

Tundra Swan Avian Influenza Surveillance
and Banding Effort
Alaska Peninsula
15-25 July 2006



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ABSTRACT

Tundra swans (*Cygnus columbianus*) were captured on the Alaska Peninsula as part of statewide Avian Influenza (AI) investigations in late July 2006. At Caribou River, south of Nelson Lagoon, 64 birds were captured and 63 swabbed for AI and on the Northern Alaska Peninsula south of King Salmon, 95 birds were captured and 94 birds were swabbed for AI. In addition to the AI testing, birds were banded, collared, measured and feather samples were taken for genetics and isotopic analysis. Methods used, preliminary results, and recommendations for future work are summarized in this progress report.

INTRODUCTION

The Bristol Bay coastal plain of the Alaska Peninsula supports significant breeding, molting and migrating populations of tundra swans. Tundra swans have been the focus of interest for wildlife biologists both at Izembek and Alaska Peninsula National Wildlife Refuges since the 1970s. The breeding pairs survey, which does not sample south of N57.38° (Dog Salmon River), indicates the northern Alaska Peninsula region supports 6 – 18% of the annual tundra swan breeding population in Alaska (Conant and Groves 2004). The Pavlof area between Herendeen Bay and the Cathedral River supports an average of 170 breeding pairs (2001-2005, Sowl, unpublished data). A small essentially non-migratory population resides near Izembek on the lower Alaska Peninsula (Dau and Sarvis 2002). This population has averaged 416 swans during the breeding season in recent years (2001-2005, Sowl, unpublished data), but the wintering population included 621 swans on 2 February 2006 (Sowl, 2006 memo to Refuge files). Population surveys have been conducted for the Northern Alaska Peninsula (NAKP) in 1983-1987 (Wilk 1988) and 2003 (Savage, in prep) and at Izembek in 1978-2006 and at Pavlof 1984- 2006 (Dau and Sarvis 2002; Sowl, 2001-2006 memos to Refuge files). Migrating swans have been monitored with other waterfowl on the Naknek River in spring (see Lapinski and Williamson 2005 for latest report). Aerial surveys by Izembek and Alaska Peninsula/Becharof National Wildlife Refuge (NWR) staff have identified key areas used by breeding and molting swans. On the NAKP, Wilk (1987) reported flocks of more than 50 birds commonly observed between Egegik Bay and the Naknek River during July. On the Lower Alaska Peninsula, Refuge staff usually observed molting flocks of less than 25 birds on Izembek NWR and flocks of less than 40 birds in the Pavlof area (Chris Dau, *pers. comm.*).

Birds breeding in western Alaska migrate down the Pacific Flyway (Moermond and Spindler 1997, Ely et al. 1998). From 1977 to 1996, 608 swans were collared in the Izembek area and in 1985-86, 102 swans were collared near Pavlof. Collar resightings for a few Izembek birds that did migrate and for the Pavlof birds include Alberta, Washington, Oregon and California with stragglers to New York and Baja California, Mexico (see Dau and Sarvis 2002). Use of the Pacific Flyway for NAKP was confirmed by resighting records from 58 local birds collared from 1983-85. Fourteen of these birds were resighted or found dead on the southern Kenai Peninsula, Alaska, in Alberta, British Columbia, Oregon, Washington, and California. This Pacific Flyway connection was reconfirmed from 2004 to 2006 when several tundra swans collared in Washington and Nevada were sighted on the Naknek River during spring migration.

In spring 2006, tundra swans in Alaska were identified as a priority species for sampling for the highly pathogenic Asian avian influenza virus (HPH5N1 - AI) because their distribution overlaps with far eastern Asia, and because of the seemingly high susceptibility of swans to HPH5N1 as evidenced by the prevalence of swans in AI die-offs in Asia and Europe (Interagency Avian Influenza Working Group 2006). Tundra swans have also been identified as a high priority species for sampling for avian influenza in the Pacific Flyway, where sampling of wintering birds will begin in 2006. Many tundra swans winter in California, a state particularly at risk to an AI outbreak because of a large human population and poultry industry. The Bristol Bay region may also be important for monitoring AI because mixing may occur here between birds migrating up the Aleutian chain from Asia and eastward across the Bering Straits from Chukotka.

Because the AI sampling effort called for birds to be captured, Refuge staff proposed to band and collar birds. The Alaska Peninsula effort was incorporated into a statewide marking effort with broader population goals that was being coordinated by USGS-ASC Wildlife Biologist Craig Ely. Although the resident Southern Peninsula population has been studied intensively and some marked birds were recovered from migratory swans collared on the Alaska Peninsula during the 1980s, little is known regarding the local, regional, flyway and international movements of Alaska Peninsula tundra swans. By collaring swans and by taking feather samples (used for genetic and isotope analysis) on the Alaska Peninsula, we hope to increase information in the following areas:

- Migratory paths between molting, staging, breeding, and wintering areas of Alaska Peninsula tundra swans.
- Timing of migration for various populations, age groups, breeding vs. non-breeding birds.
- Delineate populations of swans. This will allow us to determine if these populations mix or segregate in staging and wintering areas.
- Ability to easily avoid or target (to be determined) already tested birds during future sampling efforts.
- Ability of the public to identify where birds were marked and potential risk levels for Avian Influenza exposure.

Past recovery rates indicate the likelihood that many birds will be recovered from this effort and much information will be gained. Although the tundra swan is ranked number 11 of 26 priority species on the Avian Influenza priority list, incidences of avian influenza-infected swans in multiple locations throughout Eurasia have been common in the news. Due to the publicity of avian influenza, the public may be more interested in making and reporting observations.

STUDY AREA

The rugged Aleutian Mountains provide the “backbone” of the Alaska Peninsula and separate the Gulf of Alaska from the Bering Sea. Peaks to 2,510 m (Mt. Veniaminof) extend along the southern and eastern edge of the peninsula bordering the Gulf of Alaska. To the south and east the mountains generally fall steeply to the ocean, but on the north and western sides fall more gently to the Bristol Bay Coastal Plain (Plain). Volcanic and glacial processes are still active in the mountains and impact the entire area. Federal lands with Native inholdings dominate land ownership in the mountains and along the Gulf of Alaska coast while State of Alaska and Native Corporations and villages own most of the Plain (Figure 1). The Plain is dominated by low and dwarf shrub communities, tundra, and by a variety of wetland types. Broad, meandering rivers cross the landscape creating diverse wetland habitat in this boundary zone. The Plain is dotted with ponds and lakes of various sizes and depths. Some are connected by creeks and rivers, while others are isolated. Tundra swans are primarily found in moist and wet tundra dominated by sedges, grasses, ericaceous shrubs and in lakes and ponds with emergent vegetation (primarily *Potamogeton* spp., *Myriophyllum* spp., and *Sparganium hyperboreum*).

METHOD

Field Procedures

We proposed to capture 50 swans on lakes connected to the Caribou River and 100 swans on mostly isolated lakes in the northern Alaska Peninsula (NAKP) within a 60 mile radius of King Salmon. Refuge management agreed prior to the project that the Alaska Peninsula NWR Found on floats (N794) would be used at both sampling locations. Prior to the capture, reconnaissance was conducted via Refuge aircraft (the Found at Caribou River and the Husky [N756] at NAKP). During reconnaissance, pilots made low passes over the birds to see if wing molt had begun.

At Caribou River, staff used the Found, a 12' Zodiac with 30 hp outboard, and an 8' Avon with 15 hp outboard (which was substituted on the last day with a 10' Achilles and 30 hp outboard) to corral and capture birds. Staff was able to motor via boat from an established field camp on the river to the capture lakes where they met the Found. The pilot usually landed the plane just before the boats arrived and began corralling the birds. One day the aircraft was not available due to wind and staff used boats to find and capture birds. On the NAKP, staff used the Found and in some instances a contracted Beaver (used to transport crew and boats), a 10.5' Achilles with 15 hp outboard, and a 10.5' inflatable Advanced Elements kayak to corral and capture birds. Usually the pilot landed the Found first, began corralling the birds, the Beaver landed and off-loaded the crew and boats, and the crew assembled the boats. On some days, the Beaver assisted with corralling until the boats were assembled, and then the boat(s) were deployed to capture and corral birds. The kayak was used in especially shallow lakes where it was difficult to motor with the Achilles or the aircraft. On the first capture day on the NAKP, the Found was in transit from Cold Bay and staff attempted to use the Husky on wheels to corral birds from the air.

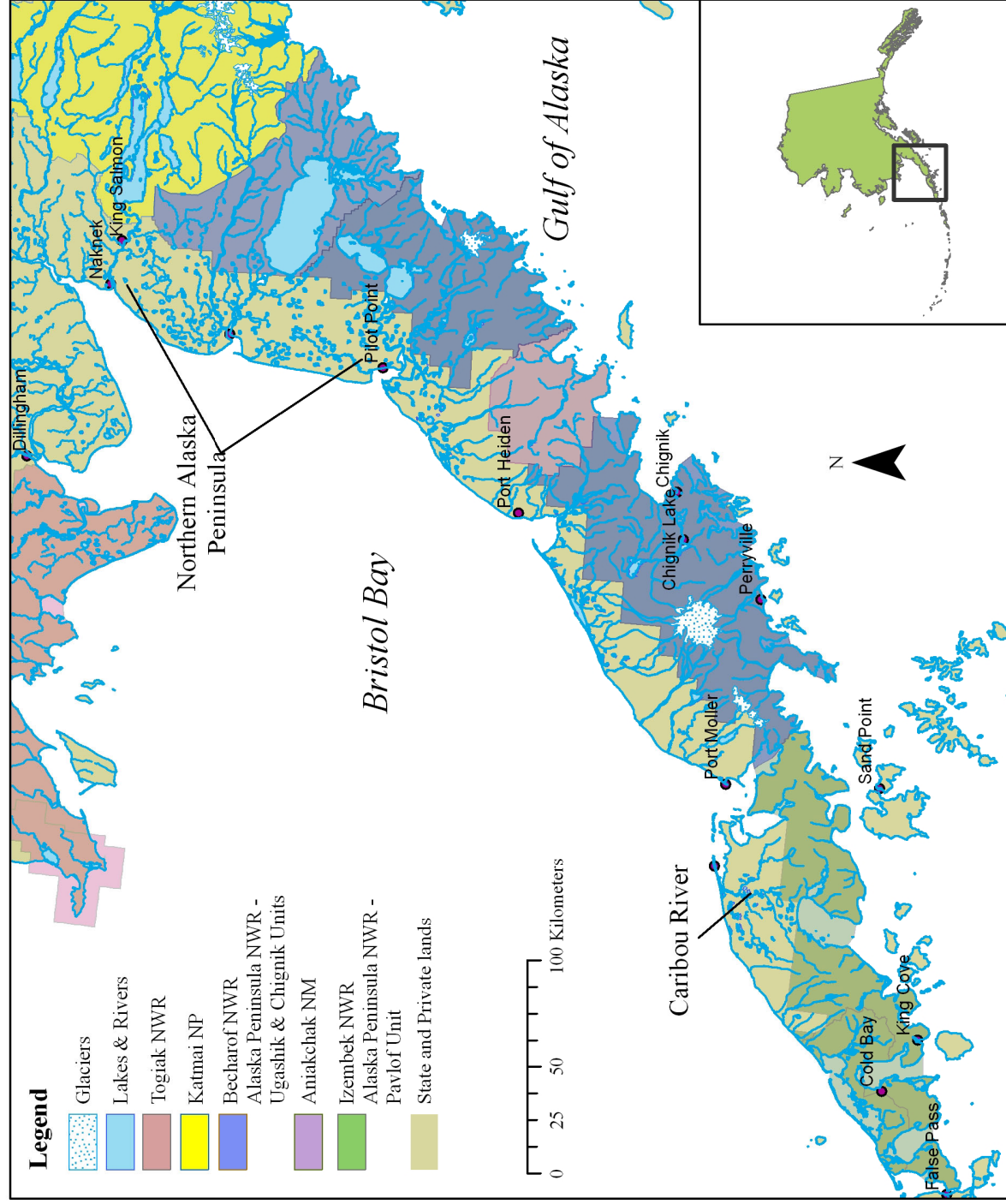


Figure 1. Map of the general study area, Alaska Peninsula Tundra Swan Project 2006.

During capture, we tried to separate off several birds at a time from large flocks so we did not scatter the whole flock. The second power boat at Caribou River was helpful to this end. Birds were captured by powering (on step) toward the birds, slowing down just before reaching the birds, and covering one bird with a large salmon dip net (see cover photo). Usually the momentum of the boat caused the birds to be pulled to the side of the boat where they were lifted into the boat by the driver. The driver held the bird while the capturer taped their legs with electrical tape. The birds were laid in the bottom of the boat on float cushions with their head tucked under their wing. Two to six birds were captured and transported to an on-shore banding station. Once on shore, birds were further restrained using swan “vests” designed by Dau during previous swan captures (Figure 2).



Figure 2. Photo of tundra swans restrained in vests, Alaska Peninsula Tundra Swan Project 2006.

Captured swans were aged (birds showing remnant gray feathers on head or neck were aged second year, others were aged after hatch year), sexed (using cloacal exam), measured (mid-toe, total tarsus, culmen, skull, lore length and width, and 9th primary to 1/10 mm), weighed, and fitted with USGS metal leg bands and blue plastic neck collars engraved with white numbers (T400 - 500 series at Caribou River and P700 series at NAKP). Banding occurred under the authority of the Izembek Station permit at Caribou River and the Alaska Peninsula Station permit at NAKP. A photo was taken of the collar number and the face to further describe the bird. Feathers were collected from the head, breast, and wing coverts for genetic and isotopic studies focused on identifying population structuring and wintering affinities in Alaska’s tundra swans. Genetic samples will also be able to confirm sex. Cloacal swabs were taken from each captured swan and placed into National Wildlife Health Center (NWHC) media in vials. Vials were temporarily placed in a cooler with ice packs and at the end of the day transferred to dry nitrogen shippers for transport back to Anchorage for cataloging before being sent on to the

NWHC. NWHC protocols were followed for protection of field personnel as well as for collection, storage, and shipping of samples. Aviation Management (formerly Office of Aircraft Safety) office procedures were followed for decontamination of materials that were transported in aircraft. A gear list for the technical gear is provided in Appendix I. Budget costs for this project can be found in Appendix II.

Data Summaries

This report will provide a basic summary of methods, capture results, and recommendations for future work. Dau (USFWS, MBM) will be using the morphometric information and the lore photos to compare with birds from other areas across Alaska. Pearce (USGS, ASC) will conduct the genetic analysis. Isotopic analysis will be conducted at University of Alaska-Anchorage under contract to ASC. NWHC will report on results of the Avian Influenza testing. Each refuge will produce banding schedules to submit to the USGS Bird Banding Laboratory. All reported band recoveries will be summarized in a future annual memo or report.

RESULTS & DISCUSSION

Reconnaissance

Preliminary reconnaissance at Caribou River determined the majority of birds to be on Lake B. After the first day of banding, swans scattered and daily reconnaissance was conducted to track bird movements. Results of preliminary reconnaissance for NAKP are found in Appendix III. Multiple concentrations of 20 to 50 and more than 50 birds as reported in Wilk (1987) were not found between Egegik and Naknek this year. Pilot Cox was asked to record flocks of more than 15, however with the paucity of flocks, he recorded flocks as small as seven birds. Information on lake depth was updated as attempts were made to visit some of the lakes.

Capture Summary

Maps of Caribou River and NAKP capture locations are provided (Figure 3 and 4). On Caribou River, 64 birds were captured (Table 1) of which two birds died and were collected. Mortalities occurred shortly after capture and their probable cause was unknown. AI samples were taken from 63 birds included one of the mortalities; the other mortality will be sampled in the lab. Photos were taken for 60 birds and feather samples were taken from 44 birds. On NAKP, 95 birds were captured (Table 1) and 94 AI samples were recorded (one sample was either not taken or was not recorded). This included 91 adults and four cygnets (all male). There were no mortalities. Photos were taken for 84 birds and feather samples were taken from 76 birds.

Table 1. Summary of tundra swan banding locations, dates of capture, and number of captures by sex, Alaska Peninsula Tundra Swan Project 2006.

Lake Name (Recon WP)	Latitude	Longitude	Date	Female	Male	Undet	Total
Caribou River (Lake B)	55.8456	-161.3688	7/16/2006	9	6		15
Caribou River (Lake C)	55.7894	-161.3755	7/17/2006	3	2		5
Caribou River (Lake A)	55.8605	-161.3443	7/18/2006	17	13		30
Caribou River (Lake B)	55.8456	-161.3688	7/19/2006	8	6		14
Caribou River Total				37	27		64
NAKP, near Becharof Lake (WP 10) Loc 1	57.9709	-156.9234	7/21/2006		2		2
NAKP, near Becharof Lake (WP 10) Loc 2	57.9588	-156.9362	7/21/2006	4	4		8
NAKP, near Becharof Lake (WP 10) Loc 3 (Same pond as Loc 1)	57.9655	-156.9028	7/21/2006	1	5		6
NAKP, Smelt Lake (WP 3)	58.5228	-156.9535	7/22/2006	20	14		34
NAKP, Leech Lake (WP 13)	57.9158	-157.3093	7/23/2006	10	8		18
NAKP, Lake 1 (WP 1)	58.4243	-157.4340	7/24/2006	10	5	1	16
NAKP, Pike Lake (WP 9)	57.6641	-157.3855	7/25/2006	3	3		6
NAKP, Pike Lake - East	57.6547	-157.3787	7/25/2006	5			5
NAKP Total				53	41	1	95

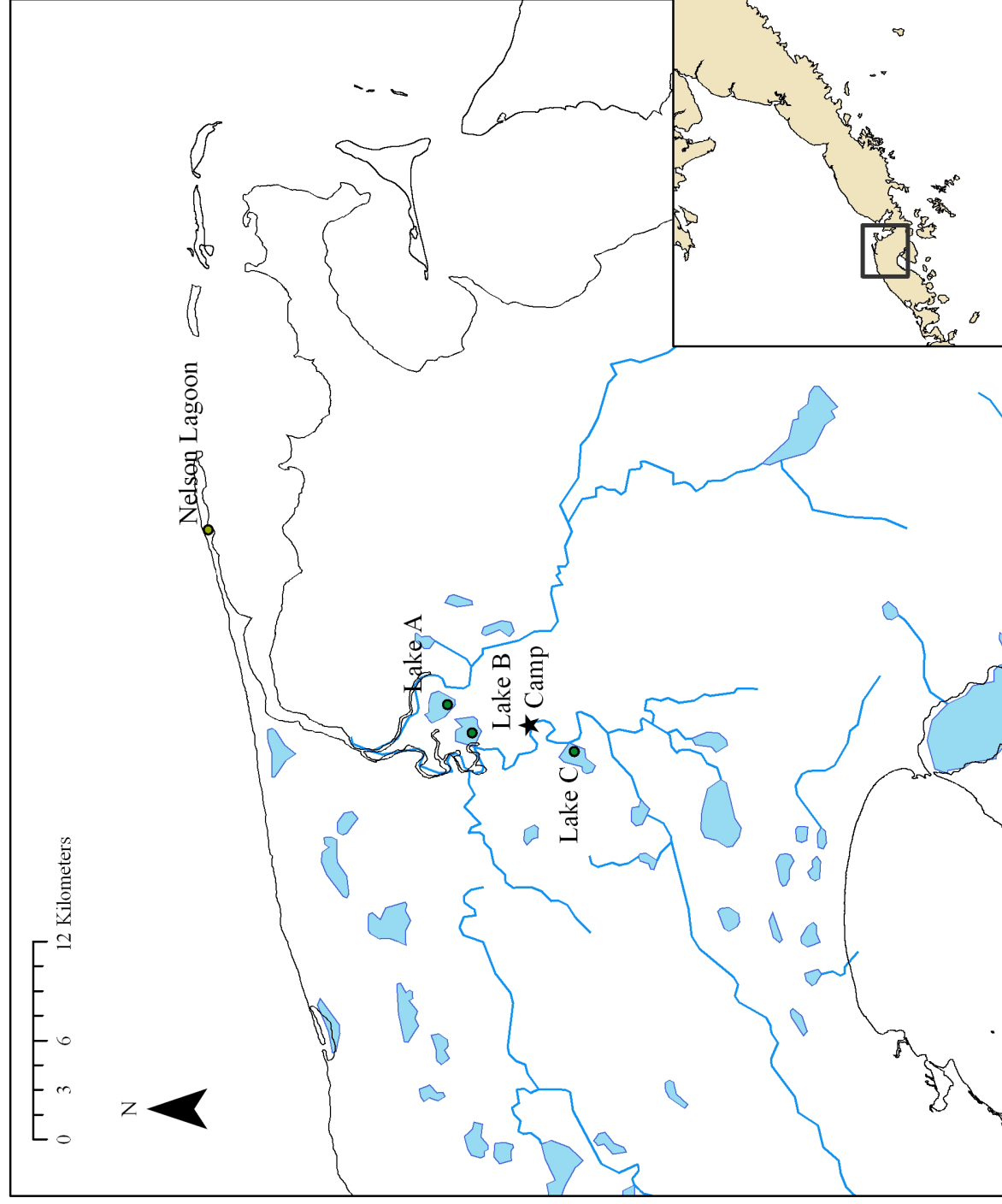


Figure 3. Detailed map of the Caribou River capture locations, Alaska Peninsula Tundra Swan Project 2006.

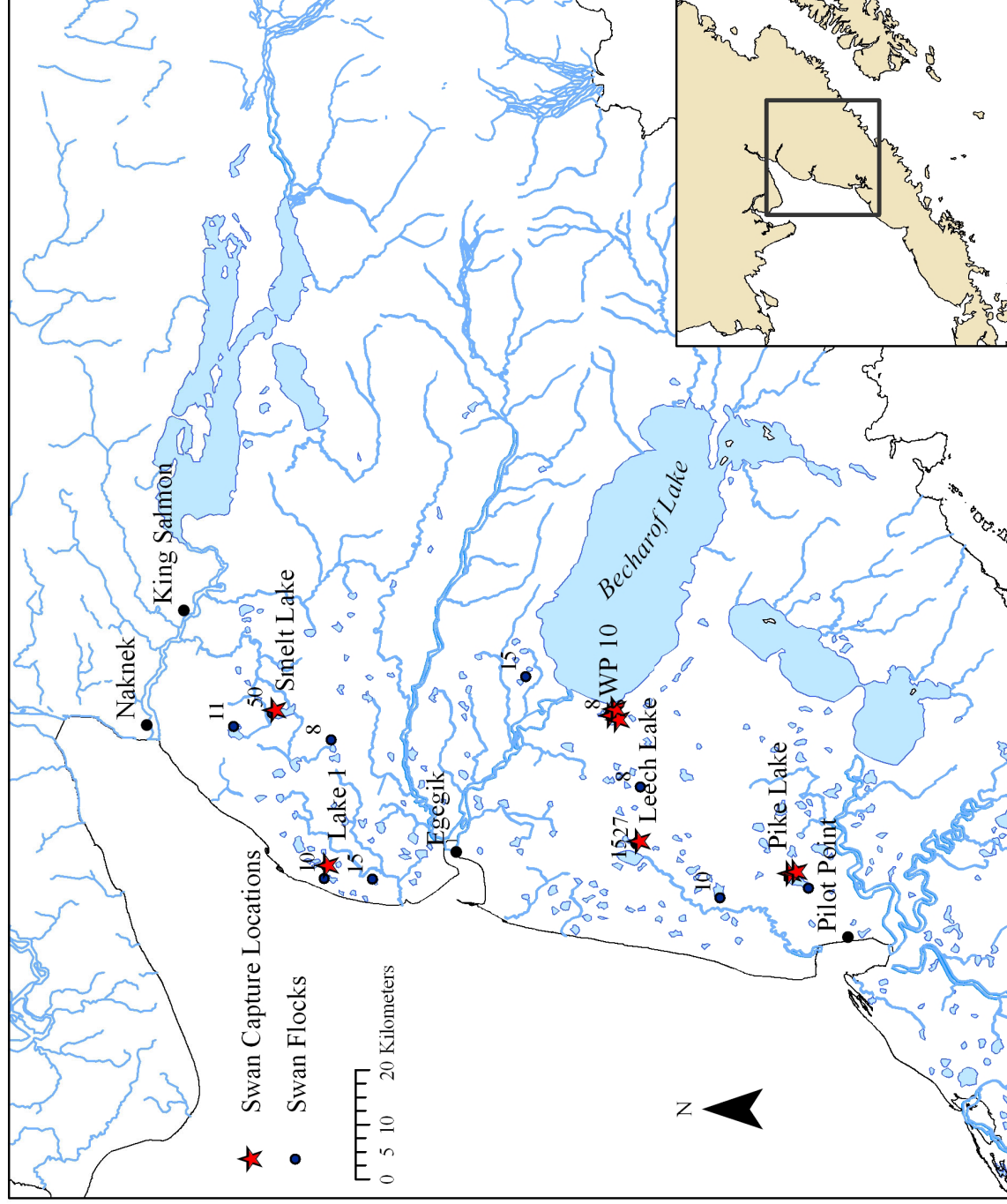


Figure 4. Detailed map of flocks found and capture locations for the Northern Alaska Peninsula, Alaska Peninsula Tundra Swan Project 2006.

Preliminary means and standard deviations were calculated for the morphometric data by sex and by location (Table 2). Although we are confident in most of the sex determinations, we consider these data preliminary until sex can be confirmed by genetic samples. Except for lore measures (which were highly variable), at each location males measured on average larger than females, however there was much overlap. It is interesting to note that skull, mass, mid toe and total tarsus means were larger per sex at Caribou River versus NAKP. Ninth primaries were longer at NAKP, but this is not surprising since dates of capture were later at NAKP. At Caribou River, 12 of 64 (18.8%) birds were second year birds, while on NAKP only 7 of 91 (7.7%) adult birds were second year birds.

Table 2. Means and standard deviations of tundra swan morphometric data by sex and location, Alaska Peninsula Tundra Swan Project 2006. Results are preliminary until sex is confirmed by genetic analysis.

Data	NAKP		Caribou River	
	Female	Male	Female	Male
Mass, Mean	6.6	7.3	7.2	8.4
Mass, Standard Dev.	0.7	0.6	0.6	0.6
Culmen, Mean	104.4	107.0	104.1	108.9
Culmen, Standard Dev.	5.6	4.4	4.9	4.1
Skull, Mean	70.9	71.4	71.2	75.2
Skull, Standard Dev.	4.8	5.1	4.8	4.5
Lore Length, Mean	23.2	19.6	20.5	22.8
Lore Length, Standard Dev.	11.1	12.2	7.9	8.1
Lore Width, Mean	9.5	8.1	8.0	9.6
Lore Width, Standard Dev.	5.2	5.4	2.5	3.1
Total Tarsus, Mean	132.0	137.4	135.9	142.2
Total Tarsus, Standard Dev.	6.2	5.7	4.3	4.5
Mid Toe, Mean	122.4	128.8	128.3	133.8
Mid Toe, Standard Dev.	5.0	4.4	5.3	4.5
9th Primary, Mean	90.6	93.8	69.3	64.0
9th Primary, Standard Dev.	42.0	39.2	42.0	29.3
Sample size	53*	37	35	27

* Because of caliper malfunction on one bird, NAKP female culmen, skull, total tarsus and mid toe are based on 52 samples.

Observations of Bird Behavior

The tundra swans at each location were initially naïve about capture. When flocks were worked for more than an hour, the birds learned that the aircraft was not capturing them and was thus less dangerous. The birds tended to flock closer to the aircraft and avoid the boats. We suspect that these birds will retain experience about the capture effort into future years and may be more

difficult to re-capture (past experience of Refuge staff during swan capture operations; Izembek NWR Annual Narrative Reports, 1978-1996; USFWS 1985). They are also more likely to avoid lakes they were captured on previously.

During capture some birds were aggressive, while other birds were relatively passive. Large males tended to be more aggressive than females. It was necessary to remove swans from the restraining vests and their legs from the electrical tape during processing. Sometimes the birds would struggle and subsequently cause damage to rain gear or skin. Some birds were anxious to get away, while others remained passive even when they were placed on the shore for release. Some would lie on the shore and some birds even droop their necks and heads so banders had to ensure that their nostrils were not in the water. After a period of a few to 30 minutes, the birds would come out of their passivity and swim away. Sometimes observing another bird swim away would prompt action. Banders were careful to monitor that birds were not becoming overheated.

Trip Narrative

July 12: Izembek Pilot Richardson picked up the Alaska Peninsula NWR Found on floats in King Salmon and flew to Cold Bay. Two bear barrels were also transported in the Found. En route Richardson conducted reconnaissance of the Caribou River cabin site.

July 13: Pilot Richardson conducted a reconnaissance of the Caribou River lakes. Almost all of the swans, 200-300, were concentrated on Lake B. Pairs and individuals were scattered.

July 15: Wildlife Biologist Sowl and Biological Technician Roush were transported in the Found to Caribou River and commenced field camp set up. Pilot Richardson made two more flights with the Found to transport camp and boat gear. Wildlife Biologist Savage and Biological Technician Sesser departed King Salmon in Branch River Air Cessna 206 and flew to the Caribou River field camp (approximately 2.3 hours). USGS-ASC Wildlife Biologists Ely and Terenzi flew from Anchorage to Cold Bay via Pen Air. They were transported to Caribou River via the fourth and final trip of the Found. Round trip from Cold Bay to Caribou River via the Found was 1.3 hours.

July 16: Although it was fairly windy, capture proceeded on Caribou River Lake B. Approximately 80-100 swans were observed on the lake, but they were in scattered flocks and some had to be driven off the shore. Due to crew inexperience, some flocks were scattered and some birds headed onto the tundra. The Found was also less maneuverable on the lake due to windy conditions. We captured 11 birds on the lake and four birds en route back to camp on the river.

July 17: The Found could not take off from Cold Bay due to high winds. Crew used the boats to scope out birds. Crew also hiked onto a bluff above the river where they spotted five birds. The birds also spotted the crew and walked away from the crew across the tundra in the opposite direction (we assume these birds had prior experience with the capture effort on Lake B). They crossed the river and entered Lake C where they were captured.

One bird died and was collected. It is possible this bird was overstressed by extensive walking over the tundra. The carcass was submitted to NWHC via Anchorage for necropsy.

On the NAKP pilot Cox conducted reconnaissance in the Refuge Husky.

July 18: Although it was rainy, we worked a flock of approximately 50 birds on Lake A and captured 30 swans. These birds were assumed to have originated from the flocks scattered off of Lake B on July 16. One bird died in the first group that was captured. This carcass was submitted to NWHC via Anchorage for necropsy. Capture operations were terminated when it was decided the remaining swans, about 15 birds, were too tired for further disturbance.

On the NAKP pilot Cox conducted reconnaissance in the Refuge Husky.

July 19: Although it was fairly windy, we returned to Lake B and captured 14 additional birds. Winds were 10-20 mph from the northeast. Swans with collars were mixed with swans without collars, increasing the difficulty of capture operations. Other swans headed out onto the tundra. At the end of the day, it was decided that it was no longer practical to continue capture operations on this lake system. No additional flocks that had not been exposed to capture operations were observed in the area. Since the capture goal had been met, we decided it was time to transfer to King Salmon.

July 20: Pilot Richardson transported three loads of camping gear, Roush and Sowl to Cold Bay. Branch River Air Beaver transported Ely, Savage, Sesser, and Terenzi to King Salmon. As there was a head wind, the flight took over three hours.

On the NAKP pilot Cox conducted reconnaissance in the Refuge Husky.

July 21: The Found and Cold Bay crew were delayed by fog. They arrived in King Salmon about 1700. Terenzi entered Caribou River data into the NWHC database. Other crew members organized logistics for the NAKP effort. About noon Ely, Savage, Terenzi, and Biological Technician Watts traveled to two lakes near Becharof Lake outlet via 4-W Beaver. Pilot Cox in the Husky attempted to corral birds from the air; however the birds were not very responsive to the aerial hazing. We tried to tow the kayak with the power boat including three people across the lake, but it was too slow and the flock of six escaped onto the tundra. We captured four on the tundra, but having shed all our gear including electrical tape, were not able to restrain two of the four birds until help arrived. Unwittingly, we crossed the isthmus to the neighboring lake and were disoriented until the Beaver relocated across the lake. Eventually, ten adults, plus two adults with a brood of four were captured. One AI sample was not taken or was not recorded for a total of 15 AI samples and 16 birds banded (cygnets were banded but not collared).

July 22: Today was the hottest capture day with thunder heads and distant rain showers threatening. Crew members Savage, Sesser, Terenzi, and Watts traveled to Smelt Lake via 4-W Beaver while Ely and Sowl traveled with Cox in the Found. Cox had to drive birds off the shore using low passes. Although the lake tended to be shallow, we were able to capture 34 birds. The kayak was useful in the shallow areas. Cox with Found had to return to King Salmon for fuel, but we were able to keep the birds corralled during the 40-minute interval with the Achilles.

Roush remained in King Salmon and entered morphometric data for Caribou River and all data for NAKP into the database.

July 23: The weather was rainy with moderate winds. Crew members Roush, Sesser, Terenzi, and Watts traveled to Leech Lake via Branch River Air Beaver while Ely and Savage traveled with Cox in the Found. Despite the leeches and shallow water, 18 birds were captured. The kayak proved useful in the shallow water. Watts captured one bird on shore.

Sowl remained in King Salmon and entered and proofed data and sorted and labeled the feather samples.

July 24: Despite crew change over, capture proceeded smoothly. Ely departed for Anchorage in the morning while USGS-ASC Wildlife Biologist Pearce arrived from field work in Dillingham. Crew members Roush, Sesser, Terenzi, and Watts traveled to a Lake 1 via 4-W Beaver while Pearce and Sowl traveled with Cox in the Found. The lake was small but deep and 16 birds were captured. The crew completed work by 1400 and 4-W Air was not available to pick them up. Because they were close to King Salmon, Cox ferried all staff and gear home in the Found. Terenzi departed for Anchorage on the evening flight.

Savage remained in King Salmon and entered data and updated budget.

July 25: Weather was rainy most of the day. Our intended lake was Lake #8 with 10 birds, but it proved too shallow for aircraft landing. Lake #9 (Pike Lake) was nearby so we targeted it. Crew members Roush, Savage, Sesser, and Watts traveled via 4-W Air Beaver while Pearce and Sowl traveled with Cox in the Found. We captured the six available birds, decontaminated the boats, and move to an adjacent lake also with six birds. One bird proved to be capable of flight, so five were captured for a total of 11 birds. Pearce departed for Anchorage on the evening flight. Because we had exceeded our combined goal of 150 birds, and the remaining known flocks were small, we decided to terminate our sampling effort.

July 26: After waiting in the standby line for eight hours, Roush and Sowl finally departed King Salmon for Anchorage via Alaska Airlines. The flights into Cold Bay were also full, so they spent three more days in Anchorage before returning to Cold Bay.

RECOMMENDATIONS

Staff members thought the project was a success and are interested in repeating the effort next year. The following insights and recommendations are made for the benefit of improving future efforts and results.

- If funds are available, fund a project to record tundra swan collar observations on the wintering areas.
- The local logistical expertise of Refuge staff and technical expertise of USGS staff made for an efficient and effective capture team. We recommend this combined effort for future work.
- Two power boats are recommended at both locations. The kayak was only useful in shallow and small lakes. The boats need to be off-loaded distant from the flocks and too much paddling effort is needed to get the kayak in position to be useful. The new Izembek Achilles with a 20-25 hp outboard and a 14' foot Zodiac with a 30 hp motor are recommended at Caribou River. The varnished wooden floorboards of the new Izembek Achilles are too slick and need to be roughened. Another Achilles with 10 to 15 hp engine of approximately the same size is recommended for the NAKP. Short-shaft outboards are also recommended. Although the 10.5' Achilles is rated for only 10 hp outboard, the staff felt with the crew of two the larger engine is needed and no safety concerns occurred.
- At least two and preferably more, experienced boat operators are needed for the project. Previous experience with driving molting waterfowl is also valuable.
- Most crew members were outfitted with inexpensive rainwear as primary PPE (in addition to gloves and eye protection). Swans frequently kicked banders and their claws often tore raingear. Banders should be prepared to repair raingear in the field or carry a spare set. Rubber gloves were difficult to put on in the field when hands were wet and also were frequently torn by the birds. Bird handlers did make frequent use of the germicidal (alcohol gel) scrub and wipes.
- Digital, non-digital, and even water-resistant calipers failed frequently due to water and sand. Banders should explore optional brands for future use. Also investigate calipers for measuring larger-sized objects. Similarly, the digital scales were sensitive to rain and water associated with banding.
- A water-resistant camera (such as the Pentax Optio WP) is preferred for taking pictures.
- Standard pliers were the preferred banding pliers with snap ring pliers available for spreading bands and two pairs of needle nose pliers available for further band manipulation. The specially purchased size 9 banding pliers from Gey Band and Tag

Company were not preferred by most banders due to their large size, heavy weight, and long handles.

- Swan vests work well for restraining birds on land. Alaska Peninsula NWR crew should make some vests to supplement the Izembek supply. Izembek should make additional vests as Velcro was wearing out on the old vests. Also, several males were too large for the existing vests, so a few larger vests should be made.
- Discuss with manufacturer of swan collars about a smaller collar diameter for the pre-formed collars.
- Consider taking blood samples from the swans to test for lead levels.
- We used approximately 6-12 gallons of boat gas each day at Caribou River. Make sure sufficient stores of gas and gas cans are available for project. Recommend boat cans with fuel lines that are interchangeable between the different motors that are used.
- A shelter for cooking and drying out sampling gear is highly recommended for Caribou River. We had permission to use a cabin; however it is in poor condition. We placed a tarp over the roof to provide additional shelter. A weather port may be an alternative but would require at least one additional flight to the field site.
- A more portable electric fence charger and smaller fence enclosure should be used for the Caribou River camp site.
- Investigate additional capture sites on the southern Alaska Peninsula, particularly around Morzhovoi Bay and Big Lagoon.
- A formal staff briefing would be useful to review capture procedures, PPE, decontamination procedures, safety issues, and banding procedure especially if new staff is recruited in future years.

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Appendix I. Gear list, Alaska Peninsula Tundra Swan Project 2006.

USGS leg bands, size 9 (check supplies well in advance of the field season)
Plastic collars (available from past efforts and new ones ordered from www.spinnerplastics.com)
Collar glue (available from Image Plastics, Anchorage but purchase well in advance due to hazmat shipping of new orders via slow barge)
Banding pliers (standard pliers)
Snap ring pliers (for spreading)
Needle nose pliers (2 pair)
Calipers (to at least 170 mm, larger would be better), waterproof
Battery for calipers
Wing-rule (while molting, only needed < 300 mm)
Rite-in-rain data sheets
Pencils
Digital scale to 15 kg (Pesola scale as back-up)
Bag to hold bird while weighing
Battery for scale
AI sampling swabs
AI sampling vials
Small cooler
Chemical ice packs
Liquid ice packs
Nitrogen shipper
Ziploc bags, gallon and quart
Sharpies, waterproof marker
Water-resistant camera
Camera Battery
Water-resistant GPS
GPS Battery
Lubricant for calipers
Pelican case (banding kit)
Tarp for laying out banding equipment (approximately 1 x 1.3 m), preferably light colored

Dip nets, large (king salmon size)
Electrical tape (four rolls)
Swan restraining vests
Floating seat cushions

Eye protection
Gloves
Raingear
Hip or Chest Waders
Respiratory protection (if needed for level II)
Kevlar sleeves

Germicidal scrub (Alcohol gel)
Antiseptic for scratches
Container with lid for PPE
Knee pads for boat operator and netter

Bleach
Spray Bottles/Backpack sprayer
Germicidal wipes
Buckets
Garbage bags
Biohazard bags
6 mm plastic bags (may be provided by Aircraft Management)

Boat, inflatable w/ floor boards
Outboard motor
Spare prop
Gas and motor boat oil
Gas tank and line
Spark plug wrench
Spark plug, spare
Paddles, oars
Anchor and/or bow line
Float coats

First aid kit
Survival gear
Camping gear (Caribou River or other field camp)

Appendix II. Expenses for the Alaska Peninsula Tundra Swan Project 2006.

Caribou River (70160-1680-LVBD-SOWL)

Achilles, Accessories, & Freight	3,379	
Outboard Motor & Freight	3,063	
Banding Equipment (pliers, calipers)	333	
Camping Gear & Food	5,013	
PPE & Raingear	1,089	
Fuel pump, filters, etc for Found	790	
TOTAL EQUIPMENT AND SUPPLIES		13,667
Ferry Found between King Salmon & Cold Bay, 7/12 & 7/21 (6.7 hr)	556	
Reconnaissance in Found, 7/13 (1.8 hr)	149	
Camp deployment and breakdown, 7/15 & 7/20 (9.1 hrs)	755	
Aircraft support for captures, 7/16-7/19 (6.1 hrs)	506	
Charter from Caribou R. to King Salmon	3,360	
Travel & per diem, King Salmon & Anchorage (pilot & 2 staff)*	4,932	
Avgas (\$5.52/gal)	Refuge	
TOTAL TRANSPORTATION AND TRAVEL		10,259
Biological Technician, GS-6, salary for 3 pp (logistics + capture)	3,941	
Biological Technician, GS-6, overtime for 3 pp - 49.5 hr	1,219	
Wildlife Biologist, GS-11, overtime - 45 hr	1,359	
TOTAL SALARY AND OVERTIME		6,519
GRAND TOTAL		30,445

* Includes pilot's checkride in Anchorage

Appendix II, con't. Expenses for the Alaska Peninsula Tundra Swan Project 2006.

Northern Alaska Peninsula (70106-1680-LVBD-SAV)

<i>Achilles</i> SPD 106 including shipping	2,012	
Achilles SPD 112 (on sale, including shipping)	2,380	
Advanced Elements Kayak, Paddle	495	
Banding Pliers, #9 - 2 pair	110	
Camping Gear, Caribou River - AKPen Staff	Refuge	
Raingear - AKP staff, Micropur (water purification)	175	
TOTAL EQUIPMENT AND SUPPLIES		5,171
Transport to Caribou River, 7/15	1,872	
Commercial support via Beaver, 7/21 - 7/25	6,925	
Reconnaissance 6.9 hours - Refuge Huskey	607	
Refuge aircraft support, Huskey and Found, 7/21 - 7/25	1,434	
Avgas for Found and Husky	Refuge	
Field Per diem, Caribou River (2 staff)	36	
TOTAL TRANSPORTATION AND TRAVEL		10,874
Pilot, GS-12 overtime 21 hours	654	
Biological Technician, GS-7 overtime 24.5 hours	551	
Biological Technician, GS-5 overtime 38.25 hours	695	
Wildlife Biologist, GS-11 overtime 42.75 hours	1,303	
Biotech base salary	Refuge	
TOTAL SALARY AND OVERTIME		3,203
PPE: Gloves, Masks, Glasses, Germicidal scub	USGS	
GRAND TOTAL		19,249

Appendix III. Results of reconnaissance on the NAKP, Alaska Peninsula Tundra Swan Project 2006.

DATE	WPT	LAT DD	LONG DD	NOTE	BASIN	FLOCK SIZE	FLIGHTLESS
7/17/2006	1	58.42433	-157.43400	EW good, 29 SW AKN		15	Y
7/17/2006	2	58.42667	-157.03833	good lake, 19 S AKN		8	Y
7/17/2006	3	58.52500	-156.96150	good lake, 13 S AKN (Smelt Lake)	open	50	Y
7/18/2006	4	58.34750	-157.46917	good lake, 33 S AKN, 9 W Egegik (too shallow)		15	Y
7/18/2006	5	58.42650	-157.47433	shallow? 30 S AKN 15N Egegik		10	Y
7/18/2006	6	58.58733	-157.01033	shallow? 11 S AKN		11	Y
7/20/2006	7	57.91850	-157.31633	big lake, 15S Egegik, 7 W Jensen (Leech Lake)	open	27	Y
7/20/2006	8	57.77533	-157.46983	11 N Pilot Pt (too shallow)		10	Y
7/20/2006	9	57.63150	-157.42600	Pike Lake, good, 5 from Ugashik		7	Y
7/20/2006	10	57.97133	-156.92033	3 S Becharof outlet, good lake	closed	8	Y
7/20/2006	10	57.97133	-156.92033	on pond next to above, drag boat 30ft to next lake	closed	8	Y
7/20/2006	11	58.11150	-156.81383	smallish NS lake 35 S AKN, light load okay?		15	Y
7/21/2006	12	57.91633	-157.14017	3 mi Jensen		8	Y

Shaded cells indicate lakes that were sampled.