United States Department of the Interior

U.S. FISH AND WILDLIFE SERVICE
Fairbanks Fish and Wildlife Field Office
101 12th Avenue, Room 110
Fairbanks, Alaska 99701

July 29, 2011

MEMORANDUM

To: **Richard Lanctot, Shorebird Coordinator, Alaska Region Migratory Bird Management**

From: **Sarah Conn, Field Supervisor**

Subject: **Biological Opinion: Migratory Bird Management's 2011 Shorebird Breeding Ecology Studies, Barrow, Alaska**

This memorandum is in response to your request for formal consultation regarding effects of USFWS Migratory Bird Management's 2011 Shorebird Breeding Ecology Studies, Barrow, Alaska on endangered and threatened species and critical habitats pursuant to Section 7 of the Endangered Species Act of 1973, as amended. Please find attached the Biological Opinion where we have concluded that shorebird research activities at Barrow are not likely to jeopardize the continued existence of listed species and are not likely to destroy or adversely modify designated critical habitat.

If you have further questions, please call Denise Walther at 907-456-0277.

INTRA-SERVICE BIOLOGICAL OPINION

for

Alaska Region Migratory Bird Management

for

2011 Shorebird Breeding Ecology Studies, Barrow, Alaska

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1. INTRODUCTION

This document is the U.S. Fish and Wildlife Service's (Service) final Biological Opinion (BO) on a proposal by the Service's Alaska Region Migratory Bird Management (MBM) Office to conduct shorebird research in the vicinity of Barrow, AK during summer 2011. This BO describes the effects of these actions on Steller's eider (*Polysticta stelleri*), spectacled eider (*Somateria fischeri*), polar bear (*Ursus maritimus*), and designated polar bear critical habitat pursuant to section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

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 or threatened species or result in the destruction or adverse modification of critical habitat. 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 MBM. Due to the protected species involved, the consulting agency is the (Fairbanks Fish and Wildlife Field Office (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.

Final project details were received on July 11, 2011, and formal consultation began on that date. This BO is based primarily on a Biological Evaluation submitted by Rick Lanctot (MBM, July 11, 2011), a teleconference with MBM on July 11, 2011, and supplemental electronic communications with MBM and the Service's eider breeding ecology program staff.

The stated objectives of the study are to: 1) serve as a Tier II site within the Arctic portion of the Program for Regional and International Shorebird Monitoring North American shorebird monitoring program designed to assess the status and trends of shorebird populations; 2) compare data collected in 2003–2011 with historical shorebird breeding ecology data collected from the study area in the 1950s through early 1980s, and again in the 1990s; and 3) address other specific aspects of the breeding and behavioral ecology of shorebird species, including studies on population structure and migratory connectivity. Proposed activities involve collecting of demographic data on all shorebird species breeding within six permanent study plots as well as some off-plot research activities.

The Service has determined that the proposed action may affect but is not likely to adversely affect polar bears or their critical habitat, but may adversely affect both Steller's and spectacled eiders. Accordingly, effects to polar bears and polar bear critical habitat are summarized below while the remainder of the document focuses on formal consultation for Steller's and spectacled eiders.

Polar Bears
Polar bears do not regularly occur on the tundra near Barrow during summer, but the possibility of encountering a polar bear exists. To minimize the risk of negative human–bear interactions and respond to potential encounters with polar bears, MBM will follow Polar Bear Interaction Guidelines (Appendix A) developed in cooperation with the USFWS Alaska Region Marine Mammals Management Office. Implementation of these guidelines should reduce the risk of polar bear–human interactions. Based on the low probability of a human–polar bear interaction in the study area and the implementation Polar Bear Interaction Guidelines, we expect that effects to polar bears will be insignificant and conclude the project is *not likely to adversely affect polar bears.*

Polar bear critical habitat
A portion of the study area occurs within designated terrestrial denning habitat for polar bear. Because proposed activities will not affect the physical or biological integrity of terrestrial denning habitat and these activities will occur outside of the denning period, we anticipate proposed activities will have an insignificant effect on the conservation role of critical habitat. The Service therefore concludes that the proposed action is *not likely to adversely affect polar bear critical habitat*.

Steller's eiders and spectacled eiders
After reviewing the information provided, the status of the species, the environmental baseline, and cumulative effects, the Service concludes the proposed activities may adversely affect listed eiders but will not jeopardize the continued existence of either species and is not likely to destroy or adversely modify designated critical habitat. To arrive at this non-jeopardy determination, we used a four-step approach for applying section 7(a)(2) standards.

Section 7(a)(2) of the Act states that Federal agencies must ensure that their activities are not likely to:

- Jeopardize the continued existence of any listed species, or
- Result in the destruction or adverse modification of designated critical habitat.

To arrive at this non-jeopardy determination, we used a four-step approach for applying section 7(a)(2) standards. These steps were:

1. Define the biological requirements and current status of spectacled and Steller's eiders;
2. Evaluate the relevance of the environmental baseline to the current status of spectacled and Steller's eider populations;
3. Determine the effects of the proposed or continuing action on the species; and
4. Determine whether the species can be expected to survive with an adequate potential for recovery under the effects of the proposed or continuing action, the effects of the environmental baseline, and any cumulative effects, and considering measures for survival and recovery specific to other life stages.

In addition to listed eiders, the Barrow area may now or hereafter contain plants, animals, or their habitats determined to be threatened or endangered. The Service, through future consultation may recommend alternatives to future developments within the Barrow area to prevent activity that will contribute to a need to list such a species or their habitat. The Service may require alternatives to proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modification of designated or proposed critical habitat. Migratory Bird Management should not conduct any activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act as amended (16 U.S.C. 1531 et seq.), including completion of any required procedure for conference or consultation.

If you have comments or concerns regarding this BO, please contact Ted Swem, Endangered Species Branch Chief, Fairbanks Fish and Wildlife Field Office at (907) 456-0441.

2. DESCRIPTION OF THE PROPOSED ACTION

The proposed action includes Shorebird breeding ecology studies and related activities that will be conducted near Barrow, Alaska at the northwestern corner of the Alaska coastal plain (71°18′N, 156°40′W) in summer 2011.

2.1 Project Actions

Proposed activities will occur from approximately 27 May to 1 August 2011. The field crew consists of 6 full-time staff plus 1–3 others rotating in for a week or two at a time. There will be no field camps. The field crew will be housed in Barrow and access shorebird study plots and the surrounding tundra by driving ATVs along Cakeeater and Gasline roads and walking from roads to plots. The field crew will follow Polar Bear Interaction Guidelines (Appendix A) developed in cooperation with the USFWS Alaska Region Marine Mammals Management Office to minimize risks associated with potential encounters with polar bears.

Breeding shorebirds are monitored primarily on six established study plots (Figure 2.1), although there are some off-plot field activities. Each plot is 600 × 600 m and divided into 144 quadrats marked by wooden stakes placed every 50 m to facilitate orientation within the plot. Shorebird nests are detected using single-person area searches and two-person rope drags. In area searches, surveyors walk in a “w” path within each 50 × 50 m quadrat, but also find nests by following individual birds displaying nest attendance behaviors or, occasionally, by accidentally flushing an incubating bird. Area searches are conducted by one person per plot, 6 days per week between 5 June and 5 July. Each surveyor generally covers less than half the plot in a given day, and daily plot maps are made so the surveyors can cover areas previously missed. In rope dragging, two people pull a 35 m rope throughout the plots to flush incubating birds. Rope-draggers systematically cover every portion of the plot by following rows of stakes. Once a nest is

found, the location is noted in a GPS and the status of the nest is determined (i.e., laying or incubating). Nest locations are noted in the field by placing a Popsicle stick 1 m and 5 m north of the nest, and a blue flag 10 m north of the nest. Alignment of the flag and sticks allows the nest to be relocated quickly.

Treatment of the nest during the initial visit and subsequent checks varies with the status of the nest. For nests found during laying, nests are revisited when the clutch is expected to reach four eggs (based on the addition of one egg per day), to determine final clutch size. Each egg is measured (length and width) once the nest is considered complete (i.e., when the nest has 4 eggs or when the nest no longer gains eggs). For nests found during incubation, two eggs are floated to determine an estimated hatch date (Liebezeit *et al.* 2007). During early nest monitoring (up to 4 days before the predicted hatch date), each nest is revisited every 5 days to estimate daily survival rates. Observers minimize disturbance during these visits by simply walking by the nest and recording whether an adult flushes or is incubating. During late nest monitoring (within 4 days of the predicted hatch date), each nest is visited 1 time per day to see if stars are present on the outside of eggs to assess hatching success. During these visits observers note the number and condition (e.g., signs of hatching) of eggs and determine the color band combinations of adults that are unknown, if possible. If no stars are found on the eggs, then the nest will not be checked the next day but rather observers will skip a day. Once eggs have stars, nests are visited each day until they hatch. Following hatch, most chicks are banded with USGS metal bands and a single cohort color band to allow estimates of natal philopatry to be made. For a few species (dunlin and long-billed dowitchers in 2011), blood samples are also collected from the chicks to ascertain paternity or for stable isotope analysis.

Additional visits are made to the nest during incubation to capture and mark adults. Adults are captured using bow nets. Traps are fired ~30 minutes after the initial set using a pull cord. Uni-parental incubators (phalaropes, pectoral sandpipers, and buff-breasted sandpipers) require 1 revisit to the nest, and bi-parental incubators (most other species) require two visits. To avoid nest desertion, the field crew will usually wait 8-10 days into incubation before capturing birds.

Nest searches and marking (banding) of adults and chicks may occur away from the plots as needed to conduct additional studies on migration ecology, re-nesting, contaminant exposure, avian influenza, stable isotope turnover, landscape and climate change effects on shorebirds, and to relocate birds equipped with geolocators. Although off-plot efforts generally occur at a smaller scale than within-plot work, the extent of these activities varies from year-to-year and has not been quantified.

In 2011, the shorebird crew had two studies that required additional off-plot work. The first was a migratory connectivity study that required the recapture of dunlin and American golden-plovers equipped with light-level geolocators. Most of these birds had been initially captured on or very near the plots. Because adults of these species occasionally shift their territories, area searches and rope-dragging around the plots was required to locate missing birds (i.e., birds that were not on their old territories). The

second study is being conducted by a master's student at the University of Colorado Denver to determine shifts in feeding regimes of dunlin via stable isotope ratios. Dunlin are primarily captured within plots, but nest searches have also occurred near Freshwater Lake.

Minimizing disturbance to nesting Steller's and spectacled eiders
Migratory Bird Management indicates that 2011 marked the first year that listed eider nests have been located on the long-term shorebird plots. Three Steller's eider and one spectacled eider nest were found by the shorebird ecology field crew. Steller's eider nests were located in Plot 2, Plot 3, and on the tundra between Plots 3 and 5. The spectacled eider nest was located near the northwestern boundary of Plot 5. Figures 2.2–2.5 show the locations of these nests along with the locations of known shorebird nests discovered as of 7 July 2011.

To minimize disturbance to breeding Steller's and spectacled eiders, the following measures will be implemented in 2011 by the shorebird ecology field crew:

- If a listed eider nest is found during shorebird ecology field activities, staff will record GPS coordinates and retreat to a distance of ≥100 m if the nest is found within a shorebird plot and ≥200 m if the nest is found outside the plots. If the nest is outside the plots but ≤ 100 m from the boundary of a plot, within-plot activities may occur ≥100 m from the nest. Staff will report the nest observation to the USFWS eider ecology program lead, David Safine, or his designee, as soon as practicable on the day the nest is found.

- The shorebird field crew will maintain a distance of ≥100 m of known active nests within a shorebird plot and ≥200 m of known active nests outside the plots. If the nest is outside the plot but ≤ 100 m from the plot boundary, within-plot activities may occur ≥100 m from the nest. Nests will be considered active unless the USFWS eider ecology crew confirms failure of the nest.

- The shorebird field crew will move to and maintain a ≥100-m distance from young eider broods that are detected during research activities to minimize the risk of fragmenting young broods or separating hens from ducklings, which would increase the predation risk to the ducklings.

- Both the shorebird ecology and eider ecology field crews will maintain communications regarding the status of eider nests in the Barrow area. The shorebird field crew will report listed eider nests observed during their field activities to the eider ecology program lead. The eider ecology program lead, David Safine, or his designee will provide the shorebird crew with the locations of active nests on- and off-plots and inform the shorebird crew when nests have failed in or near the shorebird plots.

2.2 Action Area

The action area is that area in which the direct and indirect effects of the proposed action may occur.

For activities that occur in the six permanent shorebird nest search plots (Figure 2.1), the area directly affected by the proposed project is the combined footprint of the plots (0.6 km × 0.6 km × 6 plots= 2.16 km^2). The area indirectly affected by the proposed activities is delineated by a zone of influence surrounding each plot and on either side of the walking route traveled from the road to the plot. This zone of influence is assumed to be 200 m wide. We estimate the combined affected area encompasses approximately 7.2 km^2 of tundra, including both the plots and their surrounding zone of influence and assuming the shortest walking distance from the road to the plots. Because off-plot activities occur at variable locations within walking distance of the Barrow road system, delineating the spatial extent of off-plot activities is difficult. For the purposes of this BO, we estimate the area potentially affected by off-plot work to be equivalent to the USFWS standard survey area for eider ecology studies near Barrow, 135 km^2, recognizing that activities may affect only a small portion of this area.

Figure 2.1. Locations of six plots used for studying shorebirds in 2011. Actual boundaries of Plot 5 are delineated as two offset rectangles (see Figure 5) rather than the parallelogram shown above. (Map provided by Rick Lanctot, Migratory Bird Management).

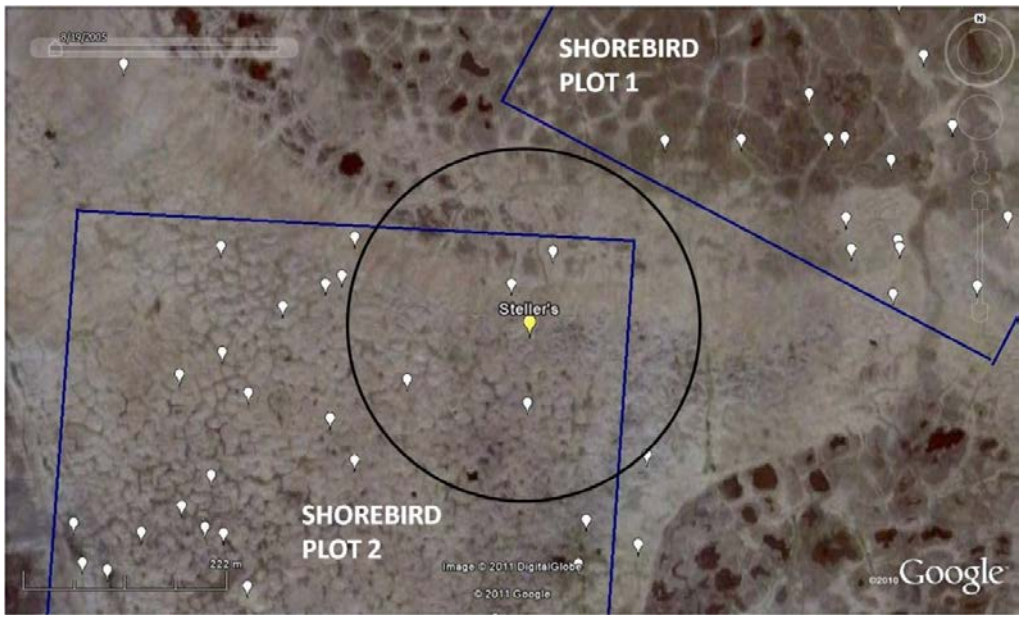

Figure 2.2. Location of shorebird nests and the Steller's eider nest found on Plot 2. White symbols indicate shorebird nests. The black circle represents a 200-m area surrounding the Steller's eider nest. The Steller's eider nest failed on approximately 8 July 2011 and is no longer active. (Map provided by Rick Lanctot, Migratory Bird Management)

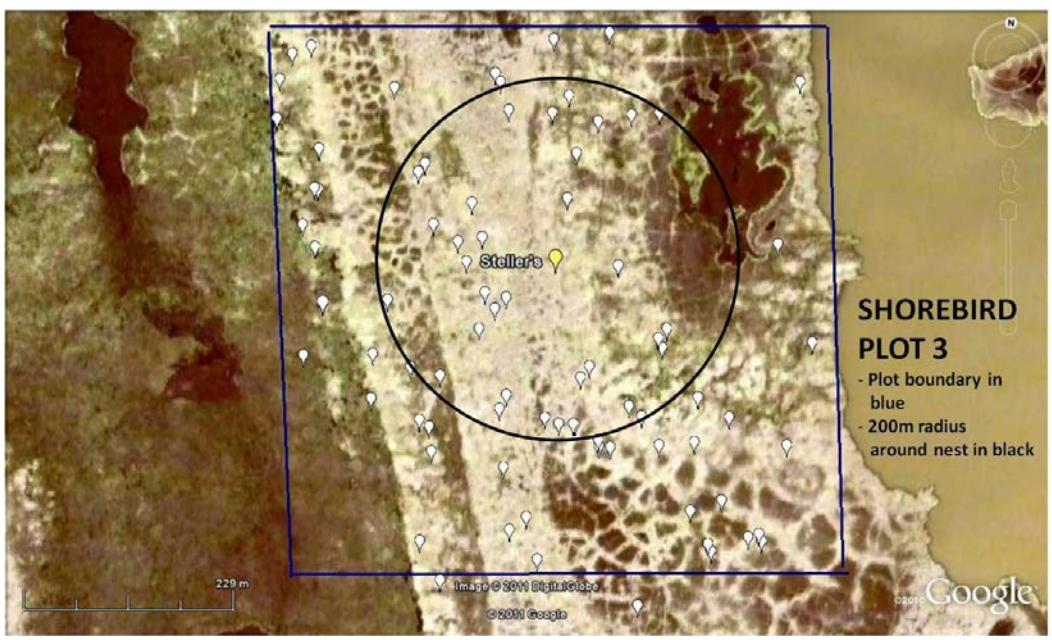

Figure 2.3. Location of shorebird nests and the Steller's eider nest found on Plot 3. White symbols indicate shorebird nests. The black circle represents a 200-m area surrounding the Steller's eider nest. (Map provided by Rick Lanctot, Migratory Bird Management)

Figure 2.4. Location of shorebird nests and the Steller's eider nest found between Plots 3 and 5. White symbols indicate shorebird nests. The Steller's eider nest failed on approximately 26 June 2011 and is no longer active. (Map provided by Rick Lanctot, Migratory Bird Management)

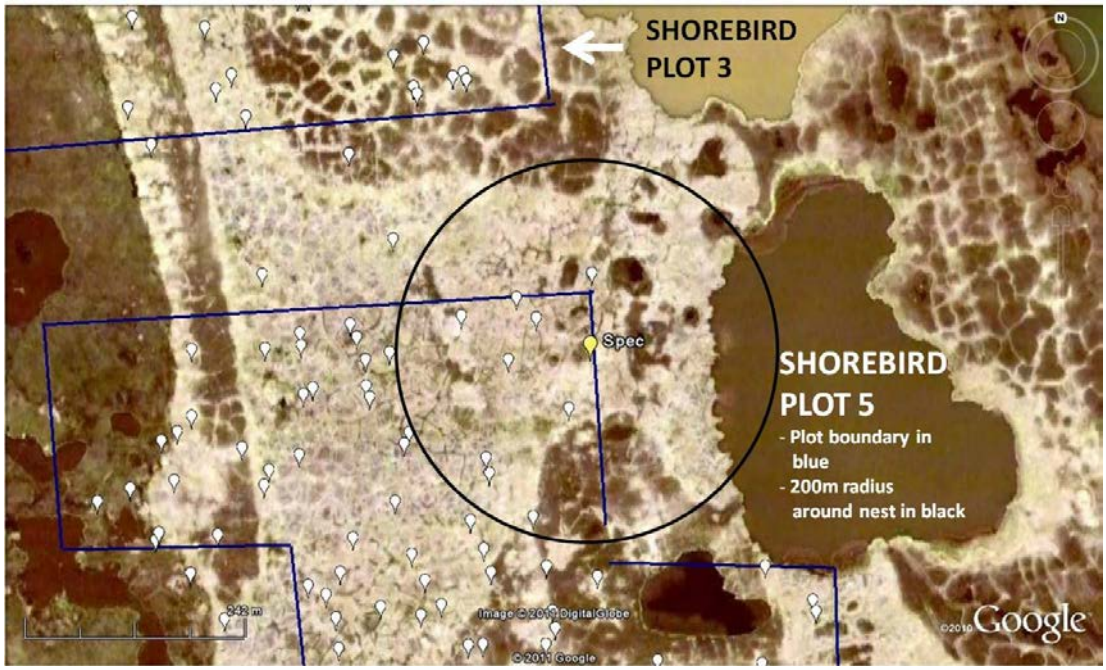

Figure 2.5. Location of shorebird nests and the spectacled eider nest found on Plot 5. White symbols indicate shorebird nests. The black circle represents a 200-m buffer surrounding the spectacled eider nest. (Map provided by Rick Lanctot, Migratory Bird Management)

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.

3.1 Spectacled Eider

Physical Appearance

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. In late summer and autumn males molt into a mottled brown plumage that lasts until late fall, when they re-acquire breeding plumage. Females are mottled brown year round, with pale tan spectacles. Juveniles attain breeding plumage in their second (female) or third (male) year; until then they are mottled brown (Petersen et al. 2000). Both males and females have long sloped bills, giving them a characteristic profile (Figure 3.1).

Figure 3.1 - Male and female spectacled eiders in breeding plumage.

Status and Distribution

Spectacled eiders inhabit the North Pacific. There are three primary breeding populations; those on Alaska's North Slope, the Yukon Kuskokwim Delta (YKD), and northern Russia. Historically, spectacled eiders nested in Alaska discontinuously from the Nushagak Peninsula north to Barrow, and east nearly to Canada's Yukon Territory (Phillips 1922-1926, Bent 1925, Bailey 1948, Dau and Kistchinski 1977, Derksen et al. 1981, Garner and Reynolds 1986, Johnson and Herter 1989). The entire species was listed throughout its range as threatened on May 10, 1993 (USFWS 1993) because of documented population declines. The YKD population had declined 96% between the 1970s and early 1990s (Stehn et al. 1993, Ely et al. 1994), and anecdotal information

indicated that populations in the other two primary breeding areas had also declined (USFWS 1996).

Research and spring aerial surveys have provided data on spectacled eider populations on Alaska's ACP (the North Slope breeding population) since 1992. On the North Slope, 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 North Slope (Figure 3.2). Breeding pair numbers peak in mid-June and the number of males declines 4-5 days later (Smith et al. 1994, Anderson and Cooper 1994, Anderson et al. 1995, Bart and Earnst 2005).

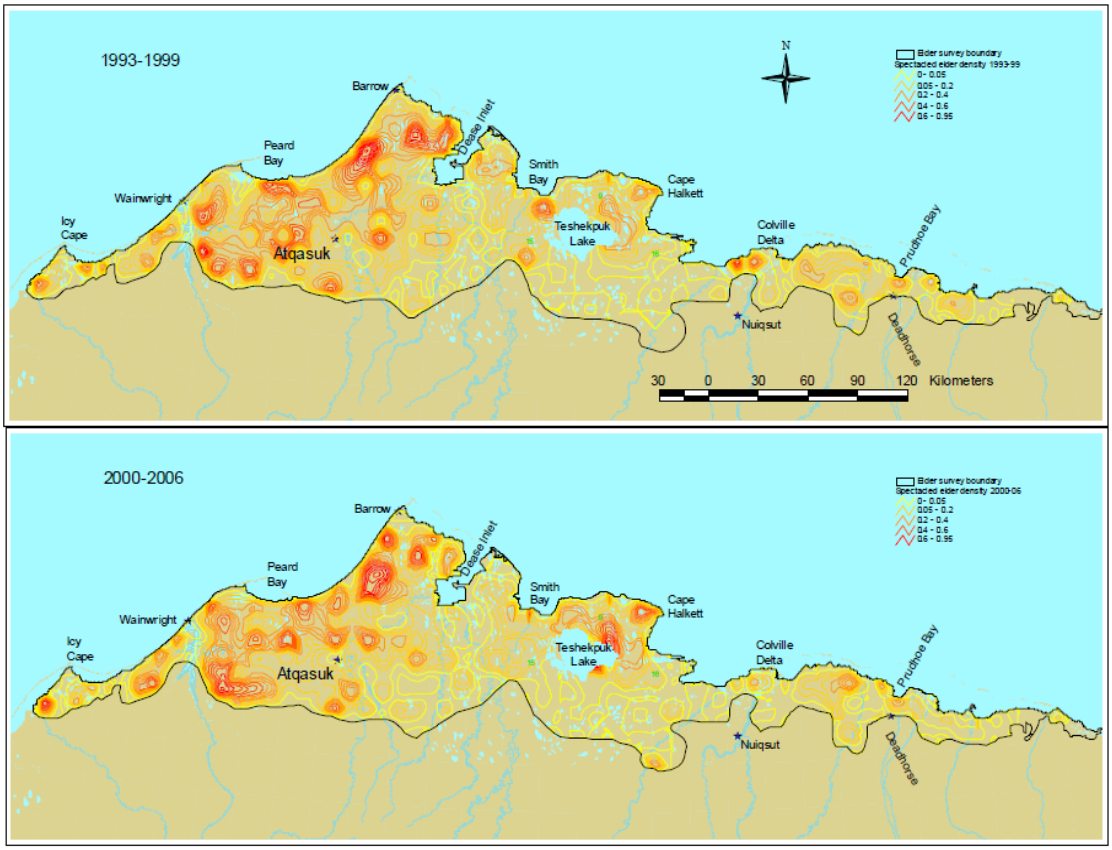

Figure 3.2 – Mean spectacled eider breeding density across Alaska's Arctic Coastal Plain 1993-1999 above and 2000 – 2006 below (from Larned et al. 2006).

North Slope spectacled eider clutch size averages 3.2-3.8, with clutches of up to eight eggs reported (Quakenbush et al. 1995). Incubation lasts 20-25 days (Kondratev and Zadorina 1992, Harwood and Moran 1993, Moran and Harwood 1994, Moran 1995), and hatching occurs from mid- to late July (Warnock and Troy 1992). On the nesting grounds, spectacled eiders feed on mollusks, insect larvae (craneflies and caddisflies), midges, small freshwater crustaceans, and plants and seeds (Kondratev and Zadorina 1992) in shallow freshwater or brackish ponds, or on flooded tundra. Young fledge

approximately 50 days after hatch, and then females with broods move directly from freshwater to marine habitats.

Nest success is highly variable and greatly 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; predation was believed to be the cause of high failure rates, with foxes, gulls and jaegers the suspected predators (Pearce et al. 1998). On Kigigak Island in the YKD, Mayfield nest success ranged from 6-92% from 1992-2007 (Lake 2007). Nest success tended to be higher in years with low fox numbers or activity (i.e., no denning) and when foxes were eliminated from the island prior to the nesting season or years. Apparent nest success in 1991 and 1993-1995 in the Kuparuk and Prudhoe Bay oil fields on the North Slope varied from 25-40% (Warnock and Troy 1992, Anderson et al. 1998). On the Colville River Delta, in the vicinity of the proposed project, average Mayfield nest success from 1994-1999 was 31% (Bart and Earnst 2005). Duckling survival is also variable and influenced by predators. Radio telemetry studies of broods on the YKD have reported duckling survival to 30 days averaging 34-45% on the Kashunuk River (Flint and Grand 1997, Flint et al. 2006) and 67% at Kigigak Island (Flint et al. 2006).

Distribution of spectacled eiders. Molting areas (green) are used July through October. Wintering areas (yellow) are used October through April. The full extent of molting and wintering areas is not yet known, and may extend beyond the boundaries shown.

Figure 3.3 - Distribution of spectacled eiders.

As with other sea ducks, spectacled eiders spend the 8-10 month-long 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 at sea. These studies are summarized in Petersen et al. (1995), Larned et al. (1995), and Petersen at al. (1999).

Spectacled eiders molt in several discrete areas (Figure 3.3), with birds from the different populations and genders apparently favoring different molting areas (Petersen et al. 1999). After molting, spectacled eiders migrate to openings in pack ice of the central Bering Sea south/southwest of St. Lawrence Island (Petersen et al. 1999; Figure 3.2), where they remain until March and April (Lovvorn et al. 2003).

Male spectacled eiders begin to depart breeding areas during incubation, which is during late June on the North Slope. On the North Slope, pair numbers peak in mid-June and the number of males declines 4-5 days later (Smith et al. 1994, Anderson and Cooper 1994, Anderson et al. 1995). Following their late June departure from the nesting areas, males apparently make little use of the Beaufort before migrating to the Chukchi Sea. During late June the Beaufort Sea has little open water, hence males present at breeding grounds east of Barrow normally do not use marine habitats and fly directly overland (most heading to a molting/staging area in Ledyard Bay) (TERA 2003). Later in the season (late June through September), when females depart the North Slope, much more of the nearshore zone is ice-free. Open water in marine habitat allows for extensive use of the western Beaufort Sea. Radio telemetry studies have shown that most female spectacled eiders that migrate west toward Barrow use the near shore zone of the Beaufort Sea as they transit to their molting/staging areas. In 2000, 13 female spectacled eiders tracked via radio telemetry primarily used the western Beaufort (71% of all bird-days) while areas near Stockton Island were also extensively used (17% of all bird-days) (TERA 2003). The females remained in the Beaufort Sea near shore zone for an average of about two weeks (range 6-30 days). After molting, spectacled eiders migrate 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 (Petersen et al. 1999). Spectacled eiders in the marine environment feed predominately on clams and small amounts of snails, amphipods, and other bivalves.

Spectacled Eider 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).

No population estimates for the North Slope breeding population are available before 1993. At Prudhoe Bay, within the North Slope breeding area, Warnock and Troy (1992) documented an 80% decline in spectacled eider abundance from 1981 until 1991. For the North Slope breeding population, ground-plot surveys have not been conducted. The 2009 population index based on aerial surveys was 5,018 birds (3343-6692, 90% CI; Larned et al. 2010). The North Slope spectacled eider population from 1993-2009 was slightly decreasing, with an average (n = 17 years) population growth rate of 0.985

(0.971, 0.999, 90% CI; Larned et al. 2010). The North Slope breeding population estimate for 2007-2009 (adjusted for detection probability = 46%) was 12,506 (9,365–15,646, 90% C.I.)

Spectacled Eider Recovery Goals and Status
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 YKD (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 (factors discussed in Section 4 – *Environmental Baseline*). Under the Recovery Plan, the species will be considered recovered when each of the three recognized populations (YKD, 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 YKD, 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 the smallest of the four eider species. From early winter until mid-summer males are in breeding plumage - black back, white shoulders and sides, chestnut breast, white head with black eye patches and a greenish tuft (Figure 3.4). During late summer and fall, males molt to dark brown with a white-bordered blue wing speculum; this plumage is replaced during the autumn molt when males re-acquire breeding plumage, which lasts through the next summer. Females are dark mottled brown with a blue wing speculum year round. Juveniles are dark mottled brown until the fall of their second year, when they acquire breeding plumage (Fredrickson 2001).

Status and Distribution
The Steller's eider is a circumpolar sea duck. Steller's eiders are divided into Atlantic and Pacific populations; the Pacific population is further divided into the Russia-breeding population along the Russian eastern arctic coastal plain, and the Alaska-breeding population.

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

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 Yukon-Kuskokwim Delta (YKD), 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 North Slope, particularly near Barrow and at very low densities from Wainwright to at least as far east as Prudhoe Bay (Figure 3.5). A few pairs may still nest on the YKD; only 10 Steller's eider nests have been recorded on the YKD since 1970 (Hollmen et al. 2007).

Steller's eiders arrive in pairs on Alaska's North Slope in early June, but nests are only found intermittently near Barrow since 1991. Nests of Steller's eiders have been found near Barrow in 12 (60%) of the last 20 years. (USFWS, unpublished data). Individuals foregoing breeding is common in long-lived eider species and is typically related to inadequate body condition (Coulson 1984), but reasons for Steller's eiders non-breeding may be more complex. In the Barrow area, Steller's eider nesting is correlated with lemming numbers and other environmental cues; nest success could be enhanced in years of lemming abundance because nest predators are less likely to prey-switch to eider eggs and young, or because avian predators such as pomarine jaegers (*Stercorarius pomarinus*) and snowy owls (*Bubo scandiaca*) that nest nearby (and consume abundant lemmings) may protect eider nests from mammalian predators such as arctic fox (Quakenbush and Suydam 1999, and summarized by Rojek 2006).

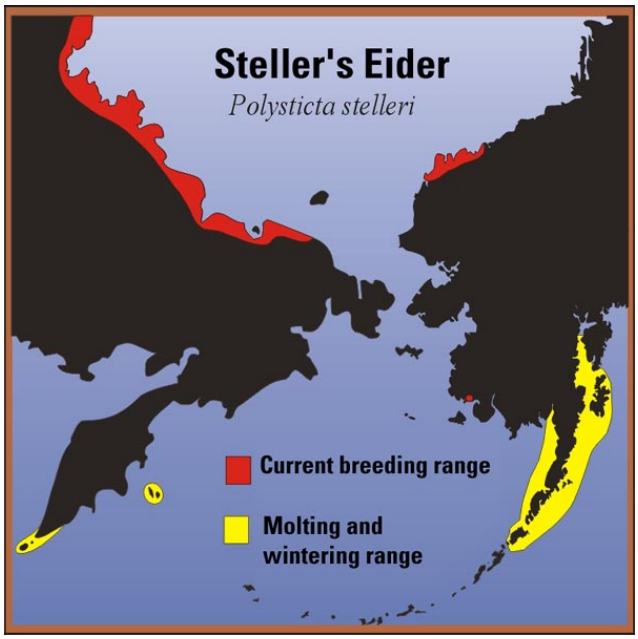

Figure 3.5 - Steller's eider distribution in the Bering, Beaufort and Chukchi seas (USFWS 2002b).

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-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). Nest survival (the probability a nest will hatch at least one egg) averaged 0.23 in nesting years (1991-2004) prior to fox control, whereas nest survival during nesting years after fox control began (2005–2010) was 0.48 (USFWS, unpublished data).

Within a day or two after hatch, hens move their broods to adjacent ponds with emergent vegetation dominated by *Carex* spp. and *Arctophila fulva* (Quakenbush et al. 2000, Rojek 2006, 2007) Here they feed on insect larvae and other wetland invertebrates. Broods may move up to several kilometers from the nest prior to fledging (Quakenbush et al. 2000, Rojek 2006, 2007). Fledging occurs from 32-37 days post hatch (Obritschkewitsch et al. 2001, Quakenbush et al. 2004, Rojek 2006).

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, five 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.

Departure from the breeding grounds differs between sexes and between breeding and non-breeding years. Male Steller's eiders typically leave the breeding grounds after females begin incubating, around the end of June or early July (Quakenbush et al. 1995,

Obritschkewitsch et al. 2001). Females whose nests fail may remain near Barrow later in summer; a single failed-breeding female equipped with a transmitter in 2000 remained near the breeding site until the end of July and stayed in the Beaufort Sea off Barrow until late August (Martin et al. in prep). Successfully-breeding females and fledged young depart the breeding grounds in early to mid-September. In a non-breeding year, satellite-transmittered males and females dispersed across the area between Wainwright and Admiralty Inlet in late June and early July, with most birds entering marine waters by the first week of July. They were tracked at coastal locations from Barrow to Cape Lisburne, and made extensive use of lagoons and bays on the north coast of Chukotka (Martin et al. in prep.).

After the breeding season, Steller's eiders move to marine waters where they undergo a complete flightless molt for about 3 weeks. The combined (Russia- and Alaska-breeding) Pacific population molts in numerous locations in southwest Alaska, with exceptional concentrations in 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). Molting areas are characterized by extensive shallow eelgrass (*Zostera marina*) beds and intertidal sand flats and mudflats, where Steller's eiders forage on marine invertebrates such as mollusks and crustaceans (Petersen 1980, 1981; Metzner 1993).

After molt, many of the Pacific-wintering population of Steller's eiders disperse to winter in the eastern Aleutian Islands, the south side of the Alaskan Peninsula, and east to Cook Inlet, although thousands may remain in lagoons used for molt unless or until freezing conditions force them to move (USFWS 2002). Wintering Steller's eiders usually (although not always; Martin et al. in prep.) occur in waters less than 10 m deep, which are normally within 400 m of shore or at offshore shallows. The listed Alaska-breeding population is only a small proportion of the Pacific-wintering population of Steller's eiders, approximately 0.7%. This estimate is derived by taking the most recent North Slope breeding bird estimate of 576 birds (described below, Stehn and Platte, 2009), adding 1 for the YKD population, and then dividing by the population estimate of Pacific-wintering Steller's eiders from 2007 (87,400; Larned 2007). Thus, 576 ÷ 87,400 = (0.00659 * 100) = 0.7% or rounded to 1%.

Prior to spring migration, thousands of Steller's eiders stage in estuaries along the north side of the Alaska Peninsula, including some molting lagoons, and at the Kuskokwim Shoals near the mouth of the Kuskokwim River in late May (Larned 2007, Martin et al. in prep.). Like other eiders, Steller's eider may use spring leads for feeding and resting, but there are few conclusive data about habitat use during spring migration. It seems likely Steller's eiders are also using the Chukchi lead system similarly to king eiders (Steffen Oppel, University of Alaska-Fairbanks, unpublished data).

During winter, Steller's eiders generally use and feed in shallower water than the other eider species, although they may also use deeper (20-30 m) habitats if feeding on water-column invertebrates (Philip Martin, USFWS, pers. comm.). They are likely associated with shallow spring leads, therefore, although they possibly also use leads in deeper

water if an abundant and nutritious invertebrate community is present in the water column. Alaska-breeding Steller's eiders typically return to breeding areas near Barrow in early June (Rojek 2006).

Steller's Eider Abundance and Trends – Pacific Population

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 since 1992 to monitor the population status and habitat use of Steller's eiders (*Polysticta stelleri)* staging for spring migration in southwestern Alaska. Annual Steller's eider estimates ranged from 137,904 (1992) to 54,888 (2010), mean 73,904. The long-term trend indicates an exponential decline of 2.7 percent per year (R^2=0.43; Larned and Bollinger, 2010). Larned and Bollinger (2010) suggest 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 the single annual counts in subsequent years. A variable low-bias may also be present in most annual estimates due to inaccuracies in timing, observer effects and other uncontrolled variables (Larned and Bollinger 2010).

Steller's Eider Abundance and Trends – Listed Alaska-Breeding

The listed Alaska-breeding population is only a small proportion of the Pacific-wintering population of Steller's eiders, approximately 0.8%. This estimate is derived by taking the most recent North Slope breeding bird estimate of 576 birds (described below, Stehn and Platte, 2009), adding 1 for the YKD population, and then dividing by the population estimate of Pacific-wintering Steller's eiders from 2010 (73,904; Larned and Bollinger 2010). Thus, 577 ÷ 73,904 = 0.8% or rounded to 1%.

Stehn and Platte (2009) conducted a review of the distribution, abundance, and trends of the listed population of Steller's eiders on the arctic coastal plain (ACP). Using data from three aerial surveys, (the ACP, the North Slope eider survey [NSE], and the Barrow Triangle survey [ABR]), they assessed population status and trends of the Steller's eider population nesting on the ACP of Alaska. Data reported from these three surveys provide different estimates of average population size and trend. The 1989-2006 ACP survey (Mallek et al. 2007) estimated a total average population size of 866 birds with a declining population growth rate of 0.778 (Stehn and Platte 2009); the NSE survey (1992-2008; Larned et al. 2009) averaged 162 birds with increasing growth rate of 1.059. The ABR survey, which surveys only the Barrow triangle, which is a subset of the larger ACP and NSE survey areas (1999-2007; Obrishkewitsch et al. 2008) averaged 100 birds with a growth rate of 0.934. Average population size and trend can be biased by changes in observer, detection rates and survey timing. Survey timing was considered especially important for species with male departure early in incubation, or other marked shifts in habitat use, movements, or flocking behavior (ground breeding surveys near Barrow indicate the best time for aerial surveys of breeding Steller's eiders is about 12-20 June, after arrival of most breeding individuals but before most males depart. Using a subset of data least confounded by changes in survey timing and observer, the appropriately-timed NSE survey observations from 1993-2008 averaged 173 indicated total Steller's eiders (88-258, 90% confidence interval) with an estimated growth rate of 1.011 (0.857 – 1.193, 90% CI). The authors assumed a detection probability of 30% (based upon reasonable

estimates with similar species and habitats), yielding a total average population of Steller's eiders breeding in the ACP of about 576 (292-859, 90% CI; Stehn and Platte 2009).

Standardized ground surveys for eiders near Barrow have been conducted since 1999, and have found an average density near Barrow of 0.63 birds/ km^2 (Rojek 2008). The Barrow vicinity supports the largest known concentration of nesting Steller's eiders in Alaska. The highest number of Steller's eiders observed during systematic surveys at Barrow occurred in 1999 with 135 males counted during ground surveys (36 nests found); in 2008, 114 male Steller's eiders were counted during ground surveys (28 nests found). Counts of males are the most reliable indicator of Steller's eider presences because females are cryptic and are often undercounted. Approximately 90% of all Steller's eiders nests found near Barrow since 1991 were within one mile of the Barrow road network (1991-2007 locations are summarized in Rojek 2008; 2008 locations are USFWS, unpublished data).

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, over hunting, 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 number needed to ensure the risk of extinction is tolerably low (with extinction risk estimated by population modeling). 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 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 2,830 mi^2 (7,330 km^2) of critical habitat for the Alaska-breeding population of Steller's eiders at breeding areas on the YKD, 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. In accordance with section 3(5)(A)(i) of the Act and regulations in 50 C.F.R. 424.12, critical habitat for a species contains those physical or biological features that are essential for the conservation of the species and which may require special management considerations and protection. Under the Act these features are considered "primary constituent elements" of critical habitat, and include, but are not limited to: space for individual and population growth, and for normal behavior; food, water air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and habitats that are protected from disturbance or are representative of the historical geographic and ecological distribution of a species.

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 action area. 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 ACP in the project action area 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) (Pattee and Pain 2003). 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 (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 (Matz, USFWS, pers. comm.). However, the USFWS Office of Law Enforcement 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.

Eider breeding ecology studies at Barrow indicate fox control may have a positive effect on Steller's eider nest survival rates (the probability a nest will hatch at least one egg). Nest survival averaged 0.16 before fox control was implemented near Barrow (1991–2004) and 0.52 in 2005–2007 during fox control (Rojek 2008). Average nest survival in 2008 was 0.58 (n = 27; Safine 2011; (no eiders nested in 2009 and only 2 nests were found in 2010).

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 across the North Slope that required formal section 7 consultation, and the estimated incidental take of listed eiders, is presented in Table 4.1. These actions were considered in the final jeopardy analysis of this BO. It should be noted that incidental take is estimated prior to the implementation of reasonable and prudent measures and associated terms and conditions which 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 YKD 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 YKD (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 YKD, 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 likely reduced by the implementation of terms and conditions in each biological opinion, is spread over the life-span of a project (often 50 years), and is dominated by the *potential* loss of eggs/ducklings which, 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	< 4 spectacled eider eggs/ducklings < 10 Steller's eider eggs/ducklings

	Collision	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 Inlet (2010)	Disturbance	35 spectacled eider eggs/ducklings
Intra-Service, Migratory Bird 2011 Subsistence Hunting Regulations	Shooting	400 adult Steller's eiders (lethal take) 4 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 ducklings Steller's eider or spectacled eider (lethal take) 30 Steller's eider and 30 spectacled eider hens (nonlethal take) 40 Steller's eider or spectacled eider ducklings (nonlethal 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 2006). 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 2006), 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 BO provides an analysis of the effects of the Action on listed species, and critical habitat. Both direct effects (those immediately attributable to the Action), and indirect effects (those caused by the Action, but which will occur later in time, and are reasonably certain to occur) are considered. Finally, the effects from interrelated and interdependent activities are also considered.

5.2 Direct Effects

Investigator disturbance during shorebird ecology field activities could adversely impact Steller's and spectacled eiders by: 1) displacing adults and/or broods from preferred habitats during pre-nesting, nesting, and brood rearing; 2) displacing females from nests, exposing eggs or small young to inclement weather or predators; and 3) reducing foraging efficiency and feeding time. The results of published studies on the impacts of human disturbance to nesting waterfowl are variable but suggest low to moderate effects on nest survival and rates of nest abandonment. Data from the YKD indicates that nest disturbance from human activity results in decreases in spectacled eider nest survival rate of 4% (Bowman and Stehn 2003), and 14% (Grand and Flint 1997). However, Mickleson (1975) suggested very low rates of desertion, 0.8% naturally with an additional 0.7% as a result of human disturbance, in his studies of cackling geese and spectacled eiders on the YKD. A 6% desertion rate for ducks nesting on a refuge in Wisconsin was documented by Livezey (1980), and Johnson (1984) documented several nests abandoned by female common eiders after human disturbance on Thetis Island, northern Alaska. Hens may be more likely to abandon nests if disturbance occurs early in the incubation period (Livezy 1980, Götmark and Ählund 1984).

Individual tolerance and behavioral response of Steller's and spectacled eiders to disturbance likely varies. Steller's eiders have been observed nesting and raising broods close to the Barrow airport, and spectacled eiders are known to nest close to the Deadhorse airport (USFWS data). Studies of spectacled eider responses to aircraft and construction activities at the Alpine oilfield suggests broods can be raised successfully close to areas with significant levels of disturbance (Johnson et al. 2006). Steller's eiders 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. Disturbance that is regular and ongoing allows sensitive individuals to move away and less sensitive individuals to become habituated.

Predation is an important mechanism through which human disturbance affects nesting success. In a review of the effects of field observers on nesting success of common eiders, Götmark (1992) found that 76% of studies that reported reduced nest success identified predation as the primary cause. While both avian and mammalian predators have been documented depredating nests after a hen has been flushed by humans, Götmark (1992) concluded that avian predators were most likely to have an effect as a result of disturbance. Grand and Flint (1997) suggested avian predators, particularly gulls, were more prevalent than mammalian predators on the YKD. Similar results were

reported from studies in the area by Mickelson (1975) who attributed 85.9% of nest predation to avian predators, while Vacca and Handel (1988) attributed 78% of predation to avian predators. Given the similar fauna, vegetation, and terrain it is possible that avian predators would also be more significant than mammalian predators if nests are disturbed on the ACP. However, arctic foxes were also responsible for a substantial portion of nest depredation observed in camera-monitoring studies of waterfowl nests in the Barrow area (Safine 2011) and shorebird and passerine nests in the Prudhoe Bay region of the ACP (Liebezeit and Zack 2008).

Investigator disturbance within shorebird study plots

It is difficult to predict the number of Steller's eiders and spectacled eiders that may nest within the shorebird plots in a given year. The number of potentially affected eider nests and broods could be estimated by multiplying the mean historical density of breeding pairs of each species in the Barrow eider ecology study area by the combined area of the plots and the zone of influence in which eiders may be disturbed. However, these estimates may particularly underestimate the actual number of Steller's eider nests in the action area in some years because they have a patchy distribution within the eider ecology standard survey area that changes among years, as well as considerable interannual variation in nesting effort. In 2011, 4 Steller's eiders and one spectacled eider nested in or within 200 m of Plots 1, 2, 3, and 5 (4 of these nests are shown in Figures 2–4; the 5th nest is north of Plot 3). Five additional Steller's eider nests were also found within ~800 m of Plots 3 and 5. Historically, numerous nests of both eider species have been found within 1 km of the shorebird plots, including two Steller's eider nests in Plot 5 (2005, 2008) and two spectacled eider nests in Plot 8 (2000, 2008).

Breeding eiders that choose to nest within the shorebird plots are likely to experience a single surveyor or bander walking near their nest up to several times during their nest initiation period and may be relatively tolerant to the presence of surveyors that remain at a perceived safe distance from the nest. When unknown eider nests are detected during shorebird field activities, the close proximity of the field crew may flush a female from the nest or preclude a female on recess from returning to the nest. This exposes eggs or young ducklings to inclement weather and predators. Safine (2011) reported depredation of a camera- monitored nest by glaucus gulls and parasitic jaegers after a spectacled eider delayed returning to incubate the nest following capture by investigators. Investigator disturbance may also fragment young broods or separate hens from ducklings, making the ducklings more vulnerable to predators.

The frequency of investigator activity in the shorebird plots during nest searching and return visits to shorebird nests can be expected to increase the risk of adverse effects to listed eiders in terms of loss of production, which may occur through abandonment of the nest; full or partial depredation of an unattended nest; or depredation of ducklings associated with fragmented broods. Repeated visits by investigators near the Steller's eider nest located between Plots 3 and 5 (Figure 4) likely contributed to subsequent abandonment of the nest in late June. Because this BO will be issued late in incubation when most nests have hatched and hens are least likely to abandon their nests, we anticipate the 100-m buffer that will be maintained from active eider nests during within-

plot activities, and the 200-m buffer that will be maintained during foot access to the plots, will adequately prevent incidental take through loss of nests (eggs or young ducklings). We also recommend maintaining a distance of 100 m from eider broods that are detected during field activities to minimize the risk of incidental take of ducklings that have been separated from the hen.

To summarize, we do not anticipate incidental take to occur through loss of production of eggs or ducklings associated with continued activities in the permanent shorebird study plots during the 2011 field season.

Off-plot activities
Although some shorebird research activities also occur outside the plots, the shorebird investigators have more flexibility in the locations where these activities will occur. Because field crews will remain at least 200 m from known active nests, we do not anticipate incidental take of listed eiders during off-plot research activities.

5.2 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.

5.3 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.

Future development by the State of Alaska or the North Slope Borough may occur in the area through developments like improved roads, transportation facilities, housing or utilities or other infrastructure. However, the entire action area and the surrounding undeveloped tundra are wetlands, and are therefore subject to Section 404 permitting requirements by the U.S. Army Corps of Engineers. This permitting process would serve as a federal nexus, and hence trigger a review of any major state or borough construction project in the area.

Additional scientific research is likely to occur in the action area. We anticipate that most research would involve a Federal action agency through funding or permitting of those activities. While there is the possibility future scientific research may occur in the action area that does not require consultation under the Act, we have determined that such research is not reasonably certain to occur.

7. CONCLUSION

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." 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 MBM's 2011 shorebird ecology research activities, as proposed, are not likely to jeopardize the continued existence of the Steller's and spectacled eiders.

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 disturbance during field work (i.e. flushing pairs and hens from nests or separating a hen from her ducklings), resulting in loss of production. Effects due to single temporary disturbances of listed eider nests during shorebird research activities are not likely to rise to the level of take, provided conservation measures are in place to prevent sustained or repeated disturbance to the Steller's and spectacled eider nests and broods. *No incidental take of Steller's eiders or spectacled eiders* is anticipated during MBM's remaining 2011 shorebird research activities if minimization measures integrated into the proposed action are consistently implemented by the shorebird field crew.

Any observations of Steller's or spectacled eiders, or their nests, along with the location, date of observation, and a brief description of any observed behavior should be provided to the David Safine, Endangered Species Branch, Fairbanks Fish and Wildlife Field Office (907-456-0354, Fairbanks; 907-367-3761, Barrow) or his designee as soon as practicable. These reports will help us to improve our understanding of the impact of disturbance on nesting Steller's and spectacled eiders.

If Steller's or spectacled eiders are encountered injured or killed during permitted activities, please contact David Safine (contact information above), Neesha Stellrecht (907-456-0297), or Angela Matz at (907-456-0442) with the Fairbanks Fish and Wildlife Field Office, Endangered Species Branch, Fairbanks, Alaska at for instructions on the handling and disposal of the injured or dead bird.

8. REINITIATION NOTICE

This concludes formal consultation on proposal by MBM to conduct shorebird research in the vicinity of Barrow, AK during summer 2011. 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.

While this BO satisfies the requirements of the Act 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 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 with the Fairbanks Fish and Wildlife Field Office, Endangered Species Branch, Fairbanks, Alaska at (907) 456-0297.

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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.

When camping:

- 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.