# INTRA-SERVICE BIOLOGICAL OPINION

**For**

**Hunting Regulations for the**
**2014 Spring/Summer Harvest**

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

Prepared by:
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# 1. INTRODUCTION

This document transmits the U.S. Fish and Wildlife Service's (Service) Biological Opinion (BO) in accordance with Section 7(a)(2) of the Endangered Species Act of 1973, as amended (Act), on effects of the proposed 2014 Regulations for Migratory Birds Subsistence Harvest in Alaska (Regulations) on the listed spectacled eiders (*Somateria fischeri*) and Alaska-breeding Steller's eiders (*Polysticta stelleri*), and the candidate species yellow-billed loons (*Gavia adamsii*) 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*), so polar bearsand walruses are not discussed in this biological opinion.

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 December 11, 2013 in the Federal Register (Vol. 78, No. 238). 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, 2014 and expire August 31, 2014. 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, so 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 2014 hunt. Specifically, this BO evaluated 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 2010a), 2) the U.S. Fish and Wildlife Service Environmental Assessment: Hunting Regulations for the 2014 Spring/Summer Harvest (EA), 3) current and historical survey data for Steller's and spectacled eiders and yellow-billed loons, 4) published literature, unpublished reports, and 5) other sources of information.

This BO concludes the consultation regarding the effects of the proposed 2014 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 Act requires that Federal agencies shall insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any threatened or endangered species, or result in the destruction or adverse modification of critical habitat. When the actions of a Federal agency may adversely affect a protected species, that agency (i.e., the action agency) is required to consult with either the National Marine Fisheries Service (NMFS) or the Service, depending upon the protected species that may be affected.

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 2014 spring/summer harvest of migratory birds in Alaska from April 2, 2014 until August 31, 2014. 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 Steller's eiders, spectacled eiders, emperor geese, and yellow-billed loons[1], and 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 and the North Slope.

To ensure the subsistence harvest does not jeopardize the continued existence of Steller's eiders and to minimize impacts to spectacled eiders, the Service developed a combination of regulations and Conservation Measures for implementation in 2014.

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

Regulations:

- Steller's eiders and spectacled 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.

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[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.

While the Service believes some provisions in the regulations should remain, in 2011 the 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 2014 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 program 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 program. 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, Ukpeagvik 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 2014 hunt. Examples of programs include the Migratory Bird Fair, 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 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*
Steller's and spectacled 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 2014, the Service will continue to perform the following annual surveys:

- Arctic Coastal Plain aerial survey for Steller's and spectacled eiders (June; MBM)
- Barrow-area aerial survey for Steller's and spectacled 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 the 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 2009). 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 (Census 2009, USFWS 2009a)

The Action Area contains foraging, resting, breeding, migrating, molting, and wintering habitat for spectacled and Steller's eiders (listed as threatened under the Act), and yellow-billed loons (candidates for listing under the Act).

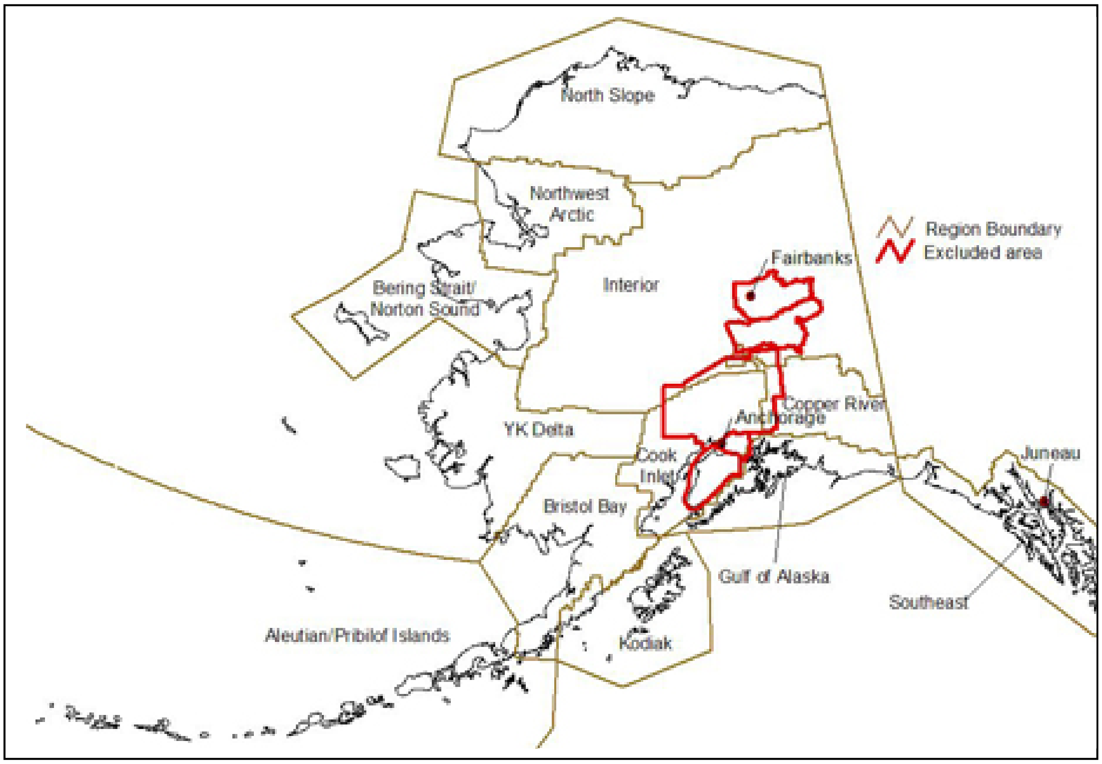



Figure 2.1. All lands of included areas within the 11 regions established by the AMBCC are proposed for the subsistence hunt, excluding national monuments, parks, and preserves managed by the National Park Service and not specifically designated as open to subsistence (AMBCC 2009).

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

### 3.1 Steller's Eider

The Steller's eider is a sea duck with a circumpolar distribution and the sole member of the genus *Polysticta*. The Steller's eider is the smallest of the four eider species, weighing approximately 700–800 g (1.5–1.8 lb). Males are in breeding plumage (Figure 3.1) from early winter through mid-summer. During late summer and fall, males molt to dark brown with a white-bordered blue wing speculum. Following replacement of flight feathers in the fall, males re-acquire breeding plumage, which lasts through the next summer. Females are dark mottled brown with a white-bordered blue wing speculum year round. Juveniles are dark mottled brown until fall of their second year, when they acquire breeding plumage.


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

Steller's eiders are divided into Atlantic and Pacific populations; the Pacific population is further divided into the Russia-breeding population, which nests along the Russian eastern arctic coastal plain, and the Alaska-breeding population. The Alaska breeding population of the Steller's eider was listed as threatened on July 11, 1997 based on:

- Substantial contraction of the species' breeding range on the 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 Arctic Coastal Plain (ACP) and molt and winter, along with the majority of the Russia-breeding population, in southcentral Alaska (Figure 3.2). Periodic non-breeding of the entire population of Steller's eiders breeding near Barrow, AK, the species' primary breeding grounds, coupled with low nesting and fledging success, has resulted in very low productivity (Quakenbush et al. 2004) and may make the population particularly vulnerable to extirpation. In 2001, the Service designated 2,830 $mi^2$ (7,330 $km^2$) of critical habitat for the Alaska-breeding population of Steller's eiders at historic breeding areas on the Y-K Delta, a molting and staging area in the Kuskokwim Shoals, and molting areas in marine waters at Seal Islands, Nelson Lagoon, and Izembek Lagoon (66 FR 8849, February 2, 2001). No critical habitat for Steller's eiders has been designated on the ACP.

*Life History*

*Breeding ecology* – 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 ).

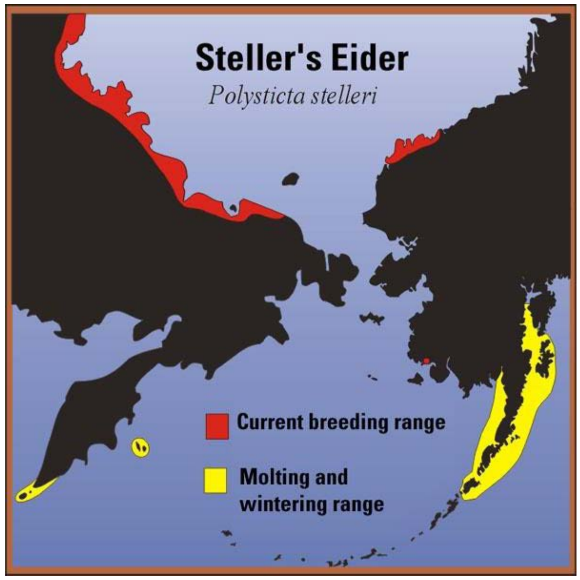



Figure 3.2. Steller's eider distribution in the Bering, Chukchi, and Beaufort seas.

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, six banded birds that nested near Barrow were recaptured in subsequent years again nesting near Barrow. 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).

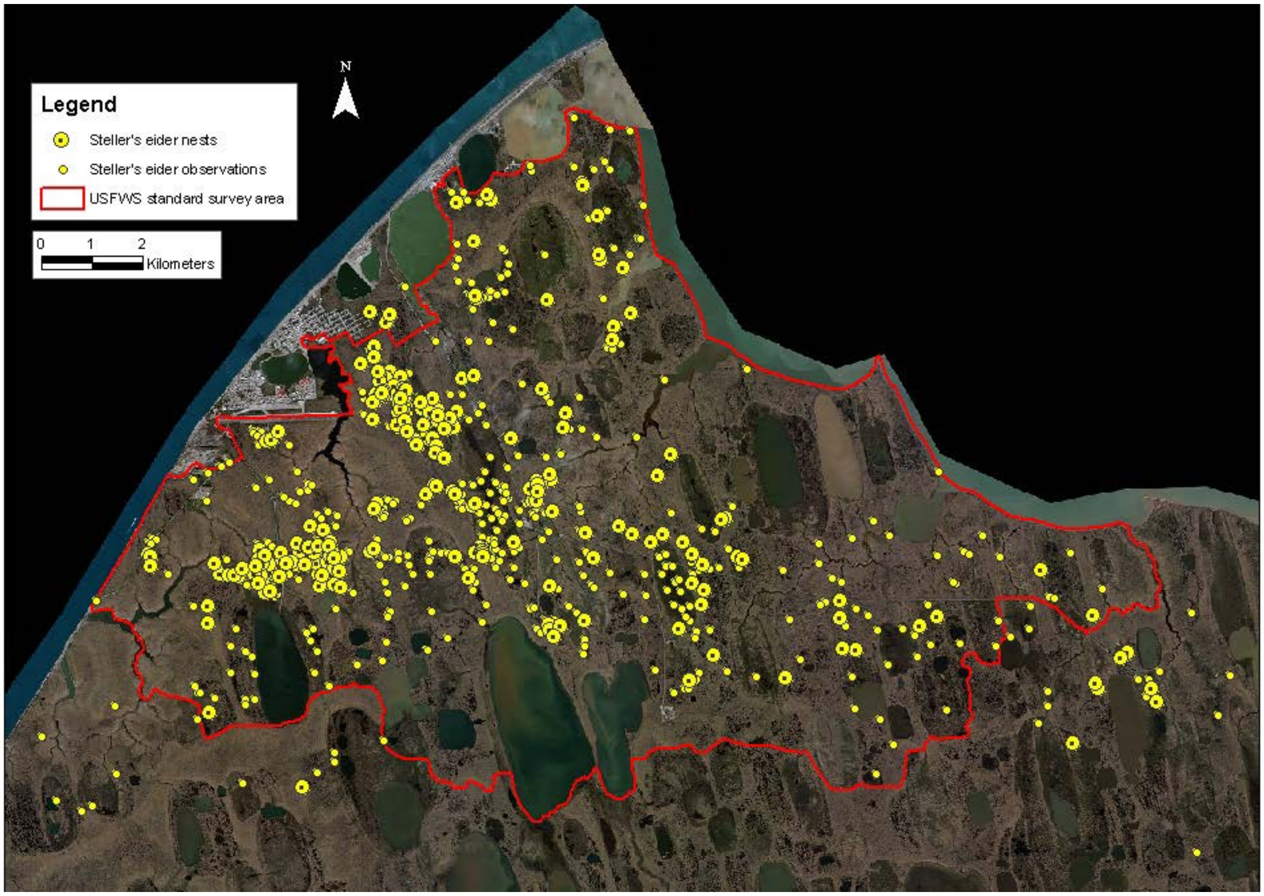


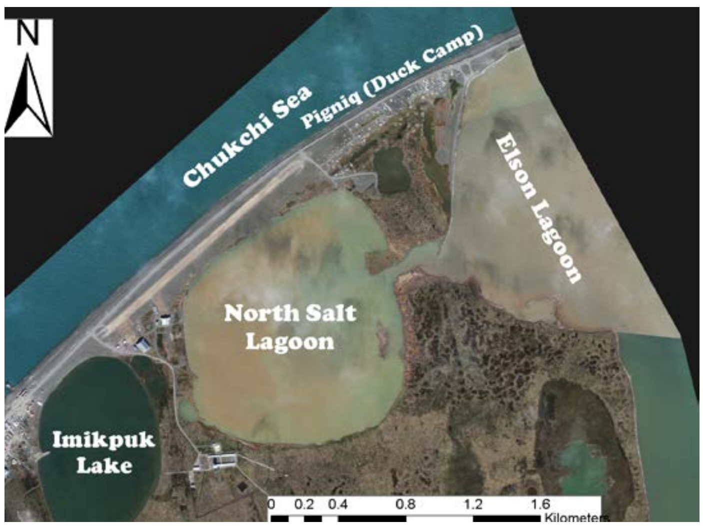

Figure 3. 3. Steller's eider nest locations (1991–2010) and breeding pair observations (1999–2010). The standard survey area is surveyed annually. The survey area is expanded beyond the standard area in some years.

*Localized post-breeding 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 3.4A; 3.4B; and 3.5). There is both a spatial and temporal overlap between Steller's eiders and subsistence hunters during the post-fledging period.

A




B

Figure 3.4. (A) Location of Steller's eider post-breeding staging areas in relation to Pigniq (Duck Camp) hunting area north of Barrow, Alaska. (B) VHF marked Steller's eider hen with brood of fledglings resting in Elson Lagoon in close proximity to Duck Camp. Photo by N. Docken, USFWS.

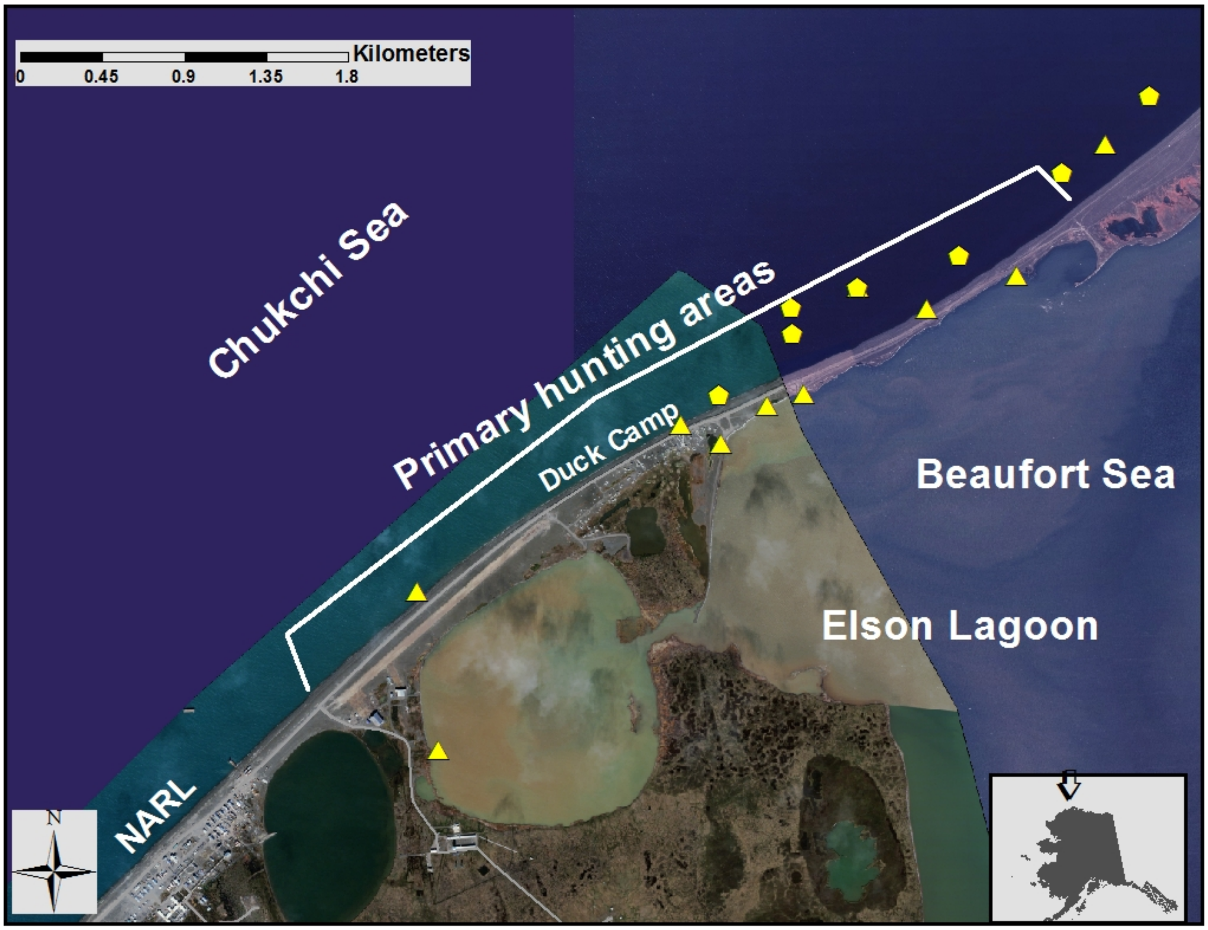


Figure 3.5. Marine locations of successful (triangles) and failed (pentagons) adult Steller's eiders (and juveniles) in the immediate vicinity of areas commonly used for subsistence hunting near Barrow, Alaska from mid-August to early September 2011.

*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).

*Wintering distribution* – After molt, many of the Pacific-wintering Steller's eiders disperse throughout the Aleutian Islands, the Alaskan Peninsula, and the western Gulf of Alaska including Kodiak Island and lower Cook Inlet (Figure 3.6; Larned 2000b, Martin et al. *in prep*), although thousands may remain in lagoons used for molting unless freezing conditions force them to move (USFWS 2002). The USFWS estimates that the Alaska-breeding population comprises only ~ 1%[2] of the Pacific-wintering population of Steller's eiders. Wintering Steller's eiders usually occur in shallow waters (< 10 m deep), which are generally within 400 m of shore or at offshore shallows (USFWS 2002). However, Martin et al. (*in prep*) reported substantial use of habitats > 10 m deep during mid-winter. Use of these habitats by wintering Steller's eiders may be associated with night-time resting periods or with shifts in the availability of local food resources (Martin et al. *in prep*).

*Spring migration* – Early in spring migration, thousands of Steller's eiders stage in estuaries along the north side of the Alaska Peninsula, including some molting lagoons, and at Kuskokwim Shoals near the mouth of the Kuskokwim River in late May (Figure 3.6; Larned 2007, Martin et al. *in prep*). Larned (1998) concluded that Steller's eiders show strong site fidelity to preferred habitats[3] during migration, where they congregate in large numbers to feed before continuing northward migration.

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

*Migration patterns relative to breeding origin* – There is limited information available on the migratory movements of Steller's eiders, particularly in relation to their breeding origin, and it remains unclear where the Russia and Alaska breeding populations merge and diverge during molt and spring migrations, respectively. The best available information is from the Martin et al. (*in prep*; Figure 3.6) satellite telemetry study discussed previously and a second telemetry study by Rosenberg et al. (2011). Martin et al. (*in prep*) marked 14 birds near Barrow, Alaska (within the range of the listed Alaska-breeding population) in 2000 and 2001. Although samples sizes were small, results suggested disproportionately high use of Kuskokwim Shoals by Alaska-breeding Steller's eiders during wing molt compared to the Pacific population as a whole. However, Martin et al. (*in prep*) did not find Alaska-breeding Steller's eiders to preferentially use specific wintering areas. The second study marked Steller's eiders wintering on Kodiak

[2] See further discussion under Population Dynamics subsection.

[3] 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).

Island, Alaska and followed birds through the subsequent spring (n = 24) and fall molt (n = 16) migrations from 2004–2006 (Rosenberg et al. 2011). Most of the birds marked on Kodiak migrated to eastern arctic Russia prior to the nesting period and none were relocated on land or in nearshore waters north of the Yukon River Delta in Alaska (Rosenberg et al. 2011).

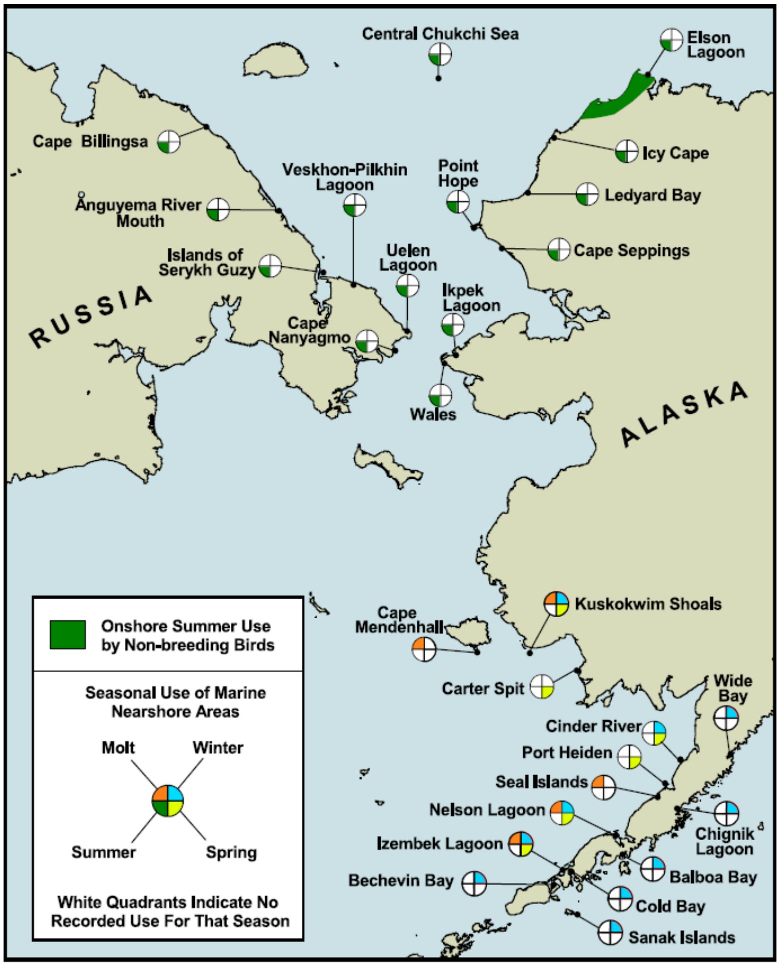



Figure 3.6. Distribution of Alaska-breeding Steller's eiders during the non-breeding season, based on the location of 13 birds implanted with satellite transmitters in Barrow, Alaska, June 2000 and June 2001. Marked locations include all those at which a bird remained for at least three days. Onshore summer use area comprises the locations of birds that departed Barrow, apparently without attempting to breed in 2001. (Fig 9 in USFWS 2002; study described further in Martin et al. *in prep*).

*Population Dynamics*

*Pacific population: spring population estimates and trends* – The majority of the world population of Steller's eiders migrates along the Bristol Bay coast of the Alaska Peninsula in the spring, where they linger en route to feed at the mouths of lagoons and other productive habitats.

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

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

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

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

In 2007, the ACP and NSE surveys were combined under a new ACP survey design. Surveys differed in spatial extent, seasonal timing, sampling intensity, and duration. Consequently, they produced different estimates of Steller's eider population sizes and trends. These estimates, including results from previous analyses of the ACP and NSE survey data (Mallek et al. 2007, Larned et al. 2009), are summarized in Table 3.1. Most observations of Steller's eider from both surveys occurred within the boundaries of the NSE survey (Figure 3.7).

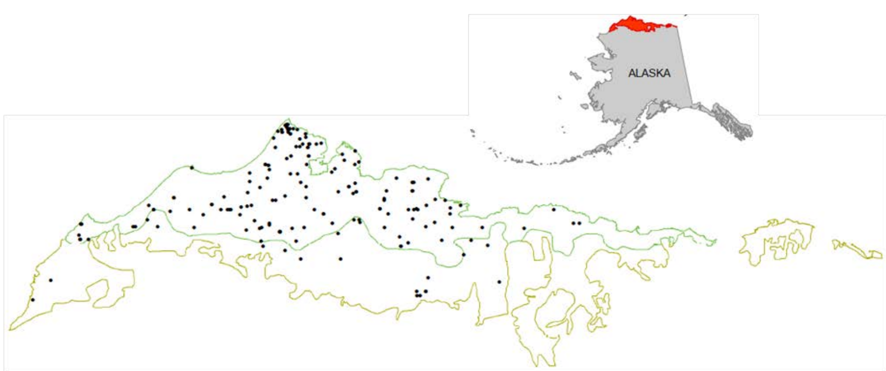



Figure 3.7. All sightings from the Arctic Coastal Plain (ACP) survey (1989–2008) and the North Slope eider (NSE) survey (1992–2006). The ACP survey encompasses the entire area shown (61,645 $km^2$); the NSE includes only the northern portion outlined in green (30,465 $km^2$). (Modified from Stehn and Platte 2009).

Following assessment of potential biases inherent in the two USFWS surveys, Stehn and Platte (2009) identified a subset of the NSE survey data (1993–2008) that they determined was "least confounded by changes in survey timing and observers." Based on this subset of the NSE survey, the average population index[4] for Steller's eiders was 173 (90% CI 88–258) with an estimated population growth rate of 1.011 (90% CI 0.857–1.193). The average population size of Steller's eiders breeding in the ACP was estimated at 576 (292–859, 90% CI; Stehn and Platte 2009) assuming a detection probability of 30%[5]. Currently, this analysis provides the best available estimate of the Alaska-breeding Steller's eider population size and growth rate from the ACP. Note that these estimates are based on relatively few observations of Steller's eiders each year with none seen in many survey years.

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

*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[6] 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).

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

Table 3.1. 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).

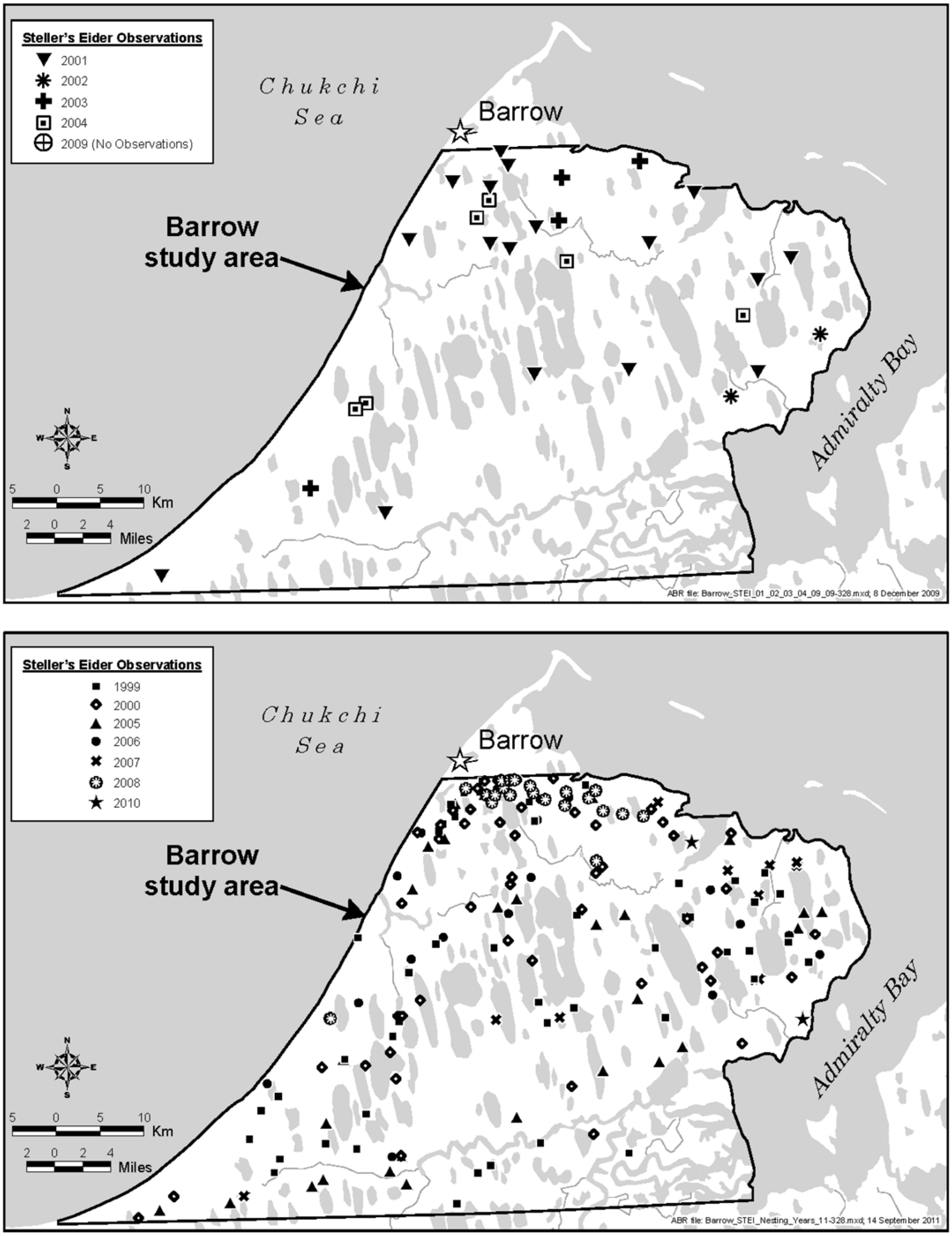



Figure 3.8. Locations of Steller's Eiders Located by ABR, Inc. during the Barrow Triangle aerial surveys in non-nesting years (top) and nesting years (bottom) near Barrow, Alaska, June 1999–2010 (Obritschkewitsch and Ritchie 2011). Obritschkewitsch and Ritchie (2012) reported 16 Steller's eiders from 10 locations in the study area during 2011 (not shown).

*Status and Distribution*

On June 11, 1997, the Alaska-breeding population of Steller‘s eiders was listed as threatened based on a substantial decrease in this population’s breeding range and the increased vulnerability of the remaining Alaska-breeding population to extirpation (USFWS 1997). Although population size estimates for the Alaska-breeding population were imprecise, it was clear Steller’s eiders had essentially disappeared as a breeding species from the Y-K Delta, where they had historically occurred in significant numbers, and that their Arctic Coastal Plain (North Slope) breeding range was much reduced. On the North Slope they historically occurred east to the Canada border (Brooks 1915), but have not been observed on the eastern North Slope in recent decades (USFWS 2002). The Alaska-breeding population of Steller’s eiders now nests primarily on the Arctic Coastal Plain (ACP; Figure 3.2), particularly near Barrow and at very low densities from Wainwright to at least as far east as Prudhoe Bay. A few pairs may still nest on the Y-K Delta; only 10 Steller’s eider nests have been recorded on the Y-K Delta since 1970 (Hollmen et al. 2007).

*Recovery Criteria*

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

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

*Steller’s Eider Critical Habitat*

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

### 3.2 Spectacled Eider

Spectacled eiders are large sea ducks. Males in breeding plumage have a white back, black breast, and pale green head with large white "spectacles" around the eyes (Figure 3.9A) Spectacled eiders were listed as threatened throughout their range on May 10, 1993 (USFWS 1993) based on indications of steep declines in the two Alaska-breeding populations. There are three primary spectacled eider populations, each corresponding to breeding grounds on Alaska's North Slope, the Yukon–Kuskokwim Delta (Y-K Delta), and northern Russia. The Y-K Delta population declined 96% between the early 1970s and 1992 (Stehn et al. 1993). Data from the Prudhoe Bay oil fields (Warnock and Troy 1992) and information from Native elders at Wainwright, AK (R. Suydam, pers. comm.in USFWS 1996) suggested concurrent localized declines on the North Slope, although data for the entire North Slope breeding population were not available. Spectacled eiders molt in several discrete areas (Figure 3.9B) during late summer and fall, with birds from the different populations and genders apparently favoring different molting areas (Petersen et al. 1999). All three spectacled eider populations overwinter in openings in pack ice of the central Bering Sea, south and southwest of St. Lawrence Island (Petersen et al. 1999; Figure 3.9B), where they remain until March–April (Lovvorn et al. 2003).

*Life History*

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

Spectacled eiders arrive on the ACP breeding grounds in late May to early June. Numbers of breeding pairs peak in mid-June and decline 4–5 days later when males begin to depart from the breeding grounds (Smith et al. 1994, Anderson and Cooper 1994, Anderson et al. 1995, Bart and Earnst 2005). Mean clutch size reported from studies on the Colville River Delta was 4.3 (Bart and Earnst 2005). 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 YK-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 YK-delta compared to the ACP. Mean annual clutch size ranged from 3.8–5.4 in coastal areas of the YK-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 influenced by predators, including gulls (*Larus* spp.), jaegers (*Stercorarius* spp.), and red (*Vulpes vulpes*) and arctic (*Alopex lagopus*) foxes. In arctic Russia, apparent nest success was calculated as <2% in 1994 and 27% in 1995; low nest success was attributed to predation (Pearce et al. 1998). Apparent nest success in 1991 and 1993–1995 in the Kuparuk and Prudhoe Bay oil fields on the ACP was also low, varying from 25–40% (Warnock and Troy 1992, Anderson et al. 1998). Nest survival probability for spectacled eiders in an area near Barrow employing fox control in 2011 was 72.72% (95% CI, 27-92%; Safine 2012). On Kigigak Island in the Y-K Delta, nest survival probability ranged from 0.06–0.92 from 1992–2007 (Lake 2007); nest success tended to be higher in years with low fox numbers or activity (i.e., no denning) or when foxes were eliminated from the island prior to the nesting season. Bowman et al. (2002) also reported high variation in nesting success (20–95%) of spectacled eiders on the Y-K Delta, depending on the year and location.

Available data indicates egg hatchability is high for spectacled eiders nesting on the ACP, in arctic Russia, and at inland sites on the Y-K Delta, but considerably lower in the coastal region of the Y-K Delta. Spectacled eider eggs that are addled or that do not hatch are very rare in the Prudhoe Bay area (Declan Troy, TERA, pers. comm. 1997), and Esler et al. (1995) found very few addled eggs on the Indigirka River Delta in Arctic Russia. Additionally, from 1969 to 1973 at an inland site on the Yukon Delta National Wildlife Refuge, only 0.8% of spectacled eider eggs were addled or infertile (Dau 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 natural attenuation of existing lead pellets (Flint and Schamber 2010) in coastal Y-K Delta wetlands.

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

(A)


(B)


Figure 3.9. (A) Male and female spectacled eiders in breeding plumage. (B) Distribution of spectacled eiders. Molting areas (green) are used July –October. Wintering areas (yellow) are used October –April. The full extent of molting and wintering areas is not yet known and may extend beyond the boundaries shown.

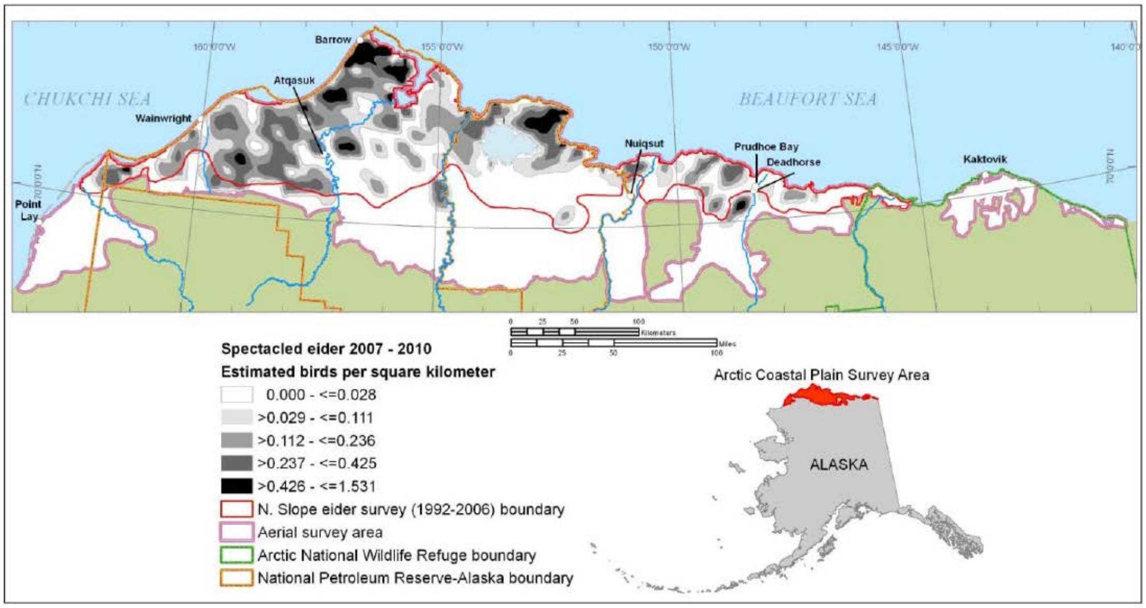



Figure 3.10. Density distribution of spectacled eiders observed on aerial transects sampling 57,336 km$^2$ of wetland tundra on the North Slope of Alaska during early to mid-June, 2007–2010 (Larned et al. 2011).

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

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

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

Spectacled eiders use specific molting areas from July to late October/early November. Larned et al. (1995) and Petersen et al. (1999) discussed spectacled eiders' apparently strong preference for specific molting locations, and concluded that all spectacled eiders molt in four discrete areas (Table 3.2). 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 3.2. Important staging and molting areas for female and male spectacled eiders from each breeding population.

| Population and Sex | Known Major Staging/Molting Areas |
|---|---|
| Arctic Russia Males | Northwest of Medvezhni (Bear) Island group |
| | Mechigmenskiy Bay |
| | Ledyard Bay |
| Arctic Russia Females | unknown |
| North Slope Males | Ledyard Bay |
| | Northwest of Medvezhni (Bear) Island group |
| | Mechigmenskiy Bay |
| North Slope Females | Ledyard Bay |
| | Mechigmenskiy Bay |
| | West of St. Lawrence Island |
| Y-K Delta Males | Mechigmenskiy Bay<br>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 must have ample food resources, and the rich benthic community of Ledyard Bay (Feder et al. 1989, 1994a, 1994b) likely provides these for spectacled eiders. Large concentrations of spectacled eiders molt in Ledyard Bay to use this food resource; aerial surveys on 4 days in different years counted 200 to 33,192 molting spectacled eiders in Ledyard Bay (Petersen et al. 1999; Larned et al. 1995).

*Wintering* – Spectacled eiders generally depart all molting sites in late October/early November (Matt Sexson, USGS, unpublished data), migrating offshore in the Chukchi and Bering Seas to a single wintering area in openings in pack ice of the central Bering Sea south/southwest of St. Lawrence Island (Figure 3.9B). In this relatively shallow area, > 300,000 spectacled eiders (Petersen et al. 1999) rest and feed, diving up to 70 m to eat bivalves, other mollusks, and crustaceans (Cottam 1939, Petersen et al. 1998, Lovvorn et al. 2003, Petersen and Douglas 2004).

*Spring migration* – Recent information about spectacled and other eiders indicates they probably make extensive use of the eastern Chukchi spring lead system between departure from the wintering area in March and April and arrival on the North Slope in mid-May or early June. Limited spring aerial observations in the eastern Chukchi have documented dozens to several hundred common eiders (*Somateria mollissima)* and spectacled eiders in spring leads and several miles offshore in relatively small openings in rotting sea ice (W. Larned, USFWS; J. Lovvorn, University of Wyoming, pers. comm.). Woodby and Divoky (1982) documented large numbers of king eiders (*Somateria spectabilis*) and common eiders using the eastern Chukchi lead system, advancing in pulses during days of favorable following winds, and concluded that an open lead is probably requisite for the spring eider passage in this region. Preliminary results from an ongoing satellite telemetry study conducted by the USGS Alaska Science Center (Figure 3.11; USGS, unpublished data) suggest that spectacled eiders also use the lead system during spring migration.

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

*Abundance and trends*

The most recent rangewide estimate of 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. 2012). 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. 2012).

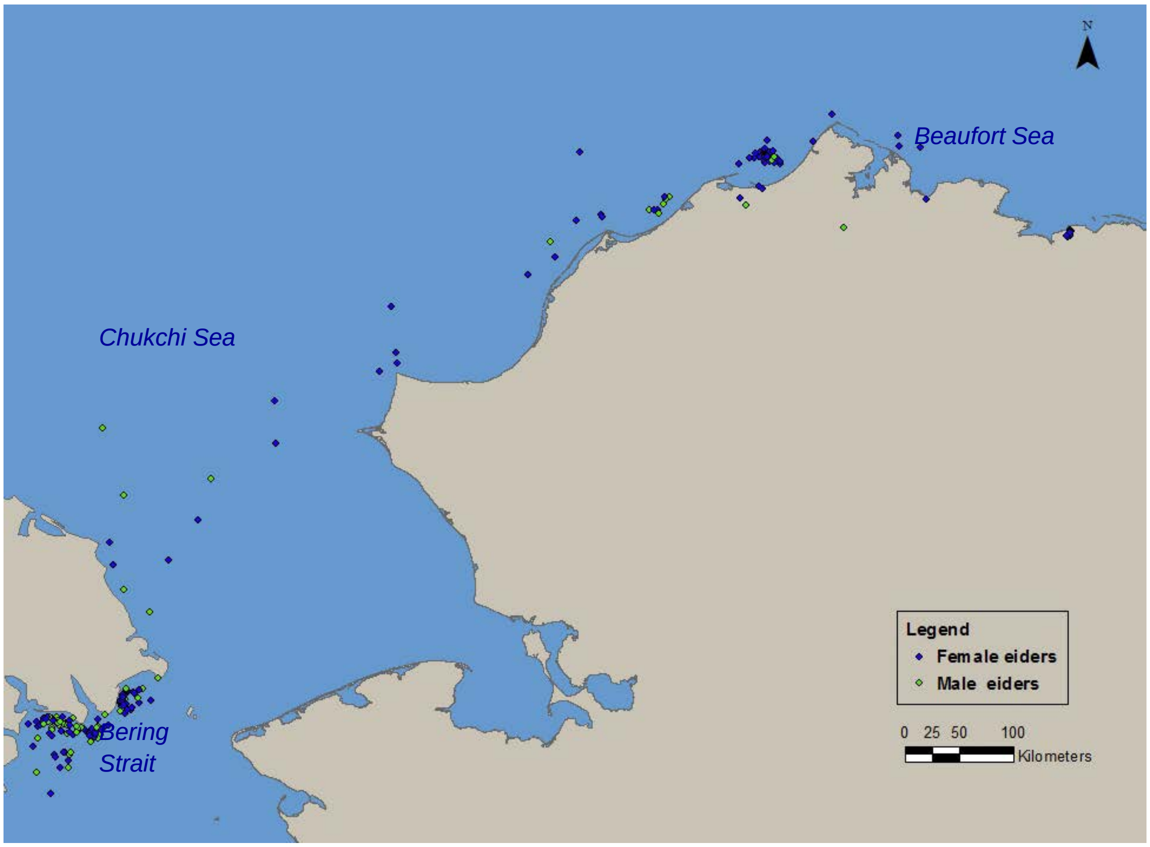



Figure 3.11. Spectacled eider satellite telemetry locations for 12 female and 7 male spectacled eiders in the eastern Chukchi Sea from 1 April – 15 June 2010 and 1 April – 15 June 2011. Additional locations from the northern coast of Russia are not shown. Eiders were tagged on the North Slope during the 2009 and 2010 breeding seasons. Data provided by Matt Sexson, USGS Alaska Science Center (USGS, unpublished).

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 YK-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 YK-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 YK-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 YK-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 YK-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 YK-delta in 2011 and evaluate long-term trends in the YK-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 nests in 2011 was estimated at 3,608 (SE 448) spectacled eiders nests on the YK-delta, the second lowest estimate over the past 10 years. The average population growth rate based on these surveys was 1.049 (90% CI = 0.994–1.105) in 2002–2011 and 1.003 (90% CI = 0.991–1.015) in 1985–2011 (Fischer et al. 2011). Log-linear regression based solely on the long-term YK-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 Act is no longer required. Although the cause or causes of the spectacled eider population decline is not known, factors that affect adult survival are likely to be the most influential on population growth rate. These include lead poisoning from ingested spent shotgun pellets, which may have contributed to the rapid decline observed in the Y-K Delta (Franson et al. 1995, Grand et al. 1998), and other factors such as habitat loss, increased nest predation, over harvest, and disturbance and collisions caused by human infrastructure. Under the Recovery Plan, the species will be considered recovered when each of the three recognized populations (Y-K Delta, North Slope of Alaska, and Arctic Russia): 1) is stable or increasing over 10 or more years and the minimum estimated population size is at least 6,000 breeding pairs, or 2) number at least 10,000 breeding pairs over 3 or more years, or 3) number at least 25,000 breeding pairs in one year. Spectacled eiders do not currently meet these recovery criteria.

## 3.3 Yellow-billed Loon

*Physical Appearance*

The yellow-billed loon (*Gavia adamsii*) is the largest, rarest, and most northerly distributed of the five loon species in the family Gaviidae. Although the yellow-billed loon is similar in appearance to the common loon (*Gavia immer*), the yellow-billed loon is most easily distinguished by their larger yellow or ivory-colored bill. During the non-breeding season, yellow-billed loons lose their distinctive black and white plumage and molt into gray-brown plumage, with paler undersides and head, and a blue-gray bill. Similarity of plumage among loon species in non-breeding and juvenile plumages, makes distinguishing among species difficult. Yellow-billed loons are specialized for aquatic foraging with a streamlined shape and legs near the rear of the body, and are unable to take flight from land.

*Status and Distribution*

On March 25, 2009, the yellow-billed loon was designated a candidate for protection under the Act because of its small population size range-wide and concerns about levels of subsistence harvest and other potential impacts to the species (Federal Register 74(56):12932-12968). This finding resulted in a determination that listing under the Act is "warranted but precluded" by higher priority listing actions, with the desire that improved information on subsistence harvest and other potential threats will be gathered and used to inform subsequent decisions regarding the species' possible listing.

Yellow-billed loons are intrinsically vulnerable due to a combination of small population size, low reproductive rate, and very specific breeding habitat requirements. There is no reliable scientific information on lifespan and survivorship, but as large-bodied birds with low clutch size, yellow-billed loons are probably "K-selected;" that is, they are long-lived and dependent upon high annual adult survival to maintain populations.

Yellow-billed loons nest from June to September near freshwater lakes in tundra on Alaska's North Slope, northwestern Alaska, and St. Lawrence Island; in Canada east of the Mackenzie Delta and west of Hudson Bay; and in Russia on a relatively narrow strip of coastal tundra from the Chukotka Peninsula in the east and on the western Taymyr Peninsula in the west, with a break in distribution between these two areas (Earnst 2004, North 1993, Red Data Book of the Russian Federation 2001, Ryabitsev 2001, Il'ichev and Flint 1982, Pearce et al. 1998) (Figure 3.12).

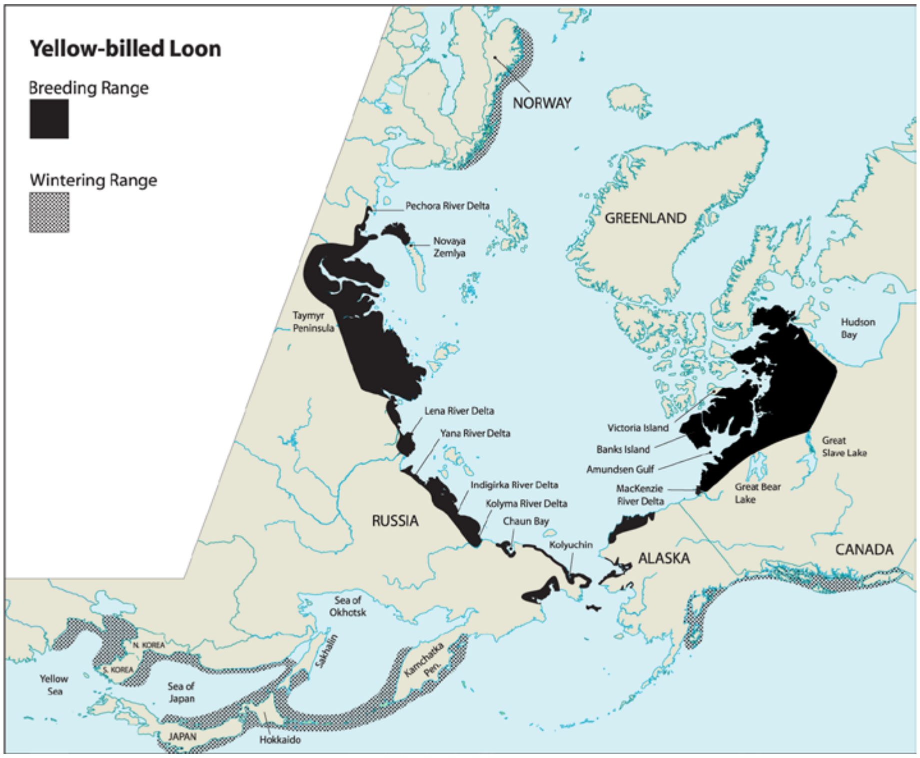
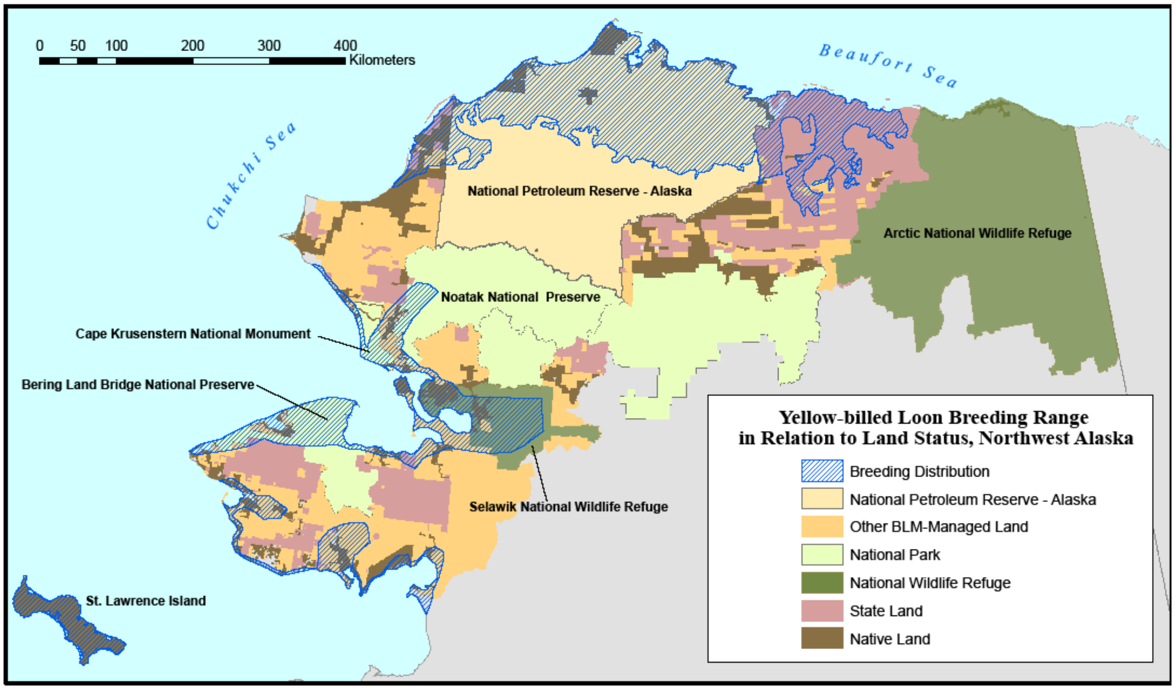


Figure 3.12. Range of the yellow-billed loon

The yellow-billed loon is a migratory species. During the non-nesting season (October through May), the species winters in principally coastal marine waters at mid to high latitudes, including southern Alaska and British Columbia to Puget Sound; the Pacific coast of Asia from the Sea of Okhotsk south to the Yellow Sea; the Barents Sea and the coast of the Kola Peninsula; coastal waters of Norway; and possibly Great Britain (Earnst 2004, North 1993, Ryabitsev 2001, Schmutz *pers. comm.* 2008, Strann and Østnes 2007, Burn and Mather 1974, Gibson and Byrd 2007) (Figure 3.12). A small proportion of yellow-billed loons may winter in interior lakes or reservoirs in North America (North 1994). Non-breeding birds remain in marine waters throughout the year, either in wintering areas or offshore from breeding grounds.

*Life History - Breeding*

Yellow-billed loons nest exclusively on margins of lakes and islands in coastal and inland low-lying tundra from latitude 62° to 74° North. Yellow-billed loons are sparsely distributed during the breeding season, and are somewhat clumped at a large scale, perhaps because of non-uniform habitat quality. Within Alaska, there are two breeding areas – the North Slope region north of the Brooks Range and the region surrounding Kotzebue Sound in northwest Alaska, primarily the northern Seward Peninsula (Earnst 2004, North 1993) (Figure 3.13).




Yellow-billed Loon breeding distribution follows Earnst (2004); land status from Alaska Department of Natural Resources, General Land Status Database

Figure 3.13. Yellow-billed loon breeding distribution in Alaska.

Nest sites are usually located on islands, hummocks, peninsulas, or along low shorelines, within 1 m of water. Nests are constructed of mud or peat, and are often lined with vegetation. It is thought that loons occupy the same breeding territory throughout their reproductive lives. One or two large eggs are laid in mid- to late June (North 1994). Egg replacement after nest predation occurs rarely as the short arctic summer probably precludes the production or success of replacement clutches (Earnst 2004). Hatching occurs after 27 to 28 days of incubation by both sexes. Although the age at which young are capable of flight is unknown, it is probably similar to common loons (8-9, possibly up to 11, weeks). Young leave the nest soon after hatching, and the family may move between natal and brood-rearing lakes. Both males and females participate in feeding and caring for young (North 1994).

Information on reproductive success is limited but significant inter-annual variation has been described. Mayfield survival rates to 6 weeks of ages for yellow-billed loons on the Colville River Delta between 1995-2000 ranged from 4% to 60% (Earnst 2004), with low success attributed to late ice melt or extreme flooding. Apparent nest success on the Colville River Delta recorded by aerial surveys ranged from 19% - 64% between 1993 and 2007 (ABR, Inc. 2007, ABR, Inc., unpublished data).

During the breeding season, foraging habitats include lakes, rivers, and the nearshore marine environment. Successfully breeding adults feed their young almost entirely from the brood-rearing lake (North 1994).

*Life History – Migration and Wintering*

Yellow-billed loon migration routes are thought to be primarily marine. J. Schmutz (2008) found that adult yellow-billed loons marked with satellite transmitters on Alaska breeding grounds generally remained between 1 and 20 miles from land during migration and winter.

Yellow-billed loons migrate singly or in pairs, but gather in polynyas (areas of open water at predictable, recurrent locations in sea-ice covered regions), ice leads (more ephemeral breaks in sea ice, often along coastlines), and early-melting areas off large river deltas near breeding grounds in spring along the Beaufort Sea coast of Alaska and Canada (Barry et al.1981, Barry and Barry 1982, Woodby and Divoky 1982, Johnson and Herter1989, Barr 1997, Alexander et al. 1997, Mallory and Fontaine 2004).

Yellow-billed loons breeding in Alaska are also being studied to determine their migration routes. Twenty-six yellow-billed loons captured on the ACP between 2002 and 2009 were outfitted with satellite transmitters (J. Schmutz; pers. comm. 2010). All of them migrated south to Asia, predominantly along the Russian coastline from the Chukotka Peninsula (either through the Bering Strait or across the mountains from the north side of the Chukotka Peninsula to the Gulf of Anadyr), and along the Kamchatka coast (J. Schmutz; pers. comm. 2010, Rizzolo and Schmutz 2010); these loons wintered in the Yellow Sea and Sea of Japan off the coasts of China, North Korea, Russia, and near Hokkaido, Japan (near). All 10 yellow-billed loons captured on the Seward Peninsula, Alaska and fitted with transmitters in 2007 and 2008 also used the Bering Strait region after leaving their breeding grounds. Five of these loons migrated to Asian breeding grounds as described above for ACP breeding birds; the other 5 wintered throughout the Aleutian Islands from Shemya Island in the west to the Semidi Islands off the coast of the Alaska Peninsula (Schmutz in litt,. 2008). Most of these yellow-billed loons departed breeding areas in late September, arrived in wintering locations in mid-November, started spring migration in April, and arrived on breeding grounds in the first half of June; these dates are consistent with breeding ground arrival dates reported by North (1994).
Non-breeders or failed nesters may start their fall migration in late June to mid-July (Rizzolo and Schmutz 2010). Satellite telemetry data indicate that many yellow-billed loons that breed on the ACP likely migrate to Asia during the winter; some also migrate to the Aleutian Islands (3.14; Rizzolo and Schmutz 2010: 1). However, specific wintering sites are still unknown due to a loss of signal reception of all birds once they moved west of Japan; signals reappeared during spring migration (Rizzolo and Schmutz 2010: 13).

The migration routes of yellow-billed loons breeding in Russia have not been studied. Because of the proximity of the Chukotka Peninsula to the North Slope in Alaska, and the fact that North Slope breeding yellow-billed loons use the Chukotka Peninsula during migration (J. Schmutz in litt., 2008), it is likely that some or all yellow-billed loons from eastern Russia migrate through the Chukchi Sea and Bering Straits to Asian wintering areas.

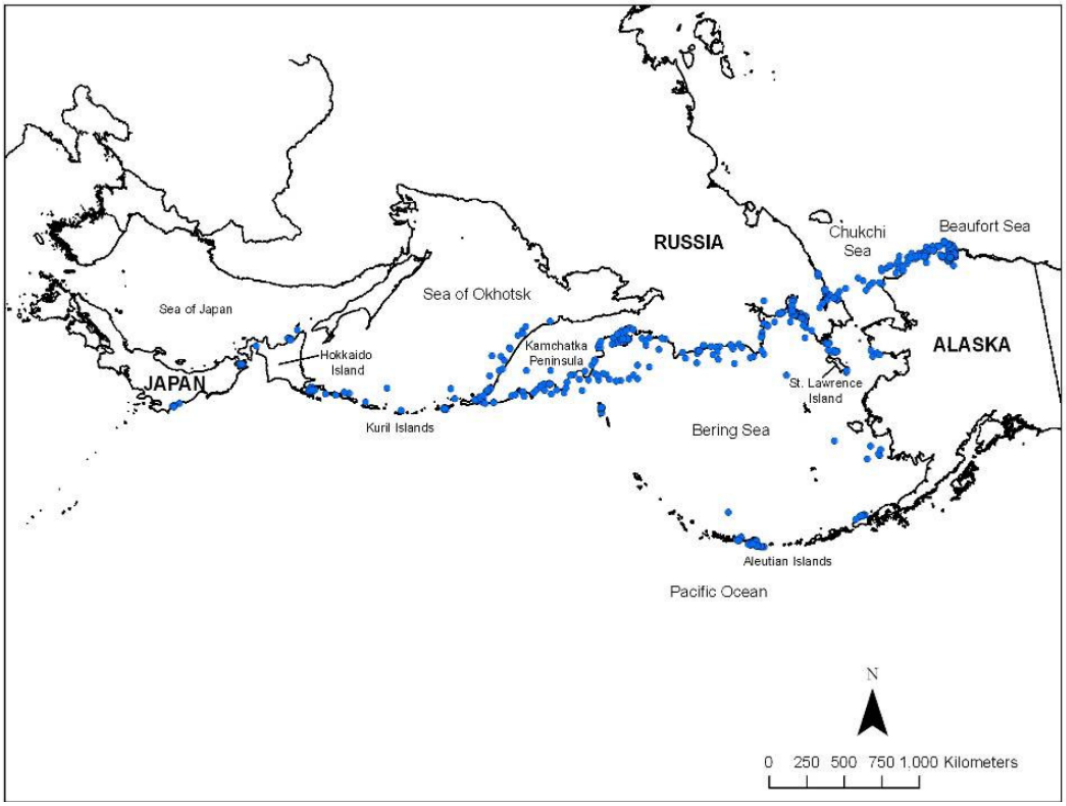



Figure 3.14. Satellite telemetry locations of yellow-billed loons in 2008-2010. From Rizzolo and Schmutz (2010).

*Abundance and Trends*

The global population size of yellow-billed loons is unknown, but probably in the range of 16,000-32,000, with 3,000-4,000 thought to breed in Alaska (Federal Register 74(56):12932-12968). Maximum estimates based on the amount of available habitat (plus limited survey data for Canada) are 20,000 birds in Canada and 8,000 in Russia. Most of the breeding range of the yellow-billed loon has not been adequately surveyed, and only in Alaska have surveys been conducted specifically for breeding yellow-billed loons.

Until 2007, yellow-billed loon population indices on the North Slope were determined by two independent fixed-wing aerial transect surveys for waterfowl conducted each year by the Service's Migratory Bird Management program (MBM). The North Slope Eider survey was flown in early June (1992-2008) and the Arctic Coastal Plain survey in late June (1986-2006). Survey timing and coverage differed between the two surveys, and consequently the resulting yellow-billed loon population index differed. In 2007, MBM merged the two surveys into a single Arctic Coastal Plain survey flown in early June. Based on several studies and survey methods, an estimated 2,500-3,500 yellow-billed loons breed on the North Slope (USFWS unpublished data based on examining results in Earnst et al. 2005, Stehn et al. 2005, Mallek et al. 2007, Larned et al. 2009).

Population indices in western Alaska are determined from fixed-wing aerial lake-circling surveys flown on the Seward Peninsula and Cape Krusenstern (June 2005 and 2007) and transect surveys of Selawik National Wildlife Refuge (June 1996 and 1997) (Platte 1999, Bollinger et al. 2008). Approximately 500 loons are estimated to breed in the Kotzebue Sound region in western Alaska.

Although there is no recent survey estimate of yellow-billed loon nesting population on St. Lawrence Island (USFWS 2009b) and no published record since the late 1950s (Fay and Cade 1959), the number nesting there is thought to be approximately 50 birds (Fair 2002).

Several analytical approaches have been used to estimate population trends for yellow-billed loons breeding on the North Slope. Aerial survey data adjusted for the possible confounding variation due to survey timing, phenology, and observer experience, indicated an average trend from 1986-2003 of 0.991 (0.964–1.018, 95% CI; Earnst et al. 2005). The Service recently examined a subset of the NSE data through 2008 that analyzed the pilot-observer data and estimated the average growth rate as 0.986 (0.967–1.006, 95% CI). Finally, including the most recent aerial indices for the NSE survey not adjusted by covariates, the 1992-2011 growth rate was 1.020 (1.007–1.034, 90% CI, Larned et al. 2012). These multiple analytical approaches provide varying estimates of trends ranging from slightly increasing to slightly decreasing, and those estimates with the most precision (95% CIs) include a lambda of 1.0. Thus, the population of yellow-billed loons breeding on the North Slope may be stable, slightly increasing, or slightly decreasing.

Surveys in western Alaska have not been conducted for a long enough period (only in 2005 and 2007) to detect trends. Similarly, limited surveys have been conducted only in small parts of the Russian and Canadian breeding ranges, so population sizes for these ranges are gross approximations and no information on trends is available. Therefore, we are not able to estimate trends at the species level.

# 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 12,916 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), Steller's and spectacled eiders can be moving from wintering to breeding areas, on breeding area, migrating from breeding to molting areas, and on molting areas. Spectacled eiders occur in the following AMBCC regions during the proposed Action:

North Slope, Northwest Arctic, Bering Strait/Norton Sound, and YK Delta. Steller's eiders have a wider distribution during the proposed Action and can occur in the same AMBCC regions as spectacled eiders in addition to the following regions: Aleutian/Pribilof Islands, Bristol Bay, Kodiak, and Cook Inlet.

Both species have undergone significant, unexplained declines in their Alaska-breeding populations. Factors that may have contributed to the current status of spectacled and Steller's eiders are discussed below and include, but are not limited to, toxic contamination of habitat (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.

Data from annual aerial surveys adjusted by a surrogate visual correction factor estimates the North Slope-breeding population of spectacled eiders is approximately 12,916 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, increased predator populations, harvest, and impacts of development, science impacts, and climate change. Factors that affect adult survival may be most influential on population growth rates. Recovery efforts for both species are underway in portions of the Action Area.

*Increased Predator Populations*

There is some evidence that predator and scavenger populations may be increasing on the North Slope near sites of human habitation, such as villages and industrial infrastructure (Eberhardt et al. 1983, Day 1998, Powell and Bakensto 2009). Researchers have proposed that reduced fox trapping, anthropogenic food sources in villages and oil fields, and nesting/denning sites on human-built structures have resulted in increased fox, gull, and raven numbers (R. Suydam and D. Troy pers. comm., Day 1998). These anthropogenic influences on predator populations and predation rates may have affected eider populations, but this has not been substantiated. However, increasing predator populations are a concern, and Steller's eider studies at Barrow attributed poor breeding success to high predation rates (Obritschkewitsch et al. 2001), and in years where arctic fox removal was conducted at Barrow prior to and during Steller's eider nesting, nest success appears to have increased significantly (Rojek 2008, 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 (DEW) Line sites at Cape Lonely and Cape Simpson (*circa* 1957), and more recently, the initiation and expansion of oil development since construction of the Prudhoe Bay field and Trans Alaska Pipeline System (TAPS) in the 1970s.

The population of communities such as Barrow has been increasing, and the U.S. Bureau of Land Management (BLM) (2007) predicts growth to continue at approximately 2% per annum until at least the middle of this century. Assuming community infrastructure and footprint grow at roughly the same pace as population, BLM (2007) estimates that community footprint could cover 3,600 acres by the 2040s. Major community development projects such as the new hospital, landfill, and water treatment plant at Barrow, airport improvements and development of science support facilities in the area, have all undergone formal section 7 consultations
There are currently few permanent structures associated with the oil and gas industry in National Petroleum Reserve-Alaska (NPR-A), a vast area that contains virtually all currently occupied nesting habitat for the listed population of Steller's eiders, and almost 90% of the North Slope breeding habitat of spectacled eiders (USFWS 2008). However, development has steadily moved westward towards NPR-A since the initial discovery and development of oil on the North Slope. Given industry's interest in NPR-A as expressed by lease sales, seismic surveys, drilling of exploratory wells, and the construction of the Alpine field, industrial development is likely to continue in NE and NW NPR-A. Development in NPR-A may also facilitate development in more remote, currently undeveloped areas such as the Chukchi Sea or areas of the Beaufort Sea, and vice versa. Formal section 7 consultations were conducted for MMS's Lease Sale 193 in the Chukchi Sea, and Lease Sales 185, 196, and 202 in the Beaufort Sea. Consultation on these areas will continue if development proceeds past the exploration phase under the incremental step consultation authority granted to Outer Continental Shelf (OCS) activities (50 CFR § 402.14(k)).

*Incidental Take*
Recent activities across the North Slope that required formal section 7 consultation, and the estimated incidental take of listed eiders, is presented in 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 enter (recruit) into the breeding population. Similarly, we expect that only a small proportion of spectacled and Steller's eider eggs or ducklings on the North Slope would eventually survive to recruit into the breeding population.

Appendix 8 illustrates the number and diversity of Actions that required consultation in Alaska. We believe these estimates have overestimated, possibly significantly, actual take. Actual take is likely reduced by the implementation of terms and conditions in each biological opinion, is spread over the life-span of a project (often 50 years), and is dominated by the *potential* loss of eggs/ducklings which, as described above, is of less significance than adult mortality for survival and recovery of these K-selected species. Also, it remains unknown to what degree spectacled and Steller's eiders potentially affected by disturbance can reproduce in disturbed areas or move to other less disturbed areas to reproduce. If either or both occur, these factors also serve to reduce actual impacts from the maximal potential impacts.

*Research*

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

The FWS has issued permits under Section 10 of the Act to authorize take of endangered or threatened species for purposes of propagation, enhancement, or survival. Annual reporting requirements associated with §10 permits for both spectacled and Steller's eiders indicate 11 spectacled eider adults and 5 eggs have reportedly died as an indirect result of research activities since 1993 (due to the numerous amended actions and permits, and because of the variation and inconsistencies in reporting, accomplishing a precise tally of incidental take proved difficult). From 1997 to present, the Service estimates approximately 1 Steller's eiders from the listed Alaska-breeding population has died incidental to research activities (based on a total of 37 Steller's eiders reportedly taken from the non-listed Pacific-wintering population, incidental to research activities, and the estimate that approximately 1% of the Pacific-wintering population are Alaska-breeding Steller's eiders). Since listing, there likely have been no listed Steller's eider adults intentionally taken (from a probabilistic standpoint), though there have been 16 permitted and 16 actual, direct and intentional takings of non-listed Steller's eider adults. Additionally, permits have been issued to salvage and opportunistically collect up to 68 Steller's eider eggs from the Alaska-breeding population for a captive breeding program at the Alaska Sea Life Center (ASLC). To date, 31 eggs have been taken. The eiders taken in these research programs have provided biological information and the eggs have been used to establish a captive breeding population of the species to ultimately improve our understanding of their reproduction in the wild and help future efforts to recover the species.

*Climate Change*

High latitude regions, such as Alaska's North Slope, are thought to be especially sensitive to 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 the MOU between the subsistence community representatives and the Service describing the collaboration that will occur during the harvest to reduce/eliminate shooting mortality and injury of Steller's eiders. Thus, the environmental baseline, which describes the present human and natural context, provides the starting point for the Service's effects analysis.

## 4.2 Yellow-billed Loons

In designating the yellow-billed loon as a candidate species, the Service considered the best available data about factors that could affect their populations. Factors that may be affecting yellow-billed loons in the Action Area are thought to include harvest (assessed in this document in the Effects of the Action section), oil and gas development, inadvertent fishing by-catch, climate change, and conservation efforts. These are discussed below.

*Oil and Gas Development*

Oil and gas development has occurred on the North Slope, primarily on state lands between the Arctic National Wildlife Refuge and NPR-A. Over 90% of yellow-billed loons nesting on the North Slope nest within NPR-A (USFWS 2009c). The majority of yellow-billed loon nesting habitat in NPR-A is not presently affected by development because only seismic and exploratory operations have been conducted in NPR-A to date. However, the BLM has authorized two satellite production pads (CD-6 and CD-7) as part of the ConocoPhillips Alpine Satellite Development project (Alpine) in the Northeast Planning Unit (USBLM 2004), and the USACE has recently authorized the development of another Alpine satellite facility (CD-5; USACE Permit No. POA-2005-1576, issued December 19, 2011) and associated roads and pipelines on Ukpiagvik Inupiat Corporation (UIC) lands within the Northeast Planning Unit boundary. Although additional development has been authorized and is likely to occur in the future, we expect disturbance and habitat degradation that may result from oil and gas development on BLM-managed lands in NPR-A would largely be mitigated by BLM's stipulations and required operating procedures (USBLM 2004, USBLM 2008). The remaining North Slope nesting population, particularly yellow-billed loons nesting on the Colville River Delta and lower concentrations in the Kuparuk and Prudhoe Bay oil fields, may be affected by current oil and gas development on non-Federal lands, including Alpine's existing Central Processing Facility (CPF; CD-1) and satellite production pads (CD-2, CD-3, and CD-4) on the Colville River Delta.

The potential negative effects of industrial development in yellow-billed loon nesting areas includes disturbance caused by aircraft, vehicular traffic, heavy-equipment use, maintenance activities, and pedestrian traffic. Disturbance to nesting birds from oil infrastructure has been widely discussed but poorly documented (National Research Council 2003, BLM 2008). Loons as a genus are susceptible to disturbance, although they sometimes habituate to predictable disturbance (Vogel 1995, Barr 1997, Evers 2004, Earnst 2004, Mills and Andres 2004, North

1994). Human disturbance could cause yellow-billed loons to abandon reproductive efforts or leave eggs or chicks unattended and exposed to predators or bad weather (Earnst 2004).

Both non-nesting and breeding yellow-billed loons on Alaska's North Slope use marine areas of the Beaufort and Chukchi seas to forage. Additionally, in spring yellow-billed loons gather in polynyas, ices leads, and open shorelines near river deltas offshore of breeding areas prior to dispersing to nesting grounds. Thus yellow-billed loons are at risk from spills of crude and refined oils that may result from oil and gas development in the area.

Surveyors saw a group of three yellow-billed loons in Klondike and two groups totaling three birds in the Burger Prospect area in early fall; they also saw a single bird in Klondike Prospect area in late fall (Gall and Day 2010). In 2009, surveyors saw 23 groups totaling 48 yellow-billed loons, and they were seen primarily in early fall and primarily in Burger Prospect area and the eastern half of Klondike Prospect Area (Gall and Day 2010).

Water withdrawal from freshwater lakes to construct ice roads and pads, or supply exploration camps may adversely affect nesting habitat. However, regulations by the State of Alaska and BLM will likely prevent any significant adverse effects to yellow-billed loons from water withdrawal activities (USFWS 2009*c*).

As the majority of yellow billed loon breeding areas in western Alaska are managed as wildlife refuges or national parks, they are not subject to the same broad-scale extractive industry or infrastructure as the North Slope. While future development could occur there, oil and gas development is not a threat at present.

*Subsistence Fishing By-catch*

Across the Alaska breeding range of the yellow-billed loon, rural residents fish using gill nets near villages and fish camps, in marine inlets and lagoons, lakes, and rivers (Craig 1987, Bacon 2008 pers. comm.). During the breeding season, yellow-billed loons often forage for fish in the same areas targeted for fishing (Earnst 2004), which leads to the potential for loons being inadvertently caught in nets. Yellow-billed loons may also be susceptible during spring and fall migrations when foraging in near-shore marine habitats.

While it is illegal to kill yellow-billed loons under the MBTA, fishermen on the North Slope are allowed to possess up to 20 total yellow-billed loons inadvertently caught in nets annually (USFWS 2009a). Little information is available regarding the number of loons caught in subsistence nets for most of the state, with the exception of the North Slope, which is discussed in more detail, below.

Fisherman on the North Slope, as part of the AMBCC regulation allowing possession of yellow-billed loons, are required to report their catch to The North Slope Borough Department of Wildlife Management (NSB), who provides a summary report to the AMBCC at the end of the fishing season. Participation by fishermen is incomplete, subject to numerous unquantifiable biases, and likely varies annually. NSB reports indicate that 2 to 14 yellow-billed loons were reported as killed in subsistence nets annually from 2005-2010 in Barrow (NSB-DWM 2006, 2007, 2008, 2009, 2010, 2011a). Small numbers of loons, including yellow-billed loons, were also reported as found alive and released. These numbers are likely a minimum estimate of yellow-billed loon subsistence by-catch in the Barrow area because not all fishermen were contacted (NSB-DWM 2008). Additionally, anecdotal evidence suggests that yellow-billed loons killed in fishing nets have been reported as part of the subsistence harvest rather than as inadvertent catch in fishing nets (USFWS 2010b). This suggests that larger numbers of yellow-billed loons are taken as fisheries by-catch than assumed previously. To address this discrepancy, the North Slope Borough developed more effective by-catch survey methods for use in 2011-2013 to better quantify take in this region. A total of 125 and 116 households in Barrow, Atqasuk, and Nuiqsut were surveyed in 2011 and 2012, respectively, to estimate the number of yellow-billed loons inadvertently entangled in subsistence fishing nets. The total number of dead yellow-billed loons reported was approximately 19 in 2011 and 10 in 2012. A total of 13 were released alive and 8 loons were kept for traditional and ceremonial purposes (Sformo et al. 2012, 2013). The 2013 NSB-DWM report is not available.

In summary, data is limited on the number of yellow-billed loons taken inadvertently during subsistence fishing in Alaska. We do not have enough information to extrapolate subsistence by-catch accounts to areas lacking data or to evaluate likely population-level affects. While it is possible that take of yellow-billed loons during subsistence fishing, combined with other threats, may impact recovery of the species, conservation recommendations by the Service will strive to improve estimates of this source of mortality.

*Climate Change*

There are multiple hypothetical mechanisms associated with climate change that could potentially affect loons and their breeding and non-breeding habitats. Currently, however, we lack predictive models on how climate change will affect yellow-billed loon terrestrial, freshwater, and marine habitats, and there is little certainty regarding the timing, magnitude, and net effect of impact. However, despite uncertainty over how climate change will affect yellow-billed loons in the long term, we have no reason to believe that climate change will provide a significant stressor to yellow-billed loon populations within the next year, which is the interval over which the effects of this Action are being evaluated.

*Conservation Efforts*

In 2006, the Service, National Park Service, Alaska Department of Natural Resources, Alaska Department of Fish and Game, Bureau of Land Management, and the North Slope Borough entered into a “Conservation Agreement for the Yellow-billed Loon (*Gavia adamsii)*.” The agreement specifies the goal of protecting the yellow-billed loon and its habitat in Alaska and identifies several strategies for achieving this goal. These strategies include: (1) implement specific actions to protect yellow-billed loons and their breeding habitats in Alaska from potential impacts of land uses and management activities, including oil and gas development; (2) inventory and monitor yellow-billed loon breeding populations in Alaska; (3) reduce the impact of subsistence activities (including fishing and hunting) on yellow-billed loons in Alaska; and (4) conduct biological research on yellow-billed loons, including response to management actions.

The Conservation Agreement partners have continued collaborating to collect and refine information about the yellow-billed loon to help guide future management. For example, BLM has proactively worked with loon experts and the Service to identify appropriate protections for the species and its habitat. Those protections were incorporated into their Records of Decision for NPR-A management plans.

Past Service outreach efforts have included staff trips to Gambell and Savoonga on St. Lawrence Island in 2003 and 2009 (Zeller 2003, Ahmasuk 2010) to gain information on loon subsistence harvest. Based on these visits and information from other villages, the Service has developed conservation measures to reduce take of yellow-billed loons and improve harvest surveys, which are included in this document.

# 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 (TEK), 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 2010b), 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 (2009a, 2009b). 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 eggs harvest data produced by the annual harvest monitoring program of the Alaska Migratory Bird Co-Management Council (AMBCC) (Naves 2010a, 2010b, 2011, 2012, Naves 2014, *in prep*; Appendices 4,5,6,7,and 8). 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, fall). These data were not included in Huntington (2009a, 2009b).

4) Dedicated study conducted on Saint Lawrence Island specifically addressing yellow-billed loon conservation concerns in 2011–2012 (Naves and Zeller 2013) This study addressed loon identification issues and harvest levels.

In using harvest survey reports to evaluate harvest, it is important to consider that 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 2009, USFWS 2010b). 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 2009 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 Biological Opinion 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. Additionally, for yellow-billed loons we considered the effects of inadvertent by-catch in subsistence fishing nets.

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 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 the subsistence harvest for whales. Therefore, hunters along the western coast of Alaska may encounter Steller's eiders during spring migration, and they may be harvested during hunting focusing 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.

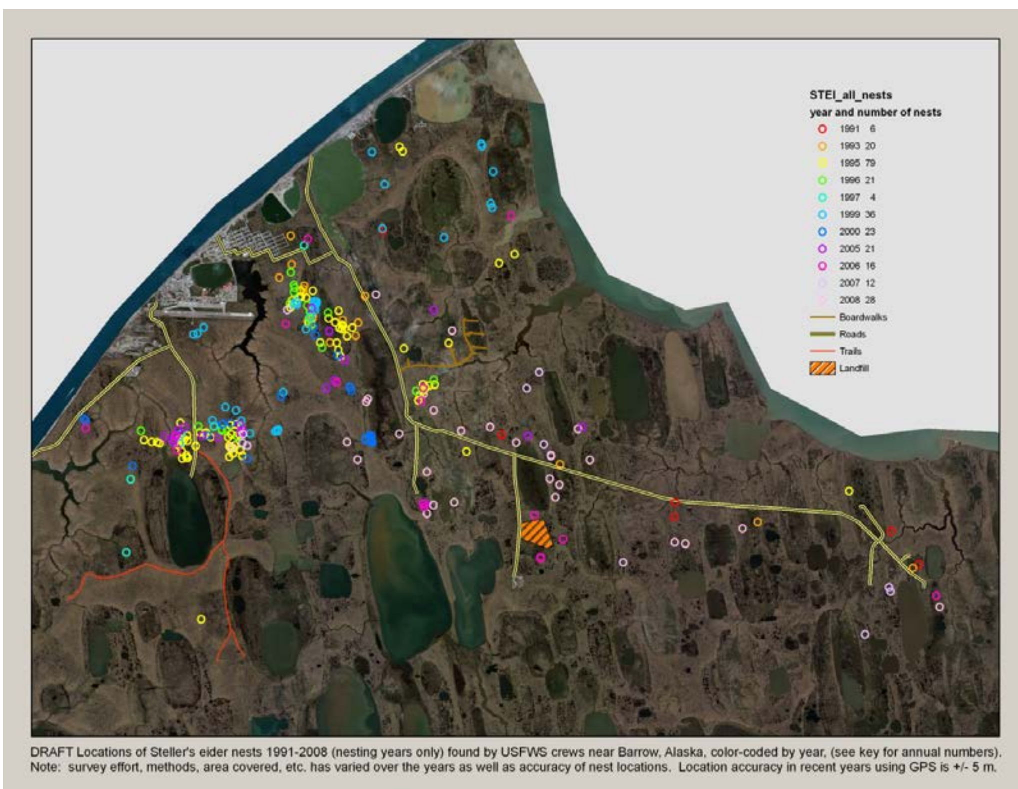



Figure 5.1. Steller's eider nests found during studies near Barrow, 1991-2008 (Quakenbush *et al.* 1998, Rojek 2008).

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 (2009a) 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 Steller's eider harvest of 321 in that year (Fuller and George 1997, and summarized by Huntington 2009a), 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 (2009a) 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 (2009a) 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 2010, 29 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 2014, 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 threatened 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.

## 5.2 Spectacled Eiders

*Vulnerability of Spectacled Eiders to Harvest*

Similar to Steller's eiders, 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. 3.6 and 3.7). 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 (2009a) 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 2014 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. As with Steller's eiders, 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.

As with Steller's eiders, spectacled eider harvest data may be plagued by misidentification among eider species. 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. As identified above with Steller's eiders, 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 –Steller's and Spectacled Eiders*
Proposed subsistence harvest subsistence 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 Steller's and spectacled 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 2012 (AMBCC 2010b). The closure is likely most effective near Barrow, where increased outreach and LE 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 Steller's or spectacled 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 Steller's and spectacled 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 2004-2010 (Naves 2009a, Naves 2011, Naves 2012). 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 Steller's and spectacled 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- Steller's and spectacled 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 (G. Peltola, Refuge Manager, pers. comm.) in 2009 although lead shot was still available in stores and hunters were 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 2012 spring waterfowl hunt, but take is difficult to quantify. While outreach and LE efforts may have reduced the use of lead shot over time, any spent lead shot in breeding wetlands will remain available to Steller's and spectacled eiders for years. However, we believe that the contribution caused only by the 2012 hunt to this long-term problem will be minimal.

*Increased human disturbance*

The activities associated with the spring hunt will likely result in an increase of hunter presence in areas used by Steller's and spectacled 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.

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.

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.

Given: 1) the uncertainty in how disturbance affects recruitment; 2) 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; and 3) the sparse distribution of spectacled eider nests across both breeding areas, we expect that the adverse effects to Steller's and spectacled eiders from disturbance as a result of the Action is possible but will likely be minimal.

*Listed Eider Critical Habitat*
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. 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. 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 Steller's and spectacled eiders for years. However, we believe that the contribution caused by the 2014 hunt to this long-term problem will be minimal, and therefore the Action is unlikely to adversely modify critical habitat for listed eiders.

### 5.3 Yellow-billed Loon

The Action may affect yellow-billed loons through hunting mortality, egg collection, lead contamination, and/or disturbance. Effects are described below.

*Harvest Surveys*
Huntington (2009b) summarized historical Alaska bird harvest data in 1965–2006. Harvest of yellow-billed loons was reported in the Bering Strait-Norton Sound, Y-K Delta, and Bristol Bay regions. In 19 years with information for more than one region, reported harvest ranged 14–650

loons/year. In most years, significant numbers were reported in the Y-K Delta (4–370 loons/year). Relatively high numbers were reported in some years in the Bering Strait-Norton Sound (25–322 loons/year) and Bristol Bay (5–269 loons/year) regions. In 19 years with data for multiple regions, totals were <100 loons/year in 9 years, 100–200 loons/year in 5 years, and >200 loons/year in 5 years, while sampling coverage was highly variable among years (Huntington 2009). Recent studies suggest that species misidentification could be a major source of error in harvest estimates at the species level.

Estimates for harvest for the North Slope (Bacon et al. 2011) in 1994–2003 suggested low levels of yellow-billed loon harvest in most communities and years. Data for Barrow reported yellow-billed loon harvest in 2 years (12 and 18 loons/year). AMBCC data for the North Slope suggest that hunting harvest reports have included an unknown number of loons inadvertently entangled in subsistence fishing nets (Naves 2010a, 2010b). In 2005–2010, the North Slope Borough conducted an assessment of loon entanglement in fishing nets largely based on self-reporting by fishers (NSB-DWM 2006, 2007, 2008, 2009, 2010, 2011a). In 2011–2013, the North Slope Borough implemented a survey specifically designed to assess loon entanglement (NSB-DWM 2011b, Sformo et al. 2012, 2013). It is unknown the extent to which loons represented in North Slope hunting harvest reports include take from fisheries bycatch.

AMBCC surveys (2004–2011, entire documents) show harvest reports of yellow-billed loons and their eggs in the Bering Strait-Norton Sound, Bristol Bay, North Slope, and Y-K Delta regions (Naves 2010a, 2010b, 2011, 2012, 2014 *in prep*). Harvest for 2004 to 2011 was reported from the 4 regions (with variable coverage among years); a total of 1,924 yellow-billed loons (average 241 /year) were estimated to be taken, with slightly less than half during the spring hunt and slightly more than half during the fall hunt. As noted above, about half of the 237 estimated from the North Slope in 2007–2009 were reported as drowned in fishing nets (Naves 2010a, 2010b). However, it is not possible to distinguish shooting and entanglement in fishing nets as a source of take for other regions of the state because AMBCC surveys do not ask about means of capture (Naves 2010a, Naves 2010b). NSB-DWM (2011b) reports that yellow-billed loons are not targeted using fishing nets or any other means by subsistence users. Few (less than 5/year on average) were reported in the Y-K Delta in contrast to earlier survey reports summarized by Huntington (2009b). By far the greatest harvest was from Bering Strait-Norton sound, where annual harvest estimates ranged 22–1,077 (Naves 2010a, Naves 2010b, Naves 2011Naves 2012, Naves 2014 *in prep*). Concurrent with high estimated yellow-billed loon harvest from the Bering Strait-Norton sound were high common loon harvest estimates, which ranged from 404 to 2,514, and comprised the majority (60%) of reported loon harvest from these years. Common loons are considered rare near St. Lawrence Island (Lehman 2011) suggesting significant misidentification and reporting error in the loon harvest survey reports from this area.

Across 8 years of harvest reports, point estimates for statewide yellow-billed loon egg harvest ranged 0–60 annually (8-year total = 162), with 92 (57%) of the reported total from the Y-K Delta, where the species rarely, if ever nests (B. McCaffery, USFWS, pers. comm., USFWS 2006), and 70 (43%) from the Bering Strait-Norton Sound region, where the species does nest. Thus, egg harvest data also suggest significant error in harvest survey estimates for yellow-billed loons.

The 2011–2012 dedicated loon study on St. Lawrence Island included fall bird counts, harvest surveys, ethnographic research, and outreach activities addressing yellow-billed loon conservation concerns (Naves and Zeller 2013). A key goal of the project was to conduct the 2011–2012 St. Lawrence Island bird harvest surveys with scientific rigor. Important components include: (1) Implementation of the sampling design included local expertise (local surveyors) and expertise in harvest data collection (anthropologists) and loon identification (avian biologists). (2) Outreach and education efforts informed and involved the communities. (3) Sampling coverage was maximized and only a small proportion of households was not surveyed (households that could not be contacted or that declined to participate in the survey). (4) Recall bias was minimized by collecting fall harvest data (when most loon harvest occurs) just at the end of the season. (5) Although it was not possible to specifically assess potential biases in harvest reporting (under or over-reporting), there were no indications that potential biases could have significantly affected harvest estimates including loon estimates. (6) Limitations in loon species identification in harvest surveys were established with ethnographic information and bird counts and adjusted species-specific harvest estimates were based on fall bird counts. (7) Data review included extensive participation of the communities and staff from ADF&G, USFWS, and USGS. In this context, this study addressed some difficulties with previous harvest surveys and provided more reliable harvest estimates representing bird and egg harvest levels in the study communities.

In 2011, use of the historical survey materials in a context of increased sampling effort and dedicated expertise in harvest data collection and loon identification clarified harvest levels and highlighted difficulties in species identification. Modifications to the 2012 survey materials minimized species identification issues and allowed quantification of harvest preference for young loons. The 2011–2012 annual average total bird harvest was 5,171 birds for Gambell and 4,038 birds for Savoonga. Loons represented 0.3% of the total bird harvest in Gambell and 3.7% in Savoonga. Harvest of loon eggs was not reported. In 2011, harvest estimates included 151 loons reported as common (53.6%), Pacific/Arctic (27.8%), yellow-billed (11.3%), and red-throated (7.3%) loons. In 2012, harvest estimates included 179 loons reported as nonbreeding unidentified (64.2%), common (3.4%), Pacific/Arctic (26.3%), yellow-billed (1.7%), and red-throated (4.4%) loons. Because of indications of significant misidentification in reported harvest, harvest species composition was also estimated by adjusting for the proportion of nonbreeding loons in harvest reports and the proportion of species and plumages in counts of loons seen from St. Lawrence Island. First, the proportion of nonbreeding loons in 2012 summer and fall harvests (64.2%, seasons combined) was applied to 2011summer and fall harvests to account for selective harvest of young loons (the 2011 survey did not include nonbreeding loon plumages). Second, the 2011–2012 average species and plumage composition in counts of loons seen near St. Lawrence Island (Naves and Zeller 2013) were used to estimate adjusted species-specific harvest estimates (2011 breeding and nonbreeding plumages, 2012 nonbreeding plumages). Yellow-billed loon harvest estimated using these adjustments were 4 birds in 2011 and 5 birds in 2012 (Naves and Zeller 2013). Note these adjusted estimates assume that loons are taken in proportion to their relative abundance near the island, with no differences in hunter preference or vulnerability to hunting among species.

In the context of the 2011–2012 St. Lawrence Island loon dedicated study, a new data release agreement was established with the villages to retrospectively evaluate 2004–2010 AMBCC harvest estimates. Loon harvest estimates for the Bering Strait-Norton Sound region in 2007 (4,042 loons, all species, Naves 2010a) were largely associated with unusually high estimates for the community of Savoonga (3,748 loons, all species). Actual variability in harvest effort and resource availability may have resulted in the unusual 2007 harvest estimates. However, during this review no evidence was found of unusual ecological or socio-economic events that could have affected bird and egg harvests in 2007. Potential issues with 2007 harvest estimates were therefore attributed to implementation of the sampling design (Naves and Zeller 2013).

*Difficulties in Using Available Data to Evaluate Yellow-billed Loon Harvest*

Most available harvest data come from surveys designed to cover many bird species across a large area. Some surveys also include all subsistence resources (moose, caribou, salmon, marine mammals, etc.), such as the surveys conducted by the North Slope Borough and selected villages summarized in Huntington (2009b). Some species are abundant and harvested in relatively large numbers; others such as the yellow-billed loon are harvested only occasionally because they are rare, have restricted distribution, or are not widely used for subsistence. Harvest estimates for species rarely harvested will be less accurate and less precise than those for more commonly harvested species.

Additionally, harvest data collection faces its own challenges (Georgette 2009 and Wentworth 2004 cited in Huntington 2009, Naves and Zeller 2013). Subsistence harvest surveys usually involve particular socio-cultural settings in remote areas, and depend on collaborations and relationships that tend to be fragile. It may be difficult to implement standard sampling and data collection procedures, resulting in unquantifiable measurement errors. Also, respondents may under report species closed to harvest (biasing estimates low), or may over-estimate harvest to emphasize the importance of subsistence (biasing estimates high). Other potential biases include recall error and failure to report birds downed but not recovered. These sources of errors and biases certainly compromise the accuracy of harvest data, but it is impossible to know the magnitude and direction (over- or underestimating) of each and their cumulative effect upon estimates. Additionally, differences in effort and methods among studies compromise comparisons among years or studies. Another bias in loon harvest estimates is the mischaracterization of fishing bycatch as hunting harvest (Huntington 2009, Omelak 2009, Naves 2012). This likely has resulted in overestimation of loon hunting harvest at least for the North Slope. Finally, reported loon harvest survey data make clear that estimates are significantly compromised by misidentification among loon species. This topic, discussed in detail in the following section, indicates that without targeted surveys accompanied by significant effort, and discussion targeting individual hunters, harvest survey estimates of loons at the species level are unreliable.

*Misidentification of Yellow-billed Loons*

Identification of loon species requires advanced skills whether following western taxonomy or ethnotaxonomy. In both western and Alaska Native cultures, likely only a small proportion of people have such skills. Misidentification of loon species reported in harvest surveys is likely a large source of error in yellow-billed loon harvest estimates. In historical surveys, a significant number of yellow-billed loons (>100 birds/year) were reported as harvested in the Y-K Delta (Huntington 2009), of which over half occurred in inland areas where the species is extremely rare and this level of harvest is therefore unlikely (USFWS 2006; B. McCaffery, Yukon Delta National Wildlife Refuge, pers. comm.). In more recent surveys, 82% of the estimated statewide egg harvest occurred in the Y-K Delta (Naves 2010a), where the species is not known to nest (USFWS 2006; B. McCaffery, Yukon Delta National Refuge, pers. comm.). These estimates of high harvest rates for areas outside the species' normal range suggest a high rate of misidentification or reporting error.

Evidence of misidentification in reported harvest is also available for the Bering Strait-Norton Sound region, where the largest yellow-billed loon harvest estimates occurred in the AMBCC survey. High harvest rates of yellow-billed loons are possible for this region given that a large proportion of the range-wide population migrates through the Bering Strait in spring and fall, and that a small number of yellow-billed loons nest on St. Lawrence Island and the northern Seward Peninsula (see Distribution section above). Among 31 hunters interviewed on St. Lawrence Island, 26 (84%) stated that they harvested loons; Pacific and yellow-billed loons were the most frequently harvested loons (Zeller et al. 2011). Over half of the loons harvested in this region were reported as common loons (404–2,514, Naves 2010a), although common loons are rare in this region (Fay and Cade 1959; Kessel 1989; Lehman 2011). Therefore, it is likely that other species more common near St. Lawrence Island and on the Northern Seward Peninsula (Pacific, yellow-billed, and red-throated loons) were misidentified as common loons. In late August–early October, observations of birds migrating past Gambell made by skilled birders showed that Pacific loons outnumbered yellow-billed loons by 3–4 to 1 (Lehman 2011). Visual bird counts were conducted in 2011–2012 close to the communities of Gambell and Savoonga to assess the relative abundance of species in coastal waters from mid-September to mid-October, when most loon harvest occurs, and compared with species reported in harvest survyes (Naves and Zeller 2013). Sixty species were recorded in fall bird counts. Loons represented up to 0.1% of the total number of birds. Four loon species were observed: Pacific (94.5% of total number of loons), yellow-billed (4.2%), red-throated (0.5%), and Arctic (0.4%) loons. The common loon was not recorded.

The majority of loon eggs reported as harvested likely results from misidentification or reporting error. Eggs of all loon species are similar in shape and size (Baicich and Harrison 1997). Loon nests are widely dispersed and in general there is only one nest per lake. Loon clutches have only 1–2 eggs, as compared to ducks (10+ eggs) and gulls (4 eggs). Targeting loon eggs for harvest would involve high effort and low return, although sporadic and opportunistic harvest may occur. St. Lawrence Island hunters interviewed about loon harvest and subsistence practices informed us that they did not harvest loon eggs or know of others who did (all 23 respondents; Zeller et al. 2011). Several people explained that loons are aggressive and are generally avoided during the breeding season because oral tradition tells about a man and a swan who died as a consequence of loon attacks (T. Zeller and L. C. Naves, pers. comm.). Absent any historical or contemporary indication that yellow-billed loon eggs are important subsistence resources, we surmise that at most low tens, and most likely less than ten, yellow-billed loon eggs are harvested each year in Alaska, and reports suggesting higher numbers very likely reflect error.

On St. Lawrence Island, attempts to verify identification of harvested loons on a large scale have not been successful. Verification of hunter bags is not a common practice in subsistence communities and it is very difficult to implement because birds are commonly harvested and consumed at camps far from villages (Zeller et al. 2011). In 2010–2012, in a few cases, species verification by a USFWS biologist was possible on St. Lawrence Island based on voluntary communications by hunters leading to positive identification of one Pacific loon, one red-throated loon, and two yellow-billed loons (T. Zeller, USFWS Migratory Bird management, pers. comm.).

During studies of loon harvest on St. Lawrence Island, hunters (n=31) interviewed by Zeller et al. (2011) referred to the Pacific loon as the "common loon" due to its frequency of occurrence, suggesting that reports of some common loons on harvest survey reports may be Pacific loons. When interviewees were shown pictures of loons without the western science names, 42% (10 of 24) stated that the Pacific loon was the most "common" or abundant loon seen. Only 4 of 31 hunters interviewed identified the common loon as the "common" loon; 3 hunters stated that they had never seen a common loon in their lifetime. In addition, many hunters simply refer to loons in general terms and do not differentiate among species especially when juvenile loons or loons in non-breeding plumage are taken (Zeller et al. 2011).

The St. Lawrence Island Yupik names for loons do not match western biological taxonomy (Omelak 2009, Amhasuk 2009, Zeller et al. 2011, Naves and Zeller 2013). Local people identify kinds of loons based on size and plumage. *Yuwayu* is the name for loons in general (all species), although it may refer to small loons (Pacific, Arctic, and red-throated loons), or yet more specifically, to small loons in breeding plumage. *Yuwayaaghaq* refers to young loons in general (all species in nonbreeding plumage) or specifically to young, small loons. *Melqupak* is the name for Pacific and Arctic loons in breeding plumage and *eghqaaq* are red-throated loons in breeding plumage. *Nangqwalek* is the name for large loons, both yellow-billed and common loons, or specifically for large loons in breeding plumage. Large loons in nonbreeding plumage are named *nangqwalgaaghaq*. Loon identification requires advanced bird identification skills. As in western societies, a considerable proportion of people could not tell loon species apart and there were inconsistencies in uses of Native names. The dominant factor for loon identification in harvest surveys was the word "common" presented in survey materials rather than morphologic characteristics (size, plumage, and bill color). "Common loons" reported in harvest surveys most likely refer to the most common loon in the area, which is the Pacific loon. Harvest surveys, bird counts, and ethnographic information indicated that identification of loon species in harvest surveys is possible (but not perfect) for breeding plumages and likely not possible for nonbreeding plumages. Efforts to obtain more detailed loon species identification in harvest surveys may lead to unreliable data (Naves and Zeller 2013).

Previous common loon harvest estimates (Naves 2010a) seemed excessively high compared to numbers known to occur on St. Lawrence Island. This led biologists to consider that yellow-billed loons could have been misidentified as common loons based on body size and that yellow-billed loon harvests could be underestimated because common loon harvest estimates were high (USFWS 2010a). It is now established that the Pacific loon is by far the most abundant loon on St. Lawrence Island and that summer and fall records of common loons are rather occasional (Lehman 2011, Naves and Zeller 2013). Changes to harvest survey materials in 2012 resulted in great reduction of common loon harvest reports. These results support that the main factor for loon identification in harvest surveys prior to 2012 was the word "common" presented in survey materials rather than morphologic characteristics such as size, plumage, or bill color and that reports of common loons most likely referred to Pacific loons (Naves and Zeller 2013).

*Annual Variation in Availability of Loons as Subsistence Resources*
Subsistence harvest estimates show high annual variation, which may at least in part be explained by annual variation in loon migration routes and timing. Regional annual bird harvest estimates ranged 4–370 birds (Y-K Delta; 19 years; Huntington 2009), 5–269 birds (Bristol Bay; 7 years; Huntington 2009), and 44–1,077 (Bering Strait; 3 years; Naves 2010a,). Egg harvests ranged from 0–60 (5 years; Naves 2010a, entire document). In a study investigating yellow-billed loon migration routes, some birds implanted with transmitters in 2002, 2003, and 2007 on Alaskan breeding grounds moved to marine waters near St. Lawrence Island before migrating south, while other birds (including all eight birds tracked in 2008) moved from Alaskan breeding grounds to Kolyuchin Bay on the north side of the Chukotka Peninsula, and crossed overland to the southwest over the peninsula and into Anadyr Bay, thereby bypassing St. Lawrence Island (Joel Schmutz USGS, pers. comm.). Point counts on St. Lawrence Island in 2011 showed a 47% decrease in numbers of yellow-billed loons observed compared to 2010 despite a 30% increase in observation efforts (Zeller et al. 2011, Naves and Zeller 2013). In fall 2011–2012, there were no large movements of yellow-billed loons as observed in 2010, which may reflect differences in migration conditions between years. Migratory behavior may vary from year to year due to many environmental and ecological factors in breeding and migrating areas, and loon harvest could vary with the number and timing of loons migrating across hunting areas. Weather conditions may also affect access by hunters to hunting areas, especially in fall, and could also account for substantial annual variation in harvest (Naves and Zeller 2013). However, knowledge of conditions affecting migratory behavior and their interactions with harvest effort are still poorly understood. It is likely that high annual variation in harvest estimates could at least partially reflect measurement and species identification errors in reported harvest (SHSAC 2003).

*Fishing Bycatch as a Source of Error in Estimates of Bird Hunting*
An additional factor affecting some harvest estimates for yellow-billed loons is apparent mis-reporting of yellow-billed loon fishing bycatch on the North Slope. Estimates for harvest for the North Slope for the years 1994–2003 provide little indication of harvest of yellow-billed loons from most communities in most years, although reports from Barrow in 2 years resulted in village-wide estimates of 12 and 18 (Bacon et al. 2009, p. 54). In contrast, AMBCC harvest survey estimates in 2004–2009 ranged from 2–102; however, reports indicate that about half were reported as drowned in fishing nets (Naves 2010a, 2010b). NSB-DWM (2011b) reports that yellow-billed loons are not targeted using fishing nets or any other means by subsistence users on the North Slope.

Considering evidences of substantial measurement and species identification errors in harvest estimates and potential to high annual variation in the availability of loons as a subsistence resource, at this time it is impossible to balance potential under- and overestimation of harvests in a quantifiable manner. The application of regular harvest surveys to quantify mortality of avian species of conservation concern is very limited.

*Other Available Information Regarding Harvest*
Other sources of information can help assess risk to yellow-billed loons from subsistence harvest in Alaska. Current studies of yellow-billed loon migration ecology, local and traditional knowledge (LTK), and the dedicated study conducted on St. Lawrence Island have contributed to

our understanding of this potential threat. Yellow-billed loons occur in areas traditionally used for subsistence harvests of diverse resources and hunters state that some are taken. Loons breeding in Alaska may be available for harvest in late May–late August and a large proportion of yellow-billed loons breeding in Alaska, Canada, and Russia are potentially subject to harvest during their spring and fall migration through the Chukchi and Bering seas (J. Schmutz, USGS, unpubl. data).

Although some St. Lawrence Island hunters (11%, 3 out of 28) informed us that they target loons for harvest (USFWS 2010b), LTK and ethnographic information support that yellow-billed loons are not an important subsistence resource. Therefore, harvest estimates described above may be biased high, at least in some cases. Discussions with St. Lawrence Island hunters indicated that most hunters do not target loons in spring and summer (Ahmasuk 2009; Zeller et al. 2011), which would serve to limit the number harvested. A small proportion of Gambell hunters (10% of households) reported hunting loons in fall, and those that do so reported to harvest “only a few” yellow-billed loons (Ahmasuk 2009). Hunters portrayed their yellow-billed loon take as opportunistic and small and incidental (90%, 25 out of 28; Zeller et al. 2011). Loon harvests occurred mainly by boat, frequently in combination with seal hunting (222 out of 237 reports). Rough sea and weather conditions in fall appear to limit opportunities for boat trips. Loons were also harvested from onshore blinds or otherwise as opportunities arose. Loons, as other birds, were taken with shotguns (Naves and Zeller 2013).

Information provided by local residents and fall bird counts supports that loons typically occur as single birds or pairs and only sporadically occur in groups of dozens of birds. In fall bird counts, only 5 groups with 20–49 loons were observed, 1 group with 78 loons, and 1 group with 182 loons (Naves and Zeller 2013). Day et al. (2003) reported average size of groups of loons close to Gambell was 1.4 (range 1–3, n=12 groups; 47 hours of observation in 23 October–3 November 2002). Large groups may be related to migration waves (environmental conditions cause migration to be compressed in time, as it may have been in 2012) and local feeding aggregations on high concentrations of forage fish. These feeding aggregations occur more frequently at a few locations, such as 20 mi north of Eevwak Point (5–6 mi west of Savoonga) and off the Stolbi Rocks (1–2 mi east of Savoonga) (Huntington et al. 2013).

St. Lawrence Island local and traditional knowledge did not indicate harvest preferences for bird species including loon species. On the other hand, many respondents reported to prefer young birds (babies or juveniles) over adults (parents) of species such as kittiwake, puffin, cormorant, guillemot, gulls, and loons because young birds are tender and have more fat. Young birds harvested just before or after fledging are likely easy to tell apart from other age categories. However, in late fall and winter, “young” may also include adults in nonbreeding plumage. The proportion of loons (species combined) in fall harvests (2011=0.4%, 2012=4.4%) was similar to that in bird counts (2011=1.3%, 2012=3.0%; short-tailed shearwaters excluded), which did not indicate selective harvest of loons. However, higher proportion of nonbreeding loons in 2012 fall harvest estimates (62.7%) compared to the proportion of loons in nonbreeding plumage in the 2012 bird count (23.5%) suggest positive harvest selectivity of loons in nonbreeding plumage, in accordance with harvest preference for young birds in general. Difficulties in loon species identification precluded an assessment of harvest selectivity for individual loon species, especially in 2011 when misidentification of common loons was prominent (Naves and Zeller 2013).

Molt of adult yellow-billed loons may extend from late September until December, progressing from neck feathers through flight feathers, lesser wing coverts, back, head, and scapulars (reviewed in North 1994). Adult Pacific loons may retain breeding plumage into October or November (reviewed in Russel 2002). The yellow-billed loon adult plumage is acquired through a succession of molts in the first 3 years of life. The first plumage of hatching year yellow-billed loons is worn during the first fall and winter (reviewed in North 1994). However, subadults and some nonbreeding adults may remain on wintering grounds throughout the year. Therefore, yellow-billed and Pacific loons called juveniles in fall harvest surveys on St. Lawrence Island likely consist largely of hatching year birds (Naves and Zeller 2013).

Yellow-billed loons are considered an “uncommon to fairly common migrant” at Gambell (Lehman 2011) and may aggregate along western and southern shores of the island (Ahmasuk 2009). However, radio-telemetry data of 13 yellow-billed loons that passed by St. Lawrence Island showed that most remained well offshore (only 49 of 254 radio-relocations were within 10 km of shore; J. Schmutz, USGS, unpubl. data). This indicates that hunters may have to travel far offshore to access significant numbers of yellow-billed loons. A limited sample of subsistence-harvested loons on St. Lawrence Island in 2006 (n=31) and 2009 (n=1) examined by biologists included only 2 (6%) yellow-billed loons (USFWS 2010b), although yellow-billed loons represent 23% of contemporary loon harvest estimates (Naves 2010a). While these observations and LTK do not provide a basis for quantitative estimation of harvest, they suggest that recent harvest estimates (Naves 2010a) are likely biased high.

In summary, harvest survey reports and available TEK and anecdotal observations indicate that yellow-billed loons are available for subsistence harvest during the breeding season as well as spring and fall migration, and some are certainly taken. Methods to quantify harvest are subject to a number of unquantifiable biases, and harvest estimates show evidence of systemic misidentification among loon species, which compromises the veracity of all loon harvest reports, including both positive and negative reports. Additionally, there is high inter-annual variation that likely is at least in part symptomatic of high measurement error. Several factors likely bias estimates high, but it is possible that some also bias estimates low. These cannot be quantified or cumulatively assessed, which seriously constrains precise estimation of future harvest. All things considered, we conclude that tens to hundreds of yellow-billed loons are likely taken each year in Alaska, but that more precise estimates are impossible with the available information.

The majority of whatever harvest does occur likely consists of migrants, as little credible evidence exists for subsistence hunting during summer in areas where the species nests. The available information suggests that most or possibly all of the reported yellow-billed loon harvest from the North Slope may result from inadvertent drowning in fishing nets rather than hunting. Similarly, the majority of reported egg harvest likely results from misidentification. Absent any historical or contemporary indication that YBLO eggs are important subsistence resources, we believe it is reasonable to conclude that at most low tens, and most likely less than ten, YLBO eggs are harvested each year in Alaska.

*Lead Contamination*

Based on currently available information, lead exposure on the breeding grounds does not appear to be a problem for yellow-billed loons, at least in NPR-A. Twelve of 13 blood samples collected in 2007 in NPR-A from incubating adult yellow-billed loons had lead levels below the detection limit of 0.05 ppm wet weight (ww); the 13th had 0.115 ppm ww, which is still well below the threshold for background exposure (which is 0.2 ppm ww, Pain 1996). Based on this information, we conclude that lead shot deposition associated with the Action will affect at most a limited number of yellow-billed loons.

*Disturbance*
Subsistence hunting is expected to lead to some unknown amount of hunter presence in the three yellow-billed loon nesting areas in Alaska, which could result in disturbance to individual yellow-billed loons and their eggs or young.

Loons as a genus are susceptible to disturbance, although they sometimes habituate to predictable disturbance (Vogel 1995, Barr 1997, Evers 2004, Earnst 2004, Mills and Andres 2004, North 1994). Human disturbance can cause yellow-billed loons to abandon reproductive efforts or leave eggs or chicks unattended and exposed to predators or bad weather (Earnst 2004). Observations by Earnst (2004) indicated that adults left nests when an approaching human is as much as 1.6 km (1 mi) away, or as close as a few meters. These behaviors varied by individual and circumstance, and have not been subject to formal study (Earnst 2004); more importantly, the impacts to nest success, fitness, and the potential for habituation have not been studied.

While little quantitative data on the effects of disturbance to nesting yellow-billed loons exists, it is possible that disturbance of sufficient frequency, duration or severity could result in reduced nest success or brood survival at individual nests. Yellow-billed loon nests are widely dispersed throughout their breeding areas, and not concentrated near village areas where hunting or egg collecting pressure is high; thus a small proportion of the overall number of Alaska breeding loons would be affected by disturbance. Given the low number of nesting loons likely to be subject to possible disturbance from hunters, it is reasonable to conclude that disturbance from the Action will affect at most a small number of yellow-billed loon nests.

# 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 Act.

*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 Steller's or spectacled 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 (COE), 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 Act.

*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 Act, 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 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 population 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 just the effects of lead shot deposited in 2014, and we believe that the contribution caused by the 2014 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 2014 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 2014; consultation will be re-initiated in 2015 with the proposal of subsistence harvest regulations, when information from 2014 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*.

### 7.2 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. 2012). 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. 2012). 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 2014, and we believe that the contribution caused only by the 2014 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 2015 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 not attempted to separate or exclude, the effects of the fall hunt (which is a separate 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*.

### 7.3 Yellow-billed loon

After reviewing the current status of the yellow-billed loon, 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 yellow-billed loons. Because the species has not been proposed for listing under the Act, no critical habitat has been proposed or designated, and, therefore, none will be affected.

As described in the *Effects of the Action* section, we conclude that tens to hundreds of yellow-billed loons are likely taken each year in Alaska, but that more precise estimates are not possible with the available information. The available information suggests that few eggs or adults are taken during the breeding season, so the majority of harvest likely occurs during spring and fall migrations, as yellow-billed loons move along the coast of Alaska or through the Chukchi and Bering seas. In addition to Alaska-breeding populations, significant numbers of yellow-billed loons that nest in Russia and Canada likely migrate through the Bering and Chukchi seas. As a result, what harvest actually is occurring is extracted from a migrant population that likely includes much of the species' total range-wide numbers of 16,000–32,000 (USFWS 2009d). Thus, despite uncertainty surrounding harvest levels, breeding-population composition of the migrant population, and total population size, it is most likely that a small proportion of the migrant population is harvested each year.

As described in the *Status of the Species* section, we currently have no means to assess population trends in Russia- or Canada-breeding populations, but systematic, standardized aerial surveys in Alaska provide a means of assessing trends in Alaska. Various analytical approaches yield slightly different estimates of population trend that range from slightly decreasing to slightly increasing, with no indication of rapid population trend in either direction.

Due to changes in harvest survey and sampling methods over time, we cannot assess trends in harvest levels over time. However, we possess no information suggesting that the number of subsistence hunters or the amount of effort expended in hunting loons has significantly increased over time, and therefore we have no reason to expect that loon harvest would have increased significantly in recent years. Therefore, current population trends, likely reflect population-level response to the ongoing effects of harvest over time. We find no reason to conclude that harvest in 2014, which is the Action we are evaluating, will cause significant population-level effects.

In summary, based on our best estimates of current harvest levels and likely population-level response, and our belief that conservation recommendations to be implemented this year will further reduce risk, we conclude that the proposed Action will not jeopardize the continued existence of yellow-billed loons.

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 few yellow-billed loon 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 yellow-billed loons through harvest in the tens to hundreds; however, this is thought to comprise only a small proportion of the population from which it is extracted. We do not expect the proposed Action to affect the distribution of the yellow-billed loon, as harvest is likely extracted from Russia-, Canada-, and Alaska-breeding populations, diffusing any potential effect across the species' range.

It is 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 conference later this year), and by-catch of yellow-billed loons in subsistence fishing nets (which we do not expect to be included in a separate conference at this time), from the effects of the subsistence hunt (which is the Action evaluated in this conference). 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 Service 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 conference is identified in the interim*.

## 8. INCIDENTAL TAKE STATEMENT

Section 9 of the Act and regulations pursuant to section 4(d) of the Act prohibits the take of endangered and threatened species, except as provided in section 6(g)(2) and 10 of the Act. "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 Act, the provisions of the Act 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 Act.

Although the taking of listed species for subsistence purposes here is not prohibited under the Act, 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.

*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 2014 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.

*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.

## 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 agency 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;
4) If a new species is listed or critical habitat designated that may be affected by the Action.

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