Summaries of ongoing or new studies of Alaska shorebirds during 2005

December 2005

No. 4

Compiled and lightly edited by Bob Gill for the Alaska Shorebird Group. Anyone wanting more information about these studies should contact the individual(s) noted at the end of each project summary.

Table of Contents

A note from the compiler: I begin my comments by thanking the artists who contributed to this year's summary. The cover art comes from Keith Woodley, the manager of the Shorebird Center of the Miranda Naturalists' Trust in New Zealand. Besides being a walking encyclopedia of information on "sports" such as cricket, he is an accomplished artist who captures our study subjects—shorebirds—like few others can. In addition to Keith's art, we again feature drawings by Maksim Dementyev as well as drawings from two other Russian artists, Eugeny Koblik and Alexsei Mosalov. Thank you all for your contributions.

The summaries herein appear in geographical sequence from north to south. This year we received reports of 33 projects, about the same as in 2003 and 2004. Listed among the 33 summaries are 68 individual investigators, 18 of which were involved in two or more projects. Your summary compiler was spread the thinnest among these, being involved in eight different projects; Brian McCaffery was a close second at seven projects. Women led a third of the studies—up from 23% last year—while accounting for 41% of total investigators this year.

Most principal investigators (48%, $n = 16$) were affiliated with government resource agencies, including U.S. Fish and Wildlife Service (8), U.S. Geological Survey (5), Alaska Department of Fish and Game (2), and U.S. Forest Service (1). Thirty-nine percent ($n = 13$) of principal investigators were from academic institutions, including Brigham Young University, Max Planck Research Center, Montana State University, Simon Fraser University, University of Alaska, University of Nevada Reno, Kansas State University, Lund University, Sweden, Royal Netherlands Institute for Sea Research, and Netherlands Institute for Ecology. Four (12%) principal investigators represented non-governmental organizations (NGOs), including Audubon Alaska, PRBO Conservation Science, Prince William Sound Science Center, and Wildlife Conservation Society.

In 2005, a strong body of work continued over the North Slope, particularly around the Barrow area, where existing and planned resource development continued to drive studies (eight summaries). Work on population and breeding ecology of Black Oystercatchers was expanded to include studies in British Columbia, and a new study was initiated on the Copper River Delta to assess shorebird use of barrier islands. But by far the most ambitious project undertaken in 2005 was the Beringian Shorebird Expedition to western Alaska, which saw over two dozen researchers from 11 countries participate in an array of studies focused around long-distance migrant shorebirds (see summary by McCaffery and Gill). No fewer than eight project summaries report on work conducted on either the Yukon-Kuskokwim Delta or Alaska Peninsula, with Bar-tailed Godwits, Sharp-tailed Sandpipers, and Dunlin their focus.

Finally, last year's report included a summary of activities from international meetings, namely the Shorebird Working Group of the East Asian-Australasian Flyway and the International Wader Study Group. I am foregoing a summary this year since the Shorebird Working Group meeting is not scheduled until mid-December 2005 and a summary of the International Wader Study Group was recently posted on the U.S. Shorebird Plan home page (http://www.fws.gov/shorebirdplan/).

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Project: Nest survivorship of tundra-nesting birds in relation to human development on Alaska's North Slope (Arctic Refuge Study Site)

Investigator: Steve Kendall, U.S. Fish and Wildlife Service

The Arctic Coastal Plain of Alaska is an important breeding area for several bird species, especially shorebirds and waterfowl. This area has also experienced increased human development, primarily associated with petroleum exploration and extraction. Availability of human food sources and man-made structures for use as nest, den, or surveillance sites associated with this development may alter abundance and distribution of nest predators. Increased numbers of predators may have negative consequences for productivity of breeding birds via increased predation on eggs and young. The dynamics of this predator-prey system are poorly understood, however. The Arctic National Wildlife Refuge joined several partners in 2002 in a multi-year, multi-site study of nest survival and predation of tundra nesting birds on the Arctic Coastal Plain in an effort to determine anthropogenic influences on this relationship (for additional information see Alaska shorebird project summaries from 2002–2004).

Cooperators on the project include the U.S Fish and Wildlife Service-Arctic National Wildlife Refuge (NWR) and the Fairbanks Fish and Wildlife Field Office; Wildlife Conservation Society; BP Exploration (Alaska), Inc.; ConocoPhillips Alaska; Exxon Mobil, Inc., Alaska; and Manomet Center for Conservation Sciences. In 2005, we conducted a fourth season of field studies, with study sites located in the National Petroleum Reserve-Alaska (NPR-A) near Teshepuk Lake, the Prudhoe Bay oilfield, and the Arctic NWR. On the Arctic NWR we continued investigations at the Canning River Delta site used in previous years. This site is located near the coast in the northwest corner of the Refuge.

We located and monitored 160 nests of 14 species in 2005. The most abundant shorebird species were Pectoral Sandpipers (n = 48 nests) and Semipalmated Sandpipers (n = 24 nests). Pectoral Sandpipers had the highest nest density observed for that species at our study site during this study (24.0 nests/km^2), but had daily survival rates below those observed in 2003 and 2004. For other species, daily survival rates were not different than those previously recorded. As observed in 2004, nest densities of Red Phalaropes in 2005 (5.5 nests/km^2) continued to be below the high density observed during the first year of this project (21.1 nests/km^2). Snow cover early in the breeding season was the highest observed thus far on this project, but nest initiation dates did not differ from previous years.

We now have data from >2,200 nests from all sites and years combined. These data are being analyzed by an independent statistician using a spatially adjusted proportional hazards survival model with covariates for distance to and density of infrastructure, predator abundance, nest site habitat, and climate conditions to compare nest survival relative to human development. We expect the analysis to be complete by December 2005. Our goal is to summarize our results and submit a paper for publication in a professional journal in 2006.

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Project: Nest survivorship of tundra-nesting birds in relation to human development on the North Slope of Alaska—Prudhoe Bay and Teshekpuk Lake field sites

Investigators: Joe Liebezeit and Steve Zack, Wildlife Conservation Society

In 2002, the Wildlife Conservation Society, along with cooperators including the U.S. Fish and Wildlife Service–Fairbanks, BP Exploration (Alaska), ConocoPhillips Alaska, Inc., Exxon Mobil, Inc., and the Manomet Center for Conservation Sciences initiated a study at multiple sites on the Alaskan North Slope to investigate the potential impact of predators on the nest survival of tundra-nesting birds in human-developed and undeveloped areas in this region. Study sites are located at seven locations from the Teshekpuk Lake Special Area in the west to the Jago River in the east–an area stretching over 300 kilometers.

The impetus for this research stems from the growing concern that the abundance of nest predators has increased in developed regions of the North Slope. These increases are believed to be due to the presence of human infrastructure that, in turn, has provided artificial nest and den sites. The presence of anthropogenic food subsidies is also thought to be a contributing factor to the reported increase in nest predators. A number of studies support these claims but this is the first large-scale effort to determine if avian nesting success may be adversely affected. The need to investigate this issue is three-fold: 1) the North Slope is an important breeding area for shorebirds and waterfowl, 2) nest predation is believed to be a major factor regulating populations of North Slope nesting birds, and 3) human development is increasing in this region.

In this summary, we report results from the 2005 field season at the study sites that the Wildlife Conservation Society has established in the Teshekpuk Lake Special Area and the Prudhoe Bay Oilfields as part of the larger collaborative study. At these two sites alone, we established 28 10-ha study plots that were systematically placed in a region covering approximately 64 km^2 and 300 km^2, respectively. Along with the other cooperators we are following a standardized protocol to collect data on nest survival, nest density, predator abundance, small mammal abundance, climate (snow melt), and habitat. At the Prudhoe Bay site we are also using remote camera systems in an attempt to record the identity of nest predators.

In 2005, we discovered and monitored 238 nests of 19 species from 10 June–16 July. At both sites, nests of Semipalmated Sandpiper, Pectoral Sandpiper, and Lapland Longspur accounted for the majority (71%) of those found. Among all species, 135 nests successfully hatched/fledged, 53 failed, and the fate of 50 nests went unknown. Nest predation was the most important cause of nest failure (85%); other sources of failure included abandonment for unknown reasons ($n = 4$), observer-related causes ($n = 3$), and trampling (likely due to caribou; $n = 1$). Among the three most common species, Mayfield estimates of nesting success ranged from 0.291 for Lapland Longspurs at Prudhoe Bay ($n = 19$) to 1.0 for Semipalmated Sandpipers at Teshekpuk ($n = 13$). Daily survival rate was significantly higher ($P < 0.05$) for both Lapland Longspurs and Pectoral Sandpipers at Teshekpuk vs. Prudhoe Bay. Overall nest densities were higher at Teshekpuk: 90.7 nests/km^2 at Teshekpuk compared to 75.8 at Prudhoe Bay.

Eleven species of potential nest predators were detected during timed predator abundance surveys. At both sites, the most numerous were Glaucous Gulls and Parasitic and Long-tailed jaegers. Mean number (± SE) of Glaucous Gulls detected per 30-min. survey was higher on study plots at Prudhoe Bay compared to Teshekpuk (0.82 ± 0.22 vs. 0.58 ± 0.23), while the opposite was true for jaegers (0.28 ± 0.07 vs. 0.46 ± 0.09). We did not record any predation events using two remote camera systems at Prudhoe Bay. All nests monitored by cameras (*n* = 4) were successful.

We used landform type (as defined by Walker et al. 1980) as a surrogate classification method for habitat type. Nests were found in 9 of 15 landform types. At both sites, most nests were located in Unit 7 (strangmoor and disjunct polygon rims), Unit 1 (high-center polygons, center-trough relief >0.5m), and Unit 2 (high-center polygons, center-trough relief ≤0.5m) landform types. As in the three previous years, numbers of lemmings were low with no apparent boom in their population at either site. Snowmelt occurred slightly later at Teshekpuk (~50% snow cover on 7 June) compared to Prudhoe Bay (~40% snow cover on 5 June). At both sites, snow cover dropped to below 10% by 13 June.

We have completed four years of data collection and are currently conducting the final analysis. These results will help evaluate the relationship between nest survivorship, proximity to human infrastructure, and other factors related to nest predation using a Cox proportional hazards model/information theoretic approach.

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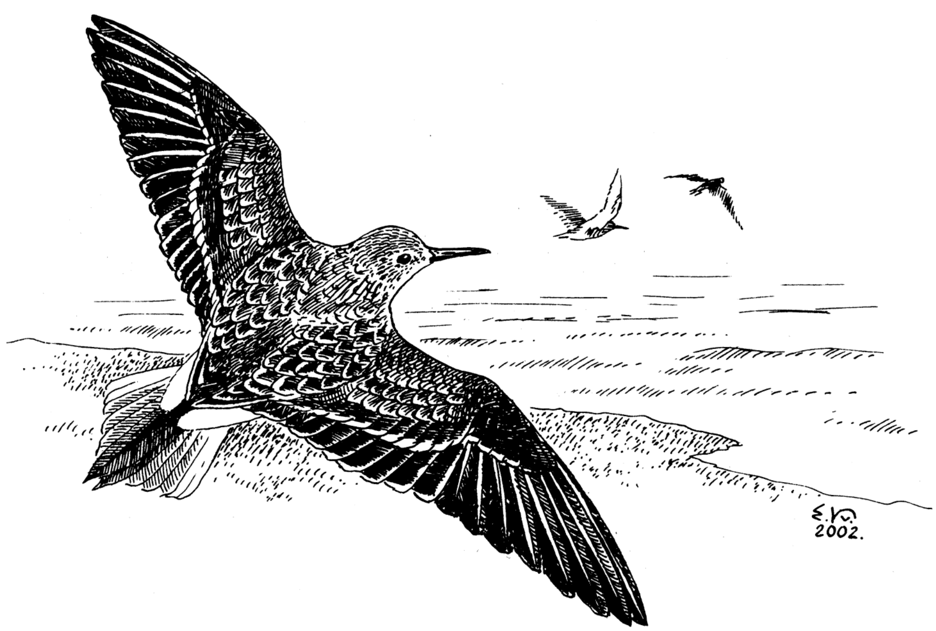

Project: Shorebird ecotoxicology

Investigators: Brett Sandercock and Khara Strum, Kansas State University

Compiler's note: This summary, while not directly involving work in Alaska, was included because of its focus on Buff-breasted Sandpipers.

Monitoring programs in North America indicate that many species of migratory shorebirds have experienced ongoing declines in population numbers. The goal of this project is to assess the potential role of exposure to organophosphorus and carbamate pesticides as one factor that might be contributing to declining shorebird numbers. Study sites will include migratory stopover sites in the Central Flyway of the United States and nonbreeding sites in South America. Within both regions, birds will be sampled in control areas unlikely to be treated with pesticides (WSHRN sites and federally protected wildlife areas), and agricultural areas under crop production (e.g., rice fields, pastures, sod fields). The study species will include shorebirds of conservation concern that are associated with upland (American Golden-Plover, Buff-breasted Sandpiper and Upland Sandpiper) and wetland habitats (Greater Yellowlegs, Pectoral Sandpiper and White-rumped Sandpiper). These Neotropical migrants were selected because they are: (1) ranked as species of conservation concern by national and regional conservation plans, (2) experiencing population declines for unknown reasons, or (3) using staging and nonbreeding sites in areas where exposure to contaminants is likely. Organophosphorus (OP) and carbamate (CB) pesticides are widely used pesticides that have replaced more persistent organochlorines such as DDT. Both OP and CB pesticides are a major threat to nontarget wildlife because they have a range of sub-lethal and lethal effects, primarily through cholinesterase (ChE) inhibition. Depressed levels of cholinesterase activity in body tissues indicate recent exposure (24–48 hours) to OP and CB pesticides. Biological samples will include blood samples, feathers, leg scrapings and footwashes taken from live birds, and tissue samples collected from bird carcasses. A small number of birds will be collected at sites where live capture is difficult; carcasses will be salvaged from airport strikes and if pesticide mortality incidents should occur. ChE activity and reactivation assays will be used to measure cholinesterase activity in blood plasma and brain tissues. Levels of OP and CB exposure to migratory shorebirds are currently unknown. Our research results will be used to evaluate habitat quality at important nonbreeding and migration sites, and to develop conservation efforts aimed at reducing the impacts of pesticides on Neotropical migrant shorebirds.

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Project: Distribution, movements, and physiology of post-breeding shorebirds on the North Slope

Investigators: Audrey Taylor and Abby Powell, AKCFWRU, University of Alaska Fairbanks; Richard Lanctot, U.S. Fish and Wildlife Service

Little information exists to quantify pre-migratory shorebird distribution across Alaska's North Slope or what factors may influence site selection, movement patterns, or residency times. This information is critical given increased levels of human activity and development near littoral areas across the Arctic Coast. This project was initiated to gain a better understanding of the abundance, distribution, phenology, movements, and physiology of post-breeding shorebirds during the staging period, and to aid in assessing how future industrial and human activity across the North Slope may affect shorebird populations. The specific objectives for this research are (1) to assess the abundance, distribution, and species composition of shorebirds staging along North Slope coastlines prior to the fall migration, (2) to quantify phenological aspects of staging, such as timing of arrival after breeding for adult and hatch-year birds, overall and species-specific peaks in shorebird numbers, residency times at staging sites, and movement patterns of birds across the North Slope, and (3) to examine differences in measures of physiological condition (fattening rates and stress hormone concentrations) among species and sites.

In 2005, we conducted the first aerial survey specifically designed to count shorebirds staging along the entire coastline of the North Slope. We surveyed 2,468 km of shoreline from the southern end of Kasegaluk Lagoon (69.28490°N, 163.27091°W) to the eastern border of the Arctic National Wildlife Refuge (69.66046°N, 141.06690°W) between 7 and 16 August 2005. Approximately 16,850 individual shorebirds were counted during the survey; the majority of these were small calidrid sandpipers and phalaropes. We also expanded site-specific studies examining staging phenology and physiology from one location (Barrow) to five locations across the North Slope (Barrow, Peard Bay, Colville River delta, Sagavanirktok River delta, and Okpilak River delta). Personnel at each location conducted regular surveys to examine shorebird abundance, distribution, species composition, and habitat use from late July to late August. Field crews also captured birds to collect blood samples for physiological analysis, and to band and radio-equip individuals to determine residency time at each site. In total, we banded 410 shorebirds across the North Slope (Dunlin, Western Sandpipers, Semipalmated Sandpipers, Red Phalaropes, and Red-necked Phalaropes), collected blood from 337 individuals, and radio-equipped 49 adults and 70 hatching-year birds of the same five species as listed above. Each camp maintained an automated telemetry station and conducted manual telemetry on a regular basis to examine the probability of birds dispersing between and among breeding and staging areas. Three remote automated telemetry stations located at the Ikpikpuk Delta, at the Canning River Delta, and in Kasegaluk Lagoon monitored birds moving to these sites.

Initial analysis of data collected at each field camp showed that numbers of staging shorebirds fluctuated substantially throughout the late July–late August study period, and that the date of peak staging abundance increased from west to east across the North Slope. Wind and weather had a major effect on the distribution of shorebirds at staging areas, particularly when winds switched from east to west and back. Semipalmated Sandpipers were the most common species at all field camps. Dunlin were present everywhere across the Slope and increased in number later in August compared to other species. Red phalaropes were dominant on the western side of the Slope, giving way to Red-necked Phalaropes at the eastern field camps. Residency time of banded and radio-equipped birds varied within and among field camps and across shorebird species. Dunlin appeared to remain the longest at all field camp locations. Most banded and radio-tagged birds moved widely around each field camp's study area as indicated by manual and automatic telemetry results. Data entry and analysis is ongoing and is expected to comprise the majority of the fall and winter.

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Project: Buff-breasted Sandpipers in Brazil: numbers, movement and fidelity

Investigators: Juliana Bosi de Almeida and Lewis W. Oring, University of Nevada Reno, and Richard B. Lanctot, U.S. Fish and Wildlife Service

Between October 2004 and March 2005, we conducted our third field season studying the wintering ecology of Buff-breasted Sandpipers in southern Brazil (see 2003 and 2004 summaries). The goals of this project were to document within and between season site-fidelity and density of Buff-breasted Sandpipers at three major wintering sites. Secondary objectives were to monitor molt and changes in body mass of captured Buff-breasted Sandpipers throughout the austral summer. Surveys were conducted at Lagoa do Peixe National Park (Nat'l Park), Ilha da Torotama (Torotama), and Taim Ecological Station (Ecol. Station)—all located in Rio Grande do Sul State, Brazil. Buff-breasted Sandpipers were captured, color-banded, and equipped with radio-transmitters at the Nat'l Park and Ecol. Station sites.

Double-observer methodology was used to survey Buff-breasted Sandpipers. This method yielded detection probabilities between 0.61 and 1.0 depending upon the observer and pasture surveyed. At the Nat'l. Park, densities of sandpipers were about 5 birds/ha for most of the 2004–2005 field season. The two exceptions included a peak of 10/ha during early November 2004 and 13/ha during late February 2005. The density of sandpipers at Torotama varied from about 2–10/ha, and at the Ecol. Station from 0–1/ha. Preliminary analyses of density patterns across all three years of the study resulted in the selection of a model that contained all interactions between site, day and year, as well as the interactions between quadratic and cubic terms of Julian date with year and site. Additional analyses that take into account soil moisture need to be conducted to better ascertain how sandpipers distribute themselves through time and space.

One-hundred and fifteen Buff-breasted Sandpipers were captured between 13 October 2004 and 16 March 2005 at the Nat'l. Park. These captures are in addition to the 30, 25, and 87 birds captured in the austral summers of 2001–2002, 2002–2003, and 2003–2004, respectively. Previously, 2 of 30 (6.6%) birds banded at the Ecol. Station in 2001–2002 were resighted in 2002–2003, 3 of 11 (27.3%) birds banded in 2002–2003 at the Nat'l. Park were resighted in 2003–2004, and 1 of 11 (9.1%) and 54 of 85 (63.5%) birds banded at the Nat'l. Park in 2002–2003 and 2003–2004, respectively, were resighted in 2004–2005. Finally, during the first 20 days of November 2005, we resighted 1 of 11 (9.1%), 24 of 85 (28.2%) and 30 of 115 (26.1%) birds banded at the Nat'l. Park in 2002–2003, 2003–2004 and 2004–2005, respectively. Only one bird, banded at the Nat'l Park, has been resighted in more than two subsequent years. All birds resighted were observed at the same site in which they were banded. Different sample size and search effort might explain the differences in resighting rates among years.

Data on local movement was collected at the Nat'l Park. Here, Buff-breasted Sandpipers moved between three pastures (north, middle, and south) within- and between-years. Fifty percent and 27% of the sandpipers marked at the middle pasture were resighted at the north pasture in 2003–2004 and 2004–2005, respectively, while 0% and 2% of the sandpipers marked at the south pasture were resighted at a different pasture within those years. Sandpipers were not banded at the north pasture. Between-year movement was also greater between the middle and north pastures. Thirty-one percent and 0% of sandpipers marked at the middle pasture in 2003–2004 were resighted in the following year at the north and south pastures, respectively. Only 3% and 1.5% of the sandpipers banded at the south pasture during that year, were resighted at the north and middle pastures, respectively, in the following year. Site-tenacity, on the other hand, was greater for sandpipers marked at the south pasture, with 64% of the sandpipers marked in 2003–2004 resighted at this pasture in the following year. At the middle pasture, 37.5% of the sandpipers marked in 2003–2003 were resighted at this same pasture the following year. Differences in movement probability and site-tenacity might be caused by different habitat characteristics, such as soil moisture.

As in previous years, body mass differed between males and females, with mass males being larger. However, average mass for both sexes was constant throughout the season, suggesting Buff-breasted Sandpipers must rely on staging areas for fuel to successfully migrate north. Female and male sandpipers had a similar molt pattern as documented in prior years, being nearly completed by mid-February. Timing of tail molt was more variable for both females and males.

Field work is being conducted now (November 2005–January 2006) to collect a third year of resighting data that will allow us to use mark-recapture analyses to determine between- and within-year site fidelity, as well as movement probabilities, more accurately. These data will also allow us to calculate the first survival rates for this species.

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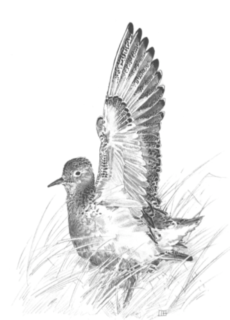

Project: Tundra-nesting shorebirds in relation to landscape transformation and climate change

Investigators: Nathan Coutsoubos and Falk Huettmann, University of Alaska Fairbanks; and Richard Lanctot, U.S. Fish and Wildlife Service

In June and July 2005, we initiated a dissertation research program on tundra-nesting shorebirds in relation to ongoing local-scale landscape transformation and climate change. Work was conducted 5–12 km south of Barrow and involved studies at a recently constructed landfill, at a water-level manipulated wetland, and at transects sites established in the 1970s. The North Slope Borough began constructing a new, modern landfill during the winter of 2004–2005. Construction will be completed this winter and waste transfer will start in 2006. This construction project provides an ideal opportunity to determine how local birds respond to a landfill prior to and during landfill use. Ten transects (8.5 km total) were established near the landfill (stratified by distance and direction). Distance sampling surveys were conducted along these transects weekly during the territory establishment, nest initiation, and incubation periods of the breeding cycle. Individual avian detections (single or clusters) numbered 1,333 from 27 species, including 793 shorebird detections of 9 species. The most common shorebirds (unadjusted counts) were Red Phalarope (n = 281 detections), Pectoral Sandpiper (n = 225), Dunlin (n = 170), and Semipalmated Sandpiper (n = 57). This and similar information collected in succeeding years will allow us to assess changes in shorebird distribution and abundance as the landfill grows. We also measured parental attendance at 12 shorebird nests located in and near the landfill, using within-nest temperature probes. We plan to expand our sampling to 40 nests in 2006. This information may provide mechanistic evidence of how landfill disturbance affects nesting shorebirds.

Additionally, we carried out surveys in a 60-ha wetland—whose water levels will be manipulated over the next several years—to mimic the predicted effects of global climate change on tundra hydrology (the Barrow Biocomplexity Project). This year, no wetland manipulation occurred. Surveys were conducted twice weekly on three separate 200-m-long transects during shorebird nesting. A total of 403 avian detections were recorded belonging to 23 species, including 216 shorebird detections of 7 species. The most common shorebirds (unadjusted counts) were Red Phalarope (n = 76 detections), Dunlin (n = 63), and Pectoral Sandpiper (n = 56). Shorebird surveys will continue as the local hydrology is manipulated, providing experimental evidence of the local effects of a warming climate and altered hydrology on shorebirds. Finally, we located and reestablished four 1,000-m-long tundra transects surveyed in the 1970s. In 2006, we plan to conduct bird surveys along these transects, using methods employed in the 1970s and modern distance sampling. A comparison of data collected in the 1970s and now will demonstrate whether the distribution and abundance of local shorebird populations have changed over time. This survey work will begin in 2006.

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Project*: *Behavioral ecology of Semipalmated Sandpipers

Investigators: Bart Kempenaers and Mihai Valcu, Max Planck Institute for Ornithology, and Richard Lanctot, U.S. Fish and Wildlife Service

In 2003, we began a study in Barrow to investigate the mating system of the Semipalmated Sandpiper. The main aims of our study are (1) to obtain information about the occurrence of extra-pair paternity to test hypotheses about the evolution of avian promiscuity, and (2) to obtain data on breeding site and mate fidelity within and between breeding seasons to test hypotheses about the adaptive value of divorce. A secondary aim is to collect baseline data on survival, arrival date, and breeding success in this species. We are using a combination of field data and molecular analyses using microsatellite markers.

In 2005, we continued our field study in a 2-km^2 study area where we captured 58 adults. The recapture rate was 55% (for males) and 23% (for females). All individuals were measured, had blood taken, and were individually marked with color bands. We found a total of 50 nests (51 in 2003; 93 in 2004) and collected DNA material from 156 chicks, belonging to 48 broods. Nest predation was extremely low this year, possibly due to a predator control program targeting Arctic foxes in the Barrow area.

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Project*: *Behavioral ecology of Pectoral Sandpipers

Investigators: Bart Kempenaers and Mihai Valcu, Max Planck Institute for Ornithology, and Richard Lanctot, U.S. Fish and Wildlife Service

In 2004, we began a study in Barrow to investigate the mating system of the Pectoral Sandpiper. The species has been described as polygynous, serially polygynous, or promiscuous, but detailed behavioral data on individually marked males and females in combination with parentage analyses are still lacking. The main aims of our study are to describe the mating strategies of males, and the mate sampling behavior and mate choice of females. A secondary aim is to collect baseline data on site fidelity, arrival date, nest initiation, and hatching success of this species.

In 2005, we continued our field study, now focusing on a 2-km^2 study area where we captured 67 adult females and 80 adult males. One male was a recapture from 2004. All individuals were measured, had blood taken, and individually marked with color bands. Eleven females and 39 males were also equipped with a radio-transmitter. Using radio tracking, we located each bird on a daily basis and collected behavioral data by following target birds for one hour at a time. We found 65 nests, of which one was a renest after predation. Because nest predation was expected to be high, we replaced eggs with dummy eggs and artificially incubated the eggs in 59 nests. The eggs of 52 broods hatched successfully and were transferred to females that incubated the dummy eggs. Observations showed that incubating females readily accepted the chicks. In total, we collected DNA material from 238 chicks belonging to 66 broods.

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Project: Reproductive ecology of shorebirds: studies at Barrow, Alaska, in 2005

Investigators: Richard Lanctot, U.S. Fish and Wildlife Service; Audrey Taylor and Nathan Coutsoubos, University of Alaska Fairbanks; and Bart Kempenaers, Max Planck Research Centre for Ornithology

In 2005, we conducted the third year of a long-term shorebird study at Barrow, Alaska (71.29°N, 156.64°W). The objectives of this study are to (1) collect baseline data on arrival date, nest initiation and effort, clutch and egg size, and hatching success of arctic-breeding shorebirds, (2) to establish a marked population of as many shorebird species as possible that would allow us to obtain estimates of adult survival, mate and site fidelity, and natal philopatry, and (3) to relate weather and the abundances predator and prey to shorebird productivity. Data on demographic parameters are vitally needed to understand why many shorebird populations are declining.

We located and monitored nests in six 36-ha plots in 2005. Four of the plots were the same as those sampled in 2004. A fifth plot, also sampled in 2004, was modified when the North Slope Borough constructed a road and landfill fence over portions of the plot during the winter of 2004/2005. This plot and the adjoining areas are the subject of intensive study to document possible disturbance from landfill activities on shorebirds (see summary by Coutsoubos). The sixth plot was new, having been moved to a less wet area from that sampled in 2004. We used the same search intensity and methodology as in 2004. The nest density of all shorebird species on our plots (controlling for number of plots) was 52.1/km^2 in 2003, 66.6 in 2004, and 63.0 in 2005 (overall average density across years was 60.6). Although we thought the unusually high density of nests in 2004 (especially when compared to 2003) was due to high predation and thus a high rate of renesting, we had a similar density levels in 2005 as 2004. We believe the high densities in 2005 may be due to a fox removal program that allowed many nests to survive to hatching (see below), and in effect, gave us more time to find the nests. Thus, we believe the density of nests from 2005 may be our best estimate of the number of pairs initiating nests calculated to date.

The species assemblage in Barrow has consistently included good numbers of Red Phalarope (3-year average density = 25.9 nest/km^2), Dunlin (13.3), Pectoral Sandpiper (11.5), and

Semipalmated Sandpiper (5.2). Only a few nests are discovered each year belonging to American Golden-plover (1.2), Long-billed Dowitcher (1.9) and Red-necked Phalarope (0.9). Three other species have only been documented nesting on our tundra plots in one year (Western Sandpiper, White-rumped Sandpiper, and Baird's Sandpiper). Pectoral Sandpiper densities are known to increase and decrease dramatically across years, and 2005 appeared to be an especially high year. A total of 136 nests were located on our plots, including 43 Pectoral Sandpiper, 38 Red Phalarope, 31 Dunlin, 15 Semipalmated Sandpiper, 5 Long-billed Dowitcher, 2 Red-necked Phalarope, and 1 American Golden-Plover. In addition we located our first Baird's Sandpiper on the tundra plots, near disturbed habitat in the new landfill. This species regularly breeds on the gravel areas near the Barrow Arctic Science Consortium housing.

The first shorebird clutch was initiated on 3 June and the last on the 4 July in 2005 (on or within one day for both dates in prior years). Median and peak initiation dates were the 13 and 10 June, respectively; the median was a few days earlier and the peak was nearly a week earlier than prior years. Median nest initiation dates for the more abundant species was the 10 June for Dunlin and Semipalmated Sandpiper, 14 June for Red Phalarope, and the 15 June for Pectoral Sandpiper. This pattern is similar to prior years for the more abundant species, whereas the rest of the species vary tremendously from year-to-year. Predators destroyed only 11.2% of the nests in 2005 compared to 42.6% in 2003 and 67.9% in 2004. A comparison of nesting success across the more abundant species indicated hatching success (# hatching at least one young/total number of nests) was highest in Pectoral Sandpiper (86.4%, *n* = 59), followed by Dunlin (76.1%, *n* = 56), Semipalmated Sandpiper (72.7%, *n* = 23), and Red Phalarope (70.2%, *n* = 62). A similar comparison across study plots indicated plots 1, 2, and 3 had extremely high hatching success (73.9, 66.6, and 88.8%, respectively) compared to that reported in 2003 (52.6, 46.2 and 38.8%) and 2004 (3.2, 4.2, and 11.1%). The two plots established in 2004 also had higher hatching success in 2005 (85.7 vs. 11.1, and 75.6 vs. 20.5%). These extremely high hatching success rates are likely due to the removal of Arctic foxes in the Barrow area by contractors paid through the Steller's Eider Research Team.

In 2005, we captured and color-marked 179 adults and 379 young. This represents a substantially greater number of marked adults and young relative to 2003 or 2004. Adults captured included 51 Dunlin, 44 Pectoral Sandpiper, 36 Semipalmated Sandpiper, 31 Red Phalarope, 8 Long-billed Dowitcher, 4 American Golden-Plover, 3 Red-necked Phalarope, and 2 Baird's Sandpiper. Chicks banded at nests on our plots included 136 Pectoral Sandpiper, 91 Dunlin, 78 Red Phalarope, 52 Semipalmated Sandpiper, 10 Red-necked Phalarope, 7 Long-billed Dowitcher, 3 Baird's Sandpiper ,and 2 American Golden-Plover. Unlike 2004, but similar to 2003, we documented very few cases of renesting in 2005. We captured 26 Dunlin, 2 Semipalmated Sandpiper, and 1 Red Phalarope that were initially marked in prior years. Other marked birds were resighted but the total number has not been quantified yet.

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Project: Ongoing life history studies of Ruddy Turnstones at Woolley Lagoon, Seward Peninsula, Alaska

Investigators: Phil and Andrea Bruner, Brigham Young University, Hawaii

Our 2005 field season (28 May–8 June) was devoted to searching for Ruddy Turnstones color banded in 2004 and banding additional turnstones in the Woolley Lagoon population 40 mi. NW of Nome. Most of the area was clear of snow upon our arrival but turnstones were just beginning to nest, whereas the turnstone hatch was already underway on 5 June in 2004.

Three of the 11 turnstones (2 adults and a chick) banded in 2004 were located in 2005. The two adults (a male and a female) were from pairs with adjoining territories. They paired and established a nest exactly half way between each of their 2004 nests! The female was the mate of the turnstone that wintered at Kona, on the Big Island of Hawaii, from September 2004 to March 2005. This male did not return to Woolley Lagoon in 2005. The 2004 mate of the male was missing two toes on each foot and was not observed this past breeding season. The last chick we banded in 2004 returned as a first year breeding female and nested in the same area where she was caught as a chick. Only one record of natal philopatry in Ruddy Turnstones is reported in the literature (Bergmam 1946).

Birds were extremely trap wary in 2005. We only color banded three nesting males and none of their mates would sit on the nest if the trap was present. This behavior was similar to what we have observed in Pacific Golden-Plovers early in the breeding season. In 2004 we had no problem trapping turnstone pairs, but this was at or very near hatch when they were more committed to the nest. In 2005 we experienced a number of very cold days, some with frost. There were also much higher levels of predator disturbance from foxes and Parasitic Jaegers in 2005, which might also have contributed to our difficulty in trapping. We observed turnstones chasing and striking Parasitic Jaegers that were attacking and killing Western Sandpipers. We observed 11 turnstone pairs in the study area in 2005, only 4 of which were nesting during the time we were present.

For the second year in a row one of our banded turnstones (a male) is wintering in Hawaii where first seen in August at Kualoa Park, Oahu. We have repeatedly seen it foraging in large (300+) flocks of turnstones on the park lawns during high tide.

We will continue our turnstone work in June 2006. In addition to color banding adults and chicks we are mapping the location of each nest and photographing the area around each nest cup for later use in testing whether or not they are selecting the site of the nest cup based on certain ecological parameters. We did this work with Pacific and American Golden-Plovers and Black-bellied Plovers and found they were looking for areas with an abundance of lichens that provided camouflage for the eggs.

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Project: Beringian Shorebird Expedition—2005

Investigators: Brian J. McCaffery, U.S. Fish and Wildlife Service, and Robert E. Gill, Jr., U.S. Geological Survey

In 2005, the Swedish Polar Research Secretariat sponsored an international expedition to Beringia. Although most scientists associated with the expedition worked from a large research vessel in the Bering and Chukchi seas, the expedition's shorebird biologists focused their research on migrant shorebirds using the mudflats and wetlands of western Alaska. Over two dozen researchers from 11 countries collaborated with the U.S. Geological Survey's Alaska Science Center and Yukon Delta National Wildlife Refuge on migration studies of Bar-tailed Godwits, Rock Sandpipers, Dunlins, and Sharp-tailed Sandpipers. Led by Dr. Åke Lindström (Lund University, Sweden), this international cohort included participants from Australia, Canada, Germany, Hungary, The Netherlands, New Zealand, Norway, Poland, Sweden, Switzerland, and the U.S.A.

Field work was conducted on both the Yukon-Kuskokwim Delta and the Alaska Peninsula. On the Delta, field crews worked at three field camps: the mouth of the Tutakoke River, Kanaryarmiut Field Station, and Tern Mountain. On the Alaska Peninsula, the field crew was based at Egegik Lagoon. Aerial surveys, for both telemetry and population assessments, were flown by staff of the Yukon Delta, Togiak, and Izembek National Wildlife Refuges, and Birchwood Air out of King Salmon. Delta surveys were flown along the shoreline from the mouth of the Kuskokwim River to the north mouth of the Yukon River, and on the Peninsula from Egegik Lagoon to Nelson Lagoon.

At the Tutakoke River, research included an investigation of staging movements in Sharp-tailed Sandpipers and Dunlin (via handheld, automated recording, and aerial telemetry), a systematic mapping of macro benthos on the mudflats of north-central Angyoyaravak Bay, an analysis of Sharp-tailed Sandpiper diet and mass gain, and an assessments of Bar-tailed Godwit foraging behavior and fat profiles. Work at Tern Mountain focused on Bar-tailed Godwits, and included determining the age composition of staging flocks, re-sighting flagged and color-banded birds, and documenting age-related variation in the locations and success rates of foraging godwits. At Kanaryarmiut Field Station, the primary focus was on migratory orientation in both shorebirds (Dunlin and Sharp-tailed Sandpiper) and passerines (Savannah and White-crowned sparrows). Experimentation on captive birds included observations of birds under natural and artificially manipulated conditions. A final aspect of work at the field station was an investigation of Sharp-tailed Sandpiper diet and mass gain at an inland site to compare with data from Tutakoke on the immediate coast.

At Egegik Lagoon, research included mapping the macro benthos of the southern half of the lagoon to compare with data from Tutakoke and Tern Mt., quantifying Bar-tailed Godwit foraging behavior, determining the number of shorebirds (Bar-tailed Godwits, Dunlin, and Rock Sandpipers) using the lagoon, and searching for shorebirds color-marked and/or outfitted with transmitters farther north on the Delta. As at Tern Mt., the Egegik field crew also determined the age composition of godwit flocks, and searched for birds color-flagged at other sites in the East Asian/Australasian Flyway.

An unusual synchrony among unexpected environmental phenomena conspired to make the ambitious scope of the Beringian expedition's research even more challenging than originally anticipated. Perhaps the biggest surprise was the relative scarcity and inaccessibility of Bar-tailed Godwits at our largest field camp at Tutakoke. Although the site typically supports thousands of staging godwits each fall, only a few hundred were present this fall. In addition, most of the birds that were present did not use the roosting site identified last year as the best local venue for capturing godwits. In August, both survey and re-supply flights were postponed repeatedly due to poor visibility caused by smoke from the largest fires recorded to date on the Yukon-Kuskokwim Delta. In September, the Aleutian Low forced storms northeast into the Bering Sea (rather than the more typical easterly route across or south of the Alaska Peninsula). The result was a steady parade of systems into our study areas that brought strong westerly winds. As with the smoke in August, these storms radically altered re-supply flight schedules, reduced the frequency of telemetry flights, confounded coordination of joint aerial surveys on the Delta and Peninsula, and virtually precluded nocturnal clear-sky experiments on migratory orientation. The storms also precipitated three different evacuations of the Tutakoke camp in anticipation of coastal storm surges. In each case, the field crew was transported safely to Kanaryarmiut to ride out the storm. During the final major storm of the field season (which prompted the third evacuation), September's lowest barometric pressure and highest winds coincided with the month's highest tide, resulting in the central Delta's largest storm tides in over half a century. The Tutakoke field camp was literally swept away, with shelters in various stages of disarray and/or destruction deposited nearly 10 km away.

Despite these obstacles and setbacks, the expedition produced a vast amount of data on shorebirds. Accomplishments of the expedition include transmitters deployed on, and telemetry data collected from, 75 individuals of 3 species (9 Bar-tailed Godwits, 36 Dunlins, and 30 Sharp-tailed Sandpipers), migratory orientation experiments on dozens of individuals of 4 species, invertebrate numbers and species composition from 810 benthic samples at 3 sites, 372 focal scans of foraging birds, 413 scans of abdominal profiles to assess rates of fattening, 380 blood samples for isotopic and/or genetic analysis, 142 cloacal swabs from 5 species for avian influenza, morphometric data from 1,150 birds of 14 species captured and banded, multiple aerial surveys of godwits over the vast majority of their staging range on the Yukon-Kuskokwim Delta and Alaska Peninsula, over 200 resightings of godwits captured and marked elsewhere in the East Asian/Australasian Flyway, and over 75,000 observations of godwits in which the age of the individual (adult or juvenile) was determined. Data analysis is underway, and we predict a plethora of peer-reviewed and popular publications shedding ever more light on the ecology of migrant shorebirds in western Alaska.

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Project: Foraging and fattening in long-distance migrants: the benthos of major autumn staging sites in Alaska and its use by Bar-tailed Godwits

Investigators: Anne Dekinga, Theunis Piersma, and Petra de Goeij, Royal Netherlands Institute for Sea Research (NIOZ); Grant Pearson, Western Australian Dept. of Conservation and Land Management; Robert Gill, U.S. Geological Survey; Martin Green, Lund University, Sweden. With help from: Jesse Conklin, USFWS and Marnie Shepard, USGS

A major component of the Beringian Shorebird expedition (see summary by McCaffery and Gill) was to assess the migration energetics of Bar-tailed Godwits. The approach taken involved an assessment (identification, distribution, and biomass) of macro benthos inhabiting the upper 25 cm (~probing depth of a godwit) of intertidal substrates at three major autumn staging sites: 1) Angyoyaravak Bay (130 km^2 of intertidal flats) on the central Yukon-Kuskokwim Delta, 2) a 10-km-long segment of coast with broad intertidal flats near Tern Mountain on the southern Yukon-Kuskokwim Delta, and 3) Egegik Bay (55 km^2 of intertidal flats) near the base of the Alaska Peninsula. At all sites sampling stations were derived from a 200-m grid that was superimposed over available aerial imagery. Transects were established along E-W oriented grid lines and sample cores (two per grid cell) were taken at each grid centrum (located by GPS). Most samples at Angyoyaravak and Egegik bays were collected from a boat using a 3-m-long coring devise; samples at Tern Mt. were collected along a walking transect. Samples from all sites were sieved (1 mm mesh) on station. At Angyoyaravak Bay, 550 total samples (498 by boat and 52 on foot) were collected from 25 August–6 September; at Egegik Bay, 164 samples (100 by boat and 64 on foot) from 11–20 September; while at Tern Mt., 96 samples were collected from 9–13 September. The samples are currently being processed at NIOZ, but from initial assessments the three staging sites differ markedly in their benthic makeup. The most abundant bivalve at all sites was *Macoma balthica*, occurring in 90% of the samples from Angyoyaravak Bay, 89% from Egegik Bay, and 84% from Tern Mt. The bivalve *Mya arenaria* was also very abundant (found in 58% and 49% of the Angyoyaravak and Egegik samples, respectively; analysis of Tern Mt. samples is incomplete at this writing). What makes Egegik special is the abundance of the polychaete lugworm *Arenicola* sp. that occurred in 60% of the samples. In contrast, only three percent and one percent, respectively, of samples from Angyoyaravak Bay and Tern Mt. contained *Arenicola* sp.

At Angyoyaravak and Egegik bays, a clear zonation in the benthic fauna was observed that followed gradients in sediment coarseness and physical stress. In Egegik Bay this zonation was very distinct with high densities of *Arenicola* in the middle of the bay (muddy sand) and high numbers of *Macoma* in the more sheltered south part of the bay bordering the saltmarsh (fine mud). The flats nearer the mouth of the bay consisted of very coarse sand/pebbles where both density and numbers of benthic organisms were low. The exception was a large bed of mussels (*Mytilus* sp.) near the tip of the South Spit, which covered a dense "substrate" of *Mya*. The combination resulted in by far the highest biomass per square meter found in the bay. The comparative richness of these western Alaska sites is obvious when compared to the macro benthos in the Dutch Wadden Sea, a world-renowned intertidal area, where sampling in 2005 revealed much lower frequencies of *Macoma* (31%), *Mya* (21%), and *Arenicola* (25%).

The companion aspect of the study was to derive an energy budget (energy intake and basic energetic costs) for godwits staging at the three sites. To do this we conducted three-minute-long focal scans of foraging birds, noting the age and sex of the bird, the type and size of prey being ingested, the profile of the abdomen—a relative measure of the amount of fat on the bird—and collected feces dropped during foraging bouts. At Angyoyaravak Bay we conducted 103 scans (total time = 4.3 h) from 31 August–7 September, most (102/103 total scans) of hatching-year birds. In contrast, at Tern Mt., 128 scans (6.2 hours) were conducted from 9–13 September, where all of the birds that were aged (111/128) were adults. At Egegik Bay, 141 scans (total time 7.7 h) were conducted from 9–19 September, including 120 scans of hatching-year birds and 21 of adults.

In Angyoyaravak Bay, the main prey (numbers of ingested prey) consumed by Bar-tailed Godwits were small bivalves (32%) and polychaetes (21%). The remainder (37%) was comprised of unidentified prey. An Egegik Bay, 60% of the diet consisted of *Arenicola* (compared to 2% in Angyoyaravak Bay), with 5% small bivalves and 27% unidentified prey. Both sites were used mainly by hatching-year birds, whereas at Tern Mt. where most birds were adults and their diet contained hardly any polychaetes, but consisted primarily of small bivalves, presumably *Macoma*.

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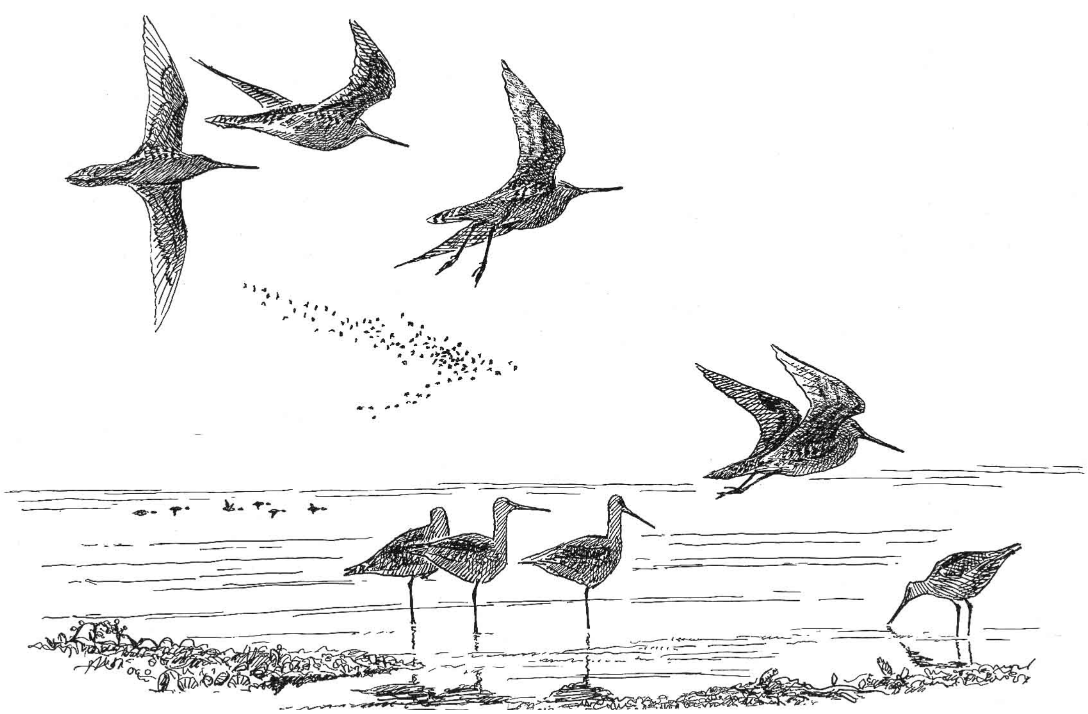

Project: Breeding biology of Dunlin nesting on the Y-K Delta, Alaska

Investigators: Sarah Jamieson, Simon Fraser University, and Brian McCaffery, U.S. Fish and Wildlife Service

This summer we continued studying the breeding ecology of Dunlin on the Yukon Delta National Wildlife Refuge. We were at Kanaryarmiut Field Station from April 27–July 27. This was the second field season of a Ph.D. project examining parental investment in Dunlin.

Every 1–2 days we surveyed 58 ha of wet meadow for breeding Dunlin. Nests were found by mapping territories and observing behaviors. Once a nest was found we identified the parents and, if they were unbanded, we trapped and individually color banded ($n = 49$) them. Of the 27 territorial males banded last year 21 returned. Nests were visited, at a minimum, every three days to determine whether they were still active. Once hatched, broods were banded (only if found in the nestcup; $n = 49$) and located daily to determine parental roles and desertion dates. The first Dunlin was observed on April 30th. The first completed nest was found on May 18th and the last was completed on July 1st. Compared to the previous summer, the arrival date is the same day and nesting finished only one day later, however nesting began six days later in 2005 than it did in 2004.

We found 57 nests of Dunlin, representing 33 first nesting attempts, 21 were first renests, and 3 second renest attempts. Males tended to renest with the female of their first nest (60%), however third nests were always with new females. The overall Mayfield estimate for nesting success was 46.7% and for fledgling success was 41.1% (number of nests that hatched that fledged at least one chick). We suspect that mink were the primary predator of nests while the primary predator of fledglings was Sandhill Cranes. Interestingly, we had eight birds produce a second clutch after hatching a first—we had three birds that, after failing to fledge their first broods, initiated another clutch and five other birds that laid another clutch after deserting their first brood to the care of the other parent.

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Project: Migratory orientation of Dunlin and Sharp-tailed Sandpipers on the Yukon-Kuskokwim Delta

Investigator: Johanna Grönroos, Lund University, Sweden, with help from Rachel Muheim, Brian McCaffery, Robert Gill, Åke Lindström & Sarah Jamison

Orientation research has convincingly demonstrated that migratory birds are capable of deriving directional information from a wide array of environmental references. These cues include both celestial (stars, sun and the related pattern of skylight polarization) and geomagnetic cues. As part of the Swedish Polar Research Secretariat (SPRS) Beringia expedition 2005, I investigated the migratory orientation of Dunlins and Sharp-tailed sandpipers at Kanaryarmiut Field Station on the Yukon Delta National Wildlife Refuge from 4 August to 23 September 2005.

Preliminary results demonstrate that Dunlin caught early (9–11 August) in the autumn staging period showed a preferred mean migratory direction towards the SE while Dunlin caught later (4–9 September) showed an almost significant mean direction towards the SW ($P = 0.07$) under clear sky conditions. The different orientation could be because early and late caught birds belong to different subspecies that both stage on the delta during autumn migration, but migrate to different nonbreeding areas. If early caught birds were mostly the *pacifica* subspecies that move to nonbreeding areas along the Pacific coast then the SE orientation would be expected. Alternatively, if *pacifica* Dunlin move from the Yukon Delta to terminal staging areas on the Alaska Peninsula before migrating to the Pacific coast (see summary by Warnock et al.), then birds would also be expected to orient to the SE. Dunlin caught later in the season could be a mixture of both *pacifica* and *arcticola*, the latter, which nests in northern Alaska, spends the nonbreeding season along the coast of central East Asia. This would help explain the SW orientation direction recorded in birds captured during the latter period. What I don't know is the proportion of the different subspecies among the late catches of Dunlin.

Dunlins tested under complete overcast conditions showed no significant mean direction. Several field studies have shown that waders almost exclusively depart when the sun is visible indicating their need for celestial orientation cues. This could explain the lack of significant mean direction under overcast. The data from the experiments where I shifted magnetic north 90º clockwise from its normal position (by using magnetic coils) are now being analysed.

Juvenile Sharp-tailed Sandpipers migrate from nesting grounds in Siberia to staging grounds in western Alaska before continuing to nonbreeding quarters in Australia. In my orientation experiments the Sharp-tailed Sandpipers showed a significant mean direction towards south-southeast under clear sky conditions. I was rather expecting a SSW or SW mean direction towards Australia, but maybe this SE direction takes them to staging areas further south along the Alaska Peninsula. The Sharp-tailed Sandpipers showed no significant mean direction under overcast conditions.

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Project: Movements of radiomarked Dunlin* Calidris alpina pacifica *on the Yukon-Kuskokwim Delta

Investigators: Nils Warnock, PRBO Conservation Science; Robert Gill, U.S. Geological Survey; Brian McCaffery, U.S. Fish and Wildlife Service. Greatly aided by: Jesse Conklin, Sarah Jamison, Åke Lindström, Marcel Klaassen, David Melville, Adrian Riegen, Dan Ruthrauff, Lee Tibbitts, Dick Veitch, and Liv Wennerberg

Under the embracing arms of the Beringia 2005 expedition, from mid-August through September 2005, we embarked on a radio-telemetry study of movements of fall staging Dunlin on the Yukon-Kuskokwim Delta (Delta). Two subspecies of Dunlin use the Delta: *Calidris alpina pacifica* which breeds in western Alaska (including on the Delta), stages there in the fall, and migrates to the Pacific Coast to winter from the Pacific Northwest to Mexico, and *C. a. arcticola* which breeds in northern Alaska and comes south (the proportion of the population as yet undetermined) to stage on the Delta before flying to nonbreeding areas in Asia (see summaries by Grönoos and Taylor and Lanctot).

We used VHF radio transmitters to track individual Dunlin to learn how birds use regions of the Delta and if birds from there move to the Alaska Peninsula before migrating from Alaska. Additionally, by banding and measuring hundreds of birds on the Delta we added data on how quickly birds fattened for migration, how molt affects their migration decisions, and what subspecies of Dunlin occur on the Delta. At the Tutakoke Field Camp, we trapped Dunlin at high tide roosting areas and radio-marked 36 birds between 4 and 13 August. Of these birds, half were adults and half juveniles. Based on morphometrics, all the birds that we radio-marked were the *pacifica* subspecies.

While movement patterns have not been analyzed yet, several things stood out. First, Dunlin marked at the Tutakoke Field Camp did not stay around the camp for very long. Radioed birds were heard around the field camp for 1–5 days before departing to other areas. Due to the barrage of storms that occurred on the Delta this fall, getting up in airplanes to look for radio-marked birds proved to be difficult, but the Yukon Delta National Wildlife Refuge pilots did a tremendous job flying out in the small holes of suitable weather. In the immediate weeks after capture birds were found along the coast at roost sites ranging from 9–15 km north and 3–15 km south of their banding site. Most birds eventually moved farther south to sites ranging from Hazen Bay to the mouth of the Kuskokwim River, a coastline distance from Tutakoke of about 250 km. Dunlin were detected on the Delta into early October. Three of our Dunlin, however, moved from the Delta to the Alaska Peninsula, over 600 km from their banding site at Tutakoke. Two birds were heard at Nelson Lagoon while one bird was heard at Ugashik Bay. These birds appear to have departed from the Alaska Peninsula (presumably south towards Canada or the USA) sometime in the first week of October.

Next fall, we hope to replicate parts of this study and also look at how Dunlin are migrating from the Alaska Peninsula south to Canada and the USA. We are hoping that the storms will be smaller and the sun more abundant next time around.

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Project: Site fidelity and other features of Pacific Golden-Plovers wintering on Saipan, Marianas Islands

Investigators: Wally and Patricia Johnson, Department of Ecology, Montana State University; Roger Goodwill, Department of Biology, Brigham Young University-Hawaii.

Pacific Golden-Plovers winter in coastal and upland habitats across an immense region of the world including the Hawaiian Islands, Japan, insular Pacific, Australia, New Zealand, Indonesia, Philippines, southeastern Asia, India, and northeastern Africa. In this vast nonbreeding area, the only previous studies involving uniquely banded plovers (many also radio-tagged) were conducted by the Johnsons and various coworkers on the island of Oahu and at Johnston Atoll. These investigations demonstrated a major migratory link between Oahu and breeding grounds in Alaska, plus strong site fidelity on nonbreeding grounds with marked individuals reoccupying the same territories season after season. In an effort to expand knowledge of this species on its nonbreeding range, we banded 36 plovers (of these, 24 also were radio-tagged) in late March-early April '05 at Saipan in the western Pacific. As an adjunct to the Saipan project, we banded and radio-tagged 10 plovers captured in mid-April '05 on Oahu. Following northward migration (both groups departed at about the same time in late April), USFWS biologists in Alaska commenced aerial monitoring for plover radio signals in the Cold Bay, King Salmon, Bethel, and Kotzebue regions.

The final score for radio-tagged plovers detected in Alaska was: 0/24 Saipan, 4/10 Oahu. Of the birds found, three were on the Alaska Peninsula near the towns of Egegik and Port Heiden, and one was in the Yukon-Kuskokwim Delta region north of Bethel. Although the possibility of a migratory link between Saipan and Alaska remains an open question, this difference between the two sample groups suggests that the migratory route of Saipan plovers does not arc eastward to Alaska but instead leads to breeding grounds in Siberia. One of the Saipan plovers (with transmitter still attached) was sighted and photographed during fall migration by a birder near Tokyo, Japan on 13 August and again on 20 August. The bird was foraging with other plovers on an uncultivated rice field.

We checked our study sites for marked birds in late October (after southward migration) and found that 25 Saipan plovers (69% of the sample population) and 9 of the Oahu plovers (90%) had returned for another nonbreeding season. In the Saipan group, there were nearly equal proportions of birds that had been radio-tagged (17/24 = 71%) and those that had not been tagged (8/12 = 67%). Clearly, the attachment of transmitters had no apparent effect on subsequent survival. In contrast to the Oahu plovers (each with a specific territory and thus easily observed), the Saipan plovers were almost entirely non-territorial. Most were in flocks difficult to approach closely, and the birds often foraged in grass tall enough to obscure the bands on their legs. Given these variables, it is almost a certainty that some banded birds went unrecorded during the fall survey. Therefore, the return rate of 69% is a minimal estimate of site fidelity at Saipan. Perhaps the actual rate there was similar to nonbreeding grounds on Oahu where returns of territorial plovers have averaged around 80% over many seasons.

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Project: Reproductive ecology of Bar-tailed Godwits on the Yukon-Kuskokwim Delta

Investigators: Brian J. McCaffery and Jesse Conklin, U. S. Fish and Wildlife Service

In 2005, we conducted the second year of a study focusing on the breeding ecology of Bar-tailed Godwits on the outer Yukon-Kuskokwim Delta. From 26 April to 5 July, 2–7 people conducted field work on and adjacent to a 4-km^2 study area surrounding the Old Chevak field station. The study area is along the Kashunuk River, and is characterized by a diversity of wetlands either embedded in, or surrounding, extensive patches of uplands. Wetlands include tidal sloughs (which make up >80% of the plot's borders), tidal meadows, freshwater meadows, freshwater marshes, and steep-sided lake basins. The upland tundra was dominated by dwarf shrubs, *Carex* sedges, lichens, and *Sphagnum* moss. Nest-searching efforts included focal observations of breeding godwits as well as walking zigzags in sites or habitats suspected of supporting godwit nests. Field work pertaining to godwit telemetry is described in the following project summary.

As in 2004, 12 godwit nests were located on the study area, and an additional 5 nests were located on adjacent tundra. Eight were found during laying, four after clutch completion, two after depredation events, and the timing of three relative to clutch completion was unknown. Final clutch size was determined at nine nests, with eight four-egg clutches and one five-egg clutch. The latter is the third five-egg clutch on record for this species from the Yukon-Kuskokwim Delta. One egg was markedly different in pattern than the other four, suggesting that it was produced by a second female. Nest initiations ranged from 19 May to 14 June ($n = 8$), with an average date of 25 May (two days later than in 2004). At least one egg was collected from seven nests for contaminants analysis. Following egg collection, adults resumed incubation at $\geq$4 of those nests.

None of the 17 godwit nests hatched. Daily survival rates (DSR) were very low for all classes of nests. DSR during laying and incubation was 0.722 and 0.841, respectively. Overall DSR was 0.797. Based on a comparison of DSR between nests at which we did and did not capture birds (n = 7 and 10, respectively), there was no evidence that capturing, flagging, and outfitting nesting godwits with transmitters affected rates of nest survival. This pattern held even when only considering nest histories of impacted birds after the day of capture. In fact, the point estimates for DSR were higher at those nests where we captured adults. Given the absence of an effect on DSR, we combined data from our two years to generate an overall DSR for 2004–2005 ($n = 22$) of 0.815. With an estimated exposure period for successful nests of 27 days, the point estimate for nest success based on this DSR is 0.4%. Comparable data from Black-bellied Plovers at Old Chevak in 2004–2005 (with a DSR of 0.943, estimated exposure period of 29.5 days, and $n = 15$) yields a nest success estimate of 17.7%. Thus, relative to another large shorebird species with open (i.e., uncovered) nests and aggressive predator-mobbing behavior, Bar-tailed Godwit nest success at Old Chevak is strikingly low.

Two broods were discovered on or near the main study plot. On 27 June, a pair with three chicks (approximately two weeks old) was detected in the marsh north of the northwest edge of the plot. This family was not seen subsequently. On 28 June, a pair with a single chick (about 10 days old) was found near the plot's eastern edge. On 29 June, this chick swam across the tidal slough that forms the eastern border of the plot. A reciprocal trip from outside the study area could have preceded our initial detection of this family; thus, we had no conclusive evidence that any nests hatched successfully on our main study plot.

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Project: Use of satellite telemetry to study the migratory behavior of Bar-tailed Godwits

Investigators: Lee Tibbitts, Robert Gill, Dan Ruthrauff, and Dan Mulcahy U.S. Geological Survey; Brian McCaffery and Jesse Conklin, U.S. Fish and Wildlife Service

In June 2005, we conducted a pilot study to determine if satellite telemetry could be used to monitor the migration of Bar-tailed Godwits on their southward flight (11,000 km) between breeding grounds in Alaska and nonbreeding grounds in New Zealand and western Australia. Our immediate goals were to determine if godwits could successfully carry satellite transmitters (PTTs) and if the transmitters could perform reliably over a 5- to 6-month period.

We captured nine godwits, representing six pairs, on their nests in the vicinity of Old Chevak (61° 26′ N, 165° 27′ W) on the central Yukon-Kuskokwim Delta (YKD). Our team veterinarian (Mulcahy) surgically implanted satellite transmitters (Microwave Telemetry, Inc., 22 g implantable) in the coelomic cavity of five females and subcutaneously-implanted conventional VHF radio transmitters (Advanced Telemetry Systems, model A2830, 12 g) onto the upper backs of three males and one female. PTTs were implanted under general anesthesia while VHF radios were done under local anesthesia. All birds appeared to recover fairly quickly from their surgery—usually within 30 minutes—and upon release promptly returned to their breeding territory. One pair (female with PTT and male with VHF radio) was observed incubating their nest for up to 14 days post-surgery. We monitored PTT-tagged birds remotely via the ARGOS system. To extend battery life PTT units were programmed to emit signals only every seventh day from June through August and then daily for an eight-hour from September through October. We monitored VHF tagged birds using handheld radio receivers at Old Chevak in June and during aerial surveys of the south coast of the YKD during July–September and along the Alaska Peninsula during September and early October. Tagged birds departed Old Chevak 0–22 days after nest failure (nest loss was quite high generally among Bar-tailed Godwits at Old Chevak in 2005; see summary by McCaffery et al.) and then spent at least 42 days at coastal staging sites in Angyoyaravak Bay (61° 16′ N, 165° 41′ W) and on Kuskokwim Shoals (59° 51′ N, 164° 09′ W). At least three tagged females used Angyoyaravak Bay, while all males and four females used Kuskokwim Shoals. One female traveled from Kuskokwim Shoals to Port Heiden (56° 50′ N 158° 54′ W) and back again within a 10-day period in early August, a minimum roundtrip distance of 1,000 km.

Unfortunately, PTTs began to malfunction in early July and all signals were lost by mid-August, 2–4 weeks prior to the normal departures of godwits from western Alaska. However, two tagged birds were observed subsequently in New Zealand at South Manukau Harbor (37° 00′ S, 174° 30′ E). One of these birds, a male, was seen on 19 September; the other, a female, was seen on 9 October. No information was provided on the status of the VHF transmitter on the male, but for the female the antenna from the PTT was still intact. This indicates that the loss of signals, at least from this particular PTT, was due to technical failure. Both sightings indicate that godwits can successfully carry implanted transmitters on their long flight. Before embarking on additional studies using satellite telemetry we need to assess the technical problems encountered in 2005. The manufacturer of the PTTs is currently evaluating the signal data to determine if and how the “bugs” in this model can be fixed.

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Project*: *Bar-tailed Godwits staging at Tern Mountain, Yukon-Kuskokwim Delta

Investigators: Brian J. McCaffery, Jesse Conklin, Alexandra Hoffmann, Denes Laczik, and Kriszta Sebe, U. S. Fish and Wildlife Service

The Yukon-Kuskokwim Delta is an important staging area for the Alaska breeding race of the Bar-tailed Godwit. In 1999, post-breeding surveys were initiated to determine the proportion of juveniles present in staging flocks on the Delta's outer coast near Tern Mountain. Such estimates are being increasingly used around the world as indices of annual shorebird productivity. Data collected in 1999 and from 2001–2004 yielded annual estimates of $\leq$3% juveniles present at Tern Mountain during the post-breeding staging period.

In 2005, we continued this effort at Tern Mountain. Minimum daily counts of godwits exceeded 2,000 on 27 of 54 field days between 1 August and 27 September. The highest minimum daily counts at Tern Mountain were 10,600 and 9,500 on 9–10 September. Unlike 2004, numbers stayed relatively high into the fourth week of September. In 2004, daily totals never exceeded 165 after 12 September. In contrast, from 5–26 Sep 2005, daily totals averaged 4,446 and dropped below 1,400 on only one date. A major decline, coinciding with a dramatic shift to northern winds, occurred over 26–27 Sep, when godwit numbers dropped from 1,648 to 242.

We surveyed 204 flocks on 49 days from 1 Aug–27 Sep. Among 59,033 godwits sampled, 5,086 were juveniles (8.6%). In 2004, the comparable values were 37 flocks surveyed, 24,546 godwits sampled, and 545 juveniles detected (2.2%).

At Tern Mountain, we also had 168 sightings of godwits marked elsewhere in the East Asian-Australasian Flyway with site-specific color flags. These sightings included 108 color-flagged godwits from Victoria, 5 from Queensland, and 1 from New South Wales, Australia; 31 from the North Island and 19 from the South Island, New Zealand; 2 from Chongming Dao and 1 from Yalu Jiang, China; and 1 from Japan. Finally, we detected 40 individually color-banded birds marked by our colleagues in New Zealand as part of a major demographic study.

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Project: Leaving the Arctic: how Sharp-tailed Sandpipers prepare for southward migratory flights of 10,000 km

Investigators: Marcel Klaassen, Netherlands Institute of Ecology; Åke Lindström, Lund University, Sweden; Sarah Jamieson, Simon Fraser University; Brian McCaffery, U.S. Fish and Wildlife Service; Robert E. Gill, U.S. Geological Survey; Liv Wennerberg, Oslo University, Norway

The coastal zone of Alaska is an important refuelling and staging area for a great number and variety of migratory High Arctic shorebirds. Many birds are on their way from the Nearctic tundra to areas farther south in the Americas, but the coastal wetlands of Alaska also hosts shorebirds en route from northern Siberia to Australia and New Zealand! Notably juvenile Sharp-tailed Sandpipers, born in Siberia, use the Yukon delta in large numbers to fuel and prepare for what might be a spectacular trans-Pacific flight. The Sharp-tailed Sandpipers may well make one of the longest uninterrupted flights in the avian world (approx. 10,000 km), and such flights necessitate storage of large fuel loads. To understand the ecological conditions that enable birds to fuel up fast and efficiently, we studied their fuelling rates, diet choice, and local movements, in relation to fuelling performance.

After a two-week reconnaissance trip to the YKD in 2004, a major research effort was made in August through October 2005. The major base for this research was the Tutakoke River Field Camp right at the coast, but birds were also caught inland at Kanaryarmiut Field Station and Old Chevak. Sharp-tailed Sandpipers were caught in walk-in traps and mist-nets during 3–13 September 2004 and 1–26 September 2005, with an additional single bird trapped 20 August 2005. In total 129 birds were processed in 2004 and 228 in 2005, making a total of 357 birds. All birds were juveniles. Male Sharp-tailed Sandpipers are clearly bigger than females, with a notable difference in wing length, but there is nevertheless some overlap in measurements. Using blood samples to genetically sex the birds we hope to design a discrimination algorithm for sexing the birds on structural measurements. Interestingly, we caught significantly more males (61%) than females (39%). Body mass and fat score generally increased throughout the study period. However, there seemed to be a shift in the speed of deposition around mid September, with fuel rates being about 10 times higher in the latter half of the month. Also the fuel loads of the heaviest birds were impressive, with some birds certainly more than doubling their body mass.

We also addressed the question on what these remarkable waders feed. Prey items from a number of stomachs of Sharp-tailed Sandpipers collected at SW Alaska staging sites over the period 1976–1986 (data Bob Gill) already indicated that a large amount of plant seeds can be found in the guts of Sharp-tailed Sandpipers. Using stable isotopes in blood samples we wanted to establish whether these seeds are also metabolized and form an important part of the diet of these waders. Data from 2004 indicated that this is the case but that individual variation in diet choice may be large with some individuals feeding exclusively on invertebrates and others being granivores only. Blood samples collected in 2005 will serve to study any temporal shifts in diet selection as well as spatial variation (inland versus coastal) in diet choice and differences in diet choice between the sexes. Also niche (i.e., diet)-differentiation with other species of waders staging in the YKD will be investigated using blood samples taken on many other species of waders caught over the same periods.

Finally, we also wanted to elucidate the spatial strategies that the Sharp-tailed Sandpipers employ during their relatively short stay in Alaska. We therefore deployed 30 radio-transmitters throughout the 2005 research period. We regularly scanned for the presence of transmitter birds at the catching sites using handheld receivers. At the major catching site (Tutakoke Camp) we also had an automated receiving station installed from September 19 until October 4. At a larger scale aerial surveys were made whenever conditions permitted. All data together indicated that the Sharp-tailed Sandpipers were relatively site-faithful with the majority of birds staying for a prolonged period of time until early October, when apparently the major exodus started.

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Project: Hudsonian Godwits staging at Aropuk Lake, Yukon-Kuskokwim Delta

Investigator: Brian J. McCaffery, Michael B. Rearden, and George Walters, U. S. Fish and Wildlife Service

In 2004, Yukon Delta National Wildlife Refuge personnel documented a large concentration of post-breeding Hudsonian Godwits at Aropuk Lake on the central Yukon-Kuskokwim Delta. Aropuk Lake is a shallow (2–3 m max. depth), 85-km^2 lake about 80 km inland from the Bering Sea (61° 07' N, 165° 53'W). Based on our observation of juveniles in late July and anecdotal observations provided by other researchers at the site in early July, we estimated that 3,000–6,000 post-breeding godwits (adults and juveniles) used this area during the summer of 2004.

In 2005, we visited the Aropuk Lake region on four dates from 12–16 July. An aerial survey of the large lakes used by foraging godwits immediately west of Aropuk on 12 July yielded an estimate of about 5,300 Hudsonian Godwits. On 14 July, we counted approximately 1,500 roosting godwits on a small peninsula at Aropuk Lake also used by roosting birds in 2004. On 15 July, 3,700 birds were detected during an aerial survey of the lakes. On 16 July, we again detected approximately 1,500 birds at the known roost site. We landed and conducted an age composition survey of the roosting flock. We aged 510 godwits, 435 adults and 75 juveniles, for adult and juvenile proportions of 85% and 15%, respectively. If these proportions can be applied to the entire roosting flock from which the data were collected, that roost was occupied by about 1,275 adults and 225 juveniles. If these proportions reflect the overall age composition of Hudsonian Godwits in the area during the second week of July, then the greater Aropuk Lake region may have supported about 4,500 adults and 800 juveniles. Our observations in 2005 augment those made in 2004, and confirm that the Aropuk Lake area supports one of the largest post-breeding aggregations of Hudsonian Godwits in North America.

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Project: Inventory of montane-nesting birds in Katmai National Park and Preserve

Investigators: Dan Ruthrauff, Lee Tibbitts, and Robert Gill, U.S. Geological Survey

In 2005, we completed the second year of a three-year study to inventory montane-nesting birds within the National Park Service's Southwest Alaska Network (SWAN) of parks. We deployed three, two-observer crews within Katmai National Park and Preserve from 11–25 May, and surveyed a total of 23, 10- x 10-km study plots distributed throughout the Park. In total, we conducted 382 15-minute-long point counts utilizing variable circular plot methodology, complementing 379 counts we conducted in Lake Clark National Park and Preserve in 2004.

Spring conditions were similar to those we experienced in 2004. Western sections of the Katmai region were mostly snow-free during our survey period, in contrast to eastern sections of the Park with delayed spring phenology typified by near complete snow cover and below-normal temperatures. Noteworthy observations included sightings of breeding Baird's Sandpipers, Surfbirds, and Wandering Tattlers at locations at or beyond the southern limit of their known breeding range, and unexpectedly high numbers of Whimbrel and American Golden-Plovers in the area surrounding Kukaklek Lake. Pacific Golden-Plovers, while known to be common in low-lying areas of the Alaska Peninsula, were detected at sites further inland than expected. In contrast to these intriguing shorebird observations, observers were struck by the relative dearth of high-montane passerines (e.g., Northern Wheatear, Say's Phoebe, Gray-crowned Rosy-Finch), species that were detected in low numbers at Lake Clark in 2004.

In 2006, we will finish our inventory of Lake Clark and Katmai by surveying study sites in eastern sections of both Parks in early June, a time of year when snow cover will be less extensive, thus facilitating plot access. These data will be utilized to calculate park- and habitat-specific bird densities, and park-wide densities and distributions will be linked to a GIS database delineating sample area. These surveys serve not only as basic avifaunal inventories, but the repeatable nature of the methodology will also enable land managers to monitor population changes over time.

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Project: Alaska Peninsula shorebird inventory

Investigators: Susan Savage and Kristin Sesser, U.S. Fish and Wildlife Service; Lee Tibbitts, U.S. Geological Survey

In 2005, personnel with the Alaska Peninsula/Becharof National Wildlife Refuge again conducted inventories of birds inhabiting lowlands of the Alaska Peninsula. The goal of the work is to establish baseline information on distribution and abundance of the region's breeding birds (with a focus on shorebirds). The sampling universe for the inventory encompassed all lowland areas (defined as lands <100 m in elevation) located between the Naknek River drainage and the tip of the Alaska Peninsula. A stratified random sampling design was used to select plots (n = 68; size = 5 x 5 km) and variable circular plot methodology incorporating distance estimation (i.e., point transects) was used to survey plots. For details see the 2004 project summary.

Between 8 May and 1 June, teams of two observers spent 1–2 days at each of 16 plots located between Pilot Point and Port Heiden (6 plots), just south of Port Heiden (3 plots), inland between the Egegik and Ugashik rivers (3 plots), in the upper Ugashik/Dog Salmon drainages (3 plots), and on the Pacific Coast (1 plot). Among these plots, we sampled a total of 247 points on which we recorded 12 species of shorebirds totaling 1,777 individuals. We also recorded 12 species of avian predators, totaling 782 individuals. Besides shorebirds and avian predators, we also recorded 19 species of landbirds (e.g., ptarmigan, passerines) and 19 species of waterbirds (e.g., loons, grebes, waterfowl, terns) on the point transects. An additional 11 species (4 raptors, 4 waterbirds, 2 seabirds, 1 landbird) were observed on plots, but not detected during a point transect. To date, we have surveyed 29 plots and 401 points and recorded information for 2,943 shorebirds and 1,244 avian predators. These data will be used to calculate species-specific estimates of relative abundance and density and to assess habitat associations.

During visits to plots, we found seven nests of five species of shorebird (Pacific Golden-Plover, Short-billed Dowitcher, Dunlin, Semipalmated Plover, and Rock Sandpiper) as well as a recently fledged chick of a Wilson's Snipe. We also found 15 nests of 9 other species including 2 nests of Short-eared Owl.

Based on the 2004 and 2005 data sets, Least Sandpipers and Wilson's Snipe were the most widely distributed shorebirds, occurring on all but one of the 29 plots (97%). Short-billed Dowitchers and Dunlin were also widely distributed, occurring on 83% and 76% of plots, respectively. Marbled Godwits, a species of conservation concern, were found on 13 plots (45%) ranging from 27 km ENE of Pilot Point to 11 km NE of Port Heiden.

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Project: Status of the Marbled Godwit on BLM lands on the Alaska Peninsula, May 2005

Investigators: Robert Gill, Colleen Handel, and Lee Tibbitts, U. S. Geological Survey, and Maksim Dementyev, Moscow State University

Between 6 and 10 May 2005, personnel of USGS's Alaska Science Center continued an avifaunal inventory of birds on selected Bureau of Land Management (BLM) lands on the north side of the Alaska Peninsula and initiated aerial line transect surveys over known or suspected godwit nesting habitat in order to derive a population estimate. The investigation was funded by BLM as part of its evaluation of critical natural resources, particularly special-status species occurring on BLM lands for which title might be conveyed to other federal, state, or Native interests. The lands inventoried in this investigation occur within or just outside the suspected breeding range of the Marbled Godwit and include three inholdings along the central Alaska Peninsula between Becharof Lake and Port Heiden. The single inholding (13 km^2) sampled in 2005 was located 20.0 km SSW of Pilot Point (see 2004 project summary for details of sampling methodology). Lands over which aerial surveys were flown included a 20 x 30 km (600-km^2) area that extends east from Ugashik Bay to Lower Ugashik Lake and a 25 x 60 km (1,500-km^2) area that extends from Ugashik Bay southwest past Cinder Lagoon. The latter area encompassed the inholding surveyed from the ground in 2005.

Aerial transects in the two sampling areas were 60- and 30-km long with transects separated at 2.5-km intervals. Surveys were conducted from a Hughes 500 helicopter flown at a ground speed of 80 knots and an altitude of 50 m above ground level. The primary observer, who sat in the right front seat with an unobstructed view through the forward window, concentrated on detecting birds on both sides of the centerline and at farther distances on the right side. The observer in the right rear seat recorded birds laterally from the helicopter. The pilot concentrated on recording birds on or near the centerline, primarily on the left side. All observations were verbally recorded to avoid duplicate records of the same birds by different observers. Most birds were detected when they flushed as or just before the helicopter flew over them. Godwits were recorded at fixed lateral intervals from the transect centerline (0–25 m, 26–50 m, 51–100 m, and 101–200 m) as determined by markers on the windows positioned to subtend the appropriate angle for each distance from the centerline at the survey altitude. For each observation we recorded the observer, distance interval, number of birds in the group, and behavior (standing, flushing, or flying). We also recorded a GPS waypoint to document the exact coordinates of each sighting.

We used program DISTANCE (Thomas et al. 2003) to estimate densities of godwits by modeling the probability of detection at increasing distances from the survey centerline (Buckland et al. 2001). We assessed the fit of different detection functions to the survey data using AIC_c and χ^2 goodness of fit. We pooled detections across all observers and assumed that the detection function did not differ between the two study areas. We estimated densities and population sizes, along with 95% confidence intervals, separately for each study area.

The two, two-person teams that conducted the ground surveys (7–8 May) produced 18 detections of Marbled Godwits on the plot, totaling 23 individual birds (5 couplets and 13 individuals). The array of behaviors among birds included 3 seen in flight display, 3 on the ground giving alarm calls, 6 standing and silent on the ground, and 11 flying and calling.

During aerial transects we observed 64 godwits in 46 groups along 840 km of transects. Almost all of the sightings (44 of 46 groups; 61 of 64 birds) were observed on the larger and most southerly of the census areas. Godwits were observed as singles or pairs, with mean group size of 1.39 ± 0.07 SE (n = 46). The primary observer in the right front seat recorded most of the sightings (59%) and detected birds in all four intervals. The pilot augmented sightings in the first two intervals (11% of total sightings) and the right rear observer detected birds in the first three zones (30%). With the three observers combined, there was no evidence of movement away from the centerline. The probability of detection of godwits was best explained by a half-normal model with no adjustments ($AIC_c = 113.37$, Goodness-of-fit $\chi^2 = 0.65$, df = 2, $P = 0.65$). The model was equivalent to a hazard-rate-model ($\Delta AIC_c = 1.64$, $P = 0.60$) and better than a uniform model with a single cosine-term adjustment ($\Delta AIC_c = 3.28$, $P = 0.18$).

Based on the half-normal detection model, we estimated densities of Marbled Godwits at 0.862 ± 0.208 SE birds per km^2 on the southern area and 0.098 ± 0.065 on the northern area. These project to a total population of 1,352 birds (859–2,204 95% CI) on the two census areas combined. The hazard rate detection model produced a similar point estimate of 1,309 birds (775–2,214 95% CI).

In 2006, we hope to expand the aerial surveys to other portions of the breeding range and to stratify sampling effort by major land cover types. This should allow a population estimate for most of the breeding range in Alaska.

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Project: Monitoring shorebirds on barrier islands of the Copper River Delta

Investigators: Mary Anne Bishop and Heather Gates, Prince William Sound Science Center

Along the Pacific Coast of North America, the majority of research on shorebird migration has been conducted in protected waters, such as bays and estuaries. In contrast, relatively little information exists on shorebird use of ocean beaches, even though >25 species migrate or winter along Pacific coast beaches from California northward. The Copper River Delta is one of the most important shorebird stopover sites in North America. The Delta's extensive mudflats are protected from the Gulf of Alaska by a series of barrier islands and spits ranging in size up to 16 km long and 6 km wide.

In July 2005, the Prince William Sound Science Center initiated the first comprehensive study of shorebird use of the Copper River Delta's barrier islands. The objectives of the study include to: a) determine the phenology, relative abundance, and species composition of shorebirds using the outer barrier islands during spring and fall migration; b) examine spatial and temporal distribution of shorebirds on outer beaches; and, c) establish permanent transects for baseline and long-term studies. The project is funded by the Alaska Department of Fish and Game Nongame

Program and the Prince William Sound Oil Spill Recovery Institute. Other cooperators include Chugach National Forest-Cordova Ranger District and Alaska Department of Fish and Game Cordova office.

We established a field camp at Egg Island, a 6.3-km-wide and 14.5-km-long island located on the western edge of the Copper River Delta. We established two line transects on the exposed outer beach (facing the Gulf of Alaska) and three transects in a small estuary on the island. We conducted transects from 26 July–19 September 2005, alternating survey days between the two habitats. Additionally, two sets of beach surveys were conducted 3 and 15 October. Two upland transects close to and parallel to the beach, were established 12 August and surveyed three times per week through 19 September. During transects observers recorded species, number, age (based on plumage) and habitat.

We recorded 13,560 shorebirds representing 27 species during 110 transects. These included 24 shorebird species each on beach and estuarine transects and 16 species on upland transects. The most abundant species observed on the beach (n = 53 transects) were Least Sandpiper and Semipalmated Plover, both local breeders, followed by Pacific Golden-Plover and Black Turnstone, both migrants from western Alaska. In the island's estuary (n = 26 transects) the most abundant species observed were Least Sandpiper, Long-billed Dowitcher (a migrant), and Short-billed Dowitcher, a local breeder. Upland transects (n = 31) were dominated by migrant Pectoral Sandpipers. Based on plumage, we observed juveniles of 22 shorebird species. We also observed but could not reliably age Whimbrel, Wilson's Snipe, Ruddy Turnstone, and Dunlin. Juveniles comprised 48% of the birds aged. For juveniles of species known to breed locally, peak numbers were recorded in late July through early August.

We also flew fixed-wing surveys of the outer beaches during high tide. We initially used a Cessna 185 but after three flights changed to a Piper Cub for more maneuverability and lower speed. We flew 11 aerial surveys from 23 July through 15 October. Shorebirds were observed almost exclusively on the barrier islands west of the Copper River.

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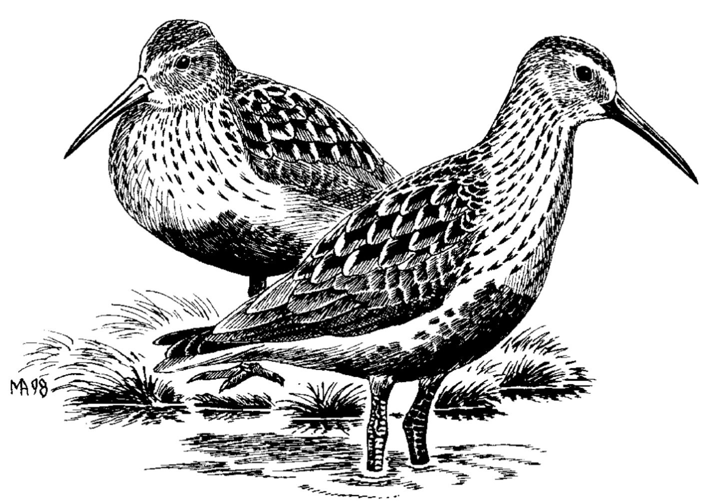

Project: Population size and habitat requirements of Pribilof Rock Sandpipers

Investigators: Robert E. Gill, Lee Tibbitts, Dan Ruthrauff, U.S. Geological Survey, and Maksim Dementyev, Moscow State University

The nominate subspecies (*Calidris p. ptilocnemis*) of the Rock Sandpiper breeds only on Pribilof, St. Matthew, and Hall islands and moves to nonbreeding areas in Cook Inlet. In 2005, we continued work that will allow us to refine a population estimate for this population (see summaries for 2003 and 2004). This year we created a habitat map of St. George Island by classifying a LANDSAT 7 satellite image using artificial neural networks. Neural networks are mathematical constructs that emulate the processes people use to recognize patterns, learn tasks, and solve problems. The power of neural networks comes form their ability to learn from experience (i.e., from data collected in some field or laboratory context). A neural network learns how to identify patterns (e.g., spatial and spectral signatures in digital images) by adjusting its weight in response to input data. We visited St. George in June to ground-truth the map and preliminary analysis suggests that it is highly accurate. Once we refine the habitat-mapping techniques used at St. George, we can then apply them to information collected previously on St. Paul (2001) and St. Matthew (2003) to create maps for those islands. The end product will be habitat-based population estimates for each of the breeding islands.

In conjunction with work on the nesting grounds, we continued work on the nonbreeding grounds by flying monthly (October–April) aerial surveys of upper Cook Inlet (see summaries for 2002 and 2003 for methodology). Aerial surveys are now into their eighth season and total 86 through November 2005. Numbers in winter 2004–2005 peaked at 14,000 birds in March 2005. The November 2005 survey produced 11,500 birds, down from the 14,600 recorded the previous November (all counts adjusted for observer bias). Temperature and ice cover are the two variables most affecting numbers and distribution of birds in upper Cook Inlet, especially north of Trading Bay.

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Project: An integrated regional ecological assessment of the Black Oystercatcher

Investigators: David Tessler (ADF&G), Susan Boudreau (NPS), Peter Clarkson (Parks Canada), Tony Gaston (CWS), Verena Gill (USFWS), Michael Goldstein (USFS), Brian Guzzetti (UAF, ADF&G), Sue Haig (USGS), Barb Johnston (Parks Canada), Matt Kirchoff (ADF&G), Richard Lanctot (USFWS), Julie Morse (UAF), Abby Powell (UAF), Kristen Romanoff (ADF&G), Caleb Speigel (USGS), Sandra Talbot (USGS), Mike Tetreau (NPS), Denny Zwiefelhofer (USFWS), Kristine Sowl (USFWS)

This project aligns and expands the research objectives and methodologies of several previously unrelated studies of the Black Oystercatcher at multiple sites in the heart of this species' range (See summaries by Morse, Spiegel, V. Gill). A core set of shared methods address several key aspects of oystercatcher ecology critical to the conservation of this poorly understood species.

The principal aims of the current project are to: 1) Determine the size and nesting density of several important local breeding populations throughout the range; 2) Assess adult survival, breeding site fidelity, and natal philopatry, and other demographic parameters important in regulating population size; 3) Assess regional differences in nesting effort, breeding success, and productivity; 4) Identify local threats or limitations to productivity; 5) Elucidate levels of population structuring and the degree of connectivity between regional breeding populations; 6) Identify locations of important wintering areas and the numbers of birds in those areas; and 7) Identify movement patterns between various breeding and wintering areas.

Coordinated productivity and population genetics investigations are under way in Glacier Bay National Park, Kenai Fjords National Park, Prince William Sound, Middleton Island, and in British Columbia on Vancouver Island and the Queen Charlotte Islands. Although 2005 was the third and final year of Morse's work in Kenai Fjords, it was the second summer of productivity field work at the other Alaska sites. We surveyed each study area thoroughly to determine the locations of all actively defended territories, and revisited each territory every five to seven days (within the average relaying period of nine days). We monitored the fate of nests, eggs, and chicks, and the causes of loss, and relaying effort. We also continued banding efforts for another year, and captured adult oystercatchers using a variety of techniques including: Noose mats, nest nooses, long handled dip nets, and mist nets. We banded each captured adult with metal and colored plastic bands to identify both the individual and it's breeding location, and measured a suite of morphometric characters. We captured chicks by hand and banded each to identify hatching location, cohort year, and the individual if the tarsus was long enough to accommodate the bands. We collected blood samples from all captured birds for subsequent genetic analyses. Broken eggshells with attached membrane were collected opportunistically for inclusion in the population genetics dataset. Collaborators in British Columbia with the Laskeek Bay Conservation Society in the Queen Charlotte Islands, Gwaii Hanaas National Park, and Pacific Rim National Park contributed eggshell membrane for the population genetics work, but, due to logistical constraints preventing weekly visitation schedules, used different methods to assess productivity.

Data are still being compiled and analyzed, so any results reported here are to be considered extremely preliminary and are not intended for citation. In 2005, at least 130 oystercatchers (45 adults, 85 chicks) were banded in Alaska, bringing the total number banded in Alaska since 2003 to 390 (between 3.6 and 4.9 % of the estimated global population). We monitored 176 territories in Alaska in 2005, and have monitored 330 territory-seasons since 2003. Clutch size, hatching percentage, fledging success, overall productivity, and causes of egg and chick loss vary widely both between study areas and between years. When study areas and years are considered together, average clutch size is 2.43; hatching percentage (#chicks hatched/#of eggs laid) 32.8%; fledging success (#fledged Chicks/#eggs laid) 18.5%; and overall productivity (#fledged chicks/#pair-seasons) is 61.2%. The greatest cause of egg and nest loss in most study areas is tidal inundation, accounting for over 40% of 2005 losses in Glacier Bay and Prince William Sound, but only 3% of losses on Middleton Island, where avian predation was the principal cause of loss. We have collected nearly 400 genetic samples in Alaska and British Columbia, an amount sufficient to analyze the degree of population structuring between the six productivity sites considered.

Work in winter 2006 will continue to identify important wintering concentrations and possible movement patterns. To locate concentrations of oystercatchers and estimate their numbers, we intend to fly survey of parts of the Aleutian Islands, all of Kenai Fjords National Park, Prince William Sound, the Gulf coast from Cordova to Juneau, Glacier Bay National Park, and a sizable portion of the Southeast Alaska coast. Flights will be conducted from an altitude of 150 feet at an airspeed of 85 miles per hour. In Prince William Sound and Glacier Bay these aerial surveys will be used to target boat-based efforts for resighting banded birds and enumerating flocks. Flock location, enumeration and band resighting efforts will be conducted by boat on Kodiak Island, and via ground based surveys on Middleton Island. These efforts will be repeated February 2007.

2005 was intended to be the first year of winter surveys, and although severe weather curtailed most of these efforts, we did uncover a few tantalizing pieces of information. Aerial surveys conducted in parts of Izembek National Wildlife Refuge sighted 121 overwintering oystercatchers. Boat based surveys of Kodiak Island revealed at least 1,716 oystercatchers, none of which was banded. And interestingly, despite being the summer home of over 1,000 oystercatchers, none was sighted on Middleton Island during ground counts last winter. Where did they go?

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Project: Black Oystercatcher surveys in the western Aleutian Islands

Investigator: Verena Gill, U. S. Fish and Wildlife Service

In May 2005, John Haddix, Angela Doroff, and Dana Jenski (Region 7 USFWS), with logistical support from the Alaska Maritime NWR, conducted skiff surveys in the Near Islands for Black Oystercatchers, Pigeon Guillemots, Common Eiders, and northern sea otters (*Enhydra lutris kenyoni*). The surveys involved a circumnavigation (100 m off-shore) of Attu and Agattu islands, and along the south side of Alaid and Nizki islands. No oystercatchers were observed at these sites. In August, Verena Gill, John Haddix, and Douglas Burn surveyed the Rat Islands (north side of Amchitka, all of Kiska, Little Kiska, and Rat), the western extent of the oystercatcher's known range. There the number of oystercatchers appeared to be either stable or increasing since last counted by the same group of observers in 2003. If the population has increased it is likely due to the fox removal program conducted in the Aleutian Islands by the Alaska Maritime NWR.

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Project: Effects of recreational disturbance on breeding Black Oystercatchers in Kenai Fjords National Park

Investigators: Julie Morse and Abby Powell, Alaska Cooperative Fish and Wildlife Research Unit, University of Alaska, Fairbanks

The potential conflict between increasing recreational activities and nesting birds in coastal habitats has raised concerns about the conservation of the Black Oystercatcher. To address these concerns, we studied the breeding ecology of oystercatchers in Kenai Fjords National Park from 2003–2005, and examined the impact of recreational disturbance on breeding parameters.

Most recreational disturbance of breeding territories in our study area was from kayak campers and occurred after June 13, the peak hatch of first clutches. Mean annual fledging success (24%) was low but our analyses suggested that daily survival rates of nests and chicks did not differ between territories with and without recreational disturbance. Nest survival varied annually and seasonally, and declined during periods of extreme high tides. Daily survival rate of chicks was higher on island territories than mainland territories, presumably due to differences in predator communities. Most (96%) color-banded oystercatchers returned to their breeding territory in the subsequent year regardless of level of disturbance.

We conducted field experiments in 2004 and 2005 to assess the resilience of incubating oystercatchers to recreational disturbance. Black Oystercatchers decreased incubation constancy by 34% in response to experimental disturbance. We found no difference between sexes in nest attendance rates or response to disturbance. Response of individual pairs was highly variable, but we found no evidence that oystercatchers habituated to recreational disturbance within seasons or between years. While recreational disturbance clearly altered the incubation behavior of oystercatchers, and this certainly had the potential to affect population dynamics through nest survival, we did not detect any effects of this behavioral change on rates of nest survival.

Our data suggest that oystercatchers in Kenai Fjords National Park are resilient at the population-level to the current low levels of recreational disturbance. We encourage the continued monitoring of oystercatchers in and around Kenai Fjords National Park to take advantage of the information that can be obtained from a uniquely banded population of birds. We resighted six, two-year-old birds in 2005 and suspect these birds may breed for the first time in 2006, providing sparse data on known age breeders.

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Project: Black Oystercatcher surveys of eastern Prince William Sound

Investigators: Jason Fode and Paul Meyers, U.S. Forest Service

We surveyed 70 km of shoreline on Green and Montague islands for Black Oystercatchers and other water birds from 31 May–10 June 2005. We encountered 13 species of water birds totaling over 300 individuals. We found 16 black oystercatcher nests. Highest densities of oystercatcher occurred on the northwest coast of Green Island. However, this area also appeared to have a high failure rate for first nesting attempts. Of the nine nesting territories found there only three contained active nests. In the past six years, we have surveyed nearly 800 km of shoreline in eastern Prince William Sound. Future plans call for completing surveys of Montague, Hinchinbrook, and Hawkins islands.

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Project: Use of video cameras to document nest failure, nesting disturbance, and incubation behavior of Black Oystercatchers in western Prince William Sound

Investigators: Caleb S. Spiegel, Oregon State University & USGS, Susan M. Haig, USGS, and Michael I. Goldstein and Bridget A. Brown, U.S. Forest Service

From May–July 2005 we documented nesting behavior and hatching success at 11 Black Oystercatcher nests in Harriman Fjord, western Prince William Sound, Alaska, using digital video cameras and recorders. This work is part of a multi-year, collaborative study on oystercatcher demographics being conducted by several agencies and institutions including the U.S. Forest Service, Alaska Department of Fish and Game, Oregon State University, USGS-BRD, U.S. Fish and Wildlife Service, and University of Alaska Fairbanks.

Video technology is a valuable tool for collecting data on the causes of nest failure and parental nesting behavior because it allows data to be collected 24 hours per day with minimal observer disturbance, and permits decisive determination of nest fates. Studies of reproductive success often fail to conclusively identify specific causes of failure, instead relying on frequently scant evidence and educated guesses. In 2004, 52% of nest losses documented at Harriman Fjord resulted from unknown causes (Brown et al. 2004). Studies of parental nesting behavior and time budgeting can also be greatly aided by around-the-clock video monitoring. Information collected at night is especially lacking in studies of nesting behavior, although research has indicated important variations in parental sex roles during periods of darkness (Warnock and Oring 1996, Wallander 2003). Processes driving incubation patterns such as day length, tides, and disturbance may have a large effect on reproductive success (Warnock and Oring 1996). Having comprehensive nesting information is vital for truly understanding these behavioral patterns and processes.

During the field season 11 oystercatcher nests (7 first clutches and 4 renests) were continuously monitored with remote camera and video recorder units (SeeMore Wildlife Technologies), from early incubation through nest failure, or until approximately 8 days post-hatching. We selected nests where at least one member of the pair was banded, to allow for identification of individuals and gender determination during footage analysis. Image quality was high, allowing for color band combinations to be read, for subtle nesting behaviors to be observed, and for all causes of failure and potential failure to be clearly identified.

Nest failure due to monthly extreme tidal flooding was recorded at 2 of 11 nests. Previously undocumented response behaviors, such as immersion of the incubating parent, and the digging of new nest scrapes for washed out eggs, were recorded. One egg-predation event was captured on video, revealing evidence of American mink (*Mustela vison*) as a predator of oystercatcher nests in Harriman Fjord. Since mink leave few signs and usually removing eggs whole, such predation events would likely be underestimated without video monitoring. All recorded nest failure events occurred during darkness when infrared LEDs were effective in capturing nighttime footage.

Nine successful hatches were documented on video. Novel footage of nesting- and chick-rearing behavior was obtained, including removal of recently hatched eggshells by adults, simultaneous chick brooding and incubation by both pair members during asynchronous hatching, and abandonment of a late hatching chick.

No nests were abandoned as a result of video camera use alone. Hatching success at nests with video units was far higher than the average hatching success at our field site (82% vs. 32%). This result supports several video nest monitoring studies that indicated that the technology does not cause a greater incidence of nest failure than standard monitoring methods (Keedwell and Sanders 2001, Williams and Wood 2002).

Work is underway at Oregon State University to analyze video footage to derive time budgets of nesting birds. We will conduct an in-depth analysis of nesting and early chick rearing and attempt to relate activity to reproductive performance. Specifically, we will search for video evidence of direct threats to reproductive failure and frequency of these threats, determine whether natural processes such as the tide cycle are driving nesting behavior, and examine sex based differences in breeding behavior. Results will determine the degree to which such threats and life history traits limit reproductive performance.

Video footage will also be used for several public education projects. At the U.S. Forest Service Glacier Ranger District headquarters, a web-based public information program about oystercatcher reproduction in PWS has recently been released (http://www.fs.fed.us/r10/chugach/pages_district/glacier/GRDWildlifeWeb/grdbloy_videos.html). This program uses video footage collected in 2005 to inform the public about basic oystercatcher life history, the importance of Chugach National Forest as a breeding area, and the threats oystercatchers face during reproduction.

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Project: Updates on the Alaska Department of Fish and Game's Comprehensive Wildlife Conservation Strategy and Nongame Program

Investigator: Mary L. Rabe, Alaska Department of Fish and Game

Following a 60-day public comment period that closed on 18 April 2005, Alaska Department of Fish and Game (ADF&G) reviewed the information received and made extensive revisions to Alaska's draft Comprehensive Wildlife Conservation Strategy (CWCS). ADF&G submitted the CWCS on August 26, 2005 for approval by the National Advisory Acceptance Team (NAAT). The NAAT is a national committee comprised of 12 leaders from U.S. Fish and Wildlife Service and the International Association of Fish and Wildlife Agencies that is responsible for reviewing each state and territories' strategy. If the NAAT determines that Alaska's CWCS meets all eight required elements, Alaska will receive final approval from the Director of the USFWS late in 2005 and become eligible for future Congressional appropriations of State Wildlife Grant (SWG) funds. The SWG program currently funds ADF&G Nongame Program projects, as well as cooperator projects participating in our Partner Program.

Alaska's CWCS is a cooperative effort produced with input from a broad array of participants, including representatives of state and federal agencies, university and non-governmental organizations, hunting and other conservation groups, and members of the general public. The shorebird portion of the CWCS was based on information from the Alaska Shorebird Conservation Plan, primarily an early draft of version 2. The CWCS can be viewed on-line at: http://www.sf.adfg.state.ak.us/statewide/ngplan/NG_outline.cfm.

Over the next few months, ADF&G staff will develop products based on information in the CWCS; we welcome suggestions from ASG members. We are especially interested in developing web-based sections that would allow us to track ongoing activities, incorporate regular updates, and expand the existing material.

For example, the Shorebird section could include a template that covers needs common to all shorebirds (i.e., general information that is presented in the introduction to the Alaska Shorebird Conservation Plan), similar to other species. The existing shorebird templates could be revised to link conservation actions to specific issues (either a one-to-one or many-to-one relationship), as this makes for a clearer presentation.

Other efforts to implement the CWCS likely will include ranking species, including their habitats and specific projects for conservation. While templates were organized in sequential order for the most part, some indication of priority would be helpful.

The Nongame Program continues to support Dave Tessler's work on an integrated regional ecological assessment of Black Oystercatcher in Alaska. Several other projects of possible interest to shorebird conservationists have been funded through our Partner Program, including 1) Monitoring Shorebirds on Barrier Island Beaches: Copper River Delta, Prince William Sound Science Center; 2) Developing an International All-Bird Conservation Plan for the Northwestern Interior Forest Bird Conservation Region, Alaska Bird Observatory; 3) Identifying Important Bird Areas of Alaska, Audubon Alaska; and 4) Developing a Nongame Species Database, Alaska Natural Heritage Program, UAA.

For current information on the Nongame and Partner programs, please check our website: http://www.wildlife.alaska.gov/management/nongame/nongame.cfm.

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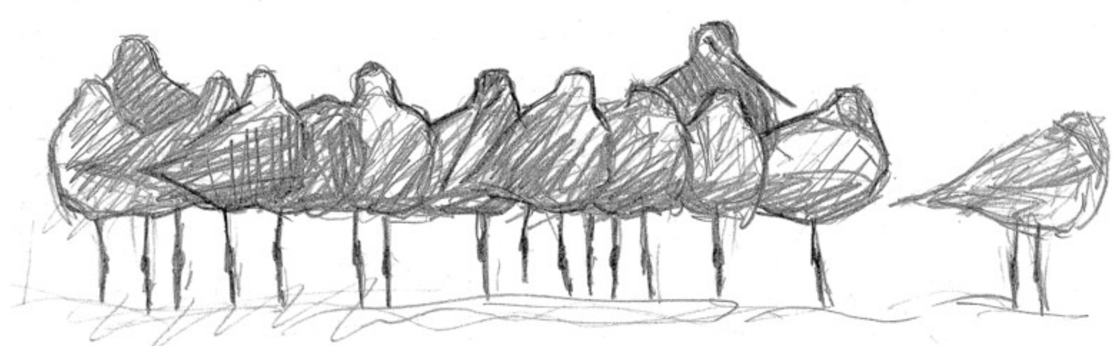

Project: Identifying and cataloging the Important Bird Areas of Alaska

Investigator: Iain Stenhouse, Audubon Alaska

The Important Bird Area (or IBA) concept was developed in Europe in the 1980s by BirdLife International, and IBAs are now recognized around the world as a valuable tool in bird conservation. As the BirdLife International partner in the U.S., the National Audubon Society launched an IBA initiative in 1995 and now has IBA programs in 46 states. To qualify as an IBA, sites must satisfy at least one of a series of strict criteria: they must support (1) species of conservation concern, (2) species with restricted ranges, (3) species with particular habitat requirements, and/or (4) species, or groups of species, which are vulnerable because they congregate at specific sites. IBAs are usually discrete sites that stand out from the surrounding landscape as having local, continental or global significance for birds.

In 2005, building on previous work in the Bering Sea and Cook Inlet regions, Audubon Alaska launched a statewide IBA project. Over the next few years, we will identify and inventory IBAs across Alaska, most of which are expected to be of global significance. Much of this work will involve collaboration and cooperation with a range of partnering organizations and communities across Alaska, including the Alaska Shorebird Group. Some IBAs will be identified solely on the presence of large concentrations of migrating shorebirds. Anyone can nominate a site as a potential IBA. To request an IBA nomination package, or for further information,

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Avian taxa mentioned in this summary. Common and scientific names follow *The A.O.U. Check-list of North American Birds* (7th ed., 1998) and supplements.

COMMON NAME	SCIENTIFIC NAME
Steller's Eider	P*olysticta stelleri*
Common Eider	*Somateria mollissima*
Sandhill Crane	*Grus canadensis*
Black-bellied Plover	*Pluvialis squatarola*
American Golden-Plover	*P. dominica*
Pacific Golden-Plover	*P. fulva*
Semipalmated Plover	*Charadrius semipalmatus*
Black Oystercatcher	*Haematopus bachmani*
Greater Yellowlegs	*Tringa melanoleuca*
Lesser Yellowlegs	*T. flavipes*
Wandering Tattler	*Heteroscelus incanus*
Upland Sandpiper	*Bartramia longicauda*
Whimbrel	*N. phaeopus*
Hudsonian Godwit	*Limosa haemastica*
Bar-tailed Godwit	*L. lapponica baueri*
Marbled Godwit	*L. fedoa beringiae*
Ruddy Turnstone	*Arenaria interpres*
Black Turnstone	*A. melanocephala*
Surfbird	*Aphriza virgata*
Semipalmated Sandpiper	*Calidris pusilla*
Western Sandpiper	*C. mauri*
Least Sandpiper	*C. minuta*
White-rumped Sandpiper	*C. fuscicollis*
Baird's Sandpiper	*C. bairdii*
Sharp-tailed Sandpiper	*C. acuminata*
Pectoral Sandpiper	*C. melanotos*
Rock Sandpiper	*C. ptilocnemis*
Dunlin	*C. alpina*
Buff-breasted Sandpiper	*Tryngites subruficollis*
Short-billed Dowitcher	*Limnodromus griseus*
Long-billed Dowitcher	*L. scolopaceus*
Wilson's Snipe	*Gallinago delicata*
Red-necked Phalarope	*Phalaropus lobatus*
Red Phalarope	*P. fulicarius*
Parasitic Jaeger	*Stercorarius parasiticus*
Long-tailed Jaeger	*S. longicaudus*
Glaucous Gull	*Larus hyperboreus*
Pigeon Guillemot	*Cepphus columba*
Short-eared Owl	*Asio flammeus*
Common Raven	*Corvus corax*
Say's Phoebe	*Sayornis saya*
Northern Wheatear	*Oenanthe oenanthe*
Lapland Longspur	*Calcarius lapponicus*
Savannah Sparrow	*Passerculus sandvichensis*
White-crowned Sparrow	*Zonotrichia leucophrys*
Gray-crowned Rosy Finch	*Leucosticte arctoa*