United States Department of the Interior

FISH AND WILDLIFE SERVICE

Anchorage Fish & Wildlife Field Office
605 West 4th Avenue, Room G-61
Anchorage, Alaska 99501-2249

March 11, 2005

_ Brent P
_ Marie
_ Eric

In reply, refer to:
AFWFO

Mr. Al Ewing
Denali Commission
510 L Street, Suite 410
Peterson Tower
Anchorage, Alaska 99501

Subject: Biological Opinion on the Effects of Installing Wind Turbines and New Power Lines in Savoonga, St. Lawrence Island, on the Threatened Spectacled Eider *(Somateria fischeri)* (consultation number 2004181).

Dear Mr. Ewing,

Enclosed is the U.S. Fish and Wildlife Service's Biological Opinion based on our review of the proposed installation of wind turbines and associated infrastructure in Savoonga on St. Lawrence Island, Alaska, and its effects on the spectacled eider (*Somateria fischeri*) in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). This letter provides only a summary of the findings included in the Biological Opinion where a complete discussion of the effects analyses is provided.

This Biological Opinion is based on information provided by the Alaska Village Electric Cooperative (AVEC) and ABR, Inc., and information available in our files and from experts within and outside federal government agencies. The complete administrative record for this consultation is on file at the Anchorage Fish and Wildlife Field Office.

Following is a summary of the consultation history for this project:

- On 4/21/04 representatives from AVEC, Alaska Energy Authority, and CE2 Engineers met with the Service to discuss the proposed installation of a meteorology tower and subsequent development of a wind power generation facility in Savoonga.
- On 5/10/04 informal consultation was initiated with AVEC as the non-federal representative to the Denali Commission for the installation of a meteorological tower as required for assessment of wind resources prior to installation of a wind power generation facility (consultation #2004180).
- On 5/10/04 informal consultation was initiated with AVEC as the non-federal representative to the Denali Commission for the installation of a wind power generation facility in Savoonga (consultation #2004181).
- On 7/6/04 a "not likely to adversely affect" determination was concurred with by the Service for the meteorology tower installation at Savoonga (consultation #2004180).
- On 7/6/04, the Service recommended to AVEC that the Denali Commission initiate formal section 7 consultation for the proposed construction of wind turbines and new power lines in Savoonga.

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- On 8/26/04 representatives from AVEC, ABR, Inc., CE2 Engineers, and Army Corps of Engineers met with the Service to discuss potential issues with the proposed wind power generation facility in Savoonga and threatened eiders.
- On 11/1/04 AVEC notified the Service that the location of the proposed wind facility and meteorology tower location had been moved to Alternative site 2, near the proposed new school and the landfill.
- On 12/19/04 AVEC requested formal consultation.
- On 1/31/05 the complete consultation package was received by the Service
- On 2/4/05 the Service acknowledged receipt of the complete consultation package in a letter to AVEC.

Our evaluation of direct and indirect effects of the proposed wind power generators and associated power lines include those of a beneficial nature and those that may result in harm to spectacled eiders. The Service believes that adverse affects will occur to spectacled eiders from striking the new power lines that will be installed as part of this project. While we believe that take of spectacled eiders is likely to occur over the life of the project, the magnitude of the take will be small, and we acknowledge the potential long term environmental benefits this project may bring. We commend AVEC for their availability to meet with the Service and discuss options to avoid and monitor for bird strikes.

After reviewing all available information on the location, construction, and operation of this facility, along with the best available information on the status, distribution, and life history of the spectacled eider, it is the Service's Biological Opinion that the action, as proposed, is not likely to jeopardize the continued existence of the species or cause adverse modification to designated critical habitat.

This Biological Opinion includes a Reasonable and Prudent Measure, and a Term and Condition to monitor the take that is anticipated for this project. We note that the monitoring specified in the Biological Opinion was already stated in the project plan for the wind "garden" and our reiterating this is a formality. The Service believes that the steps already taken in the project plan are adequate to minimize the impacts of incidental take of spectacled eiders.

We thank you for your cooperation in meeting our joint responsibilities under section 7 of the Endangered Species Act. Please call me at (907) 271-2787, or Endangered Species Biologist Ellen Lance at (907) 271-1467 if you have any questions or concerns.

Sincerely,

Ann G. Rappoport
Field Supervisor

Enclosure

cc: Meera Kohler, AVEC
Brent Petrie, AVEC

BIOLOGICAL OPINION

On the Effects of Installing Wind Turbines and New Power Lines in Savoonga, St. Lawrence Island, on the Threatened Spectacled Eiders *(Somateria fischeri)*

DESCRIPTION OF PROPOSED ACTION

The Denali Commission proposes to provide funding to the Alaska Village Electric Cooperative, Inc. (AVEC) for an alternative energy project in Savoonga, Alaska. AVEC has been designated the Denali Commission's non-federal representative for this project. The proposed alternative energy project comprises the installation of two-Northwind 100™ wind turbines and 335 m (1100 ft) of new power transmission line. Construction is proposed to commence in spring of 2005, with foundation construction. Wind turbine and power line installation will not occur until summer of 2005. A third wind turbine is proposed to be constructed within the project area in the reasonably foreseeable future.

Northwind 100™ wind turbines are installed atop tubular towers that are tapered such that the base is approximately twice the diameter as the top; the base is approximately 2.4 m (8 ft) and the top is approximately 1.2 m (4 ft) in diameter (respectively). Towers are anchored into a concrete foundation, and no guy wires are required for stability. The hub of the turbine head is about 32 m (105 ft) high, has three rotor blades, and the blade length is approximately 20 m (66 ft). A short gravel roadway will be constructed from the existing road to access the turbines. Although Federal Aviation Administration (FAA) has not provided the lighting determination for the wind turbines as yet, it is expected that a solid red light determination will be made due to the proximity to the airport.

Power distribution lines will be extended from the airport to the proposed new school site and further to the turbines. The length of the line from the airport to the wind generation site is expected to be 335 m (1,100 ft). Power transmission lines will be strung over eight-10.7 m (35 ft) poles that are embedded in the ground. Ultimately, the height of the new power lines (considering the sag between the spans) will be 5.9-8.4 m (19.5-27.5 ft) above ground level, and consist of four lines (three energized and one neutral).

The location of the proposed wind generation site is on the western edge of the town of Savoonga on St. Lawrence Island. The village of Savoonga occupies approximately 1580 hectares (6.1 sq. miles) of land on the north coast of St. Lawrence Island, which is 264 kilometers (164 miles) west of Nome (State of Alaska 2005). The Bering Sea freezes around St. Lawrence Island about mid-November and break-up occurs in late May.

Primarily living a subsistence way of life, Savoonga residents number 643 people (State of Alaska 2005), and it is a growing community. A new school is planned for the village in the reasonably foreseeable future. The school is proposed to be built on a 10.13-acre site to the northeast of the wind generation facility. The airport runway is at least 690 m (2263 ft) from the nearest proposed turbine.

The wind resources in Savoonga are exceptional; a class 7 wind regime, which is the highest rating for wind power generation. One Northwind 100™ generator may produce 430,000 kWh/year. Based on the installation of two turbines and the anticipated diesel efficiency of 13 kWh/gallon, wind power generation could displace 66,000 gallons of diesel fuel per year. Displacement of diesel fuel means reduced probability of hydrocarbon contamination due to potentially fewer fuel transfers of lower volume. Further, wind power generation reduces the emissions from burning fossil fuels, thereby reducing the anthropogenic greenhouse gasses that are possibly accelerating global warming.

As a result of AVEC meeting with the Service regarding this project early in the planning phase, numerous project modifications have been made, up front, to avoid harm to threatened spectacled eiders. Design for the turbines has been modified from a lattice tower with guy wires to a tubular tower with a cement foundation. This modification produced significant reduction of risk to all migrating birds. Although three turbines are proposed for this site, AVEC is initially planning to install the two turbines, located further away from the coastline, so that assessment of conflict with birds can take place before the installation of the third turbine. AVEC modified their initial plans to construct closer to the airstrip and further from the coastline and power plant. Although this modification was not only made for concern over bird collisions, the Service appreciates their willingness to comply with our siting recommendation. Bird flight diverters will be installed on new power line every 20 meters (65 feet) to increase visibility of the lines to birds. Bird mortality monitoring will be conducted using a combination of personnel walking the perimeter of the wind "garden" looking for carcasses one time/week, and a remote camera/heat and motion detector in place at each turbine.

STATUS OF THE SPECIES –

Steller's eider

Steller's eiders (*Polysticta stelleri*), listed as threatened in 1997, are known to occur in the vicinity of Savoonga on St. Lawrence Island. Although historical data indicate Steller's eiders once nested on St. Lawrence Island (Nelson 1887, Bailey 1925, Fay and Cade 1959, Fay 1961), no nesting has been reported in more than 40 years. Steller's eiders appear to be limited in occurrence to the offshore waters and lagoons during spring migration and during summer. Some areas are believed to be important for molting (AVEC 2005) as indicated by presence during molting time-periods (Fay 1961, Philip Martin, Service, unpublished data, Dan Rosenberg, ADF&G, unpublished data).

While Steller's eiders do occur in the waters in the vicinity of the project area, there are no documented reports of Steller's eiders striking towers or lines in Savoonga. Furthermore, critical habitat for Steller's eiders has not been designated in or near the project area. Because no strikes are known from this area, we assume that the likelihood of take occurring as a result of the proposed project is so small, it is discountable. Therefore, the Service concurs with your determination that the installation of wind turbines and 1100 feet of new power lines in Savoonga may affect, but is unlikely to adversely affect Steller's eiders.

Spectacled eider

The spectacled eider was listed as a threatened species under the Act in May 1993 after undergoing a population decline of about 96% (Stehn et al. 1993, USFWS 2002). The primary nesting grounds of the spectacled eider are the Yukon-Kuskokwim Delta (Y-K Delta), the North Slope (Cape Simpson to the Sagavanirktok River) of Alaska, and in the Chaun Gulf and the Kolyma, Indigirka, and Yana river deltas of Arctic Russia. Post-breeding flocks of staging and molting spectacled eiders have been observed in Mechigmenan Bay (on the eastern coast of Russia's Chukotsk Peninsula), Alaska's Ledyard Bay (southwest of Point Lay), Peard Bay, Norton Sound, and 80 km south of Saint Lawrence Island.

An estimated 7,149 spectacled eiders occupied the North Slope nesting grounds in June 2003 (Larned et al. 2003), and about 7,058 birds on the Y-K Delta nesting grounds (Fischer et al. 2004). The long-term population trend for spectacled eiders appears stable on the North Slope and slightly negative on the Y-K Delta, although the short-term population trend is an increasing one in recent years (Fischer et al. 2004, Larned et al. 2003).

Life History

Reproductive Strategy

Sea ducks tend to be long lived with high annual survival rates, deferred sexual maturity, and low rates of recruitment to breeding (Goudie et al. 1994). Such "K-selected" characteristics minimize the importance of annual investment in reproduction, and maximize the importance of annual survival and a few successful years of reproduction (Wilson 1980).

Spectacled eiders appear to arrive on the breeding grounds in pairs, probably pairing while still on their wintering grounds in the Bering Sea (Dau and Kistchinski 1977, Kistchinski and Flint 1974, Larned et al. 1995a), although some disparity in that observation exists. On the Y-K Delta they arrive as singles, pairs, and flocks (Moran 1994, 1996a, 1996b). In the Prudhoe Bay area, spectacled eiders arrive in a 1:1 sex ratio (TERA 1993, 1996a, 1996b), and evidence suggests that pair bonds span across years (Declan Troy, TERA pers. comm.2000).

At least some spectacled eider females exhibit strong fidelity for nesting areas (Dau 1974). On the Y-K Delta, females nested within 1.5 km of their previous nest sites (Dau 1974, Harwood and Moran 1993, Moran and Harwood 1994, Moran 1996a, Moran 1996b). Moran (1994) reports that a female banded as a chick returned after 2 years to successfully nest only 750 m from her natal nest site.

Spectacled eiders lay an average of five eggs (Strobel 2004), and their incubation period averages 23 days in Arctic Russia (Kondratev and Zadorina 1992), and 24 days on the Y-K Delta (Dau 1974). Hatch success on the North Slope and in Arctic Russia is very high for nesting spectacled eiders. Spectacled eider eggs that are addled or that do not hatch are very rare in the Prudhoe Bay area (Declan Troy, TERA, pers. comm. 1997), and Esler et al. (1995) found very few addled eggs on the Indigirka River Delta in Arctic Russia. Additionally, from 1969 to 1973 at an inland site on the Yukon Delta National Wildlife Refuge, only 0.8% of spectacled eider eggs were addled or infertile (Dau 1974). In contrast, 24% of all nests monitored in a coastal region of the Y-K Delta during the early to mid-1990s contained inviable eggs (Grand and Flint 1997). Approximately

10% of eggs in successful nests did not hatch due to either embryonic mortality or infertility, and the relatively high occurrence of inviable eggs is believed to be related to exposure to contaminants (Grand and Flint 1997).

In a coastal region of the Y-K Delta, duckling survival to 30 days averaged 34%, with 74% of this mortality occurring in the first 10 days. Survival of adult females during the first 30 days post hatch was 93±3% (Flint and Grand 1997). This survival rate applied to spectacled eider females for the rest of the year leads to an extremely low survival of 40% compared to other eiders (Coulson 1984, Flint and Grand 1997, Reed 1975, Wakeley and Mendall 1976). This estimated annual survival based on daily survival during the breeding period may not be probable however, because mortality rate is typically highest during brood rearing (Milne 1963). Clearly though, adult female mortality during brood rearing may be an obstacle to recovery (Flint and Grand 1997).

Seasonal Distribution Patterns

Breeding-- Historically, spectacled eiders nested in Alaska discontinuously from the Nushagak Peninsula north to Barrow, and east nearly to Canada's Yukon Territory (Phillips 1922-1926, Bent 1925, Bailey 1948, Dau and Kistchinski 1977, Derksen et al. 1981, Garner and Reynolds 1986, Johnson and Herter 1989).

On the Y-K Delta, spectacled eiders historically bred throughout the coastal zone. They currently breed primarily within about 15 km (~9 miles) of the coast from Kigigak Island north to Kokechik Bay (USFWS 1996), although a number of sightings have been made on the Y-K Delta both north and south of this area during the breeding season (Bob Platte, USFWS, MBM, pers. comm. 1997). Breeding density in 2004 was approximately 2.94 pairs per square kilometer (Fischer et al. 2004)

On the North Slope, spectacled eiders breed north of a line connecting the mouth of the Utukok River to a point on the Shaviovik River about 24 km (~15 miles) inland from its mouth. Spectacled eider nests are widely separated, nesting mainly from the Sagavanirktok River to the Chukchi Sea, and only sparsely to the east (Larned et al. 2001). The highest densities determined from Service aerial surveys for eiders in 1998-2001 on the Arctic Coastal Plain east to the Arctic National Wildlife Refuge were found south of Barrow, with smaller areas east of Teshekpuk Lake, on the Colville River Delta, and near western Simpson Lagoon. Overall density was determined as 0.24 birds per square kilometer in 2001 (Larned et al. 2001). It is unknown whether the breeding range of this species on the North Slope has changed in recent history.

In Arctic Russia, spectacled eiders nest from the northern side of the Chukotsk Peninsula west to the Lena River Delta and the Novosibirski Islands (Buturlin 1910, Dementev and Gladkov 1952, Portenko 1972). They are most abundant on the Indigirka River Delta and on the tundra west of the Kolyma River mouth (Kistchinski 1973). Aerial surveys by Hodges and Eldridge (1994, 1995, 1996, 2001) found eiders breeding at widely varying densities (0.02-8.8 birds/km^2) from the Kolyma River Delta west along the coast to the Indigirka River Delta, and from there, further west both along the coast and well inland to the west edge of the Lena River Delta. There is no data to indicate whether the breeding range in Russia has changed in recent decades.

Winter Distribution-- From late December to early April, the only known wintering area of spectacled eiders is among leads in the pack ice southwest of St. Lawrence Island in the Bering Sea (Petersen et al. 1999). Spectacled eiders from all three breeding populations appear to mingle in one common wintering area (Larned et al. 1995b). This area is typically well north of the southern extent of the sea ice cover during winter, and flocks of spectacled eiders have been observed in exceedingly dense flocks in small ephemeral openings in the ice. Wintering in open areas among the ice floes is energetically costly, but roosting atop the ice may lower that cost (Petersen and Douglas 2004). Single wintering flocks as large as 150,966 birds have been observed (Larned and Tiplady 1997), and most wintering flocks occur within a 32 km (~20 mile) radius of each other at any given time.

Table 1. Important staging and molting areas for each sex of each population of spectacled eiders.

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

Molt Distribution – Molting and staging grounds for spectacled eiders occur near all three breeding grounds (Table 1), and receive use by large numbers of birds each year. Telemetry data suggests that virtually all female, spectacled eiders nesting on the Y-K Delta molt in eastern Norton Sound, and females nesting on the North Slope molt in either Ledyard or Mechigmenskiy Bays (Petersen et al. 1999).

Males departing from the Y-K Delta breeding grounds leave 3-weeks sooner than males from Russia and the North Slope (Petersen et al. 1999). On the North Slope, male spectacled eiders depart breeding areas in late June. Later in the season (late June through September), when females depart the North Slope, much more of the nearshore zone is ice free. Radio telemetry studies have shown that most female spectacled eiders that migrate west toward Barrow use the nearshore zone of the Beaufort Sea as they transit to their molting/staging areas (Troy 2003).

Food Habits

During winter, spectacled eiders inhabit the leads in the Bering Sea ice and feed in near freezing water for benthic prey (Lovvorn et at. 2003). Spectacled eiders dive 40-60 m to feed on the benthic organisms that occur in high densities below the ice (Grebmeier and Cooper 1995, Lovvorn et al. 2003). This feeding depth is considerably deeper than other sea ducks: oldsquaw (*Clangula hyemalis*), common eiders (*Somateria mollissima*), and king eiders (*S. spectabilis*) have been reported to forage at depths of 22 m, <10 m, and <40 m, respectively (Nilsson 1972, Bustnes and Lonne 1997, Frimer 1994, Guillemette et al. 1993).

During 2001, spectacled eiders consumed mainly *Nuculana radiata* clams while on their main wintering area south of St. Lawrence Island (Lovvorn et al. 2003). Other prey reported from spectacled eider stomachs include other clams (Pelecypoda), Crustacea (barnacle, amphipod, and crab), and Mollusca, including gastropods (snail). Where the predominate species group eaten was *Macoma* spp. (clam) in earlier studies from the shores of St. Lawrence Island (Petersen et al. 1998), this clam is not prevalent in the diet of the birds on the wintering grounds (Lovvorn et al. 2003). Long-term studies of benthic organisms in this area suggest a shift in dominant clams from *Macoma calcarea* to *Nuculana radiata* (Sirenko and Koltun 1992) as well as a decline in benthic fauna biomass from 1988 throug 1999 (Grebmeier and Dunton 2000).

On the molting grounds spectacled eiders feed on mollusks, and snails (*Trichotopis* spp.; Balogh 1997). On the nesting grounds, they feed by dabbling in shallow freshwater or brackish ponds, or on flooded tundra (Dau 1974, Kistchinski and Flint 1974). Food items include molluscs, insect larvae such as craneflies, trichopterans, and chironomids; small, freshwater crustaceans, and plants or seeds (Cottam 1939, Dau 1974, Kistchinski and Flint 1974, Kondratev and Zadorina 1992).

On the Indigirka River Delta in 1971, shortly after their arrival to the breeding grounds, spectacled eiders ate primarily Tipulidae larvae (Diptera) (Kistchinski and Flint 1974). By 28 June, dipterans (primarily Chironomids) and Trichopterans made up most of the eider diet, with a notable presence of *Ranunculus pallasii* seeds also occurring in the birds upper digestive tracts. During brood rearing on the Indigirka River Delta, the spectacled eider diet was composed almost exclusively of Trichopteran larvae and *Ranunculus pallasii* seeds (Kistchinski and Flint 1974).

Incubating and brood-rearing females ate Trichoptera and Chironomidae larvae, and as the season progressed, fairy shrimp (*Polyartemia* and *Branchineta*) and tadpole shrimps (*Lepidurus arcticus*) (Kondratev and Zadorina 1992). Spectacled eider chicks prefer to remain near shore, and are primarily surface feeders, but are capable of diving, gleaning insects on land, and capturing flying insects (Kondratev and Zadorina 1992). The primary food of spectacled eider chicks in Arctic Russia is thought to be *Cyzicus*, a freshwater shrimp. After the first month, spectacled eider chicks feed like adults (Kondratev and Zadorina 1992).

Population Dynamics

Population Size

The total population of spectacled eiders is estimated at 375,000 (Larned and Tiplady 1999).

North Slope Breeding Population -- Historical estimates of spectacled eiders breeding on the North Slope were highly tentative, and likely inaccurate. However, modern aerial surveys of the North Slope from 1993-1996 indicated an average of 7,330 spectacled eiders (Larned and Balogh 1997) and in 2004, the breeding index for spectacled eiders on the North Slope was 5,985 birds (Larned et al. 2005). This estimate is 13% below the long-term mean.

Yukon-Kuskokwim Delta Breeding Population -- In 1992, the Y-K Delta spectacled eider population was reportedly at about 4% of historic levels (Stehn et al. 1993). Evidence of the dramatic decline in spectacled eider nesting on the Y-K Delta was corroborated by Ely et al. (1994). They documented a 79% decline in eider nesting between 1969 and 1992 for areas near the Kashunuk River. Aerial and ground survey data indicated that spectacled eiders were undergoing a decline of 9-14% per year from 1985-1992 (Stehn et al. 1993). Further, from the early 1970s to the early 1990s, numbers of pairs on the Y-K Delta declined from 48,000 to 2,000, apparently stabilizing at that low level (Stehn et al. 1993). Before 1972, an estimated 47,700 to 70,000 pairs of spectacled eiders nested on the Y-K Delta in average to good years (Dau and Kistchinski 1977), but aerial surveys of the Y-K Delta in 2003 detected a total of 3,487 birds or 1,744 pairs, and a population growth rate, calculated from 1988 to 2003, of 1.073 (Platte and Stehn 2004). The estimated Y-K Delta nesting spectacled eider breeding population from ground searches and expanded for the entire coastal zone of the Delta in 2004 was 3,529 pairs (Fischer et al. 2004).

Reasons for Listing

Habitat Loss -- Stehn et al. (1993) speculated that spectacled eiders at sea may be competing with certain marine mammals for food during fall and winter. From 1960 to 1980, the Pacific walrus (*Odobenus rosmarus*) population apparently tripled and began to show signs of overpopulation (Fay et al. 1989). It is thought that the walrus population increase was due largely to harvest regulations enacted in Russia. In addition, gray whale (*Eschrichtius robustus*) numbers in the northern Bering and Chukchi seas have been increasing at a rate of 3.29% per year over the past several decades (Rice and Wolman 1971, Buckaland et al. 1993), also likely a result of the enactment of protection measures in Russia. Both walrus and gray whales can, while feeding, disturb substantial areas of benthos which spectacled eiders depend upon while at sea.

Ecological changes in the Bering Sea may be related to complex changes in fish and invertebrate populations. Bering Sea ecosystem stocks of crab, herring, halibut and various groundfish have been the focus of huge harvests in the past 30 years. Commercial fishing-induced ecosystem changes could be affecting other bird species as well. Steller's eiders, oldsquaw, and emperor geese, (species that winter at the southern edge of the Bering Sea), all underwent population declines between 1970 and 1992 (Kertell 1991).

Additional potential causes of Bering Sea ecosystem changes include global climate change (discussed in more detail below), and contamination, including radioactive waste disposed of in Russian territorial waters (Office of the President of the Russian Federation 1993), acids, metals, and toxic organic compounds (Barrie et al. 1992).

Alaska Native villages periodically undertake construction activities that may result in the loss of small portions of spectacled eider breeding range. Housing construction in Barrow along Gaswell Road is taking place within a wetland used by both spectacled and Steller's's eiders, and will result in loss of some of that wetland. Y-K Delta villages may also experience growth along their outer edges which impinges on spectacled eider breeding habitat. Overall, however, the direct effect of village growth, in terms of habitat degradation, is probably minuscule.

Disturbance-- Prudhoe Bay area (North Slope) spectacled eiders have been observed to be disturbed by noise from a compressor plant (Anderson et al. 1992). However, Warnock and Troy (1992) found that spectacled eiders and their nests were neither closer to, nor farther from oilfield facilities than expected from random sampling, with the exception of water impoundments adjacent to facilities, which supported above average densities of birds. The effect of oil development and associated activities on spectacled eiders in Arctic Russia is unknown (USFWS 1996).

Vessel traffic causing disturbance in concentration areas such as where spectacled eiders molt in Norton Sound is believed to have adverse effects (Petersen et al. 1999). These effects may be especially severe during high stress times, such as molting, when the birds are flightless. As a response to this potential disturbance, the Service established a voluntary "no traverse zone" for the primary molting area in Norton Sound. Other areas of high concentration of spectacled eiders, where vessels may cause disturbance while feeding or resting include the wintering grounds at Unalaska and the molting and staging grounds near the Kuskokwim shoals.

Hunting -- Spectacled eiders are seldom taken by Inupiat Natives on the North Slope. Most of the annual eider harvest in this area targets common and king eiders during their spring migration. Spectacled eiders are rarely seen by eider hunting parties north and east of Wainwright. It has been speculated that spectacled eiders migrate over land from Wainwright to points north and east, inadvertently avoiding the coastally-located hunting parties.

Yup'ik Eskimos on the Y-K Delta traditionally harvested spectacled eiders for subsistence purposes (Klein 1966, Johnson 1971). Although the human population on the Y-K Delta has grown substantially, changes in the numbers of active hunters are unknown. Similarly, available harvest technologies have become increasingly efficient, but the actual effects of new technologies on harvest levels are unknown. The estimated harvest of spectacled eiders on the Y-K Delta from 1992-95 averaged 272 birds/year (Wentworth and Siem 1996); the 1992-2001 average is 123 (Trost and Drut 2002). This annual harvest comprises about 4% of the nesting population on the Y-K Delta, and may be a continuing obstacle to recovery. However, it is unlikely that subsistence harvest directly caused the spectacled eider population declines of the past 20 years, unless subsistence harvest was previously much higher (Stehn et al. 1993).

Research -- Although effects to nesting spectacled eiders from research activities have been reported (Bowman and Stehn 2003), adverse effects of researchers on nesting success is not believed to be substantial (Bety and Gauthier 2001). Protocols have been established to minimize the impact of investigators on breeding spectacled eiders. Visitation to nests in the random nest plot survey on the Y-K Delta accounted for an additive loss of 0.08% of the eider egg production

for the average year from 1994-2002. Applying these loss rates to all other Y-K Delta eider studies, cumulative visitation effects on spectacled eiders amounted to a loss of 15 nests and 57 eggs per year (Bowman and Stehn 2003).

Predation -- Depressed fur prices, and the resultant decrease in trapping effort may have allowed Alaska's fox populations to increase. Moreover, the 90% decline in cackling Canada and white-fronted goose populations on the Y-K Delta may have resulted in prey switching; arctic foxes (*Alopex alopex*) foraging in territories of fixed size would increase their focus and impact on the remaining waterfowl nesting populations (Stehn et al. 1993). Between the 1960s and 1983, foxes may have switched to spectacled eiders.

Predators of spectacled eider eggs include gulls, jaegers, and foxes. In Arctic Russia, nest success may have been as low as < 2% in 1994 and 27% in 1995; foxes, gulls, and jaegers are suspected to have depredated most of the nests (Pearce et al. 1998). On Kigigak Island in the Yukon Delta NWR, nest success ranged from 20-95% in 1991-1995 (Harwood and Moran 1993, Moran and Harwood 1994, Moran 1995, Moran 1996a,b). This reported range of nest success may have been influenced by fox control on Kigigak Island in 1992. On the North Slope, nest success ranged from 25-40% during the early to mid-1990s in the Kuparuk and Prudhoe Bay oil fields (Warnock and Troy 1992, Anderson et al. 1998). Kistchinski and Flint (1974) reported that gulls depredated a large number of spectacled eider clutches on the Indigirka River Delta, and Degtyarev (1993) documented five successful attacks of gulls on downy spectacled eider ducklings.

Lead Poisoning -- Ingestion of lead by spectacled eiders was first reported in 1978 (Franson et al. 1995). Since then, acute lead poisoning of spectacled eiders on the Y-K Delta has been documented, and four spectacled eiders have been confirmed dead as a result of lead pellet consumption (Franson et al. 1995). Likely, the documented deaths from lead poisoning are an underestimate of the true mortality on the Y-K Delta, since: 1) lead poisoned birds seek heavy cover when they are afflicted, 2) they are probably never found, and 3) they are probably predated or scavenged.

Poisoning from the ingestion of spent lead shot on the Y-K Delta's lower Kashunuk River area and on Kigigak Island is the cause of additive mortality in spectacled eiders, that is, mortality over and above that caused by natural circumstances (Grand et al. 1998). The proportion of spectacled eiders on the Y-K Delta's lower Kashunuk River drainage that contained lead shot in their gizzards was high (11.6%, n=112) compared to other waterfowl in the lower 48 states from 1938-1954 (8.7%, n=5088) and from 1977-1979 (8.0%, n=12,880). Further, the lead exposure rate in spectacled eiders (based on X-rays) is likely biased low (Flint et al. 1997), because lead is retained in the gizzard for only about 3-weeks (Elder 1954, Dieter and Finley 1978, Anderson and Havera 1986, Franson 1986, Anderson et al. 1987). Blood analyses of spectacled eiders indicate elevated levels of lead in 13% of pre-nesting females, 25.3% of females during hatch, and 35.8% of females during brood rearing. Nine of 43 spectacled eider broods (20.9%) contained one or more ducklings exposed to lead by 30 days after hatch (Flint et al. 1997).

Lead shot deposited in pond sediment on the Y-K Delta is persistent in the organic layer of sediment; its settlement rate is slow but measurable at approximately 1 cm per year (Flint 1998).

However, most ponds have an active organic layer, underlain by a firm in-organic mud at 6 to 8 cm below the surface. Pellets apparently settle to the interface between these layers where they may remain indefinitely (Paul Flint, USGS, pers. comm. 2002). Use of lead shot for waterfowl hunting has been banned, nationwide since September 1, 1991, however enforcement of the ban did not begin in Alaska until March 1, 1998 (USFWS 1997).

New Threats

Collisions – Spectacled eiders have been documented colliding with wires, communication towers, boats, and other structures (Table 2). The incidence of bird strikes appears to rise when objects are illuminated with constant diffuse light, and the tendency for birds to be drawn to diffuse light appears to increase during rainy or foggy weather. Fog or low cloud cover makes the attraction problem worse, because the moisture droplets associated with overcast conditions increase the area illuminated by refraction (Rojek 2001).

The incidence of species specific bird strikes certainly relates to life histories. Eiders are nocturnal and are known to fly below an altitude of 10 meters (Johnson and Richardson 1982, Day et al. 2003), making them susceptible to flying into structures, particularly during periods of low visibility. Except for breeding purposes, spectacled eiders do not tend to spend much time over land, but during late June when the Beaufort Sea has little open water, males spectacled eiders traveling to Ledyard Bay to molt from breeding grounds east of Barrow normally do not use marine habitats and fly directly overland (Troy 2003). Moreover, although spectacled eiders tend to fly off shore during migration, they may stray inland during periods of low visibility or "cut a corner" of the landscape while migrating.

Table 2. Reported Eider Collisions in Alaska or in Alaskan Waters.

SEASON/ YEAR	TYPE	# OF BIRDS DEAD OR INJURED	LOCATION	COMMENTS
October, Year unknown	Collision with guy wires of tower	One or more spectacled eider	Gambel, St. Lawrence Island	Tower is reportedly a favorite place among villagers to collect dead ducks after a fog event.
April, 1998	Collision with power line	1 to 6 spectacled eiders	Savoonga, St. Lawrence Island	6 spectacled eiders captured and shipped to Bird TLC in Anchorage for rehabilitation. All birds were emaciated upon arrival. One observed striking power line, others found unable to fly
June, 1998	Collision with unknown structure	One spectacled eider	Barrow	Picked up by villager, broken wing
March, 2001	Collision with vessel Coast Guard Cutter	Three spectacled eiders	Bering Sea	Predawn collision
October, 2002	Collision with vessel *F/V Sea Storm*	6 sea birds, 2 positively identified as spectacled eiders	Eastern Bering Sea: 62 59.741N 172 30.366W	Stormy weather conditions, blowing snow and whiteout conditions. Necropsy report noted massive internal injuries throughout neck and torso. Leg and wing broken.
June 22, 2003	Collision with vehicle or power line	1 spectacled eider	North Slope	Broken right wing. Wing amputated and is currently (2004) housed at Alaska Sea Life Center. Adult male
June 29, 2004	Possible collision with vehicle or overhead wires	1 spectacled eider	Barrow	Found under a tall power line. Broken neck and possibly broken back. Fog not noted that day.
July 12, 2004	Possible collision with radio tower	1 spectacled eider	Barrow	Found in pond in close proximity to a 122 m tall radio tower. Laceration of right wing. Unable to fly.

Avian literature is replete with reports of birds attracted to the artificial lights of communication towers and other tall lighted structures. Further these reports suggest that extinguishing lights stops or prevents birds' responses (Cochran and Graber 1958, Aldrich et al. 1966, Herbert 1970, Avery et al. 1976, Avise and Crawford 1981, Crawford 1981a, Crawford 1981b, Verheijen 1981, Larkin and Frase 1988, Fedun 1995, Bower 2000). Bird attraction to artificial lights is so strong the scientific community utilizes artificial lights as a technique for capturing birds for research purposes. This technique, used on several species of waterfowl (Cummings and Hewitt 1964, Bishop and Barratt 1969) and common eiders (Snow et al. 1990), disorients birds, allowing easy capture. Shielding lights, a technique commonly recommended by regulatory agencies and

utilized by industry, can reduce attraction more than 40%, but does not eliminate the problem (Reed et al. 1985, Rojek 2001). Good shielding reduces the amount of light escaping into space and reflects more light into a discrete pool on the ground and reduces confusion in navigating birds (Wong 2002).

The attraction of seabirds to lights of commercial fishing vessels has been noted by observers involved with long-line fisheries (Cherel et al.1996, Ryan and Watkins 1999, Weimerskirch et al. 2000). Furthermore, large seabird wrecks (otherwise known as bird storms) have been noted in the literature and are well documented within the commercial crab fishery fleet as a result of their use of bright lights during inclement nighttime weather. Dick and Donaldson (1978) documented over 6,000 crested auklets (*Aethia cristatella*) landing aboard a crab-fishing vessel near Kodiak Island, Alaska. The boat had bright fishing lights on and the crew feared they might capsize. After the crew finally realized that their outside lights attracted the birds and turned them off, the number landing on board decreased. Several hundred birds were still on the boat the following day.

The issue of birds striking man-made objects is not unique to Alaska. Drawn to lights atop towers, particularly at night and during low cloud cover, birds circle in confusion, dying by the thousands in collisions with towers, its guy wires and related structures, each other, or even the ground (Ornithological Societies of North America 2002).

Avian mortality associated with power line strikes has also been well documented (Crowder and Rhodes 2002). Factors that may influence a bird's prevalence to strike power lines include normal flight altitude, flock size, size of bird, and wing morphology (Crowder and Rhodes 2002). Ducks are considered good flyers with high wing loading (ratio of wing span^2 to wing area), and are twice as likely to react to power lines as birds with low wing loading (Crowder and Rhodes 2002). Further, flocks of over ten birds reacted to power lines at a significantly greater mean distance than did solitary birds (Crowder and Rhodes 2002). Some believe that waterfowl almost never strike power lines, but others report contrary results (Crowder and Rhodes 2002). During an avian mortality study along a 9.6 km power line in North Dakota, waterfowl collisions accounted for 26% of all bird mortalities documented, although the majority of those waterfowl were dabbling ducks (Faanes 1987). In this 2-year study, 81% of all bird mortality was found during fall migration. As opposed to electrocution from striking the conductor, collision with the overhead ground wire was responsible for most of the bird deaths (93%). Typical injuries from striking the wires included broken wings, broken legs, lacerations, puncture wounds, and abrasions (Faanes 1987). Likewise, in a study of 5.9 km of power line in Oregon and Washington, green-winged teal (*Anas carolinensis*) collided with overhead ground wires of the power lines more frequently than other bird species (>35%; Meyer 1978).

In Alaska, spectacled eiders are known or suspected to have collided with power lines on at least three separate occasions. Two of those accounts were from power lines near Barrow on the North Slope and one account was from the Village of Savoonga on St. Lawrence Island. Further, Steller's eiders have reportedly collided with power lines on at least two occasions, once in Pilot Point (150 Steller's eiders reported killed) and once in Naknek (one Steller's eider reported wounded; USFWS unpublished data).

Accelerated Climate Change – This global phenomenon, defined by a drastic change in climatic parameters including air and water temperature, is believed to be caused by atmospheric carbon enrichment, otherwise known as the greenhouse effect. Greenhouse gasses are produced in many natural ways, but since the industrialization of the modern world, the production of these gasses may be accelerated by the burning of fossil fuels and other anthropogenic means.

Fueled by warming air and sea temperatures, glaciers and other permanent or semi-permanent ice sheets melt and cause the sea level to raise. While ocean level seemingly rose a minute amount over the past 100 years (0.1-0.2 m), it is projected to rise at double or quadruple the rate over the next 100 years (IPCC 2001). If sea level rises at the high end of the projection, thousands of square miles of coastal wetland could be covered by water (Inkley et al. 2004). In some areas, such as those surrounding tidewater glaciers in Alaska, sea level rise will have minimal effect on coastal wildlife areas due to the subsequent glacial rebound (from the melting glaciers) offsetting the rising waters (Shaw et al. 1998). Conversely, in coastal urban areas, intertidal habitat availability may be limited to wildlife following a rising sea (Parmesan and Galbraith 2004). Already scientists are able to detect range changes in wildlife species and correlate those changes with rising temperatures (Root et al 2003). Expansions of spring waterfowl ranges have been correlated with a significant increase in the number of April and May days with temperatures above 6°C (Prop et al 1998). Milder springs enhance reproductive success (Boyd and Diamond 1994, Alisauskas 2002, Fischer et al. 2004) with average date of egg laying growing earlier (Dunn and Winkler 1999). Milder weather leads to later migratory departure dates (Able 1973). Migration routes have shifted, apparently in response to changing sea surface temperatures (Spear and Ainley 1999). However, more plastic taxa may have the ability to change in place, rather than shift their range (Smith and Betancourt 1998).

The warming trend is more pronounced during winter than summer (Houghton et al. 1996, Inkley et al. 2004). Furthermore, increased nighttime temperatures could markedly influence range patterns of species with life histories especially influenced by ice cover (Inkley et al. 2004). Arctic sea ice thickness decreased 1-2 meters during the past few decades (Rothrock et al. 1999). In some parts of Alaska, average annual temperatures have increased by 2-4 °C (4-7 °F) since 1900 (Oechel et al. 1993, IPCC 2001).

Exceptional climate change in the Arctic, associated changes in marine communities and ice dynamics in spring may have had important impacts on spectacled eiders whose declines of ~90% are largely unexplained. Spectacled eiders in the marine environment feed predominately on clams and small amounts of snails, amphipods, and other bivalves. In March-April 1999 and 2001, studies within the spectacled eider wintering areas showed that the esophagi of collected eiders contained only clams, almost entirely *Nuculana radiata* with no trace of the once-dominant and preferred *Macoma calcarea* (Lovvorn et al. 2003). Changes in the density of *Macoma calcarea* in the Bering Sea are coincident with an oceanic regime shift to warmer conditions in 1976-77 (Lovvorn et al. 2003). Declines in biomass and mean sizes of clams since the mid 1980s reflect widespread alterations in the Bering Sea food web that seem to be related to climate change (Grebmeier and Dunton 2000, Lovvorn et al. 2003). The Russian breeding population of spectacled eider did not undergo a similar decline as the Y-K Delta population, even though they

apparently all winter together. Due to this fact and because the timing of prey switching was not concordant with the timing of the eider decline, it is believed that the change in prey availability had little to do with the eider's population decline (Petersen and Douglas 2004).

There is growing consensus among the scientific community that the increase in average yearly temperatures over the past 50 years is primarily due to the global rise in anthropogenic greenhouse gasses (IPCC 2001, Crowley 2000, Karl and Trenberth 2003, Stott 2003). There is also shared concern that this drastic change in the environment will have a lasting effect on wildlife. In one large study, 40% of species examined showed no response to climate change in the last 100 years, but 59% did have a significant response (Parmesan and Yohe 2003). If the response to this change is negative, this could be an additive problem for species in a human dominated, contaminated, fragmented landscape (Parmesan and Galbraith 2004). The cumulative affect of warmer temperatures, rising oceans, and the subsequent changing habitat may exacerbate the problems before some species at risk, and the fate of those species may lie in the net effect of all stressors combined (Parmesan and Galbraith 2004). A model of the potential impacts of climate change on species extinction risk for endemic species from some regions found that 15-37% will go extinct in 50 years (Thomas et al, 2004). Elimination of other factors besides those caused by global climate change may help reduce the combined negative effects (Parmesan and Galbraith 2004).

Petroleum Spills -- Eiders, scoters and long-tailed ducks are among the most frequent avian victims of oil pollution in the world's seas due to several factors, including: the large amount of time spent on water, their foraging behavior, and their presence in heavily navigated sea lanes (Day and Pritchard 2000). Their tendency to clump into discrete areas during molting and winter makes them vulnerable to large impacts from petroleum spills (Petersen et al. 1999). Significant risk to spectacled eiders from an acute oil spill is most likely to occur on their molting grounds due to the bird's tendency to concentrate and their extreme vulnerability during that time (Stout 1998). Considering the nature and extent of vessel traffic, spills are unlikely scenarios in Ledyard Bay or Norton Sound where spectacled eiders molt (Stout 1998). However, the recent and unexpected grounding of the Selandang Ayu, in which hundreds of thousands of gallons of bunker fuel were released into the nearshore environments of Unalaska Island in the Aleutians killing at least 1,600 wintering water birds, reminds us that these devastating events are unpredictable.

Other Toxins -- In addition to lead concentrations above toxic thresholds, selenium and mercury were detected at toxic levels in adult and duckling spectacled eiders on their breeding grounds on the North Slope (Wilson et al. 2004). Additionally, because mercury concentrations increased while breeding females were on the nesting grounds, it is presumed that this metal is available on the North Slope.

Range-Wide Population Trend

North Slope – The North Slope population appears to be stable; the population trend from 1993 to present is reportedly flat (i.e., not significantly different from 1.0; Larned et al. 2005; Figure 1).

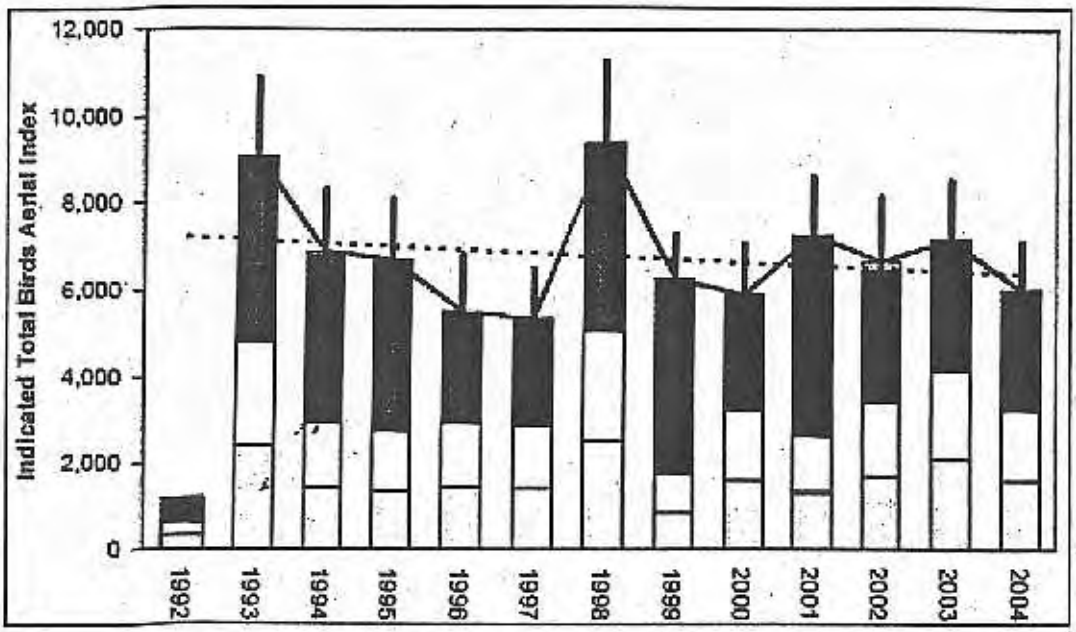

Figure 1. Population trend, calculated by log-linear regression, for spectacled eiders observed on aerial survey transects on the North Slope of Alaska. The indicated total birds population index is the sum of birds observed as singles, an equal number of unseen but indicated single birds, birds in pairs, and all birds in flocks, indicated by column divisions from bottom to top. Vertical lines indicate 95% confidence intervals based on sampling error calculated among transects (Larned et al. 2005). A low index of 1,202 in 1992 was excluded from trend calculation because the survey was flown too late in June.

Yukon-Kuskokwim Delta-- Although the long-term annual growth rate of the Y-K Delta nesting spectacled eider population is -0.5% (Fischer et al. 2004, Figure 2), there seem to have been gains in the population since the very low levels of 1992. When annual growth rates of Y-K Delta nesting spectacled eiders are estimated in 5-year increments, population growth rates are positive since 1995.

West coast between the Y-K Delta and the North Slope: The historical abundance of spectacled eiders breeding along the west coast of Alaska between the Y-K Delta and the North Slope, where this species has been nearly or completely extirpated, is unknown. Recolonization is unlikely due to female philopatry (Scribner et al. 2001).

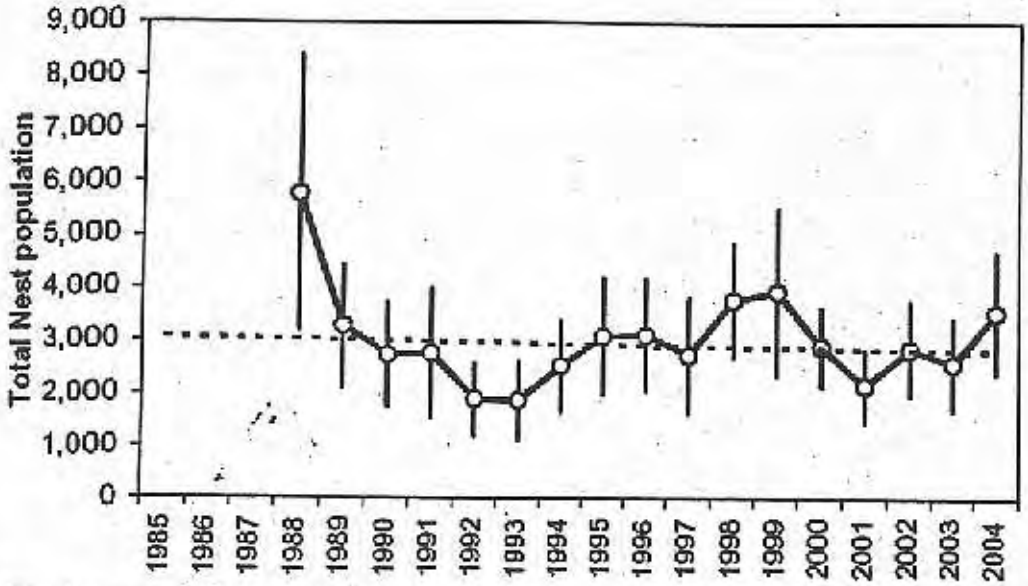

Figure 2. Nesting population trend for spectacled eiders on the Y-K Delta, 1985-2004. 1985-2004 log-linear slope = -0.005; annual chance -0.5% (Fischer et al. 2004).

ENVIRONMENTAL BASELINE

The "environmental baseline" section summarizes the effects of past and present human and natural phenomena on the current status of threatened and endangered species and their habitat in the action area. The information presented here establishes the baseline condition for natural resources, human usage, and species usage in the action area that will be used as a point of comparison for evaluating the effects of the proposed action.

Determination of Action Area

Defining the action area of the proposed action is integral to analyzing the effects of past, present, and future actions as well as the proposed action. The action area should be determined based on consideration of all direct and indirect effects of the proposed action, and other activities that are interrelated or interdependent with that action, on the species and/or its critical habitat. Indirect effects are those that are caused by the proposed action and are later in time, but are reasonably certain to occur.

The action area includes all areas that may be affected directly or indirectly by the activities associated with installing wind power generators and associated infrastructure including power lines, power plant, bulk fuel facility, and fuel transfer areas in Savoonga, on St. Lawrence Island.

Status of the Species Within the Action Area

Savoonga is located on the northeastern coast of St. Lawrence Island, and is in the vicinity of critical habitat designated for the spectacled eider (*Somateria fischeri*), which was listed as threatened under the Act in 1993. Spectacled eiders congregate in the polynyas between St.

Matthew and St. Lawrence islands during winter months. The nearest critical habitat boundary to Savoonga is 40.2 km (25 miles) away. At least 333,000 birds winter in flocks in the pack ice south of St. Lawrence Island (Petersen et al. 1999).

Local observations indicate that spectacled eiders may fly over the island during winter and spring and during migration (Greg Balogh, USFWS, Pers. com., Thomas Akeya, Savoonga resident, Pers. com.). Flocks of spectacled eiders periodically may fly back and forth across St. Lawrence Island, presumably as leads or polynyas open and close on opposite sides of the island.

Although spectacled eiders are known to nest on St. Lawrence Island, and subsistence harvest of eggs has been reported (Tahbone et al. 2004), it is believed that they do not nest there with great frequency. In June 1997, the first breeding record for spectacled eiders was made on St. Lawrence island since 1961 (Fay.1961, Shawn Stephensen (USFWS, MBM pers. comm. 1997).

Spectacled eiders stage and migrate off the northeastern and eastern coastline of St. Lawrence Island (Petersen et al. 1999). Non breeding subadults may make up a large portion of the population of spectacled eiders. They remain primarily in offshore waters (Dau and Kistchinksi 1977).

Factors Affecting Species' Environment Within the Action Area

Subsistence Harvest – In 2002, residents of Savoonga harvested an estimated 288 spectacled eiders and 17 spectacled eider eggs (Tahbone et al. 2004). This represents a considerable increase in harvest pressure compared to the year the species was listed as threatened. In 1993, the year spectacled eiders were listed as threatened, 9 spectacled eiders were reported harvested by Savoonga residents (Paige et al. 1996). It should be noted however, that the two harvest survey methods may not be comparable.

Collisions – Since spectacled eiders were listed as threatened in 1993, at least one and possibly as many as six individuals have collided with power lines in Savoonga. During April of 1998, six spectacled eiders were captured after observers saw at least one of the six hit a power line. The incident occurred during white out conditions, and it was drizzling and windy (Thomas Akeya, Savoonga resident, Pers. com.). The birds may have been flying over the island from the south (Thomas Akeya, Savoonga resident, Pers. com.). All six birds were shipped to a bird rehabilitation center in Anchorage, Alaska. All six birds were emaciated upon arrival at the bird rehabilitation center, but showed no signs of serious injury. All responded well to treatment and were reintroduced to the wild near their point of capture in mid-May of 1998 (US Fish and Wildlife Service, 1998).

Local residents of Savoonga believe that when sea ice off Savoonga is heavy, and the eiders are looking for open water to feed, they fly down into the village, believing that the reflection of the metal roofs of the houses are actually ponds (Dean Kulowiyi, Savoonga resident, Pers. com.). Observers believe that the six spectacled eiders in 1998 were behaving in this way when they struck or flew near village power lines (Dean Kulowiyi, Savoonga resident, Pers. com., Thomas Akeya, Savoonga resident, Pers. com.).

Fuel Spills – In 2003, the Service concurred with the Denali Commission's determination that upgrades to bulk fuel farms and power plant facilities in Savoonga was not likely to adversely affect threatened species including spectacled eiders (consultation number 2003-0036). On June 24, 1998, 450 gallons of diesel fuel were reportedly spilled on the shores of Savoonga when a barge was punctured when it landed on the beach to transfer fuel to the bulk fuel facility (Alaska Department of Environmental Conservation 2002). No oiled birds were reported from that event, but spectacled eiders tend to remain off-shore and are unlikely to wash up on shore.

EFFECTS OF THE ACTION

"Effects of the action" refers to the direct and indirect effects of the action on the species or its critical habitat. The effects of the action will be evaluated together with the effects of other activities that are interrelated or interdependent with the action. These effects will then be added to the environmental baseline in determining the proposed action's effects upon the species or its critical habitat (50 CFR Part 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

Factors to be Considered

Proximity of the Action -- Foraging, molting, staging, and wintering, and potential breeding habitat for spectacled eiders is in the vicinity of the action area, and critical habitat has been designated to the south of St. Lawrence Island. Although the action area comprises the land within the Village of Savoonga, spectacled eiders from adjacent foraging, molting, staging, wintering, and breeding areas may traverse the action area.

Distribution – The distribution of effects resulting from the proposed activities will be localized. Adverse affects will be specific to the wind turbines and power lines. Beneficial affects will be specific to the marine habitats that could be impacted by an oil spill; reduced demand for oil due to power generated by the wind turbines will reduce the quantity of oil shipped to, and perhaps the number of oil shipments made to, this village. This represents a reduction in risk of spills.

Timing – The proposed wind turbines and power lines will be present and presumed operational year-round. Spectacled eiders may occur within or adjacent to the action area at any time of the year (Fay 1961, Shawn Stephensen, Service, unpublished data, Petersen et al. 1999, Day et al. 2003). The previous incident of spectacled eiders colliding with power lines in Savoonga was during the month of April. Other strikes with on-land structures on St. Lawrence Island have reportedly occurred during October (Anonymous, Gambell resident, Pers. com.).

Nature of the Effect -- Accidental take of adult breeding and non-breeding spectacled eiders from colliding with power lines has occurred in the past and is expected to occur at a slightly increased frequency as a result of the power line installation associated with this project.

Adult breeding and non-breeding spectacled eiders are expected to benefit from the reduced emissions and lowered risk of oil spills resulting from this project.

Duration – The expected life of power lines and wind turbines is 50 years.

Disturbance Frequency – The frequency of birds colliding with lines and towers is stochastic and difficult to predict. In Savoonga, historic data suggests that spectacled eiders collide with power lines at a frequency of between 0.2 and 1.0 birds/year.

Disturbance Intensity – Due to the stochastic nature of the expected effects of the proposed action, prediction of intensity is difficult. Because collisions tend to occur with unknown frequency and in unknown quantities of birds, the intensity of the disturbance is considered variable.

In Gambell on St. Lawrence Island, sea ducks reportedly collide with the tower and wires of the Federal Aviation Administration's non-directional beacon during foggy October mornings (Anonymous Gambell Resident, Pers. com.). As many as 18 sea ducks have been recovered from underneath the tower in one morning, and at least one of those ducks was reportedly a spectacled eider.

Disturbance Severity -- Due to the stochastic nature of the expected effects of the proposed action, prediction of severity is difficult. Evidence suggests that multiple birds at one time may be susceptible to collisions with power lines. Further, other documented bird collisions are of large numbers of one species striking power lines in one event. Severity of the disturbance may be low to high.

Analyses for Effects of the Action

This section analyses the direct and indirect effects of the proposed and all interrelated and interdependent actions identified in the Environmental Baseline section. This includes a discussion of any beneficial effects anticipated to occur as a result of the proposed action.

Beneficial Effects -- Beneficial effects are those effects of an action that are wholly positive, without any adverse effects, on a listed species or designated critical habitat. This proposed project is anticipated to displace 66,000 gallons of diesel fuel/year. Wind power generation will not only decrease the CO^2 emissions that are believed to accelerate the global warming trend, but it will also decrease the probability of a fuel spill. Most fuel spills occur during fuel transfer (Day and Prichard 2000). By reducing fuel consumption, the amount and duration of fuel transfers will be decreased, thereby reducing the probability of spill.

The project plan includes monitoring of the wind turbine facility using remote cameras attached to heat and motion detectors to detect birds moving through in close vicinity to the turbine blades and tubular tower. Although this technique is still experimental and its effectiveness as a monitoring tool is yet unclear, its use in this project will help determine the efficacy of this technique for future monitoring in remote locations.

Direct Effects – We do not anticipate loss of nesting, molting, feeding or staging habitat as a result of this project. Very few nests have been documented from St. Lawrence Island, and we assume that spectacled eiders will not nest within the footprint of the village. Further, we do not expect any direct effects to nearby critical habitat.

Because no guy wires are associated with the support structure of the turbines, we believe the probability of spectacled eiders striking the tubular tower is so low, it can be considered discountable. Moreover, because spectacled eiders tend to fly low (approximately 9 meters) off the water and ground, and because the lower edge of the wind turbine blades will be approximately 22 meters from the ground, we believe the probability of spectacled eiders striking the turbine blades is also low enough to be considered discountable.

Collision with the 335 meters of power distribution line proposed for installation is expected over the life of the project (50 years). The four lines (3 energized conductors and one ground wire) will be strung at the approximate height that spectacled eiders are known to fly. Historic collisions between spectacled eiders and power lines in Savoonga confirm the potential for power line strikes. Bird deterrent devices will be installed on the power lines. However, the effectiveness of the deterrent devices is unknown, especially with birds that are known to migrate at night and during other poor visibility conditions (i.e., fog, snow).

Based on the assumption that spectacled eiders have an equal probability of striking the new power lines as they do of striking the existing power lines, a model was developed to assess the quantity of incidental take (Table 3). Given the assumptions of this model, the range of bird strikes predicted for the 50-year life of the project is 0.25 (minimum) to 1.5 (maximum) spectacled eiders, with a mean of 0.75 birds (average). **Based on this model, the estimated take of spectacled eiders over the life of this project is one bird.**

Interrelated and Interdependent Actions – Actions that are interrelated and interdependent with the proposed construction and operation of this wind power generation project include the potential displacement of diesel fuel, which the beneficial effects described above.

Indirect Effects -- Avoidance behavior has been reported in other bird species around wind farms. Spectacled eiders may avoid the action area due to the audio and visual disturbance of the wind "garden", but this can only be viewed as a positive response. The terrestrial habitat proposed for wind "garden" development is not known to be used by spectacled eiders, and avoidance of the wind turbines might also cause birds to avoid the rest of the Village in general, which includes many other power lines.

Table 3. Calculations of the number of birds expected to strike the proposed power lines in Savoonga, Alaska. Calculations assumed that birds had an equal probability of striking the power lines over 50 years.

Variable	Data	Units
Length of Existing Power Lines	36,008	feet
Length of Proposed Power Lines	1100	feet
	37,108	feet
Thus, the new power lines will add 3% more to the total amount of power lines		
MAXIMUM Number of Spectacled eiders striking existing power lines since listing	6	birds
MINIMUM Number of Spectacled eiders striking existing power lines since listing	1	bird
AVERAGE Average of Max. and Min – spectacled eiders striking existing power lines since listing	3	birds
Frequency of strike (Maximum)	1.00	bird/year
Frequency of strike (Minimum)	0.17	bird/year
Frequency of strike (Average)	0.5	bird/year
MAXIMUM		
expected strikes over 50 years	50	birds
expected number of birds to strike the new power lines in 50 years	1.5	birds
MINIMUM		
expected strikes over 50 years	8.33	birds
expected number of birds to strike the new power lines in 50 years	0.25	bird
AVERAGE		
expected strikes over 50 years	25	birds
expected number of birds to strike the new power lines in 50 years	0.75	bird

Species' Response to Proposed Action

Numbers of Individuals in the Action Area Affected -- The entire world's population of spectacled eiders (at least 333,000 birds; Petersen et al. 1999) is believed to winter in the waters to the south of St. Lawrence Island. It is unknown what proportion of those wintering birds migrate and stage off the eastern shore of St. Lawrence Island on their way to Russia or mainland Alaska.

Sensitivity to Change – Because it is atypical for spectacled eiders to fly over Savoonga, this project is not expected to cause abandonment of habitat. But the sound and sight of the turbines may alter their flight patterns away from the village.

Resilience -- We believe that the level of take related to this project is relatively minor when considering resiliency to mortality factors inherent to this species. We do note, however, that because of the species low fecundity and recruitment rates, resilience to disturbance is generally poor.

Recovery Rate -- The natural recovery rate of spectacled eiders is not known. Long-lived species with low annual fecundity have a relatively slow recovery rate compared to short-lived species with high annual fecundity. Given the eider's observed low fecundity (i.e., small clutch sizes, high variability in nesting attempts, and generally low nest success; Moran and Hardwood 1994, Quakenbush et al. 1995, Moran 1996a, 1996b, Grand and Flint 1997), the recovery rate for these species is believed to be quite slow.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Fisheries conducted in the vicinity of St. Lawrence Island may impact this federally protected sea duck. At least five spectacled eiders have been documented colliding with fishing vessels and their gear in the vicinity of St. Lawrence Island (Table 2). The potential for conflict is especially high where large numbers of this species congregate. Anecdotal evidence suggests that eiders may become disoriented and strike lighted vessels in adverse weather conditions. Eight residents of Savoonga hold commercial fishing licenses, supporting the operation of Norton Sound Seafood. Additionally, lighted fuel barges may also account for some level of collision risk to spectacled eiders in the vicinity of Savoonga. As stated previously, this action may reduce the frequency that fuel barges enter the Savoonga waters, thereby reducing collision risk as well as the risk of petroleum contamination.

A new school facility has been proposed in the vicinity of the wind "garden", and the preliminary site design for this facility suggests it will be located between the power lines proposed in this consultation and the shore line. The height of the building will likely be above the highest power lines, and may shield spectacled eiders from striking the power lines.

There is no dock facility in Savoonga; supplies are offloaded from the beach. Future development plans may include a small boat harbor and dry dock. Although a small boat harbor may reduce the probability that a boat may become damaged and leak fuel while offloading on the beach, the development of a boat harbor will increase vessel traffic in the area, increasing the probability of chronic and acute petroleum contamination.

Conclusion

Regulations (51 FR 19958) that implement Section 7(a)(2) of the Act define "jeopardize the continued existence of" as "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed

species in the wild by reducing the reproduction, numbers, or distribution of that species." In evaluating the current status of the spectacled eider, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the spectacled eider, and is not likely to destroy or adversely modify designated critical habitat. This conclusion is based on the following information:

- Spectacled eider populations on the North Slope and Y-K Delta both appear to have population growth rates that are not significantly different from 1.0.
- The population size of the listed entity is over 330,000.
- The population within Alaska is over 10,000.
- We do not believe that the increased take of one bird over 50 years, resulting from this action will, directly or indirectly, reduce appreciably the likelihood of either survival or recovery of the species in the wild.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity.

AMOUNT OR EXTENT OF TAKE

Collisions with Wind Turbines -- Because the turbines will be installed on tubular towers with a cement foundation, which significantly reduces the probability of collision as compared to lattice towers with guy wires, and because the lowest point of the turbine blades will be well above the known flight altitude of spectacled eiders, the Service believes that the probability of take is discountable.

Collisions with Power Lines – Because spectacled eiders have previously collided with power lines in Savoonga, and because this project proposes to add 3% more power line to the existing lines, the Service believes that **take as a result of colliding with power lines over the next 50 years will amount to one spectacled eider.**

It is important to note that the above estimates for incidental take from strikes with turbines and power lines are crude. The deterministic model used for our take estimate does not take into consideration the episodic nature of collisions by spectacled eiders as well as many other bird species. Therefore, as more data on spectacled eider strikes is gathered for this and other projects

in the spectacled eider's range become available, the Denali Commission may need to reinitiate consultation if observed strike rates are higher than the above anticipated incidental take level.

REASONABLE AND PRUDENT MEASURES

The Denali Commission has been very proactive in modifying the project description to minimize the level of incidental take for spectacled eiders. They have 1) modified wind turbine location; 2) switched from guyed lattice towers to non-guyed tubular towers; 3) agreed to install bird flight diverters on horizontal power lines; and 4) gathered baseline data by monitoring for bird activity at the proposed wind "garden" site prior to construction. The Service finds that there are no other minor changes that can be made to this project to further minimize risk of take. However, it is appropriate to require a measure to monitor actual level of take to ensure that the actual take does not exceed the level of permitted take.

TERM AND CONDITION

In order to be exempt from the prohibitions of Section 9 of the Act, the Denali Commission must assure compliance with the following term and condition, which implements the required reporting/monitoring requirements. This term and condition is non-discretionary.

1. Monitor for bird collisions in the project area. This monitoring requirement includes area of the wind turbines and the power lines. Local personnel will routinely walk the perimeter of the wind turbines and the power line corridor and immediately report any strikes to the Service. Further, the Trailmaster™ heat and motion detector attached to a camera will be routinely serviced and monitored for evidence of birds flying through the wind "garden" or striking the towers or blades. All evidence of strikes will be reported to the Service within one business day of discovery. Bird carcasses will be frozen and shipped to the Service* for necropsy. A report of the monitoring effort shall be submitted to the Service on an annual basis, beginning 1-year from the issuance of this Biological Opinion and ending after 5 years.

* US Fish and Wildlife Service, Anchorage Fish and Wildlife Field Office, 605 W. 4th Ave. Rm, G61, Anchorage, AK 99501

CONSERVATION RECOMMENDATION

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

The Service believes that burying the power lines will completely eliminate the risk of spectacled eiders striking them. Therefore, we recommend that all new and old power lines in Savoonga be buried underground.

REINITIATION NOTICE

This concludes formal consultation on the proposed action. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a matter or to an extent not considered in this biological opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this biological opinion; (4) any of the non-discretionary Terms and Conditions are not implemented in a timely manner and completed by the deadlines set forth; or (5) a new species not covered by this opinion is listed or critical habitat designated that may be affected by this action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take should cease pending reinitiation.

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