Spectacled Eider
(Somateria fischeri)

5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Fairbanks Fish and Wildlife Field Office
Fairbanks, Alaska

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5-YEAR REVIEW
Spectacled Eider/*Somateria fischeri*

I. GENERAL INFORMATION

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act of 1973 (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the Act that includes public review and comment.

Contact Information:

Lead Regional or Headquarters Office: Sonja Jahrsdoerfer, Regional Endangered Species Coordinator, Region 7, Alaska; 907-786-3323.

Lead Field Office: Kate Martin, Eider Recovery Coordinator, Fairbanks Fish and Wildlife Field Office, (907) 456-0215; and Ted Swem, Chief, Endangered Species Branch, Fairbanks Fish and Wildlife Field Office, (907) 456-0441.

Methodology used to complete the review:

This review was prepared by the Fairbanks Fish and Wildlife Field Office (FFWFO) in 2010. The Service solicited information on this species through a Federal Register notice (April 7, 2010, 75 FR 17760); we received 2 comments to this notice. We used information from the recovery plan for the spectacled eider (Service 1996), survey information from experts who have been monitoring eider populations, information available in published and unpublished literature, discussions with other agency biologists, discussions with species experts, information available on the Internet, and FFWFO species files. This 5-year review contains updated information on the species' biology and threats, and an assessment of that information compared to that known at the time of listing. There has been no previous 5-year review. We focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we recommend a list of conservation actions to be completed or initiated within the next 5 years.

Federal Register (FR) Notice Citation Announcing Initiation Of This Review: A notice announcing initiation of the 5-year review of this species and the opening of a 60-day period to receive information from the public was published in the Federal Register on April 7, 2010, (75 FR 17760); we received 2 comments in response to this notice, which we have considered in preparing this 5-year review.

Listing History:

<u>**Original Listing**</u>
FR notice: 58 FR 27474
Date listed: May 10, 1993
Entity listed: Species
Classification: Threatened

<u>**Associated Rulemakings**</u>
Critical Habitat Designation: February 6, 2001: 66 FR 9146

Review History: Since the original listing in 1992, the recovery plan (Service 1996) has been the only written status review produced for this species.

Species' Recovery Priority Number at start of 5-year review: The recovery priority number for the spectacled eider is 5 according to the Service's 2009 Recovery Data Call, based on a 1-18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (Endangered and Threatened Species Listing and Recovery Priority Guidelines, 48 FR 43098, September 21, 1983). The value of 5 indicates that the spectacled eider is a species that faces a high degree of threat and has a low probability of recovery.

Recovery Plan or Outline:
Name of plan: *Spectacled Eider Recovery Plan*
Date issued: August 12, 1996
Dates of previous revisions: None; however, the Eider Recovery Team and the Service review the list of spectacled eider recovery actions annually and revise as needed.

Critical Habitat: Critical habitat was designated for molting in Norton Sound and Ledyard Bay, for nesting on the Yukon-Kuskokwim (Y-K) Delta, and for wintering south of St. Lawrence Island on February 6, 2001 (66 FR 9146). In accordance with section 3(5)(A)(i) of the Act and regulations in 50 CFR 424.12, critical habitat for a species contains those physical or biological features that are essential for the conservation of the species and which may require special management considerations or protection.

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) policy

The Endangered Species Act defines “species” as including any subspecies of fish or wildlife or plants, and any distinct population segment (DPS) of any species of vertebrate wildlife. The 1996 Policy Regarding the Recognition of Distinct Vertebrate Population Segments under the Endangered Species Act (61 FR 4722, February 7, 1996) clarifies the interpretation of the phrase “distinct population segment” for the purposes of listing, delisting, and reclassifying species under the Act.

The spectacled eider was listed throughout its range in 1993, largely based on steep declines in the Y-K Delta and Arctic Coastal Plain (ACP) breeding populations; the size of the Arctic Russia breeding population was unknown at listing. The Spectacled Eider Recovery Plan (USFWS 1996a, p. 26) concluded that the three spectacled eider breeding populations met the definition of DPSs in the policy. The Plan developed delisting and reclassification criteria based on these three populations. The Eider Recovery Team, an implementation team in operation since listing, has recommended that the Service initiate rulemaking to create legal DPSs for the three breeding populations. Such action would allow delisting of the Arctic Russia breeding population, which is much larger than the other populations, and exceeds the delisting criteria for a population. However, because the males breed in different breeding areas from year to year, and are not permanently associated to any single area, the Service believes that the populations do not meet the criteria of discreteness, and therefore would not qualify to be considered as separate DPSs under this policy. Therefore, the current delisting criteria for separate populations should be revised to reflect the fact that it is not possible to separately delist populations of the spectacled eider.

Information on the Species and its Status

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

Habitat and Food

Spectacled eiders spend most of the year in marine waters, where they feed on benthic invertebrates, primarily clams (Petersen et al. 1998, p. 124; Lovvorn et al. 2003, p. 259). From November through March or April, they remain in open sea or in polynyas (areas of open water at predictable, recurrent locations in sea ice covered regions), or open leads (more ephemeral breaks in the sea ice, often along coastlines) in the sea ice of the northern Bering Sea at water depths of less than 80 meters (m) (240 feet (ft)); Petersen et al. 2000, p. 5). Lovvorn et al. 2009 (p. 1607) suggest that in winter foraging areas, the availability of ice as a resting platform is important for energy conservation; models estimate that resting and swimming on the water surface costs 1.3 and 1.9 times more energy, respectively, than resting on ice.

As open water becomes available in spring, breeding pairs move to nesting areas on wet coastal tundra (Petersen et al. 2000, p. 5; Bart and Earnst 2005, pp. 88-90). They establish nests near shallow ponds or lakes, usually within 3 m (10 ft) of water. During the breeding season hens and broods feed in freshwater ponds and wetlands, eating aquatic insects, crustaceans, and vegetation (Petersen et al. 2000, p. 5). Males return to the marine environment after incubation begins. Petersen et al. 1999 (p. 1017) suggested that molt is synchronous among males based on arrival dates of marked birds. Females move to molting areas in July if unsuccessful at nesting, or in August/September if successful (Petersen et al. 1999, p. 1017). When moving between nesting and molting areas, spectacled eiders travel along the coast up to 60 kilometers (km) (36 miles (mi)) offshore (Petersen et al. 1999, p. 1013). Molting flocks gather in relatively shallow coastal water, usually less than 36 m (120 ft) deep.

Distribution

At present, there are three primary breeding populations: on Alaska‘s ACP and Y-K Delta, and along the Arctic coast of Russia from the Chaun Delta to the Yana Delta (Dau and Kistchinski 1977, pp. 67-70; Petersen et al. 2000, p. 13; Solovieva and Lyatieva 2006, pp. 1-20). The U.S. Geological Survey (USGS) is conducting an ongoing satellite telemetry study, and provides near-real time information on spectacled eider movements at http://alaska.usgs.gov/science/biology/seaducks/spei/index.php. Little is known about historical population distribution in Russia (Petersen et al. 2000, p. 13). In Alaska, spectacled eiders nested discontinuously from the Nushagak Peninsula north to Barrow, and east nearly to Canada’s Yukon Territory (Gabrielson and Lincoln 1959, pp. 225-227; Dau and Kistchinski 1977, pp. 68-69; Kessel 1989, pp. 105-107).

After breeding, spectacled eiders molt in several discrete areas, with birds from the different populations and genders favoring different molting areas (Petersen et al. 1999, p. 1009). Late summer and fall molting areas have been identified in eastern Norton Sound (northern Bering Sea) and Ledyard Bay (eastern Chukchi Sea) in Alaska, and in Russia in Mechigmenskiy Bay and an area offshore between the Kolyma and Indigirka River deltas on the Arctic Ocean (Petersen et al. 1999, pp. 1009-1020). On the ACP, Troy (2003, pp. 1-17) monitored spectacled eiders marked with satellite transmitters at breeding grounds near Prudhoe Bay and Teshekpuk Lake. Ten of fourteen males migrated onshore but parallel to the coast to reach the Chukchi Sea within 1 to 5 days of leaving breeding areas in late June; four males that left later than the others used marine areas of the Beaufort Sea near river deltas for up to 30 days before moving west to the Chukchi Sea; (Ibid. p. 5). All 13 marked females used the Beaufort Sea en route to the Chukchi Sea, staying along the coast of the Beaufort Sea for an average of 2 weeks after leaving breeding areas in late July (Ibid. p. 5). Use of the Beaufort Sea could be a function of ice cover at the time of departure from breeding areas, since near shore areas remain ice-covered until late June or early July. Open water is often first available, even if only from overflow, at river mouths (Ibid. p. 9).

After molting, spectacled eiders from all breeding subpopulations migrate in October and November to the central Bering Sea south/southwest of St. Lawrence Island, where they remain in large flocks in polynyas until March or April (Petersen et al. 1999, pp. 1014-1015). From April until arrival on breeding grounds in May or June, some eiders remain in the wintering area, while others move to staging areas in Russia (Mechigmenskiy Bay on the Chukchi Peninsula, and the Arctic coast of the western Chukchi and East Siberian Seas) and in Alaska (the spring ice lead system offshore of the Y-K Delta and Norton Sound, and the Alaska coast of the eastern Chukchi Sea southwest of Barrow) (M. Sexson, USGS Alaska Science Center, pers. comm., 2010, and see web site provided at the beginning of this section). Limited spring aerial observations in the eastern Chukchi have documented dozens to several hundred common (*Somateria mollissima)* and spectacled eiders in open water leads and several miles offshore in relatively small openings in rotting sea ice (W. Larned, USFWS, and J. Lovvorn, Southern Illinois University, pers. comm., 2010).

Breeding

Incubation generally begins after the last egg is laid, and lasts approximately 22 days (Flint and Grand 1999, p. 414). Males do not incubate; instead, they leave breeding grounds after incubation begins (Petersen et al. 1999, p. 1011). Timing of waterfowl nest initiation on the Y-K Delta is closely correlated with spring breakup; since 1982, a significant trend in earlier waterfowl nest initiation has been shown in random plot studies, amounting to an advance of 9 days since data collection began (Fischer et al. 2009, p. 11, Fig. 4). Spectacled eider hatch dates on the Y-K Delta occur from mid-June through early July (Fischer et al. 2009, Table 3). Nest initiation in the 1990s was mid-June on the ACP (Warnock and Troy 1992, p. 21) and mid to late June in Arctic Russia (Pearce et al. 1998, p. 113). Hatch dates on the Colville River Delta (ACP) were in early July (Johnson et al. 2008, p. 11). Following hatch, broods move from nests to freshwater ponds, usually traveling < 3 km, but occasionally up to 13 km (Petersen et al. 2000, p. 12). Young fledge approximately 50 days after hatch. After fledging, broods move from freshwater to marine habitats (Petersen et al. 1999, p. 1011).

Spectacled eider clutch size varies among years and study sites (Petersen et al. 2000, pp. 10-11). At Kigigak Island on the Y-K Delta, mean clutch size ranged from 4.0 to 5.5 eggs from 1992-2009 (Lake 2008, p. 9; Wege 2009, p. 4). Average clutch size on the Colville River Delta on the ACP was 4.32 eggs per nest (sample size (n) = 22) (Bart and Earnst 2005, p. 92). From 1993-2004, average clutch size at CD-3 oil well pad on the Colville Delta, ACP was 4.0 eggs (n = 40; Johnson et al. 2008, p. 28). Average clutch size on the Chaun Delta in Arctic Russia was 4.52 eggs (standard error (SE) 0.21, n = 33) (Solovieva and Lyatieva 2006, p. 6).

Nest success, the probability that a nest survives to hatch at least one egg, is variable and greatly influenced by predators, including gulls (*Larus* spp.), jaegers (*Stercorarius* spp.), and red (*Vulpes vulpes*) and arctic (*Alopex lagopus*) foxes. Nest success is reported in several ways; apparent nest success is simply the proportion of observed nests that hatched at least one egg, and Mayfield nest success refers to a method of estimating nest success by taking into account variation in the probability of success over time, and is generally considered to be a more accurate depiction of true nest success (Mayfield 1961). In Arctic Russia, apparent nest success was less than 2% in 1994 and 27% in 1995; predation was believed to be the cause of high failure rates, with foxes, gulls and jaegers the suspected predators (Pearce et al. 1998, p. 115). Nest success ranged from 43% to 93% on the central Y-K Delta between 1985 and 2009 (Fischer et al. 2009, Fig. 2). On the lower Kashunuk River, Y-K Delta, nest success varied from 18% to 76% between 1991 and 1995, with some differences likely due to variations in predator (mew gull (*L. canus*)) populations (Grand and Flint 1997, pp. 929, 931). On Kigigak Island in the Y-K Delta, Mayfield nest success ranged from 6% to 92% from 1992 to 2008 (Lake 2008, Table 3). During years in which arctic foxes were killed, apparent and Mayfield estimates of nest success were 20% and 26% higher, respectively, than during years in which no foxes were killed (Swem 2010 memo Feb 4). Mean apparent nest success from 1993 to 2007 in the Kuparuk oil fields on the ACP was 41.7%, (range 12.5% to 92.3%; Anderson et al. 2007, p. 12, 14, Table 6). Mayfield nest success on the Colville Delta from 1994 to 1999 was 31% (SE 0.01, n = 41) (Bart and Earnst 2005, Table 4). Apparent nest success for all spectacled eider nests with known fate found on the Colville Delta before construction of CD-3 satellite oil well pad (1993-2004) was 37%; apparent nest success after development was 33% in 2005, 40% in 2006 and 40-43% in 2007 (Johnson et al. 2008, p. 28). Of 10 nests monitored by camera on the Colville River Delta in 2007, five failed, all due to depredation by arctic foxes (Ibid., p. 30). Mayfield nest success on the Chaun Delta in Arctic Russia from 2003 to 2005 was 42.4-46.2% (Solovieva and Lyatieva 2006, p. 12, Table 3). Apparent nest success for this study, including nests already depredated when found, was only 16.5-31.9% (Ibid.). In summary, spectacled eider nest success varies by year and location and is negatively affected by predation.

Egg hatchability varied over time and among nesting areas. Spectacled eider eggs that did not hatch were very rare in the Prudhoe Bay area (Declan Troy, TERA, pers. comm. 1997), and Pearce et al. (1998, p. 115) found only one inviable egg from 1994 to 1995 on the Indigirka River Delta in Arctic Russia. Solovieva and Lyatieva (2006, p. 7) found 1.2-2.1% of eggs inviable on the Chaun Delta in Arctic Russia from 2003 to 2005. From 1969 to 1973 at a site on the Y-K Delta, only 0.8% of spectacled eider eggs were addled or infertile (Dau 1974). In contrast, 24% of all nests monitored in the lower Kashunuk River, Y-K Delta during the early to mid-1990s contained one or more inviable eggs; approximately 5% of eggs in successful nests (those that survived to hatch at least one egg) were inviable (Grand and Flint 1997, p. 928). At Kigigak Island, Y-K Delta between 1992 and 2008, 1.7 to 12% of eggs were inviable (Lake 2008, Table 4). In 2002-2006, 26% of nests contained inviable eggs at Kigigak Island. Prevalence of nests with inviable eggs varied from 23% to 30% among years (T. Hollmen, Alaska Sea Life Center pers. comm., 2010).

Duckling survival to 30 days averaged 34% (95% confidence interval (CI) 25-47%) on the lower Kashunuk River, Y-K Delta from 1993 to 1995 (Flint and Grand 1997, p. 217). Survival of adult females during the first 30 days post hatch was 93% (SE ±3%; Flint and Grand 1997, p. 217). Flint et al (2006, p. 901) found duckling survival averaged 45% from 1999 to 2000 in the same area and 67% at Kigigak Island. Survival of adult females and juveniles from 30 days after hatch to departure from the YKD (1997-1999) was 88.5 and 71.4%, respectively (Flint et al. 2000, p. 292). Annual survival rates of adult females breeding on the Y-K Delta varied depending on lead exposure on the breeding grounds, with females exposed to lead surviving at a lower rate than females not exposed to lead (Grand et al. 1998, Table 4, p. 1107; Anderson et al. 2000, pp. 919-920). Winter ice conditions in the Bering Sea may influence adult female survival (P.L. Flint, USGS, unpublished data).

Lake (2008, p. 13) documented that no female spectacled eiders banded as ducklings breed in their second year (age 1.5 years) but that 24.1% made breeding attempts in their third year. Age at first breeding has not been determined for males, but probably occurs the third or fourth year, coinciding with the acquisition of adult plumage (Petersen et al. 2000, p. 11).

Abundance and Trends

Aerial surveys of the wintering area in the Bering Sea were conducted in 1996 and 1997, providing a range-wide estimate of the minimum total number of spectacled eiders in late winter 1997 of 363,000 (95% CI 333,526-392,532) (Petersen et al. 1999, p. 1014). Aerial surveys were repeated in 2009 and 2010. Preliminary results from 2009 indicate a minimum estimate of 301,812 spectacled eiders, but this value will be updated when surveys from both years are analyzed (Larned et al. 2009, p. 2).

Before 1972, an estimated 47,700 to 70,000 pairs of spectacled eiders nested on the Y-K Delta in average to good years (Dau and Kistchinski 1977, p. 69). In 1992, the Y-K Delta spectacled eider breeding population had declined 96% from estimates in the 1970s to fewer than 2,000 pairs (Stehn et al. 1993, p. 264). On a smaller study site within the Y-K Delta, Ely et al. (1994, p. 84) documented a 79% decline in spectacled eiders nesting near the Kashunuk River between 1969 and 1992.

Fischer et al. (2009, p. 2-5) used ground-based and aerial surveys to estimate the number of nests of spectacled eiders on the coastal zone of the Y-K Delta from 1985 to 2009. The estimated total number of nests is a direct measure of effective breeding population size and an index to the number of potential nesters (Fischer et al. 2009, p. 5). In 2009 they estimated that spectacled eiders built 7,253 nests (SE 1,149) (Ibid., Fig. 2, p. 23). The 2009 index, based solely on aerial surveys for the entire coastal zone, was 6,537 birds (SE 527) (Platte and Stehn 2009, Fig. 12). The aerial index can be lower than the nest estimate, because not all birds are seen from the aerial platform, and the number not seen is unknown.

The average annual growth rate of estimated number of nests on the Y-K Delta from 2000-2009 was increasing at 1.085 (90% CI 1.042-1.127) (Fischer et al. 2009, Fig. 2). The population growth rate from 2000 to 2009 for the Y-K Delta indicated total bird aerial index for spectacled eiders was increasing at 1.081 (90% CI 1.050-1.113) (Platte and Stehn 2009, p. 7; Fig. 12). After accounting for observer experience and survey timing, the indicated total bird index from aerial surveys yielded a growth rate of 1.042 (90% C.I. 1.030-1.053) for 1993-2006 (Stehn et al. 2006, p. 5). In summary, these data suggest that the Y-K Delta population is increasing slightly.

No population surveys were conducted for the ACP breeding population before 1993 but 3,000 pairs (6,000 birds) were estimated based on data from limited migration and ground studies (Dau and Kistchinski 1977, p. 69). At Prudhoe Bay, within the ACP breeding area, Warnock and Troy (1992, p. 20) documented an 80% decline in spectacled eider abundance from 1981 until 1991. Since 1993, aerial surveys of eider nesting areas on the ACP have been conducted each year. The 2009 population index based on aerial surveys was 5,018 birds (SE 854; unadjusted for detection probability) (Larned et al. 2010, Fig. 14). The ACP spectacled eider population from

1993 to 2009 declined, with an average (n = 17 years) annual population growth rate of 0.985 (90% CI 0.971- 0.999) (Ibid.).

Aerial surveys on the eastern Arctic coast of Russia from 1993 to 1995 produced an index of 146,245 (coefficient of variation (CV) = 0.08, unadjusted for detection rate) spectacled eiders (Hodges and Eldridge 2001, Table 2). Approximately 20% of the spectacled eiders observed were in flocks (Ibid., p. 132), which suggested a large number of non-breeding birds compared to Y-K Delta and ACP surveys, in which flocks are rare (Stehn et al. 2006, p. 6). No surveys in Arctic Russia have occurred since 1995, and range-wide population numbers and trends are unknown, other than what can be inferred from winter population estimates, which as described above encompass the world population of spectacled eiders.

Genetics

Scribner et al. (2001, pp. 2105-2115) examined genetic markers in spectacled eiders to evaluate spatial genetic structuring among breeding regions. Genetic differences among regions were considerably lower for nuclear DNA loci than was observed for maternally inherited mitochondrial DNA (mtDNA) (Ibid., p. 2110). Differences in the magnitude and spatial patterns of gene correlations for mtDNA and nuclear genes revealed that females exhibit greater natal philopatry (the likelihood that individuals breed at or near their place of origin) than do males (Ibid., p. 2111-2112). Although there appeared to be high fidelity between genders from the same natal area, the authors cautioned that “low estimates of male dispersal do not imply that males are philopatric, but rather suggest that they are highly likely to pair with females from the same breeding area” (Ibid., p. 2113). This is likely to occur when one breeding area contributes a large portion of the population. The authors noted the large disparity in population sizes among breeding areas, which greatly reduces the proportion of total genetic variance captured by dispersal (Ibid., p. 2113).

The results of Scribner et al. (2001) are consistent with results from an ongoing satellite transmitter study, in which females returned in subsequent years to the Alaska breeding areas on which they were marked; males were more likely to spend subsequent summers on the Arctic Russia breeding grounds (M. Sexton, USGS Alaska Science Center, pers. comm. 2010).

In summary, the available genetic and movement data indicate that males move among breeding areas; therefore, each breeding population is not genetically isolated. The results of these studies were not available prior to the Recovery Team’s recommendation that the breeding populations be separated into 3 DPSs.

Five-factor Analysis

Section 4 of the Act established a rulemaking procedure that requires a five-factor analysis for determining whether to list a species as endangered or threatened. The listing rule (58 FR 27474) supported listing based on the low population estimates and declining trends of the Y-K Delta breeding population and a subset (Prudhoe Bay) of the ACP breeding population. The size and trend of the Arctic Russia breeding population were unknown at the time of listing. Factors causing the declines were unknown, but a number of potential contributory factors were identified, including subsistence harvest, increased predation due to human activities, consumption of spent lead shot, oil spills or other pollution in the marine environment, effects of large scale fishery fleets on marine ecology, and direct mortality in fishing nets or from strikes to fishing vessels, and severe weather.

The following analysis describes and evaluates the threats attributable to one or more of the five listing factors outlined in section 4(a)(1) of the Act that were not known when the species was listed.

FACTOR A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

The destruction of habitat was not known to be a factor in the decline of the species at listing, and no development or other substantial threats to the species' principal breeding habitat on the Y-K Delta were foreseen (58 FR 27476). Nesting habitat on a small portion of the central coast of Alaska's ACP was altered by oil and gas development, causing potential threats from contamination from accidental spills, off-road vehicle use, wetland filling and indirect effects of human presence, including changes in predator populations discussed under Factor C (Disease or Predation) (58 FR 27476). Potential threats identified in the marine environment included toxic contaminants, indirect impacts of shifting populations of species with overlapping food habits, secondary effects of commercial fish and invertebrate harvests in the Bering Sea, and future oil and gas leases (58 FR 27476). All these listed threats continue to exist. Habitat conditions in Russian breeding grounds were, and remain, largely unknown, and were not discussed in the listing document.

Habitat Contamination by Lead Shot

The 1991 Federal ban on lead shot for waterfowl hunting resulted in dramatically reduced mortality rates from lead poisoning for waterfowl in the lower 48 states. In Alaska, however, ice underlying most waterfowl breeding habitat may keep lead shot near the surface and available to waterfowl for many more years compared to ice-free sediments farther south; and waterfowl breeding habitat might be exposed to lead shot from upland bird hunting in winter.

Waterfowl feed in the top few inches of sediment and shot that settles below this level is functionally unavailable to waterfowl. Availability and persistence of lead shot in Yukon Delta tundra wetlands were assessed experimentally; in some wetlands, shot settled beyond the feeding range of birds in 3-4 years, but in other habitats, it persisted for more than 10 years (Flint 1998, pp. 1100-1101; Flint and Schamber 2010, Fig. 1, p. 149). Thus, spent shot distributed in wetlands may be available to feeding waterfowl for many years.

In a study of spectacled eider lead exposure at the Y-K Delta, nesting females were exposed at higher rates than other components of the population (Flint et al. 1997, pp. 439-443). High rates of exposure to nesting females are a concern, because growth rates of waterfowl populations are often sensitive to adult female annual survival rates (Goudie et al. 1994, pp. 27-49). Flint et al. (1997, pp. 439-443) measured blood lead concentrations, and used a portable veterinary x-ray machine in the field to measure presence of lead in female ducks captured on their nests This study showed that 12% of sampled hens contained spent lead pellets in their gizzards (Ibid.). Lead exposure rates for spectacled eiders increased over the summer, from arrival on the breeding grounds through brood rearing (Ibid.). It was estimated that by the end of brood rearing 36% of adult female spectacled eiders and 12% of ducklings were exposed to lead (based on 0.2 parts per million blood concentration exposure threshold), a pattern consistent with the scenario where the longer eiders remain on the breeding grounds, the higher the probability they will encounter and ingest a spent lead pellet. When the geographic coverage of blood lead sampling was expanded to assess the degree of exposure across the entire spectacled eider nesting range on the Y-K Delta, lead exposure in waterfowl was detected in all locations sampled. Consistent with lead shot being the source of exposure, the probability of lead exposure was related to distance from villages and access routes to hunting areas, such as major rivers and sloughs (M. R. Petersen unpublished data).

Grand et al. (1998, pp. 1103-1109; see also re-analysis by Anderson et al. 2000, pp. 919-920) examined the effects of lead exposure on adult female spectacled eider survival. Survival rates were compared between exposed and unexposed females (determined by blood lead concentrations), and exposure to lead reduced estimated survival from 0.78 (SE 0.05) to 0.44 (SE 0.10). Geographic differences in annual survival rates could be explained by differences in lead exposure rates among areas. Incorporation of lead-induced mortality into an overall population model clearly demonstrated that lead exposure could have a major negative effect on spectacled eider populations.

Lead is probably available to eiders in hunting areas on the ACP. In 1996, elevated blood lead levels were found, indicating lead exposure on the ACP (Wilson et al. 2004, p. 408), although levels were low compared to the Y-K Delta.

In 2006 and 2007, the State of Alaska Board of Game passed regulations prohibiting the use of lead shot for upland game bird hunting on the ACP 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. Several high priority recovery actions mandating education and law enforcement help to prevent the use of lead shot by hunters in eider breeding habitat. These actions are being conducted by the Service, U.S. Bureau of Land Management (BLM) and state and local partners. 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, success has varied regionally: compliance was considered “excellent” in portions of the Y-K Delta (G. Peltola, pers. comm., 2010) in 2009, but in 2010 lead shot was still available in stores and hunters were found in possession of lead shot on the ACP (USFWS, unpubl. observations).

Little information is available concerning lead contamination in waterfowl in Russia. However, harvest surveys conducted in northeastern Russia in 2002-2004 suggest that lead shot is the primary hunting ammunition: very few interviewed hunters had heard about lead poisoning in waterfowl and the possibility of using steel shot for hunting (Syroechkovski and Klokov 2009). Therefore, it is likely that lead contamination may affect the Russian population of spectacled eiders, particularly those individuals that use habitat near villages and hunting areas.

In summary, because spent lead shot remains in sediments available to birds for years, and because it is still sold and used in rural communities near eider habitat, we consider lead contamination to be a continuing, though likely decreasing, threat to spectacled eiders.

Other Contaminants

Grand et al. (2002, pp. 1673-1678) examined the correlation of trace elements (arsenic, cadmium, mercury, and selenium) and productivity in spectacled eiders on the Y-K Delta. Trace element concentrations were not related to egg viability or nest success, and selenium blood concentrations declined through the breeding season. For spectacled eiders on the ACP, selenium was lower than for eiders on the Y-K Delta, and also declined through the season (Wilson et al. 2004, p. 408). Low levels of mercury were found in ACP eiders (Ibid.). Trust et al. (2000, p. 112) determined that cadmium, copper and selenium were elevated in male spectacled eiders collected near St. Lawrence Island, Alaska in May, but birds appeared healthy. Stout et al. (2002, p. 215) found that organochlorine and trace elements were below toxic levels, but cadmium, copper, lead and selenium were higher than levels found in other waterfowl. Wang et al. 2005 (pp.760-767) measured low levels of polychlorinated byphenyls (PCBs) in spectacled eiders breeding on the Y-K Delta in 1995.

In summary, some trace elements were elevated in sampled spectacled eiders, but based on one study it appears that elevated trace elements are not correlated to reproductive success. With the available information, we surmise that contaminants, with the exception of lead, are not a threat to spectacled eiders at this time.

Human Development

With the exception of contamination by lead shot, destruction or modification of Y-K Delta and ACP 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 eiders. At listing, spectacled eider breeding habitat on the ACP was largely unaltered by humans, although limited areas were altered by fill of wetlands, the presence of infrastructure that presented collision risk, and other types of human activity that could disturb birds or increase populations of nest predators.

Oil development is gradually spreading westwards across the ACP from the original hub at Prudhoe Bay. Given industry’s interest in the National Petroleum Reserve - Alaska (NPR-A) as expressed by lease sales, seismic surveys, drilling of exploratory wells, and the construction of the Alpine field at the eastern end of NPR-A, expansion of industrial development is likely to continue. Development in NPR-A could also facilitate development in more remote, currently undeveloped areas of the Chukchi Sea or additional areas of the Beaufort Sea, both of which are important migration and staging areas for spectacled eiders.

Currently, no oil and gas development has occurred within range of spectacled eider in Russia, but as extensive oil and gas reserves are thought to exist in northeast Siberia, development may occur there in the future. Significant natural gas development has begun on the Yamal Peninsula (Barents Observer 2008, p.1). The Yuzhnoe-Khykchuyu oil field in the Timan-Pechora province is among the largest in Russia, and is planned as an anchor field for further development

(ConocoPhillips 2008, p. 1). New oil and gas discoveries are being developed in Chukotka near Anadyr (Gazprom Neft 2004, p. 1). The East Siberia Pacific Ocean pipeline, which transverses southern Siberia, may facilitate the development of previously untapped fields (US Energy Information Adminstration 2008, p.1). In addition to these activities west and south of the Russian breeding area, reserves exist but are not currently planned for development in the Laptev formation on the arctic coast east of the Lena River (USGS 2007, pp. 1-2).

In summary, at present we do not consider development on the ACP, Y-K Delta, or in Russia to be a significant threat to spectacled eiders because only a small proportion of the species' range is within or near developed areas. Additionally, virtually all future developments in Alaska will require section 7 consultation under the ESA, which will evaluate their effect to the species and habitat, and allow for mitigation and reduction of potential adverse effects.

Climate Change

Global climate change presents a variety of potential threats to eider habitats identified since listing. For the last several decades, surface air temperatures in the arctic have warmed at a rate that exceeds the global average and they are projected to continue on that path (IPCC 2007, pp. 4, 9). The sub-surface and surface waters of the Arctic Ocean have warmed, and are predicted to continue to warm (Overland 2009, pp. 13-23). Increased ocean acidification as a result of increasing levels of atmospheric carbon dioxide could affect marine food webs in spectacled eider marine habitats. Aragonite undersatuation due to acidification is projected to become more widespread in the range occupied by eiders (Steinacher et al. 2009, p. 530). Reduced summer sea ice extent is predicted to increase the amount of vessel traffic in Arctic waters, increasing the likelihood of fuel spills, disturbance and collisions. Coastal erosion rates are increasing in Alaska and Arctic Russia (Mars and Houseknecht 2007, p. 585; Rachold et al. 2002, cited in Walsh et al. 2005, p. 233), posing the risk of direct loss of nesting habitat. The greatest sea-level increases over the next century are projected for the arctic, although with much uncertainty (Christensen et al. 2007, p. 914; Walsh et al. 2005, pp. 232-234). Terrestrial warming is also expected to change breeding environments.

Marine Environment
Ocean warming is expected to cause changes in species composition, with a variety of cascading effects. The northward expansion of warmer water has already resulted in an increase in total biomass, species richness, and average trophic level as sub-Arctic fauna colonized newly favorable habitats (Overland and Stabeno 2004, p. 309; Mueter and Litzow 2008, pp. 316-317). Walleye Pollock (*Theragra chalcogramma*), a species common in the sub-Arctic, and which avoid temperatures less than 2° C, have now moved northward into the Arctic zone; Arctic cod (*Arctogadus glacialis*) have moved further north following colder temperatures (Stabeno et al. 2007, p. 2605). With the redistribution of species, benthic fauna will face a new set of predators (Coyle et al. 2007, pp. 2901-2902). Movement of commercially harvested species such as crabs could lead to competition with eiders for food, and could bring commencement of commercial fishing in the spectacled eider wintering area, where it does not yet occur. NOAA Fisheries, in consultation with the North Pacific Marine Fisheries Council, recently created a research zone in the northern Bering Sea, including the spectacled eider wintering area, in anticipation of continuing changes in species composition there.

In recent years, summer sea ice in the Chukchi and Beaufort Seas has receded beyond the continental shelf, forcing walruses to land along the Alaska and Russia coasts in late summer and early fall. These haul-outs include areas in and near Ledyard Bay, Alaska, where spectacled eiders molt in fall. The spectacled eider recovery team has identified a high priority action to determine whether walrus compete for food with eiders under these circumstances. Recently, Lovvorn et al. (2010, pp. 53-56) observed walruses attacking spectacled eiders in the Bering Sea wintering area. They speculated that predation attempts could affect dispersion and energy balance of eiders (Ibid. p. 55).

Warming on the Bering Sea shelf could alter patterns of energy flow and food web relationships in the benthic invertebrate community, leading to overall declines in biomass (Coyle et al. 2007, p. 2902). The timing of the spring sea ice retreat plays an important role in the timing, amount, and fate of primary production over the Bering shelf with late melting leading to higher import of food to the benthos and earlier melting contributing primarily to the pelagic system (Coyle et al. 2007, p. 2901).

Future changes in winter sea ice conditions could affect the energy balance of spectacled eiders. Lovvorn et al. (2009, pp. 1605-1606) found that availability of ice was important for eiders as a resting platform to conserve energy when not foraging. Simulations indicated that if the percentage of non-foraging time spent resting on ice were decreased from 80% to 20%, nighttime energy cost, a large fraction of daily energy expenditure, would increase by almost 40%, essentially eliminating viable habitat (Lovvorn et al. 2009, p. 1607). Currently there is no data on the amount of time spectacled eiders spend on ice during non-foraging periods, or how that percentage varies with weather and ice conditions (Lovvorn et al. 2009, p. 1608).
Winter winds and ice concentration affect the ability of spectacled eiders to survive winter in the Bering Sea. Petersen and Douglas (2004, pp. 79-94) found that the number of winter days with dense sea ice concentration, extreme winds, and winds in spring explained some variability in annual breeding ground indices on the Y-K Delta. Eiders require sea ice for roosting to conserve energy, but also need open water to dive for food; in winters when ice is densely packed, lack of openings in the ice could lower eider survival or reproduction in the following summer (Ibid. p. 89). Whether climate change will bring more or fewer periods of high winds and dense ice concentration in the Bering Sea is unknown.

The Arctic Ocean could be ice-free for a short period in summer perhaps as early as 2015 (Arctic Council 2009, p. 4). Greater marine access and longer seasons of navigation would likely follow. The most significant potential threat from an increasing number of ships to the Arctic marine environment is the release of oil through accidental or illegal discharge (Ibid. p. 5); other threats include collisions of birds and ships, and effects of vessel emissions.

Ocean acidification is likely to change the prey base of spectacled eiders. Eiders forage in large part on calcifying invertebrates such as bivalves. If widespread aragonite undersaturation due to acidification were to occur as predicted in the Arctic, it could have a major impact on bivalves' ability to form shells (Steinacher et al. 2009, p. 515). In addition, bivalves are filter feeders and depend on the rain of organic particles from the water column and melting sea ice. Because of the tight link between sea ice algae and the benthos (Grebmeier et al. 2006, p. 339), disruption of the quantity or quality of sedimenting organic material due to acidification could affect bivalves (McMahon, Jr. et al. 2006, p. 12). The physiology of all animals is sensitive to acid/base balance so there is the potential for all benthic invertebrates to be affected. Ocean acidification is likely to increasingly affect the ecosystem structure in spectacled eider habitat, but the timing, nature and magnitude of these impacts cannot be predicted yet.

Terrestrial Environment: Y-K Delta Breeding Area
Spectacled eiders breed in the broad vegetated coastal zone of the Y-K Delta, which is characterized by a very low elevational gradient (Jorgenson and Ely 2001, p. 129). Alteration of habitats through coastal erosion, inundation and salinization from storm surges, thawing permafrost, and sedimentation changes due to sea level rise and increased river discharge could change the value of current nesting areas (Fischer et al. 2009, p. 11). The Y-K Delta coastal zone is considered to be highly vulnerable to these effects (Jorgenson and Dissing 2010 in prep, p. 6-7).

Data collected at Kigigak Island, Y-K Delta since 1999 have shown a declining trend in mass of spectacled eider ducklings at 35 days of age (B. Lake, Service, pers. comm. 2010). Salinity is known to negatively influence eider duckling growth and survival (e.g. DeVink et al. 2005, pp. 523-529). Pond salinity or changes in food availability could be important factors affecting juvenile survival and subsequent productivity of female spectacled eider ducklings recruiting to the local breeding population (Flint et al 2006, p. 909). H. Wilson (USFWS Migratory Bird Management, pers. comm., 2010) is currently monitoring salinity in conjunction with random nest plots on the coastal zone of the Y-K Delta. In addition, a study to measure salinity effects on growth of captive ducklings is ongoing (T. Hollmen, Alaska SeaLife Center, pers. comm., 2010).

The trend in May air temperature at weather stations on the Y-K Delta from 1960 to 2009 is increasing 0.058 degrees Fahrenheit (F) (0.032 degrees Centigrade (C)) annually, for an overall increase of 2.84 degrees F (1.57 degrees C) since 1960 (Fischer et al. 2009, p. 11). Continued long-term increases in temperatures are predicted by climate change models (Meehhl et al. 2007, p. 764). Because the timing of waterfowl nest initiation is closely correlated with spring breakup (Raveling 1978, pp. 294-303), it is not surprising that a significant trend in earlier waterfowl nest initiation on the Y-K Delta has already been documented by Fischer et al. (2009, p. 11; Fig. 3). The potential effects of earlier nest initiation on spectacled eider populations are not known.

Terrestrial Environment: ACP and Arctic Russia Breeding Areas
There is a potential for climate-induced changes on morphology and biotic communities of brood-rearing ponds on the ACP and Arctic Russia breeding areas, but these are little understood. Permafrost is continuous in these areas, and could be hundreds of meters (ft) deep. Breeding habitat on the arctic coast depends on a unique hydrological system, which is in turn dependent upon cold temperatures that maintain continuous and stable permafrost underlying perched (i.e., isolated above the groundwater) lakes (Rovansek et al. 1996, p. 316) and relatively consistent weather patterns, such as most precipitation deposited in winter as snow, and spring ice-jams and floods contributing to lake recharge (Prowse et al. 2006, pp. 330-331). If these patterns change, alterations could occur in breeding habitat.

In summary, climate change effects discussed here could potentially affect the future status of the spectacled eider. Although some changes in spectacled eider life history have been documented (e.g., earlier nest initiation), at present we do not have information indicating negative effects of climate change on eiders, so we are unable to predict population-level effects. However, we recommend that the Service re-evaluate this conclusion at the next 5 year review to reflect improved understanding and prediction capabilities.

FACTOR B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Commercial Activities

Commercial fishing has rarely occurred in the Bering, Chukchi or Beaufort Seas. Since 2008, in anticipation of movement of commercial species into the area, NOAA Fisheries closed the northern Bering Sea (73 FR 43362-43373) (http://edocket.access.gpo.gov/2008/E8-17144.htm), and the Chukchi and Beaufort Seas (74 FR56734-56746) (http://www.fakr.noaa.gov/frules/74fr56734.pdf) to commercial fishing. Consequently, we conclude that commercial fishing is not a threat to spectacled eiders at this time. Commercial and recreational hunting of eiders is prohibited.

Scientific activities

Bowman and Stehn (2003, pp. 1-22) reported on the impact of nest searching and biological study camps on spectacled eiders on the Y-K Delta. Cumulative nest visitation effects of studies occurring from 1994 to 2002 were estimated at losses of 15 nests and 57 eggs per year (Ibid., p. 8). There was no indication of a long-term local adverse effect of study camps on eider populations (Ibid., p. 9). There are currently fewer field studies in eider breeding areas of the Y-K Delta than during the period studied, so current effects are likely smaller than those reported.

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 funded or permitted by Federal agencies (e.g., activities in NPR-A and those funded by the National Science Foundation) require section 7 consultation. While the Service consulted on the major long-term research area near Barrow, and some researchers are currently conducting activities in ways that minimize impacts to listed eiders, other researchers are unaware of the necessity of consultation prior to conducting their work. The Service intends to increase researcher awareness through outreach and the implementation of a Barrow conservation plan. While it is possible that individual birds could be affected, the Barrow area only constitutes a small portion of the ACP breeding population range, thus it is unlikely that researcher activities pose a population-level threat to spectacled eiders.

Research activities in marine habitats are mostly limited to U.S. Coast Guard icebreaker cruises, which occur no more than once a year in spectacled eider habitats (http://www.icefloe/net/icebreakers.html). Collections of spectacled eiders for research are rare, and amounted to fewer than 100 birds between 2001 and 2010 (Service data). The NOAA sponsored benthic surveys of the northern Bering Sea will occur in 2010, subject to Section 7 consultation with the Service to avoid disturbance to spectacled eiders molting in Norton Sound. In March 2009 and 2010, aerial surveys of spectacled eiders were conducted by the Service. In general, these flights were at approximately 244 to 305 m (800-1,000 ft) altitude, and did not cause eiders to flush (T. Bowman, Service, pers. comm. 2010).

In addition to field studies, a captive population of spectacled eiders is housed at the Alaska SeaLife Center. At present, the captive population is only supplemented with birds found injured in the wild; therefore, its maintenance does not affect the wild population.

In summary, although a variety of research activities are conducted within spectacled eider habitat, we do not believe these activities pose population-level effects. For the reasons discussed above, we conclude that overutilization for commercial, recreational, scientific, or educational purposes is not currently a threat to spectacled eider.

FACTOR C: Disease or Predation

Disease

Information about infectious disease prevalences in spectacled eiders is available from serologic surveys conducted in the late 1990s and during 2002-2006 in western Alaska, and from the national avian influenza surveillance program in Alaska in the late 2000s. For these studies, data was collected during the breeding season. Information about disease occurrence during the nonbreeding season is lacking.

Evidence of exposure to infectious bursal disease virus (IBDV) was detected in nesting spectacled eider hens on the Y-K Delta in 1998 (Hollmen et al. 2000). IBDV is a known pathogen of domestic poultry, causing immunosuppression in young birds (Eterradossi and Saif 2008), but the source of exposure in spectacled eiders remains unknown. Hollmen et al. (2000) suggested that the IBDV or a closely related virus may have established itself in free ranging spectacled eiders at some earlier time, due to lack of evidence of direct contact with domestic poultry or poultry waste. Potential health effects in spectacled eiders are also unknown.

During 2002-2006, spectacled eiders breeding on the Y-K Delta were screened for serologic evidence of exposure to sea duck adenovirus (SDA), sea duck reovirus (SDR), Newcastle disease virus (NDV), and avian influenza (AI). Samples were obtained from Lower Kashunuk River in 2002 and from Kigigak Island in 2002-2006 and serum was tested using virus neutralization assays. Among the years, prevalence of birds with serological evidence of exposure was 34-100% for SDA, 60-100% for SDR, 3-11% for NDV, and 37-69% for AI (Hollmen, unpubl. data). Cloacal swabs collected from the same individuals were found negative for viruses in cell culture. In 2006-2007, spectacled eiders were screened for influenza viruses as part of the avian influenza surveillance program in Alaska and 0.57% of birds tested positive for influenza A in RT-PCR (Ip et al. 2008). Health effects of IBDV, SDA, SDR, NDV, and AI viruses in spectacled eiders are largely unknown. Adenoviruses and reoviruses have been linked to mortality in a closely related sea duck species, the common eider (Hollmen et al. 2002; Hollmen et al. 2003a), and adenoviruses have been linked to mortality in another sea duck species, the long-tailed duck, in Alaska (Hollmen et al. 2003b).

In 2002-2003, serum samples from spectacled eider hens from the Y-K Delta were tested for *Aspergillus spp.* and *Chlamydophila spp.* antibodies, and 31-68% and 13-16%, respectively, were found positive (Hollmen, unpubl. data). Eiders in captivity are known to be susceptible for aspergillosis, but health effects of exposure to *Aspergillus spp.* in free ranging populations have not been characterized. *Chlamydophila spp*. is a known bacterial pathogen of some avian species (Andersen and Vanrompay 2008), but pathogenicity in spectacled eiders is unknown.

In summary, evidence of exposure to a variety of potentially pathogenic viruses, bacteria, and fungi has been detected in spectacled eiders, but information about potential health effects of these agents is largely lacking. Some potential pathogens have been found at high exposure rates (up to 100% in some years and locations) and thus, if adverse health effects occur, they may impact a significant proportion of the population. However, based on available information, disease does not appear to be causing population-level effects to the species at this time.

Predation

As described above, predation has a large effect on nesting success of spectacled eiders. The eider recovery team has identified high priority actions to investigate the feasibility of controlling glaucous gulls and arctic foxes on the Y-K Delta.

Y-K Delta
Arctic foxes are a primary predator of eider nests on the Y-K Delta, causing near complete nest failure in some years. Researchers have correlated control of foxes with increased nest success in spectacled eiders (Lake 2008, p. 5). Because spectacled eiders nest in low-lying areas distant from fox denning areas, it is likely that non-breeding foxes are primarily responsible for nest predation (Flint et al. 2009, pp. 1-12). Flint et al. (2009, pp. 1-12) began a 5 year study in 2006 to provide a model to predict years when fox populations will be high and vole populations low, resulting in high predation on eider nests. They will also evaluate the efficacy of trapping to reduce fox density enough to reduce predation risk to nesting eiders.

Predatory behavior of gulls toward waterfowl appears to be variable, even within the coastal zone of the Y-K Delta. For example, Schmutz and Hobson (1998, pp. 119-130) observed that glaucous gulls near the coast, including at Kigigak Island, ate more marine food than gulls nesting further from the coast, and that the proportions of marine- and terrestrial-derived food varied through the summer season. Researchers on the Y-K Delta have observed glaucous gulls (*Larus hyperboreus*) killing spectacled eider ducklings, but did not find evidence of eider predation in gull stomachs collected there in 1994, possibly because of the low numbers of eiders compared to goose populations in the sampled areas (Bowman et al. 2004, p. 294). Grand and Flint (1997, pp. 929, 931) observed mew gull predation on spectacled eiders on the lower Kashunuk River, and correlated gull removal with increased nest success. Gulls have not been documented as important predators at Kigigak Island (close to the coast), where spectacled eiders have been studied for two decades (e.g. Lake 2008, pp. 1-16).

The ratio of gulls to eiders on the Y-K Delta has varied substantially since the 1980s. Increases in glaucous gull populations between the 1980s and mid-1990s caused concern for waterfowl populations (Schmutz and Hobson 1998, p. 120). The aerial index of glaucous gulls on the Y-K Delta varied substantially between 1988 and 2009, but overall the growth rate was flat or slightly declining during that period (average annual growth rate=0.981 (90% CI=0.959-1.004)), and declined between 2000 and 2009 (average annual growth rate=0.949 (90% CI=0.910-0.989) (Platte and Stehn 2009, Figure 22), a period in which the estimated number of spectacled eider nests increased (Fischer et al. 2009, Figure 2).

Given the apparent variability in gull predatory behavior, it is difficult to define the magnitude of the threat, or whether the impact of gull predation would be blunted by large scale control.

ACP

There is some evidence that predator and scavenger populations increased on the ACP near human habitation such as villages and industrial infrastructure (Eberhardt et al. 1983, pp. 66-70; Day 1998, pp. 1-106; Powell and Bakensto 2009, pp. 1-41). 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. 2010, Day 1998, pp. 7-9, 13, 18, 27). These anthropogenic influences on predator populations and predation rates could affect eider populations, but this has not been substantiated.

Arctic Russia

In Arctic Russia, apparent nest success for a study on the Indigirka Delta was calculated as <2% in 1994 and 27% in 1995; predation was believed to be the cause of high failure rates, with foxes, gulls and jaegers the suspected predators (Pearce et al. 1998, p. 115). On the Chaun Delta, apparent nest success calculated using nests found already depredated was 16.5-31.9%, attributed largely to arctic fox predation in years of depressed vole populations (Solovieva and Lyatieva 2006, pp. 6, 8-9, 12, Table 3).

In summary, significant future changes in predator abundance, predation rates, or predator-prey relationships could potentially pose population-level impacts. However, the apparent increase in the size of the Y-K Delta population suggests that predation is not currently constraining recovery there. Yet, predation, possibly in combination with other threats such as harvest and lead contamination, may be inhibiting the population growth rate in the ACP population, although data substantiating this conjecture is limited. Lacking trend information for the Russian population, it is impossible to assess the threat of predation in the context of population growth. Therefore, we conclude that the best available information indicates that predation may pose a threat for the ACP population of spectacled eiders.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

Alaska

The spectacled eider was closed to sport hunting under the Migratory Bird Treaty Act in 1991, and has remained closed under Federal and State of Alaska sport hunting regulations since then (http://www.wildlife.alaska.gov/index.cfm?adfg=regulations.main). The species was included in the Service's enforcement policy species list to eliminate illegal subsistence harvest in 1993 (58 FR 27477). Federal regulations requiring the use of non-toxic shot for hunting waterfowl, cranes and snipe nationwide were implemented in 1991 (Ibid.).

After the spectacled eider was listed in 1993, the Migratory Bird Conventions between the United States and Canada, and between the United States and Mexico, were amended to allow subsistence harvest of migratory birds in Alaska in spring and summer. Migratory Bird Treaty Act procedural regulations for this harvest were published in 2002 (67 FR 53511) and annual regulations were first promulgated in 2003. Since 2003, the spectacled eider has remained closed to harvest under annual regulations (for 2010, see 75 FR 18764 18773). Intra-Service consultations for subsistence and sport hunting regulations for species open to hunting are conducted annually. As described under Factor E, harvest of tens to hundreds of spectacled eiders continues despite these prohibitions.

As described under Factor A, lead poisoning is a threat to spectacled eiders, and exposure to lead shot is an indirect effect of hunting and the related regulatory mechanisms. In 2006 and 2007, the State of Alaska Board of Game passed regulations prohibiting the use of lead shot for upland game bird hunting on the ACP 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. Several high priority recovery actions mandating education and law enforcement help to prevent the use of lead shot by hunters in eider breeding habitat. These actions are being conducted by the Service, U.S. Bureau of Land Management (BLM) and state and local partners. 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, success has varied regionally; compliance was considered "excellent" in portions of the Y-K Delta (G. Peltola, Service, pers. comm., 2010) in 2009, but even in 2010 lead shot was still available in stores on the ACP and hunters were found in possession of lead shot (Service, unpubl. observations).

The National Environmental Policy Act (NEPA) requires federal agencies to consider the environmental impacts of their proposed actions, including actions of others requiring a federal permit, and reasonable alternatives to those actions. To meet this requirement, federal agencies conduct environmental reviews, including Environmental Impact Statement and Environmental Assessments. The NEPA does not specifically regulate impacts to spectacled eiders, but requires full evaluation and disclosure of information regarding the effects of contemplated Federal actions on threatened and endangered species and their habitat.

Oil spill response in Alaska is regulated by the Oil Pollution Act of 1990, which requires the U.S. Coast Guard (USCG) and the Environmental Protection Agency to develop a statewide oil spill response plan, and by Alaska Statute 46.04, which requires the Alaska Department of Environmental Conservation to develop a statewide response plan and individual response plans for ten geographic subareas spanning the State of Alaska (Oil Pollution Act of 1990 (33 U.S.C. 2701-2761; http://www.uscg.mil/NPFC/About_NPFC/opa.asp; Alaska Statute Title 46, Water, Air, Energy and Environmental Conservation, http://www.dec.state.ak.us/SPAR/statutes_regs.htm). Additionally, Alaska Statute 46.04

requires that the oil industry develop oil discharge prevention and contingency plans. Despite planning efforts, the USCG has no offshore response capability in Northern or Western Alaska and we only marginally understand the science of recovering oil in broken ice (O'Rourke 2010, p. 23).

The Coastal Zone Management Act (CZMA; 16 U.S.C. 1451 et seq.) was enacted to "preserve, protect, develop, and where possible, to restore or enhance the resources of the Nation's coastal zone." The CZMA is a state program subject to Federal approval. The CZMA requires that Federal actions be conducted in a manner consistent with a state's coastal zone management plan to the maximum extent practicable. Federal agencies planning or authorizing an activity that affects any land or water use or natural resource of the coastal zone must provide a consistency determination to the appropriate state agency. The CZMA is applied in Alaska through the Alaska Coastal Management Program (ACMP). The primary tool used to implement the ACMP is the consistency review process. Through this process, proposed resource development activities are reviewed for consistency and compliance with the State's coastal management program which includes State laws, State standards, and district enforceable policies. Protections for spectacled eiders and their habitat are applied through incorporation of local district input and application of State ACMP enforceable policies to Federal agency activities.

Russia

The spectacled eider is not listed as rare or endangered in the Red Data Book of the Russian Federation, but is in Appendix 3 (Red Data Book of the Russian Federation, 2001, p. 855), which lists populations requiring special attention or are listed on other "red lists." (Ibid. p. 9). The species is nominally protected under the 1978 U.S. Migratory Bird Treaty with the former Soviet Union (Convention between the United States of America and the Union of Soviet Socialist Republics Concerning the Conservation of Migratory Birds and their Environment; Public Law 95–616), which specifies that each party shall prohibit the taking of migratory birds, the collection of their nests and eggs, and the disturbance of nesting colonies. Exceptions include subsistence purposes for indigenous people. The Treaty also mandates that to the extent possible, the parties shall undertake measures necessary to protect and enhance the environment of migratory birds and to prevent and abate the pollution or detrimental alteration of that environment. We do not have reliable information on enforcement of regulations in Russia, and we also do not have information that insufficient regulation or enforcement has caused a population-level threat to the spectacled eider.

In summary, spectacled eiders are still harvested from all three breeding populations, despite regulations prohibiting take in Alaska. Additionally, lead shot is still sold and used illegally in eider breeding areas. As discussed further in Factor E, offshore response capability and effective strategies to clean up oil spills in the Arctic are lacking. Therefore, although the Oil Pollution Act mandates development of response plans, oil spills remain a potential threat to the species. Therefore, because harvest, lead contamination and oil spills may have significant population-level effects, we conclude that existing regulatory mechanisms are not currently adequate to address these threats to spectacled eiders.

FACTOR E: Other Natural or Manmade Factors Affecting Its Continued Existence

Direct Effects of Oil and Gas Development and Vessel Traffic in the Marine Environment

Spectacled eiders spend the majority of their lives in the marine environment, and are exposed to potential impacts of disturbance, collisions with oil and gas structures, and spills of oil and toxic substances from offshore oil and gas development and other vessel traffic. Offshore oil and gas development might also affect terrestrial habitats (e.g., through construction of pipelines, support facilities, etc.). Those impacts are discussed under Factor A.

The magnitude of potential impacts from offshore oil and gas development is related to the type, size, and probability of development, and its location in relation to spectacled eider distribution and use of an area. Eiders gather in polynyas and ice leads and along open shorelines near river deltas on the coasts of northern Alaska and Russia. Eiders are particularly vulnerable during the fall molting period, when they are unable to fly for approximately three weeks between June and October. The oil industry is active in spectacled eider habitats in Alaska; examples include Pioneer's Oooguruk development near the Colville River Delta, and preliminary exploration activities near the spectacled eider molting area in the eastern Chukchi Sea. Undiscovered reserves in Arctic Russia are thought to occur in the East Siberian Sea and the Laptev Sea Shelf in the Arctic Ocean, but exploration has not occurred there (USGS 2007, pp. 1-2). It is important to note that while it is likely that oil and gas development will continue, the location and extent of future activities is uncertain.

Disturbance

Air and boat traffic associated with oil and gas development could disturb spectacled eiders, decreasing foraging success or displacing individuals to less preferred areas at some unknown energetic cost. The severity of disturbance and displacement effects depends upon the duration, frequency, and timing of the disturbing activity. Hence, construction and operation of offshore facilities, which could persist for years or decades, will likely have greater impacts than seismic and exploratory activities, which generally last less than one year. Expected increases in arctic shipping traffic due to reduced summer sea ice are discussed in the Climate Change section under Factor A.

Collisions

Offshore oil and gas development would result in both fixed (e.g., offshore platforms) and mobile structures (e.g., supply ships) in the marine environment, posing a potential collision risk for spectacled eiders. Birds are particularly at risk of collision with objects in their path when visibility is impaired during darkness or inclement weather, such as rain, drizzle, or fog (Weir 1976, p. 6). In a study of avian interactions with offshore oil platforms in the Gulf of Mexico, Russell (2005, pp. 266-297) found that collision events were more common and more severe (by number of birds) during poor weather. Weather conditions that increase collision risk are common in northern waters such as the Bering, Beaufort, and Chukchi Seas.

Certain types of lights (such as steady-state red) on structures increase collision risk, particularly in poor weather (Russell 2005, pp. 266-297; numerous authors cited by Manville 2000, pp. 1-15; Gehring et al. 2009, pp. 505-514). In an effort to reduce collision risks resulting from bird attraction to lighted structures, the Bureau of Ocean Energy Management, Regulation, and Enforcement (formerly Minerals Management Service) will require that vessels in the Chukchi and Beaufort Sea program areas minimize the use of high-intensity work lights, especially within the 20-m bathymetric contour. Exterior lights will only be used as necessary to illuminate active, on-deck work areas during periods of darkness or inclement weather; otherwise they will be turned off. Interior and navigation lights will remain on for safety. Lessees are also required to implement lighting protocols aimed at minimizing the radiation of light outward from exploratory drilling structures (USFWS 2009, pp. 63-64).

Over-water flight behavior of spectacled eiders places them at risk of colliding with human-built structures. Day et al. (2005, p. X) suggested that eider species may be particularly susceptible to collisions with offshore structures because they fly low and at relatively high speed (~ 45 mph) over water. Johnson and Richardson (1982, p. 296), in their study of migratory behavior along the Beaufort Sea coast, reported that 88% of eiders flew below an altitude of 10 m and >50 % flew below 5 m.

Collision risk is a function of proximity of structures to habitats used by eiders, including migratory routes. Estimating the number of collisions is complicated by: 1) a lack of information on migration routes, behavior, and vulnerability to collisions with these types of structures; 2) uncertainty over the location of any development; and 3) the extent to which MMS‘s lease stipulations governing lighting and operations will reduce collision risk.

Because spectacled eiders stage, molt, and winter in the Chukchi and Bering seas to the west of their North Slope nesting range, the entire North Slope population of each species could conceivably pass structures in the Chukchi Sea. In the Beaufort Sea Program Area, however, there is a significant longitudinal gradient in the numbers of eiders. Data from aerial surveys for breeding eiders (1993–2006) on the North Slope were combined to provide a longitudinal distribution of spectacled eider observations (Service, unpublished data). These data indicate that 58% of spectacled eider observations occurred east of Barrow, and that by Deadhorse this had dropped to 7%; less than 1% of observations were made east of Point Thompson.

Collision data for common eiders at Northstar Island (BP data provided to the Service) was compared to the population estimate for common eiders migrating across the Beaufort Sea to provide a strike rate (percentage of the population killed per year by collision with Northstar) of 0.0017% (U.S. Fish and Wildlife Service 2009, pp. 95-97). This collision rate can be used as a surrogate to assess potential impacts to spectacled eiders, by converting it to a percentage and applying that to the estimated population sizes of listed eiders that may migrate past a structure. Using this approach, for each structure in the Chukchi Sea, an estimated 0.44 spectacled eiders could be killed each year. The number would likely be significantly lower for structures in the Beaufort Sea, and decrease the further east a structure is located (Ibid.). The proportion of birds potentially vulnerable to collision, and the validity of this means of estimating potential impacts, is also affected by the proximity of facilities to migration flight paths, however.

Oil Spills
Spills of oil, refined petroleum products (e.g., diesel fuel), or other toxic substances (e.g., drilling mud) from offshore oil and gas development can occur as a result of well blowouts, operational

discharges, pipeline failures, tanker or other vessel leaks, and numerous other potential accidental discharges (AMAP 2007, pp. 24-25). A discharge of these products could cause direct mortality of spectacled eiders or result in indirect effects through habitat degradation or impacts to prey species. Mortality following exposure to oil is common in aquatic birds, which are vulnerable to surface oil (Albers 2003, pp. 354-356). Moreover, a spill can result in persistent environmental contamination by oil and its toxic breakdown products and reduced food resources, resulting in lower survival and hydrocarbon exposure years after visible oil has been abated (Esler et al. 2000, p. 843; Trust et al. 2000, pp. 399-402). Large numbers of spectacled eiders are most vulnerable to direct contamination from an oil spill from June through October, when they gather in large flightless molting congregations in the eastern Chukchi Sea, where initial exploratory drilling is planned for 2011.

While a large spill in an area supporting large numbers of spectacled eiders could have significant adverse effects, we consider the relative probability of a large spill occurring to be low. Spills resulting from offshore oil exploration and development are relatively infrequent. Until 2007, 13,463 exploratory wells had been drilled in the coastal United States, which resulted in 66 blowouts and four oil spills (range 1 to 200 bbl; average ~78 bbl) (U.S. Minerals Management Service 2007, Appendix A.1, p. 2). To date, there have been no large oil spills in the arctic marine environment from oil and gas activities (AMAP 2007, p. 24). No exploratory drilling blowouts have occurred from the 98 wells drilled to date in Alaska's arctic offshore region (U.S. Minerals Management Service 2007, Appendix A.1, p. 2). However, the possibility of a large spill from exploratory drilling does exist, as evidenced by the Deepwater Horizon blowout in the Gulf of Mexico on April 20, 2010. The amount of oil spilled to date in the Gulf is still unknown, but is estimated to be in the millions of barrels.

Although the probability of a spill occurring is low, in light of the events following the Deepwater Horizon incident, the efficacy of oil spill response is of concern, particularly in the Arctic. The Commander of the Coast Guard's 17th District, which covers Alaska, noted in an online journal that "...we are not prepared for a major oil spill [over 100,000 gallons] in the Arctic environment. The Coast Guard has no offshore response capability in Northern or Western Alaska and we only dimly understand the science of recovering oil in broken ice" (O'Rourke 2010, p. 23). The behavior of oil spills in cold and icy waters is not well understood (O'Rourke 2010, p. 23). Cleaning up oil spills in ice-covered waters will be more difficult than in other areas, primarily because effective strategies have yet to be developed. The Arctic conditions present several hurdles to oil cleanup efforts (O'Rourke 2010, p. 24). Therefore, in the unlikely event that a large spill does occur, the magnitude of the effect on spectacled eiders could be catastrophic as effective oil spill response would be difficult or impossible in the Arctic. It is unlikely that spilled petroleum products can be contained or cleaned up in offshore areas due to the difficulty in mobilizing adequate resources in the face of ice, high winds, and high seas.

In summary, at present we believe that the risk to spectacled eiders from collisions and disturbance resulting from offshore oil and gas development and shipping activity to be low, as it is unlikely to have population-level effects. Conversely, although the probability of a large spill occurring in spectacled eider habitat is low, given the recent events in the Gulf of Mexico, and the lack of adequate response capability in the Arctic, the magnitude of the effect from an oil spill could be very large. An improved risk assessment that takes into account these concerns is not yet available. Therefore, until an improved risk assessment reliably demonstrates that the threat from offshore oil spills is discountable, and we can be assured of the sufficiency of current Arctic oil spill response plans, we cannot dismiss the possibility that oil spills may be a threat to spectacled eiders. We recommend a re-analysis of the threat of offshore oil spills as more information becomes available.

Harvest

Spectacled eiders are most subject to harvest during spring and fall migration along the western and northern coasts of Alaska, and in eastern Russia. Because they may fly in mixed-species flocks, and are similar in size to common and king eiders, spectacled eiders can be difficult to distinguish from other eiders; thus they are subject to misidentification and inadvertent harvest during migration. Spectacled eiders molting in Ledyard Bay and Norton Sound could be shot during the course of other legal subsistence activities (e.g., marine mammal hunting by boat) in July and August. Breeding spectacled eiders are not found in dense concentrations near villages or areas of high human activity, and their dispersed nesting distribution probably limits the proportion of the nesting population that is subject to harvest. It is unlikely that spectacled eiders wintering in ice leads and polynyas south of St. Lawrence Island are subject to harvest.

Sport hunting of spectacled eiders was closed in 1991 by Alaska State regulations and Service policy. Since listing, the Migratory Bird Conventions between the United States and Canada, and between the United States and Mexico, were amended to allow subsistence harvest of migratory birds in Alaska in spring and summer. Migratory Bird Treaty Act regulations for this harvest were first promulgated in 2003. The spectacled eider remains closed to harvest under these regulations as well as under sport hunting regulations. Intra-service consultations for the Migratory Bird Subsistence Hunting Regulations are conducted annually. Harvest of all species, included listed eiders, is being monitored. Outreach efforts occur on the Y-K Delta and the ACP by the Yukon Delta National Wildlife Refuge (NWR), Migratory Birds and State Programs of the U.S. Fish and Wildlife Service, the Alaska Department of Fish and Game (ADFG) in their harvest regulation materials, and by the North Slope Borough and BLM.

Harvest of Spectacled Eider Adults

Huntington (2009, pp. 1-39) summarized harvest survey data between 1972 and 2007. Not all regions and sub-regions, or all years, are represented in these data; in addition, methodology varied. The only year that had significant survey coverage on the ACP (five villages) was 1992, with reported harvest of 995 spectacled eiders (Ibid. p. 30, Table 2). However, Huntington (2009, p. 3) suggested that misidentification among eider species likely occurred. In the Northwest Arctic region eiders were not identified to species; total reported eider harvest in this region ranged from 0 to 196 annually, and could have included common, king, spectacled or Steller's eiders (Huntington 2009, p. 31, Table 3). In the Bering Strait – Norton Sound region, annual reported harvest ranged from 0 – 517 spectacled eiders (Ibid. p. 32, Table 4). The Y-K Delta region has the most complete historical data set of harvest surveys because ADFG 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) (Ibid. p. 35, Table 5). Reported annual harvest of spectacled eiders in the Bristol Bay region ranged from 0 to 156 (Ibid. p. 39, Table 6).

Bacon et al. (2009, pp. 1-105) provided harvest data for villages on the ACP from 1994-2003. Of particular interest is the harvest estimate of 253 spectacled eiders from Wainwright for July 2002 through June 2003 (Ibid. p. 87, Table W2). These data support the supposition that spectacled eiders are harvested on migration, but this single report may not be representative of normal harvest levels.

Harvest of spectacled eiders was reported by the Alaska Migratory Bird Co-Management Council (AMBCC) between 2004 and 2007 in four regions: North Slope, Bristol Bay, Y-K Delta, and Bering Strait – Norton Sound (Naves 2009a, pp. 1-183). Estimates of annual harvest in the ACP and Y-K Delta regions, where spectacled eiders nest, range from 9 to 99 (Ibid. Tables 72, 146) and 13 to 55 (Ibid. Tables 16, 56, 88, 128), respectively. Harvest estimates ranged from 11 to 231 in the Bristol Bay region (Ibid, Tables 11-14, 50, 120) and 6 to 863 in the Bering Strait – Norton Sound region (Ibid. Tables 32, 70, 144).

The accuracy of spectacled eider harvest data could suffer from misidentification among eider species. It is plausible that spectacled eiders are harvested in their two primary nesting areas in Alaska, the ACP and Y-K Delta, and discussion with hunters on the North Slope and observations of Service employees confirm that spectacled eiders are taken during the subsistence hunt. Service biologists and enforcement agents in Barrow have documented shot spectacled eiders along the roads, in hunters' possession, and hanging from racks. As they winter and migrate through the Bering Strait – Norton Sound region, it is also reasonable to assume that spectacled eiders are harvested there. The Bristol Bay region is not within the documented range of the species (Peterson et al. 2000, p. 4), so the reports of harvest there during breeding are questionable. 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, Service, pers. comm. 2010).

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

Estimates from limited harvest surveys conducted in a subset of villages in Yakutia and Chukotka, Russia, suggest that approximately 10,000 – 14,000 spectacled eiders are shot annually in the region (Syroechkovski and Klokov 2009). Trends in harvest cannot be calculated from the available information. These surveys are subject to the same biases as, and methods are less consistent than, the Alaska harvest surveys; therefore, inference from these data are limited, but they provide evidence that a significant number of spectacled eiders are harvested in Russia. Moreover, harvest is not regulated in the region (Syroechkovski and Klokov 2009).

Harvest of Spectacled Eider Eggs
Subsistence harvest seasons coincide with sensitive periods such as egg laying, incubation, and brood rearing, for both listed eider species. Egg harvesters target goose nests, and especially those of colonially-nesting species. Eiders sometimes nest near and among colonially-nesting geese. Spectacled eider nests are cryptic and occur at low densities, so they are probably not targeted by egg collectors, but could be collected or disturbed by serendipitous discovery.

Egg collection is probably reduced to some unknown extent by subsistence harvest closures designed to protect nest and broods during the middle of the nesting season. On the ACP, the annual regulations include a 30-day closure around June 15 – July 15; on the Y-K Delta, the dates of the 30-day closure vary annually with current year nesting phenology. The closure is likely most effective near Barrow, where increased outreach and law enforcement 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 egg collection occurs despite the closure, so some harvest of spectacled eider eggs could occur.

Recent AMBCC subsistence harvest surveys reported take of spectacled eider eggs in two regions from 2004 to 2008 (Naves 2009a, pp. 1-184; Naves 2009b, pp. 1-86). Although the Y-K Delta is surveyed annually, the only report of spectacled eider egg harvest on the Y-K Delta between 2004 and 2008 was from the mid coast sub-region in 2008, with an estimate of 109 eggs harvested (Naves 2009b, p. 41, Table 25). The Bering Strait/Norton Sound region reported spectacled eider egg harvest in 2 of 3 years surveyed, with estimates of 23 in 2004 (Naves 2009a p. 44, Table 33) and 48 in 2005 (Ibid. p. 83, Table 71). No listed eider eggs were reported taken in the North Slope region, which was surveyed in 2005 and 2007 (Ibid).

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 spectacled eiders in the Bering Strait/Norton Sound region exists. Therefore data suggesting spectacled eider egg collection in the Bering Strait/ Norton Sound region are also questionable.

Spectacled eiders nest in significant numbers on the Y-K Delta; therefore, take of eggs in this region is possible. However, numbers 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 may reduce egg collection. Therefore, given that: 1) subsistence hunting and egg collection are closed during the egg-laying and incubation stages of spectacled eiders on their primary nesting areas of the ACP 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 roughly low tens of spectacled eider eggs are collected annually throughout Alaska.

Subsistence harvest surveys conducted in Yakutia and Chukotka indicate that harvest of spectacled eider eggs occurs in Russia (Syroechkovski and Klokov 2009); however, because of limited data, precise estimates and trends cannot be determined.

In summary, it is likely that roughly low tens of eggs, and tens to hundreds of spectacled eiders from the ACP and Y-K Delta populations, are harvested every year. It is also likely that significant numbers of spectacled eiders are harvested in Russia each year, but data is limited. While untested formally, it is possible that harvest was a factor in the decline of spectacled eiders on the Y-K Delta (USFWS 1996a). However, the population appears to be recovering for unknown reasons; therefore at present it is unlikely that the Y-K Delta breeding populations is incurring population-level effects from harvest. Yet, harvest may be inhibiting the population growth rate on the ACP, where population surveys indicate a slightly decreasing population trend (Larned et al. 2010, Fig. 14). Population and harvest trends are not well documented in Russia; thus it is difficult to assess its effect on the Russian breeding population. We conclude that in combination with other potential threats, such as predation and lead contamination, harvest may be a threat, particularly on the ACP where population surveys indicate a slightly decreasing trend.

Egg inviability

At the two spectacled eider nesting areas monitored for egg inviability on the Y-K Delta (Lower Kashunuk River and Kigigak Island), approximately 5% and 1.7-12% of eggs were inviable, respectively. Furthermore, an estimated 23% of nests on the Lower Kashunuk River contained inviable eggs in the early to mid-1990s, and an estimated 26% of nests at Kigigak Island contained inviable eggs in 2002-2006. These estimates from western Alaska are high compared to information from other spectacled eider nesting populations.

In the avian egg, failure to hatch may be due to lack of fertilization or embryo mortality. Multiple factors have been considered as causes of hatching failure, including contaminants, disease, genetic inbreeding, nest microclimate and ambient environmental conditions, and parental nutrition (Serrano et al. 2005). Some studies have been conducted to investigate potential causes of inviability in spectacled eiders. Grand et al. (2002) did not find a clear relationship between trace element concentrations and hatchability in spectacled eiders on the Y-K Delta. Adenovirus exposure, which has been implicated in reproductive problems in other avian species (Adair and Smyth 2008), was not found to correlate with inviability in spectacled eiders (Hollmen unpubl. data). The cause(s) of inviability in spectacled eider eggs remains unknown. Furthermore, it is currently not well understood whether failure of some spectacled eider eggs to hatch is mainly due to infertility (of females or males) or embryo mortality, or a combination of both. Work is in progress to develop laboratory methodologies to determine the mechanism of egg inviability in spectacled eiders.

In summary, egg inviability may decrease productivity, and studies indicate relatively high inviability in the Y-K Delta population. However, at present, the apparent increase in the size of the Y-K Delta population suggests that egg inviability is not a constraint to recovery, and therefore also does not pose a threat to the population.

III. RECOVERY CRITERIA

The recovery plan for the spectacled eider was finalized in 1996, and contains objective, measurable recovery criteria based on the best available and most up-to-date information at the time (USFWS 1996a, criteria listed here in Appendix A). The recovery plan lists *Strategies for Recovery* and recommended to proceed on three fronts: (1) preliminary management actions targeting known sources of mortality; (2) exploratory data collection and analysis; and (3) hypothesis-testing about the causes of the decline and importance of specific obstacles to recovery. The discussion of *Strategies for Recovery* was followed in the Recovery Plan by a *Narrative Outline of Recovery Tasks* (Ibid., pp.46-74). The Eider Recovery Team has updated these tasks every 1-3 years since the plan was completed; the updated lists are approved by the Regional Director and posted on the USFWS Endangered Species web site: (http://www.fws.gov/ecos/ajax/speciesProfile/profile/speciesProfile.action?spcode=B08Z), and are included here as Appendix B. The updated lists include tasks addressing potential new threats related to climate change.

Data gathered since 1996 on the species' biology and movements suggest that the recovery criteria in the recovery plan may not be applicable, as described in the section *Application of the 1996 Distinct Population Segment (DPS) Policy* above. Additionally, while threats were discussed in the recovery plan, the recovery criteria were based on population size rather than assessment of the listing factors. Therefore, we recommend that the recovery criteria be revised to address listing factors/threats when possible, and reflect our current understanding of genetic differentiation and movement among breeding populations.

Although the recovery criteria in the recovery plan may not be applicable in light of current understanding of spectacled eider biology and Service policy, they nonetheless provide a means to measure progress. Therefore, below we discuss the status of the three breeding populations in context of the recovery criteria, and how these criteria may or may not have been met.

Delisting Criteria

For reclassifying the status of spectacled eider populations, the recovery plan (Service 1996a, p. 36) considered the status of each of the 3 major populations independently. Unless otherwise indicated, the term "population" means the pool of birds that breeds in one of three primary geographic areas (Y-K Delta, ACP, and Arctic Russia; see Section E, Introduction). Fewer spectacled eiders may also nest in Alaska on St. Lawrence Island, the Seward Peninsula, and elsewhere along the west coast of Alaska between the Yukon-Kuskokwim Delta and ACP. For the purposes of the recovery plan, these eiders were classified with the ACP population until data are obtained that support an alternative approach.

The recovery plan states that a population will be considered for delisting when the population is increasing as judged by: 1) a Bayesian analysis indicating the over-protection loss exceeds the under-protection loss (see Appendix II, Figure II-1 in Service 1996a), and the minimum estimated population size is ≥6,000 breeding pairs; 2) the minimum estimated population size is ≥10,000 breeding pairs over ≥3 surveys; or 3) the minimum estimate of abundance exceeds 25,000 breeding pairs in any survey (Appendix A).

In 2009, the estimated number of nests (an indication of the number of breeding pairs) on the Y-K Delta was 7,253 (SE 1,149); the growth rate of the population over the previous 10 years was 1.085 (90% CI=1.042 – 1.127) (Fischer et al. 2009, p. 23). Based on these data, the Y-K Delta population could be approaching delisting criteria as judged by the statistical measures in criterion 1; however, statistical analysis is ongoing.

Based on annual spring surveys, the ACP population has not approached the delisting criteria, and appears to be declining (Larned et al. 2010, Fig. 13). The factors contributing to the apparent population decline are unknown.

The population trend for the Russian population has not been estimated, but preliminary data from winter range-wide population surveys indicate that the minimum world population size of spectacled eiders is 301,812 birds (Larned et al. 2009, Table 1); therefore, taking into account the number of birds estimated in the two Alaska populations, the Arctic Russia population exceeds the delisting criteria.

While two of the three breeding populations of spectacled eiders may be approaching or currently exceed the delisting criteria set forth in the recovery plan, the spectacled eider is listed range-wide, not as DPSs. Because the delisting criteria were developed for separate populations, it is not appropriate to determine if the listed entity should be recommended for delisting without revising the criteria first.

IV. SYNTHESIS

The spectacled eider was listed under the Act in 1993 due to steep declines of the breeding population on the Y-K Delta. Neither estimates nor trends of the ACP and Russia breeding populations were available in 1993. Since listing, population size and trends for Y-K Delta and ACP breeding populations have been estimated using data from annual surveys. The trend of annual estimates of the Y-K Delta spectacled eider breeding population is increasing; ACP estimates suggests a slightly decreasing trend. Winter surveys of the worldwide population have been conducted intermittently, including in 2009 and 2010, and can be used to infer the size of the Russia breeding population, but trends have not been estimated.

Potential threats have been examined since listing, but considerable uncertainty remains in the assessment of the relative contribution of individual threats to population trends. Yet, we have relatively robust data on breeding population size and trend of the Alaska-breeding populations. These data suggest that the threats may have been reduced or eliminated, particularly on the Y-K Delta. However, this approach cannot be extrapolated to the entire listed population as we know little about population trends in Russia.

Ongoing threats to spectacled eiders on the breeding grounds are thought to include lead contamination, illegal harvest, and predation. The increasing breeding population on the Y-K Delta may reflect a reduction in one or more threats; however, identifying the cause is impossible with the available information. The suggestion of a slightly decreasing trend in the ACP population implies that one or more threats remain, and we have no data suggesting that these threats have been eliminated in Russia.

Spectacled eiders spend the majority of their life cycle in marine habitats, but at this time we have little information suggesting that significant threats in the marine environment currently affect spectacled eider survival or recovery. However, two factors, climate change and offshore oil spills, could conceivably affect spectacled eiders at the population level in the future.

Climate change effects discussed here could threaten spectacled eiders in both terrestrial and marine habitats. Although some changes in spectacled eider life history, such as earlier nest initiation, have been documented, at present we do not have information indicating negative effects of climate change on spectacled eiders, so we are currently unable to assess the potential for future population-level effects. However, we recommend the Service re-evaluate this conclusion at the next 5 year review to reflect improved understanding and prediction capabilities.

Oil and gas development in the Chukchi and Beaufort seas is a potential threat to spectacled eiders: although the probability of a spill is low, the remoteness and weather conditions in the Arctic would make oil spill containment difficult, causing large effects on the ACP breeding population, particularly in molting areas where eiders are flightless for several weeks each autumn. We recommend the threat of Arctic offshore oil spills be re-evaluated as more information becomes available.

In summary, while the trend for the Y-K Delta population is increasing, population monitoring has occurred for a relatively short period of time, and we do not understand if the population increase is temporary or due to the elimination of one or more threats. The ACP population appears to be declining slightly, and the contribution of identified threats to this decline is also unknown. Similarly, little is known about the trend or factors affecting the Russia-breeding population. Given these uncertainties, and the inability to apply the recovery criteria set forth in the 1997 Recovery Plan to the listed population to determine the suitability of a status change, we recommend the spectacled eider remain classified as threatened until the next 5 year review, unless revision of the recovery criteria warrants evaluation of the species' status against new criteria in the interim.

V. RESULTS

Recommended Listing Action:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist (*Indicate reasons for delisting per 50 CFR 424.11):*
  ____ *Extinction*
  ____ *Recovery*
  ____ *Original data for classification in error*
_X_ No change is needed

New Recovery Priority Number and Brief Rationale: The current number for the spectacled eider is 5. This recovery priority number reflects a species that faces a high degree of threat and a low recovery potential. A high degree of threat is defined in the Service guidelines as "extinction is almost certain in the immediate future because of a rapid population decline or habitat destruction" (FR 48 43104). Low recovery potential means that the biological and ecological limiting factors are poorly understood, and the threats to the species existence are poorly understood or pervasive and difficult to alleviate (FR 48 43104).

Information gained since the 1993 listing suggests that the population decline on the Y-K Delta prompting the species' listing has reversed; the ACP population may be declining slightly; and the population trend in Russia is unknown, but its population size appears robust. These trends indicate that threats may have been reduced in at least a portion of the species' range. Based on these data, we suggest that the degree of threat is more accurately characterized as moderate, which means that "the species will not face extinction if recovery is temporarily held off, although there is continual population decline or threat to its habitat" (FR 48 43104). We recommend that the recovery potential of the spectacled eider remain low because while we have more information on threats, they are still poorly understood, and some, such as predation, illegal harvest, and potential climate change effects may be difficult to alleviate.

Therefore, we recommend that the recovery priority number be changed to 11, which reflects a species with a moderate degree of threat and a low recovery potential.

VI. RECOMMENDATIONS FOR FUTURE ACTIONS

1. The Eider Recovery Team updates a prioritized task list every few years based on the Recovery Plan and current information about the species' status and threats (attached as Appendix B). We recommend that the actions outlined in the current task list continue to be implemented by the Service and their partners.

2. Update the Recovery Plan, including an assessment of the current delisting criteria, and possible modification, to reflect new data and current interpretation of DPS policy.

3. The mechanism of population growth on the Y-K Delta is unknown. We recommend developing and testing hypotheses addressing the possible elimination of threats on the Y-K Delta to determine future management needs.

4. New information on the risk of offshore oil spills will become available as the result of the Deepwater Horizon incident. We recommend that both risk assessment methods and spill management plans for Arctic oil and gas exploration and development be revised to reflect this information so the potential threat to spectacled eiders can be appropriately evaluated and planned for.

5. We are unable to assess the potential for future population-level effects of climate change on spectacled eiders at this time. However, we recommend that the Service re-evaluate this conclusion at the next 5 year review to reflect improved understanding and prediction capabilities.

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T. Bowman, U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Anchorage, Alaska.

P.L. Flint, U.S. Geological Survey, Alaska Science Center, Anchorage, Alaska.

B. Lake, U.S. Fish and Wildlife Service, formerly at Yukon Delta National Wildlife Refuge, Bethel, Alaska; currently at Yukon Flats National Wildlife Refuge, Fairbanks, Alaska.

B. McCaffery, U.S. Fish and Wildlife Service, Yukon Delta National Wildlife Refuge, Bethel, Alaska.

M.R. Petersen, U.S. Geological Survey, Alaska Science Center, Anchorage, Alaska.

M. Sexson, U.S. Geological Survey, Alaska Science Center, Anchorage, Alaska.

H.M. Wilson. U.S. Fish and Wildlife Service, Anchorage, Alaska.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW OF SPECTACLED EIDER

Current Classification: Threatened

Recommendation resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__X_ No change needed

Appropriate Listing/Reclassification Priority Number, if applicable: 11

Review Conducted By: Fairbanks Fish and Wildlife Field Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve ____ Date _________

The lead Field Office must ensure that other offices within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. The lead field office should document this coordination in the agency record.

REGIONAL OFFICE APPROVAL:

The Regional Director or the Assistant Regional Director, if authority has been delegated to the Assistant Regional Director, must sign all 5-year reviews.

Acting

Lead Regional Director, Fish and Wildlife Service

Approve ____ Date 26 Aug 2010

The Lead Region must ensure that other regions within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. Written concurrence from other regions is required.

Cooperating Regional Director, Fish and Wildlife Service

_____Concur _____ Do Not Concur

Signature____ Date_______

APPENDIX A:

Criteria for Reclassifying or Delisting the Spectacled Eider
From the 1996 Spectacled Eider Recovery Plan (Service 1996a, p. 36-38)

Criteria for Reclassifying from Threatened to Endangered

A population of spectacled eiders will be considered for reclassification from threatened to endangered when the five factors are reviewed for evidence of threats to the population and when:

(1) The population is declining ≥5%/year, as judged by the following statistical measures:

the under-protection loss exceeds the over-protection loss, which is calculated using trend data [based on at least 5 years (1 survey/year) of data but not exceeding a 15 year period] and loss functions where the loss when classifying is zero when $r \leq -0.05$ and the loss when not classifying is zero when $r \geq 0$ (figure 8); AND

the minimum estimated population size is <3,000 breeding pairs for ≥1 year;

OR

(2) the minimum estimated population size is <2,000 breeding pairs for ≥3 surveys (1 survey/year, with surveys preferably being consecutive).

In these criteria, "r" is the population growth rate. "Minimum estimated breeding population size" is intended to mean that the population has a very high probability of exceeding this value. It therefore can be the greater of two estimates, as determined from the "best" available data: (1) the lower limit of the 95% confidence interval (CI) of the population estimate (derived from using any subset of the data that yields the highest lower limit), including a visibility correction factor; or (2) the actual number of birds counted during population surveys. Use of the lower 95% CI of the population estimate accounts conservatively for lack of precision in abundance estimates. Using the lower 95% CI means there will be **at least** that many, and probably more, pairs of birds still breeding in that population. Breeding population size may be estimated by aerial (breeding pair) surveys or ground (nesting) surveys, whichever provides more precise estimates. In addition, population estimates may be derived from using one survey to appropriately adjust the estimates from another survey (example, using ground-based nest plot data to adjust for visibility bias in aerial surveys). However, when combining surveys to derive a minimum population estimate, the variance parameters for each component survey must be appropriately considered.

The criteria for reclassifying from threatened to endangered status are independent, in that either criterion may be met for reclassification. Either strong evidence for a significant decline over a several-year period, in conjunction with a specific minimum population size, or a low minimum size of the breeding population signifies the possibility of imminent extinction of that population. The ≥5 samples (surveys) should be taken over ≥5 consecutive years, although the use of consecutive years is not a formal requirement. Use of trend data is also limited to the 15 most recent years to omit historical data from current estimates of risk. Further, the specified rate of decline does not have to be met every year of the sampling period--it only must average this rate over the entire sampling period."

Neither of the criteria for reclassifying any spectacled eider population as endangered is met at present.

Delisting Criteria

The recovery plan (Service 1996, pp. 38-39) stated: "A population will be considered for delisting from threatened status when the five factors for listing under the Endangered Species Act are reviewed for evidence of threats to the population and when:

(1) The population is increasing as judged by the following statistical measures:

> the over-protection loss exceeds the under-protection loss, which is calculated using trend data [based on at least 10 years (1 survey/year) of data but not exceeding a 15 year period] and where loss functions symmetrical around $r = 0$ with a zero loss for both functions when $r = 0$ (see Appendix II, Figure II-1); AND
>
> the minimum estimated population size is ≥6,000 breeding pairs;

OR

(2) the minimum estimated population size is ≥10,000 breeding pairs over ≥3 surveys (1 survey/year, with surveys preferably being consecutive) or the minimum estimate of abundance exceeds 25,000 breeding pairs in any survey.

The criteria for delisting a population are independent, in that either criterion may be met for delisting to occur. Once recovery has begun, the evidence should be strong that a population is either large or increasing, is self-sustaining, and is no longer in danger of extinction in the foreseeable future.

Toward achieving the recovery objectives outlined above, this plan establishes intermediate objectives to: (1) identify and, if possible, eliminate the cause(s) of the decline; and (2) identify and, if possible, eliminate any obstacle(s) to recovery. Note that increasing our understanding of causes of decline and obstacles to recovery is not the primary objective of the recovery plan. For example, the species may recover without the Service ever determining the actual cause for the original decline. Under such circumstances, delisting should proceed if the population has increased to desired levels and appears to be in no danger of extinction in the foreseeable future.

APPENDIX B:

Spectacled Eider Recovery Task List

December 2007*

This list of recovery tasks was revised at a Spectacled Eider Recovery Team meeting in December 2007. Tasks are listed under general categories that address threats and obstacles to recovery. There is also a category to address additional miscellaneous research and monitoring needs. Ranked tasks are high priority; tasks marked M are medium priority; and tasks marked L are low priority. Ranks are numbered beginning at 1 for highest priority based on a ranking process established in February 2003. High priority tasks given a number with a small letter attached reflect ties in the ranking (e.g., Tasks 8a and 8b were tied in the ranking process). This list was not changed at the February 2009 recovery team meeting.

* NOTE: This list is under revision following changes made by the Recovery Team at the 2010 meeting, and will be finalized by the end of 2010.

1.) Reduce Exposure to Lead

PRIORITY	TASK
8b	Continue education to eliminate the use of lead shot for waterfowl in the range of the spectacled eider.
14a	Continue monitoring spectacled eider blood lead levels in areas where information is lacking, such as the North Slope and Russia, and monitor lead levels periodically throughout the range of the eider.
28a	Monitor the use of lead shot by checking hunters and local stores for availability of lead shot.
28c	Start shot settling study on the North Slope.
M	Continue the lead shot settling study currently underway on the Yukon Kuskokwim Delta.
M	Identify source of lead in North Slope birds.
M	Conduct a study to determine if lead is consumed via selection as grit or food

2). Reduce Predation on the Breeding Grounds

PRIORITY	TASK
2	Evaluate the feasibility and efficacy of fox control on the Yukon Kuskokwim Delta where foxes may be affecting spectacled eiders.
17a	Evaluate the feasibility and efficacy of gull control on the Yukon Kuskokwim Delta where gulls may be affecting spectacled eiders.
L	Implement local fox/gull/raven control on North Slope
L	Investigate whether fisheries enhance SPEI predator populations

3). Understand and Predict Potential Effects of Climate Change/Regime Shift

PRIORITY	TASK
5	Evaluate and predict effects of environmental change in marine habitats on spectacled eiders.
6	Evaluate and predict effects of environmental change in breeding areas on spectacled eiders.
26b	Examine effects of pond salinity on spectacled eiders (especially ducklings).
M	SPEI winter energetics study
M	Study environmental patterns and processes on the Yukon-Kuskokwim Delta to guide management actions such as predator control (SPEI) and re-introduction (STEI) (added January 2006)
M	How may changes in winter ice conditions affect eiders
L	Examine historical middens to determine whether population oscillations have occurred

4). Reduce Hunting and Shooting Mortality

PRIORITY	TASK
8a	Increase education efforts across the range of the spectacled eider to eliminate take.
11a	Develop a subsistence harvest monitoring program with the appropriate evaluation instrument to reliably quantify the take of spectacled eiders throughout their range
17b	In concert with education efforts, increase law enforcement across the range of the spectacled eider to eliminate take.

5.) Reduce Exposure to Oil in the Marine Environment

PRIORITY	TASK
31	Continue education program involving villages, barge companies, and others of eider concentrations in an effort to prevent the chronic and acute oiling of spectacled eiders
M	Provide updated information regarding eider concentration areas and spill response strategies to appropriate agencies/organizations so Response Plans (geographic and Local) can be revised; also identify rehabilitation requirements/conditions and obligations and protocols for handling oiled birds. (Task changed to M at January 2006 meeting)
M	In cooperation with the U.S. Coast Guard, develop Best Management Practices protocol for fuel shipping and transfer in areas used by spectacled eiders.
M	Encourage development of spill clean-up in broken ice
L	Evaluate relative risks of wind/fossil fuel energy to SPEI
L	Evaluate impacts of spills on SPEI in Beaufort

6). Understand the Effects of Disease and Parasites

PRIORITY	TASK
22c	Continue studies to increase understanding of the incidence and impact of diseases on eiders.

7). Support Duck Management in Russia

PRIORITY	TASK
M	Initiate government to government (Alaska to Chukotka) discussions regarding duck management relative to hunting spectacled eiders, particularly where such hunting affects American breeding populations.
M	Investigate the Red Data Book criteria for listing species in the Chukotka Red Book and contact the Committee for Nature Conservation to request consideration of including the spectacled (and Steller's) eiders on the Red Book List; focus particularly on areas where American breeding birds spend time in Russia.
M	Develop (translate, adapt Alaska/U.S) information and education materials on listed eiders and make them available in Russia, focusing particularly on areas in Russia where American breeding populations spend time.
M	Investigate developing cooperative efforts with eastern Chukotkan native groups to conduct education efforts and harvest surveys.
M	Bilateral treaty talks (education).

8). Reduce Researcher Disturbance

PRIORITY	TASK
32d	Develop and distribute education materials to educate researchers working in spectacled eider breeding areas as to their obligations under the ESA and identify the actions they should take to minimize the impacts of their studies on spectacled eiders.
M	Evaluate researcher impact of intensive study site at Kigigak Island.
M	Conduct a tower-based multi-species visitor disturbance study.

9). Evaluate and Reduce Effects of Human Activities on Spectacled Eiders in Marine Habitats

PRIORITY	TASK
4	Evaluate and reduce impacts from oil and gas activities on spectacled eiders in the Chukchi Sea, particularly in Critical Habitat in Ledyard Bay.
11c	Evaluate and reduce impacts of commercial fishing on spectacled eiders in the Bering Sea, particularly in Critical Habitat south of St. Lawrence Island.
L	Obtain by-catch information from gillnet fisheries in Kolyma, Indigirka, Mechigmenski (subsistence mostly)
L	Investigate feasibility of having at-sea processors dispose of fish offal (a supplemental food source for gulls) beneath the surface where it is unavailable to most non-diving seabirds, including gulls.

10). Understand the Effects of Eider Collisions with Structures

PRIORITY	TASK
M	Summarize existing information into one document
M	Studies to determine best lighting regime for platforms/boats/towers/turbines

11). Understand the Effects of Contaminants (other than lead & oil)

PRIORITY	TASK
M	Periodic monitoring of eggs/birds for contaminants (including PBDE and other emerging contaminants)
M	Continue captive studies on metals (COEI as surrogate or SPEI from captive flock overflow)
L	Radionuclids/nuclear fallout – put this issue to rest (sample winter prey)

12). Reduce Habitat Destruction

PRIORITY	TASK
28b	Continue education program on the effects of ATVs on spectacled eider breeding habitats on the Yukon Delta National Wildlife Refuge.
L	Reduce number of trails through select trail improvement

13). Investigate Interspecific Competition

PRIORITY	TASK
17c	Investigate competition with walrus in Ledyard Bay.
L	Investigate competition with walrus south of St. Lawrence Island
L	Evaluate patterns of distribution and population change and density dependence and competition between geese and spectacled eiders.
L	Summary report on whether competition is a problem and how would we manage it

RESEARCH AND MONITORING TASKS FOR RECOVERY

14). Population Monitoring (includes monitoring population size and demography)

PRIORITY	TASK
1	Characterize locations and use of marine habitats, especially in the Chukchi Sea.
3	Continue the *Yukon-Kuskokwim Delta Nest Plot Survey* and *Aerial Breeding Pair Survey* used together to provide a nest population estimate.
7	Capture and mark adult female spectacled eiders nesting on Kigigak Island, Yukon Delta NWR to estimate annual survival.

10	Determine whether Ledyard Bay is a staging and molting area for North Slope or Arctic Russia breeding populations.
11b	Repeat the survey of the wintering area (last conducted in 1998).
16	Continue the *Arctic Coastal Plain Survey*.
22a	Monitor recruitment of spectacled eiders on Kigigak Island, Yukon Delta NWR.
22b	Monitor productivity of spectacled eiders on Kigigak Island, Yukon Delta NWR.
22d	Repeat Norton Sound molting survey.
26a	Monitor for annual survival on the North Slope.
32b	Conduct productivity and survival study of spectacled eiders in Arctic Russia comparable to the study conducted at Kigigak Island, Yukon- Kuskokwim Delta.
32c	Prepare a report to the recovery team summarizing information on the mortality rate of eiders implanted with transmitters with percutaneous antennae.
M	Develop a visibility correction factor for the North Slope Eider Survey.
M	Aerial surveys in Arctic Russia (repeat survey methods from 1993-1995)
M	Repeat Norton Sound molting survey
M	Mechigmentskaya Bay surveys (aerial)
M	Monitor recruitment at Hock Slough, YKD
M	Monitor annual survival at Hock Slough, YKD
M	Monitor productivity at Hock Slough, YKD
M	Monitor productivity at North Slope
M	Monitor recruitment at North Slope
L	Nest plot surveys on North Slope
L	Nest plot surveys in Arctic Russia (Chaun Delta, Indigirka Delta)
L	Aerial survey on St. Lawrence Island
L	Aerial survey on N. Seward peninsula
L	Monitor annual survival at Indigirka River Delta, Arctic Russia
L	Monitor productivity at Indigirka River Delta, Arctic Russia
L	Monitor recruitment at Indigirka River Delta, Arctic Russia

15). General Research

PRIORITY	TASK
14b	Explore hypothesis that sub-adults winter separately from adults.
20	Evaluate factors affecting duckling growth and survival.
21	Determine cause and population effects of egg inviability.
M	Examine breeding season diets of SPEI (added January 2006).
M	Maintain captive flock of spectacled eiders.
L	Develop techniques for diet assessment.

16). Assess cumulative effects of human development of SPEI

PRIORITY	TASK
32a	Develop technique and identify information needs for evaluating cumulative effects of human development on spectacled eiders.