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
May 25, 2012

Memorandum

To: John Lohrey, Field Operations Engineer, Federal Highways Administration, Alaska Division

Mary Romero, Project Manager, U.S. Army Corps of Engineers, Alaska District

From: Sarah Conn, Fairbanks Field Office Supervisor

Subject: Formal Section 7 Consultation for the Barrow Roads Improvement Project (Barrow Arctic Research Center Road AK 113 -Federal Project Number: HPRM-0002(210)/State Project Number: 76970; North Slope Borough Road Improvements AK 048 – Federal Project Number: SDP-0002(209)/State Project Number: 76972)

This memo transmits the U.S. Fish and Wildlife Service's (Service) final Biological Opinion (BO) in accordance with Section 7 of the Endangered Species Act of 1973, as amended, on the effects of a proposal by the North Slope Borough, in cooperation with the Alaska Department of Transportation and Public Facilities and the Federal Highways Administration (FHWA), to construct a new road that would provide an alternative route between Barrow and the former Naval Arctic Research Lab and the Barrow Arctic Research Center. The FHWA is the lead Federal agency for this BO with cooperation from the U.S. Army Corps of Engineers (USACE). The project will require a USACE permit under Section 404 of the Clean Water Act.

This BO describes the effects of the Proposed Action on Steller's eiders (*Polysticta stelleri*), spectacled eiders (*Somateria fischeri*), and polar bears (*Ursus maritimus*) pursuant to section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.). The project area is excluded from polar bear critical habitat (USFWS 2010) as part of the Barrow townsite.

The Service has determined the Proposed Action may affect but is not likely to adversely affect polar bears and is likely to affect Steller's eiders and spectacled eiders. After reviewing the status and environmental baseline of listed eiders and analysis of the potential effects of the Proposed Action to listed species, the Service concludes the Proposed Action is not likely to jeopardize the continued existence of Steller's or spectacled eiders.

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.

BIOLOGICAL OPINION

for

THE BARROW ROADS IMPROVEMENT PROJECT

Consultation with the
Federal Highways Administration
Juneau, Alaska
and
U.S. Army Corps of Engineers
Anchorage, Alaska

Prepared by:
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101 12th Ave, Room 110
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May 25, 2012

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1. INTRODUCTION

This document is the U.S. Fish and Wildlife Service's (USFWS) Biological Opinion (BO) on a proposal by the North Slope Borough (NSB), in cooperation with the Alaska Department of Transportation and Public Facilities (ADOT&PF) and the Federal Highways Administration (FHWA), to construct a new road that would provide an alternative route between Barrow and the former Naval Arctic Research Lab (NARL) and the Barrow Arctic Research Center (BARC)[1] (the Proposed Action). The FHWA is the lead Federal agency for this BO with cooperation from the U.S. Army Corps of Engineers (USACE). The project will require a USACE permit under Section 404 of the Clean Water Act.

This BO describes the effects of the Proposed Action on Steller's eiders (*Polysticta stelleri*), spectacled eiders (*Somateria fischeri*), and polar bears (*Ursus maritimus*) pursuant to section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.). The project area is excluded from polar bear critical habitat (USFWS 2010) as part of the Barrow townsite. We used information in the biological assessment (BA; FHWA 2011) submitted to the Service by the FWHA on May 5, 2011, the USACE permit application package dated March 6, 2012, and additional project details provided by FWHA and the applicant to develop this BO.

Section 7(a)(2) of the ESA states that Federal agencies must ensure 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.

The Service has determined the Proposed Action may affect but is not likely to adversely affect polar bears and is likely to affect Steller's eiders and spectacled eiders. After reviewing the status and environmental baseline of listed eiders and analysis of the potential effects of the Proposed Action to listed species, the Service concludes the Proposed Action is not likely to jeopardize the continued existence of Steller's or spectacled eiders.

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 project will extend Laura Madison Road from the intersection with Qaiyaan Street to Cakeeater Road and construct Uivaqsaagiaq Road from the Laura Madison–Cakeeater roads intersection, along the south shore of Middle Salt Lagoon, to the BARC facility (Figures 2.1 and 2.2). The purpose of this project is to 1) provide reliable access to research, educational, subsistence, governmental and commercial facilities along the coast north and east of Middle Salt Lagoon; 2) provide a more direct route for evacuation and emergency service vehicles; 3)

[1] Barrow Arctic Research Center Road AK 113 -Federal Project Number: HPRM-0002(210)/State Project Number: 76970; North Slope Borough Road Improvements AK 048 – Federal Project Number: SDP-0002(209)/State Project Number: 76972.

reduce road maintenance cost and allow abandonment of portions of Stevenson Street (FHWA 2011).

Action Area

The direct and indirect effects of the action define this area. The area directly affected by the proposed project is the footprint of the new road sections. The area indirectly affected by the proposed project is delineated by a zone of influence surrounding new infrastructure within which listed eiders may be affected by disturbance resulting from the Proposed Action. This zone of influence is assumed to be 200 m wide. We applied the 200-m zone of influence to Uivaqsaagiaq Road and the south side of the Laura Madison extension. We applied a 50-m zone along the north side of the Laura Madison extension to account for the close proximity of the sewage lagoon. The resulting Action Area encompasses 1.4 km^2 (346 acres) of tundra comprising the gravel footprint (0.09 km^2 [21.4 acres]) and the estimated zone of influence in the tundra surrounding the new road sections (1.31 km^2 [324.5 acres]).

Proposed Action

The total project length is 11,577 ft, comprising the 2,150-ft Laura Madison extension and the new 9,427-ft Uivaqsaagiaq Road. The Laura Madison extension will be 32 ft wide at the shoulders with 3:1 side slopes; Uivaqsaagiaq Road will be 40 ft wide at the shoulders with 4:1 side slopes. Uivaqsaagiaq Road will cross a channel that feeds Middle Salt Lagoon. The channel crossing will be 700-feet long to accommodate a 100-year flood event and the roadway will widen to 42 feet with 4:1 side slopes with armor stone on both slopes to protect the road prism from erosion. A guardrail will be installed along the crossing with space left available for future utilities.

Construction of the project will occur in two one-year phases:

- Phase 1 – Construction of the Laura Madison extension.

- Phase 2 – Construction of Uivaqsaagiaq Road.
  - place gravel for road embankment
  - installation of 3 multi-plate pipe arches at the channel crossing
  - excavation for drainage structures

The NSB expects Phase 1 to be implemented 2012 – 2013 and Phase 2 to be implemented 2013 – 2014, excluding eider nesting windows. However, the years in which construction would occur may change based on availability of funding.

Gravel will be placed directly onto the tundra during winter. All exposed slopes and fills that are susceptible to erosion will be permanently stabilized at the earliest practicable date. Gravel will be sourced from one of two existing, commercial material sites in Barrow, AK.

In-water work at the crossing at the inlet to Middle Salt Lagoon will also occur during winter while the tundra and lagoon are frozen. The existing channel bottom will be removed and filled with pipe bedding for the underlayment of the three multi-plate pipe arches. The pipe arches will be installed and gravel placed on top of them.

Maintenance will include summer grading activities that will produce noise and dust along the road corridor.

Conservation measures for Steller's and spectacled eiders

The following measures have been incorporated into the project action by the applicant to reduce potential adverse effects to listed eiders (FHWA 2011).

- The Uivaqsaagiaq Road alignment minimizes fragmentation of Steller's eider nesting habitat by staying close to the south shore of Middle Salt Lagoon.

- New road sections will have no pullouts or turnoffs, reducing the likelihood that vehicles would park along the road and the occupants would access the tundra on foot.

- Overhead power lines will be prohibited in future utilities projects along the new road. The BA (FHWA 2011) states "Although utilities are not a part of the project scope, they are anticipated to be constructed in the future. The Borough will put stipulations in the platting documents for the ROW (right of way) that prohibits overhead power lines along this corridor."

- All work except for final grading will take place in the winter. Final grading and placement of armor rock to stabilize side slopes will occur after eider broods have fledged in the late summer–fall. Therefore, construction will not disturb nesting eiders or young broods.

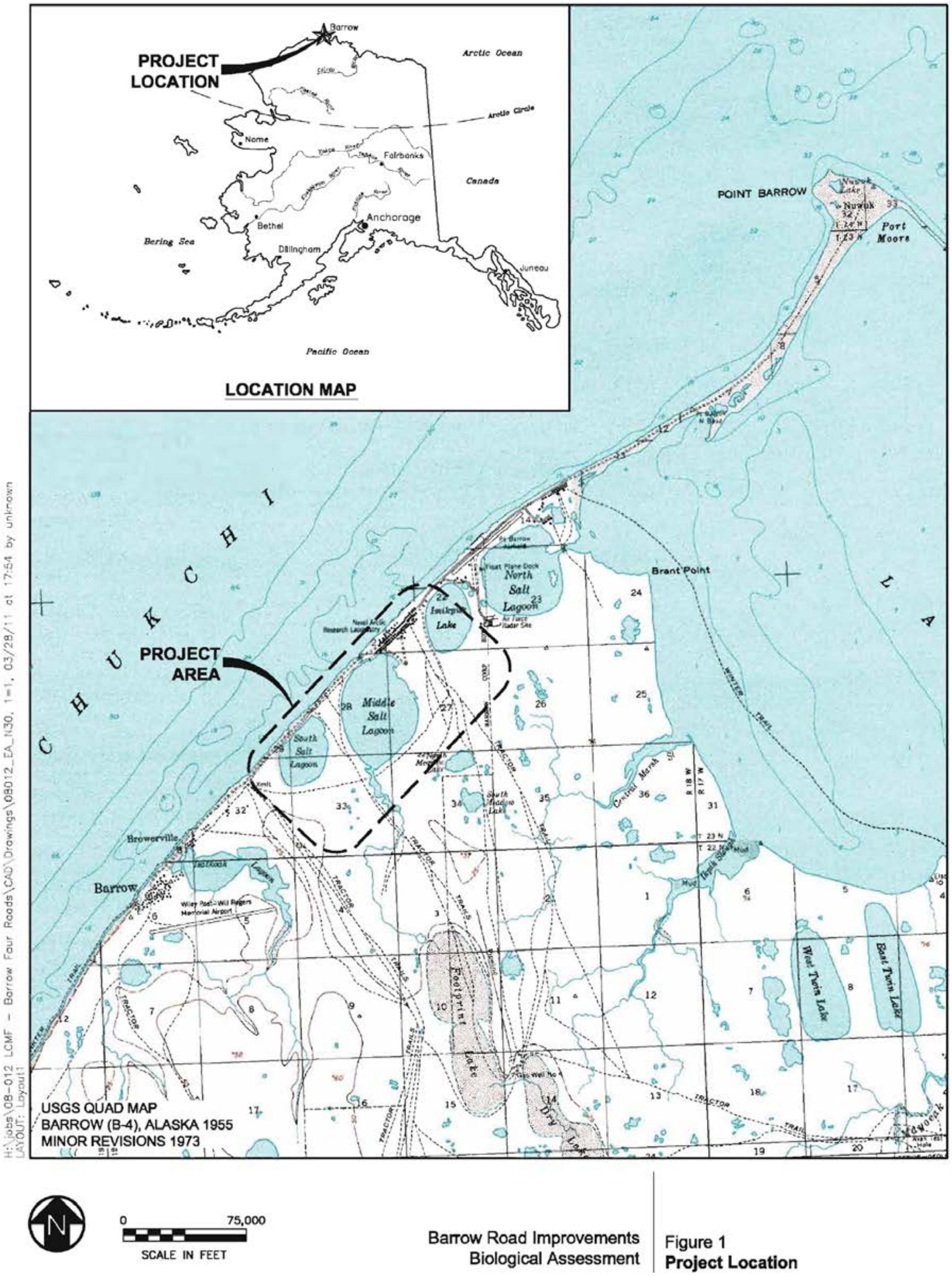

Figure 2.1. Project area in Barrow, AK. (Source: FHWA 2011)

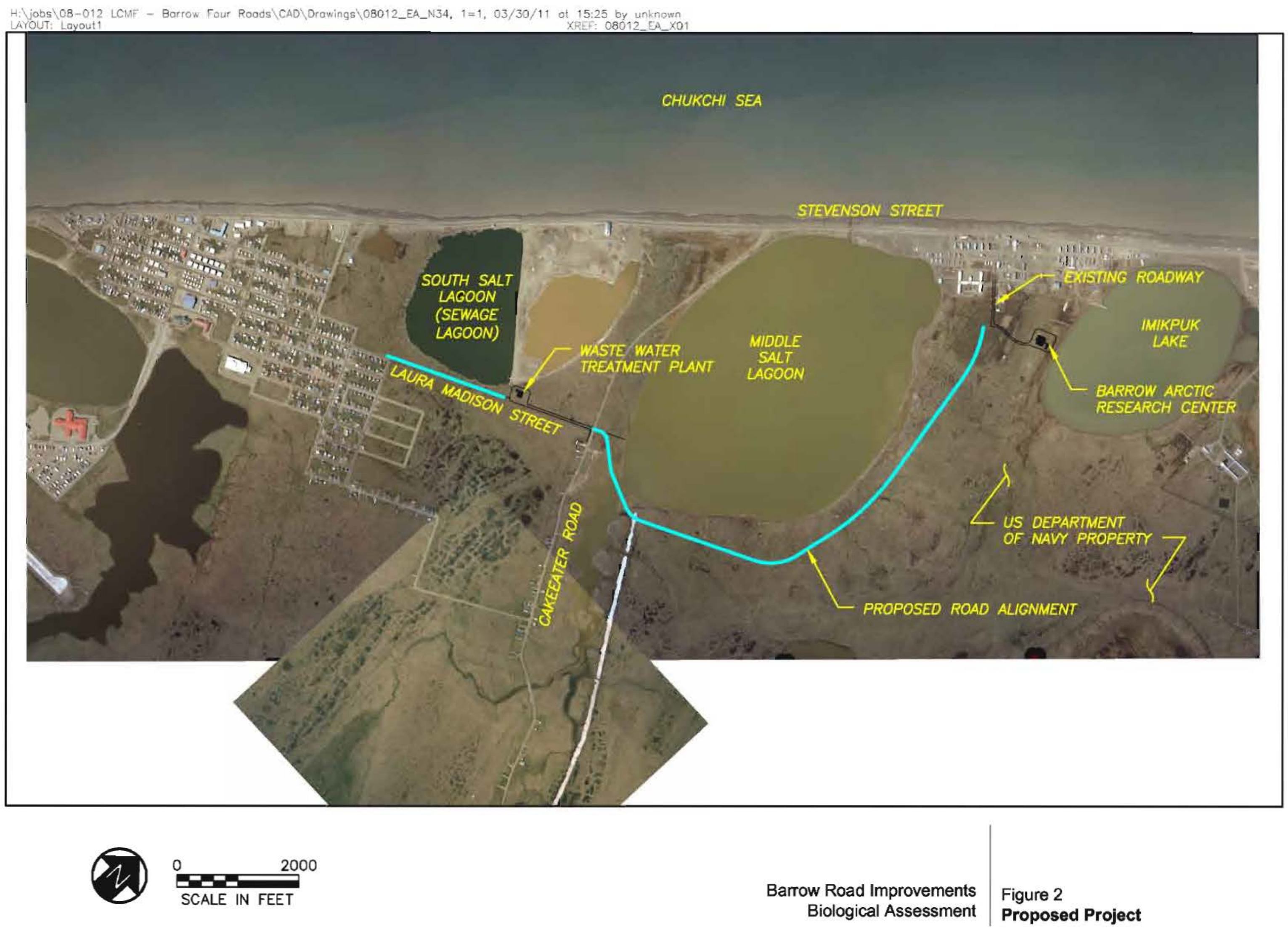

Figure 2.2. Locations of Barrow Road Improvements (light blue lines) comprising the extension of Laura Madison Street and construction of Uivaqsaagiaq Road (labeled as proposed road alignment). (Source: FHWA 2011)

3. EFFECT DETERMINATION FOR POLAR BEARS

Polar bears are widely distributed throughout the Arctic where the sea is ice-covered for large portions of the year. Sea ice provides a platform for hunting, feeding, breeding, denning, resting, and long-distance movement. Polar bears primarily hunt ringed seals, which also depend on sea ice for their survival, but they also consume other marine mammals (USFWS 2008). Female polar bears excavate maternal dens in snow drifts in areas with suitable topographic relief in terrestrial habitats as well as on pack ice. In Alaska, non-denning polar bears usually occur on sea ice, but may occupy onshore habitats during the open-water period in late summer and early fall (reviewed in Schliebe et al. 2008).

Effects to denning polar bears

Based on historical den observations (Durner et al. 2010), polar bears probably den at very low densities in coastal terrestrial denning habitat in the general vicinity of Barrow. The closest den locations were at Point Barrow, approximately 7 miles (11 km) northeast of the Action Area, where two dens were observed in 1994. We anticipate parturient females would be extremely unlikely to enter the Action Area or attempt to den there because they are sensitive to disturbances such as the ongoing human activities in the adjacent community.

Effects to non-denning polar bears

Although polar bears are not known to regularly use the Action Area, they travel though the surrounding tundra and sometimes enter developed areas in the vicinity of Barrow. Non-denning polar bears may be more likely to occur onshore near Barrow in summer and early fall when they forage on whale carcasses placed at Point Barrow (Schliebe et al. 2008). We expect most transient bears would move quickly through the area to a less disturbed location with minimal disruption of their normal behavior patterns; however, potential encounters with polar bears in the project area could result in harassment, injury, or killing of bears and pose a risk to human safety.

According to the Service's Polar Bear Interaction Guidelines, the methods for minimizing human-bear conflicts involve avoiding detection and close encounters; minimizing attractants; and recognizing and responding appropriately to polar bear behaviors. These elements are addressed in the Barrow Roads Improvement Project's polar bear–human interaction plan (Appendix C of the BA), which will be followed during project implementation. Minimization measures include polar bear awareness training for all personnel working on the project; the use of trained bear guards on site during all construction activities; and measures to avoid attracting bears. We expect these measures to reduce potential adverse effects to polar bears associated with negative polar bear–human interactions by managing food and other wastes that may attract bears to the project site and supporting early detection and appropriate responses by field personnel if polar bears do enter the area.

Conclusion

The Service has determined effects to denning polar bears would be discountable because they are very unlikely to occur in the Action Area and effects to non-denning bears would be insignificant because transient polar bears are likely to experience only minor and short-lived effects associated with disturbance from proposed activities and minimization measures are in place to reduce further potential adverse effects should a polar bear approach the work site. Accordingly, we conclude the Proposed Action is not likely to adversely affect polar bears.

4. STATUS OF THE SPECIES

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.

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 lb). Males are in breeding plumage (Figure 4.1) 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 4.1. 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 (YKD) 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 southcentral Alaska (Figure 4.2). 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 historical 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 (USFWS 2001). No critical habitat for Steller's eiders has been designated on the ACP.

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 4.3) 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-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. 2004). 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).

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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.

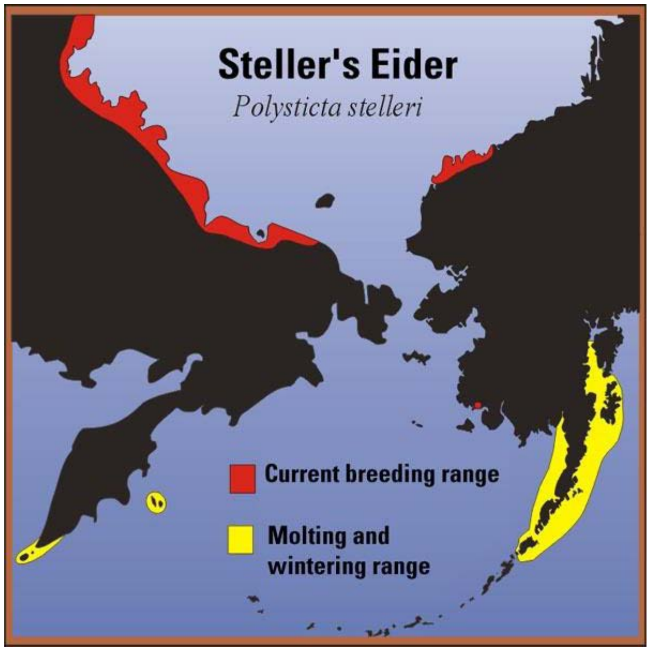

Figure 4.2. Steller's eider distribution in the
Bering, Beaufort, and Chukchi seas.

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).

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.

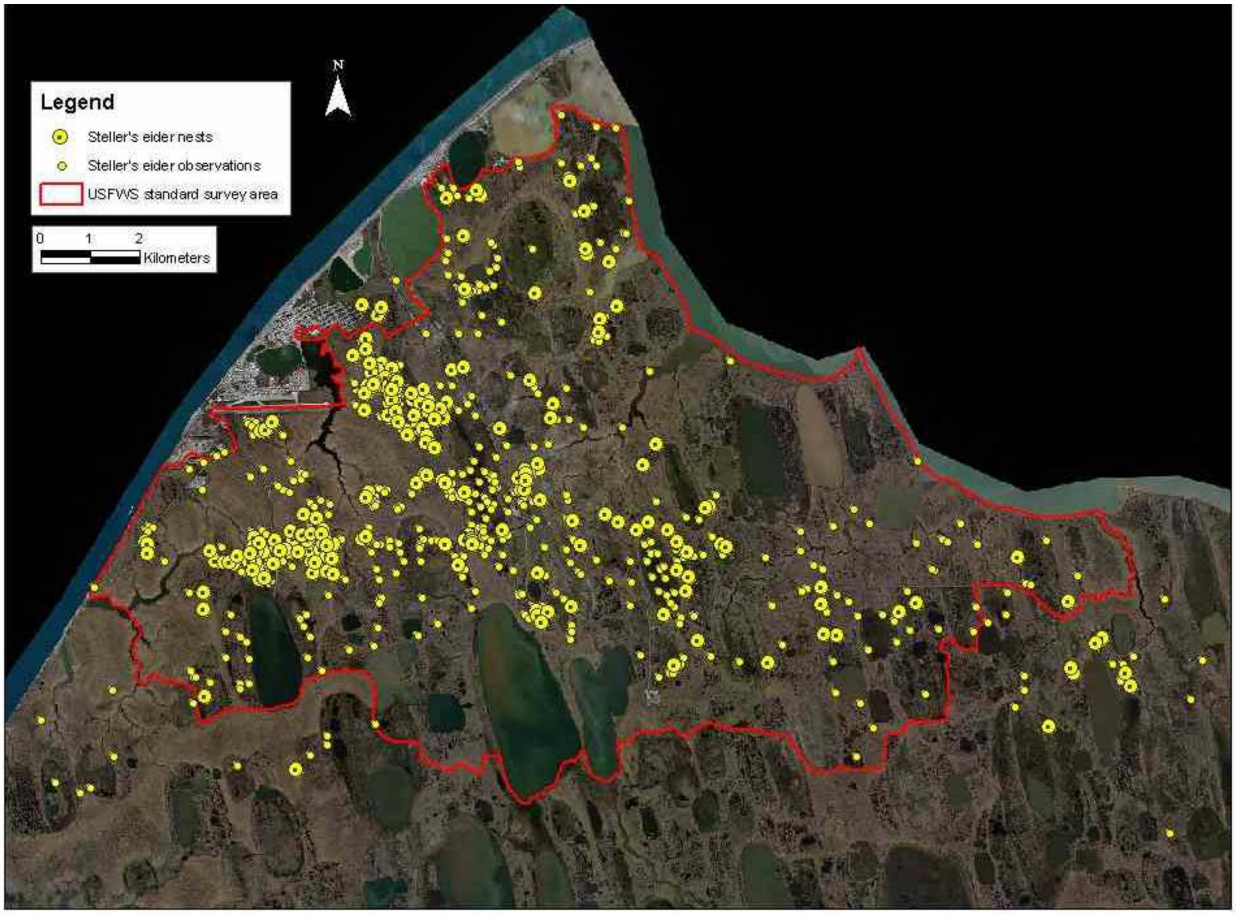

Figure 4.3. Steller's eider nest locations (1991–2010) and breeding pair observations (1999–2010). The standard survey area is surveyed annually. The survey area is expanded beyond the standard area in some years.

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 4.4). 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 4.5). There is both a spatial and temporal overlap between Steller's eiders and subsistence hunters during the post-fledging period.

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 mollusks 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).

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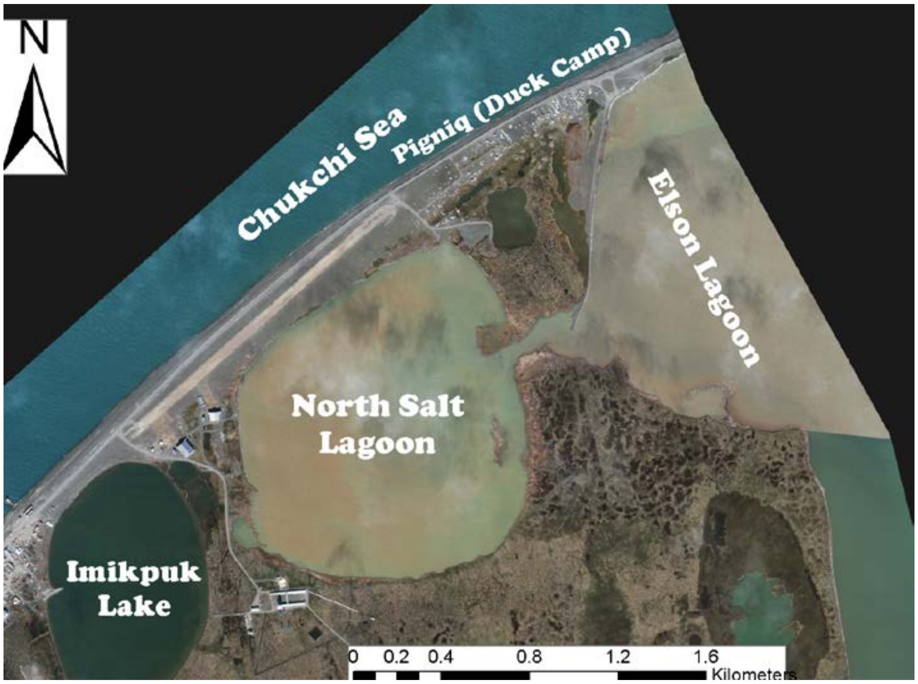

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Figure 4.4. (A) Location of Steller's eider post-breeding staging areas in relation to Pigniq (Duck Camp) hunting area north of Barrow, Alaska. (B) VHF marked Steller's eider hen with brood of fledglings resting in Elson Lagoon in close proximity to Duck Camp. Photo by N. Docken, USFWS.

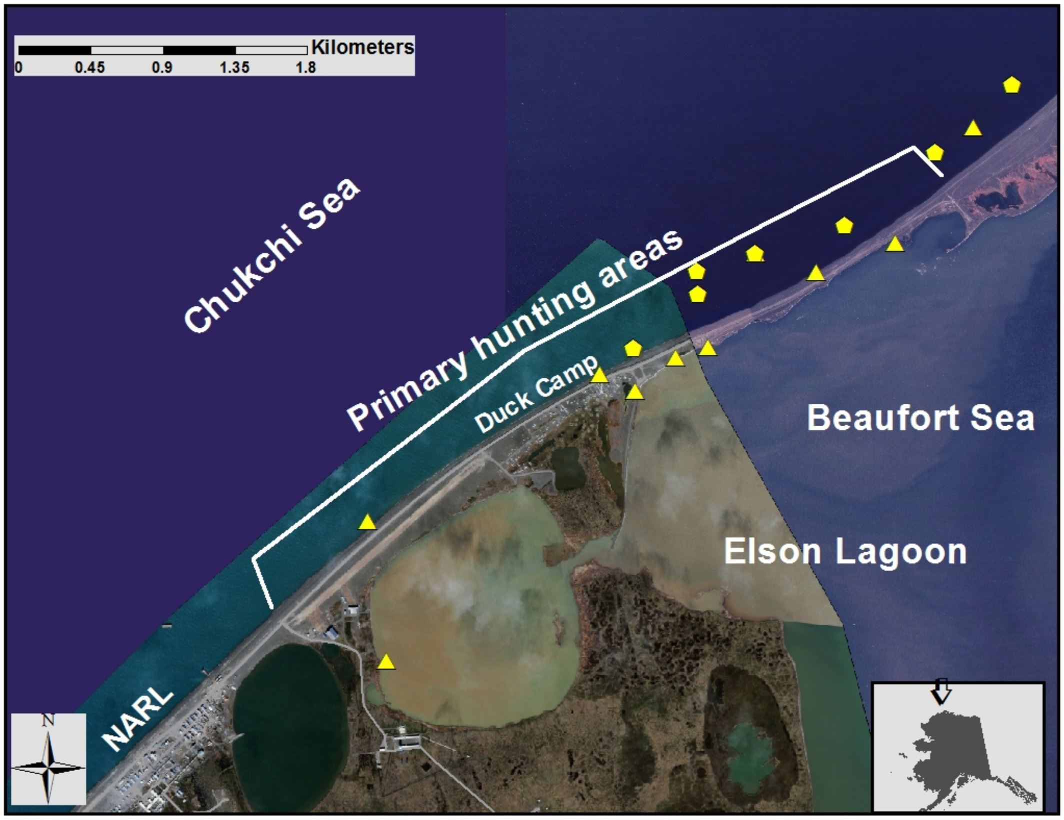

Figure 4.5. Marine locations of successful (triangles) and failed (pentagons) adult Steller's eiders (and juveniles) in the immediate vicinity of areas commonly used for subsistence hunting near Barrow, Alaska from mid-August to early September 2011.

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 4.6; Larned 2000a, 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 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 4.6; Larned 2007, Martin et al. *in prep*). Larned (1998) concluded that Steller's eiders show strong site

[3] See further discussion under Population Dynamics subsection.

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 4.6) 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 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).

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.

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[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).

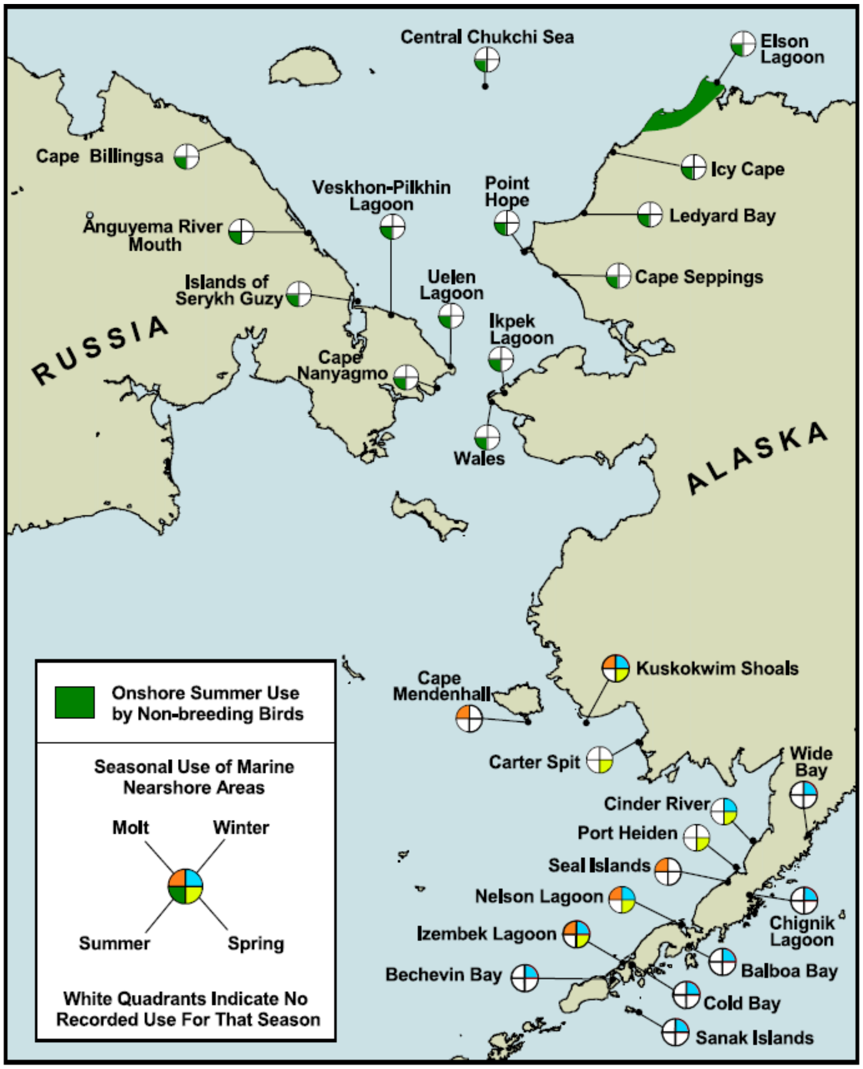

Figure 4.6. Distribution of Alaska-breeding Steller's eiders during the non-breeding season, based on the location of 13 birds implanted with satellite transmitters in Barrow, Alaska, June 2000 and June 2001. Marked locations include all those at which a bird remained for at least three days. Onshore 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*).

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.; Obrishkewitsch 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 4.1. Most observations of Steller's eider from both surveys occurred within the boundaries of the NSE survey (Figure 4.7).

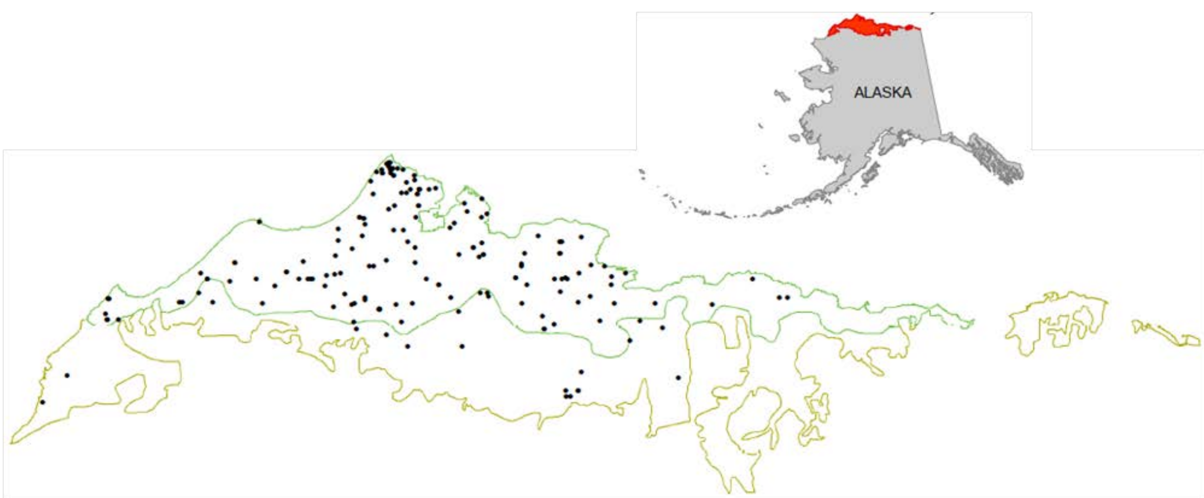

Figure 4.7. All sightings from the Arctic Coastal Plain (ACP) survey (1989–2008) and the North Slope eider (NSE) survey (1992–2006). The ACP survey encompasses the entire area shown (61,645 km^2); the NSE includes only the northern portion outlined in green (30,465 km^2). (Modified from Stehn and Platte 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 community on the ACP. Standardized ground surveys for eiders near Barrow have been conducted since 1999 (Rojek 2008; standard survey area shown in Figure 4.3). 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 and in 2008 with 114 males (Table 4.1; Safine 2011). 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 4.8). 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.

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

Table 4.1. 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
2011	180	69	0.38	59	0.44	10	0.01	27

[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).

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 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 Arctic Coastal Plain (ACP; Figure 4.7), 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 YKD; only 10 Steller's eider nests have been recorded on the YKD since 1970 (Hollmen et al. 2007).

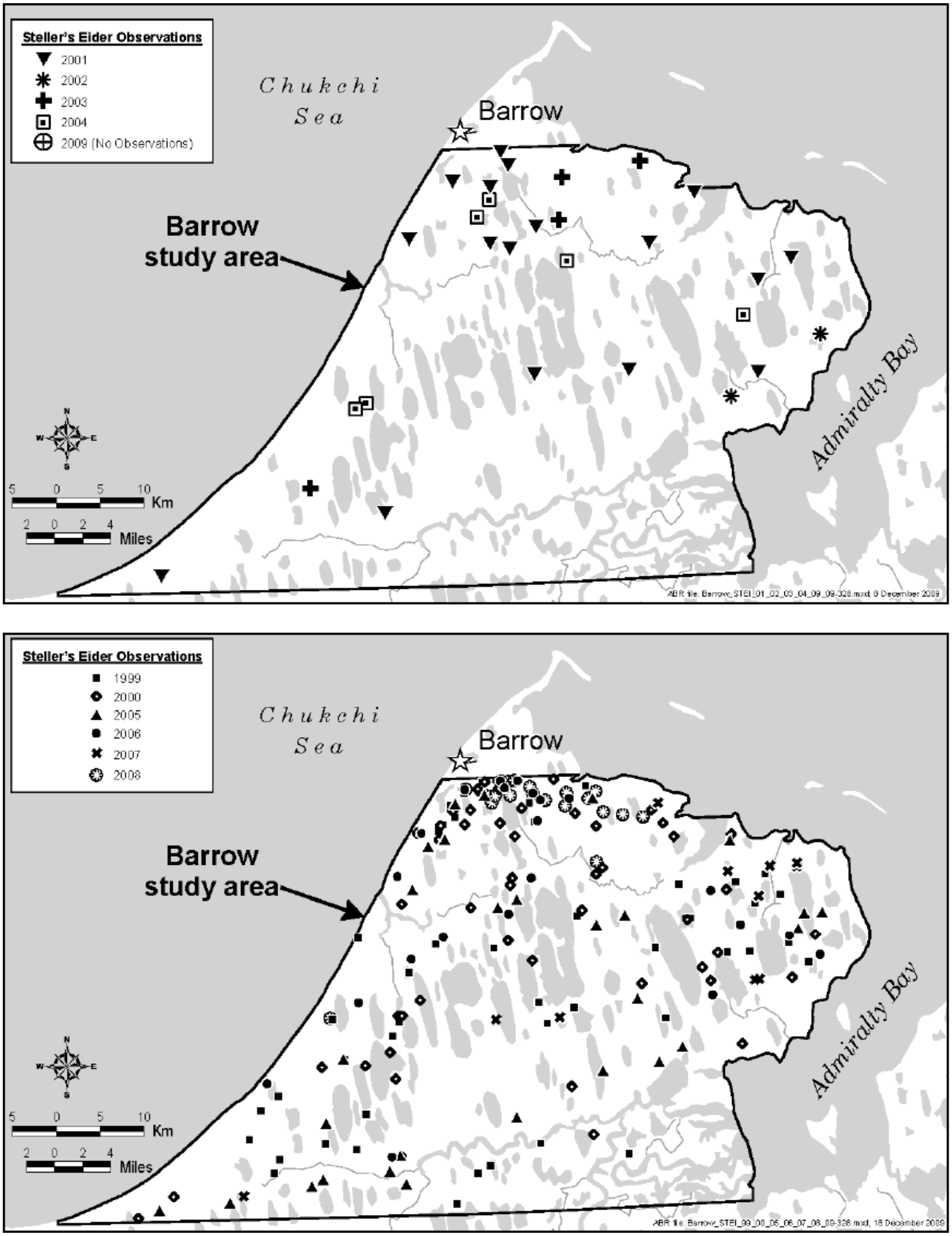

Figure 4.8. Locations of Steller's Eiders Located by ABR, Inc. during the Barrow Triangle aerial surveys in non-nesting years (top) and nesting years (bottom) near Barrow, Alaska, June 1999–2009 (Obritschkewitsch and Ritchie 2011). Obritschkewitsch and Ritchie (2011) reported 5 Steller's eiders from 3 locations in the study area during 2010 (not shown)

Recovery

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 ESA 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 YKD, 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.

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 4.9A) 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 (YKD), and northern Russia. The YKD 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 4.9B) 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 4.9B), 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 YKD. 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 4.10). Although spectacled eiders historically occurred throughout the coastal zone of the YKD, 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 YKD 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). Spectacled eider clutch size near Barrow has averaged 3.2–4.1, with clutches of up to eight eggs reported (Safine 2011, USFWS unpublished data). 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).

Nest initiation on Kigigak Island on the YKD occurs from mid-May to mid-June (Lake 2007). Incubation lasts approximately 24 days (Dau 1974). Mean spectacled eider clutch size is higher on the YKD compared to the ACP. Mean annual clutch size ranged from 3.8–5.4 in coastal areas of the YKD (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.

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). Apparent nest success in 1991 and 1993–1995 in the Kuparuk and Prudhoe Bay oil fields on the ACP was also low, varying from 25–40% (Warnock and Troy 1992, Anderson et al. 1998). On Kigigak Island in the YKD, 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 YKD, 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 YKD, but considerably lower in the coastal region of the YKD. 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 1974). In contrast, 24% of all nests monitored in a coastal region of the YKD 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 YKD 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 YKD 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 YKD, 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).

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 (YKD) 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 follow coast lines but also migrate straight across the northern Bering and Chukchi seas in route to northern Russia (Matt Sexson, USGS, pers. comm.).

(A)

(B)

Figure 4.9. (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.

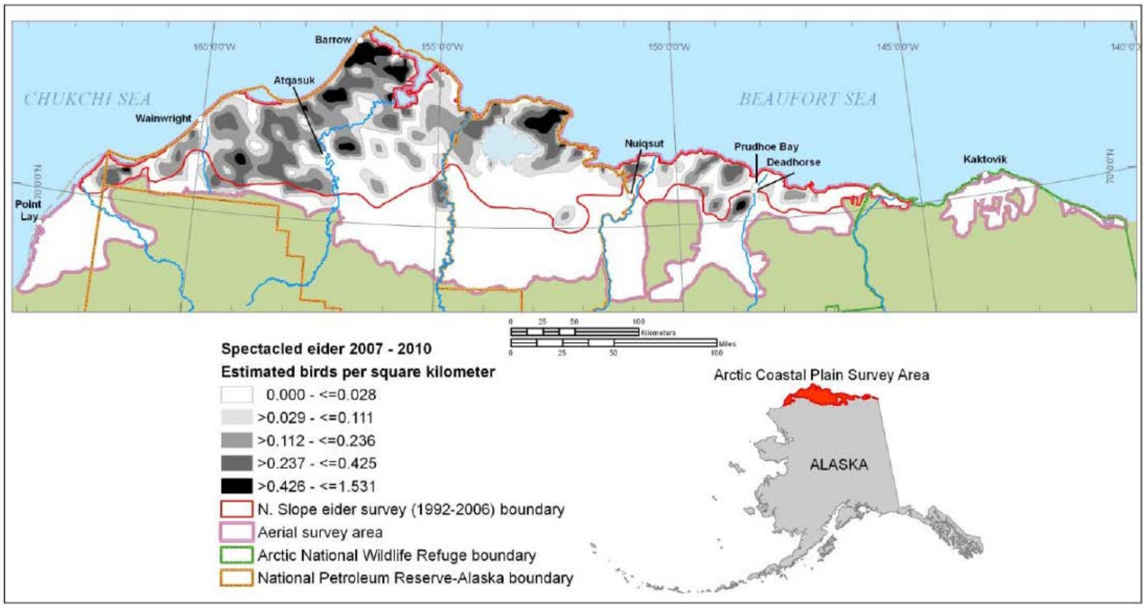

Figure 4.10. Density distribution of spectacled eiders observed on aerial transects sampling 57,336 km^2 of wetland tundra on the North Slope of Alaska during early to mid-June, 2007–2010 (Larned et al. 2011).

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 4.2). Females generally used molting areas nearest their breeding grounds. All marked females from the YKD molted in nearby Norton Sound, while females from the North Slope molted in Ledyard Bay, along the Russian coast, and near St. Lawrence Island. 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).

Table 4.2. Important staging and molting areas for female and male spectacled eiders from each breeding population

Population and Sex	Known Major Staging/Molting Areas
Arctic Russia Males	Northwest of Medvezhni (Bear) Island group
	Mechigmenskiy Bay
	Ledyard Bay
Arctic Russia Females	unknown
North Slope Males	Ledyard Bay
	Northwest of Medvezhni (Bear) Island group
	Mechigmenskiy Bay
North Slope Females	Ledyard Bay
	Mechigmenskiy Bay
	West of St. Lawrence Island
YKD Males	Mechigmenskiy Bay Northeastern Norton Sound
YKD Females	Northeastern Norton Sound

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 4.9B). 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).

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, University of Wyoming, 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 4.11; USGS, unpublished data) suggest that spectacled eiders also use the lead system during spring migration.

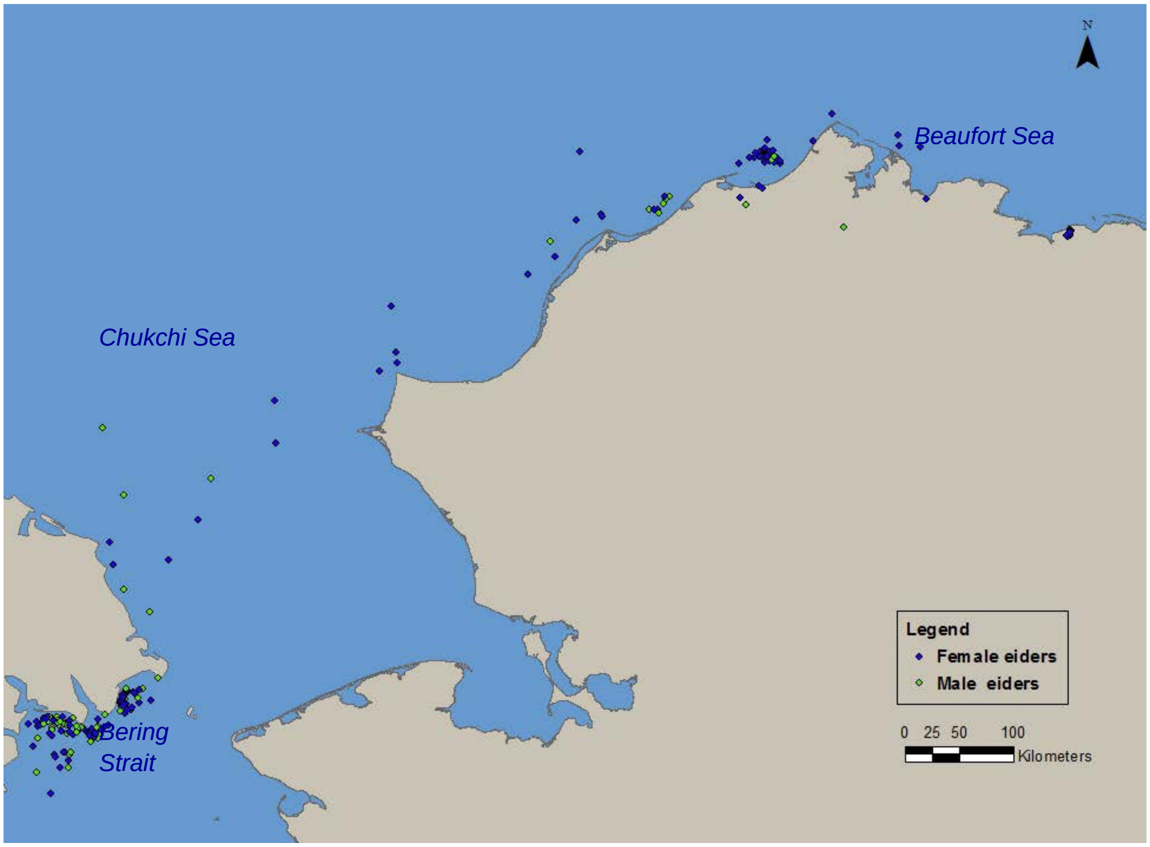

Figure 4.11. Spectacled eider satellite telemetry locations for 12 female and 7 male spectacled eiders in the eastern Chukchi Sea from 1 April – 15 June 2010 and 1 April – 15 June 2011. Additional locations from the northern coast of Russia are not shown. Eiders were tagged on the North Slope during the 2009 and 2010 breeding seasons. Data provided by Matt Sexson, USGS Alaska Science Center (USGS, unpublished).

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).

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 YKD. 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 YKD spectacled eider population was thought to be about 4% of historical levels in 1992 (Stehn et al. 1993). Evidence of the dramatic decline in spectacled eider nesting on the YKD 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 YKD 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 YKD 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 YKD in 2011 and evaluate long-term trends in the YKD 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 YKD, 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 YKD 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 YKD spectacled eider breeding population to be 12,601 (95% CI[8] = 10,173–15,028) in 2010.

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 ESA 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. 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.

5. ENVIRONMENTAL BASELINE

The environmental baseline, as described in section 7 regulations (50 CFR §402.02) includes the past and present impacts of all Federal, State, or private actions and other human activities in the Action Area, the anticipated impacts of all proposed Federal projects in the Action Area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The environmental baseline provides the context within which the effects of the Action will be analyzed and evaluated.

Status of Listed Eiders in the Action Area

Breeding Steller's eiders concentrate in tundra wetlands surrounding Barrow (Figure 4.1), and occur at very low densities elsewhere on the ACP (Larned et al. 2010). Although spectacled eiders breed at variable densities across much of the ACP (Figure 4.2), they also regularly breed near Barrow. Both species arrive in the action area in late May to early June and may remain as late as mid-October. The channel at the south end of Middle Salt Lagoon is one of the first open water areas available to eiders arriving in the area in early June and an important staging area until additional freshwater habitats are open. Several observations of Steller's eider breeding pairs and nests have occurred within the Action Area, and multiple observations of spectacled eider breeding pairs in wetland complexes south of the Action Area suggest they may also nest in

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

Action Area (Figure 5.1). Broods of both species may forage in the Action Area in late summer and early fall.

Factors that may have contributed to the current status of Steller's and spectacled 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.

Environmental contaminants

The deposition of lead shot in tundra or nearshore habitats used for foraging is considered a threat to spectacled 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 (Matz, USFWS, unpublished data). Use of lead shot for hunting waterfowl is prohibited statewide, and for hunting all birds on the North Slope, and the Service reports good compliance in most areas with the lead shot prohibitions.

Other contaminants, including petroleum hydrocarbons from local sources and globally distributed heavy metals, may also affect spectacled eiders. For example, Trust et al. (2000) reported high concentrations of metals and subtle biochemical changes in spectacled eiders wintering near St. Lawrence Island. Spectacled eiders breeding and staging on the Colville River Delta area may have experienced varying levels of exposure to petroleum hydrocarbons, heavy metals, and other contaminants; however, it is difficult to assess the impacts of this exposure to eiders.

Increases in Predator Populations

There is some evidence that predator and scavenger populations may be increasing on the North Slope near sites of human habitation, such as villages and industrial infrastructure (Eberhardt et al. 1983, Day 1998, Powell and Bakensto 2009). Researchers have proposed that reduced fox trapping, anthropogenic food sources in villages and oil fields, and nesting/denning sites on human-built structures have resulted in increased fox, gull, and raven numbers (R. Suydam and D. Troy pers. comm., Day 1998). These anthropogenic influences on predator populations and predation rates may have affected eider populations, but this has not been substantiated. However, increasing predator populations are a concern, and Steller's eider studies at Barrow attributed poor breeding success to high predation rates (Obritschkewitsch et al. 2001), and in years where arctic fox removal was conducted at Barrow prior to and during Steller's eider nesting, nest success appears to have increased significantly (Rojek 2008, Safine 2011).

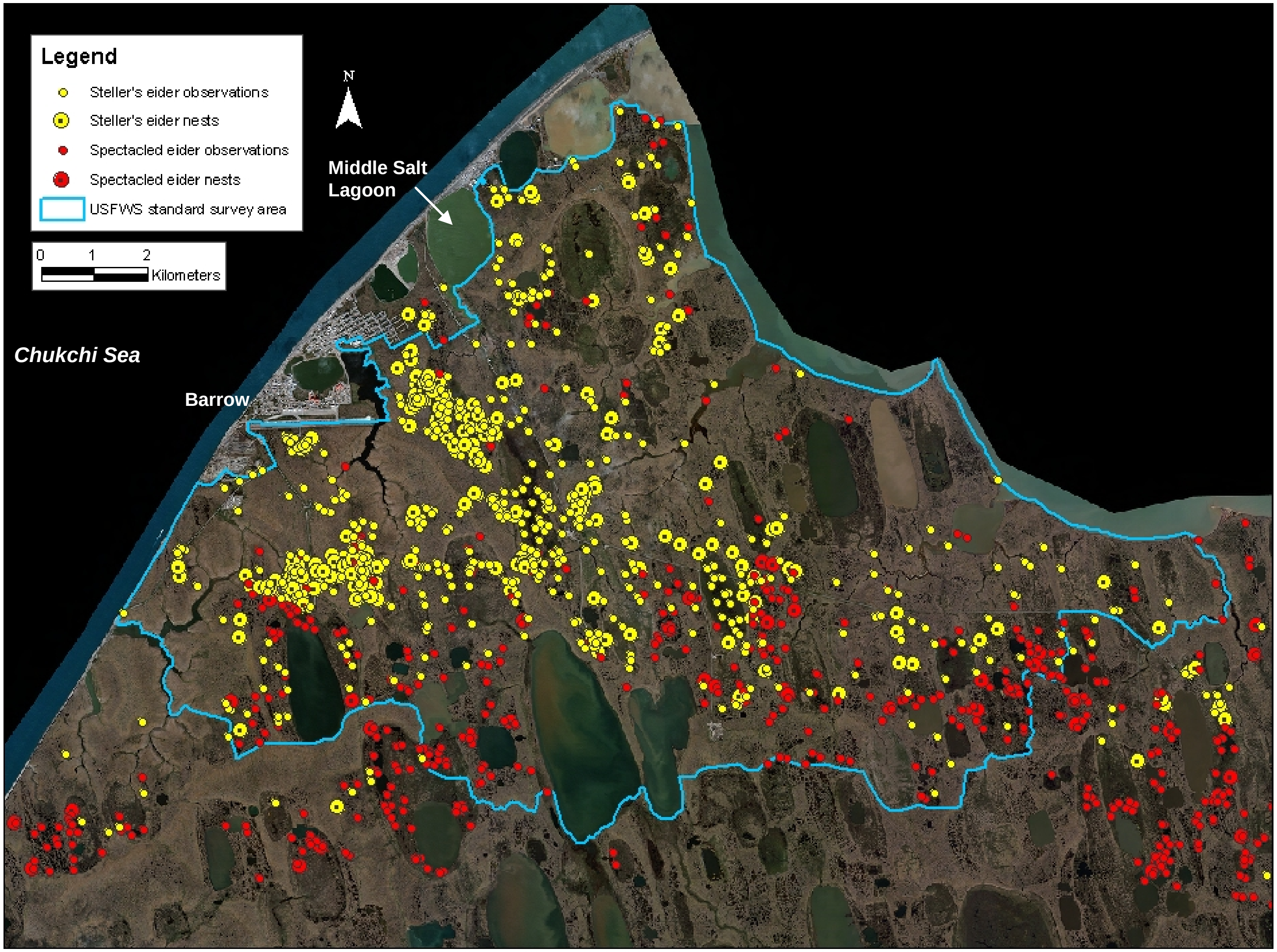

Figure 5.1. Observations of Steller's eiders and spectacled eiders during USFWS breeding pair and nest foot surveys at Barrow, AK (1999–2010; Steller's eider nest locations 1991–2010).

Subsistence Harvest

Prior to the listing of Steller's and spectacled eiders under the ESA, some level of subsistence harvest of these species occurred across the North Slope (Braund et al. 1993). Hunting for spectacled and Steller's eiders was closed in 1991 by Alaska State regulations and Service policy, and outreach efforts have been conducted by the North Slope Borough, BLM, and Service to encourage compliance. Recent harvest data indicate that listed eiders continue to be taken during subsistence hunting on the North Slope. Although estimates of the number taken are imprecise, the Service is concerned about the scale of impacts, particularly for Steller's eiders. Continued efforts to eliminate harvest are being implemented in North Slope villages, and particularly at Barrow, where the greatest known concentrations of listed Steller's eiders occur. Intra-service consultations for the Migratory Bird Subsistence Hunting Regulations are conducted annually and harvest of all species, included listed eiders, is being monitored.

Habitat Loss from 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.

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 (14.6 km^2) 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.

Research

Scientific, field-based research has also increased on the ACP in response to interest in climate change and its effects on Arctic ecosystems. 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.

Federal Actions

Activities in the vicinity of Barrow, AK that have required formal section 7 consultation under the ESA are summarized in Table 5.1. We believe these estimates have likely 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 30–50 years). Also, it remains unknown to what degree spectacled and Steller's eiders 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 levels of actual take

Table 5.1. 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 Inlet (2010)	Disturbance	35 spectacled eider eggs/ducklings
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 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.

6. EFFECTS OF THE ACTION ON LISTED EIDERS

This section of the BO provides an analysis of the effects of the action on listed species and, where appropriate, critical habitat. Both direct effects (effects immediately attributable to the action) and indirect effects (effects that are caused by or will result from the Proposed Action and are later in time, but are still reasonably certain to occur) are considered. Interrelated and interdependent effects of the action are also discussed.

Our analyses of the effects of the Proposed Action on species listed under the ESA 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.

Adverse effects to Steller's and spectacled eiders could occur through disturbance from construction activities and road operations, increased access to the tundra, and long-term habitat loss. Each of these factors is evaluated below.

Disturbance from Construction
We do not anticipate adverse effects from construction activities because construction has been scheduled outside of the period when eiders generally occupy the tundra surrounding Barrow (early June – late August).

Disturbance from Road Operations
Disturbance can adversely affect Steller's and spectacled eiders by causing significant disruptions in behavior that may reduce reproductive success or individual fitness. Road operations and associated activities could potentially disturb eiders to the extent that breeding pairs are displaced from the area or hens are flushed from established nests. Flushing events may result in damage to eggs by the departing hens, increased vulnerability of unattended eggs or young ducklings to predation, and risk of eggs or ducklings dying from exposure if nests remain unattended for extended periods or are abandoned. Adult non-breeding eiders and older broods would be less vulnerable to adverse effects from disturbance because they can easily move to a perceived safe distance from disturbances.

The behavioral response of listed eiders to nesting disturbance is not well-studied. Some Steller's eiders have nested and reared broods near the Barrow Airport and spectacled eiders have been observed nesting near the Deadhorse Airport (Service unpublished data). Approximately 28% of Steller's eider nest observed near Barrow in 1993, 1995, and 1996 were located within 800 m of a road; however, only one (3.1%) of these 32 nests was successful compared to 16.4% of total nests (Quakenbush 2000). Steller's eiders are known to nest successfully close to ATV trails near Barrow (Quakenbush 2000, USFWS unpublished data). These data suggest that some individuals may tolerate or habituate to regular disturbances.

However, individual tolerances are likely to vary and we anticipate some negative impacts on reproductive success resulting from the ongoing operation of the new roads. These impacts are considered further in terms of loss of eider production resulting from indirect habitat loss below.

Increased Tundra Access

The Uivaqsaagiaq Road may facilitate foot and ATV access to the tundra by residents and tourists for hunting and other activities. However, the new road has been designed without pullouts, which will discourage the use of Uivaqsaagiaq Road to access the tundra. Thus, we do not expect the project to increase the risk of disturbance or hunting mortality.

Long-term Habitat Loss

Based upon the description of the Proposed Action, the Service concludes potential effects to Steller's and spectacled eiders will occur primarily through direct and indirect loss of breeding habitat. *Direct habitat loss* will result from placement of gravel within the footprint of the new road, rendering the habitat unavailable to listed eiders for pre-nesting, nesting, brood rearing, and pre-migratory staging. *Indirect habitat loss* occurs within a zone of influence surrounding human infrastructure where the reproductive success of eiders occupying otherwise suitable habitat may be compromised by disturbance.

Extent of habitat loss

Direct loss of habitat would occur by placement of gravel onto 0.087 km^2 (21.6 acres) of tundra and estuarine wetlands. Thus, 0.087 km^2 of nesting habitat would be rendered permanently unavailable to eiders.

We expect indirect habitat loss will occur within a 200-m zone of influence on either side of the road through disturbance to listed eiders from future road traffic and maintenance operations. The area within the zone of influence, and excluding the gravel footprint of the road sections, is 1.31 km^2 (324.5 acres), including 0.16 km^2 (40.5 acres) along the Laura Madison Street Extension and 1.15 km^2 (284.0 acres) along Uivaqsaagiaq Road.

Thus, combined direct and indirect habitat loss encompasses 1.40 km^2 (345.9 acres) of wetlands.

Loss of production in eiders

It is difficult to predict the number of Steller's eiders and spectacled eiders that may nest within the general area of the new roads each year. Both species have a patchy distribution within the USFWS eider ecology standard survey area that changes among years. Additionally, Steller's eiders show considerable interannual variation in nesting effort near Barrow. For the purpose of quantifying the effects of habitat loss on Steller's and spectacled eiders, we assume these effects result in the loss of production of an estimated number of eggs or ducklings. To estimate loss of production, we first estimate the number of potentially affected eider nests by multiplying the mean density of breeding pairs of each species by the area affected by direct and indirect habitat loss (the Action Area). We then multiply the estimated number of nests in the Action Area by mean clutch size to estimate the potential number of eggs or ducklings lost for each species.

For the purpose of calculating loss of eider production, we assume long-term habitat loss will occur over 50 years.

Steller's eiders
We estimated the potential number of Steller's eider nests lost by multiplying the average density of breeding pairs within the USFWS standard survey area (Figure 5.1) 1999–2010 (Safine 2011; 0.3142 breeding pairs/km^2) by the extent of the affected area (1.4 km^2). Thus, the mean number of nests affected by the project annually was estimated as:

0.3142 pairs/km^2 × 1 nest/pair × 1.4 km^2 = 0.44 nests.

Based on the potential number of Steller's eider nests lost annually, we estimated that 13 nests may be lost over an assumed 50-year project life (0.44 nests/year × 50 years = 22.0 nests).

We estimated the potential number of eggs or ducklings lost over the project life as the product of average clutch size[9] for Steller's eiders near Barrow and the number of affected nests, resulting in an estimated loss of production of 121 Steller's eider eggs or ducklings (22 × 5.5 = 121) over 50 years.

Spectacled eiders
Although spectacled eiders nest in the vicinity of Barrow, they appear to use the tundra surrounding the project at low densities. No spectacled eider nests have been detected north of latitude 71.26° in the Barrow area during eider ecology studies (USFWS, unpublished data); however, a few historical sightings of breeding pairs have occurred within the Action Area. Spectacled eider density polygons constructed from the 2007–2010 waterfowl breeding population survey of the Arctic Coastal Plain, Alaska (ACP survey; USFWS Migratory Bird Management, unpublished data) provide our best estimates of spectacled eider nesting in the project area. We used the highest estimated spectacled eider density within the Action Area (0.111 birds/km^2 or 0.056 breeding pairs/km^2) to be conservative.

We estimated the potential number of spectacled eider nests lost by multiplying the estimated number of breeding pairs (0.056 pairs/km^2) by the extent of the affected area (1.4 km^2). Thus, the mean number of nests affected by the project annually was estimated as:

0.056 pairs/km^2 × 1 nest/pair × 1.4 km^2 = 0.078 nests.

Based on the potential number of spectacled eider nests lost annually, we estimated that 4 nests may be lost over an assumed 50-year project life (0.078 nests/year × 50 years = 3.9 nests).

We estimated the potential number of eggs or ducklings lost over the project life as the product of average clutch size[10] for spectacled eiders near Barrow and the number of affected nests, resulting in an estimated loss of production of 16 spectacled eider eggs or ducklings (4 × 3.9 = 15.6).

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[9] Average clutch size estimated using mean annual clutch sizes for 10 nesting years from 1991–2007 (Quakenbush et al. 1995, Obritschkewitsch et al. 2001, Quakenbush et al. 2004, Rojek 2006, Rojek 2007, Rojek 2008).
[10] Average clutch size for spectacled eiders in northern Alaska is estimated as 3.9 based on results of Petersen et. al. 2000, Bart and Earnst 2005, and Johnson et al. 2008.

Interrelated and Interdependent Actions

Future utilities are likely to be installed along Uivaqsaagiaq Road following completion of the road, but are not included in the Barrow Roads Improvement Project. Overhead power lines pose a serious collision risk for listed eiders in the Barrow area. However, the North Slope has committed to prohibit overhead power lines in future utilities projects along the new road through restrictions in the platting documents. Therefore, we do not anticipate the project will result in increased risk of list eider mortalities from collisions with overhead transmission lines.

7. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the Action Area considered in this biological opinion. Future Federal actions that are unrelated to the Proposed Action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. When analyzing cumulative effects of a Proposed Action, it is important to define both the spatial (geographic), and temporal (time) boundaries. Within these boundaries, the types of actions that are reasonably foreseeable are considered.

Future development may occur in the area through developments like improved roads, transportation facilities, utilities or other infrastructure. However, the entire Action Area, and the undeveloped lands surrounding 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 construction project in the area.

8. CONCLUSION

Regulations (51 CFR 19958) that implement section 7(a)(2) of the ESA 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.”

In evaluating the impacts of the proposed project to listed eiders, the Service identified direct and indirect adverse effects that could result from habitat loss and disturbance. Using methods and logic explained in the *Effects of the Action* section, the Service estimates 121 Steller’s eider and 16 spectacled eider eggs/ducklings (22 Steller’s eider and 4 spectacled eider nests) may be lost resulting from long-term habitat loss over an assumed 50-year project life. However, we expect this loss of production will not have a significant effect at the population level because only a small proportion of eider eggs or ducklings would eventually survive to recruit into the breeding populations. For example, spectacled eider nest success recorded on the YKD ranged from 18-73% (Grand and Flint 1997). 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 that 0.9–6.6% of eggs/ducklings would be expected to survive and recruit into the breeding population. Thus, the loss of eggs or ducklings is of lower significance for survival and recovery of listed eiders than the death of an adult bird.

If we also apply these rates to the estimated loss of production for the Proposed Action for both listed eiders, we would expect the project to preclude 1.1–8.0 adult Steller's eiders and 0.1–1.1 adult spectacled eiders from entering the breeding populations over an assumed 50-year project life.

Given the potential loss of eider recruitment is small and this loss would be distributed over ~50 years, we believe the population-level effects of loss of production from the Proposed Action will not significantly affect the likelihood of survival and recovery of Alaska-breeding Steller's eiders or spectacled eiders. Accordingly, it is the Services' biological opinion that the Proposed Action is not likely to jeopardize the continued existence of Alaska-breeding Steller's eiders or spectacled eiders.

This BO's determination of non-jeopardy is based on the assumption that the USACE and their agents will consult with the Service on any future activities related to the Barrow Roads Improvement Project that are not evaluated in this document.

In addition to listed eiders and polar bears, the area affected by 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 project 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. The Federal action agencies should not authorize any activity that may affect such species or critical habitat until it completes its obligations under applicable requirements of the ESA as amended (16 U.S.C. 1531 et seq.), including completion of any required procedure for conference or consultation.

9. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA 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 that 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 (ITS).

Adverse effects to listed eiders have been substantially reduced through implementation of conservation measures (see section 2) by the applicant. However, the Service still anticipates some adverse effects to Steller's and spectacled eiders. As described in Section 5, *Effects of the Action*, the activities described and assessed in this BO may adversely affect listed eiders through direct and indirect long-term habitat loss. Long-term habitat loss would occur directly from placement of gravel fill and indirectly through disturbance associated with road operations and maintenance. Methods used to estimate loss of eider production resulting from long-term habitat loss are described in the *Effects of the Action* section. Based on these estimates of loss of production, the Service anticipates that *121 Steller's eider eggs or ducklings* and *16 spectacled eider eggs or ducklings* are likely to be taken over a 50-year period as a result of the Proposed Action through long-term direct and indirect habitat loss (harm).

While the incidental take statement provided in this consultation 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.

The measures described below are non-discretionary, and must be undertaken/required by USACE 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. USACE has a continuing duty to regulate the activity covered by this Incidental Take Statement (ITS). If USACE (1) fail to assume and implement the terms and conditions or (2) fail 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.

10. REASONABLE AND PRUDENT MEASURES

These reasonable and prudent measures (RPMs) and their implementing terms and conditions (T&Cs) aim to minimize the incidental take anticipated from activities described in this BO.

1. Reduce loss of nests and eggs by project timing that initiates construction activities and fills wetland prior to normal or expected eider arrival dates (1 June);

11. TERMS AND CONDITIONS

To be exempt from the prohibitions of Section 9 of the ESA, the USACE and FHWA must comply with the following terms and conditions, which implement the RPMs described above. These terms and conditions are non-discretionary.

1a. The first lift of fill shall be placed in the non-nesting season, 11 August – 31 May, such that the natural vegetation and landforms are covered and rendered unsuitable for nesting birds.

1b. No construction activities shall occur on undisturbed tundra during the nesting season, 1 June – 10 August.

12. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to utilize their authorities to further the purposes of the ESA 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. We recommend the following action be implemented:

1. The proposed project would result in the loss of 21.6 acres of wetlands that provide important habitat for pre-nesting, nesting, brood-rearing, and post-breeding Steller's and spectacled eiders. The NSB has proposed to remove 1 mile of overhead power lines and poles in the vicinity of the project, which pose a significant collision risk to listed eiders and other waterbirds that nest in the tundra wetlands surrounding Barrow. The Service recommends that USACE and FHWA consider the proposed removal of power lines for a portion of the required compensatory mitigation for unavoidable impacts to wetlands because the power lines pose a significant collision hazard to Steller's and spectacled eiders that breed on tundra wetlands in the vicinity of Barrow. We also recommend the NSB coordinate with the Service to determine which power lines, if removed, would result in the greatest conservation benefit to listed eiders.

13. REINITIATION NOTICE

This concludes formal consultation for the Barrow Roads Improvement Project. As provided in 50 CFR 402.16, re-initiation 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 species or critical habitat not considered in this opinion; or
4. A new species is listed or critical habitat is designated that may be affected by the action.

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