U.S. Fish & Wildlife Service
INTRA-SERVICE BIOLOGICAL OPINION

to the

Fairbanks Fish and Wildlife Field Office

for

Issuance of a Section 10 Permit for Breeding Biology Research

of Steller's Eiders and Other Waterfowl

and

Control of Foxes

near Barrow, Alaska (2012-2014)

May 2012

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1. INTRODUCTION

This document transmits the U.S. Fish and Wildlife Service's (Service's) final biological opinion (BO) based on our review of the Fairbanks Fish and Wildlife Field Office's (FFWFO's) Threatened and Endangered Species Permit Amendment Application for Recovery Permit number TE043136-0, known from here on as the recovery permit, for threatened Steller's (*Polysticta stelleri*) and spectacled (*Somateria fischeri*) eiders in accordance with Section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

This BO is based on information from scientific journals, agency reports and personal communication. A record of this consultation is on file at the Fairbanks Fish and Wildlife Field Office.

The purpose of this opinion is to fulfill the Section 7 requirements for intra-service consultation on breeding biology studies on Steller's and spectacled eiders nesting near Barrow, Alaska. The recovery permit, TE043136-0, for the study entitled, "Breeding Biology of Steller's Eiders and Other Waterfowl near Barrow, Alaska" will allow the: 1) capture, handling, marking, and attachment of transmitters; 2) collection of biological tissue samples; 3) marking, floating, and candling of eggs; 4) nest monitoring; 5) searching for nests of spectacled eiders, Steller's eiders, and other waterfowl; and 6) trapping of foxes to reduce depredation on Steller's eider nests. This BO describes the effects of these actions (Action) on threatened spectacled and Steller's eiders pursuant to Section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

Polar bears (*Ursus maritimus*) do not regularly occur within the action area during summer, but the possibility of encountering a polar bear exists. The project participants have agreed to abide by Polar Bear Interaction Guidelines (Appendix A) to avoid potential conflict with polar bears. As a result of agreement to follow the guidelines, no adverse impacts to this species are anticipated. Because no alteration to the physical or biotic features of polar bear habitat will be made, the Service concludes that the issuance of a Section 10 permit for the Action will have no effect on proposed polar bear critical habitat. The Action is not likely to adversely affect the threatened polar bear or polar bear critical habitat so polar bears and polar bear critical habitat are not discussed in this biological opinion.

Project details were received on February 22nd, 2012. Formal consultation began on February 27th, 2012. A complete administrative record of this consultation is on file at the Fairbanks Fish and Wildlife Field Office, 101 12th Ave., Room 110, Fairbanks, Alaska 99701. If you have any comments or concerns regarding this biological opinion, please contact Ted Swem, Endangered Species Branch Chief, Fairbanks U.S. Fish and Wildlife Service Field Office at 907-456-0441.

2. DESCRIPTION OF THE PROPOSED ACTION

2.1 Background

The proposed action involves the issuance of recovery permits per Section 10(a)1(A) of the Act. Section 10(a)1(A) specifically authorizes activities that are designed to assist in the conservation of listed species and which often directly affect listed species. Recovery of Steller's and spectacled eiders is largely dependent on improving FFWFO's understanding of the reasons for their decline and taking corrective action where possible. As such, the collection of information regarding the ecology of these species is of paramount importance. Research needs that will be addressed by this action include studies of Steller's and spectacled eider ecology, demographics, and epidemiology that will in turn help the Eider Recovery Team and FFWFO identify and implement future recovery actions.

Section 7(a)(2) of the Endangered Species Act, (16 U.S.C. § 1531 et seq.), requires that each Federal agency shall insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of critical habitat of such species. When the action of a Federal agency may adversely affect a protected species, that agency (i.e., the "action" agency) is required to consult with either the National Marine Fisheries Service (NMFS) or the Service, depending upon the protected species that may be affected. For the actions described in this document, the action agency is the Service's FFWFO. Due to the protected species involved, the consulting agency is also the FFWFO. Section 7(b) of the Act requires that the consultation be summarized in a BO detailing how the action may affect protected species. Intra-service consultations must be held to the same rigorous consultation standards other federal agencies are required to meet under Section 7. At all times during this consultation the Service has attempted to be as impartial as possible. Section 7 regulations allow a formal consultation to encompass a number of similar actions within a given geographic area or a segment of a comprehensive study plan (50 CFR 402.14).

2.2 Action Area

Steller's and spectacled eiders nest in Alaska near Barrow at the northwestern corner of the Alaska coastal plain (71°18'N, 156°40'W). The Barrow area is dominated by ice-wedge polygons, shallow-oriented lakes, and drained-lake basins, all underlain by continuous permafrost. Plant communities include upland meadow, wet meadow, marshes with emergent vegetation, and open water in large and small lakes and ponds (Bunnell et al. 1975).

2.3 Project Actions

In 2012, 2013 and 2014, researchers will continue to study abundance and distribution of Steller's eiders, their nests (i.e., ground-based breeding pair surveys, and ground-based nest searches), and will continue contaminants work (collection of blood from breeding hens and ducklings). If it is a nesting year for Steller's eiders, field crews will monitor nest survival, nest habitat use, and brood survival for this species. Project plans also include monitoring nest success of other waterfowl species (i.e., spectacled eiders and other sea ducks). Researchers will also continue a study aimed at determining the causes of nest failures by monitoring a small number of Steller's eider nests with time lapse digital cameras.

If Steller's eiders do not nest during the research period, researchers will use other sea duck species, including spectacled eiders, as surrogates for the nest camera study. Researchers also plan to continue studying contaminants in non-nesting years by capturing other species of sea ducks (i.e. spectacled and king eiders, and long-tailed ducks) to further assess the exposure risk to lead by threatened eiders. In non-nesting years for Steller's eiders, researchers plan to capture and radio-mark adult spectacled eider females near hatch to determine brood survival and habitat use, and help determine priority recovery tasks. This information was obtained from the 2012 study plan.

Project plans include reducing predation of Steller's eider nests by controlling foxes in the nesting area near Barrow. Using three trappers and two assistants on foot, daily trapping will occur in the Barrow Steller's Eider Conservation Planning Area from about 23 May to 31 July. If Steller's eiders are not found nesting at Barrow, which will be known by the last week in June, the Service will terminate fox control operations for the year. Up to 120 arctic and up to 15 red fox may be taken. Specific zones of control activity within the Planning Area will be identified in consultation with Service personnel. This information was obtained from the 2012 fox control operational plan (Appendix B).

Determining abundance and distribution of Steller's eiders near Barrow

To determine abundance and distribution of Steller's eiders near Barrow, two ground-based surveys will be conducted within 5 miles of the Barrow road system: a road survey to document the arrival of Steller's eiders, and a breeding pair (formerly called "foot survey") to document Steller's eider breeding pair distribution and abundance during the pre-nesting and early-nesting period. After the USFWS crew arrives in Barrow and prior to starting breeding pair surveys, the field crew in place will conduct road surveys to assess arrival, numbers, and locations of Steller's eiders. Road surveys are conducted from vehicles on existing roads near Barrow. Typically, Steller's eiders arrive in late May to early June.

Breeding pair foot survey

A ground-based breeding pair survey will be performed in spring when Steller's eiders arrive. The survey will begin immediately after pairs of Steller's eiders disperse from Footprint Lake and other wetlands where they typically congregate after arriving in Barrow. This survey will be conducted for about 10-14 days starting in mid-June. Study area boundaries can fluctuate, but generally include a 192 km^2 of tundra (Figure 2.2). Surveys will cover close to 100% of the area. Three teams of about 3-4 surveyors each will conduct the daily survey.

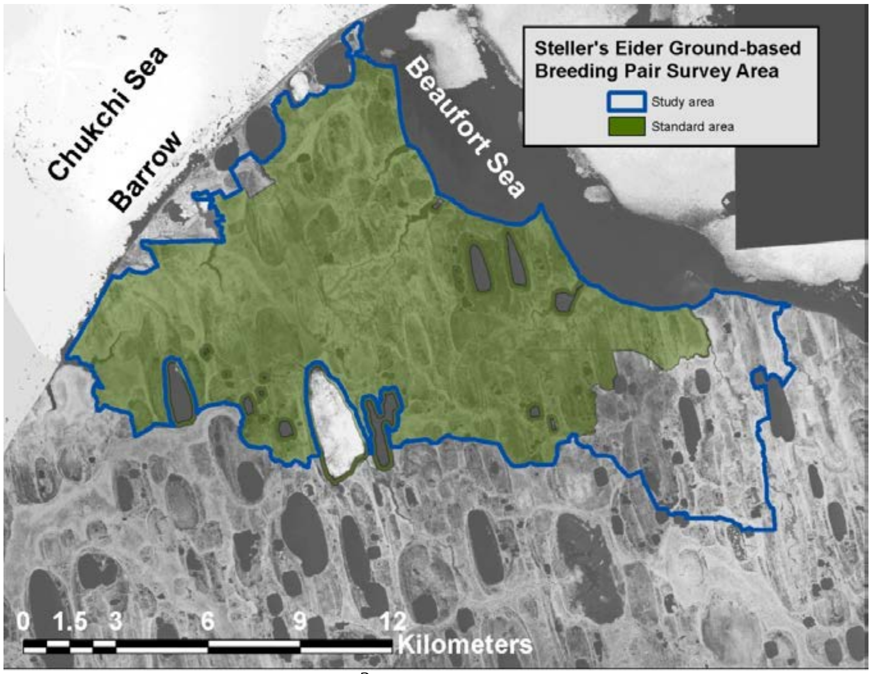

Figure 2.1. Barrow 192 km^2 study area (outlined in blue) and the 135 km^2 standard area surveyed all years (shaded in green) along the road system near Barrow, Alaska.

Determining nest success, and causes of nest failure for Steller's and spectacled eiders and other waterfowl

Nest surveys will also be within 5 miles of the Barrow road system. Low productivity may be contributing to observed population declines in Steller's eiders. Predation is thought to be the primary cause of Steller's eider nest failures near Barrow (Quakenbush et al. 1995). Between 1991 and 2008, nest success probability (the proportion of nests in which at least one egg hatches) averaged 0.34. Due to significant overlap in patterns of nest depredation among predator species, examination of nest remains alone cannot identify the predators responsible for nest destruction. Camera monitoring has been used to identify predators while minimizing the frequency of nest visits by researchers. By monitoring nest survival of other waterfowl species (i.e. greater white-fronted geese, long-tailed ducks, and northern pintails), researchers can place Steller's and spectacled eiders nest survival in a context compared with other waterfowl species that nest near Barrow. Additionally, in years when Steller's eider do not nest near Barrow, monitoring nest survival of waterfowl that did nest may help to discover factors that contributed to the non-nesting. In 2009, field crews monitored survival of all waterfowl nests located near Barrow during a non-nesting year for Steller's eiders, and estimated nest survival probability of sea ducks that did nest at 0.07 (0.01, 0.20 95% CI). This indicated Steller's eiders would have likely had very low nest survival if they had nested, and sheds light on possible reasons behind foregoing nesting in 2009. Researchers also found nest survival in geese and swans to be relatively high in 2009 (0.70; 0.54, 0.81 95% CI), further illustrating the greater susceptibility to predation of smaller-bodied waterfowl without bi-parental care (Safine 2011).

Nest search survey
Nest searching will be conducted from late June to mid-July after completion of the ground-based breeding pair survey (Obritschkewitsch et al. 2001). Nest searchers will use two methods: targeted searches near observed territorial pairs and a search of areas previously used for nesting by Steller's eiders. Targeted searches will consist of searching areas near sightings of territorial pairs or males recorded during the breeding pair surveys or from information provided by other researchers. The other nest searching method involves searching as completely as possible areas used for nesting in past years. Although nesting use patterns have changed somewhat over time, some areas have been used consistently for nesting since 1991. Field crews will search areas used heavily in past years and other areas used more recently. An example of areas searched in recent years using this method can be seen in Figure 2.2.

During nest searching, 2-5 observers spaced ~10 m apart walk at the same pace, searching the area within 5 m to either side of themselves as they move through the area. This distance was chosen to maximize the likelihood of detecting hens on nests. In this research period field crews will also use rope dragging to improve efficiency. Nest searching with a rope has been used widely for waterfowl in grasslands. Searchers will use one individual on either end of a 30-50 m rope. The two searchers will move forward and drag the rope over the tundra with a third person used as a spotter walking behind the rope to look for flushing waterfowl hens. This method permits fewer people to cover the same area that can be searched by a larger crew without a rope, and ensures complete coverage of an area. Nest searching method (with or without a rope) will be chosen based on habitat type and staffing constraints.

Nest data will be recorded for all waterfowl nests located, including: location, species, date, time, presence of male and female, distance to flush, number of eggs, incubation stage (obtained by candling eggs), nest status, and nest lining. Contour feathers will be collected from nests where the species identification is unknown or it is believed to be a Steller's eider. Nest locations are not physically marked (to avoid attracting predators), but GPS coordinates are used to relocate nests.

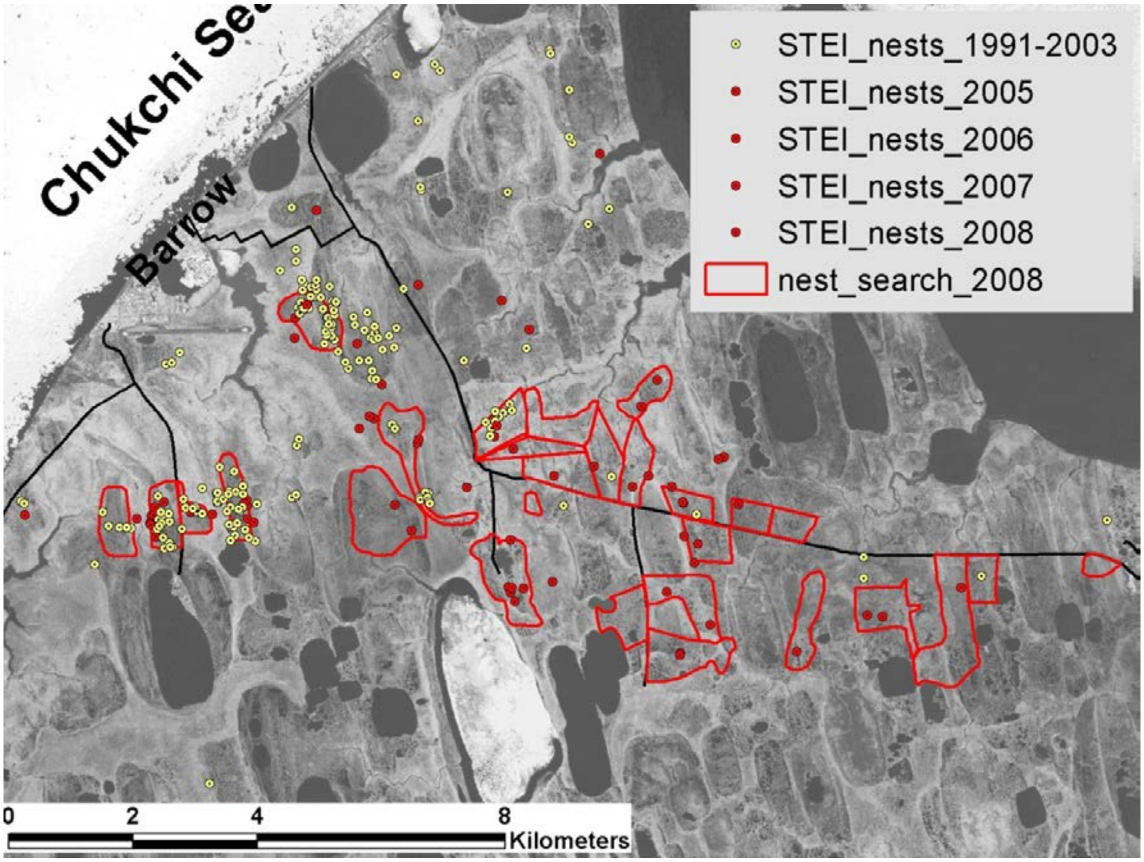

Figure 2.2. Map of Steller's eider (STEI) nests since 1991, and example nest search areas from 2008.

Nest monitoring

Field crews plan to continuously monitor up to ten nests using Reconyx digital cameras. Reconyx cameras were tested in 2006 and used in 2007-2011, and hens rarely flushed during camera installation or during maintenance visits. Cameras, attached to tripods, are placed 10-30 m from nests. Some of the Reconyx cameras are equipped with zoom lens, which allow field personnel to place them a further distance from nests (30 m), whereas non-zoom models will be ~10 m from the nest. Cameras will be visited approximately every 5 days to exchange data discs and batteries. Steller's eiders will be the priority species to monitor by camera, but if they are not available field crews will monitor spectacled eiders and other sea ducks. A small number of cameras may be placed on white-fronted geese to investigate the difference in nest survival between sea ducks and geese.

Nests not monitored by camera will be visited approximately every 7 to 10 days during incubation. Incubation lasts ~24 days post-laying of the penultimate egg for many waterfowl species. Nests will be relocated with GPS coordinates and maps. When visiting a nest, field crews aim to confirm the presence of the female on the nest without flushing her. For many species personnel can confirm presence with binoculars from ~20 – 40 m away. If the hen is absent from the nest or accidentally flushed when approached, field crews will visit the nest briefly to count, age, and cover the eggs. Surgical gloves will be worn when touching the nest or eggs. Nest visits generally take only a few minutes. Field crews will avoid placing backpacks within 20m of the nest and using more than 1 person to visit the nest to limit exposure to human odors and matting vegetation that may attract predators.

Consistent with past years, after nest failure or hatch, field crews will collect nest and brood-rearing habitat information for Steller's and spectacled eiders to characterize basic breeding requirements. Eggshell and contour feathers will be collected for possible future genetics work.

Determining Steller's eider breeding area fidelity, sampling for lead exposure, and collection of DNA and viral swabs

Determining female Steller's eider fidelity to the breeding area by capturing, marking and re-sighting hens at Barrow is a high priority recovery task. Breeding hens are captured late in incubation, ideally 2-3 days prior to hatch to reduce risk of nest abandonment. In addition to collecting banding information, captures allow us the opportunity to collect samples, including blood (primarily for contaminants screening but also for DNA testing and viral screening), cloacal swabs (for virus screening), and feathers (for isotope analysis). Field crews also plan to capture spectacled and king eiders and long-tailed ducks near hatch to collect samples for lead exposure on the North Slope (a high priority task for spectacled eiders). These additional species would be captured using the same methods as for Steller's eiders, and would provide additional samples to evaluate lead exposure risk in North Slope waterfowl.

Hen capture and banding

Each year hens will be captured by lowering a mist net onto the nest. This will be accomplished by two persons approaching the nest holding the mist net in a horizontal plane, with one panel of the net stretched fully between outstretched arms (method similar to that described in Bacon and Evard 1990). After lowering the net, the two persons will kneel on either end of the net and crawl towards the nest. In most cases, the hen stays tight on the nest until the trappers are in reaching distance. Alternatively, hens may be captured on the nest using a bow-net (Sayler 1962). Bow-nets are string-activated nest traps constructed of netting on two semi-circular aluminum pole frames joined by a spring in the middle. Bow-nets are set on a nest while a female is absent; the researchers lead a string that is attached to the trigger out from the trap about 80m and then leaves the area to allow the female to return to the nest. In approximately 2 hours field personnel return to the site, trigger the trap, and retrieve the female from the trap.

USFWS metal tarsus bands (stainless steel, size 6 or 7a depending on species) and plastic color bands (yellow with black alpha-numeric code for Steller's eiders) will be applied to hens. Blood will be drawn from the jugular vein for lead contaminants, DNA, and hormone analyses. Cloacal swabs will be taken for viral screening. Body weight (to the nearest gram using a spring scale) and the following morphometric measurements will be taken: culmen (from center of bill to highest point of bill tip), tarsus (diagonal and total), and wing (wing chord and flattened wing) lengths (to the nearest mm with calipers and metric rulers).

Blood and fecal swab collection

Ingestion of lead shot has been identified as a cause of mortality in spectacled eiders (*Somateria fischeri*) on the Yukon-Kuskokwim Delta and may result in reduced over-winter survival and reduced fecundity (Flint and Grand 1997, Flint et al. 1997). Screening for exposure to lead in Steller's and spectacled eiders on the Alaska breeding grounds has been identified as a high priority recovery task. Preliminary results have revealed lead in nesting Steller's eiders in Barrow (A. Matz, USFWS, unpublished data). Field crews plan to capture nesting female Steller's and spectacled eiders during late incubation to screen for the presence of lead. Field personnel also plan to capture other sea ducks as surrogates for lead exposure in Steller's eiders (i.e. spectacled and king eiders and long-tailed ducks).

In the current recovery permit, the FFWFO is authorized to nest capture and collect blood and fecal samples from up to 20 adult Steller's and spectacled eider hens, and capture and band up to 40 Steller's or spectacled eider ducklings. The current Federal Bird banding Permit authorizes personnel to trap, band, and take blood and feather samples from all species of waterfowl, including threatened Steller's and spectacled eiders. Approximately 3 ml of blood will be collected, not to exceed 1% of body weight. In birds not undergoing surgery, guidelines suggest taking no more than 1% of body weight (assuming 1 ml blood = 1 gram). 3 ml whole blood sample is needed to perform all assays, and is within guidelines for a 500 g bird. This activity will only be conducted by personnel trained in the procedure (PI and avian technicians). Dr. Angela Matz, FFWFO contaminants ecologist, will coordinate the laboratory analysis of the samples.

Blood from captured Steller's and spectacled eiders (and other sea ducks) may also be used for DNA analysis, to screen for the presence of pathogenic viruses, and for quantification of cortisol and thyroid hormones. Field personnel will also collect a fecal sample or cloacal swab to analyze for hormones and virus exposure.

Determining Steller's and spectacled eider brood survival

Several high priority recovery tasks relate to brood monitoring for both Steller's and spectacled eiders. For Steller's eiders, the continuation of brood monitoring and determining post hatch to fledging duckling survival are high priority tasks listed in the most recent (December 2009) recovery task list. For spectacled eiders, evaluating factors affecting duckling growth and survival and evaluating and predicting effects of environmental change in breeding areas are high priority tasks listed in the most recent (December 2009) recovery task list.

To address the recovery tasks related to survival and habitat use of ducklings, each year field personnel will mark adult females just prior to hatch with radio-transmitters and re-sight females frequently to count brood size. With this type of data researchers can use known-fate models to estimate brood survival, or the probability that at least one duckling will survive to fledging or a specific period of time (i.e. 30 days; Flint and Grand 1997). Due to the low density of breeding eiders on the North Slope, radio-marked females are essential for locating ducklings for any captures later in brood rearing. Brood tracking has been done in past years for Steller's eiders in Barrow, but sample sizes have been limited. A continuation of this effort, to improve the precision of survival estimates and increase understanding of inter-annual variation, is important for managing this species. Spectacled eider broods have been tracked extensively on the YKD, but survival and habitat-use information from the North Slope breeding population is very scarce. For both species, documentation of current brood rearing habitat requirements is a priority to help understand how eider populations may be affected by changes to the arctic breeding habitats predicted by climate change.

To assess factors affecting duckling growth and survival for spectacled eiders, each year field personnel may capture broods of marked females at approximately 30-35 days of age to measure duckling size and collect tissue samples for contaminants analysis. Spectacled eider broods at ~35 days of age have been captured in recent years on the YKD, and their mass has been low compared to historic data (B. Lake, USFWS, Unpublished data). The low mass of YKD ducklings is thought to be related to habitat conditions (specifically salinity), and a comparison to ducklings from the North Slope where salinity is not currently believed to be a concern would provide a useful comparison. Measuring lead exposure in ducklings has been conducted on the YKD to examine exposure during the nesting season, and lead poisoning was believed to reduce juvenile survival to fledging (Flint et al. 2000). Data for lead exposure in ducklings is not available for the North Slope, and would be useful to compliment measurements for adult female sea ducks from Barrow.

Transmitter attachment to female Steller's and spectacled eiders and radio tracking broods

Each year up to 10 female Steller's or spectacled eiders will be equipped with a VHF transmitter to achieve the brood monitoring objective. The transmitters are prong and suture type (Mauser and Jarvis 1991, Rotella et al. 1993) modified with glue. Transmitters are manufactured by Advanced Telemetry Systems (model A4430 with mortality indicator, 9 g).

This anchor attachment technique (prong and glue method) is frequently used to attach small transmitters to the back of adult birds. This attachment method is used frequently for waterfowl. The advantage of the prong and glue design is that it does not encumber the wings, body or neck of the bird which is important for species such as waterfowl that have daily flights and migrate long distances in the fall. The prong and glue attachment method is for short-term monitoring of nesting birds and assessing the timing and causes of mortality in newly hatched young. According to the manufacturer, some prong and glue transmitters are shed in 50 to > 150 days, with most lost when the bird undergoes its next molt. The 9-g transmitter used in this project is approximately 1.3% of the typical nesting Steller's eider hen's body weight of approximately 700 g.

The general attachment procedure is as follows: A 2-3 mm incision is made in the skin on the bird's back between the scapulas. The stainless steel prong is inserted in the incision and maneuvered to anchor the front of the transmitter to the bird's back. The incision site is closed with veterinary grade super glue (Vet Bond). The rear of the transmitter is glued to the bird's feathers with fast setting medium viscosity cyanoacrylate glue.

Field personnel will attempt to locate radio-marked females every three days until ducklings are about 15 days old, then every 7 days thereafter until the brood fledges, fails, or the signal can no longer be heard after repeated attempts. For tracking, field personnel will use a VHF radio-tracking receiver (Wildlife Track, WTI-1000) and 3-element hand-held Yagi antenna. Whenever possible, field personnel will attempt to observe broods from a distance (with binoculars) without altering hen and duckling behavior, and will leave the area as soon as possible. Tracking should not occur on stormy or unusually cold days when ducklings might seek sheltered areas or spend more time being brooded. Field crews will record information on brood size, habitat use, location (GPS coordinates and description), interactions with predators, and time.

Capture, marking, and sampling of spectacled eider ducklings
If an adequate number of radio-marked spectacled eider broods survive to ~one month post-hatch, field personnel will attempt to capture ducklings in August. As hatch dates will be known from nest captures, duckling age will also be known (within a couple days), and capture efforts can target ducklings at 30 – 35 days of age to be consistent with previous studies (Flint et al. 2000, B. Lake, USFWS, Unpublished data). Known-age broods will be relocated using radio-telemetry, and field personnel will attempt to capture as many brood members as possible and the brood female. Field personnel will capture broods by driving them across ponds into staked mist-nets (Dau 1976, Flint et al. 2000). Ducklings will be banded with USFWS stainless steel bands, plastic tarsal markers, weighed, and morphological measurement will be taken. Field crews will collect 1-2 cc of blood from the jugular vein for lead and disease exposure analysis, and collect a cloacal swab to examine for exposure to viral pathogens. All members of a brood will be released simultaneously along with the adult female (if captured) to minimize risk of brood fragmentation. If the female is not captured, field personnel will move the ducklings as close her as possible, quickly release the ducklings, and leave the area immediately to allow the female to reunite with the brood. Efforts will be made to handle ducklings as quickly as possible and reunite the brood with the female.

3. STATUS OF THE SPECIES AND CRITICAL HABITAT

This section presents biological and ecological information relevant to formation of the BO. Appropriate information on the species' life history, habitat and distribution, and other factors necessary for their survival is included for analysis in later sections.

Our analyses under the Act include consideration of ongoing and projected changes in climate. The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). "Climate" refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007, p. 78). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

3.1 Spectacled Eider

Spectacled eiders are large sea ducks. Males in breeding plumage have a white back, black breast, and pale green head with large white "spectacles" around the eyes (Figure 3.1A) Spectacled eiders were listed as threatened throughout their range on May 10, 1993 (USFWS 1993) based on indications of steep declines in the two Alaska-breeding populations. There are three primary spectacled eider populations, each corresponding to breeding grounds on Alaska's North Slope, the Yukon–Kuskokwim Delta (Y-K Delta), and northern Russia. The Y-K Delta population declined 96% between the early 1970s and 1992 (Stehn et al. 1993). Data from the Prudhoe Bay oil fields (Warnock and Troy 1992) and information from Native elders at Wainwright, AK (R. Suydam, pers. comm.in USFWS 1996) suggested concurrent localized declines on the North Slope, although data for the entire North Slope breeding population were not available. Spectacled eiders molt in several discrete areas (Figure 3.1B) during late summer and fall, with birds from the different populations and genders apparently favoring different molting areas (Petersen et al. 1999). All three spectacled eider populations overwinter in openings in pack ice of the central Bering Sea, south and southwest of St. Lawrence Island (Petersen et al. 1999; Figure 3.1B), where they remain until March–April (Lovvorn et al. 2003).

Life History

Breeding

In Alaska, spectacled eiders breed primarily on the North Slope (ACP) and the Y-K Delta. On the ACP, spectacled eiders breed north of a line connecting the mouth of the Utukok River to a point on the Shaviovik River about 24 km (15 miles) inland from its mouth. Breeding density varies across the ACP (Figure 3.10). Although spectacled eiders historically occurred throughout the coastal zone of the Y-K Delta, they currently breed primarily in the central coast zone within about 15 km (~9 miles) of the coast from Kigigak Island north to Kokechik Bay (USFWS 1996). However, a number of sightings on the Y-K Delta have also occurred both north and south of this area during the breeding season (R. Platte, USFWS, pers. comm. 1997).

Spectacled eiders arrive on the ACP breeding grounds in late May to early June. Numbers of breeding pairs peak in mid-June and decline 4–5 days later when males begin to depart from the breeding grounds (Smith et al. 1994, Anderson and Cooper 1994, Anderson et al. 1995, Bart and Earnst 2005). Mean clutch size reported from studies on the Colville River Delta was 4.3 (Bart and Earnst 2005). Mean spectacled eider clutch size near Barrow was 4.1 ± 0.3 SE in 2009–2010 and 4.7 ± 0.3 in 2011 (Safine 2011, Safine *in prep*). Hatching occurs in mid-July (Bart and Earnst 2005, Safine 2011, Safine *in prep*).

Nest initiation on Kigigak Island on the Y-K Delta occurs from mid-May to mid-June (Lake 2007). Incubation lasts approximately 24 days (Dau 1976). Mean spectacled eider clutch size is higher on the Y-K Delta compared to the ACP. Mean annual clutch size ranged from 3.8–5.4 in coastal areas of the Y-K Delta (1985–2011; Fischer at al. 2011), and 4.0–5.5 on Kigigak Island (1992–2011; Gabrielson and Graff 2011), with clutches of up to eight eggs reported (Lake 2007).

On the breeding grounds, spectacled eiders feed on mollusks, insect larvae (craneflies, caddisflies, and midges), small freshwater crustaceans, and plants and seeds (Kondratev and Zadorina 1992) in shallow freshwater or brackish ponds, or on flooded tundra. Ducklings fledge approximately 50 days after hatch, and then females with broods move directly from freshwater to marine habitat to stage prior to fall migration.

Survivorship

Nest success is highly variable and thought to be influenced by predators, including gulls (*Larus* spp.), jaegers (*Stercorarius* spp.), and red (*Vulpes vulpes*) and arctic (*Alopex lagopus*) foxes. In arctic Russia, apparent nest success was calculated as <2% in 1994 and 27% in 1995; low nest success was attributed to predation (Pearce et al. 1998). On the ACP, apparent nest success was 40% for 15 spectacled eiders nests monitored in the Prudhoe Bay oil fields from 1981 to 1991 (Warnock and Troy 1992) and 35% (range 27–42%) for nests in the Kuparuk oilfields in 1993–1998 (Anderson et al. 1998). On Kigigak Island in the Y-K Delta, nest survival probability ranged from 0.06–0.92 from 1992–2007 (Lake 2007); nest success tended to be higher in years with low fox numbers or activity (i.e., no denning) or when foxes were eliminated from the island prior to the nesting season. Bowman et al. (2002) also reported high variation in nesting success (20–95%) of spectacled eiders on the Y-K Delta, depending on the year and location.

Available data indicates egg hatchability is high for spectacled eiders nesting on the ACP, in arctic Russia, and at inland sites on the Y-K Delta, but considerably lower in the coastal region of the Y-K Delta. Spectacled eider eggs that are addled or that do not hatch are very rare in the Prudhoe Bay area (Declan Troy, TERA, pers. comm. 1997), and Esler et al. (1995) found very few addled eggs on the Indigirka River Delta in Arctic Russia. Additionally, from 1969 to 1973 at an inland site on the Yukon Delta National Wildlife Refuge, only 0.8% of spectacled eider eggs were addled or infertile (Dau 1976). In contrast, 24% of all nests monitored in a coastal region of the Y-K Delta during the early to mid-1990s contained inviable eggs and ~10% of eggs in successful nests did not hatch due to either embryonic mortality or infertility (Grand and Flint 1997). This relatively high occurrence of inviable eggs near the coast of the Y-K Delta may have been related to exposure to contaminants (Grand and Flint 1997). It is unknown whether hatchability of eggs in this region has improved with decreased use of lead shot in the region and natural attenuation of existing lead pellets (Flint and Schamber 2010) in coastal Y-K Delta wetlands.

Recruitment rate (the percentage of young eiders that hatch, fledge, and survive to sexual-maturity) of spectacled eiders is poorly known (USFWS 1999) because there is limited data on juvenile survival. In a coastal region of the Y-K Delta, duckling survival to 30 days averaged 34%, with 74% of this mortality occurring in the first 10 days, while survival of adult females during the first 30 days post hatch was 93% (Flint and Grand 1997).

(A)

(B)

Figure 3.1. (A) Male and female spectacled eiders in breeding plumage. (B) Distribution of spectacled eiders. Molting areas (green) are used July –October. Wintering areas (yellow) are used October –April. The full extent of molting and wintering areas is not yet known and may extend beyond the boundaries shown.

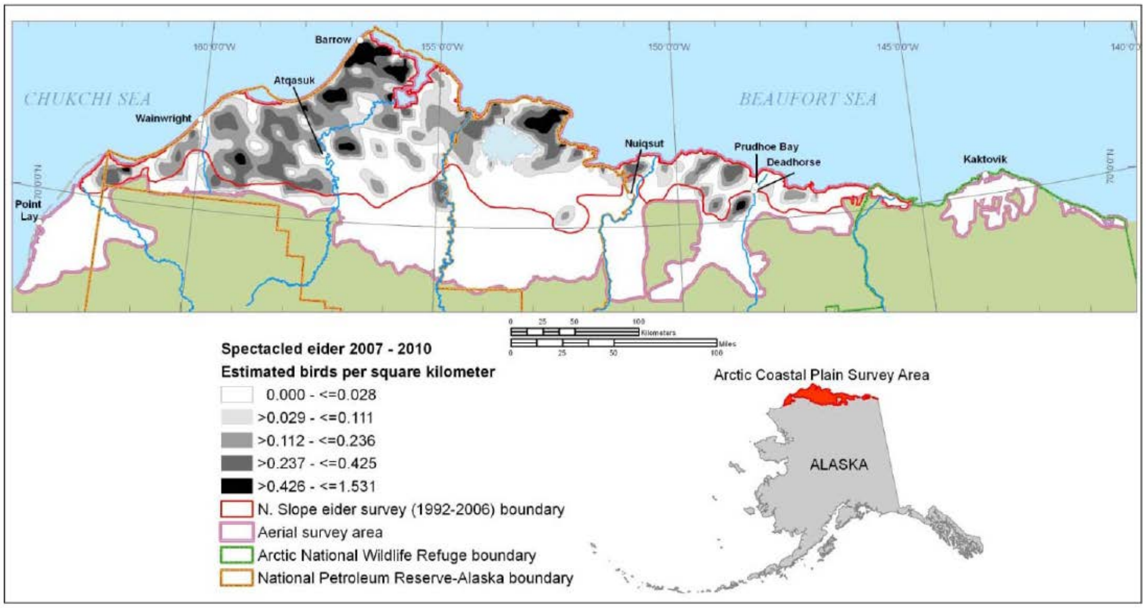

Figure 3.2. Density distribution of spectacled eiders observed on aerial transects sampling 57,336 km^2 of wetland tundra on the North Slope of Alaska during early to mid-June, 2007–2010 (Larned et al. 2011).

Fall Migration and Molting

As with many other sea ducks, spectacled eiders spend the 8–10 month non-breeding season at sea, but until recently much about the species' life in the marine environment was unknown. Satellite telemetry and aerial surveys led to the discovery of spectacled eider migrating, molting, and wintering areas. These studies are summarized in Petersen et al. (1995), Larned et al. (1995), and Petersen at al. (1999). Results of recent satellite telemetry research (2008–2011) are consistent with earlier studies (Matt Sexson, USGS, pers. comm.). Phenology spring migration and breeding, including arrival, nest initiation, hatch, and fledging, is 3–4 weeks earlier in western Alaska (Y-K Delta) compared to northern Alaska (ACP); however, phenology of fall migration is similar between areas. Individuals depart breeding areas July–September, depending on their breeding status and molt in September–October. (Matt Sexson, USGS, pers. comm.).

Males generally depart breeding areas on the North Slope (ACP) when the females begin incubation in late June (Anderson and Cooper 1994, Bart and Earnst 2005). Use of the Beaufort Sea by departing males is variable. Some appear to move directly to the Chukchi Sea over land, while the majority moved rapidly (average travel of 1.75 days), over near shore waters from breeding grounds to the Chukchi Sea (TERA 2002). Of 14 males implanted with satellite transmitters, only four spent an extended period of time (11–30 days), in the Beaufort Sea (TERA 2002). Preferred areas for males appeared to be near large river Deltas such as the Colville River where open water is more prevalent in early summer when much of the Beaufort Sea is still frozen. Most adult males marked in northern and western Alaska in a recent satellite telemetry study migrated to northern Russia to molt (USGS, unpublished data). Results from this study also suggest that male eiders are likely to follow coast lines but also migrate straight across the northern Bering and Chukchi seas in route to northern Russia (Matt Sexson, USGS, pers. comm.).

Females generally depart the breeding grounds later, when much more of the Beaufort Sea is ice-free, allowing for more extensive use of the area. Females spent an average of two weeks in the Beaufort Sea (range 6-30 days) with the western Beaufort Sea the most heavily-used (TERA 2002). Females also appeared to migrate through the Beaufort Sea an average of 10 km further offshore than the males (Petersen et al. 1999). The greater use of the Beaufort Sea and offshore areas by females was attributed to the greater availability of open water when females depart the area (Petersen et al. 1999, TERA 2002). Recent telemetry data indicates that molt migration of failed/non-breeding females from the Colville River Delta through the Beaufort Sea is relatively rapid, 2–weeks, compared to 2–3 months spent in the Chukchi Sea (Matt Sexson, USGS, pers. comm.).

Spectacled eiders use specific molting areas from July to late October/early November. Larned et al. (1995) and Petersen et al. (1999) discussed spectacled eiders' apparently strong preference for specific molting locations, and concluded that all spectacled eiders molt in four discrete areas (Table 3.1). Females generally used molting areas nearest their breeding grounds. All marked females from the Y-K Delta molted in nearby Norton Sound, while most marked females from the North Slope molted in Ledyard Bay. Males did not show strong molting site fidelity; males from all three breeding areas molted in Ledyard Bay, Mechigmenskiy Bay, and the Indigirka/Kolyma River Delta. Males reached molting areas first, beginning in late June, and remained through mid-October. Non-breeding females, and those that nested but failed, arrived at molting areas in late July, while successfully-breeding females and young of the year reached molting areas in late August through late September and remained through October. Fledged juveniles marked on the Colville River Delta usually staged in the Beaufort Sea near the delta for 2–3 weeks before migrating to the Chukchi Sea.

Avian molt is energetically demanding, especially for species such as spectacled eiders that complete molt in a few weeks. Molting birds must have ample food resources, and the rich benthic community of Ledyard Bay (Feder et al. 1989, 1994a, 1994b) likely provides these for spectacled eiders. Large concentrations of spectacled eiders molt in Ledyard Bay to use this food resource; aerial surveys on 4 days in different years counted 200 to 33,192 molting spectacled eiders in Ledyard Bay (Petersen et al. 1999; Larned et al. 1995).

Wintering

Spectacled eiders generally depart all molting sites in late October/early November (Matt Sexson, USGS, pers. comm.), migrating offshore in the Chukchi and Bering Seas to a single wintering area in openings in pack ice of the central Bering Sea south/southwest of St. Lawrence Island (Figure 3.3). In this relatively shallow area, > 300,000 spectacled eiders (Petersen et al. 1999) rest and feed, diving up to 70 m to eat bivalves, other mollusks, and crustaceans (Cottam 1939, Petersen et al. 1998, Lovvorn et al. 2003, Petersen and Douglas 2004).

Table 3.1. Important molting areas for female and male spectacled eiders from each breeding population.

Population and Sex	Molting Area
Arctic Russia Males	Indigirka-Kolyma Delta Area
	Mechigmenskiy Bay
	Ledyard Bay
Arctic Russia Females	unknown
North Slope Males	Ledyard Bay
	Indigirka-Kolyma Delta Area
	Mechigmenskiy Bay
North Slope Females	Ledyard Bay
	Mechigmenskiy Bay
Y-K Delta Males	Mechigmenskiy Bay Eastern Norton Sound Indigirka-Kolyma Delta Area
Y-K Delta Females	Eastern Norton Sound

Spring Migration

Recent information about spectacled and other eiders indicates they probably make extensive use of the eastern Chukchi spring lead system between departure from the wintering area in March and April and arrival on the North Slope in mid-May or early June. Limited spring aerial observations in the eastern Chukchi have documented dozens to several hundred common eiders (*Somateria mollissima)* and spectacled eiders in spring leads and several miles offshore in relatively small openings in rotting sea ice (W. Larned, USFWS; J. Lovvorn, Southern Illinois University Carbondale, pers. comm.). Woodby and Divoky (1982) documented large numbers of king eiders (*Somateria spectabilis*) and common eiders using the eastern Chukchi lead system, advancing in pulses during days of favorable following winds, and concluded that an open lead is probably requisite for the spring eider passage in this region. Preliminary results from an ongoing satellite telemetry study conducted by the USGS Alaska Science Center (Figure 3.3; USGS, unpublished data) suggest that spectacled eiders also use the lead system during spring migration.

Adequate foraging opportunities and nutrition during spring migration are critical to spectacled eider productivity. Like most sea ducks, female spectacled eiders do not feed substantially on the breeding grounds, but produce and incubate their eggs while living primarily off body reserves (Korschgen 1977, Drent and Daan 1980, Parker and Holm 1990). Clutch size, a measure of reproductive potential, was positively correlated with body condition and reserves obtained prior to arrival at breeding areas (Coulson 1984, Raveling 1979, Parker and Holm 1990). Body reserves must be maintained from winter or acquired during the 4-8 weeks (Lovvorn et al. 2003) of spring staging, and Petersen and Flint (2002) suggest common eider productivity on the western Beaufort Sea coast is influenced by conditions encountered in May to early June during their spring migration through the Chukchi Sea (including Ledyard Bay). Common eider female body mass increased 20% during the 4-6 weeks prior to egg laying (Gorman and Milne 1971, Milne 1976, Korschgen 1977, Parker and Holm 1990). For spectacled eiders, average female body weight in late March in the Bering Sea was 1,550 ± 35 g (n = 12), and slightly (but not significantly) more upon arrival at breeding sites (1,623 ± 46 g, n = 11; Lovvorn et al. 2003), indicating that spectacled eiders must maintain or enhance their physiological condition during spring staging.

Abundance and Trends

The most recent rangewide estimate of the total number of spectacled eiders was 363,000 (333,526–392,532 95% CI), obtained by aerial surveys of the known wintering area in the Bering Sea in late winter 1996–1997 (Petersen et al. 1999). Winter/spring aerial surveys were repeated in 2009 and 2010. Preliminary results from 2009 indicate an estimate of 301,812 spectacled eiders, but this value will be updated when surveys from both years are analyzed (Larned et al. 2009).

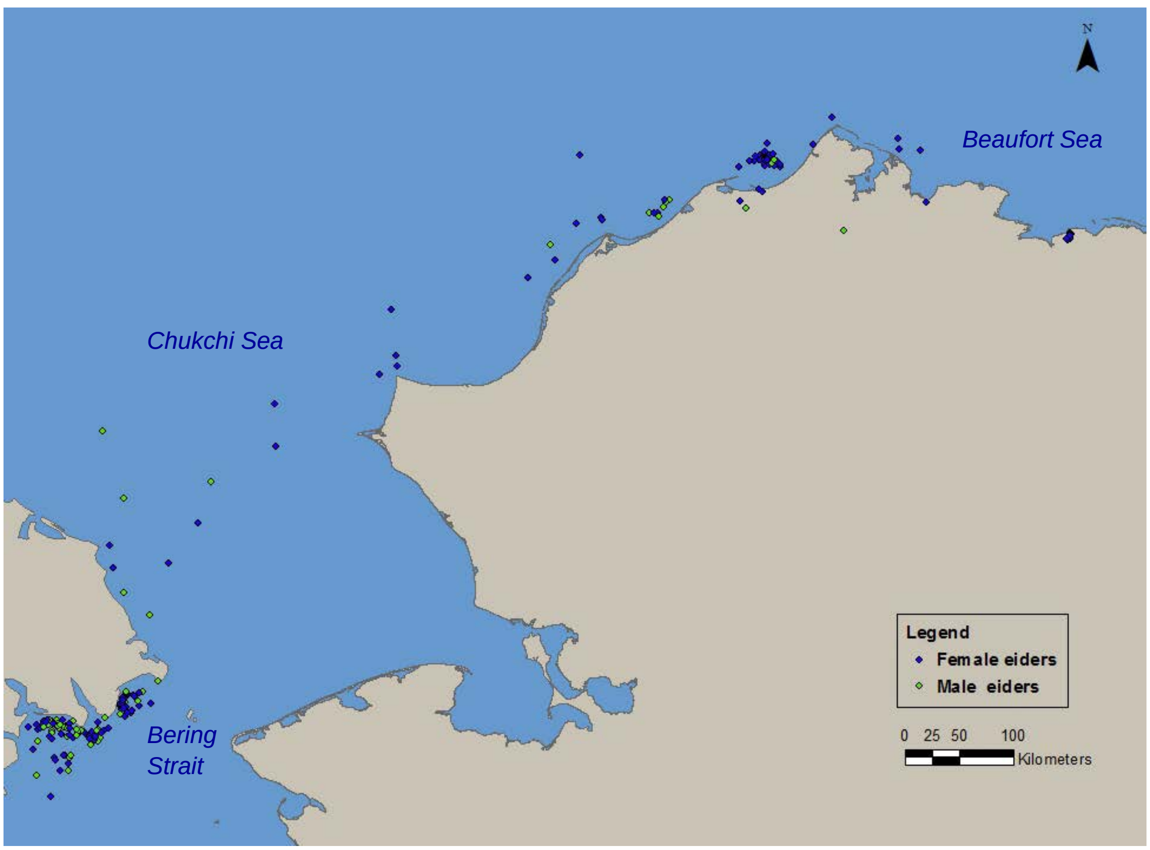

Figure 3.3. Spectacled eider satellite telemetry locations for 12 female and 7 male spectacled eiders in the eastern Chukchi Sea from 1 April – 15 June 2010 and 1 April – 15 June 2011. Additional locations from the northern coast of Russia are not shown. Eiders were tagged on the North Slope during the 2009 and 2010 breeding seasons. Data provided by Matt Sexson, USGS Alaska Science Center (USGS, unpublished).

Population indices for North Slope-breeding spectacled eiders are unavailable prior to 1992. However, Warnock and Troy (1992) documented an 80% decline in spectacled eider abundance from 1981 to 1991 in the Prudhoe Bay area. Since 1992, the Service has conducted annual aerial surveys for breeding spectacled eiders on the ACP. The 2010 population index based on these aerial surveys was 6,286 birds (95% CI, 4,877–7,695; unadjusted for detection probability), which is 4% lower than the 18-year mean (Larned et al 2011). In 2010, the index growth rate was significantly negative for both the long-term (0.987; 95% CI, 0.974–0.999) and most recent 10 years (0.974; 95% CI, 0.950–0.999; Larned et al. 2011). Stehn et al. (2006) developed a North Slope-breeding population estimate of 12,916 (95% CI, 10,942–14,890) based on the 2002–2006 ACP aerial index for spectacled eiders and relationships between ground and aerial surveys on the Y-K Delta. If the same methods are applied to the 2007–2010 ACP aerial index reported in Larned et al (2011), the resulting North Slope-breeding population estimate is 11,254 (8,338–14,167, 95% CI).

The Y-K Delta spectacled eider population was thought to be about 4% of historic levels in 1992 (Stehn et al. 1993). Evidence of the dramatic decline in spectacled eider nesting on the Y-K Delta was corroborated by Ely et al. (1994). They documented a 79% decline in eider nesting between 1969 and 1992 for areas near the Kashunuk River. Aerial and ground survey data indicated that spectacled eiders were undergoing a decline of 9–14% per year from 1985–1992 (Stehn et al. 1993). Further, from the early 1970s to the early 1990s, the number of pairs on the Y-K Delta declined from 48,000 to 2,000, apparently stabilizing at that low level (Stehn et al. 1993). Before 1972, an estimated 47,700–70,000 pairs of spectacled eiders nested on the Y-K Delta in average to good years (Dau and Kistchinski 1977).

Fischer et al. (2011) used combined annual ground-based and aerial survey data to estimate the number of nests and eggs of spectacled eiders on the coastal area of the Y-K Delta in 2011 and evaluate long-term trends in the Y-K Delta breeding population from 1985 to 2011. The estimated total number of nests measures the minimum number of breeding pairs in the population in a given year and does not include potential breeders that did not establish nests that year or nests that were destroyed or abandoned at an early stage (Fischer et al. 2011). The total number of nests in 2011 was estimated at 3,608 (SE 448) spectacled eiders nests on the Y-K Delta, the second lowest estimate over the past 10 years. The average population growth rate based on these surveys was 1.049 (90% CI = 0.994–1.105) in 2002–2011 and 1.003 (90% CI = 0.991–1.015) in 1985–2011 (Fischer et al. 2011). Log-linear regression based solely on the long-term Y-K Delta aerial survey data indicate positive population growth rates of 1.073 (90% CI = 1.046–1.100) in 2001–2010 and 1.070 (90% CI = 1.058–1.081) in 1988–2010 (Platte and Stehn 2011). The 2010 population index based on these aerial surveys was 5362 birds (SE 527). Platte and Stehn (2011) estimated the Y-K Delta spectacled eider breeding population to be 12,601 (95% CI[1] = 10,173–15,028) in 2010.

[1] Confidence intervals calculated based on information provided in Platte and Stehn (2011).

Spectacled Eider Recovery Criteria

The Spectacled Eider Recovery Plan (USFWS 1996) presents research and management priorities with the objective of recovery and delisting so that protection under the Act is no longer required. Although the cause or causes of the spectacled eider population decline is not known, factors that affect adult survival are likely to be the most influential on population growth rate. These include lead poisoning from ingested spent shotgun pellets, which may have contributed to the rapid decline observed in the Y-K Delta (Franson et al. 1995, Grand et al. 1998), and other factors such as habitat loss, increased nest predation, over harvest, and disturbance and collisions caused by human infrastructure. Under the Recovery Plan, the species will be considered recovered when each of the three recognized populations (Y-K Delta, North Slope of Alaska, and Arctic Russia): 1) is stable or increasing over 10 or more years and the minimum estimated population size is at least 6,000 breeding pairs, or 2) number at least 10,000 breeding pairs over 3 or more years, or 3) number at least 25,000 breeding pairs in one year. Spectacled eiders do not currently meet these recovery criteria.

Spectacled Eider Critical Habitat

Critical habitat for molting spectacled eiders was designated in Norton Sound and Ledyard Bay molting areas, nesting areas on the Y-K Delta, and the wintering area southwest of St. Lawrence Island (critical habitat was not designated on the ACP; 66 CFR 9146 [February 6, 2001]) .

3.2 Steller's Eider

Physical Appearance

The Steller's eider is a sea duck with a circumpolar distribution and the sole member of the genus *Polysticta*. The Steller's eider is the smallest of the four eider species, weighing approximately 700–800 g (1.5–1.8 lbs.). Males are in breeding plumage (Figure 3.4) from early winter through mid-summer. During late summer and fall, males molt to dark brown with a white-bordered blue wing speculum. Following replacement of flight feathers in the fall, males re-acquire breeding plumage, which lasts through the next summer. Females are dark mottled brown with a white-bordered blue wing speculum year round. Juveniles are dark mottled brown until fall of their second year, when they acquire breeding plumage.

Figure 3.4. Male and female Steller's eiders in breeding plumage.

Steller's eiders are divided into Atlantic and Pacific populations; the Pacific population is further divided into the Russia-breeding population, which nests along the Russian eastern arctic coastal plain, and the Alaska-breeding population. The Alaska breeding population of the Steller's eider was listed as threatened on July 11, 1997 based on substantial contraction of the species' breeding range on the Arctic Coastal Plain (ACP) and on the Yukon–Kuskokwim Delta (Y-K Delta) in Alaska, reduced numbers of Steller's eiders breeding in Alaska, and the resulting vulnerability of the remaining breeding population to extirpation (USFWS 1997). In Alaska, Steller's eiders breed almost exclusively on the Arctic Coastal Plain (ACP) and molt and winter, along with the majority of the Russia-breeding population, in south-central Alaska (Figure 3.5). Periodic non-breeding of the entire population of Steller's eiders breeding near Barrow, AK, the species' primary breeding grounds, coupled with low nesting and fledging success, has resulted in very low productivity (Quakenbush et al. 2004) and may make the population particularly vulnerable to extirpation. In 2001, the Service designated 2,830 mi^2 (7,330 km^2) of critical habitat for the Alaska-breeding population of Steller's eiders at historic breeding areas on the Y-K Delta, a molting and staging area in the Kuskokwim Shoals, and molting areas in marine waters at Seal Islands, Nelson Lagoon, and Izembek Lagoon (66 FR 8849, February 2, 2001). No critical habitat for Steller's eiders has been designated on the ACP.

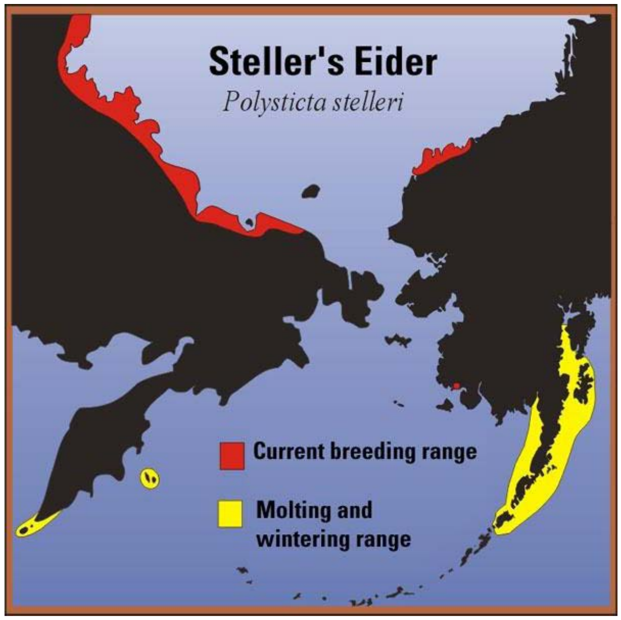

Figure 3.5. Steller's eider distribution in the Bering, Beaufort and Chukchi Seas.

Life History

Breeding Ecology

Steller's eiders arrive in small flocks of breeding pairs on the ACP[2] in early June. Nesting on the ACP is concentrated in tundra wetlands near Barrow, AK (Figure 3.6) and occurs at lower densities elsewhere on the ACP from Wainwright east to the Sagavanirktok River (Quakenbush et al. 2002). Long-term studies of Steller's eider breeding ecology near Barrow indicate periodic non-breeding by the entire local breeding population. Since 1991, Steller's eiders nests were detected in 12 of 20 study years (1991–2010; Safine 2011). Periodic non-breeding by Steller's eiders near Barrow seems to be associated with fluctuations in lemming populations and related breeding patterns in pomarine jaegers (*Stercorarius pomarinus*) and snowy owls (*Nyctea scandiaca*) (Quakenbush et al. 2004). In years with high lemming abundance, Quakenbush et al. (2004) reported that Steller's eider nesting success was a function of a nest's distance from pomarine jaeger and snowy owl nests. These avian predators nest only in years of high lemming abundance and defend their nests aggressively against arctic foxes. By nesting within jaeger and owl territories, Steller's eiders may benefit from protection against arctic foxes even at the expense of occasional partial nest depredation by the avian predators themselves (Quakenbush et al. 2002, Quakenbush et al. 2004). Steller's eiders may also benefit from the increased availability of alternative prey for both arctic foxes and avian predators in high lemming years (Quakenbush et al. 2004).

Steller's eiders initiate nesting in the first half of June (Quakenbush et al. 2004). Nests are preferentially located on the rims of low-center polygons, low polygons, and high-

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[2] Steller's eiders nest in extremely low numbers on the YKD and will not be treated further here. See the *Status and Distribution* section for further discussion of the YKD breeding population.

center polygons (Quakenbush et al. 2000). Mean clutch size at Barrow was 5.4 ± 1.6 SD (range = 1–8) over 5 nesting years in 1992–1999 (Quakenbush et al. 2000). Males leave the nests with the onset of incubation. Nest survival (the probability a nest will hatch at least one egg) is affected by predation levels, and averaged 0.23 (±0.09, standard error [SE]) from 1991–2004 before fox control was implemented near Barrow and 0.49 (±0.10 SE) from 2005–2011 during years with fox control (USFWS, unpublished data). Steller's eider nest and egg loss has been attributed to depredation by pomarine jaegers, parasitic jaegers (*Stercorarius parasiticus*), common raven (*Corvus corax*), arctic fox (*Alopex lagopus*), and glaucous gulls (*Larus hyperboreus*) (Quakenbush et al. 1995, Rojek 2008, Safine 2011). Nest depredation by a family group of polar bears was also documented in 2011 (Safine in prep).

Hatching occurs from mid-July through early August (Rojek 2006, 2007, 2008). Hens move their broods to adjacent ponds with emergent vegetation dominated by Carex spp. and Arctophila fulva (Quakenbush et al. 2000, Rojek 2006, 2007). There they feed on aquatic insect larvae and freshwater crustaceans. Broods tracked in 1995–1996 (n = 13) remained within 0.7 km of their nests (Quakenbush et al. 2004); however, 9 broods tracked in 2005–2006 moved up to 0.3–3.5 km from their nests (Rojek 2006, 2007). Rojek (2006) speculated that drying of ponds in the vicinity of nests in 2005 may have caused broods to move greater distances. Observations of known-age ducklings indicate that fledging occurs 32–37 days post hatch (Obritschkewitsch et al. 2001, Quakenbush et al. 2004, Rojek 2006, Rojek 2007).

Information on breeding site fidelity of Steller's eiders is limited. However, some information is available from the breeding ecology study at Barrow. Since the mid-1990s, six birds that were originally captured as confirmed nesters near Barrow were recaptured in subsequent years nesting near Barrow. The time between capture events ranged from 1 to 12 years and the distance between nests ranged from 0.1 to 6.3 km (USFWS, unpublished data).

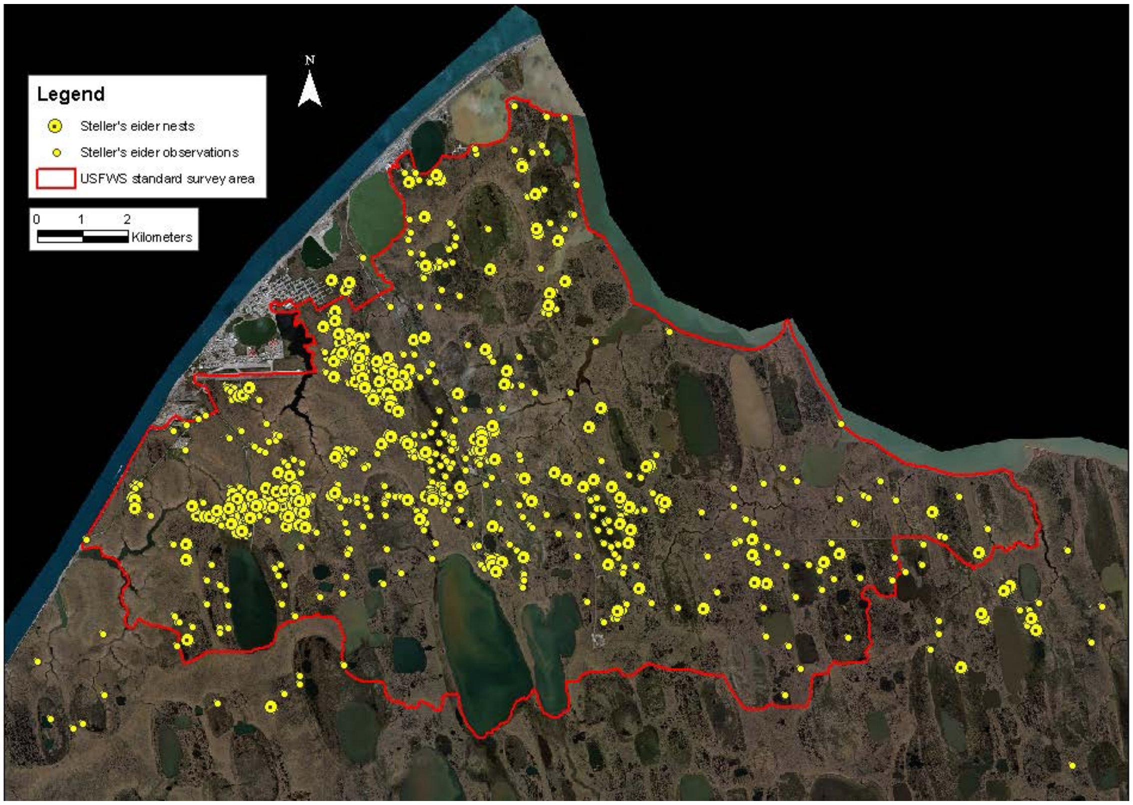


Figure 3.6. Steller's eider nest locations (1991–2010) and breeding pair observations (1999–2010). The standard survey area is surveyed annually. The survey area is expanded beyond the standard area in some years.

Localized Post-breeding Movements

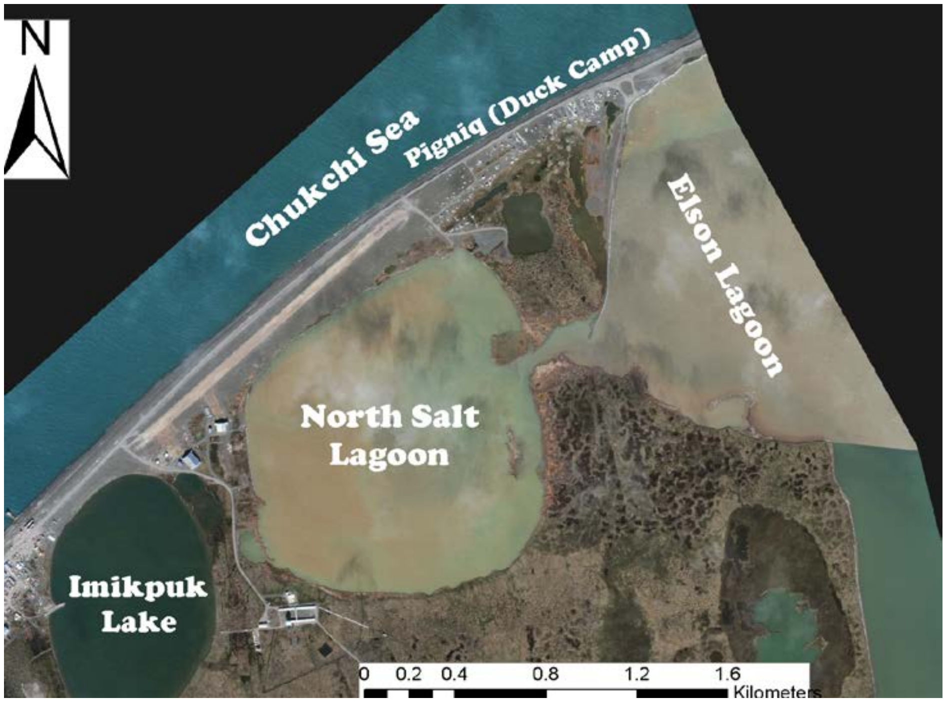
Departure from the breeding grounds near Barrow differs between sexes and between breeding and non-breeding years. In breeding years, male Steller's eiders typically leave the breeding grounds in late June to early July after females begin incubating (Obritschkewitsch et al. 2001, Quakenbush et al. 1995, Rojek 2006, 2007). Females with fledged broods depart the breeding grounds in late August to mid-September and rest and forage in water bodies near the Barrow spit prior to their southward migration along the Chukchi coast.

Prior to spring migration in both nesting and non-breeding years, some Steller's eiders rest and forage in Elson Lagoon, North Salt Lagoon, Imikpuk Lake, and the Chukchi Sea in the vicinity of Pigniq (Duck Camp; Figure 3.7A&B). Groups of Steller's eiders have been observed in nearshore areas of the Chukchi Sea from the gravel pits located south of Barrow north to Nuvuk, the northern most point of the Barrow spit. In nesting years, these flocks were primarily composed of males and persist until about the second week of July; in non-breeding years, the flocks have more even sex ratios and departed earlier compared to nesting years (J. Bacon, North Slope Borough Department of Wildlife Management [NSBDWM], pers. comm.). From mid-July through September single hens, hens with broods and small groups of two to three birds have been observed in North

Saltwater Lagoon, Elson Lagoon and near shore on the Chukchi Sea. The majority of observations have been of individuals swimming in North Salt Lagoon, but occasionally individuals and small groups flying between North Salt Lagoon, Elson Lagoon and the Chukchi Sea have been observed. Females with broods have been observed mostly near the channel that connects North Salt Lagoon and Elson Lagoon (J. Bacon, NSBDWM, pers. comm.). In 2008, 10–30 Steller's eider adult females and juveniles were observed daily between late August and mid-September staging in Elson Lagoon, North Salt Lagoon, Imikpuk Lake, and the Chukchi Sea (USFWS, Unpublished data).

To further study Steller's eider post-fledging and post-failure movements, Safine (*in prep*) marked 10 female Steller's eiders with VHF radio transmitters just prior to nest hatching in 2011. Movements of females and ducklings were monitored until early September or until females could no longer be located in the Barrow area. Most radio-marked females hatched their nests and their ducklings survived until they achieved flight (8 of 10 females produced broods that fledged). For the females whose broods fledged, females and broods were first located post-fledging near their brood rearing areas, and later, most were found in nearby marine areas. Over half (5/8) of the successful adult females were located subsequently in marine areas near Barrow, and the remaining females could not be located after leaving brood-rearing areas. Starting in late August and continuing until monitoring ceased in early September, females and fledged juveniles were observed on both the Chukchi and Beaufort Sea sides of the narrow spit of land that extends to Point Barrow. During this time adult females and juveniles were also observed further South along the Chukchi coast, near the City of Barrow. Marine locations of Steller's eiders from mid-August to early September in 2011 overlapped with the most commonly used subsistence waterfowl hunting locations near Barrow, Alaska (Figure 3.8). There is both a spatial and temporal overlap between Steller's eiders and subsistence hunters during the post-fledging period.

A



B

Figure 3.7. (A) Location of Steller's eider post-breeding staging areas in relation to Pigniq (Duck Camp) hunting area north of Barrow, Alaska.
(B) VHF marked Steller's eider hen with brood of fledglings resting in Elson Lagoon in close proximity to Duck Camp. Photo by N. Docken, USFWS.

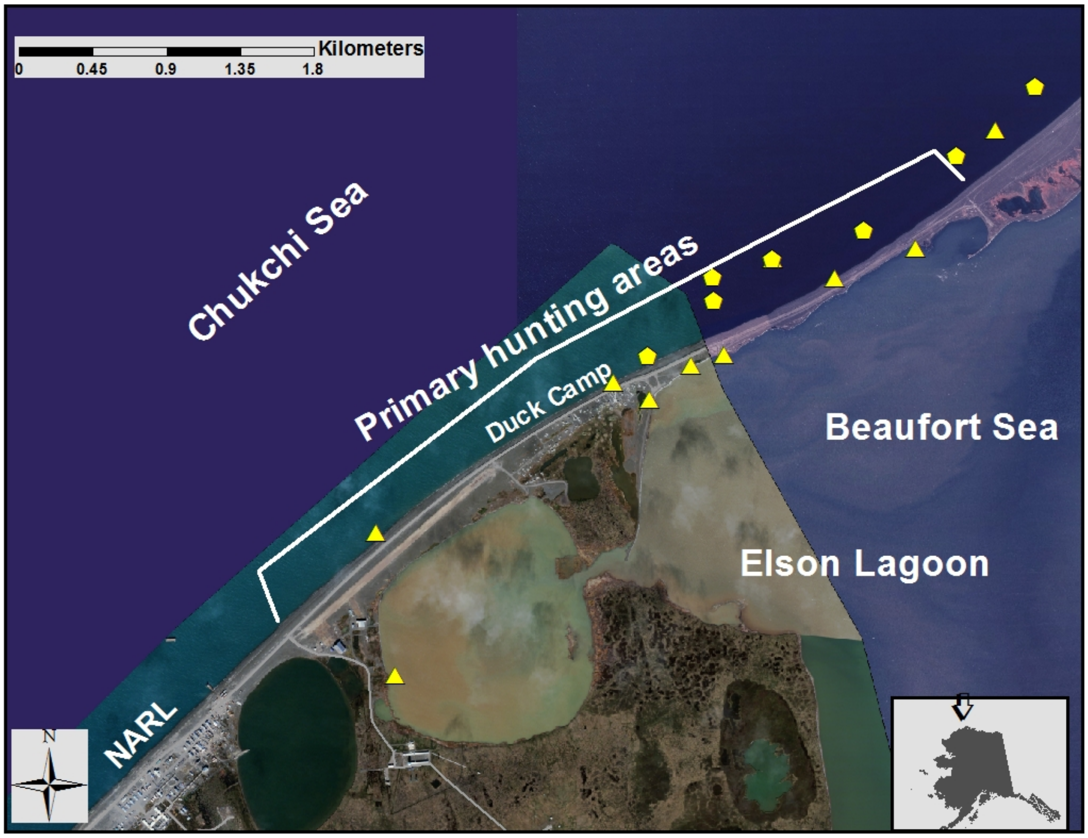


Figure 3.8. Marine locations of successful (triangles) and failed (pentagons) adult Steller's eiders (and juveniles) in the immediate vicinity of areas commonly used for subsistence hunting near Barrow, Alaska from mid-August to early September 2011.

Wing Molt

Following departure from the breeding grounds, Steller's eiders migrate to molting areas in the nearshore waters of southwest Alaska where they undergo a complete flightless molt for about 3 weeks. Steller's eiders seem to have high molting site fidelity (Flint et al. 2000). Preferred molting areas are characterized by extensive shallow areas with eelgrass (*Zostera marina*) beds and intertidal sand flats and mudflats where Steller's eiders forage primarily on bivalve molluscs and amphipods (Petersen 1980, 1981; Metzner 1993).

Both the Russia- and Alaska-breeding populations molt in numerous locations in southwest Alaska. Primary molting locations include four areas along the north side of the Alaska Peninsula: Izembek Lagoon, Nelson Lagoon, Port Heiden, and Seal Islands (Gill et al. 1981, Petersen 1981, Metzner 1993). However, Kuskoskwim Shoals, in northern Kuskokwim Bay, may also be an important molting location for Alaska-breeding Steller's eiders (Martin et al. *in prep*), especially considering the high molting site fidelity reported by Flint et al. (2000). Larned (2005) also reported >2,000 eiders molting in lower Cook Inlet near the Douglas River Delta, and smaller numbers of molting Steller's eiders have been reported from around islands in the Bering Sea, along the coast of Bristol Bay, and in smaller lagoons along the Alaska Peninsula (e.g., Dick and Dick 1971; Petersen and Sigman 1977; Wilk et al. 1986; Dau 1987; Petersen et al. 1991).

Wintering Distribution
After molt, many of the Pacific-wintering Steller's eiders disperse throughout the Aleutian Islands, the Alaskan Peninsula, and the western Gulf of Alaska including Kodiak Island and lower Cook Inlet (Figure 3.9; Larned 2000b, Martin et al. *in prep*), although thousands may remain in lagoons used for molting unless freezing conditions force them to move (USFWS 2002). The USFWS estimates that the Alaska-breeding population comprises only ~ 1%[3] of the Pacific-wintering population of Steller's eiders. Wintering Steller's eiders usually occur in shallow waters (< 10 m deep), which are generally within 400 m of shore or at offshore shallows (USFWS 2002). However, Martin et al. (*in prep*) reported substantial use of habitats > 10 m deep during mid-winter. Use of these habitats by wintering Steller's eiders may be associated with night-time resting periods or with shifts in the availability of local food resources (Martin et al. *in prep*).

Spring Migration
Early in spring migration, thousands of Steller's eiders stage in estuaries along the north side of the Alaska Peninsula, including some molting lagoons, and at Kuskokwim Shoals near the mouth of the Kuskokwim River in late May (Figure 3.9; Larned 2007, Martin et al. *in prep*). Larned (1998) concluded that Steller's eiders show strong site fidelity to preferred habitats[4] during migration, where they congregate in large numbers to feed before continuing northward migration.

Spring migration usually includes movements along the coast, although some Steller's eiders may take shortcuts across water bodies such as Bristol Bay (W. Larned, USFWS, pers. comm. 2000). Interestingly, despite many daytime aerial surveys, Steller's eiders have never been observed during migratory flights (W. Larned, USFWS, pers. comm. 2000). Like other eiders, Steller's eider probably use spring leads for feeding and resting as they move northward, but there is little information on habitat use after departing spring staging areas.

Migration Patterns Relative to Breeding Origin
There is limited information available on the migratory movements of Steller's eiders, particularly in relation to their breeding origin, and it remains unclear where the Russia and Alaska breeding populations merge and diverge during molt and spring migrations, respectively. The best available information is from the Martin et al. (in prep; Figure 3.9) satellite telemetry study discussed previously and a second telemetry study by Rosenberg et al. (2011). Martin et al. (*in prep*) marked 14 birds near Barrow, Alaska (within the

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[3] See further discussion under Population Dynamics subsection.

[4] Several areas receive consistent use by Steller's eiders during spring migration, including Bechevin Bay, Morzhovoi Bay, Izembek Lagoon, Nelson Lagoon/Port Moller Complex, Cape Seniavin, Seal Islands, Port Heiden, Cinder River State Critical Habitat Area, Ugashik Bay, Egegik Bay, Kulukak Bay, Togiak Bay, Nanwak Bay, Kuskokwim Bay, Goodnews Bay, and the south side of Nunivak Island (Larned 1998, Larned 2000a, Larned 2000b, Larned et al. 1993).

range of the listed Alaska-breeding population) in 2000 and 2001. Although samples sizes were small, results suggested disproportionately high use of Kuskokwim Shoals by Alaska-breeding Steller's eiders during wing molt compared to the Pacific population as a whole. However, Martin et al. (*in prep*) did not find Alaska-breeding Steller's eiders to preferentially use specific wintering areas. The second study marked Steller's eiders wintering on Kodiak Island, Alaska and followed birds through the subsequent spring (n = 24) and fall molt (n = 16) migrations from 2004–2006 (Rosenberg et al. 2011). Most of the birds marked on Kodiak migrated to eastern arctic Russia prior to the nesting period and none were relocated on land or in nearshore waters north of the Yukon River Delta in Alaska (Rosenberg et al. 2011).

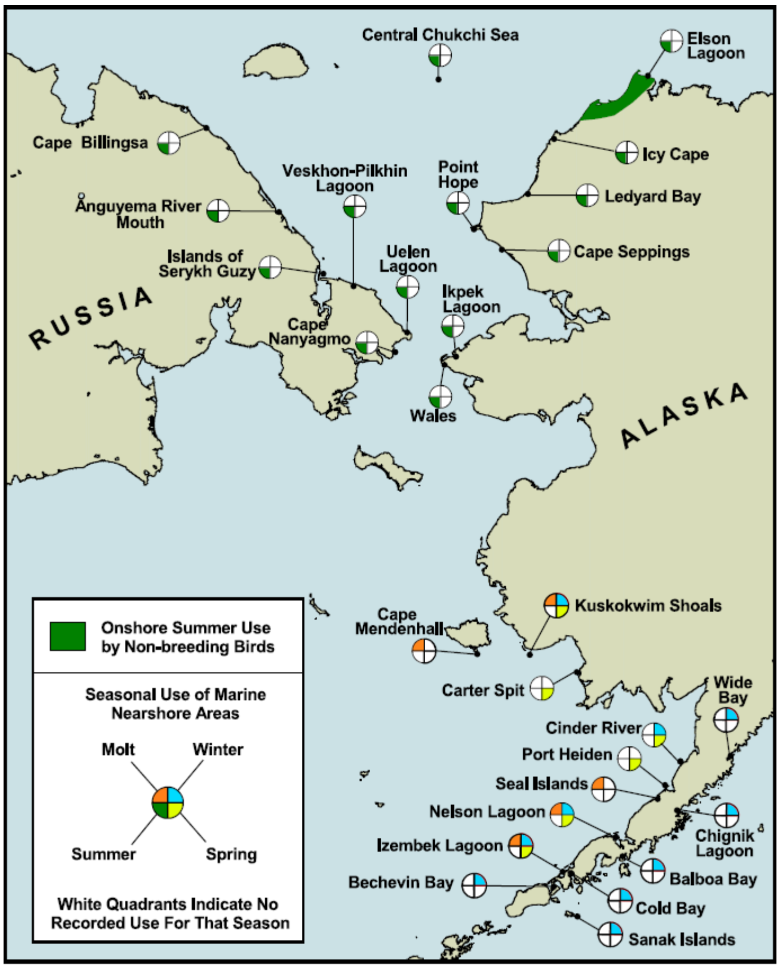

Figure 3.9. Distribution of Alaska-breeding Steller's eiders during the non-breeding season, based on the location of 13 birds implanted with satellite transmitters in Barrow, Alaska, June 2000 and June 2001. Marked locations include all those at which a bird remained for at least three days. Onshore summer use area comprises the locations of birds that departed Barrow, apparently without

attempting to breed in 2001. (Fig 9 in USFWS 2002; study described further in Martin et al. *in prep*).

Population Dynamics

Pacific Population

Spring Population Estimates and Trends

The majority of the world population of Steller's eiders migrates along the Bristol Bay coast of the Alaska Peninsula in the spring, where they linger en route to feed at the mouths of lagoons and other productive habitats. Annual spring aerial surveys have been conducted most years since 1992 to monitor the population status and habitat use of Steller's eiders staging in southwest Alaska prior to spring migration. Annual abundance estimates have ranged from 54,888 (2010) to 137,904 (1992) to with a mean of 81,925 birds. The long-term trend (1992–2011) indicates an annual decline of 2.3 percent per year (R^2=0.34; Larned 2012). Larned (2012) suggests that a slight negative trend bias may have resulted from a higher frequency of optimally-timed counts in early years due to free selection from among survey replicates, compared to single annual counts in later surveys.

The best available estimate of North Slope breeding Steller's eiders (576 birds; Stehn and Platte 2009; also see discussion below) is approximately 1% of the estimate of Pacific-wintering Steller's eiders from 2011 (74,369; Larned 2012). Thus, the listed Alaska-breeding population is thought to represent only a small proportion of the Pacific-wintering population of Steller's eiders.

Alaska-breeding Population

Abundance and Trends on the Arctic Coastal Plain

Stehn and Platte (2009) evaluated Steller's eider population and trends obtained from three aerial surveys on the ACP:

- USFWS Arctic Coastal Plain (ACP) survey
  - 1989–2006 (Mallek et al. 2007)
  - 2007–2008 (new ACP survey design; Larned et al. 2008, 2009)
- USFWS North Slope eider (NSE) survey
  - 1992–2006 (Larned et al. 2009)
  - 2007–2008 (NSE strata of new ACP survey; Larned et al. 2008, 2009)
  - Barrow Triangle (ABR) survey, 1999–2007 (ABR, Inc.; Obritschkewitsch et al. 2008)

In 2007, the ACP and NSE surveys were combined under a new ACP survey design. Surveys differed in spatial extent, seasonal timing, sampling intensity, and duration. Consequently, they produced different estimates of Steller's eider population sizes and trends. These estimates, including results from previous analyses of the ACP and NSE survey data (Mallek et al. 2007, Larned et al. 2009), are summarized in Table 3.4. Most observations of Steller's eider from both surveys occurred within the boundaries of the NSE survey (Figure 3.10).

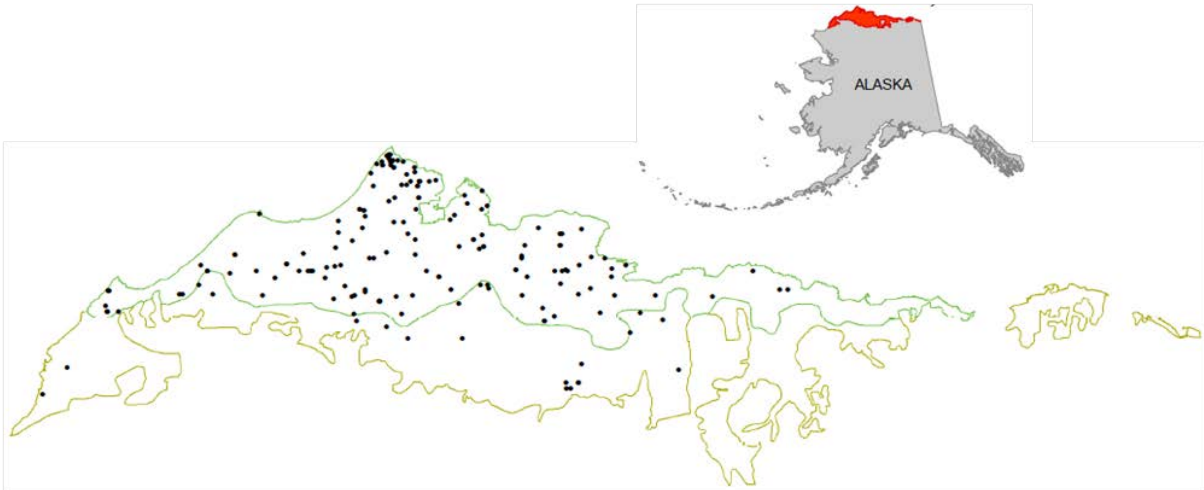

Figure 3.10. All sightings from the Arctic Coastal Plain (ACP) survey (1989–2008) and the North Slope eider (NSE) survey (1992–2006). The ACP survey encompasses the entire area shown (61,645 km^2); the NSE includes only the northern portion outlined in green (30,465 km^2). (Modified from Stehn and Platte 2009).

Following assessment of potential biases inherent in the two USFWS surveys, Stehn and Platte (2009) identified a subset of the NSE survey data (1993–2008) that they determined was "least confounded by changes in survey timing and observers." Based on this subset of the NSE survey, the average population index[5] for Steller's eiders was 173 (90% CI 88–258) with an estimated population growth rate of 1.011 (90% CI 0.857–1.193). The average population size of Steller's eiders breeding in the ACP was estimated at 576 (292–859, 90% CI; Stehn and Platte 2009) assuming a detection probability of 30%[6]. Currently, this analysis provides the best available estimate of the Alaska-breeding Steller's eider population size and growth rate from the ACP. Note that these estimates are based on relatively few observations of Steller's eiders each year with none seen in many survey years.

The Barrow Triangle (ABR) survey, conducted annually by ABR, Inc., provides more intensive coverage (50%, 1999–2004; 25–50%, 2005–2010) of the northernmost portion of the ACP. Based on ABR survey data, Stehn and Platte (2009) estimated the average population index for Steller's eiders residing within the Barrow Triangle was 99.6 (90% CI 55.5–143.7) with an estimated population growth rate of 0.934(90% CI 0.686–1.272). If we also assume the same 30% detection probability applied to the NSE estimate described in the previous section, the average population size of Steller's eiders breeding in the Barrow Triangle survey area would be 332 (185–479, 90% CI).

Alaska-breeding Population near Barrow, Alaska

The tundra surrounding Barrow, Alaska supports the only significant concentration of nesting Alaska-breeding Steller's eiders in North America. Barrow is the northernmost

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[5] Geographically extrapolated total indicated Steller's eiders derived from NSE survey counts.

[6] Detection probability of 30% (visibility correction factor = 3.33) selected based on evaluation of estimates for similar species and habitats (Stehn and Platte 2009).

community on the ACP. Standardized ground surveys for eiders near Barrow have been conducted since 1999 (Rojek 2008; standard survey area shown in Figure 3.6). Counts of males are the most reliable indicator of Steller's eider presence because females are cryptic and often underrepresented in counts. The highest numbers of Steller's eiders observed during ground surveys at Barrow occurred in 1999 with 135 males (Rojek 2008) and in 2008 with 114 males (Safine 2011; Table 3.3). Total numbers of nests found (those found viable[7] and post-failure) ranged from 0–78 during 1991–2011, while the number of viable nests ranged from 0–27. Steller's eider nests were found in 12 or 60% of years between 1991 and 2010 (Safine 2011).

The Barrow Triangle (ABR) aerial survey, discussed above, has been conducted annually by ABR, Inc., over a 2,757 km^2 area south of Barrow since 1999 to compliment ground surveys closer to Barrow (Figure 3.11). Estimated densities for the survey area range from <0.01–0.03 birds/km^2 in non-nesting years and 0.03–0.08 birds/km^2 in nesting years, except in 2010 when only 2 nests were found during ground surveys and density was 0.01 birds/km^2.

Table 3.2. Steller's eider males, nests, and pair densities recorded during ground-based and aerial surveys conducted near Barrow, Alaska 1999–2010 (modified from Safine 2011, 2011 data from Safine *in prep*).

	Overall ground-based survey area			Standard Ground-based Survey Area[a]		Aerial survey of Barrow Triangle		
Year	Area (km^2)	Males counted	Pair density (males/km^2)	Males counted	Pair density (males/km^2)	Males counted	Pair density (males/km^2)[b]	Nests found near Barrow
1999	172	135	0.78	132	0.98	56	0.04	36
2000	136	58	0.43	58	0.43	55	0.04	23
2001	178	22	0.12	22	0.16	22	0.02	0
2002	192	1	<0.01	0	0	2	<0.01	0
2003	192	10	0.05	9	0.07	4	<0.01	0
2004	192	10	0.05	9	0.07	6	<0.01	0
2005	192	91	0.47	84	0.62	31	0.02	21
2006	191	61	0.32	54	0.40	24	0.02	16
2007	136	12	0.09	12	0.09	12	0.02	12
2008	166	114	0.69	105	0.78	24	0.02	28
2009	170	6	0.04	6	0.04	0	0	0
2010	176	18	0.10	17	0.13	4	0.01	2

[a]Standard area (the area covered in all years) is ~134 km^2 (2008 – 2010) and ~135 km^2 in previous years.
[b]Actual area covered by aerial survey (50% coverage) was ~1408 km^2 in 1999 and ~1363 km^2 in 2000 – 2006 and 2008. Coverage was 25% in 2007 and 2010 (~682 km^2) and 27% in 2009 (~736 km^2). Pair density calculations are half the bird density calculations reported in ABR, Inc.'s annual reports (Obritschkewitsch and Ritchie 2011).

[7] A nest is considered viable if it contains at least one viable egg.

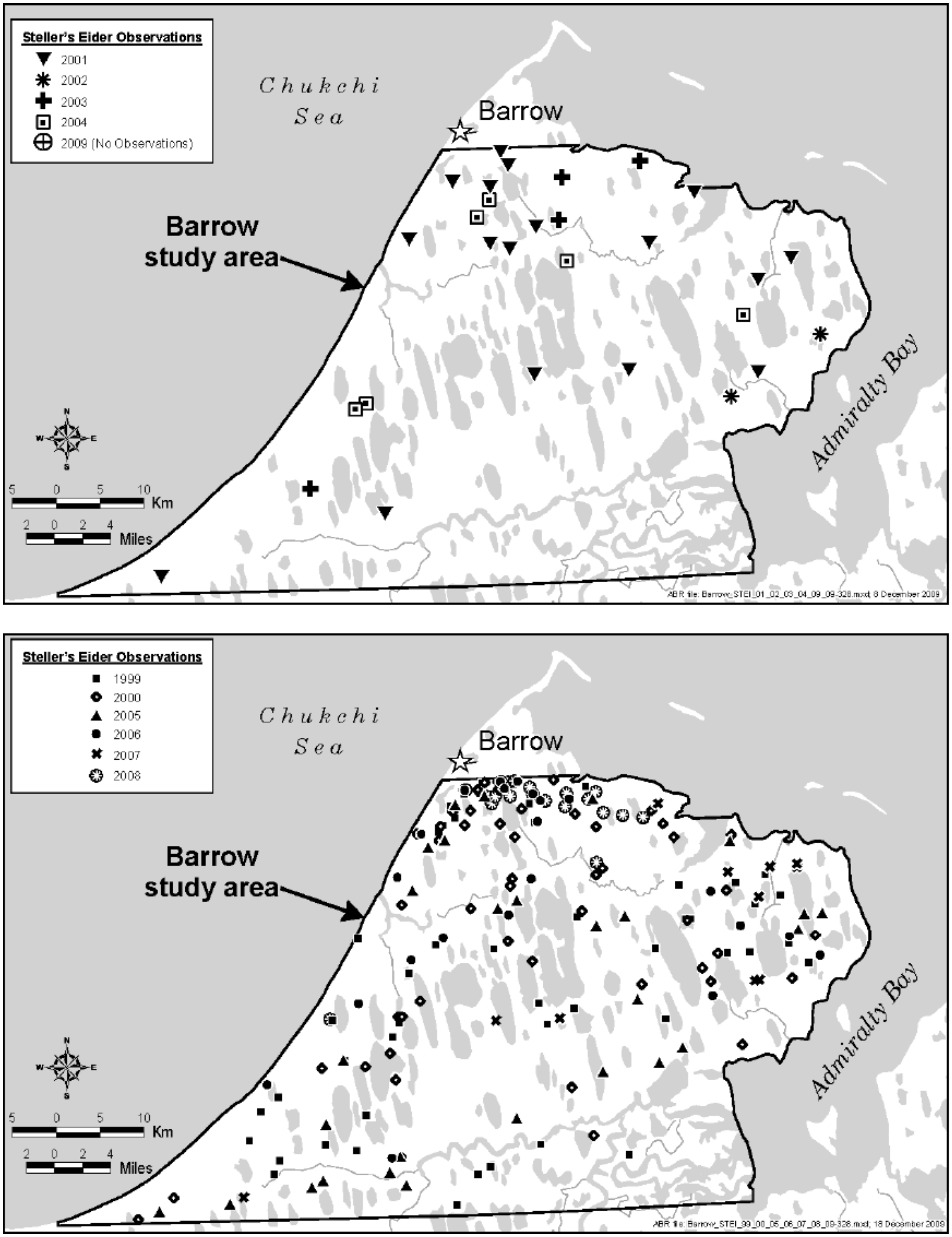

Figure 3.11. Locations of Steller's Eiders Located by ABR, Inc. during the Barrow Triangle aerial surveys in non-nesting years (top) and nesting years (bottom) near Barrow, Alaska, June 1999–2009 (Obritschkewitsch and Ritchie 2011).

Obritschkewitsch and Ritchie (2011) reported 5 Steller's eiders from 3 locations in the study area during 2010 (not shown)

Status and Distribution

On June 11, 1997, the Alaska-breeding population of Steller‘s eiders was listed as threatened based on a substantial decrease in this population's breeding range and the increased vulnerability of the remaining Alaska-breeding population to extirpation (USFWS 1997). Although population size estimates for the Alaska-breeding population were imprecise, it was clear Steller's eiders had essentially disappeared as a breeding species from the Y-K Delta, where they had historically occurred in significant numbers, and that their Arctic Coastal Plain (North Slope) breeding range was much reduced. On the North Slope they historically occurred east to the Canada border (Brooks 1915), but have not been observed on the eastern North Slope in recent decades (USFWS 2002). The Alaska-breeding population of Steller's eiders now nests primarily on the Arctic Coastal Plain (ACP; Figure 3.5), particularly near Barrow and at very low densities from Wainwright to at least as far east as Prudhoe Bay. A few pairs may still nest on the Y-K Delta; only 10 Steller's eider nests have been recorded on the Y-K Delta since 1970 (Hollmen et al. 2007).

Steller's Eider Recovery Criteria

The Steller's Eider Recovery Plan (USFWS 2002) presents research and management priorities that are re-evaluated and adjusted every year, with the objective of recovery and delisting so that protection under the Act is no longer required. When the Alaska-breeding population was listed as threatened, factors causing the decline were unknown, but possible causes identified were increased predation, overhunting, ingestion of spent lead shot in wetlands, and habitat loss from development. Since listing, other potential threats have been identified, including exposure to other contaminants, scientific research, and climate change but causes of decline and obstacles to recovery remain poorly understood.

Criteria used to determine when species are recovered are often based on historical abundance and distribution, or on the population size required to ensure that extinction risk, based on population modeling, is tolerably low. For Steller's eiders, information on historical abundance is lacking, and demographic parameters needed for accurate population modeling are poorly understood. Therefore, the Recovery Plan for Steller's Eiders (USFWS 2002) establishes interim recovery criteria based on extinction risk, with the assumption that numeric population goals will be developed as demographic parameters become better understood. Under the Recovery Plan, the Alaska-breeding population would be considered for reclassification to endangered if the population has ≥ 20% probability of extinction in the next 100 years for 3 consecutive years, or the population has ≥ 20% probability of extinction in the next 100 years and is decreasing in abundance. The Alaska-breeding population would be considered for delisting from threatened status if it has ≤ 1% probability of extinction in the next 100 years, and each of the northern and western subpopulations are stable or increasing and have ≤ 10% probability of extinction in 100 years.

Steller's Eider Critical Habitat
In 2001, the Service designated 7,330 km^2 (2,830 mi^2) of critical habitat for the Alaska-breeding population of Steller's eiders at breeding areas on the Y-K Delta, a molting and staging area in the Kuskokwim Shoals, and molting areas in marine waters at Seal Islands, Nelson Lagoon, and Izembek Lagoon (USFWS 2001). No critical habitat for Steller's eiders has been designated on the ACP.

4. ENVIRONMENTAL BASELINE

The environmental baseline is the current status of listed species and their habitats, and critical habitat, as a result of past and ongoing human and natural factors in the area of the proposed action. Also included in the environmental baseline are the anticipated impacts of other proposed Federal projects in the action area that have already undergone formal Section 7 consultation.

Spectacled and Steller's Eiders
Spectacled and Steller's eiders are present on the North Slope in the project action areas from late May through September. Both species have undergone significant, unexplained declines in their Alaska-breeding populations. Factors that may have contributed to the current status of spectacled and Steller's eiders are discussed below and include, but are not limited to, toxic contamination of habitat, increase in predation, over harvest, and habitat loss through development and disturbance. Recovery efforts for both species are underway in portions of the action area.

Toxic Contamination of Habitat
The deposit of lead shot in tundra or nearshore habitats used for foraging is a threat for spectacled and Steller's eiders. Lead poisoning of spectacled eiders has been documented on the YKD (Franson et al. 1995, Grand et al. 1998) and Steller's eiders on the ACP (Trust et al. 1997; Service unpublished data). Female Steller's eiders nesting at Barrow in 1999 had blood lead concentrations that reflected exposure to lead (>0.2 ppm lead), and six of the seven tested had blood lead concentrations that indicated poisoning (>0.6 ppm lead); additional lead isotope tests confirmed the lead in the Steller's eider blood was of lead shot origin, rather than natural sources such as sediments (A. Matz, USFWS, unpublished data). A juvenile Steller's eider, found shot dead at Barrow in 2008, also had a single ingested lead pellet in its gizzard, indicating spent lead shot is still available to migratory birds that feed in that environment (A.Matz, USFWS, pers. comm.). However, the Service is encouraged by much recent progress in the decreasing use of lead shot, especially on the North Slope (use of lead shot for hunting waterfowl is prohibited statewide, and for hunting all birds on the North Slope). Hunter outreach programs are ongoing to reduce any continuing use of lead shot in waterfowl nesting areas, and the Service reports good compliance in most areas with the lead shot prohibitions.

Water birds in arctic regions are also exposed to global contamination, including radiation, industrial, and agricultural chemicals that can be transported by atmospheric and marine transport. Twenty male spectacled eiders wintering near St. Lawrence Island examined for the presence and effects of contaminants apparently were in good condition, but had high concentrations of metals and subtle biochemical changes that may have long-term effects (Trust et al. 2000).

Increase in Predator Populations

It has been speculated that anthropogenic influences on predator populations or predation rates may have affected eider populations, but this has not been substantiated. Steller's eider studies at Barrow suggest that high predation rates explain poor breeding success (Quakenbush et al. 1995, Obritschkewitsch et al. 2001). Researchers have proposed that reduced fox trapping, anthropogenic food sources in villages and oil fields, and nesting sites on human-built structures have increased fox, gull, and raven numbers (R. Suydam and D. Troy pers. comm., Day 1998), but the connection between these factors and increased predation rates has not been proven.

Over Harvest

Hunting for spectacled and Steller's eiders was closed in 1991 by Alaska State regulations and Service policy. Outreach efforts have been conducted by the North Slope Borough, BLM, and Service to encourage compliance. However, harvest data collected from the spring/summer subsistence hunts suggests that both Steller's and spectacled eiders are being taken during this hunt on the North Slope (Service data). Measures are being implemented to avoid and minimize the lethal take of listed eiders on the North Slope during the 2011 and subsequent spring/summer subsistence hunts.

Habitat Loss through Development and Disturbance

With the exception of contamination by lead shot, destruction or modification of North Slope nesting habitat of listed eiders has been limited to date, and is not thought to have played a major role in population declines of spectacled or Steller's eiders. Until recently eider breeding habitat on the ACP was largely unaltered by humans, but limited portions of each species' breeding habitat have been impacted by fill of wetlands, the presence of infrastructure that presents collision risk, and other types of human activity that may disturb birds or increase populations of nest predators. These impacts have resulted from the gradual expansion of villages, coupled with cold war era military developments such as the Distant Early Warning (DEW) Line sites at Cape Lonely and Cape Simpson (*circa* 1957), and, more recently, the initiation and expansion of oil development since construction of the Prudhoe Bay field and Trans Alaska Pipeline System (TAPS) in the 1970s.

The population of communities such as Barrow has been increasing, and BLM (2007) expects growth to continue at approximately 2% per annum until at least the middle of this century. Assuming community infrastructure and footprint grow at roughly the same pace as population, BLM (2007) estimates that community footprint could cover 3,600 acres by the 2040s. Oil and gas development has steadily moved westward across the ACP towards NPR-A since the initial discovery and development of oil on the North Slope. Given industries interest in NPR-A, as expressed in lease sales, seismic surveys, and drilling of exploratory wells, the westward expansion of industrial development is likely to continue. Scientific, field-based research is also increasing on the ACP as interest in climate change and impacts to high latitude areas continues.

Scientific, field-based research is also increasing on the ACP as interest in climate change and its effects on high latitude areas continues. While many of these activities have no impacts on listed eiders as they occur in seasons when eiders are absent from the area, or use remote sensing tools, on-the-ground activities and tundra aircraft landings likely disturb a small number of listed eiders each year. Many of these activities are considered in intra-Service consultations, or under a programmatic consultation with BLM for summer activities in NPR-A.

Incidental Take

Recent activities in Alaska that required formal Section 7 consultation, and the estimated incidental take of listed eiders (lethal and non-lethal), is presented in Table 4.1. These actions were considered in the final jeopardy analysis of this biological opinion. It should be noted that incidental take is estimated prior to the implementation of reasonable and prudent measures and associated terms and conditions that serve to reduce the levels of incidental take. Further, in some cases included in this table, estimated take is likely to occur over the life of the project (often 30–50 years) rather than annually or during single years reducing the severity of the impact to the population. There are also important differences in the type of incidental take. The majority of the incidental take estimated is a loss of eggs/ducklings, which is of much lower significance for survival and recovery of the species than the death of an adult bird. For example, spectacled eider nest success recorded on the Y-K Delta ranged from 18-73% (Grand and Flint 1997), and average clutch size was 5 eggs (Petersen et al. 1999). From the nests that survived to hatch, spectacled eider duckling survival to 30-days ranged from 25-47% on the Y-K Delta (Flint et al. 2000). Over-winter survival of one-year old spectacled eiders was estimated at 25% (P. Flint pers. comm.), with annual adult survival of 2-year old birds (that may enter the breeding population) of 80% (Grand et al. 1998). Using these data (in a very simplistic scenario) we estimate for every 100 spectacled eider nests on the Y-K Delta, less than 2 - 17 adult females would be expected to survive and enter (recruit) into the breeding population. Similarly, we expect that only a small proportion of spectacled and Steller's eider eggs or ducklings on the North Slope would eventually survive to recruit into the breeding population.

Table 4.1 illustrates the number and diversity of actions that required consultation in Alaska. We believe these estimates have overestimated, possibly significantly, actual take. Actual take is: 1) likely reduced by implementation of terms and conditions in each biological opinion; 2) spread over the life-span of a project (often 50 years); and 3) dominated by the *potential* loss of eggs/ducklings that, as described above, is of less significance than adult mortality for survival and recovery of these K-selected species. Also, it remains unknown to what degree spectacled and Steller's eiders potentially affected by disturbance can reproduce in disturbed areas or move to other less disturbed areas to reproduce. If either or both occur, these factors also serve to reduce actual impacts from the maximal potential impacts.

Table 4.1. Activities near Barrow, Alaska that have required formal Section 7 consultation and the amount of incidental take provided.

Project Name	Impact Type	Estimated Incidental Take
Barrow Airport Expansion (2006)	Habitat loss	14 spectacled eider eggs/ducklings 29 Steller's eider eggs/ducklings
Barrow Hospital (2004 & 2007)	Habitat loss	2 spectacled eider eggs/ducklings 17 Steller's eider eggs/ducklings
Barrow Landfill (2003)	Habitat loss	1 spectacled eider nest/ year 1 Steller's eider nest/year
Barrow Artificial Egg Incubation	Removal of eggs for captive breeding program	Maximum of 24 Steller's eider eggs
Barrow Tundra Manipulation Experiment (2005)	Habitat loss Collisions	2 spectacled eider eggs/ducklings 1 Steller's eider eggs/ducklings 2 adult spectacled eiders 2 adult Steller's eiders
Barrow Global Climate Change Research Facility, Phase I & II (2005 & 2007)	Habitat loss Collisions	6 spectacled eider eggs/ducklings 25 Steller's eider eggs/ducklings 1 adult spectacled eider 1 adult Steller's eider
Barrow Wastewater Treatment Facility (2005)	Habitat loss	3 Steller's eider eggs/ducklings 3 spectacled eider eggs/ducklings
ABR Avian Research/USFWS Intra-Service Consultation	Disturbance	5 spectacled eider eggs/ducklings
Intra-service on Subsistence Hunting Regulations 2007	No estimate of incidental take provided	
Intra-service on Subsistence Hunting Regulations 2008	No estimate of incidental take provided	
NOAA National Weather Service Office in Barrow	Habitat loss Disturbance Collision	< 4 spectacled eider eggs/ducklings < 10 Steller's eider eggs/ducklings 1 adult Steller's eider
Intra-service on Subsistence Hunting Regulations 2009	No estimate of incidental take provided	
Intra-Service on Section 10 permit for USGS 2009 telemetry study	Loss of Production Capture/surgery	130 spectacled eider eggs/ducklings 4 adult spectacled eiders
Intra-Service, Migratory Bird 2010 Subsistence Hunting Regulations	No estimate of incidental take provided	
Intra-Service, Section 10 permit for USFWS eider survey work at Barrow (2010)	Disturbance Capture/handling	3 Steller's eider or spectacled eider clutches 90 pairs + 60 hens, Steller's eider 60 pairs + 60 hens, spectacled eider 1 Steller's eider or spectacled eider adult (lethal take) 7 ducklings Steller's eider or spectacled eider (lethal take) 30 Steller's eider or spectacled eider hens (nonlethal take) 40 Steller's eider or spectacled eider ducklings (nonlethal take)
Intra-Service, Section 10 permit for ABR Inc.'s eider survey work on the North Slope and at Cook	Disturbance	35 spectacled eider eggs/ducklings

Inlet (2010)		
Intra-Service, Migratory Bird 2011 Subsistence Hunting Regulations	Shooting	4 adult Steller's eiders (lethal take) 400 adult spectacled eiders (lethal take)
Barrow Gas Fields Well Drilling Program, 2011	Loss of production	20 spectacled eider eggs/ducklings 22 Steller's eider eggs/ducklings
Intra-Service, Section 10 permit for ABR Inc.'s eider survey work on the North Slope and at Cook Inlet (2011)	Disturbance	20 spectacled eider eggs/ducklings
Intra-Service, Section 10 permit for USFWS eider survey work at Barrow (2010)	Disturbance Capture/handling	3 Steller's eider or spectacled eider clutches 90 pairs + 60 hens, Steller's eider 60 pairs + 60 hens, spectacled eider 1 Steller's eider or spectacled eider adult (lethal take) 7 Steller's or spectacled eider ducklings (lethal take) 30 Steller's and 30 spectacled eider hens (nonlethal take) 40 Steller's eider or spectacled eider ducklings (nonlethal take)
Intra-Service, Alaska Region Migratory Bird Management, 2011 Shorebird Breeding Ecology Studies, Barrow, Alaska	No estimate of incidental take provided	
Intra-Service, Section 10 permit for USFWS eider survey work at Barrow (2011)	Disturbance Capture/handling/	4 Steller's and 4 spectacled eider clutches 90 Steller's and 60 spectacled eider pairs (nonlethal take; pre-nesting monitoring) 60 Steller's and 60 spectacled eider hens (nonlethal take; nest monitoring) 30 Steller's and 30 spectacled eider hens (nonlethal take) 40 Steller's or spectacled eider ducklings (nonlethal take) 1 Steller's eider or spectacled eider adult (lethal take) 7 Steller's or spectacled eider ducklings (lethal take) 20 additional Steller's or spectacled eider eggs (death in captivity)
Intra-Service, Migratory Bird 2012 Subsistence Hunting Regulations	Shooting	4 adult Steller's eiders (lethal take) 400 adult spectacled eiders (lethal take)

Climate Change

High latitude regions, such as Alaska's North Slope, are thought to be especially sensitive to the effects of climate change (Quinlan et al. 2005, Schindler and Smol 2006, and Smol et al. 2005). While climate change will likely affect individual organisms and communities it is difficult to predict with any specificity how these effects will manifest. Biological, climatological, and hydrologic components of the ecosystem are interlinked and operate on multiple spatial, temporal, and organizational scales with feedback between the components (Hinzman et al. 2005).

There are a wide variety of changes occurring in the arctic worldwide, including Alaska's North Slope. Arctic landscapes are dominated by lakes and ponds (Quinlan et al. 2005), such as those used by listed eiders for feeding and brood rearing. In many areas these water bodies are drying out during the summer as a result of thawing permafrost (Smith et al. 2005 and Oechel et al. 1995), and increased evaporation and evapotranspiration as they are ice-free for longer periods (Schindler and Smol 2006, and Smol and Douglas 2007). Productivity of lakes and ponds appears to be increasing as a result of nutrient inputs from thawing soil and an increase in degree days (Quinlan et al. 2005, Smol et al. 2005, Hinzman et al. 2005, and Chapin et al. 1995). Changes in water chemistry and temperature are resulting in changes in the algal and invertebrate communities, which form the basis of the food web in these areas (Smol et al. 2005, Quinlan et al. 2005).

With the reduction in summer sea ice, the frequency and magnitude of coastal storm surges has increased. These often result in breaching of lakes and low lying coastal wetland areas killing salt-intolerant plants and altering soil and water chemistry, and hence, the fauna and flora of the area (USGS 2006a). Historically sea ice has served to protect shorelines from erosion; however, this protection has decreased as sea ice has declined. Coupled with softer, partially-thawed permafrost, the lack of sea ice has significantly increased coastal erosion rates (USGS 2006a), potentially reducing available coastal tundra habitat.

Changes in precipitation patterns, air and soil temperature, and water chemistry are also affecting tundra vegetation communities (Hinzman et al. 2005, Prowse et al. 2006, Chapin et al. 1995), and boreal species are expanding their range into tundra areas (Callaghan et al. 2004). Changes in the distribution of predators, parasites, and disease causing agents resulting from climate change may have significant effects on listed species and other arctic fauna and flora. Climate change may also result in mismatched timing of migration and the development of food in Arctic ponds (Callaghan et al. 2004), and changes in the population cycles of small mammals such as lemmings to which many other species, including nesting Steller's eiders (Quakenbush and Suydam 1999), are linked (Callaghan et al. 2004).

While the impacts of climate change on listed species in both the action area and marine environment that comprises the rest of their range are unclear, species with small populations are vulnerable to environmental change (Crick 2004). Some species will increase in abundance and range with climate change, while others will suffer from reduced population size and range. The ultimate effects of climate change on listed eiders are undetermined at present.

5. EFFECTS OF THE ACTION ON LISTED SPECIES

This section of the biological opinion provides an analysis of the effects of the Action on listed species` and on critical habitat. Both direct effects (those immediately attributable to the Action), and indirect effects (those caused by the Action, but that will occur later in time, and are reasonably certain to occur) are considered. Finally, the effects from interrelated and interdependent activities are also considered. These effects will then be added to the environmental baseline in determining the proposed Action's effects to the species or its critical habitat (50 CFR Part 402.02).

Spectacled and Steller's Eiders

5.1 Beneficial Effects

Beneficial effects are those effects of an action that are wholly positive, without any adverse effects, on a listed species or designated critical habitat. This project will have beneficial effects for the species, in that it will provide FFWFO with information that will better enable us to determine causes of population decline and management actions to aid recovery. Additionally, controlling foxes, potential Steller's eider predators, may also benefit the species by reducing predation pressure on nests.

5.2 Direct Effects

Investigator and trapping disturbance/capture

This project will likely affect nesting Steller's and spectacled eiders through investigator disturbance of pairs, disturbance of incubating hens, capture of hens, handling of eggs, and capturing of broods and their associated hen. Fox trappers may also disturb Steller's eiders pairs and incubating hens as they walk across the study area to check traps. The disturbance to pairs may occur through interruption of normal behavior via flushing. We expect this disturbance to be temporary and not adversely affect either eider species because eiders typically resume normal behavior soon after a disturbance event. The disturbance to nesting eiders that will occur during potentially viable but abandoned egg collection, capture, and transmitter attachment efforts is not expected to rise to the level of lethal take because the field crew is experienced at handling waterfowl. We also expect the capture and banding of broods to have non-lethal take in the form of harassment/capture because of the field crew's experience.

It is generally recognized among researchers that investigator disturbance and capture can have a negative impact on nesting success. However, this effect is usually assumed to be minimal in magnitude and unavoidable. Few quantitative estimates of the extent of detrimental effects of investigator disturbance to nesting waterfowl exist for tundra environments. Some studies demonstrate negative effects of investigator disturbance on waterfowl nesting success, whereas others show little or no effect. Infrequently, waterfowl will permanently abandon nests after they are disturbed. On the YKD, investigators estimated that nest trapping resulted in a loss of 5% of cackling goose eggs due to desertion (Mickelson 1975). A single search of study plots for an investigator disturbance study done for spectacled eiders on the YKD caused the loss of 0.08% of eggs production (Bowman and Sten 2003). Gulls were attracted to, and more nests were destroyed at, eider nesting islands after disturbance (Ahlund and Gotmark 1989). However, in 1997 investigators marked and visited spectacled eider nests at varying schedules and found no difference in survival rates due to observer impact (Grand and Flint 1997).

Steller's eiders behavior appears to change with changing environmental conditions. At times, they have been observed foraging near human-made structures such as the Barrow Airport (Service, unpublished). They have also been observed foraging and resting adjacent to docks along the Alaska Peninsula (Service, unpublished). However, researchers have observed that they move and maintain a distance of at least 100 meters from humans and vessels. As such, researchers do not anticipate total abandonment of areas due to investigator activity (assessment of nesting pairs), but anticipate some level of disturbance due to the presence of the investigators.

Direct effects anticipated due to investigator activities include handling eggs and disturbance to adult birds during the capture process. One-time disturbance of birds not captured is not considered to rise to the level of take. Mist nets will be constantly monitored and never be left unattended, and every effort will be made to remove captured birds from nets as quickly as possible. Examples of impacts that may occur to Steller's and spectacled eiders due to these research activities include accidental breakage of toe nails, wings, and legs, mortality due to infection from radio transmitter prong insertion, and the accidental damaging of eggs.

Investigator and trapping activities could also adversely impact Steller's and spectacled eiders by: 1) displacing adults and/or broods from preferred habitats during pre-nesting, nesting, brood rearing and migration; 2) displacing females from nests, exposing eggs or small young to inclement weather or predators; and 3) reducing foraging efficiency and feeding time. The behavioral response of eiders to nesting disturbance is unknown. Some Steller's eiders nest and rear broods near the Barrow Airport, indicating that some individuals may tolerate frequent aircraft noise. However, individual tolerances are likely to vary and the intensity of disturbance associated with the proposed action would, in most cases, be greater than that experienced by birds near the airport. Some birds may be displaced with unknown physiological and reproductive consequences. The number of Steller's eiders that would be exposed to investigator activity is variable, however.

In conclusion, activities covered under Recovery Permit #TE043136-0 could adversely affect individual Steller's and spectacled eiders; however, their low nesting densities combined with the minimal number of nests to be studied suggest that few individuals would likely be impacted. Additionally, the experience of the crew and the precautions that they typically take during capture efforts for VHF transmitter attachment assure us that FFWFO activities are not likely to cause any incidental mortality during capture efforts. Likewise, the wide range of tolerances found in individual birds to this type of potential disturbance makes it difficult to predict whether adverse impacts would actually occur.

5.3 Indirect Effects

Indirect effects of the action are defined as "those effects that are caused by or will result from the proposed action and are later in time, but are still reasonably certain to occur" (50 CFR §402.02). While the activities that may be authorized could lead to additional research in the future, they cannot be said to be reasonably expected to occur. Therefore, no indirect effects to listed eiders are anticipated to result from the proposed activities.

5.4 Interrelated and Interdependent Actions

Interdependent actions are defined as "actions having no independent utility apart for the proposed action," while interrelated actions are defined as "actions that are part of a larger action and depend upon the larger action for their justification" (50 CFR §402.02).

The Service has not identified any interdependent or interrelated actions that may result from the issuance of the proposed permit or activities authorized by it that could result in impacts to listed eiders.

6. CUMULATIVE EFFECTS

Under the Act, cumulative effects are the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this BO. Future Federal actions that are unrelated to the proposed action are not considered because they require separate consultation under the Act.

7. CONCLUSION

After reviewing the proposed action, the current status of Steller's and spectacled eiders, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that actions outlined within the Recovery Permit # TE043136-0 and associated activities, as proposed, are not likely to jeopardize the continued existence of the Steller's and spectacled eiders, nor is it likely to adversely modify or destroy Steller's or spectacled eider critical habitat. There is no designated or proposed critical habitat on the North Slope for Steller's eiders.

The regulations (51 FR 19958) that implement Section 7(a)(2) of the Act define "jeopardize the continued existence of" as, "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species." We have concluded that the proposed action is not likely to jeopardize the continued existence of the Alaska breeding population of Steller's eiders or the global population of spectacled eiders or adversely modify or destroy their critical habitat.

The following information led us to the conclusion that this action, as proposed, is not likely to jeopardize the continued existence of these species:

1) effects due to disturbance for nest investigations and trapping is not likely to rise to the level of take; adverse effects to Steller's and spectacled eiders due to permitted activities are temporary and should be offset by the net benefit of the research to recovery of the species;
2) the experience of the crew and the precautions taken during capture efforts for banding, biological samples, and VHF transmitter attachment cause us not to expect incidental mortality during capture efforts; and
3) FFWFO plans to monitor all activities conducted pursuant to this biological opinion to guide the development/refinement of measures designed to avoid/reduce impacts to Steller's and spectacled eiders due to research activities.

The number of Steller's or spectacled eiders expected to be harmed or harassed as a result of the proposed research and renewal of Permit # TE043136-0 is not expected to have a significant adverse effect on the species' overall numbers, distribution, or reproductive potential. Therefore, we do not expect the loss of listed birds resulting from this action to cause jeopardy.

8. INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to Section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. "Harm" is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement. In addition, because the proposed action is the issuance of permits per Section 10(a)1(A) of the Act, direct take is permitted per the statute and implementing regulations.

The measures described below are non-discretionary; describe the maximum take per year; and must be undertaken by FFWFO so that they become binding conditions of any grant or permit issued to an applicant, as appropriate, for the exemption in Section 7(o)(2) to apply. FFWFO has a continuing duty to regulate the activity covered by this Incidental Take Statement. If FFWFO (1) fails to assume and implement the terms and conditions or (2) fails to require any applicant to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the permit or grant document, the protective coverage of Section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the FFWFO or any applicant must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR 402.14(i)(3)].

As described in the *Effects of the Action* section, the activities described and assessed in this BO may adversely affect Steller's and spectacled eiders through investigator and trapper disturbance during field work (i.e. flushing pairs and females from nests), nest capture and handling of adult females with mist-nets and bow traps, the prong and glue VHF transmitter attachment procedure on adult females, and capture and handling of ~30 day old ducklings. For the recovery permit, the researchers may annually (2012-2014):

1. Measure and candle eggs at up to 30 Steller's eider (STEI) and 30 spectacled eider (SPEI) nests;

2. Monitor with video or digital cameras up to 20 active STEI nests, or if Steller's eiders are unavailable monitor with video or digital cameras up to 20 active SPEI nests (for a total of 20 nests monitored);
3. Nest-capture, weigh, measure, band up to 20 STEI females during incubation, remove 1 primary and 1head feather, and fit up to 10 of these females with VHF transmitters;
4. Collect blood samples from up to 20 adult STEI females, approx. 3 ml, not to exceed 1 % of body weight and collect fecal samples and cloacal swabs;
5. Collect contour feathers from STEI and SPEI nest linings;
6. Remove up to 20 potentially viable Steller's eider eggs from abandoned nests, to be transported to the Alaska Sea Life Center, and captive- reared under Permit #TE065912.
7. Salvage up to 20 inviable eggs from inactive STEI and SPEI nests.

Depending on Steller's eider availability, similar work may be conducted on spectacled eiders, as follows:

8. Nest-capture, weigh, measure, band up to 20 SPEI females during incubation; remove 1 primary and 1head feather, and fit up to 20 of these females with VHF transmitters;
9. Incidentally capture and weigh up to 20 radio-marked SPEI females while conducting duckling capture activities;
10. Collect blood samples from up to 20 adult SPEI females approx. 3 ml, not to exceed 1 % of body weight and collect fecal samples and cloacal swabs.

For all activities described above the maximum, annual, lethal incidental take authorized is:

1. no more than 1 clutch of STEI and 1 clutch of SPEI eggs abandoned, depredated or crushed due to video monitoring activity;
2. no more than 2 clutches of STEI and 2 clutches of SPEI eggs abandoned, depredated or crushed due to research activities other than artificial incubation or video monitoring activity;
3. no more than 20 eggs taken as a result of death in captivity associated with artificial incubation;
4. no more than 1 adult STEI OR SPEI killed, due to capture or handling during any permitted activity;
5. no more than 7 STEI OR SPEI ducklings killed (directly from trapping or handling, or indirectly by exposure to predators, energetic costs, etc.);

The following maximum, annual, non-lethal incidental take is also authorized:

1. disturbance of up to 90 STEI pairs and up to 60 SPEI pairs during pre-nesting monitoring activities and fox trapping;
2. disturbance of up to 60 STEI hens and up to 60 SPEI hens on nests during nest monitoring activities and fox trapping;
3. capture, handling, sample collection and tagging of up to 30 STEI and 30 SPEI hens;
4. attachment of VHS radio transmitters on up to 10 STEI and 20 SPEI hens;

5. capture, handling, and banding of up to 40 STEI or SPEI ducklings; and
6. Collection of blood samples from up to 40 SPEI ducklings approx. 2 ml, not to exceed 1 % of body weight and collection of fecal samples and cloacal swabs.

9. REASONABLE AND PRUDENT MEASURES

The Service believes that the following reasonable and prudent measures are necessary and appropriate to minimize take of Steller's eiders:

1. To minimize the likelihood that nest investigation work will increase predation rates and reduce nesting and fledgling success of Steller's and spectacled eiders in the Barrow area, FFWFO shall ensure that only qualified individuals are permitted to work directly with Steller's and spectacled eiders and their eggs.

2. Direct and indirect impacts to nesting Steller's and spectacled eiders and eggs due to research activities shall be minimized through the incorporation of appropriate special *Terms and Conditions* for each permitted activity.

10. TERMS AND CONDITIONS

In order to be exempt from the prohibitions of Section 9 of the Act, FFWFO must comply with the following terms and conditions, which implement the reasonable and prudent measures (RPMs) described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. The following terms and conditions shall implement RPM #1.

    A. Only qualified personnel with an appropriate level of experience/training shall be authorized to conduct scientific research and/or population census activities on the Steller's and spectacled eider. Experienced personnel, for the purposes of this term and condition, shall be those with at least one prior season of experience conducting such activities.

    B. Prior to approaching nests, the surrounding area shall be visually checked for predators. If a predator is spotted in close proximity (i.e., would be able to locate nest through movement of female eider), the nest shall not be approached. Predators, for the purposes of this term and condition, shall include fox, ravens, gulls and jaegers.

2. The following terms and conditions shall implement RPM #2.

    A. Capturing of adults shall only occur through the use of mist nets and bow nets while they are in late incubation (e.g. within ~4 days of predicted hatch date). Other methods of capture must be pre-approved by the Fairbanks Fish and Wildlife Field Office.

B. During research activities, eggs remaining in nests shall be immediately recovered with down. In addition, eggs being handled shall be shielded from direct exposure to the breeze/wind (i.e. they will be protected from rapid cooling).

C. Only veterinarians, others trained/supervised by veterinarians, or those with extensive experience collecting blood samples from waterfowl shall collect blood or other tissue samples from living Steller's and spectacled eiders.

The Service believes that no more than one adult, seven ducklings, and three clutches (1 from video monitoring + 2 from other activities) of both spectacled and Steller's eiders will be incidentally, lethally taken during each year of the recovery permit. The RPMs, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measure provided. The Federal action agency must immediately provide an explanation of the causes of the take and review with the Service the need for possible modification of the reasonable and prudent measure. If Steller's or spectacled eiders are encountered injured or killed as a result of permitted activities, please contact the Fairbanks Fish and Wildlife Field Office, Endangered Species Branch, Fairbanks, Alaska at (907) 456-0441 for instruction on the handling and disposal of the injured or dead bird.

11. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. No conservation recommendations have been developed for this project.

12. REINITIATION NOTICE

This concludes formal consultation on the actions outlined in FFWFO's internal email circulated May 20, 2003. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the action agency that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; 3) the agency action is subsequently modified in a manner that causes an effect to listed or critical habitat not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation. FFWFO must also reinitiate consultation if it becomes evident that any activity that may impact directly or indirectly Steller's or spectacled eiders resulting from the recovery permit may take place without separate consultation on that action. In addition if modifications are proposed for the activity then reinitiation will take place.

While the incidental take statement provided in this consultation satisfies the requirements of the Act, as amended, it does not constitute an exemption from the prohibitions of take of listed migratory birds under the more restrictive provisions of the Migratory Bird Treaty Act. However, the Service will not refer the incidental take of any migratory bird or bald eagle for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§ 703-712), or the Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. §§ 668-668d), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

Thank you for your concern for endangered species and for your cooperation in the development of this biological opinion. If you have any comments or require additional information, please contact Ted Swem at (907) 456-0441 with the Fairbanks Fish and Wildlife Field Office, Endangered Species Branch, Fairbanks, Alaska.

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Appendix A.

POLAR BEAR INTERACTION GUIDELINES

These Polar Bear Interaction Guidelines (Guidelines) were developed to ensure that activities are conducted in a manner that avoids conflicts between humans and polar bears. Polar bears are protected under the Marine Mammal Protection Act (MMPA), and were listed as a threatened species under the Endangered Species Act (ESA) in 2008. The MMPA and ESA both prohibit the "take" of polar bears without authorization. Take includes disturbance/harassment, as well as physical injury and killing of individuals.

In addition to sea ice, polar bears use marine waters and lands in northern Alaska for resting, feeding, denning, and seasonal movements. They are most likely to be encountered within 25 miles of the coastline, especially along barrier islands during July-October. Polar bears may also be encountered farther inland, especially females during the denning period (October-April). Polar bears may react differently to noise and human presence. The general methods for minimizing human-bear conflicts are to: 1) avoid detection and close encounters; 2) minimize attractants; and 3) recognize and respond appropriately to polar bear behaviors. These Guidelines provide information for avoiding conflicts with polar bears during air, land, or water-based activities.

Unusual sightings or questions/concerns can be referred to: Susanne Miller or Craig Perham, Marine Mammals Management Office (MMM Office), 1-800-362-5148; or to Sarah Conn (907) 456-0499 of the Fairbanks Fish & Wildlife Field Office (FFWFO).

When operating aircraft:

- If a polar bear(s) is encountered, divert flight path to a minimum of 2,000 feet above ground level or ½ mile horizontal distance away from observed bear(s) whenever possible.

When traveling on land or water:

- Avoid surprising a bear. Be vigilant—especially on barrier islands, in river drainages, along bluff habitat, near whale or other marine mammal carcasses, or in the vicinity of fresh tracks.

- Between October and April special care is needed to avoid disturbance of denning bears. If activities are to take place in that time period the MMM Office should be contacted to determine if any additional mitigation is required. In general, activities are not permitted within one mile of known den sites.

- Avoid carrying bear attractants (such as strongly scented snacks, fish, meat, or dog food) while away from camp; if you must carry attractants away from camp, store foods in air-tight containers or bags to minimize odor transmission until you return them to “bear-resistant” containers.*

- If a polar bear(s) is encountered, remain calm and avoid making sudden movements. Stay downwind if possible to avoid allowing the bear to smell you. Do not approach polar bears. Allow bears to continue what they were doing before you encountered them. Slowly leave the vicinity if you see signs that you’ve been detected. Be aware that safe viewing distances will vary with each bear and individual situation. Remember that the closer you are to the animal, the more likely you are to disturb it.

- If a bear detects you, observe its behavior and react appropriately. Polar bears that stop what they are doing to turn their head or sniff the air in your direction have likely become aware of your presence. These animals may exhibit various behaviors:

    - *Curious* polar bears typically move slowly, stopping frequently to sniff the air, moving their heads around to catch a scent, or holding their heads high with ears forward. They may also stand up.

    - *A threatened or agitated* polar bear may huff, snap its jaws together, stare at you (or the object of threat) and lower its head to below shoulder level, pressing its ears back and swaying from side to side. These are signals for you to begin immediate withdrawal by backing away from the bear. If this behavior is ignored, the polar bear may charge. Threatened animals may also retreat.

    - In rare instances you may encounter a *predatory* bear. It may sneak or crawl up on an object it considers prey. It may also approach in a straight line at constant speed without exhibiting curious or threatened behavior. This behavior suggests the bear is about to attack. Standing your ground, grouping together, shouting, and waving your hands may halt the bear’s approach.

- If a polar bear approaches and you are in the bear’s path—or between a mother and her cubs—get out of the way (without running). If the animal continues to approach, stand your ground. Gather people together in a group and/or hold a jacket over your head to look bigger. Shout or make noise to discourage the approach.

- If a single polar bear attacks, defend yourself by using any deterrents available. If the attack is by a surprised female defending her cubs, remove yourself as a threat to the cubs.

<u>When camping:</u>

- Avoid camping or lingering in bear high-use areas such as river drainages, coastal bluffs and barrier islands.

- Store food and other attractants in “bear-resistant” containers*. Consider the use of an electric fence as additional protection. Do not allow the bear to receive food as a reward in your camp. A food-rewarded bear is likely to become a problem bear for you or someone else in the future.

- Maintain a clean camp. Plan carefully to: minimize excess food; fly unnecessary attractants out on a regular basis (i.e. garbage, animal carcasses, excess anti-freeze or petroleum products); locate latrines at least ¼ mile from camp; and wash kitchen equipment after every use.

- If a polar bear approaches you in camp, defend your space by gathering people into a large group, making noise and waving jackets or tarps. Continue to discourage the bear until it moves off. Have people watch the surrounding area in case it returns later, keeping in mind that polar bears are known to be more active at night. Additional measures to protect your camp, such as electric fences or motion sensors can be used.

Harassment of polar bears is not permissible, unless such taking (as defined under the MMPA) is imminently necessary in defense of life, and such taking is reported to FWS within 48 hours.

*Containers must be approved and certified by the Interagency Grizzly Bear Committee as "bear-resistant." Information about certified containers can be found at http://www.igbconline.org/html/container.html.

FOR DEPARTMENT OF INTERIOR EMPLOYEES ONLY

Use of Deterrents

In addition to following the Guidelines above, all U.S. Fish and Wildlife Service (Service) employees must have completed the Department of the Interior’s (DOI) Bear and Firearm Safety Training course and be current in certification before engaging in field activities. Service staff must practice with and know how to use deterrents prior to conducting field work. If working in bear habitat, Service staff must anticipate and plan for possible scenarios of encountering polar bears, and identify appropriate responses, prior to initiating field work. Use of non-lethal polar bear deterrents by Service staff is only permissible if it is done in a humane manner and is for the purposes of protection or welfare of the bear or the public. Service staff has the right to use lethal methods to protect the public from polar bears in defense of life situations, and may do so when all reasonable steps to avoid killing the bear(s) have been taken.

Notification of Use of Deterrents

The Department of the Interior Bear Incident Report Form will be used to record and report polar bear-human interactions *that require use of deterrents*. These incidents will be reported to the MMM Office. This information will be used to track interactions over time and improve polar bear conservation and management.

Operational Plan to Take, Capture, Mark, or Collar Wildlife

Project Title: Arctic fox control to increase recruitment in threatened Steller's eiders near Barrow, Alaska

Goal for species and number: Up to 120 arctic fox; up to 15 red fox

Dates that work will be performed: May 1 to July 31, 2012

Service Office/Field Station performing work: Endangered Species Program of the Fairbanks Fish and Wildlife Field Office (FFWFO), Division of Fisheries and Ecological Services, U. S. Fish & Wildlife Service (USFWS)

Responsible person/party for the project: Ted Swem (Branch Chief, Endangered Species Program, FFWFO, USFWS; Terry Smith (Alaska District Supervisor, USDA APHIS Wildlife Services (USDA WS))

Names of all subpermittees (other individuals who will work on the project): USDA WS employees will conduct the project in coordination with USFWS. All field staff that may take part in fox control activities include: three temporary hires (USDA WS); Ted Swem, David Safine, Neesha Stellrecht, Ernest Nageak, Matthew Wilson, Megan Zarzycki, and additional temporary and volunteer hires (USFWS); Two temporary hires (Barrow Arctic Science Consortium).

Who are the partners (names, titles, agencies/organizations)? Terry Smith, District Supervisor, USDA WS; Robert Suydam, Wildlife Biologist, North Slope Borough Department of Wildlife Management (NSBDWM), Glenn Sheehan, Senior Scientist, Barrow Arctic Science Consortium (BASC).

Where will animals be taken or captured (include clear reference to USGS map grid, GPS locator coordinates, or other reliable means for locating work area)? Areas within 20 miles of the road system network near Barrow, Alaska (including the Steller's Eider Conservation Planning Area; Figure 1); central coordinates of the Conservation Planning Area are approximately N 71˚18' W 156˚40'

Will animals be taken or captured on non-refuge lands? If yes, describe situation: Yes. This is not a refuge related project. Foxes will be taken near Barrow, Alaska, entirely off refuge lands, because this is the only known concentration of nesting Steller's eiders, listed as threatened under the Endangered Species Act. The work will take place primarily on land owned by ANCSA Barrow village corporation (Ukpeagvik Inupiat Corporation).

Methods to be employed (if drugs are to be used, list specific type(s): USDA WS may use the following control methods in the removal of fox and/or other nest predators: leg-hold traps, cage traps, conibear traps, collarum neck snares, conventional snares, firearms, and possibly others. USDA WS will remove all control tools from the field at the culmination of the project.

Is the project to be coordinated with local Fish and Wildlife Protection Officer and the Alaska Dept. of Fish & Game Biologist? If yes, list any special provisions that have been established. Geoff Carroll, the Alaska Fish and Game biologist stationed in Barrow, is apprised of our activities. No special provisions have been established.

Describe how collected specimens will be utilized and what their final disposition will be. (Provide justification if disposition does not follow the State salvage policy - Salvage3.wpd). Dead foxes will be donated to the NSBDWM in Barrow, Alaska to be used in a collaborative project studying rabies with the NSBDWM and the Department of Wildlife Biology at the University of Alaska, Fairbanks.

Project Description

Purpose and Need for Fox Control:

The listed Alaska-breeding population of Steller's eiders (*Polysticta stelleri*) nests primarily near Barrow on the Arctic Coastal Plain, where they appear to breed only intermittently. Nests were found in only 13 of the last 21 years near Barrow. In nesting years from 1991-2004 (prior to fox control), mean nest survival probability was 0.23 (SE 0.09). Although the causes of Steller's eider decline in Alaska are unknown, increased predation pressure may have contributed to the near disappearance of Steller's eiders from the Yukon-Kuskokwim Delta. Predation is known to be a critical threat to many threatened, endangered and locally rare species and management actions to reduce predation may be vital for maintenance or recovery of some species. The Steller's eider is a migratory bird which is listed as threatened under the U.S. Endangered Species Act.

Potential nest predators in the Barrow area include arctic fox (*Alopex lagopus*), red fox (*Vulpes vulpes*), weasel (*Mustela* spp.), common raven (*Corvus corax*), jaegers (*Stercorarius* spp.), and glaucous gull (*Larus hyperboreus*). Arctic foxes occur in high density near Barrow, where their numbers may have increased as a result of anthropogenic food sources. Arctic foxes are considered to be the principal predators of waterfowl in the arctic region, with eggs and young being particularly vulnerable. The use of digital cameras on some Steller's eiders nests near Barrow indicated the primary nest predator was arctic fox. Red fox are not considered common in the area, but have been sighted and caught near Barrow in this project.

In light of the Steller's eider's intermittent breeding, poor reproductive performance, and band data showing an ageing population, management actions that have the potential to increase recruitment are important. At this time it is unknown whether the Alaska-breeding population is augmented with individuals from the larger, non-listed Russian population. If the listed Alaska-breeding population is largely or entirely dependent on local recruitment, a significant and immediate reduction in predation is likely needed to prevent extinction. For this reason, reduced nest predation is considered an important component of Steller's eider recovery (per USFWS 2002 Steller's Eider Recovery Plan).

Fox control has been conducted near Barrow from 2005-2011, with an apparent increase in Steller's eider nest success. Nest survival probability during nesting years from 2005 - 2011 (years with fox control) averaged 0.49 (SE 0.10).

Steller's eider brood survival rates are more difficult to estimate, because radio telemetry is required and only small numbers of broods can be monitored. We do have data to suggest brood survival was significantly enhanced in 2005, 2006, 2008, and 2011 when broods were monitored (no broods monitored in 2007, 2009, and 2010). Only one of 14 monitored broods fledged ducklings prior to fox control, whereas 6 of 10 fledged in 2005 and 2006 and 4 of 7 apparently fledged in 2008, and 8 of 9 fledged in 2011 with fox control in effect (Rojek 2006, 2007, Safine 2011, and USFWS unpublished data). Several other large unmarked broods with fledging-size ducklings were also observed in 2006, 2008, and 2011 indicating that nests not included in our study sample also presumably benefited from fox control efforts.

While sample size of monitored Steller's eider nests and broods is small due to their rarity, concurrent shorebird nesting studies have been conducted since 2003 within our study area with much larger sample sizes. Shorebird nest success in 2003 and 2004 (no fox control) was 49% and 15% respectively, while success was 87%, 77%, 84%, and 69% in 2005-2008 (with fox control), respectively (Richard Lanctot, pers. comm.). These data provide further support that ground-nesting birds benefit from fox control in this area.

Management Objective:
The main objective is to increase nest (and possibly brood) success for Steller's eiders by reducing the number of foxes in the nesting area near Barrow. The Steller's eider is a migratory bird which is listed as threatened under the U.S. Endangered Species Act.

Benefit to Migratory Birds:
Steller's eiders are migratory birds, and as described above, fox control from 2005 to 2011 is believed to have benefited this species. Shorebird researcher Richard Lanctot reported that fox control appeared to benefit shorebirds nesting in the vicinity of the Steller's eider nesting area. He observed higher shorebird nesting success, and lower predation rates, than in previous years in which foxes were not controlled.

Methods:
This project will begin about May 1, 2012 and end about July 31, 2012, and will likely be conducted in future years. If Steller's eiders are not found nesting at Barrow in 2012, which will be known by early July, the USFWS will terminate fox control operations for the year.

Up to 120 arctic and 15 red fox may be taken within the control area (Figure 1). Specific target areas for trapping efforts within the control area shall be identified by consultation between USFWS and USDA personnel. Land use permits will be obtained from landowners.

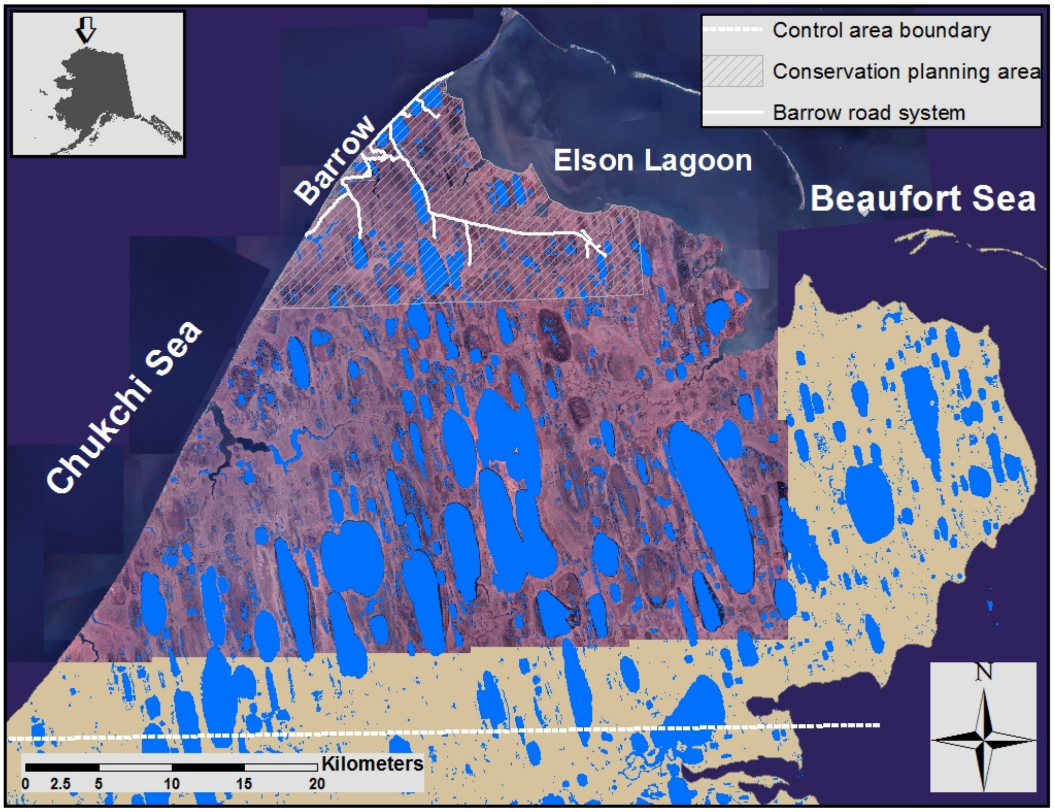

Figure1. Map of the fox control area near Barrow, Alaska.

Field personnel from USDA WS, USFWS, and BASC will work collaboratively on this project. USDA WS (assisted by BASC) will provide a total of five seasonal hires to conduct the fox trapping/removal effort. USFWS will provide information to USDA WS on locations to focus predator trapping/removal efforts on and current year Steller's eider nesting locations that need protection.

USDA WS may use the following control methods in the removal of fox: leg-hold traps, cage traps, conibear traps, neck snares, collarum neck snares, firearms, and possibly others. USDA WS will remove all control tools from the field at the culmination of the project.

During 2012, we will continue to use the protocols implemented in 2009 to attempt to eliminate incidental catch and reduce the trap check interval for non-lethal traps. In previous years incidental catch has included mainly snowy owls (*Nyctea scandiaca*), glaucous gulls, jaegers, and white-fronted geese (*Anser albifrons*). The following protocols will be followed to reduce incidental take:

1) Using collarums, a canid-specific neck snare device, near mounds that may be attractive to snowy owls and other bird species. Because collarums are only activated when the trigger is pulled upward, an incidental bird catch is much less likely than a conventional leg-hold trap.

2) Keep trap sets off the top and sides of tundra mounds. Most trap sets will still need to be located near mounds because they are heavily used by foxes and are often the only dry ground available to make a set.

3) Avoid setting on tundra mounds with evidence of predatory bird use (owl pellets, etc…).

4) Use no visual attractants such as bones and feathers at trap sets. Visual attractants can lure avian species such as raptors into trap sets.

5) Strive to keep leg-hold traps covered; the shiny metal may attract some avian species such as raptors and gulls.

6) Investigate all sets with incidental take and collect additional information. Information collected will improve knowledge on how to reduce incidental take in the future.

7) Improve field communication regarding incidental take. Develop a standardized release protocol that can be shared with other parties.

Any traps that are not specifically set to kill canids (e.g., leg-hold and cage) will be checked at least every 48 hours to reduce suffering of target and non-target animals and the chance of injury or debilitation to any incidental catch.

Need for Lethal versus Non-lethal Control:
We have considered two avenues for decreasing fox predation on eiders without killing foxes, and we are taking action on both of them. First, foxes may be present in unnaturally-high densities near Barrow because of availability of human-generated food sources. To address this problem, the North Slope Borough and USFWS are working cooperatively to reduce human food sources that may attract foxes to the Barrow area. For example, the design of the new landfill makes it more difficult for foxes to gain access to potential food sources. Second, we are taking action to directly protect eider eggs from predation. We have conducted experiments with the Alaska SeaLife Center to artificially incubate Steller's eider eggs and return them to nests at hatch to minimize nest predation. This activity, done in past years, is not currently capable of providing benefits at a large scale. We know of no means to non-lethally reduce the predation of ducklings.

We believe these non-lethal actions are important, but insufficient to reduce predation to the point that production of young is adequate to conserve the eider population. Given the likelihood of extinction of the local eider population, lethal methods are needed in concert with non-lethal methods.

Plan for Monitoring Effectiveness of Fox Control:
As stated above, USFWS will terminate fox control if Steller's eiders are not found to be nesting near Barrow by early July. Employees of USFWS, USDA WS, and BASC will monitor the study area for presence of foxes to gauge the success of the operation.

Because Steller's eider breeding success at Barrow is highly variable among years, to determine whether fox control is increasing nesting success will require multiple years of action. USFWS has an ongoing study of Steller's eiders nesting at Barrow, and will monitor nesting success concurrently with fox control. Annual reports for this larger study are available upon request.