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

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

Figures

Tables

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.

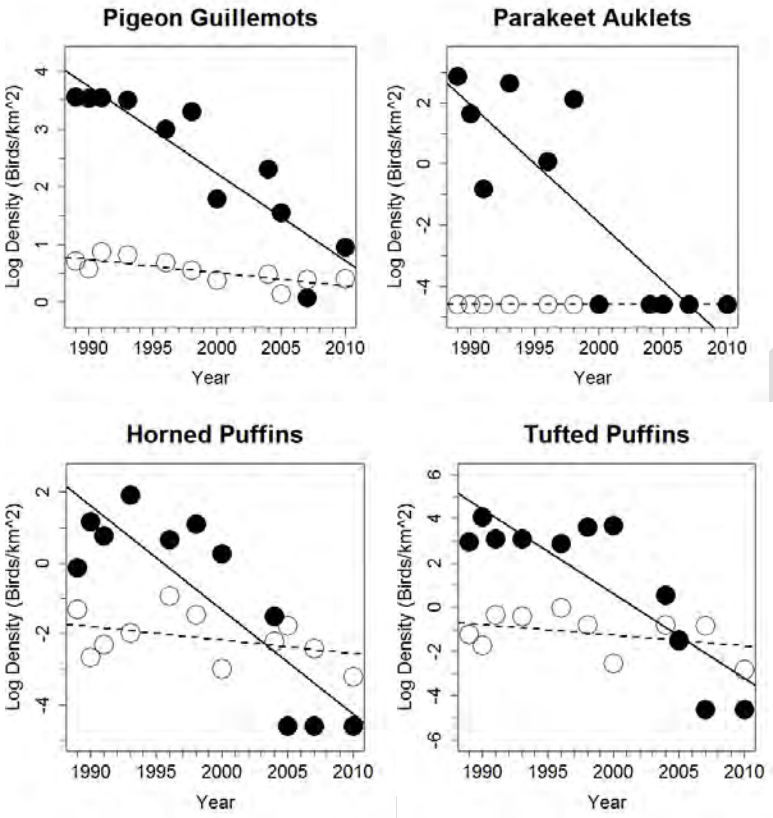
Pigeon guillemot nest in talus and rock crevices and are susceptible to ground based predation. Mink are the only known ground-based predator occurring at the Naked Island group, except for river otter. Little predation of seabirds by river otter has been observed at the Naked Island group (Irons, pers.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

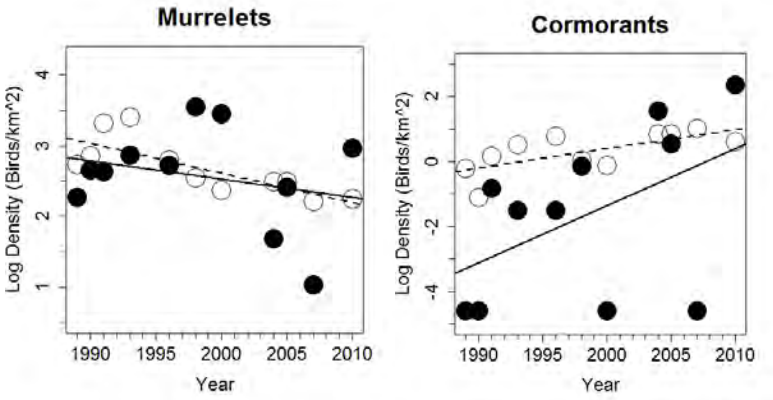


Figure 3. Comparison of population trends from 1989 to 2010 for species of fish-eating seabirds, with nests are susceptible to mink predation, and with nests are not susceptible to mink predation at the Naked Island group (filled circles) and the remainder of PWS (open circles). Data are from EVOS Trustee 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.

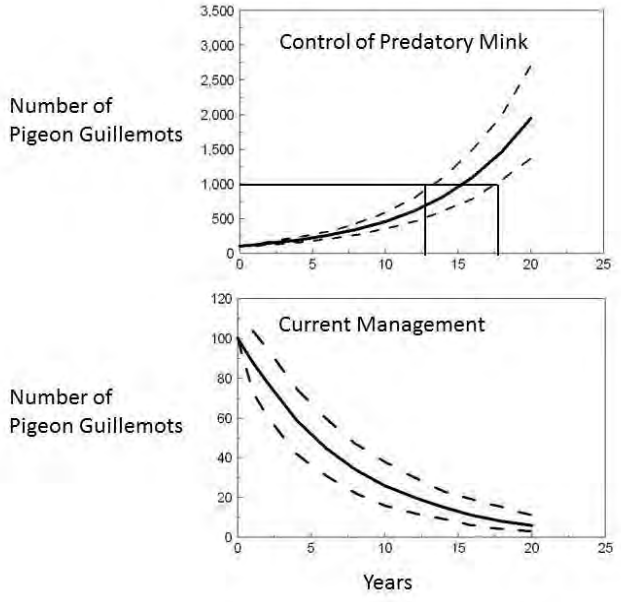


Figure 4. Results of stochastic Leslie matrix modeling of the changes in the pigeon guillemot population at the Naked Island group for the Proposed Action-Control of Predatory Mink and No Action-Current Management Alternatives (Fleming and Cook 2010). Pigeon guillemot

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.

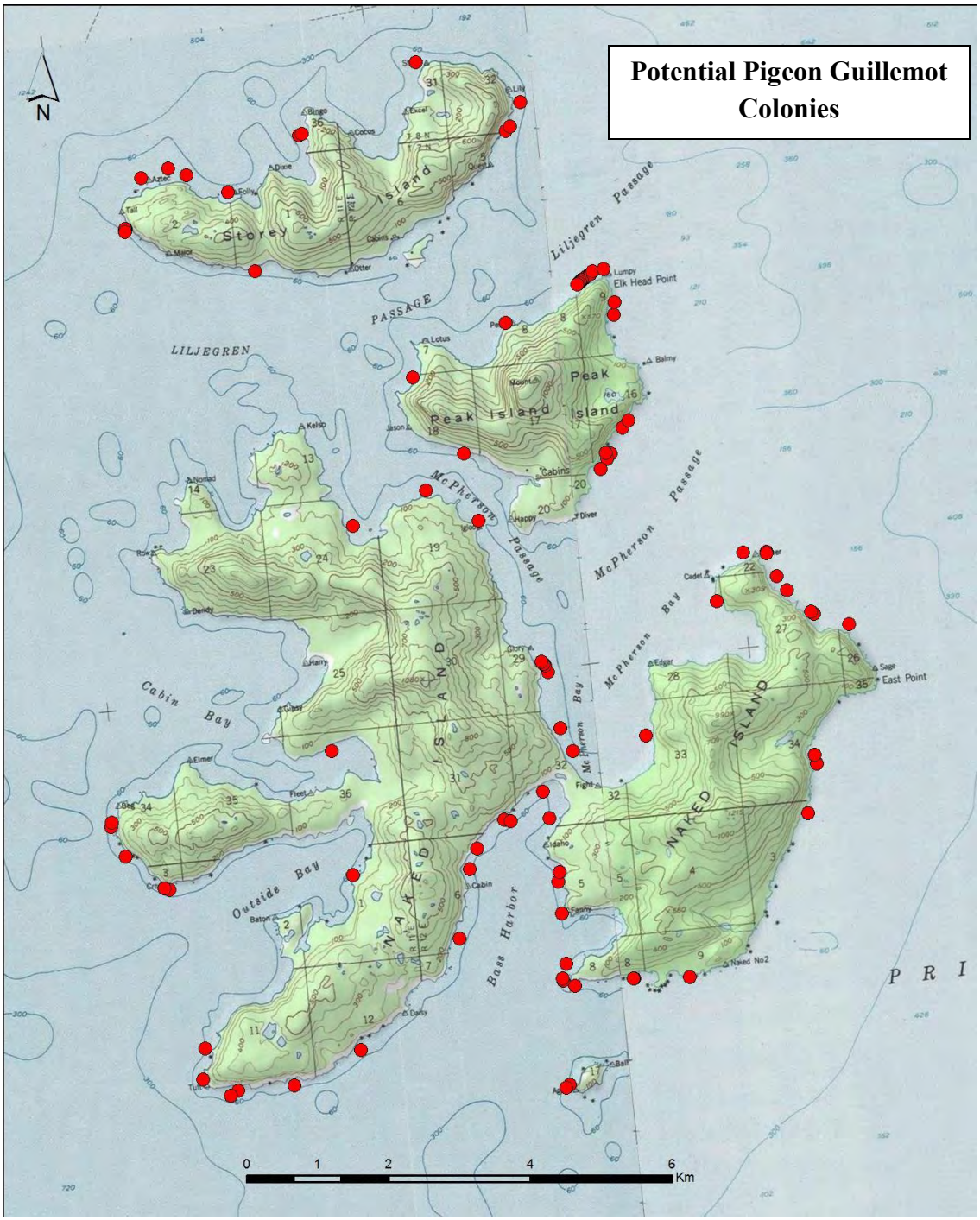


Figure 5. Locations of potential pigeon guillemot colonies based on sightings of breeding birds on the water (red dots) at the Naked Island group.

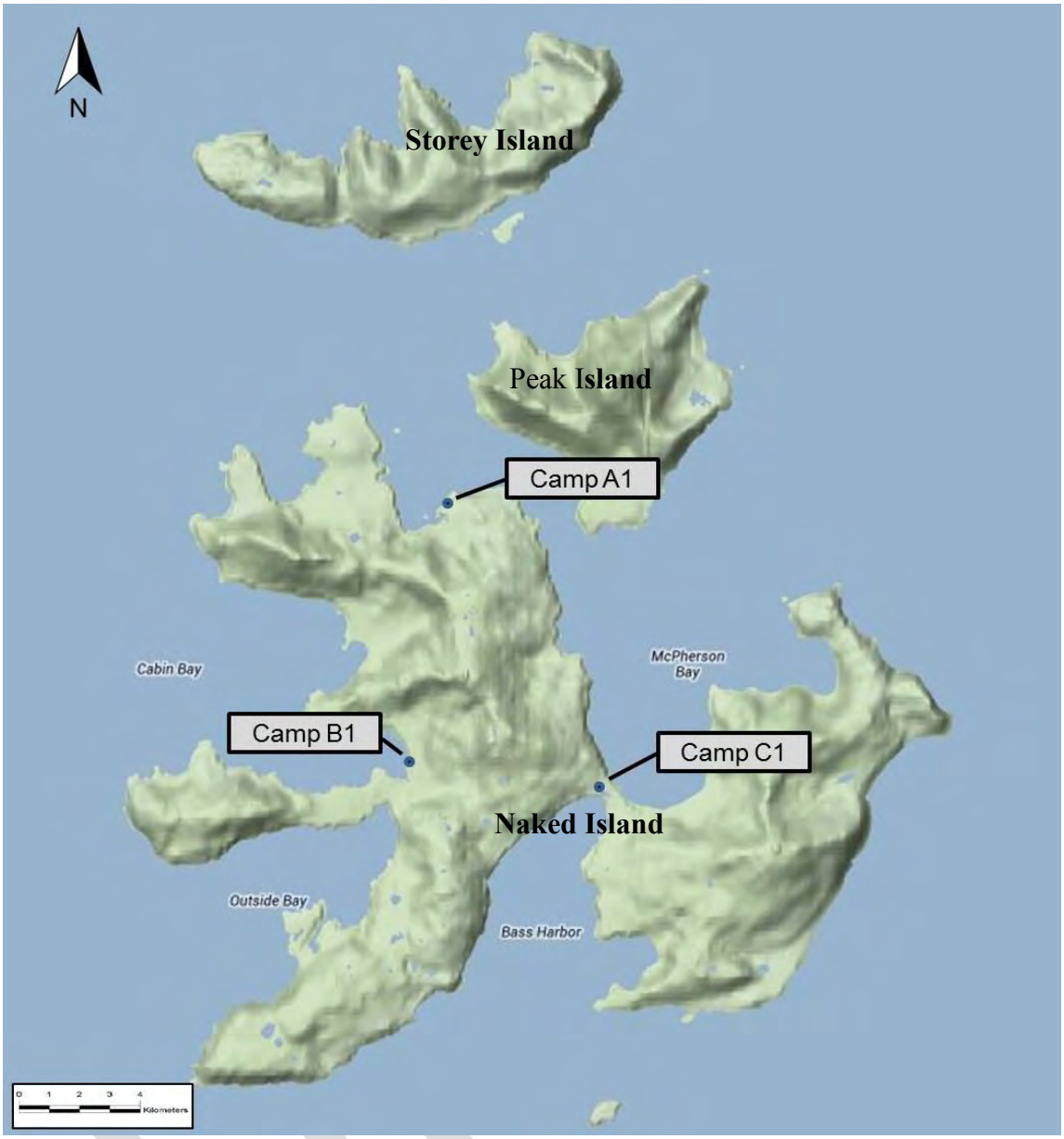


Figure 6. Map of Naked, Storey and Peak Islands showing three potential camp sites, Camp A1 - North Camp, Camp B1 – Cabin Bay and Camp C1 – Bass Harbor. All three camps would be used in winter and Camp B1- Cabin Bay would also be used in summer.

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.

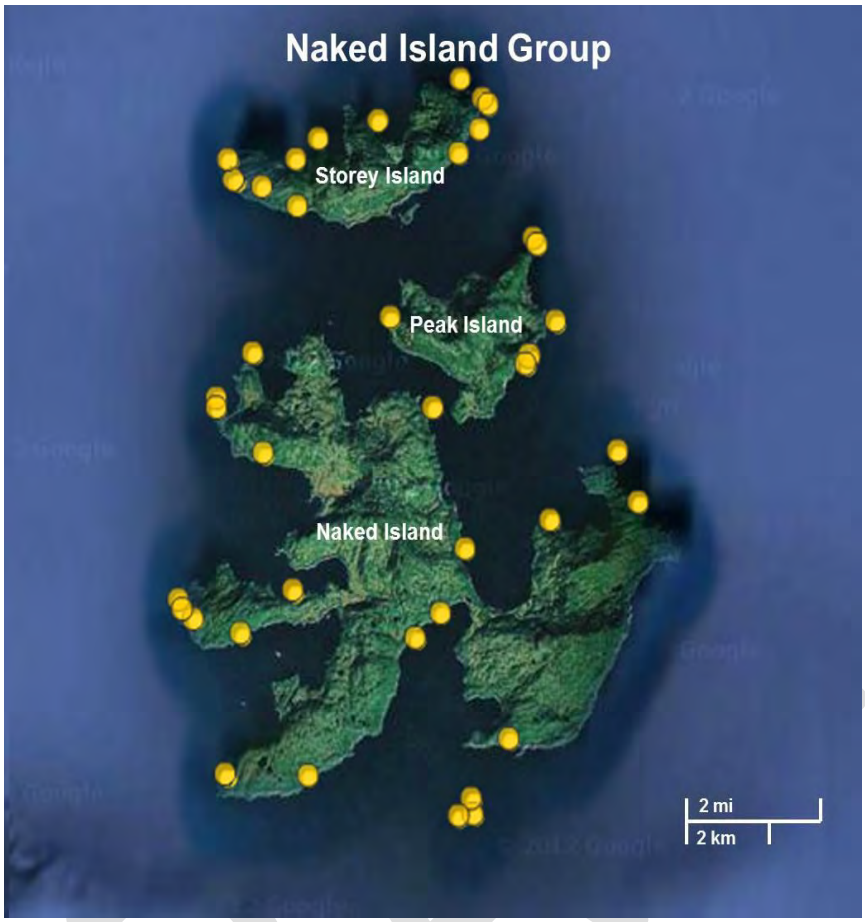


Figure 7. Locations of historical pigeon guillemot colonies at the Naked Island group (yellow dots).

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.

PREPARERS

Bill Haglan, Wildlife Biologist, GAP Solutions, Inc., Reston, VA.
David Irons, Seabird Coordinator, U.S. Fish and Wildlife Service, Anchorage, AK.
Brad Palach, Program Manager, Alaska Department of Fish and Game, Anchorage, AK.
Michael Spratt, Environmental Planner, GAP Solutions, Inc., Reston, VA.
Roger Woodruff, Washington/Alaska State Director, USDA, APHIS Wildlife Services, Olympia, WA.
Steve Zemke, Chugach National Forest, *former* EVOS Liaison/Aquatic Program Manager, U.S. Forest Service, Anchorage, AK.

REVIEWERS

Merav Ben-David, University of Wyoming, Alaska Department of Fish and Game
Tim Charnon, Glacier District Ranger, U.S. Forest Service, Girdwood, AK.
Erin Cooper, PWS Zone Wildlife Biologist, Cordova, AK
Dave Crowley, Area Management Wildlife Biologist Alaska Department of Fish and Game
Howard Golden, Fur Biologist, Alaska Department of Fish and Game, Anchorage, AK.
Heather Hall, Glacier District Archeologist, U.S. Forest Service, Girdwood, AK.
Carole Jorgenson, Chugach National Forest, Wildlife Biologist, U.S. Forest Service, Anchorage, AK.
Tim Joyce, PWS Zone Wildlife Program Manager, Cordova, AK
Terri Marceron, Chugach National Forest, Forest Supervisor, U.S. Forest Service, Anchorage, AK.
Josh Milligan, NEPA Coordinator, U.S. Forest Service, Anchorage, AK.
Marc Pratt, Alaska USDA, APHIS Wildlife Services, Palmer, AK.
Terry Smith, Alaska District Supervisor, USDA, APHIS Wildlife Services, Palmer, AK.

LITERATURE CITED

Alaska Department of Commerce, Community, and Economic Development. Alaska Community Database online. 2012.

Alaska Department of Fish and Game. 2006. Our wealth maintained: a strategy for conserving Alaska's diverse wildlife and fish resources. Alaska Department of Fish and Game, Juneau.

Alaska Department of Fish and Game. 2008. Alaska Department of Fish and Game Wildlife Notebook Series. Alaska Department of Fish and Game, Juneau. <http://www.adfg.alaska.gov/static/education/wns/mink.pdf> Accessed 29 November 2012.

Alaska Humanities Forum. 2012. Alaska history and cultural studies, Russia's colony. Alaska Humanities Forum, Anchorage, AK. <http://www.akhistorycourse.org/articles/article.php?artID=182> Accessed 29 November 2012.

Banks, P. B., M. Nordström, M. Ahola, P. Salo, K. Fey, and E. Korpimäki. 2008. Impacts of alien American mink predation on island vertebrate communities of the Baltic Sea Archipelago: review of a long-term experimental study. Boreal Environment Research 13:3-16.

Ben-David, M., R. T. Bowyer, and J. B. Faro. 1996. Niche separation by mink (*Mustela vison*) and river-otters (*Lutra canadensis*): co-existence in a marine environment. Oikos 75: 41-48

Ben-David, M. 2012a. Evaluation of the U.S. Fish and Wildlife Service Environmental Assessment document for mink eradication on the Naked Island Archipelago, Prince William Sound, Alaska. Unpublished report, April 2012, University of Wyoming, Laramie.

Ben-David, M. 2012b. Supporting document for the evaluation of the U.S. Fish and Wildlife Service Environmental Assessment document for mink eradication on the Naked Island Archipelago, Prince William Sound, Alaska. Unpublished report, July 2012, University of Wyoming, Laramie.

Bixler, K.S. 2010. Why aren't pigeon guillemot in PWS, Alaska recovering from the *Exxon Valdez* oil spill? Thesis, Oregon State University, Corvallis.

Bixler, K.S., D.D. Roby, and D.B. Irons, M.A. Fleming, and J.A. Cook. 2010. Pigeon Guillemot restoration research in PWS, Alaska. *Exxon Valdez* Oil Spill Restoration Project Draft Final Report (Restoration Project 10070853), Oregon State University, Corvallis.

Boggess, E. K. 1994. American mink. *in* S. E. Hygnstrom, R. M. Timm, and G. E. Larson, editors. Prevention and Control of Wildlife Damage. University of Nebraska-Lincoln, Lincoln.

Bonesi, L., S. Rushton, and D.W. Macdonald. 2007. Trapping for American mink control and water vole survival; identifying key criteria using a spatially explicit individual based model. Biological Conservation 136:636-650.

Bonesi, L., and S. Palazon. 2007. The American mink in Europe: status impacts, and control. Biological Conservation 134:470-483.

Boulinier, T., and E. Danchin. 1997. The use of conspecific reproductive success for breeding patch selection in terrestrial migratory species. Evolutionary Ecology 11:505-517.

Burnham, K.P., D.R. Anderson, G.C. White, C. Brownie, and K.H. Pollock. 1987. Design and analysis methods for fish survival experiments based on release-recapture. American Fisheries Society Monograph 5.

Byrd, G. V. 2001. Wildlife surveys at Simeonof, Chernabura and nearby islands in the Outer Shumagin Islands in July 2001. U.S. Fish and Wildlife Service report, Alaska Maritime National Wildlife Refuge, Homer, AK.

Byrd, G. V., E. P. Bailey, and W. Stahl. 1997. Restoration of island populations of Black Oystercatchers and Pigeon Guillemot by removing introduced foxes. Colonial Waterbirds 20:253-260.

Chugach Alaska Corporation. 2012. The people of the Chugach region. < http://www.chugach-ak.com/whoweare/cultural/Pages/people.aspx> Accessed 22 March 2012.

Clode and MacDonald 2002 Clode, D., and D. W. MacDonald. 2002. Invasive predators and the conservation of island birds: the case of American mink *Mustela vison* and terns *Sterna* spp. in the Western Isles, Scotland. Bird Study 49:118-123.

Cook, L., and F. Norris. 1998. A stern and rocky-bound coast. Kenai Fjords National Park Historic Resource Study. U. S. National Park Service, Alaska Support Office, Anchorage, AK.

Courchamp, F., J. L. Chapuis, and M. Pascal. 2003. Mammal invaders on islands: impact, control and control impact. Biological Review 78:347-383.

Courchamp, F., and S. J. Cornell. 2000. Virus-vectored immunocontraception to control feral cats on islands: a mathematical model. Journal of Applied Ecology 37:903-913.

Craik, C. 1997. Long-term effects of North American mink *Mustela vison* on seabirds in western Scotland. Bird Study 44(30):303-09.

Cushing, D. A., A. McKnight, D. B. Irons, K. J. Kuletz, and S. Howlin. 2012. PWS Marine Bird Surveys, Synthesis and Restoration. *Exxon Valdez* Oil Spill Restoration Project Final Report (Restoration Project 10100751), U. S. Fish and Wildlife Service, Anchorage, Alaska.

Davis. E.F., Anderson, C.B., A.E.J. Valenzuela, J.L.Cabello, and N. Soto. 2012. American mink (*Neovision vision*) in the Cape Horn Biosphere Reserve: enhancing current trap systems to control an invasive predator. Finnish Zoological Board and Publishing Board, Annales Zoologici Fennici 49.

Dywer, T.J, P. Isleib, D.A. Davenport and J.L. Haddock. 1976. Marine Bird Populations in Prince William Sound, Alaska. U.S. Fish and Wildlife Service, Anchorage, Alaska. Unpubl. Report.

Ferreras, P., and D. W. MacDonald. 1999. The impact of American mink *Mustela vison* on water birds in the Upper Thames. Journal of Applied Ecology 36:701-708.

Fleming, M.A. and J.A. Cook. 2010. MtDNA and Microsatellite DNA provide evidence of fur farm ancestry for American mink populations in PWS. Final Report to Dave Irons and Dan Roby for "Pigeon Guillemot Restoration Research in PWS," Exxon Valdez Oil Spill Trustee Council Project 070853. Museum of Southwestern Biology University of New Mexico, Albuquerque, NM.

Frederiksen, M., and A. Petersen. 1999. Adult survival of the black guillemot in Iceland. Condor 101:589-597.

Golet, G. H., P. E. Seiser, A. D. McGuire, D. D. Roby, J. B. Fischer, K. J. Kuletz, D. B. Irons, T. A. Dean, S. C. Jewett, and S. H. Newman. 2002. Long-term direct and indirect effects of the 'Exxon Valdez' oil spill on Pigeon Guillemot in PWS, Alaska. Marine Ecology Progress Series 241:287-304.

Hayes, D. L. 1996. A comparison of the breeding and feeding ecology of pigeon guillemot at Naked and Jackpot Islands in PWS, APEX: 95163 F. US Fish and Wildlife Service, Anchorage, AK.

Heller, E. 1910. Mammalogy of the 1908 Alexander Alaska expedition. Univ. of CA. publications in Zoology 5(11):321-360.

Irons, D., K. Bixler, and D. Roby. 2013. Pigeon guillemot restoration research in PWS, Alaska, summary of project and evidence of American mink introduction to Naked Island group. Unpublished report. United States Fish and Wildlife Service, Anchorage, AK.

Isleib, M. E. P., and B. Kessel. 1973. Birds of the north Gulf Coast - PWS region, Alaska. Biological Papers of the University of Alaska 14:1-149.

Isto, S.C. 2012. The fur farms of Alaska, two centuries of history and a forgotten stampede. University of Alaska Press, Fairbanks.

Janson, L. 1985. Those Alaska Blues: a fox tail. Alaska Historical Commission Studies in History No 186. Department of Education, State of Alaska, Anchorage.

Johanson, H.W. 1971. The effects of elevation changes on benthic algae in Prince William Sound. *in* The Great Alaska Earthquake of 1964: Biology. NAS Pub. 1604. Washington: National Academy of Sciences. Pp. 35-68.

Kuletz, K.J. 1996. Marbled murrelet abundance and breeding activity at Naked Island, PWS, and Kachemak Bay, Alaska, before and after the Exxon Valdez oil spill. Pages 770-784 In: S.D.

Lethcoe, J., and N. Lethcoe. 2001. A history of PWS, Alaska, 2nd edition. PWS Books, Valdez, AK.

Liebezeit, J. R., and T. L. George. 2002. A summary of predation by corvids on threatened and endangered species in California and management recommendations to reduce corvid predation. California Department of Fish and Game, Sacramento, CA.

MacDonald, S.O. 2003. The amphibians and reptiles of Alaska: a handbook. Alaska Natural Heritage Program, Univ. of Alaska. <http://aknp.uaa.alaska.edu/herps/title.htm> Accessed 15 Mar 2012.

Macdonald, D. W., and L. A. Harrington. 2003. The American mink: the triumph and tragedy of adaptation out of context. New Zealand Journal of Zoology 30:421-441.

Moore, N. P., S. S. Roy, and A. Helyar. 2003. American mink (*Mustela vison*) eradication to protect ground-nesting birds in the Western Isles, Scotland, United Kingdom. New Zealand Journal of Zoology 30:443-452.

National Wildlife Research Center. 2008. Vertebrate control products. *in* Wildlife damage management. U.S. Department of Agriculture, Animal and Plant Health Inspection Service. <http://www.aphis.usda.gov/wildlife_damage/nwrc/registration/control_products.shtml> Accessed 12 February 2012.

Nordström, M., J. Högmander, J. Nummelin, J. Laine, N. Laanetu, and E. Korpimäki. 2002. Variable responses of waterfowl breeding populations to long-term removal of introduced American mink. Ecography 25:385-394.

Nordström, M., J. Högmander, J. Laine, J. Nummelin, N. Laanetu, and E. Korpimäki. 2003. Effects of feral American mink removal on seabirds, waders and passerines on small islands in the Baltic Sea. Biological Conservation 109:359-368.

Nordström, M., and E. Korpimäki. 2004. Effects of island isolation and feral American mink removal on bird communities on small islands in the Baltic Sea. Journal of Animal Ecology 73:424-433.

Oakley, K. L., and K. J. Kuletz. 1979. Summer distribution and abundance of marine birds and mammals in the vicinity of Naked Island, PWS, Alaska, in 1978, and aspects of the reproductive ecology of the Pigeon Guillemot. U.S. Fish and Wildlife Service, Office of Special Studies, Anchorage, AK.

Oakley, K. L., and K. J. Kuletz. 1994. Population, reproduction, and foraging of pigeon guillemot at Naked Island, Alaska, before and after the Exxon Valdez oil spill. Exxon Valdez Oil

Spill State Federal Natural Resources Damage Assessment Final Reports: Bird Study No. 9. Unpubl. report, U.S. Fish and Wildlife Science. Anchorage, AK.

Oakley, K. L., and K. J. Kuletz. 1996. Population, reproduction, and foraging of Pigeon Guillemot at Naked Island, Alaska, before and after the *Exxon Valdez* oil spill. American Fisheries Society Symposium 18:759-769.

Paul, T. 2009. Game transplants in Alaska. Technical bulletin No. 4, second edition. Alaska Department of Fish and Game, Juneau.

Piatt, J. F., and R. G. Ford. 1996. How many seabirds were killed by the *Exxon Valdez* oil spill? American Fisheries Society Symposium 18:712-719.

Rice, R.B. Spies, D. A. Wolfe, and B.A. Wright (eds.), Exxon Valdez Oil Spill Symposium Proceedings. American Fisheries Society No. 18.

Sanger, G. A., and M. B. Cody. 1994. Survey of pigeon guillemot colonies in Prince William Sound, Alaska. U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, AK.

Schmutz, J.A. 2009. Stochastic variation in avian survival rates: life-history predictions, population consequences, and the potential responses to human perturbations and climate change. Environmental and Ecological Statistics 3:441-461.

Southcentral Federal Subsistence Regional Advisory Council. 2011. Southcentral Federal Subsistence Regional Advisory Council, March 10, 201 public meeting proceedings transcript, Volume II, Anchorage, AK.

USDA Forest Service. 2002. Revised land and resource management plan. Alaska Region Chugach National Forest, Anchorage, AK.

USDA Forest Service. 2005. Western Sound Landscape Assessment. USDA Forest Service, Region 10, Alaska.

USDA Forest Service. 2010. Third amended programmatic agreement among the USDA Forest Service, Alaska Region, the Advisory Council on Historic Preservation, and the Alaska State Historic Preservation Officer regarding Heritage Program Management on National Forests in the State of AK. USDA Forest Service, Region 10, Alaska.

UJSDA Forest Service, 2012. Forest Service Handbook (FSH) 2709.11, USDA Forest Service < http://www.fs.fed.us/cgi-bin/Directives/get_dirs/fsh?2709.11> Accessed 4 April 2013.

U.S. Census Bureau. 2010 Census., People and Households. < http://www.census.gov/people/> Accessed 8 January 2011.

USFWS. 2013. Pigeon Guillemot Restoration Project: Cultural Resource Reconnaissance Survey of Proposed Campsites. Report to USDA Forest Service, Chugach National Forest, prepared by Tiffany Curtis, USFWS Archaeologist.

APPENDIX A: ONLINE RESOURCES

Alaska Department of Fish and Game. 2006. Our wealth maintained: a strategy for conserving Alaska's diverse wildlife and fish resources. Alaska Department of Fish and Game, Juneau. < http://www.adfg.alaska.gov/index.cfm?adfg=species.wapabout>

Bixler, K. S. 2010. Why aren't pigeon guillemot in PWS, Alaska recovering from the *Exxon Valdez* Oil Spill? Thesis. Oregon State University, Corvallis, USA. <http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/19472/BixlerKirstenS2010.pdf?sequence=1#page=92>

Golet, G. H. 1999. The breeding and feeding ecology of pigeon guillemot at Naked Island, PWS, Alaska. Exxon *Valdez* Oil Spill Restoration Project Annual Report, Restoration Project 98 163F, U.S. Fish and Wildlife Service, Anchorage, AK. < http://www.evostc.state.ak.us/Files.cfm?doc=/Store/AnnualReports/1998-98163F-Annual.pdf&>

Heller, E. 1910. Mammalogy of the 1908 Alexander Alaska expedition. Univ. of CA. Publications in Zoology 5(11):321-360. <https://play.google.com/store/books/details?id=GbcrAAAAYAAJ&rdid=book-GbcrAAAAYAAJ&rdot=1>

Kuletz, K. J. 1998. Pigeon guillemot, *Cepphus columbia*. Restoration Notebook, *Exxon Valdez* Oil Spill Trustee Council. Anchorage, AK. <http://www.evostc.state.ak.us/universal/documents/publications/restorationnotebook/rn_pguillem.pdf>

Roby, D. and A. K. Hovey. 2002. Pigeon guillemot restoration research at the Alaska SeaLife Center. *Exxon Valdez* Oil Spill Restoration Project 01327-1 Final Report. U.S. Geological Survey - Oregon Cooperative Fish and Wildlife Research Unit, Oregon State University, Corvallis. <http://www.evostc.state.ak.us/Files.cfm?doc=/Store/FinalReports/2001-01327CLO-Final.pdf&>

Sanger, G. B., and M. B. Cody. 1994. Survey of pigeon guillemot colonies in PWS, Alaska. *Exxon Valdez* Oil Spill Restoration Project 93034 Final Report. U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, AK. < http://www.evostc.state.ak.us/pdf/final_reports/034.pdf>

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 50^{th} and 950^{th} 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).

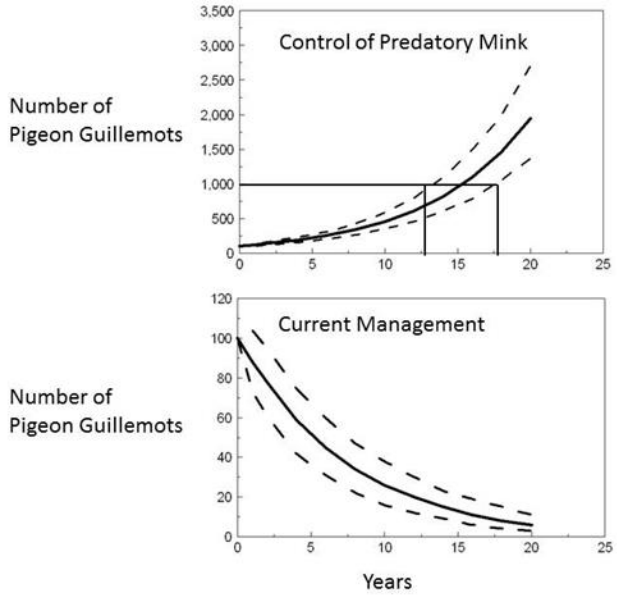


Figure 1. Results of stochastic Leslie matrix modeling of the changes in the pigeon guillemot population at the Naked Island group for two alternatives: No Action – Current Management and Proposed Action – Control of Predatory Mink (Fleming and Cook 2010). Across the two model scenarios, guillemot productivity 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.	