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
December 5, 2014

Memorandum

To: Assistant Regional Director, Migratory Bird Management and State Programs

From: Endangered Species Branch Chief, Fairbanks Fish and Wildlife Field Office Ted Swem

Subject: Biological Opinion for Migratory Bird Subsistence Hunting in Alaska: Hunting Regulations for the 2015 Spring/Summer Harvest

This document transmits the U.S. Fish & Wildlife Service's (Service) Biological Opinion (BO) in accordance with section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA), on effects of the proposed 2015 Regulations for Migratory Birds Subsistence Harvest in Alaska (Regulations) on the listed spectacled eider (*Somateria fischeri*) and Alaska-breeding Steller's eiders (*Polysticta stelleri*). The Action is not likely to adversely affect the threatened polar bear (*Ursus maritimus*), or Northern sea otter (*Enhydra lutris kenyoni)* or the candidate species Pacific walrus (*Odobenus rosmarus divergens*), therefore polar bears, sea otters, and walrus are not discussed further in this biological opinion. Additionally, in previous BOs the Service provided a conference on the candidate species yellow-billed loon (*Gavia adamsii*). However on October 1, 2014, after reviewing the best scientific and commercial data available, the Service published a not warranted 12-month finding for the yellow-billed loon in the Federal Register (Vol. 79, No. 190). Therefore, the yellow-billed loon is not discussed further herein.

This BO is based on information provided in: 1) the Intra-agency Biological Assessment for 2010 proposed Alaska migratory bird subsistence hunt (BA; USFWS 2010); 2) the U.S. Fish & Wildlife Service Environmental Assessment: Hunting Regulations for the 2015 Spring/Summer Harvest (EA; AMBCC 2014); 3) current and historical survey data for spectacled and Steller's eiders; 4) published literature, unpublished reports; and 5) other sources of information.

This BO concludes the consultation regarding effects of the proposed 2015 Regulations for the migratory bird subsistence harvest in Alaska on listed and candidate species. An administrative record of this consultation is on file at FFWFO, 101 12th Ave., Room 110, Fairbanks, AK, 99701. If you have comments or concerns regarding this BO, please contact Ted Swem, Endangered Species Branch Chief, FFWFO at (907) 456-0441.

INTRA-SERVICE BIOLOGICAL OPINION

For

Hunting Regulations for the
2015 Spring/Summer Harvest

Consultation with the
U.S. Fish and Wildlife Service – Migratory Birds
Anchorage, Alaska

Prepared by:
Fairbanks Fish and Wildlife Field Office
U. S. Fish and Wildlife Service
101 12th Ave, Room 110
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December 5, 2014

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1. INTRODUCTION

This document transmits the U.S. Fish & Wildlife Service's (Service) Biological Opinion (BO) in accordance with section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA), on effects of the proposed 2015 Regulations for Migratory Birds Subsistence Harvest in Alaska (Regulations) on the listed spectacled eider (*Somateria fischeri*) and Alaska-breeding Steller's eiders (*Polysticta stelleri*). The Action is not likely to adversely affect the threatened polar bear (*Ursus maritimus*), or Northern sea otter (*Enhydra lutris kenyoni)* or the candidate species Pacific walrus (*Odobenus rosmarus divergens*), therefore polar bears, sea otters, and walrus are not discussed further in this biological opinion. Additionally, in previous BOs the Service provided a conference on the candidate species yellow-billed loon (*Gavia adamsii*). However on October 1, 2014, after reviewing the best scientific and commercial data available, the Service published a not warranted 12-month finding for the yellow-billed loon in the Federal Register (Vol. 79, No. 190). Therefore, the yellow-billed loon is not discussed further herein.

The proposed Regulations were developed by the Alaska Migratory Bird Co-management Council (AMBCC) involving the Alaska Department of Fish and Game, Alaska Native representatives, and the Service, and published by the Service on September 5, 2014 in the Federal Register (Vol. 79, No. 172). The objective of the Regulations is to enable the continuation of customary and traditional uses of migratory birds in Alaska with a spring and summer harvest, while ensuring conservation of migratory birds. The Regulations prescribe dates when harvesting of birds may occur, species that can be taken, and methods and means excluded from use. The rulemaking proposes region-specific harvest regulations that go into effect on April 2, 2015 and expire August 31, 2015. Annual rulemaking is necessary because the migratory bird harvest season is closed unless opened, and the regulations governing subsistence harvest of migratory birds in Alaska are subject to public review and annual approval.

Because regulations for a spring/summer subsistence harvest expire immediately after the hunt, new regulations must be promulgated each year by the Alaska Migratory Bird Co-Management Council. Thus potential impacts of a spring/summer subsistence harvest on listed and candidate species and critical habitat are evaluated each year by a section 7 consultation.

On March 19, 2010 the Service's Region 7 Office of Migratory Bird Management (MBM) provided the Fairbanks Fish and Wildlife Field Office (FFWFO) with a biological assessment that indicated the spring/summer subsistence harvest may affect spectacled and Steller's eiders. Therefore, a formal consultation was initiated regarding the Regulations. Because little new data or information are available, the FFWFO did not request a new biological assessment for the 2015 hunt. Specifically, this BO evaluates whether issuance of Regulations allowing a spring/summer subsistence hunt are likely to jeopardize the continued existence of listed and candidate species, or destroy or adversely modify designated critical habitat.

This BO is based on information provided in: 1) the Intra-agency Biological Assessment for 2010 proposed Alaska migratory bird subsistence hunt (BA; USFWS 2010); 2) the U.S. Fish & Wildlife Service Environmental Assessment: Hunting Regulations for the 2015 Spring/Summer Harvest (EA; AMBCC 2014); 3) current and historical survey data for spectacled and Steller's eiders; 4) published literature, unpublished reports; and 5) other sources of information.

This BO concludes the consultation regarding the effects of the proposed 2015 Regulations for the migratory bird subsistence harvest in Alaska on listed and candidate species. An administrative record of this consultation is on file at FFWFO, 101 12th Ave., Room 110, Fairbanks, AK, 99701. If you have comments or concerns regarding this BO, please contact Ted Swem, Endangered Species Branch Chief, FFWFO at (907) 456-0441.

2. DESCRIPTION OF THE PROPOSED ACTION

2.1 Background

Section 7(a)(2) of the ESA 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 or the Service, depending upon the protected species that may be affected.

For the Action described in this document, the action agency is the Region 7 Migratory Bird Management Office of the U.S. Fish and Wildlife Service, and consultation is being conducted with the Endangered Species Branch of the Fairbanks Fish and Wildlife Field Office. This section of the BO describes the Action Area and activities that may occur as a result of promulgating subsistence hunting regulations.

2.2 Proposed Action

The Service proposes to open a 2015 spring/summer harvest of migratory birds in Alaska from April 2, 2015 until August 31, 2015. To the extent possible, the harvest would be consistent with the customary and traditional subsistence harvest of migratory birds by Alaskan indigenous inhabitants, while providing for their long-term sustained use. Most species of Alaska's migratory birds will be open to the spring/summer subsistence harvest, and are listed in the Federal Register Proposed Rule. Species not listed open will remain closed, as well as some region-specific restrictions for certain open species for which there are local or specific concerns. Waterfowl that would remain closed to hunting and egg-gathering throughout Alaska are spectacled and Steller's eiders, emperor geese, yellow-billed loons[1], tundra swans, and the Aleutian cackling goose in certain areas. Cackling geese are closed throughout Alaska for egg gathering only, and black brant are closed for egg gathering on the Yukon Kuskokwim Delta (Y-K Delta) and the North Slope.

[1] Yellow-billed Loons: Annually, up to 20 yellow-billed loons caught inadvertently in subsistence fishing nets in the North Slope Region may be kept for subsistence use. Individuals must report each yellow-billed loon inadvertently caught while subsistence gill net fishing to the North Slope Borough Department of Wildlife Management by the end of the season.

To ensure the subsistence harvest does not jeopardize the continued existence of spectacled and Steller's eiders, and to minimize impacts to these species, the Service developed a combination of regulations and Conservation Measures for implementation in 2015.

The regulations and conservation measures address threats and management needs for listed species. Below are portions of the Final Rule that are particularly protective of listed eiders.

Regulations:

- Spectacled and Steller's eiders are closed to hunting and egg gathering.
- Possession or use of lead shot or other toxic shot while hunting is prohibited.
- A 30-day harvest closure for migratory birds during their peak nesting period.

While the Service believes some provisions in the regulations should remain, in 2011 a request to eliminate the shooting hours provision from the regulations was considered and ultimately adopted. Although we believe that shooting hours minimize the risk of inadvertent shooting of closed species when light levels are low and misidentification is more likely, we believe we can work with our North Slope partners to provide the same protections to listed eiders in other ways. To this end, the 2015 proposed regulations do not include the shooting hours provision along the coastal areas encompassing Point Hope, Point Lay, Wainwright, and Barrow.

Two additional legal requirements published in the Final Rule aid in compliance with the Regulations and the verification of harvest:

- No person shall at any time, by any means, or any manner, possess or have in custody any migratory bird or part thereof, taken in violation of these regulations.
- Upon request from a Service law enforcement officer, hunters taking, attempting to take, or transporting migratory birds taken during the subsistence harvest season must present them to the officer for species identification.

The Final Rule also specifically describes the Service's authority to prescribe emergency regulations, if necessary, to protect Steller's eiders:

- §92.32 *Emergency regulations to protect Steller's eiders*. Upon finding that continuation of these subsistence regulations would pose an imminent threat to the conservation of threatened Steller's eiders, the U.S. Fish and Wildlife Service Alaska Regional Director, in consultation with the Co-management Council, will immediately under § 92.21 take action as is necessary to prevent further take. Regulation changes implemented could range from a temporary closure of duck hunting in a small geographic area to large-scale regional or State-wide long-term closures of all subsistence migratory bird hunting. Such closures or temporary suspensions will remain in effect until the Regional Director, in consultation with the Co-management Council, determines that the potential for additional Steller's eiders to be taken no longer exists.

Thus, several spectacled and Steller's eider management needs are addressed by the Final Rule. It clarifies for subsistence users that Service law enforcement personnel have authority to verify species of birds possessed by hunters; it clarifies that it is illegal to possess any bird closed to harvest; and it describes how the Service's existing authority of prescribing emergency regulations would be implemented, if necessary, to protect Steller's eiders.

In addition to the regulations, conservation measures will be implemented to:

1. Verify compliance of migratory bird hunting regulations and the harvest of species;
2. Enhance a culture of conservation through continuing education of hunters; and
3. Continue to gather data on listed eiders allowing more informed management decisions.

The Service believes the immediate need of verifying compliance of migratory bird hunting regulations and harvest of species will be accomplished through the continued presence of the Service's Office of Law Enforcement (OLE). This immediate monitoring provides data allowing for additional management actions to be implemented if they are appropriate to protect these species. While this provides immediate, short term protection, we recognize that stewardship for listed eiders and voluntary compliance of the migratory bird hunting regulations is the desired long-term goal. The Service commits to continuing the outreach, education, and communication programs developed and continually modified by the Service and its partners. In addition, the Service will continue biological monitoring to gather data critical to managers tasked with making informed management decisions.

Details of the conservation measures are provided below.

Service Enforcement of Migratory Bird Regulations and Harvest Verification
OLE will have a presence on the North Slope during the migratory bird hunts, commensurate with the threat to the Steller's eiders and other species of concern. This presence will include Barrow and outlying villages. The Service believes this will help increase community understanding and acceptance of the shooting mortality problem, deter violations, and obtain compliance with the regulations.

While present in Barrow and other villages, OLE will document mortality of Steller's eiders and other species of concern, including shooting mortality, to ensure that appropriate and timely corrective actions are taken to prevent further mortality.

OLE will participate in outreach activities related to enforcement of regulations as requested.

Education, Communication, and Outreach
The Service commits to continuing the education, communication, and outreach programs. Successful conservation of listed eiders in Alaska will require partnerships with local residents, subsistence hunters, land owners, and many others. The Service will continue to build effective working relationships that are beneficial to all parties and result in listed eider conservation. An example of our commitment to working with partners to promote eider conservation is to assist the partners by providing staff time and funding to produce outreach materials. The Service will continue to meet with the North Slope Borough, Ukpeaġvik Inupiat Corporation, Inupiat Community of the Arctic Slope, Native Village of Barrow, and local community members to refine the education and outreach plan, including implementation of education programs for the 2015 hunt. Examples of programs include the Migratory Bird Fair/Spring Gathering, Eider Journey, science camps, outreach to hunters on the roads and at Pigniq (duck camp), radio shows, flyers, meetings, and others. Additionally, the Service in collaboration with North Slope partners will routinely monitor and verify that listed eiders are not being shot and will evaluate

the effectiveness of our education, communication, and outreach efforts. If mortality is detected, the Service will reassess current outreach and education strategies, determine where changes are needed, and heighten targeted outreach and targeted law enforcement efforts commensurate with the risk. If it is determined that success is not likely, the Service Regional Director may institute emergency regulations in consultation with AMBCC until impacts can be revaluated and minimized.

Biological Monitoring

Spectacled and Steller's eider aerial and ground-based breeding surveys are used to locate pre-breeding and breeding concentrations of listed eiders. Amongst other things these data identify high use areas, habitat preferences, and population size and trends which help inform management decisions. In 2015, the Service will continue to perform the following annual surveys:

- Arctic Coastal Plain (ACP) aerial survey for spectacled and Steller's eiders (June; MBM)
- Barrow-area aerial survey for spectacled and Steller's eiders (June; ABR)
- Barrow ground survey for Steller's eiders (June; FFWFO)
- Barrow ground survey for Steller's eiders nests and broods (June-August; FFWFO)

2.3 Action Area

The Action Area is that area in which direct and indirect effects of the proposed Action may occur. The Action Area for this consultation is all lands of included areas within the 11 regions established by the AMBCC for the subsistence hunt, excluding national monuments, parks, and preserves managed by the National Park Service and not specifically designated as open to subsistence (Figure 2.1; AMBCC 2014). Eligible participants for the proposed subsistence hunt are permanent residents, regardless of race, located within the established regions. Overall, this Action is available to 13 percent of the state's total population of 686,293 (U.S. Census Bureau 2009, USFWS 2009). The Action Area contains foraging, resting, breeding, migrating, molting, and wintering habitat for spectacled and Steller's eiders (listed as threatened under the ESA).

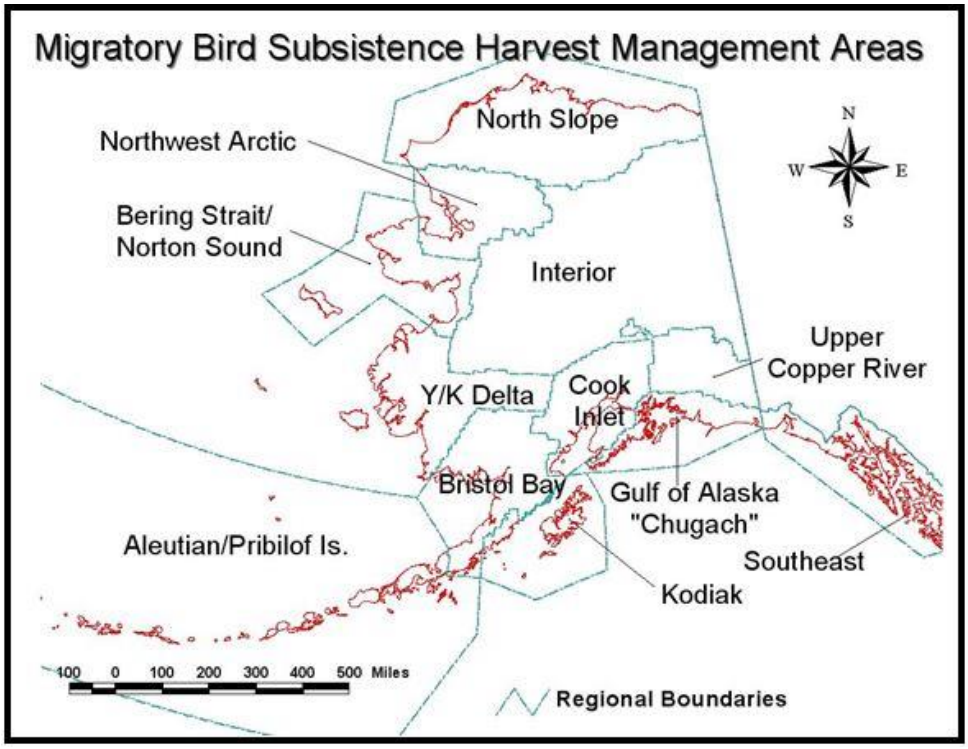


Figure 2.1. Regional boundaries for subsistence harvest of migratory birds, excluding national monuments, parks, and preserves managed by the National Park Service and not specifically designated as open to subsistence (AMBCC 2014)

3. STATUS OF SPECIES AND CRITICAL HABITAT

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

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

3.1 Spectacled eider

Spectacled eiders (Figure 3.1A) were listed as threatened throughout their range on May 10, 1993 (USFWS 1993) based on indications of steep declines in the two Alaska-breeding populations. There are three primary spectacled eider populations, corresponding to breeding grounds on Alaska's North Slope, Y-K Delta, and northern Russia. The Y-K Delta population declined 96% between the early 1970s and 1992 (Stehn et al. 1993). Data from the Prudhoe Bay oil fields (Warnock and Troy 1992) and information from Native elders at Wainwright, Alaska (R. Suydam, pers. comm. in USFWS 1996) suggested concurrent localized declines on the North Slope, although data for the entire North Slope breeding population were not available. Spectacled eiders molt in several discrete areas (Figure 3.1B) during late summer and fall, with birds from different populations and genders apparently favoring different molting areas (Petersen et al. 1999). All three spectacled eider populations overwinter in openings in pack ice of the central Bering Sea, south of St. Lawrence Island (Petersen et al. 1999; Figure 3.2), where they remain until March–April (Lovvorn et al. 2003).

Life History

Breeding – In Alaska, spectacled eiders breed primarily on the North Slope (ACP) and the Y-K Delta. On the ACP, spectacled eiders breed north of a line connecting the mouth of the Utukok River to a point on the Shaviovik River about 24 km (15 mi) inland from its mouth, with breeding density varying across the ACP (Figure 3.2). Although spectacled eiders historically occurred throughout the coastal zone of the Y-K Delta, they currently breed primarily in the central coast zone within about 15 km (9 mi) of the coast from Kigigak Island north to Kokechik Bay (USFWS 1996). However, sightings on the Y-K Delta have also occurred both north and south of this area during the breeding season (R. Platte, USFWS, pers. comm. 1997).

Spectacled eiders arrive on the ACP breeding grounds in late May to early June. Numbers of breeding pairs peak in mid-June and decline 4–5 days later when males begin to depart from the breeding grounds (Smith et al. 1994, Anderson and Cooper 1994, Anderson et al. 1995, Bart and Earnst 2005). Mean clutch size reported from studies on the Colville River Delta was 4.3 (Bart and Earnst 2005). Spectacled eider clutch size near Barrow has averaged 3.2–4.1, with clutches of up to eight eggs reported (Quakenbush et al. 1995, Safine 2011). Incubation lasts 20–25 days (Kondratev and Zadorina 1992, Harwood and Moran 1993, Moran and Harwood 1994, Moran 1995), and hatching occurs from mid- to late July (Warnock and Troy 1992).

Nest initiation on Kigigak Island on the Y-K Delta occurs from mid-May to mid-June (Lake 2007). Incubation lasts approximately 24 days (Dau 1974). Mean spectacled eider clutch size is higher on the Y-K Delta compared to the ACP. Mean annual clutch size ranged from 3.8–5.4 in coastal areas of the Y-K Delta (1985–2011; Fischer at al. 2011), and 4.0–5.5 on Kigigak Island (1992–2011; Gabrielson and Graff 2011), with clutches of up to eight eggs reported (Lake 2007).

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

Survivorship – Nest success is highly variable and thought to be primarily influenced by predators, including gulls (*Larus* spp.), jaegers (*Stercorarius* spp.), and red (*Vulpes vulpes*) and arctic foxes (*Vulpes lagopus*). In arctic Russia, apparent nest success was estimated to be < 2% in 1994 and 27% in 1995; low nest success was attributed to predation (Pearce et al. 1998). Apparent nest success in 1991 and 1993–1995 in the Kuparuk and Prudhoe Bay oil fields on the ACP was also low, varying from 25–40% (Warnock and Troy 1992, Anderson et al. 1998). On Kigigak Island in the Y-K Delta, nest survival probability ranged from 0.06–0.92 from 1992–2007 (Lake 2007); nest success tended to be higher in years with low fox numbers or activity (i.e., no denning) or when foxes were eliminated from the island prior to the nesting season. Bowman et al. (2002) also reported high variation in nest success (20–95%) of spectacled eiders on the Y-K Delta, depending on year and location.

(A)

(B)

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

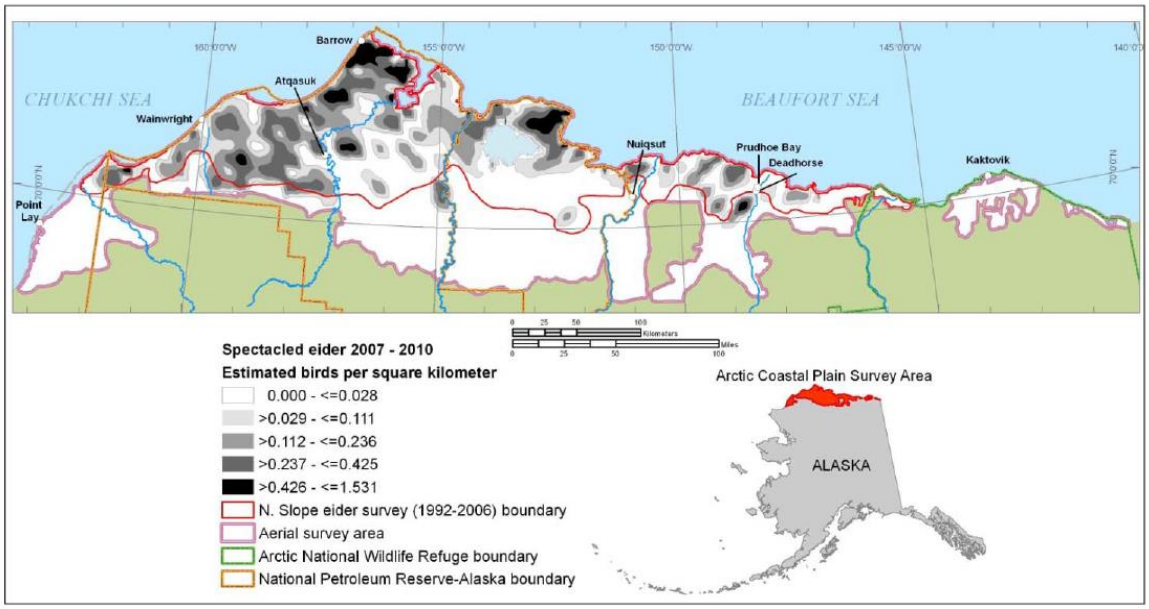


Figure 3.2. Density distribution of spectacled eiders observed on aerial transects sampling 57,336 km^2 of wetland tundra on the North Slope of Alaska during early to mid-June, 2007–2010 (Larned et al. 2011).

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

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

Fall migration and molting – As with many other sea ducks, spectacled eiders spend the 8–10 month non-breeding season at sea. Satellite telemetry and aerial surveys led to the identification of spectacled eider migrating, molting, and wintering areas. These studies are summarized in Petersen et al. (1995 and 1999) and Larned et al. (1995). Results of more recent satellite

telemetry research (2008–2011) are consistent with earlier studies (Matt Sexson, USGS, pers. comm.). Phenology, spring migration and breeding, including arrival, nest initiation, hatch, and fledging, is 3–4 weeks earlier in western Alaska (Y-K Delta) than northern Alaska (ACP); however, phenology of fall migration is similar between areas. Individuals depart breeding areas July–September, depending on breeding status and success, and molt in September–October (Matt Sexson, USGS, pers. comm.).

Males generally depart breeding areas on the ACP when 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 move rapidly (average travel of 1.75 days), over nearshore 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). Males appeared to prefer areas near large river deltas such as the Colville River where open water is more prevalent in early summer when much of the Beaufort Sea is still frozen. Most adult males marked with satellite transmitters in northern and western Alaska in a recent satellite telemetry study migrated to northern Russia to molt (USGS, unpublished data). Results from this study also suggest that male eiders likely follow coast lines but also migrate straight across the northern Bering and Chukchi seas en route to northern Russia (Matt Sexson, USGS, pers. comm.).

Females generally depart the breeding grounds later, when more of the Beaufort Sea is ice-free, allowing 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 males (Petersen et al. 1999). The greater use of the Beaufort Sea and offshore areas by females was attributed to the greater availability of open water when females depart the area (Petersen et al. 1999, TERA 2002). Recent telemetry data indicate that molt migration of failed/non-breeding females from the Colville River Delta through the Beaufort Sea is relatively rapid, 2 weeks, compared to 2–3 months spent in the Chukchi Sea (Matt Sexson, USGS, pers. comm.).

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

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

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

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

Wintering – Spectacled eiders generally depart molting areas in late October/early November (Matt Sexson, USGS, pers. comm.), migrating offshore in the Chukchi and Bering seas to a single wintering area in pack-ice lead complexes south/southwest of St. Lawrence Island (Figure 3.1B). In this relatively shallow area, > 300,000 spectacled eiders (Petersen et al. 1999) rest and feed, diving up to 230 ft (70 m) to eat bivalves, other mollusks, and crustaceans (Cottam 1939, Petersen et al. 1998, Lovvorn et al. 2003, Petersen and Douglas 2004).

Spring migration – Recent information indicates spectacled eiders likely 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 observations in the eastern Chukchi Sea have documented dozens to several hundred common eiders (*Somateria mollissima)* and spectacled eiders in spring leads and several miles offshore in relatively small openings in rotting sea ice (W. Larned, USFWS; J. Lovvorn, University of Wyoming, pers. comm.). Woodby and Divoky (1982) documented large numbers of king (*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 spring eider passage in this region. Preliminary results from an ongoing satellite telemetry study conducted by the USGS Alaska Science Center (Figure 3.3; USGS, unpublished data) suggest that spectacled eiders also use the lead system during spring migration.

Adequate foraging opportunities and nutrition during spring migration are critical to spectacled eider productivity. Like most sea ducks, female spectacled eiders do not feed substantially on the breeding grounds, but produce and incubate eggs while living primarily off body reserves

(Korschgen 1977, Drent and Daan 1980, Parker and Holm 1990). Clutch size, a measure of reproductive potential, was positively correlated with body condition and reserves obtained prior to arrival at breeding areas (Coulson 1984, Raveling 1979, Parker and Holm 1990). Body reserves must be maintained from winter or acquired during the 4-8 weeks (Lovvorn et al. 2003) of spring staging, and Petersen and Flint (2002) suggest common eider productivity on the western Beaufort Sea coast is influenced by conditions encountered in May to early June during 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), suggesting that spectacled eiders maintain or enhance their physiological condition during spring staging.

Abundance and trends

The most recent rangewide estimate of abundance of spectacled eiders was 369,122 (364,190–374,054 90% CI), obtained by aerial surveys of the known wintering area in the Bering Sea in late winter 2010 (Larned et al. 2012a). Comparison of point estimates between 1997 and 2010 indicate an average of 353,051 spectacled eiders (344,147-361956 90% CI) in the global population over that 14-year period (Larned et al. 2012b).

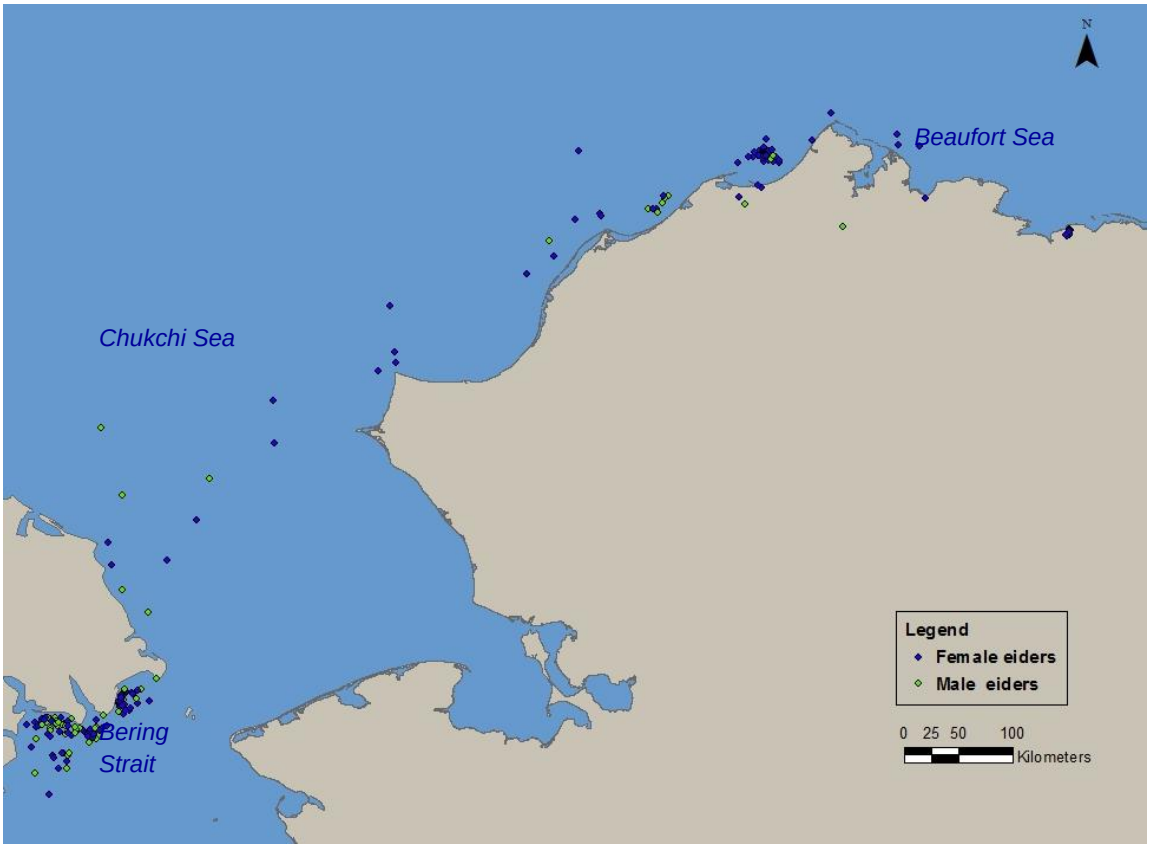


Figure 3.3. Spectacled eider satellite telemetry locations for 12 female and 7 male spectacled eiders in the eastern Chukchi Sea from 1 April – 15 June 2010 and 1 April – 15 June 2011. Additional locations from the northern coast of Russia are not shown. Eiders were tagged on the North Slope during the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

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

The Y-K Delta spectacled eider population is thought to have declined by about 96% from the 1970s to 1992 (Stehn et al. 1993). Evidence of the dramatic decline in spectacled eider nesting on the Y-K Delta was corroborated by Ely et al. (1994), who found a 79% decline in eider

nesting near the Kashunuk River between 1969 and 1992. Aerial and ground survey data indicated that spectacled eiders declined 9–14% per year from 1985–1992 (Stehn et al. 1993). Further, from the early 1970s to the early 1990s, the number of pairs on the Y-K Delta declined from 48,000 to 2,000, apparently stabilizing at that low level (Stehn et al. 1993). Before 1972, an estimated 47,700–70,000 pairs of spectacled eiders nested on the Y-K Delta in average to good years (Dau and Kistchinski 1977).

Fischer et al. (2011) used combined annual ground-based and aerial survey data to estimate the number of nests and eggs of spectacled eiders on the coastal area of the Y-K Delta in 2011 and evaluate long-term trends in the Y-K Delta breeding population from 1985 to 2011. In a given year, the estimated number of nests reflects the minimum number of breeding pairs in the population and does not include non-nesting individuals or nests that were destroyed or abandoned (Fischer et al. 2011). The total number of spectacled eider nests on the Y-K Delta in 2011 was estimated at 3,608 (SE 448), the second lowest estimate over the past 10 years. The average population growth rate based on these surveys was 1.049 (90% CI = 0.994–1.105) in 2002–2011 and 1.003 (90% CI = 0.991–1.015) in 1985–2011 (Fischer et al. 2011). Log-linear regression based solely on the long-term Y-K Delta aerial survey data indicate positive population growth rates of 1.073 (90% CI = 1.046–1.100) in 2001–2010 and 1.070 (90% CI = 1.058–1.081) in 1988–2010 (Platte and Stehn 2011).

Spectacled eider recovery criteria

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

3.2 Steller's Eider

The Steller's eider is a small sea duck with circumpolar distribution and the sole member of the genus *Polysticta*. Males are in breeding plumage (Figure 3.4) from early winter through mid-summer (Figure 3.4). Females are dark mottled brown with a white-bordered blue wing speculum. Juveniles are dark mottled brown until fall of their second year, when they acquire breeding plumage.

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

Steller's eiders are divided into Atlantic and Pacific populations; the Pacific population is further subdivided into the Russia-breeding and Alaska-breeding populations. The Alaska-breeding population of Steller's eiders was listed as threatened on July 11, 1997 based on:

- Substantial contraction of the species' breeding range on the ACP and Y-K Delta;
    - Steller's eiders on the North Slope historically occurred east to the Canada border (Brooks 1915), but have not been observed on the eastern North Slope in recent decades (USFWS 2002).
    - Only 10 Steller's eider nests have been recorded on the Y-K Delta since 1970 (Hollmen et al. 2007).
- Reduced numbers breeding in Alaska; and
- Resulting vulnerability of the remaining Alaska-breeding population to extirpation (USFWS 1997).

In Alaska, Steller's eiders breed almost exclusively on the ACP and winter, along with the majority of the Russia-breeding population, in south-central Alaska (Figure 3.5). Periodic non-breeding of Steller's eiders coupled with low nesting and fledging success, has resulted in very low productivity (Quakenbush et al. 2004). 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, including historical breeding areas on the Y-K Delta, a molting and staging area in the Kuskokwim Shoals, and marine molting areas at Seal Islands, Nelson Lagoon, and Izembek Lagoon (USFWS 2001). No critical habitat for Steller's eiders has been designated on the ACP.

Life History

Breeding – Steller's eiders arrive in small flocks of breeding pairs on the ACP in early June. Nesting on the ACP is concentrated in tundra wetlands near Barrow, AK (Figure 3.6) and occurs at lower densities elsewhere on the ACP from Wainwright east to the Sagavanirktok River

(Quakenbush et al. 2002). Long-term studies of Steller's eider breeding ecology near Barrow indicate periodic non-breeding by the entire local population. From 1991-2010, Steller's eiders nests were detected in 12 of 20 years (Safine 2011). Periodic non-breeding by Steller's eiders near Barrow seems to correspond to fluctuations in lemming populations and risk of nest predation (Quakenbush et al. 2004). During years of peak abundance, lemmings are a primary food source for predators including jaegers, owls, and foxes (Pitelka et al. 1955*a*, Pitelka et al. 1955*b*, MacLean et al. 1974, Larter 1998, Quakenbush et al. 2004). It is hypothesized that Steller's eiders and other ground-nesting birds increase reproductive effort during lemming peaks because predators preferentially select (prey-switch) for hyper-abundant lemmings and nests are less likely to be depredated. (Roselaar 1979, Summers 1986, Dhondt 1987, and Quakenbush et al. 2004). Furthermore, during high lemming abundance, Steller's eider nest survival (the probability of at least one duckling hatching) has been reported as a function of distance from nests of jaegers and snowy owls (Quakenbush et al. 2004). These avian predators aggressively defend their nests against other predators and this defense likely indirectly imparts protection to Steller's eiders nesting nearby.

Steller's eiders initiate nesting in the first half of June and nests are commonly located on the rims of polygons and troughs (Quakenbush et al. 2000, 2004). Mean clutch size at Barrow was 5.4 ± 1.6 SD (range = 1–8) over 5 nesting years between 1992 and 1999 (Quakenbush et al. 2004). Breeding males depart following onset of incubation by the female. Nest survival is affected by predation levels, and averaged 0.23 (±0.09, standard error [SE]) from 1991–2004 before fox control was implemented near Barrow and 0.47 (±0.08 SE) from 2005–2012 during years with fox control (USFWS, unpublished data). Steller's eider nest failure has been attributed to depredation by jaegers (*Stercorarius* spp.), common ravens (*Corvus corax*), arctic fox (*Alopex lagopus*), glaucous gulls (*Larus hyperboreus*), and in at least one instance, polar bears (Quakenbush et al. 1995, Rojek 2008, Safine 2011, Safine 2012).

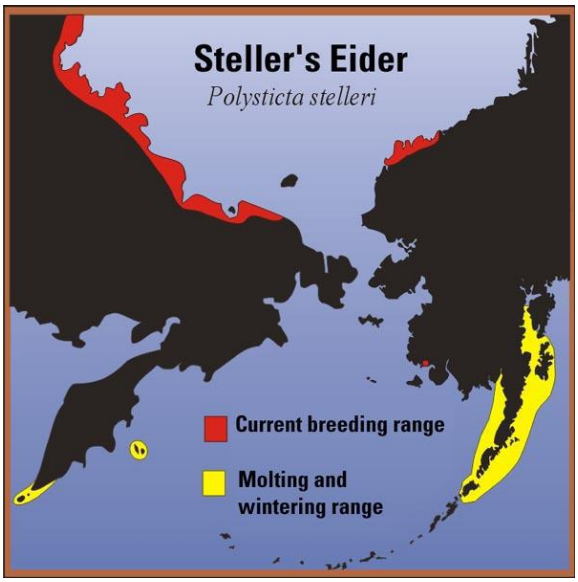


Figure 3.5. Steller's eider distribution in the Bering, Chukchi, and Beaufort seas.

Hatching occurs from mid-July through early August, after which hens move their broods to adjacent ponds with emergent vegetation dominated by *Carex* spp. and *Arctophila fulva* (Quakenbush et al. 2000, Rojek 2006, 2007, and 2008). In these brood-rearing ponds, hens with ducklings feed on aquatic insect larvae and freshwater crustaceans. In general, broods remain within 0.7 km of their nests (Quakenbush et al. 2004); although, movements of up to 3.5 km from nests have been documented (Rojek 2006 and 2007). Large distance movements from hatch sites may be a response to drying of wetlands that would normally have been used for brood-rearing (Rojek 2006). Fledging occurs 32–37 days post hatch (Obritschkewitsch et al. 2001, Quakenbush et al. 2004, Rojek 2006 and 2007).

Information on breeding site fidelity of Steller's eiders is limited. However, ongoing research at Barrow has documented some cases of site fidelity in nesting Steller's eiders. Since the mid-1990s, eight banded birds that nested near Barrow were recaptured in subsequent years, and some of these birds were recaptured more than once. Time between capture events ranged from 1 to 12 years and distance between nests ranged from 0.1 to 6.3 km (USFWS, unpublished data).

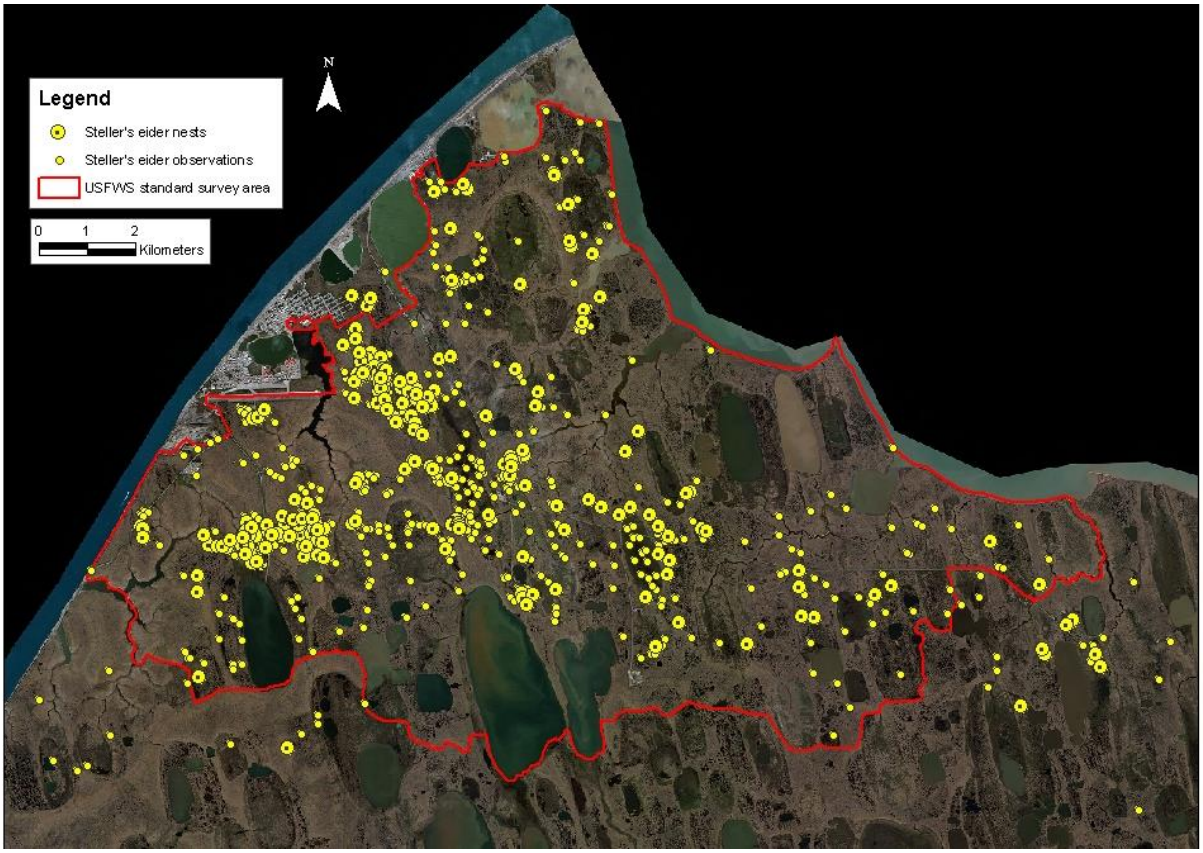


Figure 3.6. Steller's eider nest locations (1991–2010) and breeding pair observations (1999–2010). The red border represents the standard annual survey area. This survey is expanded beyond the standard area in some years.

Localized movements – Timing of departure from the breeding grounds near Barrow differs between sexes and between breeding and non-breeding years. In breeding years, male Steller's eiders typically leave the breeding grounds in late June to early July after females begin incubating (Obritschkewitsch et al. 2001, Quakenbush et al. 1995, Rojek 2006 and 2007). Females with fledged broods depart the breeding grounds in late August and mid-September to rest and forage in freshwater and marine habitat near the Barrow spit prior to fall migration along the Chukchi coast. Females with broods are often observed 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 staging daily in Elson Lagoon, North Salt Lagoon, Imikpuk Lake, and the Chukchi Sea from late August to mid-September (USFWS, unpublished data).

Before fall migration in breeding and non-breeding years, some Steller's eiders rest and forage in in coastal waters near Barrow including Elson Lagoon, North Salt Lagoon, Imikpuk Lake, and the vicinity of Pigniq (Duck Camp; Figure 3.7). In breeding years, these flocks are primarily composed of males that remain in the area until the second week of July, while in non-breeding years, flocks are composed of both sexes and depart earlier than in nesting years (J. Bacon, North Slope Borough Department of Wildlife Management [NSBDWM], pers. comm.).

Safine (2012) investigated post-hatch movements of 10 Steller's eider hens with VHF transmitters in 2011. Most (8 of 10) females successfully reared broods to fledging. From late August through early September, females and fledged juveniles were observed in nearshore waters of the Chukchi and Beaufort seas from Point Barrow south along the coast approximately 18 km. During this period, marked Steller's eiders and broods frequented areas traditionally used for subsistence waterfowl hunting (e.g., Duck Camp; Figure 3.7).

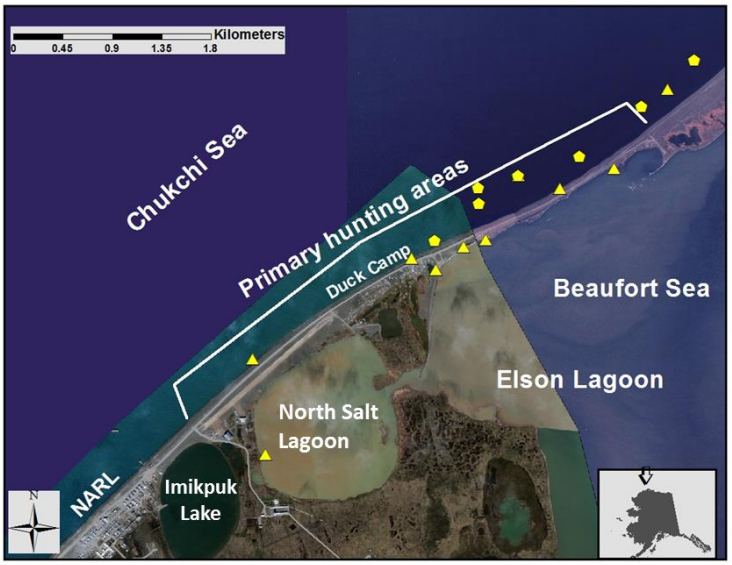


Figure 3.7. Some post-breeding and pre-migration staging areas for Steller's eiders near Barrow, Alaska. Locations of Steller's eider hens with successfully-fledged (triangles) and failed broods (pentagons) from mid-August to early September 2011.

Wing molt – Following departure from the breeding grounds, Steller's eiders migrate to southwest Alaska where they undergo complete flightless molt for about 3 weeks. Preferred molting areas are shallow with extensive eelgrass (*Zostera marina*) beds and intertidal mud and sand flats where Steller's eiders forage on bivalve mollusks and amphipods (Petersen 1980, 1981; Metzner 1993).

The Russia- and Alaska-breeding populations both molt in southwest Alaska, and banding studies found at least some individuals had a high degree of molting site fidelity in subsequent years (Flint et al. 2000). Primary molting areas include the north side of the Alaska Peninsula (Izembek Lagoon, Nelson Lagoon, Port Heiden, and Seal Islands; Gill et al. 1981, Petersen 1981, Metzner 1993) as well as the Kuskoskwim Shoals in northern Kuskokwim Bay (Martin et al. *in prep*). Larned (2005) also reported > 2,000 eiders molting in lower Cook Inlet near the Douglas River Delta, and smaller numbers of molting Steller's have been reported around islands in the Bering Sea, along the coast of Bristol Bay, and in smaller lagoons along the Alaska Peninsula (e.g., Dick and Dick 1971; Petersen and Sigman 1977; Wilk et al. 1986; Dau 1987; Petersen et al. 1991).

Winter distribution – After molt, many Pacific-wintering Steller's eiders disperse throughout the Aleutian Islands, Alaskan Peninsula, and western Gulf of Alaska including Kodiak Island and lower Cook Inlet (Figure 3.8; Larned 2000a, Martin et al. *in prep*), although thousands may remain in molting lagoons unless freezing conditions force departure (USFWS 2002). The Service estimates the Alaska-breeding population comprises only ~ 1% of the Pacific-wintering population of Steller's eiders. Wintering Steller's eiders usually occur in shallow waters (< 10 m deep), within 400 m of shore or in shallow waters further offshore (USFWS 2002). However, Martin et al. (*in prep*) reported substantial use of habitats > 10 m deep during mid-winter, although this use may reflect nocturnal rest periods or shifts in availability of food resources (Martin et al. *in prep*).

Spring migration – During spring migration, thousands of Steller's eiders stage in estuaries along the north coast of the Alaska Peninsula and, in particular, at Kuskokwim Shoals in late May (Figure 3.8; Larned 2007, Martin et al. *in prep*). Larned (1998) concluded that Steller's eiders show strong site fidelity to specific areas[2] during migration, where they congregate in large numbers to feed before continuing northward.

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

Figure 3.8. Distribution of Alaska-breeding Steller's eiders during the non-breeding season, based on locations of 13 birds implanted with satellite transmitters in Barrow, Alaska, during June 2000 and June 2001. Marked locations include all those at which a bird remained for at least three days. Onshore summer use areas comprise locations of birds that departed Barrow, apparently without attempting to breed in 2001 (USFWS 2002).

Spring migration usually includes movements along the coast, although some Steller's eiders may make straight line crossings of water bodies such as Bristol Bay (W. Larned, USFWS, pers. comm. 2000). Despite numerous aerial surveys, Steller's eiders have not been observed during migratory flights (W. Larned, USFWS, pers. comm. 2000). Steller's eiders likely use spring leads for feeding and resting as they move northward, although there is little information on distribution or habitat use after departure from spring staging areas.

Migration patterns relative to breeding origin – Information is limited on migratory movements of Steller's eiders in relation to breeding origin, and it remains unclear where the Russia- and Alaska-breeding populations converge and diverge during their molt and spring migrations. Martin et al. (*unpublished data*) attached satellite transmitters to 14 Steller's eiders near Barrow in 2000 and 2001. Despite the limited sample, there was disproportionately high use of

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

Alaska-breeding population abundance and trends – Stehn and Platte (2009) evaluated Steller's eider population and trends from three aerial surveys on the ACP:

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

In 2007, the ACP and NSE surveys were combined under a single ACP survey design. Previously, surveys differed in spatial extent, timing, sampling intensity, and duration, and consequently, produced different estimates of population size and trend for Steller's eiders. These estimates, including results from previous analyses of the ACP and NSE survey data (Mallek et al. 2007, Larned et al. 2009), are summarized in Table 3.2. Most observations of Steller's eider from both surveys occurred within the boundaries of the NSE survey (Figure 3.9).

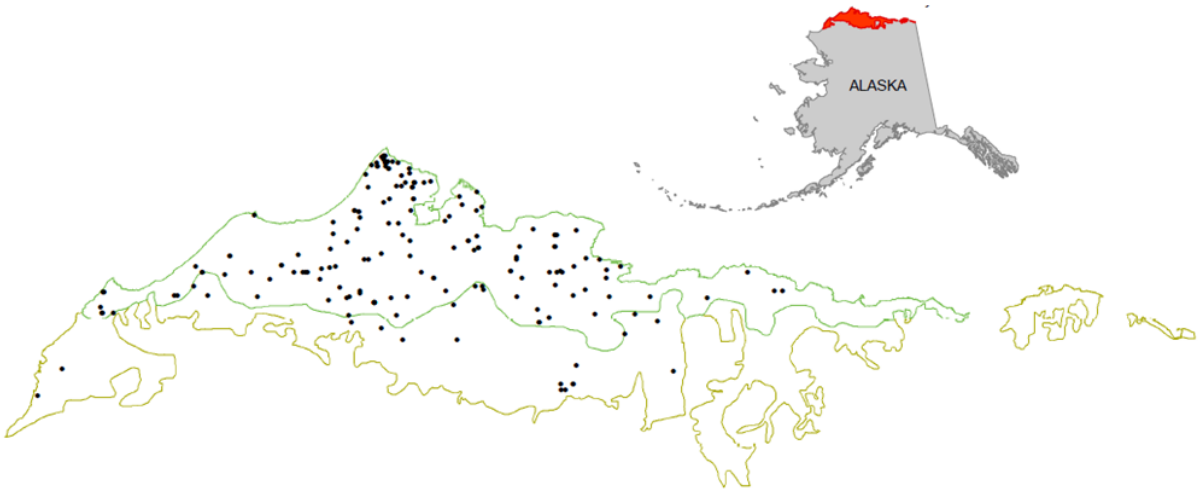


Figure 3.9. All Steller's eider sightings from the ACP survey (1989–2008) and the North Slope eider (NSE) survey (1992–2006). The ACP survey encompasses the entire area shown (61,645 km^2); the NSE includes only the northern portion outlined in green (30,465 km^2; modified from Stehn and Platte 2009).

Following assessment of potential biases inherent in both surveys, Stehn and Platte (2009) identified a subset of the NSE survey data (1993–2008) that were determined to be "least confounded by changes in survey timing and observers." Based on this subset, the average population index[3] for Steller's eiders on the ACP was 173 (90% CI 88–258) with an estimated growth rate of 1.011 (90% CI 0.857–1.193). Average population size of Steller's eiders breeding on the ACP was estimated at 576 (292–859, 90% CI; Stehn and Platte 2009) assuming a detection probability of 30%[4]. Currently, this analysis provides the best available estimate of the Alaska-breeding Steller's eider population size and growth rate for the ACP. Note that these estimates are based on relatively few actual observations of Steller's eiders with none detected in some years.

The annual Barrow Triangle (ABR) survey provides more intensive coverage (50%, 1999–2004; 25–50%, 2005–2010) of the northern portion of the ACP. This survey has been conducted since 1999 over a 2,757 km^2 area south of Barrow (Figure 3.10) to compliment ground surveys closer to Barrow. Estimated Steller's eider density for the ABR survey area ranges from <0.01–0.03 birds/km^2 in non-nesting years to 0.03–0.08 birds/km^2 in nesting years. The estimated average population index for Steller's eiders within the Barrow Triangle was 99.6 (90% CI 55.5–143.7; Stehn and Platte 2009) with an estimated growth rate of 0.934 (90% CI 0.686–1.272). If we assume the same 30% detection probability applied to NSE estimates, average population size of Steller's eiders breeding in the Barrow Triangle area would be 332 (185–479, 90% CI).

Breeding population near Barrow, Alaska – The tundra surrounding Barrow supports the only significant concentration of Steller's eiders nesting in North America. Barrow is the northernmost community on the ACP and standardized ground surveys for eiders have been conducted near Barrow since 1999 (Figure 3.6; Rojek 2008). Counts of males are the most reliable indicator of Steller's eider presence because females are cryptic and often go undetected in counts. The greatest concentrations of Steller's eiders observed during Barrow ground surveys occurred in 1999 and 2008 with 135 and 114 males respectively (Table 3.2; Safine 2011). Total nests found (both viable[5] and post-failure) ranged from 0–78 between 1991 and 2011, while the number of viable nests ranged from 0–27. Steller's eider nests were found in 14 of 22 years (64%) between 1991 and 2012 (Safine 2013).

[3] Geographically extrapolated total Steller's eiders derived from NSE survey counts.
[4] Detection probability of 30% with a visibility correction factor of 3.33 was selected based on evaluation of estimates for similar species and habitats (Stehn and Platte 2009).
[5] A nest is considered viable if it contains at least one viable egg.

Table 3.2. Steller's eider males, nests, and pair densities recorded during ground-based and aerial surveys conducted near Barrow, Alaska 1999–2012 (modified from Safine 2013).

	Overall ground-based survey area			Standard Ground-based Survey Area[a]		Aerial survey of Barrow Triangle		
Year	Area (km^2)	Males counted	Pair density ($males/km^2$)	Males counted	Pair density ($males/km^2$)	Males counted	Pair density ($males/km^2$)[b]	Nests found near Barrow
1999	172	135	0.78	132	0.98	56	0.04	36
2000	136	58	0.43	58	0.43	55	0.04	23
2001	178	22	0.12	22	0.16	22	0.02	0
2002	192	1	<0.01	0	0	2	<0.01	0
2003	192	10	0.05	9	0.07	4	<0.01	0
2004	192	10	0.05	9	0.07	6	<0.01	0
2005	192	91	0.47	84	0.62	31	0.02	21
2006	191	61	0.32	54	0.40	24	0.02	16
2007	136	12	0.09	12	0.09	12	0.02	12
2008	166	114	0.69	105	0.78	24	0.02	28
2009	170	6	0.04	6	0.04	0	0	0
2010	176	18	0.10	17	0.13	4	0.01	2
2011	180	69	0.38	59	0.44	10	0.01	27
2012	176	61	0.35	55	0.41	37	0.03	19

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

Steller's Eider Recovery Criteria

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

Criteria used to determine when species are recovered are often based on historical abundance and distribution, or on the population size required to ensure that extinction risk, based on population modeling, is tolerably low. For Steller's eiders, information on historical abundance is lacking, and demographic parameters needed for accurate population modeling are poorly understood. Therefore, the Recovery Plan for Steller's Eiders (USFWS 2002) establishes interim recovery criteria based on extinction risk, with the assumption that numeric population goals will be developed as demographic parameters become better understood. Under the Recovery Plan, the Alaska-breeding population would be considered for 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.

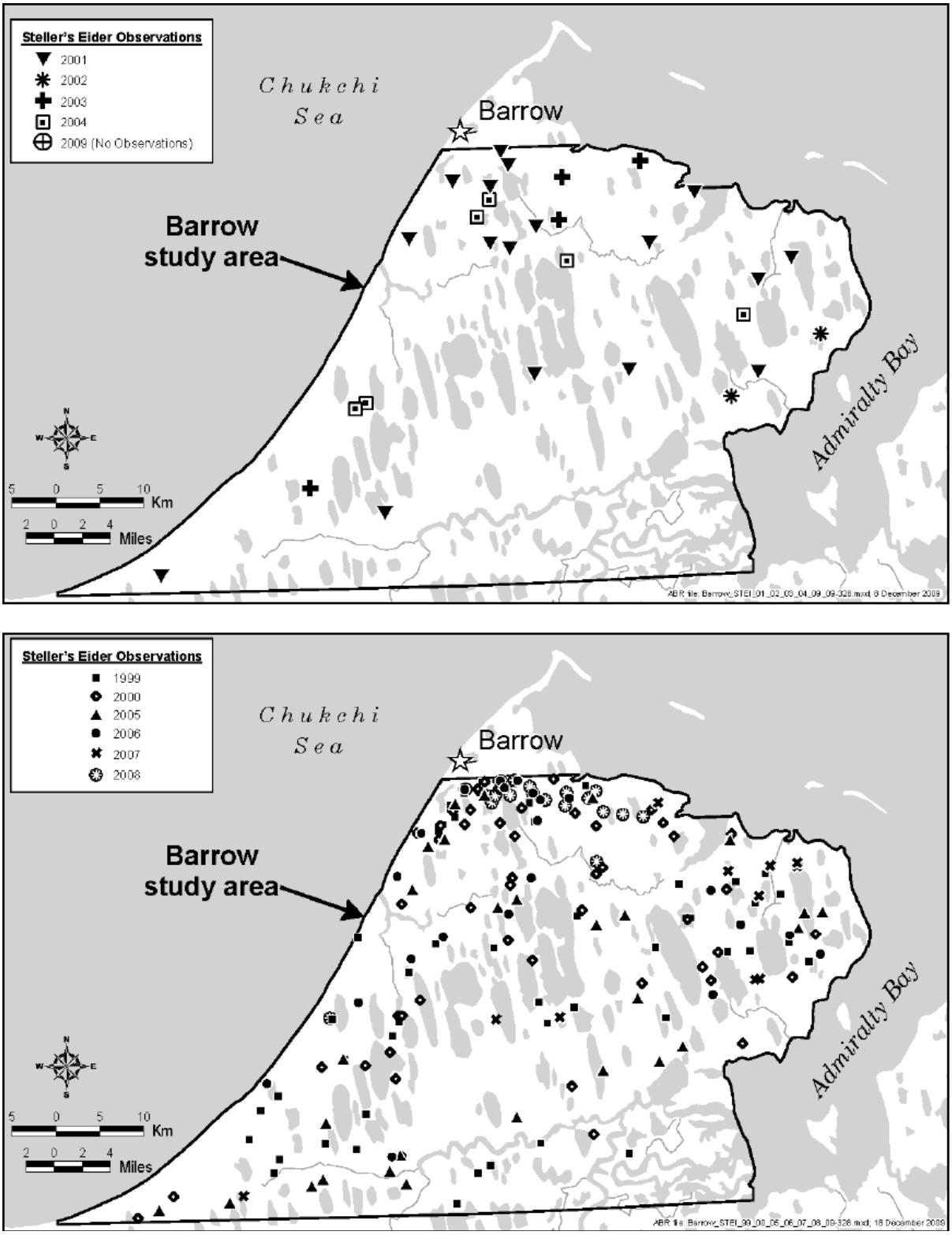


Figure 3.10. Locations of Steller's Eiders observed by ABR, Inc. during aerial surveys in non-breeding (top) and breeding years (bottom) near Barrow, Alaska, June 1999–2009 (Obritschkewitsch and Ritchie 2011).

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 Spectacled and Steller's Eiders

Status in the Action Area

The North Slope breeding population of spectacled eiders (approximately 11,254 breeding birds), 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), spectacled and Steller's eiders can be moving from wintering to breeding areas, on breeding areas, 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 Y-K 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.

Data from annual aerial surveys adjusted by a surrogate visual correction factor estimates the North Slope-breeding population of spectacled eiders is approximately 11,254 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 3.10).

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 (including ingestion of spent lead shot), 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.

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 listed eider populations, but this has not been substantiated. However, increasing predator populations are a concern, and Steller's eider studies at Barrow have attributed poor breeding success to high predation rates (Obritschkewitsch et al. 2001), and in years where arctic fox removal was conducted at Barrow prior to and during Steller's eider nesting, nest success appears to have increased significantly (Rojek 2008, Safine 2011).

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 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 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 almost 90% of the North Slope breeding habitat of spectacled eiders, and virtually all currently occupied nesting habitat for the Alaska-breeding population of Steller's 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 Minerals Management Service'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 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 Appendix 8. 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 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.

Appendix 8 illustrates the number and diversity of Actions that required section 7 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.

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 Service 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. 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 effects of climate change (Quinlan et al. 2005, Schindler and Smol 2006, Smol et al. 2005). While climate change will likely affect individual organisms and communities it is difficult to predict with certainty how these effects will manifest. Biological, climatological, and hydrologic components of the ecosystem are interlinked and operate on varied spatial, temporal, and organizational scales with feedback between each component (Hinzman et al. 2005).

There are a wide variety of changes occurring across the circumpolar Arctic. Arctic landscapes are dominated by freshwater wetlands (Quinlan et al. 2005), which listed eiders depend on for forage and brood rearing. As permafrost thaws, some water bodies are draining (Smith et al. 2005, Oechel et al. 1995), or drying due to increased evaporation and evapotranspiration during prolonged ice-free periods (Schindler and Smol 2006, and Smol and Douglas 2007). In addition, productivity of some lakes and ponds is increasing in correlation with elevated nutrient inputs from thawing soil (Quinlan et al. 2005, Smol et al. 2005, Hinzman et al. 2005, and Chapin et al. 1995) and other changes in water chemistry or temperature are altering algal and invertebrate communities, which form the basis of the Arctic food web (Smol et al. 2005, Quinlan et al. 2005).

With reduced summer sea ice coverage, the frequency and magnitude of coastal storm surges has increased. During these events, coastal lakes and low lying wetlands are often breached, altering soil/water chemistry as well as floral and faunal communities (USGS 2006). When coupled with

softer, semi-thawed permafrost, reductions in sea ice have significantly increased coastal erosion rates (USGS 2006), which may reduce available coastal tundra habitat over time.

Changes in precipitation patterns, air and soil temperatures, and water chemistry are also affecting terrestrial communities (Hinzman et al. 2005, Prowse et al. 2006, Chapin et al. 1995), and the range of some boreal vegetation species is expanding northward (Callaghan et al. 2004). Climate-induced shifts in distributions of predators, parasites, and disease vectors may also have significant effects on listed and un-listed species. Climate change may also cause mismatched phenology between listed eider migration, development of tundra wetland invertebrate stocks, fluctuation of small mammal populations, and corresponding abundance of predators (Callaghan et al. 2004, Quakenbush and Suydam 1999).

While the impacts of climate change are on-going and the ultimate effects on listed eiders within the action area are unclear, species with small populations are more vulnerable to the impacts of environmental change (Crick 2004). Some species may adapt and thrive under changing environmental conditions, while others decline or suffer reduced biological fitness.

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 a Memorandum of Understanding 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 AND CRITICAL HABITAT

The following section discusses the possible effects of the Action on listed and candidate species. This discussion includes, where appropriate, quantitative information from harvest survey reports, published literature, agency reports, and qualitative information from Traditional Ecological Knowledge, anecdotal observations, results of recent or ongoing research on the species, the Intra-agency Conference for Proposed 2010 Alaska Migratory Bird Spring/Summer Subsistence Hunt (USFWS 2010), and best professional judgment regarding the species' availability and vulnerability to harvest.

Harvest survey reports used in this evaluation are derived primarily from three sources:

1) 1965–2006 Bird harvest data for western and northern Alaska were summarized in Huntington (2009). This summary included surveys conducted in selected villages and years by a range of organizations and 1985–2002 annual harvest monitoring on the Y-K

Delta and semi-annual 1995–2002 harvest monitoring in the Bristol Bay region conducted in the context of the Goose Management Plan; (Appendices 1 and 2);

2) A draft report summarizing subsistence harvest surveys sponsored by the North Slope Borough for 1994-2003 (Bacon et al. 2011; Appendix 3).

3) 2004–2011 Bird and egg harvest data produced by the annual harvest monitoring program of the Alaska Migratory Bird Co-Management Council (AMBCC) (Naves 2009a, 2009b, 2011, 2012, and 2014; Appendices 2, 3, 5, 6,and 7). This program was created to implement provisions of the Migratory Bird Treaty Act Amendment, which allowed legal spring-summer subsistence harvest of migratory birds in Alaska. Data has been reported by management regions (further divided in sub-regions) and harvest seasons (spring, summer, and fall). These data were not included in Huntington (2009).

In using harvest survey reports to evaluate harvest, it is important to consider their reliability is affected by a number of unquantifiable biases. Identified biases include sampling flaws or measurement error such as targeting unrepresentative households or villages, inaccurate recall by survey respondents, reluctance to report illegally-taken species, mischaracterization of fishing by-catch as hunting harvest, lack of detection of unrecovered killed or crippled birds, and errors in data collection (Huntington 2009, Omelak et al. 2009, Naves 2009a, USFWS 2010). Additionally, for rare species, survey coverage may not be adequate to detect harvest since it occurs at low levels, particularly in large villages. Each of these biases has likely affected the accuracy of survey data, but the direction and magnitude of each, and how they cumulatively affect the estimates, remains unknown. Additionally, coverage has varied among years, and methods and sampling designs have evolved over time, compromising comparison among years or over other intervals (Georgette 2000 and Wentworth 2004, as cited in Huntington 2009). Further, the available harvest survey data contain considerable evidence of misidentification among species. Although we find numerous examples where other species appear to have been incorrectly reported as listed or candidate species ("false positives"), it follows that systemic confusion over identification among closely-related or similar species will also have resulted in "false negatives" where listed or candidate species have been incorrectly reported as other species. How these negative and positive biases balance out cannot be determined from the available information. The evidence of biases including misidentification and their possible influence on the reliability of harvest estimates is discussed below, on a species-specific basis.

This BO exclusively pertains to the Alaska Migratory Bird Spring/Summer Subsistence Hunt (subsistence hunt). It is important to note that in assessing the effects of the subsistence hunt, we also included the effects of subsistence harvest in the fall season. Waterfowl hunting in Alaska is defined by the Service as two separate hunting periods, governed by different regulations in April – August and in September – February. Several methodological reasons make it difficult to divide the available harvest survey data separately into these two distinct categories. First, survey methods have changed over time; in early surveys, eider harvest was not separated by time period. Second, harvest surveys are generally (but not always) conducted after the end of the fall hunt, when hunters are asked to recall the number of birds shot before August 31, and the number shot afterward. As most hunters probably do not see the August 31 date as particularly noteworthy, and significant time has passed between the early spring hunt and the day the survey

takes place, it is reasonable to assume that assigning harvest accurately to two different time periods would be difficult.

The fall hunt will be considered in a separate Biological Opinion developed by the Service's Washington Office. However, because of the difficulty with splitting the subsistence harvest data into two different time periods, we will consider the total annual harvest in this effects analysis. This is a more conservative approach that will allow us to ensure we are considering the total effect of the subsistence harvest. Further, we reason that precise allocation of impacts to the correct subsistence-related increment is essential only in the event that our final conclusion were to jeopardize the continued existence of listed and candidate species. If our final conclusion, after summing all identified increments of impact, is non-jeopardy, it follows that each subset of this total i.e., both the spring/summer subsistence and fall hunts is also non-jeopardy.

5.1 Spectacled Eiders

Vulnerability of Spectacled Eiders to Harvest

Spectacled eiders are at risk to shooting during the subsistence harvest during their spring and fall migrations along the western coast and North Slope of Alaska. Because they often fly in mixed-species flocks, and are similar size to common and king eiders, spectacled eiders can be difficult to distinguish from other eiders that can be legally hunted; thus they are subject to misidentification and inadvertent harvest during migration. They may also be taken by hunters that are unaware of that fact that spectacled eiders cannot be legally hunted, and by hunters not inclined to comply with species-specific closures.

Spectacled eiders breed on the Y-K Delta and the North Slope of Alaska, where nests are broadly dispersed (Figs. 3.1 and 3.2). Breeding spectacled eiders are not found in unusually large concentrations near villages or areas of high human activity, and their dispersed nesting distribution probably prevents a large proportion of the nesting population from being subject to possible harvest.

Although data are lacking, molting spectacled eiders may be at risk from shooting. Spectacled eiders molting in Ledyard Bay and Norton Sound may be shot during the course of other legal subsistence activities (e.g., marine mammal hunting by boat) in July and August. However, during winter, most spectacled eiders occur in ice leads and polynyas south of St. Lawrence Island, where they are likely inaccessible to hunters.

Based on limited information, we expect that spectacled eiders are at greatest risk from shooting during the subsistence harvest on their spring and fall migrations, and to a lesser degree on their breeding and molting areas.

Harvest Survey Data

Huntington (2009) summarizes harvest survey data from several sources from various years between 1972 and 2007, but spatial coverage is incomplete and varies annually. The only year that has significant survey coverage on the North Slope (five villages) is 1992, with reported harvest of 995 spectacled eiders. Fuller and George (1997) suggested that some of these birds were misidentified and may have been king or common eiders. In the Northwest Arctic region

spectacled eider harvest was not identified specifically in the data; however, total reported eider harvest in this region ranged from 0 to 196 annually, and may have included common, king, spectacled and/or Steller's eiders. In the Bering Strait – Norton Sound region, annual reported harvest ranged from 0 – 517 spectacled eiders. The Y-K Delta region has the most complete historical data set of harvest, since Alaska Department of Fish and Game conducted annual subsistence surveys in the region from 1985 to 2005 (except 1988 and 2003), with reported annual harvest of spectacled eiders ranging from 20 (2005) to 305 (1986). Reported annual harvest of spectacled eiders in the Bristol Bay region ranges from 0 to 156. Not all regions and sub-regions, or all years, are represented in this data; in addition, methodology varied. Therefore, it is impossible to predict 2015 harvest levels from these data.

Bacon et al. (2011) is another source of harvest data for villages on the North Slope from 1994-2003. Of particular interest are the harvest estimates of 253 spectacled eiders from Wainwright in May and June, 2003. These data support the supposition that spectacled eiders are susceptible to harvest on migration, but this single report cannot be assumed to be representative of normal harvest levels.

Harvest of spectacled eiders was reported by AMBCC in four regions: North Slope, Bristol Bay, Y-K Delta, and Bering Strait – Norton Sound. Estimates of annual harvest in the North Slope and Y-K Delta regions, where spectacled eiders nest, range from 9 to 392 and 13 to 225, respectively. Harvest estimates ranged from 11 to 231 in the Bristol Bay region and 6 to 863 in the Bering Strait – Norton Sound region.

Spectacled eider harvest data may be plagued by misidentification among eider species. For example, if Steller's eiders, which are significantly smaller in size and have behaviors that distinguish them from other species, are misidentified as other eiders, it follows that spectacled eiders would be even more likely to be misidentified, because they are closer in size to common and king eiders and also fly in mixed flocks.

While the variability and accuracy of harvest estimates may be affected by misidentification, reports of spectacled eider harvest in the four regions are consistent with spectacled eider distribution and thus do not indicate any misidentification bias based on likelihood of occurrence in a particular area. It is plausible that spectacled eiders are harvested in their two primary nesting areas in Alaska, the North Slope and Y-K Delta. As they winter and migrate through the Bering Strait – Norton Sound region, it is also reasonable to assume that spectacled eiders may be harvested there. Little is known about the presence of spectacled eiders in the Bristol Bay region; in fact, this area is not within the documented range of the species in published reports (Peterson et al., 2000). However, due to Bristol Bay's proximity to the Y-K Delta breeding grounds, it is possible that non-breeding, failed-breeding, or post-breeding individuals may temporarily occupy Bristol Bay, providing possible legitimacy to these reports of harvested birds (B. McCaffery,Y-K Delta NWR, pers. comm.).

Other Available Information Regarding Harvest

Discussion with North Slope hunters and observations of Service employees confirm that some spectacled eiders are taken during the subsistence hunt. North Slope hunters report that spectacled eiders often fly in mixed flocks with king and common eiders and are inadvertently

shot on occasion. Service biologists and enforcement agents in Barrow have documented shot spectacled eiders along the roads, in hunters' possession, and hanging from racks.

Summary
While the accuracy of harvest estimates may be affected by misidentification, reports of spectacled eider harvest in the four regions are generally consistent with known or feasible spectacled eider distribution and thus do not indicate obvious errors based on likelihood of occurrence. Several factors could bias estimates high, but it is possible that some also bias estimates low. These biases cannot be quantified or cumulatively assessed, which seriously constrains the precision with which we can estimate harvest; however, these data, combined with information on spectacled eider availability, direct observations, and information from local residents, suggest that roughly tens to hundreds of spectacled eiders are likely harvested each year, but more precise estimates are not possible with the available information.

Loss of Eggs/Chicks –Spectacled and Steller's Eiders
Proposed subsistence harvest seasons coincide with sensitive periods such as egg laying, incubation, and brood rearing, for both listed eider species.

Egg harvesters target goose nests, and especially those of colonially nesting species of geese. While it is true that eiders sometimes nest near and among colonially nesting geese, we do not believe the nests of tundra-nesting eiders, such as spectacled and Steller's eiders, are typically targeted by egg collectors because they tend to nest at lower density and their nests are very cryptic. Yet, listed eiders and their nest contents could be collected or disturbed by serendipitous discovery.

Egg collection is probably reduced to some extent by subsistence harvest closures designed to protect nests and broods during the middle of the nesting season. On the North Slope, the proposed regulations include a 30-day closure June 15 – July 15; on the Y-K Delta, the dates of the 30-day closure vary annually with current year nesting phenology and are not yet established for 2015 (AMBCC 2014). The closure is likely most effective near Barrow, where increased outreach and OLE efforts have been successful at announcing and enforcing the closure, particularly since 2008. The closure does not encompass the entirety of the listed eider nesting season, and it is possible that some illegal egg collection of other species occurs during the closure, so some harvest of listed eider eggs may occur.

Limited egg-gathering data presented by Trost and Drut (2001 and 2002) suggest that collection of spectacled or Steller's eider eggs is low, with an average of seven spectacled eider eggs and one Steller's eider egg taken annually between 1992 and 2001. The 2001 Pacific Flyway Data Book (Trost and Drut 2001) reported annual average egg harvest for the years 1995, 1997 and 1999 ranges between 4 and 84 for spectacled eiders and up to 1 for Steller's eiders in the Bristol Bay region. Because the Bristol Bay region is well outside the breeding range of spectacled and Steller's eiders, the reported harvest from that region calls the reliability of these data into question.

More recently, AMBCC subsistence harvest surveys have reported take of Steller's eider eggs in two regions during 2004-2011 (Naves 2009a, Naves 2011, Naves 2012, Naves 2014). The Y-K

Delta region reported 12 Steller's eider eggs in 2007 and 66 in 2009. Steller's eider egg harvest was reported in the Bering Strait-Norton Sound region in 3 of 5 years it was surveyed by AMBCC, with harvest estimates ranging from 40 to 120 annually. The same two regions reported take of spectacled eider eggs: the only report of spectacled eider egg harvest on the Y-K Delta was from the mid coast sub-region in 2008, with an estimate of 109 eggs harvested; and the Bering Strait/Norton Sound region reported spectacled eider egg harvest in 3 of 5 years surveyed, with estimates of 23 in 2004,48 in 2005, and 49 in 2010. No listed eider eggs were reported taken in the North Slope region.

Similar to the harvest survey data, egg collection data reported in harvest surveys are subject to potential bias, and several examples of misidentification are apparent based on species distribution information, so caution must be used in interpreting results. For example, Fay and Cade (1959) reported nesting Steller's eiders on St. Lawrence Island as recently as the 1950s, but no data currently suggests that a breeding population of Steller's eiders or spectacled eiders in the Bering Strait/Norton Sound region exists. Likewise, the number of Steller's eiders nesting on the Y-K Delta is extremely small and probably non-existent in some years (Flint and Herzog. 1999.). Therefore data suggesting Steller's eider egg collection in the Bering Strait/ Norton Sound region are probably erroneous, and Steller's eider egg collection reports from the Y-K Delta are either anomalous or erroneous.

Spectacled eiders nest in significant numbers on the Y-K Delta (see *Status of the Species*), therefore take of eggs in this region is possible. However, previously reported numbers (Naves 2009a) are probably small because spectacled eider nests are normally sparsely distributed as compared to targeted species such as geese, and the closure of harvest during the middle of the nesting period probably discourages egg collection.

Therefore, given that: 1) subsistence hunting and egg collection are closed during the egg-laying and incubation stages of spectacled and Steller's eiders on their primary nesting areas of the North Slope and Y-K Delta; 2) egg collectors tend to target other species; and, 3) although biased by some unknown amount, harvest surveys suggest that low numbers of listed eider eggs are collected; we estimate that the proposed subsistence regulations will result in low tens of spectacled eider eggs, and no Steller's eider eggs, collected annually throughout Alaska.

Lead Contamination- spectacled and Steller's eiders

Spring subsistence hunting may result in the deposition of lead shot into freshwater environments, especially near villages on the Y-K Delta and the North Slope. Ingestion of lead shot by listed eiders could occur during the breeding season, particularly for breeding hens and young birds that forage in shallow tundra ponds. Steller's eiders may be more vulnerable to lead poisoning during egg laying and incubation as they continue to forage throughout nesting, whereas spectacled eider females largely fast during incubation. Ducklings could be exposed to lead pellets in ponds after they hatch and begin foraging in tundra ponds.

The toxic effect of lead poisoning varies among individuals, but includes lethal and sublethal effects (Hoffman 1990). Ingestion of spent lead shot reduced annual survival of spectacled eiders on the Y-K Delta in Alaska (Franson et al. 1995, Flint et al. 1997, Flint and Grand 1997, Grand et al. 1998, Flint and Herzog 1999). Similar rates of exposure have been found in long-

tailed ducks (*Clangula hyemalis*). Steller's eiders breeding near Barrow on the North Slope showed high levels and rates of exposure (Trust et al. 1997, A. Matz, unpublished data), and 11 percent of long-tailed ducks captured northeast of Teshukpuk Lake on the North Slope in 1980 had lead shot in their gizzards (Taylor 1986). Lead shot was identified as the source of high and harmful lead levels through blood samples, radiographs, necropsy, and lead isotope analysis (Matz et al., in prep.).

The use of lead shot for hunting waterfowl has been illegal since 1991 in Alaska, and the Service intensified efforts in 1998 to enforce prohibitions against the possession and use of lead shot for migratory bird hunting. Later, the State of Alaska, at the request of regional advisory boards, passed more restrictive regulations that prohibit the use of lead shot for upland game bird hunting on the North Slope and all bird and small game hunting on the Y-K Delta.

There are indications that compliance with these regulations is improving as a result of outreach, education, and enforcement. In recent years, indices of lead shot use such as examination of spent shell casings, checking for illegal shot in stores, and checks of hunters have shown improvement. However, this has varied regionally; compliance was considered "excellent" in portions of the Y-K Delta in 2009 (G. Peltola, Refuge Manager, pers. comm.) although occasionally, lead shot is still available in stores or hunters are found in possession of lead shot on the North Slope (USFWS, unpublished observations). Further, permafrost under shallow water bodies contributes to the persistence and availability of lead pellets years after their deposition (Flint and Schamber 2010).

The rate of deposition of lead shot in eider breeding habitat is expected to remain constant under the time frame of the proposed Action, which is the 2015 spring waterfowl hunt, but take is difficult to quantify. While outreach and OLE efforts may have reduced the use of lead shot over time, any spent lead shot in breeding wetlands will remain available to spectacled and Steller's eiders for years. However, we believe that the contribution caused only by the 2015 hunt to this long-term problem will be minimal.

Increased human disturbance

Activities associated with the spring hunt will likely result in an increase of hunter presence in areas used by spectacled and Steller's eiders for breeding, feeding, and roosting on the North Slope and the Y-K Delta. Hunters shooting waterfowl and/or collecting eggs may incidentally disturb listed eiders during egg laying, incubation, and brood rearing. The amount of increased disturbance will be dependent on hunter density, accessibility of nesting areas, and factors that influence the level of subsistence hunting required for rural Alaskans to meet their nutritional needs.

While little quantitative data is available on the effects of disturbance to nesting eiders, it is possible that disturbance of sufficient frequency and severity could result in decreased nest or brood survival. If females are regularly flushed from their nests during incubation, successful hatching may be precluded. After hatching, if brood rearing is frequently interrupted by human disturbance, fitness of the chicks may decrease and their vulnerability to predation may increase. However, the magnitude of disturbance necessary to affect nesting behaviors to an extent that declines in recruitment are observable is unknown.

Nesting spectacled eiders are distributed across the North Slope as well as the Y-K Delta. As spectacled eider nests are sparsely distributed across both nesting areas, it is unlikely that disturbance from hunters affects a large proportion of nesting spectacled eiders.

Steller's eiders are particularly at risk to disturbance based on their proclivity to nesting near the road system outside of the largest population center on the North Slope. However, mid-season closures are included in the subsistence harvest regulations to minimize effects to nesting birds. Some hunters may illegally hunt during the closure; however, beginning in 2009 significant outreach and enforcement were successful at announcing the closure period and discouraging hunting during the closure near Barrow.

Given: 1) the uncertainty in how disturbance affects recruitment; 2) the sparse distribution of spectacled eider nests across both breeding areas; and 3) the mid-season closure and the indication of success of outreach and enforcement in encouraging compliance in Barrow, where the highest densities of Steller's eiders nest, we expect that the adverse effects to spectacled and Steller's eiders from disturbance as a result of the Action is possible but will likely be minimal.

Listed 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. Steller's eider critical habitat includes breeding areas on the Y-K Delta, molting and staging areas in the Kuskokwim Shoals, and molting areas on the Alaska Peninsula. Lead shot deposition during subsistence hunting may affect the conservation value of these critical habitat units, particularly on the Y-K Delta breeding area where more hunting probably occurs than in other units. As stated above in *Lead Contamination*, the rate of lead deposition is difficult to quantify, and any spent lead shot in breeding wetlands will remain available to spectacled and Steller's eiders for years. However, we believe that the contribution caused by the 2015 hunt to this long-term problem will be minimal, and therefore the Action is unlikely to adversely modify critical habitat for listed eiders.

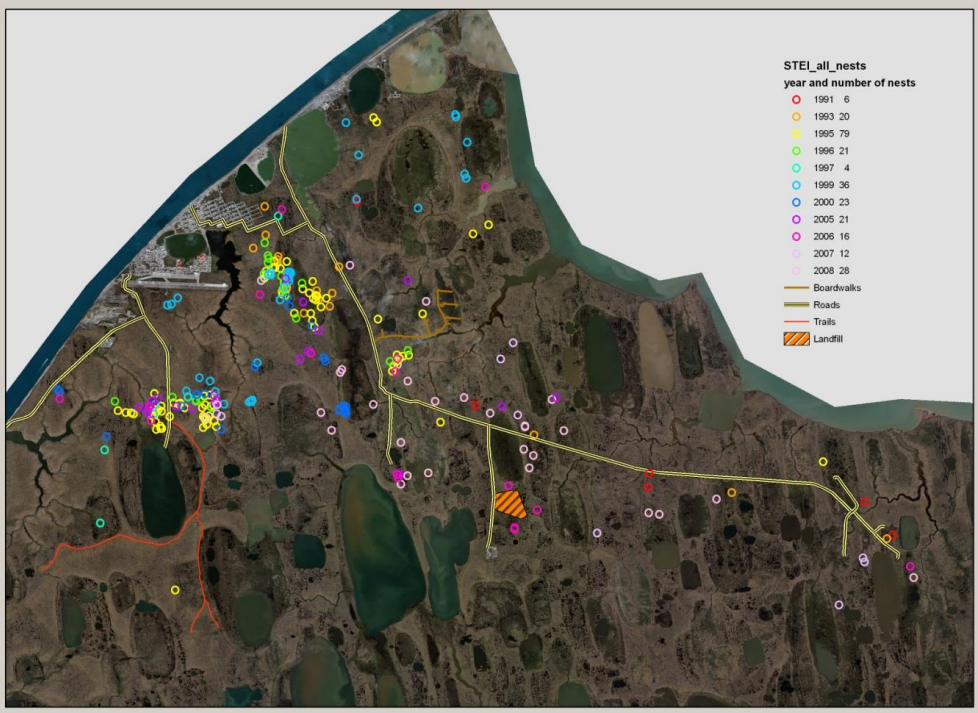
5.2 Steller's eiders

Vulnerability of Steller's Eiders to Harvest

The vulnerability of Steller's eiders to subsistence harvest varies according to location, year, and time of year. Steller's eiders are thought to migrate northward from the Bering Sea to the North Slope as leads of open water develop in the Bering and Chukchi sea pack ice. North Slope hunters anecdotally report that during migration, Steller's eiders may fly in single or mixed-species flocks, and are difficult to distinguish from other eiders that are legally hunted during this time. The early subsistence harvest (April and May) of migratory birds typically commences from the coast or shorefast ice, and in some cases, in conjunction with subsistence harvest of whales. Therefore, hunters along the western coast of Alaska may encounter Steller's eiders during spring migration, and they may be harvested during hunting focused primarily on other species.

Steller's eiders arrive on the North Slope, including Barrow, in early June. A large portion of Alaska-breeding Steller's eiders remain near Barrow, and can be observed from the road system

for several weeks in non-breeding years, and several months in breeding years (Figure 5.1). Because ducks and geese are regularly hunted from this road system (USFWS, unpublished observations), Steller's eiders are at risk from shooting during the breeding season near Barrow.



DRAFT Locations of Steller's eider nests 1991-2008 (nesting years only) found by USFWS crews near Barrow, Alaska, color-coded by year, (see key for annual numbers). Note: survey effort, methods, area covered, etc. has varied over the years as well as accuracy of nest locations. Location accuracy in recent years using GPS is +/- 5 m.

Figure 5.1. Steller's eider nests found during studies near Barrow, 1991-2008 (Quakenbush *et al.* 1998, Rojek 2008).

In non-breeding years both male and female Steller's eiders return to the ocean by mid-summer, where they may be vulnerable to subsistence hunting from boats. In mid-August through September, successfully breeding females and their ducklings are vulnerable as they stage and forage in waterbodies near Barrow Duck Camp before commencing their southward migration (USFWS, unpublished data).

There is limited information available on the movements of non-breeding and post-breeding Steller's eiders, particularly on the North Slope. However, birds radio-tracked near Barrow moved along the Chukchi Sea coast from Barrow to Pt. Hope, near the Seward Peninsula, and in southern Norton Sound (USFWS, unpublished data); therefore, it is reasonable to assume that Alaska-breeding Steller's eiders may be vulnerable along the coast where hunting occurs during fall migration.

Because the majority of Steller's eiders are thought to molt and winter in nearshore waters in southwest Alaska, sometimes near known hunting areas, they may be at risk to harvest. However, in southwest Alaska, Alaska-breeding Steller's eiders are mixed with the larger Russia-breeding population which also molts and winters in southwest Alaska, so presumably

only a very small proportion of Steller's eiders taken in this region are from the Alaska-breeding population.

Therefore, the Service believes Alaska-breeding Steller's eiders may be shot during the subsistence hunt: 1) during northward, spring migration; 2) while on their breeding grounds on the North Slope, especially near Barrow; 3) during post-breeding movements and migration; and 4) to a much lesser extent, throughout their traditional molting and wintering range. Steller's eiders appear to be at particular risk near Barrow during the spring, summer, and fall because of their concentrated use of the Barrow area, use of habitats near the road system at Barrow, and repeated flights near Barrow Duck Camp.

Harvest survey data

Huntington (2009) summarized harvest survey data from several sources, but spatial and temporal coverage is incomplete and varies annually. Methods also varied; for example, in some years eiders were not identified to species, but grouped as "eiders." Harvest was reported in some villages in the North Slope, Northwest Arctic, Bering Strait-Norton Sound, Bristol Bay, and Y-K Delta regions. Many villages in most years reported zero take of Steller's eiders. When take was reported, estimates ranged from to 2 to 160 Steller's eiders harvested in each village annually. The most comprehensive survey included five villages on the North Slope in 1992, which estimated 321 Steller's eiders harvested that year (Fuller and George 1997, and summarized by Huntington 2009), although the authors suggested that some of these birds were misidentified and may have been king or common eiders. We also question the reliability of this estimate, as harvest of over 300 from a small population would be reflected in a severe decline that would be observable from Service monitoring efforts. Additionally, such a large harvest of a species that occurs in small numbers on the North Slope would be difficult to accomplish. In the Northwest Arctic region, the only indicated listed eider harvest from various years between 1972 and 2007 indicated 115 Steller's eiders shot in the village of Kotzebue in 1997. Other regional annual harvest summarized in Huntington (2009) ranges from 0 to 60 for Bering Strait – Norton Sound, 0 to 90 for the Y-K Delta, and 4 to 90 in the Bristol Bay region.

Bacon (2011) is another source of harvest information for villages on the North Slope from 1994-2003. Harvest is identified to species level in some years and villages, but grouped as "eider species" and not separated into species in other instances. Of particular note is an estimate of 43 Steller's eiders harvested in Wainwright in 2003 (based on reported harvest of 38 Steller's eiders). Aerial survey data and information from village residents indicate that Steller's eiders are very rare near Wainwright during the breeding season. Thus it is reasonable to assume that if Steller's eiders are harvested at Wainwright, they are most likely taken during spring or fall migration, as Steller's eiders migrate along coastlines (and thus past coastal villages) in spring as leads open and in fall *en route* to molting areas. Because this estimate is only from a single year, we do not assume that it is representative of normal or average harvest rates, and it may in fact be either anomalous or erroneous (possibly because of misidentification), but we cannot determine its credibility with the available information.

Harvest of Steller's eiders was reported by AMBCC in four regions: North Slope, Bristol Bay, Y-K Delta, Bering Strait/Norton Sound (Appendices 4, 5, 6, 7, and 8). AMBCC estimates of harvest in the North Slope region, where the Alaska population breeds, range from 0 to 36 birds

during the spring/summer subsistence hunt. The North Slope was not sampled in 2010 or during the fall hunt period of 2004-2009, although Steller's and spectacled eiders are still available for harvest on the North Slope during this time, as breeding females and fledged young depart the breeding grounds in mid-August to mid-September (USFWS, unpublished data and observations). Therefore, these AMBCC estimates of 0 to 36 do not include potential fall harvest and thus may be biased low.

AMBCC reports annual harvest estimates of Steller's eiders ranging from 0 to 78 in Bristol Bay, 0 to 135 in the Y-K Delta, and 30 to 121 in the Bering Strait/Norton Sound region. We believe that listed, Alaska-breeding Steller's eiders comprise a very small proportion of those Steller's eiders occurring in the Bristol Bay and the Y-K Delta regions, so risk to the listed population of harvest in these regions is proportionately very low. The proportion of listed Steller's eiders within the total Steller's eider population in these regions likely roughly approximates the proportion in southwest Alaska wintering areas, which is generally thought to be < 1%; see *Status of the Species* above. In contrast, harvest of Steller's eiders in the Bering Strait/Norton Sound region may include a larger proportion of Alaska-breeding Steller's eiders, depending on where within this region the harvest actually takes place. Available satellite telemetry data provide no evidence that Russia-breeding Steller's eiders regularly move along the Seward Peninsula or through Norton Sound *en route* to or from Russia. Thus, harvest along the Seward Peninsula or in Norton Sound may include members of the listed population, possibly even a high proportion, depending on the frequency at which Russia-breeding individuals do actually pass through these sub-regions. We do not currently have Bering Strait harvest data at the sub-regional scale for all years, but at least 121 of the 199 (61%) of three-year total estimated Steller's eider harvest came from the Nome sub-region, and therefore from the Seward Peninsula.

From all sources, Steller's eider harvest survey data exhibit high inter-annual variation, which could reflect high sampling error or actual high inter-annual variation in harvest rates. The fact that Steller's eiders only breed intermittently, and have decidedly different patterns of occurrence on the North Slope in breeding and non-breeding years, provides a biological basis for inter-annual variation, but it is unknown how much this contributes to variation in harvest estimates. Regardless, high inter-annual variation in harvest estimates makes it difficult to reliably estimate average annual harvest rates or predict harvest in advance for a specific year.

Reported Steller's eider harvest estimates also indicate chronic and numerically significant misidentification error which undermines the credibility of the harvest estimates. Older harvest surveys summarized by Huntington (2009) include an estimate of Steller's eider harvest for the North Slope of 321, which are highly unlikely for the reasons stated above. More recent and locally-designed estimates by the North Slope Borough (Bacon, 2011) include an estimate of 43 Steller's eiders for Wainwright in a single year, which although possible, is probably not representative of average harvest levels from this village. Finally, the AMBCC reports estimate Steller's eider egg harvest of 40 to 120 eggs in three years in the Bering Straits/Norton Sound region (egg harvest is discussed further in *Loss of Eggs/Chicks*), although it is unlikely that Steller's eiders nest in this region, and therefore, highly unlikely that they nest there in numbers required to support this level of egg harvest. The last recorded nest in the region was on St. Lawrence Island over 50 years ago (Fay and Cade 1959), and the last recorded nest from the

Seward Peninsula was in the 19th century (Portenko 1989). Because confusion among eider species apparently accounts for many reports of Steller's eider harvest, it must be assumed that some harvested Steller's eiders may be misidentified and reported as other species.

It appears that Steller's eider harvest estimates are plagued by significant unquantifiable biases, and none of the three general sources of information appear to be immune or provide a means of estimating harvest that is decidedly more reliable. Even though the harvest survey data have many notable shortcomings, it is the best information available, and it influences our analysis when estimating the amount of harvest. To imply an appropriate level of confidence in the data, we considered the range of values given from harvest surveys in a general sense by considering the estimates as orders of magnitude instead of precise numbers (for example, "tens" rather than "23"). We conclude that while these data do not allow for a precise estimate of harvest with a reasonable degree of reliability, it is probably reasonable to assume, based on the range of estimates reported in areas where Alaska-breeding Steller's eiders are vulnerable to harvest, that roughly tens of Alaska-breeding Steller's eiders may be harvested during subsistence hunting in spring, summer, and fall in many years, with actual harvest rates in individual years likely varying with breeding conditions on the North Slope.

Other Available Information Regarding Harvest

Discussion with hunters on the North Slope and direct observations confirm that some Steller's eiders are taken during the subsistence hunt. North Slope hunters indicate that Steller's eiders often fly in mixed flocks with king and common eiders, are hard to identify, and on occasion, are inadvertently shot. Specifically, hunters report that Steller's eiders staging in waterbodies near Duck Camp may join migrating king and common eider flocks and are subject to shooting. Direct observations by the Service's law enforcement officers and biologists in Barrow have documented shot Steller's eiders along the roads and in hunters' possession. Between 1993 and 2014, 31 shot Steller's eiders were detected at Barrow; 21 of these were shot in 2008 (16 were found at Duck Camp, 5 along roadsides). The year 2008 was considered a highly successful breeding year for Steller's eiders (USFWS, unpublished data). These observations suggest that Steller's eiders are highly vulnerable to shooting mortality in breeding years, and during these years, subsistence harvest may result in roughly tens of Steller's eiders shot in the Barrow area alone, which is consistent with our conjecture based on harvest survey data.

In summary, our ability to enumerate Steller's eider harvest from harvest survey reports is limited by the unquantifiable bias associated with the harvest estimates. However, these data, coupled with information on Steller's eider availability, direct observations, and observations from local residents, suggest that roughly tens of Steller's eiders may have been harvested annually during subsistence hunting, but the harvest rate likely varied annually with the breeding status of Steller's eiders on the North Slope. Although we cannot quantify harvest, we are certain that Steller's eider mortality has occurred in past years, and we cannot precisely predict future mortality risk; therefore, a conservation program to eliminate or reduce the risk of mortality began in 2009 and will be implemented in 2015, as described below.

Conservation Measures to Reduce Risk of Harvest

In response to indications that Steller's eiders have been shot in recent years, particularly 2008, the Service has developed and implemented a species-specific conservation program intended to reduce the risk. This program currently focuses on the North Slope, especially Barrow, where the species' propensity to nest, combined with observations described in *Other Available Information Regarding Harvest*, indicate risk is likely the greatest. This program consists of 3 major components:

1) Regulations for the subsistence hunt which include the expressed intent to check hunters to verify compliance with prohibitions against closed species (which include spectacled and Steller's eiders) and the expressed capability for the Service's Alaska Regional Director to prescribe emergency regulations necessary in the event that substantial harvest of Steller's eiders is indicated, ranging from temporary closure of duck hunting in a small geographic area to large-scale regional or State-wide long-term closures of all subsistence migratory bird hunting;

2) The presence of Service law enforcement agents during the subsistence harvest on the North Slope, commensurate with the need, aimed at: a) enforcing regulations; b) engaging in outreach and education efforts with hunters; and c) verifying compliance with prohibitions against taking Steller's eiders, to ensure a timely and appropriate response in the event that mortality of Steller's eiders takes place; and

3) A long-term outreach and education effort developed and implemented collaboratively with hunters and residents of the North Slope, to seek support for Steller's eider conservation efforts.

The regulations, implemented in accordance with the Conservation Measures, are considered the principal way in which threateneded eider shooting mortality will be substantially reduced or eliminated. The authority to prescribe emergency regulations provides an additional level of assurance that, if an unexpected amount of Steller's eider shooting mortality occurs, it will be curtailed to avoid approaching jeopardy to the existence of the species.

Summary

In summary, we conclude that we cannot reliably characterize previous Steller's eider harvest levels in Alaska. Our ability to assess impacts is further compromised by difficulty in appropriately allocating harvest in some portions of Alaska to listed and unlisted populations. It is possible that no Steller's eiders are harvested in non-breeding years because of their short tenure in breeding areas and resulting lack of availability to hunters. However, we expect that in a breeding year, some Steller's eiders could be taken (possibly in the order of tens), particularly on the North Slope where the majority of the listed taxon breeds, but the conservation measures described above reduce that risk.

Additionally, the Service in collaboration with North Slope partners will routinely monitor and verify that listed eiders are not being shot and will evaluate the effectiveness of our education, communication, and outreach efforts. If mortality is detected, the Service will reassess current outreach and education strategies, determine where changes are needed, and heighten targeted outreach and targeted law enforcement efforts commensurate with the risk. If it cannot be reasonably assumed that the factors leading to shooting of Steller's eiders have been identified

and adequately ameliorated, the Service Regional Director may institute emergency regulations in consultation with AMBCC until impacts can be revaluated and minimized.

6. CUMULATIVE EFFECTS

Community Growth
Community growth is anticipated to continue across the North Slope. The footprints of North Slope villages will likely increase, through expansion of roads, powerlines, communication towers, landfills, and gravel pits and these activities may adversely affect listed species. The scale of impacts will depend not only on the amount of growth, but the location as it relates to eider habitat. For example, community development projects at Barrow may potentially impact Steller's eiders to a much higher degree than developments at Point Lay.

Because over 97% of the Action Area is wetlands or open water (USGS National Land Cover Database), and listed eiders breed near and use wetland areas, a section 404 permit from the U.S. Army Corps of Engineers would likely be necessary for all large scale community development projects that may impact eiders. The issuance of these permits would also trigger consultation under the ESA.

Projected Growth in Hunter Numbers
United States 2000 Census data indicate the estimated village size in the Wade-Hampton and Bethel census areas, where subsistence hunters on the Y-K Delta might encounter spectacled or Steller's eiders, is increasing. Census data is also provided for the North Slope, which encompasses the ACP breeding area for these two species. At current rates of population growth, increases in the numbers of households and projected population numbers can be approximated (Table 6.1).

Predicting future levels of take of either listed eider species as a result of population growth is problematic. However, the Service anticipates that the potential number of subsistence hunters will grow in Alaska, indicating a continuing and growing need for careful management of the subsistence hunt and a need for long-term education, outreach, and law enforcement activities to protect listed species during the hunt.

Table 6.1. Projected human population and household increases in rural Alaska areas where Steller's and spectacled eiders are found during spring and summer.

Census Area	Bethel Population	Bethel Households	Wade-Hampton Population	Wade-Hampton Households	North Slope Population	North Slope Households
2000	16006	4226	7028	2063	7385	2109
2010	18538	4847	8264	2364	8788	2543
2020	21056	5559	9718	2709	10457	2958
2030	24151	6376	11428	3104	12443	3567

Oil and Gas Development
Oil and gas development, whether in Federal or State waters or in the terrestrial environment on State, private, Native-owned, or Federal lands, would require Federal permits (such as section 404 of the Clean Water Act authorization from the U.S. Army Corps of Engineers, and National Pollution Discharge Elimination System permits from the Environmental Protection Agency) and, therefore, are not considered cumulative effects.

Gas Line
The BLM now considers the development and export of North Slope natural gas from the Action Area via pipeline to be reasonably foreseeable. While much of this line is likely to be on State lands, a project of this magnitude would require Federal permits and section 7 consultation. It is therefore, not a cumulative effect under the ESA.

Increased Scientific Research
Scientific research across the North Slope is increasing as concern about effects of climate change in the arctic grows. There are a number of long-term study plots near Barrow and NPR-A providing baseline data, further increasing interest in the area. While much research is conducted by universities and private institutions, all activities in NPR-A require land use authorization by BLM and therefore, require section 7 consultation. The Service is consulting on the major long-term research near Barrow. Any research on listed species requires a Section 10 recovery permit and therefore, also requires section 7 consultation. Researchers are currently conducting activities in ways that minimize impacts to listed eiders.

Summary of Cumulative Effects
In summary, we anticipate community growth, a gradual increase in subsistence hunter numbers (with community growth), terrestrial and offshore oil and gas development, scientific activities, and other activities will continue in the Action Area in coming decades. Most notably activities with potential to affect significant numbers of individuals of listed species (such as oil and gas development, community growth, and large-scale science projects) are expected to require consultation under the ESA, whereas those that may not require consultation (such as non-federal research) will likely have minor impacts to only a few individuals.

7. CONCLUSION

7.1 Spectacled eider

After reviewing the current status of the spectacled eider, 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 Action, as proposed, is not likely to jeopardize the continued existence of the spectacled eider or adversely modify spectacled eider critical habitat. This conclusion is based on the following factors.

The most recent rangewide estimate of abundance of spectacled eiders was 369,122 (364,190–374,054 90% CI), obtained by aerial surveys of the known wintering area in the Bering Sea in late winter 2010 (Larned et al. 2012a). Comparison of point estimates between 1997 and 2010

indicate an average of 353,051 spectacled eiders (344,147-361956 90% CI) in the global population over that 14-year period (Larned et al. 2012b). While there is some uncertainty in the range-wide estimate, the lower bound on the confidence interval is still well above 300,000 individuals. Additionally, due to the difficulty in conducting species-wide population surveys, this estimate likely represents a minimum population size (Petersen et al. 1999). Because the population is relatively large, it is likely robust to stochastic events and anthropogenic effects that may decrease population vital rates in any given year.

Rangewide trend estimates for spectacled eiders are not available. For the two nesting populations in Alaska, based on aerial survey data, the most current trend analysis (1988-2010) estimates a growth rate of 1.070 (1.058-1.081, 90% CI) for the Y-K Delta (Platte and Stehn 2011), meaning that the population is growing at a rate of about 7% per year. This is a high population growth rate for sea ducks, which are typically long-lived species with relatively low reproductive rates (Esler et al. 2002, Goudie et. al.1994). This indicates that the Y-K Delta population is recovering, through some combination of high reproduction, survival or immigration, from the depressed population of the 1990s. The North Slope breeding population's growth rate as of 2011 is thought to be approximately stable, as the growth rate does not differ significantly from 1.0 (0.99, 90% CI 0.98-1.01).

As outlined in the *Effects of the Action* section, we conclude that tens to hundreds of spectacled eiders are likely taken each year, but that more precise estimates are not possible with the available information. Additionally, estimates are highly variable among years. Using a conservative approach by assuming the current population is approximately equal to the lower confidence limit of the abundance estimates, roughly 0.1% of the listed population (90/364,190= 0.02%, 400/364,190= 0.1%) may be harvested annually.

In addition to the direct effect of shooting, potential adverse effects of the Action include the direct effect of egg harvest and the indirect effects of disturbance and lead contamination. We expect that spectacled eider eggs are harvested annually in the low tens, and a small number of nests may be disturbed during harvest of adults or eggs on the breeding grounds. Lead contamination may affect the survival and reproduction of spectacled eiders to an unknown extent for more than 25 years after lead shot deposition (Flint and Schamber 2010), and is of particular concern as lead contamination may have been a major factor in the species' decline on the Y-K Delta (listing document). This consultation is evaluating just the effects of lead shot deposited in 2015, and we believe that the contribution caused only by the 2015 hunt to this long-term problem will be minimal. We expect that egg collection, disturbance, and lead contamination resulting from this Action will occur, but in absence of reliable empirical data, cannot quantify their effect on the population.

In summary, biases and imprecision plague the available harvest data, but using conservative estimates we expect that a minimal proportion of the listed population is shot, or collected as eggs, annually during subsistence activities. Additionally, while it is impossible to quantify the indirect effects of disturbance and lead contamination, their effects are expected to be low. Therefore, considering the sum of direct and indirect effects, it is reasonable to expect that a small proportion of the listed population is likely to be taken annually as a result of the Action. After considering the status of the species, the environmental baseline, and the effects of the

Action, we do not reasonably expect the Action to appreciably reduce the likelihood of survival and recovery of spectacled eiders by reducing the reproduction, numbers, or distribution of the species. Furthermore, this consultation considers the effect of the Action during one year; consultation will be re-initiated in 2016 with the proposal of subsistence harvest regulations, when new information can be incorporated into the Service's jeopardy analysis.

This conclusion is based on the following: The potential effects of the proposed Action on the species' reproduction will be limited, as we believe that low tens of spectacled eider eggs are harvested in most years, and that only a small number of individual nests are disturbed during the course of hunting and egg gathering. Given the number of eggs and nests each year range-wide, this comprises a negligible proportion. The subsistence hunt has the potential to affect numbers of spectacled eiders through harvest of tens to hundreds annually. This comprises roughly 0.1% of the listed population, so we believe this will have a negligible effect on total numbers. We do not expect the proposed Action to affect the distribution of the spectacled eider, as total impacts are insufficient to affect the number of individuals breeding in any portion of the species' range.

It is important to note that in reaching our conclusion, we have considered, and have not attempted to separate or exclude, the effects of the fall hunt (which is a distinct Action requiring a separate consultation later this year) from the effects of the subsistence hunt (which is the Action evaluated in this Biological Opinion). We have done this due to the difficulty in disentangling these sources of impact in available harvest estimates, and to ensure that all identified increments of impact were considered in reaching our jeopardy/non-jeopardy conclusion, as explained in the *Effects of the Action*. While this may result in confusion over which specific Service Action particular impacts should be linked to, we believe this approach ensures all possible impacts are considered. Further, by including impacts of the fall hunt in our jeopardy/non-jeopardy conclusion for this Action, we believe that our non-jeopardy conclusion also applies to the fall hunt *unless new information indicating that we have underestimated impacts in this consultation is identified in the interim*.

7.2 Steller's Eider

After reviewing the current status of the Steller's eider, 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 Action, as proposed, is not likely to jeopardize the continued existence of the Steller's eider or adversely modify Steller's eider critical habitat. This conclusion is based on the following factors.

Our best estimates of abundance and trend for the Alaska-breeding population of Steller's eiders are imprecise, probably due to the species' rarity and the annual variability of abundance on the North Slope related to the number of breeding birds in any given year. The most recent population estimate of Steller's eiders breeding on the North Slope is 576 (292-859, 90% CI) with an estimated growth rate of 1.011 (0.857 – 1.193, 90% CI). The low precision associated with the trend estimate limits interpretation, and we cannot determine if the population of Alaska-breeding Steller's eiders is stable, increasing, or decreasing. It is important to note that because the population is relatively small, it is presumably more vulnerable to stochastic events and anthropogenic effects that may decrease population vital rates.

Information on take of Steller's eiders resulting from the Action is also unclear. As outlined in the *Effects of the Action* section, in general, estimates from harvest surveys are subject to a number of unquantifiable biases. Harvest reports also contain obvious misidentifications (or language translation errors) that cast question upon the reliability of harvest estimates. We conclude that roughly tens of Alaska-breeding Steller's eiders have been harvested in most years, but this likely varies considerably among years. More precise estimates are not possible with the available information. We expect that Steller's eiders face the highest mortality risk near Barrow, where the majority of the Alaska-breeding population nests near the largest human population center on the North Slope.

In addition to shooting, potential adverse effects of the Action include egg harvest, disturbance caused during hunting and/or egg gathering, and lead contamination. We expect that no Steller's eider eggs are harvested in most years, and a small number of nests may be disturbed during harvest of adults or eggs of other species on the breeding grounds. Based on the available information, we believe that the effects of egg harvest and disturbance caused by hunting and egg gathering will affect at most a few individuals or nests, and therefore will likely have negligible population-level effects. In contrast, ingestion of spent lead pellets is likely affecting a number of nesting females near the village of Barrow, possibly causing minor population level effects. Fortunately, our indices of use of lead shot suggest that outreach and enforcement actions have recently reduced the sale and use of lead shot, and thus we expect exposure rates and potential impacts to continue to gradually decrease over time. Importantly, though, this consultation is evaluating solely the effects of lead shot deposited in 2015, and we believe that the contribution caused by the 2015 hunt to this long-term problem will be minimal.

The small size of Alaska-breeding population of Steller's eiders, the lack of information from which to adequately assess the risk of effect of the Action on the population, and the apparent vulnerability of Steller's eiders to harvest mortality in Barrow is of concern to the Service.

While we believe that it is *unlikely* that the subsistence hunt will appreciably reduce the likelihood of survival and recovery of the Alaska-breeding population of Steller's eiders, given the uncertainty surrounding harvest rates and population status, we cannot be certain that jeopardy will not result if the hunt is left unmitigated. Therefore, to meet our obligation that we *ensure* that the proposed Action will not appreciably reduce the likelihood of survival and recovery of the Alaska-breeding population of Steller's eiders, the Service has: 1) promulgated regulations specifically intended to reduce risk of harvest of Steller's eiders on the North Slope; 2) committed to maintain the presence of law enforcement agents on the North Slope during the course of the hunt, commensurate with the risk to eiders, to enforce existing regulations, ensure compliance with regulations prohibiting harvest of Steller's eiders, and conduct outreach; and 3) committed to ongoing, long-term collaborative outreach and education effort with hunters and North Slope residents. In combination, we believe that these efforts will reduce the effects of subsistence harvest throughout Alaska, including harvest in spring, summer, and fall to the point that we have ensured that the 2015 hunt will not appreciably reduce the likelihood of survival and recovery of the Alaska-breeding population of Steller's eiders.

This conclusion is based on the following: The potential effects of the proposed Action on the species' reproduction will be limited, as we believe that no Steller's eider eggs are harvested in

most years, and that only a small number of individual nests are disturbed during the course of hunting and egg gathering. The subsistence hunt has the potential to affect numbers of Alaska-breeding Steller's eiders through harvest at a level best estimated to be in the tens; however, we believe that the conservation measures described above will reduce harvest to the point that survival and recovery are not compromised. We do not expect the proposed Action to affect the distribution of the Alaska-breeding population, as the greatest harvest levels in previous years have been proximal to the village of Barrow. Even when unmitigated by the conservation measures described above, Steller's eiders have continued to nest in this area.

It should be noted that this consultation considers exclusively the effect of the Action during 2015; consultation will be re-initiated in 2016 with the proposal of subsistence harvest regulations, when information from 2015 will be incorporated into the Service's consultation.

It is also important to note that in reaching our conclusion, we have considered, and not attempted to separate or exclude, the effects of the fall hunt (which is a separate Service action requiring a separate consultation later this year), from the effects of the subsistence hunt (which is the Action evaluated in this Biological Opinion). We have done this due to the difficulty in disentangling these sources of impact in available harvest estimates, and to ensure that all identified increments of impact were considered in reaching our jeopardy/non-jeopardy conclusion, as explained in the *Effects of the Action*. While this may result in confusion over which Action the specific impacts should be linked to, we believe that it ensures all possible impacts are considered. Further, by including impacts of the fall hunt in our jeopardy/non-jeopardy conclusion for this Action, we believe that our non-jeopardy conclusion also applies to the fall hunt *unless new information indicating that we have underestimated impacts in this consultation is identified in the interim*.

8. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and regulations pursuant to section 4(d) of the ESA prohibits the take of endangered and threatened species, except as provided in section 6(g)(2) and 10 of the ESA. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity.

However, under section 10(e) of the ESA, the provisions of the ESA shall not apply with respect to the taking of any such species, or the importation of such species taken pursuant to this section, by any Indian, Aleut, or Eskimo who is an Alaska Native who resides in Alaska, or any non-Native permanent resident of an Alaska Native village if such taking is primarily for subsistence purposes, unless the Secretary determines that the taking of an endangered or

threatened species materially and negatively affects the species. Because the proposed Action here is to authorize the spring and summer hunting of migratory birds for subsistence purposes, and all those authorized to participate in this activity are either Alaska Natives or non-Native permanent residents of an Alaska Native village, all potential incidental take that is anticipated from the proposed Action qualifies under section 10(e), and therefore, is not prohibited under the ESA.

Although the taking of listed species for subsistence purposes here is not prohibited under the ESA, the taking of spectacled and Steller's eiders remains prohibited under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§ 703-712). Therefore, the Service will refer the incidental or intentional take of any listed migratory bird species for prosecution under the Migratory Bird Treaty Act.

Amount or extent of take
As described in the *Effects of the Action* section, the activities described and assessed in this BO may adversely affect spectacled and Steller's eiders through accidental or illegal shooting. In general as previously described, estimates from harvest surveys are subject to a number of unquantifiable biases making it difficult to reliably estimate take.

Spectacled eider
Based on the harvest data that are available, other sources of information, what we believe are reasonable assumptions, and the potential benefits of conservation, outreach and educational efforts regarding prohibited species, we anticipate that up to 400 spectacled eiders could be taken by hunters during the spring and summer hunting season. As described above, this estimate equates to approximately 0.1% of the listed population (400/364,190 = 0.1%) harvested annually. The Service believes that the loss of this proportion of the listed population from the direct effect of harvest will not appreciably reduce the likelihood of survival and recovery.

Steller's eider
Based on the harvest data that are available, other sources of information, and what we believe are reasonable assumptions, we anticipate that up to 4 Alaska-breeding Steller's eiders could be taken by hunters during the 2015 spring and summer hunting season. We believe the conservation measures included in the project description and incorporated into the description of the proposed Action will reduce the risk of take of Steller's eiders. This estimate of 4 Steller's eiders was established based on what we think is reasonable from all available information, our assessment of risk, consideration of the likely benefits of recently implemented conservation measures, and is one that provides an appropriate and conservative threshold for reinitiation of consultation to ensure that Jeopardy is avoided.

Additionally, the Service in collaboration with North Slope partners will routinely monitor and verify that listed eiders are not being shot and will evaluate the effectiveness of our education, communication, and outreach efforts. If mortality is detected, the Service will reassess current outreach and education strategies, determine where changes are needed, and heighten targeted outreach and targeted law enforcement efforts commensurate with the risk. If it cannot be reasonably assumed that the factors leading to shooting of Steller's eiders have been identified

and adequately ameliorated, the Service Regional Director may institute emergency regulations in consultation with AMBCC until impacts can be revaluated and minimized.

9. REINITIATION NOTICE

This concludes formal consultation on the proposed Action. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the Action has been retained (or is authorized by law) and if:

1) If the amount or extent of incidental take is exceeded;
2) If new information reveals effects of the Action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion;
3) If the agency Action is subsequently modified in a manner that causes an effect to listed or critical habitat not considered in this opinion; and
4) If a new species is listed or critical habitat designated that may be affected by the Action.

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