Relation of highly pathogenic avian influenza (H5N1) prevalence to migration patterns of Pacific common eiders nesting in Northwest Alaska

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ABSTRACT To examine relationships between highly pathogenic avian influenza prevalence and migration patterns of Pacific common eiders (*Somateria mollissima v-nigrum)* nesting in Northwest Alaska, we marked 25 adult Pacific common eiders (24 females and 1 male) from the Cape Espenberg breeding area (28 June-7 July 2007) with satellite transmitters and sampled individuals for highly pathogenic avian influenza (H5N1). From each captured eider, we also collected whole blood, serum, and breast, head, and flight feathers for genetic, contaminant, and stable isotope analyses. After transmitter deployment, all marked females remained in the vicinity of Cape Espenberg through October 2007, while the single satellite-tagged male left Cape Espenberg by 31 July and embarked on a molt migration along the northern coast of Alaska, arriving at a molting area in western Canada by 20 August, after having traveled in excess of 1,500 km. As of December 2007, all satellite transmitters remained active (i.e., no deaths or equipment failure) and all but 2 females had migrated to wintering locations away from the Seward Peninsula. By 31 December, 13 of the 25 tagged individuals were located along the southern Chukotka Peninsula, Russia (including the single male), 3 near northwestern St. Lawrence Island, Alaska, and 7 along the coast of the Yukon-Kuskokwim Delta. Given a two-year battery life and our current transmission cycle, we hope to obtain locations for one winter (2007/2008), two autumn seasons, and two breeding/molt seasons. Results from the National Wildlife Health Center indicated that no common eiders or long-tailed ducks sampled at Cape Espenberg were positive for H5N1. Continuing movement data from the satellite transmitters deployed at Cape Espenberg will provide information on migration routes, wintering areas, and seasonal movement patterns for common eiders breeding in northwest Alaska and help clarify population structure among breeding aggregations of Pacific common eiders statewide.

KEY WORDS Alaska, avian influenza, migration, Pacific common eider, satellite telemetry, *Somateria mollissima v-nigrum*

Inter-continental and inter/intra-specific transmission of highly pathogenic avian influenza (H5N1) by migratory birds could have catastrophic impacts on both national and global economies, as well as human health. Modeling the potential spread of H5N1 is dependent on understanding the probability of interacting with birds that are infected, in addition to knowledge of the proportion of populations of interest that frequent areas where H5N1 is present or is likely to occur. However, for many migratory bird species, even basic information on distribution and movement patterns is unknown (Convention on Migratory Species 2005, Nairobi Conference 2005).

Previous studies have shown that populations of Pacific common eiders (*Somateria mollissima v-nigrum*) nesting in northern Alaska (western Beaufort Sea) also winter in northeast Asia (Petersen and Flint 2002). Further, there is evidence that these birds occur in large flocks while staging during migration and just prior to nesting, potentially leading to the spread of H5N1 among individuals. In an interagency avian influenza strategic plan developed for Alaska, the Pacific common eider was included as a priority species for H5N1 monitoring based on, 1) known seasonal movements between Alaska and Asia (Interagency Avian Influenza Working Group 2006), and 2) the potential for affecting human health (eiders are an important subsistence food in Alaska; Wentworth 2004).

Based on our current knowledge of distribution patterns of other subspecies of common eiders in Canada and Europe, as well as other Pacific common eiders breeding in northern and western Alaska, we hypothesized that common eiders nesting on the Seward Peninsula winter in both Russia and western Alaska. If so, and if H5N1 were to become present in northeast Asia, these common eiders could potentially contact infected individuals at wintering areas and translocate H5N1 to other eider populations and species in Alaska. Thus, given common eiders potential role as a migratory host to H5N1, we sought to better understand their non-breeding distribution in northeast Asia and migration patterns within Alaska.

Our study was designed to integrate information on the historic and contemporary relationships among populations of common eiders based on yearly movement patterns and genetic data, and to evaluate the likelihood of H5N1 spreading amongst breeding birds in Alaska. The specific objectives of our study were threefold: 1) to determine the relative potential for exposure to avian influenza based on movement patterns, 2) to evaluate historic movements using genetic analyses and thus, the probability of long-term intermixing among eider populations, and 3) to determine the probability of transmission among individuals subsequently moving to different areas and thereby spreading the virus, based on contemporary movement patterns.

Herein, we report the preliminary results for Northwest Alaska, including H5N1 testing and current bird movement patterns.

STUDY AREA

Our study was conducted at Cape Espenberg (66°30'N, 163°30'W), Alaska; the northern-most tip of land on the Seward Peninsula (Fig. 1). The Cape is composed of a series of oblong ponds and marshes bordered to the north and south by sand-dune beach ridges. Eiders primarily nest in the low-lying marshes of Cape Espenberg, along lake and pond shores. A single eider colony with 25 nests was identified on one island (total area = 0.004 km^2) on an inland lake. This island was previously termed "Eider Island" by Schamel et al. (1999) and was surveyed in 1976, 77, and 1994-1998 (see Fig. 1 and Appendix 1).

METHODS

We searched the perimeter of all ponds and surrounding areas in the interior of Cape Espenberg (over a region comprising ~13 km^2) for nests of Pacific common eiders between 28 June and 7 July 2007.

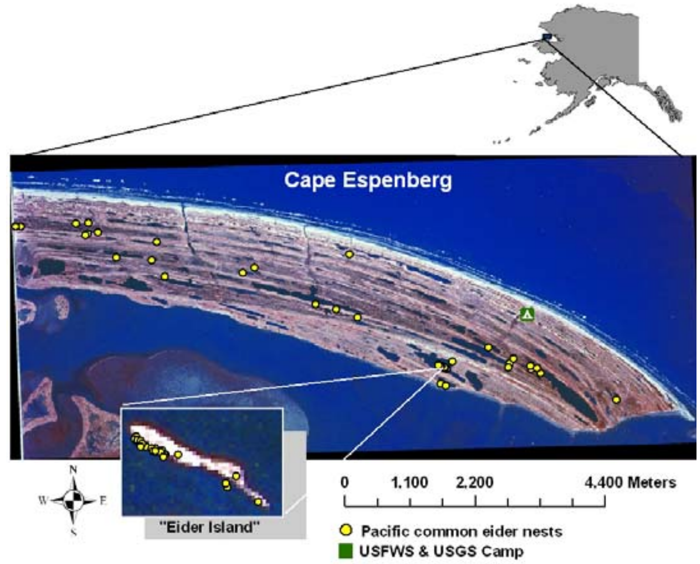

Figure 1. Locations of female Pacific common eider nests found at Cape Espenberg, Alaska (28 June-7 July 2007). 25 of the 54 total nests were found on a single inland island ("Eider Island") in the southeast region of the Cape.

During eider searches, we also recorded locations of other waterfowl and loon nests found. All searches were conducted on foot, with the aid of a trained dog. Our initial searches were focused on historical common eider nesting locations (J. Schmutz, unpub. data 2000-2002) and then expanded to all unsearched areas surrounding major wetlands. Upon finding a common eider nest, we recorded the GPS location, clutch size, distance to water, nearby habitat features, and gathered a sample of eider contour feathers (~10$^+$/nest) for genetic analyses (Pearce et al. 1997). We used egg-flotation and candling data (Weller 1956) and assumed a 26 d incubation period, to calculate age of eider eggs and determine nest initiation dates. We returned to all eider nests within 1-5 d of discovery to trap hens and assess nest status/fate. We captured Pacific common eiders using mist-nets (Fig. 2) and bow-net traps (Salyer 1962) on or near nests (28 June- 6 July 2007). Each captured eider was held in a portable cat-carrier until surgery. Eiders were placed under anesthesia within 1-3 h of trapping and implanted with satellite transmitters (platform transmitting terminals or PTTs) by a team of veterinarians in the field (Alaska Wildlife and Wildfowl Conservation, Grand Cane, Louisiana). Veterinarians followed standard implant techniques developed by Korschgen et al. (1996), and modified by Petersen et al. (1995, 1999), and others.

Figure 2. Large eider capture set-up at Cape Espenberg, Alaska. Two mist-nets were joined end on end and stretched from one side of a lake to the other. The double-net was hung from a parachute cord 'clothesline' strung between steel conduit poles on each side of the lake. Metal shower-curtain rings, placed every 2-3 m, were used to attach the mist-net to the parachute cord.

Figure 3. A female common eider recovers after satellite transmitter implantation surgery at Cape Espenberg, Alaska, 2007 (photo courtesy of Corrine Brown DVM).

While recovering from anesthesia, all implanted eiders were marked with U.S. Geological Survey (USGS) metal bands and sampled for avian influenza (1 oral-pharyngeal and 1 cloacal swab each). Additionally, 5 mL of blood was drawn via jugular venipuncture, and a sample of breast, head, and flight feathers for genetic, contaminant, and stable isotope analyses were collected from each bird. All avian influenza and serum samples were frozen and stored in portable liquid nitrogen shippers in the field. Other species opportunistically captured during the course of eider trapping were also sampled for avian influenza.

All satellite transmitters were programmed to transmit one pulse every 60 s for each 5 hr transmission period, with 72 hrs (3.2 d) between transmissions. This transmission cycle was scheduled to begin at the time of deployment (1-6 July) and last through ~27 Oct. 2008, resulting in a total of 750 potential PTT hours of transmission. Under ideal conditions, this would include two autumn seasons, two breeding/molt seasons, and one winter (2007/2008). However, given historical failure rates, we expected only a few transmitters (~12 of 25) would reach this goal.

All satellite transmitters were equipped with sensors to monitor the body temperature of individuals (to indicate survival) and battery voltage (to indicate the likelihood of future transmitter failure). Data collection began immediately after transmitter deployment, but future data analysis will only include locations beginning 14 d (2 wks) after deployment, in order to minimize the effects of surgery on locations and subsequent survival. Data were received through the ARGOS data collection and location system in Landover, Maryland (Service Argos 2001). We used the Douglas Argos-Filter Algorithm (Douglas 2007) in addition to standard location-processing services to assess the plausibility of every ARGOS location according to: 1) distances between consecutive locations, and 2) rates and bearings among consecutive movement vectors.

RESULTS

Nesting

We located a total of 54 common eider nests, 44 of which were active, and 46% of which (25 of 55) were located on "Eider Island" (Fig 1.). Average clutch size of 'completed' common eiders nests (i.e., those past the laying stage) was 4.61 eggs (SE ± 0.22). Average common eider initiation date at Cape Espenberg was 12 June 2007 (SE ± 6 d), and initiation dates were significantly earlier at Eider Island ($\bar{x}$ =9 June) than elsewhere at Cape Espenberg ($\bar{x}$ =12 June; t_{21} = 3.17, $p < 0.01$). Using Program MARK (White and Burnham 1999) and assuming a constant daily survival rate, we estimated daily nest survival to be 0.81 (SE ± 0.04) and we calculated the probability of overall nest success (assuming a 4 d laying + 26 d incubation period) to be <0.01.

While searching for common eiders, we also documented nests of other waterfowl and loons, including; 8 red-throated loons (*Gavia stellata*), 10 Pacific loons (*Gavia pacifica*), 1 yellow-billed loon (*Gavia adamsii*), 3 tundra swans (*Cygnus columbianus),* 1 canada goose (*Branta canadensis*), 8 emperor geese (*Chen canagica*), 2 northern pintails (*Anas acuta*), 7 greater scaup (*Aythya marila*), 4 long-tailed ducks (*Clangula hyemalis*), and 1 red-breasted merganser (*Mergus serrator*).

Captures, sampling, and satellite implants

We captured a total of 25 Pacific common eiders (24 adult females and 1 adult male) from Cape Espenberg. Of the 24 females, 10 were captured on or their nests using bow nets or mist-nets placed on-top of the nest. All other eiders were captured with mist-nets and decoy spreads near Eider Island (Fig. 2). In addition to the captured eiders, we opportunistically obtained avian influenza samples from 6 long-tailed ducks, 1 red-throated loon, and 2 phalaropes (1 red phalarope (*Phalaropus fulicaria*) and 1 red-necked phalarope (*P. lobatus*)), inadvertently captured in eider nets. All avian influenza samples from target species (e.g., common eiders and long-tailed ducks), were sent to the USGS National Wildlife Health Center in Madison, Wisconsin for analysis, while samples from non-target species (e.g., phalaropes and loons) were sent to the University of Alaska, Fairbanks. Remaining blood and feather samples were archived at the USGS Alaska Science Center. Results from the National Wildlife Health Center indicated that no common eiders or long-tailed ducks sampled at Cape Espenberg were positive for H5N1.

Captured eiders were transported to veterinarians on foot or by small boat within 2 hrs of capture (average: 30 min) and held in cat-carriers while awaiting surgery. Average pre-surgery hold time was 2 hrs 7 min (SE ± 7 min). Average surgery time (from initial isoflurane gas, until extubation) was 1 hr 7 min (SE ± 6 min) and ranged from 0:27-2:11 (hrs:min). There were no mortalities as a result of surgeries. Total holding time for captured eiders (from capture to release, post-surgery) averaged 5:12 (SE ± 0:25) and ranged from 3:17 to 7:23, including the minimum 2 hr recovery period. After surgery, but prior to recovery, we collected whole blood (3 mL), serum (1 mL), and cloacal and oral-pharyngeal swabs from all 25 captured eiders. Head, breast, and secondary feathers were collected from 15 of the 25 captured eiders. We did not perform a final visit to the nests of all captured eiders. However, we observed at least one implanted female on her nest and commencing incubation post-surgery.

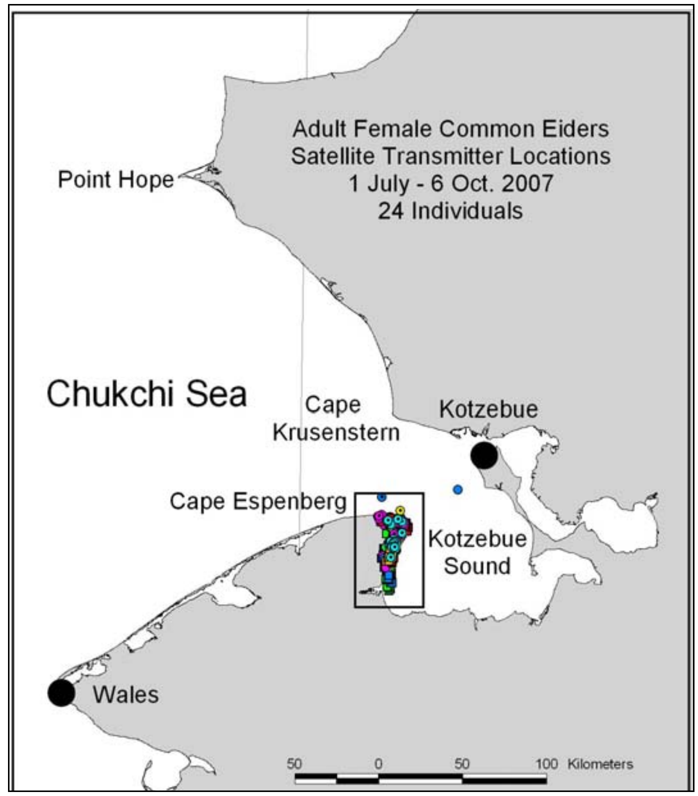

Figure 4. Locations of female Pacific common eiders marked at Cape Espenberg for the period of 1 July to 6 October 2007.

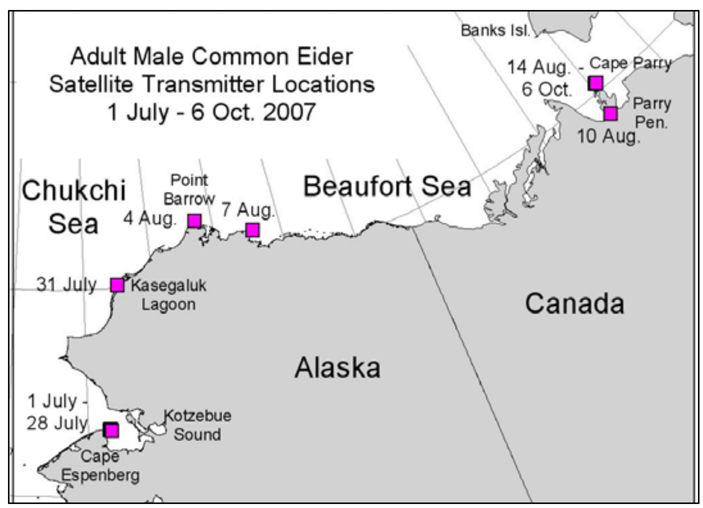

Figure 5. Locations of the single Pacific common eider male marked on the Cape Espenberg breeding grounds for the period of 1 July to 6 October 2007.

As of early October 2007, all satellite transmitters were active (i.e., no deaths or equipment failures had occurred) and all satellite-tagged common eider females remained in the vicinity of Cape Espenberg (Fig. 4). In contrast, the single satellite-tagged male left Cape Espenberg by 31 July and continued his molt migration along the northern coast of Alaska (Fig. 5). He arrived at a molting area in western Canada by 20 August, traveling in excess of 1,500 km.

As of December 2007, all satellite transmitters were active and continued to transmit high quality location data at regular intervals. December 2007 locations showed all but two females migrated to wintering locations away from the Seward Peninsula (Fig. 6). Of the 25 common eiders implanted at Cape Espenberg, 13 were wintering along the southern Chukotka Peninsula, Russia and 3 were wintering near northwestern St. Lawrence Island, Alaska, with some movement observed between the two locations. Together, birds wintering in this region comprised 80% of our sample. Of the remaining 9 birds, 7 (12%) are currently wintering on the Yukon-Kuskokwim Delta, Alaska, and two (8%) remain on the Seward Peninsula, near the Point Spencer/Point Douglas area.

DISCUSSION

Movement data

During fall 2007, females tagged at Cape Espenberg remained close to the breeding area, then moved to wintering areas off the Chukotka Peninsula, Russia, St. Lawrence Island, and the Yukon-Kuskokwim Delta, Alaska (November and December 2007; Fig. 6).

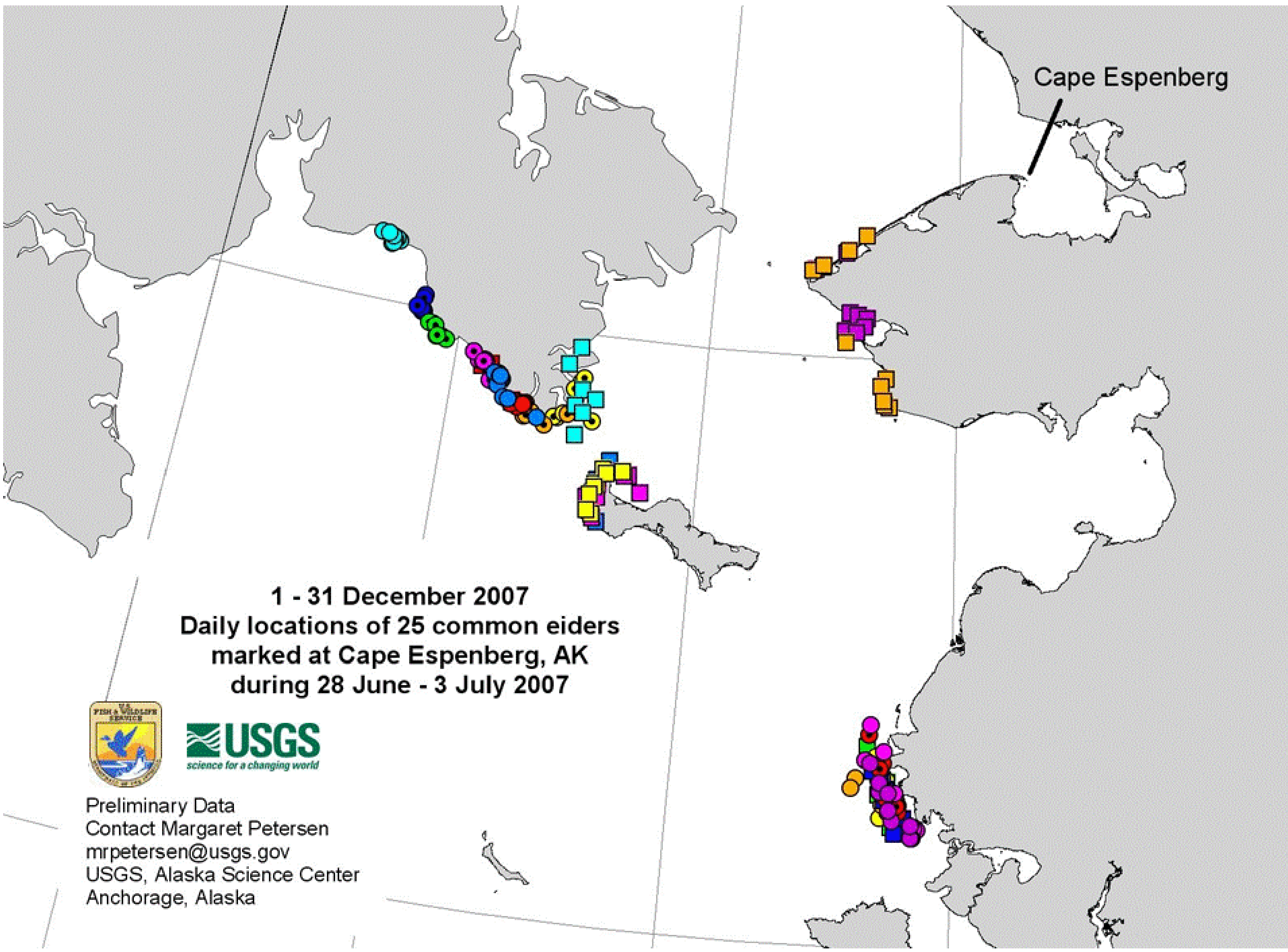

Figure 6. Locations of all Pacific common eiders marked at Cape Espenberg for the period of 1-31 December 2007. The four prominent wintering areas appear to be the Chukotka Peninsula, Russia, northwestern St. Lawrence Island, the Seward Peninsula, and the Yukon-Kuskokwim Delta, Alaska.

These movement patterns indicate that the Cape Espenberg breeding population mixes with both the Beaufort Sea and Yukon-Kuskowim Delta breeding populations on their respective wintering grounds (Petersen and Flint 2002). Further, the molt-migration (Fig. 5) of our single implanted male to western Canada, followed by his subsequent fall migration back to the Chukotka Peninsula, suggests that male mediated gene-flow between western Canada, the Beaufort Sea, and Cape Espenberg is likely. Moreover, the migration pattern exhibited by this male was nearly identical to that of male Pacific common eiders satellite-tagged in western Canada (L. Dickson 2004). We believe that the initial movement information from our single satellite-tagged male provides strong support for future satellite work involving males and that such data could be useful in augmenting female-based studies with a more complete picture of the movements, habitat utilization, and possible routes of genetic dispersal for Pacific common eiders throughout their range. Finally, our forthcoming movement data and genetic analyses should help elucidate the breeding and winter site fidelity of Seward Peninsula breeders and allow us to examine the degree of genetic differentiation between the Seward Peninsula, Beaufort Sea, Yukon-Kuskokwim, and Aleutian Island breeding aggregations in Alaska. Updated movement data for the eiders marked at Cape Espenberg will be available on-line at www.alaska.usgs.gov.

Avian Influenza

No eiders tested at Cape Espenberg were positive for H5N1, but continuing movement data from the satellite transmitters deployed at Cape Espenberg will help elucidate routes of possible H5N1 transmission on wintering grounds. Further, the information on migration routes and wintering areas for common eiders breeding in northwest Alaska will help clarify population structure and possible transmission routes among breeding aggregations of Pacific common eiders statewide.

Historical comparison of common eiders nesting at Cape Espenberg

Our project was primarily focused on capturing nesting hens, rather than monitoring their reproductive success. However, our 2007 data do provide a direct comparison with historical counts of eider nests, particularly at Eider Island (Appendix 1). Eider Island was one of three plots intensively monitored by Schamel et al. (1999) for waterbird breeding activity and in 1976 and 1977, Seguin (1981) and Schamel et al. (1999) found 272 and 323 common eider nests, respectively, on Eider Island (Appendix 1). Further, Seguin (1981) noted that the Eider Island colony had significantly higher nesting density than most other island-based eider colonies documented at that time (e.g., 975 nests/ha at Eider Island versus 5-250 nests/ha at other island colonies around the world). Between 1994 and 1998, Schamel returned to Cape Espenberg and noted a significant reduction in the number of nesting eiders on the Cape between the 1970's and 1990's (Schamel et al. 1999; Appendix 1). By 1998, Schamel reported the count at Eider Island had been reduced to ~10 nests (Appendix 1), and subsequent visits suggested reindeer were accessing the island and consuming eider eggs (P. Flint pers. comm.). Our count of 25 common eider nests on Eider Island in 2007 indicated a slight increase from the 1998 count, but was still 91% lower than counts in the 1970's. Schamel et al. (1999) proposed increasing predation by foxes as the likely cause of the decline in nesting eiders, but we observed no foxes at Cape Espenberg in 2007. Reasons for the dramatic decline remain unknown and deserve further investigation.

Similar to the observations of Seguin (1981), we found nest initiation dates to be significantly earlier (~3 d earlier) at Eider Island than the rest of mainland Cape Espenberg; perhaps due to older aged/more experienced individuals occupying nest sites on the island versus the mainland. We also observed eider nests to be more densely distributed under willow shrubs (*Salix spp*.), which lined the south end of Eider Island (see distribution of nests at Eider Island in Figure 1), in accord with Seguin's (1981) findings. Presumably, individuals and nests associated with the willows received more protection from aerial nest predators.

Other observations and suggestions for the future

As a new project, there was a steep learning curve associated with the common eider captures at Cape Espenberg in 2007. In light of this, we outline observations and suggestions based on our experiences that may benefit future waterbird research in the area.

Finding and capturing nesting common eiders

Finding nests of common eiders throughout Cape Espenberg, over the short time-period available to us, required an intensive search effort. This effort was aided by the use of a trained dog, historical maps of eider nest locations (Schmutz 2000-2002), and tireless and strong-legged observers. After searching, we returned to all located nests to attempt capturing females; initially with mist-nets strung between observers, then with bow-nets. However, many of the mainland nests had already been destroyed by predators (e.g., Jaegers *Stercprarois spp*.) by our second visits.

We began trapping with walk-up mist-nets (nets deployed between two observers and placed on top or near the nest, approaching from up-wind), but most females were too early in incubation, with low nest site fidelity, for successful capture (i.e., they flushed too early). Therefore, during this period, we focused trapping on the Eider Island colony. We trapped this area two times, each time setting a double mist-net from the southwest corner of Eider Island out into the lake, just southwest of the highest nest density area in the willows (Fig. 1). Several decoys (usually two drakes and a hen) were deployed on the downwind side of the net. Hens that had been flushed from the island flew or swam into the decoys upon their return and were then 'flushed' into the net with an approaching inflatable boat (driven with a small outboard motor). One observer hiding on the back side of the island and two observers flushing with the boat (all within radio contact) resulted in quick captures. This method was especially effective when the wind and sun were both behind the net, blinding the hens as they approached the decoys into the wind. In conjunction with the trap set-up at Eider Island, we simultaneously set-up a second mist-net system (Fig. 2) spanning the width of a nearby lake. Eiders displaced from Eider Island were observed staging at this nearby lake on previous visits. Upon the initial flush of Eider Island, we caught birds in both the Eider Island net, as well as birds displaced to the nearby lake.

In order to reduce handling time prior to surgery, we staged the veterinarians and all necessary surgery/camp gear near trapping lakes on the southern shoreline of Cape Espenberg. Under this scenario, veterinarians were less than a10-min. walk away from traps and birds could be released near their nests, post-surgery. After trapping the Eider Island area twice, we shifted all capture activities to walk-up mist-netting or bow-netting of birds on nests within mainland Cape Espenberg.

Capturing male common eiders

The single male eider we captured was near Eider Island and was attending a female who approached the decoys. Because all our trapping activities were focused towards nesting females, we did not experiment with alternative methods which may have led to higher male capture rates. However, we observed many male eiders swimming and flying just off the north shore of Cape Espenberg and believe capturing these near-shore males could be accomplished using floating mist-nets, decoys, and common eider vocalization playbacks.

Capturing long-tailed ducks

Although long-tailed ducks have historically been difficult to trap away from the nest, they were relatively easy to capture with mist-nets strung across ponds and decoys at Cape Espenberg. In total, we inadvertently captured 9 long-tailed ducks during the course of eider mist-netting. Long-tailed duck captures might be improved in the future by using same-species decoys coupled with vocalization playbacks.

Ancillary mammal observations

Musk ox (*Ovibos moschatus*) were abundant at Cape Espenberg and we observed groups of ~2-10 near the eastern tip of the Cape, as we were traveling along the northern dunes and beach. We also saw sign of musk ox near all human structures. We observed several marine mammal carcasses and many bones, including walrus (*Odobenus rosmarus*), spotted seal (*Phoca largha*), and beluga whales (*Delphinapterus leucas*) along the northern beach of Cape Espenberg. However, we observed only two brown bears (*Urus arctos horriblis*), both on a single occasion, walking along the far northwestern shoreline, near the mainland. Additionally, we observed one moose (*Alces alces*) and one reindeer (*Rangifer tarandus*) crossing the southern bay between Cape Espenberg and the mainland. In contrast to the daily fox observations noted by Schamel et al. (1999), no fox were observed during our time at Cape Espenberg.

Logistics

We traveled to Cape Espenberg from Kotzebue by small, fixed wing aircraft on wheels (Cessna-185, 206, and 207) operated by Arctic Air Guides and Hageland Air, Kotzebue, Alaska (Pilots: Buck Maxon and Eric Sieh, respectively). The trip was ~1 hr each way. All landings occurred along the long northern beach, near our campsite. We used a total of 11 round-trip flights between Kotzebue and Cape Espenberg to deploy and remove 6 personnel and all field equipment. We found Hageland Air's C-207 (equipped with large tires) to be the most efficient means of transporting personnel and gear, due to it's larger useful load.

Once at Cape Espenberg, we traveled primarily by foot, or used small inflatable boats with outboard motors (courtesy of the Selawik NWR and USFWS Migratory Bird Management). Boats were useful for transporting heavy equipment and personnel to distant capture locations along north and south shorelines, and around the Cape, but often could not be used in the constantly windy conditions at Cape Espenberg. We recorded aerial GPS locations of channels around the tip of Cape Espenberg and used these to help guide outboard travel through shallow areas. However, despite GPS points, we were usually forced to run the motors on tilt or pull the boats through the shallowest areas each time we crossed the Cape.

With the permission of the National Park Service (Permit #BELA-2007-SCI-0001), we occupied a historical research camp (66 34'20.06 N, 163 39'37.44 W; Fig. 1) previously inhabited by biological research crews from the U.S. Geological Survey, Alaska Science Center (PI: Joel Schmutz 2000-2002). At the campsite we found an intact 10x12 ft. weather-port floor, 7 old bear-barrels with (4) 5-gal buckets, (1) 5-gal water container, and (1) 5-gal container of kerosene, and remnants of driftwood furniture, including (1) 6-shelf unit and an outhouse sitting platform, which we left at the site upon departing (see Fig. 7a). While at Cape Espenberg, our camp consisted of a 10x12.5 ft. weather-port (courtesy of the Selawik NWR), 6 tents, and 6 bear-barrels stocked with food, surrounded by a solar-charged bear-fence (Fig. 7b). We added a 6 in. extension to the existing weather-port floor to make it large enough for our 10x12.5 ft. weather-port (Fig. 7a).

Figure 7a. Historical camp items at Cape Espenberg, Alaska: 10x12.5 ft. weather-port floor, 7 bear-barrels, shelves and outhouse base, as left upon our departure from Cape Espenberg.

Figure 7b. Our 2007 camp, with tents, weather-port, and bear-fence deployed, at Cape Espenberg, Alaska.

Our outhouse was located away from camp, near the beach (Fig. 7c) and consisted of a portable shower tent, with a 5-gal bucket and seat. All outhouse water was treated and dumped at sea, per our NPS permit. We collected fresh drinking water from a pond near our camp and filtered/boiled all water before consuming. We communicated daily with the Selawik NWR by satellite phone and used hand-held radios to talk with one-another during field operations. In the future, having spare radios would greatly facilitate capture efforts. Climbing to the top of dunes allowed for line-of-sight communications with hand-held radios (within a 1-2 km distance). In all, we relied heavily on the Selawik NWR to help us stage equipment and expedite personnel and gear from Kotzebue to Cape Espenberg. The refuge graciously assisted us with

Figure 7c. View north from camp towards Kotzebue Sound. Our portable camp outhouse (with honey-bucket) stands in the near distance.

2007 Cape Espenberg Field Crew. Pictured left to right: Joanne Luebbert, Chuck and Jennifer Steffen, Tim Bowman, Heather Wilson, Matt Sexson, Ayme Johnson, and Corrine Brown. Not pictured, "Otter", our nest-searching dog.

these and many other project needs in 2007. However, in the future, we would advocate hiring a dedicated project expediter staged out of Kotzebue to help with equipment, travel, resupplies, etc., to help lesson/eliminate the burden on refuge staff.

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Appendix 1. Number of nests found at Eider Island at Cape Espenberg, Alaska 1976-2007. 1976-1998 data are from Seguin (1981) and Schamel et al. (1999). 2007 data from the current project.

Species	1976	1977	1994	1995	1996	1997	1998	2007
Common eider	272	323	100	47	80	~50	~10	25
Glaucous gull	2	3	1	1	1	0	0	0
Arctic tern	17	20	0	0	0	0	0	0
Long-tailed duck	1	6	0	0	0	0	0	0
Tundra swan	0	0	1	1	1	0	1	0
Greater scaup	0	0	0	0	0	0	0	1