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
April 6, 2011

Memorandum

To: Robert W. Jobson, Project Manager, U.S. Army Corps of Engineers, Alaska District

From: Ted Swem, Endangered Species Branch Chief Ted Swem

Subject: Formal Consultation for the Barrow Gas Fields Well Drilling Program Section 7 Consultation

This document 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 (Act), on the effects of the North Slope Borough's (NSB) proposal to drill new gas production wells and related gas field activities in the vicinity of Barrow during 2011 and 2012. The BO evaluates effects of these actions on Steller's eider (*Polysticta stelleri*), spectacled eider (*Somateria fischeri*), polar bears (*Ursus maritimus*), and designated polar bear critical habitat

After reviewing the information provided, the status of the species, the environmental baseline, and cumulative effects, the Service concludes the proposed activities will not jeopardize the continued existence of any listed species and is not likely to destroy or adversely modify designated critical habitat. However, the Service expects the proposed action will adversely affect listed eiders and has issued an Incidental Take Statement for this non-jeopardy BO as well as Reasonable and Prudent Measures, and Terms and Conditions that are mandatory for the USACE to implement.

A complete administrative record of this consultation is on file at the Fairbanks Fish and Wildlife Field Office, 101 12th Ave., Room 110, Fairbanks, Alaska 99701. We look forward to working collaboratively with your staff in implementing the terms and conditions of the BO. If you have any comments or concerns regarding this BO, please contact Denise Walther, Endangered Species Branch, at (907) 456-0277.

BIOLOGICAL OPINION

for

THE BARROW GAS FIELDS WELL DRILLING PROGRAM

Consultation with the
U.S. Army Corps of Engineers
Anchorage, Alaska

Prepared by:
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101 12th Ave, Room 110
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April 6, 2011

Table of Contents

List of Figures

List of Tables

1. INTRODUCTION

This document is the U.S. Fish and Wildlife Service's (Service) Biological Opinion (BO) on a proposal by the North Slope Borough (NSB) to drill new gas production wells and related gas field activities in the vicinity of Barrow during 2011 and 2012. The NSB has applied for coverage under U.S. Army Corps of Engineers (USACE) Nationwide Permits 12 and 35. This BO describes the effects of these actions on Steller's eider (*Polysticta stelleri*), spectacled eider (*Somateria fischeri*), polar bear (*Ursus maritimus*), and designated polar bear critical habitat pursuant to section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

Final project details were received on March 23, 2011, and formal consultation began on that date. This biological opinion is based on the project's Permit Plan of Operations (NSB, February 22, 2010), a supplemental letter from the NSB to the Service (December 6, 2010, and additional information provided by the NSB primarily through electronic communications with Petrotechnical Resources of Alaska (PRA). The complete administrative record for this consultation is on file at the Service's Fairbanks Fish and Wildlife Field Office.

The NSB with technical and management assistance from PRA proposes to drill and complete a total of up to six new natural gas production wells within two of its existing Barrow Gas Fields (East and Walakpa). In addition, plug and abandonment of up to eight depleted wells will be conducted at the existing East and South Barrow Gas Fields. All work proposed will be conducted on Ukpeagvik Inupiat Corporation (UIC) surface and NSB subsurface privately owned lands.

Section 7(a)(2) of the Act 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.

Polar bears

The project area is located within the range of polar bears approximately 0.6–8 miles (1–12 km) inland from the eastern Chukchi Sea and western Beaufort Sea coasts. Polar bears are a marine mammal and activities that may affect them must be reviewed, and if appropriate, authorized, under the Marine Mammal Protection Act (MMPA). Oil and gas activities on Alaska's North Slope have been reviewed under the MMPA through the issuance of the Beaufort Sea Incidental Take Regulations (ITRs). An intra-service section 7 consultation was conducted on the issuance of these regulations, and any Letters of Authorization (LOA) issued under these ITRs will also provide incidental take coverage under the Act. In order to meet your obligations under Section 7 of the Act, the applicant must hold and comply with the terms of an LOA that provides coverage for project activities with regard to polar bears.

Polar bear critical habitat

The portion of the project area located east of longitude 156.7030 W is located within polar bear terrestrial denning habitat (critical habitat unit 2), except for land excluded

from the final designation (USFWS 2010) as part of the Barrow town site. Most project activities that will occur within the boundaries of terrestrial denning habitat are confined to manmade structures such as roads and pipeline, which are also excluded from critical habitat in the final designation (USFWS 2010). We do not anticipate proposed activities would appreciably increase the likelihood of disturbance to denning polar bears in nearby critical habitat beyond background levels of activity associated with current pipeline and gas well facility operations, access to the North Slope Borough Landfill, and other road traffic. Accordingly, we do not anticipate that the proposed activities would further compromise the ability of the affected critical habitat to support polar bears. Given the very small spatial scale of potentially affected critical habitat within the project area once exclusions are considered and minimal increase in potential disturbance to polar bears within nearby terrestrial denning habitat, we do not anticipate that the proposed activities will appreciably diminish the intended conservation role of polar bear critical habitat in the action area. Therefore, the Service concludes that the project will not result in destruction or adverse modification of polar bear critical habitat. There will be no further treatment of polar bear critical habitat in this document.

Steller's eider and spectacled eider

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

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

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

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

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

In addition to listed eiders, the Barrow area may now, or hereafter contain plants, animals, or their habitats determined to be threatened or endangered. The Service, through future consultation may recommend alternatives to future developments within the Barrow area to prevent activity that will contribute to a need to list such a species or

their habitat. The Service may require alternatives to proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modification of designated or proposed critical habitat. The USACE should not approve any activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act as amended (16 U.S.C. 1531 et seq.), including completion of any required procedure for conference or consultation.

A complete administrative record of this consultation is on file at the Fairbanks Fish and Wildlife Field Office, 101 12th Ave., Room 110, Fairbanks, Alaska 99701. If you have any comments or concerns regarding this 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

2.1 Background

Section 7(a)(2) of the Endangered Species Act, (16 U.S.C. § 1531 et seq.), requires that Federal agencies shall insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any threatened or endangered species, or result in the destruction or adverse modification of critical habitat. When the actions of a Federal agency may adversely affect a protected species, that agency (i.e., the action agency) is required to consult with either the National Marine Fisheries Service (NMFS) or the Service, depending upon the protected species that may be affected.

2.2 Proposed Project

The North Slope Borough (NSB) comprises an area of 89,000 square miles within the National Petroleum Reserve-Alaska (NPR-A). Based on current estimates of remaining reserves and consumption rates, the Borough's overall gas reserves are considered adequate. However, as the community has grown over the years, increased peak demand for natural gas required that new wells be drilled. The last drilling program in Barrow occurred in the early 1990's. New wells are needed to supply existing and future demands.

The NSB with technical and management assistance from Petrotechnical Resources of Alaska (PRA) proposes to drill and complete a total of up to six new natural gas production wells within two of its existing Barrow Gas Fields (East and Walakpa). In addition, plug and abandonment of up to eight depleted wells will be conducted at the existing East and South Barrow Gas Fields. All work proposed will be conducted on Ukpeagvik Inupiat Corporation (UIC) surface and NSB subsurface privately owned lands.

Rig work will be conducted in the East Barrow Gas Field from existing gravel in summer and fall 2011 and from ice roads and ice work pads in the Walakpa Field in winter 2011–

2012. Equipment will be barged to Barrow as early as mid-July depending on ice conditions and equipment and materials will be demobilized and barged from Barrow by September 2012. Ice/snow road access and ice pads are proposed where needed. No gravel roads or gravel pads are proposed to be constructed by the project. No new overhead electrical transmission lines or poles will be installed as part of the project. Work inside of the USFWS recommended eider nesting window of June 7–August 10 will be limited to transportation and staging of barged equipment on existing roads and gravel pads to minimize effects to listed eiders.

2.3 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 developed area on the tundra at Walakpa Field, including surface area covered by two well-house platforms, which will each support up to two well houses and associated equipment (1024 ft^2 each; 0.047 acres combined footprint) and surface area disturbed during the installation of VSMs to support up to 700 ft of gathering line at Walakpa Field (0.0008 acres). Thus, a 0.048-acre area is to be developed. The area indirectly affected by proposed new development at Walakpa Field is delineated by a zone of influence surrounding new infrastructure within which eiders will be affected by disturbance resulting from continued gas field operations. This zone of influence is assumed to be 200 m wide. The estimated zone of influence at Walakpa Field encompasses 104.1 acres of tundra.

There will be no new development on undisturbed tundra at the East Barrow or South Barrow Gas Fields. The area indirectly affected by proposed summer activities at the East Barrow Field and along the East Barrow pipeline is delineated by a zone of influence surrounding existing infrastructure within which eiders will be affected by disturbance resulting from gas field operations. The 200-m zone of influence was applied to the length of the East Barrow pipeline (1352.6 acres) and existing gravel pads at the East Barrow Field (281.5 acres). The combined zone of influence is 1634 acres.

2.4 Project Actions

Project activities are summarized below. A project work schedule is provided in Table 1.

East Barrow Field

Off-gravel work at the East Barrow pipeline is limited to spring pipeline repair and summer hydrotesting. Approximately two thirds of the pipeline length to be tested parallels Cakeater and East Field Roads. Hydotesting work will commence no earlier than August 11, 2011. Inspection of the pipeline will be conducted by crews walking along the pipeline where it departs from the existing gravel road or accessing it on foot from the shortest route possible where it parallels the road. Repairs identified during hydrotesting are expected to be minimal. If leaks are detected, repairs may involve tightening of flange bolts or cutting out and installing a short section (approximately three feet) of pipe. Repairs will be made by small crews (3-7 people) that will usually access the pipeline by pickup trucks on existing gravel roads and by walking. The

Barrow Gas Field maintenance rolligon or tucker will be used on the tundra where necessary to access the pipeline where it departs from the road. Water trucks, pumps, air compressor and other small truckable equipment (such as temporary light plants) will support the operation and will be located on existing gravel pads or roads. The NSB will supply freshwater required for hydrotesting (approximately 60,000 gallons). Hydrotest wastewater will be treated and discharged via the existing Barrow Municipal wastewater treatment system, injected into a disposal well which would be established after August 10, 2011, or managed in a manner appropriate to analytical test results of the hydrotest wastewater.

Work conducted on existing gravel pads and roads includes transportation of barged equipment, staging of equipment until rig work begins, establishment of a rig camp of 22 modules that will house up to 60 people, work activities related to the drilling of 2 new production wells, including construction of 2 new well houses and gathering line on existing gravel, and plug and abandonment of 4 depleted wells. The rig camp will not be occupied and rig work will not commence earlier than August 11, 2011. Well houses at East Barrow Gas Field will be supported on pilings on existing gravel pads. New powerlines to support well houses will be mounted on pipeline VSMs. Approximately 250 feet of VSM-supported gas line will be installed on existing gravel pads. Activities at East Barrow Field will also include disposal operations at a selected disposal well site for liquid downhole wastes generated by project well work at both the East Barrow and Walakpa Fields.

Walakpa Field
All work at Walakpa field will be conducted during winter on frozen tundra. The site will be accessed via an ice road and all work activities will be conducted from ice pads (Figure 1). Ice road construction and maintenance will begin with pre-packing of snow expected to begin approximately October 1, 2011. Support camps and rig camps transported to the field via the ice road, installed on ice pads, and occupied during the 2011–2012 winter drilling season only. Camp modules will be dismantled and removed prior to ice breakup in spring 2012. Rig work will begin in December 2011. Four new production wells, associated well houses, and up to 700 feet of new VSM-supported pipeline will be installed. Well houses will be on 32 ft x 32 ft decking platforms supported on pilings over the tundra. Two well houses and associated equipment will be installed on each platform. New powerlines to support well houses will be mounted on pipeline VSMs. Upon completion of rig work in spring 2012, the rig will be removed from the field and staged at a secure location in Barrow until it is barged to West Dock or Oliktok Point.

South Barrow Field
Work at the South Barrow Field includes plug and abandonment of 4 depleted wells, 2 along the existing road system and 2 that will be accessed via temporary ice trails.

Transportation of barged equipment
Approximately 80 loads will be transported to the East Barrow Gas Field over 5 days (in excess of normal gas field operations traffic) following barge arrival (approximately mid-

July 2011). Loads will go to the existing South Barrow Field Gas Handling Facility gravel pad, East Barrow 15 (EB15) pad, East Barrow 19A (EB19A) pad, and Savik Pad (East Barrow Manifold Pad). Most loads will be highway-legal loads. Although equipment will have reverse signal alarms, no additional disturbances such as flashing lights or horns are planned. Personnel do not walk alongside loads. Travel will be at slow speeds particularly with loads that extend beyond truck beds. Loads will be dropped (slid off the back of flat beds) or may be offloaded with forklifts. A crane may be needed for some loads or stacking of modules. It is anticipated that there will be 2-10 personnel at each site during offloads depending on level of activity (drivers, forklift operator, crane operator, on the ground staff). Demobilization to the 2012 barge will begin as early as mid-July 2012 with up to 20 loads transported over 2 days prior to the end of the eider nesting window and remaining loads transported after August 10, 2012.

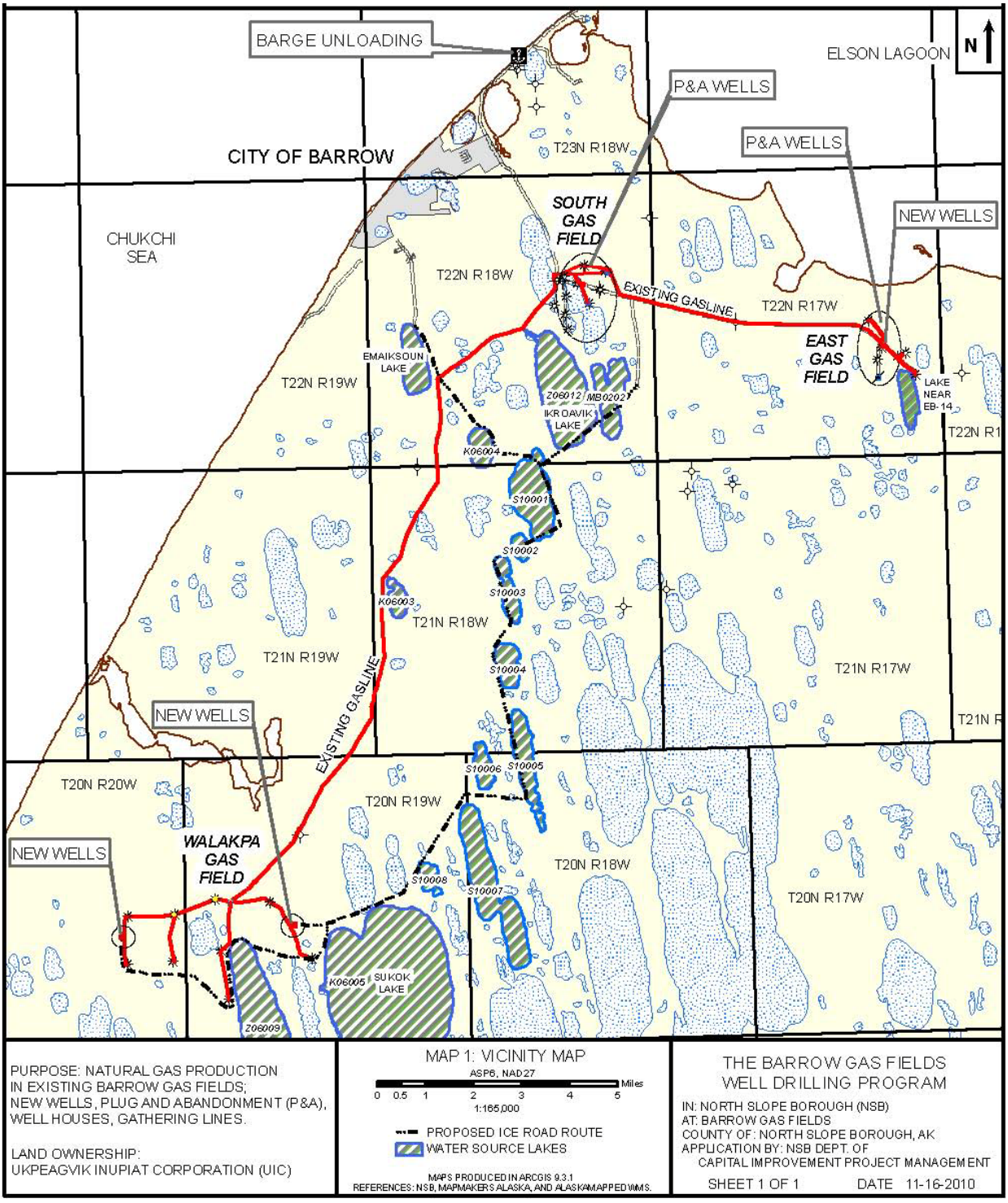

Figure 2.1. Map of project area showing locations of Barrow Gas Fields, existing pipeline infrastructure, and proposed wells. (Source: Petrotechnical Resources of Alaska)

Table 2.1. Proposed work schedule. Dates will vary depending on weather conditions. Dates related to barge operations are subject to variable ice conditions in summer/fall and the fall whaling season.

Activity	Approximate Start	Approximate End
Initial repairs to East Barrow pipeline	April 7, 2011	June 6, 2011
Hydrotest East Barrow pipeline and repair of identified leaks	August 11, 2011[a]	mid-September 2011
Complete East pipeline tie in and installation of other pipeline equipment	August 11, 2011	December 2011
Staging at existing facilities near Oliktok Point or West Dock in Prudhoe Bay, AK	late May 2011	late August 2011
Barging to Barrow from Oliktok Point or West Dock, Nikiski, Seattle	July2011	September 1, 2011
Move High Risk Barged Equipment - approximately 80 loads over 5 days on existing gravel roads may need to be moved during potential eider nesting window	mid-July 2011	Through fall/winter 2011 until deployed.
Move other Barged Materials to well site (Equipment and materials may be held in secure storage in Barrow prior to moving to existing gravel pad via existing gravel road)	August 11, 2011	Through fall/winter 2011 until deployed.
Plug and abandonment of depleted wells and disposal well operations at EB 15	September 1, 2011	June 6, 2012
East Barrow Gas Field rig up, drill, complete, install well houses and gathering line on existing gravel	August 11, 2011	Late December, 2011
Ice road construction and maintenance to access Walakpa Gas Field	October 1, 2011	April 15, 2012
Walakpa Gas Field rig up, drill, complete, install well houses and gathering line on ice pads	December 28, 2011	April 15, 2012
Transport equipment from storage in South Barrow Field to barge (Up to 20 loads over 2 days may be transported during potential eider nesting window with additional loads after August 10, 2012)	mid-July 2012	September 1, 2012
Secure storage of other equipment and wastes to be hauled from Barrow	April 15, 2012	September 1, 2012
Barging of all equipment and waste for off-site disposal from Barrow	mid-July 2012	September 1, 2012

[a] East Barrow pipeline work will not occur during the June 7–August 10, 2011 eider nesting window to avoid negative effects to nesting Steller's and spectacled eiders unless USFWS survey results indicate that work may proceed earlier without affecting eider nest success.

3. STATUS OF 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.

3.1 Steller's Eider

Physical Appearance

The Steller's eider is the smallest of the four eider species. From early winter until mid-summer males are in breeding plumage - black back, white shoulders and sides, chestnut breast, white head with black eye patches and a greenish tuft (Figure 3.1). During late summer and fall, males molt to dark brown with a white-bordered blue wing speculum; this plumage is replaced during the autumn molt when males re-acquire breeding plumage, which lasts through the next summer. Females are dark mottled brown with a blue wing speculum year round. Juveniles are dark mottled brown until the fall of their second year, when they acquire breeding plumage (Fredrickson 2001).

Figure 3.1. Male and female Steller's eider in breeding plumage.

Status and Distribution

The Steller's eider is a sea duck with a circumpolar distribution. Steller's eiders are divided into Atlantic and Pacific populations; the Pacific population is further divided into the Russia-breeding population along the Russian eastern arctic coastal plain, and the Alaska-breeding population. On June 11, 1997, the Alaska-breeding population of Steller's eiders was listed as threatened based on a substantial decrease in this population's breeding range and the increased vulnerability of the remaining Alaska-breeding population to extirpation (USFWS 1997). Although population size estimates for the Alaska-breeding population were imprecise, it was clear Steller's eiders had essentially disappeared as a breeding species from the Yukon-Kuskokwim Delta (Y-K Delta), where they had historically occurred in significant numbers, and that their Arctic Coastal Plain (North Slope) breeding range was much reduced. On the North Slope they

historically occurred east to the Canada border (Brooks 1915), but have not been observed on the eastern North Slope in recent decades (USFWS 2002). The Alaska-breeding population of Steller's eiders now nests primarily on the North Slope, particularly near Barrow and at very low densities from Wainwright to at least as far east as Prudhoe Bay (Figure 3.2). A few pairs may still nest on the Y-K Delta; only 10 Steller's eider nests have been recorded on the Y-K Delta since 1970 (Hollmen et al. 2007).

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

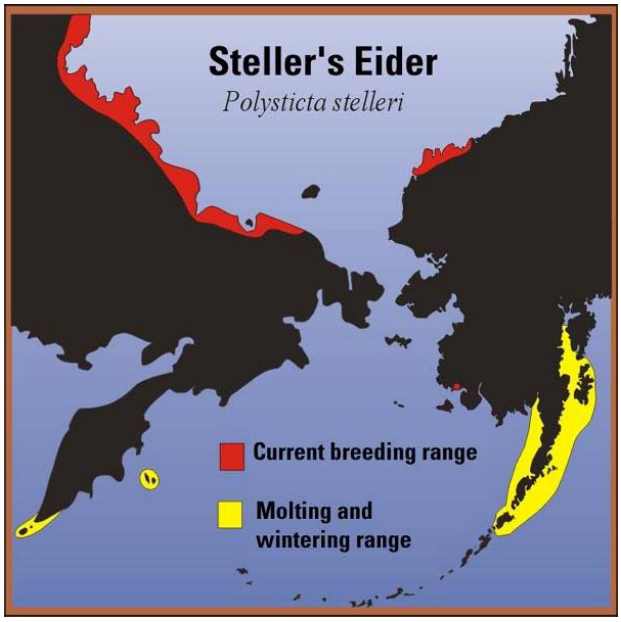

Figure 3.2. Steller's eider distribution in the Bering, Beaufort and Chukchi seas

When they do nest, Alaska-breeding Steller's eiders use coastal tundra adjacent to small ponds or within drained lake basins, occasionally as far as 90 km inland. Nests are initiated in the first half of June (Quakenbush et al. 1995), and hatching occurs from July

7 to August 3 (Quakenbush et al. 1998). Nests located in the vicinity of Barrow were in wet tundra, in drained lake basins or low-center or low indistinct flat-centered polygon areas (Quakenbush et al. 1998). Average clutch sizes at Barrow varied from 5.3-6.3, with clutches of up to 8 reported (Quakenbush et al. 1998). Nest survival (the probability a nest will hatch at least one egg) averaged 0.23 in nesting years (1991-2004) prior to fox control, whereas nest survival during nesting years after fox control began (2005–2010) was 0.48 (USFWS, unpublished data).

As with spectacled eiders, nest and egg loss was attributed to predation by jaegers, common raven (*Corvus corax*), arctic fox, and possibly glaucous gulls (*Larus hyperboreus*) (Quakenbush et al. 1995, Obritschkewitsch et al. 2001).

Within a day or two after hatch, hens move their broods to adjacent ponds with emergent vegetation, particularly *Carex* spp. and *Arctophila fulva* (Quakenbush et al. 1998, Rojek 2006, 2007) Here they feed on insect larvae and other wetland invertebrates. Broods may move up to several kilometers from the nest prior to fledging (Quakenbush et al. 1998, Rojek 2006). Fledging occurs from 32-37 days post hatch (Obritschkewitsch et al. 2001, Rojek 2006).

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

Life History – Non-breeding

Localized post-breeding movements.–Departure from the breeding grounds near Barrow differs between sexes and between breeding and non-breeding years. However, prior to their migration in both breeding and non-breeding years, some Steller's eiders stage in Elson Lagoon, North Salt Lagoon, Imikpuk Lake, and the Chukchi Sea in the vicinity of Pigniq (Duck Camp; Figure 3.3). Male Steller's eiders typically leave the breeding grounds after females begin incubating, around the end of June or early July (Quakenbush et al. 1995, and Obritschkewitsch et al. 2001). Groups of Steller's eiders have been observed just off the Chukchi beach from the gravel pits, which are south of Barrow, north to Nuvuk (the northern most point of the Barrow spit). In breeding years these flocks were comprised of mostly drakes and persisted until about the second week of July (J. Bacon, North Slope Borough Department of Wildlife Management [NSBDWM], pers. comm.; figure 3.4).

Females that successfully hatch nests and fledged young depart the breeding grounds in late August to mid-September and stage in water bodies near Pigniq prior to their southward migration along the Chukchi coast. 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

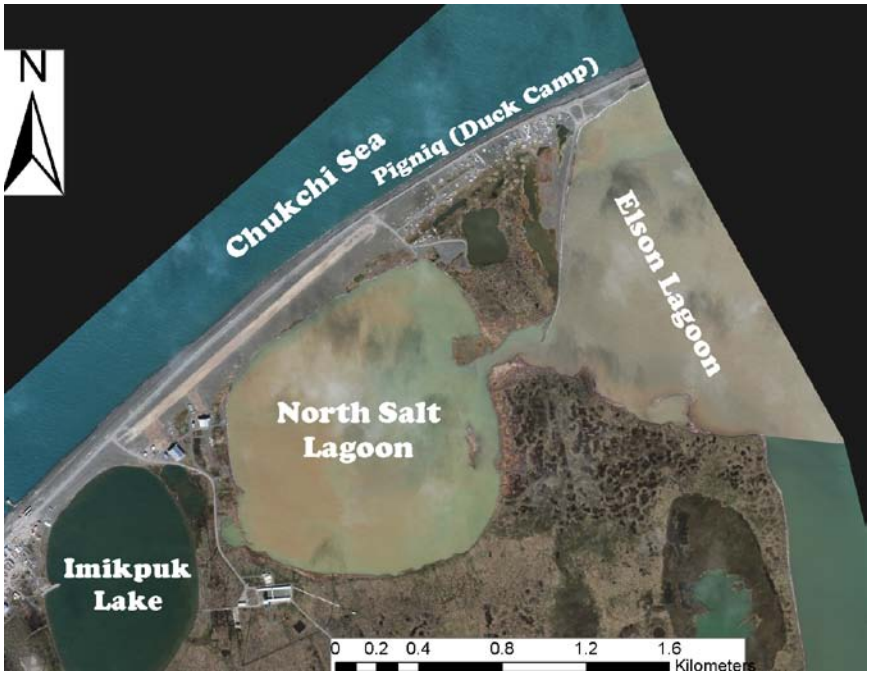

Figure 3.3. Location of Steller's eider post-breeding staging areas in relation to Pigniq (Duck Camp) hunting area north of Barrow, Alaska.

Figure 3.4. Steller's eiders (20 males and 4 females) in the Chukchi Sea a few meters offshore from the cabins at Pigniq (Duck Camp). Photo by J. Bacon, NSBDWM.

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. Hens 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). Females whose nests fail may also remain near Barrow later in summer; a single failed-nesting female equipped with a transmitter in 2000 remained near the breeding site until the end of July and stayed in the Beaufort Sea off Barrow until late August (Martin et al. *in prep*).

In non-breeding years, groups of Steller's eiders are observed just off the Chukchi beach from the gravel pits north to Nuvuk, however they became absent earlier compared to breeding years and the sex ratios were more even (J. Bacon, NSBDWM, pers. comm.). Telemetry data showed at least 5 of 14 birds used Elson Lagoon and males and females dispersed across the area between Wainwright and Admiralty Inlet in late June and early July, with most birds entering marine waters by the first week of July (Martin et al. *in prep*.).

Migration Patterns Related to Breeding Origin.

There is limited information available on the migratory movements of Steller's eiders, particularly connecting breeding populations with migratory routes or specific molting or wintering areas. The best information available is from two satellite telemetry studies of Steller's eiders. One study marked Steller's eiders wintering on Kodiak Island, Alaska and followed birds through the subsequent spring (n = 24) and fall (n = 16) migrations from 2004 – 2006 (D. Rosenberg, Alaska Department of Fish and Game [ADFG]). Most of the birds marked on Kodiak returned to eastern arctic Russia during the nesting period, and none of these birds (all presumed to be from the Russian breeding population) were relocated on land or the near shore waters North of the mouth of the Yukon River in Alaska (ADFG, unpublished data). The second (but earlier) study marked birds (n = 14) near Barrow, Alaska (within the range of the listed Alaska-breeding population) in 2000 and 2001(Martin et al. in prep). Birds from this study were relocated subsequently along arctic coast of Alaska Southwest of Barrow to areas near Pt. Hope, on the Seward Peninsula, and in Southern Norton Sound (Martin et al. in prep). The birds marked near Barrow were also relocated further South in Alaska and in eastern arctic Russia in similar locations to birds marked in Kodiak. Based on the data from two satellite telemetry studies of Steller's eiders in Alaska, it remains unclear where the the Russia and Alaska breeding populations merge and diverge during molt and spring migrations, respectively.

Molt and Winter Distribution.– During post-breeding migration, Steller's eiders move toward molting areas in the near shore waters of Southwest Alaska where they undergo a complete flightless molt for about 3 weeks. The combined (Russian and Alaskan-breeding) Pacific population molts in numerous locations in Southwest Alaska, with exceptional concentrations in four areas along the north side of the Alaska Peninsula: Izembek Lagoon, Nelson Lagoon, Port Heiden, and Seal Islands (Gill et al. 1981, Petersen 1981, Metzner 1993). Additionally, smaller numbers are known or thought to

molt in a number of other locations along the western Alaska coast, around islands in the Bering Sea, along the coast of Bristol Bay, and in smaller lagoons along the Alaska Peninsula (Swarth 1934; Dick and Dick 1971; Petersen and Sigman 1977; Wilk et al. 1986; Dau 1987; Petersen et al. 1991).

After molt, many of the Pacific-wintering Steller's eiders disperse to additional areas in the eastern Aleutian Islands, the south side of the Alaskan Peninsula, Kodiak Island, and as far east as Cook Inlet, although thousands may remain in lagoons used for molting unless or until freezing conditions force them to move (USFWS 2002). During the winter, this species congregates in select near shore waters throughout the Alaska Peninsula and the Aleutian Islands, around Nunivak Island, the Pribilof Islands, the Kodiak Archipelago, and lower Cook Inlet (Larned 2000b, Bent 1987, Agler et al. 1994, Larned and Zwiefelhofer 1995). Wintering Steller's eiders usually (although not always; Martin et al. in prep.) occur in waters less than 10 m deep, which are normally within 400 m of shore or at offshore shallows.

Northward Spring Migration.– During spring migration, thousands of Steller's eiders stage in estuaries along the north side of the Alaska Peninsula, including some molting lagoons, and at the Kuskokwim Shoals near the mouth of the Kuskokwim River in late May (Larned 2007, Martin et al. *in prep*.). Like other eiders, Steller's eider may use spring leads for feeding and resting, but there is little information on habitat use during spring migration. Spring migration usually includes movements along the coast, although birds 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). Larned (1998) concluded that Steller's eiders show strong site fidelity to "favored" habitats during migration, where they congregate in large numbers to feed before continuing their northward migration.

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 et al. 1993, Larned 1998, Larned 2000a, Larned 2000b).

Steller's Eider Abundance and Trends – Pacific Population

The majority of the world population of Steller's eiders migrates along the Bristol Bay coast of the Alaska Peninsula in the spring, where they linger en route to feed at the mouths of lagoons and other productive habitats. Annual spring aerial surveys have been conducted since 1992 to monitor the population status and habitat use of Steller's eiders (*Polysticta stelleri)* staging for spring migration in southwestern Alaska. Annual Steller's eider estimates ranged from 137,904 (1992) to 54,888 (2010), mean 73,904. The long-term trend indicates an exponential decline of 2.7 percent per year (R^2=0.43; Larned and Bollinger, 2010). Larned and Bollinger (2010) suggest that a slight negative trend bias may have resulted from a higher frequency of optimally-timed counts in early years due to free selection from among survey replicates, compared to the single annual counts in subsequent

years. A variable low-bias may also be present in most annual estimates due to inaccuracies in timing, observer effects and other uncontrolled variables (Larned and Bollinger 2010).

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

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

Stehn and Platte (2009) conducted a review of the distribution, abundance, and trends of the listed population of Steller's eiders on the arctic coastal plain (ACP). Using data from three aerial surveys, (the ACP, the North Slope eider survey [NSE], and the Barrow Triangle survey [ABR]), they assessed population status and trends of the Steller's eider population nesting on the ACP of Alaska. Data reported from these three surveys provide different estimates of average population size and trend. The 1989-2006 ACP survey (Mallek et al. 2007) estimated a total average population size of 866 birds with a declining population growth rate of 0.778 (Stehn and Platte 2009); the NSE survey (1992-2008; Larned et al. 2009) averaged 162 birds with increasing growth rate of 1.059. The ABR survey, which surveys only the Barrow triangle, which is a subset of the larger ACP and NSE survey areas (1999-2007; Obrishkewitsch et al. 2008) averaged 100 birds with a growth rate of 0.934. Average population size and trend can be biased by changes in observer, detection rates and survey timing. Survey timing was considered especially important for species with male departure early in incubation, or other marked shifts in habitat use, movements, or flocking behavior (ground breeding surveys near Barrow indicate the best time for aerial surveys of breeding Steller's eiders is about 12-20 June, after arrival of most breeding individuals but before most males depart. Using a subset of data least confounded by changes in survey timing and observer, the appropriately-timed NSE survey observations from 1993-2008 averaged 173 indicated total Steller's eiders (88-258, 90% confidence interval) with an estimated growth rate of 1.011 (0.857 – 1.193, 90% CI). The authors assumed a detection probability of 30% (based upon reasonable estimates with similar species and habitats), yielding a total average population of Steller's eiders breeding in the ACP of about 576 (292-859, 90% CI; Stehn and Platte 2009).

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

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

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

Steller's Eider Critical Habitat
In 2001, the Service designated 2,830 mi^2 (7,330 km^2) of critical habitat for the Alaska-breeding population of Steller's eiders at breeding areas on the Y- K Delta, a molting and staging area in the Kuskokwim Shoals, and molting areas in marine waters at Seal Islands, Nelson Lagoon, and Izembek Lagoon (66 FR 8849, February 2, 2001). No critical habitat for Steller's eiders has been designated on the ACP. In accordance with section 3(5)(A)(i) of the Act and regulations in 50 C.F.R. 424.12, critical habitat for a species contains those physical or biological features that are essential for the conservation of the species and which may require special management considerations and protection. Under the Act these features are considered "primary constituent elements" of critical habitat, and include, but are not limited to: space for individual and population growth, and for normal behavior; food, water air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and habitats that are protected from disturbance or are representative of the historical geographic and ecological distribution of a species.

3.2 Spectacled Eider

Physical Appearance
Spectacled eiders are large sea ducks. Males in breeding plumage have a white back, black breast, and pale green head with large white "spectacles" around the eyes. In late summer and autumn males molt into a mottled brown plumage that lasts until late fall, when they re-acquire breeding plumage. Females are mottled brown year round, with pale tan spectacles. Juveniles attain breeding plumage in their second (female) or third (male) year; until then they are mottled brown (Petersen et al. 2000). Both males and females have long sloped bills, giving them a characteristic profile (Fig 3.5).

Figure 3.5 - Male and female spectacled eiders in breeding plumage.

Distribution and Status
Spectacled eiders inhabit the North Pacific. There are three primary breeding populations; those on Alaska's North Slope, the Y-K Delta, and northern Russia. Historically, spectacled eiders nested in Alaska discontinuously from the Nushagak Peninsula north to Barrow, and east nearly to Canada's Yukon Territory (Phillips 1922-1926, Bent 1925, Bailey 1948, Dau and Kistchinski 1977, Derksen et al. 1981, Garner and Reynolds 1986, Johnson and Herter 1989). The entire species was listed throughout its range as threatened on May 10, 1993 (USFWS 1993) because of documented population declines. The Y-K Delta population had declined 96% between the 1970s and early 1990s (Stehn et al. 1993, Ely et al. 1994), and anecdotal information indicated that populations in the other two primary breeding areas had also declined (USFWS 1996). The global

population of spectacled eiders is estimated at 363,000 birds (Petersen et al. 1999), or 418,420 birds (USFWS & USGS Spectacled Eider Experts Meeting 2006).

Spectacled eiders molt in several discrete areas (Figure 3.6), with birds from the different populations and genders apparently favoring different molting areas (Petersen et al. 1999). After molting, spectacled eiders migrate to openings in pack ice of the central Bering Sea south/southwest of St. Lawrence Island (Petersen et al. 1999; Figure 3.6), where they remain until March or April (Lovvorn et al. 2003).

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

Figure 3.6. Distribution of spectacled eiders.

Life History – North Slope Population (Breeding)
Research and spring aerial surveys have provided data on spectacled eider populations on Alaska's ACP (the North Slope breeding population) since 1992. On the North Slope, spectacled eiders breed north of a line connecting the mouth of the Utukok River to a point on the Shaviovik River about 24 km (~15 miles) inland from its mouth. Breeding density varies across the North Slope (Figure 3.7). Breeding pair numbers peak in mid-June and the number of males declines 4-5 days later (Smith et al. 1994, Anderson and Cooper 1994, Anderson et al. 1995, Bart and Earnst 2005).

North Slope spectacled eider clutch size averages 3.2-3.8, with clutches of up to eight eggs reported (Quakenbush et al. 1995). Incubation lasts 20-25 days (Kondratev and Zadorina 1992, Harwood and Moran 1993, Moran and Harwood 1994, Moran 1995), and hatching occurs from mid- to late July (Warnock and Troy 1992). On the nesting grounds, spectacled eiders feed on mollusks, insect larvae (craneflies and caddisflies), midges, small freshwater crustaceans, and plants and seeds (Kondratev and Zadorina 1992) in shallow freshwater or brackish ponds, or on flooded tundra. Young fledge approximately 50 days after hatch, and then females with broods move from freshwater to marine habitats.

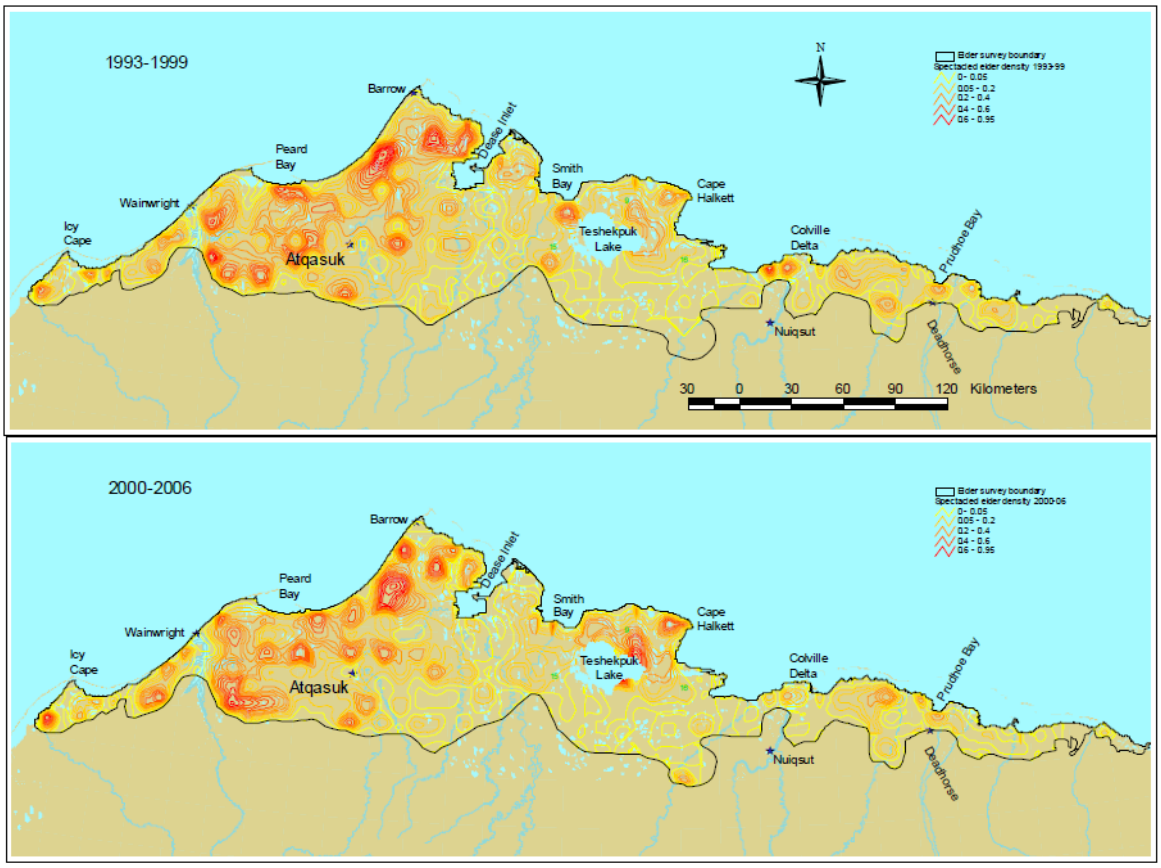

Figure 3.7. Mean spectacled eider breeding density across Alaska's Arctic Coastal Plain 1993–1999 (above) and 2000–2006 (below; from Larned et al. 2006).

Nest success is highly variable and greatly influenced by predators, including gulls (*Larus* spp.), jaegers (*Stercorarius* spp.), and red (*Vulpes vulpes*) and arctic (*Alopex lagopus*) foxes. In arctic Russia, apparent nest success was calculated as <2% in 1994 and 27% in 1995; predation was believed to be the cause of high failure rates, with foxes, gulls and jaegers the suspected predators (Pearce et al. 1998). Apparent nest success in 1991 and 1993-1995 in the Kuparuk and Prudhoe Bay oil fields on the ACP varied from 25-40% (Warnock and Troy 1992, Anderson et al. 1998)

Life History – Y-K Delta Population (Breeding)
Spectacled eiders historically nested throughout the coastal zone of the Y-K Delta. They currently breed primarily within about 15 km (~9 miles) of the coast from Kigigak Island north to Kokechik Bay (USFWS 1996; Figure 3.8), although a number of sightings have been made on the Y-K Delta both north and south of this area during the breeding season (R. Platte, USFWS, pers. comm. 1997). Breeding density varies in the primary nesting area, the central coast zone, of the Y-K Delta (Platte and Stehn 2009; Figure 3.8).

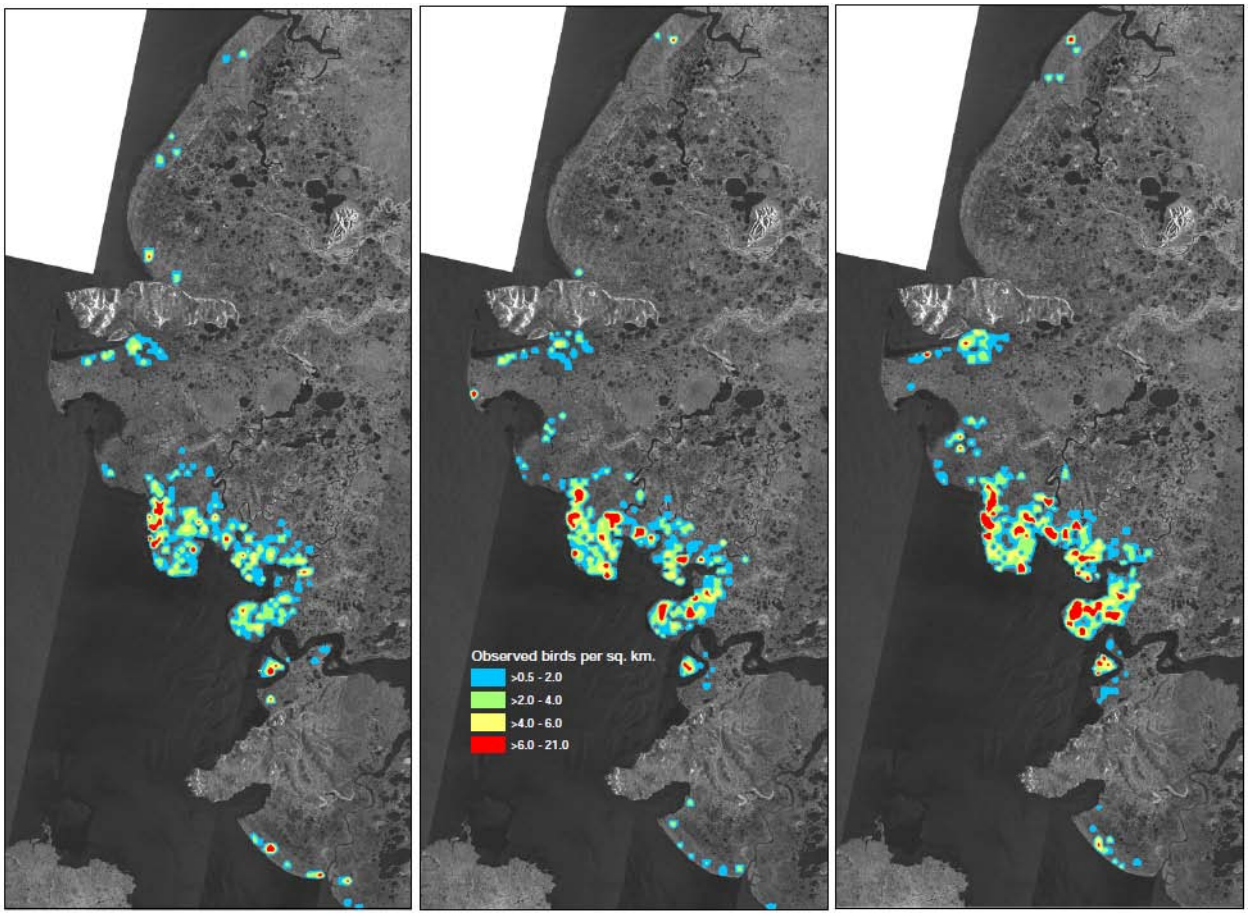

Figure 3.8. stimated relative density distribution of spectacled eiders on the central coast zone of the Yukon Delta, Alaska based on 3 time periods: 1998–2001 (left), 2002–2005 (middle), and 2006–2009 (right; from Platte and Stehn 2009).

Spectacled eider clutch size at Kigigak Island on the Y-K Delta has averaged 4.9 eggs from 1992-2007, with clutches of up to eight eggs reported (Lake 2007). At Hock Slough on the Y-K Delta, clutch size averaged 5.2 from 1991-1995, with clutches up to seven eggs (Grand and Flint 1997). Nest initiation occurs from mid-May to mid-June (Lake 2007), incubation lasts approximately 24 days (Dau 1974), and hatching occurs from mid-June to mid-July (Warnock and Troy 1992). On the nesting grounds, spectacled eiders feed on mollusks, insect larvae (craneflies and caddisflies), midges, small freshwater crustaceans, and plants and seeds (Kondratev and Zadorina 1992) in shallow freshwater or brackish ponds, or on flooded tundra. Young fledge approximately 50 days after hatch, and then females with broods move directly from freshwater to marine habitats. Nest success is variable and greatly influenced by predators, including gulls (*Larus* spp.), jaegers (*Stercorarius* spp.), and red (*Vulpes vulpes*) and arctic (*Alopex lagopus*) foxes. On Kigigak Island in the Y-K Delta, nest survival probability ranged from 0.06 – 0.92 from 1992-2007 (Lake 2007). Nest success tended to be higher in years with low fox numbers or activity (i.e., no denning) and when foxes were eliminated from the island prior to the nesting season or years.

Life History – Demographics

Age at first breeding has not been determined but probably occurs most often in the third year for females and the third or fourth year for males, coinciding with the acquisition of plumage (USFWS 1999). Wild and captive spectacled eiders are documented to breed as early as 2 years of age. Spectacled eiders lay an average of five eggs (Strobel 2004), and their incubation period averages 24 days (Dau 1974). Egg hatchability on the North Slope and in arctic Russia is very high for nesting spectacled eiders. 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 Y-K Delta during the early to mid-1990s contained inviable eggs (Grand and Flint 1997). Approximately 10% of eggs in successful nests did not hatch due to either embryonic mortality or infertility, and the relatively high occurrence of inviable eggs is believed to be related to exposure to contaminants (Grand and Flint 1997).

Recruitment rate (the percentage of young eiders that hatch, fledge, and survive to sexual-maturity) of spectacled eiders is poorly known (USFWS 1999) as there is limited data on juvenile survival. The nesting success of spectacled eiders is variable, ranging from 20% to 95 % depending on the year and location (Bowman et al. 2002). Adult female survival can average 93%, and duckling survival can average 34 % (Flint and Grand 1997). In a coastal region of the Y-K Delta, duckling survival to 30 days averaged 34%, with 74% of this mortality occurring in the first 10 days. Survival of adult females during the first 30 days post hatch was 93+3% (Flint and Grand 1997).

Life History – (Non-breeding)

General

As with many other sea ducks, spectacled eiders spend the 8-10 month-long non-breeding season at sea, but until recently much about the species' life in the marine environment was unknown. Satellite telemetry and aerial surveys led to the discovery of spectacled eider migrating, molting, and wintering areas. These studies are summarized in Petersen et al. (1995), Larned et al. (1995), and Petersen at al. (1999).

Post-breeding – North Slope

Males generally depart breeding areas 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.

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 (Peterson 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 (Peterson et al. 1999, TERA 2002).

Post-breeding – Y-K Delta

Males departing from the Y-K Delta breeding grounds leave 3-weeks sooner than males from Russia and the North Slope (Petersen et al. 1999).

Molt

Spectacled eiders use specific molting areas from July to late October. Larned et al. (1995) and Peterson et al. (1999) discussed spectacled eiders' apparently strong preference for specific molting locations, and concluded that all spectacled eiders molt in four discrete areas (Table 3.1). Females generally used molting areas nearest their breeding grounds. All transmittered females from the Y-K Delta molted in nearby Norton Sound (n = 18), while females from the North Slope (n = 15) molted in Ledyard Bay (10), along the Russian coast (4), and near St. Lawrence Island (1). 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 or September and remained through October.

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

Wintering

After molting, spectacled eiders migrate offshore in the Chukchi and Bering Seas to a single wintering area in openings in pack ice of the central Bering Sea south/southwest of St. Lawrence Island (Figure 3.6). In this relatively shallow area, hundreds of thousands of spectacled eiders (Petersen et al. 1999) rest and feed, diving up to 70 m to eat bivalves, mollusks, and crustaceans (Cottam 1939, Petersen et al. 1998, Petersen and Douglas 2004). Twelve spectacled eiders collected in the Bering Sea wintering area in March 2001 contained primarily the bivalve *Nuculana radiata* (Lovvorn et al. 2003). Sampling over several decades suggests that the benthic community in the overwintering area has shifted from larger to smaller species of clams (Lovvorn et al. 2000, Richman and Lovvorn 2003).

Table 3.1 Important staging and molting areas for each sex of each breeding population of spectacled eiders.

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
Y-K Delta Males	Mechigmenskiy Bay Northeastern Norton Sound
Y-K Delta Females	Northeastern Norton Sound

Late winter/spring

Recent information about spectacled and other eiders indicates that 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 (*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 (*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. Information obtained in 2002-2006 about 57 satellite marked king eiders found that 100% of the birds migrating from the Bering Sea to breeding grounds in North America occupied the spring lead system in the eastern Chukchi (Figure 3.9) for approximately 3-4 weeks (S. Oppel, University of Alaska Fairbanks, unpublished data).

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 primarilyoff body reserves (Korschgen 1977, Drent and Daan 1980, Parker and Holm

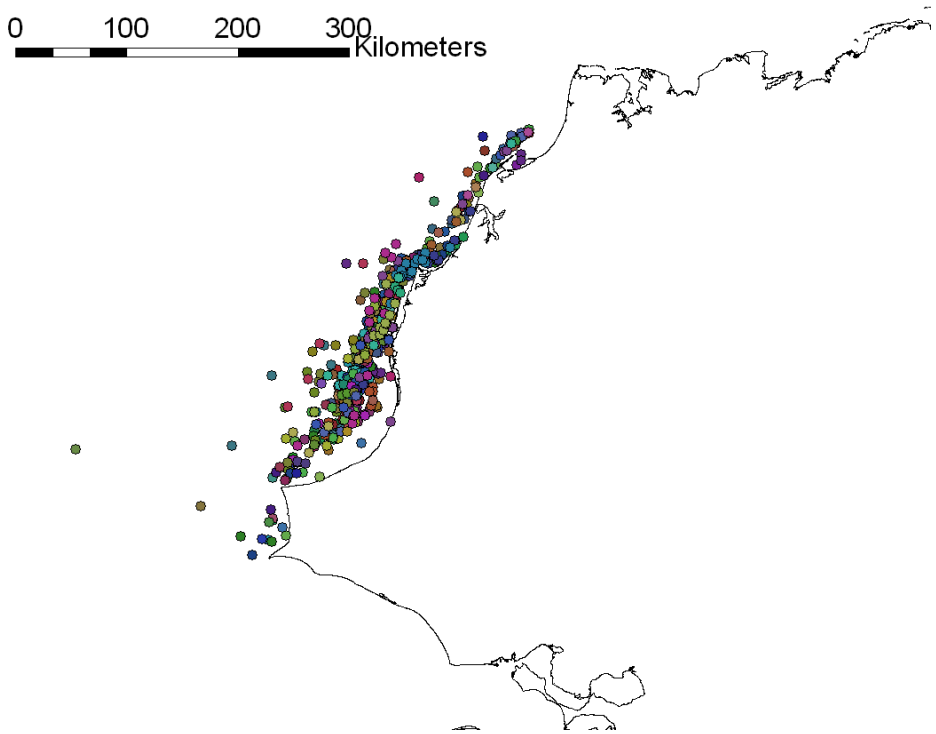

Figure 3.9. Spring migration locations of satellite-marked North Slope king eiders, 2002–2006 (Data from Steffen Oppel, University of Alaska-Fairbanks).

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, p. 2).

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

Fischer et al. (2010) used ground-based and aerial surveys to estimate the number of nests and eggs of spectacled eiders on the coastal zone of the Y-K Delta from 1985–2010. The estimated total number of nests is a direct measure of effective breeding population size and an index to the number of potential nesters (Fischer et al. 2010). In 2010 they estimated 6,750 (SE 866) spectacled eiders nests on the Y-K Delta. The 2009 indicated total bird index, based solely on aerial surveys for the entire coastal zone, was 6,537 birds (SE 527; Platte and Stehn 2009). The aerial index is lower than the nest estimate because the indicated total number of birds has not been corrected for detection probability. The average aerial index for 2005–2009 was 5,244 birds (4,872–5,616, 90% C.I.), and the estimated population averaged for the last 5 years was 11,411 spectacled eiders (9,657–13,165, 90% C.I.; corrected for detection probability of 46%).

The average population growth rate of the estimated number of nests on the Y-K Delta from 2000–2010 increased at 1.098 (1.057-1.138, 90%CI; Fischer et al. 2010). The population growth rate from 2000 to 2009 for the Y-K Delta indicated total bird index from aerial surveys of spectacled eiders was 1.081 (1.050–1.113, 90% CI; Platte and Stehn 2009). A more thorough analysis accounting for observer experience and survey timing yielded a 1993-2006 adjusted growth rate of 1.042 (1.030–1.053; 90% C.I.; Stehn et al. 2006).

No population estimates for the North Slope breeding population are available before 1993. At Prudhoe Bay, within the North Slope breeding area, Warnock and Troy (1992) documented an 80% decline in spectacled eider abundance from 1981 until 1991. For the North Slope breeding population, ground-plot surveys have not been conducted. The 2009 population index based on aerial surveys was 5,018 birds (SE 854; unadjusted for detection probability). The North Slope spectacled eider population from 1993-2009 was slightly decreasing, with an average (n = 17 years) population growth rate of 0.985 (0.971–0.999, 90% CI; Larned et al. 2010). The North Slope breeding population estimate for 2007-2009 (adjusted for detection probability = 46%) was 12,506 (9,365–15,646, 90% C.I.)

Spectacled Eider Recovery Criteria

The Spectacled Eider Recovery Plan (USFWS 1996) presents research and management priorities with the objective of recovery and delisting so that protection under the Act is no longer required. Although the cause or causes of the spectacled eider population decline is not known, factors that affect adult survival are likely to be the most influential on population growth rate. These include lead poisoning from ingested spent shotgun pellets, which may have contributed to the rapid decline observed in the Y-K Delta (Franson et al 1995, Grand et al. 1998), and other factors such as habitat loss, increased nest predation, over harvest, and disturbance and collisions caused by human infrastructure (factors discussed in Section 4 – *Environmental Baseline*). Under the Recovery Plan, the species will be considered recovered when each of the three recognized populations (Y-K Delta, North Slope of Alaska, and Arctic Russia): 1) is stable or increasing over 10 or more years and the minimum estimated population size is at least 6,000 breeding pairs, or 2) number at least 10,000 breeding pairs over 3 or more years, or 3) number at least 25,000 breeding pairs in one year. Spectacled eiders do not currently meet these recovery criteria.

Spectacled Eider Critical Habitat

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

4. 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.

4.1 Steller's and Spectacled Eiders

Status in the Action Area
The North Slope and Y-K Delta breeding populations of spectacled eiders (approximately 12,506 and 11,411 breeding birds, respectively), and Steller's eiders (approximately 576 breeding birds) occupy terrestrial and marine portions of the Action Area for significant portions of their life history. Spectacled and Steller's eiders from both the Y-K Delta and North Slope breeding populations spend the majority of their annual cycle within the terrestrial and marine environments of the Action Area. During the proposed action (hunt dates 2 April – 31 August), Steller's and spectacled eiders can be moving from wintering to breeding areas, on breeding area, migrating from breeding to molting areas, and on molting areas. Spectacled eiders occur in the following AMBCC regions during the proposed action: North Slope, Northwest Arctic, Bering Strait/Norton Sound, and YK Delta. Steller's eiders have a wider distribution during the proposed action and can occur in the same AMBCC regions as spectacled eiders in addition to the following regions: Aleutian/Pribilof Islands, Bristol Bay, Kodiak, and Cook Inlet.

Both species have undergone significant, unexplained declines in their Alaska-breeding populations. Factors that may have contributed to the current status of spectacled and Steller's eiders are discussed below and include, but are not limited to, toxic contamination of habitat, increased predator populations, harvest, and impacts of development, science impacts, and climate change. Factors that affect adult survival may be the most influential on population growth rates. Recovery efforts for both species are underway in portions of the Action Area.

Data from annual aerial surveys adjusted by a surrogate visual correction factor estimates the North Slope-breeding population of spectacled eiders is approximately 12,506 individuals most of which nest in the Action Area. Of spectacled eiders observed on the North Slope during aerial surveys, the highest densities of spectacled eiders are consistently found in the Barrow Triangle, the area near Peard Bay, southeast of Wainwright, and northeast of Teshekpuk Lake (Figure 3.5).

As discussed in *Section 3 – Status of the Species*, it is difficult to determine the number of Steller's eiders that breed on the North Slope. However, annual aerial eider surveys show Steller's eiders are not evenly distributed across the ACP, with highest densities occurring in the Barrow Triangle, which comprises lands near Barrow, north of 70°50' N and west of Dease Inlet. This area accounts for only 4.8% of the survey area, but contained 40% of all

Steller's eider observations in the aerial surveys. This is likely an underestimate of the proportion of Steller's eiders in this area because: 1) the scale of the concentration is too small to be adequately represented in the sampling regime; and 2) a portion of the concentration area is excluded because the area near the Barrow airport cannot be surveyed due to aviation safety concerns. Both species have undergone significant, unexplained declines in their Alaska-breeding populations. Factors that may have contributed to the current status of spectacled and Steller's eiders are discussed below and include, but are not limited to, toxic contamination of habitat, increased predator populations, harvest, and impacts of development, science impacts, and climate change. Factors that affect adult survival may be most influential on population growth rates. Recovery efforts for both species are underway in portions of the Action Area.

Increased 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).

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

The population of communities such as Barrow has been increasing, and the U.S. Bureau of Land Management (BLM) (2007) predicts growth to continue at approximately 2% per annum until at least the middle of this century. Assuming community infrastructure and footprint grow at roughly the same pace as population, BLM (2007) estimates that community footprint could cover 3,600 acres by the 2040s. Major community development projects such as the new hospital, landfill, and water treatment plant at Barrow, airport improvements and development of science support facilities in the area, have all undergone formal section 7 consultations

There are currently few permanent structures associated with the oil and gas industry in National Petroleum Reserve-Alaska (NPR-A), a vast area that contains virtually all currently occupied nesting habitat for the listed population of Steller's eiders, and almost 90% of the North Slope breeding habitat of spectacled eiders (USFWS 2008). However, development has steadily moved westward towards NPR-A since the initial discovery and development of oil on the North Slope. Given industry's interest in NPR-A as expressed by lease sales, seismic surveys, drilling of exploratory wells, and the construction of the Alpine field, industrial development is likely to continue in NE and NW NPR-A. Development in NPR-A may also facilitate development in more remote, currently undeveloped areas such as the Chukchi Sea or areas of the Beaufort Sea, and vice versa. Formal section 7 consultations were conducted for MMS's Lease Sale 193 in the Chukchi Sea, and Lease Sales 185, 196, and 202 in the Beaufort Sea. Consultation on these areas will continue if development proceeds past the exploration phase under the incremental step consultation authority granted to Outer Continental Shelf (OCS) activities (50 CFR § 402.14(k)).

Incidental Take

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

Table 4.1 illustrates the number and diversity of actions that required consultation in Alaska. We believe these estimates have overestimated, possibly significantly, actual take. Actual take is likely reduced by the implementation of terms and conditions in each biological opinion, is spread over the life-span of a project (often 50 years), and is dominated by the *potential* loss of eggs/ducklings which, as described above, is of less significance than adult mortality for survival and recovery of these K-selected species.

Also, it remains unknown to what degree spectacled and Steller's eiders potentially affected by disturbance can reproduce in disturbed areas or move to other less disturbed areas to reproduce. If either or both occur, these factors also serve to reduce actual impacts from the maximal potential impacts.

Table 4.1 - Activities in Alaska that required formal section 7 consultation and the amount of incidental take provided.

Project Name	Impact Type	Estimated Incidental Take
False Pass Harbor (2001)	Contaminants	4 adult Steller's eiders
NPDES-GP (2001)	Collisions	1 adult Steller's eider
Chignik Lagoon Tank Farm (2001)	Contaminants	14 adult Steller's eiders
Chignik Dock (2002)	Contaminants	4 adult Steller's eiders
Chignik Bay Tank Farm (2002)	Contaminants	5 adult Steller's eiders
Sandpoint Harbor (2002)	Contaminants Collisions Habitat loss	13 adult Steller's eiders
Beaufort Sea Planning Area Lease Sale 186, 195, & 202 (2002)	Collisions	5 adult spectacled eiders 1 adult Steller's eider
Fairweather Seismic (2003)	Disturbance	66 adult Steller's eiders
Nelson Lagoon Tank Farm (2003)	Contaminants Collisions	21 adult Steller's eiders
Akutan Mooring Basin (2003)	Contaminants Collisions	10 adult Steller's eiders
Alpine Development Project (2004)	Habitat loss Collisions	4 spectacled eider eggs/ducklings 3 adult spectacled eiders
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
Savoonga Wind Turbine (2005)	Collisions	1 adult spectacled eider
Chukchi Sea Lease Sale 193 (2007)	Collisions	3 adult spectacled eiders 1 adult Steller's eider
ABR Avian Research/USFWS Intra-Service Consultation	Disturbance	5 spectacled eider eggs/ducklings

Pioneer's Oooguruk Project	Habitat loss Collisions	3 spectacled eider eggs/ducklings 3 adult spectacled eiders
BP's 69Kv Powerline	Collisions	10 adult spectacled eiders over 50 years
BP's Liberty Project	Habitat loss Collisions	2 spectacled eider eggs/ducklings 1 adult spectacled eider
Intra-service on Subsistence Hunting Regulations 2007	No estimate of incidental take provided	
BP Alaska's Northstar Project	Collisions	≤ 2 adult spectacled eiders/year ≤ 1 adult Steller's eider/year
KMG Nikaitchuq Project	Habitat loss Collisions	2 spectacled eiders/year 7 adult spectacled eiders over 30 years
Akutan Transportation (2007)	Disturbance	20 adult Steller's eiders
Unalaska Harbor (2007)	Contaminants Collisions Habitat loss	3 adult Steller's eiders
Intra-Service Consultation 2007 on MBM Avian Influenza Sampling	Disturbance	6 spectacled eider eggs/ducklings
BLM 2007 Programmatic on Summer Activities in NPR-A	Disturbance	21 spectacled eider eggs/ducklings
Goodnews Bay Processor (2008)	Disturbance	28 adult Steller's eiders
Intra-service on Subsistence Hunting Regulations 2008	No estimate of incidental take provided	
BLM 2008 Programmatic on Summer Activities in NPR-A	Disturbance	56 spectacled eider eggs/ducklings
BLM 2009 Programmatic on Summer Activities in NPR-A	Disturbance	49 spectacled eider eggs/ducklings
BLM Northern Planning Areas of NPR-A (2008)	Disturbance Collision	87 spectacled eider eggs/ducklings/year 12 Steller's eider eggs/ducklings/year < 7 adult spectacled eiders < 1 adult Steller's eider
MBM/USFWS Intra-Service Consultation 2008	Disturbance	21 spectacled eider eggs/ducklings
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 Dr. Peterson's 2009 PTT project	Loss of Production Capture/surgery	130 spectacled eider eggs/ducklings 4 adult spectacled eiders
MMS Beaufort and Chukchi Sea Program Area Lease Sales (2009)	Collision	12 adult spectacled eiders <1 adult Steller's eider
Intra-Service, Migratory Bird 2010 Subsistence Hunting Regulations	No estimate of incidental take provided	
Intra-Service, Section 10 permit for Dr. Peterson's telemetry research on spectacled eider use of the the Chukchi and Beaufort Seas (2010)	Loss of Production Capture/handling/ surgery	130 spectacled eider eggs/ducklings 7 adult/juvenile spectacled eiders (lethal take) 108 adult/juvenile spectacled eiders (non-lethal take)
BLM programmatic for activities between June 5 and Oct 31, 2010	Disturbance	32 Spectacled eider eggs

Intra-Service, Migratory Bird Management goose banding on the North Slope of Alaska (2010)	Disturbance	4 spectacled eider eggs/ducklings
Intra-Service, Section 10 permit for USFWS eider survey work at Barrow (2010)	Disturbance Capture/handling	3 Steller's eider or spectacled eider clutches 90 pairs + 60 hens, Steller's eider 60 pairs + 60 hens, spectacled eider 1 Steller's eider or spectacled eider adult (lethal take) 7 ducklings Steller's eider or spectacled eider (lethal take) 30 Steller's eider or spectacled eider hens (nonlethal take) 40 Steller's eider or spectacled eider ducklings (nonlethal take)
Intra-Service, Section 10 permit for ABR Inc.'s eider survey work on the North Slope and at Cook Inlet (2010)	Disturbance	35 spectacled eider eggs/ducklings
Intra-Service, Migratory Bird 2011 Subsistence Hunting Regulations	Shooting	400 adult Steller's eiders (lethal take) 4 adult spectacled eiders (lethal take)

Research

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

The FWS has issued permits under Section 10 of the ESA to authorize take of endangered or threatened species for purposes of propagation, enhancement, or survival. Annual reporting requirements associated with §10 permits for both spectacled and Steller's eiders indicate 11 spectacled eider adults and 5 eggs have reportedly died as an indirect result of research activities since 1993 (due to the numerous amended actions and permits, and because of the variation and inconsistencies in reporting, accomplishing a precise tally of incidental take proved difficult).

From 1997 to present, the Service estimates approximately 1 Steller's eiders from the listed Alaska-breeding population has died incidental to research activities (based on a total of 37 Steller's eiders reportedly taken from the non-listed Pacific-wintering population, incidental to research activities, and the estimate that approximately 1% of the Pacific-wintering population are Alaska-breeding Steller's eiders). Since listing, there likely have been no listed Steller's eider adults intentionally taken (from a probabilistic standpoint), though there have been 16 permitted and 16 actual, direct and intentional takings of non-listed Steller's eider adults. Additionally, permits have been issued to salvage and opportunistically collect up to 68 Steller's eider eggs from the Alaska-breeding population for a captive breeding program at the Alaska Sea Life Center (ASLC). To date, 31 eggs have been taken. The eiders taken in these research programs

have provided biological information and the eggs have been used to establish a captive breeding population of the species to ultimately improve our understanding of their reproduction in the wild and help future efforts to recover the species.

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 arctic water bodies are draining and drying out during summer as the underlying permafrost thaws (Smith et al. 2005, Oechel et al. 1995). Further, many are losing water through increased evaporation and evapotranspiration resulting from longer ice-free periods, warmer temperatures, and longer growing seasons (Schindler and Smol 2006, 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 also resulting in changes in the algal and invertebrate communities that 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 decreases in extent and duration. 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 ranges 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 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 the Action Area are unclear, species with small populations are more vulnerable to environmental change (Crick 2004). Some species may increase in abundance or range with climate change, while others will suffer from reduced population size or range. The ultimate effects of climate change which will impact both the terrestrial and marine habitats of listed eiders are undetermined at present. While it is certain that listed eiders will be impacted by the effects of climate change on their terrestrial and marine habitats, it is presently impossible to predict the direction or magnitude of these individual impacts or their combined sum.

Summary of Environmental Baseline
Because this is a state-wide consultation with a very large Action Area (the ACP alone is about the size of Minnesota), the environmental baseline is necessarily also quite large and complex. The listed eiders are migrating to and breeding principally on the Y-K Delta and ACP during the Action, so that will focus the evaluation. As discussed above, because the Service has consulted upon these regulations since their inception in 2003, it now has several years of harvest survey information documentation of the effects of the action on listed species. The Service has also included information in the environmental baseline about the MOU between the subsistence community representatives and the Service describing the collaboration that will occur during the harvest to reduce/eliminate shooting mortality and injury of Steller's eiders. Thus, the environmental baseline, which describes the present human and natural context, provides the starting point for the Service's effects analysis.

5. EFFECTS OF THE ACTION ON LISTED SPECIES

5.1 Introduction
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.

Based upon the description of the proposed action, the Service concludes that there are two principal effects on Steller's and spectacled eiders. These are:

1. Direct and indirect habitat loss at Walakpa Field;
2. Disturbance during activities related to work at the East Barrow Field.

Subsequent sections discuss mechanisms, and estimates levels of impact.

5.2. Habitat Loss at Walakpa Field

Direct loss of habitat would occur by installation of gas field infrastructure onto 0.048 acres (0.0002 km^2) of tundra at Walakpa Field. Thus, 0.048 acres (0.0002 km^2) of nesting habitat would be rendered permanently unavailable to eiders. Additional indirect habitat loss would result from disturbance to eiders within a 200-m zone of influence surrounding new infrastructure. The area delineated by the zone of influence at Walakpa Field is 104.1 acres (0.42 km^2).

Spectacled eiders

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. Density polygons were used to estimate incidental take by multiplying approximate density by the estimated footprint size as described below.

The potential number of spectacled eider pairs displaced by new development at Walakpa Field was estimated by multiplying the highest estimated spectacled eider density estimate within the affected area by the extent of the affected area (0.42 km^2). For purposes of estimating impacts, the duration of the project impact is assumed to be 30 years. The Service assumes that spectacled eiders will be present and attempt to nest annually on the North Slope. Loss of production of 12 eggs or ducklings from the resulting estimate of 3 spectacled eider nests lost (or spectacled eider pairs displaced) over a 30-year project life was estimated as follows:

0.425 birds/km^2 × 0.5 nests/pair × 0.42 km^2 × 30 years = 2.68 nests.

Average clutch size for spectacled eiders in northern Alaska is 3.9 (Petersen et. al. 2000, Bart and Earnst 2005, Johnson et al. 2008). Using this figure, we estimate that activities described in this BO would result in the loss of production of 3 spectacled eider nests, resulting in the loss of 12 spectacled eider eggs or ducklings (3 × 3.9 = 11.7).

Steller's eiders

Steller's eiders nesting on the ACP are concentrated in near Barrow, AK. The Barrow Triangle (ABR) aerial survey (Obritschkewitsch and Ritchie 2011) 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. The ABR survey provides the best available estimates of Steller's eider densities for Walakpa Field, which is located south of the USFWS eider survey area near Barrow. Estimated densities for the ABR survey area range from 0.03–0.08 birds/km^2 in nesting years, except 2010. In 2010, when only 2 nests were found during ground surveys, density was 0.01 birds/km^2.

The potential number of Steller's eider pairs displaced by new development at Walakpa Field was estimated by multiplying the average density during the 6 nesting years within 1999–2009 (0.05 birds/km^2) by the extent of the affected area (0.42 km^2). The duration of the project impact is again assumed to be 30 years. The Service assumes that Steller's eiders will be present and attempt to nest annually on the North Slope. No appreciable

loss of production is anticipated from the resulting estimate of 0.32 nests lost (or Steller's eider pairs displaced) over a 30 year project life. The potential number of affected pairs was estimated as follows:

0.05 birds/km^2 × 0.5 nests/pair × 0.42 km^2 × 30 years = 0.31 nests.

To summarize, incidental take of 12 spectacled eider eggs or ducklings and no Steller's eiders may be caused by direct and indirect habitat loss at Walakpa Field.

5.3. Disturbance from Summer Activities at East Barrow Field

The area indirectly affected by proposed summer activities at the East Barrow Field and along the East Barrow pipeline is delineated by a zone of influence surrounding existing infrastructure within which eiders will be affected by disturbance resulting from gas field operations.

Two principal mechanisms by which disturbance can adversely affect reproductive success are:
1. Displacing adults and/or broods from preferred habitats during pre-nesting, nesting, brood rearing, and migration; and
2. Displacing females from nests, exposing eggs or small young to inclement weather or predators.

Several studies demonstrate negative effects of disturbance on waterfowl nesting success. Infrequently, waterfowl will permanently abandon nests after they are disturbed. On the YKD, investigators estimated that nest trapping resulted in a loss of 5% of cackler geese eggs due to desertion (Mickelson 1975). A single search of study plots for an investigator disturbance study done for spectacled eiders on the YKD caused the loss of 0.08% of egg production (Bowman and Stehn 2003). Gulls were attracted to, and more nests were destroyed at, eider nesting islands after disturbance (Ählund and Götmark 1989). However, in 1997 investigators marked and visited spectacled eider nests at varying schedules and found no difference in survival rates due to observer impact (Grand and Flint 1997). While the human activities in these studies differ from those associated with construction and operation of National Weather Service facilities, it is likely that the response of nesting birds to human-caused disturbance is somewhat similar.

Steller's and spectacled eider behavior appears to change with changing environmental conditions. The behavioral response of listed eiders to nesting disturbance is unknown. Some Steller's eiders nest and rear broods near the Barrow Airport and spectacled eiders have been seen nesting near the Deadhorse Airport (Service unpublished data). Quakenbush et. al. (1997) documented successful Steller's eiders nests within 40m of ATV trails at Barrow. These data suggest that some individuals may tolerate or habituate to disturbances such as frequent aircraft noise. However, individual tolerances are likely to vary, and the intensity of disturbance associated with the proposed action would, in most cases, be more variable and potentially more disturbing than that experienced by birds near the Barrow and Deadhorse airports. The Service anticipates some negative

impacts on reproductive success resulting from proposed activities related to the installation of new production wells at the East Barrow Field.

Work scheduled during pre-nesting and brood rearing
Proposed activities that may disturb eiders before and following the June 7–August 10 nesting window include 1) spring repairs to the East Barrow pipeline; 2) summer hydrotesting and repair of East Barrow pipeline; and 3) activities associated with rig work and camp operations.

Spring repairs to the East Barrow pipeline may occur as late as June 6, 2011. Eiders that arrive on the breeding grounds near Barrow during the last week of May and first week of June congregate in small flocks within the limited, thawed freshwater habitat available on the tundra at that time. Because we do not expect spring repair work to occur on thawed tundra or in preferred spring staging areas for eiders, we anticipate the risk of impacts to pre-nesting spectacled and Steller's eiders will be low.

Hydrotesting of the East Barrow pipeline, repair of detected leaks, and activities associated with rig work and camp operations at the East Barrow Field will occur no earlier than August 11, 2011. Transportation of some equipment and materials in support of project activities may also occur during late summer and fall 2011 and 2012 (demobilization), beginning no earlier than August 11. Work at the East Barrow Field and related activities will not occur until after eiders have hatched. These activities may disturb hens with broods that are foraging in the area. However, broods can easily move away from local disturbances and we expect that a hen with a brood would move to a perceived safe distance from project activities. Therefore, the Service does not anticipate significant impacts to spectacled or Steller's eiders from activities at the East Barrow Field, as described in Section 2, that are scheduled after August 10, 2011.

Work scheduled during the eider nesting period, June 7–August 10
In support of proposed activities at East Barrow Field, high risk equipment will be transported from the barge in Barrow directly to existing gravel pads at South Barrow and East Barrow Fields beginning as early as mid-July, 2011. Demobilization of high risk equipment to the 2012 barge will begin as early as mid-July 2012. Work involves loading, unloading, and staging of heavy equipment, including camp and rig modules, on existing gravel pads and require the presence of additional personnel in the field for extended periods during the nesting season. The Service expects these activities to result in high levels of disturbance to nesting eiders in the project area relative to those associated with normal gas field operations. Proposed activities may disturb nesting eiders to the extent that hens are flushed from their nests. Flushing events may result in damage to eggs by the departing hens, increased vulnerability of unattended eggs or ducklings to predation, and risk of eggs or ducklings dying from exposure if nests remain unattended for extended periods or are abandoned.

We estimated potential effects to nesting eiders in the study area using methods similar to those applied in section 5.2. However, we derived spectacled and Steller's eider densities from standard ground-surveys conducted from 1999–2007. Average bird densities

observed in those years were 0.29 birds/km^2 for spectacled eider and 0.63 birds/km^2 for Steller's eider. We assumed that both spectacled and Steller's eiders will be present and attempt to nest on the North Slope during the summers of 2011 and 2012. We estimated the size of the area in which nesting eiders may be affected by applying a 200-m zone of influence (see section 2) to the length of the East Barrow pipeline (1352.6 acres) and existing gravel pads at the East Barrow Field (281.5 acres). Thus the total area subject to disturbance was estimated to be 1634 acres or 6.61 km^2.

Incidental take of spectacled eiders. Loss of production of 4 eggs or ducklings per year from the resulting estimate of one spectacled eider nest lost per year was estimated as follows:

0.29 birds/km^2 × 0.5 nests/pair × 6.61 km^2 = 0.96 nests per year.

Average clutch size for spectacled eiders in northern Alaska is 3.9 (Petersen et. al. 2000, Bart and Earnst 2005, Johnson et al. 2008). Using this figure, we estimate that activities described in this BO would result in the loss of production of one spectacled eider nests, resulting in the loss of 4 spectacled eider eggs or ducklings (1 × 3.9 = 3.9).

Incidental take of Steller's eiders. Loss of production of 11 eggs or ducklings per year from the resulting estimate of two spectacled eider nest lost per year was estimated as follows:

0.63 birds/km^2 × 0.5 nests/pair × 6.61 km^2 = 2.08 nests per year.

Average clutch size for Steller's eiders near Barrow is 5.5 based on 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). Using this figure, we estimate that activities described in this BO would result in the loss of production of two Steller's eider nests, resulting in the loss of 11 Steller's eider eggs or ducklings (2 × 5.5 = 11).

To summarize, incidental take of 4 spectacled eider eggs or ducklings and 11 Steller's eiders eggs or ducklings in 2011 and an additional 4 spectacled eider eggs or ducklings and 11 Steller's eiders eggs or ducklings in 2012 may be caused by disturbance to nesting hens in the East Barrow project area.

5.5 Interrelated and Interdependent Actions

The project is not expected to lead to substantive changes in land use because proposed activities occur within or in close proximity to the existing footprint of gas field infrastructure.

To summarize, no incidental take of spectacled eiders or Steller's eiders is anticipated due to interrelated and interdependent actions.

6. 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 by the State of Alaska or the North Slope Borough 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 state or borough construction project in the area.

To summarize, no incidental take of spectacled eiders or Steller's eiders is anticipated due to cumulative effects.

7. CONCLUSION

After reviewing the proposed action, the current status of spectacled and Steller's eiders, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the North Slope Borough Barrow Gas Fields Well Drilling Program, as described in this BO, is not likely to jeopardize the continued existence of the spectacled eider or Steller's eider. Critical habitat has been designated for these species; however, the proposed action does not affect these areas, and no destruction or adverse modification of that critical habitat is expected. This BO's determination of non-jeopardy is based on the assumption that the USACE and its agents will consult with the Service on future activities at the Barrow Gas Fields that are not discussed in this document.

Regulations (51 CFR 19958) that implement section 7(a)(2) of the Act define "jeopardize the continued existence of" as "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species." In evaluating the impacts of the proposed project to Steller's and spectacled eiders, the Service identified direct and indirect impacts that could result from habitat loss and disturbance. However, the Service believes that the impacts to these species will be relatively low for the reasons given in the *Effects of the Action* and *Cumulative Effects* sections of this BO.

Using methods and logic explained in the Incidental Take Statement below, the Service estimates that incidental take of spectacled eider's would be 20 eggs/ducklings resulting from the loss of 3 nests from long-term habitat loss over an assumed 30 year project life, and the loss of one nest in 2011 and one nest in 2012 from disturbance related to summer activities. Incidental take of Steller's eiders is estimated as 22 eggs/ducklings resulting from the loss of two nests in 2011 and two nests in 2012 from disturbance related to summer activities.

The population of North Slope-breeding spectacled eiders is estimated at 12,916 (10,942–14,890 95% CI; Stehn et al. 2006). The population of Alaska-breeding Steller's eiders is estimated at 576 (as described in the *Status of the Species* section). If we assume that 100% of eggs/ducklings are recruited into the adult population, incidental take estimates for the proposed action would represent approximately 0.02% of the North Slope-breeding spectacled eider population and 4% of the Alaska-breeding Steller's eider breeding population. However, we expect that population-level effects of the proposed action would be substantially lower because only a small proportion of spectacled and Steller's eider eggs or ducklings on the North Slope would eventually survive to recruit into the breeding populations. Accordingly, the Service believes that the estimated level of incidental take will not significantly affect the likelihood of survival and recovery of listed eiders.

8. INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. "Harm" is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns 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).

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. 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.

As described in Section 5, *Effects of the Action*, the activities described and assessed in this BO may adversely affect Steller's and spectacled eiders through habitat loss at the material site, collision with structures, an increase in predators in the area, and oil spills.

Estimating take of listed eiders from the proposed project activities such as filling of wetlands and disturbance from rig work and related activities is extremely difficult. There is little information on tolerance of sea ducks to disturbance as a result of these types of human activities and their ability/willingness to relocate successfully to other areas once disturbed. The Service anticipates that incidental take of listed eiders will be difficult to detect because injury or death to eggs, young, or adults may not be directly observed.

Incidental take will occur from two sources: loss of habitat through direct fill and structures supported on pilings at Walakpa Field and disturbance from activities associated with the drilling of new production wells at East Barrow Field. Methods used to estimate incidental take for each of these are described in the *Effects of the Action* section. Table 8.1 provides a summary of the Service's incidental take estimates.

Table 8.1. Service's estimates of incidental take for the 2011–2012 Barrow Gas Fields Well Drilling Program project by species. Incidental take is quantified here as loss of production resulting from project activities for each species

Method	Spectacled Eider	Steller's Eider
Habitat loss	12 eggs/ducklings	none
Disturbance – 2011	4 eggs/ducklings	11 eggs/ducklings
Disturbance – 2012	4 eggs/ducklings	11 eggs/ducklings
Total incidental take	**20 eggs/ducklings**	**22 eggs/ducklings**

Despite the predicted incidental take, the Service does not foresee that the proposed project would result in jeopardy to the species, or destruction or adverse modification of critical habitat. This predicted level of incidental take may be reduced further by implementing the terms and conditions of this BO. However, the estimates of incidental take are based on few data and consultation may need to be re-initiated, and the BO amended, if incidental take is higher than predicted.

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.

9. REASONABLE AND PRUDENT MEASURES

These reasonable and prudent measures (RPMs) and their implementing terms and conditions aim to minimize the incidental take anticipated from activities described in this BO. As described in *Section 8 – Incidental Take Statement*, activities conducted by USACE and their agents are anticipated to lead to incidental take of spectacled eiders and Steller's eiders through long-term habitat loss and disturbance of nesting females during project implementation in 2011 and 2012.

RPM A – To reduce disturbance to nesting eiders, project activities within the action area should occur outside of the eider nesting window of June 7–August 10 to the extent practicable.

RPM B – To increase our understanding of the impact of disturbance on nesting Steller's and spectacled eiders, the location of eider nests and observed responses of these birds to activities associated with the proposed action should be reported.

10. TERMS AND CONDITIONS

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

RPM A – To reduce disturbance to nesting eiders, project activities within the action area should occur outside of the eider nesting window of June 7–August 10 to the extent practicable.

The NSB has scheduled most project activities outside of the eider nesting window. Changes to this schedule that affect the timing of proposed activities relative to eider nesting should be reported to USFWS so that potential effects to eiders can be evaluated. The USFWS will coordinate with the NSB through PRA during the 2011 and 2012 eider breeding seasons to establish earlier start dates for summer activities if USFWS eider survey results indicate that work may proceed earlier without affecting eider nest success.

RPM B – To increase our understanding of the impact of disturbance on nesting Steller's and spectacled eiders, the location of eider nests and observed responses of these birds to activities associated with the proposed action should be reported.

Any observations of eider nests should be provided to the Endangered Species Branch of the Fairbanks Fish and Wildlife Field Office by calling David Safine (907-367-3761, cell) or the Barrow USFWS office (907-852-2058) within 24 hours.

11. CONSERVATION RECCOMENDATIONS

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

12. REINITIATION NOTICE

This concludes formal consultation for the North Slope Borough's proposed Barrow Gas Fields Well Drilling Program. 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.

Thank you for your cooperation in the development of this biological opinion. An administrative record of this consultation is on file at the Fairbanks Fish and Wildlife Field Office, 101 12th Ave., Room 110, Fairbanks, Alaska 99701. If you have any comments or concerns regarding this biological opinion, please have your staff contact Ted Swem, Fish and Wildlife Biologist, Fairbanks Fish and Wildlife Field Office at (907) 456-0441.

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