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Restoring Wildlife Habitat on Rat Island: Environmental Assessment

Restoring Wildlife Habitat on Rat Island

Alaska Maritime National Wildlife Refuge
Aleutian Islands Unit

Environmental Assessment

U.S. Fish and Wildlife Service

Alaska Maritime National Wildlife Refuge

December 2007

Executive Summary

Restoration of natural ecosystem function on Rat Island promises to re-establish native seabirds and other native species, thus returning this wilderness island to a healthy natural community. This restoration cannot occur until the island is cleared of the invasive non-native rats that now dominate the living community.

Introduced non-native species are a leading cause of extinctions in island communities worldwide. Increasingly, land managers are removing introduced species to aid in the restoration of native ecosystems. Rats are responsible for 40-60% of all recorded bird and reptile extinctions worldwide. Given their widespread successful colonization on islands and the resulting impact to native species, introduced rats are identified as key species for eradication.

Most of the Aleutian Islands lying within the Alaska Maritime National Wildlife Refuge (NWR) provide important breeding habitat for seabirds, including many for which the Aleutians provide a substantial portion of their worldwide range. Norway rats are established on at least 10 Aleutian islands or island groups, and the diversity and numbers of breeding seabirds occurring on those islands are now conspicuously low. Rat-caused modifications to other components of the island ecosystems (e.g., other birds, plants, and invertebrates) are also evident.

The restoration of Aleutian ecosystems through introduced predator eradications has long been identified as a priority for Alaska Maritime NWR, and the initial efforts have been directed to removing introduced foxes. The focus now has turned to rats. This Environmental Assessment evaluates the environmental effects of eradicating introduced non-native rats from Rat Island, located in the central Aleutians within Alaska Maritime NWR. The consequences of the No Action alternative are addressed along with the Preferred Alternative (Proposed Action hereafter) which is to eradicate rats from Rat Island employing an aerial broadcast of rodenticide, and subsequently maintaining the island in rodent-free status. The intent of the Proposed Action is to facilitate the restoration of the natural island ecosystem by improving habitat quality for native species.

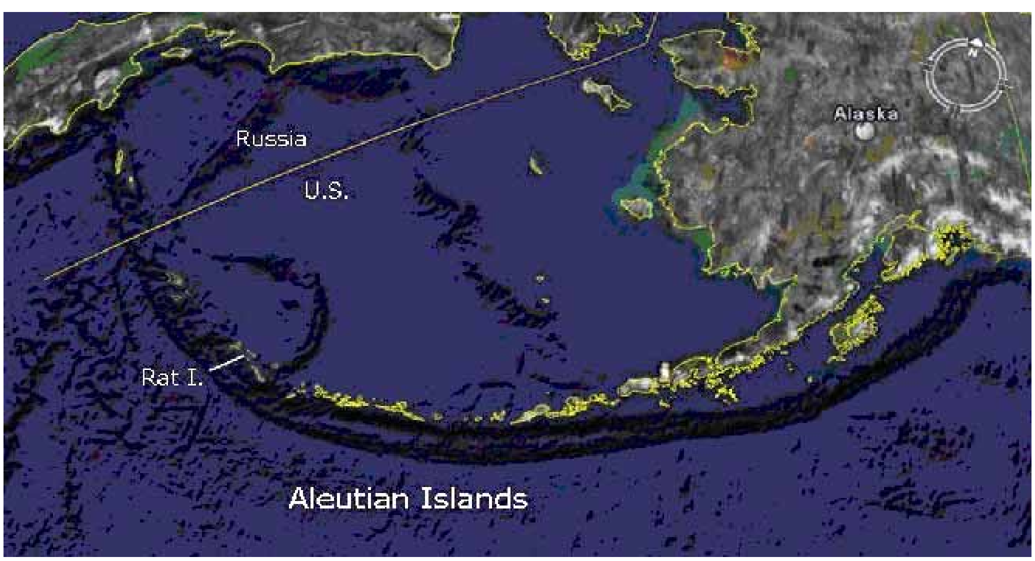

Figure 1. Rat Island is located in the central Aleutian Islands.

Public Comment Period:

December 12, 2007 through January 11, 2008

The Alaska Maritime National Wildlife Refuge is seeking public comment on this Environmental Assessment which proposes the restoration of native species and natural ecosystem function on Rat Island through the eradication of invasive rats. A 30 day comment period opens December 12, 2007. Written comments via fax, mail or email are requested by the close of business January 11, 2008.

The document is available online at **http://alaskamaritime.fws.gov/news.htm.** Reading copies have been placed in the public libraries of the communities of Unalaska, Homer and at the US Fish and Wildlife Service Alaska Regional Office reception desk located at 1011 E. Tudor Road in midtown Anchorage. If you need a paper copy please contact the Refuge.

Following the closing of the comment period, the Service will examine the comments and determine whether the Environmental Assessment action warrants a "Finding of No Significant Impact". If a Finding of No Significant Impact is warranted, plans will proceed for rat eradication on Rat Island.

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Table of Contents

List of Figures and Tables

FIGURES

TABLES

List of Acronyms used in this document

AAC	Alaska Administrative Code
ACMP	Alaska Coastal Management Program
ADF&G	Alaska Dept of Fish and Game
AIU	Aleutian Islands Unit (of the Alaska Maritime NWR)
AMNWR	Alaska Maritime National Wildlife Refuge (Alaska Maritime NWR)
ANCSA	Alaska Native Claims Settlement Act
ANILCA	Alaska National Interest Lands Conservation Act
APHIS	Animal Plant Health Inspection Service, USDA
AS	Alaska Statutes
BGEPA	Bald and Golden Eagle Protection Act
BIA	Bureau of Indian Affairs
CCP	Comprehensive Conservation Plan
CEQ	US Council on Environmental Quality
CFR	Code of Federal Regulations
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DEC	Alaska Dept. of Environmental Conservation
DCED	Alaska Dept. of Commerce, Community and Econ. Development
DGPS	Differential global positioning system
DNR	Alaska Dept. of Natural Resources
DOI	Department of Interior
DOT	Alaska Dept. of Transportation and Public Facilities
DPS	Distinct population segment
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	US Environmental Protection Agency
ESA	Endangered Species Act
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding of No Significant Impact
FWS	US Fish and Wildlife Service
GPS	Global positioning system
LD50	Dosage of a toxin that is lethal to 50% of animals in a laboratory test
MBTA	Migratory Bird Treaty Act
MMPA	Marine Mammal Protection Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NWR	National Wildlife Refuge (as in Alaska Maritime NWR)
OPMP	Alaska DNR, Office of Project Management and Permitting
UNESCO	United Nations Educational, Scientific, and Cultural Organization
USC	United States Code
USDA	United States Department of Agriculture
WWII	World War II

1. Purpose & Need

Figure 2. Rat Island, Alaska   Google Earth Satellite Image

1.1. Introduction

This environmental assessment (EA) evaluates the environmental effects of one alternative other than the No Action alternative for rat eradication on Rat Island, a wilderness area, within the Alaska Maritime National Wildlife Refuge (Alaska Maritime NWR or Refuge). The EA will be used by the U.S. Fish and Wildlife Service (FWS) to solicit public involvement and to determine whether the implementation of the alternatives would have a significant impact on the quality of the human environment. This EA is part of the FWS decision-making process in accordance with the National Environmental Policy Act (NEPA), as amended and its implementing regulations.

1.2. Purpose of Action

The purpose of the Proposed Action is to eradicate introduced non-native rats from Rat Island and maintain its rodent-free status, which will facilitate the restoration of the natural island ecosystem and improve habitat quality for native species.

1.3. Need for Action

1.3.1. Introduced Rats on the Alaska Maritime National Wildlife Refuge

Introduced non-native species are a leading cause of extinctions in island communities worldwide (World Conservation Monitoring Centre 1992). Increasingly, land managers are developing and implementing techniques for removing introduced species to aid in the restoration of native ecosystems. Rats living in close association, or commensally, with humans (the Norway rat *Rattus norvegicus*, black rat *R. rattus*, and Polynesian rat *R. exulans*) have been introduced to about 90% of the world's islands (Towns et al. 2006), and are responsible for 40-60% of all recorded bird and reptile extinctions globally (Atkinson 1985; Island Conservation analysis of World Conservation Monitoring Centre data). Given the widespread successful colonization of rats on islands and their impact on native species, rats are identified as key species for eradication (Howald et al. 2007).

Norway rats (and in one recorded case, the black rat) are established on at least 10 independent Aleutian islands or island groups within the Aleutian archipelago. The Aleutians, including many of the islands in Alaska Maritime NWR, provide breeding habitat for 26 species of seabirds (Gibson and Byrd 2007) including species and subspecies for which the Aleutians provide a substantial portion of their worldwide range. However, the diversity and numbers of breeding seabirds are conspicuously low on islands with an established population of introduced rats (Atkinson 1985; Ebbert and Byrd 2002; Major and Jones 2005). This phenomenon is consistent with worldwide observations of the devastating direct impacts of introduced rats on seabirds (Atkinson 1985; Towns et al. 2006; and see below for examples).

In the Aleutians, besides the indirect evidence of rat impacts cited above (i.e., absence of otherwise widespread species), there is direct observational and experimental evidence of rat predation on seabirds. For example, rat impacts on seabirds are documented for Kiska Island, where rats are preying on least (*Aethia pusilla*) and crested auklets (*A. cristatella*) (Major and Jones 2005). Food caches from rats near the Kiska auklet colony have been found to contain up to 150 auklet carcasses in a single cache (I.L. Jones, pers. comm.). Experiments in the Bay of Islands, located off Adak Island, indicated very high egg predation rates on artificial alcid nests, demonstrating that invasive rat impact to nesting seabirds can be severe and that the removal of the rat population has the potential to provide measurable increases in the nesting success of impacted seabirds (Buckelew et al. 2007a). Furthermore, recent research suggests that rat predation on nesting marine birds such as glaucous-winged gulls (*Larus glaucescens*) and black oystercatchers (*Haematopus bachmani*) might also indirectly alter intertidal community structure (Kurle 2005). Shorebirds and some seabirds forage heavily on intertidal invertebrate grazers, and are capable of significantly altering both the species assemblage and algal abundance of intertidal communities. Significant predation by rats on intermediate marine predators has shifted the intertidal community structure of islands with introduced rats (Kurle 2005; C. Kurle, pers. comm.). Other research on the Aleutians, which addressed the impacts of another seabird predator, arctic fox (*Alopex lagopus*), suggests that predation on seabirds also has the potential to broadly impact the terrestrial ecosystem through removal of marine-derived nutrients formerly supplied by seabirds (see Croll et al. 2005; Maron et al. 2006).

Rats are thought to have been introduced to Rat Island by shipwreck in the late 1700s (Black 1983). Other than these non-native invasive rats and non-native introduced fox, which were

removed from the island in 1984, no terrestrial mammals occur on Rat Island. Because the initial rat introduction was so long ago, the lack of baseline biological data from Rat Island before rats were introduced makes it difficult to determine the previous ecological condition of the island with great precision. Consequently, it is also difficult to precisely infer the ecological impacts of introduced rats on Rat Island specifically. The ecological impacts that rats have caused on Rat Island may have largely occurred soon after they were introduced, leaving the island ecosystem in an altered state for an extended period. However, the relative ecological similarity between neighboring islands in the Aleutians gives us clues to the former ecological state on Rat Island. Such a comparison reveals that Rat Island has a much lower abundance and diversity of breeding seabirds than other apparently similar Aleutian islands that are rat-free. Furthermore, the terrestrial vegetation on Rat Island is quite different than neighboring islands that have large seabird colonies and no rats (Byrd 1984, 1989; Croll et al. 2005). This evidence, when combined with the preponderance of evidence implicating rats in serious ecological damage on other temperate-climate and sub-polar islands worldwide, cast the presence of introduced rats on Rat Island as a serious threat to native species and natural ecosystem processes.

Figure 3. Map of Alaska Maritime National Wildlife Refuge

1.3.2. Impacts of Introduced Rats on Island Ecosystems in General

The most pronounced impact of introduced rats on island ecosystems is the extinction of endemic species of mammals, birds and invertebrates on islands throughout the world's oceans (Andrews 1909; Daniel and Williams 1984; Meads et al. 1984; Atkinson 1985; Hindwood 1940; Tomich 1986).

Even if species are not completely extirpated, rats can have negative direct and indirect effects on native species and ecosystem function. For example, comparisons of rat-infested and rodent-free islands, and pre- and post-rat eradication experiments, have shown that rats depressed the population size and recruitment of birds (Thibault 1995; Campbell 1991; Jouventin et al. 2003), reptiles (Bullock 1986; Cree et al. 1995; Whitaker 1973; Towns 1991), plants (Campbell et al. 1984; Pye et al. 1999) and terrestrial invertebrates (Ramsey 1978; Bremner et al. 1984). Rats are

known to cause disturbance to sensitive breeding seabirds, resulting in failed breeding attempts and higher susceptibility to predation by other species (Jouventin et al. 2003; Tomkins 1985). Rats also affect the abundance and age structure of intertidal invertebrates (Navarrete and Castilla 1993). Rats alter key ecosystem properties; for example, total soil carbon, nitrogen, phosphorous, mineral nitrogen, marine-derived nitrogen and pH are lower on invaded islands relative to rat-free controls (Fukami et al. 2006). Such changes are a result of indirect negative effects of rats mediated by the reduction in seabird populations – rat predation often drives seabird colonies to near-extirpation (Moller 1983; Atkinson 1985; McChesney and Tershy 1998), resulting in the loss of seabird-derived nutrients on islands (Fukami et al. 2006). Where rats co-exist with other predators (such as cats or predatory birds) the collective direct impact of introduced predators on seabirds is greater than the sum of the individual impacts because rats also act as a food resource to higher level predators when seabirds are absent from the islands (Atkinson 1985; Moors and Atkinson 1984).

In addition to preying on local seabird colonies, introduced rats feed opportunistically on plants, and alter the floral communities of island ecosystems (Campbell and Atkinson 2002), in some cases degrading the quality of nesting habitat for birds that depend on the vegetation. On Tiritiri Matangi Island, New Zealand, ripe fruits, seeds, and understory vegetation cover underwent significant increases after rats were eradicated from the island, indicating their previous impacts on the vegetation (Graham and Veitch 2002).

Each of the three species of introduced rats has been implicated in extinctions and changes in prey population structure. Although all rat species affect insular biota, due to their different natural histories each species has slightly different impacts. For example, of the three introduced rat species, the Norway rat tends to have the greatest impact on burrow-nesting seabirds, the black rat tends to prefer preying on tree-nesting birds, and the Polynesian rat appears to impact both types of nesters (Atkinson 1985). Consequently, the introduction of new *Rattus* species should be avoided, even to islands that already have introduced rats (Moors et al. 1992).

Figure 4: Norway rat on Rat Island 2007 Island Conservation

1.3.3. Eradication of Rats from Islands

Removal of introduced apex predators such as foxes and rats from islands can reverse the cascading detrimental ecosystem effects initiated by these species and allow for the recovery of seabirds and other impacted species (e.g. the Aleutian cackling goose, *Branta canadensis leucoparia,* which was removed from the Endangered Species list in 2001 after introduced foxes were removed from critical habitat in the Aleutian Islands). The restoration of Aleutian ecosystems through introduced predator eradications has long been identified as a priority for Alaska Maritime NWR in its Comprehensive Conservation Plan (USFWS1988) and management efforts (Murie 1959; Bailey 1993).

There have been at least 318 successful island rat eradications worldwide, from the deep tropics to high latitudes (Howald et al. 2007). The fundamental methodology that all but one of these eradications used was the delivery of bait containing a rodenticide into every potential rat territory on the island. Bait was typically delivered during the time of year when rats were relatively food deprived, as indicated by annual resource-dependent population declines. Depending on island topography and size, climate, native species assemblages, operational logistics and other factors, these eradication projects applied bait using broadcast or bait stations or both. Bait stations were typically laid out on a grid pattern. Bait broadcast was by hand or using spreaders suspended under a helicopter (Howald et al. 2007).

Island ecosystems worldwide have repeatedly demonstrated major positive changes as a result of rat eradication. Some examples include:

- Whale Island in New Zealand, where the breeding success of grey-faced petrels (*Pterodroma macroptera* ssp. *gouldi*) increased after rat eradication (Imber et al. 2000)
- Mokoli'i Islet, offshore of the Hawai'ian island of Oahu, where breeding success in wedge-tailed shearwaters (*Puffinus pacificus*) increased after rat eradication (D. Smith, pers. comm.)
- Anacapa Island, off the coast of southern California, where the number of breeding attempts and proportion of successful breeding attempts in Xantus's murrelets (*Synthliboramphus hypoleucus*) have both increased since rats were eradicated (Whitworth et al. 2005)
- Breaksea Island in New Zealand, where seedling numbers of numerous native plants increased after rat eradication (Allen et al. 1994)

1.4. Scope of Analysis

The Proposed Action is focused on methods for the eradication of introduced rats from Rat Island. Other actions that may occur in the future as a result of the Proposed Action will not be analyzed in detail in this document. The potential implications of the Proposed Action in relation to future actions will be discussed in the Cumulative Impacts sections of the Environmental Consequences section (Chapter 4). This analysis will not focus on restoration actions on Rat Island other than the eradication of introduced rats.

1.5. AUTHORITY FOR ACTION & REGULATIONS GOVERNING ACTION

1.5.1. Authorities for Taking Action

The Proposed Action is authorized by the Federal laws, regulations, guidelines, and Presidential Executive Orders listed below.

1.5.1.1. U.S. Fish and Wildlife Service statutes, policies, and plans

When the **Alaska National Interest Lands Conservation Act (ANILCA) of 1980** established Alaska Maritime NWR in its current form, Section 303 (1)(b) established the following purposes (among others) for the establishment and future management of the Refuge:

- "To conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to marine mammals, marine birds and other migratory birds, [and] the marine resources upon which they rely…; [and]
- "To fulfill the international treaty obligations of the United States with respect to fish and wildlife and their habitats."

The **Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531-1544, 87 Stat. 884), as amended,** directs the FWS to conserve ecosystems upon which threatened and endangered species depend. Under the Act, the National Marine Fisheries Service (NMFS) and the FWS publish lists of endangered and threatened species. Section 7 of the Act requires that Federal agencies consult with these two agencies to minimize the effects of Federal actions on endangered and threatened species. The Refuge will conduct Section 7 consultations with the appropriate entities.

The **Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j, not including 742 d-l, 70 Stat. 1119), as amended,** gives general guidance which can be interpreted to include alien species control, that requires the Secretary of the Interior take steps "required for the development, management, advancement, conservation, and protection of fish and wildlife resources."

National Wildlife Refuge System Improvement Act of 1997. The Improvement Act which amends the National Wildlife Refuge System Administration Act of 1966, serves as an "Organic Act for the Refuge System" and provides comprehensive legislation on how the Refuge System should be managed and used by the public. The Improvement Act:

- Identified a new mission statement for the Refuge System.
- Established six priority public uses (hunting, fishing, wildlife observation and photography, environmental education and interpretation).
- Emphasized conservation and enhancement of the quality and diversity of fish and wildlife habitat.
- Stressed the importance of partnerships with Federal and State agencies, other organizations, and the general public.
- Mandated public involvement in decisions on the acquisition and management of refuges.

- Required, prior to acquisition of new refuge lands, identification of existing compatible wildlife-dependent uses that would be permitted to continue on an interim basis pending completion of comprehensive conservation planning.

The Improvement Act establishes the responsibilities of the Secretary of the Interior for managing and protecting the Refuge System; requires a Comprehensive Conservation Plan for each refuge by the year 2012; and provides guidelines and directives for the administration and management of all areas in the Refuge System, including wildlife refuges, areas for the protection and conservation of fish and wildlife threatened with extinction, wildlife ranges, game ranges, wildlife management areas, or waterfowl production areas.

Comprehensive Conservation Plan/Environmental Impact Statement/Wilderness Review for the Alaska Maritime National Wildlife Refuge. This congressionally mandated plan was completed in 1988 and provides the overall general guidance for managing the Alaska Maritime National Wildlife Refuge.

The **USFWS policy for maintaining biological integrity and diversity and environmental health (601 FW 3, 2001)**, directs refuges to “prevent the introduction of invasive species, detect and control populations of invasive species, and provide for restoration of native species and habitat conditions in invaded ecosystems.” 601 FW 3 further directs refuge managers to “develop integrated pest management strategies that incorporate the most effective combination of mechanical, chemical, biological, and cultural controls while considering the effects on environmental health.”

1.5.1.2. Executive Orders

Presidential Executive Order 13112 on Invasive Species (February 3, 1999): Section 2(a)(2), on Federal agency duties, states: “Each Federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law, subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them.”

Executive Order 13112 defines “invasive species” as an alien species [a species that is not native with respect to a particular ecosystem] whose introduction does or is likely to cause economic or environmental harm or harm to human health.”

1.5.2. Regulatory Framework

The Proposed Action would be carried out in compliance with the Federal and state laws and regulations listed below.

1.5.2.1. Federal laws

National Environmental Policy Act (NEPA) of 1969, as amended, and including all relevant subsequent guidelines and regulations

Endangered Species Act (ESA) of 1973, as amended

Marine Mammal Protection Act (MMPA) of 1972, as amended

Migratory Bird Treaty Act (MBTA) of 1918, as amended

Bald and Golden Eagle Protection Act (BGEPA) of 1940

National Historic Preservation Act (NHPA) of 1966, as amended)

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) of 1947, as amended

Clean Water Act (CWA), as amended (formally, the Water Pollution Control Act, USC 33 1251 et seq.)

Coastal Zone Management Act (CZMA) of 1972, as amended

Archaeological Resources Protection Act of 1979, as amended, 16 USC 470

Wilderness Act of 1964

Alaska National Interest Lands Conservation Act (ANILCA), 1980

1.5.2.2 Alaska state laws and policies

1.5.2.2.1 Alaska Board of Game

Alaska Statute (AS) 16.05.255 authorizes the Board of Game to adopt regulations it considers advisable in accordance with AS 44.62 (Administrative Procedure Act) for the following actions relating to game including rats and other rodents:

> (2) establishing open and closed seasons and areas for the taking of game;
> (3) establishing the means and methods employed in the pursuit, capture, taking, and transport of game;…
> (5) classifying game as . . . big game animals, fur bearing animals, predators, or other categories;
> (6) methods, means, and harvest levels necessary to control predation and competition among game in the state;

> (7) watershed and habitat improvement, and management, conservation, protection, use, disposal, propagation, and stocking of game;
> (8) prohibiting the live capture, possession, transport, or release of native or exotic game or their eggs;…
> (11) taking game to ensure public safety; and
> (12) regulating the activities of persons licensed to control nuisance wild birds and nuisance wild small mammals.

1.5.2.2.2. Alaska Department of Fish and Game (ADF&G)

AS 16.05.940(19) defines rats as “game,” and AS 16.05.330 requires a hunting license for the taking of game. This means a person killing rats by any means (poison, traps, shooting, sticky boards, etc.) needs a hunting license. Other provisions relating to rats are found in the following state wildlife regulations.

5 Alaska Administrative Code (AAC) 92.990(a)(52) – Defines as Deleterious Exotic Wildlife any Muridae rodent that is “unconfined or unrestrained.”

5 AAC 92.990(a)(73) – Effective September 13, 2007, defines as Nuisance Wildlife any Deleterious Exotic Wildlife that is feral, and any animal that invades or comes to occupy a dwelling, vessel, vehicle, structure, or storage container; causes property damage, or is an invasive or introduced nonnative species that poses immediate or long-term threats to human health, safety, or property or to native wildlife, wildlife health, or habitat.

5 AAC 92.990(a)(76) – Effective September 13, 2007, defines: “invasive species” as a nonnative species whose introduction does or is likely to cause economic or environmental harm or harm to human health; this includes all of the species listed in 5 AAC 92.990(52); and “Muridae rodent” as including true mice and rats, gerbils, and their relatives.

5 AAC 85.075 – Establishes no bag limits/no closed season for Deleterious Exotic Wildlife.

5 AAC 85.075 (b) – Allows take by any means (except those prohibited in 5 AAC 92.080) for Deleterious Exotic Wildlife.

5 AAC 92.080(2) – Requires written consent from the Board of Game to take wildlife using poisons; effective September 13, 2007, the use of poisons for taking deleterious exotic wildlife within a building, vessel, port, vehicle, or aircraft, is authorized without board approval when using Alaska Department of Environmental Conservation registered pesticides in their approved manner.

5 AAC 92.029 – Allows possession of specifically listed animals without a permit but prohibits their release into the wild; requires a permit for possessing all other rodent species/subspecies. [Note: Rodents that are allowed with a permit include white rats (*R. norvegicus* var. *albinus*); white, waltzing, singing, shaker, and piebald mice (*Mus musculus* vars.); fat-tailed gerbil (*Pachyuromys duprasi*); gerbil (*Gerbillus* spp.); hamster (golden) (*Mesocricetus auratus*); chinchilla (*Chinchilla laniger*); cavy (*Cavia aperea*); and guinea pig (*Cavia porcellus*)]. As of

September 13, 2007, includes rats and mice in the list of Deleterious Exotic Wildlife that can be captured or destroyed if found feral or unrestrained by an owner.

5 AAC 92.230 – Effective September 13, 2007, a person may not intentionally feed deleterious exotic wildlife (including rats and mice), or negligently leave human food, pet food, or garbage in a manner that attracts these animals. However, this prohibition does not apply to use of bait for trapping Deleterious Exotic Wildlife.

5 AAC 92.141 – (a) Effective September 13, 2007, it is unlawful for the owner or operator of a vessel, vehicle, aircraft, structure being translocated, or other means of conveyance to knowingly or unknowingly harbor live Muridae rodents, or to enter Alaska (including Alaskan waters) while knowingly or unknowingly harboring live Muridae rodents. (b) It is unlawful for an individual to release to the wild any live Muridae rodent. (c) It is unlawful for the owner or operator of a facility to knowingly or unknowingly harbor live Muridae rodents. The owner or operator of a harbor, port, airport, or food processing facility in which live Muridae rodents have been found shall develop and implement an ongoing rodent response and eradication or control plan.

5 AAC 92.210 – Allows Deleterious Exotic Wildlife to be used as food for dogs or furbearers or for bait.

ADF&G Invasive Species Program released an invasive rodent management plan in October 2007 aimed at preventing and removing rat infestations in the state: Wildlife and People at Risk: A Plan to Keep Rats Out of Alaska (Fritts 2007).

1.5.2.2.3. Alaska Department of Health and Social Services, Division of Public Health, Section of Epidemiology

Under 7 AAC 27.020, the Department of Health and Social Services can take actions to control rodents or other animals found to carry diseases transmissible to humans. The Department may, alone or in cooperation with federal or other state agencies, investigate the circumstances and extent of the threat, and quarantine or euthanize the diseased animals to protect human health.

1.5.2.2.4. Alaska pesticide-related laws and responsible entities

A suite of other state laws is designed to protect humans and non-target organisms against the adverse effects of pesticides (Alaska State Pesticide Laws 18 AAC 90). Agencies with responsibility for administering these laws in Alaska include: the Alaska Department of Environmental Conservation; Alaska Department of Transportation and Public Facilities; Alaska Department of Commerce, Community, and Economic Development; and the Alaska Department of Natural Resources, Office of Project Management and Permitting, Coastal Zone Management Program. For more information on Alaska pesticide terminology and laws, see: http://www.dec.state.ak.us/eh/pest/index.htm (state laws); and http://www.dec.state.ak.us/regulations/pdfs/90mas.pdf (state pesticide regulations).

Specific state permitting requirements for Alaska Coastal Zone Management Act consistency determination and State Historic Preservation Act consultation will be conducted simultaneous

with the public comment period on this EA. Prior to implementing the Proposed Action, Alaska Maritime NWR will request a state permit for aerial application of rodenticide from ADEC, as well as renew our Collections and Wildlife Nuisance permits with ADF&G.

1.6. PURPOSE OF THIS ANALYSIS

The analysis is composed of four parts:

1. The purpose of the Proposed Action and the need for action are described;
2. The reasonable ways to meet the purpose of the action are discussed, including a description of the Proposed Action as well as a description of the No Action alternative for comparison purposes;
3. The natural and physical environment potentially affected by the action is described; and
4. The potential for a range of environmental impacts as a result of the action is analyzed, quantified as much as possible, and described.

Using this document, the decision maker who has authority to approve the Proposed Action should be able to make an informed decision as to how best to meet the purpose of the action, which action is environmentally preferable, whether or not the Proposed Action may have significant environmental impacts, and to address any unresolved environmental issues.

2. Alternatives

Figure 5. Coastal environment on Rat Island Ebbert 2001

2.1. ALTERNATIVE A: NO ACTION

Analysis of the No Action alternative is required under NEPA. Rats will not be eradicated from Rat Island under this alternative. The other ongoing invasive species management programs in the Aleutians, including a response program for rodents escaping from grounded ships and the Aleutians-wide introduced fox eradication program, will be maintained based on previous agency decision documents. Any other related programs or projects, now or in the future, decided and implemented under different authority will also be maintained. However, the presence and negative ecosystem impacts of rats is counter to the establishing purpose of Alaska Maritime NWR and other FWS policies for conservation and restoration of natural biodiversity; these negative ecosystem impacts will continue under the No Action alternative. Removal of introduced foxes from some of the islands with rats will have only limited effectiveness as long as rats remain. Additionally, the value of Rat Island to wildlife and its character as a wilderness area will continue to be compromised.

2.2. ALTERNATIVE B (PROPOSED ACTION): INTRODUCED RAT ERADICATION FROM RAT ISLAND, AERIAL BAIT BROADCAST TECHNIQUE

2.2.1. Summary of Actions

- Eradication of rats from Rat Island to facilitate restoration of the island ecosystem;

- Removal techniques based on successful island rat eradications elsewhere in the US and globally;
- Pressed-grain bait pellets (1 – 5 g [0.04 – 0.1 oz]), containing 25 ppm brodifacoum applied at the minimum quantity necessary to achieve rat eradication, according to Environmental Protection Agency (EPA) approved pesticide label instructions;
- Bait applied to every potential rat territory on Rat Island and all vegetated offshore rocks and islets within 2000 m (6562 ft);
- Whole-island coverage attempted using helicopters and specialized bait-spreading buckets;
- Supplemental hand application of bait pellets on land adjacent to coastal areas and overhanging cliffs, where automated helicopter spreading will be limited or is not feasible;
- Limited supplemental installation of bait stations;
- All bait application activities to be conducted under the supervision of a Pesticide Applicator certified by the State of Alaska.

2.2.2. Description of Action Operations

The purpose of eradicating rats from Rat Island is to conserve, protect and enhance habitat for native wildlife species, especially nesting habitat for seabirds, and to restore the biotic integrity of the island. The overarching goal in a successful rodent eradication is to ensure the delivery of a lethal dose of toxicant to every rodent on the island. This Proposed Action presents a detailed analysis of a rodenticide, delivered by aerial broadcast, as the primary method for eradicating rats from Rat Island. A list of other methods of rat removal that have been used elsewhere or suggested in the past, but are considered to be ineffective or inappropriate for Rat Island, are discussed in Section 2.3 below.

2.2.2..1 Timing

The timing of an aerial broadcast rodent eradication is a critical factor in its ultimate success. Timing an aerial broadcast to maximize the probability of eradication success is dependent on three major factors: 1) the local population biology of rats; 2) the local population biology and migratory patterns of animals other than rats that may be vulnerable to rodenticide exposure; and 3) local weather conditions and seasonal patterns that would affect the feasibility of conducting operations.

Biology of rats: Rat eradications from islands are more likely to be successful if they take place when the rat population is declining in response to annual resource declines. At this time, rodents are typically more food stressed and therefore more likely to eat the bait presented. The probability of success is also increased if bait application takes place when rats are not breeding. During peak breeding season, it is more likely that juvenile rats exist that are too young to leave the nest during bait application. These juvenile rats could mature and emerge from the nest after bait becomes scarce, and survive the eradication attempt. Population monitoring of rats on the Aleutian Islands indicates that the most favorable time window for eradication is between late fall and early spring:

- No pregnant female rats have been detected between November and March (Dunlevy and Scharf 2006), indicating the lowest probability that juvenile rats would be in burrows, thereby avoiding exposure and compromising efficacy, during any bait application in that timeframe (USFWS unpubl. data; Witmer 2005).
- Rat populations in the Aleutians are at their lowest point between February and April, and at their highest in June and July (Dunlevy and Scharf 2006).
- The lowest diversity and abundance of alternative foods for rats occurs between December and March (Dunlevy and Scharf 2006).

Seasonal sensitivities of native wildlife: Effects of the activities associated with rat eradication (e.g., helicopter operations, non-target impacts associated with rodenticide application) on birds, marine mammals and potentially on anadromous fish would be reduced by avoiding the breeding seasons.

For birds, most nesting occurs between April and September and all nesting is over by early to mid-September (see Gibson and Byrd 2007).

Specific timing considerations for marine mammals follow:

- The reproductive period (when pups are born) for Steller sea lions (*Eumetopias jubatus*) is generally late May through early July, with a peak in the second and third weeks of June (Pitcher and Calkins 1981; Gisiner 1985). Pups stay on land for about 2 weeks after which they spend increasing time in nearshore marine waters until they begin to disperse from rookeries to haul-outs with females at about 2.5 months of age (Raum-Suryan et al. 2004; Maniscalco et al. 2002, 2006). Therefore, in the Aleutian Island area, assuming most pupping is done by the last week of June, dispersal should occur by mid-September.
- For harbor seals (*Phoca vitulina*), there are two periods of relatively high activity on islands; pupping occurs on land during May-June and molting occurs on land August-September (Jemison and Kelly 2001; Daniel et al. 2003).
- Although northern sea otters (*Enhydra lutris kenyoni*) may have pups at any time of the year, their peak period of production is spring and summer (Kenyon 1969). Consequently, the number of small pups in the population would be relatively low in fall and winter (Pitcher and Calkins 1981; Kurle and Worthy 2001, Burns 1970; Estes 1990).

Conducting aerial bait application operations after marine mammal breeding and molting is complete reduces the potential for disturbance to these species during the sensitive periods of breeding, pup rearing, and molting.

No anadromous fish streams were identified on Rat Island during statewide surveys (Johnson and Weiss 2007), and no anadromous fish were found in the small island streams in 2007 (S. Buckelew, pers. comm.). Where anadromous salmonid species occur elsewhere in the Aleutian Islands, their entrance into freshwater bodies for spawning typically occurs between late summer and late fall (Palmer 1995; National Marine Fisheries Service 2005), depending on the species.

Seasonal logistics considerations: Winter working conditions in the central Aleutians introduce safety issues for the field crews and project efficiency. Also winter adds potential complications of snow and freezing temperatures which could affect bait availability. Starting in late fall, the strengthening of the Aleutian low pressure system begins to generate frequent severe storm

events. By November, temperatures can fall below freezing causing "white-out" conditions and snow accumulation during storms, and these conditions can continue throughout the winter (see Armstrong 1971; Alaska Ocean Observing System website). Although it is possible that persistent ground-covering snow may begin on Rat Island in some years as early as October, it is more likely that a major portion of Rat Island will be covered by snow in March and April. The effectiveness of aerial application of brodifacoum on top of snow cover to eradicate island rats is unknown (J. Parkes, pers. comm.).

Synthesis of timing considerations: No specific range of dates for the eradication is ideal from all standpoints. For personnel safety and project efficiency, the ideal operational window would likely be spring or summer. However, it is unreasonable to plan aerial bait application operations at this time because rat populations are growing rapidly, and alternative food sources are widely available. Furthermore, spring and summer are the periods when disturbance to native wildlife would likely be highest. We conclude that the most reasonable time period to conduct bait application operations on Rat Island is outside the breeding period for most species (April to mid-September), but before the onset of winter storms and snow accumulation on the ground.

The actual dates of the application window for the Proposed Action will not be determined until project leaders can ascertain, with reasonable certainty, the anticipated seasonal patterns discussed above for that particular year. Bait broadcast will be completed within a 45-day window, allowing for anticipated weather contingencies.

2.2.2.2. Project staging

Field personnel will visit Rat Island during the summer and will install temporary infrastructure and storage sites. These will include:

- A camp site capable of supporting 20 people for up to seven weeks;
- Three bait staging areas, where bait will be contained in up to 200 wooden storage units at each staging area; and
- A fuel storage site that will comply with all appropriate safety standards and regulations.

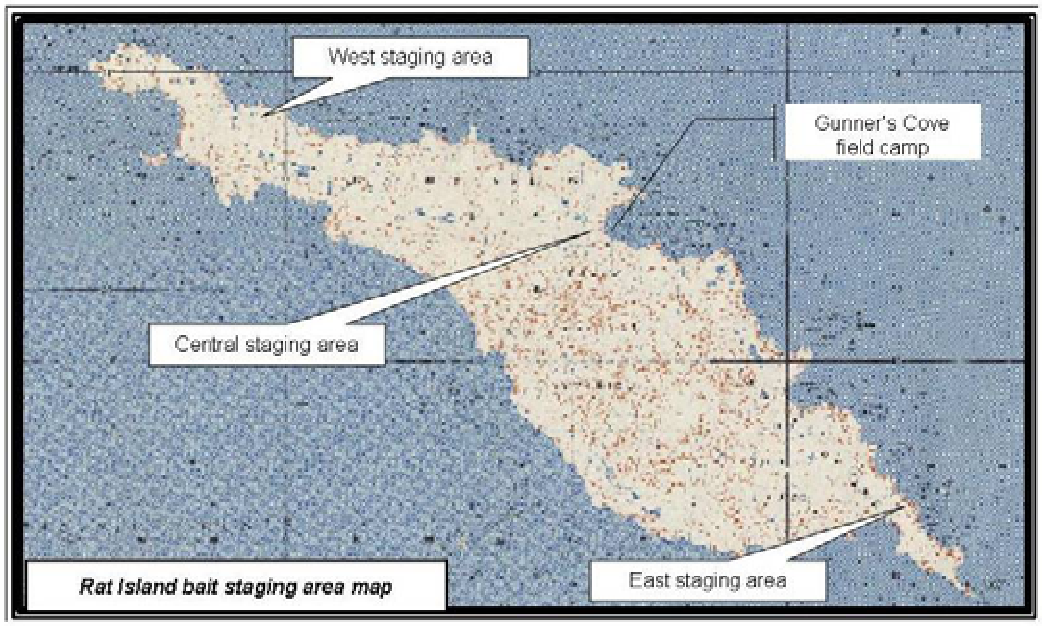

Figure 6. Proposed Rat Island field camp and staging areas

Additional material may be brought to the island at that time and staged for the fall application of bait. Helicopters will deliver most of the necessary materials to each site on the island. Staging procedures in summer will be conducted using a helicopter capable of lifting a 700 kg (1,543 lb) payload. Helicopter operations during project staging will be localized to discrete flight paths and landing sites, servicing the camp, three bait staging locations, and a fuel storage site. All of these flight paths will be routed to avoid or minimize helicopter disturbance to sensitive species such as hauled-out marine mammals and nesting waterfowl.

2.2.2.3. Introduction to broadcast bait application

Aerial broadcast of pelletized bait across an entire island in one or two concerted applications is becoming the common method of rodenticide delivery on large islands (Howald et al. 2007; Towns and Broome 2003). Aerially broadcasting bait is operationally preferable to bait stations when sections of a large target island are very steep or otherwise inaccessible to foot traffic (i.e., unsafe to hand-deliver bait), if the island is very large (reducing the practicality of hand broadcasting or the use of bait stations [Howald et al. 2007]), and/or if a regimen of regular foot traffic on the island would likely cause substantial ecosystem damage (through permanent trails, repeated disturbance to sensitive animals, and trampling of sensitive vegetation).

Bait application operations will be conducted using a single-primary-rotor/single tail-rotor helicopter. Helicopter models that will be used for the operations are small, 2-4 passenger aircraft. Models considered for use in the operations will include Bell 206B Jet Ranger, Bell 206L4 Long Ranger, or other small-medium sized aircraft. Bait will be applied from a specialized bait hopper (see Section 2.2.2.7) slung beneath the helicopter by 15 – 20 m (49 – 66 ft). Helicopter operations for the bait application will necessitate low-altitude overflights of the entire land area of Rat Island and adjacent vegetated islets. The helicopter will fly at a speed

ranging from 25 – 50 knots (46 – 93 km/hr or 29 – 58 mph) at an average altitude of approximately 50 m (164 ft.) above the ground.

To make bait available to all possible rat home ranges on the island, bait will need to be applied evenly across emergent land area, with every reasonable effort made to prevent bait spread into the marine environment (see section 2.2.2.11). The baiting regime will follow common practice in which parallel, overlapping flight swaths are flown across the interior island area and overlapping swaths with a deflector attached to the hopper (to prevent bait spread into the marine environment) flown around the coastal perimeter. Flight swaths will be defined by the uniform distance of bait broadcast from the hopper, ranging from 50 – 75 m (164 – 246 ft). Flight swaths will be flown in a parallel pattern, with subsequent flight swaths overlapping the previous by approximately 25-50% to ensure no gaps in bait coverage.

During one application all points on Rat Island may be subject to up to three helicopter passes. Within each bait application, there should be no more than three consecutive operating days, and it is likely that there will be two separate applications. The entire helicopter operations window for bait application will be no longer than seven weeks and could be as short as half that time.

Figure 7. Aerial broadcast of rat rodenticide on Anacapa Is., CA. S. Ebbert 2002

2.2.2.4. Bait pellet composition

The bait used will be registered with EPA in compliance with the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). The bait product will be designed to be highly attractive to rats, and colored blue to minimize attractiveness as a food item for granivorous birds (Pank 1976; Tershy et al. 1992; Tershy & Breese 1994; Buckle 1994; Island Conservation, unpubl. data). The

bait will be a compressed grain pellet, 1 – 5 g in weight (0.04 – 0.1 oz), containing 25 ppm brodifacoum. All ingredients in bait pellets will be non-germinating grains (either sterile or crushed). The bait pellets are designed to withstand the wet maritime environment of the Aleutians. Any bait not initially consumed will likely remain attractive to rats, including juveniles that newly emerged from the nest (typically, emergence is between 21 and 28 days post-parturition). However, frequent, heavy rainfall of the late fall and winter will cause bait degradation before winter is over (Buckelew et al. 2007a).

2.2.2.5. Determining application rate

Bait will be applied strictly according to the instructions given on the product's EPA-approved label. If the label instructions provide an acceptable range of application rates, the precise application rate will be determined based on experiments conducted in similar habitat in the Aleutians (see Buckelew et al. 2007a). These experiments will use a non-toxic placebo bait replica to measure the rate of bait uptake (i.e., includes both consumption and breakdown) on Rat Island. Soon after application, baits are consumed and cached by rats and other wildlife, including invertebrates. Baits exposed to heavy moisture will degrade faster than baits which fall in drier locations. Application rate will stay within the rate legally allowed on the EPA pesticide label of the bait. The proposed label allows for more than one aerial broadcast application if rodent sign persists. The application rate will be calculated so an adequate amount of bait is available for consumption by rats for a period of at least 4 days.

2.2.2.6. Number of bait applications

Rat eradication has been successful with a single island-wide broadcast application (Howald et al. 2007). On Rat Island, we propose a second application, begun approximately 7-10 days after the initial treatment, to minimize the likelihood of juvenile rats surviving the initial broadcast. However, trial bait broadcasts conducted in the Aleutians in 2006 (see Buckelew et al. 2007a) showed that palatable bait may be available for rat consumption for longer than 10 days after an initial application. The environmental impacts analysis in Chapter 4 of this document is based upon two applications of brodifacoum, with the second application conducted at a lower application rate than the first.

2.2.2.7. Bait hopper

Bait will be applied across Rat Island through the use of a commercial bait hopper suspended from a helicopter. The hopper is composed of a bait storage compartment, a remotely-triggered adjustable gate to regulate bait flow out of the storage compartment, and a motor-driven broadcast device that can be turned on and off remotely and independently of the outflow gate. The broadcast device will include a deflector that can be easily installed when directional (rather than 360°) broadcast is necessary, such as on the coastline or near significant freshwater lakes or streams (deflector use is discussed in greater detail below).

Figure 8. Bait hopper loaded for broadcast, Anacapa Is. rat eradication S. Ebbert 2002

2.2.2.8. Equipment calibration

Before bait application, the pilot, helicopter, and hopper combination to be used in the application will be calibrated and tested for consistency and accuracy of application using a placebo bait broadcast. The calibration will occur over a test site off-island, in Aleutian conditions similar to those on Rat Island.

2.2.2.9. Flight plan

The bait will be applied according to a flight plan that will take into account:

- The need to apply bait relatively evenly and to prevent any gaps in coverage or excessive overlap;
- Island topography;
- The need to avoid bait spread into the marine and freshwater environments;
- The need to minimize disturbance to native wildlife, especially any marine mammals hauled-out on land and resting in nearshore waters; and
- The need to minimize the substantial costs associated with helicopter flight time.

2.2.2.10. Monitoring bait application

To ensure complete and uniform application:

- The actual application path will be monitored onboard the helicopter using an onboard differential global positioning system (DGPS) and computer to guide the application in order to avoid gaps and unanticipated overlaps in application coverage.
- The application rate will be calculated using the known rate of bait flow from the hopper, the helicopter's reported velocity, and overlaps in the bait swath reported by the onboard DGPS tracking system.

Adjustments in bait flow rates, helicopter speed, and flight lines will be made as necessary to meet the optimal application rate, stay within limits legally required on the EPA pesticide label, and comply with FIFRA.

2.2.2.11. Preventing bait spread into the marine environment

Every reasonable effort will be made to minimize the risk of bait being broadcast into the marine ecosystem. The broadcast deflector will be attached to the hopper for all treatment passes of coastal bluffs and cliffs. The deflector directs bait within approximately 120° of the onshore side of the helicopter, to minimize the risk of bait entering the ocean on the opposite, or seaward, side.

2.2.2.12. Preventing bait spread into the freshwater environment

The freshwater bodies on Rat Island can be broken roughly into two categories, streams and lakes. The "stream" category consists of all moving water bodies on the island, whether or not they are continuous or run all the way to the ocean. The "lake" category consists of all standing bodies of fresh water on the island, regardless of depth. On Rat Island, the lakes occur almost entirely in clusters, rather than being evenly distributed (Buckelew et al. 2007b). Project managers will plan flight paths for aerial bait application that leave a buffer around the perimeter of each lake cluster to minimize bait entry into freshwater bodies.

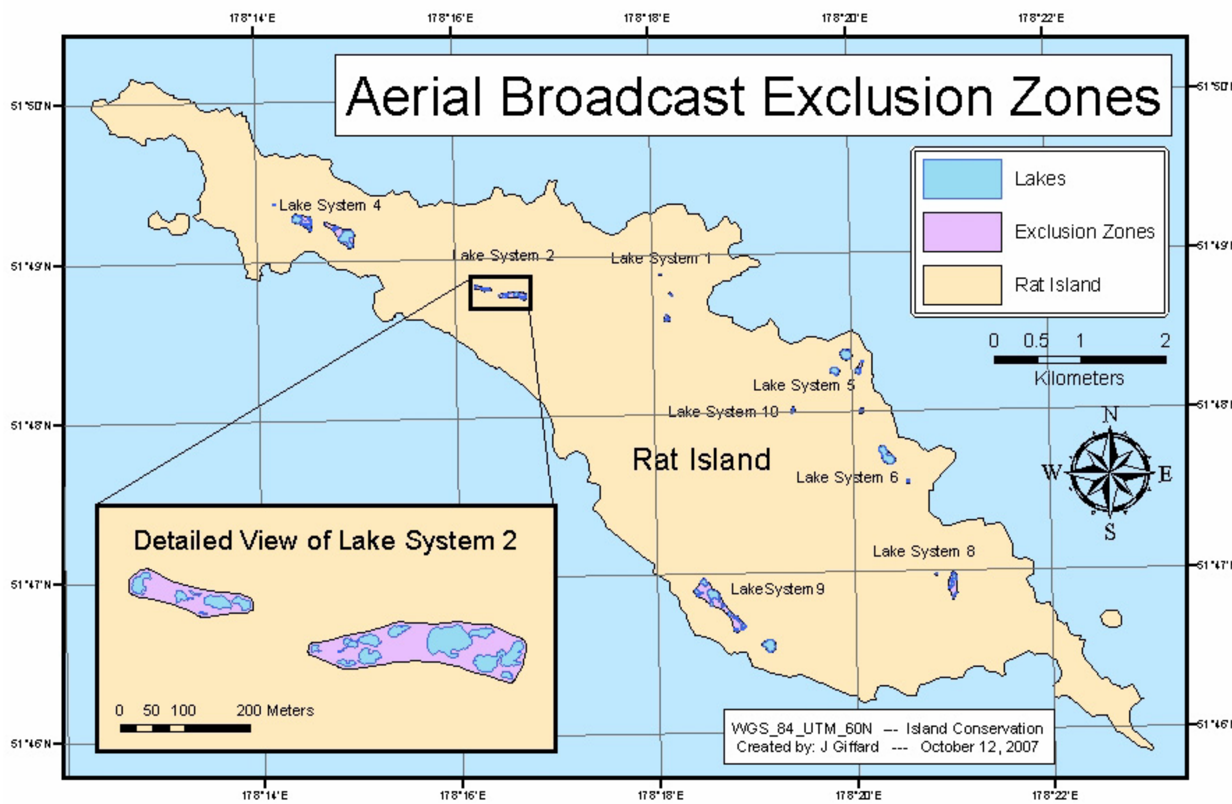

Figure 9. Map of Rat Island showing lake clusters

2.2.2.13. Supplemental bait broadcast

As a result of the need for caution near the marine and freshwater environments, the coastline of the main island, offshore islets, and the land areas within the lake clusters that are omitted from aerial treatment, all of which are potential rat habitat, may not receive the optimal bait coverage with helicopter broadcast. In cases where it is evident or suspected that any land area on Rat Island or offshore islets did not receive full coverage, there will be supplemental systematic hand broadcast either by foot, boat, helicopter, or any combination of the above. All personnel who may participate in supplemental hand broadcasts will be trained and tested in systematic bait application at a target application rate (as described in Buckelew et al. 2005).

Figures 10a & b. Coastal cliffs on Rat Island.

2.2.2.14. Special treatment of the islet off Ayugadak Point

The islet located 1.6 km (1 mi) off Ayugadak Point is a Steller sea lion rookery, qualifying as Critical Habitat under the Endangered Species Act (ESA). However, the islet is nevertheless potential rat habitat and the thick kelp beds between the main island and this islet make rat migration to and from the islet theoretically possible. Bait will be delivered to the islet off Ayugadak Point with an adaptive alternative-baiting strategy designed to mitigate helicopter disturbance.

During staging operations in early summer, project crews will attempt to access the islet by boat, landing on a beach that is out of view of hauled-out sea lions. Personnel will install multiple enclosed bait stations on the islet, which will be designed to provide rats easy access to the bait inside while minimizing bait access by non-target species that may be present on the islet, including a relict song sparrow population. Stations will be anchored securely in place, and filled with enough bait to ensure that any rats on the island will have bait available for many weeks.

During the major bait application operations in the fall, project crews will attempt to access the islet by boat again, although the likely sea state during this season may make access more difficult than the previous attempt. If personnel can access the island by boat, they will check the bait stations installed earlier for signs of bait consumption or other rat activity. Bait stations will be refilled as necessary during this visit. If rats are detected or suspected, personnel may additionally hand-broadcast bait pellets on the islet.

If project crews are unable to access the islet by boat at any time during fall operations, it will be necessary to aerially treat the island.

2.2.2.15. Personal protective equipment

All personnel that handle bait or monitor bait application in the field will meet or exceed all requirements for personal protective equipment described on the bait's EPA pesticide label.

2.2.2.16. Training and supervision

All bait application activities (aerial broadcast, hand broadcast, and bait station filling) will be supervised by personnel certified by the state of Alaska as pesticide applicators.

2.2.3. Rodenticide (Brodifacoum)

2.2.3.1. Introduction to brodifacoum

Brodifacoum is a coumarin-based anticoagulant. It is a vertebrate toxicant that acts by interfering with the blood's ability to form clots, causing sites of even minor tissue damage to bleed continuously. Brodifacoum is the most commonly-used rodenticide in the United States, and it is widely available for household consumers (Erickson and Urban 2002), although the EPA is currently considering restricting its use to professional pest control operations (72 FR 10 pp. 1992-3, 2007).

Before the toxin can have any measurable physical effects, brodifacoum levels in the liver must reach a toxic threshold; this level can vary widely between species. Most vertebrates (e.g. mice, cats, ducks) are less susceptible to brodifacoum than are rats, and would have to consume a higher dose, relative to body mass, before reaching a toxicity risk threshold. A few species are more sensitive to brodifacoum, such as dogs and pigs.

The effects of sublethal exposure are becoming an interest of study; however, there has been nothing identified to date that would warrant concern over sublethal effects of exposure to brodifacoum, especially for those species that could be considered even slightly at risk of exposure.

2.2.4. Impact Mitigation

2.2.4.1. Archaeological site impact mitigation

There are four "cemetery sites or historical places," on Rat Island that are selected by The Aleut Corporation in accordance with the Alaska Native Claims Settlement Act (ANCSA), Section 14(h)(1). The precise archaeological contents of these parcels have yet to be determined, but they are likely to include barabara (house) pits and midden sites. Project personnel will be briefed on the locations and identification of archaeological and cultural resources that may be present on the island. Further, they will be instructed in how to avoid disturbing any sites of archeological or cultural importance within these parcels and anywhere else on the island where sites of significance have been identified (such as artifacts from the WWII era).

2.2.4.2. Wildlife impact mitigation measures

There are no known endemic animal species or subspecies unique to Rat Island. Most of the native species on Rat Island are highly mobile and known to travel between nearby islands or their populations are relatively wide-spread in the Aleutians. These facts will be taken into consideration in Chapter 4, which analyzes the environmental consequences of the action proposed in this chapter.

This environmental analysis focuses on determining whether or not any impacts to wildlife on Rat Island may be significant. Regardless of the determination made, the FWS and refuge manager of Alaska Maritime NWR recognize the need to minimize disturbance and loss of individual animals during this operation to ultimately restore native populations. The eradication project is designed to ensure the protection of native wildlife. The seasonal timing chosen for the application (post breeding seasons for birds and marine mammals), the use of only enough bait to achieve success, the use of a bait that biodegrades and becomes unattractive to non-targets quickly in the fall Aleutian environment, and the use a grain-based bait to minimize primary hazard to scavengers are all examples of ways the project is designed to minimize impacting native wildlife. Other mitigation measures will depend on the final interpretation of this analysis in the decision document for this action, further consultation among project planners, the results of further studies of the Rat Island ecosystem especially in the months leading up to implementation, and the advice of scientific and technical experts.

In this analysis of the potential impacts of the Proposed Action on each species addressed in the mitigations described below, impacts both with and without these mitigation measures will be examined.

2.2.4.2.1. Mitigating for rodenticide risks

Mitigation considerations as part of the planning to minimize non-target wildlife exposure to bait pellets will include the following:

- Temporal considerations: As discussed above, aerial bait application operations will avoid seasons when the greatest number of migratory wildlife species, especially breeding seasons when more species of birds and individuals of those species, would potentially be exposed to rodenticides.
- Pellet size: Pellets are designed to be too large for small passerines such as sparrows to easily consume, but too small to be an object of interest for larger scavengers.
- Inert ingredients: The grain base of the bait pellets is attractive as a food item only to granivorous and opportunistic omnivorous animals. Pellets may be attractive to highly curious birds such as gulls, but this would occur regardless of the inert “matrix” of the bait.
- Bait color: Pellets will be dyed blue, which has been suggested to make pellets less attractive to some birds (Pank 1976; Tershy et al. 1992; Tershy and Breese 1994; Buckle 1994; Island Conservation, unpubl. data).
- Operational aspects: Use of a bait deflector when making helicopter passes along the coastline of Rat Island, avoiding bait application to the upland lake clusters and significant freshwater streams, and meeting the target application rate by supplemental

hand-broadcasting in areas where aerial application must be limited to minimize accidental bait drift into the marine and freshwater environments.

Mitigation measures described above are designed to protect individual animals even if expected impacts are not considered significant to the population. Eradication of rats from Rat Island is anticipated to have long term positive impacts for non-target species, even those populations that may experience some level of mortality as a result of bait application.

Rat Island birds will be monitored before and during bait application to determine if management actions may be necessary. When on the island, crews will collect and remove non-target bird remains and any dead rats found. Rat Island monitoring is planned for subsequent years to monitor recovery of native wildlife and determine if further habitat improvement or translocation is warranted.

2.2.4.2.2. Mitigating for disturbance risk

The primary mitigation that will be incorporated into planning is timing the eradication activities to occur after the Aleutian summer breeding season. Outside of the breeding season, species that inhabit Rat Island are comparatively less sensitive to disturbance. Before eradication operations begin, personnel will be briefed on strategies and techniques for avoiding wildlife disturbance whenever possible and these techniques will be implemented during actual eradication operations.

2.2.5. Public Information

Informational posters will be distributed to community centers in the Aleutians from which ships might embark for the vicinity of Rat Island. Researchers with an interest in the Rat Islands group will also be updated about eradication activities and timing.

Signs stating brodifacoum is present on the island, pellet description, and project purpose will be posted just before bait application. The signs will remain until spring after bait application, and long after baits remaining on the ground have deteriorated.

2.2.6. Monitoring Eradication Efficacy and Ecosystem Response

We will monitor rats on Rat Island during and immediately after bait application to assess effectiveness of eradication effort. Pre-eradication surveys were conducted on Rat Island in 2007, and will continue in 2008 up until the eradication. Monitoring will likely continue in 2009.

Monitoring activities may include:

- Rat detection devices such as traps, chew indicators, and special tracking surfaces to capture rat tracks and bite marks;

- Radio transmitters attached to individual rats, which will allow project personnel to track rat activity and confirm 100% mortality within a sample of rats on the island.

The impacts of monitoring are not expected to be significant to any aspect of the Rat Island environment. Monitoring activities on Rat Island are described as appropriate Alaska Maritime NWR activities for the collection of scientific data, general management and conservation of the natural resources on the refuge, and other approved FWS actions (Byrd 1995; USFWS 1988). The potential environmental impacts of post-eradication monitoring activities will not be analyzed in this document.

2.2.7. Rodent Prevention and Response to New Introductions

The benefits of a successful eradication could be lost with introduction of just one pregnant female rodent. Rodents can be accidentally transported to islands and escape from:

- Watercraft moored onshore or anchored near islands
- Watercraft pulled up on shore
- Cargo containers such as food boxes, fishing gear or other bulk materials
- Debris washed ashore from other rat-infested places
- Sinking or disabled vessels
- Aircraft

2.2.7.1. Prevention

Alaska Maritime NWR currently works to prevent new rodent introduction onto rat-free refuge islands. The program includes shore- and ship-based rodent prevention and shipwreck response. The prevention program is designed to reduce the number of rats traveling on ships between ports in Alaska. The goal is to reduce the likelihood of a disabled ship to "spill" rats onto islands, including Rat Island.

Alaska Maritime NWR has adopted procedures to prevent transport of invasive rodents between Homer, Adak, and other ports to refuge islands, and between refuge field camps, including Rat Island. These measures are briefly described below:

- Inspection of gear supplies delivered and stored at the Alaska Maritime NWR Homer and Adak warehouses for rodent sign; infested gear is discarded and replaced. Inspection continues during gear preparation and staging for loading onto a ship. The gear for the planned action will be inspected according to these standard procedures as it is loaded onto vessels for transport to Rat Island.

- Some gear and supplies may be loaded from ports that have rats and are out of FWS control and inspection. In those cases, gear is inspected before and during loading for signs of infestation. Rodent control devices are maintained on the Alaska Maritime NWR research vessel, M/V *Tiĝlax̂*, and will also be installed on other vessels used to transport gear to Rat Island.

- Another opportunity to inspect gear and supplies is during handling on the ship prior to sending it to camp ashore. Again, the gear is inspected for rodent sign, and if gear is infested, it is not taken ashore until sanitized.

- The last opportunity to capture a rodent that might have gotten aboard, or escaped undetected from other camp gear on the ship, is during unpacking in camp. If rodent sign is detected in gear or supplies brought ashore, rodent control measures are implemented as soon as possible.

The Rat Island project will pose additional challenges because of the number of participants traveling to and from the island, the amount of gear being transported and stored on the island, and the utilization of aircraft in addition to watercraft to transport supplies to the island. A combination of rodent traps and poison bait will be maintained at arrival points on Rat Island after the eradication and during monitoring phases. There is currently no formal infrastructure to support vessel arrivals on the island, and none is planned.

2.2.7.2. Response

Eradication protocols include the possibility of multiple (two) bait applications to ensure that all rats have been removed from Rat Island. After it has been determined that the eradication operation has concluded, efforts will be re-focused on monitoring the island for new rodent introductions or the possibility that some rats remained after eradication operations. In the event that rodents are detected on Rat Island after FWS has declared the end of the eradication operation, a rodent response plan will be implemented immediately. The response plan will be based on the FWS emergency rodent eradication response plan for shipwrecks and grounded vessels on Alaska Maritime NWR.

2.3. Alternatives Dismissed from Detailed Consideration

2.3.1. Widespread Use of Bait Stations for Bait Delivery

Bait stations are box-like enclosures with small entryways designed to be attractive to rodents but difficult to navigate for other animals such as birds. On Rat Island, bait stations would prevent bait exposure to some species that would be attracted to bait pellets (e.g. granivorous, omnivorous and/or curious birds). However, their installation and maintenance to completely cover Rat Island would require a very large crew (>50 people) to be present on the island continuously for a period of up to two months. Furthermore, the installation and maintenance of bait stations would result in a network of trails across the island. While much of Rat Island is hikeable, some island sections would require ropes, anchors bolted to rocks, and construction of pathways or crude stairways. Rat eradication requires placement of rodenticide into every potential rat territory or foraging area. Station placement may be as close together as every 25 m (82 ft) (Howald et al. 2004). After placement, stations are monitored for a period of up to two years, with near-daily visits for the first six to eight weeks of the bait application period. Bait station placement and maintenance, including bait replacement, could at times be dangerous for field personnel, especially stations placed on and near cliffs which pose a serious safety risk.

The remoteness of Rat Island increases the seriousness of field injuries because of the time and difficulty to obtain medical attention and treatment.

2.3.2. Use of a First-Generation Anticoagulant (Diphacinone)

The vast majority of island rodent eradications have used the rodenticide brodifacoum, which is classified as a “second-generation” anticoagulant. Due to the potency of brodifacoum, there is interest in the conservation community for the examination of less toxic alternative compounds for rodent eradication purposes (Brakes and Smith 2005; Donlan et al. 2003; DuVall et al. 1989; Fishel 2005; O’Connor and Eason 2000). Diphacinone, a “first-generation” anticoagulant, is the most commonly considered alternative compound. The comparisons below will focus on these two compounds.

2.3.2.1. Toxicology comparison: brodifacoum vs. diphacinone

The anticoagulants brodifacoum and diphacinone both bind to the same molecular site in the liver. Ingestion of these compounds will only lead to death in the exposed animal if a toxic threshold of one or more of these compounds is maintained in the liver consistently for a sufficient period of time.

Brodifacoum molecules bind comparatively tightly in the liver, so the same brodifacoum molecules that are ingested on Day 0 are highly likely to remain in the liver for an extended period (Fisher et al. 2003). Thus, a single feeding of a threshold quantity of brodifacoum is sufficient to ultimately induce lethal toxic effects in the exposed animal.

Diphacinone, on the other hand, binds comparatively loosely in the liver with a half-life measured in days (Fisher et al. 2003), so diphacinone molecules ingested on Day 0 are much less likely to remain in the liver for multiple days from a single feeding. Thus, in order to maintain a threshold lethal level of diphacinone in the liver consistently for sufficient time, a rodent needs to consume diphacinone in multiple feedings over a few days so that it accumulates in the system faster than the liver processes it out. In application, this means bait must be available to each rodent to feed on multiple times over a few days.

2.3.2.2. Pros and cons of diphacinone in comparison to brodifacoum

Diphacinone presents less risk to non-target species than brodifacoum (Howald et al. 2007; Erickson and Urban 2004). As described above, species that might ingest bait pellets opportunistically or accidentally are much less likely to ingest a lethal amount of diphacinone in one exposure (Hoare and Hare 2006). Predatory and scavenger species are also less likely to consume a lethal amount of diphacinone when preying on individuals that are dead or dying from primary exposure to the rodenticide, since diphacinone is retained only at a low level in body tissues.

The successful eradication of rats on islands using baits is partly dependent upon overcoming bait avoidance by rats and inadequate bait consumption. While diphacinone generally presents

less risk to non-target species than brodifacoum, its low retention in body tissues and its multiple-feeding requirement makes rodent eradication efforts using diphacinone at increased risk of failure (Donlan et al. 2003). Rats are naturally wary and initially eat only very small amounts of unfamiliar food encountered in their environment. Ill effects typically cause the rats to associate the food with the effect and result in avoidance, even transferring this learned avoidance to other rats (Jackson 1982). This characteristic “bait shyness” renders diphacinone more problematic as a toxicant than brodifacoum. All other operational considerations being equal, the task of delivering enough bait to all rats on the island to ensure 100% mortality is less certain to succeed when using diphacinone than when using brodifacoum. Rats that survive a diphacinone bait application could be resistant to first generation anticoagulants (e.g. diphacinone), or unable to find adequate bait to maintain lethal effects of diphacinone dose, or avoid bait after a single feeding, or combination of these. These rats, and possibly their offspring, could consequently be more difficult to eradicate from the island in subsequent attempts.

2.3.2.3. Diphacinone and eradication efficacy

Rat eradications are highly complex and require the consideration of a large number of variables. While the likelihood of success of a proposed eradication program cannot be precisely quantified, there are certain variables that are critical to the success of an eradication attempt. Likewise, there are certain variables that can independently influence the necessary balance between ensuring eradication success and minimizing non-target impacts.

In the case of Rat Island, while both sides of this balancing equation are important, the need to ensure eradication success is particularly acute. Targeted control efforts, or an incomplete eradication attempt, will provide few conservation returns in the long term, since rats at low densities have the ability to reproduce at high rates and quickly re-occupy vacant territories throughout the island. If FWS decides to invest in rat removal from Rat Island, the only way to attain cost-effective, and ecologically secure, long-term conservation returns on this investment is through a successful eradication on the first attempt.

2.3.2.4. Diphacinone and operational considerations

From an operational perspective, there are a number of variables that increase the complexity of the proposed eradication. At 2800 ha (6919 ac), Rat Island will be one of the largest islands worldwide on which rat eradication is conducted, and its large size will require careful logistical coordination, a competent staff, and a lengthy implementation period. Even with careful planning, the chance that bait will be applied unevenly, or that there will be coverage gaps, increases with each additional pass the helicopter must make to cover the island. Multiple passes also increases the risk of excess bait being spread in other places, consequently increasing the hazard for non-target species. The unsettled fall and winter weather of the Aleutians (the proposed time of action) makes operating a helicopter for long periods of time exceptionally risky. When planning helicopter operations in the Aleutians, experts recommend bracketing several additional flight days on either side of a target operation day, because unexpected weather can prevent helicopter flights for days at a time. Each additional day on which helicopter operations are required increases the chance of serious project delays, which can make the difference between a successful eradication and an unsuccessful (incomplete) one.

An analysis of these operational variables leads to the conclusion that, for the sake of safety and the effectiveness of the operation, the number of helicopter flights and amount of flight time must be minimized to the greatest extent possible. At the same time, however, the large size of Rat Island increases the chances that a full-island application will have coverage gaps.

If diphacinone were used as the primary toxin for rat eradication from Rat Island, every potential rat territory on the island would need to have bait available for consumption continuously for a period of up to four days. If any of the scheduled application sessions are delayed due to weather, the risk of less than 100% mortality of rats increases dramatically. If even only a few rats survive exposure to diphacinone, for example juvenile rats that emerge from the nest midway through a diphacinone application, the long-term conservation returns of rat eradication will be lost.

2.3.2.5. Weighing the costs and benefits of rat eradication

Conservation practitioners in general, and FWS in particular, seek to avoid causing harm to biological resources whenever practical. However, in the case of conservation projects that have a high likelihood of success and the achievement of measurable results, harm to individual animals or plants that is incidental to the conservation action may prove necessary in the balance. Furthermore, FWS policies and other government regulations, some of which are discussed in more detail elsewhere in this document (Section 1.5.1.1), acknowledge that there are circumstances in which the responsible management of refuge lands necessitates actions that may incidentally harm individual animals or plants. Alaska Maritime NWR staff believes that rat eradication from Rat Island is a highly valuable conservation project, and using brodifacoum offers the highest probability of a successful rat eradication operation and thus the highest probability of successful restoration of Rat Island ecosystems. Therefore, the staff is prepared to accept the potential for harm to some individual animals incidental to the use of brodifacoum on Rat Island as long as these individual negative effects are outweighed by the expected beneficial effects of rat eradication.

2.3.3. Other Toxins

The use of other rodenticides registered with the EPA was dismissed from further consideration, for one or more of the following reasons: 1) lack of proven effectiveness in island rat eradications; 2) potential for development of bait shyness in the rat population; and 3) the unavailability of an antidote in case of human exposure. Each of these issues and the associated rodenticides are discussed below.

The vast majority of island-wide rat eradication projects (at least 226) have used brodifacoum or similar so-called “second-generation” anticoagulants, while only 29 have used “first-generation” anticoagulants such as diphacinone. Of the nine eradications that have used non-anticoagulant toxins (such as zinc phosphide, strychnine, and cholecalciferol), none have been on islands larger than 22 ha (~54 ac), making them untested as effective toxins for large-island eradications (Howald et al. 2007).

Acute rodenticides, such as zinc phosphide and strychnine, have the ability to kill rats quickly after a single feeding. However, because poisoning symptoms appear rapidly, the acute rodenticides can induce future bait avoidance if animals consume a sub-lethal dose. Studies with zinc phosphide have demonstrated that rodents associate toxic symptoms with a novel bait consumed earlier if the onset of symptoms occur even 6 – 7 hours after consumption (see Lund 1988). Thus, any individual consuming a sub-lethal dose is likely to avoid the bait in the future (Record and Marsh 1988). Also, acute rodenticides are often extremely toxic to humans and there are not always effective antidotes. The combination of these factors disqualifies the acute rodenticides from detailed consideration.

Cholecalciferol, which is classified as a "subacute" rodenticide, has the ability to kill rats more quickly than the anticoagulant rodenticides, but most often more slowly than the acute rodenticides. Cholecalciferol has a lower level of toxicity to birds. It has been used successfully to eradicate rats from very small islands. While these characteristics show potential as a candidate for eradications, cholecalciferol has not been tested on a large island such as Rat Island. Additionally, its potential effects on non-target organisms is not well-understood in the Aleutian environment. The lack of field-testing of cholecalciferol disqualifies it from detailed consideration for use in Rat Island rat eradication.

2.3.4. Use of Disease

While there is ongoing research focused on the development of taxon-specific diseases that can control populations of exotic species (such as by the Australian agency CSIRO, http://www.cse.csiro.au/research/rodents/publications.htm), there are no pathogens with proven effectiveness at eradicating rats (Howald et al. 2007). In any event, the use of lethal disease would be ineffective at eradicating rats from Rat Island, because if the rat population rapidly declined, the introduced disease would likely disappear before being able to affect the few remaining individuals. Furthermore, the introduction of novel diseases into the environment carries tremendous potential risks to non-target species.

2.3.5. Trapping

This alternative would call for the use of live traps and/or lethal ("snap") traps to eradicate rats. This action is highly unlikely to succeed on Rat Island. The use of live traps and/or kill traps to remove rats from an area is a strong selection agent in favor of rats that are "trap shy." Thus, after extensive trapping the only rats that will remain will be those that are behaviorally less likely to enter a trap, and these rats will be very difficult to remove without the introduction of alternate methods such as toxins. Given the large size of Rat Island, the widespread use of traps is not feasible because of the extensive effort and considerable personnel risk required to set and monitor traps in sometimes steep and rough terrain. Additionally, trapping would put a range of non-target animals at risk for the entire length of the trapping program. Therefore, this alternative is considered infeasible to implement.

2.3.6. Biological Control

The introduction of predators on rats, such as snakes and cats, was dismissed because biological control most often only reduces, rather than fully eliminates the target species and thus fails to achieve the desired ecological benefit gained through complete rat removal. There is no known effective biological control agent for rats on large islands, and some forms of biological control would result in unreasonable damage to the environment. The introduction of cats to islands in order to control introduced rats has been attempted numerous times since European explorers began crossing the Atlantic and Pacific Oceans. The introduction of a rat predator, such as cats, generally results in a greater impact on birds than if one or the other were present alone. When seabirds are present, cats have been known to prey heavily on seabirds (Keitt 1998; Atkinson 1985), consuming fewer rats during these times. When seabirds migrate off the islands following the breeding season, cats switch prey to rats which allows the island cat population to remain stable at a higher level than if no rats were present on the island (Atkinson 1985). Thus, birds are impacted not only by rats but the larger number of cats that are sustained by rat presence on the island. Introduction of another species onto an island can have severe and permanent consequences to the ecosystem (see Quammen 1996).

2.3.7. Fertility Control

Fertility control has been used with limited success as a method of pest management in a few species. Fertility control for male rats was developed in the 1980's. Oral fertility control is temporary and variable in its effectiveness between individual rats, and multiple applications of anti-fertility baits on a remote island is impractical and risky. Because of their mating strategies, birth control is not effective for wild populations of highly prolific rodents. Only some members of a population need to be fertile to maintain a rat colony or population. There is no method of rodent sterilization developed that has demonstrated success to a wild rat population. Impacts of experimental fertility control substances for rodents on non-target animals are unknown. Other reproductive inhibiters are chemicals or proteins delivered by vaccine or a genetically modified viral pathogen. Aerial application of rodenticide is a more practical, effective, and safer method to eradicate rats than repeated baiting of oral contraceptives on a remote island across seasons or capturing, vaccinating, and releasing every member of one gender of a 6900-acre island rat population. This lack of data and tools disqualifies the use of fertility control from detailed consideration (see Tobin and Fall 2005).

2.3.8. Rat Removal with the Goal of "Control"

The net conservation gain achieved by rat control (i.e., reducing rat populations to extremely low levels), rather than complete eradication, is slight, yet the risks to non-target wildlife are nearly the same. Rats can reproduce rapidly and recolonize areas from which they were previously eliminated. The benefits to nesting seabirds last only as long as population control. In fact, even a low density of rats in high-quality nesting habitat of some seabirds result in complete nesting failure. The constant maintenance of an ecologically beneficial rat control program on Rat Island

is far less cost effective and does not result in the permanent conservation benefits of entire-island eradication.

3. Affected Environment

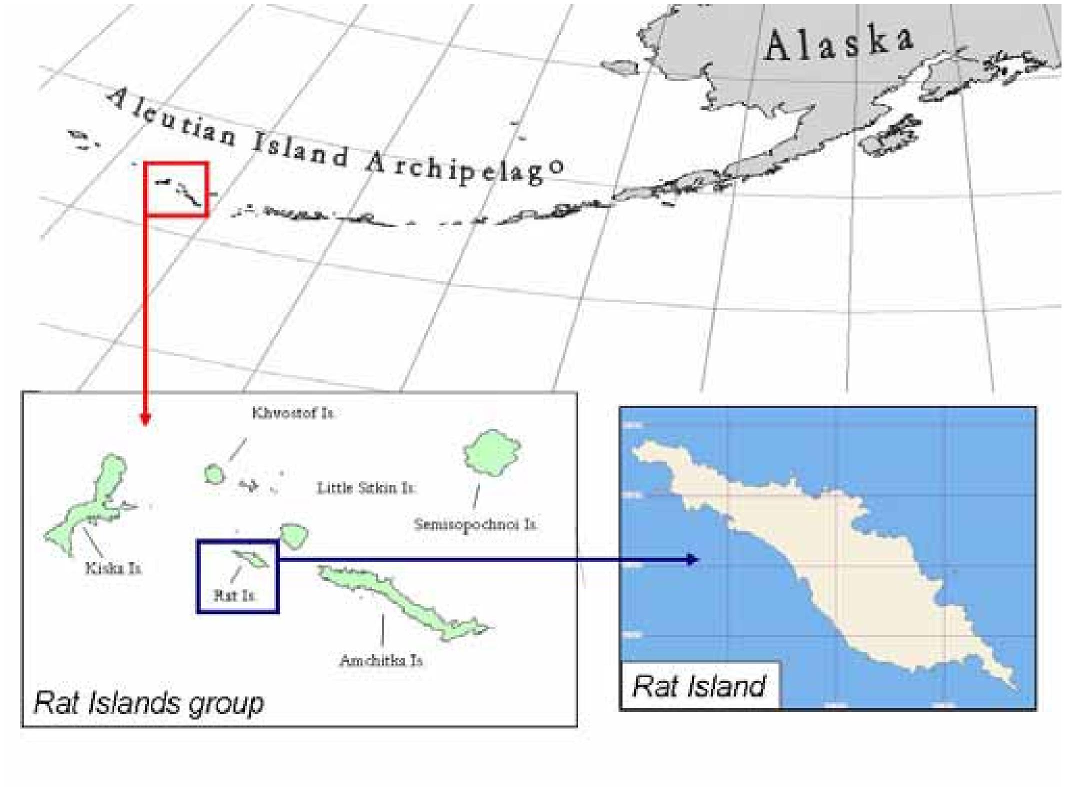

Figure 11. Location map of Rat Island in Alaska

3.1. INTRODUCTION

Rat Island is located in the Rat Islands group of the Aleutian Islands and is part of the Aleutian Islands Unit of Alaska Maritime NWR. The Aleutian Islands Unit (formerly known as the Aleutian Islands NWR) has been part of the National Wildlife Refuge System since 1913. See also Figure 3 for a map of the Alaska Maritime NWR showing Rat Island.

In 1980, most of the islands in Alaska Maritime NWR, including Rat Island, were designated as Wilderness under the Wilderness Act and ANILCA.

The Aleutian Islands are also designated as an International Biosphere Reserve by the United Nations UNESCO Man and the Biosphere program, which recognizes areas worldwide whose management strategies promote solutions to reconcile the conservation of biodiversity with its sustainable use (UNESCO 2007).

Rat Island, and subsequently the Rat Islands group, was named after shipboard Norway rats that escaped from a shipwreck about 1780 (Black 1983). An Aleut name reported for the island is Hawadax (or Howadak) Island, an Aleut word possibly meaning “entry,” (see Bergsland 1994). No accounts of Rat Island are known that were written before this first known rat introduction. However, Rat Island was probably more similar then to nearby rat-free islands than it is today, and supported a richer diversity of bird life prior to rat introduction.

One of the goals of Alaska Maritime NWR is to restore native ecosystems by removing introduced non-native animals, and a program has been underway for decades to remove introduced foxes (Ebbert and Byrd 2002). Eradication of non-native arctic foxes was completed on Rat Island in 1984 (Hanson et al. 1984). The Proposed Action is to continue the restoration of native biodiversity by removing Norway rats.

To determine the feasibility and most appropriate strategy of eradicating rats from islands in the Aleutians, several field studies were conducted between 2003 and 2006 in order to:

- assess the efficacy of two different rodenticides;
- test different delivery methods (bait stations and aerial broadcasts);
- evaluate the effects of rodenticides on non-target species (animals other than rats); and
- describe various aspects of rat biology and effects on native ecosystems in the Aleutians (Dunlevy and Scharf 2006; Kurle 2005; Howald et al. 2007).

Additionally, we conducted studies on Rat Island in June and August 2007 to establish a baseline inventory, develop and update descriptions of wildlife habitat and abundance, and examine the topography and water resources of the island (Buckelew et al. 2007b).

Prior to 2007, wildlife studies at Rat Island included: evaluation of fox populations (Berns 1969), general wildlife surveys (Murie 1940; Dragoo and Deines 1983; Byrd et al. 2006), the Aleutian Goose Recovery Program research (Byrd 1989), and preliminary rat population studies (Williams and Howald 2007).

3.2. PHYSICAL DESCRIPTION

Figure 12. Rat Island, Alaska Maritime NWR S. Ebbert 2001

Rat Island is about a 2800 ha (6861 ac) volcanic island. The coastline is mostly surrounded by steep, vegetated, 50-m high (164 ft) cliffs and slopes. Rolling plateaus stretch 1 km (.6 mi) inland to the base of a small range of mountains with a peak elevation of 343.5 m (1127 ft). Much of the island is accessible by foot. Shallow freshwater lakes occur in seven separate clusters (Figure 9), and scattered small drainages carry water during spring melt and heavy rains. The majority of these narrow, shallow streams end in a waterfall or closed terminus, thereby precluding fish passage (Buckelew et al. 2007b).

Nearshore pelagic marine waters surrounding Rat Island are influenced by the Alaska Stream on the south side in the North Pacific Ocean (Favorite 1974) and by the Aleutian North Slope Current on the north side in the Bering Sea (Reed and Stabeno 1999). Net flow of water through passes in the Rat Islands is northerly and there are strong currents (Ladd et al. 2005). A narrow band of shallow water (<50 m (<164 ft) deep) extends out to 1 km (.6 mi) from Rat Island, but beyond that, depths rapidly increase to >100 m (328 ft) within 2 km (1.2 mi) of the island, and then to depths of more than 250 m (820 ft) at 5 to 15 km (3.1 to 9.3 mi) offshore (see Lewis et al. 1960).

The nearshore marine environment adjacent to Rat Island’s 32 km-long (20 mi) coastline includes several shallow coves, but no protected bays. Shallow reefs and rocks abound in the nearshore marine waters of the south side of the island, making the area extremely challenging for boating.

Several offshore islets occur along the coastline. The largest, 1.6 km (1 mi) off Ayugadak Point on Rat Island’s southeast end, is approximately 4 ha (10 ac) in area.

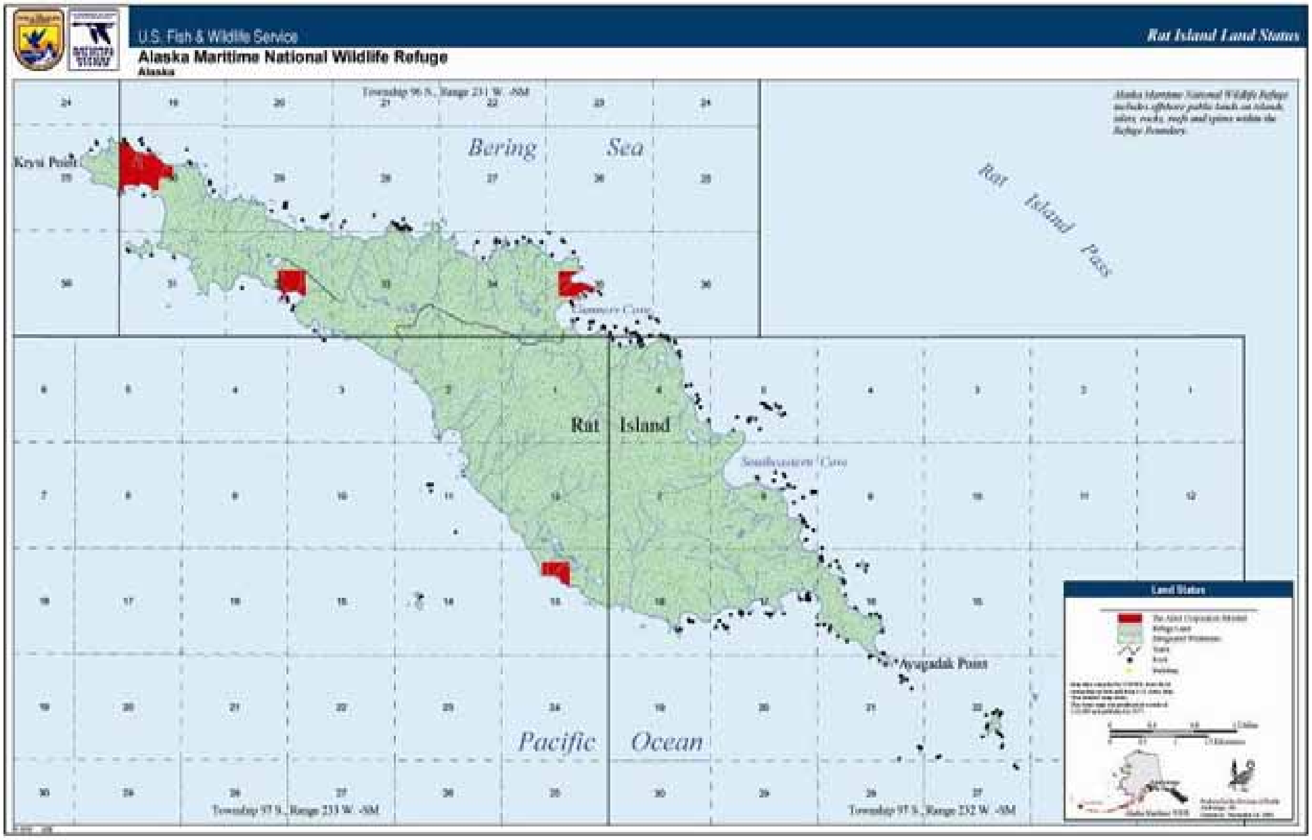

Figure 13. Map of Rat Island, Alaska Maritime NWR, including The Aleut Corporation selections (red).

3.3. Climate

The Aleutian climate is primarily marine-influenced and is characterized by generally overcast skies, frequent and often severe storm events driven by the Aleutian low pressure system (see Rodionov et al. 2005), and high winds. Year-round, the average air temperature is cool but not cold – summer temperatures average 9° C (48.2° F) and winter temperatures average 1° C (33.8° F). Although minimum temperatures seldom reach below -12° C (10.4° F), the effect of wind chill often pushes them lower in winter. Rain falls frequently throughout the year, with snow, often slushy, falling throughout the colder months. Snow accumulations are highly variable among years, but blowing snow causing “white-out” conditions occurs periodically from November through February and sometimes into March. This also is the period when daily minimum temperatures most frequently fall below freezing. There is frequent gusty wind year-round, but most particularly during the fall and early winter seasons, with an average daily wind speed of 25 km/hr (15.5 mph or 13.4 knots).

3.4. Biological Description

3.4.1. Marine Waters

Deep pelagic marine waters near the Rat Islands group are foraging areas for whales, porpoises, miscellaneous groundfish species, and numerous seabird species. Kelp forests are the dominant plant community in the shallow subtidal zone, and they extend around Rat Island typically up to 0.5 km from shore. The kelp forest's food web includes marine mammals, marine birds and a diverse suite of fishes (e.g., greenling [family Hexagrammidae], blennies and pricklebacks [family Stichaeidae], and sculpins [family Cottidae]) (Simenstad et al. 1977).

3.4.2. Intertidal

Introduced rats are significantly affecting the intertidal ecosystem on Rat Island (Kurle 2005). Rats prey directly on intertidal invertebrates, but also on shorebirds that depend on Rat Island as nesting habitat. Due to reduced shorebird (and seabird/marine bird) populations, the abundance of intertidal organisms, such as sea urchins and sea stars (phylum Echinodermata); barnacles, mussels, limpets, and herbivorous snails (phylum Mollusca); sea anemones (phylum Cnidaria); tunicates or sea squirts (phylum Urochordata); and sponges (phylum Porifera) (O'Clair 1977) – all common prey items for shorebirds – is much higher on Rat Island than on nearby rat-free islands (Kurle 2005). At the same time, the relative abundance of fleshy algae, which is consumed by grazing invertebrates such as those mentioned above, is much lower on Rat Island as a result of the increased numbers of grazers, and the abundance of less-palatable coralline algae is much higher than expected.

3.4.3. Terrestrial Vegetation

Terrestrial plant communities in the Aleutians are classified as "maritime tundra" (Amundsen 1977) or, more recently, "oceanic boreal heath" (Talbot et al. 1999). Aleutian vegetation lacks trees, instead being characterized by <2 m tall plant communities dominated by grasses, forbs, and dwarf shrubs. The only studies of terrestrial vegetation specifically on Rat Island were part of an effort to map potential Aleutian cackling goose nesting habitat (Byrd 1989) and several vegetation plots (relevés) surveyed in August 2002 to classify plant communities (S.S. Talbot unpubl. data). Rat Island is dominated by short grasses (e.g., *Calamagrostis nutkaensis*), sedges (e.g., *Carex macrochaeta*, *C. pluriflora*), dwarf shrubs (e.g., *Empetrum nigrum*) and non-vascular plants (e.g., *Cladina* spp., *Cladonia* spp.). Tall-plant communities, which are fairly extensive on islands in the Aleutians with dense breeding birds (e.g., Byrd 1984; Croll et al. 2005), are uncommon on Rat Island (Byrd 1989). The presence of rats on Rat Island is likely suppressing seabird numbers, and rat eradication may ultimately lead to an increase in tall-plant abundance as seabirds recolonize the island and again deposit nutrients into the soil (see Croll et al. 2005).

The only plant currently listed as Endangered in Alaska, the Aleutian shield fern (*Polystichum aleuticum*), has not been found on Rat Island and is unlikely to be present, based on its habitat requirements (S.S. Talbot, pers. comm.). However, Rat Island is one of only two known locations for Aleutian wormwood (*Artemisia aleutica*), which is not federally listed under ESA but is listed in the Atlas of Rare Endemic Vascular Plants of the Arctic (Talbot et al. 1999) and in the Alaska Rare Plant Field Guide (Lipkin and Murray, 1997).

3.4.4. Freshwater Wetlands

The freshwater bodies on Rat Island can be broken roughly into two categories, streams and lakes. The "stream" category consists of all moving water bodies on the island, whether or not they are continuous or run all the way to the ocean. The "lake" category consists of all standing bodies of fresh water on the island, regardless of depth. On Rat Island, the lakes occur almost entirely in clusters predominantly across the rolling upland plateau (Buckelew et al. 2007b). The largest lakes are <200 m (<656 ft) across. No fish species were observed in any of these lakes during surveys in August 2007 (Buckelew et al. 2007b). The majority of lakes do not have associated wet meadows, and those that do have only very narrow bands of meadow habitat. The two largest streams on Rat Island flow into Gunner's Cove, on the northern side of the island. The streams are on average less than 2 m (6.6 ft) wide. Numerous runoff drainages are active during spring melt and heavy rains, but most do not contain water perennially.

Figure 14. Overlooking upland plateau on Rat Island, showing a lake cluster.

3.4.5. Marine Mammals

Three species of marine mammals haul-out on Rat Island and forage in nearshore waters: harbor seals, sea otters, and Steller sea lions. All three species are protected by the Marine Mammal Protection Act (MMPA), and the latter two are also listed under the ESA. The sea otter is listed as Threatened throughout southwest Alaska, including the Aleutians. The Steller sea lion is listed

as Endangered in the Aleutians. The most recent surveys for these species on Rat Island are summarized in Table 3.1.

Steller sea lions have an exclusively piscivorous diet, which includes walleye pollock, Pacific cod, herring, sculpins, octopus, and squid (National Marine Fisheries Service 2007). Like many other species in the Aleutians, Steller sea lions generally breed and give birth during the summer months (Pitcher and Calkins 1981), and pups remain at rookeries until about early to mid-September (Calkins et al. 1999). The western Distinct Population Segment (DPS) of Steller sea lions has recently experienced a major decline: a reduction of 75% over 20 years (Calkins et al. 1999; USFWS 1997a; NMFS 2007). The reasons for this decline are unknown and currently under investigation. At Rat Island, a persistent haul-out site is known from near Krysi Point and a rookery is known from the islet off Ayugadak Point (NMFS database, Table 3.1). Both sites were active in 2007 (Buckelew et al. 2007b).

Sea otters have an exclusively carnivorous diet, consisting primarily of benthic invertebrates such as sea urchins, bivalves, crustaceans, and molluscs (Estes 1990). Sea otters inhabit waters within 1 – 2 km (0.6 – 1.2 mi.) of land and can reproduce throughout the year, but are assumed to have peak breeding seasons in early summer (Estes 1990). Although they spend most of their lives at sea and typically give birth at sea, sea otters have been found to occasionally haul-out and give birth onshore (Barabash-Nikiforov et al. 1968). However, they tend to haul-out more in the winter months in the intertidal zone, and as high as about the storm tide line, in the Aleutian Islands (T. Tinker, pers. comm.). Sea otters were nearly extirpated from Alaska in the 18th and 19th centuries due to over-hunting (Kenyon 1969). As a result, sea otter hunting was banned in 1919 (Estes 1990). The Alaskan sea otter population rebounded quickly following the hunting ban (Estes 1990); however, since the mid-1980s sea otters in Alaska have undergone a 55-67% decline (Doroff et al. 2003; Burn et al. 2003; Burn and Doroff 2005; Estes et al. 2005; USFWS 2005). More specifically, the population decline in the Rat Islands group was about 94%; Rat Island decreased from a count of 270 in 1959 to 11 in 2000 (Kenyon 1969; Doroff et al. 2003). The reasons for this decline are unknown with certainty, and are under investigation. Twenty-two sea otters were noted at Rat Island during boat surveys in 2007 (Buckelew et al. 2007b) (see Table 3.1).

Table 3.1. Recent survey results for marine mammals that haul-out on Rat Island.

Species	Number	Year	Source	Comments
Harbor seal	93 “Fairly common”	1999 2007	Small et al. in press Buckelew et al. 2007b	Aerial survey Often seen in water, not seen Hauled-out
Sea otter	11	2000	Doroff et al. 2003	
	22	2007	Buckelew et al. 2007b	
Steller sea lion	45 171* present	2004 2005 2007	NMFS database NMFS database Buckelew et al. 2007b Buckelew et al. 2007b	Aerial survey for Rat I. Aerial survey for islet off Ayugadak Point (plus 5 pups) Seen from boat offshore at Rat I. and Ayugadak Point

*Survey numbers for islet off Ayugadak Point, which is a Steller sea lion rookery

3.4.6. Birds

Knowledge of the status of birds at Rat Island is based largely on incidental observations made during periodic short visits, largely by refuge staff, in summer (e.g., Dragoo and Deines 1983; Byrd 1989; Williams and Howald et al. 2007; Byrd et al. 2004; Buckelew et al. 2007b). These observations and general knowledge about the seasonal distribution of birds in the central Aleutians (Gibson and Byrd 2007) may be used to characterize the avifauna that is likely to be present at Rat Island in fall (Table 3.2, Appendices 2 and 3).

3.4.6.1. ESA-listed bird species

Short-tailed albatross (*Phoebastria albatrus*), listed as Endangered, is considered rare May – September in the Aleutians in offshore marine waters (Gibson and Byrd 2007). The species does not occur on land anywhere in the Aleutians, and it is unlikely to occur in nearshore waters at Rat Island. The Threatened seaduck Steller’s eider (*Polysticta stelleri*) is considered rare in fall, winter, and spring in the central Aleutians, where it occupies nearshore marine waters. Nevertheless, most records in the central Aleutians are east of Rat Island (Gibson and Byrd 2007). Few records exist for Amchitka, the island closest to Rat Island where observers have been present during the winter. In fact, the species was never recorded at Amchitka during the extensive studies 1967 – 1973 (White et al. 1977). Therefore, it is unlikely the species will occur at Rat Island during the proposed eradication project.

3.4.6.2. Non-ESA-listed bird species

At least five species of waterfowl are likely present annually at Rat Island in fall (Table 3.2). Emperor goose (*Chan canagica*) may begin to arrive in September, although most probably are not present until late November or December (Gibson and Byrd 2007) when at least several tens of individuals may remain until at least March. A few pairs of Aleutian cackling goose (*Branta hutchinsii leucopareia*) have recently been found nesting on Rat Island (Buckelew 2007b), but most of the fall use is expected to be flocks of at least several tens of birds making brief stopovers during their migration from western Aleutian breeding areas to wintering areas in California. Aleutian green-winged teal (*Anas crecca crecca* [*nimia*]), and Pacific common eiders (*Somateria mollissima v-nigrum*) probably nest on Rat Island, but by fall both species would be using inshore marine waters for foraging and roosting. Teal also use island wetlands. Non-breeding harlequin ducks (*Histrionicus histrionicus*) summer near Rat Island using inshore marine waters, and they are joined in late fall by harlequins that nest in mainland of Alaska. Small numbers of other species of seaducks like black scoter (*Melanitta nigra*) also may occur after mid-September in some years.

One of the Aleutian endemic birds that is resident on Rat Island is Townsend’s rock ptarmigan (*Lagopus muta townsendi*). This form occurs throughout the Rat Island group, and is one of the species that seems to have begun to partially recover after removal of introduced arctic foxes (Alaska Maritime NWR, unpubl. data). Recently at least 50 birds were seen on the island during a September survey (Williams and Howald 2007). The species tends to assemble in flocks in the

fall where, at least in some locations in the Aleutians, they feed on *Empetrum* berries and other vegetation.

Few, if any, burrow-nesting seabirds still breed on Rat Island, because these species are probably particularly susceptible to extirpation by introduced rats, but analysis of faunal remains from Aleutian midden sites on the island indicate the likelihood that puffins (species not specified) and possibly other burrow-nesting species in the family Alcidae were common prior to rat introductions (D.G. Corbett and C.L. Funk, unpubl. data). Also found fairly frequently were bones of species within the order Procellariidae which includes storm-petrels (*Oceanodroma* spp.). Interestingly, on the islet about 1.6 km east of Ayugadak Point on Rat Island, Dragoo and Deines (1983) discovered a diverse colony of burrow-nesting species including fork-tailed and Leach's storm-petrels (*Oceanodroma furcata* and *O. leucorhoa*), ancient murrelet (*Synthliboramphus antiquus*), Cassin's auklet (*Ptychoramphus aleuticus*), and tufted puffin (*Fratercula cirrhata*). The presence of these species suggest rats were not present on the islet at least as recently as the early 1980s, and if these species remain today (and numbers of some of the species seen in the water near the islet suggest they have persisted) they may provide a nearby source for eventual repopulation of Rat Island after it is rat-free. Seasonal timing of breeding among these species varies; ancient murrelets and Cassin's auklets departing the colonies in the Aleutians by early to mid-August (Gibson and Byrd 2007), and therefore, they are not shown in the Table 3.2 of birds likely to be present at Rat Island in fall. Fork-tailed storm-petrels and tufted puffins usually depart after chicks fledge by mid or late September, but some late chicks of Leach's storm-petrels are not fledged until late October or early November in extremely late years. Although some individuals of some of these species may continue to be in the vicinity of the Rat Islands in fall and winter, these plankton and fish feeders typically occupy offshore marine waters.

Table 3.2. Birds expected to occur at Rat Island in fall (Sept.-October)[a]

Species	Rat Island Abundance[b]	Primary Foraging Habitat on Rat Island[c]	Rat Islands Group Abundance[d]	Source for Rat Island
Emperor goose	<10	Beach and Reefs	low hundreds	Byrd pers. comm[e]
Cackling goose	<50	Dwarf Shrub Meadow	ten thousands	Byrd pers. comm.
Green-winged teal	15+	Ponds, Inshore Marine	low thousands	Williams and Howald 2007
Common eider	mid hundreds	Inshore Marine Waters	mid thousands	Williams and Howald 2007, Buckelew et al. 2007b
Harlequin duck	mid hundreds	Inshore Marine Waters	mid thousands	Buckelew et al. 2007b
Rock ptarmigan	50+	Dwarf Shrub Meadow	mid thousands	Williams and Howald 2007
Fork-tailed storm-petrel	hundreds	Offshore Marine Waters	ten thousands	Dragoo and Deines 1983
Leach's storm-petrel	hundreds	Offshore Marine Waters	ten thousands	Dragoo and Deines 1983
Red-faced cormorant	low hundreds	Inshore Marine Waters	mid thousands	Byrd et al. 2004
Pelagic cormorant	low hundreds	Inshore Marine Waters	mid thousands	Byrd et al. 2004
Bald eagle	6 nesting prs	Various habitats	mid hundreds	Buckelew et al. 2007b
Peregrine falcon	2 pairs	Inshore Marine Waters	low hundreds	Dragoo and Deines 1983
Pacific golden-plover	<20	Grass and Shrub Meadows	low hundreds	Byrd pers. comm.
Black oystercatcher	30-40	Beach and Reefs	mid hundreds	Byrd et al. 2004
Wandering tattler	1-3	Beach and Reefs	mid tens	Buckelew et al. 2007b
Ruddy turnstone	<10	Beach and Reefs, Dwarf Shrub Mat	low hundreds	Byrd pers. comm.
Pectoral sandpiper	<20	Wet Meadow	low hundreds	Byrd pers. comm.
Sharp-tailed sandpiper	<10	Wet Meadow	low hundreds	Byrd pers. comm.
Rock sandpiper	20+	Beach and Reefs	mid-thousands	Williams and Howald 2007
Glaucous-winged gull	500+	Beach and Reefs	high thousands	Buckelew et al. 2007b
Parasitic jaeger	<10	Dwarf Shrub Mat	mid hundreds	Byrd et al 2004
Pigeon guillemot	200	Inshore Marine Waters	low thousands	Byrd et al 2004
Whiskered auklet	low tens	Inshore Marine Waters	ten thousands	Byrd pers. comm.
Horned puffin	<150	Inshore Marine Waters	ten thousands	Buckelew et al. 2007b, Byrd et al 2004

Species	**Rat Island Abundance[b]**	**Primary Foraging Habitat on Rat Island[c]**	**Rat Islands Group Abundance[d]**	**Source for Rat Island**
Tufted puffin	<300	Inshore Marine Waters	ten thousands	Buckelew et al. 2007b, Byrd et al 2004
Short-eared owl	1-2	Grass Meadow	low tens	Byrd pers. comm.
Common raven	2-4	various	high tens	Buckelew et al. 2007b, Hanson et al. 1984
Winter wren	low hundreds	Beach and Reefs	low thousands	Buckelew et al. 2007b
Song sparrow	2-5[f]	Tall Forb Meadow	mid hundreds	Buckelew et al. 2007b
Lapland longspur	mid hundreds	Grass Meadow	ten thousands	Buckelew et al. 2007b
Snow bunting	<20	Grass Meadow	high hundreds	Byrd pers. comm.
Gray-crowned rosy-finch	50-100	Cliffs and Beaches	high hundreds	Buckelew et al. 2007b

[a] These are species very likely to occur at Rat Island in fall. Other migrating species (e.g. waterfowl, shorebirds, and passerines) could also possibly occur in low numbers in some years, but effects of the proposed project would be similar to those discussed for similar taxa listed here;
[b] Approximate estimates based on the listed source;
[c] Habitats from Gibson and Byrd 2007;
[d] Approximate estimates for the Rat Islands group are from Gibson and Byrd 2007 and Alaska Maritime NWR unpubl. data (see Appendices 2 & 3);
[e] Low thousands = 1-3 thousands, medium thousands = 4-6 thousands, high thousands = 7-10 thousand; estimates based on information in Gibson and Byrd 2007, and Alaska Maritime NWR unpubl. data for fall populations in the Rat Islands group;
[e] Subjective estimate based on knowledge of the status of birds in the area;
[f] 15 additional birds were seen on the islet off Ayudagak Pt. (Buckelew et al. 2007b)
.

Ledge-nesting seabirds like cormorants (*Phalacrocorax* spp.) and crevice-nesting seabirds like pigeon guillemot (*Cepphus columba*), whiskered auklet (*Aethia pygmaea*), and horned puffin (*Fratercula corniculata*) apparently still nest on Rat Island or on the islet off Ayugadak Point, because numbers were seen in marine waters, where they forage on fish or plankton, near the island (Table 3.2). The former two species likely are resident in the area, but horned puffins probably depart after young fledge by mid- September.

Inland, surface-nesting seabirds at Rat Island include glaucous-winged gull (*Larus glaucescens*) and parasitic jaeger (*Stercorarius parasiticus*), the former a scavenger and the latter a kleptoparasite on seabirds. Gulls congregate on beaches and rocky reefs in fall and winter, whereas jaegers depart the Aleutians usually by early to mid-September (Gibson and Byrd 2007).

Rat Island could possibly have saturated breeding densities of bald eagle (*Haliaeetus leucocephalus*) with an estimated 4-5 breeding pairs. Additionally, numbers of subadult eagles have been recorded on the island on one visit when a dead whale was present (see Appendix 2). As predators and scavengers, eagles congregate, particularly after breeding is done by late August, at food sources such as beach-cast whales, concentrations of spawning salmon, or artificial sources of food like refuse at dumps and associated with seafood processing in the Aleutians (Gibson and Byrd 2007). Peregrine falcon (*Falco peregrinus pealei*) also breeds on Rat Island, and this species is primarily a predator and not a scavenger.

The only breeding shorebirds on Rat Island are black oystercatcher (*Haematopus bachmani*) and rock sandpiper (*Calidris ptilocnemis*), and both are resident in the region. In fall, rock sandpipers join oystercatchers on beaches and rocky reefs where they both winter, feeding on invertebrates the intertidal. During fall migration at least five additional species of shorebirds probably stop at least briefly at Rat Island annually (see Table 3.2). Numbers of these migrants typically are low (typically fewer than 20 individuals at any one time). Some of these species such as Pacific golden-plover (*Pluvialis fulva*) use grass and shrub meadows, whereas others like pectoral and sharp-tailed sandpipers (*Calidris melanotos* and *C. acuminata*, respectively) primarily are found in wet meadows. Wandering tattler (*Heteroscelus incanus*) and ruddy turnstone (*Arenaria interpres*) tend to use beaches and rocky shores, but tattlers are sometimes found at stream edges as well.

It is likely that a few migrant short-eared owls (*Asio flammeus*) stop at Rat Island each fall where they probably take some rats. Most records of migrating short-eared owls in the central Aleutians are for the period September 17 to the end of October.

Breeding Lapland longspurs (*Calcarius lapponicus*) are flocking by late August and moving around the island, primarily feeding on seeds. Most depart by the end of September. Resident perching birds known to be present at Rat Island include: common raven (*Corvus corax*), winter wren (*Troglodytes troglodytes*), song sparrow (*Melospiza melodia*), snow bunting (*Plectrophenax nivalis*), and gray-crowned rosy-finch (*Leucosticte tephrocotus griseonucha*) (Table 3.2). Wrens and rosy-finches are common along the coast on beaches, cliffs, and reefs. Wrens appear to feed on invertebrates in fall, but rosy-finches probably also take seeds. Snow buntings probably are not very common in fall, but these seed-eaters can be found from sea level to uplands. Very few ravens have been seen on Rat Island during past surveys. These scavengers

and predators take a wide variety of food. Likewise, very few sightings have been recorded of song sparrow on Rat Island, and it is possible rats have all but extirpated them from the main island. Evidence for this is the presence of 15 sparrows on the islet off Ayugadak Point, which may be rat-free, during a brief survey in August (Buckelew 2007b).

All of the bird species listed above are protected under the Migratory Bird Treaty Act except rock ptarmigan which are protected as a game bird by the State of Alaska. Bald eagles have added protection from the Bald and Golden Eagle Protection Act.

3.4.7. Terrestrial Mammals

There are no terrestrial mammals on Rat Island other than the Norway rats. At one time, introduced arctic foxes occurred on the island, but were eradicated (Hanson et al. 1984).

Norway rats are the largest of the three species of commensal rats, with large males weighing up to 450 g (1 lb). Norway rats are generally highly secretive, remaining hidden whenever possible and preferring to travel along edges rather than entering open spaces. Norway rats are omnivorous generalists, adapting their feeding habits constantly to exploit the most nutrient-rich and easiest to obtain food items in their environment. However, Norway rats are also considered "neophobic," or wary of novel objects in their environment including potential food items. Rats will often avoid novel food items completely at first, then sample small tastes, and only wholly consume new food items after multiple exposure events (information above adapted from Jackson 1982). Norway rats in the Aleutians have been documented consuming a very wide variety of food items, including plant matter, invertebrates (both terrestrial and intertidal marine species), and vertebrates such as birds, fish, sea otter, and even other rats (Brechbill 1977, Dunlevy and Scharf 2007). Rats in the Aleutians have been shown to actively breed from mid-spring through late fall, with a population peak in late summer and a crash in early spring (Dunlevy and Scharf 2006).

3.4.8. Freshwater Fish

Anadromous stream surveys have been conducted by ADF&G throughout the Aleutians and none have been found to occur on Rat Island (Johnson and Weiss 2007). Previous reports indicate that two of the perennial streams flowing into Gunner's Cove may support Dolly varden (*Salvelinus malma*) and pink salmon (*Oncorhyncus gorbuscha*) in their lower reaches. However, no fish of either species were recorded in streams or intertidally during surveys in August 2007 (Buckelew et al. 2007b). During these surveys, observers recorded stickleback (*Gasterosteus aculeatus* or *Pungitius pungitius*) in some of Rat Island's coastal streams.

3.5. Cultural Resources

Rat Island is presently uninhabited and the most recent residents (other than visiting Refuge personnel and other researchers) were probably fox trappers in the 1920s. There are four sites

which have been certified by the Bureau of Indian Affairs (BIA) as cemetery and historical sites eligible for conveyance to The Aleut Corporation under section 14(h)(1) of ANCSA. These areas have been selected by The Aleut Corporation under that entitlement, but have not yet been conveyed.

Recent archeological work to identify faunal remains in a midden site is not yet published, but ultimately will provide information on relative abundance of species used by the Aleuts for food prior to the introduction of rats on the island (Corbett et al. 2003).

3.6. CURRENT HUMAN USES OF THE AREA

Some commercial fishing occurs in the vicinity of the Rat Islands. For instance golden king crab (*Lithodes aequispinus*) are harvested in nearby Oglala Pass and there is some fishing for halibut (*Hippoglossus stenolepsis*), cod (*Gadus morhua*), sablefish (*Anoplopoma fimbria*) and Atka mackerel (*Pleurogrammus monopterygius*) in the Rat Islands group and probably occasionally near Rat Island (F. Bowers, pers. comm.).

Due to its extreme isolation, Rat Island is rarely, if ever, visited by the public. In fact, the Refuge has no records of known recreational visitors, although the island may be visited occasionally by commercial fishermen. Smaller cruise ships (~120-passenger) visit the Aleutian Islands in summer, and up to four might pass in the vicinity of Rat Island during June and July in a typical year. The Refuge has not had any requests from tour companies to go ashore on Rat Island. Probably the most frequent visitors have been Refuge personnel, as well as other researchers with special use permits from FWS.

Little, if any, subsistence activity is known to occur near Rat Island because the nearest community, Adak is about 322 km (200 mi) away. In the Aleutians, residents have traditionally made use of the following types of resources: marine resources, including fish, (salmon, halibut, cod, etc.); marine mammals (Steller sea lions, sea otters, harbor seals, and northern fur seals (*Callorhinus ursinus*) in the Pribilofs); and intertidal invertebrate resources such as sea urchins, razor clams, butter clams, cockles, mussels, and chitons, crab and shrimp. Plants harvested include berries (blueberries, salmonberries, mossberries, strawberries, and lingonberries), wild celery (*Angelica lucida*), wild rice (*Fritillaria camschatcensis*) giant kelp, and fiddlehead ferns. Birds are harvested, including ducks, geese, and ptarmigan. Eggs are collected primarily from gull colonies, although mallard, merganser, puffin, and murre eggs are also collected, depending on the location (above data from BIA 1992; Fall et al. 1998; Veltre and Veltre 1981, 1983; and Wolfe et al. 1990).

4. Environmental Consequences

Figure 15. Norway rat survey on Rat Island 2002   AMNWR

4.1. INTRODUCTION

The purpose of this chapter of the EA is to determine whether or not any significant impacts to the environment of Rat Island should be expected from either of the Alternatives. According to federal Council on Environmental Quality (CEQ) regulations (40 CFR 1508.27), significance is determined by considering both the context in which the action will occur and the intensity of the action. "Context" is the setting within which an impact is analyzed, such as a particular locality, the affected region, or society as a whole. "Intensity" is a measure of the severity of an impact. Determining the intensity of an impact requires consideration of the appropriate context of that impact as well as a number of other factors.

In the analysis below, the potential significance of impacts of the Proposed Action and the No Action alternative will be discussed on a case-by-case basis for each impact topic, with an identification of both the context used for the analysis and the considerations included for a determination of the intensity of the impact.

4.2. CATEGORIES ANALYZED (DESCRIPTIONS)

4.2.1. Restoration Efficacy

The Proposed Action has a stated purpose of benefiting Rat Island's local environment. The impacts analysis in this chapter will examine the extent of this benefit – the efficacy of the Proposed Action in meeting restoration objectives. As stated in Section 1.2, the specific objectives of this project are to 1) eradicate non-native rats from Rat Island, and 2) keep Rat Island rodent-free through an introduction-prevention program. Both of these objectives are

necessary conditions for successful restoration. Restoration efficacy as defined by these two objectives will be evaluated according to simple yes-or-no answers to the questions “does the action have a high probability of eradicating rats from Rat Island?” and “do the appropriate elements of the action have a high probability of preventing the reintroduction of rodents to Rat Island in the future?” We believe that the established record of successes (as well as failures) in previous island rat eradication attempts is the best predictor available of this project’s probability of success.

We anticipate that the primary result of the Proposed Action will be a shift in the plant and animal communities and ecosystem processes on Rat Island toward a state more representative of it’s ecosystem before rats were introduced. We anticipate this shift to include, among other things, an increase in the number of breeding seabirds on the island, especially burrow- and crevice-nesting species. However, there are too many variables that will contribute to the post-eradication ecosystem responses to effectively analyze all of them within the scope of this document.

4.2.2. Assessing Impacts to Biological Resources

The impacts of the Proposed Action on the biological resources of Rat Island, including the condition of the ecosystem in general, will be examined in two different contexts. First, this document will analyze the risks as well as the benefits that the Proposed Action will bring to individual animals that utilize Rat Island. Second, and most critical from the perspective of environmental analysis under NEPA regulations, this document will analyze whether impacts to a particular resource could be considered significant as described in Section 4.1. The concept of “significance” will be defined separately for each topic analyzed below. In some cases, impacts at the individual level (e.g. causing mortality or behavior changes to individual animals) must be considered significant. However, in the case of many of the species (see Sections 4.5.2.1 - 4.5.6.3), impacts to individual organisms, however major, may not qualify as significant impacts in the context of population-level impacts to species utilizing Rat Island. Risk analyses for individual animals will contribute to the overall analysis of significance for each biological taxon considered, but should not be used independent of, or interchangeably with, the significance determination for each impact topic considered.

4.2.2.1. Assessing risks to biological resources from rodenticide use

The risk of impacts from brodifacoum or any other rodenticide to individual animals is determined by two factors:

- the toxicity of the compound to that individual; and
- the probability of that individual’s exposure to the compound (Erickson and Urban 2002).

4.2.2.1.1. Toxicity

The toxicity of a particular compound on an individual animal is often expressed in a value known as the “LD50” – the dosage (D) of a toxin that is lethal (L) to 50% of animals in a laboratory test. The EPA has compiled laboratory data on the LD50 quantity of brodifacoum for

a number of species. However, due to the difficulty and expense of obtaining extensive laboratory data, the LD50 values for most species remain unknown. Therefore, for the purpose of estimating individual impacts, this document will use the following LD50 values to generalize potential toxicity for birds and mammals respectively (adapted from Erickson and Urban 2002):

- For birds, an LD50 value of 0.26 mg/kg will be used – this is the average LD50 value for the mallard (*Anas platyrhynchos*)
- For mammals, an LD50 value of 0.4 mg/kg will be used – this is the average LD50 value for the laboratory rat (*Rattus norvegicus*)

In comparison to real-world values that toxicologists have obtained from a wide class of species, these values are conservative. This toxicity model assumes that an animal's body mass is the primary determinant of how much brodifacoum is required for that animal to reach an LD50 threshold, within each taxonomic category (in this case, birds and mammals). In reality, there are other variables that affect LD50 as well, but using conservative LD50 values such as those above decreases the possibility that the model will under-estimate the risk to individual animals.

Erickson and Urban (2002) use another general model to determine the amount of bait needed to reach an LD50 threshold for birds at a mass of 25 g, 100 g, and 1000 g, compared to average daily food intakes for each of these size classes. See Table 4.1.

Table 4.1. Generalized proportion of daily food intake that must be bait for birds to reach an LD50 threshold (adapted from Erickson and Urban 2002, using a brodifacoum concentration of 25 ppm)

Size class:	**Amt of bait for LD50:**	**% of daily food intake:**
25 g	0.26 g	4.2
100 g	1.04 g	10.8
1000 g	10.4 g	19.2

Erickson and Urban use a similar model to determine the amount of bait needed to reach an LD50 threshold for mammals, using the same size classes as Table 4.1 above. However, Steller sea lions, sea otters, and harbor seals are the only mammals, other than rats (and project personnel), that may be present in baited areas, and the large size of each of these animals (orders of magnitude larger than 1000 g) makes it difficult to apply this particular model. Therefore, marine mammal toxicity will be analyzed primarily using the generalized mammal LD50 of 0.4 mg/kg, described earlier, with an extrapolation of the number of bait pellets needed to reach an LD50 threshold. For these estimates, as well as elsewhere in the impacts analysis of this document, there will be an assumption that bait pellets will weigh 2.4 g each, the mid-range of expected pellet size.

Besides lethal toxicity, there are other effects from ingestion of anticoagulants. Erickson and Urban (2004) report that individual birds and mammals surviving toxicity tests may experience internal hemorrhaging, external bleeding, etc. In rabbits dosed at the time of gestation, internal hemorrhaging was reported at concentrations two orders of magnitude less than the LD50. Further, the authors suggest fetuses may be more susceptible to brodifacoum effects than adults. Erickson and Urban (2004) also note that rat two-generation reproduction tests are not available for the nine rodenticides they evaluated.

The EPA 1998 Reregistration Eligibility Decision (RED) Rodenticide Cluster report discusses developmental toxicity studies in rats and rabbits. The no effects level (NOEL) for rabbits was set at 0.002 mg/kg and the lowest effects level (LOEL) was determined to be 0.005 mg/kg.

4.2.2.1.2. Exposure

Exposure to brodifacoum is essentially dependent on two factors:

1. The availability of rodenticide in the local environment; and
2. Any food habits, behavior patterns, and other specific characteristics that increase or decrease an animal's exposure to the rodenticide.

Bait will be applied according to EPA-approved label instructions, which will set application rate values, ranges, and/or limits for the bait product used. As permitted by FIFRA, different application rates may be considered for different habitat types. For the purpose of risk modeling in this document, application rates will be used based on data collected in 2006 during a trial bait broadcast at the Bay of Islands on Adak Island, 322 km (200 mi) east of Rat Island (Buckelew et al. 2007a). There were two target application rates calculated during this trial: 17 kg/ha for coastal areas with a higher density of rats, and 8 kg/ha for upland areas where rat density is lower. Given an estimated individual pellet weight of 2.4 g (.08 oz), these application rates equate to a target application rate of 0.7 pellets/m^2 (or 1 pellet every 1.4 square meters) for coastal areas, and a target of 0.33 pellets/m^2 (or 1 pellet every 3 square meters) for upland areas (Buckelew et al. 2007a).

Bait will not be broadcast directly into the marine environment, and precautions will be taken to reduce the likelihood of incidental or unintentional application. Application of pellets will not occur above the wind speed specified on the product label. A deflector will be used on the bait spreader for all flight paths that come near the coast in order to direct bait away from the ocean, but a limited number of pellets are likely to drift into the intertidal or nearshore zones. On Anacapa Island, project personnel monitoring bait drift into the intertidal environment reported 72 bait pellets in the water over a 500 m^2 (598 sq yd) area, which equates to 0.14 pellets/m^2 (Howald et al. 2005). Bait pellets that enter the water will be available for consumption for a short period of time after entry. In bait disintegration experiments and observations in New Zealand (Empson and Miskelly 1999) and California (Howald et al. 2005), observers found that pellets similar to those planned for use on Rat Island sank almost immediately and disintegrated completely in as little as fifteen minutes. Although the bait that will be used on Rat Island has been engineered to withstand moisture better than the baits in the observations mentioned above, the frequent turbulence of the waters surrounding Rat Island, especially in the intertidal and nearshore areas, will accelerate the bait's disintegration. Brodifacoum's water solubility is very low (Primus et al. 2005; US EPA 1998), making the risk of brodifacoum contaminating the water column also very low. Hypothetically, even if brodifacoum was highly water soluble, and bait was broadcast at the full application rate of 17 kg/ha into water only 1 m (3.3 ft) deep, the resultant brodifacoum concentration in the water – about 0.04 parts per billion – would still be nearly 1000 times less than the measured LC50 value for trout (0.04 parts per million) (Syngenta 2003). Similar in concept to an LD50 value, this LC50 value represents the concentration of brodifacoum dissolved in water that will be lethal to 50% of the trout within 96 continuous hours of exposure in a laboratory test. While dissolution of brodifacoum into the water-column is

expected to be low given its solubility, it is likely that as pellets break apart, some particles containing brodifacoum residues may be available to filter-feeders such as mussels and clams.

Post-application sampling during the 2006 bait trial study in the Bay of Islands off Adak did not detect brodifacoum in the water (Buckelew et al. 2007a; Island Conservation, unpubl. data), and post application sampling in the Anacapa Island rat eradication did not detect any brodifacoum residue in intertidal mussels or shore crabs (Howald et al. 2005). Further, an estimated 360 g of brodifacoum (from 17.7 tons of bait) was accidentally spilled in the tidal environment in New Zealand (Primus et al. 2005). The brodifacoum was measurable in the water at the spill location for only 36 hours and was undetectable afterwards (measuring less than .020 ppb). Additionally, brodifacoum was undetectable in sediment samples taken from the ocean floor nine days after the spill. In terms of intertidal invertebrates, brodifacoum concentrations peaked in mussels one day after the spill but averaged just above detectible after Day 29 and lasted in limpets for up to 80 days. The similar sampling results of the Bay of Islands trial and the Anacapa eradication, in concert with the results of the accidental spill event in New Zealand, demonstrate the low solubility of brodifacoum in water and its lack of accumulation or persistence in filter feeders such as mussels. Nevertheless, uptake by these filter feeders may be a potential exposure pathway over the short term, and will be considered in this EA.

Bait will not be broadcast within the freshwater lake clusters identified on Rat Island (see Figure 6), and the planned helicopter flight paths will leave a 1.5 m (5 ft) minimum buffer around the outer perimeter of each lake cluster. Within this buffer and between lakes in each cluster, personnel will hand broadcast bait pellets at the same target application rate applied by the helicopter. When possible, the helicopter will also avoid flight paths over the largest streams on the island.

These mitigation measures will result in there being a low likelihood of bait entering lakes (similar to the likelihood of bait entering the marine environment) and a somewhat higher likelihood of bait entering streams. Any bait that does enter the water will sink to the bottom and disintegrate quickly. In rapidly flowing water, bait pellets will disintegrate and become unavailable for consumption nearly as quickly as in the marine environment. In standing or slowly flowing water, bait disintegration will be slower, but much more rapid than bait disintegration on land.

In the form used for rodent control or eradication, brodifacoum can only effectively be delivered through oral ingestion; animals can either ingest brodifacoum by consuming bait pellets (known as “primary exposure”), or by preying or scavenging on other animals that have previously consumed bait pellets (known as “secondary exposure”). Because the bait is composed primarily of grains, herbivorous and omnivorous species are more likely to consume bait (primary exposure) than carnivorous species, including insectivores (see Table 4.2 below). Bait persistence in the Aleutian environment is variable and dependent on the rate of application, density of rats in a given location and ambient weather conditions (rainfall, early or late onset of freezing conditions), as well as on consumption by rats, non-target animals. Previous observations have determined that bait not taken by rats or non-target species could persist for 2 – 8 months, depending on exposure to rain and/or snow conditions (S. Buckelew, pers. comm.).

The low application rate and high bait consumption by rats should reduce the likelihood of bait persistence in the environment.

Once consumed, brodifacoum is retained in the body of the consumer for an amount of time that varies considerably between taxa. The exact mechanisms of brodifacoum retention in invertebrates are unclear. In vertebrates, ingested brodifacoum exits the body (primarily through feces) in a bi-phasic pattern over time: Most of the compound is flushed soon after ingestion, but the brodifacoum that is retained after this initial flush exits the body much more slowly. In mammals (the only vertebrate taxon for which extensive data are available), the half-life of brodifacoum in the blood has been measured at no more than 30 days; brodifacoum half-life in the bloodstream of rats has been measured at 6.5 days (Erickson and Urban 2002). The amount of brodifacoum that is retained in the liver and other tissues may remain present for much longer. In rats, the half-life of a sub-lethal brodifacoum dose in the liver has been measured at 350 days (Erickson and Urban 2002). Because the likelihood of all rats consuming a lethal brodifacoum dose is very high, it is unlikely that animals feeding on rats will be at risk of brodifacoum exposure for this long – rat carcasses are not likely to be available for longer than 30 days before decomposing to the point of becoming unavailable as a food item. The majority (88%) of rat carcasses recovered after bait application on islets within the Bay of Islands off Adak were found underground or in burrows, reducing the probability of secondary poisoning to avian predators or scavengers (Buckelew et al. 2007a). However, as long as some bait pellets remain in the environment there will be a low risk of secondary exposure to predators or scavengers of birds killed as non-targets.

Table 4.2. Likelihood of exposure to brodifacoum based on food habits and other characteristics

Food habits/habitat	**Likelihood of primary exposure**	**Likelihood of secondary exposure**	**Taxon example(s) (not a comprehensive list)**
Largely granivorous (terrestrial)	High	Very low	Some passerines; some waterfowl
Omnivorous (terrestrial)	Probably high	High	Rats; ravens; gulls; bald eagles; others
Largely carnivorous (terrestrial) -			
Rat consumption	Very low	High	Ravens; bald eagles
Bird consumption	Very low	Low	Peregrine falcons, bald eagles
Largely insectivorous (terrestrial)	Low	Low	Some passerines
Scavenger (terrestrial)	High	High	Ravens; gulls; eagles; rats
Intertidal invertebrates*	Very low to low	Very low	Mussels; limpets; sponges
Marine mammals**	Very low to low	Very low	Steller sea lions; harbor seals; sea otters

*Invertebrate exposure data is only relevant for extrapolations of secondary exposure likelihood for predators on intertidal invertebrates

**Only pinnipeds and sea otters are considered in detail due to their occasional use of terrestrial habitat

4.2.2.1.3. Assessing overall risk from brodifacoum use

The risk of brodifacoum poisoning is a function of both exposure and toxicity. In other words, the theoretical toxicity of a compound is only relevant if the species of concern has an actual risk of exposure. The toxicity of brodifacoum to each species analyzed here, as well as that species'

likelihood of exposure (Table 4.2), will be considered together. For example: A 300 g (.7 lb) Norway rat (average adult size) will need to consume only 2 bait pellets to have a 50% risk of mortality. Because Norway rats have a high likelihood of primary exposure to the rodenticide (as opportunistic omnivores in concert with the design of the bait to be a rat attractant), rats are very likely to be at risk of brodifacoum poisoning.

4.2.2.2. Assessing risk to biological resources from disturbance

The operation of low-flying aircraft throughout Rat Island is likely to result in disturbance to wildlife from sound, the sudden appearance of an aircraft, or a combination of both (Efroymson et al. 2001). Wildlife on Rat Island will be exposed to noises that exceed background levels. Helicopters will be used both during staging procedures in summer and during bait application in fall. There are, therefore, two opportunities for sound disturbance to wildlife. The relatively low altitude at which helicopters will fly will result in a narrow focus of the narrow cone of highest noise underneath the helicopter, minimizing disturbance of marine mammals or birds in nearshore marine waters or on offshore rocks.

Pinniped responses to aircraft overflights vary from no reaction to completely vacating haul-outs in response to a single overflight (Efroymson and Suter 2001). In general, pinnipeds hauled-out for molting or pupping are most responsive to aircraft (Richardson et al. 1995). In order to estimate the risk of disturbance for each taxon of concern, the anticipated helicopter operations pattern described above will be compared against observational evidence of effects displayed elsewhere in that taxon or a sufficiently similar group (based on literature reviewed in US Air Force and US Fish and Wildlife Service 1988).

Wildlife could be disturbed or harmed as a result of installing the temporary field camp, staging areas, fuel storage site, and bait stations (on the islet off Ayugadak Point). Additional wildlife disturbance could result from personnel traveling by foot across the island (e.g., when hand broadcasting bait, surveying for non-target mortality, and collecting rat carcasses). Personnel will be based on Rat Island in the summer for staging and continuing pre-eradication surveys and then for at least a seven-week period in the mid-to-late fall, including the bait application operation. Following eradication, there will be monitoring visits to the island for at least two years. Personnel will be briefed on strategies and techniques to reduce wildlife disturbance whenever possible, but some level of disturbance is still likely to occur. Anthropogenic disturbance to marine mammals has been described many times by behavioral researchers (Richardson et al. 1995). Although most of these descriptions are anecdotal, they do provide information about the level of reaction in specific situations. Almost all descriptions of disturbance reactions involved short-term behavioral reactions such as movement from haul-out sites to water. The significance of these short-term behavioral responses to individual fitness of individuals and populations are generally not known, although such brief interruptions likely have little effect on overall energy balance or reproductive performance (Richardson et al. 1995). Disturbance from personnel movements and activities is anticipated to be much lower than that caused by helicopter operations.

4.2.2.3. Assessing cumulative impacts to biological resources

Impacts to a biological resource that occur as a result of rat eradication on Rat Island, even if they are individually minor, could potentially contribute to cumulative effects when combined with other unrelated impacts. The following is a brief description of the major impacts that have occurred on Rat Island in the past, as well as an assessment of unrelated impacts to biological resources that are occurring today or could occur in the foreseeable future.

Rat Island is currently uninhabited and there probably have not been year-round residents on the island since the fox farming era, prior to WWII. Evidence of human habitation, including Alaska Natives, prior to the fox trapping era exists as well. Human habitation itself did not likely have much impact on the biological resources of Rat Island, but island residents and traveling vessels likely harvested large numbers of pinnipeds and sea otters from its shores, which probably reduced populations locally. Additionally, non-native foxes, which were introduced specifically for trappers to harvest, preyed heavily on the island's bird populations for decades until the foxes were eradicated in 1984 (Hanson et al. 1984). Last but not least, non-native rats have impacted many of the species on the island, as described in detail in Chapter 1. Because Rat Island is now being managed in perpetuity as a National Wildlife Refuge, the biological resources on and around the island are unlikely to be affected by anything other than natural forces in the foreseeable future. However, many of the species that use Rat Island have large ranges and may be currently experiencing unrelated impacts elsewhere in their ranges. Additionally, many of these far-ranging species have experienced impacts in the past that are still affecting their populations. These unrelated impacts will be considered for each biological resource analyzed.

4.2.2.4. Limited analysis of invertebrates

Most invertebrate species are not known to be susceptible to toxic effects from the use of brodifacoum in the field (Hoare and Hare 2006), nor are they anticipated to be measurably affected by helicopter operations or personnel activities. However, both marine and terrestrial invertebrates are known to consume bait pellets. Therefore, they will be considered in this document only in reference to their function as intermediate carriers of brodifacoum. As referenced in Section 4.5.7, during a catastrophic accidental spill of 20 tons of brodifacoum into nearshore waters in New Zealand (Primus et al. 2005), a peak concentration of the toxicant measured in mussels occurring at the spill site was 0.41 ppm one day after the spill; this equates to 1/60th of the brodifacoum found in one bait pellet. Within 30 days, the concentration had dropped to just above 0.002 ppm or 200 times less than the peak.

4.2.2.5. Limited analysis of vegetation

Plants are not known to be susceptible to toxic effects from brodifacoum, nor are they anticipated to be significantly affected by helicopter operations. However, the impact of personnel activities and temporary infrastructure installation related to the Proposed Action on the vegetative communities occurring on Rat Island will be analyzed.

4.2.2.6. Assessing significance of impacts to biological resources

The purpose of the Proposed Action is to restore the biological diversity and environmental health of Rat Island through rat eradication. While the precise responses of Rat Island's species

to rat eradication are unknown, data from elsewhere in the Aleutians and from islands around the world indicate that rat eradication has the potential to contribute to beneficial effects in a wide variety of birds, among other species. At the same time, the Proposed Action has the potential to cause short-term negative impacts to individual animals. Therefore, the relationship between potential short-term risks to individual animals and the long-term benefits to animal species must be examined. For the Proposed Action to be considered a successful conservation effort, the long-term benefits to the island ecosystem must outweigh the potential risks to individual animals.

For biological resources analyzed below, except those identified in the “special considerations” described later in this section, the potential for significance will be determined using the following guidelines:

1. Is there a high likelihood that the Rat Island population of a species will experience noticeable changes that will not be counteracted by inter-island migration?
2. Is there a high likelihood that impacts on animals at Rat Island will have global population-level impacts for the species?
3. Is the species in question protected by special legislation such as ESA, MMPA, MBTA, or BGEPA?

4.2.2.7. Special considerations for ESA-listed species

There are three species known or suspected (based on their known range) from Rat Island that have been listed under ESA: the southwestern Alaska DPS of northern sea otter (Threatened), the western DPS of the Steller sea lion (Endangered), and the Alaska breeding population of Steller’s eider (Threatened). Listing under ESA provides a context for impacts analysis which lowers the threshold of significance. The ESA regulations require any federal agency that believes an action it is planning may affect a species listed under ESA to initiate a formal process of consultation with either the FWS Ecological Services division or NMFS, depending on the species potentially affected. Through this consultation, the agencies determine whether or not the action will put the potentially affected species in jeopardy of continued survival. The impacts analysis for biological resources in this document will identify any ESA-listed species and any ESA-designated critical habitat that may be affected by the Proposed Action.

The significance of these impacts will be determined separately, but the ESA-listed status of the species affected will be given special weight. For marine mammals (Steller sea lions and northern sea otters), the significance threshold will be set according to the MMPA’s definition of Level A Harassment: “any act which injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild” (MMPA 515.18(A)). For Steller’s eiders, the significance threshold will be set as the likely take (which includes harassment or harm) of one or more Steller’s eiders as a result of the Proposed Action as defined under the ESA (16 U.S.C. 1532(19)).

4.2.2.8. Special considerations for marine mammals

Listing under MMPA also provides a context for impacts analysis which lowers the threshold of significance. Except for the case of subsistence harvesting activities, the MMPA regulations

generally prohibit the killing, injury or disturbance of marine mammals. However, permits can be granted allowing exceptions to this prohibition for actions that may impact a marine mammal if the impact is incidental to, rather than the intention of, the action. This analysis will identify the potential for impacts to marine mammals that may require additional permits under MMPA.

The significance of these impacts will be determined separately, but the MMPA-listed status of the species affected will be given special consideration. For marine mammals, the significance threshold will be set according to the MMPA's definition of Level A Harassment: "any act which injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild" (MMPA 515.18(A)). The lesser MMPA category, Level B Harassment, will not alone constitute a significant impact, but other potential circumstances (including cumulative impacts analysis) may nevertheless contribute to an overall determination of significant impacts.

4.2.2.9. Special considerations for migratory birds

The regulations of the MBTA generally prohibit the intentional killing of migratory birds except by permit and other special exceptions. However, the MBTA has been interpreted not to apply to invasive species management actions in which migratory birds are killed incidental to the management action (Humane Society of the United States v. Glickman, Case No. 99-5309, decided 18 July 2000).

The potential impacts to these species will be determined using the following guidelines:

1. Is there a high likelihood that the Rat Island population of a species will experience noticeable changes that will not be counteracted by inter-island migration?
2. Is there a high likelihood that impacts on animals at Rat Island will be measurable elsewhere in the region (i.e. will impacts on individual animals on Rat Island have global population-level impacts for the species)?

4.2.2.10. Special considerations for bald eagles

Bald eagles in the lower 48 states were removed from the Endangered Species list in June 2007 (eagles in Alaska were never listed under ESA). Eagles remain protected under BGEPA, but FWS is currently in the process of reviewing and revising the regulations of the BGEPA. In the meantime, FWS is strongly recommending that all agencies and non-federal entities follow the recommendations of the Bald Eagle Management Guidelines issued by FWS in May 2007. The management guidelines' recommendations include (in part):

- Avoiding operating aircraft within 1000 feet of the nest during breeding season; and
- Using pesticides only in accordance with federal and state laws.

Because bald eagles are also protected under MBTA any permits that must be granted under MBTA will include any anticipated bald eagle take. The FWS will adhere to the recommendations of the Bald Eagle Management Guidelines in implementing the Proposed Action, as well as any additional permitting or compliance requirements that are implemented or clarified at any time before project implementation begins.

The potential significance of impacts to bald eagles will be determined using the following guidelines:

1. Is there a high likelihood that the Rat Island population of eagles will experience noticeable changes that will not be counteracted by inter-island migration?
2. Is there a high likelihood that impacts on eagles at Rat Island will have population-level impacts for central Aleutian bald eagles?

4.2.3. Assessing Impacts to Water Resources

Water quality in the State of Alaska is regulated by the Alaska Department of Environmental Conservation (DEC), Division of Water Quality, which requires all state waters to meet minimum criteria for a number of designated uses. The only reasonably foreseeable potential impact to water quality on or around Rat Island would involve the incidental introduction of rodenticide into the water column. There are no specific criteria set by the State of Alaska for maximum allowable quantities of brodifacoum or other rodenticides. While the federal Clean Water Act (CWA) prohibits the discharge of "pollutants" into waters of the United States, the EPA recently clarified its interpretation of this term to exclude pesticides that may unavoidably enter the water while being applied to control pests that occur "over, including near" water bodies (71 CFR 227 pp. 68483-68492). As rats on Rat Island are known to frequently live at the shoreline and feed near and/or in bodies of water, the application of a rodenticide to eliminate rats according to the techniques described in the Proposed Action and as permitted by rodenticide label requirements under FIFRA may include areas immediately adjacent to water bodies without additional compliance requirements under CWA. The potential for significant environmental impacts of the Proposed Action on water quality, irrespective of other water quality regulations, will be analyzed as an examination of the potential for biologically adverse quantities of brodifacoum to be introduced into Rat Island's associated water bodies.

4.2.4. Assessing Impacts to Wilderness Character

All of Rat Island is designated Wilderness as regulated by the Wilderness Act (PL 88-577), as well as being part of Alaska Maritime NWR as established in ANILCA (PL 96-487). In some instances the use of mechanized tools or equipment is necessary for the managing agency to effectively administer designated wilderness areas. Section 4(c) of the Wilderness Act provides for an administrative exception for some specific uses. When the use of tools otherwise prohibited by the Wilderness Act is necessary for an agency to administer a wilderness area, a Minimum Requirements Analysis (MRA) is completed. The MRA process determines whether or not the proposed activity is necessary within the wilderness area and if so, which least intrusive action or "minimum tool" is needed to achieve the objective. The MRA is documented through the Minimum Requirements Decision Guide, which demonstrates how the agency arrived at the decision to conduct a specific administrative action. The completed Minimum Requirements Decision Guide worksheet associated with the Proposed Action is included in this EA as Appendix 3.

Preservation of wilderness character is not a category of analysis required under NEPA regulations, but the special designation of Rat Island as Wilderness will be considered through an analysis of the impacts of the Proposed Action. Under the Wilderness Act, an area's wilderness character is defined by the following qualities:

1. Untrammeled by human impacts;
2. Undeveloped, without permanent structures or habitations;
3. Influenced primarily by natural forces; and
4. "Has outstanding opportunities for solitude or a primitive and unconfined type of recreation."

The impacts of the Proposed Action that relate to Wilderness Act and ANILCA will be discussed according to their benefit or harm to each of the above four qualities that characterize wilderness.

4.2.5. Assessing Impacts to Historical and Cultural Resources

The categories of historical and cultural resources are broad and impacts to these resources are usually difficult to quantify, especially in the context of NEPA's requirement to identify "significant" impacts. The National Historic Preservation Act (NHPA) defines the concept of an "adverse impact" to historical resources, but the regulations make clear that "a finding of adverse effect on a historic property does not necessarily require an EIS under NEPA" (36 CFR 800.8(a)(1)). Regardless, Section 106 of the NHPA requires agencies to consult with the appointed regional Historic Preservation Officer(s) if adverse impacts to historical or cultural resources are possible. This analysis will describe the potential impacts to historical and cultural resources on Rat Island as a reference for consultation with the appropriate Historic Preservation Officers.

4.2.6. Assessing Impacts to Social and Economic Values

The CEQ guidelines at 40 CFR 1508.14 include the human relationship with the natural environment as a category of potential impacts that should be considered in a NEPA analysis. This is interpreted to mean that a NEPA analysis examine potential effects on any economic and/or social values. In the case of Rat Island, the issues of concern identified were:

- Impacts to visitors of the Refuge in the vicinity of Rat Island;
- Impacts to commercial fishing activities in the vicinity of Rat Island; and
- Impacts to subsistence harvests by rural Alaskans in the vicinity of Rat Island.

The potential for significant impacts to human uses of the Rat Island environment will be analyzed based on input from any potentially affected parties during the circulation of the draft of this EA.

4.3. Aspects of the Environment Excluded from Detailed Analysis (with Rationale)

4.3.1. Marine Fish

Potential impacts of rat eradication activities to marine fish in the waters surrounding Rat Island will not be analyzed in this EA, because the likelihood of the Proposed Action having measurable impacts on marine fish populations is negligible.

- The number of bait pellets that will enter the marine environment as a result of bait application activities will be low as a result of the mitigation measures described in the Alternatives chapter for avoiding bait application into the ocean;
- The probability that fish will consume bait pellets is considered to be very low;
- The bait pellets will disintegrate rapidly upon contact with the water;
- In tests conducted by researchers in the Aleutians, as well as in California, Hawai'i, and the equatorial Pacific, marine fish species demonstrated almost no interest in placebo bait pellets that entered the water nearby (Buckelew et al. 2007a; Howald et al. 2005; USFWS 2005; A. Wegmann, pers. obs.).

4.3.2. Cetaceans

Potential impacts of rat eradication activities to cetaceans (whales, dolphins, and their close relatives) in the waters surrounding Rat Island will not be analyzed in this EA. Except for small boat traffic, which will be limited in duration and concentrated immediately offshore of the island, all of the activities described in the Proposed Action are terrestrial, and the likelihood of the Proposed Action having measurable impacts on cetaceans is negligible.

4.3.3. Air Quality

Air quality in the region of Rat Island is not an issue of concern. Rat Island is 322 km (200 mi) away from the nearest permanent human settlements, the town of Adak and the Air Station at Shemya, which are themselves extremely isolated from any major sources of air pollution. The helicopter operations described in the Proposed Action will not generate measurable levels of pollutants or contribute to air quality thresholds being reached.

4.4. Alternative A: No Action

4.4.1. Introduction

Under the No Action alternative, rats will be allowed to persist on Rat Island, subject to the natural processes of the island ecosystem. There will be no use of rodenticide to control rats. With No Action on the island, the rat population will not be controlled, and population sizes will fluctuate within an annual cycle. Rat population levels on Aleutian islands typically increase during the summer, and decline during the winter (Dunlevy and Scharf 2006; Major et al. 2006).

As a direct result of rats remaining on the island, habitat quality for native species has been altered. Restoration of natural biodiversity and habitat may only occur after the eradication of invasive rats on Rat Island. The direct impacts invasive rats have on the island's native species, for which the Refuge was established, will continue under the No Action alternative.

4.4.2. Restoration Efficacy

Adoption of the No Action alternative will not meet the purpose and need of the Proposed Action – rats will remain and impacts on Rat Island's habitats and ecosystem will go unaddressed. The continued presence of rats on Rat Island is inconsistent with FWS policy for land management. The agency's policy for maintaining biological integrity, diversity and environmental health (601 FW 3, 2001) guides refuge management priorities. It directs managers to:

- "Restore lost or severely degraded elements of integrity, diversity, [and] environmental health…;
- "Favor management that restores or mimics natural ecosystem processes or functions to achieve refuge purpose(s)…"; and
- "Strive to prevent the further loss of natural biological features and processes; i.e., biological integrity."

The ongoing negative impacts of rats on the environmental health and natural biological processes of Rat Island make them a candidate for FWS action under 601 FW 3.

4.4.3. Impacts to Species Listed Under the Endangered Species Act

4.4.3.1. Steller sea lion

Rats are not known to impact Steller sea lions. Steller sea lions on and around Rat Island are not expected to be affected if the No Action alternative is adopted.

4.4.3.2. Northern sea otter

Rats are not known to impact northern sea otters. However, there is evidence that rats directly or indirectly affect nearshore environments (Navarrete and Castilla 1993, Drummond 1960). This may have an unknown indirect impact on sea otters. Nonetheless, sea otters on and around Rat Island are not expected to be affected if the No Action alternative is adopted.

4.4.3.3. Steller's eider

Steller's eiders do not breed in the Aleutians (Fredrickson 2001) and are considered rare in the central Aleutian Islands in winter (Gibson and Byrd 2007; Kenyon 1969). There is no reasonable likelihood that Steller's eiders will be affected by the continued presence of rats on Rat Island, as will be the case if the No Action alternative is adopted.

4.4.4. Impacts to Species Listed Under the Marine Mammal Protection Act

4.4.4.1. Species also listed under ESA

Steller sea lions and northern sea otters are protected by the MMPA regulations as well as the ESA. See Section 4.4.3 above for impacts analysis for both of these ESA-listed species.

4.4.4.2. Harbor seal

Rats are not known to directly impact harbor seals. There is some concern that diseases could be transferred from rats to pinnipeds, and from there to subsistence users (M. Williams, pers. comm.). Even so, harbor seals on and around Rat Island are not expected to be affected if the No Action alternative is adopted.

4.4.5. Impact on Species Listed Under the Migratory Bird Treaty Act

4.4.5.1. Waterfowl

Rats are known predators of ground-nesting birds including waterfowl. Additionally, rats are known to crop vegetation and thereby reduce waterfowl nesting habitat. The combined impacts of threats such as predation and habitat destruction have led to severe population declines and species endangerment in some waterfowl, such as the Laysan duck (*Anas laysanensis*) in Hawai`i (Reynolds 2004; Moulton and Marshall 1996). Adoption of the No Action alternative will leave waterfowl on Rat Island, including the Aleutian green-winged teal and Pacific common eider, vulnerable to the impacts of rat predation and disturbance.

4.4.5.2. Birds of prey

Rats may present a direct threat to breeding raptors on Rat Island; rats are known predators of peregrine falcon chicks in the Aleutians (Jones and Byrd 1979). Furthermore, peregrine falcons in the Aleutians depend heavily on seabirds for prey (White et al. 2002). The negative impacts that rats have on seabird colonies may indirectly reduce food availability to the peregrine falcon population on Rat Island, and the historical impacts that rats had on Rat Island’s seabird colonies may have led to a long-term decrease in the island’s habitat quality for peregrine falcons. Adoption of the No Action alternative will prevent any major seabird recovery on Rat Island and continue to suppress the potential habitat quality of the island for peregrine falcons.

On average, rats accounted for 13% of bald eagles’ diet in a two-year study on nearby Kiska and Amchitka Islands (Anthony et al. 1999). However, bald eagles are opportunistic feeders and consume a range of food items, both in the marine and terrestrial environments. Due to the abundance of alternative eagle prey in the region, it is unlikely that changes in Rat Island’s rat population have noticeable effects on local eagle populations.

4.4.5.3. Passerines and other landbirds

Rats are known predators of landbirds in all life stages in the Aleutians (Atkinson 1985; I. Jones, pers. obs.). Landbirds will continue to be vulnerable to rat predation under the No Action alternative. Upon introduction, rats caused a major decline in winter wren and song sparrow populations on Amchitka Island (White et al. 1977), and it is likely that landbird populations on

Rat Island continue to be suppressed. There are no trees on Rat Island, forcing all birds to nest on or near the ground. Ground-nesting landbirds are particularly vulnerable to disastrous population reduction from rat predation (Atkinson 1985), and adoption of the No Action alternative will allow negative impacts to landbirds on Rat Island to continue.

The continued presence of rats will provide a potential food source for ravens that visit or reside on Rat Island. However, the abundance of alternative food sources for ravens on Rat Island makes the continued presence of rats unlikely to influence the local raven populations. The continued presence of rats may also provide a food source for migrant short-eared owls, which appear uncommonly on Rat Island but likely feed on rats during their stay on the island.

4.4.5.4. Seabirds and shorebirds

Predation and loss of nesting habitat caused by invasive rats is the leading cause of the decline of seabirds on islands (Towns et al. 2006). Rats are known to significantly reduce breeding success of some species of seabirds in the Aleutian Islands (Major et al. 2006) and worldwide (Atkinson 1985; Jones et al. in review), both through predation and through repeated disturbances that lead to higher abandonment of nests and of breeding partners (Jouventin et al. 2003). On Kiska Island, rat predation on auklets is considered intense enough to potentially cause the future extirpation of the millions of auklets that now use this island (Major et al. 2006). Cumulatively, rat impacts can cause complete extirpation of insular breeding seabirds in some cases (Jones et al. in review). Thus, the No Action alternative will continue to preclude recovery of seabirds that are attempting to breed on Rat Island.

Shorebirds are also susceptible to rat predation. Densities of black oystercatchers on rat-free islands in the Aleutians are more than an order of magnitude higher than on rat-invaded islands (Kurle et al. in review). The No Action alternative will allow rats to continue negatively affecting shorebird communities on Rat Island, with a consequent effect on the intertidal community.

4.4.6. Impacts to Other Species On and Around Rat Island

4.4.6.1. Terrestrial invertebrates

Rats are omnivores and invertebrates make up a portion of their diet in the Aleutians (Major et al. 2007). The impacts of rats on each species of invertebrates on and around Rat Island are unknown. Some invertebrate species can be critical components of a food web. The impacts of rat predation on one particular insect species potentially could have widespread ecological consequences (Schmitz 2006). In some cases, direct rat predation coupled with other indirect impacts from rats can cause the complete elimination of an invertebrate species from an island (e.g. weta in New Zealand [Rufaut and Gibbs 2003]). Adoption of the No Action alternative will continue to leave the invertebrates that inhabit Rat Island vulnerable to rat impacts.

4.4.6.2. Freshwater organisms

Rats are known to prey on Dolly varden and freshwater algae in the Aleutians (Major et al. 2007). Adoption of the No Action alternative will allow this predation to continue and may alter natural ecological processes in freshwater habitats.

4.4.6.3. Intertidal organisms

A study of intertidal communities in the Aleutian Islands found that rats prey on intertidal algae and invertebrates (Kurle et al. in review). This study suggested the largest effects of rats in the intertidal could be a result of predation on shorebirds. Rat predation on black oystercatchers and glaucous-winged gulls releases their intertidal herbivorous snail prey from predation and may noticeably alter intertidal communities. Adoption of the No Action alternative will allow rats to continue to directly prey on intertidal organisms and to continue depressing shorebird populations, both of which may affect the trophic structure of intertidal communities.

4.4.6.4. Vegetation

Vegetation can comprise up to 80% of rat diet on some Aleutian Islands (Major et al. 2006). The reduction of nutrient availability in the environment through predation-driven seabird declines has been shown to indirectly affect Aleutian Island vegetative communities (Croll et al. 2005). Introduced foxes drove seabirds to such low levels that without the nutrient subsidy provided by their guano, vegetation changed from grassland to tundra, resulting in long-term cumulative impacts (Croll et al. 2005). Vegetation may be indirectly impacted by rats through impacts on the invertebrate community. As discussed above (Section 4.4.6.1), predation of invertebrates may lead to major impacts on the local vegetative community. Under the No Action alternative, vegetative communities on Rat Island will continue to be shaped by direct and indirect rat effects. See more detail in Section 4.4.6.5 below.

4.4.6.5. Multi-trophic cascading effects

As a result of impacts from invasive species (such as rats), island ecosystems can experience effects that cascade through multiple trophic levels, leading to major changes in ecosystem functioning (Fukami et al. 2006). As described in Section 4.4.6.4 above, the No Action alternative will leave the Rat Island ecosystem in a modified state as a result of reduced input from marine derived nutrients formerly supplied by nesting seabirds (Croll et al. 2005; Maron et al. 2006).

4.4.7. Impacts to Water Quality

There is no evidence that rats currently have a perceptible impact on water quality on or around Rat Island. Therefore, there is no reasonable risk that adopting the No Action alternative will affect the island’s water quality.

4.4.8. Impacts to Wilderness Character

After their introduction more than 200 years ago, rats have dramatically changed ecological processes on Rat Island. Prior to this introduction, the island likely supported significant populations of breeding seabirds and other ground-nesting birds that evolved in the absence of mammalian predators, similar to the other islands in the Rat Islands group. In addition to extirpating seabirds, rats have changed the vegetative community structure and possibly intertidal life of the island. As a result, their presence has altered the natural character of the island, and adoption of the No Action alternative will allow this unnatural state to continue.

4.4.9. Impacts to Historical and Cultural Resources

While Rat Island is uninhabited today, there is evidence of multiple former Aleut village sites. Within these sites, there are items of archaeological value. The Aleut Corporation has selected four of these sites for eventual incorporation as ANCSA 14(h)(1) cemetery sites and historical places. Norway rats excavate large and extensive burrows and increase erosion that may harm or destroy sensitive archaeological resources within these and other archaeological and cultural sites on the island. If the No Action alternative is adopted, this risk to Rat Island's Aleut cultural resources will continue.

4.4.10. Impacts to Social and Economic Values

4.4.10.1. Fishery resources

Fishery resources around Rat Island will not be affected if the No Action alternative is adopted.

4.4.10.2. Refuge visitors

Visitation to Rat Island by the general public is very low. Most visits are by researchers and government personnel. However, tour boats occasionally pass within view. With the adoption of the No Action alternative, these visitors will continue to experience Rat Island as a compromised ecosystem that is not meeting its potential as a unique refuge for wildlife, especially birds that could be viewed from passing boats.

4.4.10.3 Subsistence uses

Subsistence harvest of animals and plants occurs almost exclusively in the areas immediately surrounding communities in the Aleutians. The closest settlement to Rat Island, on Adak Island, is over 322 km (200 mi) away. For that reason, it is very unlikely that Rat Island is used for subsistence harvest activities. Regardless, if the No Action alternative is adopted, rats will continue to degrade habitat quality on Rat Island for waterfowl, through damage to vegetation used for nesting, and possibly through predation. Rural Alaskan subsistence harvests often include waterfowl, which eventually migrate over inhabited islands. Therefore, the continued presence of rats on Rat Island will affect potential subsistence resources on the island into the future.

4.5. ALTERNATIVE B: RAT ERADICATION FROM RAT ISLAND, AERIAL BROADCAST TECHNIQUE

4.5.1. Restoration Efficacy

Rat eradication has been conducted successfully on more than 300 islands worldwide (Howald et al. 2007). The largest successful rat eradication, an aerial broadcast of brodifacoum to eradicate Norway rats, was from 11,500 ha (28,417 ac) Campbell Island in the Southern Ocean south of New Zealand. With effective implementation of this similar aerial broadcast technique, according to the specifications described in the Proposed Action (Section 2.2), there is a high probability of successful rat eradication from Rat Island.

Rat eradication must be followed by an ongoing reintroduction prevention plan that will keep Rat Island free of rodents and allow the ecosystem to respond and recover. Such a program will be implemented under the Proposed Action, which will allow rat eradication to have lasting conservation benefits.

Island ecosystems have a demonstrated history of responding quickly and dramatically as a result of rat eradication. On Anacapa Island in Southern California, breeding success and number of nests found for Xantus' murrelets (*Synthliboramphus hypoleucus*), small crevice-nesting seabirds, began increasing immediately after rat eradication and within three years hatching success in monitored murrelet nests nearly doubled (Whitworth et al. 2005). Almost immediately after rats were eradicated on Campbell Island, the Campbell Island snipe began successfully recolonizing the island from an offshore islet where it had persisted in low numbers for decades after being extirpated from the main island (Miskelly and Fraser 2006).

In the Aleutians, the removal of introduced foxes has led to major recovery in island bird populations (see Ebbert and Byrd 2002). Seabird colonies on some islands grew four- to five-fold after foxes were removed (Byrd et al. 2004), and the Aleutian cackling goose recovered from an estimated population of 1000 total birds to a population of well over 100,000 throughout the Aleutians (V. Byrd, pers. comm.). In fact, fox removal and subsequent goose re-introduction allowed the Aleutian cackling goose to recover sufficiently to be removed from the Endangered Species list in 2001. Rats have been conclusively shown to prey heavily on seabirds within nesting colonies. While islands throughout the Aleutians that are ecologically similar to Rat Island have large seabird colonies, Rat Island has comparatively few nesting birds of any kind, which strongly suggests that the presence of rats is preventing certain species of seabirds from nesting on the island. The removal of rats will therefore likely be followed by an influx of new breeding seabirds. Rat eradication will also restore Rat Island's native vegetation, which rats consume as a major part of their diet in the Aleutians at certain times of the year (Dunlevy and Scharf 2006). It will also be beneficial to ecological balance of the island's intertidal community, which is currently heavily influenced by rat predation. This benefit will extend to Rat Island's shorebird population, which depends on intertidal organisms as a major food source.

One of the critical aspects of a NEPA analysis (Sec. 102(I)(iv)) is addressing "the relationship between local short-term uses of man's environment and the maintenance and enhancement of

long-term productivity.” The restoration benefits described above make the Proposed Action beneficial to the long-term productivity of Rat Island as a refuge for plants and wildlife.

4.5.2. Impacts to Species Listed Under the Endangered Species Act

4.5.2.1. Steller sea lion

Brodifacoum toxicity risk – The brodifacoum LD50 value for Steller sea lions has not been established. Using a conservative LD50 figure of 0.4 mg/kg, a small juvenile sea lion weighing 45 kg (100 lbs) will need to ingest the equivalent of approximately 300 bait pellets to be at a 50% risk of mortality. A large male adult, weighing 1088 kg (2400 lbs; National Marine Mammals Laboratory 2006), will need to ingest more than 7500 pellets. Steller sea lions are carnivorous (almost exclusively piscivorous), so brodifacoum ingestion will need to occur either accidentally or through an intermediate prey species (fish) that previously consumed bait pellets. However, fish are extremely unlikely to consume the bait themselves (Section 4.3.1 and 4.5.6.2).

Brodifacoum exposure risk – Steller sea lions are marine mammals, but they also use terrestrial habitat year-round. Sea lions are likely to be present in the waters surrounding Rat Island, and are likely to be hauled-out on offshore rocks off Krysi Point, on the islet off Ayugadak Point, and perhaps elsewhere on Rat Island or surrounding offshore stacks and islets at any given time during rat eradication operations. Sea lions may encounter stray bait pellets, at low densities, if they are hauled-out on Rat Island or surrounding islets during bait application. Nevertheless, the majority of stray pellets will be consumed by rats within 4 days of the final bait application. Most of the remaining stray pellets within the sea lions’ normal terrestrial ranges, particularly the low intertidal zone, will be washed away with the first high tide after each bait application. A scattered few pellets may remain present in areas that are above the high-water line for up to a few months after the application, but these are outside the sea lions normal terrestrial range. Sea lions in the water may encounter bait pellets in the ocean or intertidal zones, but this is unlikely because of the mitigation measures that will be implemented to minimize bait entry into the marine ecosystem. If bait does enter the water, it will be available immediately after entry but will disintegrate and disperse within hours.

The offshore islet off Ayugadak Point is listed by NMFS as a Steller sea lion rookery (50 CFR 226.202). The bait that will be applied to this islet during early summer staging operations will be enclosed in bait stations, which will prevent sea lions from being exposed. If bait is later broadcast onto the islet during bait application operations in the fall (according to the criteria described in the Proposed Action, Section 2.2), hauled-out sea lions will encounter bait pellets according to the same conditions described in the previous paragraph.

Steller sea lions are exclusively carnivorous (almost exclusively piscivorous) and do not feed while on land, so the only possible routes for bait ingestion are accidental. The likelihood of primary exposure is therefore very low, and the likelihood of secondary exposure through fish or other prey species is negligible (as discussed above in Section 4.3.1).

Overall risks from brodifacoum use – The toxicity of brodifacoum to Steller sea lions is high, however due to their large size, it would require a high dose for any toxic effect to be measured. Further, the likelihood of sea lions experiencing either primary or secondary exposure is very low to negligible; under the proposed baiting regime, sea lions will not be exposed to a high enough dose to experience measurable effects. Therefore, the overall risk of sea lion mortality or sub-lethal effects as a result of brodifacoum use is negligible.

Risks from aircraft disturbance on Rat Island –The response of pinnipeds like Steller sea lions to aircraft overflights varies from no discernable reaction to completely vacating haul-outs after a single overflight (Calkins 1979;Efroymson and Suter 2001). Approaching aircraft generally flush animals into the water. In one case, Withrow et al. (1985 in Richardson et al. 1995) reported Steller sea lions left a beach in response to a Bell 205 helicopter >1.6 km away, but the noise from a helicopter is typically directed down in a “cone” underneath (Richardson et al. 1995) so disturbance at such great distance is probably uncommon.

At Rat Island there is a known persistent haul site on rocks off Krysi Pt. and a rookery on the islet off Ayugadak Point. Occasionally sea lions probably also haul-out elsewhere on Rat Island. During staging operations, helicopter flight lines will avoid the rookery, the known haul site and any other haul sites discovered prior to helicopter operations. However, in spite of these precautions, sea lions encountered unexpectedly during helicopter operations could be flushed from land temporarily. An individual sea lion’s exposure to peak noise from the helicopter will be limited to animals that remain ashore, and is likely to be of short duration, as the elevation and speed of the helicopter (see Section 2.2.2.3) will limit the time that any single location is exposed to maximum noise.

Unlike during staging, it will be more difficult to avoid known haul sites on Rat Island with the helicopter during bait application because of the need for thorough coverage. No pups are expected on Rat Island, but the impacts of disturbance to sea lions during molting (a sensitive period to disturbance, Richardson et al. 1995) will be minimized by timing overflights after the peak molting period is over.

Risks from disturbance on the islet off Ayugadak Point – Installation of bait stations on the islet off Ayugadak Point is likely to result in short-term flushing of some animals off the land. This disturbance is likely to be limited to the few-hour period when personnel are present on the island. Sea lion pups could potentially be present on the islet during installation of bait stations, depending upon the exact timing of the operation (e.g., a summer effort occurring after pups are born or a fall effort occurring while pups are still being nursed on land). To minimize disturbance to the rookery, the islet will be approached slowly in a small boat, from the side of the island opposite and out of sight of the rookery. This is expected to reduce the tendency of animals to stampede, thereby reducing the possibility of pup injury. While on the islet personnel will remain out of sight of the rookery as much as possible.

In late summer or fall, the bait stations on the islet will need to be replenished. Again, the approach to the island will be slow, and opposite the haul-out. This may result in flushing the haul-out and short-term displacement for the few hour period that personnel are present on the islet. If it is not possible to land a skiff on the islet, the island will be baited with the helicopter as

described in Section 2.2.2.3, in the fall after the pupping and primary molting season. Nevertheless, this is likely to result in flushing sea lions from the islet resulting in short-term displacement. However, as helicopter baiting will be a very short process (approximately 10 min), disturbance to Steller sea lions is likely to be very short-term.

Risks from camps on Rat Island-Impacts to Steller sea lions from camps on Rat Island will be minimal as camps and storage sites will be installed well inland.

Overall, the effects of the operations described in the Proposed Action on Steller sea lions will vary depending on the number of disturbance events. However, the short-term displacement from haul-outs that is likely to occur as a result of helicopter noise and personnel is not anticipated to have any effect on overall energy balance or fitness of any individual animals.

Indirect effects – There is no reason to believe that the Proposed Action will lead to any effects in the habitat, prey base, or other ecological interactions of Steller sea lions that will indirectly affect them.

Cumulative effects – Steller sea lions in the Aleutians have undergone a major population decline over the last 20 years, but the reasons for this decline are poorly understood. The two potentially greatest threats to sea lions that have been identified are competition with fisheries for food resources, and variability in environmental conditions that affect the availability of food for sea lions (NMFS 2007). Both of these ongoing effects lead to malnutrition and a corresponding decrease in the fitness of individual animals. Although there is no known evidence of malnourishment in sea lions using Rat Island, there is a possibility that some of the sea lions on and around the island could be malnourished. If that were the case, the disturbance effects from the Proposed Action may disproportionately affect these animals. However, if disturbance from operations is minimized by planning flight paths and helicopter activity to coincide as little as possible with the known locations of sea lions, disturbance effects from bait application operations are not likely to contribute measurably to negative cumulative effects on sea lions.

In the foreseeable future, there is the possibility for rat eradication efforts on additional Aleutian Islands. These eradications are unlikely to occur soon enough after the Rat Island project to contribute to cumulative effects on any sea lions affected by the eradication on Rat Island. Thus, especially if helicopter activity is adjusted to minimize the amount of necessary sea lion disturbance while still ensuring a successful rat eradication, there is no reasonable risk for measurable cumulative effects on Steller sea lions.

Significance of effects to Steller sea lions on and around Rat Island – It is not likely that any Steller sea lions will suffer injury or the significant potential for injury as a result of the activities described in the Proposed Action. Therefore, this analysis concludes that implementation of rat eradication activities as described in the Proposed Action is not likely to adversely affect individual Steller sea lions on an individual or population level.

Special considerations under ESA – The ESA regulations obligate federal agencies to ensure that the actions they take are not likely to “jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat” (ESA Section

7(a)2). If a federal action may adversely affect an ESA-listed species or its designated critical habitat, the action agency must enter a process of formal consultation with either FWS or NMFS, depending on the species in question. Based on the impacts analysis above, the possibility of adverse effects to individual Steller sea lions cannot be reasonably eliminated, although adverse effects are unlikely to occur. Furthermore, helicopter and personnel operations will occasionally need to occur within the "no-entry zones" established by 50 CFR 223.202. Agency personnel acting in the course of official "legitimate governmental activities" are exempted from the no-entry zones, but appropriate consultation with NMFS will be conducted to ensure compliance with Sections 7 and 9 of the ESA.

4.5.2.2. Northern sea otter

Brodifacoum toxicity risk – The brodifacoum LD50 value for sea otters has not been established. Toxicity testing with a related species, the American mink (*Mustela vison*) suggests that mink are relatively insensitive to brodifacoum, with an LD50 of 9.2 mg/kg (cited in Fournier-Chambrillon et al., 2004). Young of the year are the most sensitive indicator of toxicant exposure (P. Johnson, pers. comm.) as well as of the northern sea otter population overall (Ballachey et al. 2003; A. Doroff, pers. comm.). Therefore, using a conservative LD50 figure of 0.4 mg/kg, a juvenile sea otter of average mass, 9.1 kg (20 lb) (A. Doroff, pers. comm.), will need to ingest the equivalent of approximately 61 bait pellets to be at a 50% risk of mortality. Sea otters are exclusively carnivorous, so brodifacoum ingestion will need to occur either accidentally (i.e., by sticking in the fur and being accidentally ingested when grooming) or through an intermediate prey species that previously consumed bait pellets or particulate-bound residues. However, based on studies from California and New Zealand, there is no reasonable likelihood that intertidal invertebrates will register biologically harmful, or even detectable, levels of brodifacoum as a result of bait application to Rat Island (see Section 4.5.7).

Brodifacoum exposure risk – Northern sea otters are primarily marine organisms, but they also haul-out on beaches and offshore rocks year-round. Sea otters are likely to be present in the waters surrounding Rat Island during the rat eradication effort, and a few could be hauled-out on beaches. Although the intent is to keep rodenticide pellets out of the intertidal zone and nearshore marine waters, stray pellets may be present in the vicinity of a few sea otters. The majority of this bait will be consumed by rats within 4 days of the final application. Most of the unconsumed stray pellets within the lower intertidal zone, where sea otters are likely to haul-out, will be dispersed in marine waters at the first high tide after each bait application. A scattered few pellets may remain in areas that are above the high-water line for up to one month after the last application. Bait pellets quickly began to soften and disintegrate in the water after a major spill in New Zealand (Primus et al. 2005). If bait does enter the water, it will be available immediately after entry but will dissolve within hours. Sea otters may encounter an occasional bait pellet in the nearshore or intertidal zones, but it is unlikely because of the mitigation measures to minimize bait entry into the marine ecosystem (Section 2.2.2.11).

Northern sea otters are exclusively carnivorous, feeding on benthic invertebrates such as sea urchins, crabs, and octopus (USFWS 2005) and do not feed while on land. As a result, the only possible route for bait ingestion on land is accidental. Sea otters are known to groom themselves and each other while on land, and although possible it is not likely that grooming behavior will

lead to accidental bait ingestion (i.e., bait pellet dust). Little is known about sub-lethal effects of bait ingestion in sea otters. However, the likelihood of primary exposure is low to begin with and the chance that enough pellets would be ingested to negatively impact an individual sea otter is very low. Further, the chance of secondary exposure through consuming prey is negligible. Any stray pellets in the intertidal or nearshore zone would be in such low density and viable for such a short time, that the brodifacoum level would not be detectable in the invertebrate prey the sea otters feed upon.

On Anacapa Island, Howald et al. (2005) collected mussels and crabs at Day 15 and 30, and tidepool sculpins at Days 15, 30 and 90 post-application. They reported that no brodifacoum residues were detected in the invertebrate and fish samples.

<u>Overall risks from brodifacoum use</u> – Due to the relatively large size of sea otters, the toxicity of brodifacoum to them is very low, enough to be discountable. Furthermore, the likelihood of sea otters experiencing either primary or secondary exposure to brodifacoum is low to very low. A sublethal dose of brodifacoum can result in clotting abnormalities and hemorrhaging in animals (Erickson and Urban 2002), but in the case of a sea otter, the dose is unlikely to be sufficient to predispose an otter to other causes of death. However, there is no data available on the potential for subclinical affects from low levels of exposure, particularly for young of the year. Nonetheless, the overall risk of sea otter mortality or noticeable sub-lethal effects as a result of brodifacoum use is very low (see Sections 2.2.3.1 and 4.5.7).

<u>Risks from the operation</u> – Sea otters have not been reported as particularly sensitive to sound and/or movement disturbance, especially in comparison to other marine mammals such as pinnipeds (US Air Force and US Fish and Wildlife Service 1988; Efroymson and Suter 2001). However, observations of sea otters indicate their responses to disturbance are highly variable (A. Doroff, pers. comm.). If any sea otters are present during the eradication project, some of them may be temporarily disturbed by helicopter noise or boats operating in the area; however, it is unlikely that the Proposed Action will result in measurable effects to sea otters at Rat Island.

<u>Indirect effects</u> – Persistent rat predation on shorebirds in the Aleutians has contributed to inflated populations of some intertidal invertebrates that would normally be controlled by shorebird predation. A possible increase in the abundance of shorebirds after rat removal may facilitate a transformation in the intertidal ecosystem from invertebrate-dominated to algae-dominated, as are many of the intertidal ecosystems on rat-free Aleutian islands (Kurle et al. in review). Sea otters feed in the intertidal zone and adjacent nearshore waters but it is unlikely that intertidal community shifts after rat eradication will measurably affect their feeding success because of the local availability of a variety of food sources.

There is no reason to believe that the Proposed Action will lead to any other effects in the habitat, prey base, or other ecological interactions of sea otters that will indirectly affect them.

<u>Cumulative effects</u> – Sea otter hunting for pelts in the 18th through the early 20th centuries essentially extirpated the Aleutian sea otter population. Sea otter populations recovered after hunting was banned in 1911, but after an initial recovery the sea otter population in the Aleutians began declining sharply in the 1980s. The Rat Islands region posted one of the largest declines of

the archipelago. The reasons for this decline are unclear, but the implication is that at present, the sea otter population at Rat Island is very vulnerable. However, effects from bait application operations are not likely to contribute measurably to negative cumulative effects in individual sea otters or the sea otter population.

In the foreseeable future, there is the possibility for rat eradication efforts on additional Aleutian Islands. These eradications are unlikely to occur soon enough after the Rat Island project or close enough to Rat Island to contribute to cumulative effects on sea otters that were affected by the eradication on Rat Island. Thus, there is no reasonable risk for measurable cumulative effects on northern sea otters.

Significance of effects to sea otters on and around Rat Island – There will likely be no acute mortality to sea otters that will result from this operation. Further, it is not likely that any sea otters will experience injury or the significant potential for injury as a result of the activities described in the Proposed Action. Therefore this analysis concludes that implementation of rat eradication activities as described in the Proposed Action is not likely to adversely affect northern sea otters on an individual or population level.

Special considerations under ESA – Appropriate consultation will occur to ensure compliance with Section 7 of the ESA.with regard to Threatened sea otters.

4.5.2.3. Steller’s eider

As indicated in the Affected Environment section (Section 3.4.6.1), Steller’s eiders are unlikely to be present near Rat Island. Nevertheless, since they are listed under the ESA, analysis is completed below.

Brodifacoum toxicity risk – The Steller’s eider is in the same taxonomic family as the mallard, which has an LD50 of 0.26 mg/kg. Steller’s eiders average about 850 g (1.9 lb) in mass (Fredrickson 2001). However, the estimates of bait intake needed to reach an LD50 threshold illustrated in Table 4.1 are not informative for Steller’s eiders, as eiders are almost exclusively carnivorous. Given an eider’s average mass and an LD50 assumption of 0.26 mg/kg, one bird will need to eat enough primarily-exposed prey animals to ingest the equivalent of only four full bait pellets to be at a 50% risk of mortality.

Brodifacoum exposure risk – Steller’s eiders are not likely to be present during application activities, since the few birds that occur in the central Aleutians do not typically arrive until early winter, after the operations window will likely be closed by weather (Gibson and Byrd 2007). No Steller’s eiders have been reported at Rat Island in the record of historical observations (see Appendix 2). Nevertheless, if there are Steller’s eiders present in the Rat Island area during bait application activities, they would be on the water offshore. Birds in the water may encounter some bait pellets in the nearshore or intertidal zones immediately after bait application, but the planned mitigation measures to minimize bait entry into the marine ecosystem reduce this likelihood. However, if bait does enter the water, it will dissolve within hours. Typically, Steller’s eiders are carnivorous feeders and not expected to deliberately ingest bait pellets when their natural prey is readily available. Bait pellets entering the water will disintegrate, but the

active ingredient is mostly insoluble in the water. Grain particles will either be suspended in the nearshore turbulence or settle to the bottom. Small particles, each only 25 parts per million or less active ingredient that reach benthic filter feeders could be ingested. In the New Zealand brodifacoum spill (Primus et al. 2005) brodifacoum concentration peaked one day after the spill. Although Steller's eiders prey on intertidal and subtidal invertebrates, they will be at very low risk of secondary brodifacoum exposure.

Overall, based on the availability of brodifacoum in the environment over time, and their food habits and distribution patterns, Steller's eiders are very unlikely to be exposed to brodifacoum.

<u>Overall risks from brodifacoum use</u> – The toxicity of brodifacoum to Steller's eiders is high. However, they are very unlikely to be exposed to the toxin. Overall, therefore, Steller's eiders are very unlikely to suffer lethal or sublethal effects as a result of the Proposed Action because so little bait, and therefore active ingredient, is likely to enter the water column.

<u>Risks from the operation</u> – While there are no data on the sensitivity of Steller's eiders to helicopter noise, waterbirds in general have been reported to flush from roosts and nests in response to noise from low-flying helicopters (US Air Force and US Fish and Wildlife Service1988). Steller's eiders are also likely to flush (or swim away) when approached by personnel. Birds are generally more vulnerable to disturbance during the breeding season, but Steller's eiders do not breed on Rat Island or anywhere in the Aleutians. There is no reason to believe that disturbances over the temporal scale described in the Proposed Action will result in measurable effects to Steller's eiders on Rat Island, if they are present.

<u>Indirect effects</u> – Persistent rat predation on shorebirds in the Aleutians has contributed to inflated populations of some intertidal invertebrates that would normally be controlled by shorebird predation. A possible increase in the abundance of shorebirds after rat removal may facilitate a transformation in the intertidal ecosystem from invertebrate-dominated to algae-dominated, as are many of the intertidal ecosystems on rat-free Aleutian islands (Kurle et al., in review). Steller's eiders depend on the intertidal zone for food resources, but it is unlikely that intertidal community shifts after rat eradication will measurably affect the feeding success of eiders.

<u>Cumulative effects</u> – Steller's eiders are listed as Threatened under the ESA, due to an ongoing contraction in their breeding range. However, the causes of this contraction are unclear and possibly due to a number of different factors (USFWS 2002). Regardless, there are no impacts anticipated as a result of the Proposed Action that could be considered additive to any external impacts that eiders may be facing.

In the foreseeable future, there is the possibility for rat eradication efforts on additional Aleutian Islands. These eradications are unlikely to occur soon enough after the Rat Island project to contribute to cumulative effects on eiders that were affected by the eradication on Rat Island.

Thus, there is no reasonable risk for measurable cumulative effects on Steller's eiders that can be linked to the Proposed Action.

Significance of effects to Steller's eiders on and around Rat Island – There is no reasonable risk that the Proposed Action will lead to the harassment, harm, or mortality of any Steller's eiders, and therefore no risk of significant effects at the individual or population level.

Special considerations under ESA – Based on the analysis above it is unlikely that a formal consultation will be conducted under Section 7 of the ESA will be necessary for Steller's eiders.

4.5.3. Impacts to Species Listed Under the Marine Mammal Protection Act

4.5.3.1. Species also listed under ESA

As previously stated, two marine mammal species on Rat Island, Steller sea lions and northern sea otters, are protected by the ESA as well as the MMPA. Any compliance requirements required by NMFS for the Proposed Action will be relevant to these species. See Section 4.5.2 above for impacts analysis for both of these ESA-listed species.

4.5.3.2. Harbor seal

Brodifacoum toxicity risk – The brodifacoum LD50 value for harbor seals has not been established. Using a conservative LD50 figure of 0.4 mg/kg, a harbor seal of average mass, 80 kg (176 lb) (Kinkhart and Pitcher 1994), will need to ingest the equivalent of more than 500 bait pellets to be at a 50% risk of mortality. Harbor seals are exclusively carnivorous, so brodifacoum ingestion will need to occur either accidentally or through an intermediate prey species that previously consumed bait pellets.

Brodifacoum exposure risk – Harbor seals are primarily marine organisms, but they also utilize beaches year-round. Seals are likely to be present in the waters surrounding Rat Island, and are likely to be hauled-out somewhere on the island or surrounding offshore stacks and islets at any given time during rat eradication operations. Seals could conceivably encounter stray bait pellets, if they are hauled-out on Rat Island during bait application. Most of this bait will be consumed by rats within 4 days of the final bait application, and most of the stray bait in the lower intertidal zone where seals tend to be, will be carried away with the first high tide after each bait application. A scattered few pellets may remain present in areas that are above the high-water line for up to a few months after the application, but these are outside seals' normal terrestrial range. Seals in the water may encounter occasional bait pellets in ocean or intertidal zones, but this is unlikely because the few pellets that might inadvertently enter the nearshore marine waters will dissolve within hours.

Harbor seals are exclusively carnivorous (almost exclusively piscivorous) and do not feed while on land, so the only possible routes for bait ingestion are accidental. The likelihood of primary exposure is therefore very low. The likelihood of marine fish ingesting bait pellets is very low (as discussed in Section 4.3.1) and therefore the likelihood of secondary exposure in seals is negligible.

Overall risks from brodifacoum use – Due to their large size, the probability that an individual would consume enough bait to achieve toxic levels of brodifacoum is, in practice, low. Furthermore, the likelihood of harbor seals experiencing either primary or secondary exposure is very low to negligible. Overall, the overall risk of harbor seal mortality or noticeable sub-lethal effects as a result of brodifacoum use is negligible.

Risks from the operation – The response of pinnipeds like Steller sea lions to aircraft overflights varies from no discernable reaction to completely vacating haul-outs after a single overflight (Calkins 1979;Efroymson and Suter 2001). Approaching aircraft generally flush animals into the water.

During staging operations, project managers will plan helicopter flight lines and boat travel to minimize the potential for disturbance to harbor seal haul-outs known from existing databases and surveys conducted prior to the operations. However, in spite of these precautions, seals encountered unexpectedly during helicopter operations could be flushed from land temporarily. An individual seal's exposure to peak noise from the helicopter will be limited to animals that remain ashore, and is likely to be of short duration, as the elevation and speed of the helicopter (see Section 2.2.2.3) will limit the time that any single location is exposed to maximum noise.

Unlike during staging, it will be more difficult to avoid known haul sites on Rat Island with the helicopter during bait application because of the need for thorough coverage of the entire island. No young pups are expected on Rat Island during fall but the impacts of disturbance to seals during molting (another sensitive period) will be minimized by timing overflights after the peak molting period is over.

The sporadic personnel presence and temporary infrastructure installations that may be necessary near seal haul-outs during both staging and bait application operations may result in localized disturbances, although this is much less likely to disturb animals than helicopter overflights. The camps and staging areas themselves will be well inland and will have negligible impacts on seals hauled out on the coastline.

Overall, the effects of the operations described in the Proposed Action on harbor seals will vary depending on the number of disturbance events. However, the short-term displacement from haul-sites that is likely to occur as a result of helicopter noise and personnel is not anticipated to have any significant effect on overall energy balance or fitness of any individual animals.

Indirect effects – There is no reason to believe that the Proposed Action will lead to any effects in the habitat, prey base, or other ecological interactions of harbor seals that will indirectly affect them. Any pellets unintentionally deposited into nearshore marine waters will dissolve quickly; they are not likely to enter the food web by being ingested by fish that are then eaten by harbor seals. Nevertheless, even if a harbor seal eats a fish that has ingested a bait pellet, the likelihood of negative effects on the seal is negligible.

Cumulative effects – Harbor seals in Alaska were hunted in the 19th and early 20th centuries, and Alaska Natives continue to harvest them for subsistence. However, harbor seals are not

currently listed as depleted under the MMPA. Any effects from bait application operations are not likely to contribute measurably to negative cumulative effects in seals.

In the foreseeable future, there is the possibility for rat eradication efforts on additional Aleutian Islands. These eradications are unlikely to occur soon enough after the Rat Island project or close enough to the island to contribute to cumulative effects on seals that were affected by the Rat Island eradication. Thus, especially if helicopter activity is adjusted to minimize the amount of seal disturbance – within the constraints of ensuring a successful rat eradication – there is no reasonable risk for measurable cumulative effects on harbor seals.

Significance of effects to harbor seals on and around Rat Island – It is not likely that any harbor seals will suffer injury or the significant potential for injury as a result of the activities described in the Proposed Action. Therefore this analysis concludes that implementation of rat eradication activities as described in the Proposed Action is not likely to result in significant effects to harbor seals at an individual or population level.

Special considerations under MMPA – With the exception of subsistence harvests, the MMPA regulations generally prohibit the killing, injury or disturbance of marine mammals. However, permits can be granted allowing exceptions to this prohibition for actions that may impact a marine mammal if the impact is incidental to rather than the intention of the action. Carrying out an action that is likely to lead to the disturbance of hauled-out harbor seals to the point that they enter the water may be considered "harassment" under the MMPA, but the precedent for this determination is unclear. On Anacapa Island in southern California, where harbor seals are known to haul-out, aerial broadcast of rodenticide bait pellets for a rat eradication operation required no special permits from NMFS.

4.5.4. Impact on Species Listed Under the Migratory Bird Treaty Act

No endemic species or subspecies of birds are restricted to Rat Island (see Gibson and Byrd 2007). Of the Aleutian endemics that occur on Rat Island (e.g., rock ptarmigan, winter wren, song sparrow), Townsend's rock ptarmigan is the only taxon restricted to the Rat Island group (Kiska to Amchitka), but it occurs on most of the islands in the group being particularly abundant on nearby Amchitka Island.

4.5.4.1. Waterfowl

As indicated in section 3.4.6, the following five species of waterfowl are likely to be present at Rat Island in fall. Other species of migrant waterfowl could also occur in some years, but risks would be similar to appropriate taxa analyzed here (e.g. data for mallards and Canada geese could be applied to other species of ducks and geese respectively).

- Emperor goose
- Aleutian cackling goose
- Aleutian green-winged teal
- Common eider
- Harlequin duck

Emperor geese occur on beaches and rocky shores, migrant cackling geese are typically found in grass and dwarf shrub meadows, teal are in freshwater wetlands or inshore marine waters, and eiders and harlequins occur in inshore marine waters primarily. In the section immediately following, only geese and teal are treated because their exposure risk is different than the risk for eiders and harlequin ducks (seaducks) occupying marine waters. Environmental consequences for seaducks are discussed later with other marine birds (section 4.5.4.6). Geese and teal are unlikely to eat whole bait pellets, but pieces of pellets after baits begin to breakdown, could potentially be ingested.

Brodifacoum toxicity risk – There are multiple LD50 data points for waterfowl. For green-winged teal, use of the known LD50 for mallards (0.26 mg/kg) is appropriate. For Aleutian cackling geese and emperor geese, the LD50 value measured for Canada geese of <0.75 mg/kg (Godfrey 1985, as cited in Erickson and Urban 2002) would be most accurate. However, for the sake of consistency and caution, mallards appear to be one of the more sensitive avian species based on the literature (P. Johnson, pers. comm.), the lower value of 0.26 mg/kg will be used for all waterfowl. The average mass range for a small adult of these species is between 270 g (.6lb) (for green-winged teal) and almost 2 kg (4.4 lb) (for emperor geese) (Mowbray et al. 2002; Petersen et al. 1994; Johnson 1995). Based on this size range (which falls between the 100 g and 1000 g (.2 and 2.2 lb) size classes in Table 4.1), the estimated portion of daily food intake that must be bait for these species to be at a 50% risk of mortality is between 10% and 20%. However, because some of these waterfowl may be at risk of both primary and secondary exposure (see further analysis below), an actual bait pellet intake less than this may still contribute to some birds reaching a 50% risk of mortality, if these individuals also consume invertebrates that were previously exposed to brodifacoum and have stored the chemical their gut.

Brodifacoum exposure risk – Any waterfowl that are present on Rat Island during bait application activities will be likely to encounter bait pellets in both upland (0.33 pellets/m^2 or 0.28 pellets/sq yd) and coastal (0.7 pellets/m^2 or 0.6 pellets/sq yd) areas. Waterfowl are unlikely to encounter bait pellets in marine or freshwater habitat because large waterbodies will be avoided to prevent applying bait directly to water and a directional shield will minimize the amount of bait that drifts towards water. Some bait will inadvertently fall into water where steep-sided cliffs with hard (rock) faces are adjacent to the coastline. If bait does enter the water, it will be available immediately after entry but will dissolve within hours. Most of the bait on land will be consumed, primarily by rats within 10 days of the final bait application, but a scattered few pellets may remain present for up to a few months after the application. Some invertebrates on the island may continue to register measurable levels of brodifacoum for as long as bait pellets are available in the environment (Howald et al. 2005), but the actual risk of waterfowl experiencing secondary exposure through the consumption of invertebrates will decline from low (immediately after bait application) to negligible (within 30 days of bait application).

Animals on Rat Island are only at risk of exposure to brodifacoum if they are likely to consume bait pellets and/or if they are likely to prey or scavenge on animals that have consumed the bait pellets. Emperor geese and green-winged teal can be generally characterized by omnivorous food habits (Petersen et al. 1994; Johnson 1995). Aleutian cackling geese are almost exclusively

herbivorous (Mowbray et al. 2002). While there are no specific field data to demonstrate this, a general diet analysis indicates that emperor geese and teal are likely to experience primary exposure to brodifacoum. In an observational trial conducted on Shemya Island (western Aleutians) in September 2007, Aleutian cackling geese did not recognize a non-toxic bait replica spread in their foraging area as food (Schwitters 2007). This study suggests that Aleutian cackling geese on Rat Island are unlikely to experience primary exposure to brodifacoum as a result of the Proposed Action.

It is possible emperor geese and green-winged teal could be exposed to low levels of brodifacoum by consuming invertebrates that have fed upon bait. Because they are herbivorous, Aleutian cackling geese are very unlikely to experience secondary exposure through invertebrates.

Regardless of food habits, waterfowl will only be at risk of exposure to brodifacoum if they are present on Rat Island for the period of time during and soon after bait is applied to the island (likely to be in mid- to late fall, and for a few months afterward). As indicated in Section 3.4.6, up to 15 – 20 green-winged teal could be present on Rat Island in fall, mostly associated with wetlands and inshore marine waters where they are not likely to encounter baits. Emperor geese winter in the Aleutians. A few birds arrive by September, but numbers typically do not reach a peak until December (Gibson and Byrd 2007; Petersen et al. 1994). Emperors feed almost exclusively in the intertidal zone so they will be exposed to relatively low densities of baits for a relatively short period of time. The few pairs of Aleutian cackling geese that have recently been found breeding on Rat Island (Buckelew et al. 2007b), will be feeding in dwarf shrub and grass meadows in fall, where they could be joined in September or early October by passing flocks of migrant birds from western Aleutian breeding sites. Most geese have left the Aleutians for wintering grounds by early to mid-October (Gibson and Byrd 2007).

Overall, based on the availability of brodifacoum in the environment over time, and the food habits and migratory patterns of the waterfowl on Rat Island:

- Emperor geese and green-winged teal may be exposed to brodifacoum as a result of the Proposed Action, although it is somewhat unlikely; and
- Aleutian cackling geese are unlikely to be exposed to brodifacoum.

Overall risks from brodifacoum use – The toxicity of brodifacoum to the waterfowl analyzed here is probably high. Exposure to brodifacoum is possible. Therefore, as a result of brodifacoum use as described in the Proposed Action:

- Some individual green-winged teal and/or emperor geese may die or experience sub-lethal effects, although it is somewhat unlikely; and
- Aleutian cackling geese are unlikely to die or be exposed sub-lethally.

Risks from the operation – Waterfowl have been reported to flush in response to noise from low-flying helicopters (US Air Force and US Fish and Wildlife Service 1988). Waterfowl are also likely to flush when approached by personnel. Birds are generally considered to be particularly sensitive to disturbance during breeding activities, and altered breeding behaviors have been noted as a result of aircraft disturbance (US Air Force and US Fish and Wildlife Service 1988). Summer staging operations may result in localized disturbances to nesting waterfowl, but the

FWS will conduct island-wide nest surveys during staging operations, and project managers will take every reasonable measure to avoid placing helicopter flight lines or temporary infrastructure in the immediate vicinity of any known waterfowl nest sites. Bait application operations will not take place until after breeding seasons are over for the waterfowl species analyzed here. There is no reason to believe that disturbance over the temporal scale described in the Proposed Action will result in measurable effects to any of the waterfowl on Rat Island.

Indirect effects – Rats are known predators of ground-nesting birds, chicks, and eggs, including waterfowl. A successful rat eradication will remove the risk of predation from rats and may lead to an increase in waterfowl numbers.

Cumulative effects – When foxes were present on Rat Island, there were likely few breeding waterfowl on the island. Aleutian cackling geese were driven to near extinction in the 19th and 20th centuries by introduced foxes, and they were listed as an endangered species in 1967 (USFWS 1999). Fox removal from many Aleutian Islands, and other protective measures in wintering grounds, led to the Aleutian cackling goose being removed from the Endangered Species list in 2001, and a few breeding pairs have recently reoccupied Rat Island (Buckelew et al. 2007b). Green-winged teal were undoubtedly also prey items for foxes, and since fox eradication the teal population on Rat Island has likely increased.

In the future, there is the possibility for rat eradication efforts on additional Aleutian Islands. These eradications are unlikely to occur soon enough after the Rat Island project to contribute to cumulative effects on waterfowl that were affected by the eradication on Rat Island.

Thus, there is no reasonable risk for measurable cumulative effects on waterfowl that can be linked to the Proposed Action.

Significance of effects to waterfowl on Rat Island – The three species of waterfowl analyzed here are present on the islands surrounding Rat Island (Table 3.2), and there is likely gene flow between these islands. There is no reason to believe that the impacts to individual birds that are predicted above as a result of brodifacoum use will lead to noticeable changes in Rat Island's waterfowl community over the long term. There is likewise no reason to believe that impacts to individual birds on Rat Island will be measurable elsewhere in the region. This analysis concludes that implementation of the Proposed Action will not result in significant negative effects to waterfowl, but will likely produce positive long-term benefits for waterfowl populations and their recovery on Rat Island.

4.5.4.2. Birds of prey

Effects of the Proposed Action on the following birds of prey will be analyzed here:

- Peregrine falcon
- Short-eared owl

Effects of the Proposed Action on Bald eagles will be analyzed separately in Section 4.5.5.

As indicated in Table 3.2, typically two pairs of peregrine falcons nests on Rat Island, and with normal reproductive success there could be up to 10 falcons (including fledglings) associated with the island in fall. Furthermore, one or two short-eared owls could be present during fall migration.

Brodifacoum toxicity risk – There are studies that have established an average LD50 for a raptor (the Australasian harrier *Circus approximans*) at 10 mg/kg (Godfrey 1985, as cited in Erickson and Urban 2002). However, for the sake of consistency and caution, the much lower value of 0.26 mg/kg will be used as with the other birds analyzed in this document. The average mass for a peregrine falcon is between 900 and 1000 g (2 and 2.2 lb) (White et al. 2002), while the average mass for short-eared owls is between 300 and 400 g (.6 and .9 lb) (Wiggins et al. 2006). The estimates of bait intake needed to reach an LD50 threshold illustrated in Table 4.1 are not informative for animals such as birds of prey, which are exclusively carnivorous. However, given the average mass for each bird, and using the reported LD50 range of between 0.26 mg/kg and 10 mg/kg:

- A peregrine falcon will need to eat enough primarily-exposed prey animals to ingest the equivalent of at least 4 full bait pellets to be at a 50% risk of mortality.
- A short-eared owl will need to eat the enough primarily-exposed prey animals to ingest the equivalent of at least 2 full bait pellets to be at a 50% risk of mortality.

Brodifacoum exposure risk – Peregrine falcons and short-eared owls are exclusively carnivorous, and therefore they have a very low likelihood of primary exposure to brodifacoum. Peregrine falcons are specialist predators that almost exclusively feed on birds, and some birds on Rat Island are likely to consume bait pellets, which means that falcons may experience secondary exposure to brodifacoum.

Peregrine falcon diet on Amchitka Island (White et al 1973) largely consisted of seabirds and waterfowl, but rats were also taken (1.3% of diet). Ptarmigan, a potentially affected species from bait application, comprised 11.6% of the diet, and passerines were also taken at low percentages (total about 1% of diet). Non-target birds exposed to brodifacoum may be more susceptible to predation by peregrines and owls. American kestrels have been reported killed by secondary exposure to brodifacoum (Erickson and Urban 2004).

The anticipated risk of falcons experiencing secondary exposure through the consumption of birds will decline from low (immediately after bait application) to negligible (within 30 days of bait application).

Short-eared owls are known to prey on rats as well as birds, and therefore the likelihood of owls experiencing secondary exposure will be initially high (immediately after bait application) and will decline to negligible (within 30 days of bait application). Barn owls have been reported killed by secondary exposure to brodifacoum (Erickson and Urban 2004).

Through secondary exposure, both peregrine falcons and short-eared owls are likely to be exposed to brodifacoum.

Overall risks from brodifacoum use – While precise figures are unavailable, a conservative analysis must assume that the toxicity of brodifacoum to both peregrine falcons and short-eared owls is high. Because rats might be targeted as prey by owls, they are more likely to be exposed to the toxin than peregrines, but both could be exposed with at least sub-lethal effects and some birds might be killed by secondary exposure. Birds of prey exposed to brodifacoum-poisoned prey died (42%) and 1/3 of the surviving individuals showed signs of toxicosis (Erickson and Urban 2004). However, on Langara Island in British Columbia, the population of breeding peregrine falcons in fact increased one year after rat eradication efforts (W. Nelson, pers. comm.).

In summary, the relatively few birds of prey occurring on Rat Island during or soon after the proposed time of application may be exposed to brodifacoum, and there is risk of some mortality as a result.

Risks from the operation – Raptors have been reported to flush in response to noise from low-flying helicopters (US Air Force and US Fish and Wildlife Service 1988). Raptors are also likely to flush when approached by personnel. Birds are generally considered to be particularly sensitive to disturbance during breeding activities, and altered breeding behaviors have been noted as a result of aircraft disturbance (US Air Force and US Fish and Wildlife Service 1988). Peregrine falcons are known to breed on Rat Island, but short-eared owls are not. Helicopter operations during summer staging activities will be localized to discrete flight paths, making disturbance to nesting peregrines unlikely but possible. Bait application operations will not begin until after the breeding season is over for peregrines (White et al. 2002). There is no reason to believe that disturbance over the temporal scale described in the Proposed Action will result in measurable effects to peregrine falcons or short-eared owls.

Indirect effects – Peregrine falcons in the Aleutians depend largely on seabirds for prey. The negative impacts that rats have on seabird colonies may be indirectly reducing food availability to the peregrine population on Rat Island. Furthermore, rats are known predators of peregrine chicks in the Aleutians (Jones and Byrd 1979). The Proposed Action may result in an increase in food abundance (seabirds) for peregrines on Rat Island, and will eliminate rat predation.

Short-eared owls that arrive on Rat Island during migration likely prey on rats, and rat removal may negatively affect food availability for owls on the island. However, it is unlikely that this will have measurable effects on the migratory population of owls in the Rat Island region.

Cumulative effects – Owls and falcons can have large ranges, and it is possible that individual birds present on Rat Island are presently experiencing harm elsewhere in their ranges. However, there are no impacts anticipated as a result of the Proposed Action that could be considered additive to any external impacts that these birds may be facing.

In the foreseeable future, there is the possibility for rat eradication efforts on additional Aleutian Islands. These eradications are unlikely to occur soon enough after the Rat Island project to contribute to cumulative effects on birds of prey that were affected by the eradication on Rat Island.

Thus, there is no reasonable risk for measurable cumulative effects on either of the birds of prey analyzed here that can be linked to the Proposed Action.

Significance of effects to birds of prey on and around Rat Island – Peregrine falcons and short-eared owls are both present on the islands surrounding Rat Island (Table 3.2), and there is likely gene flow between birds on Rat Island and birds on surrounding islands. Furthermore, short-eared owls are considered uncommon on Rat Island and there are not likely to be more than a few, if any, owls present during or shortly after bait application operations (Gibson and Byrd 2007). There is no reason to believe that the impacts to individual birds predicted above as a result of brodifacoum use will lead to noticeable changes in Rat Island's peregrine or owl populations over the long term. There is likewise no reason to believe that impacts to individual birds on Rat Island will be measurable elsewhere in the region, such as through changes in regional populations. Therefore this analysis concludes that implementation of the Proposed Action will not result in significant effects to peregrine falcon or short-eared owl populations.

4.5.4.3. Shorebirds

Effects of the Proposed Action on the following shorebird species will be analyzed:

- Pacific golden-plover (fall migrant)
- Black oystercatcher (resident)
- Wandering tattler (fall migrant)
- Ruddy turnstone (fall migrant)
- Pectoral sandpiper (fall migrant)
- Sharp-tailed sandpiper (fall migrant)
- Rock sandpiper (resident)

Numbers of migrant shorebirds that are likely to be present in fall at Rat Island probably will not exceed 20 birds for any of the species (Table 3.2). The resident species, black oystercatcher and rock sandpiper could occur in numbers up to 40 or so. These latter two species will be primarily confined to intertidal areas in fall, but some of the migrants will likely occur in the uplands. The bait pellets are too large to be consumed whole by shorebirds, but particularly omnivorous migrant shorebirds foraging inland, where pellet density is higher, might ingest pieces of pellets by pecking at them or by picking up pieces after baits not consumed by rats begin to disintegrate.

Brodifacoum toxicity risk – The conservative LD50 value of 0.26 mg/kg will be used to estimate brodifacoum toxicity to shorebirds, as with the other birds analyzed in this document. The average mass range for a small adult of these species is between around 70 g (2.5 oz) (for wandering tattlers) (Gill et al. 2002b) and over 500 g (17.6 oz) (for black oystercatchers) (Andres and Falxa 1995). This places the shorebirds analyzed here between the 100 g and 1000 g (.2 and 2.2 lb) size classes on Table 4.1. According to this table, the estimated portion of daily food intake that must be bait for these birds to be at a 50% risk of mortality is between around 10% and 20%. Because some of these birds may be at risk of both primary and secondary exposure (see further analysis below), an actual bait pellet intake of a lower proportion of their diet may still contribute to some birds reaching a 50% risk of mortality, if they also consume invertebrates that were previously exposed to brodifacoum.

Brodifacoum exposure risk – Shorebirds that are present on Rat Island during bait application activities will likely encounter bait pellets on the ground in both upland (0.33 pellets/m^2 or 0.28 pellets/sq yd) and coastal (0.7 pellets/m^2 or 0.6 pellets/sq yd) areas. If bait does enter the water, it will be available immediately after entry but will dissolve within hours. Most of the bait on land will be consumed by rats within 10 days of the final bait application, but a scattered few pellets may remain present for up to a few months after the application. Some invertebrates on the island may continue to register measurable levels of brodifacoum for as long as bait pellets are available in the environment (Howald et al. 2005). Brodifacoum does not persist in invertebrate tissue (e.g., land crabs see Pain et al. 2000) after one month following exposure to brodifacoum bait. The actual risk of birds experiencing secondary exposure through the consumption of invertebrates will decline from low (immediately after bait application) to negligible (within 30 days of bait application).

Animals on Rat Island are only at risk of exposure to brodifacoum if they are likely to consume bait pellets and/or if they are likely to prey or scavenge on animals that have consumed the bait pellets. All shorebirds analyzed here except the black oystercatcher and rock sandpiper are likely to occur in inland areas where bait density is relatively high. Ruddy turnstones are omnivorous during the fall (Nettleship 2000) and due to their highly-variable diet this species might peck at bait pellets and ingest some of the rodenticide directly. Golden plovers tend to feed on berries or insects in fall, and the other migrant shorebirds tend to feed on insects and are not likely to directly ingest baits (Gill et al. 2002a; Johnson and Connors 1996; Gill et al. 2002b), but would have at least a low likelihood of at least sub-lethal effects from secondary exposure. Black oystercatchers are carnivorous, and they specialize in intertidal invertebrates (Andres and Falxa 1995). During the fall and winter months, rock sandpipers also feed largely on intertidal invertebrates. The likelihood of primary exposure in these two species is thus very low, and their likelihood of secondary exposure through invertebrate consumption is somewhat higher but still low because bait densities in intertidal zones will be low and generally temporary (between high tides).

Regardless of food habits, shorebirds will only be at risk of exposure to brodifacoum if they are present on Rat Island for the period of time during and soon after bait is applied to the island (likely to be in mid- to late fall, and for a few months afterward). Black oystercatchers and rock sandpipers are both considered resident to Rat Island and are likely to be present during and after bait application. Pacific golden plovers, wandering tattlers, ruddy turnstones, and pectoral and sharp-tailed sandpipers are all long-migrating species that could be present in small numbers on Rat Island temporarily during fall migration.

Overall risks from brodifacoum use – While precise figures are unavailable, a conservative analysis must assume that the toxicity of brodifacoum to the shorebirds on Rat Island is more or less uniformly high. However, most are unlikely to be directly exposed to the toxin. Overall, therefore, as a result of the Proposed Action:

- Given their particularly broad dietary habits (Nettleship 2000), ruddy turnstones are the most likely shorebirds to directly ingest portions of bait pellets and therefore get primary exposure that could potentially cause mortality or sub-lethal effects;
- Because they primarily are feeding on berries and insects in fall, the other migrant shorebirds have a very low risk of primary exposure because they are not likely to

directly ingest parts of bait pellets, but there is a low risk of secondary exposure in quantities sufficient to cause at least sub-lethal effects in some of the relatively few individuals that could be present at Rat Island;

- Black oystercatchers and rock sandpipers are unlikely to experience primary exposure, but there is a low likelihood of secondary exposure that could cause at least sub-lethally effects in some individuals.

Risks from the operation – Waterbirds, including shorebirds, have been reported to flush in response to noise from low-flying helicopters (US Air Force and US Fish and Wildlife Service 1988). Shorebirds are also likely to flush when approached by personnel. Shorebirds, especially black oystercatchers, are considered to be particularly sensitive to disturbance during breeding activities. Helicopter operations during summer staging activities will be localized to discrete flight paths, making disturbance to nesting oystercatchers and rock sandpipers unlikely but possible. Aerial bait application operations will not begin until after Rat Island's shorebird breeding season is over. Ruddy turnstones, Pacific golden plovers, and wandering tattlers are unlikely to be present during either staging or bait application activities, although their presence is possible. There is no reason to believe that disturbance over the temporal scale described in the Proposed Action will result in measurable effects to any of the shorebirds on Rat Island.

Indirect effects – Rats are known predators of ground-nesting birds including shorebirds. A successful rat eradication will release breeding oystercatchers and sandpipers from rat predation and may lead to an increase in their numbers.

Cumulative effects – When foxes were present on Rat Island, there were likely few or no breeding rock sandpipers or black oystercatchers on the island. Fox eradication from Rat Island released shorebirds from one predation threat, but rats remained. Today, rat predation may be keeping populations of oystercatchers or sandpipers on Rat Island smaller than they would be in a rat-free state. This current persistent downward population pressure is likely more substantial than any short-term negative impacts that may occur as a result of the Proposed Action.

In the foreseeable future, there is the possibility for rat eradication efforts on additional Aleutian Islands. These eradications are unlikely to occur soon enough after the Rat Island project to contribute to cumulative effects on shorebirds that were affected by the eradication on Rat Island.

Significance of effects to shorebirds on Rat Island – The shorebirds analyzed here are present on the islands surrounding Rat Island and there is likely gene flow between these islands among all breeding species. There is no reason to believe that the impacts to individual birds that are predicted above as a result of brodifacoum use will lead to noticeable changes in Rat Island's shorebird community over the long term. There is likewise no reason to believe that impacts to individual birds on Rat Island will result in measurable population-level changes for the species elsewhere. Therefore this analysis concludes that implementation of the Proposed Action will not result in significant effects to shorebird populations on Rat Island.

4.5.4.4. Marine birds except gulls and jaegers

Effects of the Proposed Action on the following marine birds will be analyzed. Foraging strategies vary and therefore potential to exposure varies among species groups accordingly. Marine birds most likely to be exposed directly (primary exposure) or indirectly (secondary exposure) to brodifacoum are scavengers like gulls and predators like jaegers, so these species are dealt with separately in the next section (4.5.4.5).

- Seaducks (inshore marine waters)
    - Pacific common eider
    - Harlequin duck
- Pelagic Seabirds (inshore marine waters)
    - Red-faced cormorant
    - Pelagic cormorant
    - Pigeon guillemot
    - Whiskered auklet
- Pelagic Seabirds (offshore marine waters)
    - Fork-tailed storm-petrel
    - Leach’s storm-petrel
    - Horned puffin
    - Tufted puffin

<u>Brodifacoum toxicity risk</u> – There are studies that have established an average LD50 for the Southern black-backed gull (*Larus dominicanus*) at <0.75 mg/kg (Godfrey 1985, as cited in Erickson and Urban 2002). However, for the sake of consistency and caution, the lower value of 0.26 mg/kg will be used, as with the other birds analyzed in this document. The average mass range for a small adult of these various marine bird species is between only 45 g (1.6 oz) (for Leach’s storm-petrel) and 1600 g (3.5 lb) (for common eiders) (Huntington et al. 1996; Robertson and Goudie 1999; Goudie et al. 2000; Causey 2002; Hobson 1997; Ewins 1993; Piatt and Kitaysky 2002a; Piatt and Kitaysky 2002b). The estimates of bait intake needed to reach an LD50 threshold illustrated in Table 4.1 is not informative for most of the marine birds, which are exclusively carnivorous. However, common eiders may occasionally consume plant matter, making Table 4.1 applicable to them. Average common eider mass is 1600 g (3.5 lb) (Goudie et al. 2000), putting them closest to the 1000 g (2.2 lb) size class. Consequently, Table 4.1 estimates the portion of daily food intake that must be bait for these birds to be at 50% risk of mortality as around 20% (a little more than 4 pellets for a 1000 g bird). Because common eiders may be at risk of both primary and secondary exposure (see further analysis below), an actual bait pellet intake of a lower proportion of their diet may still contribute to some birds reaching a 50% risk of mortality if they also consume intertidal invertebrates that were previously exposed to brodifacoum.

Potential brodifacoum toxicity in the carnivorous marine birds is more informative for decision-making when considered, similar to other predatory birds in this analysis, as the quantity of bait pellets that would contain an LD50 threshold. Given the mass range of these birds and a very conservative LD50 assumption of 0.26 mg/kg, marine birds on Rat Island will need to consume enough primarily-exposed prey animals to ingest the equivalent of between 1 and 7 full bait pellets to be at a 50% risk of mortality.

<u>Brodifacoum exposure risk</u> – Marine birds that are present on or around Rat Island during bait application activities will be likely to encounter bait pellets in coastal areas at a density of about 0.7 pellets/m^2 (0.6 pellets/sq yd). Marine birds may encounter bait pellets in ocean or intertidal zones, but this is unlikely because of the mitigation measures that will be implemented to minimize bait entry into the marine ecosystem. If bait does enter the water, it will be available immediately after entry but will dissolve within hours. Most of the bait on land will be consumed, primarily by rats, within 10 days of the final bait application, but a scattered few pellets may remain present for up to a few months after the application.

Animals on Rat Island are only at risk of exposure to brodifacoum if they are likely to consume bait pellets and/or if they are likely to prey or scavenge on animals that have consumed the bait pellets. Seaducks feeding in shallow inshore marine waters could conceivably come into contact with stray bait pellets, in spite of mitigation to keep pellets out of the marine waters. However, it is unlikely that pellets would be ingested. If seaducks are exposed at all, it would likely be an indirect exposure through diets. Eiders (and harlequins to a lesser degree) eat sessile marine invertebrates, particularly molloscs, in the intertidal zone and nearshore subtidal zones (Robertson and Goudie 1999; Goudie et al. 2000). These are areas that likely will have low densities of bait pellets, but a few seaducks could possible ingest invertebrates that have some level of brodifacoum, there is a remote possibility of primary exposure if they encounter a pellet and ingest it and a slightly higher, but still low, due to secondary exposure from eating invertebrates which themselves have a low likelihood of consuming baits before they disintegrated. The small amount of bait which inadvertently entered the water during the baiting at Anacapa Island (Howald et al. 2007) began to degrade after 1.5 hrs in the water. No brodifacoum was detected in the water or mussel samples collected. Pelagic seabirds, which feed on plankton (whiskered auklets and storm-petrels) or fish (cormorants, guillemots, and puffins) are not subject to primary exposure, and are there is negligible likelihood of secondary exposure.

Regardless of food habits, marine birds will only be at risk of exposure to brodifacoum if they are present on Rat Island for the period of time during and soon after bait is applied to the island. As shown in Table 3.2, hundreds of common eiders and harlequin ducks will be present in fall at Rat Island, where they will forage in inshore marine waters and roost on offshore rocks, reefs, or on the water (Robertson and Goudie 1999; Goudie et al. 2000). Cormorants, gulls, pigeon guillemots, and whiskered auklets are generally resident in the region (Causey 2002; Hobson 1997; Ewins 1993, Gibson and Byrd 2007), and all feed nearshore in marine waters. Storm-petrels and puffins will be completing nesting mostly in September and departing the area until spring. While still present, these species are feeding mainly well offshore in marine waters (e.g., Piatt and Kitaysky 2002a, b).

The bait applied to the islet off Ayugadak Point in early summer will be enclosed in bait stations and will not be available to gulls that might tend to scavenge them.

<u>Overall risks from brodifacoum use</u> – While precise figures are unavailable, a conservative analysis must assume that the toxicity of brodifacoum to the marine birds on Rat Island is generally high. However, they are very unlikely to be exposed to the toxin. Overall, therefore, all of the marine birds are very unlikely to die or be exposed sub-lethally as a result of brodifacoum use as described in the Proposed Action.

Risks from the operation – Marine birds have been reported to flush from roosts and nests in response to noise from low-flying helicopters (US Air Force and US Fish and Wildlife Service 1988). Some, particularly seabirds, are also likely to flush when approached by personnel. Of all the marine birds analyzed here, ledge-nesting cormorants would be the most susceptible to disturbance from helicopter overflights or ground personnel during staging operations if they occur during the nesting season, particularly before young in nests are feathered and can thermoregulate (usually by early August in the Aleutians, Alaska Maritime NWR, unpubl. data). Altered breeding behaviors have been noted in other marine bird species specifically as a result of aircraft disturbance (US Air Force and US Fish and Wildlife Service 1988). Helicopter operations during summer staging activities will be localized to discrete flight paths, designed to avoid cormorant colonies, and ground personnel will also avoid close approach to avoid disturbance. Aerial bait application operations will not begin until after breeding seasons are over.

Bait stations will be installed on the islet off Ayugadak Point during the breeding season of the birds that likely breed on this islet, and it is possible that these activities will cause perceptible disturbance to individual burrow-nesting breeding birds. However, field personnel will be trained to avoid burrows and in techniques for burrow repair in the rare case where a burrow is damaged. Impacts from this disturbance are not likely to be perceptible within these birds' local populations.

Overall, there is no reason to believe that localized disturbances over the temporal scale described in the Proposed Action will result in measurable effects to any of the marine bird species on Rat Island.

Indirect effects – Rats are known predators of marine birds in the Aleutians. A successful rat eradication will release these species from the risk of rat predation and may lead to an increase in marine bird abundance and diversity on Rat Island.

Cumulative effects – When foxes were present on Rat Island, there were likely few or no breeding marine birds on the island. Since fox eradication, some species of marine birds on Rat Island have likely increased. However, continued rat predation may be keeping populations of many of these species smaller than they would be if Rat Island were rat-free.

In general, marine birds have large ranges, and it is possible that individual birds present on Rat Island are presently experiencing harm elsewhere in their ranges. In particular, occasional interactions with fisheries may cause disturbances to seabirds, especially near human-populated areas. However, there are no impacts anticipated as a result of the Proposed Action that could be considered additive to any external impacts that marine birds may be facing.

In the foreseeable future, there is the possibility for rat eradication efforts on additional Aleutian Islands. These eradications are unlikely to occur soon enough after the Rat Island project to contribute to cumulative effects on marine birds that were affected by the eradication on Rat Island. In the long term, a successful archipelago-wide rat eradication program may lead to noticeable improvements in the population health of Aleutian seabirds.

In conclusion, there is no reasonable risk for measurable cumulative effects on marine birds that can be linked to the Proposed Action.

Significance of effects to marine birds on and around Rat Island – Marine bird species present on Rat Island are also present on the surrounding islands and there is likely gene flow between these islands. There is no reason to believe that any impacts to individual birds will lead to noticeable changes in the marine bird community on Rat Island over the long term. There is likewise no reason to believe that impacts to individual birds on Rat Island will result in measurable population-level changes for the species elsewhere. Therefore, this analysis concludes that implementation of the Proposed Action will not result in significant effects to any of the marine bird populations analyzed here.

4.5.4.5. Scavenging and predatory seabirds

The following two species of marine birds are analyzed separately because they have different foraging strategies which make them more vulnerable to exposure to brodifacoum than the other marine birds (Section 4.5.4.4). Gulls are opportunistic scavengers and predators and jaegers are kleptoparasites and predators on other birds.

- Glaucous-winged gull
- Parasitic jaeger

Brodifacoum toxicity risk – There are studies that have established an average LD50 for a seabird (the southern black-backed gull) at <0.75 mg/kg (Godfrey 1985, as cited in Erickson and Urban 2002). However, for the sake of consistency and caution, the lower value of 0.26 mg/kg will be used as with the other birds analyzed in this document. The average mass range for adults of these species is between around 500 g (1.1 lb) for jaegers (Wiley and Lee 1999) and 1000 g (2.2 lb) for gulls (Verbeek 1993). This places these birds between the 100 g and 1000 g (.2 and 2.2 lb) size classes on Table 4.1. Consequently, this table 4.1 estimates the portion of daily food intake that must be bait for these species to be at a 50% risk of mortality as between 10% and 20%. Because gulls and jaegers may be at risk of both primary and secondary exposure (see further analysis below), an actual bait pellet intake of a lower proportion of their diet may still contribute to some birds reaching a 50% risk of mortality, if they also consume animals (such as rats or invertebrates) that were previously exposed to brodifacoum.

Brodifacoum exposure risk – Any gulls or jaegers that are present on Rat Island during bait application activities will likely encounter bait pellets on the ground in both upland (0.33 pellets/m^2 or 0.28 pellets/sq yd) and coastal (0.7 pellets/m^2 or 0.6 pellets/sq yd) areas. Most of the bait on land will be consumed, primarily by rats, within 10 days of the final bait application, but a scattered few pellets may remain present for up to a few months after the application. Gulls and jaegers, if they are present, are likely to consume bait pellets. Through predation and/or scavenging, both species are also both likely to consume rats that have been exposed to brodifacoum, as well as invertebrates (Verbeek 1993; Wiley and Lee 1999). In a trial eradication in the Aleutians, most (88% of) rat carcasses were found underground, out of reach of avian scavengers (Buckelew et al. 2007a). Any exposed rat carcasses may be available for consumption by scavengers for up to 30 days. Some invertebrates on the island may continue to

register measurable levels of brodifacoum for as long as bait pellets are available in the environment (Howald et al. 2005). The actual likelihood of gulls or jaegers experiencing secondary exposure through the consumption of rats and invertebrates will decline from high (immediately after bait application) to very low (within 30 days of bait application).

Jaegers breed in the Aleutians, but leave for wintering grounds far to the south by mid-September (Wiley and Lee 1999; Gibson and Byrd 2007). Jaegers are therefore unlikely to be present during or after the bait application. Gulls are generally resident and some are likely to be present on Rat Island year-round. Overall, gulls are very likely to be exposed to brodifacoum. Jaegers are unlikely to be exposed to brodifacoum.

<u>Overall risks from brodifacoum use</u> – While precise figures are unavailable, a conservative analysis must assume that the toxicity of brodifacoum to both gulls and jaegers is high. Gulls are likely to be exposed to the toxin, but exposure is unlikely for jaegers. Overall, therefore, as a result of brodifacoum use as described in the Proposed Action:

- Some gulls are likely to die from brodifacoum exposure; and
- Due to their migratory patterns, jaegers are unlikely to die or be exposed sub-lethally.

<u>Risks from the operation</u> – Birds have been reported to flush in response to noise from low-flying helicopters (US Air Force and US Fish and Wildlife Service 1988). Altered breeding success has also been reported in gulls as an indirect effect of noise disturbance (US Air Force and US Fish and Wildlife Service 1988). Helicopter operations during summer staging activities will be localized to discrete flight paths, making disturbance to nesting gulls unlikely but possible. However, aerial bait application operations will not begin until after breeding seasons are over for gulls on Rat Island.

Bait stations will be installed on the islet off Ayugadak Point during the breeding season of the gulls that likely breed on this islet, and it is possible that these activities will cause perceptible disturbances to some nesting gulls. However, impacts from this disturbance are not likely to be perceptible within these birds' local populations.

There is no reason to believe that localized disturbances over the temporal scale described in the Proposed Action will result in measurable effects to gulls or jaegers.

<u>Indirect effects</u> – Rats are known predators of seabirds in the Aleutians. A successful rat eradication will release seabirds from the risk of rat predation and may lead to an increase in the abundance of seabirds on Rat Island, including gulls and jaegers. Because gulls and jaegers both prey on seabirds, and parasitic jaegers in the Aleutians often rely on seabird kleptoparasitism (stealing food from other birds) (Wiley and Lee 1999), an increase in local seabird populations will provide more food resources for both of these birds.

Persistent rat predation on shorebirds in the Aleutians has also contributed to inflated populations of some intertidal invertebrates that would normally be heavily predated by shorebirds. A possible increase in the abundance of shorebirds after rat removal may facilitate the transformation in the intertidal ecosystem from invertebrate-dominated to algae-dominated, as are many of the intertidal ecosystems on rat-free Aleutian islands (Kurle et al. in review).

However, it is unlikely that intertidal community shifts after rat eradication will measurably affect the feeding success of gulls or jaegers.

Cumulative effects – When foxes were present on Rat Island, there were likely few or no breeding marine birds on the island. Since fox eradication marine bird population on Rat Island has likely increased. However, continued rat predation may be keeping populations of many seabirds from becoming reestablished on Rat Island and remnant populations are likely smaller than they would be in a rat-free state. This current persistent downward population pressure is likely more substantial than any short-term negative impacts that may occur as a result of the Proposed Action.

Gulls and jaegers have large ranges, and it is possible that individual birds present on Rat Island are presently experiencing harm elsewhere in their ranges. In particular, occasional interactions with fisheries may cause disturbances to seabirds, especially near human-populated areas. However, there are no impacts anticipated as a result of the Proposed Action that could be considered additive to any external impacts that these birds may be facing.

In the foreseeable future, there is the possibility for rat eradication efforts on additional Aleutian Islands. These eradications are unlikely to occur soon enough after the Rat Island project to contribute to cumulative effects on scavenging seabirds that were affected by the eradication on Rat Island. In the long term, a successful archipelago-wide rat eradication program may lead to noticeable improvements in the population health of Aleutian seabirds.

In conclusion, there is no reasonable risk for measurable cumulative effects on either gulls or jaegers that can be linked to the Proposed Action.

Significance of effects to scavenging seabirds on and around Rat Island – Glaucous-winged gulls and parasitic jaegers are present on the surrounding islands and there is likely gene flow between these islands. There is no reason to believe that any impacts to individual birds will lead to noticeable long-term changes in gull or jaeger populations on and around Rat Island. There is likewise no reason to believe that impacts to individual birds on Rat Island will result in measurable population-level changes elsewhere in their range. Therefore this analysis concludes that implementation of the Proposed Action will not result in significant effects to either glaucous-winged gull or parasitic jaeger populations.

4.5.4.6. Common raven

Brodifacoum toxicity risk – The conservative LD50 value of 0.26 mg/kg will be used to estimate brodifacoum toxicity to ravens, as with the other birds analyzed in this document. The average mass for ravens in Alaska is between 1100 and 1200 g (2.4 and 2.7 lb) (sexes combined) (Boarman and Heinrich 1999). This places ravens in the 1000 g (2.4 lb) size class on Table 4.1. According to the Table, the estimated portion of daily food intake that must be bait for a raven to be at a 50% risk of mortality is about 20%. Because ravens are at risk of both primary and secondary exposure (see further analysis below), an actual bait intake of less than 20% of their diet may still contribute to some ravens reaching a 50% risk of mortality, if they also consume prey or scavenged animals that were previously exposed to brodifacoum.

<u>Brodifacoum exposure risk</u> – Any ravens that are present on Rat Island during bait application activities are likely to encounter bait pellets on the ground in both upland (0.33 pellets/m^2 or 0.28 pellets/sq yd) and coastal (0.7 pellets/m^2 or 0.6 pellets/sq yd) areas. Bait will be consumed and cached by rats within days after application, but some pellets may remain for a few months.

In a trial eradication in the Aleutians, most rat carcasses were found underground (88%), out of reach of scavenging ravens (Buckelew et al. 2007a). Any exposed rat carcasses may be available for consumption by ravens for up to 30 days. Howald et al (1999) documented ravens using rat carcasses on Langara Island. Thirteen ravens were found poisoned by brodifacoum after baiting, both from feeding directly on the bait and feeding on poisoned rats. Ravens may also consume invertebrates exposed to brodifacoum. Some invertebrates on the island may continue to register measurable levels of brodifacoum for as long as bait pellets are available in the environment (Howald et al. 2005). The actual likelihood of ravens experiencing secondary exposure through the consumption of rats and invertebrates will decline from high (immediately after bait application) to negligible (within 30 days of bait application). Overall, ravens are very likely to be exposed to brodifacoum.

<u>Overall risks from brodifacoum use</u> – While precise figures are unavailable, a conservative analysis must assume that the toxicity of brodifacoum to ravens is high. Furthermore, their food habits make them very likely to be exposed to the toxin. Overall, therefore, if they are present on Rat Island during or soon after bait application operations, some ravens are likely to die or experience sub-lethal effects from brodifacoum exposure.

<u>Risks from the operation</u> – There is little information on the disturbance effects of helicopter flyovers on ravens. Birds are generally considered to be sensitive to disturbance during breeding activities, but ravens have not been noted to be particularly vulnerable to breeding-season disturbances. There is no reason to believe that disturbance over the temporal scale described in the Proposed Action will result in measurable effects to ravens.

<u>Indirect effects</u> – Ravens likely prey on rats as part of their diet on Rat Island. Rat eradication may force ravens to change their food habits. Ravens are adept at adjusting to changes in food availability (Boarman and Heinrich 1999), so the disappearance of rats is unlikely to result in any noticeable effects. Ravens in the Aleutians also readily prey on seabirds and their eggs. The negative impacts that rats have on seabird colonies may be indirectly reducing food availability to ravens on Rat Island. The Proposed Action may result in an overall increase in food abundance (seabirds) for ravens on Rat Island.

<u>Cumulative effects</u> – Ravens in Alaska have never been considered at risk or threatened. There are no known past impacts to ravens in Alaska that would add to effects caused by the Proposed Action.

Ravens can have large ranges, and it is possible that individual ravens present on Rat Island are presently experiencing harm elsewhere in their ranges. However, there are no impacts anticipated as a result of the Proposed Action that could be considered additive to any external impacts that ravens may be facing.

In the foreseeable future, there is the possibility for rat eradication efforts on additional Aleutian Islands. These eradications are unlikely to occur soon enough after the Rat Island project or close enough to Rat Island to contribute to cumulative effects on ravens that were affected by the Proposed Action.

Thus, there is no reasonable risk for measurable cumulative effects on ravens that can be linked to the rat eradication on Rat Island.

Significance of effects to ravens on and around Rat Island – Ravens are present on the islands surrounding Rat Island (see Table 3.2) and there is likely gene flow between ravens on Rat Island and ravens on surrounding islands. Furthermore, the raven population on Rat Island is thought to be very small (Buckelew et al. 2007b). There is no reason to believe that the impacts to individual birds that are predicted above as a result of brodifacoum use will lead to noticeable changes in Rat Island’s raven community over the long term. There is likewise no reason to believe that impacts to individual birds on Rat Island will be measurable elsewhere in the region, such as through changes in regional populations. Therefore this analysis concludes that implementation of the Proposed Action will not result in significant effects to ravens.

4.5.4.7. Small and medium-sized passerines (other than ravens)

Effects of the Proposed Action on the following species of passerine birds (also called songbirds) will be analyzed:

- Winter wren
- Song sparrow
- Lapland longspur
- Snow bunting
- Gray-crowned rosy finch

Brodifacoum toxicity risk – There are studies that have established an average LD50 for a passerine (the song sparrow) at “<6” mg/kg (Godfrey 1985, as cited in Erickson and Urban 2002). However, for the sake of consistency and caution, the lower value of 0.26 mg/kg will be used as with the other birds analyzed in this document. The average mass range for a small adult of these species is between less than 9 g (0.3 oz) (for winter wrens) (Hejl et al. 2002) and more than 40 g (1.4 oz) (for gray-crowned rosy finches) (MacDougall-Shackleton et al. 2000). This places the passerines analyzed here in the 25 g (0.9 oz) size class on Table 4.1. According to the estimates in this table, the estimated portion of daily food intake that must be bait for these birds to be at a 50% risk of mortality is very low, about 4% (a fraction of a pellet). Because these passerines may be at risk of both primary and secondary exposure (see further analysis below), an actual bait pellet intake of even less than 4% of their diet may still contribute to some birds reaching a 50% risk of mortality, if they also consume invertebrates that were previously exposed to brodifacoum.

Brodifacoum exposure risk – Any passerine birds that are present on Rat Island during bait application activities will be likely to encounter bait pellets on the ground in both upland (0.33 pellets/m^2 or 0.28 pellets/sq yd) and coastal (0.7 pellets/m^2 or 0.6 pellets/sq yd) areas. Most of

the bait on land will be consumed, primarily by rats, within 10 days of the final bait application, but a scattered few pellets may remain present for up to a few months after the application. Some invertebrates on the island may continue to register measurable levels of brodifacoum for as long as bait pellets are available in the environment (Howald et al. 2005), but the actual risk of birds experiencing secondary exposure through the consumption of invertebrates will decline from low (immediately after bait application) to negligible (within 30 days of bait application).

Animals on Rat Island are only at risk of exposure to brodifacoum if they are likely to consume bait pellets and/or if they are likely to prey or scavenge on animals that have consumed the bait pellets. While the makeup of each bird's diet varies considerably, all of the birds analyzed in this section can be characterized as omnivorous (feed at least occasionally on invertebrates) to an extent (Hejl et al. 2002; Hussell and Montgomerie 2002; MacDougall-Shackleton et al. 2000; Lyon and Montgomerie 1995; Arcese et al. 2002). All of the passerine birds analyzed in this section are therefore likely to experience both primary and secondary exposure to brodifacoum if they are present during or after bait application. Of the birds analyzed here, three are considered likely to be present during fall bait application operations: 1) winter wrens, 2) gray-crowned rosy finches, and 3) snow buntings. Because most, if not all, Lapland longspurs leave for their southern wintering grounds by the end of September and do not arrive again in the Aleutians until April, they are unlikely to be present during bait application (Gibson and Byrd 2007; Hussell and Montgomerie 2002). No song sparrows were detected during bird surveys in summer 2007 (Buckelew 2007b), but a few birds have been seen on the island in past surveys (Table 3.2), so a few song sparrows could possibly be on Rat Island during bait application.

Song sparrows were present in August 2007 on the islet off Ayugadak Point (Buckelew et al. 2007b). If bait stations can be used exclusively on this islet, according to the criteria described in the Proposed Action (Section 2.2), the islet's song sparrows are unlikely to be exposed to brodifacoum, but not completely protected from exposure. If bait needs to be broadcast on the islet, these sparrows are likely to be exposed.

During a trial using baits containing brodifacoum on islets in the Bay of Islands (off Adak Island), four (26%) song sparrows with radio transmitters and presumed alive at the beginning of the bait trial survived at least 21 days after baiting. Five (33%) of the tagged sparrows were recovered dead, five (33%) were missing, and one sparrow (7%) had an active transmitter but its fate was unknown. Additionally, fifteen untagged song sparrows were found dead in carcass searches following baiting (Buckelew 2007a).

Overall, based on the availability of brodifacoum in the environment over time, and the food habits and distribution and migratory patterns of the passerine birds known from Rat Island:

- Winter wrens, gray-crowned rosy finches, and snow buntings are likely to be exposed to brodifacoum;
- Although unlikely, Lapland longspurs may be exposed to brodifacoum;
- If song sparrows are present they are likely to be exposed to brodifacoum; and
- Song sparrows on the islet off Ayugadak Point are likely to be exposed to brodifacoum if it is necessary to broadcast bait on the islet, and less likely to be exposed if bait stations can be used exclusively.

Overall risks from brodifacoum use – While precise figures are unavailable, a conservative analysis must assume that the toxicity of brodifacoum to the passerine birds on Rat Island is more or less uniformly high. Based on each bird's likelihood of exposure, therefore:

- Some winter wrens are likely to die or experience sub-lethal effects as a result of the Proposed Action;
- Some gray-crowned rosy finches are likely to die or experience sub-lethal effects as a result of the Proposed Action;
- Some snow buntings are likely to die or experience sub-lethal effects as a result of the Proposed Action;
- It is somewhat unlikely that any Lapland longspurs will die or experience sub-lethal effects as a result of the Proposed Action; and
- If bait must be broadcast on the islet off Ayugadak Point, some song sparrows are likely to die or experience sub-lethal effects as a result of the Proposed Action; but
- If bait stations can be used exclusively on this islet, song sparrows are somewhat unlikely to die or experience sub-lethal effects.

Risks from the operation – There is little information on the disturbance effects of helicopter flyovers on passerines. Birds are generally considered to be sensitive to disturbance during breeding activities, and altered breeding behaviors have been noted as a result of aircraft disturbance (US Air Force and US Fish and Wildlife Service 1988). Helicopter operations during summer staging activities will be localized to discrete flight paths, making disturbance to nesting passerines unlikely but possible. Aerial bait application operations will not begin until well after the breeding season is over for these species.

Bait stations will be installed on the islet off Ayugadak Point during song sparrow breeding season, but it is unlikely that these activities will cause perceptible disturbance to breeding birds.

There is no reason to believe that disturbance over the temporal scale described in the Proposed Action will result in measurable effects to any of the passerines analyzed.

Indirect effects – Rats are known predators of all life stages of landbirds elsewhere (Atkinson 1985) and in the Aleutians (H. Jones, pers. comm.). Rats may have caused a major decline in winter wren and song sparrow populations on Amchitka Island (White et al. 1977). A successful rat eradication will release passerine birds from rat predation pressure and may lead to an increase in passerine numbers on Rat Island.

Cumulative effects – When foxes were present on Rat Island, they likely preyed on passerines at least occasionally. Fox eradication from Rat Island released passerines from that predation source, but rats remained. Today, rat predation may be keeping passerine populations on Rat Island much smaller than they would be in a rat-free state. This current persistent downward population pressure is likely more substantial than any short-term negative impacts that may occur as a result of the Proposed Action.

In the foreseeable future, there is the possibility for rat eradication efforts on additional Aleutian Islands. These eradications are unlikely to occur soon enough after the Rat Island project or close

enough to Rat Island to contribute to cumulative effects on passerines that were affected by the Proposed Action.

Significance of effects to small and medium-sized passerines on and around Rat Island – The passerine birds analyzed here are present on the islands surrounding Rat Island and there is likely gene flow between these islands. There is no reason to believe that the impacts to individual birds that are predicted above as a result of brodifacoum use will lead to noticeable changes in the passerine community on Rat Island over the long term. Results from a 2006 trial eradication elsewhere in the Aleutians support this conclusion; although some passerines (song sparrows) did experience mortality from brodifacoum, this species remained extant after bait application on all treated test islands (Buckelew et al. 2007a). There is likewise no reason to believe that impacts to individual birds on Rat Island will result in measurable population-level changes in these passerines elsewhere in their range. This analysis concludes that implementation of the Proposed Action will not result in significant effects to the passerine bird species analyzed.

4.5.5. Impacts to Bald Eagles

Brodifacoum toxicity risk – There are studies that have established an average LD50 for the Australasian harrier at 10 mg/kg (Godfrey 1985, as cited in Erickson and Urban 2002). However, for the sake of consistency and caution, the lower value of 0.26 mg/kg will be used, as with the other birds analyzed in this document. The average mass range for bald eagles in Alaska is between about 4000 and 6000 g (8.8 and 13.2 lb) (sexes combined) (Buehler 2000). The estimates of bait intake needed to reach an LD50 threshold illustrated in Table 4.1 are not informative for animals such as the bald eagle that are exclusively carnivorous (Buehler 2000). However, given the average sized eagle and a very conservative LD50 assumption of 0.26 mg/kg, one eagle will need to eat enough primarily-exposed prey animals to ingest the equivalent of at least 17 bait pellets to reach a 50% risk of mortality from the brodifacoum. As a note of comparison, if the LD50 figure of 10 mg/kg is used instead, the LD50 threshold for an average bald eagle is not reached until a bird has eaten enough primarily-exposed prey animals to ingest the equivalent of between 600 and 1000 pellets. This discrepancy between figures indicates that the potential toxicity risk to eagles is still poorly understood, but the risk may be much lower than this analysis assumes.

Brodifacoum exposure risk – Bald eagles are exclusively carnivorous and have a very low likelihood of primary exposure to brodifacoum. They are opportunistic predators, but generally demonstrate a preference for fish whenever they are available (Howald et al. 1999; Anthony et al. 1999). In the absence of available fish, eagles in the Aleutians will prey on seabirds and mammals. Because eagles are known to feed on rats, as well as birds, they will have a high likelihood of exposure to brodifacoum for a period of time immediately following bait application. While rats are still alive on the island, eagles are likely to prey on them as well as birds that may have been exposed to brodifacoum, and they are also likely to scavenge on the carcasses of rats and birds as well. In a trial eradication in the Aleutians, most (88% of) rat carcasses were found underground, out of reach of avian scavengers (Buckelew et al. 2007a). Any exposed rat or bird carcasses may be available for consumption by scavengers such as eagles for up to 30 days. The actual likelihood of eagles experiencing secondary exposure

through the consumption of rats or birds is probably dependent on the seasonal availability of fish in the nearshore waters of Rat Island. By a conservative estimate, assuming that eagles will be feeding at least occasionally on rats during bait application operations, their likelihood of brodifacoum exposure will decline from high (immediately after bait application) to negligible (within 30 days of bait application).

<u>Overall risks from brodifacoum use</u> – The toxicity of brodifacoum to bald eagles is high, but lower than other birds analyzed in this document due to eagles' much larger size. The risk that eagles will be exposed to measurable levels of brodifacoum is also thought to be high initially after bait application, but the local availability of fish (especially spawning salmonids) at the time of the bait application may correspondingly reduce eagles' brodifacoum exposure risk if birds move off Rat Island to see salmon on nearby Amchitka where many spawning streams occur (Simenstad et al 1977). For comparison, no eagles were found dead or sick or suspected of brodifacoum exposure in 2006 during a trial removal of rats near Adak Island (Buckelew et al. 2007a). Furthermore, evidence from Langara Island (Howald et al. 1999) indicates that the likelihood of bald eagles ingesting a lethal dose of brodifacoum through consumption of brodifacoum-exposed rats and birds may be low. According to the most conservative analysis, some bald eagles may be exposed to brodifacoum residues, but are unlikely to die as a result of bait application on Rat Island.

<u>Risks from the operation</u> – Eagles have been reported to flush in response to noise from low-flying helicopters (US Air Force and US Fish and Wildlife Service 1988). Eagles are also likely to flush when approached by personnel. Eagles are generally considered to be more sensitive to disturbance during breeding activities, although there is little evidence to suggest that sound disturbances over a short temporal scale cause alterations in breeding success.

During early summer staging operations, when bald eagles will be nesting or raising chicks, project managers will plan helicopter flight lines that remain more than 305 m (1000 ft.) away from all known eagle nests on the island based on nest surveys conducted before flight lines are finalized. Aerial bait application operations will not begin until after the breeding season is over for eagles on Rat Island (Gibson and Byrd 2007; Buehler 2000). There is no reason to believe that disturbance over the temporal scale described in the Proposed Action will result in measurable effects to bald eagles.

<u>Indirect effects</u> – Bald eagles likely rely on rats as a food source on Rat Island (Murie 1940; Anthony et al. 1999). However, the best scientific evidence indicates that current bald eagle predation on rats in the Aleutians is relatively low (~13% of their total diet; Anthony et al. 1999). Rat removal from Rat Island may therefore force eagles to change their food habits, but only by a small amount. It is unlikely that rat eradication will result in reduced feeding success for bald eagles, as bald eagles have the ability to switch prey depending on food availability (Anthony et al. 1999).

The negative impacts that rats have on seabird colonies may be indirectly reducing food availability to bald eagles on Rat Island. If the Proposed Action successfully facilitates growth in seabird colonies on Rat Island, it may in fact result in an overall increase in food abundance for eagles, which appear to catch seabirds with less difficulty than catching rats.

Cumulative effects – Like most raptors, bald eagles are sensitive to persistent organic pollutants in the environment. Some examples of these pollutants that occur in the Aleutian environment include polychorinated biphenlys (PCBs) and organochlorine pesticides such as DDT. Military actions, both from World War II and in the last 50 years, are said to be responsible for polychlorinated biphenyl (PCB) contamination in bald eagles in the Aleutians (Anthony et al. 1999). These high concentrations can be linked to reduced breeding success in some cases (Anthony et al. 1999) and may affect bald eagle populations on Rat Island. In the lower 48 states, bald eagles were nearly driven extinct as a result of DDT pesticide use in the early-to-mid 1900's; however, due to its remoteness, DDT did not affect Alaskan bald eagle populations (Buehler 2000). Since the abandonment of DDT use, populations in the lower 48 have rebounded enough to warrant the recent delisting of the bald eagle from the Endangered Species list.

There is evidence, however, that Aleutian bald eagles still contain organochlorine pesticides and mercury in their systems and that those contaminants can reduce bald eagle breeding success (Anthony et al. 1999). Organochlorine pesticides are mostly used as insecticides and typically associated with agricultural use. Although sources of those pesticides are far from the Aleutians, bald eagles are exposed to them secondarily, mostly through the seabirds in their diet (Anthony et al. 1999). Despite ongoing evidence of contamination, bald eagles in Alaska remain at or near their carrying capacity (Buehler 2000).

In the foreseeable future, there is the possibility for rat eradication efforts on additional Aleutian Islands. These eradications are unlikely to occur soon enough after the Rat Island project to contribute to cumulative effects on bald eagles that were affected by the eradication on Rat Island.

Thus, there is no reasonable risk for measurable cumulative effects on bald eagles that can be linked to the Proposed Action.

Significance of effects to bald eagles on Rat Island – Eagles are present on the islands surrounding Rat Island and there is likely gene flow between eagles on Rat Island and eagles on surrounding islands. There is no reason to believe that the potential impacts to individual birds as a result of brodifacoum use will lead to noticeable changes in eagle population numbers on or around Rat Island over the long term. There is likewise no reason to believe that impacts to individual birds on Rat Island will result in measurable population-level changes elsewhere in their range. Therefore this analysis concludes that implementation of the Proposed Action will not result in significant effects to bald eagle populations.

Compliance with the Bald Eagle Management Guidelines – The management guidelines for bald eagles circulated by FWS recommend measures to minimize impacts of actions, both by the government and by private entities, on bald eagles. The recommended measures relevant to the Proposed Action include 1) avoiding operating aircraft within 305 m (1000 ft.) of the nest during breeding season, and 2) using pesticides only in accordance with federal and state laws. The Proposed Action will adhere to these guidelines.

4.5.6. Impacts to Other Species On and Around Rat Island

4.5.6.1. Rock ptarmigan

Brodifacoum toxicity risk – There are studies that have established an average LD50 for another medium-sized galliform bird, the ring-necked pheasant *Phasianus colchicus*, at 10 mg/kg (Godfrey 1985, as cited in Erickson and Urban 2002). However, for the sake of consistency and caution, the lower value of 0.26 mg/kg will be used, as with the other birds analyzed in this document. The average mass for ptarmigan is about 500 g (1.1 lb) (Holder and Montgomerie 1993). This places ptarmigan between the 100 g and 1000 g (.2 and 2.2 lb) size classes on Table 4.1. According to this table, the estimated portion of daily food intake that must be bait for a ptarmigan to be at a 50% risk of mortality is between 10% and 20%.

Brodifacoum exposure risk – Ptarmigan that are present on Rat Island during bait application activities will likely encounter bait pellets in both upland (0.33 pellets/m^2 or 0.28 pellets/sq yd) and coastal (0.7 pellets/m^2 or 0.6 pellets/sq yd) areas. Most of the bait will be consumed, primarily by rats, within 10 days of the final bait application, but a scattered few pellets may remain present for up to a few months after the application. Because ptarmigan are almost exclusively herbivorous (Holder and Montgomerie 1993), they are very unlikely to experience secondary exposure. Overall, ptarmigan on Rat Island are likely to be exposed to brodifacoum.

Overall risks from brodifacoum use – While precise figures are unavailable, a conservative analysis must assume that the toxicity of brodifacoum to ptarmigan is high. Furthermore, they are likely to be exposed to the toxin. Overall, therefore, some ptarmigan are likely to die or experience sub-lethal effects as a result of the implementation of the Proposed Action.

Risks from the operation – Ptarmigan responses to low-flying aircraft have not been reported. However, experiments subjecting nesting upland game birds to simulated sonic booms found that no birds flushed as a result, and there were no changes in hatching success (US Air Force and US Fish and Wildlife Service 1988). Ptarmigan in remote areas delay their flush responses, often allowing humans to approach to within less than 10 m (33 ft.). There is no reason to believe that disturbance over the temporal scale described in the Proposed Action will result in measurable effects to ptarmigan.

Indirect effects – Rats are known predators of ground-nesting birds in the Aleutians and may be preying on ptarmigan, including eating their eggs. A successful rat eradication may lead to an increase in ptarmigan numbers on Rat Island.

Cumulative effects – When foxes were present on Rat Island, there were likely few breeding ptarmigan on the island. Since fox eradication the ptarmigan population on Rat Island has certainly increased. However, continued rat predation may be keeping ptarmigan populations on Rat Island smaller than they would be in a rat-free state. This likely downward population pressure may be more substantial than any short-term negative impacts that may occur as a result of the Proposed Action, and removal of rats may increase the population of ptarmigan.

In the foreseeable future, there is the possibility for rat eradication efforts on additional Aleutian Islands. These eradications are unlikely to occur soon enough after the Rat Island project or close enough to Rat Island to contribute to cumulative effects on ptarmigan that were affected by the Proposed Action.

Thus, there is no reasonable risk for measurable cumulative effects on ptarmigan populations in the Aleutians that can be linked to the rat eradication on Rat Island.

Significance of effects to ptarmigan on and around Rat Island – Townsend's Rock ptarmigan occurs on other islands in the Rat Islands group, including the large islands of Amchitka and Kiska (Gibson and Byrd 2007), so loss of some birds at Rat Island will not affect the subspecies at the population level. It is unlikely that impacts to individual birds on Rat Island will result in measurable population-level changes elsewhere in the region. Therefore this analysis concludes that implementation of the Proposed Action will not result in significant effects to ptarmigan populations.

4.5.6.2. Freshwater fish

Effects of the Proposed Action on the following freshwater fish will be analyzed:

- Dolly varden
- Stickleback
- Pink salmon

Brodifacoum toxicity risk – There are no brodifacoum LD50 data available for fish, so brodifacoum toxicity in fish through oral ingestion of brodifacoum is unknown. Researchers have collected data on the lethal concentration of brodifacoum necessary to kill 50% of rainbow trout (*Oncorhynchus mykiss*) in a laboratory study – a value referred to as "LC50" that is measured in mg of active ingredient/liter of solution (also see Section 4.2.2.1.2). Researchers obtained the figure for trout, 0.04 mg/L, by suspending brodifacoum in water pumped through aquarium tanks and exposing fish to the brodifacoum suspension for 96 continuous hours. Because of the very low water solubility of brodifacoum, such an extreme exposure scenario will not occur for any fish species present on Rat Island. For context, however, if we assume that brodifacoum was 100% soluble in water and is broadcast into streams on Rat Island at a rate of 17 kg/ha, the application rate for coastal areas, the maximum brodifacoum concentration in an average-sized stream (based on geographic data collected in summer 2007; Buckelew et al. 2007b) would be less than 0.0004 mg/L, or more than 100 times lower than the concentration needed for 50% mortality in trout. Upland areas would experience a lower application rate of 8 kg/ha.

Brodifacoum exposure risk – During and immediately following bait application operations, stream-dwelling fish may encounter bait pellets at an average density of 0.7 pellets/m^2 (0.6 pellets/sq yd), but these pellets will disintegrate in the water and become unavailable within hours. Tests conducted by researchers on a wide variety of fish species have shown that marine fish are largely uninterested in bait pellets as food items (Buckelew et al. 2007a; Howald et al. 2005; USFWS 2005; Empson and Miskelly 1999; A. Wegmann, pers. obs.). It is similarly unlikely that fish present in freshwater habitat on Rat Island will demonstrate an affinity for

pellets. The fish analyzed here are primarily carnivorous, feeding on invertebrates. Some aquatic invertebrates may consume bait immediately after it enters the water, but it will only be available in pellet form for a matter of hours. The risk for freshwater fish of secondary exposure is very low. Finally, most of the streams on Rat Island are tiny and discontinuous, making viable fish habitat on the island extremely limited. During observational stream surveys conducted in summer 2007, fish were recorded in very few streams. No pink salmon were reported during this survey, and salmon habitat in particular is extremely limited on the island.

Overall, none of the fish species analyzed here are likely to be exposed to toxic amounts of brodifacoum as a result of the Proposed Action.

Overall risks from brodifacoum use – While precise toxicity figures for fish are not available, the exposure risk for freshwater fish on Rat Island is very low, and the overall risk for mortality or sub-lethal brodifacoum exposure in fish is negligible.

Risks from the operation – Personnel may enter streams incidental to traveling by foot around the island. Additionally, the installation of temporary field camp facilities may have highly localized impacts on potential fish habitat. None of these activities will result in perceptible impacts to the fish species analyzed here. To further mitigate for potential impacts to fish, personnel will conduct formal surveys in any streams that may be affected by camp installation activities and will take all reasonable measures necessary to avoid disturbing streams that are identified as high-quality fish habitat.

Indirect effects – No indirect effects can be reasonably expected on these three fish species as a result of the Proposed Action.

Cumulative effects – There is no reasonable possibility that the Proposed Action will contribute to cumulative impacts on the fish species analyzed here.

Significance of effects to freshwater fish on Rat Island – There is no reason to believe that the Proposed Action will contribute to perceptible changes in the freshwater fish community on Rat Island or the freshwater fish community anywhere else in the region. Therefore this analysis concludes that implementation of the Proposed Action will not result in significant effects to freshwater fish populations.

4.5.6.3. Terrestrial Vegetation

As described above in Section 4.2.2, this document will analyze the impact of the Proposed Action on the vegetative communities found on Rat Island. The analysis will give special consideration to a rare species, the Aleutian wormwood, which is endemic to the Rat Islands group.

Risks from the operation – During staging operations in early summer, the project crew will cause moderate but localized and temporary disturbances to the plant community in five discrete locations: three bait storage areas (where bait will be kept in sealed containers), one fuel storage facility (where fuel will be stored and contained according to all applicable safety standards), and

a camp area (see Figure 6). Bait station installation activities on the islet off Ayugadak Point will result in minor and highly localized vegetation disturbance, as will crews traveling by foot on Rat Island as well as the islet off Ayugadak Point. During the fall bait application operations, helicopters landing at each staging location and personnel traveling by foot will both cause minor-to-moderate but localized and temporary damage to vegetation.

At the outset of early summer staging operations, personnel will conduct formal surveys for Aleutian wormwood at all sites where staging, storage or camp structures may be installed. All reasonable measures will be taken to avoid conducting any of these higher-impact activities in areas where the likelihood of damaging Aleutian wormwood is high. Additionally, field crew will be trained to identify Aleutian wormwood in the field and crew members will visibly mark, record, and avoid large stands of wormwood when encountered during operations.

Indirect effects – Rats are known to feed on vegetation on the Aleutian Islands (Dunlevy and Scharf 2006; S. Ebbert, pers. comm.), sometimes with noticeable or major local effects. Rat removal may in fact benefit local or even island-wide vegetation communities, potentially returning species composition, abundance & biomass more similar to rat-free islands in the Aleutians.

Cumulative effects – There is no reasonable possibility that the Proposed Action will contribute to negative cumulative impacts on Rat Island’s plant community.

Significance of effects to plants on Rat Island – It is possible that the removal of rats will result in perceptible changes to the vegetative communities on Rat Island, ultimately returning to a composition reflecting its previously undisturbed state. However, it is likely that the vegetation response to rat removal will be imperceptible or localized rather than island-wide. Therefore this analysis concludes that implementation of the Proposed Action is not likely to result in significant negative effects to the vegetation on Rat Island, but will likely produce at least moderate beneficial effects in returning Rat Island vegetation to a more natural condition.

4.5.7. Impacts to Water Resources

Some bait pellets are likely to inadvertently enter bodies of fresh water on Rat Island and potentially drift into nearshore marine waters during bait application operations. However, the bait application techniques described will include mitigation measures to limit bait entry into water bodies to a level well under the target bait application rate.

Even if bait enters water bodies on or around Rat Island at the full application rate, it is very unlikely to contribute to detectable levels of brodifacoum in the water column. The low water solubility and strong chemical affinity of brodifacoum to the grain matrix of the bait pellets largely prevents the rodenticide from entering aquatic environments via run-off. Furthermore, the concentration of brodifacoum in bait pellets is so low that even if we assume the compound was highly water soluble, and was broadcast into the water at an application rate of 17 kg/ha, the maximum brodifacoum concentration in an average-sized stream would be less than 0.0004 mg/L, or more than 100 times lower than the concentration needed for 50% mortality in trout

(stream size based on geographic data collected in summer 2007; Buckelew et al. 2007b). Similar hypothetical brodifacoum concentrations in lakes and the nearshore marine environment would be even lower.

Marine water samples from the intertidal zone of Anacapa Island taken 24 and 48 hours after aerial brodifacoum bait application did not detect any brodifacoum (Howald et al. 2005). In a more extreme example, a truck transporting brodifacoum bait pellets in New Zealand went off a coastal road and spilled more than 20 tons into the nearshore environment. Just 36 hours after this catastrophic spill, researchers could no longer detect any brodifacoum in the water column at the center of the spill site. Furthermore, within nine days of the spill, even the marine sediment at the spill site no longer registered a detectable amount of brodifacoum.

There is no reasonable likelihood that water bodies on or surrounding Rat Island will register biologically harmful, or even detectable, levels of brodifacoum as a result of bait application to the island. Samples will be collected before and after baiting and tested for brodifacoum.

4.5.8. Impacts to Designated Wilderness

The aircraft, equipment, tools, personnel and installations required to conduct a successful non-native invasive rat eradication will produce short term negative impacts on the wilderness character of Rat Island. The eradication effort will require manipulation of the existing ecological processes in an effort to restore natural systems that have been disrupted through the introduction of an invasive species. The personnel and equipment necessary for the operation have the potential to decrease a visitor’s opportunity to experience solitude and unconfined recreation. However, due to the extremely remote the location of Rat Island it is unlikely visitors would be present during the eradication effort. The long term benefits of an enduring wilderness with restored ecological systems gained through a successful rat eradication are greater than the short term negative impacts the effort may have to the wilderness character of Rat Island.

4.5.9. Impacts to Historical and Cultural Resources

None of the temporary infrastructure that will be installed as part of the Proposed Action will be placed within the four historical sites selected by The Aleut Corporation. Personnel presence within these sites will be limited, and no activities that require disturbing the soil (such as infrastructure installation) will be conducted within them. Furthermore, personnel will be briefed on how to identify possible artifacts. Any artifacts or suspected historical sites that are found during project operations, both within and outside The Aleut Corporation-selected sites, will be mapped, clearly marked and avoided. As a result of these measures, there is no reasonable likelihood that personnel foot traffic will have impacts to archaeological or cultural resources within these sites and our knowledge of, and thus ability to protect, historical and cultural sites on Rat Island may actually be enhanced.

The FWS is required by ANCSA to consult with The Aleut Corporation before conducting management actions that will affect the historical sites selected on Rat Island. Additionally, the

FWS will consult with the Region 7 FWS Regional Historical Preservation Officer before implementing the Proposed Action, as required under the National Historic Preservation Act.

4.5.10. Impacts to Social and Economic Values

4.5.10.1. Refuge visitors

There are no records of recreational visits to Rat Island since the FWS began managing it in 1913 as part of the original Aleutian Islands Refuge. However, up to four tour boats may pass within view of the island during a typical summer season. There is no reasonable risk that the Proposed Action will impact the health or safety of any Refuge visitors. However, interim scenic alteration of the island will be evident from the temporary field camps and small equipment storage structures, which will be partially visible from nearby waters for the duration of the project (from early summer through late fall). This visual alteration will degrade the pristine character of Rat Island, but this degradation will be temporary. By the summer season following eradication operations, visitors to Rat Island will no longer have their experience compromised in any way. In fact, in the intermediate to long term, an increase in nesting seabirds on the island after rats are removed will likely enhance the visitor experience of Rat Island as a wildlife refuge.

4.5.10.2. Fishery resources

The likelihood of marine fish being exposed to brodifacoum is negligible, and the likelihood of rat eradication activities having an impact on marine fish that is noticeable in a commercial fishery (either in the form of brodifacoum residues or catch amounts or compositions) is essentially nil. In advance of helicopter operations for bait application, any vessels in the vicinity of Rat Island will be notified of these planned activities and asked to avoid the island during this period of time. This request is not expected to noticeably impact the area’s fisheries.

4.5.10.3. Subsistence resources

There are no records of current or recent use of Rat Island by rural Alaskans, either for subsistence or cultural purposes. Due to its extreme isolation, there is no reasonable likelihood that the Proposed Action will affect the use of Rat Island for subsistence or recreational hunting or gathering by rural Alaskans or other island users.

Some of the migratory bird species that use Rat Island may be harvested elsewhere on their migratory routes, particularly the Aleutian cackling geese that migrate eastward in fall along the Aleutian chain. However, observational studies have shown that geese are unlikely to consume bait pellets. There is therefore no reasonable likelihood that geese harvested elsewhere will carry any brodifacoum residue. In the extremely unlikely scenario that a goose or other bird that ingested brodifacoum on Rat Island was harvested elsewhere and consumed, there is no reasonable likelihood that a harmful quantity of brodifacoum will be ingested. Using the conservative LD50 value applied elsewhere in this analysis – 0.04 mg/kg – the average human

male would need to ingest the equivalent of between 400 and 600 bait pellets to reach a 50% risk of mortality.

Regardless, the FWS will inform the hunting and subsistence use communities in the Aleutians of the minute theoretical risk of cackling geese being exposed to brodifacoum on Rat Island and then continuing their eastward migration. Because the goose migration season will likely begin before bait is applied to Rat Island, the FWS will encourage concerned hunters to harvest geese earlier in the season. There is no reasonable risk that migratory birds on Rat Island will be carrying brodifacoum residue by the subsequent fall migration.

Figure 16. Field camp in Gunner's Cove on Rat Island, 2007.

Table 4.3. Summary: Impacts of the Proposed Action, by issue

Issue	**Sub-issue**	**Likelihood and nature of impacts from rodenticide use**	**Likelihood and nature of impacts from the operation**	**Likelihood and nature of other impacts**
Restoration efficacy		NA	NA	Proposed action is likely to effectively eradicate rats and restore habitat
Native biological resources	Marine mammals (including listed species)	Very unlikely	Likely - disturbance (minor and temporary)	
	Birds (including listed species)	Taxon-dependent; mortality likely in some species	Somewhat likely - localized nesting disturbances during early summer staging period	Rat eradication will likely lead to increases in bird populations on Rat Island
	Freshwater fish	Very unlikely	Very unlikely	
	Plants	None	Likely - localized, temporary and mostly minor damage to native vegetation	Rat eradication may lead to changes in the vegetative communities occurring on Rat Island, towards a more natural state
Water resources		Very unlikely	None	
Wilderness character		None	Likely - temporary structures and motorized equipment operation (no permanent effects)	Rat eradication will enhance the wilderness character of Rat Island
Historical/cultural resources		NA	Unlikely	
Social/economic values		Very unlikely	Unlikely - temporary scenic alteration, visitation by public during operations is unlikely	

5. Consultation and Coordination

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Appendix 1: The status of birds that are likely to be present at Rat Island in fall

Common name	**Scientific name**	**Status at Rat I.**	**Special protection**	**Likely Status in September-October**	**Probable seasonal population trend in mid-fall**
Emperor goose	*Chen canagica*	Winter resident		Most not present until November	Upward
Aleutian cackling goose	*Branta canadensis leucopareia*	Rare breeder and migrant	State Species of Special Concern	Passing flocks primarily in Sept.	Downward
Aleutian green-winged teal	*Anas crecca nimia*	Probably resident		Present in low numbers	Little change
Pacific common eider	*Somateria mollissima v-nigrum*	Resident		Present in nearshore marine waters	LIttle change
Harlequin duck	*Histrionicus histrionicus*	Resident, non-breeders in summer		Wintering birds arriving in October	Upward
Rock ptarmigan	*Lagopus muta townsendi*	Resident		present in small flocks	Little change
Fork-tailed storm-petrel	*Oceanodroma furcata*	Present on islet off Ayugadak Pt.		Not likely present on the main island	Downward as young fledge and leave at end of Sept.
Leach's storm-petrel	*Oceanodroma leucorhoa*	Present on islet off Ayugadak Pt.		Not likely present on the main island	Downward as young fledge and leave in October
Red-faced cormorant	*Phalacrocorax pelagicus*	Possibly resident		Low numbers in nearshore marine waters	Possibly downward
Pelagic cormorant	*Phalacrocorax urile*	Resident		Low numbers in nearshore marine waters	Little change
Bald eagle	*Haliaeetus leucocephalus*	Probably resident	Protected under BGEPA	Present on cliffs and bluffs	Possibly declining in Sept due to dispersal to nearby islands with salmon streams
Peregrine falcon	*Falco peregrinus pealei*	Resident		Present on cliffs	Little change
Pacific golden plover	*Pluvialis fulva*	Seasonal migrant		Passing birds possibly present	Downward after October

Appendix 1: Status of birds likely to be present at Rat Island in the fall

Common name	Scientific name	Status at Rat I.	Special protection	Likely Status in September-October	Probable seasonal population trend in mid-fall
Black oystercatcher	*Haematopus bachmani*	Resident		Present in intertidal	Little change
Wandering tattler	*Heteroscelus incanus*	Seasonal migrant		Present in small numbers in intertidal	Probably gone by mid-October
Ruddy turnstone	*Arenaria interpres*	Seasonal migrant		Present in small numbers in intertidal	Probably gone by mid-October
Pectoral sandpiper	*Calidris melanotos*	Seasonal migrant		Present in small numbers in upland	Probably gone by mid-October
Sharp-tailed sandpiper	*Calidris acuminata*	Seasonal migrant		Present in small numbers in upland	Probably gone by mid-October
Rock sandpiper	*Calidris ptilocnemis*	Resident		Present in intertidal zone	Little change
Glaucous-winged gull	*Larus glaucescens*	Resident		Present in intertidal zone	Little change
Parasitic jaeger	*Stercorarius parasiticus*	Possibly breeding		Present in upland	Downward, gone by 20 Sept.
Pigeon guillemot	*Cepphus columba*	Resident		Present in nearshore marine waters	Little change
Whiskered auklet	*Aethia pygmaea*	Possibly nesting on islet off Ayugadak Pt.		A few present in nearshore waters	Little change
Horned puffin	*Fratercula corniculata*	Likely breeding in cliff crevices		A few present in nearshore marine waters	Downward, gone by 20 Sept.
Tufted puffin	*Fratercula cirrhata*	Breed on islet off Ayugadak Pt.		Present in nearshore marine waters	Downward, depart nesting areas by mid-late September
Short-eared owl	*Asio flammeus*	Seasonal migrant		One or two possibly present in uplands	Upward, migrate through area mid-Sept.-late Oct. be present)
Common raven	*Corvus corax*	Very rare visitor apparently		One or two birds possibly present	Little change

Appendix 1: Status of birds likely to be present at Rat Island in the fall

Common name	**Scientific name**	**Status at Rat I.**	**Special protection**	**Likely Status in September-October**	**Probable seasonal population trend in mid-fall**
Winter wren	*Troglodytes troglodytes*	Resident		Present near beaches	Little change
Song sparrow	*Melospiza melodia*	Rare on Rat I., common resident on islet off Ayugadak Pt.		Possibly one or two present on Rat I. near beaches	Little change
Lapland longspur	*Calcarius lapponicus*	Breeding		Pre-migratory flocks in September	Downward, gone by end of Sept.
Snow bunting	*Plectrophenax nivalis*	Possibly resident		Present in uplands	Little change
Gray-crowned rosy-finch	*Leucosticte tephrocotus griseonucha*	Possibly resident		Present in coastal areas	Little change

Data from: Gibson and Byrd 2007; Buckelew et al. 2007b, and from historic observations documented in Appendix 2.

Appendix 2: Historical observations of Wildlife at Rat Island (1937 – 2004)

Species	1937	Notes	1969	Notes	1982	Notes	1984	Notes	1989	Notes	2002	Notes	2004	Notes
BIRDS														
Mallard							P	No broods observed						
N. Pintail							P	No broods observed			1			
N. Shoveler							P	No broods observed						
Green-winged Teal					2	pair	P	No broods observed			15	one w/brood 6		
Greater Scaup							P	No broods observed						
Common Eider	30				50		P	No broods observed			72		750	
Harlequin Duck	+	a few seen			52		P		22		106		500	
Rock Ptarmigan	+	several seen					P	1 nest, <6 birds	15		50+	plus broods		
Yellow-billed Loon									1	skull found				
Fork-tailed Storm-Petrel							P	Seen from ship offshore						
Unid Cormorant					157		P		50	>50 both species			47	
Pelagic Cormorant	+	a few noted			6						1		278	
Red-faced Cormorant	3				7								474	
Bald Eagle	8	4 pairs	4	nests	14		P		11	9 ad., 2 im	12		42	numbers drawn to minke whale carcass
Peregrine Falcon					6		P		1		<11	count includes duplicates	+	lots of fledglings seen
Osprey							?	*Reported but doubtful*						
Black Oytercatcher	4	2 pairs			2		P	None nesting	8		1		37	
Whimbrel					1									
Ruddy Turnstone							P							
Ringed/Semipal. Plover											1			
Species	**1937**	**Notes**	**1969**	**Notes**	**1982**	**Notes**	**1984**	**Notes**	**1989**	**Notes**	**2002**	**Notes**	**2004**	**Notes**
Rock Sandpiper	+	several					P		4		20			
Parasitic Jaeger	4	2 pairs			1		P	2 seen all summer	8				8	

Appendix 2: Historical observations of wildlife at Rat Island, 1937-2004

Species	1937	Notes	1969	Notes	1982	Notes	1984	Notes	1989	Notes	2002	Notes	2004	Notes
Oriental Cuckoo	1	specimen												
Glaucous-winged Gull	+	common					P		100		500+		+	lots of 1 & 2 year olds and fledglings
Common Murre	12													
Thick-billed Murre													+	both murres present in low numbers
Pigeon Guillemot	+	a few			56				+	scattered adults, 1 fledgling			200	
Marbled Murrelet													3	
Ancient Murrelet	12	dozen +			125		P						+	several scattered
Parakeet Auklet					2									
Crested Auklet					4		P							
Whiskered Auklet							P	seen from ship offshore						
Least Auklet					1									
Horned Puffin	+	only a few			56								130	
Tufted Puffin	+	a few			210								160	
Common Raven	4						P							
Winter Wren							P		C	common near beaches	6		+	heard commonly
Gray-crowned Rosy-Finch	+	several					P		1		5		+	few scattered on cliffs
Snow Bunting	+	common					P		4					
Song Sparrow							P				1			
Lapland Longspur	+	common					P		C	common in interior	300+			
MARINE MAMMALS														
Harbor Seal									22	on beach 1 mi e. Krysi Pt.	25		36	
Sea Otter									+	abundant			10	
Steller Sea Lion										a few near Ayugadak Pt.			+	not counted
SOURCE		Murie 1937		Berns 1969		Dragoo & Deines 1983		Hanson et. al. 1984		Byrd 1989		Williams and Howald 2007		Byrd et al. 2004
DATES OF SURVEY		29-Jun-1937				1-Jul-2007		25 May-29 July 84		12-Aug-1989		4-6 Sept. 2002		1-2 August 2004

Appendix 3: Minimum Requirements Decision Guide

ARTHUR CARHART NATIONAL WILDERNESS TRAINING CENTER

MINIMUM REQUIREMENTS DECISION GUIDE
WORKSHEETS

". . . except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act..."

– the Wilderness Act, 1964

Please refer to the accompanying MRDG *Instructions* for filling out this guide.

The spaces in the worksheets will expand as necessary as you enter your response.

Step 1: Determine if any administrative action is necessary.

Description: Briefly describe the situation that may prompt action.

After their introduction more than 200 years ago, rats dramatically changed the natural ecological processes of Rat Island in the western Aleutian Island archipelago. Prior to this introduction, the island supported significant populations of breeding seabirds and other ground nesting birds which evolved in the absence of mammalian predators. Rats have also had detrimental impacts on the vegetation and inter-tidal life of the island. Eradicating rats from this island would restore wilderness character and allow for the recovery of extirpated wildlife populations on this wilderness island.

To determine if administrative action is necessary, answer the questions listed in A - F on the following pages.

A. Describe Options Outside of Wilderness

Is action necessary within wilderness?

Yes: ☐ **No:** ☒

Explain:

More than ten islands in the Aleutian archipelago have had rats introduced to them. However, not all of these islands are suitable for a successful rat eradication project. For a rat eradication effort to be feasible with existing technology, an island must be less than 10,000 acres and must not be within 2 km of an island which also supports a population of rats. These requirements narrow the list to a small number of islands which have some, if not all of their acres as wilderness. Conducting a successful rat eradication to restore natural diversity in the Aleutian Islands isn't possible outside of wilderness.

B. Describe Valid Existing Rights or Special Provisions of Wilderness Legislation

Is action necessary to satisfy valid existing rights or a special provision in wilderness legislation (the Wilderness Act of 1964 or subsequent wilderness laws) that allows consideration of the Section 4(c) prohibited uses? Cite law and section.

Yes: ☐ **No:** ☒ **Not Applicable:** ☐

Explain:

There are no special provisions that apply in the Wilderness Act (1964).

C. Describe Requirements of Other Legislation

Is action necessary to meet the requirements of other laws?

Yes: ☒ **No:** ☐ **Not Applicable:** ☐

Explain:

One of the establishing purposes of Alaska Maritime NWR set forth in PL 96-487; ANILCA Section 303(1)(B)(i) is "*to conserve fish and wildlife populations in their natural diversity…*".

D. Describe Other Guidance

Is action necessary to conform to direction contained in agency policy, unit and wilderness management plans, species recovery plans, tribal government agreements, state and local government and interagency agreements?

Yes: ☒ **No:** ☐ **Not Applicable:** ☐

Explain:

The Alaska Maritime NWR Comprehensive Conservation Plan recognizes the detrimental impacts of introduced predators to refuge resources and that their removal would provide the most tangible benefits possible for the restoration of bird populations and species diversity. Wilderness management guidance found in U.S. Fish and Wildlife Service Policy 6 RM 8.8 states *"Motorized equipment may be used in special circumstances if it is the minimum tool necessary to accomplish a task safely and without long term impairment of the area's wilderness character."* National Wildlife Refuge System Policy on Biointegrity 601 FW3 directs refuges to "*control populations of invasive species, and provide for restoration of native species and habitat conditions in invaded ecosystems."* Presidential Executive Order 13112 on Invasive Species directs Federal agencies whose actions may affect the status of invasive species to *"detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner"*.

E. Wilderness Character

Is action necessary to preserve the qualities of wilderness character including: untrammeled, undeveloped, natural, outstanding opportunities for solitude or a primitive and unconfined type of recreation, or unique components that reflect the character of this wilderness area?

Untrammeled: **Yes:** ☒ **No:** ☐ **Not Applicable:** ☐ **No Change:**

Explain:

The untrammeled character of this wilderness has already been affected through human influence since rats were introduced by shipwreck over 200 years ago. However, an effort to eradicate this invasive species might also be construed as a manipulation of natural processes that negatively affects the untrammeled character of this wilderness.

Undeveloped: **Yes:** ☐ **No:** ☒ **Not Applicable:** ☐ **No Change:** ☐

Explain:

The proposed action would require the use of temporary platforms and mechanized equipment over a short period of time. However, this would not result in any permanent improvements of the island and it would retain its undeveloped character.

Natural: **Yes:** ☒ **No:** ☐ **Not Applicable:** ☐ **No Change:** ☐

Explain:

Over time, rats have disrupted the natural ecological systems of the island. Rat Island lost its primeval character and differs from neighboring wilderness islands which have not been altered through human influence. Successfully eradicating rats from the island would restore the wilderness character of this area.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation:

Yes: ☐ **No:** ☒ **Not Applicable:** ☐ **No Change:** ☐

Explain:

The personnel and equipment necessary for this operation have the potential to decrease a visitor's opportunity to experience solitude and unconfined recreation. However, Rat Island is so remote it is unlikely visitors would be present during the proposed eradication.

Other unique components that reflect the character of this wilderness

Yes: ☐ **No:** ☐ **Not Applicable:** ☒ **No Change:** ☐

Explain:

F. Describe Effects to the Public Purposes of Wilderness

Is action necessary to support the public purposes for wilderness (as stated in Section 4(b) of the Wilderness Act) of recreation, scenic, scientific, education, conservation, and historical use?

Recreation: **Yes:** ☐ **No:** ☒ **Not Applicable:** ☐

Explain:

Scenic: **Yes:** ☒ **No:** ☐ **Not Applicable:** ☐

Explain:

Rats feed extensively on vegetation and their activity alters habitats affects the distribution of certain plants species over time. Rats have caused the extirpation of seabird colonies which previously provided scenic value to this wilderness.

Scientific: **Yes:** ☒ **No:** ☐ **Not Applicable:** ☐

Explain:

A successful rat eradication would provide valuable information about how natural systems recover from the elimination of an invasive species. This information would be available for public education.

Education: **Yes:** ☐ **No:** ☒ **Not Applicable:** ☐

Explain:

Conservation: **Yes:** ☒ **No:** ☐ **Not Applicable:** ☐

Explain:

The removal of rats from the island would allow species that had been extirpated from the island to re-colonize. This would allow the public to experience an area that has regained its primeval character.

Historical use: **Yes:** ☐ **No:** ☐ **Not Applicable:** ☒

Explain:

Step 1 Decision: Is any administrative action necessary in wilderness?

Yes: ☒ **No:** ☐ **More information needed:** ☐

Explain:

The presence of rats has changed the natural wilderness character of Rat Island. The proposed invasive rat eradication would restore natural ecological processes that have been disrupted for more than 200 years. The Wilderness Act provides agencies with a responsibility to preserve the wilderness character of the areas they administer. This project would allow the agency to meet it's responsibilities to preserve the wilderness character of Rat Island, provide for public purposes associated with wilderness, restore native wildlife populations and secure an enduring resource of wilderness for the nation.

If action is <u>necessary</u>, proceed to Step 2 to determine the <u>minimum</u> activity.

Step 2: Determine the minimum activity.

Please refer to the accompanying MRDG *Instructions* for an explanation of the effects criteria displayed below.

Description of Alternatives

For each alternative, describe what methods and techniques will be used, when the activity will take place, where the activity will take place, what mitigation measures are necessary, and the general effects to the wilderness resource and character.

Alternative #1, No Action

Description:

An eradication of invasive rats on Rat Island would not be conducted.

Effects:

Wilderness Character

"Untrammeled"

The existing components or processes of ecological systems of Rat Island would not be manipulated if the eradication is not conducted. The current conditions are influenced by the presence of an invasive species.

"Undeveloped"

It would not be necessary to construct temporary structures. The imprint of human activity would be unnoticed.

"Natural"

Natural conditions and ecological systems on the island would continue to be disrupted by the presence of invasive rats. Restoration of conditions on the island to support the natural biological diversity of the region would not be possible.

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation"

Opportunities for visitors to experience solitude and unconfined recreation would be maintained. However, visitors will not experience the diversity of wildlife species present on nearby wilderness islands due to the presence of rats.

Heritage and Cultural Resources

Cultural resource sites could not be disturbed by human activity associated with eradication operations if no action is taken. The burrowing and chewing activities of rats have the potential to damage or disturb cultural artifacts found in ancient house pits and midden sites.

Maintaining Traditional Skills

Traditional skills and travel methods will not be used if the proposed eradication does not occur.

Special Provisions

No special provisions or rights identified in the Wilderness Act or other legislation will apply if the proposed action is not taken.

Safety of Visitors, Personnel, and Contractors

The safety of personnel will not be a factor if no action is taken.

Economic and Time Constraints

No funding will be required and time constraints will not be applicable if no action is taken.

Additional Wilderness-specific Comparison Criteria

None identified.

Alternative # 2
Invasive Rat Eradication using Equipment, Rodenticide and Temporary Structures

Description:

An invasive rat eradication would be conducted on Rat Island using equipment, and helicopters to broadcast rodenticide on Rat Island. It would require the use of power tools to construct tent platforms and landing platforms for the helicopters. Large concrete blocks will be used to anchor the helicopters when not in use. Generators would be used at times to supply electricity for electronic equipment essential to the success and safety of the operation.

Effects:

Wilderness Character

"Untrammeled"

The existing ecological process influenced by the long term presence of an invasive species will be significantly manipulated by the rat eradication. The manipulation is intended to restore the ecological components present prior to the introduction of rats.

"Undeveloped"

The structures necessary for the successful completion of the proposed eradication will result in increased visibility of man's work.

"Natural"

Successful completion of the proposed eradication would eliminate an invasive species that has been present on the island for over 200 years. The action would allow the natural biological diversity to recover and restore the natural conditions of the island prior to the introduction of an invasive species.

"Outstanding opportunities for solitude or a primitive and unconfined type of recreation"

During the six week duration of the proposed eradication effort, the opportunity for visitors to experience solitude will be adversely affected. Over time, the eradication would restore natural conditions that would enhance the wilderness experience of visitors.

Heritage and Cultural Resources

The eradication effort would not adversely affect the cultural resources known to exist on Rat Island. Eradication of the rats may provide some protection to artifacts at risk from the burrowing and chewing activities of rats.

Maintaining Traditional Skills

The eradication effort will not involve the use of traditional skills.

Special Provisions

No special provisions apply to the proposed eradication effort.

Safety of Visitors, Personnel, and Contractors

There is a risk to agency personnel and contractors when traveling over rough terrain and through the use of tools and equipment. In particular, the use of helicopters brings an additional level of risk. All required certifications, training and protective equipment requirements will be met during the proposed operation. The weather in the Aleutian Islands poses risks that are uncontrollable, but can be minimized through proper planning and preparedness.

Economic and Time Constraints

The estimated cost for this project is $2.4 million and the eradication work on the island is expected to take six weeks. The large size and rugged terrain of Rat Island coupled with the limited time frame available to broadcast the rodenticide makes this alternative the only method with a reasonable expectation of success.

Additional Wilderness-specific Comparison Criteria

None identified.

Step 2 Decision: What is the Minimum Activity?

Please refer to the accompanying MRDG *Instructions* before describing the selected alternative and describing the rationale for selection.

Selected alternative: Alternative #2

An eradication of non-native rats will be implemented in the fall of 2008 on Rat Island. The rats will be eradicated using cereal grain pellets containing the rodenticide *brodifacoum* broadcast over the island surface from hoppers slung beneath two helicopters. Total helicopter flight time for the bait distribution will take approximately 70 hours. The operation will occur over a six week period and require a crew of approximately 20 people. No overland mechanized transport will be used.

Field camp and support facilities for the operation will require the installation of 15 – 20 tent platforms and three bait loading platforms that will be pre-fabricated prior to arrival at Rat Island. Some limited use of motorized drills may be necessary to install the platforms. Helicopters would also be used to transport bait and fuel to three staging areas. Two small generators would be used to supply power for equipment critical to the success and safety of the operation. Helicopters would be used to transport any unused fuel, bait, or other material associated with the staging areas off the island.

Rationale for selecting this alternative:

This alternative is the only method with a reasonable chance of successfully eradicating non-native invasive rats from Rat Island. Rats occupy a variety of habitats across the entire island and multiply quickly. A successful eradication requires that a lethal dose of rodenticide is delivered to every rat on the island quickly enough for the bait to be consumed before it deteriorates. Broadcasting the bait across the island with helicopters is the only method that can distribute the bait evenly across the rugged terrain of the entire island in the time needed to be effective. Although the use of helicopters, platforms and some equipment will cause adverse impacts to wilderness character over the short term, a successful eradication will restore wilderness character that has been lost due to the presence of an invasive species.

Monitoring and reporting requirements:

Following the completion of the project, the removal of all material, equipment, structures and installations will be documented and filed at the headquarters of Alaska Maritime NWR.

Check any Wilderness Act Section 4(c) uses approved in this alternative:

- ☐ mechanical transport
- ☒ landing of aircraft
- ☒ motorized equipment
- ☐ temporary road

☐ motor vehicles

☒ structure or installation

☐ motorboats

Record and report any authorizations of Wilderness Act Section 4(c) uses according to agency procedures.

Approvals	Signature	Name	Position	Date
Prepared by:				
Recommended:				
Recommended:				
Approved:				

Appendix 4: ANILCA 810 Evaluation

Alaska Maritime National Wildlife Refuge
Evaluation of the Effects on Subsistence Uses and Needs
(ANILCA Section 810 Evaluation)

The U.S. Fish and Wildlife Service, acting for the Secretary, is required by Section 810 of the Alaska National Interest Lands Conservation Act (ANILCA) to evaluate the effects on subsistence uses and needs in determining whether to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public lands on national wildlife refuges in Alaska. The evaluation of effects of this Proposed Action or use on subsistence uses and needs is documented below. If this evaluation concludes a finding that the Proposed Action would result in significant restriction to subsistence uses, and we wish to proceed, we must initiate further procedural requirements of Section 810.

Proposed Action/Use:

Rat Island is a remote, uninhabited island located in the central Aleutian Islands, Alaska. Norway rats (Rattus norvegicus) were introduced to Rat Island by shipwreck in the 1780's. Since that time, rats have caused adverse impacts to natural species on the island and extirpated nesting seabirds. The purpose of the Proposed Action is to eradicate introduced, non-native rats from Rat Island and maintain it's rodent free status, which will facilitate the restoration of the natural island ecosystem and improve habitat quality for many of the native species.

To accomplish the Proposed Action, Alaska Maritime NWR has partnered with The Nature Conservancy and Island Conservation to eradicate non-native Norway rats from Rat Island. A successful eradication will require rodenticide to be delivered into every potential rat territory on the island and timing the eradication to maximize the probability that 100% of the rat population will be exposed to the rodenticide. A re-introduction of rats to the island must also be prevented. This method of eradication involves an aerial application of a grain pellet, containing rodenticide, using specialized spreader buckets suspended beneath helicopters. The eradication is scheduled to be initiated in fall of the year, which coincides with the completion of the rat breeding cycle and a natural rat food resource decline on the island. The combination of food scarcity with bait availability to all rat territories on the island maximizes the potential for successful eradication. A more thorough description of the project including maps of the project area can be found in the Environmental Assessment, Restoring Wildlife Habitat on Rat Island (USFWS 2007).

Evaluation:

1. Subsistence Resources, Uses and Needs in the Affected Area:

In the Aleutians, residents have traditionally made use of the following types of resources: marine resources, including fish, (salmon, halibut, cod, etc.); marine mammals (Stellar sea lions, sea otters and harbor seals); intertidal resources such as sea urchins, razor clams, butter clams, cockles, mussels, and chitons, crab and shrimp. Plants harvested include berries (blueberries, salmonberries, mossberries, strawberries, and lingonberries), wild celery (Angelica lucida), wild rice (Fritillaria camschatcensis) giant kelp, and fiddlehead ferns. Birds are harvested, including ducks, geese, or ptarmigan. Eggs are collected primarily from gull colonies, although mallard, merganser, puffin, and murre eggs are also collected, depending on the location.

2. Effect of Proposed Action or Use on Subsistence Uses and Needs.

The propsed action should have no effect on subsistence uses or needs. Rat Island is uninhabited and is located more than 322 km (200 mi) from the nearest rural community of Adak, Alaska. The subsistence resources used by rural residents in the Aleutian Islands are harvested near the islands where the communities are located. Rat Island is not known to have been used for subsistence purposes since the 1800's.

3. Availability of other lands for the purpose sought to be achieved.

The goal of the proposed project is to restore the natural diversity of species and habitats to Rat Island. Therefore, no other lands can be used to achieve the purpose.

4. Alternatives which would reduce or eliminate the Proposed Action from lands needed for subsistence purposes.

There is no way to accommodate the Proposed Action other than to conduct a rat eradication on Rat Island. If successful, the project has the potential to restore traditional subsistence resources.

Finding:

Based on review and evaluation of information indicated above and in the supporting references indicated below, I have determined that the Proposed Action will not result in a significant restriction of subsistence uses. The Proposed Action will occur hundreds of miles from the nearest rural community and the island intended for restoration has not been used for subsistence purposes in over a century. If successful, the Proposed Action has the potential to restore populations of traditional subsistence resources.

Agency Decision:

A finding of no significant restriction in subsistence uses completes the Section 810 requirements. The Proposed Action or use may be authorized.

Supporting References:

Alaska Policy Manual, U.S. Fish and Wildlife Service

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Signature:

Kent A. Sundseth 12/9/07

Acting Refuge Manager | Date

Concurrence:

MB RF Supv. 12/11/07

12/11/07

Regional Chief, National Wildlife Refuge System | Date