BEFORE THE SECRETARY OF THE INTERIOR

PETITION TO LIST THE KITTLITZ'S MURRELET (*BRACHYRAMPHUS BREVIROSTRIS*) AS ENDANGERED UNDER THE ENDANGERED SPECIES ACT

May 9, 2001

CENTER FOR BIOLOGICAL DIVERSITY
COASTAL COALITION
EYAK PRESERVATION COUNCIL
LYNN CANAL CONSERVATION, INC.
SITKA CONSERVATION SOCIETY
PETITIONERS

EXECUTIVE SUMMARY

The Kittlitz's murrelet, *Brachyramphus brevirostris*, is a small diving seabird in the Alcid family which breeds only in certain sections of coastal Alaska and to a limited extent in the Russian Far East. The largest known populations occur in Southeast and Southcoastal Alaska, where dramatic population declines have been observed over the past decade or so. In Prince William Sound, data show an average 14.5% annual decline between 1989 and 1998. Recent surveys also suggest a decline of 80% in Glacier Bay between 1991 and 1999. The current worldwide population likely numbers approximately 10,000 individuals, a dramatic decline from the several hundred thousand estimated to occur in the Gulf of Alaska alone in 1972.

The Kittlitz's murrelet is a unique seabird that forages in the summer almost exclusively at the face of tidewater glaciers or near the outflow of a glacial stream. This species typically nests high in rugged coastal mountains in bare spots among the snow and ice, where females lay one egg per year. The diet of the Kittlitz's murrelet consists of forage fish and macrozooplankton. The Kittlitz's murrelet is related to the marbled murrelet, and overlaps considerably with it in range. However, the Kittlitz's murrelet is differentiated from the marbled murrelet by its highly specific glacial-affected habitat requirements.

The Kittlitz's murrelet is in need of protection under the Endangered Species Act. The species is threatened by a variety of factors including widespread reproductive failure, the elimination of suitable breeding and foraging habitat by global warming, reduction in its forage fish prey due to a climactic regime shift, oil spills, disturbance from tourism and other vessel traffic, fisheries bycatch, and other factors. Each of these threats is described in detail in this petition. One or more of these factors is likely responsible for the observed population declines. The Kittlitz's murrelet is on a trajectory towards extinction and merits prompt listing under the Endangered Species Act.

NOTICE OF PETITION AND PETITIONERS

Center for Biological Diversity
P.O. Box 40090
Berkeley, CA 94704-4090
Contact: Kassie Siegel

Lynn Canal Conservation, Inc.
P.O. Box 1324
Haines, AK 99827
Contact: Eric Holle

Coastal Coalition
P.O. Box 1636
Cordova, AK 99574
Contact: David Grimes

Sitka Conservation Society
P.O. Box 6533
Sitka, AK 99835
Contact: Don Muller

Eyak Preservation Council
P.O. Box 460
Cordova, AK 99574
Contact: Dune Lankard

The above petitioners formally request that the U.S. Fish & Wildlife Service (FWS) list the Kittlitz's murrelet (*Brachyramphus brevirostris*) as an endangered or threatened species with a concurrent designation of critical habitat under the federal Endangered Species Act, 16 U.S.C. §§1531-1544. This petition is filed under 5 U.S.C. §553(e) and 50 C.F.R. part 424.14. The FWS has jurisdiction over this petition. This petition sets in motion a specific process as defined by 50 C.F.R. part 424.14, placing definite response requirements on the FWS.

The Center for Biological Diversity is a non-profit environmental organization dedicated to the protection of native species and their habitats in the Western Hemisphere through science, policy, and environmental law. The Center for Biological Diversity submits this petition on its own behalf and on behalf of its members and staff with an interest in protecting the Kittlitz's murrelet and its habitat.

The Coastal Coalition was formed in the wake of the Exxon Valdez Oil Spill to promote the protection and restoration of ecosystems. The Coalition was instrumental in helping facilitate an out-of-court settlement between government and industry in order to provide oil-spill restoration funds to protect habitat in the oil spill region. The Coastal Coalition in recent years has been involved in global marine, forest, and biodiversity preservation issues.

The Eyak Preservation Council ("EPC") was founded in 1989, immediately following the Exxon Valdez oil spill. Our goal was to monitor and defend the Prince William Sound and Copper River Delta ecosystems from senseless and irreversible natural resource development that affects our sovereign, spiritual or subsistence way of life. The EPC's mission is to protect the inherent rights of culture, heritage, language and ancestral lands needed to preserve and restore the Eyak tribe's continued existence as an independently recognized Alaska tribal nation.

An intact ecosystem is a living monument of proof that we, as a human race, can coexist in harmony with the planet into the 21st century and beyond.

Lynn Canal Conservation, Inc. is a nonprofit organization dedicated to conserving natural resources and educating the public about ecology. Lynn Canal, Inc. is based in Haines, Alaska and has approximately 100 members.

The Sitka Conservation Society was formed in 1967 and has since worked continuously "...to conserve the natural environment of the Tongass and to protect Sitka's quality of life." Sitka Conservation Society is a membership organization with an activist Board of 12 and a staff of four. Most of SCS's work falls into in 3 main areas: forest conservation, coastal protection, and the preservation of wilderness and wilderness values.

TABLE OF CONTENTS

I. SPECIES DESCRIPTION 1

A. Non-technical 1
B. Technical 1
C. Systematics 2
1. Related Species 2
2. Geographical Variation 2

II. NATURAL HISTORY 3

A. Diet 3
B. Foraging 3
C. Vocalizations 5
D. Reproduction 5
1. Nesting Phenology 5
2. Nest Site Location 6
E. Range and Distribution 7
1. Summer 8
a. Southeastern Alaska 8
b. Southcoastal Alaska 9
c. Southwestern Alaska 9
d. Western Alaska 10
e. Northern Alaska 10
f. Russia/ Far East 10
1. Winter 11
a. Alaska 11
b. Russia/ Far East 11
F. Habitat Requirements 11

III. POPULATION STATUS 12

A. Historical Abundance Estimate 12
B. Published Abundance Estimates and Population Trends 14
1. Worldwide Population Estimates 14
2. Regional Population Estimates 15
3. Population Trends 16
C. Current Population Estimate Based on Published Estimates and Trends 19

IV. THE KITTLITZ'S MURRELET MEETS THE CRITERIA FOR LISTING UNDER THE ENDANGERED SPECIES ACT 21

A. Present or Threatened Destruction, Modification, or Curtailment of the Kittlitz's Murrelet Range 23
1. Marine Oil Pollution 23
a. The *T/V Exxon Valdez* Disaster 23
b. Future Threats 24

2. Other Marine Pollution *26*
3. Global Warming *26*
B. OTHER NATURAL OR MANMADE FACTORS AFFECTING THE KITTLITZ'S MURRELET 27
1. Lack of Recruitment *27*
2. Observed Population Declines and Small Population Size *28*
3. Commercial Fisheries *29*
a. Gill-net Bycatch Mortality 29
b. Other Fisheries Interactions 32
4. Climate Regime Shift *32*
5. Human Disturbance *33*
C. THE INADEQUACY OF EXISTING REGULATORY MECHANISMS 35
D. DISEASE OR PREDATION 37
E. OVERUTILIZATION FOR COMMERCIAL, RECREATIONAL, SCIENTIFIC, OR EDUCATIONAL PURPOSES 37

V. CRITICAL HABITAT SHOULD BE DESIGNATED FOR THE KITTLITZ'S MURRELET 37

VI. CONCLUSION 39

VII. BIBLIOGRAPHY OF LITERATURE CITED 41

I. SPECIES DESCRIPTION

A. Non-technical

The Kittlitz's murrelet (*Brachyramphus brevirostris*) is a small diving seabird in the Alcid family. Adult Kittlitz's murrelets are about one foot long, with a wingspan about 2/3 of their length, and weigh between 190-260 g (about the same as a medium to large apple). In breeding plumage, these birds are mostly grey but may also be golden or sandy colored, with off-white or buff underparts. In winter plumage, these birds appear black and white from a distance, with a white collar, grey band across the chest, and white on the face that extends to above the eye. Wings are dark grey in both breeding and winter plumage. Male and female Kittlitz's murrelets are similar in both size and coloration.

The Kittlitz's murrelet most closely resembles the marbled murrelet, with which it overlaps in range. The Kittlitz's murrelet can be distinguished from the marbled murrelet by its shorter beak, by visible white color on its tail feathers when taking off from or landing on water, and by differences in basic plumage. (The Kittlitz's murrelet has a white face extending above the eye, and the marbled murrelet has a white face extending to below the eye.) The Kittlitz's murrelet has a larger eye diameter than the marbled murrelet, which scientists believe is related to its preference for feeding in highly turbid (murky) glacial waters. (Above information from Day et al. 1999).

B. Technical

Average body length 25 cm; long, exposed culmen 10-13 mm long; wing length 136-145 mm; tail 35-37 mm; average weight 241 g ±25 SD; no sexual dimorphism. Large squat head and small, short bill with long, narrow, and pointed wings. In flight, appears as small rapidly flying bird with blurred wing-beats. Breeding and Basic (winter) plumages differ. In Breeding adults, feathers of upperparts are primarily dark gray. On all upperparts except wings and tail, feathers have highly variable, irregular edges of light buff or gold. Underparts are mostly off-white or buff, and are given a barred effect by streaking with dark gray, and with dark gray or black U-shaped feather edgings. In both Breeding and Basic plumage, wings are grayish brown with upperwing-coverts grayish brown edged with white. Axillars and underwing-coverts are brownish gray and scapulars are white. In both Breeding and Basic plumage, the tail is dark brownish gray with white tips on central retrices, to white with small brown spots on outer retrices. The amount of white is variable. In Basic plumaged adults, upperparts and sides of upper breast are gray, forming a nearly complete gray band across the breast. Gray on the head lies above eye and forms a narrow, gray crescent in front of eye. The feathers on the back and rump are narrowly edged with white. The face is clean white to above the eye, and the throat has a complete white collar around the nape. Juvenile plumage is poorly known but is believed to be similar to Basic with the exception of a faint barring on throat and breast. Breeding plumage is cryptic, making nesting birds and their nests extremely difficult to spot. (Above information from Day et al. 1999).

The Kittlitz's murrelet undergoes two molts per year. The fall molt is complete, overlaps slightly with breeding, and includes a period of flightlessness that begins in late August and continues until an unknown time (possibly late September). The spring molt is partial and does not include flight feathers. It appears to last from mid-April to late May, though birds have been observed as late as mid-June that have not completed the spring molt. (Above information from Day et al. 1999).

C. Systematics

1. Related Species

The Kittlitz's murrelet is one of three species currently classified within the genus *Brachyramphus*. Its closest relative is the marbled murrelet, *Brachyramphus marmoratus*. Mitochondrial DNA analysis suggests that these two species diverged about 2.2 million years before present ("MYBP"). (Pitocchelli et al., 1995). Analysis of cytochrome *b* sequences and allozymes suggests that the two species diverged about 1.6 MYBP. (Friesen 1996b). It has also been suggested that they may have diverged as much as 2.7 MYBP. (Day et al. 1999, J.F. Piatt in litt.).

The Kittlitz's murrelet is more distantly related to the long billed murrelet, *Brachyramphus perdix*, which until recently was classified as a subspecies of the marbled murrelet. Cytochrome *b* sequence and allozyme analysis has now led to the conclusion that there is a monophyletic relationship among North American marbled murrelets and Kittlitz's murrelets, with long-billed murrelets forming the basal lineage. (Friesen et al. 1996b). The long-billed murrelet is thought to have diverged from 5 to 6 million years ago. (Id.)

2. Geographical Variation

There has only been one genetic study of Kittlitz's murrelets, and this was with a small sample size from only 2 of the 5 known regions in Alaska where these birds occur: Attu Island in Southwestern Alaska and Kachemak Bay in Southcoastal Alaska. (Day et al. 1999). However, this study (Friesen et al. 1996b) found a genetic interchange of only ~0.40 individuals per generation, indicating a subdivided population structure. The loss of a genetically differentiated subpopulation can reduce a species' genetic resources and increase its vulnerability to extinction. (Friesen 1996b; Gilpin and Soulé 1986). The genetic variation known to occur within these two populations of Kittlitz's murrelets is as great as the level for subspecies in other taxa. (Day et al. 1999; Friesen 1996b).

II. NATURAL HISTORY

A. Diet

In the summer, Kittlitz's murrelets are known to eat primarily neritic (= inhabiting the waters of the continental shelf) forage fishes including postlarval capelin (*Mallotus villosus*), Pacific sandlance (*Ammodytes hexapterus*), and smaller amounts of Pacific herring (*Clupea pallasi*) and Pacific sandfish (*Trichodon trichodon*). (Day et al., 1999; Ewins et al. 1993; Sanger 1987; Vermeer et al.1987.) Birds in the summer are also known to eat euphausids, a type of neritic macrozooplankton; trace amounts of gammarid amphipods have also been found in some birds (Id.) Quantitative analysis of 16 Kittlitz's murrelets in the Bering sea and Kodiak Island revealed that they were eating approximately 70% fish and 30% euphausids; consequently, Kittlitz's murrelets are classified as secondary carnivores. (Day et al., 1999; Sanger 1987). The morphology of the Kittlitz's murrelets tongue and palate is thought to suggest a preference for fish as well. (Day et al. 1999; Day and Nigro, 1999).

In Prince William Sound, a visual study of Kittlitz's murrelet feeding found that the percentage of birds observed holding fishes varied with season. (Day and Nigro, 1999). Of 29 observations, about 7% of birds were observed with fish in early summer, about 17% of birds in mid-summer, and about 76% of birds in late summer. (Day and Nigro 2000). These authors stated "Although some of this seasonal increase in frequency may be caused by the holding of fishes destined for chicks in the nest, the apparent lack of production of young by Kittlitz's Murrelets (Day and Nigro, unpubl. data) but increase in fish-holding frequency suggests that other factors, such as availability, were causing this seasonal change." (Id.) Day and Nigro have suggested that Kittlitz's murrelets in Prince William Sound are likely to forage extensively on zooplankton in the early summer, switching to primarily fish by late summer. (Day and Nigro, 1999).

The winter diet of the Kittlitz's murrelet, like its range, is almost completely unknown. One bird collected on April 1, 1977 contained a neritic hyperiid amphipod, *Parathemisto libellula*. (Day et al. 1999).

B. Foraging

In general, the Kittlitz's murrelet congregates in and prefers to forage in glacial-affected habitats (e.g. near a tidewater glacier, terminal moraine, or the inflow of a glacial stream.) Studies in both Southeast and Southcentral Alaska have confirmed this preference. (See, e.g., Day and Nigro 2000; USGS 2001.) Beyond this distinctive trait, Kittlitz's murrelet foraging habits are not well known across its range. However, one major study conducted by Robert Day and Debora Nigro in Prince William Sound from 1996-1998 has yielded much useful data from that area.

In Prince William Sound, Kittlitz's murrelets forage exclusively within bays, and primarily within the nearshore areas. (Day and Nigro, 1999). Unlike the marbled murrelet, Kittlitz's murrelets do not leave the bays to feed. (Id.) Kittlitz's murrelets use tide rips for foraging both in Prince William Sound and Cook Inlet, but to what extent is unknown. Scientists believe Kittlitz's murrelets use tide rips with much less frequency than do marbled murrelets. (Id.) Kittlitz's murrelets did not use tidal fronts (standing waves) for foraging in the Prince William Sound survey, but have been seen using them off the mouth of Glacier Bay. (Id.)

Kittlitz's murrelets tend to forage singly or in small groups, with a mean feeding group size of 1.3 birds ±0.8SD (range 1-12, *n* = 689 groups) for nearshore water in bays within Prince William Sound, and 1.3 ±0.5 SD (range 1-3, *n*=77 groups) for offshore waters within these bays. (Day and Nigro, 1999, Day et al., 1999). Prey is taken underwater during wing propelled "flight," but little is known about the specifics of this activity. Prey is swallowed both at the surface and underwater. (Day et al. 1999). Mean diving time while feeding in Prince William Sound was 29.2 sec (SD = 10.4; range = 6-58; n=76), nearly identical to marbled murrelet dive times in the same area. (Day and Nigro, 1999). Foraging occurs at all times of the day and night, but appears to be most frequent in the morning. (Day et al., 1999).

The Day and Nigro study looked at 15 variables related to feeding frequency, and found eight to be significant. Variables found to be insignificant were time of day, tidal stage, current strength, secchi depth, sea-surface temperature, sea-surface salinity, and distance from nearest fresh water. The significant variables were survey type (distance from shore), season, year, habitat type, percent ice cover, distance from shore in the nearshore zone, depth of the nearshore zone, and shoreline substrate in the nearshore zone. (Day and Nigro, 1999).

Of the significant variables, the most important was survey type (distance from shore). Birds were found to be almost four times more likely to feed in nearshore areas than in offshore areas. Feeding frequency also varied by distance from shore within the nearshore zone: "Feeding frequency declined steadily with increasing distance, suggesting that these birds prefer to feed as close to shore and, thus, in as shallow water as they can. Likewise, Kittlitz's murrelets fed in decreasing frequency with increasing depth of the nearshore segment, and only ~1% of all Kittlitz's murrelets occurred in the deepest segments, suggesting actual avoidance of such areas." (Day and Nigro, 1999). Further, feeding frequency varied with water depth within the nearshore zone, and some areas less than 3 meters deep were regularly used for foraging during this study. (Id.)

Percent ice cover on the water surface was also a significant variable, with feeding frequency declining with increasing ice cover, and then jumping abruptly at the highest percentage of cover. (Id.) Day and Nigro concluded "Hence, it appears that there is a decreasing frequency with increasing cover but that the few birds that are able to penetrate high-cover areas do so because they are good places to feed. Most birds are unable to penetrate such areas, however (only ~4% of all birds were in this cover....)" (Id.)

Within the nearshore zone, feeding frequency also varied significantly by adjacent shoreline substrate. Feeding frequencies were highest offshore of large alluvium, small alluvium, or ice substrates and lowest offshore of bedrock. (Id.) Overall, Kittlitz's murrelet foraging is associated with highly turbid water in nearshore zones, resulting from proximity to either a tidewater glacier or a glacial stream flowing from a retreated glacier. The Kittlitz's murrelet's larger eye diameter in relation to the marbled murrelet is believed to be related to this preference for turbid water. (Day et al., 1999). Within the nearshore zone itself, Kittlitz's murrelets have been found to forage with equal frequency near tidewater glaciers, near the outflow of glacial streams, and in unglaciated areas (areas of lower turbidity). (Day and Nigro 1999).

C. Vocalizations

The vocal array of the Kittlitz's murrelet is not fully understood. This species appears to be a relatively reticent species, with vocalizations at sea detected primarily when boat motors were turned off and often with the aid of a directional microphone. (Van Pelt et al. 1999). This is in marked contrast to the strident calls of the marbled murrelet, which is usually detected in surveys by sound, rather than by sight. (Id.) Three calls were described by Day et al. (1999). These are the Groan Call, Long-groan Call, and Chew Call. The groan call has been observed primarily between members of a presumed pair when one bird is attempting to locate or contact the other. The Groan Call has been observed primarily during courtship displays. The Chew Call has been heard from one member of a presumed pair when it appeared to be attempting (and failing) to get its mate to fly off. (Day et al., 1999). More recently, Van Pelt et al. (2000) described the groan call and quack call, but stressed that more information is needed before vocalizations can be used in the design of effective programs to monitor the species.

D. Reproduction

Many aspects of Kittlitz's murrelet reproduction are still poorly understood. Kittlitz's murrelets are presumed to be monogamous like other members of the alcid family, but their mating system has not been confirmed. (Day et al. 1999). A courtship and/or pair maintenance display described as the "Bill Up Display" has been observed where a pair swim side by side with the head raised at an angle of ~10E above the horizontal while calling at the same time. (Id.) The displays observed have been quite short. (Id.) The display differs from that of the marbled murrelet in that the head is held at a lower angle and the display is shorter. (Id.) Kittlitz's murrelets are also suspected of carrying out this display underwater, though this has not been confirmed. (Id.) Copulation may also occur on the water.

1. Nesting Phenology

Brachyramphus murrelets are the only alcids that do not nest colonially on predator-free islands. (Piatt et al. 1999). Nesting phenology varies considerably across the five distinct geographical regions in which the Kittlitz's murrelet nests. (Day 1996). Nesting begins earlier in the southern portions of its range, and birds have a longer window of opportunity in which to breed and hence exhibit more variability in breeding times. (Id.) In the northern portions of its range, breeding begins later and occupies a smaller window of opportunity and hence variability in breeding times is less. This is a pattern observed in other seabirds as well, and is probably due to greater persistence of sea ice and terrestrial ice and snow in the northern regions. (Id.)

Extrapolating from all recorded observations of nests, eggs, and young, and assuming an incubation period identical to the marbled murrelet (~30 days), Day has calculated that egg-laying occurs from May 15-Jun 14 in the southern regions and from June 16-28 in the northern regions. Hatching occurs from Jun 14-July 14 in the southern regions and from July 16-28 in the northern regions. Fledging occurs from July 8-Aug. 7 in the southern regions and from Aug. 9-21 in the northern regions. (Day 1996; Day et al. 1999). Kittlitz's murrelets need at least 54 days from the time the egg is laid in order to successfully raise a chick to fledging. (Day and Nigro 1999).

Kittlitz's murrelets lay 1 egg per year. Both the male and female have incubation patches on the middle of their abdomens. The incubation period is not known for sure, but presumed to be about 30 days. Incubating adults have flushed only when approached within 25 m, and have been known to sit tight even when an observer was standing directly over the nest. (Day et al. 1999). Newly hatched chicks are helpless and unable to stand well. (Id.) At fledging, chicks are still relatively poor fliers, though strong swimmers, leading Day (1996) to hypothesize that chicks reach the water by a series of fluttering flights down the mountains on which their nests are built, assisted by glacial streams.

Recently a new Kittlitz's murrelet nest was discovered in Southcoastal Alaska, near Kachemak Bay, that contained weathered feces and eggshell fragments, evidence of use the prior year. (Piatt et al. 1999). The most important factor in determining whether a nest site can be re-used from year to year may be the absence of snow at the beginning of the nesting season. (Id.)

2. Nest Site Location

Although extremely few Kittlitz's murrelet nests have been located, such observations are consistent with what is known of the breeding range from at-sea surveys. These observations have exhibited consistent trends. The Kittlitz's murrelet generally nests on bare ground on talus or scree slopes on coastal mountainsides. (Day et al. 1983; Day 1995; Day et al. 1999). Nests have also been found in glacial cirques, in bare patches in snowfields, and once on a cleft in a rock face. (Id.) The nest itself is simply a scrape or depression, usually on a slope of 15-25E. (Day et al. 1999). It is unclear whether the scraping is done before egg-laying or incidentally during incubation. (Id.) Nests are usually found just downhill of a large rock or boulder, and often are surrounded by larger rocks at the perimeter of the nest. Interiors of Kittlitz's murrelets nests have been measured at 11 x15 cm (Day and Stickney 1996) and 12.6 cm in diamenter (Piatt et al. 1994, 1999).

Generally Kittlitz's murrelets nest within 2,000 meters from the nearest stream and within 200 meters of the top of the mountain or ridge, lending support to the hypothesis that young are assisted in the their maiden voyage to the sea by streams and gravity. (Day 1995; Day et al. 1999). Average elevation of the nests is about 670 m (range 140-2,000 m, n = 11) in the southern portion of the range, and about 335 m (range 230-430 m, *n*=6) in the northern portion of the range. (Day et al. 1999). The nests have all occurred between 0.25 - 75 km from the coastline, and Day's early analysis found that the average distance from the coast in the northern portion of the range (23 km) was about twice that in the southern portion of the range (11 km). (Day 1983). These trends are consistent with the rugged coastal mountain topography of the southern portions of the range as compared to the lower elevations and more rolling topography of its northern range.

Nests at higher elevations tend to be located on south facing slopes, probably because the increased sunlight melts the snow there first, making these areas the first available for nesting. (Day 1995; Day et al. 1999). Other nest sites appear to be made available early in the season by wind scouring effect. (Day et al. 1999; Piatt et al. 1999). Sites cleared of snow by wind-scouring may be more predictable than sites cleared of snow by sunlight, as the effects of sunlight would vary considerably between years due to snow depth and air temperature. (Piatt et al. 1999).

The association of Kittlitz's murrelet nesting with past and present glaciation is supported by a pattern of nesting on glacial nunataks and in glacial cirques. (Day et al. 1999). The species is believed to have nested on glacial nunataks during the last ice age and to have spread throughout its current range as the glaciers retreated approximately 10,000 years ago. (Id.) Because *Brachyramphus* murrelets are the only Alcids that do not nest on predator-free islands, it is believed that the nest site selection patterns and cryptic breeding plumage of this species reflects natural selection for a predator-free environment. (Piatt et al. 1999).

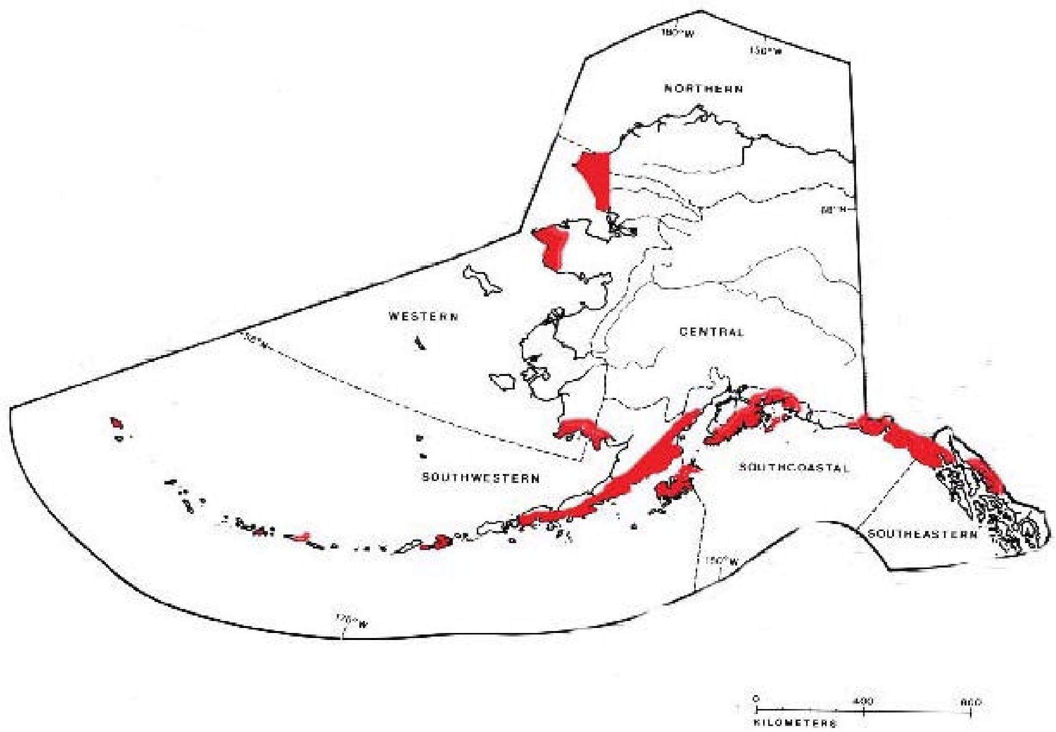
The limited information available suggests that Kittlitz's murrelets generally nest at slightly higher elevations and about twice as far inland as the marbled murrelet where their ranges overlap. (Day et al. 1983). Kittlitz's murrelets appear to be exclusively ground nesting, while the overwhelming majority (approximately 97%) of marbled murrelets within the range of the Kittlitz's are tree-nesters, not ground nesters. (Pitocchelli et al. 1995).

E. Range and Distribution

Within western North America, the Kittlitz's murrelet occurs only in Alaska. Within Alaska, the species occupies five distinct geographic regions described by Kessell and Gibson 1978 and followed by Day et al. 1999. (See Figure 1.) The species also nests in the Russian Far East. Nests have been discovered scattered throughout a vast area of the coastline from Southeastern to Western Alaska, and in Russia, but because so few total nests are known, the precise parameters of the breeding range are unknown. The best information about the range of the Kittlitz's murrelet comes from the various at-sea surveys that have been conducted.

In general, Kittlitz's murrelet populations are highly clumped "among mountainous areas with large present-day glacier fields (Glacier Bay National Park, Yakutat Bay, Prince William Sound, Kenai Peninsula, Kachemak Bay), remnant high-elevation glaciers (Kodiak Island, Katmai National Park, Alaska Peninsula, Atka and Attu Islands), and recently deglaciated coastal mountains (Seward Peninsula, Cape Lisburne)." (Piatt et al. 1999). A summary of the current known range and distribution and the Kittlitz's murrelet follows.

Figure 1: Alaska Geographic Regions and the Range of the Kittlitz's Murrelet (after Kessel and Gibson 1979 and Day et al. 1999)



1. Summer

a. Southeastern Alaska

The southern boundary of the Kittlitz's murrelet's breeding range is Le Conte Bay (on the Southeast Alaska mainland, about 25 miles northwest of the town of Wrangell.) (Day et al. 1999; Kendall and Agler 1998; Webster 1950.) Continuing up the coastline, the species is known to breed in Port Houghton, Endicott Arm, and Tracy Arm. (Day et al. 1999). Glacier Bay is believed to be the largest Kittlitz's murrelet breeding ground, with birds concentrating near the tidewater glaciers in the northern reaches of the bays. (Day et al. 1999; Kendall and Agler 1998).

The Kittlitz's murrelet may also breed in Taylor Bay, a glaciated fjord near Glacier Bay, in Lituya Bay, and in Taku Inlet (just east of the city of Juneau) and Thomas Bay. (Day et al. 1999). A scattering of reports around Baranof Island, the only glaciated island in the Archipelago, suggests that these birds may also use some areas on Baranof for breeding, but this is unconfirmed. (Id.) Kittlitz's have also been observed in Sea Otter Sound, on the west side of the northern portion of Prince of Wales Island, but it is unknown whether this area is actually used for breeding. (Day et al. 1999; Kendall and Agler 1998). Sightings of Kittlitz's murrelets in Southeast Alaska have also been recorded in Icy and N. Chatham Straits near Glacier Bay, at the southern end of Seymour Canal, in Snow Passage near Zarembo Island, and in W. Federick Sound. (Day et al. 1999).

b. Southcoastal Alaska

In Southcoastal Alaska, the Kittlitz's murrelet is known to breed in Yukutat Bay and near the Malaspina and Bering Glaciers. (Id.) The species is believed to breed near Dry and Icy Bays, both of which have glaciers nearby. (Id.) In Prince William Sound, the breeding population is concentrated in the glaciated fjords in the northwestern sound: Unakwik Inlet, College Fjord, Harriman Fjord, Balckstone Bay, Port Nellie Juan, and Nassau Fjord. (Day et al. 1999; Isleib and Kessel 1973; Kendall and Agler 1998). It breeds elsewhere in Prince William Sound in lower numbers: Hinchinbrook Island, Knight Island and Eaglek Bay, and probably at Galena Bay. (Day et al. 1999). The Kittlitz's murrelet also breeds in eastern Cook Inlet as far north as Kachemak Bay and Cape Ninilchik, and on Kodiak Island. (Day et al. 1999). In addition to these known breeding locations, the Kittlitz's murrelet likely breeds elsewhere in southcoastal Alaska, most likely along exposed coast above protected bays. (Id.)

c. Southwestern Alaska

The Kittlitz's murrelet breeds on both sides of the Alaska Peninsula, usually close to glaciers. Breeding is confirmed from western Cook Inlet as far north as Kalgin Island, from Katmai National Park, near Kiukpalik Island, Devils Cove, Kinak Bay, Portage Bay, Agripina Bay, Nakalilok Bay, Amber Bay, Chignick Bay, Castle Bay, Kumlik Island, Kuiukta Bay, Mitrofania Island, Pavlof Bay, and the Cold Bay area. On the northern portion of the Alaska Peninsula, the Kittlitz's murrelet breeds inland from Nelson Lagoon, Herendeen Bay, and Port Heiden.

The Kittlitz's murrelet breeds on the larger islands of the Aleutian Chain primarily near remnant glaciers, protected bays, and alpine nesting habitat. There are records from Unalaska, Atka, Adak, and Attu, and suspected occurrences on Unimak and Agattu. Three birds were seen in Upper Bristol Bay in 1883, suggesting possible breeding in this area. There are records from Shumagin Island and the Koniuji Island Group on the southern side of the Alaska Peninsula which suggest probable breeding. There are two records from the Pribilof Islands, but there us no affirmative evidence of breeding associated with these records.

An author writing in 1886 reported that the species was common on Amchitka Island and occurred throughout the year at Sanak Island. This account has been questioned because no birds were taken, there appears to be no suitable habitat on Sanak Island, and because extensive recent fieldwork on Amchitka has not yielded any evidence of Kittlitz's murrelet occupation. (Above information from Day et al. 1999).

d. Western Alaska

The Kittlitz's murrelet is known to breed at Goodnews Bay, and is believed to breed on the western half of Nunivak Island, on the Seward Peninsula from Nome to Wales, and possibly on Sledge Island and St. Lawrence Island. Nests have been found inland from Kivalina and Cape Thompson, and the species is believed to breed inland between these two sites and as far northeast as Cape Lisburne. The species is believed to nest as far north as Cape Sabine and Cape Beaufort.

The Kittlitz's murrelet has been observed on Little Diomede Island, but is not believed to breed there. Substantial numbers have been seen along the ice edge in the late summer and fall in the central Chukchi Sea and environs.

The species has not been observed to date in mainland Alaska from north of Goodnews Bay to the mouth of the Yukon River, in Norton sound from the mouth of the Yukon River to Nome, along the northern shore of the Seward Peninsula, or in Kotzebue Sound. (Above information from Day et al. 1999).

e. Northern Alaska

There are several Kittlitz's murrelet sightings from the 1930's, 40's, and 70's between Wainwright and Barrow. However, since suitable nesting habitat ends north of Cape Beaufort, the species is not believed to breed on the northern coast of Alaska. The Kittlitz's murrelet has never been recorded in the Beaufort Sea or along the coast on the eastern portion of the North Slope. (Above information from Day et al. 1999).

f. Russia/ Far East

A recent publication describes the Kittlitz's murrelet as "distributed on both sides of Bering Strait and in the Arctic and along the Pacific coast, between 67º N an 55º N. Along the Arctic coast, it occurs east of 180º longitude, including the coastal waters of Wrangel Island. In the North Pacific, it congregates in nearshore waters during the nesting period and has been observed along the Chukotka Coast to Kresta Bay, along the coast of the Koryak Highlands, and along eastern Kamchatka to Kamchatskiy Gulf in the south. In the northwest Sea of Okhotsk, it occurs in Shelikhov Gulf to Koni Peninsula in the south." (Kondratyev et al. 2000.)

The actual nesting range of the Kittlitz's murrelet is still largely unknown in the Russian Far East. Four nests have been found; one on the Chukot Peninsula near Provideniya Bay, one in northeastern Kamchatka, and two in the northwestern sea of Okhotsk (one in Shelikhov Gulf and one in Babushkina Bay) (Id.)

1. Winter

a. Alaska

The winter range of the Kittlitz's murrelet in Alaska is poorly understood. During all Alaska Christmas Bird Counts ("CBCs") from 1967 to 1997, only 31 Kittlitz's murrelets have been seen. Three of these were in Southeast Alaska, 21 in Southcoastal Alaska, and 7 in Western Alaska. (Day et al. 1999.)

Very few winter reports exist from Southeast Alaska, and none of these are from Glacier Bay, the area of greatest concentration in the summer. Early spring records in the vicinity of La Perouse Galcier, Lituya Bay, and Fairweather Grounds suggest some birds may winter nearby.

In Southcoastal Alaska, the Kittlitz's murrelet is mostly absent in the winter. Where it has been observed, however, it seems to occur in high densities. Many of the records are from early spring, and it is unclear whether they indicate wintering nearby or early arrival on the breeding grounds. In 1969, Kittlitz's murrelets were observed along the outer coast of the Kenai Peninsula off the Nuka, Northwest, and Aialik glaciers. Birds have been spotted very infrequently during CBCs in Cordova, Homer, and at sea between Seward and Kodiak, but never during CBCs on Kodiak Island. The Kittlitz's murrelet is reported to occur in the open waters of Prince William Sound throughout the winter, and is believed to winter over the open continental shelf in the northern Gulf of Alaska.

Kittlitz's murrelets are believed to occur only rarely in winter in southwestern and western Alaska. However there are a few records that suggest wintering (presumably of arctic nesting birds) may occur in leads in the pack ice in the Bering Sea. (Above information from Day et al. 1999).

b. Russia/ Far East

The winter range of the Russian population is largely unknown, though birds are known to occur near coastal Kamchatka Peninsula and the Kuril Islands. A few Kittlitz's murrelets may also winter in the Sireniki Polynya (= crack in the sea ice) of southern Chukotka. Kittlitz's murrelets have been seen of the coast of northeast Japan, but this is probably indicative only of casual occurrence here. (Day et al. 1999).

F. Habitat Requirements

Because so little specific research has been done on the habitat requirements of the Kittlitz's murrelet, perhaps the best way to discuss this topic is by highlighting the presumed differences between the needs of the Kittlitz's murrelet and those of the marbled murrelet. Marbled murrelets often occur in habitats used primarily by Kittlitz's murrelets, but the converse is not true. (Day et al. 1999; J.F. Piatt in litt.). This habitat separation may be an adaption of the Kittlitz's murrelet that reduces competition with the marbled murrelet.

The most complete information regarding Kittlitz's murrelet habitat requirements available is from a 1996-1998 study of Kittlitz's murrelets in Prince William Sound. (Day and Nigro 1999). In the fjords studied, Kittlitz's murrelets tended to occur in waters with a higher percentage of ice cover, and that were more turbid, cooler, and slightly less saline that those used by marbled murrelets. (Day et al. 1999; Day and Nigro 1999). However, marbled murrelets also occupied waters of the Sound outside of the glaciated fjords, waters that were without any ice cover at all and less turbid, warmer, and more saline than waters within the fjords, indicating an even greater habitat separation. (Day et al. 1999).

In Southeastern Alaska, Kittlitz's murrelets are generally restricted to fjords and bays while marbled murrelets use off shore waters extensively. Id.

While the Kittlitz's murrelet and the marbled murrelet are both primarily fish-eaters, they both also eat euphausiids and gammarid amphipods. These smaller organisms appear to be a more important component of the Kittlitz's murrelet diet than the marbled murrelet's. (Ewins et al. 1993, Sanger 1987). This may be another adaption of the Kittlitz's murrelet that decreases competition with the marbled murrelet.

III. POPULATION STATUS

A. Historical Abundance Estimate

The first systematic report of Kittlitz's murrelet abundance was a study in Prince William Sound published in 1973 by M.E. "Pete" Isleib and Brina Kessel. Their findings were as follows:

> The Kittlitz's Murrelet is a common resident of the North Gulf Coast-Prince William Sound region.
>
> Apparently preferring glacial moraines for nesting, these murrelets are abundant locally in inshore waters during the summer, especially near glaciated coastal areas; they are most abundant in the waters of upper Unakwik Inlet, upper College Fiord, and in waters abutting the Malaspina-Bering icefields, outnumbering all other alcids in these waters. U.S. Fish and Wildlife Service surveys 21 July-4 August 1972 estimated approximately 57,000 Kittlitz's Murrelets in Prince William Sound, almost all in the fiords and bays on the northern and western periphery of the sound. On 30 July 1972, there were more than 10,000 Kittlitz's Murrelets above the Unakwik Reef in Unakwik Inlet, about 2,500 birds in a single, loose flock; Kittlitz's outnumbered the Marbled Murrelet in this area, whereas the reverse was true just below Unakwik Reef.
>
> Although there are no specific breeding records for the region, these birds apparently nest above timberline and/or on unvegetated coastal glacial moraines.
>
> During the winter, Kittlitz's Murrelets apparently disperse throughout in-shore and offshore waters, becoming rare at the heads of the fiords. Several hundred Kittlitz's Murrelets were present in Prince William Sound during U.S.

> Fish and Wildlife Serice surveys 7 March-1 April 1973. Laing (1925) reported six at Yakutat Bay on 12 March 1924.
>
> Estimates of populations utilizing the North Gulf Coast and Prince William Sound: yearly, several 10,000's, probably a few 100,000's. (Isleib and Kessel 1973).

Isleib and Kessel's estimate of 57,000 Kittlitz's murrelets in Prince William Sound was later revised to 63,229 ±80,122. (Klosiewki and Laing 1994; Kendall and Agler 1998). The accuracy of this report has been questioned in the literature by Day and Nigro (1999). These authors make the following points: (1) the multiplication factor used by Isleib and Kessel was too high, because it did not take into account the highly clumped distribution of the species; (2) the account fails to mention any Kittlitz's murrelets that Pete Isleib may have seen while fishing in the area in the 1970's, therefore, the data from 1972 must have been an anomaly; (3) Isleib and Kessel may have mistaken a flock of marbled murrelets with a few Kittlitz's murrelets within it for a flock of Kittlitz's murrelets. (Day and Nigro 1999). None of Day and Nigro's points, however, provide sufficient reason to discount Isleib's 1972 surveys.

It is certainly true that the Kittlitz's murrelet exhibits a highly clumped distribution within its marine habitat, and that this makes it difficult to achieve accurate population counts. It may be that 57,000 was an overestimate for the year 1972. The 1972 population counts were conducted using different protocols than those later developed in the wake of the Exxon-Valdez disaster. It should be noted that different methods were used at different times, and sources of error in the 1972 surveys, if any, should be identified. However, there is no reason to discount this report in its entirety. Moreover, the precautionary principle requires that resource managers such as the FWS consider the 1972 data to the extent possible.

The next point made by Day and Nigro is that the failure of Isleib to mention Kittlitz's murrelets he may have observed while fishing in Glacier Bay discredits his 1972 survey. Day and Nigro state: "Pete Isleib regularly fished in Unakwik Inlet during that period, yet Isleib and Kessel (1973) mention seeing large numbers of Kittlitz's murrelets there only during this one survey in 1972. Hence, if this flock actually was composed entirely of several thousand Kittlitz's murrelets, it probably was exceptional, although Isleib and Kessel did not explicitly state that it was; conversely, if a flock this large was a regular occurrence, there would have been no reason to mention this flock in particular." This statement does not tend to prove that Isleib's identification was faulty. There was a very good reason to mention this flock in particular: it was there when the survey was conducted. Furthermore, it is possible that Isleib's statement that the Kittlitz's murrelet "is locally abundant" could have been based on his observations while fishing, or on other fishermen's observations, even though the source of the comment was not noted.

Day and Nigro's last point is that Isleib and Kessel may have misidentified Kittlitz's murrelets as marbled murrelets. Misidentification is always possible. However, this possibility, without more evidence, is not sufficient reason to discredit an authoritative published report. As stated above, marbled murrelets often occur in habitats used primarily by Kittlitz's murrelets, but the converse is not true. (Day et al. 1999; J.F. Piatt in litt.). Therefore, Day and Nigro's suggestion that there were a few Kittlitz's murrelets present in a large flock of marbled murrelets during Isleib's survey is an unlikely proposition.

The Isleib and Kessel account from 1973 is the only known historical population estimate for the Kittlitz's murrelet. It is appropriate to note the different survey methods used and possible sources of error. It may be appropriate to exclude the data from statistical analyses of population trends. However, it is not appropriate to disregard the information completely. The FWS must consider the fact that this population estimate for Prince William Sound was an order of magnitude higher than more recent population estimates.

B. Published Abundance Estimates and Population Trends

1. Worldwide Population Estimates

A current and precise abundance estimate is not available for the Kittlitz's murrelet. There have been relatively few studies of Kittlitz's murrelet abundance, and these studies have varied both in methods and results. There is also limited data on population trends for the species. However, wherever data exists that was collected over multiple years (approximately one decade or more) with comparable methods, such data show precipitous declines for the species. This section examines published population estimates and data on population trends for the Kittlitz's murrelet.

Only two detailed worldwide populations estimates have been published, both in 1993. The first, by van Vliet (1993), is shown in Table 1.

Table 1: Kittlitz's Murrelet Worldwide Population Estimate as of 1993 by van Vliet (1993)

Population	*Number of Birds*
Glacier Bay National Park and Preserve region	4,500
Wrangell-St. Elias National Park region including Yakutat Bay	3,000
College Fjord-Unakwik Inlet, Prince William Sound	3,000
Kenai Fjords National Park region	800
Kachemak Bay region	1,500
Katmai National Park and Alaska Peninsula to Unimak Pass	3,200
Kodiak Archipelago	300
Aleutian Islands - Attu to Unimak Pass	1,000
Cape Newenham to Wales - Seward Peninsula region	450
Chukchi Sea coastline, including Wrangell Island	450
Sea of Okhotsk	100
World Total	***18,300***

This estimate was based upon (1) GIS analysis of the OCSEAP pelagic seabird database for Kittlitz's Murrelet which provided an estimate of 15,600-19,800 birds, and (2) numerous discussions with biologists familiar with the species from each of the above regions. (Id.) This estimate has been called low for the following reasons: (1) the Chukchi Sea populations had been subsequently estimated by Divoky (in litt.) as 1,000-5,000+ birds; (2) there is a breeding population of probably hundreds to low thousands on Kamchatka and the Bering Sea coastline not included in the estimate; (3) there was apparently still a breeding population in Le Conte Bay in 1996, a population that van Vliet had previously believed extirpated. (Day et al. 1999; Kendall and Agler 1998). Inclusion of these numbers only change van Vliet's estimate slightly. (Both these populations are considered in the next section.)

The second Kittlitz's murrelet population estimate is 25,000-100,000 birds from Ewins et al. 1993. This estimate was based on the following sources: Forsell and Gould 1981, Gould et al. 1982, Johnsgard 1987, Kischinskii 1968, Kondratiev 1986, Sowls et al. 1978, and Tomkovitch and Sorokin 1983. Day et al. 1999 said of this estimate: "There is no evidence that the world population approaches upper population of Ewins et al. (1993), however."

2. Regional Population Estimates

Recent surveys have focused on Southeastern Alaska, Prince William Sound, and Lower Cook Inlet. Kendall and Agler (1998) estimated summer population numbers as follows: Southeastern Alaska: 5,408 ± 7,039 (95% CI); Prince William Sound: 3,368 ± 4,073; Cook Inlet: 3,353 ± 1,718; total for these three areas: 12,129 ± 8,312[1]. The only winter population estimates available are 410 ± 744 for Prince William Sound and 0 for Cook Inlet. (Id.) Day and Nigro (1999) surveyed for Kittlitz's murrelets in four bays in Prince William Sound and estimated the total population of those *four bays* as ~1,400 ± 1,700 in 1996, ~1,275 ± 750 in 1997, and 1,275 ± 1,100 in 1998. These surveys were conducted during 3-week cruises in early (May-June) and late summer (July-August) 1996-1998 and in a 1.5-week mid-summer (late June-early July) cruise in 1998. (Id.) The largest data set available for Prince William Sound is from Lance et al. (1999).[2] Available population estimates for Prince William Sound are reproduced in Table 2.

---

[1] The estimate for Southeastern Alaska is based on one survey in the summer of 1994; the estimate for Prince William Sound is based on the mean of surveys conducted in the summers of 1989-1991, 1993, and 1996; the estimate for lower Cook Inlet is based on a survey from the summer of 1993. (Kendall and Agler 1998).

[2] Lance et al. 1999 cite the population estimates as follows "…Estimated numbers of birds (N ± 95% CI) for species and species groups observed in Prince William Sound during March and July 1972-73 (Haddock et al., unpubl. Data), 1989-91 (Klosiewski and Laing 1994), 1993 (Agler et al. 1994), 1994 (Agler et al. 1995), 1996 (Agler and Kendall 1997), and 1998. No surveys were done in July 1973, July 1994, or March 1989…."

Table 2: Kittlitz's Murrelet Population Estimates for Prince William Sound by Various Authors, 1972-1998.

Author	1972	1973	1989	1990	1991	1993	1994	1996	1997	1998
Day and Nigro (1999) (four bays only)	N/a	N/a	N/a	N/a	N/a	N/a	N/a	1,400[3]	1,275[4]	1,275[5]
Kendall and Agler (1998)	N/a	N/a	N/a	N/a	N/a	3,368[6]	N/a	N/a	N/a	N/a
Lance et al. (1999) (July survey)	63,229[7]		6,436[8]	5,231[9]	1,184[10]	2,710[11]	N/a	1,280[12]	N/a	279[13]
Lance et al. (1999) (March survey)	346[14]	3,219[15]		958[16]	466[17]	448[18]	0	181[19]	N/a	78[20]
van Vliet (1993)	N/a	N/a	N/a	N/a	N/a	3,000[21]	N/a	N/a	N/a	N/a

The total population size of the Russian Far East population has long been the subject of speculation. Recently, however, it was estimated that "The total number in the Arctic basin is definitely fewer than 1000 birds…It is more common along northeastern Kamchatka, where their density was estimated at 0.8 birds/km^2 within 3 km of shore. About 5000 birds have appeared at the Kamchatka River delta in the south during the nesting period. The number nesting in the northwestern Sea of Okhotsk is evidently small." Kondratyev et al. 2000. More research is needed to confirm the size of this population. However, as discussed in Section I.C.2., *supra*, available genetics information suggests that the Russian population could be genetically isolated and possibly a distinct subspecies.

3. Population Trends

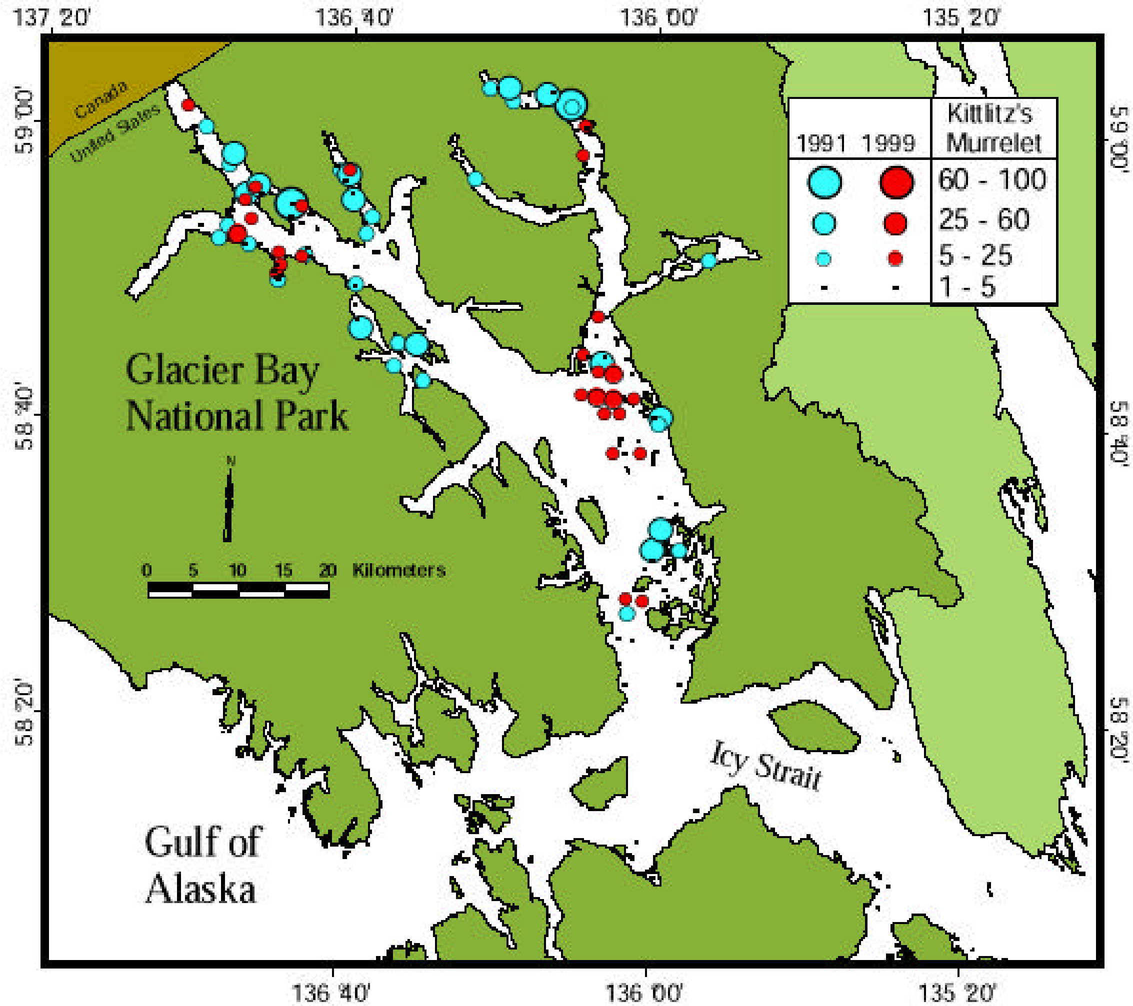
It appears that only two data sets collected over approximately ten years or more with comparable methods exist for the Kittlitz's murrelet. Both of these data sets show continuous population decline through the 1990s. The first is from Southeast Alaska by USGS (2001) and the second is from Prince William Sound by Lance et al. (1999).

---

[3] CI ±1,700.
[4] CI ±750.
[5] CI ±1,100.
[6] Population calculated with the mean of surveys conducted in 1989-1991, 1993, and 1996. (Kendall and Agler 1998). Therefore, it is placed in the year 1993 for ease of comparison. CI ±4,073.
[7] CI ±80,122.
[8] CI ±3,151
[9] CI ±8,457
[10] CI ±1,121
[11] CI ±1,343.
[12] CI ±1,364.
[13] CI ±192.
[14] CI ±657.
[15] CI ±3,827.
[16] CI ±1,599.
[17] CI ±398.
[18] CI ±326.
[19] CI ±238.
[20] CI ±96.
[21] CI not available. (Estimate obtained through GIS analysis and personal communication.)

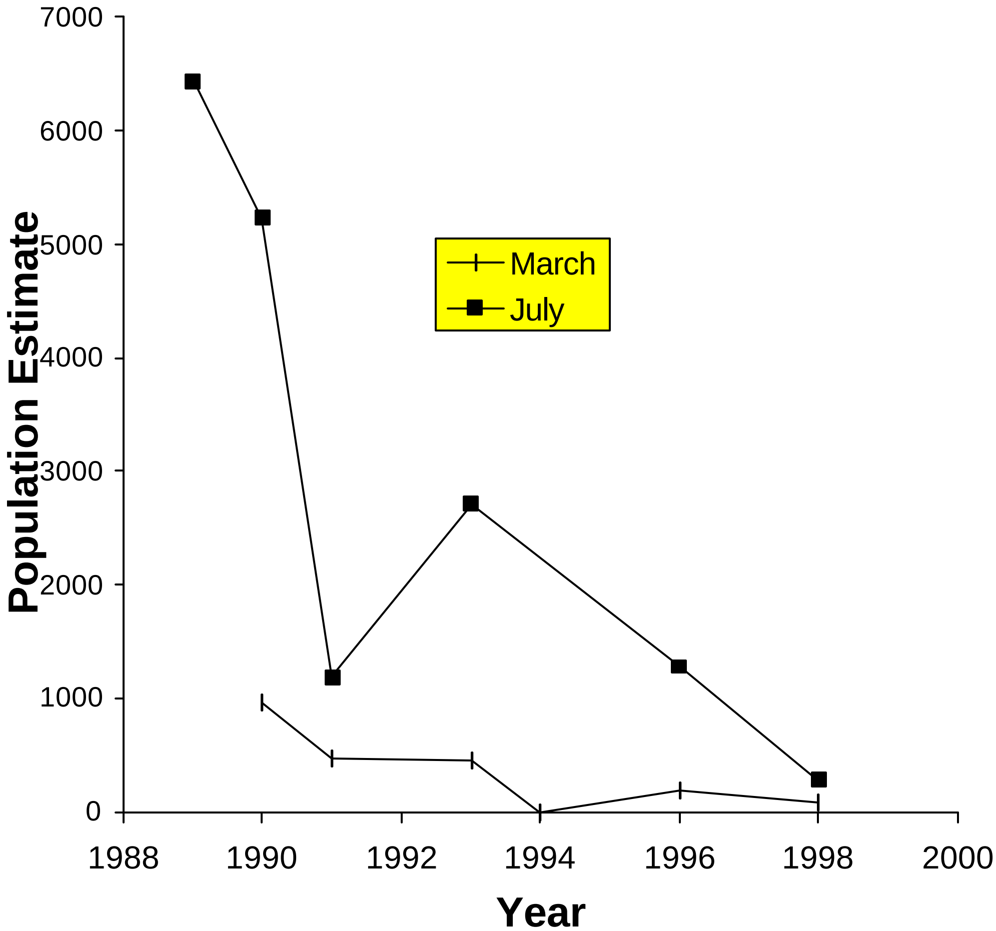
Kittlitz's murrelet surveys were conducted in Southeast Alaska in 1991 and in 1999-2000 using comparable methods. (USGS 2001). These authors stated "Preliminary analysis suggests a major decline in abundance of Kittlitz's murrelet (but no other species) since 1991, when similar studies were conducted in coastal areas." (Id.) The decline may be as great as 80%. (J. Piatt, pers. comm.) As illustrated in Figure 3, the Kittlitz's murrelet has completely disappeared from areas where it was once abundant in Glacier Bay.

Figure 3: Distribution of the Kittlitz's Murrelet in Glacier Bay National Park, 1991-1999, by USGS (2001).



The other data set is from Lance et al. (1999), and reproduced in Table 2. The 1970's data cited by Lance et al. (1999) were not collected with comparable methods and are not strictly comparable to later data. For this reason they are excluded from further consideration here. The 1990's data however do come from comparable surveys. Population counts in both March and July show precipitous and largely continuous decline during the 1990s. July population estimates show an average 14.4% approximately linear decline per year, while the March estimates show an even higher 49.4% decline per year. These declines are shown in Figure 4. The confidence intervals presented by Lance et al. (1999) are unusually large even for a species with a highly clumped population distribution, and for that reason difficult to interpret without access to raw data. For this reason and because of the small time period under consideration, a statistically valid trend analysis was not possible.

Figure 4. Population data of Lance et al. 1999 for 1989-1998



The conclusion that a significant population decline has taken place is corroborated by data presented in Lance et al. (1999) on the marbled murrelet and unidentified *Brachyramphus* murrelets (i.e. birds the observer was unable identify to species) that show parallel declines over the same period. Klosiewski and Laing (1994) also presented similar information from 1972 to 1991.

Agler et al. (1999) also documented a 50% decline in *Brachyramphus* murrelets in Prince William Sound from 1972 to 1989-93. This decline is apparently correlated with a decline in certain fish species as a result of a climactic regime shift in 1976-1977. (Agler et al. 1999). This phenomenon is discussed in more detail below.

The study of Prince William Sound from 1996-1998 by Day and Nigro (1999) found no population decline during that period. This was an intensive study of 4 bays in Prince William Sound during the summers of 1996-1998. However, the period of their investigation was too short to provide a statistically meaningful test of trend for the species. Day and Nigro counted 348 birds in 1998, leading to a population estimate of 1,272 ± 1,093 (95% CI) for four bays within Prince William Sound that year and suggesting that the decline may not be quite as catastrophic as the Lance et al. (1999) data would otherwise suggest. As discussed further below, the Prince William Sound population was impacted in 1989 by the *Exxon-Valdez* disaster, and populations should be recovering, not declining. Day and Nigro (1999) suggest that most of the Kittlitz's murrelets that died in 1989 as a direct result of oiling may have been members of the Cook Inlet population, not the Prince William Sound population, though they cite no evidence for this assertion such as genetic or marking studies.

In summary, there are only two data sets collected with comparable methods over a period of approximately one decade. These data sets deal with two of the world's largest concentrations of Kittlitz's murrelets, the Glacier Bay populations and the Prince William Sound population. Both data sets show precipitous declines of these populations.

C. Current Population Estimate Based on Published Estimates and Trends

This section presents a current population estimate calculated by Petitioners based on published abundance estimates and population trends. Table 4 presents this estimate, which was obtained by extrapolating the observed population declines from Southeast Alaska (USGS 2001) to the worldwide population estimate of van Vliet (1993).

The year 2000 population estimate was obtained using the following methods and assumptions:

(1) The starting point of the analysis is van Vliet's (1993) population estimate. To account for the Le Conte Bay breeding population that was not included by van Vliet, 200 birds have been added to this estimate.

(2) Because the actual size of the Russian Far East population is unknown, and may include a breeding population at the Kamchatka River Delta not included by van Vliet, the size of the Russian Far East Population is given as 100 (van Vliet's estimate for the Sea of Okhotsk) plus *x*.

(3) In Southeast Alaska, since the population declined by approximately 80% between 1991-2000, the population would be projected to decline 62% between 1993-2000 if this trend was applied to that time period.

(4) In Prince William Sound, as the population declined an average of 14.4% per year between 1989-1998, the population would be expected to decline 100% between 1993 and 2000. That is, extinction would be expected already if the Prince William Sound trend estimates were projected to all extant populations.

(5) In order to estimate conservatively, the lesser predicted decline of 62% from 1993-2000 from Southeast Alaska was applied to all other populations to obtain a current worldwide estimate.

The 1972 worldwide population estimate was calculated using the following methods and assumptions: It was assumed that the percentage of the worldwide population represented by the Prince William Sound population remained constant from 1972 to 1993. Thus, since the Prince William Sound population accounts for approximately 16% of the worldwide population in van Vliet's estimate, it was assumed that the 1972 estimate for Prince William Sound constituted 16% of the worldwide population in 1972. Therefore, the 1972 worldwide population is estimated at 395,181. Isleib and Kessel (1973) estimated several hundred thousand Kittlitz's murrelets in the North Gulf of Alaska alone, so the figure 395,181 as a worldwide population estimate based on the 1973 report is consistent with what is known of the species.

Table 4: Kittlitz's Murrelet Worldwide Population Estimates

Population	*1972*	*1993*	*2000*
Southeast Alaska	N/a	7,700[22]	2926
Prince William Sound	63,229	3,000	1140
Cook Inlet	N/a	2,300	874
Southwestern Alaska	N/a	3,200	1216
Western Alaska	N/a	300	114
Aleutian Islands - Attu to Unimak Pass	N/a	1,000	380
Cape Newenham to Wales - Seward Peninsula region	N/a	450	171
Chukchi Sea coastline, including Wrangell Island	N/a	450	171
Russian Far East	N/a	100+x	x
World Total	***395,181[23]***	***18,300+x***	***6992+x***

These numbers show an approximate 95% decline from 1973-1993 and a 62% projected decline from 1993-2000. This ongoing population collapse has been verified in two separate areas, by a number of scientists. The Prince William Sound population

[22] This number was obtained by adding together van Vliet's (1993) estimates for "Glacier Bay National Park and Preserve" and "Wrangell-St. Elias National Park region including Yakutat Bay." Then, 200 birds were added to approximate the number of birds in the Le Conte Bay population, which were not included in van Vliet's estimate.
[23] The Prince William Sound population represents approximately 16% of the worldwide population. 63,229= 16% of 395,181.

would be expected to be rebounding from the 1989 *Exxon-Valdez* oil-spill, and yet shows the most precipitous decline of the two populations for which longitudinal data is available.

Available data on the population status of the Kittlitz's murrelet, as analyzed above, shows an ongoing population collapse. The ESA, the FWS's implementing regulations, and the precautionary principle all require that action be taken on the reasonable expectation that the observed decline will continue toward a final extinction in the near future for this species. The Kittlitz's murrelet warrants immediate listing as endangered under the ESA, as discussed in the next section.

IV. THE KITTLITZ'S MURRELET MEETS THE CRITERIA FOR LISTING UNDER THE ENDANGERED SPECIES ACT

Under the ESA, a species may be listed as "endangered" if it is in danger of extinction throughout all or a significant portion of its range. 16 U.S.C. § 1532(6). A species may be listed as "threatened" if it is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. 16 U.S.C. § 1532(20). The FWS must consider the following five factors in determining if a species should be listed as threatened or endangered: (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commericial, recreational, scientific, or educational purposes; (3) disease or predation; (4) the inadequacy of existing regulatory mechanisms; (5) other natural or manmade factors affecting its continued existence. 16 U.S.C. § 1533(a)(1). Here, Petitioners demonstrate that the entire worldwide population of the Kittlitz's murrelet faces numerous threats. Populations in Southeast and Southcentral Alaska, where 50% or more of the worldwide population occur, are the most imperiled.

Petitioners believe that the Kittlitz's murrelet warrants listing throughout its range. While data on the Russian population are limited, data from the U.S. clearly show that the species is endangered in "all or a significant portion of its range." This petition is submitted for the worldwide population of the Kittlitz's murrelet, however, if the Fish & Wildlife Service finds that listing of the Russian population is not warranted, this petition should be treated, in the alternative, as a petition for the U.S. population of the Kittlitz's murrelet.

The U.S. population of the Kittlitz's murrelet clearly qualifies as a "distinct population segment" ("DPS") under the ESA. In the "Policy Regarding the Recognition of Distinct Vertebrate Population Segments under the Endangered Species Act," the FWS defined "distinct population segment" for purposes of listing under the ESA. (61 Fed. Reg. 4721.) Under the policy, three elements are to be considered sequentially in determining the status of a potential DPS: (1) the discreteness of the population relative to the rest of the species; (2) the significance of the population segment to the species;

and (3) the populations segment's conservation status in relation to the Act's standards for listing. (Id.)

A population will be considered discrete if it satisfies one of the following criteria: (1) it is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors, (2) it is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the Act. (Id.) The U.S. population is clearly discrete under these criteria. The main breeding populations of the Kittlitz's murrelet in Southeast Alaska and Prince William Sound are separated from the Russian breeding population by hundreds of miles. As discussed in Section I.C.2., *supra*, a genetics study of the Attu Island population and the Kachemak Bay population showed a subdivided population structure, with genetic variation as great as the level for subspecies in other taxa. One can infer that the U.S. population is genetically distinct from the Russian population. The U.S. population is also distinct on the basis of international boundaries alone. Although the international boundaries criterion is not based in biology, it clearly reflects Congress' intent to recognize populations that might be negatively affected by international inconsistencies in conservation policy. (USFWS 1996). Since the Russian population could be affected at any time by human activities beyond the control of U.S. regulatory authority, it is appropriate that, at a minimum, the U.S. population be listed as a DPS.

The consideration of significance includes, but is not limited to, the following factors: (1) persistence of the discrete population segment in an ecological setting unusual or unique for the taxon., (2) evidence that the loss of the discrete population segment would result in a significant gap in the range of the taxon, (3) evidence that the discrete populations segment differs markedly from other populations of the species in its genetic characteristics. Clearly the U.S. population of the Kittlitz's murrelet is significant under these criteria. The largest breeding populations occur in Southeast Alaska and Prince William Sound in areas with tidewater glaciers. This habitat is markedly different from that found in the Russian Far East, especially around the Kamchatka River Delta. The loss of the U.S. population would obviously represent a significant gap in the range of the taxon, as it would eliminate the majority of the worldwide range of the species. Finally, there is evidence that the U.S. and Russian populations differ genetically.

The final criterion for classifying a DPS is the conservation status of the species. The Kittlitz's murrelet warrants listing as endangered, as discussed throughout this petition. Therefore, if the FWS declines to list the worldwide population of the Kittlitz's murrelet, Petitioners request that the U.S. population be listed as endangered as a DPS.

All listing decisions must be made solely on the basis of the best scientific and commercial data available. 16 U.S.C. § 1533(b)(1)(A). The legislative history of this provision clearly states the intent of Congress to "ensure" that listing decisions are "based solely on biological criteria and to prevent non-biological criteria from affecting such decisions" H.R. Rep. No. 97-835, 97th Cong. 2d Sess. 19 (1982). As further stated in the legislative history, "economic considerations have no relevance to determinations regarding the status of species." Therefore, political and economic arguments may not be considered by the FWS in its determination of whether to list this species.

A. Present or Threatened Destruction, Modification, or Curtailment of the Kittlitz's Murrelet Range

1. Marine Oil Pollution

a. The *T/V Exxon Valdez* Disaster

On March 24, 1989, the *T/V Exxon Valdez* grounded on Bligh Reef in northeastern Prince William Sound, spilling a reported 11 million gallons of crude oil into the marine environment. Wind and currents subsequently pushed the oil out of Prince William Sound and into the Gulf of Alaska, where it eventually drifted 750 km to the southwest, past Kenai Fiords National Park, up to Kachemak Bay, past Kodiak Island, along Katmai National Park, and most of the way down the Alaska Peninsula coastline and adjacent offshore waters. (Piatt et al. 1990; van Vliet 1994). All together the oil covered approximately 30,000 km^2 of coastal and offshore waters occupied by approximately one million marine birds. (Lance et al., 1999; Piatt et al. 1990).

Over 30,000 dead and oiled birds were eventually collected along the Southcentral Alaska coastline. (Ford et al. 1991, Piatt et al. 1991). Seventy-two Kittlitz's murrelets were positively identified, as well as an additional 446 unidentified *Brachyramphus* murrelets. Given that 5-10% of the murrelet population in this area consists of Kittlitz's murrelets, another 22-45 Kittlitz's can assumed to have been recovered, for a total of 94-117. The true number could be as high as 150-200 birds, depending on possible misidentifications and counting errors. (van Vliet 1994).

Piatt et al. (1990) estimated that 10-30% of birds killed by the immediate impact of the spill were recovered. This estimate is based on actual drift experiments and observations showing that many oiled birds will drift away from coastlines and never wash ashore, sink before reaching shore, wash up on inaccessible shorelines and not be discovered, or wash up on accessible beaches and be scavenged, buried, or overlooked. (Piatt et al. 1990). Therefore, as many as 1,000-2,000 Kittlitz's murrelets could have been killed as a direct result of the spill, representing 5-10% of the estimated worldwide populations. (van Vliet 1994). Another estimate of *Brachyramphus* murrelet mortality is contained in Kuletz (1996). This author states "...the estimated mortality for all murrelets was 10,000 - 22,000, with best approximation of 12,800 - 14,800." Multiplying these numbers by the approximately 8% of birds presumed to be Kittlitz's murrlets yields an estimate of 800-1,760 birds killed, with a best approximation of 1,024-1184. If these numbers are correct, then the Kittlitz's murrelet suffered the largest proportionate loss of its estimated worldwide population of any species impacted by the spill. (van Vliet 1994).

Further, there is little evidence that the Kittlitz's murrelet population is recovering in this area. (Lance et al. 1999). Lance et al. (1999) tested for recovery in two ways: (1) if the rate of population increase of a species within the oiled zone was greater than the rate of population increase outside the oiled zone, and (2) if the density of the species within the oiled zone was increasing. Lance et al. analyzed the data for *Brachyramphus* murrelets as a group, and concluded that there is no evidence of recovery for the summer populations by either measure. The second measure of density showed some signs of recovery for the winter populations (Id.), but given that the winter population is made up primarily of marbled, and not Kittlitz's murrelets, this indicator is much less relevant for the Kittlitz's than the summer measure. (Id.)

b. Future Threats

Unfortunately, there is no evidence that the probability of a future spill is any less after the 1989 spill. In fact, the average age of the 66 ships in the U.S. tanker fleet is now 23 years - significantly older than it was at the time of the *T/V Exxon Valdez* disaster. (Parr 2000). Eleven of these tankers range in age from 37 to 54 years. The average economic life of a tanker is 20 years, according to the American Shipbuilding Association. (Brown 1999). The Oil Pollution Act of 1990 ("OPA"), passed in response to the *T/V Exxon Valdez* disaster, requires that single-hulled tankers be phased out of the U.S. fleet and replaced by double-hulled tankers by 2015. Double-hulled tankers have been shown to significantly reduce the risk of an oil spill.

Large oil companies, led by Exxon, are actively working to circumvent this law or to have it modified by Congress. Eleven years after the *T/V Exxon Valdez*, and ten years after the passage of the OPA, Exxon has yet to introduce a new double-hulled tanker into its U.S. fleet. (Id.) Instead, it is seeking to bring the single hulled *T/V Exxon Valdez*, renamed the *T/V Mediterranean*, back into Alaskan waters, and continues to seek waivers to the double hull law. (Id.) Oil companies also "creatively" remeasured their ships after the passage of the OPA so that they would become lighter in weight, and thus, qualify for a later phase-out date. Congress stopped this scheme with an amendment to the OPA in 1997. The latest effort to usurp the phase-out schedule involved a proposal by Exxon and others to segregate and not carry oil in the side tanks of some of their older vessels that had already been phased out of service. These companies argued that this reconfiguration would result in a double sided ship, which should then receive five additional years of operating time. (Id.) Whether this scheme will escape correction by Congress remains to be seen.

At the time of the passage of the OPA, oil companies claimed that there was insufficient shipbuilding capacity to phase out single-hulled tankers by 2015. The shipbuilding industry insisted that it would be possible to completely replace single-hulled tankers with double-hulled tankers within eight years. Since 1990, many shipyards that were engaged in new ship construction with the capability to build double hulled oceangoing tankers have gone out of business. There still exists today more than sufficient shipbuilding capacity to replace the U.S.-flag single hull fleet well ahead of the

OPA-90 phase-out schedule. Some oil companies are purposely delaying replacing their ships -- hoping that the shipbuilding base will shrink further in an effort to get relief from Congress on the double hull law. Their strategy includes waiting until the last minute to place an order, demanding an unachievable delivery schedule, and then using the shipbuilding industry's inability to meet that unrealistic delivery date as a reason for Congress to grant them relief from the law. As the number of eligible tankers to meet domestic oil transportation needs decline, Congress will come under increasing pressure to excuse these companies from the requirements of the OPA. The American Shipbuilding Association estimates that if orders are not placed for double-hulled tankers within the next two years, there may not be sufficient shipbuilding capacity to meet the OPA's deadlines. (Above information from Brown 1999).

In general, the magnitude of mortality after an oil spill will depend on the size of the local bird populations, their foraging behavior, whether populations are aggregated or dispersed at the time of the spill, on the quantity of the oil spilled and on the persistence of the oil spilled. (Piatt et al. 1990). After contact, oil can kill birds by causing the feathers to lose their ability to insulate, which leads to hypothermia, and through toxicological effects after ingestion. (Id.) In the case of the *T/V Exxon Valdez* disaster, cleaning operations themselves constituted additional harm to the environment by killing marine life which survived and altering shoreline sediment structure which could ultimately effect repopulation of shorelines by sediment-dwelling invertebrates. (Lance et al. 1999).

The extreme vulnerability of the Kittlitz's murrelet to oil spills was predicted as early as 1979 by King and Sanger. In their study, they analyzed the vulnerability of 176 species of birds in the Northeast Pacific on the basis of 20 factors within the categories of range, population, habits, mortality, and annual exposure. (King and Sanger 1979). The ratings ranged from 100 (most vulnerable) to 0 (least vulnerable.) The Kittlitz's murrelet received a score of 88 on this scale, four points higher than the marbled murrelet and surpassed only by the short-tailed albatross (endangered throughout its range) and the Eskimo curlew (presumed extinct). (Id.). The existence of a flightless molt from mid-August to approximately late September (Day et al. 1999) also makes the Kittlitz's murrelet particularly vulnerable to oil spills during this time.

The foregoing analysis shows that the Kittlitz's murrelet faces an extreme threat to its continued survival due to marine oil pollution. The *T/V Exxon Valdez* disaster confirmed the extreme vulnerability of this species to oil spills-- a vulnerability predicted by King and Sanger's 1979 study. Unfortunately, little has actually been done since the spill to reduce the threat of an oil spill within the range of the Kittlitz's murrelet. Analysis of the U.S. shipping fleet shows that a major spill is more likely today than it was in 1989. (Brown 1999). The Kittlitz's murrelet may in fact be the most vulnerable to future oil spills of any marine bird taxa.

The case of the southern sea otter presents a striking parallel to that of the Kittlitz's murrelet. The otter, a marine mammal under the jurisdiction of the Fish and Wildlife Service "was listed as threatened in 1977 because of 1) its small size and limited distribution, and 2) the remaining habitat and population is potentially jeopardized by oil spills, pollution, and competition with humans." (USFWS 2000.) The Kittlitz's murrelet, like the southern sea otter, warrants listing for these two reasons alone.

2. Other Marine Pollution

The Kittlitz's murrelet is also vulnerable to other forms of marine pollution such as the dumping of trash and human waste from cruiseships. While such ocean dumping is generally illegal within the breeding range of the Kittlitz's murrelet, the dumping may occur illegally or ocean currents may carry pollution to areas occupied by Kittlitz's murrelets.

3. Global Warming

There can no longer be any reasonable doubt that global warming is occurring. (See, e.g., Crowley 2000; Easterling et al. 2000; McCarty 2001; Revkin 2000a, Revkin 2000b.) While the science of global warming is extremely complex and predictions of climate change vary greatly, there is also a wealth of information suggesting that global warming is occurring even faster than most models have projected. (Easterling et al. 2000; McCarty 2001; Revkin 2000b.) The area inhabited by the Kittlitz's murrelet is warming faster than other areas of the globe: Alaska temperatures have risen about 5EF (3EC) since the 1960s and 8EF (4.5EC) in the winter. (ARAG 1999). Temperatures rose quite suddenly by 3-4EF (1.5-2EC) in the late 1970s. There has already been extensive melting of glaciers, thawing of permafrost, and reduction of ice cover in the arctic and sub-arctic. Id.

Several authors have suggested that global warming is a major threat to the Kittlitz's murrelet. (See, e.g., Day et al. 1999; Senner 1999; van Vliet 1993). This species is intimately associated with and appears to feed exclusively in glacially affected areas, that is, near the face of a tidewater glacier or near the inflow of a glacial stream. The bulk of the worldwide Kittlitz's murrelet population breeds in Southeast and Southcentral Alaska, where large amounts of this habitat type are still found. In Southwestern and Western Alaska, where only small amounts of glacial and recently de-glaciated habitats are left, Kittlitz's murrelet numbers are much smaller. This strongly suggests that the Kittlitz's murrelet is dependent upon glacially affected marine areas to survive and thrive.

The current rate of global warming and the melting of the glaciers within the range of the Kittlitz's murrelets could virtually eliminate the habitat this species uses for feeding, courtship, and mating. In general, the rate at which species' boundaries can change is thought to be of key importance to understanding how species will respond to climate change. (McCarty 2001.) In the case of the Kittlitz's murrelet, which appears to be dependent upon glacially-affected coastal areas, this may very well be a moot point when there is not suitable habitat left to move to. It is highly probable that global warming is one factor that has contributed to the observed population declines, especially in areas such as Glacier Bay. Further studies are badly needed to document the relationship between global warming, the melting of glaciers, and the decline of the Kittlitz's murrelet. However, in the meantime, the FWS's own statement is particularly germane: "The Act requires the Service to make determinations on the appropriateness of listing based upon the best biological information available. The Service is not required to know the exact extent to which many factors may affect a species." 55 Fed. Reg. 12178 at 12780. Global warming and the attendant destruction of Kittlitz's murrelet habitat is sufficient, without more, for this species to be listed as endangered.

B. Other Natural or Manmade Factors Affecting the Kittlitz's Murrelet

1. Lack of Recruitment

Day and Nigro (1999) documented a lack of recruitment in Prince William Sound from 1996 to 1998. These authors wrote: "During all 3 yr combined, we saw only one HY [hatching year, or chick] Kittlitz's murrelet, a solitary bird seen just off a rocky beach on a nearshore survey in College Fjord on 30 July 1996….The calculation of HY:AHY ratios indicated that reproductive output was extremely low or zero in all 4 bays during all 3yr []" (Day and Nigro 1999). The lack of recruitment was probably at least partially due to reproductive failure. The authors calculated that the species was not present in Blackstone Bay or in Unakwik Inlet long enough to successfully reproduce. (Id.)

In the absence of population dynamics information for the Kittlitz's murrelet, Day and Nigro (1999) used a model for the marbled murrelet developed by Beissinger (1995) to discuss the implications of such poor recruitment.

> Body mass and annual reproductive effort are good predictors of annual survivorship in alcids. Marbled murrelets, which are similar in size to Kittlitz's murrelets and which also lay 1 egg/yr, are estimated to have an annual adult survivorship of ~85%. Further, Kittlitz's murrelets, like marbled murrelets, also exhibit geographic asynchrony in the timing of movements into and out of specific locations that, presumably, reflect asynchrony in the timing of reproduction. Unfortunately, the age at first breeding is unknown for both species, so Beissinger constructed his models for a range of ages. Given these model parameters, a Kittlitz's murrelet population in which the average age at first breeding was 3 yr would need to have an annual (female fecundity of 0.39/pair to remain stable if the average annual survivorship was 85% and 0.23/pair if the annual survivorship was 90%. Such fecundity levels would require HY:AHY ratios of ~0.18-0.28:1 in late summer. After correcting for the higher numbers of AHY birds that occur in the bays in early summer, these ratios would be ~0.13-0.26 for Kittlitz's murrelets or about 6-13 times the ratio that we measured in the only bay that appeared to produce young in 1996.

> The implication of Beissinger's modeling (1995) is that, if it occurs regularly in Kittlitz's murrelets, such a low level of productivity will result in substantial annual declines in population size. Although we have not constructed such models, **the low levels of fecundity recorded in this study and average annual survival rates of 95-90% would result in annual population declines of 10-15% if maintained over many years.** (Day and Nigro 1999) (emphasis added).

Finally, these authors state: "…the apparent pairing of some Kittlitz's murrelets with marbled murrelets suggests that overall populations of Kittlitz's murrelets in these bays *may be* becoming so small and/or that the marbled murrelet populations *may be* so large that they may be swamping the Kittlitz's murrelet population. (Day and Nigro 1999) (emphasis in original).

It is possible that sustained recruitment failures are responsible for the steady declines documented in Prince William Sound. (Day and Nigro (1999) do not reach this conclusion, however.)

There is also little or no record of chicks in the Glacier Bay region from 1991-1999. (Unpublished data provided by Glacier Bay National Park.) This suggests that lack of recruitment may be responsible for the declines documented by USGS (2001).

2. Observed Population Declines and Small Population Size

The observed population declines discussed *supra* should be considered here under Section 4(a)(1)(E) of the ESA. Available data show that the Kittlitz's murrelet is on a trajectory towards extinction, and action must be taken on the reasonable assumption that the observed population declines will continue. The listing of the southern sea otter based on small population size and the risk of future oil spills provides precedent for action to be taken on this factor alone. However, the case for listing the Kittlitz's murrelet is even stronger because the Kittlitz's murrelet is threatened by many factors in addition to observed population declines and the risk of future oil spills.

Small populations size itself should also be considered here. There is general agreement among conservation biologists that small population size per se constitutes an important risk of extinction because of a number of deterministic and stochastic factors of demography and population genetics. These factors include demographic stochasticity, environmental stochasticity, Allee effects, inbreeding depression, reduced genetic variability and loss of adaptive potential in gene frequencies, and fixation of new deleterious genetic mutations. These factors are among the central principles of conservation biology, and the FWS must consider them along with the observed population declines and small population size of the Kittlitz's murrelet in its decision whether to list the species.

As the FWS has acknowledged in past listing decisions, the FWS is not required to determine the exact cause of the population declines. 55 Fed. Reg. 12178 at 12180. For example, the final rule listing the desert tortoise states:

> In the case of the Mojave population of the tortoise many factors apparently act cumulatively to threaten its continued existence; and no one threat alone appears sufficient to cause the trends that have been noted. Although the extent of each adverse activity or disease on the overall population is not precisely known, available data indicate a decline in numbers in portions of the population's range. **For the Service to not proceed with the information now available would not be in keeping with the mandates of the Act**. Id. (emphasis added.)

This statement is directly applicable to the case of the Kittlitz's murrelet, a species that is poorly understood scientifically and has received relatively little attention. The precise cause of the observed declines is not known, however, the species is declining rapidly and clearly some combination of climactic shifts, commercial fisheries bycatch, oil pollution, vessel disturbance, and the other factors detailed herein are responsible. Under these circumstances, the FWS is required to list the species under the ESA.

3. Commercial Fisheries

a. Gill-net Bycatch Mortality

Hundreds of thousands of seabirds are killed annually by commercial gill-net fisheries in the North Pacific. (DeGange et al. 1993). Two types of commercial gill-nets are used in Alaskan waters: drift gill-nets, which are released from the boat to drift with the current and are then retrieved at a later time; and set gill-nets, which remain attached to the boat and can be set at varying depths. (Id.) In general, set gill-nets are allowed in all Alaskan waters with the exception of the Beaufort Sea and the Aleutian Islands, subject to regulation. For example, near shore gill-net fisheries are currently banned from Glacier Bay National Park. Drift gill-nets are more limited, and occur far offshore, beyond the usual foraging range of the Kittlitz's murrelet. There is no known evidence of mortality from the Japanese, Korean, or Taiwanese drift gill-net fisheries for salmon or squid in the North Pacific or Bering Sea (Day et al. 1999), however, more research is needed before these fisheries can be eliminated as a potential source of mortality.

This section focuses primarily on the nearshore salmon gill-net fishery[24], which targets specific stocks of fish as they return to rivers to spawn, and occurs close to land in a river, river delta, or fjord. (Carter et al. 1995). In Prince William Sound, two of the

[24] Sometimes boats participating in the nearshore salmon gill-net fishery are called "drift gillnetters" because the boats drift with the currents while fishing. The nets, however, are technically set gillnets because they stay attached to the boat, and should not be confused with drift gill-nets used on the high seas.

four fishing districts occur in or near localized Kittlitz's Murrelet habitat. (Day et al. 1999).

In Prince William Sound, the first targeted study by Wynne et al. (1992) estimated that 133 Kittlitz's murrelets were drowned in the salmon gill-net fishery in 1991. (Day et al. 1999; Wynne et al. 1992). Kittlitz's murrelets appear to be particularly vulnerable to this fishery: they represented only 0.5% of all birds seen #10 m from nets but represented 11.3% of all birds killed by the nets; they represented only about 7% of all murrelets in Prince William Sound, but accounted for 30% of all murrelets killed. (Day et al. 1999). Assuming an annual kill of 133 birds and a current population estimate of 3,368 (Kendall and Agler 1998), nearly 4% of the population in Prince William Sound is killed by commercial fishing vessels each year.

Despite mounting concern over the effect of gill-net fisheries on seabirds in general and on murrelets in particular (Carter et al. 1995; Carter and Morrison 1992; Carter and Sealy 1984; DeGange et al. 1993), the Wynne et al. (1992) study contains the only mortality data specifically for the Kittlitz's murrelet. More information is available for the effect of gill-net fisheries on marbled murrelets. (Carter et al. 1995; DeGange 1996; DeGange et al. 1994; Carter and Sealy 1984) Given the large overlap in the ecology and range of the Kittlitz's and marbled murrelets, it is safe to assume that Kittlitz's murrelets are being impacted in much the same way as marbled murrelets. Indeed, the data from Prince William Sound indicate that Kittlitz's murrelet populations that occur in the same area as nearshore gill-net fisheries suffer greater proportional losses than marbled murrelets or other seabirds.

Carter et al. (1995) stated "It is clear that gill-net mortality has the potential to be the greatest conservation problem for Marbled Murrelets in Alaska since it occurs annually throughout almost all at-sea foraging areas during the breeding season when murrelets are aggregated," and "Gill-net mortality may act separately or in concert with the loss of nesting habitat and mortality from oil pollution to threaten survival of several populations." These statements can be applied to the Kittlitz's murrelet as well.

Carter et al. (1995) analyzed available data from the 1950's to the present. They concluded that marbled murrelet mortality was occurring at least as early as the 1950's and 1960's, due to scattered reports throughout that time. One can assume, therefore, that Kittlitz's murrelet mortality was also occurring during this time period. Pete Isleib (himself a commercial fisherman) estimated that "several hundreds" of murrelets were killed annually throughout the 1970's in Prince William Sound: 100-300 in the Copper and Bering River districts (which front the open Gulf of Alaska) and 500 birds per year in the Coghill-Unakwik and Eshamy districts. Assuming that about 7% of all murrelets in this area are Kittlitz's murrelets (Kendall and Agler 1998), this would mean an overall kill rate of 42-56 Kittlitz's murrelets per year from the fishery. However, if data from Wynne et al. (1992) are used, which show that Kittlitz's murrelets accounted for 30% of all murrelets killed in Prince William Sound in 1991, then the kill rate would be estimated at 180-240 Kittlitz's murrelets per year.

Isleib estimated that mortality in Prince William Sound increased throughout the 1980's and 1990's due to the fact that vessels began to fish continuously around the clock, more boats began fishing, and a finer web mesh was introduced for fishing nets. (Carter et al. 1995). Isleib also estimated that up to 1000 murrelets per year were taken in Southeast Alaska based on the number of boats on the water and the length of time spent fishing, fishing locations, and the types of gear used. Using Kendall and Agler's (1998) estimate that only about 1% of murrelets in Southeast Alaska are Kittlitz's murrelets, this would lead to an estimate of 100 Kittlitz's murrelets per year killed in this area from this fishery. However, this figure would probably vary greatly depending on how many Kittlitz's murrelets forage in areas with intensive gill-net fisheries. Given the overall low numbers and declining population trend of the Kittlitz's murrelet, it is vitally important that this information be gathered as soon as possible. It is known that three fishing subdistricts in Southeast with intensive gill-net fishing overlap with at-sea foraging aggregations of marbled murrelets: area 1B, at the south end of Revillagigedo Channel near the Canadian border; area 6A, near Baker Point in Sumner Strait; and area 11B, south of Juneau in the central part of Stevens Passage. (DeGange 1996). No such data has been assembled for the Kittlitz's murrelet.

Isleib also estimated that similar mortality of marbled murrelets as in Southeast Alaska and Prince William Sound occurred along the Alaska peninsula during the 1970's and 1980's. (Carter et al. 1995). As with the marbled murrelet, nearshore gill-net fisheries clearly have the potential to represent a significant source of mortality for the Kittlitz's murrelet, wherever they co-occur with aggregations of the species.

Carter et al. also noted that juvenile marbled murrelets may be disproportionately killed by gill-nets. (Id.) This is because young of the year showed little fear of vessels, and because juveniles tend to dive from suspected danger, while adults tend to fly. (Id.) This observation is quite likely true of Kittlitz's murrelet young as well, since they are excellent swimmers but poor fliers at fledging. The fact that Kittlitz's murrelets undergo a flightless molt from mid August until approximately late September makes them particularly vulnerable to gill-net mortality during this time, as their only possible response to vessel disturbance would be to dive, thereby increasing their chances of being caught by a net and drowned.

An additional source of mortality for Kittlitz's murrelets may be salmon gill-nets that are set from shore near river mouths. Because Kittlitz's murrelets can forage extremely close to shore and in extremely shallow water, it is possible that these fisheries could drown these birds as well. More research is needed to determine whether these fisheries may pose a risk to the Kittlitz's murrelet.

Mortality due to gill-net fisheries has been shown to be a significant factor in the decline of ancient murrelets (*Synthliboramphus antiquus*) in British Columbia (Bertram 1995) and in the decline of endangered Japanese murrelets (*Synthliboramphus wumizusume*). (Piatt and Gould 1994).

Mortality due to gill-net fisheries clearly has the potential to be a major threat to the Kittlitz's murrelet. Where data is available, it shows both high rates of mortality and a disproportionately large impact on this species relative to other seabirds, even the closely related marbled murrelet. It is absolutely vital for regulatory agencies to increase observer coverage of the near shore gill-net fisheries and collect better data on seabird bycatch in general. The FWS should immediately assess how many Kittlitz's murrelet populations forage in the summer in areas with active gill-net fisheries in order to better estimate the magnitude of this threat to the species.

b. Other Fisheries Interactions

Commercial fishing may also affect breeding and feeding. Day and Nigro (1999) have suggested that excessive human disturbance has caused the abandonment of certain areas by Kittlitz's murrelets in the summer. (See below section on human disturbance.) Unfortunately, Kittlitz's murrelet habitat is also preferred by commercial fishermen and tourists, due to the presence of fish stocks and the astounding natural beauty of these areas.

4. Climate Regime Shift

The ocean climate in the Gulf of Alaska cycles between warm and cold regimes. (Anderson and Piatt 1999; Hare and Mantua 2000). Two cycles have been noted in this century, with reversals in 1925 (cold to warm), 1947 (warm to cold), and 1976 (cold to warm). (Id.) The way in which these reversals are induced and the parameters of the biological response are unknown. However, recent work by Anderson and Piatt (1999) has explicated many of the responses in the Gulf of Alaska following the latest climate regime shift.

During the last reversal in 1976-1977, the Aleutian Low pressure system shifted south and intensified, leading to stronger westerly winds and warmer surface waters in the Gulf of Alaska. (Id.) Data compiled by Anderson and Piatt provide compelling evidence that a community reorganization occurred following the 1976-1977 climate regime shift. Some forage fish populations collapsed, while groundfish recruitment and catches of Pacific salmon (*Oncorhynchus* spp.) increased sharply. The biological response generally lagged 15 to 20 years behind the climate shift in the Gulf of Alaska, but happened within 2 to 5 years in some individual bays. While some of the changes observed may have been caused by commercial fishing, species such as capelin which have never been commercially harvested also collapsed almost completely, leading to the conclusion that at least some of the changes are related to the climate shift. (Id.)

Alger et al. (1999) have also suggested that the climatic regime shift is at least partially responsible for a 50% decline in total marine bird populations in Prince William Sound from 1972 to 1989-1993. They suggest that there is a direct connection between the reduced prey base available as a result of the forage fish declines, and declines in marine bird populations. (Agler et al. 1999). This study found that 14 out of 17 piscivorous bird species studied declined in Prince William Sound. During this time, the estimated population of Kittlitz's murrelets declined from 63,229 ± 80,122 in 1972 to 1,184 ± 1,121 in 1991. (Klosiewski and Laing 1994). The Kittlitz's murrelet is thought to feed primarily on capelin, sandlance, herring, and sandfish. Three of these taxa, capelin, herring, and sandfish, were documented by Anderson and Piatt (1999) to have declined sharply coincident with the climatic regime shift.

The decline in Kittlitz's murrelets may be at least partially due to the effects of the climatic regime shift of 1976-1977 in the Gulf of Alaska.

5. Human Disturbance

Day and Nigro (1999) documented dramatic declines in Kittlitz's murrelet populations in Blackstone Bay in Prince William Sound between 1996-1998. Population estimates from 1996 to 1998 were as follows: 222 ± 306 (95% CI), 119 ± 181, and 48 ± 108, respectively. (Day and Nigro 1990). Blackstone Bay is immediately adjacent to the Whittier Arm, and is heavily impacted by recreation, in particular motorized boating. Day and Nigro suggest that excessive human disturbance is causing abandonment of this area by Kittlitz's murrelets.

Since cruiseships and Kittlitz's murrelets tend to concentrate in the same fjords and bays, this issue is particularly pressing. The most vessel traffic occurs in the areas with the highest populations of Kittlitz's murrelets, i.e. Southeast Alaska and Prince William Sound. Glacier Bay National Park, which is protected from gillnet fisheries, is visited by throngs of cruiseships during the nesting season. Human activity, in particular vessel traffic, could impact the Kittlitz's murrelet in a number of ways.

Vessels may disturb the birds and decrease feeding efficiency and/or interrupt reproductive behavior. The disturbance may be from the visual aspects (e.g. a large cruiseship with many humans standing on the deck) or from the underwater noise produced by the ship. Vessel traffic is also likely to scatter the forage fish prey of the Kittlitz's murrelet, which could greatly decrease feeding efficiency. Young chicks may be disproportionately affected, since they are completely dependent on fish brought to them by their parents, and cannot switch to alternate forms of food if forage fish are unobtainable.

The precise effect of vessel traffic on the Kittlitz's murrelet is unknown, but the potential for harm is very high. Man-made underwater noise is a serious issue. Kittlitz's murrelets, like all other marine creatures, live in a sound environment influenced by both natural and man-made factors. The effect of man-made noise on the Kittlitz's murrelet must be assessed relative to the naturally occurring background noise level in the ocean. Sound is measured by the decibel unit, which is the ratio between a measured pressure value and a reference pressure value. (NMFS 1999a.) One study of Arctic waters found the ambient sound level in the absence of human activity to be 79-119 decibels. (Id.)

An important acoustic principle is that decibel measurements are logarithmic. (U.S. Navy 1999). This means that each 10 decibel increase is a ten-fold increase in pressure. Id. The decibel level encountered by a Kittlitz's murrelet from a given source depends on a number of factors including the source level, source frequency, whether the source is above or below the water and how far above or below, distance of the bird from the source, and propagation of the sound through the water. The propagation of sound through the water in turn depends on water depth, temperature, salinity, topographical features and other factors. (Richardson and Malme 1993). The speed of sound in Arctic ocean water is approximately 1440 m/s. (Id.) Putting all these principles together, one can see, for example, that a noise that raises the ambient noise level by 25 decibel 1 km from the source will make the ambient noise level 300 times greater than it would normally be. (NMFS 1999a).

Most medium to large ships (like cruiseships) produce source sound levels in the range of 165-175 decibels, though some with source levels as high as 175-185 decibels may occur. Smaller outboard and inboard motorboats produce source levels generally less than 167 decibels, however several small boats operating near each other may produce sound levels similar to that of a larger ship. (Richardson and Malme 1993.) It is obvious at the outset that vessel traffic within the range of the Kittlitz's murrelet produces sound levels many hundreds of times greater than what would ever be encountered in the absence of human activity. Cruiseships and Kittlitz's murrelets both tend to congregate in the heads of fjords and bays. This means that the ships approach extremely close to the birds. It may also have important consequences for sound propagation, as the noise from the ship may "bounce" off the walls of the fjords, creating an even greater sonic disturbance. Finally, sounds propagate better at greater depths, and therefore birds would be unable to escape the noise by diving more deeply. Diving, in fact, would make any disturbance from the noise worse.

Assessing the effect of human-caused noise on the Kittlitz's murrelet is extremely complex, and such studies have not yet been attempted. However, it is clear that there are at least three ways that Kittlitz's murrelets could be affected by underwater noise: (1) feeding and/or reproductive behavior could be disrupted because the birds are disturbed by the noise; (2) forage fish prey may be scattered, decreasing feeding efficiency; (3) individual birds could suffer permanent or temporary hearing impairment from the noise.

It is clear that regulatory agencies have not been applying the precautionary principle with regard to the possible effects of vessel traffic and human disturbance on species such as the Kittlitz's murrelet. For example, in 1996 the National Park Service ("NPS") commenced implementation of a plan that immediately increased the number of cruise ships that could enter Glacier Bay each summer season by 30%. National Parks and Conservation Association v. Babbitt, ____ F 3d. ____, 2000 WL 33181419 (9th Cir. 2001). The plan allowed for an eventual increase of 72% in vessel numbers if certain conditions were met. Id. The NPS promulgated and implemented this plan without preparing an Environmental Impact Statement ("EIS") under the National Environmental Policy Act ("NEPA"). Instead, the NPS prepared an Environmental Assessment ("EA"), a less rigorous and formal analysis than an EIS. Despite the findings in the EA that the increase in vessel traffic had the potential to disturb a host of species such as the federally threatened Steller sea lion, the federally endangered humpback whale, the killer whale, harbor seal, harbor porpoise, bald eagle, marbled murrelet, Kittlitz's murrelet and others, the NPS issued a Finding of No Significant Impact for the increase in permitted cruise ships. Id. After several years of litigation, the Ninth Circuit recently ruled that the NPS's decision to adopt the increases without further environmental analysis pursuant to an EIS was unlawful. Id. The Court stressed the fact that it was easily within the NPS's power to gather information on the effects of cruiseships on species that the NPS claimed was "unknown." Id. The Court ordered the NPS to conduct further studies and prepare an EIS on the effects of the increase in vessel traffic. Id. The Court further enjoined all increases permitted by the NPS plan until the EIS was completed. Id.

The National Parks and Conservation Association v. Babbitt case is a rare example where the court system has forced a regulatory agency to apply the precautionary principle with regard to the effects of vessel traffic on wildlife. Unfortunately, the increased human activity within the range of the Kittlitz's murrelet continues apace with few such checks and balances.

The summer of 2000 marked the opening of the Whittier Road, a tourbus and automobile route that replaced train service from Portage to the town of Whittier, one of the most popular "gateways" to Prince William Sound. The express purpose of this project was to increase commercial tourism to Whittier and to Prince William Sound over the long term. (Singer 1998). So important was this goal, in fact, that the Alaska Department of Transportation, Federal Highway Administration, and State of Alaska rejected an improved rail service alternative that would have been safer, cheaper, and less environmentally damaging on the sole basis that demand for access to Whittier via train would simply never be as great as demand for access to Whittier via road. (Id.) For the Kittlitz's murrelet, however, vastly increased tourism over the past several decades, coupled with the increase in visitation that the Whittier Road is expected to bring, presents a very great threat. This problem of increased human disturbance is evident in other areas, as well.

While the alpine nesting environment of the Kittlitz's murrelet was previously extremely inaccessible to humans, the increase in "heli-hiking" and "heli-tours" over the past decade is increasing disturbance of this area as well. Given the State of Alaska's position that increased tourism must be facilitated, as evidenced by the State's position in the Whittier Road case, there will likely be no meaningful restrictions placed on heli-tours within the range of the Kittlitz's murrelet unless this species receives protection under the ESA.

C. The Inadequacy of Existing Regulatory Mechanisms

The fact that the Kittlitz's murrelet is a rare and relatively little understood species creates special regulatory problems challenges. One author summed up the situation as follows: "Our concern here is an inability or unwillingness of agencies to focus on rare or seriously threatened species. Rarity of a species suggests that a priori data are few, and that quantitative assessment will be difficult; it also implies a high susceptibility to natural or human-caused catastrophe - all traits that predispose the species for federal listing." (Paine et al. 1996).

The Kittlitz's murrelet faces a formidable list of threats, many of which could be ameliorated or eliminated by regulatory actions. To date, few, if any, of these regulatory actions have been implemented with regard to the Kittlitz's murrelet, despite the existence of regulatory authority by various agencies. Current regulatory mechanisms are clearly inadequate to protect the Kittlitz's murrelet, as discussed further below. The documented decline of the Kittlitz's murrelet is itself *de facto* evidence of the inadequacy of existing regulatory mechanisms.

The risk of oil spills within the range of the Kittlitz's murrelet could be reduced by requiring the use of double-hulled tankers for transport. The Oil Pollution Act of 1990 (33 U.S.C. §§2701-2719) requires that single-hulled tankers be phased out of the U.S. Fleet by 2015. To date, some major oil companies, including Exxon, have yet to replace any single-hulled tankers in their fleet. An analysis of the average age of the U.S. fleet shows that an oil spill is actually more likely to occur within the range of the Kittlitz's murrelet today than in 1989. (See above section, "Marine Oil Pollution"). Clearly the Oil Pollution Act has as yet been inadequate to protect the Kittlitz's murrelet from the threat of oil spills.

Ultimately, the most serious threat facing the Kittlitz's murrelet may prove to be global warming. Clearly, the existing regulatory mechanisms have been inadequate to reduce hydrocarbon emissions and the other causes of global warming. At a minimum, the U.S. needs to implement the Kyoto protocol and decrease the amount of CO_2 and other greenhouse gasses. Instead of taking these steps the Bush Administration is going in the exact opposite direction by reversing the U.S.'s position on Kyoto, encouraging drilling for oil in ANWR, and encouraging an increase in coal-fired electricity production plants. While ESA listing will alone may not protect the Kittlitz's murrelet and its habitat from human-induced climate change, existing mechanisms are indisputably inadequate.

Several authors have pointed out that gill-net mortality could be substantially reduced by two actions: (1) excluding fishing from areas with high murrelet densities, and (2) allowing fishing during daylight hours only, since most murrelets are killed during night-time fishing. (Carter et al. 1995; Carter and Sealy 1984). No such measures are currently in place with regard to the Kittlitz's murrelet, though the regulatory authority does exist.

There is evidence that Kittlitz's murrelets are threatened by the disturbance caused by human recreation, particularly motorized tour boats, in the bays where they congregate. This problem is certain to increase as tourism in Prince William Sound increases via the newly-opened Whittier Road. Kittlitz's murrelets could be protected, for example, by establishing protective zones within which motorized boats could not approach, by prohibiting motorized access to certain Bays during the breeding season, by limiting the number or size of motorized boats on the water, or by other strategies. Few, if any, such measures are currently in place with regard to vessel disturbance, though most of the world's population of the Kittlitz's murrelet occurs in areas where the regulatory authority exists (e.g., Glacier Bay National Park, Kenai Fjords National Wildlife Refuge, Chugach National Forest). Moreover, in some cases the regulatory agencies are actually involved in promoting increased motorized access to areas inhabited by Kittlitz's murrelets.

The FWS should not hesitate to list the Kittlitz's murrelet since it is clearly imperiled by the inadequacy of existing regulatory mechanisms, particularly in regard to marine oil pollution, global warming, fisheries by-catch, and human disturbance, as discussed above.

D. Disease or Predation

Very little is known about disease and predation among Kittlitz's murrelets. Scientists believe that the Kittlitz's murrelet nests at high elevations and on rock or scree cliffs at least in part to avoid mammalian predators. (Piatt et al. 1994, Piatt et al. 1999). Common ravens may take young from nests. In addition, bald eagles and peregrine falcons are known to often take marbled murrelets in the Gulf of Alaska and the Aleutian Islands, and may prey upon Kittlitz's murrelets as well. (Day et al. 1999). Corvid populations are known to increase around areas of human inhabitation (e.g. cities, campgrounds, and dumps). Increasing human presence in areas where Kittlitz's murrelets nest could increase predation.

Almost nothing is known about diseases and parasites that affect Kittlitz's murrelets.

E. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

The Kittlitz's murrelet does not appear to be currently threatened by overutilization for commercial, recreational, scientific, or educational purposes. To the extent that the Kittlitz's murrelet itself, as an interesting and beautiful seabird, attracts tourists and tourboats, this issue has been discussed above under "Human Disturbance."

V. CRITICAL HABITAT SHOULD BE DESIGNATED FOR THE KITTLITZ'S MURRELET

Critical habitat is defined by Section 3 of the ESA as:

(i) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 1533 of this title, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and

(ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 1533 of this title, upon a determination by the Secretary that such areas are essential for the conservation of the species. 16 U.S.C. §1532(5).

The designation and protection of critical habitat is one of the primary ways in which the fundamental purpose of the ESA, "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved," (16 U.S.C. §1531(b) (emphasis added)) is achieved.

Critical habitat receives additional protection through Section 7 of the ESA. The Section 7 consultation requirements provide that no action authorized, funded, or carried out by any federal agency will "jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of [critical habitat]" 16 U.S.C. §1536(a)(2) (emphasis added). "Destruction or adverse modification" is further defined in the implementing regulations as an "alteration [of habitat] that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species." 50 C.F.R. §402.02. This prohibition is separate and distinct from, and in addition to the prohibition against actions which "jeopardize the continued existence of" a species. "Jeopardize the continued existence of" is defined as "to reduce appreciably the likelihood of both the survival and recovery of a species by reducing the reproduction, numbers, or distribution of that species." 50 C.F.R. §402.02.

Critical habitat designation offers an added layer of protection to ensure that a listed species' habitat - the loss of which is widely recognized to be the primary reason for most species' decline - will not be harmed. Without critical habitat designation, a listed species' protection under Section 7 of the ESA is effectively limited to avoiding "jeopardy" to the species in its occupied habitat, without separate consideration of the potential for "destruction or adverse modification" of habitat or suitable unoccupied habitat which may be essential to the species' recovery. This distinction was nicely summarized by the U.S. Fish and Wildlife Service in the Final Rule designating critical habitat for the northern spotted owl:

> The Act's definition of critical habitat indicates that the purpose of critical habitat is to contribute to a species' conservation, which definition equates to recovery. Section 7 prohibitions against the destruction or adverse modification of critical habitat apply to actions that would impair survival and recovery of the listed species, thus providing a regulatory means of ensuring that Federal actions within critical habitat are considered in relation to the goals and recommendations of a recovery plan. As a result of the link between critical habitat and recovery, the prohibition against destruction or adverse modification of the critical habitat would provide

> for the protection of the critical habitat's ability to contribute fully to a species' recovery. ***Thus, the adverse modification standard may be reached closer to the recovery end of the survival continuum, whereas, the jeopardy standard traditionally has been applied nearer to the extinction end of the continuum.*** (57 Fed. Reg. 1796 at 1822) (emphasis added)).

This added protection will be implemented through the issuance of a biological opinion under 16 U.S.C. §1536(b)(3)(A), which must suggest reasonable and prudent alternatives by which a finding of jeopardy or adverse modification may be avoided.

Critical habitat designation also protects species by helping to define the meaning of "harm" under Section 9 of the ESA, which prohibits unlawful "take" of listed species, including harming the species through habitat degradation. Although "take" through habitat degradation is not expressly limited to harm to "critical habitat," it is practically much easier to demonstrate that the significance of the impact to a species' habitat where that habitat has already been deemed "essential," or "critical," to the species' continued survival. (*See* Palila v. Hawaii Department of Land and Natural Resources, 852 F. 2d 1106 (9th Circ. 1988)).

Critical habitat also helps species by providing for agency accountability through the citizen suit provision of the ESA. The citizen suit provision permits members of the public to seek judicial review of the agency's compliance with its mandatory statutory duty to consider the habitat needs of imperiled species. Also, the designation of critical habitat provides valuable information for the development of recovery plans that identify actions, including habitat protection, necessary for the recovery of the species.

The Kittlitz's murrelet will benefit from the designation of critical habitat in all of the ways described above. The added layer of protection provided by critical habitat will also allow the FWS to designate reasonable and prudent alternatives to activities that are impeding recovery but not necessarily causing immediate jeopardy to the continued survival of the species. This is particularly important as the level of fishing, tourism, and industrial vessels operating within the range of the Kittlitz's murrelet continues to grow. To give this type of protection to a species through the protection of its habitat was the clearly articulated intent of Congress in the 1978 and 1982 amendments to the ESA.

VI. CONCLUSION

For all the foregoing reasons, Petitioners respectfully request that the U.S. Fish & Wildlife Service designate the Kittlitz's murrelet as an endangered species with concurrent designation of critical habitat.

SIGNATURE PAGE

This PETITION TO LIST THE KITTLITZ'S MURRELET (BRACHYRAMPHUS BREVIROSTRIS) AS AN ENDANGERED OR THREATENED SPECIES WITH CONCURRENT DESIGNATION OF CRITICAL HABITAT is hereby submitted to the Secretary of the Interior.

Respectfully submitted this 9th day of May, 2001.

Kassie Siegel
Center for Biological Diversity
P.O. Box 40090
Berkeley, CA 94704-4090

Lynn Canal Conservation, Inc.
P.O. Box 1324
Haines, AK 99827
Contact: Eric Holle

David Grimes
Coastal Coalition
P.O. Box 1636
Cordova, AK 99574

Pat Veesart
Sitka Conservation Society
P.O. Box 6533
Sitka, AK 99835

Dune Lankard
Eyak Preservation Council
P.O. Box 460
Cordova, Alaska 99574

VII. Bibliography of Literature Cited

Agler, B.A, S.J. Kendall, D.B. Irons, and S.P. Klosiewski. 1999. Changes in marine bird populations in Prince William Sound, Alaska coincident with a climactic regime shift. Colonial Waterbirds 22(1): 98-103.

Agler, B.A., S.J. Kendall and D.B. Irons. 1998. Abundance and distribution of marbled and Kittlitz's murrelets in southcentral and southeast Alaska. Condor 100: 254-265.

Alaska Regional Assessment Group (ARAG). 1999. Preparing for a changing climate. U.S. Global Change Research Program. University of Alaska Fairbanks.

Anderson, P.J. and J.F. Piatt. 1999. Community reorganization in the Gulf of Alaska following ocean climate regime shift. Mar Ecol Prog Ser 189:117-123.

Bedard, J. 1969. Adaptive radiation in Alcidae. Ibis 111: 189-198.

Bailey, A.M. 1925. A report on the birds of northwestern Alaska and regions adjacent to Bering Strait. Part II. Condor 27: 62-67.

Bailey, A.M. 1927. Notes on the birds of south-eastern Alaska. Auk 44: 1-23.

Bailey, A.M. 1943. The birds of Cape Prince of Wales, Alaska. Proc. Colo. Mus. Nat. Hist. 18: 1-113.

Bailey, E.P. 1973. Discovery of a Kittlitz's Murrelet nest. Condor 75: 457-486.

Bailey, E.P. 1976. Breeding bird distribution and abundance in the Barren Islands, Alaska. Murrelet 57: 2-12.

Bailey, E.P. 1977. Distribution and abundance of marine birds and mammals along the south side of the Kenai Peninsula, Alaska. Murrelet 58: 58-72.

Bartonek, J.C. and D.D. Gibson. 1972. Summer distribution of pelagic birds in Bristol Bay, Alaska. Condor 74: 416-422.

Bedard, J. 1966. New records of alcids from St. Lawrence Island, Alaska. Condor 68: 503-506.

Bedard, J. 1969. Adaptive radiation in Alcidae. Ibis 111: 189-198.

Bent, A.C. 1919. Life histories of North American diving birds, order Pygopodes. U.S. Nat. Mus. Bull.

Beissinger, S.R. 1995. Population trends of the marbled murrelet projected from demographic analyses. Pages 385-393 *in* C.J. Ralph, G.L. Hunt, Jr., M.G. Raphael, and J.F. Piatt, eds. Ecology and conservation of the marbled murrelet. U.S. Dept. of Agriculture, Forest Service, Pacific Southwest Research Station, Albany, CA. General Technical Report PSW-GTR-152.

Bertram, D.F. 1995. The roles of introduced rats and commercial fishing in the decline of ancient murrelets on Langara Island, British Columbia. Conservation Biology 9(4):865-872.

Blakiston and Pryer. 1878. Ibis "1878" :210.

Brown. 1999. Statement of Ms. Cynthia L. Brown, President of the American Shipbuilding Association. Before the House Committee on Transportation and Infrastructure Subcommittee on Coast Guard and Maritime Transportation. June 29, 1999. http://www.americanshipbuilding.com/news-test62999.html

Burns, R.A., L.M. Prestash, and K.J. Kuletz. 1994. Pilot study on the capture and radio tagging of murrelets in Prince William Sound, Alaska, July and August, 1993. USFWS Final Report, Project #93051B - Exxon Valdez Restoration Project.

Byrd, G.V., D.D. Gibson, and D.L. Johnson. 1974. The birds of Adak Island, Alaska. Condor 76: 288-300.

Byrd, G.V. 1988. An issue paper on the impact of foxes on the "avian ground-nesting guild" of the Aleutian islands. U.S. Fish and Wildlife Service Report, Adak, Alaska.

Carter, H.R., M.L. McAllister, M.E. "Pete" Isleib. 1995. Mortality of marbled murrelets in gill nets in North America. *In*: Ralph, C.J., G.H. Hunt, Jr., M.G. Raphael, J.F. Piatt, eds. Ecology and conservation of the marbled murrelet. Gen. Tech. Rep. PSW-GTR0152. Albany, CA: U.S. Dept. of Agriculture, Forest Service: 271-283.

Carter, H.R. and S.G. Sealy. 1984. Marbled murrelet (Brachyramphus marmoratus) mortality due to gill-net fishing in Barkley Sound, British Columbia. *In*: Nettleship, D.N., G.A. Sanger, and P.F. Springer, eds. Marine birds: their feeding ecology and commercial fisheries relationships. Spec. Publ. Ottawa, ON: Canadian Wildlife Service: 212-220.

Crowley, T.J. 2000. Climate change over the past 1000 years. Science 289: 270-277.

Day, R.H. and D.A. Nigro. 2000. Feeding ecology of Kittlitz's and marbled murrelets in Prince William Sound, Alaska. Waterbirds 23(1)1-14.

Day, R.H. and D.A. Nigro. 1999. Status and ecology of Kittlitz's murrelet in Prince William Sound, 1996-1998. Exxon Valdez Oil Spill Restoration Project Final Report 98142. ABR, Inc. Fairbanks, AK.

Day, R.H., K.J. Kuletz, and D.A. Nigro. 1999. Kittlitz's Murrelet Brachyramphus brevirostris. The Birds of North America, No. 435.

Day, R., K.L. Oakley, and D.R. Barnard. 1983. Nest sites and eggs of Kittlitz's and Marbled Murrelets. Condor 85: 265-273.

Day, R.H., 1995. New information on Kittlitz's Murrelet nests. Condor 97: 271-273.

Day, R.H., 1996. Nesting phenology of Kittlitz's Murrelet. Condor 98: 433-437.

DeGange, A.R. 1996. A conservation assessment for the marbled murrelet in Southeast Alaska. U.S. Forest Service General Technical Report PNW-GTR-388. Pacific Northwest Research Station.

DeGange, A.R., R.H. Day, J.A. Takekawa, and V.M. Mendenhall. 1993. Losses of seabirds in gill nets in the North Pacific. *In*: Vermeer, K., K.T. Briggs, K.H. Morgan, and D. Siegel-Causey, eds. The status, ecology, and conservation of marine birds of the North Pacific. Spec. Publ. Ottawa, ON: Canadian Wildlife Service: 204-211.

Dick, M. 1977. Notes on the winter seabirds of Chiniak Bay, Kodiak Island, Alaska. U.S. Fish and Wildlife Service Annual Report, Anchorage, Alaska.

Divoky, G.J. 1981. Birds and the ice-edge ecosystem in the Bering Sea. Pp. 799-804 *in* The eastern Bering Sea shelf: oceanography and resources (D.W. Hood and J.A. Calder, oeds.). Vol. 2. Univ. of Washington Press, Seattle, WA.

Divoky, G.J. 1984. The pelagic and nearshore birds of the Alaskan Beaufort Sea: biomass and trophics. Pp. 417-437 *in* The Alaskan Beaufort Sea: ecosystems and environments ((P.W. Barnes, D.M. Schell, and E. Reimnitz, eds.) Academic Press, Orlando, FL.

Dolphin, W.F. and D. McSweeney. 1983. Incidental ingestion of Cassin's Auklets by Humpback Whales. Auke 100: 214.

Dwyer, T.J., P. Isleib, D.A. Davenport, and J.L. Haddock. 1975. Marine bird populations in Prince William Sound, Alaska. Unpublished Report, USFWS, Anchorage, Alaska, 19 p.

Easterling, D.R, G.A. Meehl, C. Parmesan, S.A. Changnon, T.R. Sarl, and L.O. Mearns. 2000. Climate Extremes: Observations, Modeling, and Impacts. Science 289: 2068-2074.

Ewins, P.J., H.R. Carter, and Y. V. Shibaev. 1993. The status, distribution, and ecology of inshore-feeding alcids (*Cepphus* guillemots and *Brachyramphus* murrelets) in the North Pacific. Pp. 164-175 *in* The status, ecology, and conservation of marine birds of the North Pacific (K. Vermeer, K.T. Briggs, K.H. Morgan, and D. Siegel-Causey, eds.). Can. Wildl. Serv., Spec. Publ.

Ford, E.R. 1936. Kittlitz's Murrelet breeding at Wales, Alaska. Auk 53: 214-215.

Ford, R.G., M..L. Bonnell, D.H. Varoujian, G.W. Page, B.E. Sharp, D. Heinemann, and J.L. Casey. 1991. Assessment of direct seabird mortality in Prince William Sound and the Western Gulf of Alaska resulting from the Exxon Valdez oil spill. Unpubl. Report, Ecological Consulting, Portland, Oregon.

Forsell, D.J.; Gould, P.J. 1981. Distribution and abundance of marine birds and mammals wintering in the Kodiak area of Alaska. U.S. Fish Wildl. Serv. Biol. Serv. Prog. Rep. FWS/OBS-81/13.

Fox, J.L. and J.E. Hall. 1982. A Kittlitz's Murrelet nest in southeast Alaska. Murrelet 63: 27.

Friedman, H. 1934. The Mongolian Plover and other birds at Goodnews Bay, Alaska. Condor 36:89.

Friesen, V.L., A.J. Baker, and J.F. Piatt. 1996a. Phylogenetic relationships within the Alcidae(Charadriiformes: Aves) inferred from total molecular evidence. Mol. Biol. Evol. 13: 359-367.

Friesen, V.L., J.F. Piatt, and A.J. Baker. 1996b. Evidence from Cytochrome b sequences and allozymes for a "new" species of alcid: the Long-billed Murrelet (*Brachyramphus perdix*). Condor 98: 681-690.

Gabrielson, I.N. and F.C. Lincoln. 1959. The Birds of Alaska. Wild. Mgmt. Inst., Washington, D.C.

Gaston, A.J., and I. L. Jones. The Auks *Alcidae*. Oxford University Press. New York. 1998.

Gill, R.E., Jr., M.R. Petersen, and P.D. Jorgensen. 1981. Birds of the northcentral Alaska Peninsula, 1976-1980. Arctic 34: 286-306.

Gilpen, M.E. and M.E. Soulé. 1986. Minimum viable populations: processes of species extinction, Pp. 19-34 *in* Conservation biology, the science of scarcity and diversity (M.R. Soulé, ed.) Sinauer, Sunderland, MA.

Glacier Bay National Park and Preserve. 1998. Commercial Fishing Environmental Assessment. U.S. Department of the Interior. National Park Service Alaska Region.

Glacier Bay National Park and Preserve. 1995. Vessel Management Pland and Environmental Assessment. Department of the Interior. National Park Service Alaska Region.

Gould, P.J., D.J. Forsell, and C.J. Lensink. 1982. Pelagic distribution and abundance of seabirds in the Gulf of Alaska and Eastern Bering Sea. U.S. Fish Wildl. Serv. Biol. Serv. Prog. Rep. FWS/OBS-82-48.

Grinnell, J. 1909. Birds and Mammals of the 1907 Alexander Expedition to Southeastern Alaska. Univ. of Cal. Publ. In Zoology 5:171-264.

Grinnell, J. 1910. Birds of the 1908 Alexander Alaska Expedition. Univ. of Cal. Publ. In Zoology 5: 361-428.

Hare, S.R. and Mantua, N.J. 2000. Empirical evidence for North Pacific regime shifts in 1977 and 1989. Progress in Oceanography 47 (2000) 103-145.

Huey, L.M. 1931. Three note-worthy bird records from Barrow, Alaska. Condor 33: 36-37.

Irons, D.B., D.R. Nysewander, and J.L. Trapp. 1988. Prince William Sound waterbird distribution. Unpublished report, Marine and Coastal Bird Project, USFWS/MBM, Anchorage, Alaska.

Isleib, M.E. and B. Kessel. 1973. Birds of the North-Gulf Coast - Prince William Sound Region, Alaska. Biological Papers of the University of Alaska 14: 1-149.

Jacques, F.L. 1930. Water birds observed on the Arctic Ocean and Bering Sea, in 1928. Auk 47: 353-366.

Johnsgard, P.A. 1987. Diving birds of North American. Univ. of Nebraska Press, Lincoln.

Kendall, S.J. and B.A. Agler. 1998. Distribution and abundance of Kittlitz's Murrelets in Southcentral and Southeastern Alaska. Colonia Waterbirds 21(1): 53-60.

Kessell, B., and D.D. Gibson. 1978. Status and distribution of Alaska birds. Stud. Avian Biol. no.1. Cooper Ornithological Society.

King, J.G. and G.A. Sanger. 1979. Oil vulnerability index for marine oriented birds. USFWS, Wildlife Research Report 11: 277-289.

Kischinskii, A.A. 1968. Birds of the Kolyma Highlands (in Russia). Nauka, Moscow. 187 pp.

Kondratyev, A.Y., N.M. Litvinenko, Y.V. Shibaev, P.S. Vyatkin, and L.F. Kondrateyva. 2000. "The breeding seabirds of the Russian Far East. Pages 37-81 in Kondratyev, A. Y., N. M. Litvinenko, and G. W. Kaiser, eds. Seabirds of the Russian Far East, Canadian Wildlife Service, Ottawa.

Kondratiev, A.J. 1991. Status of the seabirds nesting in northeast U.S.S.R. Pp. 165-73 *in* Seabird Status and Conservation: A Supplement (J.P. Croxall, ed.) ICBP Technical Publication No. 11.

Kondratiev, A.Y. 1986. Colonies of seabirds of the arctic coast of the extreme northeast. Pages 37-47 in Litvinenko, N.M. (Ed.), Seabirds of the Far East: collection of scientific papers. Far East Science Center, U.S.S.R. Academy of Sciences, Vladivostok. Translated from Russian by Can. Wildl. Serv.(1988).

Konyukhov, N. N., L.S. Bogoslovskaya, B.M. Zvonon, and T.I. Van Pelt. 1998. Seabirds of the Chukotka Peninsula, Russia. Arctic 51: 4.

Kuletz, K. 1996. Marbled murrelet abundance and breeding activity at Naked Island, Prince Willilam Sound, and Kachemak Bay, Alaska, before and after the Exxon Valdex oil spill. American Fisheries society Symposium 18: 770-784.

Kuletz, K. 1989. Relative distribution of marbled and Kittlitz's murrleets in Kachemak Bay, Alaska. Pac. Seabird Group Bull. 16:60.

Kuletz, K. 1989. Murrelet Studies of Kachemak Bay Summer, 1988. USFWS, Alaska Maritime National Wildlife Refuge. Homer, Alaska.

Kuletz, K.J., and J. Piatt. 1992. Distribution of marbled and Kittlitz's murrlets in three bays in Alaska. Pac. Seabird Group Bull. 19:50.

Kuletz, K. 1989. Murrelet studies of Kachemak Bay, Summer, 1988. USFWS Unpublished Report. 32 p.

Laing, K. 1991. Assessment of Injury to Waterbirds from the Exxon Valdez Oil Spill: Boat surveys to determine distribution and abundance of migratory birds in Prince William Sound. NRDA Study No. 2. Draft Report. MNM/USFWS, Anchorage, AK.

Lance, B.K. D.B. Irons, S.J. Kendall, and L.L. McDonald. 1999. Marine bird and sea otter population abundance of Prince William Sound, Alaska: trends following the T/V Exxon Valdez oil spill, 1989-98. Exxon Valdez Oil Spill Restoration Final Report, Restoration Project 93045. Exxon Valdez Oil Spill Trustee Council, Anchorage, AK.

McCarty, J.P. 2001. Ecological consequences of Recent Climate Change. Conservation Biology 15,2:320-331.

Meehan, J.P. 1996. Status of Marbled and Kittlitz's Murrelets at the Adak Naval Reservation, Alaska. Department of Defense Legacy project numbers 400 and 1658. USFWS Report AMNWR 96/08. Adak, Alaska. 48 pp.

Moum, T., S. Johansen, K.E. Erikstad, and J.F. Piatt. 1994. Phylogeny and evololution of the auks (subfamily Alcinae) based on mitochondrial DNA sequences. Proceedings of the National Academy of Sciences 91: 7912-7916.

Murie, O.J. 1959. Fauna of the Aleutian Islands and Alaska Peninsula. N. Amer. Fauna, no. 61, USFWS, p. 1-261.

Murphy, E.C., D.G. Roseneau, and P.M. Bente. 1984. An inland nest record for the Kittlitz's Murrelet. Condor 86: 216.

National Marine Fisheries Service. 1999. Biological Opinion for Proposed Construction and Operation of the Northstar Oil and Gas Project. March 4, 1999.

Nelson, E.W. 1883. Birds of the Bering Sea and the Arctic Ocean. Cruise of the Revenue Marine Steamer, "Corwin," in Alaska and N.W. Arctic Ocean in 1881. Washington, Government Printing Office, 1883, pp. 55-118.

Nishimoto, M. and B. Rice. 1987. A re-survey of seabirds and marine mammals along the south coast of the Kenai Peninsula, Alaska during the summer of 1986. Unpublished report of USFWS/NPS Cooperative Research Project.

Paine, R. T., J. L. Ruesink, A. Sun, E. L. Soulanille, M. J. Wonham, C. D., G. Harley, D. R. Brumbaugh, and D. L. Secord. 1996. Trouble on oiled waters: lessons from the Exxon Valdez oil spill. Annual Review of Ecology and Systematics 27: 197- 35.

Parr, M. 1999. Single-hulled tankers still pose major risk to seabirds. Bird Calls 4(2): 4. (Publication of the American Bird Conservancy).

Piatt, J.F., N.L. Naslund, and T.I. van Pelt. 1999. Discovery of a new Kittlitz's Murrelet nest: clues to habitat selection and nest-site fidelity. Northwest Nat. 80: 8-13.

Piatt, J.F., and P.J. Gould. 1994. Postbreeding dispersal and drift-net mortality of endangered Japanese murrelets. The Auk 111(4): 953-961.

Piatt, J.F., C.J. Lensink, W. Butler, M. Kendziorek, and D.R. Nysewander. 1990. Immediate impact of the Exxon Valdez oil spill on marine birds. Auk 107: 387-397.

Piatt, J.F., L. Climo, A. Springer, and T. Duncan. 1991. Marine bird distribution in Glacier Bay National Park during the summer of 1991. Unpublished report, USFWS, Anchorage, Alaska.

Piatt, J.F., A. Pinchuk, A. Kitaiskiy, A.M. Springer, and S.A. Hatch. 1992. Foraging distribution and feeding ecology of seabirds at the Diomede Islands, Bering Strait. USFWS Final Report for MMS (OCS Study MMS 92-0041). Anchorage, AK 133 p.

Pitochelli, J., J.F. Piatt, and M. Cronin. 1995. Morphological and genetic divergence among Alaskan populations of Brachyramphus murrelets. Wilson Bulletin 107: 235-250.

Portenko, L.A. 1973. Birds of the Chukchi Peninsula and Wrangel Island, Voulme II. Leningrad, USSR, Translated for the Smithsonian Institution and the National Science Foundation by Amerind Publishing Co. Pvt. Ltd., New Delhi, India, 1989.

Revkin, A.C. 2000a. Study faults humans for large share of global warming. New York Times Science/Health. July 14, 2000.

Revkin, A.C. 2000b. Scientists now acknowledge role of humans in climate change. New York Times Science/Health. October 26, 2000.

Richardson, W. John. and Charles I. Malme. "Man-Made Noise and Behavioral Responses." *In*: The Bowhead Whale. Eds. J.J. Burns, J.J. Montague, C.J. Cowles. The Society for Marine Mammology. Special Publication Number 2. Lawrence: Allen Press, Inc., 1993. Pp. 631-700.

Sanger, G.A. 1987. Trophic levels and trophic relationships of seabirds in the Gulf of Alaska. Pp. 229-257 *in* Seabirds: feeding ecology and role in marine ecosystems (J.P. Croxall, ed.). Cambridge Univ Press, Cambridge, UK.

Senner, S. 1999. Climate Change and the Kittlitz's murrelet. Alaska Audubon website: http://home.gci.net/~akaudubon/NewsL1999.htm.

Singer, Mathew. 1998. The Whittier Road case: the demise of Section 4(f) since Overton Park and its implications for alternatives analysis in environmental law. 28 Environmental Law 729.

Sowls, A.L.; S.A. Hatch, and C.J. Lensink. 1978. Catalog of Alaskan seabird colonies. U.S. Fish Wildl. Serv. Biol. Rep. FWS/OB-37/80.

Swartz, L.G. 1967. Distribution and movements of birds in the Bering and Chukchi seas. Pacific Science 21: 332-347.

Thayer, J.E. 1914. Nesting of the Kittlitz's Murrelet. Condor 16: 117-118.

Thayer, J.E. and O. Bangs. 1914. Notes on birds and mammals of the arctic coast of East Siberia. Proc. New England Zoological Club 5: 1-66.

Thompson, M.C., J.Q. Hines, and F.S.L. Williamson. 1966. Discovery of the downy young of Kittlitz's Murrelet. Auk 83: 349-351.

Tomkovich, P.S., and A.G. Sorokin. 1983. The bird fauna of Eastern Chukotka (in Russian). Arch. Zool. Mus. Moscow Univ. XXI-77-159.

Udvardy, M.D.F. 1963. Zoogeographical study of the Pacific Alcidae. In: Pacific Basin Biogeography, A Symposium. Ed. J.L. Gressitt. Bishop Museum Press, p. 85-111.

U.S. Department of the Navy. 1999. Draft Overseas Environmental Impact Statement and Environmental Impact Statement for Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar. SURTASS LFA Sonar OEIS/EIS Program Manager, 901 North Stuart Street, Suite 708, Arlington, VA 22203.

USFWS. 2000. Southern Sea Otter Recovery Plan.

USFWS. 1996. Spectacled Eider Recovery Plan. Anchorage, Alaska. 157 pp.

USGS. 2001. Seabirds, marine mammals and forage fish in Glacier Bay National Park. USGS Web site: http://www.absc.usgs.gov/research/seabird&foragefish/products/presentations/GBay99web_files/frame.htm

Van Pelt, T.I., J.F. Piatt, and G.B. van Vliet. 1999. Vocalizations of the Kittlitz's Murrelet (*Brachyramphus brevirostris*). Condor 101: 395-398.

van Vliet, G.B. 1993. Status concerns for the "global" population of Kittlitz's Murrelet: is the "Glacier Murrelet" receding? Pacific Seabird Group 30: 15-16.

van Vliet, G.B. and M. McAllister. 1994. Kittlitz's Murrelet: the species most impacted by direct mortality from the Exxon Valdez oil spill? Pacific Seabirds 21: 5-6.

Vermeer, K., S.G. Sealy, and G.A. Sanger. 1987. Feeding ecology of Alcidae in the eastern North Pacific Ocean. Pp. 189-227 *in* Seabirds: feeding ecology and role in marine ecosystems (J.P. Croxall, ed.). Cambridge Univ Press, Cambridge, UK.

Walker, E.P. The Kittlitz's Murrelet in southeastern Alaska. Murrelet 3: 9-10.

Webster. J.D. 1950. Notes on the birds of Wrangell and vicinity, southeastern Alaska. Condor 52: 32-38.

Wynne, K.M., D.L. Hicks, and N.R. Munro. 1992. 1991 Marine Mammal Observer Program for the salmon driftnet fishery of Prince William Sound, Alaska. Unpubl. Report prepared for NOAA/NMFS, Alaska Region Office of Marine Mammals, Juneau, by Saltwater, Inc., Anchorage.