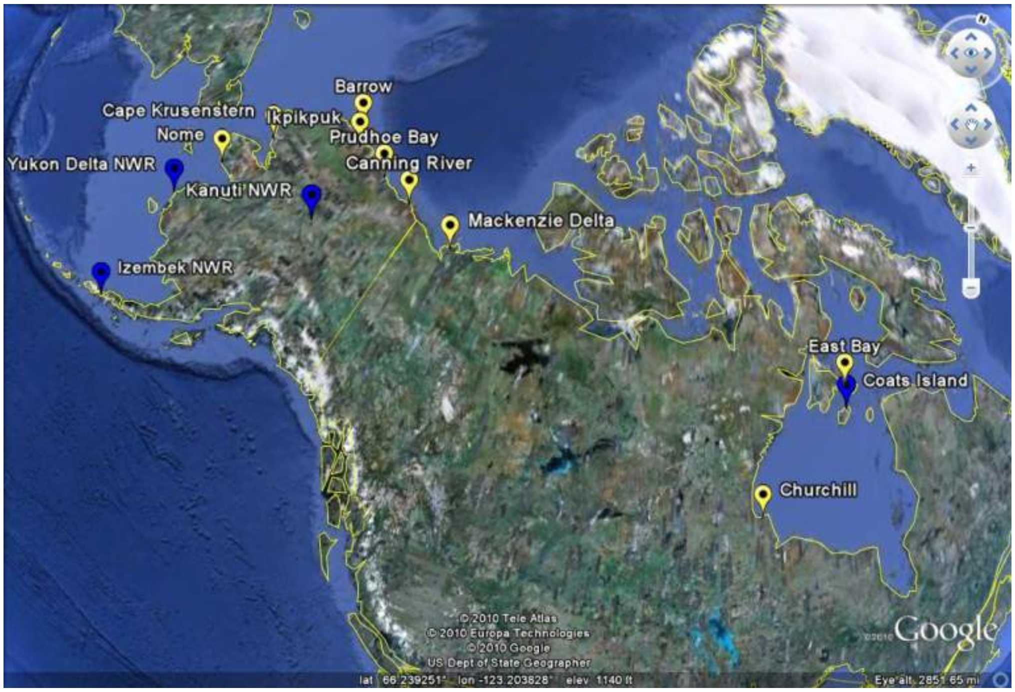

Figure 1. Study sites in the Arctic Shorebird Demographics Network. Sites in operation during 2010 are shown in yellow, and potential sites to be added in 2011 are shown in blue.

2. Site fidelity within the Copper River Delta, Alaska by migrant shorebirds - Bishop

Investigator: Mary Anne Bishop, Prince William Sound Science Center

Migrant shorebirds are likely to exhibit fidelity in stopover site selection between years because coastal stopover sites are often widely spaced and limited in number. In 2008, I began a study at

Hartney Bay on the western Copper River Delta to determine if site fidelity between years and to specific locations is a common behavior during spring migration. During May 2008 and 2009 a combined total of 297 Western Sandpiper, 142 Least Sandpiper, and 13 Semipalmated Plover were mist-netted and color-banded at Hartney Bay. All birds received a green flag on the lower right and a USFWS band on the upper left leg. Color bands on the lower left leg were used to distinguish year cohort (red for 2008, light blue for 2009) and age (adults = 1 band, juveniles = 2 bands). From 1-21 May 2010 an observer spent 2-3 hours daily at high tide scanning flocks for banded birds. Four Western Sandpipers, all banded in 1998 were resighted. Due to a schedule conflict with other field work, there was minimal trapping effort (<3 h) during 2010. Nevertheless, during a short mist netting demonstration for the local elementary school we recaptured a Least Sandpiper from 1999. During spring 2011 we will color-band as well as search for returning color-banded shorebirds at Hartney Bay.

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.

3. Shifts in spring stopovers for Surfbirds and Black Turnstones – Bishop and Taylor

Investigators: Mary Anne Bishop, Prince William Sound Science Center, and Audrey R. Taylor, Windbird Resources

Currently, little is known about how Black Turnstone and Surfbird populations migrate up the Pacific Coast to their Alaska breeding grounds. Single-day peak migration counts from 1994 through 1997 indicated that a major proportion of each species population stopped at Montague Island in Prince William Sound Alaska. However, recent declines in the abundance of herring spawn, on which the birds depend to fuel northbound migration, point to the need for reassessing spring use at Montague by both species. Between 17 March and 10 April 2010 we captured, banded and radio-tagged 45 birds (10 Surfbirds and 35 Black Turnstones). Three Surfbirds and one Black Turnstone were captured on 17 March in Barkley Sound, British Columbia in collaboration with Pacific Rim National Park. The remainder of the birds were captured and tagged at Oak Harbor on Whidbey Island, Washington. To facilitate identification in the field, bands consisted of a yellow darvic band on both lower legs as well as a USFWS or CWS band on the upper-left leg.

From 21 April through 14 May we attempted to relocate the radio-tagged birds at northern Montague Island and Unakwik (northern Prince William Sound). None of the radio-tagged individuals were detected at either location during daily boat (Montague) or ground (Unakwik) surveys. Furthermore, few individuals of either species were observed at areas on Montague Island where birds were abundant in the 1990's. We propose future work to investigate use of alternate stopover locations to inform our understanding of the connectivity of locations used throughout their annual cycle, and whether migration routes and timing for these species may be flexible in light of changing environmental conditions.

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Bar-tailed Godwit eggs hatching Dan Ruthrauff

4. Ongoing Ruddy Turnstone and Black-bellied Plover life history studies at Woolley Lagoon, Seward Peninsula, Alaska *– Bruner et al.*

Investigators: Phil Bruner, Andrea Bruner, Joann Diray, Department of Biology Brigham Young University, Hawaii; and Sheila Conant, Department of Zoology, University of Hawaii at Manoa.

Our 2010 field season (6-17 June) was marked by the most unusual dry conditions we have experienced in our 23 years at Woolley Lagoon. Areas that have always contained standing water were completely dry. Small scattered water features are commonly associated with Ruddy Turnstone nests in our study area. These ponds are important breeding sites for insects utilized by newly hatched turnstone chicks. Only one of our 44 banded Ruddy Turnstones returned to our study site this past June. We did manage to band three new turnstone males. By contrast the eight Black-bellied Plover we banded in 2009 all returned to their territories and re-nested with their 2009 mates. We banded three new Black-bellied Plover males in 2010. The exceptionally dry conditions would seem to be a factor in the small number of Ruddy Turnstones recorded this past season. Other compounding problems could be the increasing number of Red and Arctic foxes at Woolley Lagoon. There are at least three active dens in the area. However, the dry conditions and fox predation did not affect our Black-bellied Plover numbers. We have maintained 10-12 nesting pairs every year since 1993. We anticipate that 2010 was an anomaly and 2011 will see a return of many of our previously banded Ruddy Turnstones. Their failure to return is not always an indicator of mortality. Several of our turnstones have skipped one or two seasons only to later reappear in subsequent years in their former breeding territory.

Of the 51 Ruddy Turnstone chicks we sampled for DNA from 2007-2010, 35% were the result of extra-pair paternity (EPP). Nineteen were not fathered by the male attending the nest and one was not the attending female's offspring. Two pairs with repetitive data (2-3 years) had an even greater EPP of 50%. In one case the male was not the father of any of the chicks in his 2009 nest! One conclusion that might come from these data is that mate retention may not enhance male fitness. We should therefore expect that mate retention is not a cost effective strategy and should therefore be relatively rare. The overall rate of 31% EPP might be explained by the semi-colonial nesting of Ruddy Turnstones, which would enhance extra-pair paternity opportunities. Our 2009-2010 EPP samples of Black-bellied Plover and their chicks have yet to be determined.

Over the next two field seasons (2011-2012) we will continue our focus on extra-pair paternity in both Ruddy Turnstone and Black-bellied Plover. We will also begin the examination of ground cover components in Ruddy Turnstone territories as part of our investigation of whether or not nest cup placement is non-random. We look forward to the continuing participation of BYUH undergraduate students and Sheila Conant from The University of Hawaii at Manoa. Her botanical and ornithological field skills are invaluable to our study.

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5. POPULATION ESTIMATE OF RED KNOTS (CALIDRIS CANUTUS ROSELAARI) AT A MAJOR STOPOVER SITE IN THE PACIFIC FLYWAY, USA – Buchanan et al.

Investigators: Buchanan, J. B., J. E. Lyons, R. Carmona, B. A. Andres, W. L. Kendall, and J. A. Royle.

The Pacific Flyway population of Red Knots (*Calidris canutus roselaari*) uses key stopover sites in coastal Washington, USA, during spring migration. In contrast to *C.c. rufa* on the Atlantic Flyway, little is known about the abundance or status of *roselaari*. We conducted a capture-recapture/resight study to estimate the number of Red Knots passing through Grays Harbor and Willapa Bay, Washington. We marked birds with leg flags at Guerrero Negro, Mexico and searched for flagged knots at our coastal Washington study area on 19 dates between 20 April and 26 May 2009. We used a Jolly-Seber model to estimate the number of flagged birds at the Washington stopover. We estimated the proportion of the stopover population that was marked with flags using counts of marked and unmarked birds and a binomial logistic regression. To derive total stopover population size from these two types of data, we adjusted $\widehat{N}$ from the Jolly-Seber model with the ratio of marked to unmarked individuals in an integrated Bayesian analysis. We used a model selection procedure to identify the Jolly-Seber model with greatest support from six candidate models that accounted for uncertainty in probability of arrival, resight, and stopover residency. A model with constant residency and time-dependent arrival and resight probabilities (φ_c, p_t, β_t) had the most support. Under this model, residency was 0.57 (0.48–0.67) and resighting probability varied among sample occasions from 0.13–0.69. The overall ratio of marked to unmarked birds was 0.009 (0.008–0.01) and our estimated stopover population size was 17,050 Red Knots (13,730–20,200). The *roselaari* Red Knot is one of the rarest long-distance migrant shorebirds that use the Pacific Flyway at a population level, and is less abundant than *C.c rufa*. More attention should be directed toward determining what conservation actions are needed to stabilize and recover the subspecies.

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6. ESTIMATING THE SIZE OF MIGRATORY SHOREBIRD POPULATIONS ON THE STIKINE RIVER DELTA USING AERIAL DIGITAL PHOTOGRAPHY - *Cady and Anthony*

Investigators: Melissa Cady, Tongass National Forest, Prince of Wales Zone; Mike Anthony, USGS Retired

The Stikine River Delta is a critical migratory stopover for shorebirds and waterfowl, but managers have very little current, reliable population data to substantiate its importance. To obtain contemporary estimates of shorebird numbers during spring migration on the Stikine River Delta, we assembled and tested an aerial photography system, which included high-resolution digital cameras and automated computer analysis of images. Between 20 April and 22 May 2010, we took approximately 20,000 photographs from a fixed-wing aircraft at altitudes near 1000'.

We used Photoshop and Fovea Pro to automate counting of shorebirds on photographs. Imagery analysis indicated shorebirds could be counted reliably, and should allow us to estimate the number of shorebirds using the Stikine River Delta during spring migration. Further development of this methodology could be important for use on stopover and staging sites throughout the Pacific Flyway, although we caution that the size of the staging area should be considered due to limited, optimal flight windows available to survey.

U. S. Forest Service International Programs, Tongass National Forest, and the Copper River Migratory Bird Initiative provided funding for this project.

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7. RESOURCE AVAILABILITY FOR SHOREBIRDS AT DELTA MUDFLATS DURING THE POST-BREEDING PERIOD IN THE ARCTIC NATIONAL WILDLIFE REFUGE – *Churchwell et al.*

Investigators: Roy Churchwell, University of Alaska, Fairbanks; Abby Powell, U. S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit; Steve Kendall, U.S. Fish and Wildlife Service; Stephen Brown, Manomet Center for Conservation Sciences.

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

The previous summer (2009) was spent as a pilot season on the Jago River delta to develop methods that were expanded to three other river deltas in summer 2010, including the Canning, Hula Hula, and Okpilak. We collected invertebrate cores and soil samples across each delta on a 250-m grid during three equal time periods over the study period (July 15 - August 31). We also counted shorebirds across the mudflat within a 100-m grid every three days during the same timeframe. We collected blood samples from shorebirds (*n* = 80) to investigate correlations between triglyceride levels and available resources. We also collected blood samples early and late during the study period, but were unable to get an adequate sample size (20-captures/site) late in the season catching 12 birds at the Jago Delta and only a few at each of the other sites. We also collected weather data (temperature, wind speed, and wind direction) and water depth at each camp during the study period.

We are currently processing invertebrate and soil samples, and have not completed any analyses of data collected in 2010. In 2009, invertebrate resources at the Jago study area were patchily distributed on the mudflat, with large areas containing few resources. Late in the season we saw a decline in invertebrate abundance likely due to predation by shorebirds. We will be able to look for distributional trends at all of the locations sampled in 2010. Preliminary data show some differences in the invertebrate communities across study sites. The Canning River delta had different invertebrate resources, perhaps because it is not glacially fed. There were no Chironomid (midge larvae) on the Canning, which is one of the most common groups at the other sites. A Polycheate worm (*Spionidae*) was also only found at the Canning. The other sites had a similar community to that found last year on the Jago: Chironomids, Oligiocheate worms, Amphipods, Tipulid larvae, and the isopod genus *Saduria*.

Preliminary results from 2010 indicated there were fewer Semipalmated Sandpipers later in the season than in 2009. In contrast, 2010 was similar to 2009 in that we observed a migration of Western Sandpipers through the area; adults passed through early in the season and hatch-year birds at the end of the season. There was also a large pulse of Pectoral Sandpipers late in the season that we did not observe on the mudflats in the last few years. This pulse went through each location in 3-4 days, demonstrating the necessity for conducting multiple counts at regular intervals at a single location. As in past years, we were unable to successfully capture Dunlin during our study period.

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

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8. *INVESTIGATING DUNLIN MIGRATION AND REPRODUCTION USING STABLE ISOTOPES* – *Doll et al.*

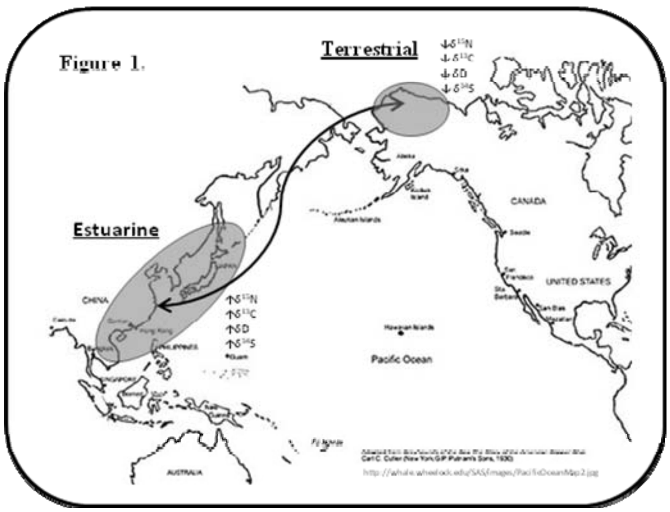
Investigators: Andrew Doll and Michael Wunder, University of Colorado – Denver; Richard B. Lanctot, U.S. Fish and Wildlife Service

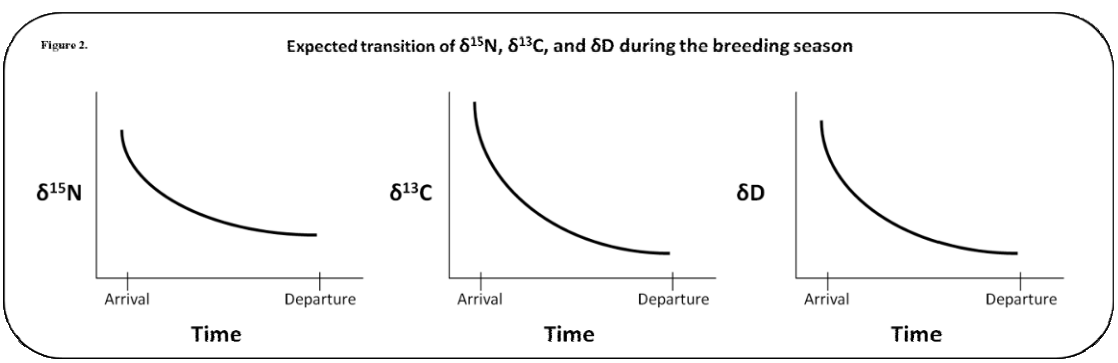
Stable isotopes have proven to be a useful tool for analyzing changes in avian physiology in relation to migration and breeding. By determining the isotope values of tissue material from Dunlin (*Calidris alpina arcticola*), we will be able to make inferences about their resource allocation process. This subspecies of Dunlin migrates between their breeding grounds on the arctic tundra of Alaska and the estuarine coastal areas of South East Asia (Figure 1). These areas represent significantly distinct isotopic environments. The estuarine environments comparatively have much higher $\delta^{13}C$, $\delta^{15}N$, $\delta^{34}S$, and δD values. When Dunlin consume prey from these different environments, they incorporate these isotopes into their tissues at levels reflective of the environments in which they forage. As such, by analyzing the tissues of captured Dunlin in the arctic tundra, we expect to see a transition in their tissues from higher isotope values reflective of their winter estuarine environment to lower values representative of the terrestrial tundra (Figure 2).

The fundamental component of this study will be blood samples collected from breeding birds in the Barrow area. Blood has been shown to have a relatively quick turnover rate for isotope incorporation after a diet shift occurs. By sampling blood from Dunlin throughout the season we should be able to determine the rate of this transition at a population level. In order to strengthen our findings, a subset of these individuals will be recaptured and re-sampled to provide an estimate of individual variation in turnover rate within the population. In addition, other tissues will be collected and analyzed to support our argument.

A comparison between primary feathers (grown in the arctic) and breast covert feathers (grown prior to arrival in the arctic) will further support the change in isotope values that occurs with their diet shift. Blood samples from brooding chicks will be collected and analyzed for comparison with the isotope values of the mothers. Abandoned eggs and chick carcasses will also be collected opportunistically. This will shed some light on the strategy of resource allocation with respect to reproduction and may provide an answer as to whether Dunlin are capital or income breeders. Finally, a small number of Dunlin will be collected upon arrival to the arctic and the same number will be collected just prior to migrating at the end of summer. Analysis of muscle, liver, blood, bone and feather tissue from these birds will provide information about the isotope turnover rates in these various tissues.

During the 2010 breeding season, 99 individual Dunlin were sampled and 33 of these were recaptured and resampled. Blood samples were collected from 29 successful chick broods. Abandoned and partially predated eggs from 14 nests and four chick carcasses were collected. Additionally, five Dunlin were collected shortly after arrival in early June and another five were collected in the latter half of July just prior to migration. Preliminary data on the isotope values of the muscle tissue and the results appear to support our assumptions. Sampling will continue in the summer of 2011 with similar sampling targets and protocols.





Contact: Andrew Doll, University of Colorado – Denver, Department of Integrative Biology, Campus Box 171, P.O. Box 173364 Denver, CO 80217-3364; Email: andrew.doll@ucdenver.edu

9. ***REPLACEMENT EGG LAYING IN AN ARCTIC-BREEDING SHOREBIRD IN RESPONSE TO EXPERIMENTAL CLUTCH REMOVAL*** *– Gates et al.*

Investigators: H. River Gates, Richard B. Lanctot, U.S. Fish and Wildlife Service, Anchorage, AK, USA; Department of Biology and Wildlife, University of Alaska, Fairbanks, Alaska, USA Abby N. Powell, U. S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit, Fairbanks, AK, USA.

From 2007 - 2009, we conducted a study to evaluate how Arctic-breeding Dunlin respond to experimental clutch removal. We measured renesting propensity, mate and territorial fidelity, and the interval between clutch removal and replacement clutch laying. We captured, radio- and color-marked approximately 40 adults (20 pairs), and removed approximately 20 clutches during early incubation (all years, clutches removed between 2 – 7 days, 2007: n = 16, 2008: n = 21, 2009: n = 23) and late incubation (2008 and 2009 only, clutches removed between 12 – 16 days, 2008: n = 20, 2009: n = 9). Dunlin persistently laid replacement clutches (82 - 95%) after clutches were removed during early incubation and regularly laid replacement clutches (35 - 50%) after removal during late incubation. Mate fidelity between initial and replacement clutches was high (58 pairs), divorce only occurred between pairs that experienced clutch loss during early incubation. In all cases of divorce (n = 4), the male remained on territory and the female moved greater distances than monogamous pairs (> 1 km) to renest with a new mate. All other pairs nested in close proximity (mean = 161 m, range 22-549, n = 58) to their first nest. The average time between collection of the first clutch and initiation of the replacement clutch was 6.0 ± 2.5 days (n = 48, 2 – 15 days) and 6.5 ± 3.0 days (n = 13, 2-14 days) for early and late treatments, respectively. Clutch size between initial and replacement clutches was not significantly different for early treatment clutches in 2007 and 2008 but was different in 2009 (t = 2.03, df = 18, p = 0.02). Clutch volume was not significantly different between early treatment initial and replacement clutches in 2007 and 2008 but was in 2009 (t = 2.40, df = 14, p = 0.03). Clutch volume was also significantly different between late treatment initial and replacement clutches in 2008 and 2009 (2008: t = 3.06, df = 4, p = 0.04, 2009: t = 1.01, df = 2, p = 0.42; no late treatment was present in 2007). Preliminary results from logistic regression analysis and AIC model selection suggest that Julian date of clutch loss; number of days of incubation and female condition are the most important factors affecting a female's renesting propensity. A reduction in clutch volume between early initial and replacement clutches in 2009 and late initial and replacement clutches in 2008 and 2009 likely demonstrates a reduction in food resources for replacement egg laying. Our study revealed an unexpectedly high rate of clutch replacement, suggesting that a female's propensity to lay a replacement clutch is due to timing of clutch loss, stage of incubation and physiological constraints of the female.

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10. Biometric and molecular techniques to determine subspecies and sex of Beringia Dunlin – Gates et al.

Investigators: H. River Gates, U.S. Fish and Wildlife Service, Anchorage, Alaska, USA; Department of Biology and Wildlife, University of Alaska, Fairbanks, Alaska, USA; Richard B. Lanctot, U.S. Fish and Wildlife Service, Anchorage, Alaska, USA; Stephen M. Yezerinac, Biology Department, Bishop's University, Sherbrooke, Quebec, Canada; Abby N. Powell, U. S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit, Fairbanks, Alaska, USA; Pavel Tomkovich, Zoological Museum, Moscow State University, Bolshaya Nikitskaya Street, 125009, Moscow, Russia; Olga P. Valchuk, Far Eastern National University, Institute of Biology and Soil Sciences, 8 Sukhanova St., 690950, Vladivostok Russia

Shorebird species are frequently composed of different subspecies or populations that may exhibit a variety of migration and wintering strategies that influence management actions and responsibilities. Characterizing subspecific variation may be difficult, however. Historically, biologists have relied on differences in morphology to separate subspecies or populations within species. Such differences are expected given a population's adaptations to local environmental conditions. Within populations of subspecies, accurately determining the sex of breeding adults helps to document sex-specific behaviors, pair dynamics, and differences in demographic rates. For many species, determining the sex of an adult shorebird can be problematic due to their weak size dimorphism and indistinct dichromatism. Biometric approaches to determine subspecies and sex have moderate error rates; equations lack broad applicability due to wide geographic variation in the species' range. Genetic approaches to determine subspecies may not detect subspecific differences in cases where gene flow is either occurring or has only recently been stopped. Conversely, genetic techniques to determine sex have low error rates and are increasingly inexpensive, but do not provide immediate results that can be useful during field studies. In this study, we quantified the geographic variation of biometric characters of individuals belonging to five subspecies of Dunlin sampled on their disjunct breeding ranges throughout Beringia. Prior efforts to separate these subspecies using genetic techniques has met with limited results. The five breeding Dunlin subspecies included the Alaskan Nearctic subspecies *pacifica* (n = 46) and *arcticola* (n = 341), and the eastern Palearctic subspecies *actites* (n = 25), *kistchinski* (n = 36), and *sakhalina* (n = 36). All individuals were captured or collected on the breeding grounds. The sex of each individual was determined by 1) using PCR amplification of distinctly-sized fragments of the CHD1 genes on the W and Z chromosomes based on DNA obtained from blood or feather samples; or 2) by inspection of the reproductive organs. For each individual, we also obtained measures of body mass, flat and straightened wing chord, exposed culmen, and diagonal tarsus using standardized methods. We then employed discriminant function analyses to create biometric equations to predict the sex and subspecies for each breeding subspecies relying on our morphometric data from individuals whose sex was verified. In addition, we generated mixed subspecies models to delineate subspecies and sex at migration stopovers where multiple subspecies congregate. Among the subspecies, *actites* is the smallest in size and *pacifica* is the largest, with females averaging larger than males in all measures. Correct classification rates to determine sex of individuals within a given subspecies was high (87 – 98%) with the best classifications rates being for females of the *kistchinski* subspecies. Mixed subspecies models had lower correct classification accuracies due to overlap in morphometric characters between males and females of the various subspecies, especially for *arcticola, sakhalina* and *kistchinski*. The mixed subspecies model involving just *arcticola* and *pacifica* correctly classified individuals 73% of the time, while a model that determined the sex of *arcticola* and *pacifica* correctly classified individuals to sex 86% of the time. Further, a model that combined four subspecies wintering in Southeast Asia (e.g. *actites, arcticola, kistchinski and sakhalina*) correctly classified sex 79% of the time but was very unreliable at differentiating individuals of the four subspecies. Using morphological measures, Dunlin sex can be reliably classified according to discriminant function equations but subspecific status remains difficult to determine among Beringian Dunlin. Additional measures such as plumage color and molt schedule may improve the likelihood of separating Dunlin subspecies.

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11. SURVEY OF BREEDING SHOREBIRDS AT CAPE KRUSENSTERN NATIONAL MONUMENT, ALASKA – Gates et al.

H. River Gates, Simon Buckell, and R. B. Lanctot, U.S. Fish and Wildlife Service, Anchorage, AK, USA; Biology and Wildlife Department, University of Alaska, Fairbanks, Alaska, USA.

In 2010, we initiated a breeding ecology study of shorebirds utilizing the upland estuarine habitats at Cape Krusenstern National Monument, north of Kotzebue in northwestern Alaska. This project was initiated to assess the site as a potential Arctic Shorebird Demographic Network site and to allow Dunlin to be equipped with light-level geolocators. A previous study in the 1990s provided evidence that this area was important to breeding shorebirds in relatively high densities and species diversity. We conducted nest searching and monitoring activities between 10-28 June 2010 during which time we found 56 nests of five species of shorebirds (Western Sandpiper, Semipalmated Sandpiper, Dunlin, Red-necked Phalarope, and Black Turnstone). We determined nest initiation dates of each nest by observing clutch completion, by using egg floatation regression equations, or using hatch date to calculate initiation dates. Mean initiation dates for Dunlin was 7 June ± 8.3d (n = 22, 29 May- 30 June); Semipalmated Sandpiper 9 June ± 4.8d (n = 16, 28 May – 9 June); Western Sandpiper 15 June ± 6.0 (n = 10, 2 June – 22 June) and Red-necked Phalarope 12 June ± 2.08 (n = 7, 9 June- 16 June). These estimates likely include infrequent replacement clutches based on a bi-modal distribution of initiation dates. We were unable to estimate breeding density because our nest searching methods were not done in a standardized fashion. However, our observations suggested Semipalmated Sandpipers were the most common breeding shorebird followed by Dunlin, Western Sandpiper and Red-necked Phalarope. Due to the short length of our field season, we were unable to determine the fate of approximately 42% of the monitored nests. For nests where fate was determined, Dunlin showed the highest apparent hatch success of 63% (n = 16), followed by Semipalmated Sandpiper: 38% (n = 8). We captured and uniquely marked 61 individuals with engraved flags and color bands, including 30 Dunlin, 11 Western Sandpiper, 18 Semipalmated Sandpiper and two Red-necked Phalarope. We also participated in a broad scale migratory connectivity study by equipping 30 Dunlin with light-level geolocators within a larger effort to equip three subspecies of Dunlin at seven locations in Alaska and Canada (see project summary #25). All captured birds were morphologically measured and had blood and feather samples collected. Cape Krusenstern has a diverse waterbird community and is an important breeding area for migratory shorebirds, waterfowl, and cranes. Funding is currently being sought to expand the Cape Krusenstern site into an Arctic Shorebird Demographics Network site in 2011; additional work would entail continued and expanded banding of focal species and intensive environmental monitoring.

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12. Pacific Shorebird Migration Project *– Gill et al.*

Investigators (in 2010): Bob Gill, Lee Tibbitts, Dan Ruthrauff, Dave Douglas, and Dan Mulcahy, U.S. Geological Survey; Nils Warnock, Audubon Alaska; Gary Page, PRBO Conservation Science; Nathan Senner, Cornell University.

The Pacific Shorebird Migration Project (PSMP) entered its sixth year of fieldwork in 2010, continuing to employ state of the art telemetry technologies to address fundamental questions about the movement ecology of members of the tribe Numeniini (curlews and godwits). In order to provide a geographic contrast with previous studies, we initiated a study of the migratory routes of Bar-tailed Godwits and Whimbrels breeding in northern Alaska along the Colville River near Nuiqsut. We surgically deployed nine satellite transmitters in Bar-tailed Godwits and five Whimbrels, and also deployed 11 backpack-style solar satellite transmitters on Whimbrels. Additionally, Nathan Senner continued his assessment of Hudsonian Godwit migration ecology by studying the birds at two sites, one near Churchill, Manitoba and the other near Beluga, Alaska. We continued to receive data from Long-billed Curlews and Marbled Godwits that were satellite-tagged in previous years, with some transmitters now entering their third year of service. We also deployed seven new transmitters on Long-billed Curlews nesting in Montana.

Species-specific highlights:
Limosa lapponica baueri and *Numenius phaeopus*: Having already identified areas of high breeding density along the Colville River during a 2009 reconnaissance, we established a field camp near Ocean Point, approximately 15 miles upriver from Nuiqsut. We timed our presence (late June / early July) to coincide with late incubation and early hatch, and crews searched for breeding birds on foot and with the help of a helicopter. Whimbrel, more abundant and indiscreet than godwits, typically revealed their nest sites and were primarily captured using bow traps, while the characteristically inscrutable godwits were primarily captured post-hatch with mist nets while tending broods. Whimbrel (two females and three males) and godwit (nine females) surgeries were performed in camp while backpack harnesses were affixed to Whimbrel (four females, four males, three undetermined) by crews in the field. After the initial capture and marking process, all nine godwits moved to coastal western Alaska, utilizing sites from Hooper Bay south to Kuskokwim Shoals; one bird made movements between Kuskokwim Shoals and sites along the Alaska Peninsula. Unfortunately, transmitter malfunctions precluded our ability to track the godwits on their trans-Pacific migration, despite tantalizingly following one godwit to within 1,500 km of landfall (this bird was observed one week later in New South Wales, Australia). In contrast, all 16 marked Whimbrels moved to sites in western Alaska, but were typically found at inland sites up to 200 km from the coast. Similar to Whimbrels marked at Kanuti National Wildlife Refuge in 2009, the Colville River Whimbrels staged at these sites for about a month before embarking on direct, nonstop flights to the Pacific Coast of North America. Initial landfall extended from northern Oregon to southern Mexico. At the time of this writing, birds have continued further south to sites in Central America, Ecuador, and southern Peru.

L. haemastica: 2010 marked the third year of field work at Churchill, Manitoba, and in this time 63 adults and 103 hatch year Hudsonian Godwits have been banded. Of these adults, three have provided two years of migration information from their geolocators and detail use of wetlands between Churchill and their non-breeding destinations in Tierra del Fuego, South America. This year also marked the second year of field work at Susitna Flats near Beluga, Alaska, where 58 adults and 124 hatch year birds have been banded. Of these adults, 13 were recaptured with geolocator tags, and these devices detail this population's dependence upon Chiloé Island, Chile, as a non-breeding destination—all but one of the 13 spent the winter at this location. Additionally, birds from this breeding site showed remarkable reliance upon only a handful of staging sites scattered across North and South America (e.g., Saskatchewan, northwest Amazon Basin, northern Argentina, southern Great Plains of Kansas and Nebraska). Additional field work is planned at both sites in 2011. We will focus on retrieving additional geolocators to refine our multi-year assessment of Hudsonian Godwit migration strategies, as well as continue efforts linking migration phenology with local site conditions and overall reproductive success.

Numenius americanus: In a continuation of previous efforts, seven new solar-powered transmitters were deployed on nesting curlews in Montana, joining seven marked at the same site last year. We received detailed northward migration tracks from the original seven marked in 2009, and information on southbound migration from 13 of the 14. These birds have dispersed to non-breeding sites across Texas and central and eastern Mexico.

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*13. **Whimbrel breeding ecology near Kanuti Lake, Kanuti National Wildlife Refuge, 2010** – Harwood*

Investigator: Christopher Harwood, U. S. Fish and Wildlife Service.

For the third consecutive year, Kanuti NWR staff documented the breeding of Whimbrels (*Numenius phaeopus*) in and near a small, approximately 5-km^2 patch of tundra adjacent to the refuge's administrative cabin at Kanuti Lake. This project, which started modestly as a general avian reconnaissance of the area during the breeding season (pre-breakup through summer), has evolved into a Master's project investigating Whimbrel breeding biology with 2010 as the pilot season. The first year of data collection under the auspices of the graduate project begins in 2011.

In 2009, USGS Alaska Science Center shorebird researchers implanted satellite transmitters (PTTs) in 15 Whimbrels to study the southward migration of Pacific Basin Whimbrels. Twenty-one adult Whimbrels (including the 15 PTT birds) were marked in 2009 with uniquely coded colored leg flags. Kanuti NWR personnel returned to the Kanuti Lake site on 30 April, 2010. Despite an early spring (e.g., no snow in the study area at this date), the first Whimbrels did not arrive until 8 May (the latest in three years). The first returning marked (i.e., PTT antenna visible) bird was resighted on 10 May, while the latest resighted marked (i.e., flag but no PTT antenna) bird was located on 28 May. On 13 May, three marked males (including one with his marked mate from 2009) were resighted on territories occupied in 2009. Of the 15 Whimbrels implanted last summer, six (five males) were resighted on the study area in 2010. One male's PTT actually transmitted long enough to document not only his southward migration, but the northward migration from Ecuador back to Kanuti (e.g., he was located on Kanuti one day after transmitting from Wasilla, AK). Three of the 15 PTT birds were known to have died over the 10 months—two in 2009 (one each at Kanuti and Norton Sound) and one in California in 2010 on its northward migration. Four (two males) of six flagged-only birds were resighted on the study area in 2010.

Compared to 2009 when at least 14 of 19 located nests hatched, 2010 was a poor year for nest success, if not breeding propensity as well. Only 3 of 14 located nests (includes one renesting attempt) actually hatched. Of the six returning PTT birds, nesting was confirmed for only four (two males likely did not secure mates); one nest was depredated, two nests were abandoned well into incubation, and the fourth was also likely abandoned during laying (i.e., an egg laid by the only returning PTT female was malformed and nonviable). Of the four returning flagged-only birds, both females nested, one successfully. Nests were not located for the two flagged males and they were never observed paired up.

Nesting was observed largely in territories occupied in 2009. The first nest was located on May 19 with one egg. A second nest was discovered with a complete clutch of four eggs on 25 May. Six nests were discovered during laying but only two survived to help calculate incubation length for this population. The incubation period for these two nests was estimated at 25 and 27-28 days, respectively. Both of these nests were found during incubation with three eggs (out of ultimately four). In the longer incubated nest, based on researcher nest visits, it appears that the male may have been solely responsible for incubating/attending during much of the final week before hatch. Hatching dates for the three successful nests were 19, 21, and 21 May. Although the study area was enlarged and Whimbrels were observed displaying in a few areas not investigated in 2009, no nests were found in these new areas (although one possible pair was observed).

Of the three pairs that nested successfully, broods were observed for two of them as lat as 25 June, the last day we visited the study area. One brood was observed being depredated by Common Ravens. Ravens were observed depredating one nest and are likely the main predator of eggs and chicks on the study area. Another male with mobile chicks was discovered on 23 June; the nest for this family had never been located.

Eleven adult Whimbrels were captured and newly marked (uniquely coded color flags) during incubation, from 9 -17 June. A twelfth adult was captured/marked post-hatch. Of the known 14 pairs that nested in 2010, six pairs had both members marked, six had one member marked, and no adults were marked for two pairs that attempted nesting (i.e., they failed early).

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14. FACTORS AFFECTING CHICK SURVIVAL OF DUNLIN NEAR BARROW, ALASKA – Hill et al.

Investigators: Brooke Hill and Christine Hunter, University of Alaska Fairbanks; and Richard Lanctot, U.S. Fish & Wildlife Service.

During the summers of 2008-09, we studied chick survival of Dunlin (*Calidris alpina arcticola*) at long-term study plots near Barrow, Alaska (see project summary #24). We monitored chicks from initial nests, as well as those from replacement nests derived from R. Gates' experimental clutch replacement study (see project summary #9), and investigated factors that affect their survival. Preliminary results are shared here.

We investigated brood survival for three treatments: un-manipulated (control), early, and late replacement nests, from which an initial nest had been removed either early (3 – 8 days) or late (12 – 16 days) into incubation. To evaluate chick survival, we put radio transmitters on one or two adults and two chicks from each brood. We monitored 66 broods (2008: n = 38; 2009: n = 28) until their fate was determined. In 2008, 19 of the 38 broods were from experimental replacement clutches (early: n = 13; late: n = 6). In 2009, 8 of the 28 broods were from replacement clutches (early: n = 7; late: n = 1). Chicks were monitored at 2-day intervals until they fledged (~16 days), died, or their radio signal was lost. During each visit we listened for radio signals and attempted to visually count the number of chicks present. When a chick with a radio was missing from a brood, we searched the surrounding areas and, if possible, determined the cause of death. We also assessed food availability during the brood-rearing period using arthropod pitfall traps. This provided an approximate measure of terrestrial insect abundance.

Ten of 19, and 15 of 20 initial broods fledged at least one chick in 2008 and 2009, respectively. In contrast, only 4 of 19, and 3 of 8 replacement broods fledged at least one chick in 2008 and 2009, respectively. Apparent causes of chick deaths (which occurred between 1-14 days old) included exposure, and mammalian and avian predation. For broods where both radio tagged chicks died, both chicks died on the same day for 21 broods, and on different days for 13 broods. Total brood loss was inferred when both radio chicks were found dead or were missing, and the adult did not act broody for at least two consecutive brood checks.

We used nest survival models in Program MARK to estimate the probability of surviving to fledging and to determine which factor(s) help explain variation in chick survival. Models that included hatch date, chick age, and insect abundance received strong support. Models with year and temperature received little support. Chick daily survival rate (DSR) was higher for chicks that hatched early in the season than for chicks that hatched later (Fig. 1). Differences in DSR in response to insect abundance were small except for very low insect abundances (< 120 mg/day). There was almost no effect of chick age on DSR for chicks hatched during the first half of the season. However, there was a strong quadratic effect of chick age on DSR for chicks hatched later in the season. For chicks hatching after about day 18, DSR was very high for very young chicks (1 – 3 days old) and for older chicks (> ~13 days), but dipped for ages in between. This dip in DSR was especially pronounced for later hatch dates and low insect abundances. This finding was unexpected, as most prior research suggests chicks have the poorest survival during their first few days and that as chicks get older their probability of survival increases. In our study, most chick deaths occurred during the first week after hatching (53 deaths for chicks ≤ 8 days old; vs. 17 deaths for chicks > 8 days old), but most chicks died around age 5, rather than at age 1 or 2 days as we expected. Our results suggest 1 or 2 day old chicks survive fairly well, even if food supply is low or weather is unfavorable. This is probably because the chicks can all be brooded together at this young age, and they can rely on body reserves for the first few days of life while they learn to forage effectively.

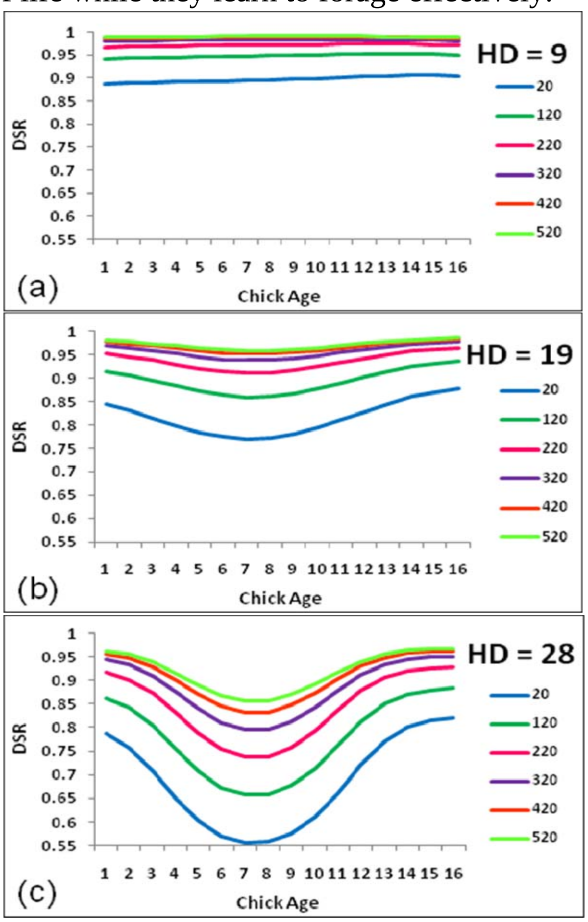

Figure 1. Effect of hatch date, age, and insect abundance on chick daily survival rates. Hatch date (HD) is held constant at day 9, 19, or 28, the average hatch dates of initial, early replacement, and late replacement nests, respectively (day 1 = 25 June). Six insect abundances are represented, and are in mg/day. Panel (a) illustrates that the DSR of chicks from initial nests shows little effect of age or insect abundance, except for low values of abundance (< 20 mg/day). Panel (b) shows the quadratic effect of chick age starting to be expressed at lower insect abundances. Panel (c) shows the stronger effect of chick age for later hatching dates, with particularly low DSR for chicks aged 6 – 9 when insect abundance is very low.

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15. Research and Conservation of Hudsonian Godwits and Whimbrels on Chiloé Island, Chile, 2010 – Johnson, J. et al.

Investigators: Jim Johnson, Brad Andres, U.S. Fish and Wildlife Service, Migratory Bird Management; Steve Kendall, U.S. Fish and Wildlife Service, Arctic National Wildlife Refuge; Humphrey Sitters, International Wader Study Group; Bob Christensen, Living Systems Design

Introduction: This year marked our fifth field season studying Hudsonian Godwits and Whimbrels on Chiloé Island, Chile. There was a strong El Nino (ENSO) effect this year at Chiloé – the weather was cold, windy, and rainy compared to the 2006–2008 field seasons. Godwit abundance appeared lower this year at our primary capture sites near Castro. Our primary objectives for the 2010 field season were to 1) resight individually marked godwits and Whimbrels and 2) capture and individually mark a new cohort of godwits and Whimbrels. Secondary objectives were to 1) conduct a cursory survey of sites on Chiloé Island that typically support godwits and Whimbrels to assess changes in abundance and distribution during this strong El Nino year and 2) participate in the first Chiloé Island shorebird conservation action plan meeting.

During 5–16 January 2010, we resighted godwits and Whimbrels at our primary capture sites in the Castro region. We resighted 180 of 525 (34%) marked godwits and 116 of 197 (59%) marked Whimbrels. Additionally, we recorded ~12 godwits banded at Susitna Flats, Alaska during the 2009 breeding season; no godwits banded at Churchill Bay in 2008 were seen in the Chiloé region (N. Senner, unpub. data). These preliminary results give some support to the idea that western and eastern breeding populations segregate during the non-breeding season.

Following the year's resighting efforts we estimated the apparent adult survival of godwits and Whimbrels using a simple CJS model. These estimates include three capture occasions and three resighting events, do not include groups or covariates, nor do they account for temporary or permanent emigration from the study area. Although estimates provided here should be considered preliminary (and biased low), apparent adult survivorship for both godwits ($\varphi = 0.76$, SE = 0.04, CI_{95} = 0.67, 0.83) and Whimbrels ($\varphi = 0.82$, SE = 0.02, CI_{95} = 0.77, 0.86) is within the range of expected values for large shorebirds (0.90; B. Sandercock, pers. comm.).

Following our resighting efforts, we switched gears to focus on capturing and individually marking additional godwits and Whimbrels. As previously, mentioned, godwit numbers appeared lower this year at the sites we relied on during past capture efforts, which made this species more difficult to capture. As a result, we were forced to look for additional sites to use the cannon net and we experienced more unsuccessful capture attempts than past years. Nevertheless, we caught 140 godwits and 120 Whimbrels during 6 cannon netting attempts. The number of new godwits banded was slightly lower than the three-year average ($\bar{x} = 175$), but higher for whimbrels ($\bar{x} = 65$). To date, we have banded 665 godwits and 315 Whimbrels on Chiloé Island.

Unlike past years, when we caught low numbers of immature and juvenile godwits ($\bar{x}$ = 1.3%, 2007–2008), all godwits captured in 2010 were adults. The majority of Whimbrels we caught were adults. In 2010, 1.6% of Whimbrels captured were juveniles or immatures, slightly lower than the 2007–2008 average of 2.1%. The question remains, where are all the immatures and juveniles?

During 30–31 January 2010, we surveyed all sites known to support concentrations of godwits to assess potential changes in distribution and abundance. We counted a total of 11,271 godwits at 24 sites on Chiloé Island, a 31% decline from the 2007 survey results (16,318). Whimbrel abundance was 15% lower at a subset of 14 sites on Chiloé (3,017 birds in 2007 and 2,549 in 2010).

Reasons for this apparent decline are unknown, however, there are several possible factors that may contribute to the reduction in species' abundances including 1) weather conditions such as prevailing wind direction and speed that affect the bird's ability to access prey (e.g., godwits primarily forage along the water's edge and increased wind-generated wave action may discourage godwits from using exposed sites); 2) colder ambient temperatures may have negatively affected invertebrate densities thereby increasing competition for food and lowering godwit densities; 3) increased wave action in combination with high tide levels increased the cover and depth of algal mats in intertidal habitats possibly limiting godwits access to prey (e.g., godwits primarily feed by probing their bills in soft, water-saturated mud); 4) prevailing wind and storm frequency in the southern hemisphere during southbound migration may have caused godwits and Whimbrels to settle at sites other than Chiloé; and 5) climatic conditions on the breeding grounds may have negatively affected adult survival of godwits and Whimbrels (e.g., the 2009 breeding season was believed to particularly poor at Churchill due to an exceptionally late spring, N. Senner, pers. comm.).

In 2009, the Packard Foundation's Shorebird Conservation Program identified Chiloé Island as one of five shorebird sites in the Pacific Basin to receive funding for conservation and education activities. The Nature Conservancy, with the cooperation of USFWS, Migratory Bird Management, received funding to develop a Conservation Action Plan for shorebirds of Chiloé Island. The first of two meetings was conducted in Castro, Chile on 27–29 January. Chilean educators, biologists, and managers attended this meeting from a wide range of governmental and non-governmental agencies and organizations. The goal for this meeting was to define focal conservation targets (e.g., Hudsonian Godwit, Whimbrel, Rufous-chested Dotteral, intertidal zones) and stresses (e.g., urbanization, contaminants, aquaculture, disturbance) and in the process set up the next meeting that will focus on identifying conservation strategies and actions.

Our work on Chiloé Island, during 2010 successfully added to our ongoing effort to provide estimates of adult annual survival for Hudsonian Godwits and Whimbrels. Additionally, one of the understated benefits of our study has been to foster collaborations among an international group of students and biologists; this year our team included five students and 9 biologists from Canada, Chile, United Kingdom, and the U.S. We also continued to initiate new and maintain existing relationships with local communities and citizens; their appreciation and awareness of the shorebirds they interact with on a daily basis is the foundation of successful conservation efforts in the region.

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16. Breeding Ecology and Surveys, Subspecies Identity, and Migratory Connectivity of Alaskan Red Knots (Calidris canutus) *- Johnson, J. et al.*

Investigators: Jim Johnson, Luke DeCicco, Nick Hajdukovich, and Rick Lanctot, U.S. Fish and Wildlife Service, Migratory Bird Management

Background: Population size estimates and precipitous declines of *Calidris canutus rufa*, which breed in the central Canadian Arctic and winter principally in Tierra del Fuego, are well-documented following long-term monitoring at spring staging sites in Delaware Bay and wintering sites in South America. In contrast, population size, trends, and conservation status of *C. c. roselaari*, which breed on Wrangel Island, Russia and Alaska and migrate along the northeastern Pacific Coast, are uncertain. Furthermore, all aspects of the breeding ecology of *roselaari* in Alaska are unstudied.

Objectives: The primary objective is to provide a minimum of 30 blood and feather samples to on-going genetic and stable isotope studies examining phylogeography of North American Red Knot populations. Secondary objectives are to 1) estimate distribution, abundance, and habitat associations in northwest Alaska, 2) describe breeding ecology, 3) individually mark birds so that they are available for resighting on the non-breeding grounds, and 4) attach geolocators to 20 individuals to determine routes and timing of their migration. This summary provides preliminary results from 2010 – the first year of our two-year study.

Red Knot Survey Methods and Preliminary Results: We stratified a 13,000 km^2 area encompassed by Cape Krusenstern National Monument and Noatak National Preserve by ecotype classes, elevation, and slope. We considered primary Red Knot habitat as alpine vegetation classes >100 m in elevation and on <40° slopes. These parameters were chosen based on where the species had been observed in northwest Alaska in the past. To increase our chances of locating nests and capturing Red Knots, we expanded our efforts to include ridgelines >100 m in elevation that supported lichen/dryas habitats accessible from the Seward Peninsula road system. Between 22 May and 8 June, we surveyed 149 of the 218 (68%) polygons that met our selection criteria. Surveyed polygons ranged in size from 15 to 700 ha ($\bar{x}$ = 98.4 ha). We recorded a total of 33 Red Knots, including an estimated 23 pairs, on 19 of 149 (13%) polygons. Red Knots were associated with large, broad-topped domes, terraces, and ridgelines comprised of dryas or lichen dominated alpine habitats. We observed birds >100 m (112–449 m; $\bar{x}$ = 237.5 m) above sea level and all records except one were <20 km from the coast (1–53 km; $\bar{x}$ = 10.2 km). There were three primary areas where observations were clustered: northwest of Kivalina, Kakagrak Hills, and west Igichuk Hills. Densities were highest on polygons in the Kakagrak Hills and bluffs above Cape Krusenstern Lagoon. Following repeated surveys of these polygons, we estimated uncorrected densities of Red Knots to be 0.31 pairs/km^2 at Kakagrak Hills and 0.62 pairs/km^2 at Cape Krusenstern. Because these areas were surveyed during egg-laying and incubation periods when birds are more difficult to observe, densities may be higher. We encountered Red Knots at higher frequencies on the Seward Peninsula than in our northern survey area. We found breeding birds at 7 of 8 road accessible ridgelines that had suitable topography and habitats, usually at a density of one or two pairs per km^2. The highest density was recorded on a 2.5 km^2 terrace that supported at least eight nests and/or broods (3.2 pairs/km^2).

Breeding Ecology: We found six Red Knot nests; three were found in our survey area and three were found on ridgelines accessible from the Seward Peninsula road system. Four nests occurred in lichen/dryas habitats and two were found in predominately rocky habitat. Mean habitat characteristics within a 10 m radius centered on the nest were 20% lichen (7–50%), 23% dryas (5–35%), 2% sedge (1–7%), 41% bare rock (30–60%), and 10% bare soil (0%–20%). Nests occurred on flat terrain ($\bar{x}$ = 2.6°) at 107–365 m ($\bar{x}$ = 243 m). Initiation of laying, based on egg float and chick age estimates, ranged from 24 May to 16 June (median = 2 June). Two nests initiated in mid-June were likely re-nesting attempts following a snow storm on 1 June. Assuming a 6-day egg laying period, initiation of incubation ranged from 29 May to 20 June (median = 7 June). Assuming an incubation period of 21 days, hatch dates ranged from 19 June to 11 July (median = 27 June).
Banding and sample collection: We banded and attached uniquely inscribed leg-flags to 25 adults and attached metal bands and/or leg-flags (depending on age) to 16 chicks. We attached 1 g geolocators to 19 adults (14 males and 5 females). Finally, we collected the outer 2/3 of the 6th greater primary covert and blood samples from 30 Red Knots. Blood samples were sent to the Leetown Science Center for analysis to determine relatedness among Alaska breeding Red Knots and populations sampled at other migration and wintering areas.
Resightings: On 28 May, we resighted one displaying knot that was originally banded in Baja California Sur, Mexico (yellow engraved flag over red band) on the hills north of Cape Krusenstern. There are four previous records from the Yukon-Kuskokwim Delta of knots banded in Mexico (McCaffery et al. 2008, M. Sexson, unpub. data). A second banded knot attending a brood was recaptured on 28 June <150 m from his original capture location along the Seward Peninsula road system. This male was originally banded while attending a brood on 28 June 2009. This is the first known evidence of breeding site fidelity by male knots in Alaska.
Future Research: In 2011, we will continue our survey efforts on the Seward Peninsula to determine distribution and occupancy of Red Knots. Other objectives include individually marking adults so that they are available for resighting during the non-breeding season and obtaining additional genetic and isotope samples to supplement ongoing analyses. Finally, we will attempt to recapture adults carrying geolocators and pending evaluation of these birds' return rate and condition, we will attach an additional 15 geolocators to new males to track their annual migration.

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***17. Geolocator studies of Pacific Golden-plovers** – Johnson, W. et al.*

Investigators: Wally Johnson and Patricia Johnson, Department of Ecology, Montana State University; Roger Gold, Roger Goodwill, Lauren Fielding, and Lael Prince, Department of Biology, Brigham Young University–Hawaii; Paul Brusseau and Nancy Brusseau, Anchorage.

We used geolocators (data loggers) to track the transpacific migrations of Pacific Golden-Plovers (Pluvialis fulva). The devices, carried on leg bands, recorded both light intensity and contact with seawater. We captured birds at two sites: wintering grounds in Hawaii and breeding grounds on the Seward Peninsula. In spring 2009 on Oahu, we equipped 12 territorial plovers with loggers, and then recaptured 10 of them in fall recovering nine functional geolocators. Flight performance (presumably related to strength and direction of winds) varied among individuals, and migrations were nonstop as there were no records of ocean contact. Mean ground speed of northbound flights to southwest Alaska was 65 kph, and individual flight times varied from 1.8 to 4.0 days. The autumn return passage to Oahu averaged 58 kph and required 1.5 to 4.7 days. Ground speeds on some legs of the flights exceeded 150 kph, likely the result of strong tailwinds.

In summer 2009 near Nome, we attached loggers selectively to 15 nesting males (male plovers being strongly site-faithful to nesting territories from year-to-year). Of these, six were recaptured in summer 2010. Their flight speeds were similar to those above, but wintering destinations were more distant than Hawaii some involving nonstop passages of a week or more. Two individuals wintered in the Marshall Is., two at Fiji, one at Wake Is., and one in Kiribati. All of these birds returned in spring via stopovers in Japan where they lingered for a number of days before continuing on to the Seward Peninsula.

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18. Arctic Shorebird Demographics Network: Canning River site – Kendall and Brown

Investigators: Steve Kendall, U.S. Fish and Wildlife Service; Stephen Brown, Manomet Center for Conservation Sciences.

In 2010, we conducted field studies at the Canning River Delta as a partner in the Arctic Shorebird Demographics Network (ASDN; see project summary #1). We had previously conducted studies on breeding shorebirds at this site in 1979-80, 2002-07, and in surveys of the Arctic Refuge Coastal Plain. All these previous efforts indicated that the highest densities of breeding shorebirds occurred in the Canning River Delta region. The ASDN was established to collect scientific data to determine, for several shorebird species, which life history stage is limiting population growth: nesting success, juvenile survival, or adult survival. The network consists of several sites across the North American Arctic at which coordinated, intensive studies of shorebird demographics will be conducted over several years. Arctic-breeding shorebirds disperse widely during the non-breeding season, making them very difficult to study at that time, so life history information is therefore best obtained when shorebirds are congregated on their breeding grounds.

At the Canning River Delta in 2010, we found and monitored 199 nests of shorebirds, waterbirds and avian predators to determine nest success rates. We also captured and color banded 196 adult shorebirds. In future we will re-sight these birds to estimate annual survival rates. In addition, we collected data on variables that may influence nests success and survival such as availability of food sources (aquatic and terrestrial invertebrates), weather, snow melt chronology, habitat, predator abundance and small mammal abundance. We also placed geolocators on 22 adult Dunlin as part of partnership to determine migration stopover and wintering sites for the subspecies that breeds on the Arctic Refuge. Determining this will provide additional information on factors may be limiting population size of this species.

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***19. Post-breeding Shorebird Use of Coastal Habitats at the Arctic National Wildlife Refuge** – Kendall et al.*

Investigators: Steve Kendall, U.S. Fish and Wildlife Service; Stephen Brown, Manomet Center for Conservation Sciences; Joel Reynolds, U.S. Fish and Wildlife Service; Audrey Taylor, University of Alaska, Fairbanks; and Roy Churchwell, University of Alaska, Fairbanks.

Since 2005 we have been investigating several species of shorebirds that aggregate in coastal habitats of Arctic Refuge after breeding and before southward migration. Staging in these habitats may be critical for building energy reserves necessary for migration. However, these coastal areas are vulnerable to contamination and disturbance associated with potential oil development in the eastern Beaufort Sea. They could also possibly face threats of habitat loss due to flooding and coastal erosion due to changing sea conditions associated with climate change.

We have identified several high-use areas on the Arctic Refuge coast, but also observed considerable spatial and temporal variability. Potential mechanisms for this variability include weather, wind, and water conditions, all of which likely affect food availability. In 2010, we continued studies to evaluate distribution and abundance of shorebirds using coastal habitats on the Arctic Refuge. A doctoral student, Roy Churchwell, is conducting a project investigating the mechanisms driving use of these habitats (see project summary #7).

In 2010, we conducted a comprehensive survey of all the larger river deltas on the Refuge, in late July and early August. We also conducted double observer counts to measure detection rates on these surveys. In this spatial comparison we found highest densities of shorebirds at the Jago, Achilik and Kongakut River Deltas. Densities at the Jago Delta were over twice that observed at the Achilik, which had the next highest densities. The Jago and Kongakut are two of the four largest deltas on the Refuge Coast. The other two large deltas, the Canning and Hulahula/Okpilak had relatively low densities of shorebirds.

We now have a comprehensive survey of mudflat habitats at all major river deltas from 2006-10, conducted during a single survey each year. We also have within season timing data on shorebird use of coastal habitats from multiple surveys conducted at the Okpilak/Hulahula (2005-06, 2008-09), Canning (2007-08) and Jago (2008-09). At all of these sites, except for Okpilak/Hulahula 2009, we also have data on use of three habitat types: mudflat, barrier island and salt marsh.

There has been considerable annual and spatial variability in shorebird use of the Refuge deltas and it appears that no one delta stands out as singularly important for staging. Rather birds may rely on the aggregate of these coastal habitats during the staging period. They may move among sites depending on environmental conditions and food availability. We anticipate that graduate studies looking at some of mechanisms driving use of coastal habitats by post-breeding shorebirds will begin to provide insight into why and when specific habitats are important for these birds.

Avian Influenza, Avian Health, Genetic and Stable Isotope Sampling

In conjunction with both the Arctic Shorebird Demographics Network and post-breeding shorebird research activities (see project summary #18) we also collected 246 cloacal and oral/pharyngeal samples from shorebirds to screen for avian influenza and to assess avian health. We collected 179 blood samples for genetic analysis and 193 feather samples for stable isotope analysis.

These projects addressed the following objectives and action items present in the Alaska Shorebird Conservation Plan (version 2):

- Investigate causes of shorebird declines (page 19).
- Within the framework of the Pan American, Eastern Pacific, and East Asian-Australasian shorebird banding program, prioritize and implement new shorebird marking programs to document migration routes, nonbreeding destinations, and stopover sites of priority species (page 19).
- Develop and implement contemporary research techniques (e.g., genetics, banding, geolocators, telemetry, stable isotopes) to identify unique populations of shorebirds that reside in Alaska and to link sites used throughout their annual cycles (page 19).
- Encourage long-term studies synthesizing measures of shorebird breeding phenology and environmental conditions (page 19).
- Conduct long-term studies to assess the impacts of global climate change (e.g., sea level rise, habitat alteration, Pacific storm cycles) on shorebird migration (page 20).
- 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 (page 20).
- Develop regional, national, and international partnerships to promote range-wide monitoring of shorebird populations (page 21).
- Monitor demographic parameters and use demographic models (developed through research initiatives) to better understand limiting factors at the population level (page 21).
- Develop and implement techniques to monitor the environmental health of important shorebird sites (page 22).

- Foster cooperative research efforts throughout the Western Hemisphere (via the Western Hemisphere Shorebird Group), Asia (East Asian-Australasian Flyway Partnership), and elsewhere along migratory flyways (page 24).
- Cooperate with other countries in the circumpolar arctic to standardize data gathering and enhance the investigation of ecological factors that occur across the arctic (e.g., Committee for Holarctic Shorebird Monitoring, and Arctic Birds Breeding Conditions Survey http://www.arcticbirds.ru; page 24).
- Identify important areas used by breeding and post-breeding shorebirds and advocate for protection, or development of GRS, for the most important sites (page 44).
- Monitor the timing of shorebird hatch in relation to insect emergence (page 47).
- Assess the value of shorebird habitats along shipping and transportation lanes and at port sites to mitigate impacts on populations (page 47).

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20. Audubon Alaska's 2010 Watchlist is published - Kirchhoff

Investigator: Matt Kirchhoff, Audubon Alaska

The 2010 Alaska WatchList was published this year by Audubon Alaska. It is a tool to identify and focus conservation attention on vulnerable and declining birds in Alaska. This WatchList is a revision of the 2005 edition of the Alaska WatchList (Stenhouse and Senner 2005), using updated data and different scoring methods. The 2010 Alaska WatchList is the state-level equivalent of the National Audubon WatchList which focuses on a larger suite of North American species (Butcher et al. 2007).

A technical report has been written (Kirchhoff and Padula 2010) that provides details on methods used in development of the 2010 Alaska WatchList, including scoring criteria, thresholds, and data sources. We report the final list, note important patterns, and compare our results with other efforts that identify species of conservation concern (e.g., USFWS 2008, Alaska Shorebird Group 2008, and International Union for the Conservation of Nature 2010).

Of the 299 species, subspecies, and populations evaluated, 49, or 16.4%, made the WatchList. Of these, 31 are declining (Red List) and 18 are vulnerable but not known to be declining (Yellow List). At the species level, 29 species (13.1%) were on the WatchList. At the subspecies and population level, 26.1 percent and 25%, respectively, made the WatchList. The higher proportions reflect the fact that subspecies and populations have smaller population sizes and more restricted geographic ranges than full species, and thus score higher on vulnerability criteria.

The WatchList shows waterbirds and shorebirds are at significantly greater risk than landbirds. This partly reflects more subspecies being evaluated in the former group, and it also reflects a higher proportion of declining populations. Of all bird groups, shorebirds appear most vulnerable, with just over one-third of the species and subspecies evaluated making the

WatchList. In comparison, 8.3% of the landbirds (a much larger grouping of species) made the WatchList.

Despite using quite different methods, agreement between the 2010 WatchList and the 2005 WatchList (Stenhouse and Senner 2005) was high. The new Alaska WatchList adds five birds and removes seven from the prior WatchList (Table 5). The International Union for the Conservation of Nature (IUCN) lists 13 Alaska species as threatened or near-threatened. The Alaska WatchList includes 11 of those, omitting the Sooty Shearwater (*Puffinus griseus*) and Laysan Albatross (*Phoebastria immutabilis*). The Alaska WatchList picks up 19 of 20 "high concern" birds identified in the Alaska Shorebird Plan, omitting the Western Sandpiper (*Calidris mauri*). The Alaska WatchList includes 27 out of 33 of the Birds of Conservation Concern (BCC) in Alaska (USFWS 2008).

For copies of the full color Watchlist booklet, or the technical report that describes methods and results in detail, please contact Audubon Alaska (see contact info below).

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21. Use of light-level geolocators to study the migration connectivity of American Golden-plovers breeding on the Seward Peninsula and near Barrow, Alaska – Lanctot et al.

Investigators: Richard Lanctot, U.S. Fish and Wildlife Service; Shane Gold, Brigham Young University – Hawaii; and Wally Johnson, Montana State University.

To unveil the migratory pathways of American Golden-plovers, we equipped adults with light-level geolocators that nest along the road systems of the Seward Peninsula and at Barrow, Alaska. The first phase of the project was conducted in the summer of 2009 when eight geolocators were attached to adults (six male and two female) nesting on the Seward Peninsula (see Johnson et al. summary from Alaska Shorebird Group 2009 Annual Summary). These birds were captured at several sites accessible along the Nome–Teller Road. Each bird was equipped with a 1.4 g geolocator (British Antarctic Survey model MK-14) attached to a leg band. Despite Herculean efforts by our team we only observed a single geolocator-banded bird to have returned in June 2010. This bird was captured and the geolocator was retrieved – preliminary results indicate the bird flew the predicted elliptical migration route: east across northern Canada, south across the Atlantic Ocean, stopover in northern South America, then south to its wintering area in Uruguay, then north through the Amazon and Central Flyway of the United States, northwest across the Rockies and the Gulf of Alaska, and finally reaching the Seward Peninsula.

In June 2010, an additional nine geolocators were deployed in plovers on the Seward Peninsula (eight males, one female). These were deployed in concentrated areas to improve chances of recovery. We also expanded our study of plovers to the Barrow vicinity. There we deployed geolocators on 15 additional birds (14 males, one unknown sex) on or near the six long-term study plots being monitored by the USFWS. We plan to re-trap as many birds as possible next season and retrieve the geolocators. Because the Mk-14 will record data for up to two years, it is possible we could learn how individuals on the Seward Peninsula vary their migration pathways from year-to-year. Efforts are also underway to obtain funds to purchase more geolocators to attach to plovers at Prudhoe Bay, Alaska, and Bylot Island and Churchill in Canada (via collaborations with Joe Liebezeit and Steve Zack, Wildlife Conservation Society; Erica Nol, Trent University; and Jean-François Lamarre, University of Quebec at Rimouski). American Golden-Plovers are among the world's longest-distance migrants, and we hope our efforts will significantly advance current knowledge of their migratory routes, wintering ground connectivity, and potential for climate to change to affect this species.

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American Golden-plover with geolocator and bands at Barrow

Brooke Hill

22. A 60 Year Evaluation of Shorebird Response to Environmental Change at Barrow, Alaska – Lanctot et al.

Investigators: Richard Lanctot, U.S. Fish and Wildlife Service; Richard T. Holmes, Dartmouth College; and Audrey Taylor and Susan Haig, U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center

The Arctic is showing accelerated rates of warming, and is predicted to experience striking changes in climate conditions. Climate models predict longer growing seasons and warmer temperatures, which are already thought to be responsible for advancement of spring phenology and northward advancement of shrubs. In addition, accelerated ice wedge degradation and accompanying thermokarst pond development have increased the proportion of land covered with surface water. Beyond direct effects on habitat conditions, earlier snowmelt may decouple the apparent synchrony between the breeding chronology of birds and food availability. Decoupling of these events could negatively affect shorebird productivity and survival. Alternatively, longer growing seasons could lengthen the time insects are available for consumption, providing more flexibility for birds to initiate or replace lost clutches and thereby increasing productivity. These longer growing seasons may also allow boreal species to expand northward in the Arctic.

Understanding how wildlife may be affected by these changes is difficult given the potential for existing species to adapt or be resilient to any change, and new invasive species to respond favorably to changing conditions. While a number of expert groups are advocating the start of long-term tracking of arctic conditions, it is also informative to use existing long-term data to see how species have responded historically to changing environmental conditions. Unfortunately these long-term data sets are limited in number, especially for non-physical parameters such as nest initiation dates, egg size, and other biological data that can not be measured remotely and require intensive field studies. Fieldwork conducted at Barrow is one excellent example where both climatic and biological data has been collected extensively for many years.

Extensive data on shorebird breeding ecology was collected on a variety of shorebird species at Barrow between the mid-1950s and early 1980s, resulting in numerous publications. During this era, long-term study plots and transects were established in the Barrow vicinity. Two of these plots have been surveyed again during the mid-1990s and again in the 2000s. Shorebird composition and abundance has also been collected along the previously established transects during the 2000s. Besides standard surveys, an extensive shorebird breeding study has been conducted in Barrow by the U.S. Fish and Wildlife Service since 2003. The latter eight years of data matches or in many cases surpasses the data collected between the 1950s and 1980s.

The objective of this study is to compare information collected on shorebird breeding ecology in Barrow during three time periods (1950-70s, 1993 and 1994, 2003-present) spanning the past 60 years and to evaluate patterns of change in relation to climatic conditions detected during the same time. To date, Lanctot, Holmes and Taylor visited the University of California's Museum of Vertebrate Zoology to investigate the type and quality of data present in notebooks archived from field biologists conducting work at Barrow between 1951 and 1980. These data are in the process of being summarized for comparison to data available in the 1990s and 2000s. We have also located long-term data on temperature, snow melt, and Arctic Ocean sea ice departure to determine whether any changes have occurred in these environmental variables that might indicate climate change has occurred. We anticipate this study to continue into 2011.

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23. USFWS Migratory Bird Management shorebird avian influenza monitoring efforts in 2010 – *Lanctot et al.*

Investigators: Richard Lanctot, U.S. Fish and Wildlife Service; H. River Gates, U.S. Fish and Wildlife Service and University of Alaska – Fairbanks, Brooke Hill, University of Alaska – Fairbanks; and Andy Doll, University of Colorado - Denver

Serious concerns surround the probability that migratory waterbirds might spread highly pathogenic H_5N_1 avian influenza (HPAI) from Asia to North America. Five of the 26 high target avian influenza species are shorebirds that breed on the North Slope of Alaska. These include the *arcticola* subspecies of Dunlin, Pectoral Sandpiper, Long-billed Dowitcher, Ruddy Turnstone, and Buff-breasted Sandpiper. All five species winter to some degree in Southeast Asia where exposure to the HPAI is likely. Since 2006, the USFWS has led an effort to sample these shorebird species for the presence of HPAI in Barrow, Alaska. We studied shorebirds at this site between the 25 May and 1 August 2010, and we collected 329 paired oral-pharyngeal and cloacal AI samples from nine shorebird species that we live-captured using mist nets during pre-breeding and bow nets at nest sites. Of the 329 paired samples, 146 were from high priority HPAI species. Roughly one-third of the samples (n = 105; 32%) were from one high priority HPAI target species (Dunlin). The remaining samples were from American Golden-plover (n = 19), Baird's Sandpiper (n = 2), Long-billed Dowitcher (n = 15), Pectoral Sandpiper (n = 26), Red Phalarope (n = 59), Red-necked Phalarope (n = 5), Semipalmated Sandpiper (n = 83) and Western Sandpiper (n = 15). USFWS personnel also sampled birds at the Cape Krusenstern National Monument between the 10 and 30 June where they captured 30 Dunlin, 18 Semipalmated Sandpiper, 11 Western Sandpiper and two Red-necked Phalarope (see Gates et al. summary). To our knowledge, no positive cases of H_5N_1 avian influenza virus were detected from the 146 and 30 priority shorebirds sampled at Barrow and Cape Krusenstern National Monument, respectively. Most birds also had feathers and blood collected for additional studies.

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24. Reproductive Ecology of Shorebirds: studies at Barrow, Alaska, in 2010 – *Lanctot et al.*

Investigators: Richard Lanctot, U.S. Fish and Wildlife Service; Brooke Hill, University of Alaska, Fairbanks; Andy Doll, University of Colorado Denver, and River Gates, U.S. Fish and Wildlife Service and University of Alaska Fairbanks.

In 2010, we conducted the eighth year of a long-term shorebird study at Barrow, Alaska (71.29°N, 156.64°W). The objectives of this study are to collect baseline data on (1) temporal and spatial variability of shorebird diversity and abundance, (2) arrival date, nest initiation and effort, clutch and egg size, hatching success and chick survival, and other demographic traits of arctic-breeding shorebirds, (3) to establish a marked population of as many shorebird species as possible that would allow us to estimate adult survival, mate and site fidelity, and natal philopatry, and (4) to relate weather, food availability, and predator and prey abundances to shorebird productivity. In addition to these objectives, Barrow began collecting additional environmental data and officially became one of nine field sites participating in the Arctic Shorebird Demographics Network in 2010 (see project summary #1).

We located and monitored nests in six 36-ha plots in 2010. All six plots are the same as those sampled in 2005-2009 and were searched with the same intensity as in past years. A total of 222 nests were located on our plots and another 74 nests were found outside the plot boundaries. Our total nest number declined substantially due to River Gates and Brooke Hill no longer locating and removing nests (which promoted renesting) near Freshwater Lake for their thesis work. Andy Doll, a new Master's student, located some nests in this area but search effort was reduced from past years. Nests on plots included 35 Pectoral Sandpipers, 72 Red Phalaropes, 32 Dunlin, 41 Semipalmated Sandpipers, 15 Long-billed Dowitchers, 7 Red-necked Phalaropes, 11 American Golden-plovers, 8 Western Sandpipers, and 1 White-rumped Sandpiper. No Baird's or Buff-breasted Sandpipers were found on the plots in 2010. The breeding density of all shorebird species on our study area was 102.8 nests/km^2 in 2010; this was the third highest nesting density recorded on our plots, after 2006 (150.5) and 2008 (107.9), and was higher than the long-term average of 91.6. In 2010, four species nested in higher densities than in an average year, including Red Phalarope, Red-necked Phalarope, Semipalmated Sandpiper, and Western Sandpiper. We also documented below average nesting densities for American Golden-plover, Baird's Sandpiper, Buff-breasted Sandpiper, and White-rumped Sandpiper. Dunlin, Long-billed Dowitchers and Pectoral Sandpipers nested at densities close to the 8-year average.

The first shorebird clutch was initiated on 4 June 2010 – 1 day later than the long-term average. Peak initiation date was the 13 June and median initiation date was the 19 June; these dates were about 1 and 5 days later, respectively, than the long-term average. Median nest initiation dates for the more abundant species were the 13 June for Dunlin, 12 June for Semipalmated Sandpiper, 20 June for Red Phalarope, and 22 June for Pectoral Sandpiper. These dates were the latest dates of nest initiation documented during our 8-year study, and contrasted dramatically with the 2009 field season when nest initiation occurred earlier than in most other years.

Predators destroyed 37.2% of the known-fate nests in 2010. This is similar to the 8-year average of 35.7% and much lower than the 68.8% of nests destroyed in 2009. Across the more abundant species, hatching success (# hatching at least one young/total number of nests) was highest in Red Phalarope (69.4%, n = 62), followed by Semipalmated Sandpiper (38.5%, n = 44), Dunlin (54.0%, N = 63), Pectoral Sandpiper (45.5%, n = 33), American Golden-plover (28.6%, n = 14) and Long-billed Dowitcher (13.3%, n = 15). We suspect the much higher nesting success in 2010 relative to 2009 was due to a number of factors. First, lemming numbers had increased in 2010 from their very low levels in 2009, possibly providing an alternative food source for fox and other predators. Second, vegetation had begun to grow back after lemmings had decimated several of the plots in 2009, providing some concealment to nests from avian predators. Third, fox trapping efforts appeared to be more successful in 2010 due to increased trapping intensity and efficacy by the USDA Wildlife Services-employed trappers.

In 2010 we captured and color-marked 339 adults. This was the third highest number of birds banded, after 2006 (342) and 2008 (358), and much higher than the 8-year average of 253.

Sixty-six of these adults (41 Dunlin, 22 Semipalmated Sandpipers, two Red Phalarope, and one American Golden-plover) had been banded in a prior year. Adults captured included 109 Dunlin, 15 Long-billed Dowitchers, 85 Semipalmated Sandpipers, 26 Pectoral Sandpipers, 61 Red Phalaropes, 19 American Golden-plovers, 15 Western Sandpipers, seven Red-necked Phalaropes, and two Baird's Sandpipers. We captured and color marked 371 chicks in 2010. This was similar to the 8-year average of 364 and much higher than the 253 chicks banded in 2009. It was much lower, however, than the number banded in 2006-2008 when at least 450 chicks were banded in each year.

In regard to other environmental features at Barrow, the summer of 2010 appeared to be a late year with a snow fall in late May causing snow to be present into mid-June. This is reflected in the later than usual nest initiation dates for most species. Lemming numbers increased slightly in 2010 from the very low numbers recorded in 2009, and the very high numbers recorded in 2006 and 2008. Pomarine Jaegers and Snowy Owls did not nest in the Barrow area in 2010, and only a few Stellar's Eider nests were found.

We continue to conduct ancillary studies as time allows at Barrow. Avian influenza sampling was a prominent feature of our work in 2006--2010 – all captured birds were swabbed to test for the highly pathogenic H5N1 avian influenza virus (see project summary #23). Audrey Taylor (PhD candidate, UAF) analyzed data and wrote a paper related to the use of physiological measures to assess postbreeding site quality for shorebirds in Barrow and other sites on the Alaska Arctic Coast (see project summary #35). River Gates (MS candidate, UAF) analyzed data and wrote papers related to renesting and the use of morphology to separate sexes and subspecies of Dunlin (see project summaries #9 & #10). Brooke Hill (MS candidate, UAF) analyzed data and wrote a paper on the survival of Dunlin chicks from un-manipulated, and early and late replacement clutches (see project summary #14). Finally, Stephen Yezerinac (Professor, Bishop's University) completed a paper on American Golden-plover extra-pair paternity as it relates to nest initiation and density using adult and offspring samples collected over six years at Barrow (see project summary #38).

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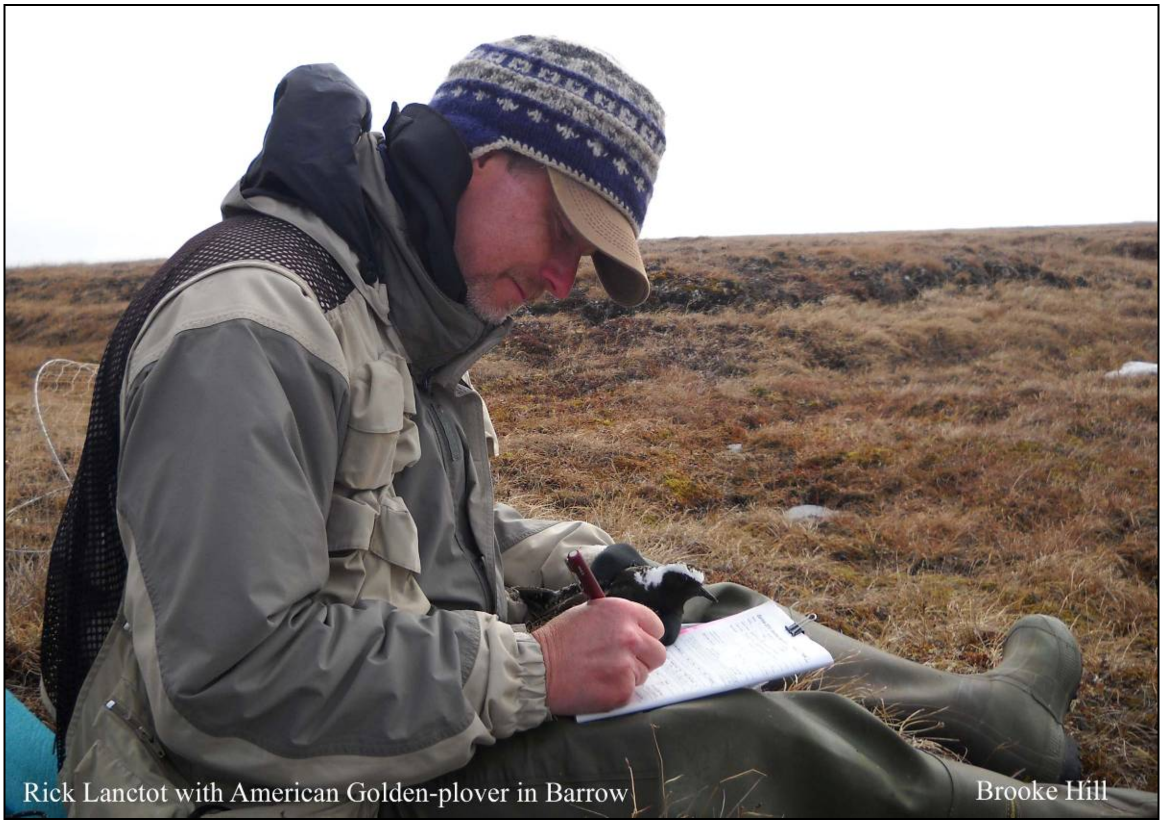

Rick Lanctot with American Golden-plover in Barrow Brooke Hill

25. Linking Dunlin breeding sites with migratory stopover and wintering locations using light-level geolocators – *Lanctot et al.*

Investigators: Richard Lanctot, U.S. Fish & Wildlife Service; Stephen Yezerinac, Mount Allison University; Nancy Hoffman and Bruce Casler, Izembek NWR; River Gates, U.S. Fish and Wildlife Service; Joe Liebezeit and Steve Zack, Wildlife Conservation Society; Steve Kendall, Arctic NWR; Stephen Brown, Manomet Center for Conservation Sciences; Erica Nol, Trent University; and Ted Miller, Memorial University.

Knowledge of the geographic links between migratory populations throughout their annual cycle is essential for effective wildlife monitoring and conservation. Many shorebirds breed in tundra regions that are relatively free of development, yet during the non-breeding season they move in migratory flyways to areas where development is much more common and widely distributed. In most cases little is known about how populations distribute themselves in space and time. Given that many shorebird species have experienced substantial population declines over the past several decades and that species that use particular migration routes are more prone to decline, there is a need to map migration routes and wintering locations. The primary objective of this project is to identify migratory routes and staging areas for three subspecies of Dunlin, *Calidris alpina arcticola*, *pacifica* and *hudsonia*. In 2010, between 22 and 51 ($\bar{x}$ = 38, SD = 10.73, n = 268) Dunlin at each of seven sites were equipped with light-level loggers (aka geolocators). The banding sites were Izembek National Wildlife Refuge, Yukon Delta National Wildlife Refuge, Cape Krusenstern National Monument, Barrow, Ikpikpuk River, the Arctic National Wildlife

Refuge, and Churchill, Manitoba. In the summer of 2011, we will travel back to the same territories and retrap returning birds that were previously equipped with geolocators. By providing accurate, daily tracking throughout the year, light-level geolocator should provide many new insights into the life cycle and behavior of Dunlin. An immediate result of this study will be information for assessing whether the current Western Hemisphere Shorebird Reserve Network adequately protects key stopover sites used by this species.

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26. ***Population structure and migratory connectivity of Western Sandpipers*** – *Lank et al.*

Investigators: David B. Lank, Samantha Franks, Birgit Schwarz, Simon Fraser University; Richard B. Lanctot, U.S. Fish and Wildlife Service; Guillermo Fernandez, Instituto de Ciencias del Mar y Limnología, UNAM, Unidad Académica Mazatlán; and many others

This study, initiated in 2008, assesses the degree of population structure and migratory connectivity of Western Sandpipers (*Calidris mauri*) using population genetic methods, stable isotope analyses, song analyses and morphological data. We have previously sampled blood and feathers from sites across the migration, wintering, and breeding ranges. In the summer of 2010, we gathered additional samples from Nome AK, in association with the ongoing field study at that site with Brett Sandercock. We also obtained samples collected in Siberia with assistance from ASG members, and additional samples were collected by G. Fernandez in western Mexico. However most of the work on this project in the past year has been analytical. PhD student Samantha Franks has developed procedures using stable isotope analyses of H/D, C, N which have some power to assign individuals to molting/wintering locations. PhD student Birgit Schwarz has thus far not found significant genetic differences among breeding samples, although this analysis is still quite preliminary and does not include all sites. On the other hand, she has found some geographical differentiation of some song elements between the YK delta, Wales, Kotzebue and Nome. We hope to have these analyses completed in time to summarize our findings for next year's summaries. We thankfully acknowledge the assistance of ASG members who helped collect material for this study, which is funded primarily by Canadian NSERC grants and a USF&WS Neotropical Migratory Bird Act grant.

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27. LONG-TERM MONITORING OF TUNDRA-NESTING BIRDS IN THE PRUDHOE BAY OILFIELD, NORTH SLOPE, ALASKA – *Liebezeit and Zack*

Investigators: Joe Liebezeit and Steve Zack, Wildlife Conservation Society

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

In 2010, we discovered and monitored 126 nests of 11 species from 8 June to 11 July on or near 12 10-ha study plots using both rope drag and behavioral nest search techniques. Lapland Longspur and Semipalmated Sandpiper nests accounted for the majority (54%) of those found. Among all species, 68 nests successfully hatched/fledged, 49 failed, and nine nests were of unknown or undetermined fate. Nest predation was the most important cause of nest failure (92%). The only other sources of nest failure was abandonment for unknown reasons (n = 4). Overall nest density was 97.5 nests / km^2, noticeably higher than at this site compared to the previous year (75.0 nests / km^2) but within the overall range of other years monitored. Mayfield estimates of nesting success ranged from 20 to 75%, for the three most common breeding species (n >10) with Lapland Longspurs having the lowest survivorship and Semipalmated Sandpipers the highest.

Lemming activity at this site was minimal comparing similarly to other years monitored with the exception to the "high lemming year" of 2006. Overall, seven species of potential nest predators were detected during timed surveys with the most common being Glaucous Gulls and Parasitic Jaegers.

It was generally cooler in this region during the breeding season compared to previous years and subsequently snow melt and tundra exposure were slightly delayed. We identified 12 predation events using remote camera systems at active nests including nine arctic fox and three red fox events.

A comprehensive annual report for this site will be available for in the spring of 2011 at http://www.wcsnorthamerica.org/.

Arctic Shorebird Demographics Network – Prudhoe Bay site

Within the framework of our pre-existing nest survivorship study, we also established Prudhoe Bay as an Arctic Shorebird Demographics Network (ASDN) site (see project summary #1). In 2010, we established two large study plots (154 and 61 ha, respectively) where we focused on the ASDN adult survivorship component for four of the ASDN target species (Semipalmated Sandpiper, Dunlin, Red and Red-necked Phalarope). This involved finding nests, trapping the birds with bow nets or mist nets, color banding the captured birds, and collecting morphometric data. Data collected as part of our separate nest monitoring efforts, including nest survivorship data as well as predator activity, lemming abundance, and snow cover will be contributed toward the ASDN effort. In 2010 we discovered 25 Semipalmated Sandpiper nests and trapped/marked 32 individuals on ASDN plots. We also discovered two Red Phalarope nests and trapped three individuals (one of which was trapped on the plot while foraging). We did not find any Dunlin or Red-necked Phalarope nests on the ASDN plots. Based on our capture success in 2010, we will likely limit our capture efforts to Semipalmated Sandpipers at this site in 2011.

We also established 10 terrestrial and five aquatic insect traps, and surface water measuring stations on the ASDN plots as specified in the ASDN protocol. Weather data for this ASDN site will be obtained from the Prudhoe Bay Airport weather station.

For all sampled species we also collected blood and feather samples to be used in on-going and potential future genetic, hormone, and stable isotope studies

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28. BREEDING BIRD DIVERSITY, DENSITY, NESTING SUCCESS AND NEST PREDATORS AT A STUDY SITE ON THE IKPIKPUK RIVER IN THE NATIONAL PETROLEUM RESERVE - ALASKA, NORTH SLOPE, ALASKA – *Liebezeit and Zack*

Investigators: Joe Liebezeit and Steve Zack, Wildlife Conservation Society

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

In 2010, we established 12 10-ha study plots on the east side of the Ikpikpuk River approximately 30km south of the river mouth (70.55242° N; 154.73222°). We detected 51 bird species at the site during informal surveys and 31 of these species we directly observed nesting or discovered other evidence indicating they likely nest at the site. On or near our study plots, we discovered and monitored 184 nests of 18 species from 9 June to 10 July using both rope drag and behavioral nest search techniques. Lapland Longspur and Semipalmated Sandpiper nests accounted for the majority (58%) of those found. Among all species, 100 nests successfully hatched/fledged and 59 failed. We were unable to reliably assess the fate of 15 nests because there was not enough evidence or contradictory evidence at the nest sites. Nest predation was the most important cause of nest failure accounting for 54 of 59 (92%) of failed nests. Other sources of nest failure were abandonment for unknown reasons (n = 2), failure due to infertile eggs (n = 1), and to trampling likely by caribou (n = 2).

Mayfield estimates of nesting success ranged from 8 to 79% for the five species with sample sizes >10 with Greater white-fronted Geese having the lowest survivorship and Semipalmated Sandpipers the highest. Overall nest density was 125.8 nests / km^2.

Lemmings were detected infrequently, similar to other "low lemming" years in this region. Overall, five species of potential nest predators were detected during timed surveys with the most common being Parasitic Jaegers, Long-tailed Jaegers, Glaucous Gulls, and arctic ground squirrel. We identified eight nest predator events using remote camera systems at active nests including six arctic ground squirrel and two arctic fox events.

It was generally cooler in this region during the breeding season compared to previous years and subsequently snow melt and tundra exposure were slightly delayed compared to nearby sites we've worked at in previous years.

A comprehensive annual report for this site will be available in the spring of 2011 at http://www.wcsnorthamerica.org/.

Arctic Shorebird Demographics Network – Ikpikpuk River site

Within the framework of our pre-existing nest survivorship studies, we also established Ikpikpuk as an Arctic Shorebird Demographics Network (ASDN) site (See project summary #1). In 2010, we established two large study plots (58 and 72 ha, respectively) where we focused on the ASDN adult survivorship component for four of the ASDN target species (Semipalmated Sandpiper, Dunlin, Red and Red-necked Phalarope). This involved finding nests, trapping the birds with bow nets and mist nets, color banding the captured birds, and collecting morphometric data. Data collected as part of our separate nest monitoring efforts, including nest survivorship data as well as predator activity, lemming abundance, and snow cover will be contributed toward the ASDN effort.

The following table contains a summary of discovered nests for each target species and birds captured and banded on the ASDN adult survivorship plots at Ikpikpuk:

Target species	**Nests found**	**Birds trapped / banded**
Semipalmated Sandpiper	70	50
Dunlin	21	34
Red Phalarope[1]	14	19
Red-necked Phalarope[1]	2	13
TOTAL	107	116

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

Based on our capture success in 2010, we will likely limit our capture efforts to Semipalmated Sandpipers and Dunlin at Ikpikpuk in 2011.

We also established 10 terrestrial and five aquatic insect traps, surface water measuring sites, and a weather station on (or near) the ASDN plots as specified in the ASDN protocol.

As part of an ancillary study, we also placed geolocators on the 35 Dunlin we trapped (see project summary #25). We will attempt to retrap these Dunlin and remove geolocators in 2011. For all sampled species we also collected blood and feather samples to be used in on-going and potential future genetic, hormone, and stable isotope studies.

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Recap Dunlin fitted with geolocator at Ikpikpuk, originally banded in China

29. Surveillance for Avian Influenza H5N1 in breeding shorebirds in the Prudhoe Bay oil fields & at Ikpikpuk River in the National Petroleum Reserve-Alaska, North Slope, Alaska – *Liebezeit et al.*

Investigators: Joe Liebezeit and Steve Zack, Wildlife Conservation Society; Richard B. Lanctot, U.S. Fish and Wildlife Service

In continuing efforts to monitor for the potential spread of H5N1 avian influenza (HPAI) from Asia to North America via their flyways in Alaska, the Wildlife Conservation Society, with support from the U.S. Fish and Wildlife Service, led these efforts at a site in the Prudhoe Bay oilfield and at a site near the Ikpikpuk River in the National Petroleum Reserve – Alaska (NPR-

A). Shorebirds deemed most likely to carry the virus to North America were targeted although other species were also sampled (see table below).

Sampling took place between 7 June and 12 July 2010. Most shorebirds were captured by finding active nests (primarily using the rope drag method) and then trapping at least one of the adult birds on the active nest during mid-late incubation using bow-nets. For Buff-breasted Sandpipers, we trapped displaying males and attendant females using mist nets at known lek locations. Some phalaropes were also captured with mist nets while foraging. For each bird we recorded culmen and tarsus length, head length, wing cord, and stage of molt for flight and tail feathers. For all sampled species we also collected blood and feather samples to be used in on-going and potential future genetic, hormone, and stable isotope studies. Personnel followed the protocols of the National Wildlife Health Center (NWHC) to protect themselves from Asian H5N1 and to collect, store, and ship samples. Cloacal and Oral-pharyngeal swabs from target species were sent to the NWHC for screening for Asian H5N1.

The following table includes the samples for each species procured at each site:

Species	**Prudhoe Bay**	**Ikpikpuk River**
Dunlin	6	35
Pectoral Sandpiper	20	30
Semipalmated Sandpiper	35	25
Red Phalarope	5	12
Red-necked Phalarope	5	12
Long-billed Dowitcher	1	8
Bar-tailed Godwit	0	6
Buff-breasted Sandpiper	5	0
Ruddy Turnstone	3	0
TOTAL	80	128

To date, no positive cases of H5N1 avian influenza virus has been detected and feather / blood samples have been distributed to collaborators for additional studies.

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30. Conservation genetic analysis of Buff-Breasted Sandpipers using contemporary and historic samples from throughout its range – Lounsberry et al.

Investigators: Zachary Lounsberry, Samantha Wisely, and Brett Sandercock, Kansas State University; and Richard Lanctot, U.S. Fish and Wildlife Service

Long-term monitoring programs indicate that populations of migratory shorebirds are declining in many regions. The Buff-breasted Sandpiper (*Tryngites subruficollis*; hereafter referred to as BBSA) is designated as a Highly Imperiled Global Species, the highest category of conservation concern. BBSA breed in the high arctic, migrate through the Great Plains, and travel to nonbreeding sites on the southeast coast of South America. The current population size estimate is from visual counts of BBSA in Nebraska's Rainwater Basin but additional information on turnover rates and surveys in other locations are needed to confirm these results. As part of a large-scale conservation genetic analysis of BBSA, we are analyzing contemporary and historical samples to address three objectives: 1) to assess connectivity among breeding, stopover and non-breeding sites, 2) to evaluate the demographic independence of breeding and non-breeding sites, and 3) to determine the population trend of BBSA over the last 150 years.

We obtained 190 blood samples from breeding BBSA sampled at Prudhoe Bay and Barrow, Alaska, between 2006 and 2009. In addition, we obtained 63 samples from stopover sites in Kansas, Nebraska and Texas. Blood samples were received in 1.5-mL microcentrifuge tubes along with all the banding data associated with each individual. DNA was extracted from 500 uL of blood for each sample using DNeasy Blood and Tissue extraction kits.

We are currently designing microsatellite primers from these DNA samples to address questions of connectivity. Currently, no microsatellite primers have been published for BBSA. We have developed an enriched microsatellite library, from which we are currently screening for polymorphic loci. We have sequenced 96 potential loci and found 29 sequences with useable microsatellite repeats. Of these, four loci are polymorphic, six are monomorphic, and 19 are still being screened. Mitochondrial DNA primers are being designed based on sequences obtained from GenBank for other Charadriiformes. We have successfully sequenced a 798 base pair (bp) region of the mitochondrial genome representing 498 bp of the non-coding control region and 300 bp of the cytochrome b subunit. For these sequences, we found two distinct haplotypes across eight individuals.

We will design mtDNA primers specifically for museum samples that typically yield DNA of lower quantity and quality. We are currently working with 16 museums to procure >500 BBSA toe pads and flank contour feathers for DNA extraction. Using samples representing every decade between 1860 and the present will allow us to quantify changes in genetic diversity to see if the effective population size reflects apparent declines the current population.

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31. KACHEMAK BAY SHOREBIRD MONITORING PROJECT: 2010 SPRING GROUND AND AERIAL SURVEY REPORT - Matz et al.

Investigators: George Matz, Kachemak Bay Birders; 20 Kachemak Bay Birders volunteers

In 2009 the Kachemak Bay Birders (based in Homer, Alaska) started a Kachemak Bay Shorebird Monitoring Project in order to obtain better information regarding the status of the Homer Spit spring shorebird migration. Following a modified International Shorebird Survey protocol, volunteers simultaneously monitored six sites every five days from April 16 to May 26. We observed 24 species of shorebirds and approximately 7,406 individual birds. It was noted that this count was considerably less than the number of shorebirds counted by George West during surveys conducted by him in 1986 and 1989-1994.

Kachemak Bay Birders continued this project in 2010, essentially following the same protocol as in 2009. In nine sessions, starting April 15, we observed 23 species of shorebirds and approximately 9,845 individual birds. What was notable this year was a slow start to the migration, perhaps because of a cold spring. However, a surge of Western Sandpipers and

Dunlin between May 10th and 15th resulted in more birds being observed in 2010 relative to 2009. Nevertheless, the total number of birds observed for 2009 and 2010 were still less than survey counts done in the late 80s and early 90s.

An element added to this year's project was an aerial survey during the peak of the migration in which the 320 mile long Kachemak Bay shoreline was flown five times, starting May 1st, once every three days. Because flying at 90 mph or more doesn't allow much time to look at details, the three volunteer observers identified shorebirds by size (small, medium, or large) rather than species. While we couldn't identify species of shorebird, we could clearly distinguish between flocks of shorebirds, gulls and ducks. Because of the late migration, our first four aerial surveys resulted in few observations. But the surge of shorebirds that finally arrived for the last aerial survey indicates that migratory shorebird concentrations are dispersed throughout Kachemak Bay where there are suitable beaches. While the Homer Spit is certainly a key area, it is not the only place where shorebirds concentrate. However, with the exception of Seldovia Bay where we saw nearly two thousand shorebirds, the flocks were not very large.

The data from our ground and aerial surveys was not robust enough to confidently estimate the number of shorebirds that visit Kachemak Bay or Homer Spit during spring shorebird migration; however, our efforts lend evidence for the following conclusions. For one, Homer Spit appears to be representative of Kachemak Bay both in terms of timing and numbers. Also, while the entire Kachemak Bay shorebird population is obviously some multiple of the Homer Spit count, the aerial surveys did not indicate significantly larger concentrations in other parts of the Bay. Based on our limited information, it appears that about 10,000 shorebirds visited Homer Spit and adjacent waters this spring and perhaps about that many visited other parts of Kachemak Bay. Future efforts will help establish the accuracy of these estimates.

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Conducting shorebird surveys at Kachemak Bay

George Matz

***32. 2010 USGS Alaska Science Center shorebird avian influenza monitoring efforts** – Ruthrauff et al.*

Investigators: Dan Ruthrauff , Bob Gill, Lee Tibbitts, and John Pearce, U.S. Geological Survey

Since 2006, the Alaska Science Center Shorebird Project has annually sampled hundreds of individuals of several shorebird species for the presence of the Asian H5N1 subtype of highly pathogenic avian influenza. In 2010, we again focused our sampling in western Alaska during the fall migration period, and augmented our sampling efforts by collecting blood samples for seroprevalence analysis on a subset of target species. Employing this technique, we targeted Ruddy Turnstones staging during fall migration on St. George Island. By virtue of their extremely high prevalence on the east coast of North America, Ruddy Turnstones are a high priority sample species in Alaska, but their low breeding densities and lack of large migratory concentrations have made them an extremely elusive sample species. In addition to these sampling efforts specifically focused on avian influenza monitoring, we opportunistically sampled Bar-tailed Godwits captured as part of a satellite telemetry study conducted along the Colville River on Alaska's North Slope (see separate project description herein).

Study Locations and Sampling Effort:

Colville River, North Slope. Bar-tailed Godwits are considered a species of high sampling priority in Alaska due to their dependence on wetlands situated near recent outbreaks of H5N1 along Asia's Pacific coast. As part of the Pacific Shorebird Migration Project (see project summary herein), we captured and surgically implanted PTT transmitters in Bar-tailed Godwits breeding along the Colville River near Nuiqsut in early July. We opportunistically collected 13 paired oral-cloacal swabs during the course of this study.

St. George Island, Bering Sea. Historically, many thousand Ruddy Turnstones staged on the Pribilof Islands during fall migration, drawn to the abundance of maggots breeding on the fur seal carcass piles left after annual pelt harvests. In more recent years, however, a greatly reduced fur seal harvest has resulted in a concomitant decrease in the number of Ruddy Turnstones staging on the Pribilof Islands. USDA Animal Control Officers on the islands recently relayed their observations of many hundred Ruddy Turnstones during the fall migration period, and this pilot effort targeted these birds. Our crew of four was present on St. George from 29 July–18 August, and utilized mist nets to capture 61 Ruddy Turnstones. From this sample, we collected blood for seroprevalence analysis from 53 individuals (28 adults, 24 juveniles, 1 undetermined age) as well as paired oral-cloacal swabs for RT-PCR analysis and feather samples for genetic and stable isotope analysis. In addition to Ruddy Turnstones, we opportunistically sampled 48 Rock Sandpipers (21 seroprevalence samples and 48 paired oral-cloacal swabs) and two Wandering Tattlers (both with seroprevalence and paired oral-cloacal swabs).

Punoarat Point, Angyoyaravak Bay, Yukon Delta National Wildlife Refuge. Our crew of as many as six biologists was present at this site from 20 August to 12 September. In past years at this site we routinely captured and collected avian influenza samples from many hundred individuals of over a dozen shorebird species. This year, however, we were only able to capture 399 individuals of six species. This decline in overall captures is partly due to the fact that we focused our efforts on smaller catches in order to collect seroprevalence samples from as many individuals of target species as possible. Drawing 0.5 ml of blood from the jugular vein of a shorebird requires time and patience, and so our decreased captures partially reflect our efforts to facilitate these collections. In addition to these refocused sample efforts, we also had many more weather days than in past years. During one one-week period, we were completely prevented from trapping due to foul weather and were finally forced to evacuate camp as a storm threatened to flood our camp. The persistent string of strong low pressure systems eventually led to our decision to shut down camp one week earlier than anticipated to avoid another flood event. Thus, our sampling window was shorter than in past years as well. All these considerations, however, cannot account for the simple fact that species diversity was conspicuously lower than in previous years. We simply did not observe, much less capture, many of the species typically found at this site at this time of year. Birds sporadically captured (but commonly seen) in previous years but not in 2010 include Pacific Golden-Plover, Black Turnstone, Bar-tailed Godwit, Long-billed Dowitcher, and Red and Red-necked Phalarope. Numerous Gray-tailed Tattlers and one Lesser Sand-Plover made conspicuous appearances, however.

We used mist nets, rocket nets, and whoosh nets to capture birds and obtained 282 paired oral-cloacal avian influenza samples during our efforts. Nearly all of the samples (n = 273; 96%) were from two target species (Dunlin and Rock Sandpiper; 220 and 53 samples, respectively); the remaining were from Ruddy Turnstone (n = 6) and Sharp-tailed Sandpiper (n = 3). Of these samples, we collected paired seroprevalence samples from 155 Dunlin, 53 Rock Sandpipers, six Ruddy Turnstones, and three Sharp-tailed Sandpipers. In addition to these samples, we collected foot-based benthic invertebrate samples at 20 near-shore sites along a randomly situated 250 m grid to better describe the species composition and prey density at this important migratory staging site.

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*33. **Decadal changes in the demography of shorebirds near Nome, Alaska*** *– Sandercock and Lank*

Investigators: Brett Sandercock, Kansas State University and David B. Lank, Simon Fraser University

We have initiated a study to assess potential changes in demographic performance of shorebirds breeding on Safety Sound, east of Nome, AK, with respect to environmental change. We expect this study to continue through summer of 2013. The study will focus on Western and Semipalmated sandpipers, taking advantage of historical demographic data for these species at the site since the mid-late 1990s. These data were gathered as part of Brett Sandercock’s PhD study at Simon Fraser University, Julie Neville’s MSc thesis at the University of Alaska, with Doug Schamel, conducted for several years following Brett’s work, and less complete data collected since 2008 by crews from Simon Fraser University as part of a migratory connectivity study of Western Sandpipers. We also plan to compare the current reproductive performance of these two biparental species with that of red-necked phalaropes at the site. The current study is adopting standard methodology being developed by the Arctic Shorebird Demographics Network (ASDN) and contributing to this effort (See project summary #1).

In May-July 2010, the Nome field crew consisted of Simon Fraser University graduate students Birgit Schwarz, Nathan Hentze, Samantha Franks, and Toby St. Clair, plus Ian Jong as a field assistant. The crew marked adults individually with uniquely coded flags and ASDN assigned site markers, and collected blood and feather samples (two wing and 4-6 breast feathers) and data on nesting success. We found 44 Western Sandpiper, 30 Semipalmated Sandpiper, and 24 Red-necked Phalarope nests on an approximately $4km^2$ plot. We recorded vegetation types of nest sites, and floated eggs to estimate egg-laying and hatch dates. Late in the season, we also captured juvenile sandpipers using mist-nets. We caught 62 Western Sandpipers, 37 Semipalmated Sandpipers and 18 Red-necked Phalaropes, including 11 Western Sandpipers and one Semipalmated Sandpiper that had been caught and banded at the site in 2008 or 2009.

The crew installed an ASDN automated weather station and measured daily wind speed, the amount of rainfall, and temperature. We measured water levels in several of the small ponds on the site every week, and deployed several insect traps both on land and within and on the surface of several ponds and emptied them every thre days, as per ASDN protocol. Insect samples were sent to the US Fish and Wildlife Service in Anchorage. We also made daily counts of all bird and mammal species seen on the study plot throughout the season. Notable bird sightings included a Gyrfalcon seen once, Canada Goose (as distinct from Cackling Goose), a pair of Gadwall, and a Red-necked Stint seen once. An Arctic Warbler was noted on one occasion on the study plot, and a Ring-billed Gull (a potential first for the Seward Peninsula) was located on the edge of Safety Lagoon. A visible migration of shorebirds and waterfowl occurred on 1 June when several hundred Western Sandpipers moved through the area, though these birds appeared to have continued on to unknown breeding locations.

Fieldwork in 2010 was supported through the Alaska Fish and Game Non-Game program, with matching funds from Simon Fraser and Kansas State. Future year's work at the site will also be funded by NSF's Polar Program. We thank the Sitnasuak Native Corporation for their cooperation.

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34. Assessing the population status of Bristle-thighed Curlews (Numenius tahitiensis) breeding in the southern Nulato Hills, Alaska – *Sowl and Jung*

Investigators: Kristine M. Sowl, U.S. Fish and Wildlife Service and Jake F. Jung, Tennessee Tech University

Due to its small population size, restricted breeding range, and potential threats on the non-breeding grounds, the Bristle-thighed Curlew (*Numenius tahitiensis*) is considered a species of conservation concern, but the current status of the population is unknown. Approximately 60% of the global breeding population of the Bristle-thighed Curlew nests within the Southern Nulato

Hills on the Yukon Delta National Wildlife Refuge. In 2010, we initiated a 3-year study to assess the current population status of the Bristle-thighed Curlew breeding in this area using the methods of territory mapping, mark-resight techniques, and point count surveys. A field camp was established at Allen Creek approximately 40 kilometers north of St Mary's, Alaska. Allen Creek has the highest known nesting density of curlews throughout their breeding range. Within our 45 km^2 study site, we mapped 22 breeding territories, surveyed curlews and other shorebird species at 180 count points, and captured and banded 32 adults and 14 chicks. In addition to the standard metal leg bands, adults were marked with coded green leg flags to aid in recognition of individuals in subsequent years. Three previously marked individuals from past studies (Northwest Hawaiian Islands, 1988-1992; Allen Creek, 1992-1994; Pacific Shorebird Migration Project, 2007) were resighted and a fourth was recaptured. We plan to add a habitat component in 2011 which will examine berry distribution, abundance, and possibly nutritive value.

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Bristle-thighed curlew on a spruce

Kristine Sowl

35. A PHYSIOLOGICAL ASSESSMENT OF STAGING SITE QUALITY FOR SHOREBIRDS ON ALASKA'S NORTHERN COAST – Taylor et al.

Investigators: Audrey Taylor, Department of Biology and Wildlife, University of Alaska – Fairbanks; Richard Lanctot, U.S. Fish and Wildlife Service, Migratory Bird Management; Tony Williams, Department of Biological Sciences, Simon Fraser University; Alexander Kitaysky, Department of Biology and Wildlife, University of Alaska – Fairbanks; Abby Powell, U. S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit, University of Alaska – Fairbanks

Previous survey efforts on the coast of northern Alaska have established that postbreeding shorebirds move to coastal areas to stage prior to fall migration; that shorebird use of coastal habitats during pre-migratory staging is non-uniform; and that specific staging "concentration areas" appear to be persistent through time. While information on large-scale patterns of abundance and distribution can lead to a better understanding of what sites are important to postbreeding shorebirds, surveys by themselves do not provide information on the mechanisms underlying the observed distribution patterns. We are seeking to use physiological metrics on a population scale to determine whether there is a match between sites that appear to be important in terms of staging shorebird preference, and sites that are high quality in terms of indicators of nutritional condition and pre-migratory fuel deposition. High quality sites should occur where nutritional condition and fuel deposition rates are maximized within the constraints of species-specific molt and migration strategies, and birds should be expected to choose high over low quality sites assuming an ideal-free distribution during migration. If these relationships hold true, development of field-quantifiable physiological metrics for assessing habitat quality could enable mechanistic explanations of pre-migratory distribution and abundance patterns, particularly for species such as migratory birds that use sites too briefly to assess fitness or demographic reasons for observed distributional patterns.

In a manuscript currently in preparation, we used plasma triglyceride and corticosterone levels to reflect fueling rate and energetic condition, respectively, for individual shorebirds captured in 2005-2006 at six sites across the northern Alaska coast (Kasegaluk Lagoon, Peard Bay, Barrow, Colville Delta, Sagavanirktok Delta, and Okpilak Delta). Because the timing and extent of prebasic molt, as well as migration patterns (early versus delayed), may affect hormonal and metabolic profiles, we examined triglyceride and corticosterone levels in three species that differ in their molt and migration schedules: Dunlin, Semipalmated Sandpipers, and Western Sandpipers. We then compared our physiology-based assessment of staging site quality to density estimates from ground surveys conducted during the same time period at each camp. Our objectives for this manuscript are 1) evaluate species- and site-specific variation in plasma triglyceride and corticosterone levels and compare these to patterns of postbreeding shorebird density across six sites, 2) evaluate how physiological metrics for habitat quality may be influenced by molt strategy and intensity, and 3) given results from objectives 1) and 2), assess the advantages and disadvantages of each metric for use as an index of staging site quality. Data have not been entirely analyzed, thus we will report our conclusions in the 2011 ASG summary.

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36. A pilot study to assess the use of geolocators to track movements of Lesser Yellowlegs – Tibbitts et al.

Investigators: Lee Tibbitts U.S. Geological Survey; Rick Lanctot U.S. Fish and Wildlife Service; and Stephen Yezerinac, Mount Allison University

Many populations of boreal-nesting shorebirds are experiencing significant declines. Suggested reasons for these declines are varied (e.g., drying boreal wetlands, unregulated hunting during winter) and difficult to pinpoint, since links between specific breeding, migrating, and wintering populations have not been established. After several recent studies successfully used archival light loggers (geolocators) to track the migration of small- and medium- sized landbirds, we were inspired to apply this technology to boreal-nesting shorebirds. In theory, many important data gaps could begin to be filled using this method. We focused our pilot effort on Lesser Yellowlegs (*Tringa flavipes*) breeding in Anchorage, because field logistics are relatively simple in town and, based on previous studies, we knew that birds in this population returned at high rates and could be recaptured (a necessity for data retrieval).

In June 2010, we tagged 20 adult Lesser Yellowlegs with modified leg flags that carried miniature (0.8g) MK-12 geolocators made by the British Antarctic Survey. All birds appeared to tolerate the flags well, and walked and perched normally. Our first opportunity to recapture the tagged birds will be next May when individuals on incubation break forage in predictable patterns in small coastal ponds. Our next (and probably best) opportunity will be just after hatch in June when birds are actively defending their young broods in upland bogs. Currently, we are compiling data from several test geolocators deployed in semi-controlled situations in Anchorage and throughout North and South America. These test data should help us calibrate the raw data retrieved from the birds' geolocators next year.

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37. The value of Chickaloon Flats, Kenai National Wildlife Refuge, Alaska, to shorebird migration and staging, in 2010 – Ulman et al.

Investigators: Sadie E.G. Ulman and Dr. Chris Williams, University of Delaware; and Dr. John Morton, Kenai National Wildlife Refuge

Chickaloon Flats is a 70 km^2 mudflat on the northern portion of Kenai National Wildlife Refuge, Alaska. It is qualitatively known as an important area for migration, and this project will fill the need of gathering more baseline information about habitat distribution and overall value to migrating, staging, and breeding birds. Chickaloon is open to public use via three airstrips, and results of this project will assist wildlife managers of Kenai NWR in focusing management strategies.

Chickaloon is located on Turnagain Arm, and is highly influenced by tides. There are seasonal 'flood tides', which inundate a large portion of the area and help to recharge the ephemeral ponds used as foraging habitat by shorebirds and waterfowl. These tides are infrequent from spring to fall however, and only occur for 3-5 days during April, July and

August. Without tides and rainfall, the ephemeral ponds and subsequent foraging habitats are greatly reduced. Compared with the 2009 season, the 2010 season brought a lot of rain, which helped to sustain the ephemeral ponds. Preliminary results indicate that the vegetated areas which hold ephemeral ponds may be more rain-dependent than tidal-dependent.

To investigate the wintering location of shorebirds, birds were captured using drop-nets to obtain feathers for stable isotope analysis. Capture results from both 2009 and 2010 are: Pectoral Sandpiper (*n* = 24), Greater Yellowlegs (*n* = 69), Lesser Yellowlegs (*n* = 34), Short-billed Dowitcher (*n* = 44), Long-billed Dowitcher (*n* = 8) and Least Sandpiper (*n* = 16). Feather samples will be analyzed with a multi-isotopic approach utilizing carbon, nitrogen, and deuterium to create a more precise location. We are still awaiting results from the 2009 analysis.

Ground based and aerial surveys were conducted throughout the duration of the study to determine bird abundance and biodiversity throughout the spring, summer, and fall seasons. For 2009 and 2010, there were 94 birds species detected, including 24 shorebird species. Five of these shorebird species are confirmed breeders on Chickaloon: Red-necked Phalarope, Wilson Snipe, Lesser Yellowlegs, Short-billed Dowitcher, and Semipalmated Plover. Notable shorebird sightings for 2010: A pair of Wilson's phalarope on June 7 (first recorded sighting on the Kenai Peninsula). Two juvenile stilt sandpipers Aug 17-19 (accidental species on the Kenai Peninsula).

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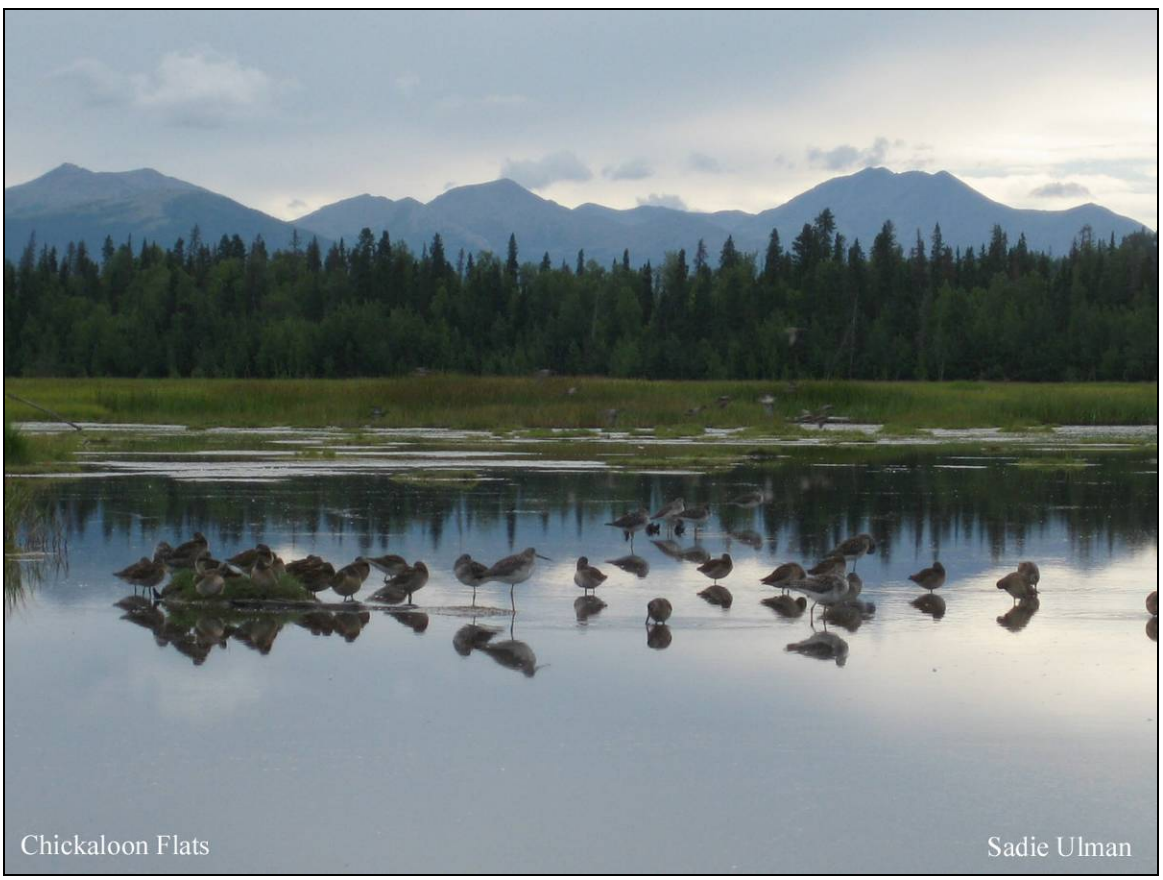

38. SOCIAL AND GENETIC MATING SYSTEM OF AMERICAN GOLDEN PLOVERS AT BARROW, ALASKA – Yezerinac et al.

Investigators: Stephen Yezerinac, Mount Allison University; Richard Lanctot, U.S. Fish & Wildlife Service; Sandra Talbot & George K. Sage, U.S. Geological Survey.

Shorebirds are exceptionally diverse in their social mating systems and genetic analyses of a few species have revealed further variation in genetic mating systems. We studied the mating system of American Golden-Plovers at Barrow, Alaska between 2004 and 2009. In this arctic population, birds bred in socially monogamous pairs, as has been seen in other populations. We used microsatellite-DNA markers for parentage analysis and found that most offspring originated from monogamous matings, however, 8% of 131 offspring and 16% of 37 nests were the result of non-monogamous matings. One nest was ambiguous; it was either a full clutch of extra-pair-sired offspring or an instance of social polygyny. Despite large variation in breeding synchrony and nesting density across years, mating patterns were unrelated to either variable. Further study of mate interactions, parental care, adult survival and philopatry are needed to understand why American Golden-Plovers have a mixed mating system and higher rates of extra-pair paternity than other socially monogamous shorebirds.

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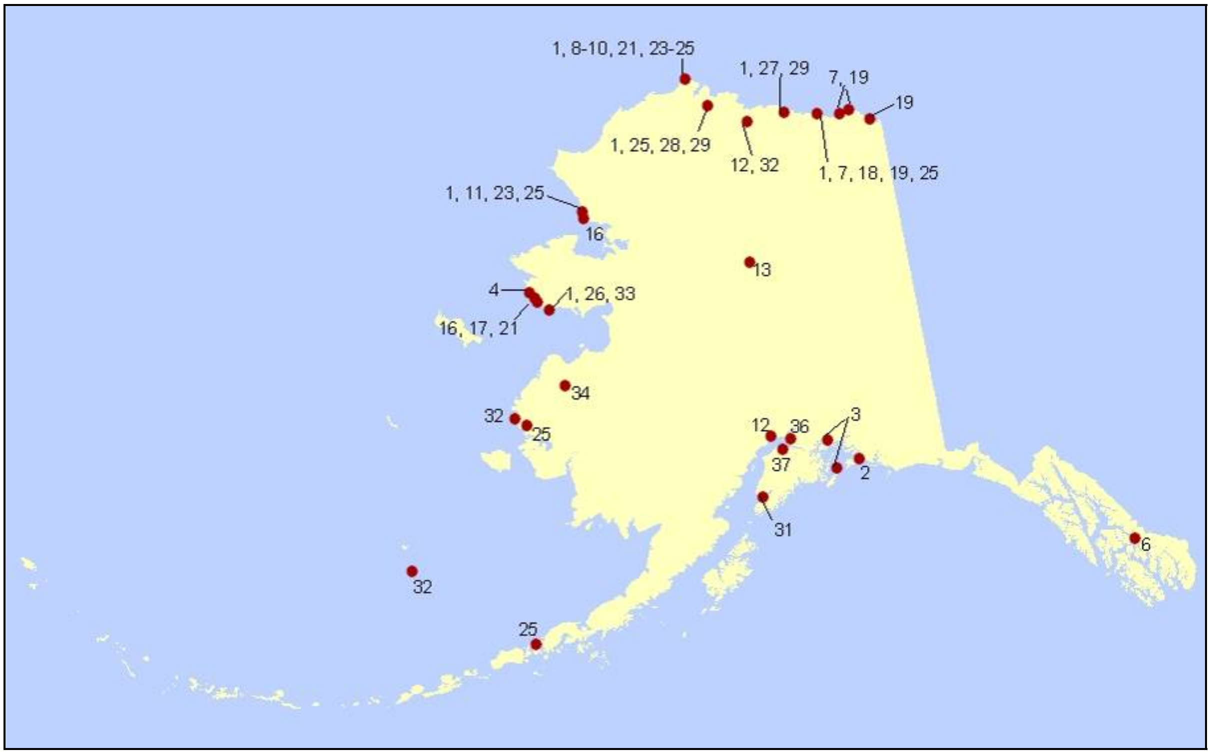
STUDY SITE MAP



This map displays the location of shorebird study sites summarized in this report. Each site is represented with a maroon dot and an accompanying number. The number corresponds to the numbered project title for each summary in the report. In some cases, the study site covered a relatively large region. In these cases either the mid-point of the study site or a subset of the more important sites within the larger study region are displayed. This map *does not* display sites where field work was conducted solely outside of Alaska (Project summaries 5, 15), studies that had no field data collection in 2010 (Project summaries 14, 22, 30, 35, 38), and studies that had no field component and/or relied on data from other sources (Project summary 20).