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PROPOSAL SUMMARY PAGE

Project Title:	Pigeon Guillemot Restoration Research in Prince William Sound, Alaska, FY14 Amendment
Project Period:	January 1, 2014 to December 31, 2018
Proposer(s):	David B. Irons, U.S. Fish and Wildlife Service, and Daniel D. Roby, U.S. Geological Survey – Oregon Cooperative Research Unit
Study Location:	Prince William Sound, Alaska

Abstract: This amendment to project 11100853, Pigeon Guillemot Restoration Research in Prince William Sound, Alaska, provides an opportunity to restore the population of Pigeon Guillemots (*Cepphus columba*) in Prince William Sound, Alaska, which has fallen by more than 90% at the Naked Island Group since 1989. A restoration plan for Pigeon Guillemots in PWS was prepared to address the species' lack of population recovery following injury by the 1989 *Exxon Valdez* oil spill. Predation on nests and adults by mink is now the primary limiting factor for guillemot reproductive success and population recovery at the most important historical nesting site for guillemots in PWS (i.e., the Naked Island group). Mink on the Naked Island group are descended in part from fur farm stock and apparently arrived on the island group during the 1980s. Control of predatory mink at these islands was selected as the preferred restoration alternative because it is feasible and most likely to result in the recovery of guillemots in PWS. Other alternatives are either currently unavailable or unlikely to be effective. A control effort is likely to be successful but if it is not then the agencies would discuss alternatives, one of which would be to amend the EA and remove the remaining mink from the islands. Potential negative effects of the preferred alternative are either negligible or largely avoidable. The Naked Island group guillemot population would likely increase five-fold within the first 10 years following mink control, and the Sound-wide population of guillemots would likely increase within 15 years of mink control at the Naked Island group, once the Naked Island group had become a source population for other parts of PWS.
Phase I : Completion of the NEPA process for the proposed action. (Completed)
Phase II: Control of predatory mink on the Naked Island Group, PWS Alaska

Funding:	**EVOS Funding Requested:** (must include 9%GA) FY 2014 -- $396,655.80 Phase II FY 2015 –$391,205.80 Phase II FY 2016 –$154,014.50 Phase II FY 2017 –$139,967.70 Phase II FY 2018 --$124,707.70 Phase II TOTAL: $1,206,551.40 Phase II **Non-EVOS Funds to be Used:** USFWS NFWF FY 2014 -- $173,000.00 $218.280.00 FY 2015 –$173,000.00 $198,280.00 FY 2016 –$113,000.00 $204,580.00 FY 2017 – $98,000.00 $215,580.00 FY 2018 --$98,000.00 $214.580.00 TOTAL non-EVOS funding: $1,716,000.00 **TOTAL, EVOS and non-EVOS funding: $2,922,851.40**
Date:	August 29, 2013

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EXECUTIVE SUMMARY

The Pigeon Guillemot (*Cepphus columba*) is now the only marine bird species in Prince William Sound (PWS), Alaska that is listed as "not recovering" on the Exxon Valdez Oil Spill Trustee Council's Injured Resources List. Since 1989, the population of Pigeon Guillemots in Prince William Sound (PWS) has undergone a continuous and marked decline, with no sign of stabilization. Given this alarming trend, restoration is warranted for the recovery of Pigeon Guillemots in PWS. The logical location to focus restoration effort for guillemots is the most important historical breeding location in the Sound, the Naked Island group in central PWS. These islands provide an opportunity for recovery of a significant proportion of the PWS guillemot population, although the Naked Island group constitutes only about 2% of the total shoreline in PWS. One fourth of all guillemots nesting in PWS in 1989 (just after the spill) were located at the Naked Island group. Restoration of guillemots at the Naked Island group to the number counted at that time would result in a substantial increase in the Sound-wide population. Most of the available information on the factors limiting the Pigeon Guillemot population in PWS originates from research on guillemot population size, nesting success, and diet conducted at the Naked Island group during 15 breeding seasons between 1978 and 2008. These data, placed in a historical and socioeconomic context, permit the development of a restoration plan designed to facilitate the population recovery of Pigeon Guillemots in PWS.

A few historical events have had a considerable impact on Pigeon Guillemots nesting at the Naked Island group in PWS. First, fox farming occurred at the Naked Island group for more than 50 years beginning in 1895. The foxes (*Alopex lagopus*) almost certainly caused severe declines in the populations of native fauna, including Pigeon Guillemots, as they did across many formerly fox-free islands in Alaska. Nearly a century later, the EVOS caused acute mortality from oiling estimated at between 500 and 1,500 Pigeon Guillemots in PWS in the immediate aftermath of the spill. There was evidence that guillemots were exposed to and negatively affected by residual oil for at least a decade after the spill. However, there was no longer an indication of guillemot exposure to residual oil from EVOS by 2004. Studies have demonstrated that EVOS and/or a climatic regime shift associated with the Pacific Decadal Oscillation affected guillemots in the Sound through reduced availability of preferred forage fish species. The prevalence of high-lipid schooling forage fish in the diet of guillemot chicks at the Naked Island group was significantly lower in the decade after EVOS, and this change was associated with lower nestling survival and growth rates, and lower overall nesting success. The level of predation on guillemot nests at the Naked Island group also increased significantly during the 1990s when compared to pre-spill, potentially limiting the recovery of Pigeon Guillemots at this location.

The primary limiting factor for guillemot reproductive success and population recovery at the Naked Island group is now predation of nests and adults by American mink (*Neovison vison*). Guillemot population trends at the Naked Island group compared to the rest of PWS are consistent with this conclusion. At sites outside of PWS, guillemot population declines and even local extirpation of breeding guillemots due to predation by mink have been successfully and rapidly reversed through mink control or eradication as a restoration action. Although a precise estimate of the guillemot population response to proposed mink control at the Naked Island group is not possible, all available evidence indicates that eliminating mink predation on

guillemot nests and adults would result in a dramatic increase in the breeding population and productivity of Pigeon Guillemots at the Naked Island group. Nest predation by mink may also have caused declines in populations of other seabirds nesting at the Naked Island group, including Arctic Terns (*Sterna paradisaea*), Parakeet Auklets (*Aethia psittacula*), Tufted Puffins (*Fratercula cirrhata*), and Horned Puffins (*Fratercula corniculata*). The presence of foraging marine mammals and large flocks of piscivorous birds provide supporting evidence that predation by mink and not limitations in food supply have caused the declines in seabirds breeding at the Naked Island group. The introduction or range expansion of mink in areas outside of PWS have caused rapid population declines in a wide variety of taxa, including several species of ground-nesting birds, small mammals, amphibians(Banks et al. 2008)(Banks et al. 2008)(Banks et al. 2008)(Banks et al. 2008), and crustaceans.

Mink are native to the mainland and nearshore islands of PWS but do not naturally occur on offshore islands. Observational data suggest that mink were absent on the Naked Island group until the 1970's (Appendix A), but the State of Alaska, ADF&G, who manage mink, has the position that mink are native to the islands and that pigeon guillemots can live in high densities, as they did in the 1970's and 1980's with mink on the islands. Data from both mtDNA sequencing and nuclear microsatellite genotyping indicate that the mink on the Naked Island group are descended in part from fur farm mink stock and were introduced to the Naked Island group by humans.

The Naked Island group is part of Chugach National Forest with the exception of one small privately-owned parcel on Peak Island. The islands are used periodically for camping, hiking, deer hunting, and fishing. Although frequently exploited for their fur in other parts of PWS, trapping of mink at the Naked Island group occurs rarely. Pigeon Guillemots contribute to the success of ecotourism in PWS through their conspicuous, vocal, and charismatic displays along the shoreline.

The restoration objective for Pigeon Guillemots in PWS is population recovery, which in this case is defined as a stable or increasing population. All reasonable potential restoration alternatives have been considered and assessed for their likelihood of facilitating guillemot population recovery. The preferred alternative (Alternative A) is the control of predatory mink (i.e., the removal of all individuals from the pigeon guillemot nesting areas) at the Naked Island group. If this alternative is not successful after 2-3 years the agencies involved will discuss other alternatives, one of which would be to amend the EA and remove all the remaining mink.The suggested method is trapping with lethal body grip traps set along the coastline during fall, winter, and especially early spring (when snow cover is present and mink are largely restricted to the shoreline), supplemented with hunting using dogs, as necessary. Successful control will likely require multiple years of effort, likely 3-5 years. Long-term monitoring of the islands should be conducted periodically. The eradication of mink (Alternative B) would result in in recovery of pigeon guillemots also. This alternative was rejected because the State of Alaska, who manages mink would prefer to try controlling mink as the first management tool and does not think it is necessary at this time to restore pigeon guillemots. Alternative C, enhancement of the guillemot food supply during the nesting season, included the release of high-lipid hatchery-reared juvenile fish (i.e., Pacific herring, *Clupea pallasi*, and/or Pacific sand lance, *Ammodytes hexapterus*) near foraging areas of Pigeon Guillemots at the Naked Island group. Although this

alternative may be an effective restoration technique for guillemots and other species in the future, it was eliminated because there is currently no stock enhancement program for herring or sand lance in PWS, plus it fails to address the primary cause of guillemot egg and chick mortality at the Naked Island group. The construction and installation of guillemot nest boxes (Alternative D) to enhance the availability of sites inaccessible to mink was considered and rejected as well. A few nest boxes were installed at the Naked Island group during the 1990s, but there was a low incidence of use by guillemots, most likely because there was an abundance of available, unoccupied natural cavities. The population of Pigeon Guillemots at the Naked Island group is now significantly lower than it was during the 1990s, and thus nest box installation would almost certainly be an ineffective restoration technique. Alternative E consists of the lethal control of avian predators of Pigeon Guillemots and their nests, including Common Ravens (*Corvus corax*), Northwestern Crows (*Corvus caurinus*), and Black-billed Magpies (*Pica pica*). This alternative would require a constant, persistent, and intensive effort to reduce populations of avian predators, and the resulting increase in survival of guillemot eggs and chicks is likely to be insignificant in comparison to the loss of eggs, chicks, and adults due to mink predation. Alternative F consisted of a combination of provisioning of nest boxes (Alternative D) and control of corvid (Alternative E) and mink (Alternative B) populations. This combination of alternatives is unlikely to be more effective than any of the alternatives implemented on its own. The current management strategy (Alternative G), involves no restoration action. Given the high predation pressure on guillemot nests at the Naked Island group, this alternative will almost certainly lead to a continued low (< 25 nesting pairs) breeding population or local extirpation of the guillemot breeding population at this site.

Control of predatory mink was selected as the preferred alternative because it is most likely alternative that was agreed upon by all agencies to facilitate the recovery of Pigeon Guillemots throughout PWS. Other alternatives are either currently unavailable or unlikely to be effective. An effort to control mink at the Naked Island group is likely to be successful in a relatively short period of time (3-5 years) due to well-developed methods of control. Although, the preferred alternative would be implemented to address the Pigeon Guillemot population decline in PWS, a suite of other seabird species, including Tufted Puffins, Horned Puffins, and Arctic Terns, with depressed breeding populations at the Naked Island group would also benefit. Mink control may also promote local increases in other populations of ground-nesting birds (e.g., waterfowl), small mammals, amphibians, and crustaceans.

Potential negative effects of the preferred alternative appear to be either negligible or largely avoidable. Proposed control methods include steps to minimize capture of non-target species (i.e., selection of trap type and use of artificial burrows in which to set traps). The restoration of guillemots at the Naked Island group will not have a significant negative impact on herring stocks because juvenile herring have never been an important part of the diet of guillemots nesting at this location. Control of mink at the Naked Island group would not adversely affect trappers in PWS because mink at the Naked Island group are rarely exploited for their fur and are remote to trappers in the region. Due to the fur farm ancestry of mink at the Naked Island group, this alternative would not injure the Sound-wide population of native mink. There is no concern over a potential detrimental population eruption by small introduced herbivores or omnivores, such as rabbits or rats, following mink control because no such species occur at the Naked Island group.

The population response of guillemots to mink control at the Naked Island group is measurable through the comparison of historical and recent guillemot population surveys completed at the Naked Island group and the Smith Island group (mink-free islands) using a Before–After–Control–Impact design. Although a precise prediction of the guillemot population response to mink control is not possible, the time expected to population recovery can be estimated. If the expected increase in guillemot productivity from mink control is realized and model assumptions are correct, guillemot population at the Naked Island group will increase five fold within 10 years following mink control and the Sound-wide population of Pigeon Guillemots will begin to increase within 15 years after control of mink at the Naked Island group.

PROJECT PLAN

I. NEED FOR THE PROJECT

A. Statement of Problem

Introduction

The Pigeon Guillemot (*Cepphus columba*) is now the only marine bird species injured by the 1989 *Exxon Valdez* oil spill (EVOS) that is listed as "not recovering" on the Exxon Valdez Oil Spill Trustee Council's Injured Resources List (*Exxon Valdez* Oil Spill Trustee Council 2010). Since 1989, the population of Pigeon Guillemots in Prince William Sound (PWS) has declined by an alarming 47%, and there is no sign of population stabilization (McKnight et al. 2008). Given this steady, long-term, and drastic trend, restoration action is warranted and in all probability necessary for the recovery of the Pigeon Guillemot population in PWS.

The Naked Island group is a logical location to focus restoration efforts for guillemots in PWS (Figure 1). These islands provide a unique opportunity to facilitate the recovery of a disproportionately large number of guillemots through restoration along a small portion (~2%) of the total PWS shoreline. The Naked Island group was historically the most important breeding location for guillemots in the Sound (Sanger and Cody 1994). Approximately one quarter of the guillemot population in PWS nested at the Naked Island group in 1989 in the aftermath of the EVOS (U.S. Fish and Wildlife Service, unpubl. data). Recovery of Pigeon Guillemots at the Naked Island group to the number counted just after the spill (Oakley and Kuletz 1996) would increase the Sound-wide population by nearly 45% (McKnight et al. 2008).

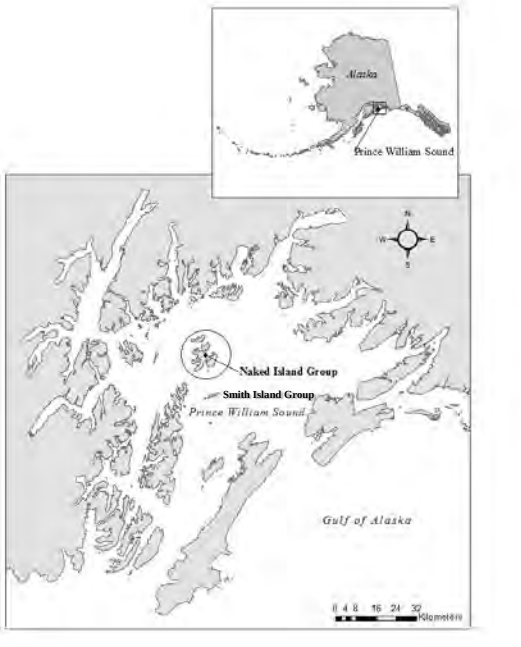

Figure 1. The location of Prince William Sound (inset map), the Naked Island group, and the nearby mink-free Smith Island group in Alaska

The Naked Island group is also the site where we have the most thorough understanding of mechanisms regulating Pigeon Guillemot populations in PWS. Data on population size, nesting success, and diet of guillemots has been collected at the Naked Island group during 15 years between 1978 and 2008 (Bixler 2010). The historical, ecological, and socioeconomic contexts of Pigeon Guillemots at the Naked Island group are presented below. This information provides the foundation crucial for the development and assessment of feasible restoration alternatives designed to facilitate the population recovery of Pigeon Guillemots in PWS.

Historical Context

The Naked Island group was the site of arctic fox (*Alopex lagopus*) fur farms for more than 50 years beginning in 1895 (Bailey 1993, Lethcoe and Lethcoe 2001). The foxes roamed free on the islands (Evermann 1914) and, as in other locations, likely relied on native small mammals (i.e., voles, shrews, and mice) and seabirds as a food source (Heller 1910, Bailey 1993). The populations of native fauna, including Pigeon Guillemots, almost certainly plummeted following the introduction of foxes to the Naked Island group, as they did across many formerly fox-free islands in Alaska (Bailey 1993). In fact, there were apparently no rodents or shrews on Storey Island and no shrews on Naked Island by 1908, within 15 years of the commencement of fox farming (Heller 1910). A variety of native species including salmon, herring, harbor seals, and even whales were killed to provide supplemental food for foxes in the Sound (Bailey 1993, Lethcoe and Lethcoe 2001, Wooley 2002), thereby altering the entire ecosystem. The depression of the 1930's, the end of World War II, and changes in women's fashions in Europe together caused fox farming to become unprofitable (Lethcoe and Lethcoe 2001). Upon closure of the fox farms, foxes in PWS either were removed by trapping or died of starvation; arctic foxes are no longer found in the PWS region (Bailey 1993).

Other historical developments in PWS that may have directly or indirectly impacted the nearshore habitat of the Naked Island group include mining, commercial fishing of salmon and herring, pink salmon hatcheries, marine mammal harvest, and logging (Lethcoe and Lethcoe 2001, Wooley 2002). The 1964 earthquake resulted in an uplift of about four feet at the Naked Island group and massively altered both the shoreline and shallow nearshore habitat (Hanna 1971) where guillemots nest and forage (Ewins 1993).

On 24 March 1989, the T/V *Exxon Valdez* ran aground at Bligh Reef in PWS resulting in the release of at least 44 million liters of Prudhoe Bay crude oil into PWS. The oil spread to the southwest through the Sound and into the northern Gulf of Alaska. An estimated 500 to 1,500 Pigeon Guillemots in PWS were immediately killed due to oil exposure (Piatt and Ford 1996). There was evidence that guillemots were exposed to residual oil for at least a decade after the spill (Golet et al. 2002). However, there was no longer indication of direct contact with oil in guillemots by 2004 (B. Ballachey, U.S. Geological Survey, pers. comm.).

Previous studies have demonstrated that EVOS and/or a climatic regime shift associated with the Pacific Decadal Oscillation may have indirectly affected Pigeon Guillemots in PWS (Agler et al. 1999, Golet et al. 2002). The decline in the number of guillemots in the Sound, which began prior to EVOS, has been associated with the 1976 shift in the Pacific Decadal Oscillation (Agler et al. 1999, Golet et al. 2002) that resulted in reduced abundance of schooling forage fish across the North Pacific Ocean (Anderson et al. 1997, Francis et al. 1998, Anderson and Piatt 1999). EVOS also apparently contributed to the decline in populations of schooling forage fish, specifically Pacific herring (*Clupea pallasi*) and Pacific sand lance (*Ammodytes*

hexapterus) in Prince William Sound (Marty et al. 1999, Golet et al. 2002, Marty 2008). The prevalence of high-lipid schooling forage fish in the diet of guillemot chicks at the Naked Island group was significantly lower in the decade after EVOS than prior to EVOS (Oakley and Kuletz 1996, Golet et al. 2002). Low proportions of high-lipid schooling prey, particularly sand lance, in the diet of Pigeon Guillemot chicks have been associated with lower nestling survival, lower nestling growth rates, and lower overall nesting success (Golet et al. 2000, Litzow et al. 2002).

Top-down factors, such as predation, may also have limited the recovery of the Pigeon Guillemot population in PWS (Hayes 1995, Oakley and Kuletz 1996, Golet et al. 2002). Common potential predators of guillemot nests in PWS include Glaucous-winged Gulls (*Larus glaucescens*), Black-billed Magpies (*Pica hudsonia*), Northwestern Crows (*Corvus caurinus*), Common Ravens (*Corvus corax*), river otters (*Lontra canadensis*), and American mink (*Neovison vison*) with mink being the most important (Oakley and Kuletz 1979, Ewins 1993, Hayes 1995, Oakley and Kuletz 1996). The level of mink predation on guillemot nests at the Naked Island group increased significantly during the late 1990s compared to earlier years (Golet et al. 2002).

Current Ecological Context

The Pigeon Guillemot is a pursuit-diving seabird that preys upon a variety of nearshore demersal fishes, schooling fishes, and, occasionally, crustaceans (Ewins 1993). Guillemots are semi-colonial members of the seabird family Alcidae that produce 1- or 2-egg clutches (Ewins 1993). Pigeon Guillemots usually nest in rock crevices or burrows along rocky shorelines but are also known to nest in crevices of anthropogenic structures such as piers, bridges, and wooden nest boxes (Ewins 1993). Guillemots nest along the coastline of western North America from the Bering Strait to Santa Barbara, California, and as far south as the Kurile Islands in the Russian Far East. The current number of Pigeon Guillemots is considered stable and estimated to be about 470,000 individuals range-wide (BirdLife International 2009). The species is regarded as "of least conservation concern" (BirdLife International 2009). The Pigeon Guillemot is however, susceptible to long-term local declines in breeding populations (Ewins 1993).

The availability of schooling forage fish may continue to limit the rate and extent of Pigeon Guillemot population recovery, both at the Naked Island group and in the Sound as a whole (Bixler 2010). The prevalence of schooling forage fish in the diet of Pigeon Guillemots at the Naked Island group has not recovered to pre-EVOS levels. In addition, the average group size of Pigeon Guillemots detected in surveys declined near the Naked Island group, but also across a number of other important guillemot nesting areas in central and western PWS, a pattern consistent with a region-wide reduction in food availability.

However, the primary limiting factor for guillemot reproductive success and population recovery at the Naked Island group is now predation by a recent colonizer of the islands, the American mink (Bixler 2010). The overall abundance of schooling forage fish at the Naked Island group has increased since the 1990s, suggesting that forage fish populations are recovering from EVOS. Despite improving prey resources, the guillemot breeding population at the Naked Island group has declined by more than 90% during the last 15 years. Guillemots, like many other seabirds, produce few offspring and their populations are sensitive to even small decreases in adult survival. The rate of egg and chick predation increased during the 1990s and caused the majority of nest failures during this period. By 1998, at least 60% of monitored guillemot nests and 4.5% of breeding adults at those nests were killed by mink. In 2008, we determined that the

rate of nest predation at the Naked Island group was similar to the late 1990s, and mink were still able to locate guillemot nests and kill guillemot nestlings, despite few remaining nests (only 17 active guillemot nests found). The prevalence of guillemot nest sites in crevices on cliffs increased at the Naked Island group, while the prevalence of nests in crevices or burrows near the ground, presumably more accessible to mink, decreased compared to pre-spill. The guillemot population trend at the Naked Island group compared to elsewhere in PWS is also consistent with the hypothesis that mink predation is the primary limiting factor. Guillemot numbers were stable between 1990 and 2008 at nearby mink-free islands (Smith Island group), and guillemot population declines at the Naked Island group since EVOS have been much more severe than across the rest of PWS. The number of guillemots at the Naked Island group comprised about 25% of the total population in PWS just after the spill in 1989. But in 2008, the number of guillemots at the Naked Island group comprised just 1% of the total Sound-wide population. Prior to the increase in mink predation the Naked Island group had the largest nesting colony of Parakeet Auklets (*Aethia psittacula*) in PWS and high densities of Tufted Puffins (*Fratercula cirrhata*), Horned Puffins (*Fratercula corniculata*), and Arctic Terns (*Sterna paradisaea*), in addition to supporting the highest numbers of nesting Pigeon Guillemots (Oakley and Kuletz 1979). Nest predation by mink likely caused declines in these other seabirds nesting at the Naked Island group. Arctic Terns and Parakeet Auklets have been extirpated as breeding species at the Naked Island group. Other seabirds currently nest in greatly reduced numbers (i.e., Tufted Puffins and Horned Puffins; KSB, pers. obs). The few remaining pairs of puffins nesting on the Naked Island group are restricted to the highest available shoreline cliffs (80 - 100 m) on the archipelago. Foraging humpback whales (*Megaptera novaeangliae*), minke whales (*Balaenoptera acutorostrata*), harbor seals (*Phoca vitulina*), and Steller sea lions (*Eumetopias jubatus*) along with large foraging flocks of piscivorous birds, including Marbled Murrelets (*Brachyramphus marmoratus*), Black-legged Kittiwakes (*Rissa tridactyla*), and Glaucous-winged Gulls (*Larus glaucescens*) still occurred in the nearshore waters of the Naked Island group in 2008 (KSB, pers. obs.). These aggregations of piscivorous marine birds and mammals near the Naked Island group provide supporting evidence that predation by mink, and not limited forage fish, have caused the decline in seabirds breeding at the site.

Mink are semi-aquatic, largely nocturnal, generalist carnivores that are native to the mainland and nearshore islands of PWS. The natural distribution of mink on the more isolated, offshore islands in PWS is less well known, however, due to two centuries of trapping of furbearers by non-Native Alaskans and 50 years of fur farms for foxes and mink (Lethcoe and Lethcoe 2001, Fleming and Cook 2010). There is evidence that there was no mink predation in the 1970s and 1980s at the Naked Island group (U.S. Fish & Wildlife Service, unpubl. Data; Appendix A. Evidence from both mtDNA sequencing and nuclear microsatellite genotyping suggest that the mink on the Naked Island group are descended in part from fur farm mink (Fleming and Cook 2010). There is no evidence of a gradual natural immigration of individuals and the founding population size was about 5 pairs, larger than expected from a natural colonization event. Mink from the Naked Island group are most closely related to those that occur on Knight Island, the nearest island to the Naked Island group (6 km away). This distance exceeds by 2 km the longest recorded natural dispersal distance over open water by mink. Mink were intentionally introduced by federal and state agencies to at least one remote island in PWS (i.e., Montague Island) in order to provide a harvestable population (Paul 2009). There is also suggestive evidence of introductions of mink to islands in PWS by fox farmers (Fleming and Cook 2010) and fur trappers (R. Ellis, pers. comm.) to establish new harvestable populations.

American mink have escaped from fur farms or from been intentionally introduced across much of Europe (Bonesi and Palazon 2007) where they have caused rapid population declines in a variety of ground-nesting birds (Ferreras and MacDonald 1999, Clode and MacDonald 2002, Nordström et al. 2002, Nordström et al. 2003, Banks et al. 2008), small mammals, amphibians (Banks et al. 2008), and crustaceans (Bonesi and Palazon 2007). These effects are especially apparent on islands (Banks et al. 2008). A long-term, large-scale American mink removal program on islands in the Baltic Sea demonstrated that 1) nearly all species of birds, mammals, and amphibians present on the islands were negatively affected by mink predation and 2) populations of most species increased following mink removal (Nordström et al. 2003, Banks et al. 2008). Mink eradication resulted in successful reversal of the population decline and local extirpation of Black Guillemots (*Cepphus grylle*), a close relative of Pigeon Guillemots, in this study (Nordström et al. 2003).

Although we are unaware of any examples of mink control or eradication programs within the breeding range of Pigeon Guillemots, introduced arctic foxes have been removed from multiple islands in the Alaska Maritime National Wildlife Refuge Complex (Byrd et al. 1997). At two of these islands, Simeonof and Chernabura islands in the Shumagin Islands, the population of Pigeon Guillemots increased by 275% and 150%, respectively, within just six years of fox removal (Byrd 2001).

Not all guillemot nesting failure on the Naked Island group is caused by mink predation and the diet of the few guillemots that continue to nest on the Naked Island group does not include as high a proportion of schooling forage fishes as pre-EVOS (Bixler 2010). Consequently, a precise estimate of the guillemot population response should mink be controlled at the Naked Island group is not possible. However, all available evidence indicates that eliminating mink predation on guillemot nests and adults would result in a measureable increase in the Pigeon Guillemot breeding population and its productivity at the Naked Island group, as well as increases in the breeding populations of other seabirds at the Naked Island group.

Socioeconomic Context

Outside of one privately owned parcel of land on Peak Island, the Naked Island group is part of the publically owned Chugach National Forest (Oakley and Kuletz 1979). The islands are used periodically for camping, hiking, deer hunting, and fishing (Oakley and Kuletz 1979). The protected bays on the west and north sides of Naked Island provide safe anchorages for sailboats, fishing boats, and an oil spill response barge. Although frequently exploited for their fur in other parts of PWS, trapping of mink at the Naked Island group rarely occurs due to the low price of furs and the time and expense involved in traveling to the islands (R. Ellis, pers. comm.).

Although Pigeon Guillemots have little subsistence value, they contribute to the success of ecotourism in PWS. Guillemots are conspicuous, vocal, and charismatic and thus play a role in the auditory and visual experience of all who frequent the shoreline of PWS.

B. Relevance to 1994 Restoration Plan Goals and Scientific Priorities

The proposed restoration would facilitate the recovery of a species injured by EVOS, the Pigeon Guillemot, through control of predatory mink at the Naked Island group. Given the high level of guillemot egg and chick mortality at the Naked Island group, there is no evidence to suggest that the population could recover without restoration action. Because the Naked Island group is the

most important historical nesting area for guillemots in PWS, this proposal provides an opportunity for recovery of a significant proportion of the PWS guillemot population.

The control of mink from the Naked Island group would promote naturally occurring productivity and diversity in Prince William Sound. This population of mink was almost certainly introduced to the Naked Island group. A suite of seabird species with depressed breeding populations at the Naked Island group (e.g., Arctic Terns, Parakeet Auklets, Tufted Puffins, and Horned Puffins) (KSB, pers. obs.; Oakley and Kuletz 1979) would benefit from this restoration action in addition to Pigeon Guillemots. Mink control may promote local increases in other populations of ground-nesting birds (Ferreras and MacDonald 1999, Clode and MacDonald 2002, Nordström et al. 2002, Nordström et al. 2003, Banks et al. 2008), small mammals, amphibians (Banks et al. 2008), and crustaceans (Bonesi and Palazon 2007).

II. PROJECT DESIGN

A. Alternatives

Introduction

The restoration objective for Pigeon Guillemots in PWS is population recovery, in this case defined as a stable or increasing population (*Exxon Valdez* Oil Spill Trustee Council 1994). All reasonable potential restoration alternatives have been considered. The ability of each alternative to meet the restoration objective was assessed and the most effective approach was selected as the preferred alternative. The preferred alternative complies with the policies and standards of restoration of the *Exxon Valdez* Oil Spill Trustee Council (*Exxon Valdez* Oil Spill Trustee Council 1994).

Detailed description of alternatives

Alternative A – Control of Predatory Mink – PREFERRED ALTERNATIVE

Actions under this alternative aim to control predatory mink at the Naked Island group. We consider control "the complete removal of all the individuals in the pigeon guillemot nesting areas". The suggested method is lethal trapping with body grip traps along the coastline within 500m of each historical or current nest location, supplemented with hunting using dogs as necessary.

Trapping is the most practical and effective method available to control mink (Boggess 1994, Macdonald and Harrington 2003, Moore et al. 2003). Although lethal trapping is more successful (Boggess 1994, Moore et al. 2003), live trapping followed by euthanasia with an air pistol or shotgun has been utilized in a few mink control projects due to concern for non-target captures and public acceptance (Moore et al. 2003). Other methods of euthanasia were considered but rejected. Although toxicants (e.g., sodium fluoroacetate - compound 1080 and sodium cyanide - M44) and fumigants (e.g. carbon monoxide) are in use in the United States for carnivore control, there are currently no chemical agents registered by the U.S. Environmental Protection Agency for the control of mink (Boggess 1994, National Wildlife Research Center

2008). Further, poisoning or secondary poisoning of non-target species (Courchamp et al. 2003, Moore et al. 2003) such as river otters (*Lontra canadensis*) and Bald Eagles (*Haliaeetus leucocephalus*) would likely be unacceptable. Shooting as a method of killing mink is considered inefficient (Boggess 1994, Courchamp et al. 2003). Although a potentially important management tool in European countries (Macdonald and Harrington 2003, Bonesi and Palazon 2007), control of mink through enhancement of possible competitors (i.e., river otters) seems unlikely to be effective in PWS given the lack of evidence for niche overlap (BenDavid et al. 1996). Other means of biological control, such as virus vectored immune-contraception, have yet to be fully developed (Courchamp and Cornell 2000, Macdonald and Harrington 2003) and might pose an irreversible danger to the viability of mink and other closely-related native furbearers (e.g., American marten) outside of the Naked Island group.

Trapping success would be maximized through continuous effort for three to five months of the year during the winter (January to May) season (Bonesi et al. 2007). The precise timing of trapping will be determined using an adaptive management approach (see below). Traps would be set along the coastline of the islands (See Bixler et al. 2010 for details). We suggest the use of experienced trappers (Macdonald and Harrington 2003) for the duration of the project and hunting dogs to locate the last few mink in the nesting area if necessary (Moore et al. 2003). Although we do not know the total number of mink at the Naked Island group, there likely is between 80 and 200 mink in this population (Fleming and Cook 2010). We anticipate that successful control would likely require multiple years of effort (Macdonald and Harrington 2003), potentially up to five years. Carcasses of mink would be frozen and placed in a tamper-proof container and removed from the island approximately every two to four weeks. Carcasses would be donated to research organizations for additional genetic and other study or to permanent archives in public museums or universities, whenever feasible. There is also the opportunity to provide carcasses to Native Alaskans for their cultural programs. Not all carcasses may be donated and some carcasses may not be salvageable (spoilage, unable to retrieve, scavenging by other animals, etc.) Carcasses that cannot be salvaged for donation may be disposed of in a city landfill.

The geography of the Naked Island group improves the likelihood of successful mink control. The islands are relatively small with gentle topography and access to safe anchorages (Courchamp et al. 2003, Bonesi and Palazon 2007). Because the Naked Island group is geographically isolated, it is unlikely to encounter mink from other islands immigrating (Nordström and Korpimäki 2004, Bonesi and Palazon 2007).

Mink control at the Naked Island group would likely be followed by a clear and dramatic increase in the guillemot breeding population, but the precise response of the guillemot population following mink control is unknown. Based on the best available information, however, we estimate that the productivity of guillemots at the Naked Island group will increase by 16% to 36%. If this change in productivity is realized and model assumptions are accurate, the Sound-wide population should begin to increase within 15 years following mink control (See Chapter 4). However, if after 2-3 years this alternative is not leading to pigeon guillemot recovery and mink are still entering the nesting zone, the agencies would discuss other alternatives, one of which would be to amend the EA and remove the mink remaining on the islands, with appropriate approvals from all agencies involved.

Alternative B - Eradication of Mink

Alternative B is similar to Alternative A, with the exception that in this alternative the aim of lethal trapping is the eradication of the mink population at the Naked Island group, rather than control. Methods used would be identical to Alternative A with one main difference; 1) lethal trapping would occur throughout the islands in all mink habitat.

This alternative was not pursued because the State of Alaska, ADF&G, who manage mink believes that the mink are native to the islands and that pigeon guillemots can coexist at high densities, as they were in the 1970s and 1980s, with mink. However if control of predatory mink is not successful in restoring pigeon guillemots after a few years ADF&G is willing to discuss other alternatives.

Alternative C – Enhance the Pigeon Guillemot Food Supply during the Nesting Season

Actions under Alternative C would include the release of hatchery-reared juvenile forage fish within PWS, preferably in close proximity to the foraging areas of Pigeon Guillemots nesting at the Naked Island group. Due to the importance of prey lipid content to the reproductive success of guillemots (Golet et al. 2000, Litzow et al. 2002), only high-lipid schooling forage fish would be released (i.e. herring and/or sand lance). An increase in the abundance of high-lipid prey might lead to increased productivity and survival in guillemots (Golet et al. 2000, Litzow et al. 2002). The enhancement of native stocks of forage fish in PWS might also have a positive impact on populations of a variety of other species of seabirds, fish, and mammals that prey upon them, including the ESA-listed humpback whale (*Megaptera novaeangliae*) and Steller sea lion (*Eumetopias jubatus*). There is currently no stock enhancement program for either herring or sand lance in PWS. The initiation of such a program requires further research in order to ensure no unexpected negative consequences to the ecosystem (*Exxon Valdez* Oil Spill Trustee Council 2009). Although this alternative might be an effective restoration technique in the future, it is not a viable solution to stem the current alarming population decline of guillemots. More importantly however, this alternative fails to address the primary cause of guillemot nesting failure at the Naked Island group, namely predation on eggs and chicks.

Other methods of supplementing the guillemot food supply have been considered and rejected. For instance, releases of dead herring or sand lance into waters adjacent to active nests are unlikely to be utilized by guillemots because there is no indication that this species currently exploits such potential food resources (i.e., offal discarded from fishing vessels; Ewins 1993). Supplementing the diet of chicks in the nest was rejected as well. Although studies suggest that the supplementation of prey to nests can significantly increase productivity of seabirds (Robb et al. 2008), Pigeon Guillemots are prone to nest abandonment when subjected to high rates of human disturbance at the nest (Ainley et al. 1990, Vermeer et al. 1993).

Alternative D - Provide Nest Boxes to Enhance Nest Site Availability

Under this alternative, nest boxes would be installed on cliff faces that appear to be inaccessible to mink. The boxes would be placed in the immediate vicinity of either current or historical nesting locations.

Other options to prevent mink from depredating guillemot adults, chicks, and eggs inside nests were considered but eliminated. For instance, fencing is highly unlikely to be effective at reducing predation of guillemot nests at the Naked Island group. The prevention of gaps larger

than 1 inch (Boggess 1994) on talus slopes and cliffs is not feasible. There are no registered chemical repellents or known effective frightening devices to modify the behavior of mink near guillemot nests (Boggess 1994, National Wildlife Research Center 2008).

There is no evidence that Pigeon Guillemots at the Naked Island group are limited by the availability of nesting habitat (Bixler 2010). A few nest boxes were installed at the Naked Island group during the late 1990s, but there was low incidence of use (DBI; pers. obs), most likely because there was an abundance of natural cavities available. The population of Pigeon Guillemots at the Naked Island group is now significantly lower than it was during the late 1990s. Consequently, nest box installation would almost certainly be an ineffective restoration technique.

Alternative E - Control Avian Predators of Pigeon Guillemot Nests

Actions under Alternative E intend to prevent the predation of Pigeon Guillemot nests through reduction in population of native avian predators at the Naked Island group. Avian species targeted would include the Common Raven (*Corvus corax*), Northwestern Crow (*Corvus caurinus*), and Black-billed Magpie (*Pica pica*). Lethal population control would be attained by shooting avian nest predators throughout the guillemot nesting season, April through August.

There are no other feasible methods of lethal or non-lethal control available. Although there is a conditioned taste aversion chemical registered by the U.S. Environmental Protection Agency (methiocarb) for corvid control, it is limited in use for the protection of federally threatened or endangered species (National Wildlife Research Center 2008). Similarly, lethal control of corvids through a toxicant (i.e. DRC-1339 [3-chloro-4-methylbenzenamine HCL]) is not permitted for this application (National Wildlife Research Center 2008). Harassment techniques, such as auditory deterrents, were rejected because they would likely negatively affect guillemot nest attendance.

There are several flaws inherent to this alternative. Culling by shooting has a decreasing efficacy for corvid species through time (Liebezeit and George 2002) suggesting that each year of control would require more effort with less success. The program would need to be conducted annually and continue indefinitely due to the high dispersal capability of these species. Finally, because an increase in survival of chicks after culling avian predators is likely to be insignificant in comparison to the loss of eggs, chicks, and adults due to mink predation, it seems very unlikely that this alternative would change the current population trajectory of Pigeon Guillemots at the Naked Island group.

Alternative F - Combination of Nest Boxes and Control of Predator Populations

Under this alternative, nest predators of Pigeon Guillemots (i.e., mink, ravens, crows, and magpies) would be culled and nest boxes would be installed at the Naked Island group. Actions taken include all of those listed in Alternatives B, D, and E. Due to flaws in each action (see above) that will not be lessened by the combination of alternatives, the population trajectory of Pigeon Guillemots at the Naked Island group is unlikely to change significantly.

Alternative G - No Action – Current Management

No management action would be taken under this alternative. The current breeding population of Pigeon Guillemots at the Naked Island group is likely to remain either exceedingly low (< 25 nesting pairs) or decline to local extirpation in the absence of restoration action given the high rate of predation on guillemot nests and adults by mink.

Rationale for selection of control of predatory mink on the Naked Island Group as the preferred alternative

Alternative A, control of predatory mink, is the preferred alternative because it is the most effective method to elevate the productivity of Pigeon Guillemots at the Naked Island group and facilitate the recovery of the species in PWS. This alternative is less expensive, both financially and in number of mink killed, than any other method (Courchamp et al. 2003). Other alternatives are either currently unavailable or unlikely to facilitate guillemot population recovery. Given the high level of guillemot egg and chick mortality at the Naked Island group, there is no evidence to suggest that the population could recover without such restoration action. Mink control at the Naked Island group is likely to be successful due to well-developed methods of control (Bonesi and Palazon 2007) and geographic isolation of the islands (Nordström and Korpimäki 2004). The control of mink at the Naked Island group can be achieved within a relatively short period of time (3-5 years). Although the population response of guillemots is difficult to predict precisely, mink control would result in an increase in adult survival, reproductive success, and population size at the Naked Island group. A suite of seabird species with depressed breeding populations at the Naked Island group (e.g., Arctic Terns, Parakeet Auklets, Tufted Puffins, and Horned Puffins) (KSB, pers. obs.; Oakley and Kuletz 1979) would also benefit from this restoration action. Mink control may promote local increases in other populations of ground-nesting birds (Ferreras and MacDonald 1999, Clode and MacDonald 2002, Nordström et al. 2002, Nordström et al. 2003, Banks et al. 2008), small mammals, amphibians (Banks et al. 2008), and crustaceans (Bonesi and Palazon 2007).

Potential negative effects of the preferred alternative appear to be negligible or largely avoidable. The preferred alternative includes steps to minimize capture of non-target species (i.e., trap type and use of artificial burrows as trap sites; see Bixler et al. 2010). There is no evidence to suggest that restoration of guillemots at the Naked Island group would have a significant negative impact on herring because they have never been an important part of the diet of guillemots at this site (Golet et al. 2000). Mink at the Naked Island group are rarely exploited for their fur (R. Ellis, pers. comm.), and thus the control of mink at these islands would not adversely affect trappers in PWS. Due to fur farm ancestry, the preferred alternative would not have a negative impact on the Sound-wide population of mink. There is no concern of sudden destructive eruptions of small exotic herbivore or omnivore (e.g. rabbits, rats) populations (Bergstrom et al. 2009) following mink control because no such introduced species occur at the Naked Island group.

B. Objectives

Phase I

Complete the NEPA process to decide how to proceed. (Completed)

Phase II

1. Restore pigeon guillemots through control of predatory mink on the Naked Island group.
2. Monitor the guillemot population response to mink control at the Naked Island group.

C. Procedural and Scientific Methods

Experimental Design

1. Mink control at the Naked Island group would require up to five years to accomplish via lethal trapping (Bixler et al. 2010) and hunting with dogs.

2. A long-term monitoring program is integral to the success of this proposed restoration. The Naked Island group would be surveyed every year of the project for sign (tracks, scat) in snow, when mink are most easily detected (Bonesi and Palazon 2007). The population of guillemots would be censused at both the Naked Island group and the Smith Island group during late May/early June every year using the protocol described in Oakley and Kuletz (1996). Monitoring will be continued by USFWS after the current project is over.

3. The preferred alternative requires an adaptive management strategy. This technique requires that data collected during trapping (e.g., trapping success, sex of trapped animals) as well as Pigeon Guillemot censuses be reviewed regularly to assess the success of the actions and methods. If there is evidence that the specified objective is not being met, the restoration methods or actions should be altered.

Time Frame for Pigeon Guillemot Population Recovery

Potential changes in the growth of the pigeon guillemot population at the Naked Island group were modeled to inform the decision-making process. This modeling coincides with the two management alternatives: Alternative G: No Action-Current Management and Alternative A: Proposed Action-Control of Predatory Mink (Chapter 2). A stochastic Leslie matrix model after Golet et al. (2002) and Bixler et al (2010) was used to project guillemot population growth under these scenarios.

The following equation was used to project the growth rate of the guillemot population:

(λ): $\lambda = ((PF * FX * PA^{2}) + (NX * PA)) / NX$

λ = annual population growth rate
P_F = annual sub-adult survival rate
F_X = number of offspring produced
P_A = age-constant annual adult survival
N_X = initial population size

The observed rate of population change of pigeon guillemot at the Naked Island group from 1989 to 2008 was an approximate 12.7 percent annual decline (Bixler et al. 2010). Observed population change of pigeon guillemot at the also oiled, but mink-free Smith Islands was a 0.53 percent increase over the same time period, as pigeon guillemot recovered from EVOS. Thus, it is assumed that the long-term decline at the Naked Island Group was likely due to mink predation.

An example of the possible maximum rate of increase for pigeon guillemot was 13.6 percent annually for six years was noted by Byrd (2001) in the western Aleutian Islands when arctic fox were removed from two islands. Pigeon guillemot numbers on nearby islands where arctic fox were not removed changed only slightly. Seabirds prospect at the end of summer for good breeding sites (ones with evident chicks) and this may result in immigration to productive colonies from nonproductive colonies (Boulinier and Danchin 1997).

The modeling strategy used the best data available to quantify a matrix population projection model. The model assumed a maximum average adult survival rate of 0.9 under optimal conditions. Although no empirical estimates of adult survival exist for pigeon guillemot, this assumption is reasonable considering adult survival data across a range of different seabird species (Schmutz 2009). The assumption is very similar to the rate of 0.89 estimated for black guillemot (Frederiksen and Petersen 1999). To emulate the decline depicted by Bixler et al. (2010), the mean nest productivity rate of 0.35 was used from study years at Naked Island (1989, 1990, and 1994-1998). Bixler et al. (2010) also noted adult pigeon guillemots were killed at up to ten percent of nest sites. This rate may be an underestimate, if mink remove carcasses from the nest, as the investigator would assume the nest had failed and the adults simply dispersed. Regardless, a maximum predation rate of ten percent of the adults was used in the presence of mink (thus base adult survival without mink of 0.9 multiplied by 0.9 (the percent surviving predation in the presence of mink) equals 0.81. This nest survival rate of 0.35 and adult survival rate of 0.81 produced a rate of decline less steep than depicted in Bixler et al. (2010). An adult emigration rate was added, sufficient to produce the trend shown by Bixler et al. (2010). The best value for emigration rate was 15 percent. If this trend were to continue, a population of 100 pigeon guillemot would decrease to seven pigeon guillemot in 20 years. This model reflects the No Action – Current Management alternative.

An adult survival rate of 0.9, a nest survival rate equal of 0.61 (Golet et al. 2002), and an immigration rate equated to the emigration rate was needed to model the pigeon guillemot observed decline at the Naked Island group. The average increase of pigeon guillemot over 20 years was 17 percent annually, nearly identical to the value noted by Byrd (2001) for Simeonof Island. The projection starting point begins when there is assumed to be no mink predation. Additional model simulations could be done to characterize pigeon guillemot response to gradual mink control. To emulate a significant removal of mink (90 percent removal) nest survival and adult survival rates of 90 percent of the maximum values in the previous model were utilized. For the Control of Predatory Mink alternative, the average rate of annual increase of pigeon guillemot, over 20 years, was 16 percent.

The above model descriptions are deterministic, as each model parameter has a singular value without variation (e.g., if adult survival is 0.9, then 0.9 is maintained throughout the projection).

Stochastic models were run where variability was applied to the system with these core model structures. If biologically realistic parameter values of variability are used, then a stochastic model should be a more realistic representation of possible outcomes. For variability in nest survival (productivity), the data presented in Golet et al. (2002) was used for Naked Island. These data represent both ecologically real variability and also variability due to the sampling process. Variance decomposition procedures were used (Burnham et al.1987) to extract an estimate of process variation in nest survival. A normal distribution of this variability was imposed on the model by using random draws from the distribution, and running the model 1,000 times. The 50th and 950th model runs, sorted by population growth estimates, reflect the confidence interval of this model projection. Stochastic variability was imposed on adult survival rates. This level of variability was taken by using the mean process variation in adult survival from 18 seabird populations listed in Schmutz (2009).

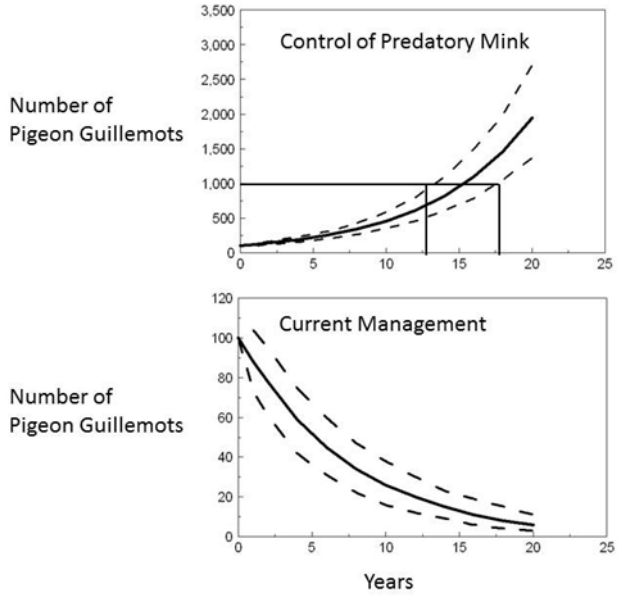

Figure 2. Results of stochastic Leslie matrix modeling of the changes in the pigeon guillemot population at the Naked Island group for two alternatives: No Action – Current Management and Preferred alternative – Control of Predatory Mink (Fleming and Cook 2010). Across the two model scenarios, guillemot productivity varies in a monotonic fashion. The graphs start with the year after the actions were completed.

The "No Action – Current Management" alternative represents no control of predatory mink at the Naked Island group and a predation rate based on the empirical predation rate of the 1990s (Bixler et al. 2010). Under the "Preferred alternative – Control of Predatory Mink", a model projecting guillemot population growth, assumed annual removal of mink was sufficient so that few survived at the Naked Island group after each annual management effort and mink predation on guillemot was minimal.

C. Data Analysis and Statistical Methods

The Pigeon Guillemot population trajectory between 1989 and 2008 at the Naked Island group and at the nearby Smith Island group (mink-free islands) can be compared to population trends following control using a Before–After–Control–Impact design (Smith 2002).

D. Description of Study Area

Restoration would occur at the Naked Island group. The Pigeon Guillemot population at both the Naked Island group and the Smith Island group would be monitored.

E. Coordination and Collaboration with Other Efforts

Implementation of this plan would require coordination with agencies with authority and responsibility of the Naked Island group, American mink, and Pigeon Guillemots (See below). Monitoring of Pigeon Guillemots would be conducted by the U.S. Fish and Wildlife Service. Permits for control of mink at the Naked Island group would be obtained from both the Alaska Department of Fish and Game and the U.S. Department of Agriculture – Forest Service. Mink control would be conducted by the U.S. Department of Agriculture – Wildlife Services or other contractor.

Authority and Responsibility

U. S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service mission is "to work with others to conserve, protect and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American people." Along with other Federal, State, Tribal, local, and private entities, the Service protects migratory birds, endangered species, certain fish species, and wildlife habitat. The Service is the primary agency responsible for the conservation of the Pigeon Guillemot and its habitat as authorized by the Migratory Bird Treaty Act.

Alaska Department of Fish and Game

The mission of the Alaska Department of Fish and Game is to "protect, maintain, and improve the fish, game, and aquatic plant resources of the state, and manage their use and development in the best interest of the economy and the well-being of the people of the state, consistent with the sustained yield principle." The Department is responsible for maintaining a harvestable surplus of fish and wildlife species, including furbearers and marine forage fish.

U.S. Department of Agriculture Forest Service

The mission of the Forest Service is "to sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations." The Forest Service is responsible for the management of the 5.4 million acre Chugach National Forest that includes nearly all of the Naked Island group, along with most of the rest of the land area of Prince William Sound.

III. SCHEDULE

A. Project Milestones

- Mink control completed at Naked Island group
  To be met by March 31, 2018

- Revise final report for EVOS project 10070853 to include details of mink management efforts and Pigeon Guillemot population trends.
  To be met by Sept 30, 2018

B. Measurable Project Tasks

FY 14, 2nd quarter (January 1 – March 31)
Trap and monitor mink at the Naked Island group

FY 14, 3rd quarter (April 1 – June 30)
Trap and monitor mink at the Naked Island group
Census breeding guillemots at Naked Island and nearby islands, 28-30 May

FY 14, 4th quarter (July 1 – September 30)
Submit annual report to Trustee Council

FY 15, 1st quarter (October 1 – December 31)

FY 15, 2nd quarter (January 1 – March 31)
Trap and monitor mink at the Naked Island group

FY 15, 3rd quarter (April 1 – June 30)
Trap and monitor mink at the Naked Island group
Census breeding guillemots at Naked Island and nearby islands, 28-30 May

FY 15, 4th quarter (July 1 – September 30)
Submit annual report to Trustee Council

FY 16, 1st quarter (October 1 – December 31)

FY 16, 2nd quarter (January 1 – March 31)
Complete mink trapping and use dogs to check for any remaining mink at the pigeon guillemot nesting areas on the Naked Island group

FY 16, 3rd quarter (April 1 – June 30)
Census breeding guillemots at Naked Island and nearby islands, 28-30 May

FY 16, 4th quarter (July 1 – September 30)
Submit annual report to Trustee Council

FY 17, 1st quarter (October 1 – December 31)

FY 17, 2nd quarter (January 1 – March 31)

Check for any remaining mink at the pigeon guillemot nesting areas using dogs at the Naked Island group

FY 17, 3rd quarter (April 1 – June 30)

Census breeding guillemots at Naked Island and nearby islands, 28-30 May

FY 17, 4th quarter (July 1 – September 30)

Submit annual report to Trustee Council

FY 18, 1st quarter (October 1 – December 31)

Monitor absence of mink at the at the pigeon guillemot nesting areas on the Naked Island group

FY 18, 2nd quarter (January 1 – March 31)

Set up field camp on Naked Island (Cabin Bay)
Monitor absence of mink at the at the pigeon guillemot nesting areas on the Naked Island group
Control complete
Remove field camp on Naked Island

FY 18, 3rd quarter (April 1 – June 30)

Census breeding guillemots at Naked Island and nearby islands, 28-30 May
Amend Final Report with information on control and guillemot population trends

FY 16, 4th quarter (July 1 – September 30)

Submit Final report to Trustee Council

IV. RESPONSIVENESS TO KEY TRUSTEE COUNCIL STRATEGIES

A. Community Involvement and Traditional Ecological Knowledge (TEK)

All community input is always welcome to our project, the proposal process is open and the PAG members and other members of local communities may comment on proposals. The findings of the study will be communicated to local communities through various means including the annual EVOS meeting, on the web, distribution of reports and of course the reports will always be available in the local libraries.

B. Resource Management Applications

The restoration described in this proposal is only option likely to be effective or currently available to "initiate, sustain, or accelerate recovery", a recovery objective for Pigeon Guillemots identified in the 1994 Restoration Plan. The amendment represents the culmination of several years of research previously supported by the EVOS Trustee Council that assessed factors limiting recovery of Pigeon Guillemot populations damaged by EVOS. It directly reflects the

findings of research conducted under Project 10070853 in 2007 and 2008 on current limiting factors of Pigeon Guillemot recovery at the Naked Island group.

V. PUBLICATIONS AND REPORTS

An annual report for each year of this project will be submitted by 15 April of the following year. The final report for this project will be submitted 30 September 2018. One manuscript will be generated from this research and will be published in peer-reviewed scientific literature.

Budget Justification

FY 2014 -- $396,655.80 Phase II
FY 2015 –$391,205.80 Phase II
FY 2016 –$154,014.50 Phase II
FY 2017 –$139,967.70 Phase II
FY 2018 --$124,707.70 Phase II
TOTAL: $1,206,551.40 Phase II

NOTE: David Irons and Dan Roby submitted a proposal to the National Fish and Wildlife Foundation for ~50% of the original $2.2 million budget (half of the budget, excluding the NEPA budget). NFWF awarded $1,051,300.00 about two years ago, dependent on EVOSTC funding.

Project Title: Pigeon Guillemot Restoration Research in Prince William Sound, Alaska, FY13 Amendment

Personnel: A project leader (GS 11) is needed to assist the Principal Investigators and must possess supervisory skills to govern the activities of 9 subordinate workers. For the recovery monitoring we will need two bio techs for one month the first two years and three bio techs for three months the last three years. We will need one bio tech for 12 months each year to take care of all field gear preparation/maintenance and survey logistics. The project leader will allocate 7 months to the project -- 4 months for field work in each year of the project to conduct QA/QC on the data, enter data into the North Pacific Pelagic Seabird Database, conduct the analysis and write the report. The analysis and writing will occur in FY18, when the report is due.

Request: (FY 2014: $43.8K; FY2015: $43.8K; FY 2016: $70.2K; FY 2017;$70.2K; FY 2018: $70.2K TOTAL: $298.2K)

Travel: Three people in years 1 and 2, and four people in years 3, 4, and 5 will be traveling throughout Prince William Sound and will need approximately 8 nights of lodging in towns around the Sound. Per diem rates will be given to each person during the survey. A tunnel fee is assessed to every vehicle traveling through the tunnel near Portage and the truck/boat will make 10 round trips during the survey.

Request: (FY 2014: $1.9K; FY2015: $1.9K; FY 2016: $3.7K; FY 2017;$3.7K; FY 2018: $3.7K TOTAL: $14.9K)

Contractual: APHIS - Wildlife Services will be contracted to control mink at the Naked Island group. A minimum of three persons per boat (3 boats) for a total of nine persons are needed to trap mink for the first two years and two boats the third year and one boat the last three years. We will need nine trappers for three months in winter the first two years, six trappers for one month in year 3, and three trappers for one month for years 4 and 5. The trappers will need 6 nights of lodging in Whittier. Per diem rates will be given to the trappers while traveling and camping.
Prince William Sound is large and requires extensive travel by boat. To make the survey cost effective, a support vessel will be contracted to provide lodging and food for the winter trapping period which is three months the first two years and one month the last three years. The small boats used to put the trappers on shore and for restoration monitoring will operate for hundreds of hours and will need repairs and replacement parts. There are also fees associated with launching and parking the boat in the harbors. Fuel storage at Naked Island will require a barge for transportation.

Request: (FY 2014: $275.2K; FY2015: $270.2K; FY 2016: $44.0K; FY 2017;$37.1K; FY 2018: $23.1K TOTAL: $649.7K)

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Commodities: Includes gas and oil to support boat transport and operation during the trapping in the winter which will have three boats for three months the first two years, two boats for one month in the third year, and one boat for one month in the last two years. Restoration monitoring will require one boast for one month in the summer the first two years. During the last three years, monitoring will require two boats for one month and one boat for two months. This also includes food for 4 people while conducting the restoration monitoring in the summer when there is no support vessel; and personal safety devices.

Request: (FY 2014: $40.0K; FY2015: $40.0K; FY 2016: $20.4K; FY 2017;$14.4K; FY 2018: $14.4K TOTAL: $129.1K)

Equipment: We are using USFWS equipment for this survey as an in-kind contribution but the survey work takes a toll on boats; on average, each boat will run a total of 30-90 full days per year. As a result, we are including funds for emergency replacement of motor parts that fail during the survey should that need arise.

Request: (FY 2014: $3.0K; FY2015: $3.0K; FY 2016: $3.0K; FY 2017;$3.0K; FY 2018: $3.0K TOTAL: $15.0K)

Indirect: We are using the standard G&A rate of 9%.

Request: (FY 2014: $32.7K; FY2015: $32.3K; FY 2016: $12.7K; FY 2017;$11.5K; FY 2018: $10.2.0K TOTAL: $99.6K)

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Appendix A

Pigeon Guillemot Restoration Research in Prince William Sound, Alaska: A Summary of Findings and Evidence for Recent Introduction of American Mink to the Naked Island Group

David Irons, Kirsten Bixler, and Dan Roby

2013

Summary

This project, Pigeon Guillemot Restoration Research in Prince William Sound, Alaska, identified an opportunity to restore the breeding population of Pigeon Guillemots (*Cepphus columba*) in Prince William Sound, Alaska. The numbers of Pigeon Guillemots that nest at the Naked Island group in central Prince William Sound (PWS) has declined by more than 90% since 1989. Based on the findings from this research project, a restoration plan for Pigeon Guillemots in PWS was prepared to address the species' lack of population recovery following injury by the 1989 *Exxon Valdez* oil spill. Predation on guillemot nests and adults by American mink (*Neovison vison*) is now the primary limiting factor for guillemot reproductive success and population recovery at the most important historical nesting site for guillemots in PWS (i.e., the Naked Island group). Mink on the Naked Island group are descended in part from fur farm stock and the available evidence and testimonies of local people indicate that mink were introduced on the island group during the 1970's. Removal of all mink in the pigeon guillemot nesting areas through control of predatory mink on the Naked Island group was selected as the preferred restoration alternative because it is feasible and likely to result in the substantial recovery of guillemots in PWS. Other alternatives are either currently unavailable or unlikely to be effective. A mink reduction effort is likely to be successful due to both well-developed methods and the low likelihood of natural re-colonization to the pigeon guillemot nesting areas. Potential negative effects of the preferred alternative are either negligible or largely avoidable. The numbers of Pigeon Guillemots nesting at the Naked Island group would likely increase five-fold within the first 10 years following mink control, and the Sound-wide population of guillemots would likely increase substantially within 15 years of mink control at the Naked Island group, once the Naked Island group has become a source population for other parts of PWS.

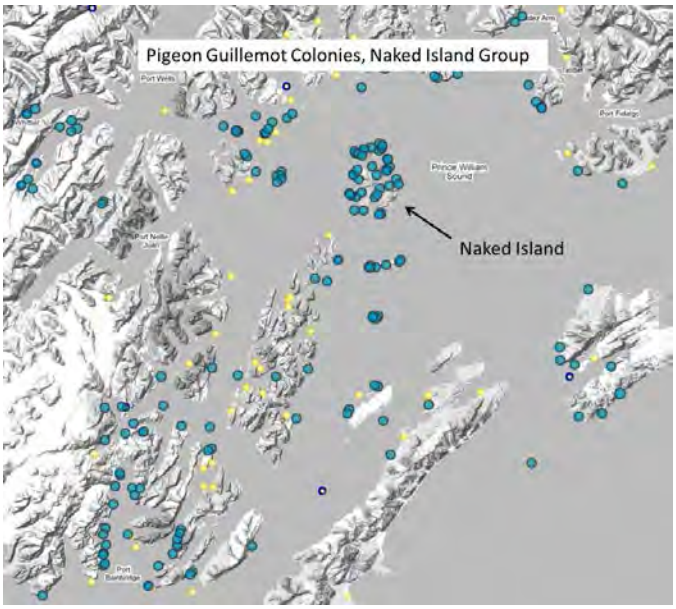


Figure1. Map of Prince William Sound and the Naked Island group showing Pigeon Guillemot breeding colonies before the detection of mink on the Naked Island group.

American Mink Introduction to the Naked Island Group in Prince William Sound, Alaska: A Review of the Evidence

A recent drastic decline in numbers of Pigeon Guillemots (*Cepphus columba*) nesting at the Naked Island group in central Prince William Sound (PWS) is concurrent with the onset of sightings of American mink (*Neovison vison*) on the Naked Island group and frequent guillemot nest failure due to mink predation.

- Data from shoreline surveys of entire islands showed four islands in central PWS without mink had an average density of 49.4 Pigeon Guillemots/kilometer of shoreline in 1993. Four islands in central PWS with mink had an average density of 0.55 Pigeon Guillemots/kilometer of shoreline in 1993. In 1978 before the introduced mink increased and began depredating pigeon guillemot nests on the Naked Island group, the average density was 47.8 Pigeon Guillemots/kilometer of shoreline. After mink colonization, in 2008, the Naked Island group had an average density of 0.96 Pigeon Guillemots/kilometer of shoreline.
- In 1978, no predation of guillemot nests was observed on the Naked Island group during an in-depth study of Pigeon Guillemot nesting ecology.
- By 1998, just 20 years later, at least 60% of guillemot nests and 4.5% of breeding adult guillemots on the Naked Island group were depredated by mink.

- The Pigeon Guillemot breeding population at the Naked Island group has declined by more than 90% during the last 15 years, following the arrival of mink; in contrast, the guillemot breeding population at nearby mink-free islands in central PWS has been stable since 1990.
- Researchers have documented abundant food for guillemots (forage fishes) near the Naked Island group.

- In addition to Pigeon Guillemots, several other colonial seabird species show similar recent drastic declines in breeding populations on the Naked Island group. Tufted Puffins (*Fratercula cirrhata*) and Horned Puffins (*F. corniculata*) nest in greatly reduced numbers on the Naked Island group and are confined to the tallest cliffs. Parakeet Auklets (*Aethia psittacula*) no longer nest at the Naked Island group. In contrast, Sound-wide populations have remained stable or declined slightly (Figure 2).

Testimonies of local people indicate that American mink were introduced at the Naked Island group.

- Herb Jenson of Cordova is the nephew of Jerry Clock who grew up on Peak Island, Herb stated that his uncle had released American mink in the 1970's on Naked Storey and Peak islands to establish a population for trapping, but that the population did not grow much until the 1990's.
- A local trapper in Cordova, Ed Bilderback, saw no mink or evidence of mink on the Naked Island group between 1946 and the mid-1990's.
- There is also other suggestive evidence of introductions of American mink to islands in Prince William Sound by fox farmers (Lethcoe and Lethceo 2001) and fur trappers (R. Ellis, USDA-WS, pers. comm.) to establish new harvestable populations

Historical and current distribution of mink in Prince William Sound (PWS) strongly suggest that mink are not native to the Naked Island group.

- Mink do not naturally occur on isolated islands (> 5 km from the nearest mainland) in PWS (i.e., Montague, Green, Seal, Smith, and Little Smith islands).
- The Naked Island group is similarly isolated (6 km from the nearest island).
- The record for longest natural dispersal distance over open water by mink is 4 km.
- There were no mink found on the Naked Island group during a collecting expedition in 1908.
- American mink have been intentionally introduced to isolated islands in PWS where they were formerly not found (i.e., Montague Island) and undocumented introductions of mink to other isolated islands have also occurred in PWS.

Studies of the population genetic structure of mink in PWS suggest that mink on the Naked Island group were introduced.

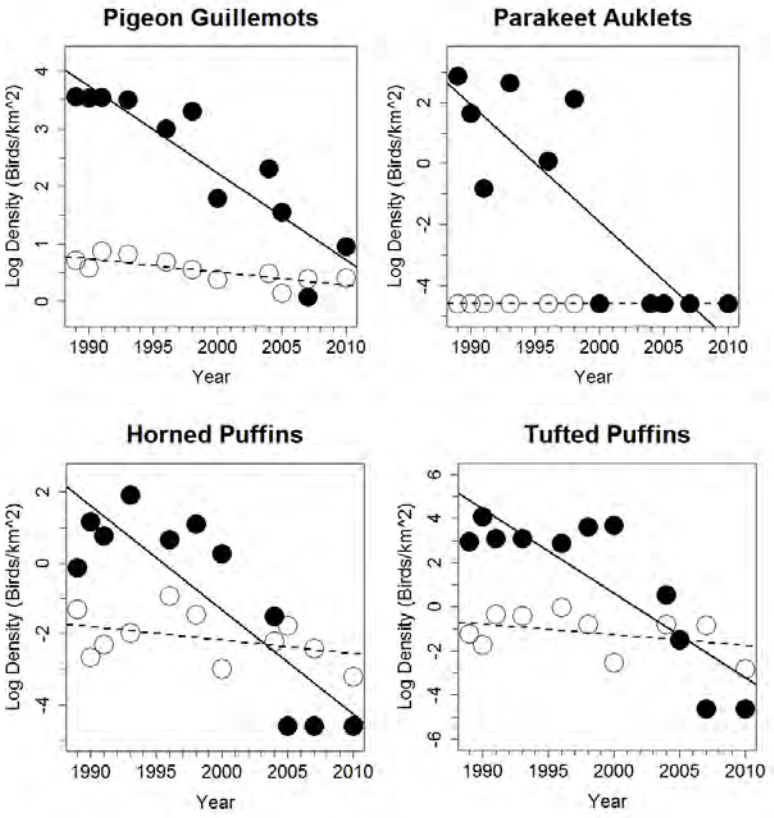
- Mink at the Naked Island group are descended in part from fur farm stock.
- Observed genetic diversity of mink at the Naked Island group is not consistent with natural colonization due to infrequent dispersal events.
- The estimate of initial (founder) population size (about 5 pairs) is much larger than would be expected from a natural colonization event.

Published accounts of the effects of introduced American mink on their prey elsewhere document rapid and drastic declines in numbers of birds after mink introduction and large increases in bird populations following mink removal.

- On islands where mink were introduced, nearly all native species of birds, mammals, and amphibians present on the islands declined due to mink predation.
- Populations of most of these native species increased dramatically following mink removal.

- Eradication of introduced American mink on islands in the Baltic Sea resulted in increases in numbers of breeding Black Guillemots (*Cepphus grylle*), a close relative of Pigeon Guillemots.

Species for which nests are susceptible to American mink predation



Species for which nests are not susceptible to American mink predation

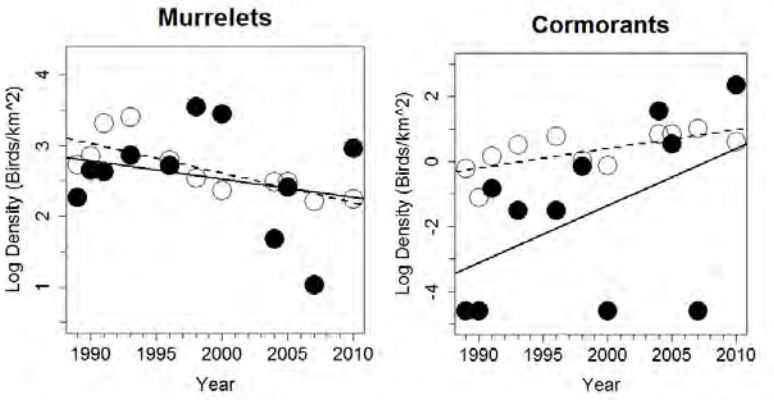


Figure 2. Comparison of population trends from 1989 to 2010 for species of fish-eating seabirds, whose nests are susceptible to American mink predation and whose nests are not susceptible to American mink predation at the Naked Island group (filled circles) and the remainder of PWS (open circles). Data are from EVOSTC-funded, PWS-wide surveys of a random sample of 25 percent of the shoreline transects. (Note: negative values on the natural log scale indicate that densities were less than one bird/km^2 (Cushing et al. 2012).

In 1978 pigeon guillemot equally nested in three habitats, but by 2008 almost all the nests occurred in cliff habitat that was least accessible to American mink (Table 3).

Table 3. Number and percent of active pigeon guillemot nests in different nest site types at the Naked Island group, PWS, Alaska in 1978 and 2008.*

	1978		2008	
Nest Type	Number	Percent	Number	Percent
In a crevice on a cliff face	52	35.6	15	88.2
In overhanging soil at a cliff top	58	39.7	2	11.8
Under boulders at the base of a cliff or amidst rocks on a cliff ledge	36	24.7	0	0.0
Total	146	100.0	17	100.0

*Reproduced from Bixler et al (2010).

History of mink on Naked, Storey and Peak Islands as told by Herb Jenson, son of Dolly Clock and nephew of Jerry Clock, to David Irons on 13 June, 2012.

Herb is a commercial fisherman and lives in Cordova. Herb spent most of his summers at the Peak Island homestead in the 1960's, 1970's and 1980's and still goes to the homestead when he can.

Alice McPherson married James Clock and homesteaded Peak Island and had a fox farm in the early 1900's. James died early, but Alice stayed on Peak Island and raised six children: Dolly, Virginia, Elizabeth, Jerry, Tom, and Ray. Jerry trapped river otter on the islands for years, but there were no mink on the islands. In the 1970's Jerry decided he wanted to be able to trap mink on the islands so he live-trapped mink in areas of Prince William Sound that had mink and released them on Naked, Storey, and Peak islands. He brought a few every year for several years, but they did not establish a sustainable population right away and Jerry was never able to trap them. He became ill with cancer in the 1980's so he stopped trapping on the Naked Island Group. As Herb remembers, mink did not become abundant on the Naked Island Group until the 1990's.

Statement from Ed Bilderback, who trapped annually in Prince William Sound from 1946-2002.

June 17, 2008

To Whom It May Concern:

I trapped mink, river otter, martin and wolverine throughout Prince William Sound from 1946 to 2002. I had a boat and traveled around trapping on the mainland and on most large islands. In the 1940's I noted that there were no mink on Montague, Green, Naked, Storey and Peak islands. There were river otter but no mink or martin. Mink occurred on the mainland and most large islands except for the ones mentioned above. Martin occurred on the mainland, but not on islands. In the 1950's the Alaska Department of Fish and Game introduced farmed mink on Montague Island, after that, I caught mink on Montague. I trapped the Sound every year and I never saw or caught a mink on the Naked Island group until the mid 1990's, when I saw a mink on Peak Island. It is my belief that mink did not naturally occur on Montague, Green, Naked, Storey, or Peak Islands.

Sincerely, Ed E. Bilderback

Ed Bilderback
P.O. Box 536
Cordova Alaska
99574

Appendix B

ENVIRONMENTAL ASSESSMENT

DRAFT

POTENTIAL RECOVERY OF PIGEON GUILLEMOT POPULATIONS

NAKED ISLAND GROUP, PRINCE WILLIAM SOUND,

CHUGACH NATIONAL FOREST, ALASKA

JULY 19, 2013

Prepared by:

U.S. Fish and Wildlife Service

U.S. Forest Service,
Chugach National Forest

U.S. Animal and Plant Health Inspection Service
Wildlife Services

GAP Solutions, Inc.

For:

The *Exxon Valdez* Oil Spill Trustee Council

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CHAPTER 1: PURPOSE OF AND NEED FOR ACTION

INTRODUCTION

On March 24, 1989, the T/V Exxon Valdez ran aground at Bligh Reef resulting in the release of at least 44 million liters of Prudhoe Bay crude oil into Prince William Sound (PWS; Figure 1). Oil spread to the southwest through the PWS and into the northern Gulf of Alaska. An estimated 500 to 1,500 pigeon guillemot in PWS were immediately killed due to oil exposure (Piatt and Ford 1996). Ten to 15 percent of the pigeon guillemot (*Cepphus columba*) population within the entire spill area, an estimated 2,000 to 6,000 birds, died from acute oiling (EVOSTC 2010). The Naked Island group (Naked, Storey, and Peak islands), located within PWS (Figure 1) were one of the first areas to be oiled (Oakley and Kuletz 1994). Evidence indicates that pigeon guillemot were exposed to and negatively affected by residual oil for at least a decade after the spill (Golet et al. 2002). By 2004 there was no longer an indication of pigeon guillemot exposure to residual oil from the Exxon Valdez Oil Spill (EVOS; Bixler 2010).

As a result of the Exxon Valdez Oil Spill (EVOS), the State of Alaska, the federal government, and Exxon Corporation entered into "the Agreement and Consent Decree (Consent Decree), as approved by the court on October 8, 1991 (A91-082-CIV)", to ensure restoration of injured resources and resources dependent services due to the oil spill. The Consent Decree provided that money paid to the Governments would only be used for certain purposes, which included to "plan, implement, and monitor the restoration, rehabilitation, or replacement of Natural Resources, natural resources services,…injured as a result of the Oil Spill…". The EVOS Trustee Council established a list of resources that suffered population-level injuries due to the spill and developed specific, measurable recovery objectives for each injured species. The pigeon guillemot is on that list. Studies were completed in 2010 (see Most Recent Research and Studies section, Chapter 1) to address the lack of population recovery of pigeon guillemot.

The Naked Island group is particularly important because it was historically the main pigeon guillemot breeding location in PWS (Sanger and Cody 1994). One fourth of all pigeon guillemot nests in PWS in 1989 (just after the spill) were located at the Naked Island group, although the islands constitute only about two percent of the total shoreline in PWS (Bixler et al. 2010). Restoration of pigeon guillemot at the Naked Island group to the 1989 levels could result in a substantial PWS-wide population increase. The Naked Island group is also the site where researchers and managers have the most information and have investigated mechanisms regulating pigeon guillemot populations in PWS. Data on population size, nesting success, and diet of pigeon guillemot has been collected at the Naked Island group for 15 years between 1978 and 2008.

Predation by American mink (*Neovision vision*) (hereafter referred to as mink) appears to be the primary factor limiting pigeon guillemot population recovery at the Naked Island group (Irons et al. 2013). Mink predation on eggs and chicks in nests and adults combined with the decline due to EVOS has likely suppressed pigeon guillemot populations at the Naked Island group. Other seabirds have also been affected. Parakeet auklets (*Aethia psittacula*), tufted puffins (*Fratercula cirrhata*), and horned puffin (*Fratercula corniculata*) declined from about 1,400 breeding birds to approximately twelve (Bixler 2010). Prior to the EVOS the Naked Island group supported the highest number of nesting pairs of parakeet auklet in PWS.

Available evidence and modeling indicate that reducing mink predation on eggs, chicks and adults would result in a measureable increase in the breeding population and productivity of pigeon guillemot.

To assess potential methodologies for recovery of pigeon guillemot within the oil spill area, the EVOS Trustee Council authorized Project 11100853, *Pigeon Guillemot Restoration Research in PWS*; *providing an opportunity to restore the population of pigeon guillemot at the Naked Island group*. Preparation of this Environmental Assessment (EA) represents the first phase of implementing Project 11100853. The EVOS Trustee Council, comprised of three state and three federal trustees, has provided funding for this EA. Once a preferred alternative is selected (except the No Action Alternative) with potential funding partners, the EVOS Trustee Council and the National Fish and Wildlife Foundation would provide funding for project implementation.

PURPOSE OF ACTION

The purpose of the action is to restore pigeon guillemot at the Naked Island group from the present 100 birds to 1,000 birds (observed at the time of the 1989 EVOS) and to remove pigeon guillemot from the EVOS Trustee Council "not recovering" list. This recovery at the Naked Island group would effectively recover pigeon guillemot in Prince William Sound. Mink are the primary predator responsible for pigeon guillemot declines and the Proposed Action discussed in Chapter 2 requires reduction in their population. Recovery is expected to be measureable three years after project initiation. Initial signs of recovery would be recognized by observing sustained or increasing pigeon guillemot productivity and an increase in the number of nesting birds. Productivity is defined as the number of young pigeon guillemots produced from each nest each year (Table 1). While recovery will be slow during initial implementation of the Proposed Action, it is anticipated that their population would be "recovered" in 15 years after the mink trapping program has been completed.

The EVOS Trustee Council has three definitions for the status of injured species: "not recovering", "recovering", and "recovered". The pigeon guillemot would be considered "recovering" when productivity at the Naked Island group is sustained or increasing, as stipulated within the EVOS Restoration Plan 2010 Update Injured Resources and Services. "Recovered" is defined as increasing the pigeon guillemot populations at the Naked Island group to 1,000 birds observed at the time of the 1989 EVOS from the current 100 birds. When the total population at the Naked Island group has reached 1,000 birds, the PWS population would also be "recovered" by having a stable population, as stipulated within the EVOS Restoration Plan 2010 Update Injured Resources and Services.

Table 1. Expected results for Proposed Action-Control of Predatory Mink and No Action-Current Management Alternatives.

Timeline*	**Pigeon Guillemot Status***	
	Proposed Action – Control of Predatory Mink	**No Action-Current Management**
Current	*Not Recovering* (100 birds)	*Not Recovering* (100 birds)
3 years after project initiation	*Recovering* Chick productivity increases to 0.5 chicks and nesting birds increase up to 10% from 100 (baseline) to 110 birds observed three years after project initiation	*Not Recovering* Chick productivity of <0.5 chicks/nest static or declining and nesting birds declining from the 100 birds (baseline) to 70 birds
5 years after project initiation	*Recovering* Chick productivity remains at 0.5 chicks/nest or higher and nesting birds increase to 10-30% from 100 (baseline) to 110 to 130 birds	*Not Recovering* Chick productivity of <0.5 chicks/nest and nesting birds declining to 55 birds
10 years after project completion	*Recovering* Chick productivity remains at 0.5 chicks/nest or higher and nesting birds increase to 500 birds or more	*Not Recovering* Chick productivity of <0.5 chicks/nest and nesting birds declining to 30 birds
15 years after project completion	*Recovered* Chick productivity remains at 0.5 chicks/nest or higher and nesting birds increase to 1,000 birds or more	*Not Recovering* Chick productivity of <0.5 chicks/nest and nesting birds declining to 18 birds

*Timeline and milestones for observing “not recovering”, “recovering”, and “recovered” pigeon guillemot status as defined by the EVOS Restoration Plan: 2010 Updated Injured Resources.

NEED FOR ACTION

The number of pigeon guillemot breeding at the Naked Island group has declined from approximately 1,000 birds in 1989 to about 100 in 2008; a 90 percent decline. Other PWS pigeon guillemot populations, excluding the Naked Island group, declined 22 percent during the same period (Irons et al. 2013; Bixler et al. 2010). The Naked Island group had 47.8 pigeon guillemot observed per kilometer of shoreline in 1990 and 0.96 in 2008 (Bixler et al. 2010, Irons et al. 2013).

Pigeon guillemot is the only marine bird species listed as "not recovering" on the EVOS Trustee Council's Injured Resources List, and shows no indication of population recovery. An EVOS Trustee

Council objective is to pursue alternatives to actively shift the population status toward full recovery. Research and several studies to address the lack of population recovery of pigeon guillemot were completed in 2010. Pigeon guillemot recovery would allow the EVOS Trustee Council to remove this bird from its "not recovering" list and added to the "recovering" list and eventually to the "recovered" list.

The primary limiting factor for pigeon guillemot recovery at the Naked Island group appears to be mink predation (Irons et al. 2013). Reduction of mink is critical to the success for "recovering" pigeon guillemot, but complete removal is currently not a viable alternative.

Figure 1. Prince William Sound, Alaska.

Figure 2. Naked Island group, Prince William Sound, Alaska.

BACKGROUND

Importance of Naked Island group

The Naked Island group was one of the most important historical breeding and rearing locations for seabirds in PWS (Bixler et al. 2010). From the early 1970s until the EVOS in 1989, the Naked Island group supported some of the highest densities of breeding pigeon guillemot (93.2 birds/km^2) as well as parakeet auklet (23.8 birds/km^2), tufted puffin (39.2 birds/km^2), and horned puffin (6.0 birds/km^2) on approximately 100 km of shoreline as compared with the remainder of PWS, which encompasses approximately 5,000 km of shoreline (Isleib and Kessel 1973; Table 2). While the purpose of the Proposed Action is the recovery of pigeon guillemot, it is important to understand the benefit to other seabirds as a result of removing predatory mink.

Table 2. Seabird densities of randomly selected transects at the Naked Island group (NIG) and Prince William Sound (PWS).

Period or Year	Pigeon Guillemot birds/km^2		Parakeet Auklet birds/km^2		Tufted Puffin birds/km^2		Horned Puffin birds/km^2	
	NIG	PWS	NIG	PWS	NIG	PWS	NIG	PWS
1970's *	93.2	15.5	23.8	1.9	39.2	9.6	6.0	3.6
1990 *	34.4	1.78	5.1	0	59.0	0.2	3.2	0.1
1998*	27.3	1.74	8.4	0	37.6	0.4	3.0	0.2
2010*	2.6	1.51	0	0	0	0.1	0	0.1

*Dywer et al. 1976, Oakley and Kultez 1979, and Cushing et al.2012

Population Decline

Declines in numbers of pigeon guillemot at the Naked Island group were concurrent with the onset of sightings of and predation by mink. No predation of pigeon guillemot nests was observed in 1978, but by the late 1990's at least 60 percent of pigeon guillemot nests and10 percent of breeding adult pigeon guillemot were depredated by mink (Irons et al. 2013, Bixler 2010, and Bixler et al. 2010). Mink were identified as a predator of pigeon guillemot at the Naked Island group by:

- snaring mink entering pigeon guillemot nest cavities (Irons et al. 2013).
- confirmation that bite wounds were the cause of chick death and that these wounds were consistent with the inter-canine width of mink (generally nine to11 mm) (Irons et al. 2013); and
- identification that the method of death is consistent with mink predation, i.e., bite wounds on the head and neck, decapitation of the bird, and caching of carcasses (Irons et al. 2013).

Aside from river otter (*Lontra canadensis*) and mink, no other mammalian predators including American marten (*Martes americana*) and weasel (*Mustela ssp*.) have been documented on the islands, despite extensive trapping efforts. River otter have been documented on the islands since at least 1908 (Heller 1910) and have been known to depredate a limited number of pigeon guillemot nests. River otter access nests by digging into them and the disturbance is obvious and easily distinguishable from mink. No such disturbance was detected in depredated nests since 1989, suggesting that the recent observed predation events can only be attributed to mink (Bixler et al. 2010).

Other predators of pigeon guillemot exist. Corvids have been observed in the vicinity of pigeon guillemot nests at the Naked Island group, but have not been observed entering a nest cavity (Irons et al. 2013). A few adult pigeon guillemot beaks have been found in bald eagle (*Haliaeetus leucocephalus*) nests, but bald eagles cannot access the pigeon guillemot nest cavity.

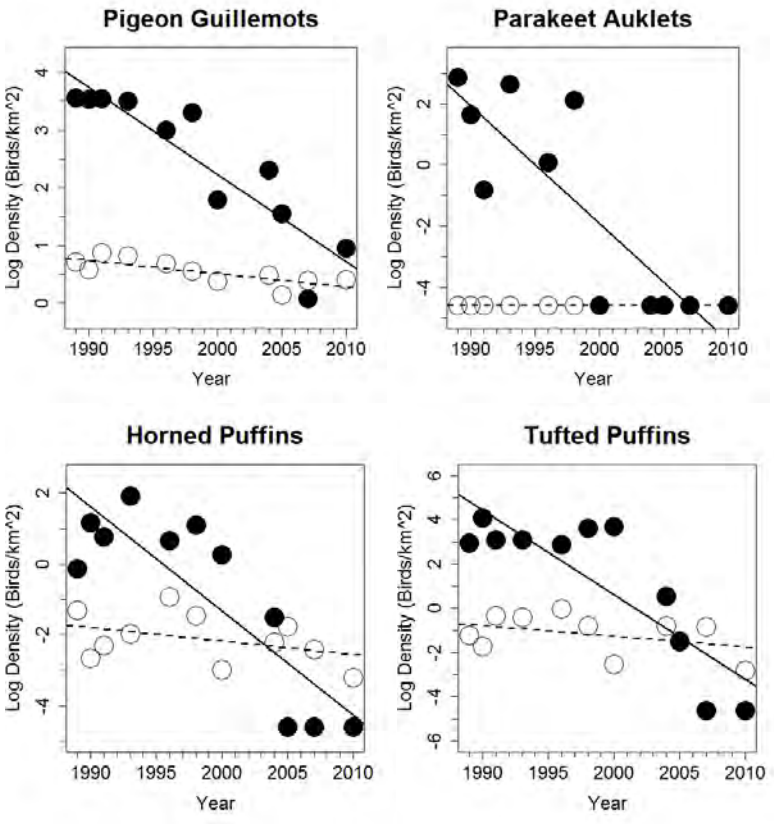
Pigeon guillemot nest in talus and rock crevices and are susceptible to ground based predation. Mink are the only known ground-based predator occurring at the Naked Island group, except for river otter. Little predation of seabirds by river otter has been observed at the Naked Island group (Irons, pers. obs.).

Mink and Seabird Populations

As stated earlier, while recovering pigeon guillemot is the purpose of the Proposed Action, it is important to show the benefit to other seabirds as a result of removing predatory mink from the Naked Island group. By comparing trends in seabird numbers susceptible to mink predation to trends in seabirds not susceptible to mink predation at the Naked Island group and the rest of PWS, indicates that an increase in mink likely caused pigeon guillemot and other seabirds to decline.

Densities of seabirds susceptible to mink predation were much higher in 1989 at the Naked Island group than in the rest of PWS. From 1989 to 2008 the seabird densities declined sharply at the Naked Island group, while declining only slightly in the rest of PWS (Figure 3). Initial densities and trends in densities of seabirds not susceptible to mink predation are similar at the Naked Island group and the rest of PWS (Cushing et al. 2012, Cushing unpubl. data). These data support the premise that in 1989, few mink were at the Naked Island group compared to the rest of PWS and mink numbers increased over the next several years at Naked Island group, but changed little in the rest of PWS. Likewise, the increase in mink caused pigeon guillemots and other bird species (whose nests are susceptible to mink predation) to decline significantly at the Naked Island group as compared to the birds in the rest of PWS.

Species With Nests Susceptible to Mink Predation



Species With Nests Not Susceptible to Mink Predation

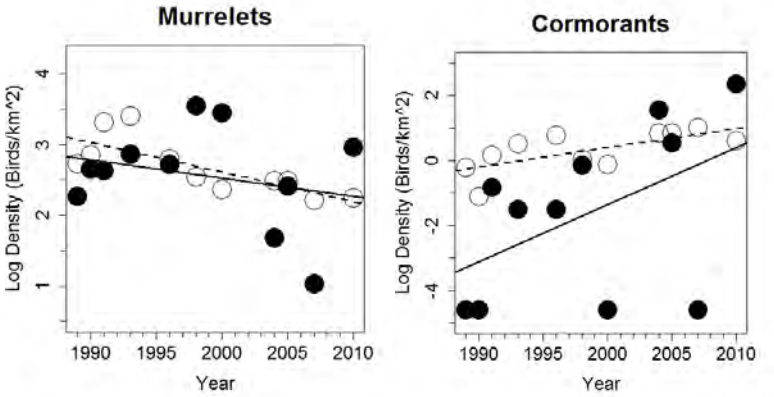


Figure 3. Comparison of population trends from 1989 to 2010 for species of fish-eating seabirds, with nests are susceptible to mink predation, and with nests are not susceptible to mink predation at the Naked Island group (filled circles) and the remainder of PWS (open circles). Data are from EVOS Trustee Council-funded, PWS-wide surveys of a random sample of 25 percent of the shoreline transects. (Note: negative values on the natural log scale indicate that densities were less than one bird/km^2 (Cushing et al. 2012).

In 1978 when little pigeon guillemot predation by mink occurred at the Naked Island group, birds nested mainly in three different habitats: crevices on cliff faces; overhanging soil at a cliff top, and under boulders at the base of a cliff, or amidst rocks on a cliff edge. Mink could access most nests in

overhanging soil at a cliff top and nests under boulders at the cliff base or amidst rocks on a cliff ledge, but mink were not able to access crevice or cliff face nests easily. Most nests in the habitat easily accessible to mink were gone by 2008 and remaining nests occurred in habitat difficult for mink to access (Table 3.). These results provide evidence that mink predation is responsible for the pigeon guillemot decline at the Naked Island group.

Table 3. Number and percent of active pigeon guillemot nests in different nest site types at the Naked Island group, Prince William Sound, Alaska in 1978 and 2008.*

	1978		2008	
Nest Type	Number	Percent	Number	Percent
In a crevice on a cliff face	52	35.6	15	88.2
In overhanging soil at a cliff top	58	39.7	2	11.8
Under boulders at the base of a cliff or amidst rocks on a cliff ledge	36	24.7	0	0.0
Total	146	100.0	17	100.0

*Reproduced from Bixler et al (2010).

Mink predation was not a recorded cause of pigeon guillemot nest failure at the Naked Island group during studies in the late 1970's and early 1980's. However, by the mid-1990's mink predation on pigeon guillemot nests was frequently recorded (Hayes 1995, Golet et al. 2002). The population of pigeon guillemot has declined at a dramatic rate, and mink are the major reason for this population decline

Mink are native to the Gulf of Alaska ecoregion (ADF&G 2006). Genetic analysis of populations in PWS (Fleming and Cook 2012) indicates mink at the Naked Island group are of the same or very close lineage to mink found in PWS. Fleming and Cook (2010) also regarded the Knight Island Archipelago, as the primary source of mink at the Naked Island group. Neither mink nor their predation was noted until mid-1990, although studies of pigeon guillemot were ongoing at the Naked Island group since the late 1970's (Hayes 1995, Golet et al. 2002). As definitive data are not conclusive, ADF&G considers mink to be native to the Naked Island group. Whether or not mink are native or introduced will not be addressed in this EA. However, what is clear is that the population of pigeon guillemot has declined at a dramatic rate, and mink are the major reason for this population decline. Additional information can be found at Irons et al. (2013).

Theoretical projections of the mink population at the Naked Island group, based on published values on reproduction and survival in other systems, suggested that mink colonization most likely preceded the EVOS and may have been followed by a decline as a result of the spill, although no study was done to confirm this (Ben-David 2012a, b). Simulations also support the hypothesis that a recovery of the mink population in the late 1990's, which coincided with low numbers of nesting seabirds, led to increase in predation rates by these carnivores (Ben-David 2012a, b). This is supported by the observation that the highest predation rates on pigeon guillemot nests occurred in 1998 (Irons et al. 2013). Mink forage at sites with shallower tidal slopes, with mostly bedrock, and protected from wave action, mostly during low tides when large areas of shallow rock-pools are exposed (Ben-David

et al. 1996). To avoid contaminated intertidal resources, a still high mink population may have switched to feed on nesting seabirds.

MODELING

The potential changes in the growth of the pigeon guillemot population at the Naked Island group were modeled in an effort to inform the decision-making process. Two management alternatives were modeled: Alternative A: No Action-Current Management; and Alternative B: Proposed Action-Control of Predatory Mink. A stochastic Leslie matrix model after Golet et al. (2002) and Bixler et al (2010) was used to project pigeon guillemot population growth under these two alternatives at the Naked Island group.

The following equation was used to project the growth rate of the pigeon guillemot population:

(λ): $\lambda = ((PF * FX * PA^{2}) + (NX * PA)) / NX$

Where,

λ = annual population growth rate
P_F = annual sub-adult survival rate
F_X = number of offspring produced
P_A = age-constant annual adult survival
N_X = initial population size

The details of the model and justification are found in Appendix C.

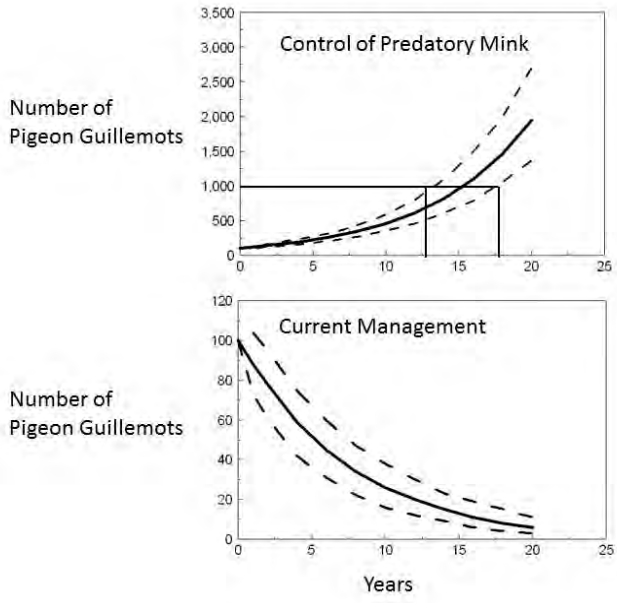


Figure 4. Results of stochastic Leslie matrix modeling of the changes in the pigeon guillemot population at the Naked Island group for the Proposed Action-Control of Predatory Mink and No Action-Current Management Alternatives (Fleming and Cook 2010). Pigeon guillemot productivity varies in a monotonic fashion across the two model scenarios. The graphs start with the year after the actions were completed.

Under the Proposed Action-Control of Predatory Mink alternative, the model projecting pigeon guillemot population growth assumes minimal mink predation (~2 nests depredated per year). Pigeon guillemot population is projected to reach 1,000 in about 15 years but could be as early as 13 years or as late as 18 years.

The No Action-Current Management alternative represents no control of mink and a predation rate based on the empirical predation rate during the 1990s (Bixler et al. 2010). The result would be a continued reduction in the pigeon guillemot population.

DECISION FRAMEWORK

U.S. Fish and Wildlife Service

The Department of Interior (DOI), U.S. Fish and Wildlife Service (USFWS) is the lead agency responsible for preparing this EA, as defined in 40 CFR 1508.16, as well as developing the National Environmental Policy Act (NEPA) analysis and findings. The USFWS has a responsibility for evaluating possible impacts on Federal trust resources (birds, mammals, etc.) in accordance with applicable Federal law. The USFWS's Chief of Migratory Bird Management is responsible for any decision document once a preferred alternative is selected.

U.S. Forest Service

The U.S. Department of Agriculture (USDA), U.S. Forest Service (USFS) is authorized by applicable Federal law and regulations to administer the management of natural resources, including fish and wildlife habitat, wilderness, and recreational resources on the Chugach National Forest. The Naked Island group is within the Chugach National Forest, Glacier Ranger District and within the Nellie Juan-College Fiord Wilderness Study Area.

The Forest Supervisor is the Responsible Official. The Forest Supervisor is responsible to ensure that action alternatives are consistent with the 2002 Chugach National Forest Revised Land and Resource Management Plan, as amended, including maintaining the character of the Nellie-Juan-College Fiord Wilderness Study Area which was designated in 1980. The Forest Supervisor's decision would be documented in a Decision Notice and if the proposed action is selected as the preferred alternative, would specify measures to implement actions proposed on National Forest System land and would issue a special use permit for project implementation.

Animal and Plant Health Inspection Service – Wildlife Services

The USDA Animal and Plant Health Inspection Service-Wildlife Services (APHIS-WS) mission is to provide Federal leadership and expertise to resolve wildlife conflicts. APHIS-WS is recognized as having the authority and expertise to conduct wildlife damage management activities on federally administered lands and would implement field operations under a funding Agreement. The APHIS-WS Western Regional Director would sign a decision document based on selection of the preferred alternative.

Alaska Department of Fish and Game

The Alaska Department of Fish and Game (ADF&G) has the responsibility and authority to provide for the sustainability of all fish and wildlife in Alaska, regardless of land ownership or designation, unless specifically preempted by Federal law. If the proposed action is selected as the preferred alternative, the ADF&G would assist the USFWS in consulting with those State entities necessary to gain authorization for a predator control program. The ADF&G is responsible for issuance of applicable permits.

EVOS Trustee Council

The Trustee Council is providing partial funding for this project and would determine whether to fund the proposed action, if it is selected as the preferred alternative. There are three State and three Federal trustees, including ADF&G, the Alaska Department of Environmental Conservation, the Alaska Department of Law, the National Oceanic and Atmospheric Administration, the USDA, and the DOI.

Cooperating Agencies

The USFWS, USFS, and APHIS-WS are cooperating agencies for preparation of this EA.

LEGAL/ADMINISTRATIVE REQUIREMENTS

Wilderness Study Area

The Naked Island group is located within the congressionally designated Nellie Juan-College Fiord Wilderness Study Area (Alaska National Interest Lands Conservation Act (ANILCA) (Section 702). The ANILCA directs the USFS to maintain the wilderness character of the area. The Nellie Juan-College Fiord Wilderness Study Area is managed to maintain and protect the existing (1980) wilderness character in the western half of PWS until Congress acts on permanent wilderness designation or releases the area from Wilderness Study Area designation. A Minimum Requirements Decision Guide is being prepared that would define the minimum required activity necessary to meet the objectives of the proposed action.

Roadless Area Conservation

The Naked Island group was part of a Roadless Area Review and Evaluation (RARE II area) in 1978 and the Chugach Forest completed an inventory of unroaded areas as part of the national process (USDA 2002). There are no roads on any of the islands at the Naked Island group and none are proposed. No tree removal or other vegetation manipulation is proposed with this action.

2002 Revised Land and Resource Management Plan, Chugach National Forest

The Revised Forest Plan (USDA Forest Service 2002), as amended, provides a framework that guides the Chugach National Forest's day-to-day resource management operations. It is reviewed and revised approximately every 15 years. The Naked Island group is managed under the Recommended Wilderness management prescription. During preparation of this EA, the two alternatives met the goals and objectives of the Revised Forest Plan. The USFS prepared a Forest Plan Consistency

Checklist (part of administrative record) to ensure that all Forest Plan standards and guidelines were considered in this EA. The Recommended Management Area is managed to maintain and protect the existing wilderness character. The ecological desired conditions stipulate that the area would be largely unaffected by human activity and dominate the area. The Recommended Wilderness Management prescriptions allow for treatments or measures to be taken on exotic animals to minimize impacts on ecological processes.

PUBLIC INVOLVEMENT

Introduction

Collaborating and communicating with federal, state, and local agencies; stakeholders and the public; including consultation with Native Alaskan Tribes and Corporations has taken place throughout preparation of this EA.

A variety of means were used during the public scoping period to reach out to those who wanted to comment. A news release was prepared; Native Alaskan consultations were conducted; four public scoping meetings were held in Valdez, Cordova, Whittier, and Anchorage, Alaska; a summary of the project was prepared and provided; and those interested in the EA were encouraged to contact the project leader. Information gathered during the public scoping period was considered during preparation of this Draft EA.

Tribal Consultation

The USFS began formal consultations on December 29, 2011. Glacier District Ranger sent out consultation letters to the Chugach Alaska Corporation, Chenega IRA Council, Native Village of Eyak, Port Graham Village Council, Seldovia Village Tribe, Tatitlek Village IRA Council, Native Village of Nanwalek, and the Valdez Native Tribe. Call back to the initial consultation did not result in further response. The Chugach Alaska Corporation stated there were pre-historic sites on the island, that needed to be protected and suggested efforts should be made to incorporate native trappers for project implementation if the proposal were to go forward. On June 11, 2013, Ed DeCleva, Chugach Forest Archaeologist and Tribal Relations Specialist, discussed the project with John Johnson, Chugach Alaska Corporation. Mr. Johnson reiterated the corporation's desire that the project would be implemented in such a way that local Alaska Native hire would be utilized.

Public Comment

The following issues, concerns, questions, and ideas were received during the public scoping period. It is recognized that not all of the issues, concerns, and questions will be addressed; however, it is important to recognize the wide range of comment received. It should be noted that these comments were based on extirpation of mink from the entire Naked Island group rather than just removal of mink in the pigeon guillemot nesting areas. Many of the questions and concerns expressed during the public scoping are reflected in Chapters 2 and 4. Please note that not all concerns related directly to

the purpose and need for preparing this EA, and as such, will not be addressed further. Responses to questions, concerns, and suggestions follow in italics

Questions and Information:

- Are mink natural or introduced, and if so, are they part of the natural ecosystem process? *Evidence indicates mink may have been introduced at the Naked Island group, but conclusive evidence is lacking. Whether or not mink are native or introduced is uncertain and beyond the scope of this EA.*

- Mink always have been present (in PWS) and were there before the EVOS. *Mink are native to the mainland and many islands close to the mainland of PWS. Again, evidence indicates mink may have been introduced at the Naked Island group, but conclusive evidence is lacking. Whether or not mink are native or introduced is uncertain and beyond the scope of this EA.*

- Did the original mink population decline from an event and then recover? *We have no data on this topic.*

- Don't know of anyone trapping at the Naked Island group. *Public trapping effort appears to be minimal due to the isolation and remoteness of the Naked Island group.*

- Forage resources, i.e. herring, that have declined are the possible impact to pigeon guillemot and other birds. *Forage fish have declined, but now are increasing and forage fish been determined to have little effect on decline of pigeon guillemot and other seabirds.*

- Herring and sand lance are recovering and you will see a recovery of forage fish, and consequently a recovery of birds. *Herring and sand lance are recovering. However, mink is the primary predator of birds and the recovery of herring and sand lance do not appear to be helping the recovery of birds.*

- Trapping will be a multi-year effort. *We expect it would take three to five years. A significant increase in the pigeon guillemot population is expected after ten years. The Proposed Action has more information on this topic.*

- Will birds be transplanted to the Naked Island group after the removal of mink to increase biodiversity? *Pigeon guillemot still nests in greatly reduced numbers at the Naked Island group, so no transplants are required.*

- How did mink get to the Naked Island group? *There is uncertainty determining how mink got to the Naked Island group.*

Issues and Concerns:

- There is concern that other animals, river otter, sea otter (*Enhydra lutris*), on these islands will not be exterminated during this removal process. *Traps that would be used are too small to*

kill or harm other mammals living on the islands. The Proposed Action in Chapter 2 as well as mitigation measures discussed in Chapter 4 address this topic in more detail.

- It is impossible to eliminate mink at the Naked Island group. R*ecovery of pigeon guillemot is the purpose of this EA, not the extirpation of mink at the Naked Island group.*

- Dangers exist with a trapping program in the winter, i.e. weather, poor anchorages. *These dangers are recognized and safety precautions would be undertaken.*

Suggestions:

- It is felt that the local PWS residents and the Native population of PWS should be offered the jobs such as: the trapping, boat charters and maintenance of camp facility. *APHIS-WS, working closely with USFWS and the USFS would provide opportunities for assisting in the trapping program.*

- The furs should be donated for cultural programs within the Chugach Region. *Mink Carcasses would be made available for cultural programs as requested.*

- Chugach Regional Corporation has a historic site on Storey Island that was once a fox farm. Efforts should be made to protect this site from adverse impacts. *Historic sites would be protected.*

- Conduct a limited harvest to reduce mink numbers. *Currently, no limit on the numbers of mink that can be legally trapped exists, but little or no public trapping occurs at this time because of the isolation of the Naked Island group.*

- Use a bounty or fee system and local trappers to eliminate mink. *Local trappers may have the opportunity to be part of the trapping program and work with APHIS-WS as part of their funding Agreement. The recovery of pigeon guillemot on the Naked Island group and PWS is the EA purpose, not the elimination of mink.*

- Utilize local people to conduct trapping effort. *APHIS-WS, working closely with USFWS and the USFS would provide opportunities for assisting in the trapping program.*

- Use a bid process to select trappers. *APHIS would be conducting the trapping and has the responsibility to select trappers.*

- Requested planning team to look at the Rat Island Plan/implementation to determine how birds are recovering after removal of rats. *The planning team reviewed the results and it appears that birds are already recovering.*

MOST RECENT RESEARCH AND STUDIES

Considerable pigeon guillemot research has been conducted in PWS, particularly since the EVOS in 1989. Most recently, three reports, building upon prior research and studies have been completed. These reports represent the most recent information on the pigeon guillemot population at the Naked Island group as well as predation by mink. Please refer to these reports for more detailed presentation of data, analysis, and findings. Lastly, please refer to the Literature Cited section for a complete listing of all materials used during preparation of this EA.

Why Aren't Pigeon Guillemot in PWS, Alaska Recovering from the *Exxon Valdez* Oil Spill? Kirsten S. Bixler. A THESIS. Submitted to Oregon State University the requirements for the degree of Master of Science. July 2010.

Exxon Valdez Oil Spill: Restoration Project Final Report. Pigeon Guillemot Restoration Research in PWS, Alaska. Restoration Project 10070853 Final Report. Kirsten S. Bixler, Daniel D. Roby, David B. Irons, Melissa A. Fleming, and Joseph A. Cook. November 2010.

MtDNA and Microsatellite DNA Provide Evidence of Fur Farm Ancestry for American Mink Populations in PWS. Melissa A. Fleming and Joseph A. Cook. February 2010.

CHAPTER 2: ALTERNATIVES, INCLUDING THE PROPOSED ACTION

INTRODUCTION

This chapter describes two alternatives, **No Action** and the **Proposed Action**. Eight other alternatives were considered and rejected. Rationale for their not being considered further is provided. Under either alternative, the Naked Island Group would remain as part of the Chugach National Forest and managed under State and Federal regulations for currently permitted public uses, including trapping, hunting, wilderness recreation, and other activities. The Naked Island group would continue to be managed as a wilderness study area to maintain and protect the existing wilderness character.

ALTERNATIVE A: NO ACTION – CURRENT MANAGEMENT

No management action to control or reduce mink would be taken under this alternative. Nesting pigeon guillemot and other seabirds would still persist at the Naked Island group but greatly reduced from historical abundance numbers (see Table 1).

Cost of Alternative A

No new additional costs.

ALTERNATIVE B: PROPOSED ACTION- CONTROL OF PREDATORY MINK

Purpose: Restore pigeon guillemot in PWS, by removing them from the "not recovering" list to the "recovered" list.

This action would be accomplished during a five year period at the Naked Island group. The first two to three years of the project would entail removing mink through trapping or shooting within 500 m of historical nest sites, from January to May, with the expectation that mink removal efforts could expand to include any new pigeon guillemot nesting sites.

If initial efforts did not produce the desired results, further action would evaluate expanding the mink removal zone to 1,000 m around historical and current pigeon guillemot nesting sites in later years to improve chances of pigeon guillemot recovery. Up to 250–300 mink may be harvested during this five year effort. It is expected that reducing the mink population would increase the current 100 pigeon guillemot at the Naked Island group to 1,000 pigeon guillemots in about 15 years following the removal of mink (see Table 1).

Pigeon guillemot recovery would be assessed by data collected for this project and by data collected for another ongoing pigeon guillemot boat-based monitoring project. The number of pigeon guillemot nests depredated by mink would be assessed by this project and a separate, ongoing pigeon guillemot boat-based monitoring project would assess pigeon guillemot productivity and population levels during the five project years and then for an additional 15 years.

After three years, chick predation by mink would be greatly reduced or eliminated and pigeon guillemot productivity would increase to 0.5 chicks fledged per nest, and the number of nesting birds would be stable or start to increase slightly to 10 percent. After five years chick predation by mink would continue to be greatly reduced or eliminated and pigeon guillemot productivity would be stable at least at 0.5 chicks fledged per nest, and the number of nesting birds would begin to increase by 10 percent to 30 percent compared to the numbers at the beginning of the project (see Table 1).

The pigeon guillemot nesting areas represent current potential and historical pigeon guillemot colonies (Figure 5 and Figure 7). Features within these areas include; beaches, creeks, game trails, cliff bases, driftwood, or points of land connecting adjacent beaches.

Trapping would be the primary means for reducing mink. Lethal body grip traps would be used as the principal trap type. Approximately 100-500 traps would be placed in groups of one to five within 500 m of nest sites and would be checked every one to14 days as weather allows. Traps would be secured with a wire to deadwood, rocks, roots, or trees less than 50 years old or approximately five inches in diameter. The wires would be attached loosely to the trees to prevent any damage.

Carcasses of mink would be frozen and placed in a tamper-proof container and removed from the island approximately every two to four weeks. Carcasses would be donated to research organizations for additional genetic and other study or to permanent archives in public museums or universities, whenever feasible. There is also the opportunity to provide carcasses to Native Alaskans for their cultural programs. Not all carcasses may be donated and some carcasses may not be salvageable (spoilage, unable to retrieve, scavenging by other animals, etc.) Carcasses that cannot be salvaged for donation may be disposed of in a city landfill.
Firearms, using non-toxic ammunition, could also be used to remove mink. Shooting is a highly species-specific method, as positive identification is made prior to shooting. Shooting would be conducted primarily prior to pigeon guillemot arrival. Firearms with sound suppression would be used to remove mink from around the breeding colonies after pigeon guillemot arrive, if required. One or two small hunting dogs may be used for a few weeks to find trap-shy mink. Dogs would be monitored at all times, when not kenneled, and would be leashed or under voice control at all other times. Dogs would be kenneled on land or on a boat. Dog food would be kept in a tamper-proof container.

The Association of Fish and Wildlife Agencies (AFWA) best management practices would be utilized to determine trapping methods. Continuous monitoring and manipulations of trapping efforts would take place to ensure maximum trapping effectiveness and to minimize or eliminate non-target take. APHIS-WS would implement the management program under a funding Agreement. An estimated eight to 12 experienced wildlife specialists would conduct mink removal efforts for the project duration. Protocols and methodologies for mink removal would be agreed upon by USFWS and APHIS-WS, prior to implementation.

Trapping success would be maximized through a continuous three to five month effort from January to May during periods of heavy snow and the mink mating season (Bones et al. 2007). The precise timing of trapping would be determined by evaluating data collected during trapping (e.g., trapping success, trapped animal sex and age class). If the specified objective is not being achieved, restoration methods or actions could be altered as per agreement with all parties involved.

Mink abundance would be assessed by numbers of tracks observed in the area, by catch per unit effort (the number caught per number of trap-nights), or by the use of bait stations with track plates or cameras placed along island shoreline., As mink numbers decline as a result of trapping, the numbers of these measures would also decline. A fur sample would be taken for DNA analysis, if further study was warranted. Age, sex, and diet from stomachs and perhaps, stable isotopes of mink would be assessed. This information would be collected and analyzed by the project leader to provide a greater understanding of pigeon guillemot and mink in PWS.

Bait, likely herring, would be purchased or caught and stored in tamper-proof containers at the camp sites or on the support vessels.

No tree removal or other vegetation manipulation is proposed with this action. No exotic plants or animals would be introduced.

If the pigeon guillemot is "recovering" after five years, and there is no mink predation, the ongoing recovery of pigeon guillemots would be documented by a separately funded, ongoing 15-year, boat-only based pigeon guillemot population monitoring program to enumerate and track pigeon guillemot numbers breeding at the Naked Island group. This monitoring program has been established and funded through the EVOS Long Term Monitoring Program. If after five years pigeon guillemot are not recovering because of mink predation, the program would be reevaluated and alternatives considered. A new EA would be written to address the depredation of pigeon guillemot by mink.

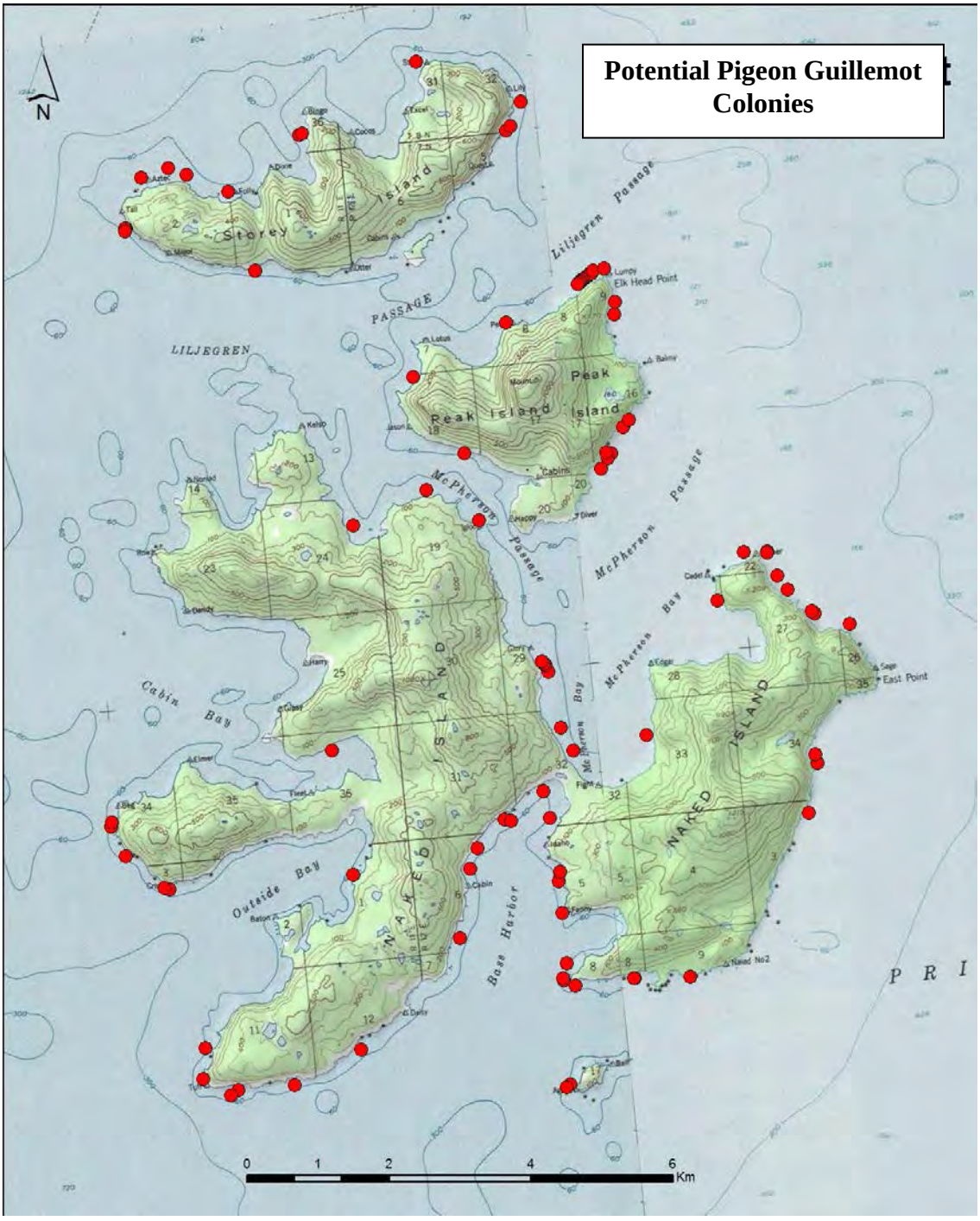


Figure 5. Locations of potential pigeon guillemot colonies based on sightings of breeding birds on the water (red dots) at the Naked Island group.

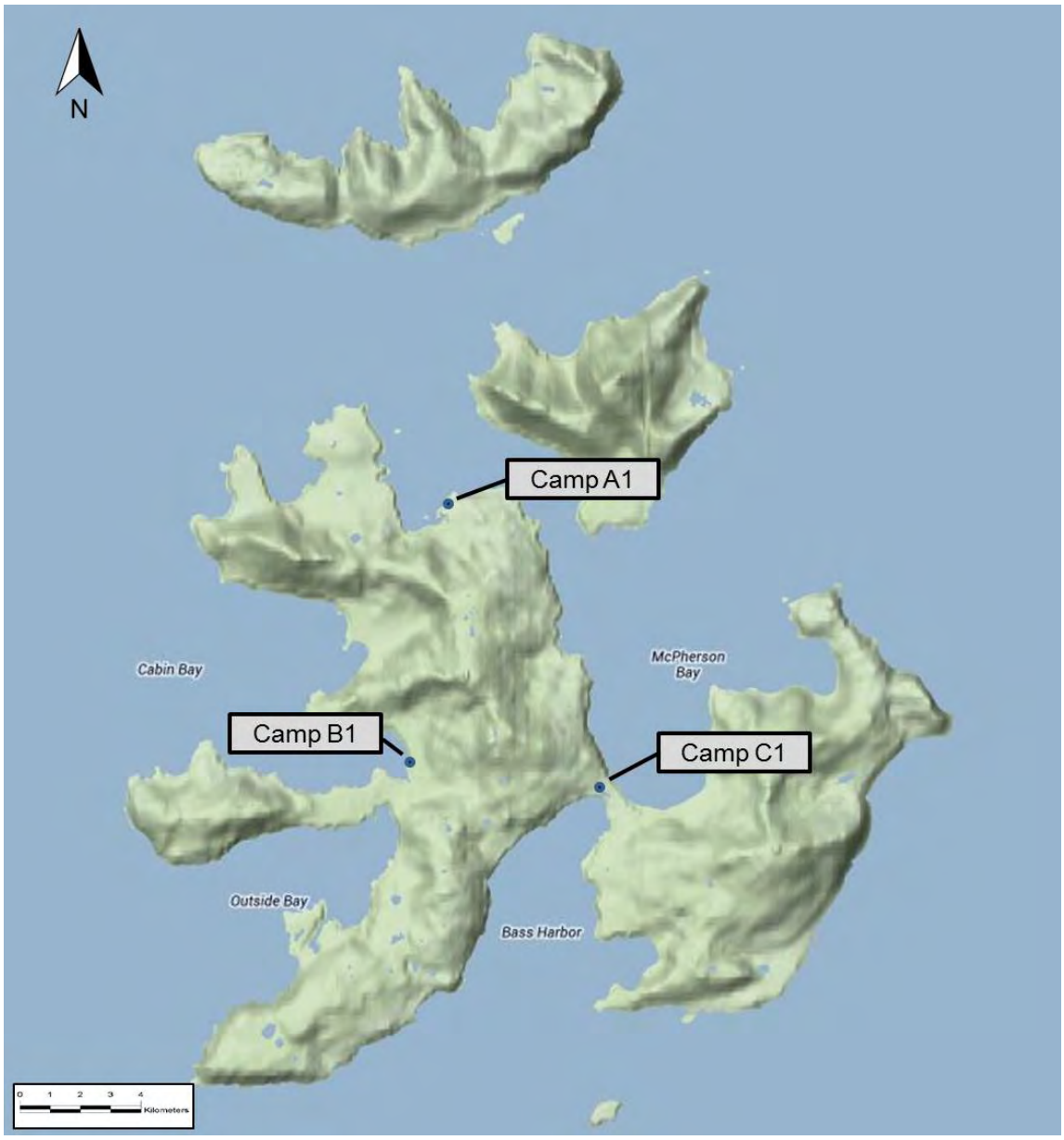


Figure 6. Map of Naked, Storey and Peak Islands showing three potential camp sites, Camp A1 - North Camp, Camp B1 – Cabin Bay and Camp C1 – Bass Harbor. All three camps would be used in winter and Camp B1- Cabin Bay would also be used in summer.

During the three to five month trapping program from January to May, two options exist for housing trappers. The trapping program would be identical for either option. Before any mink removal would be initiated, a thorough review of the details regarding either a boat based or land based operation would occur. APHIS-WS would follow all requirements agreed to by all parties. The ADF&G would issue appropriate permits for the take of mink, while the USFS would be responsible for issuing a special use permit for temporary camping associated with activities on USFS lands during the trapping program. All operational details specified in the special use permit would be according to the Forest Service Handbook, FSH 2709 – Special Uses Handbook.

Option 1: Boat Based

Under this option, up to two support vessels would provide lodging and food during the three to five month trapping period from January to May for five years. Small boats would provide access from the support vessel to Storey, Peak, and Naked Islands to conduct trapping operations. This alternative would not require temporary field camps be established on the islands. If this option is selected, additional details agreed to by all parties would be part of the APHIS-WS funding Agreement and approved by the USFS during the permitting process.

Cost of Alternative B

$1.0 million - National Fish and Wildlife Foundation
 1.2 million – EVOS Trustee Council
$2.2 million - Total (five years)

Option 2: Land Based

Up to three temporary field camps would be established where a support vessel could ferry supplies at the beginning of the field season and return for resupply as necessary on one to three islands for a three to five month period from January to May for up to five years. Each camp would have two to three wildlife specialists present. All camp locations would be approved by the USFS. Each year following trapping, the camps would be removed and tent platforms stored out of sight. Camps would be placed on frozen ground or snow and would have no impact to vegetation. If this option is selected, additional details agreed to by all parties would part of the APHIS-WS funding Agreement and approved by the USFS during the permitting process. A special use permit would outline the terms and conditions of the field operations, as well as stipulations to ensure no to minimal environmental impact.

Camp sites may vary but would likely include Camp A.1-North Camp, Camp B.1- Cabin Bay, and Camp C.1 -Bass Harbor (Figure 6). Research staff would use campsite B.1 during May-August for five years. Each camp would consist of a Weather port® structure (approximately four by seven m) for field operations (generator, fuel, oil, and battery storage); three approximately two m^2 tents for sleeping; and possibly one additional approximately three m^2 storage tent. Each camp would have a small inflatable boat, anchored off shore. Each camp would have an approved fuel storage area with a containment system. Camps would be resupplied and garbage and wastes removed every two to four weeks, weather allowing. All tents would be located on wooden platforms. Oil stoves would be used for heat. Boardwalks would be used, if necessary, to allow easy walking on the snow trails. Camps would be located along the coastline within 30 m of the high tide line. Camps would be disassembled following activities, leaving behind a stack of wooden floor sections for use the next season. All food would be stored in tamper-proof containers and all garbage would be removed from the island. Human wastes would be removed from the island when possible. There would be no fires unless allowed by a USFS special use permit.

Cost of Alternative B

$0.9 million - National Fish and Wildlife Foundation
 1.0 million – EVOS Trustee Council
$1.9 million - Total (five years)

ALTERNATIVES NOT CONSIDERED IN DETAIL

During preparation of the Restoration Project Report for the EVOS Trustee Council, it was important to explore all alternatives with potential for the recovery of the pigeon guillemot population. The final report, published in November 2010, is the most recent analysis of a range of alternatives for "recovering" pigeon guillemot.

Bixler et al. (2010) analyzed a wide range of alternatives in detail and provided the final report to the EVOS Trustee Council, most of which are presented below. The alternatives presented below represent alternatives that were considered, analyzed, and found not to be feasible for "recovering" the pigeon guillemot population at the Naked Island group and were therefore not recommended.

Removal of Mink

Complete removal of mink over a five year period from the Naked Island group would be undertaken in this alternative. Circumstantial evidence exists that mink may have been introduced at the Naked Island group, but a definitive finding with 100 percent certainty that mink were introduced does not exist. ADF&G considers mink as native to the Naked Island group. The ADF&G does not recommend removing all mink as a first management action. They prefer that mink are reduced and then determine if the pigeon guillemot are recovering. In the final report to the EVOS Trustee Council, complete removal of mink was recommended, but uncertainty that mink are native or introduced has resulted in eliminating this alternative.

Nest Boxes to Enhance Nest Site Availability

Pigeon guillemot nest boxes would be installed on cliff faces inaccessible to mink. Boxes would be placed in the immediate vicinity of either current or historical nesting locations (Figure 6). A few nest boxes were installed at the Naked Island group during the late 1990s, but there was low incidence of use (Irons; pers. obs.), most likely because there was an abundance of natural cavities available. No evidence exists that pigeon guillemot at the Naked Island group are limited by the availability of nesting habitat. This alternative was not pursued because nest box installation would most likely be an ineffective restoration technique.

Protective Fencing of Nest Sites

Protective fencing would be used to reduce predation by mink of pigeon guillemot. This alternative was not pursued because gaps larger than one inch in the fence (Boggess 1994) on talus slopes and cliffs are not practically avoidable and mink can easily swim around any fence, unless the fence completely encloses the nesting area. Fencing of numerous dispersed nesting sites would be impractical and fencing would impact pigeon guillemot movement within the nesting area.

Mink Behavioral Modification

No registered chemical repellents or known effective frightening devices to modify the behavior of mink near pigeon guillemot nests exist (Boggess 1994, NWRC 2008).

Control Avian Predators of Pigeon Guillemot Nests

Avian predation of pigeon guillemot is very limited and not a significant mortality factor (Oakley and Kuletz 1979). Avian species considered, included the common raven (*Corvus corax*), northwestern crow (*Corvus caurinus*), and black-billed magpie (*Pica pica*).

Combination of Nest Boxes and Control of Predator Populations

Nest predators of pigeon guillemot (i.e., mink, raven, crow, and magpie) would be culled and nest boxes would be installed at the Naked Island group. Actions taken include suppression of the mink population, construction and installation of nest boxes, and lethal control of avian predators. This alternative was not pursued for the same reasons each scenario was dropped as viable option on its own. Due to flaws in each action (see previous alternatives) would not be lessened by the combination of alternatives, and a combined approach would not lead to significant improvements of the population of pigeon guillemot at the Naked Island group.

Use of Toxicants

There are currently no chemical agents registered by the U.S. Environmental Protection Agency for the control of mink (Boggess 1994, NWRC 2008), Further, This alternative was not considered further because poisoning or secondary poisoning of non-target species (Courchamp et al. 2003, Moore et al. 2003) such as river otter and bald eagle would be unacceptable.

Shooting

Shooting of mink as a single technique for population reduction is not effective because of their nocturnal habits (Boggess 1994, Courchamp et al. 2003), although it is maintained as one secondary treatment option under the proposed action.

Other

Other means of biological control, such as virus vectored immune-contraception, have yet to be fully developed (Courchamp and Cornell 2000; Macdonald and Harrington 2003) and might pose an irreversible danger to the viability of mink and other closely-related native furbearers (e.g., American marten) outside of the Naked Island group.

CHAPTER 3: AFFECTED ENVIRONMENT

INTRODUCTION

The Naked Island group, a cluster of three small islands with about 100 km of shoreline, is located in western PWS, a sub-arctic, inland sea connected to the Gulf of Alaska. PWS is approximately 1,000 km^2 in size and is bounded by the Chugach and Kenai mountains. PWS is a complex fjord estuarine system with about 5,000 km of coastline and is characterized by rugged coastal mountains, glaciers, sheltered waters, and forested islands which offer relatively pristine maritime habitats. Productive inter-tidal lands, estuaries, and mature coastal forests support a diverse assemblage of terrestrial and marine wildlife species. PWS provides habitat for seabirds, waterfowl, shorebirds and marine mammals, and upland habitat for birds and mammals. The wealth of abundant wildlife has drawn people to the area for thousands of years.

The Naked Island group consists of three main islands: Naked Island (38.6 km^2), Storey Island (7.2 km^2), and Peak Island (6.1 km^2). The islands are isolated, being 75 km from Valdez and Whittier and 90 km from Cordova. The bays of Naked Island, and the passages between it and the two neighboring islands, Peak and Storey, form an expanse of water that is less than 100 m deep. Near shore habitat is characterized by numerous bays and passages with shallow shelf habitat (<30 m) radiating about one km from shore. Island shorelines are characterized by low cliffs and cobble or boulder beaches. High, steep, exposed cliffs occur along portions of the eastern shores of the Naked Island group. Naked Island is the highest at 371 m. All of these islands are part of and managed by the Chugach National Forest.

CLIMATE

The Naked Island group experiences a cool maritime climate with moderate temperatures and extended periods of clouds and fog with abundant precipitation ranging from 2.5 m to 3.0 m annually. The highest amount of precipitation generally occurs in the late summer and fall, and the lowest amount occurs in the spring and summer. Snow falls at all elevations between mid-October and mid-May and may persist for long periods at sea level. About ten percent of total annual precipitation falls as snow along the coast.

Temperatures average -7 to -3 °C in January and 12 to 13 °C in July. January is the coldest month with an average temperature of -6 °C. The Naked Island group has temperate cold and warm seasons. Temperatures do not vary much between day and night. Winter has prolonged freezing. April generally has the most sunshine. June is the driest month with rainfall and other precipitation peaking around October. Low pressure storms in PWS generally come from the southeast. Permafrost is absent.

The Naked Island group is located in Alaska's South-central Intrastate Air Quality Control Region that includes the PWS area. The air quality meets state standards for visible and particulate air quality. Potential air contamination sources are far away (communities of Valdez, Seward, and Cordova) or from marine and air traffic. No prescribed burning occurs and high precipitation and cool summer temperatures preclude wildfire.

VEGETATION, GEOLOGY, AND SOILS

The Naked Island group is within the Pacific Gulf Coastal Forest-Meadow Province and the Northern Gulf of Alaska Fiord lands ecological region. Shoreline habitats transition rapidly from beach habitat to a temperate rainforest intermingled with muskeg vegetation. All islands are forested to their summit, mostly with Sitka spruce (*Picea sitchensis*) and western hemlock (*Tsuga heterophylla*). Common understory species include blueberry (*Vaccinium sp.*), salmonberry *(Rubus sp.*), devil's club (*Oplopanax horridus*), yellow skunk cabbage (*Lysichiton americanus*), deer fern (*Blechnum spicant*), lady fern (*Athyrium filix-femina*), bunchberry (*Cornus canadensis*), and foam flower (*Tiarella trifoliate*). Common shrubland and herb land species include: salmonberry (*Rubus spectabilis*), crowberry (*Empetrum nigrum*), bog blueberry (*Vaccinium uliginosum*), cranberry (*Vaccinium sp.*), deer cabbage (*Nephrophyllidium crista-galli*), luetkea (*Luetkea sp.),* sedges (*Carex sp*.), sphagnum mosses (*Sphagnum sp*.), tufted hairgrass (*Deschampsia cespitosa*), and seaside sandplant (*Honckenya peploides).*

Naked Island shorelines are rocky and consist of cliffs, broken cliffs, and escarpments interspersed with boulder beaches. Diurnal tide ranges are 3.1 to 3.7 m.

A 9.2 magnitude earthquake occurred in the Gulf of Alaska on March 27, 1964 (the Good Friday Earthquake). Warping of the crust during this tectonic event resulted in uplift in the eastern portion of PWS and subsidence in the western portion. A maximum uplift of over 9.0 m occurred on Montague Island. The area around Whittier experienced 1.8 to 2.4 m of subsidence (USDA 2005). The Naked Island group experienced an uplift of about 1.2 m, permanently exposing nearly half of the intertidal zone (Johanson 1971) and altering both the shoreline and shallow near shore habitat.

Geologic, geophysical, and geochemical investigations have been conducted to evaluate the mineral resource potential of the Chugach National Forest. No oil or extractable mineral resources have been documented at the Naked Island group.

WATER RESOURCES

Streams at the Naked Island group are very short. Because of the marine influence, heavy precipitation, and mild temperatures, stream flows are predominantly controlled by rainfall runoff, although snowmelt runoff occurs in the spring. Peak flow events during fall rainstorms are generally larger than peak flows from snowmelt runoff. Wetlands associated with swamps, bogs, ponds, and floodplains, comprise the majority of wetlands at the Naked Island group.

Water quality is very good, with nearly pristine conditions as a result of the isolation and lack of development at the Naked Island group. The small streams generally have very low sediment loads. Human impacts on water quality are predominantly limited to the coastal areas, where most activities occur.

WILDLIFE

The Naked Island group landscapes and offshore waters provide habitat for variety of wildlife, including passerine birds, waterfowl, shorebirds, seabirds, and mammals. Federally listed endangered or threatened species that may potentially occur at the Naked Island group shorelines or offshore waters include Steller sea lion (*Eumetopias jubatus*), Steller's eider (*Polysticta stelleri*), humpback whale (*Megaptera novaeangliae*) and North Pacific right whale (*Eubalaena japonica*). The Naked Island Group provides habitat for one management indicator species identified in the Chugach National Forest Revised Land and Resource Management Plan (USDA 2002): the black oystercatcher (*Haematopus bachmani*). The Naked Island Group also provides habitat for special interest the bald eagle, marbled murrelet, Townsend's warbler (*Setophaga townsendi*), and river otter, and Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) (USDA USFS 2002). The pigeon guillemot is now the only marine bird species in PWS listed as "not recovering" by the EVOS Trustee Council's Injured Resources List (Bixler et al. 2010) (EVOSTC 2010).

A complete inventory of birds, mammals, fish, and amphibians at the Naked Island group has not been conducted and it is presumed the species present at the Naked Island group are representative of those within PWS and species expected on a remote and isolated island group.

Birds

The Naked Island group was at one time the single most important breeding location for pigeon guillemot in PWS. In 1972, one quarter of the Sound-wide population of guillemot was counted there, though these islands include just two percent of the total shoreline in the Sound (Isleib and Kessel 1972). Of the 4,000 pigeon guillemot nesting in PWS in 1989, 1,000 were found at the Naked Island group (Bixler et al. 2010).

Pigeon guillemot numbers have been monitored at the Naked Island group since 1978 under special use permits issued by the USFS. The monitoring is ongoing and will continue for another 20 years. Pigeon guillemot surveys in 1979 counted 1,871 birds (Oakley and Kuletz 1996, G. Golet, USFWS unpubl. data). The pigeon guillemot breeding population at the Naked Island group has declined by more than 90 percent during the last 20 years (Irons et al. 2013). From 1990 to 2008 pigeon guillemot censused at the Naked Island group have declined from 1,124 birds observed in 1990 to 101 birds observed in 2008 (Bixler et al 2010). In 2008, only 17 pigeon guillemot nests were found. In one area only four nests were found where 124 nests were found in 1997 (Golet unpubl. data). Figure 6 shows the historical locations of pigeon guillemot colonies and Figure 7 shows the locations of observed individual pigeon guillemot in 2012. Parakeet auklet no longer nest and tufted puffin and horned puffin nest in greatly reduced numbers.

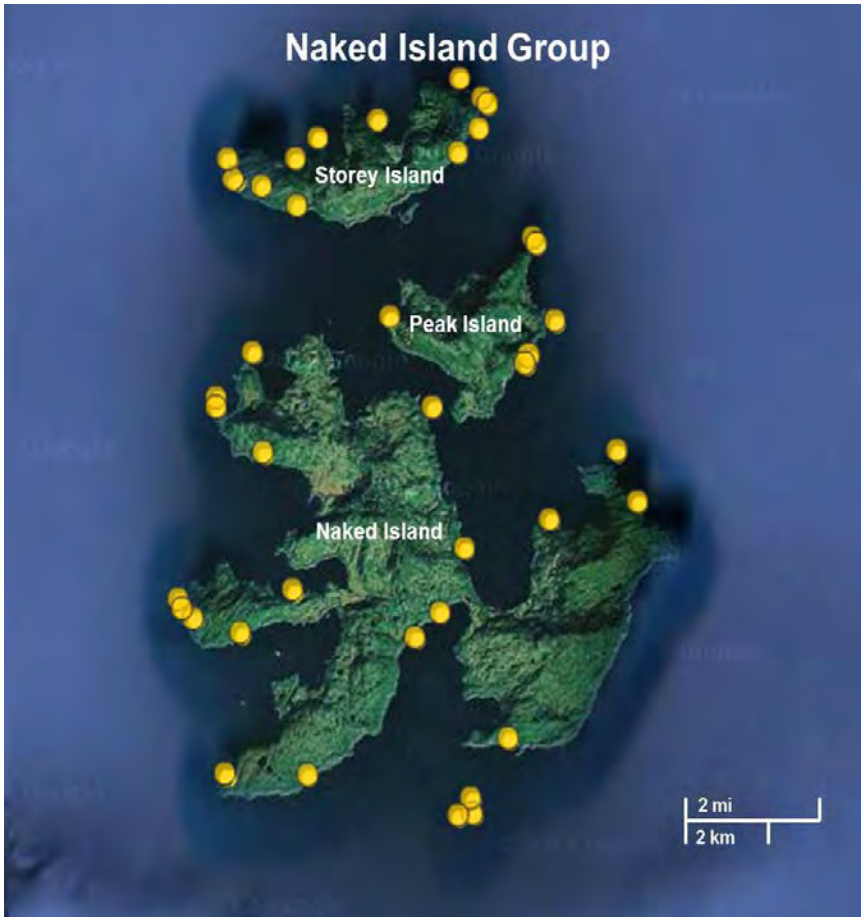


Figure 7. Locations of historical pigeon guillemot colonies at the Naked Island group (yellow dots).

Common seabirds at the Naked Island group include marbled murrelet, black-legged kittiwakes (*Rissa tridactyla*), glaucous-winged gull (*Larus glaucescens*), fork-tailed storm petrel (*Oceanodroma furcata*), mew gull (*Larus canus*), tufted puffin, Arctic tern, common murre (*Uria aalge*) pelagic cormorant (*Phalacrocorax pelagicus*) and pigeon guillemot. Common sea ducks, loons, and grebes in PWS include: harlequin duck (*Histrionicus histrionicus*), Barrow's goldeneye (*Bucephala islandica*), scoter (*Melanitta* spp.), long-tailed duck (*Clangula hyemalis*), bufflehead (*Bucephala albeola*), common loon (*Gavia immer*), pacific loon (*Gavia pacifica*), red-throated loon (*Gavia stellata*), red-necked grebe (*Podiceps grisegena*) and horned grebe (*Podiceps auritus*).

Breeding and wintering populations of black oystercatchers and migrating or wintering populations of black-bellied plover (*Pluvialis squatarola*), black turnstone (*Arenaria melanocephala*), surfbird (*Aphriza virgata*), marbled godwit (*Limosa fedoa*), western sandpiper (*Calidris mauri*), dunlin (*Calidris alpina*), and rock sandpiper (*Calidris ptilocnemis*) may be found on marine shorelines.

Common landbirds are the blackpoll warbler (*Dendroica striata*), chestnut-baked chickadee (*Poecile rufescens*), hermit thrush (*Catharus guttatus*), fox sparrow (*Passerella iliaca*), orange crowned warbler *Oreothlypis celata*), pine siskin (*Carduelis pinus*), ruby-crowned kinglet (*Regulus calendula*), tree swallow (*Tachycineta bicolor*), olive-sided flycatcher (*Contopus cooperi*), and varied thrush (*Ixoreus naevius*). Other landbirds include black-billed magpie, common raven, and northwestern crow. Bald eagles are common.

Mammals

The Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) was introduced to islands in PWS in the 1950's (ADF&G 2006) including the Naked Island group. Small mammals at the Naked Island group include meadow vole (*Microtus pennsylvanicus*), red squirrel (*Tamiasciurus hudsonicus*), and northern red-backed vole (*Myodes rutilus*).

Carnivores found at the Naked Island group include mink, river otter and sea otter. Neither American marten nor weasel has been documented at the Naked Island group (Irons et al. 2013). Mink were first documented on the island group in the mid-1990's (Bixler et al.1990). Anecdotal evidence exists that past Naked Island group residents released mink in the 1970's to establish a population for trapping, but that the population did not grow much until the 1990's (Bixler et al. 2010, Irons et al. 2013). Although mink predation was not a recorded cause of pigeon guillemot nesting failure at the Naked Island group during studies in the late 1970s and early 1980's, mink predation on guillemot nests was frequently recorded by the mid-1990's (Hayes 1995, Golet et al. 2002).

Common marine mammals include Dall's porpoise (*Phocoenoides dalli*), harbor seal (*Phoca vitulina),* humpback whale, killer whale (*Orinus orca*), minke whales (*Balaenoptera acutorostrata*), sea otter, and Steller sea lion. PWS is within the range of the North Pacific right whale.

Amphibians

No amphibians are known to occur at the Naked Island group.

Fisheries

Capelin (*Mallotus villosus*), Dover sole (*Solea solea*), lingcod (*Ophiodon elongatus*), Pacific herring, Pacific sand lance, smelt (*Osmeridae* spp.), walleye pollock (*Theragra chalcogramma*), Pacific cod (*Gadus macrocephalus*), and other species common to PWS are found in the waters surrounding the Naked Island group and most are fed on by pigeon guillemot. Three small pink salmon (*Oncorhynchus gorbuscha*) streams are located at the Naked Island group, two on western side of Naked Island, and one on the southern side of Peak Island. Coast range sculpin (*Cottus aleuticus*) and tide pool sculpin (*Oligocottus maculosus*) are found in Naked Island waters and are foraged by mink.

CULTURAL RESOURCES

Pre-history

Archaeological investigations show that the Chugach (Sugpiag) people have occupied the PWS area for thousands of years, from the time when the Sound was still largely covered by glaciers during the last ice age (CAC 2012). The Chugach lived in rectangular bark or plank houses along the shoreline in permanent settlements and traveled to temporary summer fish camps located along salmon streams. The Chugach subsisted on fishery resources, marine mammals, and shellfish supplemented with birds, land mammals, berries, and plants. Eight groups (Chenega, Montague Island, Nuchek, Shallow Water, Eyak, Gravina Bay, Tatitlek and Kiniklik) numbering 500 to700 individuals were well established throughout PWS. Because of the isolated and remote nature of the Naked Island group, it is probable that prehistoric use was transitory and related to hunting and gathering activities. Permanent settlement was unlikely.

Prehistoric archaeological sites in PWS date from within the past 4000 years and encompass three cultural phases. The Uqciuvit phase is identified with dates ranging from 4000-2500 B.P., the Palugvik phase with dates ranging from 2500-900 B.P., and the Chugach phase with dates ranging from 900-200 B.P. (Yarborough 2000). The protohistoric period dates between A.D. 1741, when Vitus Bering made landfall on Kayak Island, and A.D. 1778, when Captain James Cook made direct contact with Native inhabitants of PWS.

Archaeological surveys conducted at the Naked Island group were primarily in association with the Exxon Valdez Oil Spill Cleanup efforts. New sites were documented during this time and known sites were monitored in an active program. Monitoring of known sites and additional small scale surveys have been conducted in recent years by USFS archaeologists in association with permitted activities.

The USFS determined the proposed action alternative specific to removal of mink would cause no affect to historic properties per Appendix B of the Programmatic Agreement among the USFS, Alaska Region, the Advisory Council on Historic Preservation, and the Alaska State Historic Preservation Officer regarding Heritage Program Management on National Forests in Alaska (USDA 2010); and therefore did not conduct any surveys specific to the proposed action. However, a cultural resource survey of the proposed campsites was conducted and no cultural resources that could be considered as eligible for inclusion in the National Register of Historic Places were identified (USFWS 2013).

History

The Chugach were the first Alaskans to meet the European explorer, Vitus Bering, who came to Alaska at Kayak Island in 1741 under the Russian flag. Bering was followed in 1779 by the British explorer James Cook. Spanish expeditions occurred under Inacio Aretega in 1779 and Salvador Fidalgo in 1790, and in 1791 another British expedition to PWS was undertaken by George Vancouver. From 1785 to 1867 the Russians established settlements and developed the fur trade. Smallpox epidemics in 1837 and 1885 decimated the Chugach people.

In 1867 Alaska was purchased from Russia by the United States. Resource exploitation continued. Gold and copper mines were developed. Salmon canneries were established and railroads constructed. With the decline of sea otter, commercial fox farms developed in the late 1890's.

By the turn of the century, fox farms were increasingly common in south-central and southeastern Alaska. In 1900, 35 islands were being leased from the government. In southeast Alaska an island could be leased from the USFS for as little as $25 a year (AHF 2012). Beginning in 1903, fur prices bottomed out and many islands were abandoned. Prices remained low for a decade; during this early period, many raised foxes as breeding stock and began selling them to newly established fur farms in the U.S.

In 1913, the popularity of furs (and their prices) started to rise. For the next 15 years fur farms–particularly those that raised blue foxes,–became increasingly popular. The height of popularity was reached in 1931, when 431 Alaska fur farm licenses were issued (Paul 2009), although according to Isto (2012) 622 private farm owners were identified by at least one government agency in 1929. Though fox farming was carried on in many parts of Alaska, it was most common in the coastal areas, where salmon, harbor seals, sea lions, porpoises, whales, and other marine food sources were available. The best fox farming sites were small offshore islands, where pens and feed houses were largely unnecessary (Cook and Norris 1998). Approximately, 73 islands were stocked with foxes in the Gulf of Alaska and PWS (Paul 2009).

In 1924, the Bureau of Biological Survey identified 21 mink farms – almost all in southeast Alaska and by 1929 there were 153 mink farmers (Isto 2012). Following World War II only about 60 fur farms survived in Alaska and most were mink farms. USFS fur farm permits dropped to eight in 1955 and by 1955 31 fur farmers were active in Alaska and most raised mink. Only two fur farms permits were issued in the Tongass and Chugach National Forests in 1959 (Isto 2012). In the late 1970's increases in mink pelt prices brought renewed interest in mink farming and started four new fur farms (Isto 2012). In 1993 the last fur farm in Alaska closed.

The Naked Island group was the site of arctic fox fur farms for more than 50 years. In 1895 Jim McPherson established a fur farm on Peak Island as did Fred Liljegren on Storey Island (Lethcoe and Lethcoe 2001). As the pioneer fox farmers retired or died, their children continued the farms. Alice Clock at Peak Island was the daughter of Capt. Jim McPherson, while John Beyer on Storey Island was the son of early fur trader, Bill Beyer. His partner, Edwin Liljegren, was the son of early prospector and fox farmer, Fred Liljegren. By 1919 fur farms existed on all three islands. Mailboat records from the mid 1930's indicated there were five people living on Storey Island and 14 on Peak Island, where a school existed. The Storey Island fur farm closed in 1944 and the Peak Island farm closed in 1950. The Naked Island fur farm likely closed in 1950 or earlier.

Fox were allowed to roam freely and were fed in pens. Pens were closed to capture the fox for their pelts. The 1930's depression, end of World War II, and fashion changes lead to fox farming becoming unprofitable. The Naked Island group is now free of foxes for various reasons, including starvation after the destruction of bird colonies, the end of feeding by fur farmers, disease (Paul 2009), or intestinal worms (Lethcoe and Lethcoe 2001). Since 1950, there has been no permanent human occupation of the Naked Island group. A seasonal use dwelling and buildings associated with past fox farming are located on private land on Peak Island.

RECREATION RESOURCES

The Naked Island group is used periodically for boating, camping, hiking, deer hunting, and fishing. An average of 159 hunters harvested 153 deer annually during the last ten years from the Naked Island group during August thru December (ADF&G Harvest Data). Other recreational use is probably comparatively light, as the islands are accessible only by water and are more than 75 km from any community within PWS. An average of seven boats per day were counted during summer boat transect studies from 2005 to 2007, and no commercially-guided recreation use was reported in 2010 to 2011. The protected bays on the west and north sides of Naked Island can provide safe anchorages for boats. The Naked Island group is part of the Nellie Juan-College Fiords Wilderness Study Area. Ecotourism of the PWS is anticipated to increase and its effect on visitation at the Naked Island group is unknown. Visitors' interest in viewing wildlife, particularly pigeon guillemot, parakeet auklet, tufted puffin, and horned puffin, has been a popular activity in PWS for many years.

SOCIOECONOMIC RESOURCES

Introduction

There are five communities that are most closely associated with the Naked Island group in PWS. Each community was affected, some more significantly, by the 1964 Good Friday Earthquake. Many residents were killed either by the earthquake itself, or by the tsunami which followed. The earthquake affected community rebuilding efforts as well as destroying the livelihood of many residents.

Naked Island Group

The Naked Island group is publicly managed by the USDA, USFS as part of the Chugach National Forest. There is one privately owned parcel of land on the SW portion of Peak Island. Little or no subsistence hunting and trapping occurs because of the logistics of getting to the islands from a village.

Chenega Bay Village

Chenega is located on Evans Island at Crab Bay, 67.5 kilometers southeast of Whittier and is 167.5 air kilometers southeast of Anchorage and 80.5 kilometers east of Seward. The village has a total area of 75 square kilometers, of which, 74.5 square kilometers of it is land and 0.75 square kilometers (1.2 percent) is water. Winter temperatures range from -8 to -2 °C. Summer temperatures range from nine to 17 °C. Average annual precipitation includes 1.7 m of rain and 2.0 m of snowfall.

According to the 2010 Census, there is a population of 76 residents with a median age of 35 years old. A federally-recognized tribe is located in the community -- the Native Village of Chenega (aka Chanega). Chenega Bay is an Alutiiq community practicing a subsistence and commercial fishing lifestyle (USCB 2010).

Commercial fishing, a small oyster farming operation, and subsistence activities occur in Chenega. Cash employment opportunities are limited. Chenega has a small boat harbor and dock. Scheduled and chartered flights depart from Cordova, Valdez, Anchorage, and Seward. In 1996, the Alaska

Marine Highway began "whistle-stop" service (vessel does not stop if there are no reservations) (ADCCED 2012).

Cordova

Cordova is located near the mouth of the Copper River at the head of Orca Inlet on the east side of PWS and is 83.5 air kilometers southeast of Valdez and 241.4 kilometers southeast of Anchorage. The city has a total area of 195.5 square kilometers, of which, 159 square kilometers of it is land and 37 square kilometers of it is water. The total area is 18.9 percent water. Winter temperatures average from -8 to -2 °C. Summer temperatures average from nine to 17 °C. Average annual precipitation is 424 cm, and average annual snowfall is 203 cm.

According to the 2010 Census, there is a resident population of 2,239 with a median age of 42 years old. Cordova has a significant Eyak Athabascan population with an active village council. Commercial fishing and subsistence are central to the community's culture (USCB 2010). Cordova supports a large fishing fleet for PWS and several fish processing plants. In 2010, 337 residents held commercial fishing permits and nearly half of all households work in commercial harvesting or processing. Red salmon (*Oncorhynchus nerka)*, Chinook salmon *(Oncorhynchus tshawytscha)*, silver salmon (*Oncorhynchus kisutch)*, pink salmon, chum salmon (*Oncorhynchus keta)*, herring, halibut *(Hippoglossus stenolepis)*, bottom fish, and other fish are harvested.

Cordova is accessed by plane or boat and linked directly to the North Pacific Ocean shipping lanes through the Gulf of Alaska and has year-round barge service and state ferry service. Daily scheduled jet flights and air taxis are available. Harbor facilities include a breakwater, dock, and small boat harbor (ADCCED 2012). A 77 kilometer gravel road provides access to the Copper River Delta to the east.

Tatitlek Village

Tatitlek is located on the northeast shore of Tatitlek Narrows, on the Alaska Mainland in PWS and lies near Bligh Island, southwest of Valdez by sea and 48 air kilometers northwest of Cordova. The Tatitlek village has a total area of 19 square kilometers, all of it land.
Winter temperatures range from -8 to -2 °C, while summers average nine to 17 °C. Annual precipitation averages 0.71 m of rain and 3.8 m of snowfall.

According to the 2010 Census, there are 88 residents with a median age of 30 years old. A federally-recognized tribe is located in the community -- the Native Village of Tatitlek. Tatitlek is a coastal Alutiiq village with a fishing and subsistence-based culture (USCB 2010).

Fish processing and oyster farming provide limited employment in Tatitlek. In 2010, one resident held a commercial fishing permit. Subsistence activities provide the majority of food items (ADCCED 2012). A silver salmon hatchery, supporting subsistence activities, is located at Boulder Bay. The community has a store. Air charters are available from Valdez and Cordova. Boats are the primary means of local transportation. In 1996, the Alaska Marine Highway began "whistle stop" service (ADCCED 2012).

Valdez

Valdez is located on the north shore of Port Valdez, a deep water fjord in PWS and is 482 road kilometers east of Anchorage and 586 road kilometers south of Fairbanks. Valdez is the southern terminus of the Trans-Alaska oil pipeline and the northernmost ice-free year-round port in North America. The city has a total area of 717.5 square kilometers of which, 575 square kilometers is land and 143 square kilometers (20 percent) is water. January temperatures range from -6 to 0 °C; July temperatures are from eight to 16 °C. Annual precipitation averages 1.58 m. The average snowfall is, incredibly, 8.3 m annually.

According to the 2010 Census, there are 3,976 residents with a median age of 37 years old (USCB 2010). Valdez is a major seaport and a foreign free trade zone, with a $48 million cargo and container facility. The Port of Valdez is navigated by hundreds of ocean-going oil cargo vessels each year. Four of the top ten employers in Valdez are directly connected to the oil terminus. City, state, and federal agencies provide significant employment. In 2010, 52 residents held commercial fishing permits. Two fish processing plants operate in Valdez, as well as a fish hatchery. Several cruise ships dock in Valdez each year. In 2011, 98 uniformed Coast Guard personnel were stationed in Valdez. Valdez is a fishing port, both for commercial and sport fishing. Marine life and glacier sightseeing, deep-sea fishing, and heli-skiing support a tourist industry in Valdez (ADCCED 2012).

The Richardson Highway connects Valdez to Alaska's road system. The Alaska Marine Highway Ferry System provides transport to Cordova, Whittier, Kodiak, Seward, and Homer. Daily scheduled jet flights and air taxis are available.

Whittier

Whittier is on the northeast shore of the Kenai Peninsula, at the head of Passage Canal and on the west side of PWS, 96.5 kilometers southeast of Anchorage. The city has a total area of 51 square kilometers, of which, 32.5 square kilometers of it is land and 18.5 square kilometers of it (36 percent) is water. Winter temperatures range from -8 to -2 °C, while summer temperatures average nine to 17 °C. Average annual precipitation includes 5.0 m of rain and 6.1 m of snowfall.

According to the 2010 Census there are 220 residents with a median age of 48 years old (USCB 2010). Whittier has an ice-free port, two city docks, and a small boat harbor that accommodates fishing, recreation, and charter vessels. It is served by road, rail, the state ferry, boat, and aircraft. Since 2000, a tunnel has provided a road connection to Anchorage. The railway carries passengers, vehicles, and cargo 19.5 kilometers from the Portage Station east of Girdwood. Daily scheduled air flights are available. The city, school, local services, and summer tourism support Whittier. Tours, charters, and sport fishing in PWS attract seasonal visitors. In 2010, 12 residents held commercial fishing permits. Whittier is a popular port of call for cruise ships, as it has connections to Anchorage and the interior of Alaska by both highway and rail. Whittier is the embarkation/debarkation point of the Denali Express nonstop rail service (ADCCED 2012). Whittier is also popular with tourists, sport fishermen and hunters.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter describes the effects of the No Action – Current Management and the Proposed Action - Control of Predatory Mink alternatives. Each major environmental impact is evaluated under each alternative and the direct, indirect, and cumulative impacts are analyzed, where applicable. The following factors were considered under each alternative in evaluating impacts:

Likelihood of impact –would the action result in an impact or; is the chance of impact so small as to discount effects?

Duration and frequency of the impact – is the action seasonal, temporary, ongoing, etc.?

Magnitude of impact – is it likely the magnitude of impact would cause significant impacts to the quality of the human environment? (No impact, negligible impact, moderate impact, or severe impact).

Geographic extent – are the impacts expected to be local or far-reaching?

Legal status of a species – are there species that may be impacted that have special protections, regardless of the other levels of impact?

Under either alternative the Naked Island Group would remain as part of the Chugach National Forest and managed under State and Federal regulations for currently permitted public uses, including trapping, hunting, wilderness recreation, and other activities. The Naked Island group would continue to be managed as a wilderness study area to maintain and protect the existing wilderness character.

ALTERNATIVE A: NO ACTION – CURRENT MANAGEMENT

No management actions would be undertaken to control or reduce the population of mink. The pigeon guillemot population in PWS would not be moved toward recovery status.

Cost

No additional costs.

Impacts to Geology, Soils, and Vegetation

Vegetation, geology, and soil resources would not be affected.

Impacts to Water Resources

Streams and wetlands would not be affected.

Impacts to Wildlife

Birds

The breeding population of pigeon guillemot at the Naked Island group, where 25 percent of the PWS population bred at the time of the EVOS, would likely remain either exceedingly low (≤ 100 birds) or decline to local extirpation in the absence of restoration action (see Figure 4 and Table 1). Pigeon guillemot would remain the only marine bird species "not recovering", on the EVOS Trustee Council's Injured Resources List.

Other breeding seabird populations, including horned puffin, parakeet auklet, and tufted puffin would likely continue to decline or become absent at the Naked Island group. Mink are opportunistic feeders and would continue to predate on ground/burrow nesting seabirds, which generally breed only on predator free islands.

Mammals

Mammals present on the islands would not be affected.

Fishery Resources

Fishery resources present on and near the islands would not be affected.

Threatened and Endangered Species

North Pacific right whale, Steller sea lion, Steller's eider, and the humpback whale would not be affected.

Impacts to Wilderness Study Area

There could be moderate effects to the wilderness character at the Naked Island group, if pigeon guillemot and other seabirds continue to decrease in population. Historically, seabirds have been present and contributed to the islands wilderness character. The wilderness study area was designated in 1980 through the Alaska National Interest Lands Conservation Act (ANILCA), when bird numbers were dramatically higher than today (1979 survey of the Naked Island Group counted 1871 pigeon guillemot). There are currently only about 100 pigeon guillemot; parakeet auklets no longer breed at the Naked Island group; and tufted and horned puffin in 2010 number less than ten individuals.

Impacts to Cultural Resources

There would be no effects to cultural resources.

Impacts to Recreational Resources

Effects to recreation resources would likely be negligible to moderate. There may be fewer visitations for those interested in birding and sightseeing with few nesting seabirds and the absence of pigeon guillemot, parakeet auklet, tufted puffin, and horned puffin.

Impacts to Social and Economic Values

Communities

Social and economic effects would likely be negligible to moderate. Reduced populations of seabirds, particularly pigeon guillemot at the Naked Island group would have negligible to moderate effect on tourism.

Subsistence

Although pigeon guillemot has little subsistence value, pigeon guillemot contribute to the local culture. Effects would likely be negligible.

Cumulative Impacts

Continued reduction of pigeon guillemot to potential extirpation and dramatically reduced numbers of other seabirds could have a cumulative impact to PWS. The Naked Island group is particularly important because it was historically the main pigeon guillemot breeding location in PWS (Sanger and Cody 1994). One fourth of all pigeon guillemot nests in PWS in 1989 (just after the spill) were located at the Naked Island group, although the islands constitute only about two percent of the total shoreline in PWS (Bixler et al. 2010).

The Naked Island group is part of a larger wilderness study area which was designated in 1980. At the time of designation, the number of pigeon guillemot and other seabirds were dramatically higher than today. The lack of seabirds could have a cumulative impact to PWS within the wilderness study area.

ALTERNATIVE B: PROPOSED ACTION –CONTROL OF PREDATORY MINK

Control of predatory mink would be accomplished during five years by trapping mink entering the pigeon guillemot coastal zone nesting area.

Impacts to Geology, Soils, and Vegetation

Option 1: Boat Based

Vegetation, geology, and soil resources would not be affected by the alternative actions. Trappers would be on the islands during the day for a three to five month period from January to May when the islands are mostly covered with snow. Food would be confined to the boat and would not attract or change any wildlife behavior; no vegetation would be trampled or removed; water quality would be maintained by avoiding riparian areas and streams, No fires or land based waste would be left. No holes would be dug. This alternative would be the same as Option 2, except that a support vessel would provide food and lodging to trappers and no upland camps would be used.

Option 2: Land Based

Vegetation, geology, and soil resources would not be affected by the actions in this alternative. Wildlife specialists would be on the islands day and night during a three to five month period from

January to May, when the islands are mostly covered in snow. While there would be a temporary presence, all precautions would be taken to use minimum tools requirements and prevent natural resource impacts. All camping would be at locations approved by the USFS special use permitting process.

Impacts to Water Resources

Streams and wetlands would not be affected by the boat based or land based actions in this alternative. No waste would be deposited on the island. No latrines would be built that could leak into subsurface waterways. No carcasses would be left in the water.

Impacts to Wildlife

Birds

Trapping and the camping activities would take place during the winter season, when few birds are in the area, and no disturbance to pigeon guillemot would occur. In year five, when a dog may be used to hunt mink, the dog would be kept within sight and voice control and would not be allowed to approach birds and disturbance would be negligible.

There would be a positive effect to birds under this alternative with either the boat based or land based option. Pigeon guillemot populations at the Naked Island group are likely to recover from the current 100 birds to near the approximately 1,000 birds observed at the time of EVOS in 15 years after the project is completed (See Figure 4 and Table 1) under this alternative with either the boat based or land based option. It is anticipated that within three years of the beginning of the reduction program, the pigeon guillemot would have increasing productivity and be removed from the EVOS Trustee Council "not recovering" Injured Resources List and be classified as "recovering", and when the population reached 1,000 they would be considered "recovered".

A suite of other seabird species with depressed breeding populations at the Naked Island group (e.g., parakeet auklet, tufted puffin, and horned puffin) (KSB, pers. obs., Oakley and Kuletz 1979) would also benefit from this restoration action. Based on historical counts, tufted puffins should increase from a few to more than 750, parakeet auklets should increase from none to about 170 and horned puffins would likely increase from the few remaining birds to more than 60. Mink reduction may promote local increases in other populations of ground-nesting birds, including the black oystercatcher, a USFS "Management Indicator Species (Ferreras and MacDonald 1999, Clode and MacDonald 2002, Nordström et al. 2002, Nordström et al. 2003, Banks et al. 2008), small mammals, and crustaceans (Bonesi and Palazon 2007). The Service uses predator control as a management tool when appropriate and consistent with mandates, laws, and policies of federal land management agencies.

Black oystercatcher, a USFS "Management Indicator Species", would not be affected by trapping activities. Trapping would occur prior to the nesting initiation in May and fledgling in July. Black oystercatchers nest on rocky beach substrate just above high tide and personnel onsite would be trained to recognize defensive behavior during the breeding season and areas with nesting black oystercatchers would be avoided. Dogs would not be utilized where nesting black oystercatchers occur.

Mammals

Impacts to mammals resulting from the trapping and associated camping activities would be negligible for most species except mink. The boat based or land based actions in this alternative would reduce the mink population at the Naked Island group substantially but would likely have no measureable impact on the overall PWS mink population, as the mink habitat at the Naked Island group is about 2 percent of the PWS habitat and the mink at the Naked Island group are not genetically unique. It should also be noted that the there is no limit as to the number of mink trappers that are allowed to trap in PWS or any other Game Management Unit in Alaska.

River otter on the islands are unlikely to be captured using the AFWA Best Management Practices for mink and if captured could escape, as the traps are too small to contain an otter. There are no other mammals that reside at the Naked Island group that could be impacted by trapping.

The historic number of nesting seabirds at the Naked Island group indicates that either mink were not present or mink numbers were very low compared to current mink numbers. Populations, including ground nesting birds and small mammals would likely increase when mink are reduced. The possibility exists that all the mink on the Naked Island group would potentially be removed. Total extirpation of mink would likely not adversely affect the environment because the island ecology has evolved for long periods when mink were absent or present in low levels of abundance. Populations of the normal food of mink which include most accessible animals, small enough for the mink to eat such as: birds, fish, intertidal invertebrates, and voles, would likely increase when mink predation is absent.

Camp sites and trapping are unlikely to affect Sitka deer as deer feed in the intertidal areas. In year five, when dogs may be used to hunt mink, dogs would be kept within sight and voice control and would not be allowed to approach deer or other animals. Any disturbance would be negligible.

Fish

No impact to fish under this alternative utilizing either the boat based or land based option would occur. Actions in streams or fish-bearing habitat would be avoided. No sediment would result from these actions. Fish use by pigeon guillemot is not significant compared to fish predation by other fish, mammals, and other birds. There are about 225,000 other fish-eating seabirds in PWS and only about 2,000 pigeon guillemot (Cushing et al 2011). Impacts to herring and other fish would be negligible. Pacific herring are not an important part of the diet of guillemot (Golet et al. 2000).

The anadromous fish streams on the islands would not be disturbed by the trapping operation or by the small infrastructure necessary to trap mink on the islands. No impact to pink salmon would occur under this alternative and there would be no change to riparian vegetation.

Threatened and Endangered Species

No effect to threatened and endangered species would occur under this alternative with either the boat based or land based option. The endangered Steller sea lion do not breed or have known haul-out sites at the Naked Island group, but may occasionally occur on island beaches. Sea lion observed during the operation would not be disturbed. Trappers would avoid beaches that are being used by Steller's sea lion. Steller's eider, North Pacific right whale, and humpback whale would not be affected.

Impacts to Wilderness Study Area

Option 1: Boat Based

There would be no to negligible impacts, however, there would be temporary effects to wilderness character while the wildlife specialists were removing mink.

- No temporary shelters or structures would be used during the reduction program.
- Evening activities (food and lodging) would occur on a support vessel, while mink removal would be land based.

Option 2: Land Based

There would be no to negligible impacts, however, there would be temporary effects to wilderness character from camp operations and the presence of wildlife specialists removing mink.

- Temporary structures would be used for the reduction program for up to five years.
- Trapping operations would occur during a three to five month period from January to May, when visitation is low. The presence of snow during these periods and use of wooden floor sections and wooden walkways would negate trampling of vegetation.

Under both options, there would be a positive effect to the wilderness character as pigeon guillemot and other seabirds increase in numbers to those comparable at the time of wilderness study designation in 1980. Mink would still occur but at lower numbers than currently exist.

Impacts to Cultural Resources

According to the Programmatic Agreement among the USDA USFS, Alaska Region, the Advisory Council on Historic Preservation, and the Alaska State Historic Preservation Officer regarding Heritage Program Management on National Forests in Alaska, the proposed undertaking has no potential to effect historic properties. The Heritage Program on the Glacier Ranger District reached this conclusion based on the guidelines set forth in Appendix B of the Programmatic Agreement, section 33. Reintroduction or management of endemic or native faunal species into their historical habitats is included within the class of undertakings that has No Potential to Affect Historic Properties.

Option 1: Boat Based

No temporary shelters or structures would be used at the Naked Island group, as all mink removal support activities would be conducted by boat. Actions would cause no effects to cultural resource. In the event of unintentional discovery during trapping program implementation, any cultural artifacts or human remains encountered would not be disturbed or removed, left in place, and reported to the USFS.

Option 2: Land Based

Temporary structures would be used for support of the trapping program. Actions would cause no effects to cultural resources. All camping would be at camps approved by the USFS and would follow guidelines established in the special use permit to avoid adverse impacts to cultural resources possibly encountered during trapping program implementation.

Impacts to Recreational Resources

There would likely be a negligible to moderate positive effect to recreation resources as a result of this alternative. Recovery of pigeon guillemot and other seabirds at the Naked Island group would likely increase ecotourism potential with a greater number of seabirds to observe by visitors.

- Mink reduction activities would be conducted during the winter/spring months and would avoid potential conflicts with visiting publics, as little, if any visitation occurs during the winter/spring period.
- There would be no impact to deer hunting under this alternative, as the season ends December 31.
- Existing trapping opportunities would exist; the public trapping season starts November 10 and continues through February, but there would be fewer mink on the islands. It is likely that this alternative would have a negligible to minor impact on public trapping activities, as few trappers utilize the Naked Island group because of its remoteness.

Impacts to Social and Economic Values

Communities

Removal of mink at the Naked Island group would not adversely affect trappers in PWS, as mink fur prices are currently low and the Naked Island group is too remote for most trappers in the region. There may be temporary benefit as local trappers could potentially be used for the trapping program.

Mink carcasses could be donated to universities for research purposes and/or donated to Native villages for cultural purposes. Not all carcasses may be donated and some carcasses may not be salvageable (spoilage, unable to retrieve, scavenging by other animals, etc.)

Tourism would be enhanced as the pigeon guillemot and other seabird populations increase.

Subsistence

Removal of mink at the Naked Island group would not adversely affect subsistence trapping in PWS, as the Naked Island group constitutes less than two percent of the PWS shoreline. Low mink fur prices and the remoteness of Naked Island group preclude trapping activity. There would be temporary benefit if local Native Alaskan trappers would be used for the trapping program. Native villages could benefit from mink carcasses that would be used for cultural purposes. There is currently little interest in trapping for mink.

Cumulative Impacts

The actions in Alternative B: Proposed Action – Control of Predatory Mink would result in negligible to moderate cumulative impacts. Mink would be reduced at the Naked Island group, but it represents only two percent of the shoreline in PWS, so any impact would be negligible. Pigeon guillemot have historically been important at the Naked Island group and comprised 25 percent of the pigeon guillemot in PWS, therefore, an increase of the pigeon guillemot population as well as other seabirds would have a moderate positive cumulative impact on PWS.

Mitigation Measures

Removal methods/techniques proposed are specific to mink and would pose no risk to human health and safety. Trapping would be the primary reduction method and is the most practical and effective control method available (Boggess1994; Macdonald and Harrington 2003; Moore et al. 2003; Davis et al. 2012) and balances efficacy, humane euthanasia, and human safety. Techniques to lessen or eliminate the catching species other than mink, specifically river otter would be utilized (Bixler and Irons 2010). No other mammals similar in size to mink, such as American marten or weasel, are known to occur on the islands.

Seasonal timing and careful placement of capture devices to specifically target mink are the primary mitigation measures to avoid unintended take of other species during trapping operations. All trapping in burrow-nesting seabird colonies would be completed before seabirds begin to attend nesting burrows in May. Crevice-nesting and cliff ledge nesting seabird use areas, not likely used by mink, would not be affected by the removal operation.

Intensive trapping would take place primarily during the winter months, when public visitation is minimal, snow covers the ground, and vegetation is not vulnerable to trampling and erosion. Camp locations would be approved by the USFS.

The geography of the Naked Island group improves the likelihood of removing mink. The islands are relatively small with gentle topography and access to safe anchorages (Courchamp et al. 2003, Bonesi and Palazon 2007). By trapping in the winter/spring months when there is one to two meters of snow on the islands, the mink would be concentrated along the snow-free intertidal zone where food would be most available.

Mitigation measures to maintain and protect the wilderness character at the Naked Island group would be employed and include:

- The USFWS and APHIS-WS would coordinate with USFS personnel to select and establish camp locations to minimize impacts to vegetation and other resources.
- The USFWS, APHIS-WS, and those working under the funding Agreement would follow Leave No Trace (LNT) practices during all operations.
- The USFWS would conduct the project in a manner that requires the fewest camps (four or less) established at one time.
- Winter camps would use chargeable marine or similar batteries for electronics to minimize use of generators
- Camps would be placed to take advantage of natural screening from beaches and marine waters.
- Camp personnel would avoid having fires, unless allowed under a USFS special use permit.
- Food and food waste would be stored in a manner that prevents wildlife habituation. Camp equipment and trash would be neatly maintained and kept out of sight of visitors. Camp developments would be kept to the minimum necessary for the project.
- Sites would be restored to USFS standards before camps are abandoned for the season.
- Human waste would be packed out from all camps in sealed containers when possible.
- Camps would be at least 200m from flowing streams or lakes.

Mitigation measures designed to maintain the natural character of the Wilderness Study Area would include:

- Without compromising health or safety, vessels with minimal generator requirements are preferable to vessels requiring overnight generator use. Generator loudness is another consideration.
- Personnel would minimize motorized tender use as best as possible and avoid loud music or other sights and sounds not related to the project and that may increase impacts to solitude.
- Personnel would exercise consideration that visitors to the Wilderness Study Area often seek opportunities for solitude and primitive recreation.
- Wildlife specialists would follow LNT practices while implementing this project.
- The USFS would provide LNT training to project personnel prior to project implementation as required.

Conclusion

The opportunity to recover pigeon guillemot breeding to 1,000 birds or more from the current 100 birds and to recover the other impacted species: tufted puffins from a few to 750, parakeet auklets from a few to about 170 and horned puffins from the few remaining birds to more than 60 is possible with the control of predatory mink at the Naked Island group. These “recovered” numbers reflect the seabird populations after the wilderness study area was designated in 1980.

Recovery of pigeon guillemot at the Naked Island group would result in a substantial increase in the PWS-wide population and the removal of the pigeon guillemot from the EVOS Trustee Council “not recovering list” and be classified as “recovered”.

CONSULTATION AND COORDINATION

Collaborating and communicating with federal, state, and local agencies; stakeholders and the public; including consultation with Native Alaskan Tribes and Corporations has taken place throughout preparation of this EA. There are over 50 organizations and individuals on the EA mailing list.

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APPENDIX A: ONLINE RESOURCES

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APPENDIX B: COMPLIANCE WITH OTHER LAWS AND REGULATIONS

ANILCA Section 810, Subsistence Evaluation and Finding

As documented or reported there is little subsistence uses or resources that would be impacted by the alternatives at the Naked Island Group. For this reason, this action would not result in a significant possibility of a significant restriction of subsistence use of wildlife, fish, or other foods.

ANILCA Section 811, Subsistence Evaluation and Finding

There is no documented or reported subsistence access that would be restricted as a result of the proposed action. For this reason, this action would not result in a significant possibility of a significant restriction of subsistence users having reasonable access to subsistence resources on National Forest System Lands.

Endangered Species Act of 1973

The endangered Steller sea lion do not breed or have known haul-out sites at the Naked Island group, but may occasionally occur on island beaches. Sea lions observed during the operation would not be disturbed. Trappers would avoid beaches that are being used by Steller's sea lions. Steller's eider, North Pacific right whale, and humpback whale would not be affected.

National Historic Preservation Act of 1966

This EA evaluated the environmental impacts to cultural resources and determined that because the alternatives proposed do not propose to disturb significant areas, and most activity would be over snow, and it is unlikely that cultural resources are present or would be impacted.

Floodplain Management (E.O. 11988), Protection of Wetlands (E.O. 11990)

The construction of the facilities needed for trapping operations or the actual trapping would not impact the functional value of any floodplain as defined by Executive Order 11988 and would not have negative impacts on wetlands as defined by Executive Order 11990.

Recreational Fisheries (E.O. 12962)

There are five anadromous streams at the Naked Island group. These have the only recreational fishing potential within National Forest System lands. As documented since there are no effects to fisheries resources there would be no negative direct, indirect or cumulative impacts related to this Order.

Environmental Justice (E.O. 12898)

It has been determined that, in accordance with Executive Order 12898, the implementation of the proposed action does not have disproportionately high and adverse human health or environmental effects on minority populations and low income populations.

Magnuson-Stevens Fishery Conservation and Management Act

The project area contains five anadromous streams. Action taken under the action would not impact anadromous fish habitat. Since no disturbance of the anadromous fish habitat (EFH) on the islands is anticipated, this project would not affect EFH.

APPENDIX C: INFORMATION ON THE MODEL USED TO PROJECT PIGEON GUILLEMOT POPULATION TRENDS WITH CURRENT MANAGEMENT AND CONTROL OF PREDATORY MINK MODELING

Potential changes in the growth of the pigeon guillemot population at the Naked Island group were modeled to inform the decision-making process. This modeling coincides with the two management alternatives: Alternative A: No Action-Current Management and Alternative B: Proposed Action-Control of Predatory Mink (Chapter 2). A stochastic Leslie matrix model after Golet et al. (2002) and Bixler et al (2010) was used to project guillemot population growth under these scenarios.

The following equation was used to project the growth rate of the guillemot population:

(λ): $\lambda = ((PF * FX * PA^{2}) + (NX * PA)) / NX$

λ = annual population growth rate
P_F = annual sub-adult survival rate
F_X = number of offspring produced
P_A = age-constant annual adult survival
N_X = initial population size

The observed rate of population change of pigeon guillemot at the Naked Island group from 1989 to 2008 was an approximate 12.7 percent annual decline (Bixler et al. 2010). Observed population change of pigeon guillemot at the also oiled, but mink-free Smith Islands was a 0.53 percent increase over the same time period, as pigeon guillemot recovered from EVOS. Thus, it is assumed that the long-term decline at the Naked Island Group was likely due to mink predation.

An example of the possible maximum rate of increase for pigeon guillemot was 13.6 percent annually for six years was noted by Byrd (2001) in the western Aleutian Islands when arctic fox were removed from two islands. Pigeon guillemot numbers on nearby islands where arctic fox were not removed changed only slightly. Seabirds prospect at the end of summer for good breeding sites (ones with evident chicks) and this may result in immigration to productive colonies from nonproductive colonies (Boulinier and Danchin 1997).

The modeling strategy used the best data available to quantify a matrix population projection model. The model assumed a maximum average adult survival rate of 0.9 under optimal conditions. Although no empirical estimates of adult survival exist for pigeon guillemot, this assumption is reasonable considering adult survival data across a range of different seabird species (Schmutz 2009). The assumption is very similar to the rate of 0.89 estimated for black guillemot (Frederiksen and Petersen 1999). To emulate the decline depicted by Bixler et al. (2010), the mean nest productivity rate of 0.35 was used from study years at Naked Island (1989, 1990, and 1994-1998). Bixler et al. (2010) also noted adult pigeon guillemots were killed at up to ten percent of nest sites. This rate may be an underestimate, if mink remove carcasses from the nest, as the investigator would assume the nest had failed and the adults simply dispersed. Regardless, a maximum predation rate of ten percent of the adults was used in the presence of mink (thus base adult survival without mink of 0.9

multiplied by 0.9 (the percent surviving predation in the presence of mink) equals 0.81. This nest survival rate of 0.35 and adult survival rate of 0.81 produced a rate of decline less steep than depicted in Bixler et al. (2010). An adult emigration rate was added, sufficient to produce the trend shown by Bixler et al. (2010). The best value for emigration rate was 15 percent. If this trend were to continue, a population of 100 pigeon guillemot would decrease to seven pigeon guillemot in 20 years. This model reflects the No Action – Current Management alternative.

An adult survival rate of 0.9, a nest survival rate equal of 0.61 (Golet et al. 2002), and an immigration rate equated to the emigration rate was needed to model the pigeon guillemot observed decline at the Naked Island group. The average increase of pigeon guillemot over 20 years was 17 percent annually, nearly identical to the value noted by Byrd (2001) for Simeonof Island. The projection starting point begins when there is assumed to be no mink predation. Additional model simulations could be done to characterize pigeon guillemot response to gradual mink eradication. To emulate a significant removal of mink (90 percent removal) nest survival and adult survival rates of 90 percent of the maximum values in the previous model were utilized. For the Control of Predatory Mink alternative, the average rate of annual increase of pigeon guillemot, over 20 years, was 16 percent.

The above model descriptions are deterministic, as each model parameter has a singular value without variation (e.g., if adult survival is 0.9, then 0.9 is maintained throughout the projection). Stochastic models were run where variability was applied to the system with these core model structures. If biologically realistic parameter values of variability are used, then a stochastic model should be a more realistic representation of possible outcomes. For variability in nest survival (productivity), the data presented in Golet et al. (2002) was used for Naked Island. These data represent both ecologically real variability and also variability due to the sampling process. Variance decomposition procedures were used (Burnham et al.1987) to extract an estimate of process variation in nest survival. A normal distribution of this variability was imposed on the model by using random draws from the distribution, and running the model 1,000 times. The 50th and 950th model runs, sorted by population growth estimates, reflect the confidence interval of this model projection. Stochastic variability was imposed on adult survival rates. This level of variability was taken by using the mean process variation in adult survival from 18 seabird populations listed in Schmutz (2009).

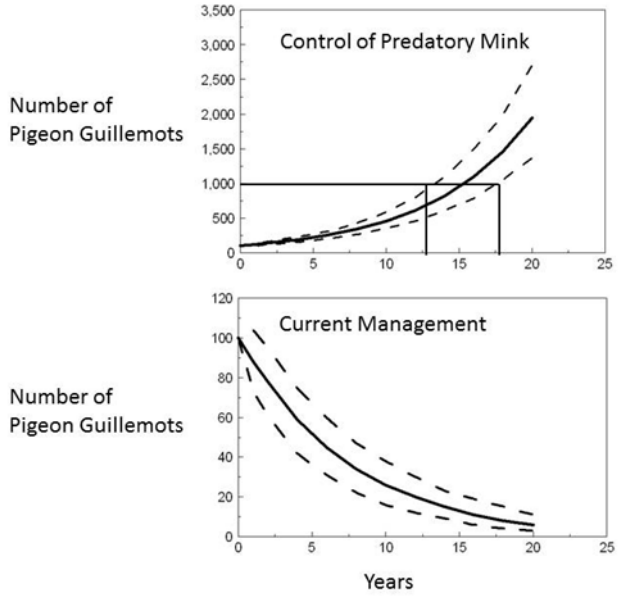

Figure 1. Results of stochastic Leslie matrix modeling of the changes in the pigeon guillemot population at the Naked Island group for two alternatives: No Action – Current Management and Proposed Action – Control of Predatory Mink (Fleming and Cook 2010). Across the two model scenarios, guillemot productivity varies in a monotonic fashion. The graphs start with the year after the actions were completed.

The "No Action – Current Management" alternative represents no control of predatory mink at the Naked Island group and a predation rate based on the empirical predation rate of the 1990s (Bixler et al. 2010). Under the "Proposed Action – Control of Predatory Mink" alternative, a model projecting guillemot population growth, assumed annual removal of mink was sufficient so that few survived at the Naked Island group after each annual management effort and mink predation on guillemot was minimal.

APPENDIX D: TIMELINES

	PIGEON GUILLEMOT	AMERICAN MINK
1895 -1950		Duration of fox fur farming at the Naked Island group.
1908		Alexander Expedition does not note the presence or absence of mink at the Naked Island group.
1929		135 mink fur farms operating, mostly in southeast Alaska
1946-1995		No mink observed at the Naked Island group according to local trapper.
1951		Mink introduced to Montague Island in PWS.
1956		Mink introduced to Strait Island in southeast Alaska by Alaska Game Commission and the USFWS.
1972	15,000 summer population of pigeon guillemot and 4,000 pigeon guillemot in winter in PWS.	
1972-1997	Pigeon guillemot declined from 15,000 to less than 3,500 in PWS.	
Mid 1970's		Mink released at the Naked Island group according to a local source.
Late 1970's – early 1980's		No mink predation recorded.
1979	1,871 pigeon guillemot recorded at the Naked Island group.	No evidence of mink predation
Pre-EVOS	Approximately 2,000 pigeon guillemot at the Naked Island group.	
1989	EVOS (3/24/1989). 500 to 1,500 pigeon killed in PWS as a result of EVOS. Just after spill – 1,000 pigeon guillemot at the Naked Island group and 4,000 in PWS.	
1990	1,000 pigeon guillemot at the Naked Island group and 4,000 in PWS.	Mink population started increasing.
1993	Estimated 3,000 - 4,900 pigeon guillemot in PWS.	

1998-2008	Dramatic decline in pigeon guillemot densities at the Naked Island group compared to PWS.	
Mid 1990's		Mink predation recorded. Local trapper observed mink on Peak Island.
2004	No evidenced of pigeon guillemot exposure to residual oil from EVOS.	
2008 to present	100 pigeon guillemot at the Naked Island group.	

Phase Two - Pigeon Guillemot Restoration Research in Prince William Sound, Alaska 2014-2018

Update of changes in proposed work since original proposal was accepted.

29 August 2013

As background, the EVOSTC has tried for years to restore the species injured by the EVOS, until this project was proposed direct restoration of seabirds has been difficult. The EVOSTC decided to fund this project to restore pigeon guillemots, the only non-recovering seabird, in two phases, the first phase was for the Environmental Assessment (EA) and was funded in 2011. Upon completion of the EA, the EVOSTC would consider the fieldwork.

The PI's had proposed to begin field work in 2012 after the EA was completed; however the EA has taken longer than expected, delaying start of the field work. By 28 October the EA will have been completed. Also since the trustees reviewed the original proposal of $2,434,218.40, the National Fish and Wildlife Foundation has agreed to fund $1,051,300 of the project and the funding for the EA has been paid. Therefore the remaining budget has declined substantially to $1,206,551.

As part of the EA, the PI's obtained additional data and revised the model on predicted recovery of pigeon guillemots. With the additional data the recovery is expected to occur more rapidly than previously predicted. Originally we predicted that after 10 years without mink predation the pigeon guillemot population would double, we now expect it to increase about five-fold in 10 years.

Additionally, as part of the EA internal review process among the four agencies involved (U.S. Fish and Wildlife Service, Alaska Department of Fish & Game, U.S. Forest Service, and Animal and Plant Health Inspection Service), the preferred alternative has changed from Eradication to Control of Predatory Mink (somewhat similar to the culling alternative in the original proposal) because ADF&G manages wildlife populations, but generally does not eradicate populations as a first step to management. Mink on the Naked Island group are likely less than 2% of the mink in Game Management Unit 6 (Prince William Sound and the Copper River Delta) and therefore reduction or removal of them would have minimal impact to the trappable population in GMU 6, particularly because it is known that very few if any mink are currently trapped on the Naked Island group.

At this point ADF&G has agreed to the Control of Predatory Mink alternative, as written in the EA, and is willing to proceed by removing all the mink from the pigeon guillemot nesting area,

but not trap mink in the upland habitat of the Naked Island group. This is different from the original culling alternative in which not all mink would have been removed from the pigeon guillemot nesting area. The Principal Investigators of the project believe this revised alternative has a much greater probability of success than the original culling alternative, because all the mink nearest the guillemots would be removed. All agencies agreed that if mink reduction does not restore pigeon guillemots then through adaptive management, based on what is learned during the first 2-3 years of the project, another decision will be made on what to do. One of those options would to amend the EA remove the remaining mink from the Naked Island group.

Also some additional work on mink has been recommended by the ADF&G. Therefore we now plan to examine diets, age, and sex of the mink that are collected. We will also take a DNA sample, in case DNA analyses are needed at some future date. By using bait stations, we will be able to estimate the mink population and learn locations of mink that may become trap shy so that other means may be used to remove them. The cost of these new components is relatively low and will not cause the budget to increase by more than $25,000 overall (this is included in the attached budget).