Biological Evaluation of Steller's Eider (*Polysticta stelleri*), Spectacled Eider (*Somateria fischeri*), and Kittlitz's Murrelet (*Brachyramphus brevirostris*)

for

Seismic Surveys in the Northeast Chukchi Sea and western Beaufort Sea Planning Areas

Minerals Management Service

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Biological Evaluation of Steller's Eider (*Polysticta stelleri*), Spectacled Eider (*Somateria fischeri*), and Kittlitz's Murrelet (*Brachyramphus brevirostris*) for Seismic Survey Activities in the Northeast Chukchi and Western Beaufort Seas

Purpose and Need

The United States has a high dependency on imported foreign oil to supply current and projected demands. Consequently it is in the national interest to investigate and develop potential domestic supplies to reduce this dependency. An initial step in oil field development is a geological and geophysical (G&G) survey of potential oil bearing strata. When conducted on Federal lands, G&G investigations are typically conducted under the direction of the Department of the Interior, Minerals Management Service (MMS).

The purpose of the MMS regulatory program is to ensure that the G&G data needed by industry and government are obtained in a technically safe and environmentally sound manner. The MMS regulations at 30 CFR 251 mandate that G&G activities may not interfere with or endanger operations under any lease or right-of-way, or permit issued, nor may they cause harm or damage to aquatic life, property, or to the marine, coastal, or human environments.

The MMS needs G&G survey information to ensure safe operations, support environmental impact analyses, protect benthic resources through avoidance measures, ensure fair market value for leases, make royalty relief determinations, conserve oil and gas resources, and to fulfill other statutory responsibilities.

Action Area

Under the current 5-year OCS leasing program (2002-2007), the Chukchi Sea Program Area encompasses approximately 137,600 km^2 (34 million acres) and the Beaufort Sea Program Area covers approximately 36,422 km^2 (9 million acres). Five sales are proposed for the Arctic OCS: Chukchi Sea Sale 193 in 2007, 211 in 2010, and 221 in 2012; and Beaufort Sea Sale 208 in 2009 and 216 in 2011. The boundaries of the action area are shown in Figure 1.

Proposed Action

This proposed action includes seismic surveys in preparation for anticipated lease sales in the Chukchi Sea Outer Continental Shelf (OCS) and the Beaufort Sea OCS. Seismic survey methodologies are limited to:

<u>Three-dimensional (3D) Streamer Surveys</u>. Marine streamer 3D surveys vary markedly depending on client specifications, subsurface geology, water depth, and geological target reservoir. The vessels conducting these surveys are generally 70 to 90 meters long.

Airguns are the acoustic source for 2D and 3D seismic surveys. A combination of airguns is called an array, and operators vary the source array size during the seismic survey to optimize the resolution of the geophysical data collected.

A 3D source array typically consists of two or three sub-arrays of six to nine airguns each. The arrays are usually aligned parallel with one another and towed 50 to 200 meters behind the survey vessel. Following behind the source arrays by another 100 to 200 meters are multiple (4 to12) streamer receiver cables. Streamers are passive listening equipment consisting of multiple hydrophone elements.

Marine 3D surveys are conducted at vessel speed of about 4.5 knots (8.3 km/hr). A source array is activated approximately every 10 to 15 seconds, depending on vessel speed. Airguns are usually fired between 20 and 70 times per mile. Modern 3D survey lines are generally parallel to one another and spaced several hundred meters apart. Seismic vessels operate day and night, and a survey may continue for days, weeks, or months, depending upon the size of the survey, data acquisition capabilities of the vessel, and weather conditions.

Two-Dimensional (2D) Streamer Surveys. Marine streamer 2D surveys use similar geophysical survey techniques as 3D surveys, but both the mode of operation and general vessel type used are different from those used in modern 3D marine surveys. The 2D surveys are designed to provide a less-detailed, coarser sampled subsurface image compared with 3D surveys, and they are conducted over wide areas or on a regional basis to identify potential prospective areas.

The 2D seismic vessels are generally smaller than modern 3D vessels, although larger 3D vessels are able to conduct 2D surveys. A 2D source array typically consists of three or more subarrays of six to eight airguns each followed by a single hydrophone streamer.

About 100,000 line-miles of 2D survey data have already been gathered in the Chukchi Sea and large areas of additional 2D data may not be necessary because the 3D surveys may focus on specific targets detected by earlier 2D surveys.

Ocean Bottom Cable Survey. Ocean bottom surveys are sometimes used in shallow coastal water that is too shallow for the data to be acquired using a marine streamer vessel. Ocean-bottom-cable surveys require up to four vessels: two for cable layout/pickup and recording, or one for recording, and one for shooting. Two small utility boats (10 to15 meters) may also be used. When a cable is no longer needed to record seismic data, it is recovered by the cable-pickup ship and moved to the next recording position. A particular cable can lay on the seafloor from 2 hours to several days, depending upon operation conditions. Normally, a cable is left in place about 24 hours.

High-resolution Survey. High-resolution seismic surveys sometimes follow seismic exploration surveys. High-resolution surveys are intended to provide required information on shallow hazards, archaeological resources, and potential benthic communities. A typical high-resolution seismic survey operation consists of a vessel towing an acoustic source (airgun) about 25 meters behind the ship and a 600-meter streamer (receiver cable) with a tail buoy. The ship travels at 3 to 3.5 knots (5.6 to 6.5 km/h), and the sound source is activated every 7 to 8 seconds (or about every 12.5 meters). Airgun volumes for high-resolution surveys are typically 90- to 150-cubic inches, and the output of a 90-inch air gun is 229 dB re 1μPa at 1 meter. Airgun pressures are typically 2,000 psi, although 3,000 psi may be used for more output.

Up to four 2D and 3D surveys in the Chukchi Sea program area and four 2D and 3D surveys in the Beaufort Sea program area may be permitted. No limitations are placed on the duration of each survey permit. Hence, a single survey may commence once ice conditions allow in the Chukchi Sea Planning Area and, with possibly minor periods of inactivity, continue until ice forms and obstructs seismic operations. The same also is possible in the Beaufort Sea Planning Area. Each 2D and 3D survey is expected to cover thousands of square miles. Hence, the entire surface waters of the Chukchi Sea and Beaufort Sea program areas may be surveyed one or more times during the open-water period of 2006. However, surface waters will not be equally subjected to airgun emissions, as adjacent lines for a modern 3D survey generally are spaced several hundred meters apart and are parallel to each other across the survey area. It is common practice to conduct the surveys using a racetrack method, whereby the next acquisition line is several kilometers away from the recently completed line. It should be noted that the towed marine source is not static and is continually activated at different spatial locations throughout the period of the survey. The 2D surveys acquire data along single track lines that are spread widely apart compared to a 3D survey.

High-resolution surveys are not scheduled in the Chukchi Sea during 2006, but could be used after exploration surveys using 2D and 3D technologies are completed. 2D seismic surveys have been completed in much of the Beaufort Sea OCS. Ocean bottom survey may be used in the Beaufort Sea because of its shallow near-shore waters. High-resolution surveys would be used to confirm the presence of shallow hazards, archaeological resources, and potential benthic communities in the planning areas. About 520 km^2 (200 square miles) of area could be surveyed every 20 to 30 days.

Survey Logistics and Timing

Marine seismic vessels are designed to operate for several months without refueling and replenishments. A guard or chase boat probably also would be used for safety considerations, general support, maintenance, and resupply of the main vessel, but it would not be directly involved with the collection of seismic data. Helicopters also may be used when available for vessel support and crew changes.

Timing and areas of surveys in the Beaufort and Chukchi action areas are dictated by relatively ice-free conditions and are based on the shipping season for the Red Dog Mine Portsite in the southeast Chukchi Sea. The Chukchi Sea would be ice free from about early June through about mid-October. The Beaufort Sea seismic survey season would start about late-July and end in early October.

Endangered Species Act (ESA) Section 7 Consultation Process

The U. S. Fish and Wildlife Service (Service), Ecological Services Alaska, provides the following description of the ESA Section 7 consultation process. "When development occurs within the range of threatened or endangered (T&E) species, the agency proposing development is expected to consult with the Service regarding the activity. The process begins informally with a request for a list of T&E species in the area of interest. If T&E species are present, then informal consultation begins. Should the informal consultation determine that a listed species might be affected by the proposed activity, the action agency prepares a biological evaluation of T&E species within the action area. If it is then determined that a listed species is likely to be adversely affected, formal consultation results. During the formal consultation, the Service prepares a biological opinion, complete with a list of reasonable and prudent measures that the action agency is bound to adhere to. An incidental take document accompanies the biological opinion, and details how many individuals may be taken as a consequence of the action before consultation is re-initiated."

Species considered by the MMS include the threatened Steller's and spectacled eiders and the candidate Kittlitz's murrelet. These species are known to seasonally occupy the Chukchi Sea and Beaufort Sea OCS action areas. The MMS initiated informal consultation with the Service by requesting a list of T&E species present in the Chukchi and Beaufort Sea OCS action areas. The Service responded with their determination of T&E and candidate species, and listed Steller's and spectacled eiders and the candidate Kittlitz's murrelet as occurring in the Chukchi Sea and Beaufort Sea action areas (USDOI, FWS 2006).

A biological evaluation of Steller's and spectacled eiders and Kittlitz's murrelet follows. Biological descriptions in the following sections were taken from information found in the Federal Register listing actions for Steller's and spectacled eiders (USDOI, FWS 1993; 1997) and Kittlitz's murrelet (USDOI, FWS 2004), the biological opinion on Steller's eider for navigation improvements at Sand Point, Alaska (USDOI, FWS 2002b), personal communications, and other literature sources referenced. A biological evaluation for candidate species, such as the Kittlitz's murrelet, is not required for NEPA, however the Kittlitz's murrelet is treated here as if it were listed as threatened or endangered solely for the purpose of minimizing potential negative effects the proposed seismic activities could have on this species.

Biological Status of Steller's Eider (*Polysticta stelleri*)

Range

Steller's eiders are found in the Arctic, North Atlantic and North Pacific oceans (Quakenbush et al. 2002). The Atlantic population ranges from northern Europe to about the Khatanga River in western Arctic Russia. The Pacific population ranges from about Cook Inlet, Alaska to the Kuril Islands, Russia during winter, and from about the Yamal Peninsula, Russia to about Prudhoe Bay, Alaska during summer (USDOI, FWS 2002a; Quakenbush et al. 2002). The Pacific population is composed of two sub-populations: an Alaskan nesting population and a Russian nesting population. Most Steller's eiders from these populations winter together in Alaska. This biological evaluation focuses on the Alaskan nesting population.

Species Description

The Steller's eider is the smallest of four northern eider species. The average weight of adult Steller's eiders is 1.94 pounds (Bellrose 1980). Adult male Steller's eiders in breeding plumage have a black back, white shoulders, and a chestnut brown breast and belly. The males have a white head with black eye patches; they also have a black chin patch and a small greenish patch on the back of the head. Females and juveniles are mottled dark brown.

Life History

Longevity

Banding studies indicate that Steller's eiders can be long lived and are known to live at least 21 years and 4 months in the wild (Dau et al. 2000).

Age to Maturity

Steller's eiders reach sexual maturity at two years (Bellrose 1980).

Reproductive Strategy

Johnsgard (1994) indicated that pair formation for most sea ducks occurs in fall and spring. Metzner (1993) hypothesized that Steller's eiders at Izembek Lagoon and Cold Bay paired in the spring because they were apparently too preoccupied with feeding during the fall and winter to form pair bonds. Long-term pair bonds have been documented in other ducks (Bengtson 1972; Savard 1985), but the length of time that Steller's eiders remain paired is unknown.

In Alaska, pairs of Steller's eiders arrive at their nesting areas as early as June 5 (Bent 1987). Steller's eiders often nest on coastal wetland tundra, but some nest near shallow ponds or lakes well inland on the Arctic Coastal Plain (Bent 1987; Quakenbush et al. 1995; Solovieva 1997).

Clutch size ranges from two to ten eggs, but averages about five eggs near Barrow, Alaska (Bent 1987, Bellrose 1980, Quakenbush et al. 1995). The average number of eggs in Russia is slightly higher at about six eggs per nest. Nesting success is variable.

Recruitment

Steller's eider recruitment rate (the percentage of young eiders that leave the nest and live to sexual maturity) is unknown (USDOI, FWS 2002b). However, there is limited information on how many Steller's eider nests have eggs that hatch. In recent years, the number of nests near Barrow that produced ducklings seems to be declining and ranged from 83 percent in 1991 to 15 percent in 2000 (USDOI, FWS 2002b). In other years, Steller's eiders did not attempt to nest near Barrow (Quakenbush et al. 1995). The reason for relatively low nesting success or failure to nest by the Alaska nesting population is unknown, but may be related to the abundance of lemmings (Quakenbush and Suydam 1999).

Seasonal Distribution Patterns

Breeding Distribution. The historical breeding range of the Alaskan nesting population of Steller's eiders is not clear (USDOI, FWS 2002a). The historical nesting range may have extended discontinuously from the eastern Aleutian Islands to the western and northern Alaskan coasts, possibly east as far as the Canadian border. In more recent times, nesting occurred in two general areas--the Arctic Coastal Plain and western Alaska– primarily on the Yukon-Kuskokwim (Y-K) Delta. Currently, Steller's eiders nest in relatively low numbers on the Alaskan Arctic Coastal Plain from approximately Point Lay east to Prudhoe Bay, and in extremely low numbers on the Y-K Delta. Female Steller's eiders, like the females of many other waterfowl species, likely have strong fidelity to nesting areas and return to the same site or locality every year.

Post-breeding Distribution, Fall Migration, and Molting. Following breeding, males and some females with failed nests leave nesting areas and return to marine waters in July. Steller's eiders are shallow-diving sea ducks that mostly feed in shallow water near shore, but they sometimes gather in small flocks over deeper waters. Successful females and their broods gather on the coast later in the summer. The timing of departure and arrival of Steller's eiders at known staging points within their range was well documented by historical observation, but until the advent of satellite technology, little was known of how Steller's eiders used marine waters during their late summer and fall migration.

From about 2000 through 2003, several Steller's eider from the Alaskan nesting population were instrumented with satellite transmitters while they were on nesting areas near Barrow. Subsequent tracking through the summer and fall indicated that Steller's eiders from the Alaskan nesting population ranged as far west as the Russian Arctic coastline before gathering at known molting areas in bays along the coast of the southeastern Bering Sea (P. Martin 2001 personal communication) (Figure 2).

In late summer and fall, large numbers of Steller's eiders from the Russian-Alaskan populations gather to molt in a few lagoons on the north side of the Alaska Peninsula. Fewer numbers of eiders also apparently molt farther north in Kuskokwim Bay and near the southern tip of the Kamchatka Peninsula and the Commander Islands in the western Bering Sea (USDOI, FWS 2002a). Steller's eiders show strong site fidelity to these molting areas. Steller's eider molting areas in Alaska were designated as critical habitat on February 6, 2001 (USDOI, FWS 2001a).

Winter Distribution. Following the molt in Alaska many, but not all, Steller's eiders disperse from major molting areas to other parts of the Alaska Peninsula and Aleutian Islands. Winter ice formation often temporarily forces birds out of shallow protected areas such as Izembek and Nelson lagoons. During the winter, this species congregates in select near-shore waters throughout the Alaska Peninsula and the Aleutian Islands, around Nunivak Island, the Pribilof Islands, the Kodiak Archipelago, and in Kachemak Bay. Although overall abundance in specific wintering areas on the south side of the Alaska Peninsula may depend on ice conditions along the north side of the Alaska Peninsula, Steller's eiders likely have a strong fidelity to specific wintering areas on the south side, with some birds occupying these areas during winter regardless of conditions on the north side.

Spring Migration. In the spring, Steller's eiders form large flocks along the north side of the Alaska Peninsula and generally move east and north. Spring migration usually includes movement along the coast, although birds may take shortcuts across large water bodies such as Bristol Bay and Kotzebue Sound. Steller's eiders show strong site fidelity for certain habitats during migration, where they congregate in large numbers to feed before continuing their northward migration.

Steller's eiders show strong fidelity to several areas along the southeastern Bering Sea/Bristol Bay coastline. These areas include: Bechevin Bay, Morzhovoi Bay, Izembek Lagoon, Nelson Lagoon/Port Moller Complex, Cape Seniavin, Seal Islands, Port Heiden, Cinder River-Hook lagoon area, Ugashik Bay, Egegik Bay, Kulukak Bay, Togiak Bay, Nanwak Bay, Kuskokwim Bay, Goodnews Bay, and the south side of Nunivak Island.

Population Structure

It seems reasonable to assume that based on the high probability for site fidelity by nesting females and the distance between breeding populations on the Y-K Delta and the Arctic Coastal Plain (805 km/500 miles), the Alaska breeding population of Steller's eiders may contain unique geographic sub-populations with limited maternal gene flow between sub-populations.

Bioenergetics

Steller's eiders winter at northern latitudes and are believed to spend the winter near the limits of their energetic threshold (Goudie and Ankney 1986). Species with this life history strategy are vulnerable to perturbations within their winter habitat. Because Steller's eiders winter near their energetic threshold, they continue to feed upon reaching their nesting areas. Female Steller's eiders continue to feed during incubation.

Food Habits

Steller's eiders are mostly a near-shore species that employ a variety of foraging strategies that include diving to a maximum depth of at least 9 meters (30 feet), bill dipping, body tipping, and gleaning from the surface of water, plants, and mud (USDOI, FWS 2002b). During the fall and winter, Steller's eiders opportunistically forage on a variety of invertebrates that are found in near-shore marine waters, but mussels comprise much of their diet in some molting lagoons. Steller's eiders food in freshwater nesting areas is believed to be mostly the relatively large, benthic larvae of the chironomid midge common in arctic tundra ponds.

Predators

Predators of Steller's eiders include snowy owls, short-eared owls, peregrine falcons, gyrfalcons, pomarine and long-tailed jaegers, rough-legged hawks, common ravens, glaucous gulls, arctic fox, and red fox. Owls, falcons, and hawks kill mostly ducklings and adult eiders, while gulls, ravens and jeagers prey on eggs and ducklings. Foxes will eat eggs, ducklings, and kill nesting females if given the opportunity.

Man must also be considered a predator of Steller's eiders. Sport and subsistence hunting of Steller's eiders is prohibited in the United States, but small numbers of Steller's eiders continue to be killed with firearms (USDOI, FWS 2002c).

Population Dynamics

Population Size

The world population of Steller's eiders is estimated to number between 100,000 and 150,000 birds (Quakenbush 2006). The Atlantic population numbers about 40,000 Steller's eiders. About 30,000 of the Pacific population winters in Russia and the remainder winters in Alaska. The Alaska wintering Steller's eiders concentrate in large flocks along the southwestern Alaska coast in spring (Larned 2002). Peak abundance estimates from aerial surveys during the spring migration are shown in table 3 below.

Table 3. Peak estimates of Steller's eiders during spring migration surveys in southwestern Alaska (Larned 2002).

Year	Peak Estimate [a]	Expanded Total
1992	137,904	
1993	88,636	
1994	107,589	
1997	90,269	
1998	84,459	
2000	68,956	72,953
2001	58,231	60,656
2002	54,191	56,704
[a] uncorrected for observer bias.		

Steller's eiders from this population mostly nest in Siberia, but a small portion of them nest in Alaska (USDOI, FWS 2002a). The Alaska nesting population is divided into two sub-populations depending on where they nest: the Y-K Delta and the Arctic Coastal Plain. The Service believes the Y-K Delta nesting population numbers in the tens or hundreds and the Arctic Coastal Plain nesting population numbers in the hundreds or low thousands.

Population Variability

Variability in the abundance of the Alaskan breeding population of Steller's eiders is not well understood. The sampling errors around population estimates are large enough to obscure large annual population fluctuations, but ground surveys in the Barrow area suggest that the local breeding populations there fluctuate substantially, with no Steller's eiders nesting during some years (Quakenbush et al. 1995; Quakenbush 1999).

Population Stability

The population of Steller's eiders molting and wintering along the Alaska Peninsula appears to be declining (USDOI, FWS 1999; 2002a). Long-lived species like Steller's eiders typically do not have highly variable populations and mortality factors may be undermining their ability to maintain a stable population. The causes of decline could be varied and are largely unknown, but if the cause of the decline is within the marine environment, it is reasonable to conclude that the Alaska nesting population and Russia nesting population are being affected similarly because a large portion of the Russian population winters with the Alaskan population.

Endangered Species Act Status of the Steller's Eider

Reasons for Listing
The Alaska nesting population of Steller's eiders was listed as a threatened species on June 11, 1997 (USDOI, FWS 1997). It was listed because of (1) its recognition as a distinct vertebrate population segment, (2) a substantial decrease in the species' nesting range in Alaska, (3) a reduction in the number of Steller's eiders nesting in Alaska, and (4) the vulnerability of the remaining breeding population to extirpation. Specific reasons the Service listed the Alaskan nesting population are:

Habitat Loss. The direct and indirect effects of future gas/oil development within the National Petroleum Reserve-Alaska, and future village expansion (e.g., at Barrow), were cited as potential threats to the Steller's eider. Within the marine distribution of Steller's eiders, perceived threats include marine transport, commercial fishing, and environmental pollutants.

Hunting. Although not cited as a cause in the decline of Steller's eiders, the take of this species by subsistence hunters was cited as a threat to the population of Steller's eiders near Barrow in the final rule. Steller's eiders from the Alaska population are known to use marine waters off the Russian coast (P. Martin 2001 personal communication) suggesting that Steller's eiders from the Alaska population could possibly be shot in Russia. Hunters from four Russian villages are reported to have shot from 3,000 to 4,500 Steller's eiders annually in the 1990's (Syroechkovski and Zockler undated).

Predation. Increased predation by arctic foxes (*Alopex lagopus*) resulting from the concurrent crash of goose populations is cited as a possible contributing factor to the decline of the Steller's eider on the Y-K Delta. The potential for increased predation near villages resulting from the villages' associated gull and raven populations was also cited as a potential threat to this species.

Lead Poisoning. The presence of lead shot in the nesting environment on the Y-K Delta was cited as a continuing potential threat to the Steller's eider. Regulations requiring the use of non-toxic shot for hunting waterfowl, cranes, and snipe in Alaska were implemented during the 1991-1992 migratory bird-hunting season (USDOI, FWS 1991). Local problems with lead in the Arctic still exist, particularly in areas where lead shot was or still is widely used for hunting. Lead pellets will continue to be eaten by birds as long as they remain in the environment. Effects of lead poisoning are apparent in some birds, such as the endangered Steller's eider in Alaska (AMAP 2002).

Ecosystem Change. The Service cites direct and indirect changes in the marine ecosystem caused by increasing populations of Pacific walrus, gray whale, and sea otter, as potential causes of the decline of Steller's eiders (USDOI, FWS 1997). Subsequent declines in sea otter populations (USDOI, FWS 2000a) and continuing declines in

Steller's eider populations suggest that otters were not responsible for a decline in eider numbers. In addition, changes in the commercial fishing industry were also cited as perhaps causing a change in the marine ecosystem with possible effects upon eiders. However, the Service (2002c) is unaware of any link between changes in the marine environment and contraction of the eider's breeding range in Alaska.

Range-wide Population Trend

Populations of Steller's eiders molting and wintering along the Alaska Peninsula have declined since the 1960s (Kertell 1991) and appear to be in continued decline (Flint et al. 2000, Larned 2000). The imprecision of breeding ground estimates precludes detection of any but the most obvious population trends. However, if a marine-based threat is causing a decline in the world population of Steller's eiders, then it seems reasonable to conclude that the Alaska breeding population may also be affected by such a threat.

Critical Habitat

Critical habitat was designated for the Steller's eider on January 10, 2001 (USDOI, FWS 2001a). Designated critical habitat includes the Y-K Delta nesting areas and the Kuskokwim Shoals fall molting and spring staging area. Other critical habitat includes molting and staging lagoons along the north coast of the Alaska Peninsula including the Seal Islands, Nelson Lagoon and Port Moller, and Izembek Lagoon. The nesting area around Barrow, and specific wintering areas south of the Alaska Peninsula and in the Aleutian Islands are not designated as critical habitat.

Steller's Eiders in the Proposed Action Areas

Steller's eiders are currently found in relatively low numbers within the proposed action areas. Although the historical range is believed to have once extended east past the Canadian border (Quakenbush et al. 2002), the current Arctic Coastal Plain nesting population is apparently centered near Barrow (Larned 2001a; 2001b; 2003). Some of the more definitive records of presence within the Chukchi and Beaufort Sea OCS areas are summarized below.

Traditional Knowledge

Migratory field notes were collected at Kivalina, Alaska, during November 1997 and published by the Alaska Department of Fish and Game in Technical Paper No. 260 (Georgette 2000). Kivalina is about 60 miles southeast of Point Hope, the southernmost point of the survey area. A comment on the occurrence of Steller's eiders at Point Hope was also made at Kivalina (Georgette 2000). Traditional knowledge is that there are not too many Steller's eiders around Point Hope. According to traditional knowledge, Steller's eiders come around Point Hope in June and July (including males) and again in the fall (females and juveniles). Steller's eiders rounding Point Hope on their way to Alaska nesting areas near Barrow likely number in the hundreds or low thousands, and are composed of the current Alaskan breeding population in addition to unknown numbers of non-breeding birds that may occupy lagoons and near-shore waters of the northeastern Chukchi and Beaufort seas.

Previous Studies

Williamson et al. (1966) listed Steller's eiders as occurring in the Cape Thompson area 25 miles southeast Point Hope during surveys for Project Chariot at Ogotoruk Creek. Steller's eiders were listed as occupying marine littoral, lacustrine, and beach environments in order of affinity. In this study, marine littoral waters extended seaward 2 miles from shore. Steller's eiders were listed as present from June 1 through October 4 and uncommon, but possibly breeding in the area. It is not known if Steller's eiders still nest in this area.

LGL (1992) reported on the use of Kasegaluk Lagoon by marine birds. Kasegaluk Lagoon is in the eastern Chukchi Sea and adjacent to the proposed seismic survey areas. Three sighting of 30 Steller's eiders were mentioned in the report. The mean density of Steller's eiders occupying the Kasegaluk Lagoon survey area in 1991 was 0.04 (s.d. = 0.17) Steller's eiders per square kilometer.

Perhaps the most important study relative to the proposed seismic surveys is the recent telemetry tagging of Steller's eiders by the Service (P. Martin 2001 personal communication). During this study the Service implanted 10 transponder tags in breeding Steller's eiders near Barrow and tracked their movements by satellite. Steller's eiders began leaving the Arctic Coastal Plain nesting areas on June 23. After leaving the Arctic Coastal Plain, there was considerable use of coastal marine waters from Wainwright to Dease Inlet, and some use of coastal waters in the vicinity of Cape Beaufort (between Cape Lisburne and Point Lay). At least eight individual Steller's eiders were tracked from Point Barrow across the Chukchi Sea to Siberia and back to Alaska (Figure 2).

Quakenbush et al. (2002) summarized the historical and present breeding season distribution of Steller's eider in Alaska to define the historical and recent breeding range on the Arctic Coastal Plain, and determined the center of recent breeding abundance to be in the region of Barrow.

Aerial surveys were conducted in near-shore waters along barrier islands of the Arctic Coastal Plan from the southern end of Kasegaluk Lagoon to the Canadian border and summarized sighting of Steller's eiders from 1999 through 2004 (Dau and Larned 2004). Steller's eiders are apparently rare along these coastal waters in June because only three Steller's eiders are reported over the 5 years summarized (Table 6 in Dau and Larned 2004).

The breeding biology of Steller's eiders near Barrow is well documented. Quakenbush (2004) studied the breeding biology of Steller's eiders during a 10-year study near Barrow that confirmed low survival and the effects of predation on broods.

Biological Status of Spectacled eider (*Somateria fischeri*)

Range

The current summer nesting range of the Spectacled eider is limited to the coastal Russian Arctic west to about the Lena River, the Arctic Alaskan Coastal Plain east to about the Canadian border, and in the Y-K River delta in southwest Alaska. The winter range is limited to areas of unfrozen ocean (polynyas) in the Bering Sea south of Saint Lawrence Island, Alaska.

Species Description
The spectacled eider is a large-bodied sea duck at 20 to 22 inches long. The adult male spectacled eider has a green head with a long, sloping forehead and large, distinctive white-eye patches, a black chest and a white back during the breeding season, but is mottled brown during the late summer and fall molt. Juveniles and adult females are brown with less distinct spectacled eye patches year round.

Life History
Longevity
Few data are available on the overall longevity of spectacled eiders, but like other eiders, they would likely be long-lived.

Age to Maturity
Age at first breeding has not been determined but probably occurs most often in the third year for females and the third or fourth year for males, coinciding with the acquisition of definitive plumage (USDOI, FWS 1999). Wild and captive spectacled eiders have been documented to breeding as early as 2 years of age.

Reproductive Strategy
Most spectacled eiders are believed to form pair bonds before reaching the nesting grounds (USDOI, FWS 1999).

Female spectacled eiders show strong fidelity to nesting areas and often return to within 1 mile of the same nesting site. They nest in sedge meadow tundra, on peninsulas in lakes and on islands in lakes up to 5 or 10 miles inland from the coast. The nests of spectacled eiders are typically, but not always, dispersed and are in nesting habitats also preferred by other waterfowl species. Nests are constructed by the female and consist of a shallow depression in the vegetation covered with grasses and down.

Nesting starts in late May and continues through mid to late June. Spectacled eiders lay one egg per day and begin incubation with the last egg. The clutch size ranges from 1 to 8 and averages 5 eggs. Incubation lasts 20 to 25 days. Most broods are raised within 3 miles of where they were hatched. Fledging occurs approximately 50 days after hatching. Males take no part in incubation or brood rearing.

Recruitment
Recruitment rate (the percentage of young eiders that leave the nest and live to sexual maturity) of spectacled eiders is unknown (USDOI, FWS 1999). The nesting success of spectacled eiders is variable, but varies from 20 to 95 percent depending on the year and location (Bowman et al. 2002). Adult female survival can average 93 percent, and duckling survival can average 34 percent (Flint and Grand 1997).

Seasonal Distribution Patterns

Breeding Distribution. Spectacled eiders breed discontinuously along the coast of Alaska from the Nushagak Peninsula on Bristol Bay north to Barrow and east nearly to the Yukon border (USDOI, FWS 1999). They were known to nest on St. Lawrence Island, Alaska and along the Arctic coast of Russia from the Chukotka Peninsula west to the Yana Delta. Known high-density breeding grounds for spectacled eiders are the Y-K Delta in Alaska and the Chaun, Kolyma, Yana and Indigirka deltas in Siberia.

Post-breeding Distribution, Fall Migration, and Molting. Breeding males leave the nesting grounds for the marine environment by mid- to late June. Adult spectacled eiders congregate to molt in large flocks along coastal areas during late summer. Four principal molting areas are known: (1) Ledyard Bay in the northeastern Chukchi Sea, (2) Norton Sound in the Northeastern Bering Sea, (3) Mechigmenskiy Bay in Russia, and (4) an area between the Indigirka River and Kolyma River deltas in Russia. Where non-breeding flocks spend the summer is not well known, but they are believed to congregate in small flocks in coastal waters throughout their range (USDOI, FWS 2002d).

Winter Distribution. The only known spectacled eider wintering area is in offshore waters from 50 to 61 meters (165 to 200 feet) deep about 105 km (65 miles) south of Saint Lawrence Island (USDOI, FWS 2002d). Thousands of spectacled eiders congregate in open areas in pack ice. The open areas are kept ice-free by the sheer numbers of eiders present.

Spring Migration. Migration routes in the spring are not well known, but at least for breeding adults, the routes are believed to be direct between the wintering area south of Saint Lawrence Island and the nesting grounds on the Y-K Delta, Arctic slope, or Russia (USDOI, FWS 1999; 2002d). The routes of non-breeding birds are likely to be along coastal areas within their range where they are believed to spend the summer in small flocks of up to 100 birds (USDOI, FWS 2002d).

Population Structure

It seems reasonable to assume that based on the high probability for site fidelity by nesting females and the distance between breeding populations on the Y-K Delta and the Arctic Coastal Plain (802 km/500 miles), the Alaska breeding population of spectacled eiders may contain unique geographic sub-populations. However, distinct mitochondrial DNA markers imply there is limited maternal gene flow between these two areas (Scribner et al. 2000).

Bioenergetics

Although the food habits of wintering spectacled eiders are undocumented it appears they forage for benthic bivalves under the shifting pack ice of the Bering Sea (Lovvorn et al. 2000; Richman and Lovvorn 2003). This energetically expensive method of foraging requires high food densities and intake rates necessary to build up fat reserves vital for spring migration and breeding. High densities of clams are present in the overwintering area. Sampling over several decades suggests that the benthic community in the overwintering area has shifted from larger to smaller species of clams (Lovvorn et al.

2000; Richman and Lovvorn 2003). Spectacled eiders apparently do not exist so close to their energetic threshold as do Steller's eiders because they arrive on the nesting grounds fit enough to fast through egg laying and incubation (USDOI, FWS 1993), but changes in the spectacled eider prey base in the overwintering area could be affecting the overwinter survival and ability of spectacled eiders to maintain the body condition necessary for spring migration and breeding.

Food Habits

The diet of spectacled eiders has been studied only within their breeding grounds and the associated near-shore marine environment. In the littoral marine environment, Dau and Kistchinski (1977) suggest that they feed primarily on benthic mollusks and crustaceans in shallow waters less than about 30.5 meters (100 feet) deep. Kessel (1989) hypothesized that they also may forage on pelagic amphipods that are concentrated along the sea water-pack ice interface. On their coastal breeding grounds, spectacled eiders feed on aquatic crustaceans, aquatic insects, and plant materials (Dau 1974).

The world population of spectacled eiders winters in large flocks in open water in the pack ice south of Saint Lawrence Island (USDOI, FWS 2002d). Shifts in the abundance or distribution of prey species (e.g., benthic bivalves) on this wintering area may have long-reaching effects on the world population of spectacled eiders (see Energetics section above).

Spectacled eiders gather in large flocks to molt. One of these molting areas is Ledyard Bay in the northeastern Chukchi Sea (Figure 1). Food habits of spectacled eiders in the Ledyard Bay molting area remain unknown. Benthic biomass is not especially high at <10 gCm^{-2} in Ledyard Bay (Grebmeier and Dunton 2000), consequently pelagic amphipods may be important to their diet during the molt in Ledyard Bay.

Predators

Predation is believed to be a principal cause for nesting failure in many waterfowl species including spectacled eiders. Substantive depredations of waterfowl eggs and young in the Arctic region are sometimes associated with predators gaining access to isolated populations. Predators of spectacled eiders include snowy owls, peregrine falcons, gyrfalcon, pomarine and long-tailed jaegers, rough-legged hawks, common raven, glaucous gulls, Arctic fox, and red fox. Owls, falcons, and hawks kill mostly ducklings and adult eiders, while gulls, ravens, and jeagers prey on eggs and ducklings.

The greatest impact on waterfowl populations often occurs when Arctic fox densities are high and densities of nesting waterfowl are low. Foxes eat eggs, ducklings, and will kill nesting females if given the opportunity. Excessive predation of nesting hens by foxes and other predators can result in imbalanced sex ratios within populations.

Population Dynamics

Population Size

The world population of spectacled eiders, based on winter surveys, is about 375,000 birds (USDOI, FWS 2001b). There are two sub-populations in Alaska: a Y-K Delta nesting population and an Arctic Coastal Plain nesting population. From 1990 to 1992, the Service estimated that 2,000 to 3,000 pairs nested on the Y-K Delta and as many as a few thousand pairs might nest on the Arctic Coastal Plain.

Population Variability
Variability in the abundance of the Alaska breeding population of spectacled eiders is not well understood (USDOI, FWS 1999). The sampling errors around population estimates are large enough to obscure large annual population fluctuations, but ground surveys in the Barrow area suggest that the local breeding populations there fluctuate with fewer spectacled eiders nesting during some years. Breeding populations on the Y-K Delta may currently have stabilized at around 2,000 to 3,000 pairs nesting annually.

Population Stability
The world population of spectacled eiders has declined substantially during the past 30 years, and may be continuing to decline (USDOI, FWS 1999; 2002d). Long-lived species like spectacled eiders typically do not have highly variable populations and unknown mortality factors may be undermining their ability to maintain a stable population. The causes of decline could be varied and are largely unknown, but if the cause of the decline is within the marine environment, it is reasonable to conclude that the Alaska nesting population and the Russia nesting population are being affected similarly because the Russian population and the Alaska population winter together in the Bering Sea.

Endangered Species Act Status of the Spectacled Eider

Reasons for Listing
The Alaskan and Russian populations of spectacled eider were listed as a threatened species on June 9, 1993 (USDOI, FWS 1993). The Service estimates that the Y-K Delta (Y-K Delta) nesting population of spectacled has declined approximately 96 percent since the 1970's (USDOI, FWS 1993). The Service believes that the geographically separate breeding segment in Prudhoe Bay, Alaska, may have declined at a similar annual rate.

Although the factors that caused these declines are unknown, a number of potential contributory factors have been identified. These, or other still-unidentified threats, have increased mortality above the rate of reproductive replacements. No data are available to show whether similar trends have affected the breeding population in Russia where as many as 40,000 pairs traditionally nested. Contributing factors for listing identified by the Service (1993) are:

Habitat Loss. The loss of habitat is not known to be a factor in the decline of the spectacled eider. Breeding habitat that encompasses vast expanses of coastal tundra and ponds remains predominantly unaltered and uninhabited. No development or other substantial threats to the species' principal breeding habitat on the Yukon Delta National Wildlife Refuge are foreseen, but habitat continues to be degraded by lead pellets deposited from years of subsistence hunting on the Y-K Delta nesting grounds and on the Arctic Coastal Plain.

Hunting. Alaskan and Siberian Natives have traditionally harvested eiders and eggs during migration and nesting. The estimated, annual subsistence harvest on the Yukon-Kuskokwim Delta from 1985 to 1992 averaged about 5 percent local nesting population. Low numbers of spectacled eiders are also harvested on the Alaskan Arctic Coastal Plain. Several thousand are believed killed annually in Russia (Shevchenko and Klokov 2001).

Predation. Mammalian and avian predators, particularly Arctic fox, glaucous gulls, and parasitic jaegers all eat eider eggs, young, and occasionally adults.

Eiders historically nested in association with geese possibly as a strategy to reduce predation losses, but when the numbers of geese declined sharply during the past few decades in Alaska, fox predation on eider eggs may have increased. Numbers of gulls and ravens may also have increased in Alaska, resulting in increased predation on eider eggs and hatchlings. Spectacled eiders' nest and brood survival are sometimes high near gull colonies on the Y-K Delta, but increasing populations of gulls and ravens due to human resources that benefit these species may put increasing pressure on spectacled eiders.

Man must also be considered a predator of Steller's eiders. Sport and subsistence hunting of Steller's eiders in the United States is prohibited, but eiders are still killed with firearms (USDOI, FWS 2002c).

Lead Poisoning. Regulations requiring the use of non-toxic shot for hunting waterfowl, cranes, and snipe in Alaska were implemented during the 1991-1992 migratory bird-hunting season (USDOI, FWS 1991). Lead shot is still used by some coastal residents of Alaska and Russia for hunting waterfowl and residual lead shot remains on the tundra or in shallow ponds for years, posing a prolonged risk to eiders. Up to 50 percent of the successfully breeding female eiders in one area of the Y-K Delta can be exposed to lead (Flint et al. 1997). Exposure to lead can lower the annual female survival rate by 34 percent. Exposure to lead shot may affect spectacled eiders similarly in some areas of the Arctic Coastal Plain.

Ecosystem Change. The spectacled eider's principal nesting grounds encompass about 13,000 km^2 (5,000 mi^2) of coastal tundra on the Yukon Delta National Wildlife Refuge. Coastal habitats in the refuge have not been subject to seismic exploration or industrial development. Human use is limited essentially to subsistence activities and refuge operations. No Federal activities are foreseen that threaten the spectacled eider's coastal tundra habitat on this refuge.

At least 13,400 km^2 (5,172 mi^2) of Alaska's Arctic Coastal Plain may be spectacled eider nesting habitat, of which less than 3,240 km^2 (1,250 mi^2) have been developed as oil production fields. No more than 168 km^2 (65 mi^2, 1 %) of the tundra wetlands within the oil fields have been altered by development. Spectacled eiders nest in low numbers in active oil fields and breeding pair densities in Prudhoe Bay are comparable to those in undeveloped regions of the Arctic Coastal Plain.

Marine spectacled eider habitat in the United States may include some or all of the Northern Bering Sea, the Chukchi Sea, and the western Beaufort Sea. Changes in the Arctic ecosystem that may be affecting spectacled eiders are evident (AMAP 2002). For example, research indicates that the size of clams available to the worlds' population of wintering spectacled eiders has shifted to a smaller species, thereby possibly affecting population energetics necessary for subsequent breeding and nesting (Lovvorn et al. 2003).

Range-wide Population Trend

The world population of spectacled eiders has declined substantially during the past 30 years and may be continuing to decline (USDOI, FWS 1999; 2002d). In 2001 the breeding index of 7,370 spectacled eiders on the Arctic Coastal Plain was slightly above the long-term average of 7,072 spectacled eiders, and there was still a non-significant downward trend in annual growth rate (0.982) of the population (Larned et al. 2001b). The 2002 breeding survey index of 6,662 spectacled eiders was closer to the long-term average of 6,896 spectacled eiders, and the population growth rate was not significantly different from 1.0 (Larned et al. 2003).

Critical Habitat

Critical habitat was designated for the spectacled eider on February 6, 2001 (USDOI, FWS 2001b) (Figure 3). Designated critical habitat includes the Y-K Delta nesting area, the Ledyard Bay and eastern Norton Sound fall molting areas, and the Saint Matthew/Saint Lawrence Island wintering area. Nesting areas on the Arctic Coastal Plain were not designated as critical habitat.

Most of the Arctic Coastal Plain breeding population of spectacled eiders likely molts on the 14,000 km^2 (5,400 mi^2) Ledyard Bay critical habitat area. Male spectacled eiders arrive at Ledyard Bay in late June and depart in mid-July (Petersen et al. 1999). Females with broods arrive at Ledyard Bay in mid October and depart in late October. Up to 33,200 spectacled eiders are known to molt in Ledyard Bay (USDOI, FWS 2000b). According to local traditional ecological knowledge, spectacled eiders that molt in Ledyard Bay do not use near-shore habitat within about 2 km from shore (USDOI, FWS 2001c).

Spectacled Eiders in the Proposed Seismic Survey Areas

Spectacled eiders are currently found in relatively moderate numbers within the proposed lease seismic survey areas (Larned et al. 2001a; 2001b). The historical range of the spectacled eider extends east past the Canadian border, but the Arctic Coastal Plain nesting population appears to be currently centered in the National Petroleum Reserve-Alaska, south and west of Barrow (Larned et al. 2001a, TERA 2002, Larned et al. 2001b). Some of the more definitive records of presence within the lease area are summarized below.

Traditional Knowledge
There is a general consensus among Iñupiaq Natives in the Barrow area that there are far fewer eiders in the Barrow area, especially spectacled and Steller's eiders, than there were a few generations ago. Older hunters on the Chukchi Sea and Beaufort Sea coasts can recall thousands of eiders nesting and gathering along the shoreline (USDOI, BLM 1982). The cause of the noted decline is not apparent, but speculation ranges from starvation to pollution to there being too many seagulls today. Observations made at Kivalina, Alaska, in November 1997 suggest that few spectacled eiders are around Point Hope (Georgette 2000).

Previous Studies
Williamson et al. (1966) listed spectacled eiders as occurring in the Cape Thompson area, 30 miles southeast of Point Hope. Spectacled eiders were listed as occupying pelagic, marine littoral, lacustrine, and beach environments. Primary affinity was for marine littoral waters, followed by pelagic waters, lacustrine waters, and beach environments in order of affinity. In this study, pelagic waters extended seaward from 2 miles offshore. Spectacled eiders were listed as present from May 21 through September 26 and uncommon but breeding in the Cape Thompson area.

During the Outer Continental Shelf Assessment Program, Divoky (1987) surveyed the relative abundance and distribution of king, common, and spectacled eiders in the eastern Chukchi Sea from July 16 through October 17. Divoky found that eiders were mostly near shore early in the summer, but moved father offshore later in the summer. The center of relative abundance early in the summer was near Point Hope and from Icy cape to Point Belcher, in mid-summer near Icy Cape, and in late summer farther offshore in the Ledyard Bay molting area.

The Service has conducted systematic aerial surveys of water birds on the Arctic Coastal Plain of Alaska since 1992. One of the objectives of the surveys is to determine the breeding range and relative abundance of the threatened spectacled eider on the North Slope. Spectacled eider nesting distribution on the Arctic Coastal Plain from aerial survey data (Larned et al. 2001a) is included in a report on the distribution of spectacled eiders in the vicinity of Point Thompson, near Prudhoe Bay (TERA 2002).

The movements of 34 Alaskan and 30 Russian spectacled eiders were tracked by satellite from 1993 through 1996 (Petersen 1996; Petersen et al. 1999). Eiders were tracked to molting areas at two locations in Russia and several molting areas in western and northwestern Alaska, including a molting area in Ledyard Bay between Cape Lisburne and Icy Cape. The overwintering area south of Saint Lawrence Island was also discovered during this study.

Biological Status of Kittlitz's Murrelet (*Brachyramphus brevirostris*)

Range
Kittlitz's' murrelet (*Brachyramphus brevirostris*) is found in discontinuous populations in both the east and west North Pacific Ocean and adjacent Arctic waters. In east Pacific

and Arctic waters it ranges from about Taku Inlet in Southeast Alaska north to about Point Barrow in the Chukchi Sea. Major population centers are Prince William Sound and Glacier Bay. Presence in the Beaufort Sea east of Point Barrow has not been confirmed, but it is likely possible they occur there.

Species Description
Kittlitz's murrelet is a small alcid seabird about 25 cm long with no distinct sexual differences in size or coloration, but breeding and winter plumage is distinct. Juvenile plumage is similar to the basic plumage with exception of faint barring visible in the throat and breast areas. Basic coloration in adults is white on the underside with speckled gray and brown plumage topside. Upper wing plumage is dark gray or brown. Kittlitz's murrelet is easily confused with the similar appearing marbled murrelet (*Brachyramphus marmoratus*).

Life History
Longevity
The longevity of Kittlitz's murrelet is unknown, but may be similar to the closely related marbled murrelet. Cooke (1999) reported that two adult marbled murrelets tagged in 1991 were at least 8 years old when recaptured in 1997. Based on predicted survivorship curves, marbled murrelets could live about 30 or 40 years (see Burger (2002).

Age to Maturity
Age to maturity in Kittlitz's murrelets is unknown, but is likely similar to that estimated for marbled murrelets. The average age of first breeding for marbled murrelets is also not known, but based on other alcids of similar size, it is assumed to be between 2 and 5 years, with 3 years as a likely average (DeSanto and Nelson 1995; Beissinger and Nur 1997; Boulanger et al. 1999).

Reproductive Strategy
Little is known about the reproductive strategy of Kittlitz's murrelet because nesting sites are difficult to find (Day et al. 1999). Birds appear to be paired upon arrival to the breeding grounds. Egg-laying ranges from mid-May to mid-June depending on the population and range. One egg per clutch with one clutch per year is speculated. Large-scale non-breeding may be common to Kittlitz's murrelet. Both parents incubate and feed their young. Fledging in northern populations is generally during August.

Recruitment
Little is known about Kittlitz's murrelet recruitment and, as in some long-lived species, recruitment may be dependant on periodic nesting success after an extended period of non-breeding (Day et al. 1999).

Seasonal Distribution Patterns
Summer Distribution. On most parts of their range Kittlitz's murrelets are typically associated with glacially influenced inlets (Day et al. 1999; USDOI, FWS 2004) where they prefer waters within about 200 meters of shore. There are no glacial inlets along the northeast Chukchi Sea coastline, and summer distribution there is based on the surveys of

Divoky (1987). Divoky found Kittlitz's murrelets had pelagic distribution from approximately 21 km to 213 km offshore, with the farthest distance offshore found during the 24 August-22 September survey period.

Breeding Distribution. Breeding distribution is discontinuous within the range in areas believed associated with past glaciations. Kittlitz's murrelets nest at higher elevations (on mountains) and on nunataks. Median elevation of nests is about 760 meters on the southern range and about 335 meters on the northern range. Nests are generally found on scree or talus slopes of about 15 to 25 degrees. Nest construction varies from a small depression in gravel to bare rock or even on snow. Nest are often associated with a nearby large rock or boulder that might give protection from wind.

Nests have been found at the distal end of the Delong Mountains south near Cape Thompson (USDOI, FWS 2004). The Center for Biological Diversity (CBD) believes the species nests as far north as Cape Beaufort between Cape Lisburne and Point Lay (CBD 2001). Information regarding fidelity to nesting sites is not available (Day et al. 1999).

Post-breeding Distribution, Fall Migration, and Molting. Post-breeding distribution is poorly understood, but is likely farther offshore than pre-breeding season. Juveniles fledge in about 24 days by fluttering down hill or using streams to assist passage to marine waters. Fall migration in the Chukchi Sea population is unknown, but is likely ahead of the advancing ice front. Juvenile Kittlitz's murrelets do not associate with adults or other juveniles at sea after fledging. Kittlitz's murrelets molt twice each year.

Winter Distribution. Winter distribution is poorly understood, but is probably pelagic. Populations along the Gulf of Alaska probably spend the winter over the continental shelf (Day et al. 1999). A few birds have been seen near the edge of pack ice in the Bering Sea and in polynyas south of the Chukotka Peninsula (Konyukhov 1990). Kittlitz's murrelets seen along the Chukchi Sea coast in summer probably move south with the advancing ice front and spend winter in the Bering Sea.

Spring Migration. Spring migration for Kittlitz's murrelets in the Chukchi Sea is unknown, but it could be assumed they follow the retreating ice front in spring. Kittlitz's murrelets may follow offshore leads north to take advantage of the abundant under ice plankton blooms and the large biomass of forage species associated with those blooms.

Bioenergetics

Similar to other small seabirds, Kittlitz's murrelets may be living close to their bioenergetic threshold most of the year and must forage with regularity to survive.

Food Habits

Summer foods are primarily forage fishes including sand lance (*Ammodytes hexapterus*) and Pacific herring (*Clupea pallasii*), but also include macro-zooplankton and other mid-water crustaceans (Day et al. 1999). The diet of the Chukchi summer residents is unknown, but Kittlitz's murrelets along the Chukchi coast during summer may be feeding on Arctic cod (*Boreogadus saida*), Pacific sand lance, capelin (*Mallotus villosus*), or euphausiids that are relatively abundant in some localities. Winter foods are unknown, but may consist mostly of pelagic euphausiids or other macro-invertebrates.

Predators

Predator species vary by locality. In some Gulf of Alaska populations, bald eagles (*Haliaeetus leucocephalus*) peregrine falcons (*Falco peregrinus*), and ravens (*Corvus corax*) are known predators (Day et al. 1999; USDOI, FWS 2004). In Arctic populations, where there are few eagles and ravens, primary predators of eggs or nesting or juvenile murrelets likely include foxes, peregrine falcons, rough-legged hawks (*Buteo lagopus*), jaegers (*Stercorarius* spp.), glaucous gulls (*Larus hyperboreus*) or Arctic ground squirrels (*Spermophilus parryii*).

Population Size

Recent population estimates for more southern populations are available (USDOI, FWS 2004), but estimates are dated for the Chukchi Sea population. Divoky (1987) surveyed the Chukchi Sea from Bering Strait to Point Barrow (Figure 4) between 16 July and 17 October 1987 and estimated the abundance of Kittlitz's murrelets at 15,000 during August and October. Divoky attributed this high estimate of Kittlitz's murrelets to an atypically large influx of Bering Sea water to the Chukchi Sea in 1987. More recent estimates are not available (USDOI, FWS 2004), but if the Chukchi Sea population has declined at a rate similar to that believed for other populations, it is likely there are far fewer Kittlitz's murrelets in the northeast Chukchi Sea today. The Center for Biological Diversity estimates the Kittlitz's murrelet population along the Chukchi Sea coastline (including Wrangel Island) was 450 in 1993 and 171 in 2000 (CBD 2001).

Endangered Species Act Status of the Kittlitz's Murrelet

The Kittlitz's murrelet is proposed for listing as threatened or endangered under the Endangered Species Act (ESA) of 1973, as amended. The Center for Biological Diversity (CBD) petitioned the Secretary of Interior to list Kittlitz's murrelet as endangered under the ESA on May 9, 2001.

The Service reviewed the status of Kittlitz's murrelet in 2004 (USDOI, FWS 2004) and determined the following:

> Kittlitz's murrelet (*Brachyramphus brevirostris*)--Kittlitz's murrelet is a small diving seabird whose entire North American population, and most of the world's population, inhabits Alaskan coastal waters discontinuously from Point Lay south to northern portions of Southeast Alaska. Kittlitz's murrelet is a relatively rare seabird. Most recent population estimates indicate that it has the smallest population of any seabird considered a regular breeder in Alaska (9,000 to 25,000 birds). This species appears to have undergone significant population declines in three of its core population centers -- Prince William Sound, Malaspina Forelands, and Glacier Bay. As populations become smaller, they become increasingly vulnerable to events that may result in extirpation. Causes for the declines are not well known, but likely include: habitat loss or degradation, increased adult and

juvenile mortality, and low recruitment, and we believe that glacial retreat and oceanic regime shifts are the factors that are most likely causing population-level declines in this species. Existing regulatory mechanisms appear inadequate to stop or reverse population declines or to reduce the threats to this species.

Consequences of the Proposed Action

The proposed seismic survey activities could affect Steller's and spectacled eiders when they are in near-shore marine waters. Male and failed female spectacled eiders typically leave the inland coastal nesting areas for near-shore marine waters by late June where they may join non-breeders to stage for migration to molting areas. Most spectacled eiders that nest on the Arctic Coastal Plain probably migrate to Ledyard Bay inshore of the 20-meter (65-foot) isobath to molt. At Ledyard Bay they tend to concentrate in waters from between 5 to 25 meters (16.4 to 82 feet) deep and from 19 to 48 km (12 to 30 miles) offshore (Petersen et al. 1999). Steller's eiders migrate to the Bering Sea to molt. Successful females and their broods leave the nesting grounds later in the summer and in early fall.

The Chukchi Sea Kittlitz's murrelet population, being far from centers of abundance, occupies marginal habitat at the fringe of its geographical range. During a normal year the density of Kittlitz's murrelets in the northeast Chukchi Sea is probably very low, and it would be infrequently encountered. If Divoky (1987) is correct, there might be years of higher abundance due to larger than normal influxes of Bering Sea water and associated higher than normal abundance of prey species.

Consequences of the proposed seismic activities on threatened or endangered birds can be grouped into four general categories:

- Disturbance from the physical presence of vessels
- Disturbance from noise by vessels, seismic airguns, and support aircraft
- Collision with vessels or aircraft
- Direct and indirect results of petroleum product spills from vessels

Disturbance from the physical presence of vessels

Steller's eiders are generally tolerant of and can habituate to occasional disturbance by vessel traffic and exposure to human activity during winter, but observations during winter abundance-distribution surveys suggest that they are more wary than many other species of sea ducks (COE 2000a; 2000b; 2000c). Flocks of king eiders observed during winter surveys for Steller's eiders appear to be less wary than do Steller's eiders (COE 2000a). Occasional or infrequent disturbance would not likely have a substantial impact, but repeated physical disturbance from vessel traffic could disrupt feeding activities that could result in Steller' eiders, a small bodied sea duck, moving closer to their energetic threshold. Consequently, disturbance to Steller's eiders by the physical presence of a vessel during seismic survey activities is expected to be minimal.

Spectacled eiders, however, winter within the pack ice south of Saint Lawrence Island. These wintering areas are inaccessible to all but the largest ice breaking vessels; consequently, the reactions of large concentrations of spectacled eiders to physical presence of vessels are not well known, but they could react similarly to flocks of king and common eiders observed during winter surveys for Steller's eiders (ibid).

Repeated vessel presence in Ledyard Bay critical habitat area during the spectacled eider molt period could disturb molting eiders with unknown results. Excluding Ledyard Bay during the molt period, the density of eiders in other areas of the Chukchi and Beaufort seas is expected to be relatively low, and survey and support vessels would mostly operate beyond the coastal areas occupied by most eiders (Figure 1). Survey and support vessels operating in near-shore coastal areas where eiders are sparsely or only temporarily concentrated are not expected to have other than very temporary and localized disturbance effects. Implementation of mitigation measures could avoid or minimize vessel-related disturbances to molting eiders in Ledyard Bay.

Reaction of Kittlitz's murrelets to the seismic survey vessels would likely be to dive and swim away from the vessel. The Corps of Engineers has made anecdotal observations of diving seabirds (including pigeon guillemots, *Cepphus columba*) in proximity to large, slow moving vessels many times during Steller's eiders surveys conducted for navigation improvements at various Alaska locations including Ouzinke, Sand Point, and Unalaska (COE 2000a; 2000b; 2000c). Diving seabirds did not appear to be stressed or otherwise negatively affected by the presence of moving vessels and the presence of survey vessels near pelagic Kittlitz's murrelets in the Chukchi Sea is not expected to have other than minimal temporary disturbance effects as well.

Disturbance from noise by vessels, seismic airguns, and support aircraft
Vessel Noise. Diving would subject a bird to the noise produced by the vessel's engines and propellers. The loudness of the noise would depend on the proximity of the vessel and other conditions including tone, presence of thermoclines, and depth that affects propagation, and other ambient noise producers including wind, rain, and waves. Vessels typically produce low frequency noise of varying intensity depending on the type and speed of the vessel. Vessel noise covers a wide range of frequencies from about 10 Hz to 10 KHz, with much of the noise emitted from larger vessels in the lower frequencies. A smaller vessel of the type used for surveying would be expected to produce noise in the range of 130 to 160 decibels re 1 $\mu Pa\ m^{-1}$ at up to over 100 Hz depending on its speed and cavitation produced by the propeller or thrusters. Noise from the seismic survey vessels might be similar to a tug-barge combination that can produce up to 162 db re 1µPa-m at 630 Hz, while moving at about 18.5 km\hr (10 knots) (Richardson et al. 1995).

The effects of vessel noise on Steller's eiders are not documented, but anecdotal observations during surveys in Ouzinki, Sand Point, and Unalaska indicated Steller's eiders were tolerant of low frequency noise produced by mostly large and smaller commercial vessels (COE 2000a, 2000b, 2000c). A possible exception to the apparent tolerance of noise by Steller's eiders might be the high frequency noise that outboard engines produce (150+ db re 1µPa-m at 6,300+ Hz). During winter surveys at Sand Point, Alaska, Steller's eiders that remain calm at the approach and passing of larger vessels were noted to take flight or dive at the approach of an outboard powered boat

(COE 2000b. It is not known, however, if the observed flight reaction was due to acoustic or visual cues.

Reactions of spectacled eiders to low-frequency vessel noise is expected to be similar to that observed for Steller's eiders, king and common eiders, and long-tailed ducks, scoters and other seabirds during winter abundance surveys in harbor areas including Sand Point, Ouzinkie, False Pass, and Unalaska (COE 2000a; 2000b; 2000c). The reaction of sea ducks and seabirds to larger vessels appeared to be relative tolerance, while the reaction to smaller outboard powered boats was wariness and flight.

The presence of survey vessels near pelagic Kittlitz's murrelets in the Chukchi Sea is not expected to have other than minimal temporary disturbance effects.

Overall, the reaction of threatened or endangered birds to seismic survey vessel noise would be similar to those caused by other large vessels transiting the action area. Any adverse effects would be negligible.

Seismic Airgun Noise. Much of the noise emitted during seismic surveys originates from air guns towed behind survey vessels. The source levels for air gun arrays are in the 230 to 255 db re 1μPa-m range depending on the array of guns used and can exceed 140 db re 1μPa-m out to approximately 32 km (20 miles) (Richardson et al. 1995). Air guns release underwater pulses that can remain above ambient noise out to distances exceeding 97 km (60 miles) depending on the bathymetry of the survey area. Air gun impulses are microseconds in duration and can range from about 8 to 24 pulses per second depending on the survey depth. The frequency of firings is variable depending on the survey. A typical 32-gun array emits peak levels of 210 db re 1μPa-m at 50 Hz (Vella et al. 2001).

There is little information regarding the effects of this activity on seabirds (Mosbech et al. 2000), but diving birds are more likely to be affected than birds that remain on or very near the surface (LGL 2001). The effects of seismic surveys on Steller's eiders have not been documented, but studies of underwater seismic surveys on flightless long-tailed ducks (*Clangula hyemalis*) suggest that seismic surveys do not have appreciable effects on the movement or diving behavior of this sea duck species (Lacroix et al. 2003). Noise from seismic survey in offshore waters is not expected to have a substantial effect on Steller's or spectacled eiders because they are mostly found in near-shore waters and noise produced in offshore waters attenuates as it approaches shallow water, especially over soft substrates. Eiders are likely to hear the advance of the slow-moving survey vessel and associated airgun operations and move away. "Ramp-up," which is a gradual increase in decibel level as the seismic activities begin, can mitigate some adverse impacts to birds capable of detecting the noise and dispersing from disturbed areas before harm occurs.

Airgun pressure waves could affect prey resources of eiders and murrelets. Research indicates that there are few effects on invertebrates from noise produced by airguns unless the invertebrate is within a few feet of the source (Brand and Wilson 1996;

McCauly 1994). Consequently, noises from seismic surveys are not likely to decrease the availability invertebrate crustaceans, bivalves, or mollusks.

Seismic surveys using airguns can disturb and displace fishes and interrupt feeding (Pearson et al. 1992), mating, or other behaviors, although information suggests that displacement may be relative to the ecology of species involved (e.g., demersal versus pelagic). Studies show that some pelagic or nomadic fishes leave the survey area during seismic surveys for at least 5 days and longer (Table III.F.3) (Engas et al. 1996; 1993; Løkkeborg and Soldal 1993). Scientists believe the catch reductions are a result of altered fish behavior due to airgun emissions, causing fish to either be less likely to take hooks and/or move away from the airgun emissions. Areas apparently affected extended up to 33 km (20.5 mi) from the survey center. The impacts of seismic noise on pelagic Kittlitz's murrelets might be temporary displacement and cessation of feeding within a few kilometers of the survey activities.

Kittlitz's murrelets feed by diving to several meters or more. The murrelets also escape from boats by diving when the vessel is close. It is possible, during the course of normal feeding or escape behavior that some birds could be near enough to an airgun to be injured by a pulse. Although MMS has no information about the circumstances where this might occur, the reactions of birds to airgun noise suggest that a bird would have to be very close to the airgun to receive a pulse strong enough to cause injury, if that were possible at all. Murrelets and other diving birds are likely to hear the advance of the slow-moving survey vessel and associated airgun operations and move away. "Ramp-up," which is a gradual increase in decibel level as the seismic activities begin, can help disperse birds capable of detecting the noise before harm occurs. A mitigation measure to document bird reactions to seismic survey vessel activities may help further evaluate the potential for murrelets to be harmed by airgun noises.

Overall, the potential that eiders or murrelets would be harmed by airgun noise during seismic survey activities appears low.

Support Aircraft Noise. Aircraft operating at low altitudes may disturb birds that are in the path of the aircraft. Implementation of mitigation measures could reduce the magnitude and frequency of aircraft-related noise disturbances to eiders and murrelets.

Collision with vessels and aircraft

Vessel Strikes. Many working vessels are equipped with high-intensity lights that illuminate a wide area around the vessel, to which seabirds, including eiders, are attracted. Survey and supply vessels are likely to be equipped with these high-intensity lights. Most seabird collisions occur on winter range during hours of darkness, but collisions can occur during times of restricted visibility due to rain or fog.

Attraction to artificial light and collision with a survey or supply vessel during the northward migration of Steller's and spectacled eiders is not expected because the northern migration is in May, and vessels, with the exception of icebreakers, typically do not enter the Chukchi Sea until July. In July and August almost 24-hour daylight prevails, and vessels operating during daylight would be less likely to be operating with high-intensity lights on.

Day-length decreases following the summer solstice and survey vessels would be more likely to operate with lights on in the late summer and early fall. This is the time when successful hens stage their broods in marine waters to prepare for migration to molting areas. Vessels operating outside about the 20-meter isobath are not likely to encounter eiders because eiders typically migrate near-shore inside the 20-meter isobath. Vessels operating with high-intensity lights near shore would have a higher potential of attracting eiders during this operating period.

Because spectacled eiders do not all molt at the same time, survey vessels operating in Ledyard Bay during the molt would encounter eiders that are flightless and able to fly. A survey vessel passing through the molting area with high-intensity lights on in inclement weather could present a high risk of collision with the portion of spectacled eiders that are able to fly. Implementation of mitigation measures could avoid or minimize the risk that eiders would be attracted to and collide with survey vessels.

As of 1999 there were no records of Kittlitz's murrelets striking vessels (Day et al. 1999). The potential for a Kittlitz's murrelet colliding with a lighted survey vessel exists. The risk of collision, however, is considered to be small because: (1) the action area is relatively large, (2) Kittlitz's murrelets are expected in very low density and limited in distribution (Divoky 1987), and (3) the surveys are expected to be relatively short in duration.

Endangered Species consultations regarding other species may require implementation of "exclusion zones" intended to avoid harming marine mammals (primarily bowhead whales). Qualified observers would be onboard the seismic survey vessels and these vessels would likely survey during darkness and restricted visibility with high-intensity lights on to assist the observers ability of detect marine mammals within the "exclusion zone". This requirement would influence the risk of attracting endangered eiders and other seabirds to the survey vessel, with potentially fatal results.

Aircraft Strikes. Seismic survey support aircraft operating at low altitudes have the potential to flush birds into the path of the aircraft where a collision could occur. While such strikes are relatively rare, implementation of mitigation measures could further reduce the frequency of strike risk to eiders and murrelets.

Direct and indirect results of petroleum product spills from vessels

Direct Results. Seismic survey activities involve vessels and aircraft that can introduce petroleum products to the environment through accidents. Accidental releases of petroleum products near large concentrations of Steller's or spectacled eiders are potentially a serious threat because of the toxicity of petroleum to birds during and after a spill event.

Small numbers of Steller's and spectacled eiders of the Alaska nesting population are expected to stage along the Chukchi and Beaufort coast from late June through September. These eiders could be directly affected by a spill from a vessel that might drift into near-shore waters where eiders are more likely to congregate. The coastal area where oiling would likely have the greatest affect on Steller's eiders is the coastline between Wainwright and Dease Inlet where most of the post-nesting Steller's eiders are likely to temporarily congregate.

Spectacled eiders in the Chukchi Sea are believed to congregate along a wider expanse of coastline between Point Hope and Wainwright (Point Belcher) depending on the time of summer (Divoky 1987). Larger numbers of spectacled eiders are expected to gather in the Ledyard Bay Critical Habitat area (Figure 1) from about late June through mid-October (Petersen et al. 1999). In the near-shore Beaufort Sea, relatively small numbers of spectacled eiders are likely to be found from Point Barrow to about Point Thompson, with most found between Point Barrow and Cape Halkett (Larned et al. 2001a).

Direct oiling of eiders and murrelets would likely result in loss of feather insulation and acute and chronic toxicity from ingestion and absorption. Oiled birds could also carry oil to nests where eggs and young could be oiled.

A petroleum spill in the Ledyard Bay critical habitat area during the molt (late June through mid-October) could affect large numbers of flightless spectacled eiders. Spills that occur along other coastal areas of the Chukchi and Beaufort seas during summer would have the potential of oiling smaller numbers of Steller's and spectacled eiders and Kittlitz's murrelets depending on the timing of a spill.

Both sexes of Kittlitz's murrelets incubate eggs and fish for their young. Lightly oiled murrelets would likely bring oil contamination back to their nest where eggs and young could be contaminated. Lightly oiled murrelets could also bring contaminated food to the nest. Heavily oiled murrelets would be prevented from returning to the nest resulting in the young dying of starvation.

Indirect Results. A life-history strategy of long life and low annual reproductive effort would be expected to evolve under conditions of predictable and stable non-breeding environments (Sterns 1992). The life history strategy of the Steller's and spectacled eiders seems to fit this model. That is, eiders are long-lived, have low annual recruitment, and mostly inhabit productive and reasonably stable near-shore marine environments. Because the Steller's eider is relatively small-bodied and winters at northern latitudes, it may do so near the limits of its energetic threshold. Environmental perturbations that reduce prey availability or increase the species energetic needs may harm Steller's eiders.

Steller's eiders are coastal sea ducks that feed on bottom-dwelling mollusks and small crustaceans in coastal water less than about 9 meters (30 feet) deep. Fuels and oils are toxic to Steller's eiders and their food resources including amphipods and snails. Therefore, spilled petroleum is also likely to indirectly affect Steller's eiders through harm to food resources or other habitat parameters. These indirect effects can result in lowered fitness for migration to molting areas, and ultimately lower winter survival.

Although spectacled eiders are capable of diving to greater depths than Steller's eiders and some other species of sea ducks, non-breeders, failed breeders, and post breeding males occupy shallow-water, near-shore coastlines during summer. Spills of petroleum products into near-shore areas at any time of year could contaminate the food resources and habitat of spectacled eiders. Contamination of food resources can result in latent mortality due to toxicity or reductions in fitness.

The density of Kittlitz's murrelets in the Chukchi Sea is so low that the probability of contacting more than a few murrelets is also low. According to the survey by Divoky (1987), the highest probability of contact is near Ledyard Bay. Implementation of mitigation measures could decrease the risk of accidents occurring near Ledyard Bay.

According to oil spill records, most accidental spills in Alaska happen in harbors or during groundings; consequently, spills from vessels on the high seas where pelagic murrelets are mostly found in the Chukchi Sea would be a rare occurrence. However, loss of more than a few birds from a population with numbers as low as the Chukchi Sea breeding population could slow or jeopardize recovery in that part of the species range.

The MMS believes that the risk of incidents involving the release of oil and fuel from vessels during seismic survey activities will likely be small. This conclusion is based on the assumption that there would be no unauthorized discharges from the seismic vessel, such as the discharge of engine oil, etc. Therefore, any effects would be due to accidental discharges, such as a spill of fuel oil during a fuel transfer from a support vessel to a seismic vessel. The MMS assumes further that the operators would be cautious and vigilant during fuel transfers; for example, if a fuel hose broke, the fuel valves would be shut off quickly.

Cumulative Effects Analysis

Although the range of Steller's eiders is sometimes described as extending east across the ACP to Prudhoe Bay, it is unlikely they currently range or nest in significant numbers farther east than about Cape Halkett or Teshekpuk Lake, 75 miles east of Barrow (Quakenbush et al. 2002). The range of spectacled eiders extends east past Prudhoe Bay.

Human development in this area of the Arctic Coastal Plain is sparse and limited to several small communities that include Point Hope, Point Lay, Wainwright, Barrow, and Nuiqsut. The closest industrial development of size southwest of the lease area is the Red Dog Mine Portsite near Kivalina and the closest industrial development east of Teshekpuk Lake is the Kuparuk and Prudhoe Bay oil fields.

The State of Alaska is considering leasing additional state-owned tide and submerged lands lying between the Canadian border and Point Barrow (ADNR 1999). Oil development of near-shore waters under state jurisdiction could add to disturbance potential, habitat loss, and collision potential experienced by Steller's and spectacled eiders in the Beaufort and Chukchi Sea regions.

Arctic ice is thinning due to global climate change, and both commercial and military large-vessel traffic in the Northeastern Chukchi and Beaufort seas might increase as shipping lanes stay ice-free for longer periods of time. Global climatic change, however, would likely have significant stochastic impacts on Steller's eiders that surpass the impacts of increasing large-vessel traffic in the Arctic. Increasing large-vessel traffic in the Arctic would increase the risk that Steller's and spectacled eiders could be exposed to oil spills resulting from vessels sinking and grounding. The probability of increased traffic by large vessels, however, is difficult to predict and is likely to be more than 50 years in the future.

Recommended Mitigation

The following measures would be implemented to mitigate potential negative effects on threatened, endangered, and candidate bird species during proposed seismic survey activities within the Chukchi and Beaufort OCS planning areas:

- Disturbance
    - Seismic surveys would be conducted in the Ledyard Bay critical habitat area (Figure 3) before July 1 or after October 15.
    - NMFS and MMS-approved observers would record responses of marine birds and waterfowl to seismic survey operations. Important aspects to record are reaction distances, bird molting status, differences in reaction by, flock size, weather conditions and whether birds moved out of the area or returned once the vessel passed by.
    - Seismic survey support aircraft would avoid overflights of the Ledyard Bay critical habitat area between July 1 and 15 October unless aircraft were 450m AGL or health/human safety dictates otherwise.

- Collisions with Vessels or Aircraft
    - Seismic survey vessels would minimize operations that require high-intensity work lights inside the 20-meter bathymetric contour. High-intensity lights should be turned off in inclement weather when the vessel is not actively conducting surveys. Navigation lights, deck lights, and interior lights could remain on for safety.
    - All bird-vessel collisions would be documented. Minimum information will include species, date/time, location, weather and operational status of survey vessel when the strike occurred. Eiders or murrelets injured or killed through collision with survey vessels should be recovered and survey personnel should contact the Fairbanks Fish and Wildlife Field Office, Endangered Species Branch, Fairbanks, Alaska, at 907-456-0499 for instructions on the handling and disposal of the injured or dead bird.
    - Seismic survey support aircraft would maintain at least 450m AGL over beaches, lagoons, and near-shore waters as much as possible.

Summary of Effects
Potential negative effects of the proposed seismic survey activities on Steller's and spectacled eiders can be summarized in categories of:

- Disturbance from the physical presence of vessels
- Disturbance from noise by vessels, seismic airguns, and support aircraft
- Collision with vessels or aircraft
- Direct and indirect results of petroleum product spills from vessels

It would be difficult to quantify effects in terms of number of eiders potentially affected or areas of habitat potentially modified or lost because the area of the proposed seismic survey areas is very large and specific knowledge of eider distribution and density within the survey area is limited. Consequently, a summarization of effects will be in general terms that address the potential effects of pre-lease seismic activities on Steller's and spectacled eiders and Kittlitz's murrelets within the survey area.

Disturbance from the physical presence of vessels
Seismic vessel activity is expected to have only temporary and localized disturbance effects on relatively small numbers of Steller's and spectacled eiders because of the relatively low density of eiders spread over a very large area. Consequently, Steller's and spectacled eiders staging or migrating along the Chukchi and Beaufort sea coast are not expected to experience adverse effects from potentially disturbing routine activities during seismic surveys because migration intervals are relatively brief. Similarly, disturbance to murrelets are expected to be minimal as murrelets occur in low densities in more offshore waters.

An exception is potential disturbance to spectacled eiders in Ledyard Bay when they gather to molt. In Ledyard Bay, repeated disturbance of flightless eiders could move molting eiders near their energetic threshold and result in lower than desired fitness for winter survival in the Bering Sea. Implementation of mitigation measures would largely avoid or minimize vessel-related disturbances to spectacled eiders molting in the Ledyard Bay critical habitat area.

Disturbance from noise by vessels, seismic airguns, and support aircraft
Vessels would be slow-moving in areas where eiders and murrelets are at low densities. Implementation of mitigation measures would largely avoid and minimize disturbance impacts to spectacled and Steller's eiders and Kittlitz's murrelets from vessel, airgun, and aircraft noise.

Collision with vessels or aircraft
Eiders, like other seabirds, can be attracted to lights and vessels in near-shore waters where Steller's and spectacled eiders are mostly found. An eider or murrelet striking a vessel could be injured or killed. Potential mortality from being attracted to and colliding with seismic survey vessels is more likely to occur inside the 20-meter isobath were the

majority of eiders are believed to migrate. An unknown number of eiders are expected to be attracted to the lights of seismic vessels during the survey period, but implementation of mitigation measures could further reduce risk that birds fly into survey vessels. Similar measures outside the 20-meter isobath could reduce impacts to Kittlitz's murrelets and other seabirds.

Direct and indirect results of petroleum product spills from vessels
Steller's and spectacled eiders are expected to be in the seismic survey areas from about mid-May through mid-October annually. This is the period of time when eiders could be directly affected by oil spills, vessel disturbance, and aircraft disturbance. Direct effects of contact with oil are loss of insulation, death from hypothermia, death from exhaustion, death from ingestion and absorption, transfer of toxicity to eggs and ducklings, and death of eggs and ducklings.

Indirect affects to Steller's and spectacled eiders could result from oil spilled when the eiders are or are not present in the survey areas. Indirect effects might be contamination of food resources that would lessen the diversity, abundance, or caloric value of food resources. Indirect affects on food resources could ultimately affect nesting success, and overwinter survival.

With exception of Ledyard Bay where large number of spectacled eider concentrate to molt, the distribution and density of Steller's and spectacled eiders along the Chukchi and Beaufort Sea coast within the seismic survey area is transitory and localized, and local oil spills would not affect large numbers of eiders or large areas of habitat. Consequently, local spills could affect a small number of eiders, but would not be likely to have an overall adverse effect on the species or Alaska population or jeopardize species recovery.

A spill in the vicinity of Ledyard Bay during the late June through mid-October molt period (Petersen et al. 1999) could affect large numbers of flightless spectacled eiders resulting in significant harm to the Arctic Coastal Plain breeding population of spectacled eiders through potential stochastic effects.

Implementing best management practices would make the risk of vessel-related spills in the action areas very small.

Determination of Effects
Because the Steller's and spectacled eiders are listed as threatened or endangered under Section 7 of the Endangered Species Act, this section considers the following categories.

- The proposed actions would have *no effect* on the listed species,
- The proposed actions *may affect* the listed species.
- The proposed action is *likely to adversely affect* the listed species.
- The proposed action is *not likely to adversely affect* the listed species.
- The proposed actions are *likely to adversely modify* critical habitat for a listed species.
- The proposed actions are *not likely to adversely modify* critical habitat for a listed species.

It is determined through this biological evaluation that the proposed Chukchi Sea and Beaufort Sea OCS seismic surveys would likely have the following level of effects on Steller's and spectacled eiders and Kittlitz's murrelets:

- Listed and Candidate Species
    - Seismic Survey activities *are not likely to adversely affect* Steller's or spectacled eiders because such activities are dynamic, relatively short term in nature, and include mitigation measures to avoid or minimize potential impacts.
    - Seismic Survey activities *are not likely to adversely affect* Kittlitz's murrelets because such activities are dynamic, relatively short term in nature, and include mitigation measures to avoid or minimize potential impacts.

- Ledyard Bay Critical Habitat Area
    - Seismic survey activities within the Ledyard Bay critical habitat area for spectacled eiders are *not likely to adversely modify* the critical habitat because the activities are relatively short term in nature, result in short-term impacts, and can be timed to minimize contact with molting spectacled eiders.

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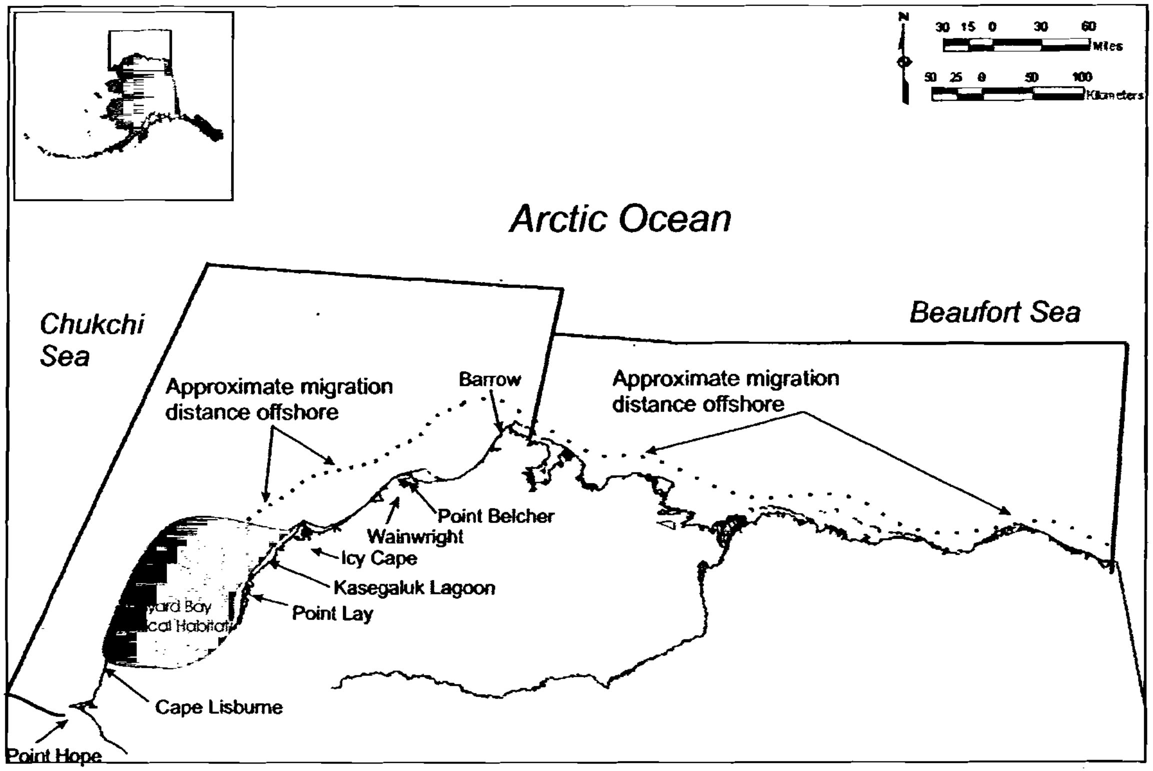

Figure 1: Action area boundaries and approximate distance from shore that Steller's and spectacled eiders migrate (20 m isobath).

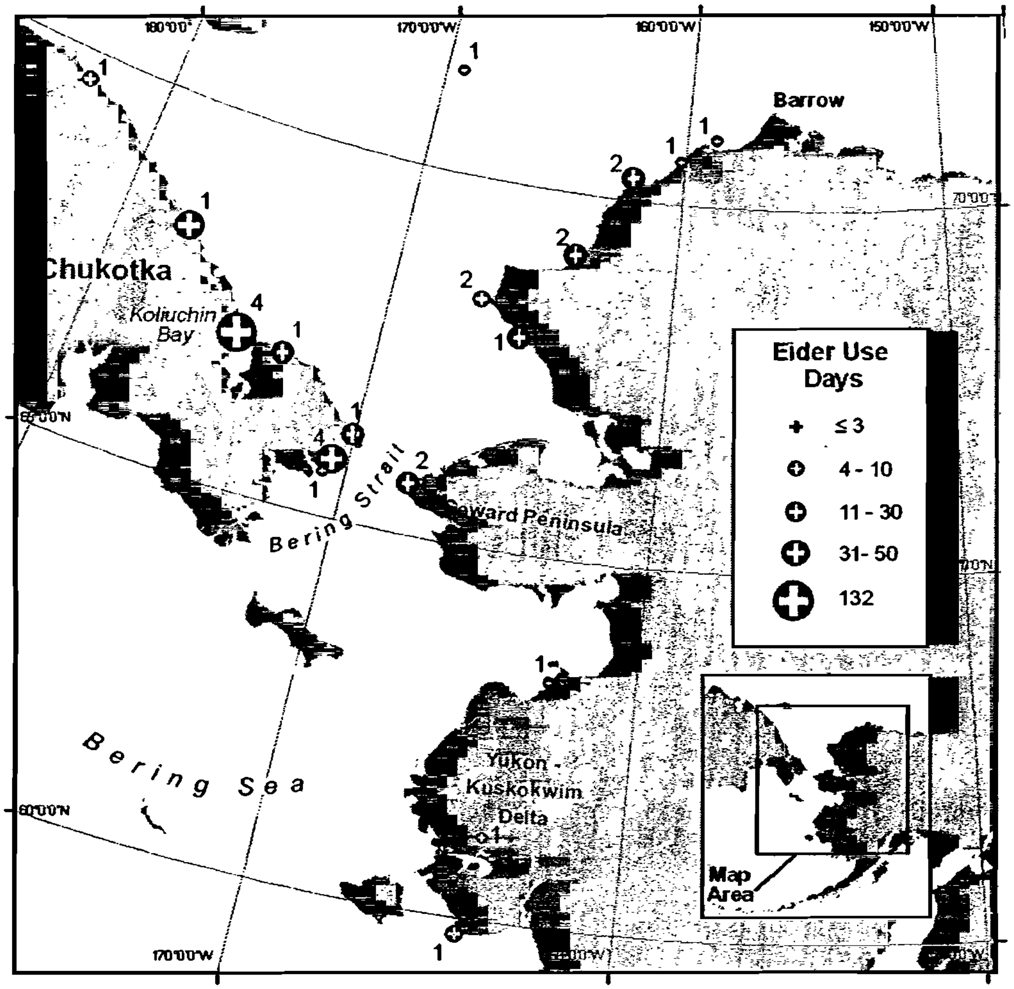

Figure 2: The number of days Steller's eiders tagged at Barrow used specific areas of the Alaska-Russian coastline after nesting (Philip Martin 2001 personal communication).

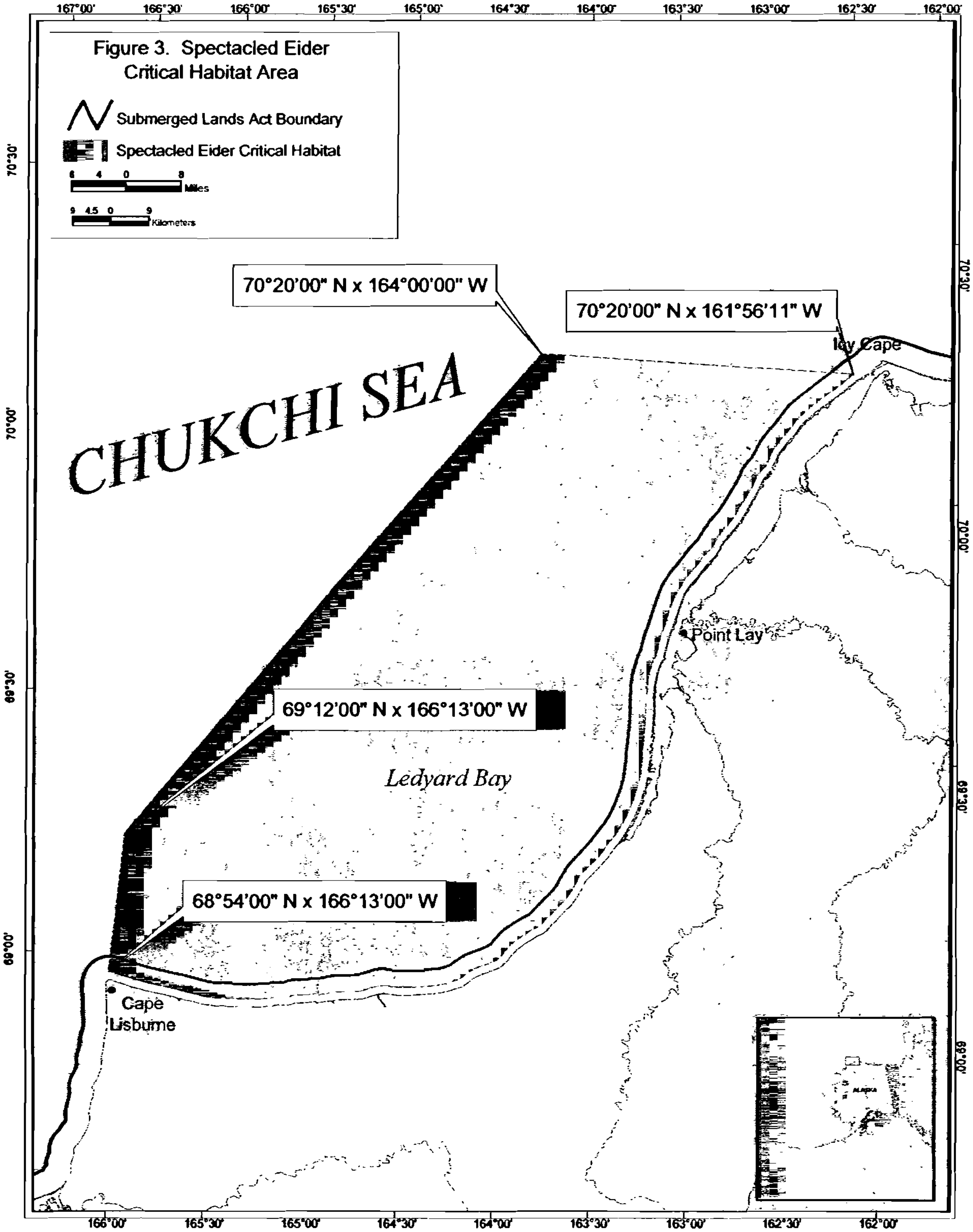

Figure 3: Spectacled Eider Critical Habitat Area. Ledyard Bay is defined as the area bound by the following description: from the point 1 nm true north of Cape Lisburne (68°54'00" N x 166°13'00" W), remaining 1.0 nm offshore of the mean low tide line (maintaining a 1.0 nm buffer from the mean low tide line) of the Alaska coast north and east to 70°20'00" N x 161°56'11" W (1 nm offshore of Icy Cape); thence west along the line of latitude 70°20'00" N to the point 70°20'00" N x 164°00'00" W; thence along a great circle route to 69°12'00" N x 166°13'00" W; thence due south to the point of origin 1 nm true north of Cape Lisburne (68°54'00" N x 166°13'00" W) (USDOI, FWS 2001a).

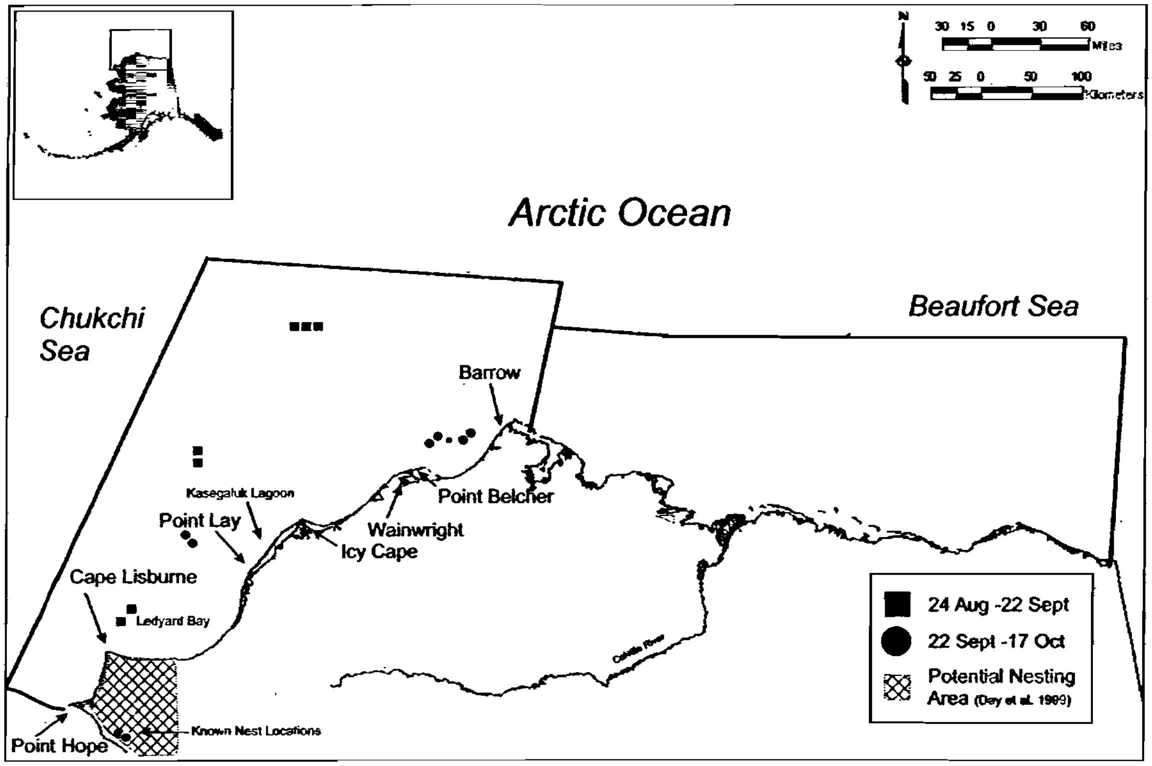

Figure 4: Boundaries of action area and Kittlitz's murrelet offshore observations (Divoky 1987) and nesting area (USDOI, FWS 2004).