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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

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SEP 16 2005

Ms. Genevieve Salmonson, Director
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, HI 96813

RE: Final Environmental Assessment (FEA) and Finding of No Significant Impact (FONSI) for the Lehua Island Ecosystem Restoration Project

Dear Ms. Salmonson:

The Notice of Availability for Comment for the Draft Environmental Assessment for the Lehua Island Ecosystem Restoration Project was published in the OEQC Bulletin on June 8, 2005. During the public comment period, four written comments were received. After review of the public comments and of the Final Environmental Assessment, the Division of Forestry and Wildlife has determined that this project will not have significant negative effect on the environment. Thus, we have issued a Finding of No Significant Impact. Please publish this notice in the next OEQC Environmental Notice (Oct. 8, 2005).

Enclosed are four copies of the Final Environmental Assessment and a completed OEQC publication form. Please call Scott Fretz, the DOFAW Wildlife Program Manger, at 587-4187 if you have any questions.

Sincerely,

PETER T. YOUNG
Chairperson

Enclosures

2005-10-08 KA FONSI LEHUA ISLAND ECOSYSTEM RESTORATION PROJECT.

Final Environmental Assessment
September 2005

Lead Agencies:

U.S. Department of the Interior
Fish and Wildlife Service

State of Hawai'i
Department of Land and Natural Resources
Division of Forestry and Wildlife

Cooperating Agency:

U.S. Department of Homeland Security
U.S. Coast Guard

LEHUA ISLAND ECOSYSTEM RESTORATION PROJECT

Kaua`i County, Hawai`i

Final Environmental Assessment

September 2005

Responsible Officials:

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ABSTRACT

This Final Environmental Assessment (EA) was prepared in accordance with the National Environmental Policy Act (NEPA) regulations, and the State of Hawai`i environmental impact statement law in Hawai`i Revised Statutes, Chapter 343.

The United States Fish and Wildlife Service (USFWS) and Hawai`i Department of Land and Natural Resources' Division of Forestry and Wildlife (DOFAW) formulated the proposed action in conjunction with Island Conservation (IC) and the Offshore Islet Restoration Committee (OIRC) to reverse the ecological degradation that is occurring on Lehua Island caused by non-native Polynesian Rats and European Rabbits. Lehua Island is one of Hawai`i's most important seabird colonies. It also offers a unique opportunity for restoring an island ecosystem. The purpose of the proposed action is to restore Lehua Island's ecosystem through eradication of rats and rabbits, to ensure restoration success by keeping Lehua rat and rabbit free, and to further Lehua Island's ecosystem quality through native plant restoration. The proposed action will improve seabird nesting habitat and aid in the

recovery of rare endemic seabirds such as Band-rumped Storm Petrels, Hawai'ian Petrels, and Newell's Shearwaters, and native coastal plants and insects. Plant restoration is also expected to benefit marine species by reducing sediment runoff into the nearshore environment and improving water quality. The proposed project is not anticipated to have any significant negative environmental effects.

The proposed alternative involves the aerial and hand broadcast of bait pellets containing the rodenticide diphacinone (followed by the rodenticide brodifacoum if necessary) into all rat territories on Lehua Island, as well as removal of all rabbits via hunting and trapping. Rat eradication would occur in the summer dry season to minimize risk of rain washing rodenticide pellets into the ocean and to maximize the efficacy of eradication by targeting the rats at the low point in their population cycle. Rabbit eradication, which involves more on the ground activity than rat eradication, would occur in the winter, at the low point in the annual seabird breeding season, to minimize risk of disturbance to nesting seabirds. Plant restoration will occur after rat and rabbit removal to ensure that native plants can thrive without being eaten by them. Because of the lack of baseline data (*i.e.*, data collected before the presence of rats and rabbits) for Lehua Island, USFWS and DOFAW will rely on the Northwest Hawai'ian Islands, the paleoecological fossil record, and relatively intact coastal areas in Hawai'i to gain an idea of what a healthy, diverse island community should look like.

The USFWS and DOFAW conducted extensive scoping of the proposed actions. As a result of comments from interested public, Federal and State agencies, and conservation groups, USFWS and DOFAW identified six environmental issues. These issues are: 1) Restoration efficacy; 2) Impacts on non-target species; 3) Increase in weed abundance caused by rabbit and rat eradication; 4) Impacts on cultural resources; 5) Impacts on human health and safety; and 6) Introduction of non-native species caused by project activities.

To address these environmental issues, USFWS and DOFAW prepared three alternatives, including the proposed action. Each alternative was developed to respond to the environmental issues identified. USFWS and DOFAW also considered many other alternatives and methods to eradicate rats and rabbits on Lehua Island but rejected the methods that failed to meet the purpose and need of the project. Following release of a Draft EA in June 2005 and analysis of public comments subsequently received, the decision was made to choose Alternative 2, the preferred alternative, over the other two alternatives analyzed.

Within this Final EA, the USFWS and DOFAW describe the affected environment for the project. This section describes what is currently known about the status and trend of affected island resources, including the physical features of the island, and its terrestrial and marine resources. There is also an analysis of the environmental consequences that could occur as a result of implementing the proposed action, and a description of mitigation measures that will be implemented.

The USFWS Field Supervisor of Ecological Services and the DOFAW Administrator are responsible for the final decision on the proposed action, in addition to plan implementation and monitoring.

GLOSSARY OF TERMS AND ABBREVIATIONS

CEQ	Council on Environmental Quality
Draft EA	Draft Environmental Assessment
DOFAW	State of Hawai`i Department of Land and Natural Resources, Division of Forestry and Wildlife
EC_{50}	Effective Concentration. The concentration at which 50% of an exposed test population is affected sublethally.
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
Final EA	Final Environmental Assessment
ft	Foot. 1 ft = 30 centimeters or 12 inches
g	Gram. 1 g = 0.035 oz.
GPS	Global Positioning System
ha	Hectare. 1 ha = 2.47 acres
IC	Island Conservation
IUCN	The World Conservation Union
kg	Kilogram. 1 kg = 2.205 pounds
LC_{50}	Lethal Concentration. Concentration of active ingredient that could cause death in 50% of an animal test population. Presented as mg active ingredient per unit volume.
LD_{50}	Lethal Dose. Acute oral dose required to cause death in 50% of an animal test population. Presented as mg active ingredient per kg body weight (mg/kg).
LOC	Level of Concern.
mg	Milligram. 1/1000 of a gram.
NEPA	National Environmental Policy Act

NHPA	National Historic Preservation Act
NOI	Notice of Intent.
OEQC	State of Hawai`i Office of Environmental Quality Control
OIRC	Offshore Islet Restoration Committee
ppm	Parts per million
ROD	Record of Decision
RQ	Risk Quotient = Exposure/Toxicity.
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service

SUMMARY OF DRAFT ENVIRONMENTAL ASSESSMENT

Introduction

Lehua Island is home to one of the most important seabird colonies in Hawai'i and has the unique potential for ecosystem-wide restoration. This document proposes actions to meet the goal of managing existing and potential invasive mammal infestations that are having negative effects on Lehua's native seabirds, plants, and insects. The proposed action would accomplish this goal by achieving the following objectives: 1) eradication of the introduced Polynesian Rat and European Rabbit on Lehua Island; 2) adoption of an emergency response plan in the event of an accidental re-introduction of rodents or rabbits on Lehua Island; 3) native plant restoration on Lehua Island; and 4) adoption of a prevention strategy to reduce the potential for invasive species to be accidentally re-introduced to Lehua Island during and after restoration activities occur. The proposed action is modeled on other successful island rat and rabbit eradication efforts worldwide.

Lehua Island is Federal property administered by the United States Coast Guard (USCG) and USCG permission is required to access and carry out natural resource enhancement and vegetation management projects on Lehua. In this case, National Environmental Policy Act (NEPA) compliance is required for the necessary USCG permit. Since the U.S. Fish and Wildlife Service (USFWS) is a lead agency in this restoration project, the USCG is able to fulfill NEPA requirements in the capacity of a cooperating agency by adopting the findings of this analysis. The USCG guidelines for being a cooperating agency are listed in Commandant Instruction M16475.1D.

The State of Hawai'i Department of Land and Natural Resources' Division of Forestry and Wildlife (DOFAW) is a co-lead agency with USFWS for the proposed project and for the purposes of preparing this document. DOFAW is also a co-trustee with USFWS for seabird resources in Hawai'i. Lehua is a designated State Seabird Sanctuary and is zoned as a Conservation District, and proposed restoration actions in a State sanctuary must be authorized by DOFAW permit. The State has determined that a Conservation District Use Application (CDUA) will not be required for this project.

Public Involvement

The Service and DOFAW conducted a thorough scoping of public comments on the proposed Lehua Island Restoration project. Scoping involved contacting the interested public, regulatory agencies, conservation groups, and experts in the field of vertebrate pest ecology and island restoration. On May 17, 2004, the Service published a Notice of Intent in the Federal Register (Volume 69, Number 95), announcing intentions to gather information necessary to prepare a joint Federal/State environmental document (environmental assessment or environmental impact statement) for the Lehua Island Ecosystem Restoration Project. The Notice of Intent also provided a description of natural resources on Lehua and the negative effects of alien species, and indicated that eradication of rats and rabbits could be considered as an alternative. Scoping letters were sent to interested parties both in Hawai'i and throughout the United States. Press releases were sent to local newspapers. A public meeting was also held in Lihue, Kaua'i on June 9, 2004.

The scoping period ended on June 23, 2004. A total of 7 letters were received, which were included in appendices in the Draft EA and in this document. Five letters supported the proposed removal of rats and rabbits from Lehua Island, one was against the project on because animals would be euthanized, and one letter requested copies of the Draft EA.

On June 8, 2005, the Draft EA was posted on the Service's Pacific Islands Office website and a notice requesting comment was published in the State of Hawai`i's Office of Environmental Quality Control Bulletin. Letters were also sent notifying interested parties of the availability of the Draft EA and requesting comments. A list of all the parties who were notified is included in the Final EA. The 30-day comment period closed on July 8, 2005. Four letters were received. One came from The Nature Conservancy, and three from State of Hawai`i agencies: the Historic Preservation Division, the Department of Health, and the Office of Environmental Quality Control. None of the letters opposed the project but two of them requested additional information. These letters and the responses to them are included in this document as appendices.

Environmental Issues

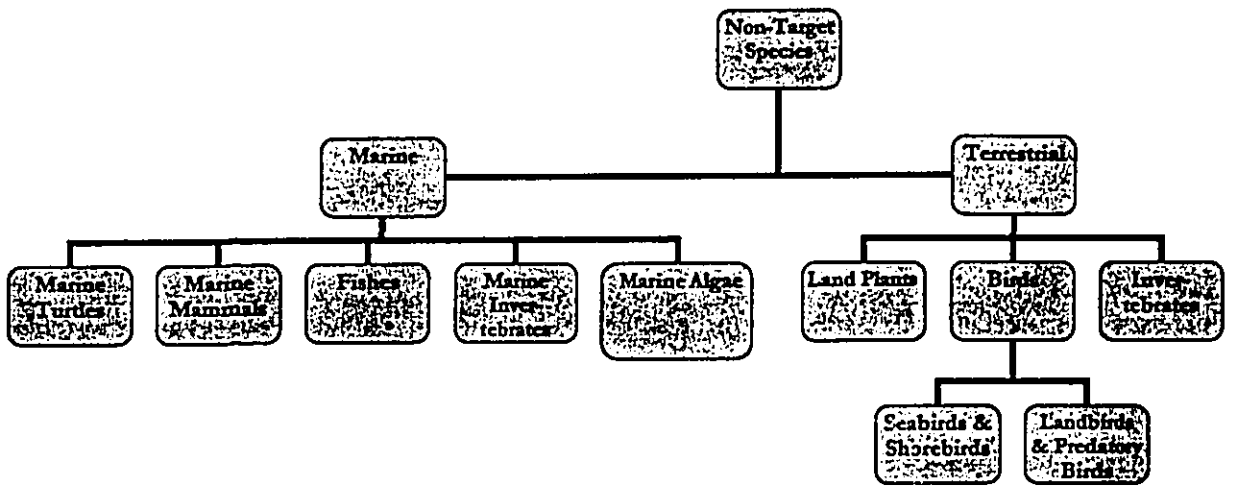
Based on internal and external comments on the proposed actions, USFWS and DOFAW concluded that the analysis would need to address six environmental issues. These issues are: 1) Restoration efficacy; 2) Impacts to non-target species; 3) Increase in weed abundance; 4) Impacts on cultural resources; 5) Impacts on human health and safety; and 6) Introduction of non-native species.

Summary of Issues

Issue	Description
Restoration Efficacy	Efficacy for this analysis is defined as how well the alternative would meet the goal of restoring Lehua Island's ecosystem.
Impacts to Non-target Species	Concerns about impacts to non-target species are separated into two categories: physical disturbance and toxicological risk. Physical disturbance may occur from the activities associated with baiting, hunting, and monitoring. Toxicological risk could be present through both primary (direct) exposure and secondary (indirect) exposure.
Increase in Weed Abundance	There is concern that eradicating rats and rabbits would eliminate grazing pressure on alien plants, resulting in an increase of weeds.
Impacts on Cultural Resources	Lehua has many archeological sites. There is concern that these sites could be damaged by human disturbance associated with project activities.
Impacts on Human Health and Safety	Although access by general public to Lehua is restricted, public safety is a concern due to public use of the intertidal areas and the waters surrounding Lehua. Exposure to toxicants through consumption of marine organisms and safety of those working with toxicants and firearms on Lehua are also concerns.

[redacted]	Increased visits to the island could pose a risk of accidentally introducing non-native species. These could include pathogens, weeds, invertebrates, and vertebrates inadvertently brought to Lehua in the course of eradication and monitoring activities.

The issue of "impacts to non-target species" is a broad category that incorporates several sub-issues. The sub-issues are the species groups that may be impacted by the proposed action. The following taxonomic hierarchy identifies the species groups that could be impacted by the project:



Alternatives

After identifying the six environmental issues associated with the proposed action, the USFWS and DOFAW began developing alternatives based on the modification of the eradication strategies to address the environmental issue concerns. A total of three alternatives were developed, including the 'No-Action' and 'Preferred' alternatives. Alternative 2, the Preferred Alternative, is the one that has been selected as the alternative that will be implemented.

Summary of Alternatives

[redacted]				
1 (No Action)	Not Applicable	Not Applicable	Not Applicable	Not Applicable
2 (Preferred)	50 ppm Diphacinone applied initially; 25 ppm Brodifacoum if necessary	Hand and/or Aerial Broadcast and/or Bait Stations	Hunting and Trapping	Native plant restoration and weed control

3	25 ppm Brodifacoum	Hand and/or Aerial Broadcast and/or Bait Stations	Hunting and Trapping	Native plant restoration and weed control

Several additional methods and techniques were eliminated from consideration in the Draft EA because they did not meet the purpose and need of the proposed project. Live trapping of rabbits and moving them to another location was not considered because it is not logistically feasible, safe, or cost-effective to remove all Lehua's rabbits by trapping and it is against Hawai`i State law to release trapped rabbits elsewhere in Hawai`i. Hawai`i Revised Statutes Chapter 197-3 states that "no species of aquatic life and wildlife shall be deliberately introduced by [DOFAW]... into any habitat within the State... [if] the species proposed to be introduced would threaten the existence and stability of any indigenous species as predator; competitor for food, cover, or breeding sites; or in any other way arising from its characteristics and ecological requirements." Poisoning of rabbits using a rabbit toxicant was also not considered because there is no bait registered with the U.S. EPA for controlling rabbits in non-agricultural areas. Thus, rabbit poisoning is not feasible as it would be difficult to comply with the Federal Insecticide, Fungicide, and Rodenticide Act. Introducing a disease for rabbits was also not considered due to the extensive agency review and permitting process required for usage of biocontrol agents. Furthermore, diseases have not been proven to eradicate 100% of a rabbit population, and thus fail to meet the purpose and need of the project. The exclusive use of bait stations to eradicate rats was also rejected due to Lehua's steep cliffs and the logistical, cost, and safety problems associated with placing bait stations in all of the rat territories on the island, including the steep cliffsides. Also, a management program that eradicated rats but not rabbits was considered and rejected because the persistence of rabbits would continue to damage the plant community, secondarily impacting seabirds, insects and marine water quality.

Environmental Consequences

For each environmental issue, the USFWS and DOFAW analyzed the potential effects that could occur should one of the three alternatives be implemented. Each Issue (1-6) was addressed separately for rabbit and rat eradication, and plant restoration. To address each issue, mitigation measures were proposed to decreases potential impacts below the level of significance.

Issue 1 (restoration efficacy): Analysis focused on the probability of achieving successful restoration of Lehua's ecosystem. Factors considered in the analysis included the efficacy of proposed methods of rat and rabbit removal, native plant restoration, and how likely these methods would be to achieve the goal of ecosystem restoration.

Issue 2 (non-target impacts): Each alternative was analyzed for potential physical disturbance, as well as the toxicological effects of the proposed rodenticides on non-target species. The analysis of physical impacts focused on short-term disturbances caused by the helicopter and project personnel during the time they are on Lehua. Toxicological impacts were analyzed for species that could be present in the project area. The effects analysis included both impacts due to primary exposure (direct consumption of the bait containing

the rodenticides), and secondary exposure (species who feed on animals that have been directly exposed). Mitigation measures were incorporated for species at risk of exposure.

Issue 3 (increase in weed abundance): The analysis focused on the potential for each alternative to increase the amount of non-native weeds on Lehua. Removing rabbits and the resultant reduction in herbivory could lead to weed release. Each alternative discusses compliance with policies and programs currently in place under USFWS and DOFAW as well as the establishment of monitoring and weed control programs, as necessary, for the benefit of the native ecosystems.

Issue 4 (impacts on cultural resources): Each alternative was examined for potential disturbance to archeological sites that could be caused by people conducting project activities. Disturbance of sensitive archeological sites or artifacts could be avoided by educating all project staff of locations, appearance, the fragile nature of such sites and artifacts, and how to properly conduct themselves. Hunters would be trained to avoid shooting at any platforms or archeological sites.

Issue 5 (impacts on human health and safety): Each alternative was evaluated for risks to humans on Lehua Island. No landing is allowed on Lehua unless permitted by the USCG. However, the public has access to the waters surrounding Lehua on private, fishing, dive, and tourist vessels. Therefore, potential risks for public exposure to toxicants in intertidal and marine food species were evaluated, as well as the risk to employees carrying out restoration actions from handling rodent bait and firearms.

Issue 6 (introduction of non-native species): Each alternative was evaluated for its inherent risks of introducing non-native species, caused by moving people, animals, and equipment and supplies onto Lehua. Non-natives could include weeds, insects, rodents and other vertebrates, and possibly pathogens. Integral to the proposed actions are a contingency plan for response to the rediscovery or reintroduction of non-native species after eradication, and a plan to avoid alien species introductions during and after the project.

STATE CRITERIA FOR PROJECT SIGNIFICANCE

State of Hawai`i Environmental Council's Criteria for Significance

The State of Hawai`i Environmental Council gives 13 criteria (in italics below) for defining significant project impacts (Hawai`i Administrative Rules, Section 11-200-12). These criteria are summarized in the Hawai`i Health Department's Office of Environmental Quality Control (OEQC) guidebook. As discussed below, this project does not trigger any of the criteria for significance and thus, under State law, does not require preparation of an environmental impact statement (EIS). A Finding of No Significant Impact (FONSI) document prepared by the USFWS provides the rationale, from the perspective of Federal guidelines and regulations, for justifying the decision not to prepare an EIS. Federal and State criteria for significance are similar but not identical.

The proposed actions do not involve an irrevocable commitment to loss or destruction of any natural or cultural resource. The action proposed in this EA will not result in loss or destruction of any natural or cultural resources. Rather, this action will result in the restoration of a healthy native ecosystem on Lehua.

The proposed actions will not curtail the range of beneficial uses of the environment. The activities proposed are intended to restore the island and improve its habitat for the native plants, nesting seabirds, and marine mammals that inhabit or historically inhabited the island, prior to its degradation by invasive rats and rabbits. Restoration of Lehua will thus improve the range of beneficial uses of the environment.

The proposed actions will not conflict with the State's long-term environmental policies. The proposed actions will not conflict with the environmental policies set forth in Chapter 344, HRS, and other statutes and regulations, since the proposed actions will not damage sensitive natural resources nor emit excessive noise or contaminants. Instead, they will improve Lehua's environment.

The proposed actions will not substantially adversely affect the economic and social welfare of the community. The proposed activities utilize the most effective strategies to remove invasive rats and rabbits, thus restoring Lehua's ecosystem. Restoring Lehua will result in a better, more aesthetically pleasing environment, thus supporting eco-tourism and enhancing social economic and social welfare.

The proposed actions will not substantially adversely affect the public health of the community. The proposed actions will not emit excessive noise or contaminants and will not have substantial adverse effects on public health. Lehua is uninhabited and overnight camping is prohibited. Visitation is only occasional and the project is not anticipated to affect the health of these visitors.

The proposed actions will not involve substantial secondary impacts, such as population changes or effects on public facilities. Lehua is approximately 19 miles offshore from Kaua`i and is uninhabited. The project does not propose construction of public facilities or involve establishing a human population on Lehua. Thus, the proposed actions will not affect any public recreational facilities and will not induce population growth or decline in the area.

The proposed actions will not involve a substantial degradation of environmental quality. Utilizing best management practices will minimize impacts to the environment during the implementation of the proposed actions. Restoration will increase the environmental quality of Lehua's ecosystem for its biota and user groups alike.

The proposed actions will not affect a rare, threatened, or endangered species or its habitat. The proposed actions will have a net benefit for rare, threatened and endangered birds and plants. With basic mitigation outlined in the EA, the human presence associated with the proposed action will have a negligible impact on listed species.

The proposed actions will not have cumulative impacts or involve a commitment for larger actions. The proposed actions will not have negative cumulative impact or involve significant commitment for larger actions than those delineated. The cumulative impact will, in fact, be beneficial. Natural ecological processes will be restored, resulting in a positive change in Lehua's ecosystem.

The proposed actions will not substantially affect air or water quality or ambient noise levels. Because of the limited scale of the project, and use of good management practices, there will be no substantial effect on air or water quality or ambient noise levels.

The proposed project is not located in an environmentally sensitive area (e.g. flood plain, tsunami zone, and coastal zone). Although the site is located in a Conservation District, the proposed actions are in accordance with the zoning of the area as preservation lands and implement management actions to restore and enhance native habitats. Project actions are in accord with environmental management goals of USFWS, DOFAW and the USCG.

The proposed actions will not substantially affect scenic vistas and view planes identified or State plans or studies. The project does not involve construction of any permanent structures or alteration of landscapes. Thus, it will not affect any sites or vistas.

The proposed project will not require substantial energy consumption. The affected area is not on a local power grid. With sources being battery, solar, or generator power, energy consumption will be minimal and periodic. There will be no need for long-term energy sources to carry out the proposed actions.

TABLE OF CONTENTS

CHAPTER 1: PURPOSE AND NEED

Introduction

The United States Fish and Wildlife Service and the Hawai`i State Department of Land and Natural Resources' Division of Forestry and Wildlife have prepared this Environmental Assessment (EA) to analyze the potential environmental effects associated with the following proposed management activities on Lehua Island:

1. Eradication of the non-native Polynesian Rat (*Rattus exulans*)
2. Eradication of the non-native European Rabbit (*Oryctolagus cuniculus*)
3. Prevention and emergency response plan for dealing with re-introduction of rats, other non-native rodents, and rabbits to Lehua.
4. Restoration of native plants

The EA is based on direction contained in the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) regulations 40 CFR 1500-1508, and the Hawai`i State environmental impact statement law (HRS 343). The proposed action involves the issuance of Federal and State agency permits, the use of Federal funds, and actions on land zoned as Conservation District by the State of Hawaii.

Purpose & Need

Purpose

The purpose of the proposed action is to restore the Lehua Island ecosystem, including native seabirds, plants, invertebrates and the nearshore ecosystem. Lehua has sustained ecological damage over many years, caused primarily by the presence of invasive alien species, most notably rats and rabbits. Eradicating these introduced mammals from Lehua Island could eliminate numerous significant negative pressures on the native flora and fauna. Prior to the introduction of mammals, Lehua's seabird colonies and native species existed in an environment relatively free of aggressive predation or herbivory. Removing introduced mammals would significantly increase the quality of seabird nesting habitat and would allow seabird species that are currently not present to recolonize the island. The eradication would likely increase the colony sizes and diversity of seabirds that use Lehua as a breeding site, and allow for the re-establishment of some of the native plant and invertebrate communities. Restoring Lehua's native plants will ensure the re-establishment of plant communities representative of those that existed before invasive rats and rabbits altered Lehua's plantlife through aggressive herbivory. Plant restoration will also reduce soil erosion, improving water quality and nearshore marine habitat. The lack of baseline, or pre-introduction data from Lehua makes it difficult to analyze trends in seabird, insect and plant population changes. Nonetheless, in the absence of that data, the USFWS and DOFAW rely on the Northwest Hawai`ian Islands, the paleoecological fossil record, and relatively intact coastal areas in Hawai`i to give an idea of what a healthy, diverse ecosystem should look like and will use them as a benchmark for project success.

Need for Action

Introduced Species and the Importance of Island Ecosystems

It is now widely accepted that current rates of species extinctions are dramatically higher than the background extinction rate (Raup 1988), that most current extinctions can be directly attributed to human activity (Diamond 1989), and that for ethical, cultural, aesthetic, and economic reasons, this current rate of extinction is cause for considerable concern (Ehrlich 1988; Ledec & Goodland 1988). The worldwide causes of anthropogenic extinctions can be roughly divided into four broad categories: non-sustainable use of resources, habitat destruction, pollution, and introduction of non-native species.

Problems in the first three categories are often acute, are relatively well known, and have become the focus of public environmental concern. The introduction of non-native species has received less publicity and professional attention (Coblentz 1990; Soulé 1990). However, introduced species are responsible for 39% of all recorded animal extinctions since 1600 for which a cause could be attributed (World Conservation Monitoring Centre 1992). Thus, some impacts of introduced species are irreversible (Groves & Burdon 1986; Hengeveld 1989) and at least as devastating as the other categories (Atkinson 1985, 1989; Soulé 1990). Once established, introduced species often become permanent unless intentionally removed (Tershy and Croll 1994).

Island ecosystems are key areas for conservation. Islands make up about 3% of the earth's surface, but are home to 15-20% of all plant, reptile, and bird species (Whittaker 1998). However, species on islands are especially vulnerable to both extinctions and the impacts of introduced species (Diamond 1985, 1989; Olson 1989). Of the 484 recorded animal extinctions since 1600, 75% were island endemics (World Conservation Monitoring Centre 1992). Introduced species were completely or partially responsible for 67% of these island extinctions (based on the 147 island species for which the cause of extinction is known, calculated from World Conservation Monitoring Centre 1992).

Islands are important to the conservation of biodiversity for four reasons:

1. A large percentage of their biota are endemic species and subspecies (Darwin 1859; Elton 1958);
2. They are important breeding areas for seabirds, pinnipeds, and sea turtles, which forage over thousands of square kilometers of ocean but are dependent on relatively small amounts of protected land on islands for breeding and nesting;
3. Many islands are sparsely inhabited or uninhabited by humans, keeping socioeconomic costs of protection low;
4. The species and ecological communities on islands have evolved in association with small land masses, making them less susceptible than continental species to the problems of habitat fragmentation caused by small reserve size.

In summary, by restoring and protecting islands, functioning ecosystems can be maintained without large expenditures for land acquisition or management, or significant conflict with local human populations (Tershy and Croll 1994).

Introduced Rats

There are three species of rats in the genus *Rattus* that have been introduced to Hawai`i and other islands throughout the world. In order of decreasing body size they are: the Norway or Brown Rat (*R. norvegicus*), the Ship or Black Rat (*R. rattus*), and the Polynesian Rat (*R. exulans*). They have different dietary preferences, distributions and histories of introduction, but all three species are omnivorous, behaviorally plastic, have high reproductive rates, and can survive in a variety of habitats (Atkinson 1985; Moors *et al.* 1992). These traits make them ideally suited to survive on a variety of predator-free islands. One or more of these species occurs on an estimated 82% of all island groups worldwide (Atkinson 1985).

Impacts of Introduced Rodents on Island Ecosystems

The most pronounced impact of introduced rodents on island ecosystems is the extinction of endemic species. Introduced rats are responsible for an estimated 40-60% of all bird and reptile extinctions (Island Conservation analysis of World Conservation Monitoring Centre data; Atkinson 1985). They have caused the extinction of endemic 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 extinctions do not occur, rats can have ecosystem-wide effects on the distribution and abundance of native species through direct and indirect effects. For example, comparisons of rat-infested and rat-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.* 1992; Whitaker 1973; Towns 1991), plants and terrestrial invertebrates. Rats are known to cause disturbance to sensitive breeding seabirds, causing failed breeding attempts and higher susceptibility to predation by other species (Jouventin *et al.* 2003; Tomkins 1985). Rats have also been shown to affect the abundance and age structure of intertidal invertebrates (Navarrete and Castilla 1993). Where rats occur together with other predators (such as cats or predatory birds) the direct impact of the rats and other predators on seabirds is greater than the sum of the individual impacts because the rats, themselves a food source, artificially support a greater population of the predators when the seabirds are absent (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 ecosystems into which they are introduced (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 and seeds and understory vegetation cover increased significantly 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 *Rattus* has been implicated in extinctions and changes in prey population structure. Although all rat species are dangerous to insular biota, due to their different natural histories each species has slightly different impacts. For example, of the three introduced rat species, *R. norvegicus* tends to have the greatest impact on burrow-nesting seabirds, *R. rattus* tends to prefer preying on tree-nesting birds, and *R. exulans*

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).

Rodents in Hawai`i

All three species of introduced rats are present on the Hawai`ian Islands. *R. rattus* occupies all of the eight major islands, and *R. exulans* has been confirmed on all of the major islands but Ni`ihau. *R. norvegicus,* the least abundant species, is absent on Kaho`olawe and Ni`ihau but present on the six other major islands (Tomich 1986). *R. rattus* was documented on Midway Atoll but has since been eradicated. *R. exulans* is found on Lehua and Mokapu Islands and is likely the species present on Ka`ula Rock.

R. exulans was introduced to Hawai`i by Polynesian settlers, and *R. norvegicus* and *R. rattus* arrived in either the 18th or 19th century, although there is disagreement as to exactly when. Atkinson (1977) suggests that *R. rattus* did not arrive until the late 1800s, after which they very rapidly expanded their population and began having significant effects on Hawai`i's ecosystem.

Impacts on Hawai`ian Seabirds

Introduced rodents have wreaked havoc on seabirds in Hawai`i. On Kure Atoll, *R. exulans* preyed on Wedge-tailed Shearwaters (*Puffinus pacificus*), Laysan Albatross (*Phoebastria immutabilis*), and Bonin Petrels (*Pterodroma hypoleuca*), and was implicated as the cause of drastic declines in the population of Bulwer's Petrels (*Bulweria bulwerii*) on Popoi`a Island near O`ahu (Tomich 1986).

R. rattus had significant impacts on nest success in Bonin Petrels on Midway Atoll (Seto 1994; Seto and Conant 1996), but reproductive success increased significantly after rats were eradicated from Midway (Seto, *pers. comm.*). Similarly, after *R. rattus* control on Mokoli`i Islet near O`ahu, nesting success of Wedge-tailed Shearwaters increased significantly (D. Smith *pers. comm.*).

Impacts on Terrestrial Birds

Impacts of introduced rodents on terrestrial Hawai`ian birds are documented throughout the history of human settlement in the islands. *R. exulans*, introduced by Polynesian settlers, likely contributed to the extinction of some of the at least 39 species of land birds that disappeared in the period before European arrival, especially flightless and ground-nesting species (Olson and James 1982). Atkinson (1977) argues that the introduction of the *R. rattus* in the late 1800s was the primary cause of the sudden extinction of 30 species or subspecies of endemic Hawai`ian forest birds between 1890 and 1910. Since then, *R. rattus* has continued to have severe effects on Hawai`i's landbirds. *R. rattus* caused the extinction of the Laysan Rail (*Porzanula palmeri*) from its last refuge of Midway Atoll, and contributed to the extirpation of the Midway population of Laysan Finch (*Telespiza cantans*) (Fisher and Baldwin 1946; Tomich 1986).

Furthermore, nest predation by *R. rattus* has been implicated as the primary cause of decline of the endangered O`ahu `Elepaio (*Chasiempis sandwichensis ibidis*) (VanderWerf 2001). Another nest predation study that focused on multiple bird species in the rainforest of Maui found that in areas of high rat density, nest predation rates by *R. rattus,* a prolific tree climber, can reach 50% (Stone *et al.* 1985, cited in Amarasekare 1993). In areas of high nest densities, it has been suggested that even a small population of rats can have a significant predatory effect because rats often prefer bird eggs to other food sources and will feed on them opportunistically whenever they encounter a nest. Rats have been confirmed as predators of eggs and nestlings of the Maui `Alauahio (*Paroreomyza montana*) (Baker and Baker 2000), and the Puaiohi, or Small Kaua`i Thrush (*Myadestes palmeri*) (T. Ka`iakapu *pers. comm.*).

Impacts on Hawai`ian Invertebrates

Rats contributed to the decimation of *Achatinella mustelina,* a tree-snail endemic to a small mountain range on O`ahu (Hadfield *et al.* 1993). Rats have also been documented to feed on endemic crickets and weevils (J. Howarth unpublished data, *pers. comm.*).

Impacts on Hawai`ian Plants

Rats eat seeds, bark, fruits, leaves and shoots of Hawai`ian plants. Rats strip the bark of koa (*Acacia koa*) saplings, girdling and killing the young trees (Scowcroft and Sakai 1984). The endemic vetch (*Vicia menziessii*) has also been girdled by rats (Clarke *et al.* 1982, L. Pratt *pers. comm.*). Rat herbivory has been shown to prevent reproduction in the wild of *Hibiscadelphus* sp. (Baker and Allen 1978) and *Pittosporum* sp. (L. Pratt *pers. comm.*). Rat seed predation has affected populations of *Pritchardia* sp. (Beccari and Rock 1921; Male and Loeffler 1997), and rat granivory has also been implicated in the reproductive failure of numerous rare endemic plant species on Mokapu Island near Moloka`i (K. Wood unpub. data). Rat herbivory has also been observed on *Dubautia* sp. (T. Ka`iakapu *pers. comm.*).

Rodents on Lehua Island

Caum (1936) reports that lighthouse personnel on Lehua saw "small rats" that may have been *R. exulans* as early as 1931. The first positive documentation of rodents on the island, however, was in 1960 with the discovery of a carcass, thought to be *R. rattus* but never positively identified (Richardson 1963, Tomich 1986). Wood *et al.* (2004) found the carcasses of two *R. exulans* during surveys of the island in 2003 and 2004, the first positive identification of a Lehua rodent to species.

USDA *et al.* (2004) confirmed the identification during rodent trapping surveys that yielded seven *R. exulans* individuals. Although the population density of rats on Lehua is not known, four days of rodent surveys using inked tracking boards yielded an average 28% visitation and showed that rats inhabited much of Lehua, with the highest activity found in the vegetated gulches in southwest portion of the island. Observations from 2001-2004 indicate that rat numbers

Figure 1. Wedge-tailed Shearwater egg partially eaten by *R. exulans* on Lehua Island.

increase in the wet winter season and decrease in the dry summer season.

Rats on Lehua have been demonstrated to impact terrestrial invertebrates and vegetation. USDA *et al.* (2004) found rat stomach contents to consist of up to 44% invertebrates and up to 38% vegetation. Removing rats would positively contribute to the recovery of native island vegetation and likely increase invertebrate populations.

The most obvious evidence of the effects of introduced rodents on Lehua has been the many seabirds found dead on the island with injuries characteristic of rat predation. Richardson (1963) found dead Bulwer's Petrels that were likely killed by rats, USDA *et al.* (2004) found rat-chewed Wedge-tailed Shearwater eggs (Figure 1), and Wood *et al.* (2004) found carcasses of both Bulwer's Petrels and Wedge-tailed Shearwaters with flesh from the breast and neck eaten away and the rest of the body intact, an indicator of rat predation (Kepler 1967). In addition, an artificial egg study done in 2004 yielded a rat-chewed artificial Band-rumped Storm Petrel egg (C. Swenson, *pers. comm.*). The same study showed 20 of 22 clay and 27 of 30 quail eggs missing, likely due to rats removing and caching the eggs.

Rat predation on Lehua is probably also reflected in the complete absence or very low breeding densities of seabird species that are highly susceptible to rat predation and disturbance (Flint 1999; Atkinson 1985). Small surface-nesting species such as Brown Noddies (*Anous stolidus*) (Lehua historically supported a breeding colony of 500 Brown Noddies, in the 1960s), Sooty Terns (*Sterna fuscata*), and Gray-backed Terns (*S.lunata*), are not breeding on Lehua despite the abundance of nesting habitat and their breeding activities on nearby Ka`ula Rock. Low numbers of Band-rumped Storm Petrel (*Oceanodroma castro*) persist on the island, suggesting that similar ground nesters susceptible to rat predation, along with all other nesting seabirds (present or potential) on Lehua Island, would greatly benefit from rat removal (*e.g.*, Newell's Shearwater (*Puffinus newelli*), Hawai`ian Petrel (*Pterodroma sandwhichensis*), Christmas Shearwater (*P. nativitatis*), and Bulwer's Petrel (VanderWerf *et al.* in prep.)).

Eradicating introduced rats from islands in New Zealand, California and Hawai`i has succeeded in increasing seabird populations. On Whale Island, New Zealand, breeding success of Grey-faced Petrels (*Pterodroma macroptera gouldi*) increased markedly and consistently in the years after the *R. norvegicus* population on the island was reduced and eventually eradicated (Imber *et al.* 2000). On Anacapa Island, California, radar detection of Xantus' Murrelets (*Synthliboramphus hypoleucus scrippsi*), a species proposed for threatened status in the State of California, increased over 100% in two years during and immediately after the eradication of *R. rattus* from the island, indicating a dramatic increase in nesting activity after eradication (Hamer *et al.* 2003). Rat eradication on Midway Atoll resulted in dramatic increases of Bonin Petrels (*Pterodroma hypoleuca*)(Seto 1994). In the two years immediately following the control of *R. rattus* from Mokoli`i Islet near O`ahu, nesting success in Wedge-tailed Shearwaters increased rapidly, from only one chick fledging in the three years prior to rat eradication to 185 chicks fledging the second year after eradication (D. Smith *pers. comm.*).

Based on these successes in other islands, we expect that the eradication of rats from Lehua would significantly increase the quality of nesting habitat for seabirds that currently breed on

the island. It would also facilitate colonization of Lehua by seabird species that are currently unable to successfully breed due to rat predation.

Introduced Rabbits

The European Rabbit (*Oryctolagus cuniculus)*, native to Spain and southern France, is now found on every continent except Antarctica, and has been observed on over 800 islands in every major ocean (Flux and Fullagar 1992). Rabbits are often intentionally introduced onto islands as a human food resource (Micol and Jouventin 2002; Torr 2002). Rabbits are generalist herbivores (MacDonald 1984) with a tolerance to a wide variety of plant types, including those containing certain toxic compounds (Freeland and Janzen 1974). A short gestation period, large litter sizes (Tomich 1986), and the ability to produce multiple litters in one season (Woodhouse 1979) allow rabbit populations to expand rapidly when environmental conditions are favorable (Gilbert *et al.* 1987). Their aggressive herbivory and ability to reach high population densities can cause severe damage to ecosystems that have not evolved to handle such pressures, such as those commonly present on oceanic islands.

Impacts of Introduced Rabbits on Island Ecosystems

Islands have been frequently invaded (Watson 1961) and often severely affected by introduced rabbits. The selective pressure that rabbits exert on certain plant species can alter or even completely transform the composition of floral communities that have evolved without rabbits (North and Bullock 1986; Chapuis *et al.* 1994; Costin and Moore 1960; Gillham 1963; Norman 1988; Flux and Fullagar 1992; Copson and Whinam 1998; Abbott *et al.* 2000). While it is not always the case (see Copson and Whinam 1998; Proulx and Mazumder 1998), rabbit herbivory can lead to severe reductions in the diversity of native plant species on islands. On Round Island, Mauritius, native vegetation was severely damaged after rabbits were introduced (Bullock 1986; North and Bullock 1986; North *et al* 1994). Rabbits not only reduce native plant species on islands, but also facilitate growth of non-native plants by preferentially grazing native species. On the San Benito Islands, México, plant cover correlated closely with the preferred forage plant species of rabbits, with natives being the most preferred and having the least cover. After the eradication of rabbits, native plants recovered rapidly and non-natives showed a corresponding decline in abundance (Donlan *et al.* 2002).

The decrease in vegetation cover brought on by introduced rabbits often leads to a corresponding increase in erosion (e.g. Norman 1988; Abbott *et al.* 2000). On Phillip Island in Australia, for example, 80% of the vegetation was lost as a result of introduced rabbit herbivory, which led to a complete loss of soil cover on the island with the exception of a few areas of level terrain (Watson 1961). Subantarctic Macquarie Island experienced significant erosion after introduced rabbits removed the previously dominant perennial vegetation (Costin and Moore 1960). The removal of topsoil by erosion severely degrades the quality of habitat for most vegetation, further taxing floral communities already compromised by rabbit herbivory (North and Bullock 1986; Costin and Moore 1960; Watson 1961).

The direct effects that introduced rabbits have on the vegetation and soil stability of island ecosystems can in turn affect the many animals that rely on this vegetation (Bullock *et al.*

2002; North and Bullock 1986; Chapuis *et al.* 1994; Gillham 1963). On Cabbage Tree Island in Australia, the destruction of the forest understory by introduced rabbits left the burrows of the endangered Gould's Petrel (*Pterodroma leucoptera leucoptera*) exposed to predation from a landbird, the pied currawong (*Strepera graculina*) (Priddel *et al.* 2000). Rabbit herbivory on Macquarie Island left breeding seabirds similarly exposed to predation (Seppelt *et al.* 1984). The rabbit-induced decline of the endemic palm savanna on Round Island, Mauritius, meanwhile, led to corresponding decreases in the native reptiles that depend on this specialized plant community (Bullock 1986).

The erosion of topsoil, caused by excessive loss of vegetation, significantly decreases the quality of nesting habitat available for burrowing seabirds. On the San Benito Islands off the Pacific coast of Baja California, México, nest densities of burrowing seabirds are significantly lower on islands that have experienced rabbit-caused erosion than on nearby rabbit-free islands (B. Tershy *pers. comm.*). Excessive soil run-off into the ocean due to erosion caused by introduced herbivores has been implicated in coral death due to oversiltation in the Revillagegido Islands off the Pacific coast of Baja California (Ochoa-López *et al.* 1998).

Introduced rabbits also exert direct competitive pressure on island-nesting seabirds by occupying new nest sites, altering existing nest burrows, and even physically harming eggs and chicks in the burrows that they enter (McChesney and Tershy 1998; Micol and Jouventin 2002). For example, On Whale Island, New Zealand, rabbits took over and altered the existing burrows of Grey-faced Petrels, affecting the breeding success of the petrel colonies (Imber *et al.* 2000). On Santa Clara Island, Juan Fernandez Archipelago, Chile, rabbits have been documented evicting the eggs of Pink-footed Shearwaters (*Puffinus creatopus*) and caused reduced reproductive success in this species (P. Hodum and M. Wainstein *pers. comm.*). Burrows dug by rabbits on Enderby Island in New Zealand even presented a hazard to pups of the threatened New Zealand sea lion (*Phocarctos hookeri*), which got trapped in rabbit burrows and died (Torr 2002).

Finally, the impacts of rabbits can go beyond simple herbivory. Rabbits can serve as supplementary prey on islands with introduced predators and help support owl, cat and/or rat populations during periods of low natural food availability. This enables predator populations to remain at high levels throughout the year and thus increases the impact of the predators on native species (Imber *et al.* 2000; McChesney and Tershy 1998; Chapuis *et al.* 1994; Taylor 1979). Anecdotal evidence also suggests that rabbits may actually prey on birds and eggs, especially when other sources of moisture or food are scarce. The suggestion has been made to collect Lehua rabbit tissue samples for chemical analysis to determine if Lehua rabbits do prey on seabirds or eggs.

Rabbits in Hawai`i

The first documentation of rabbits in Hawai`i is from 1825, when they were introduced to Ford Island in Pearl Harbor, O`ahu. People also released rabbits on Molokini (near Maui), Manana (near O`ahu), Lehua, Laysan, Lisianki, and Pearl and Hermes Atoll (Tomich 1986; Wood *et al.* 2004.). They are still found on the island of Hawai`i, O`ahu, and Kaua`i. Populations were eradicated from Pearl and Hermes, Laysan, and Manana, and have disappeared naturally from Lisianki and Molokini (Wood *et al.* 2004.). Lehua is the only offshore islet with a population of rabbits in the Hawai`ian Islands.

Where they were introduced, rabbits had drastic effects. On Lisianki Island, rabbits introduced in 1903 during guano mining operations completely removed all of the island's living vegetation within 10 years, and the starved population died off some time before 1923 (Watson 1961; Tomich 1986). On Laysan Island, rabbits introduced at the same time extirpated 22 of the 26 plant species recorded on the island within 20 years of their release (Watson 1961). By the time rabbits were eradicated from Laysan in 1936, at least three endemic land birds that were dependent on vegetation native to the island – the Laysan Miller Bird *Acrocephalus familiaris*, the Laysan Honeycreeper *Himatione sanguinea fraithii*, and the Laysan Rail – had gone extinct, most likely as a result of severe reductions in plant cover from rabbit herbivory (Watson 1961; Tomich 1986).

Rabbits on Lehua Island

Rabbits were first documented on Lehua in 1931 by Caum (1936). While the date and circumstances of their initial introduction is unknown, it has been suggested that they were introduced to Lehua in the 1880s or 1890s (Watson 1961), likely as a food source for visitors to the island (Wood *et al.* 2004). Rabbits are currently abundant on all areas of Lehua, but they appear to be most common in vegetated gulches on the south side of the island (Wood *et al.* 2004). They use burrows and rock crevices as shelter and seem to be most abundant during the wetter seasons of winter and spring, when their population responds to increased vegetation on the island (Wood *et al.* 2004). Their populations may also be subject to severe downward fluctuations during periods of drought (Watson 1961).

The rabbits introduced on Lehua have likely caused significant degradation of island plant communities. Rabbits were already present on Lehua in 1931, when the first documented vegetation surveys were conducted, so the extent of floral diversity on Lehua prior to the introduction of rabbits is unknown. It is evident, however, that Lehua's plant communities are radically different today from their original, native condition. Notably, Lehua's floral diversity of 49 currently documented species is dominated by 27 non-native plant species (Wood *et al.* 2004), a threefold increase in non-native species from Caum's 1931 record of only nine non-native plants (Caum 1936). Four native plant species noted by Caum in 1931 are no longer found on Lehua (Wood *et al.* 2004). The only native plant common on the island is the morning glory, *Jacquemontia ovalifolia* subsp. *sandwicensis*, which rabbits eat only rarely (Wood *et al.* 2004; T. Ka'iakapu *pers. comm.*). Lehua is somewhat sparsely vegetated as a result of harsh environmental conditions such as high winds and little rainfall, and its sparseness is probably increased significantly by rabbit herbivory. This lack of vegetative cover leaves the soil on much of the island highly susceptible to erosion during heavy rainfalls. The continued loss of topsoil could reduce habitat for burrow-nesting species such as Wedge-tailed Shearwaters and damage the nearshore marine environment around Lehua.

It is likely that the degraded state of Lehua's vegetation may be significantly limiting the populations of seabirds that nest on or burrow under vegetation, such as Red-footed Boobies (*Sula sula*), Great Frigatebirds (*Fregata minor*), and Newell's Shearwaters. This latter species is listed as vulnerable by the IUCN and as Threatened under the Endangered Species Act (Wood *et al.* 2004). It is likely that recovering Lehua's vegetation by removing rabbits would boost the reproductive success of sensitive seabird species. Tomich (1986) recommended the removal of rabbits to save the native vegetation that remains or might recolonize. However, there is some concern that removing rabbits would decrease grazing

pressure on weeds, leading to a proliferation of non-native plants that could potentially outcompete native flora. Lehua's rabbit populations also have indirect negative effects on breeding seabirds, by providing a constant food source for the introduced Barn Owl, which in turn preys on the seasonally present nesting seabirds, resulting in devastating impacts (VanderWerf *et al.* in prep). In fact, the bones of rats, rabbits, and a variety of seabirds, including the Brown Noddy, have been found in a Barn Owl roost on Lehua. The reduction of owl food resources as a consequence of rabbit and rat eradications could ultimately result in a release of terrestrial predator pressure on nesting seabirds as owl numbers decreased (VanderWerf *et al.* in prep).

Habitat and plant restoration, which are standard DOFAW and USFWS activities, would be carried out following rabbit removal. In the case of any listed plants that might be re-introduced to Lehua, this would be carried out in accord with species recovery plans prepared by USFWS under the authority of the ESA and the State endangered species law. These plans receive extensive Federal and State agency review and public input prior to finalization. The use of USFWS funds to carry out plant restoration is guided by the aforementioned legislation and species recovery plans and is implemented through a variety of programs, including the Coastal Program based in the USFWS Pacific Islands Office. The Coastal Program works with a variety of project partners to conserve and restore native species and habitats in Hawai`i and other Pacific islands.

Summary

Rats and rabbits on Lehua Island have both direct and indirect negative impacts on the island ecosystem. The direct impacts to seabirds through predation and reduced vegetation cover have eliminated some species and reduced the quality of breeding habitat for others. The removal of rats and rabbits and subsequent native plant restoration is believed to be the first step to restoring the ecosystem of Lehua Island, increasing seabird, plant, insect and marine habitats. These proposed actions are not anticipated to have any significant negative environmental impacts.

The lack of baseline, or pre-introduction data from Lehua makes it difficult to analyze trends in seabird and plant population changes. Nonetheless, in the absence of that data, the USFWS and DOFAW would look to the Northwest Hawai`ian Islands, the paleoecological fossil record, and relatively intact coastal areas in Hawai`i to give an idea of what a healthy, diverse ecosystem should look like.

Scope of Proposed Action

This proposed action focuses on four areas: 1) Activities that are necessary to eradicate rats and rabbits from Lehua Island, 2) Activities necessary to respond to invasive rodents and rabbits that might get back to Lehua in the future, 3) Native plant restoration on Lehua Island, and 4) Preventing additional non-native species introductions to Lehua Island.

This EA does not cover the eradication of invasive species from any other Hawai`ian Islands. Any eradication activity on other Hawai`ian Islands would require additional

environmental analysis due to the unique environmental issues associated with each individual island.

Regulatory Framework

The proposed action would be carried out in compliance with the State and Federal laws and regulations listed below.

Federal Laws

Endangered Species Act of 1973, as amended

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

Marine Mammal Protection Act of 1972, as amended

Migratory Bird Treaty Act of 1918, as amended

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

National Environmental Policy Act of 1969, as amended

Water Pollution Control Act of 1948, as amended

Coastal Zone Management Act of 1972, as amended

Hawai`i State Laws

Hawai`i Revised Statutes Chapter 344, Environmental Policy Act

Hawai`i Revised Statutes Chapter 343, Environmental Impact Statements

Hawai`i Revised Statutes Chapter 341, Environmental Quality Control Act

Hawai`i Revised Statutes Chapter 128D, Environmental Response Law

Hawai`i Revised Statutes Chapter 342D, Water Pollution

Hawai`i Revised Statutes Chapter 321, Department of Health

Hawai`i Revised Statutes Chapter 183D, Wildlife

Hawai`i Administrative Rules Title 13, Chapter 125, Rules Regulating Wildlife Sanctuaries

Authorities for Implementing Action

The proposed action is authorized by the State and Federal laws, regulations, guidelines, and Presidential Executive Orders listed below.

Hawai`i Department of Land and Natural Resources Statutes:
a) Hawai`i Revised Statutes, Chapter 26-15. Provides general authorities to the Department of Land and Natural Resources to manage and administer public lands, including wildlife resources and coastal areas.

b) Hawai`i Revised Statutes, Chapter 195D-5 (general agency authorities in Hawai`i to conserve, manage and protect indigenous species) §195D-5 Conservation programs. (a) The department shall conduct research on indigenous aquatic life, wildlife, and land plants, and on endangered species and their associated ecosystems, and shall utilize the land acquisition and other authority vested in the department to carry out programs for the conservation, management, and protection of such species and their associated ecosystems. In addition, the department is hereby authorized to acquire by purchase, donation or otherwise, lands or interests therein needed to carry out the programs relating to the intent and purpose of this chapter.

c) Hawai`i Revised Statutes, Chapter 183D-4 (agency authorities to manage wildlife sanctuaries, including Lehua State Seabird Sanctuary) §183D-4 Game management areas, wildlife sanctuaries, public hunting areas. (a) For the purposes of preserving, protecting, conserving, and propagating wildlife, the department shall establish, maintain, manage, and operate game management areas, wildlife sanctuaries, and public hunting areas on land under its control and, as it deems desirable, enter into agreements for taking control of privately owned lands for those purposes.

U.S. Fish and Wildlife Service Statutes: The Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended, directs the USFWS to conserve ecosystems upon which threatened and endangered species depend. 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 construed 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." In addition, restoration of Lehua through rat and rabbit eradication is listed as a goal in the 2005 USFWS Pacific Region Seabird Conservation Plan.

U.S. Coast Guard Guidelines: The guidelines for the management of natural resources for the CG are listed in Commandant Instruction M5090, and state that the USCG shall inventory, preserve, restore, and enhance natural resources on its administered lands to the maximum extent practicable and in the best public interest.

Presidential Executive Order 13089 on Coral Reef Protection (June 11, 1998): Section 3, on Federal agency responsibilities, states: In furtherance of section 2 of this order, Federal agencies whose actions affect U.S. coral reef ecosystems, shall, subject to the availability of appropriations, provide for implementation of measures needed to research, monitor, manage, and restore affected ecosystems, including, but not limited to, measures reducing impacts from pollution, sedimentation, and fishing.

To the extent not inconsistent with statutory responsibilities and procedures, these measures shall be developed in cooperation with the U.S. Coral Reef Task Force and fishery management councils and in consultation with affected States, territorial, commonwealth,

tribal, and local government agencies, nongovernmental organizations, the scientific community, and commercial interests.

Presidential Executive Order 13112 on Invasive Species (February 3, 1999): Section 2, on Federal agency duties, states:

(a) Each Federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law,

(1) identify such actions;

(2) 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.

CHAPTER 2: AFFECTED ENVIRONMENT

Physical Environment

Setting

The Hawai`ian Islands, located in the subtropical central Pacific Ocean, are the most isolated island chain in the world. The archipelago is composed of 137 islands arranged roughly in a line stretching almost 1,553 miles between 16 and 23° north latitude. Eleven of these 137 islands are permanently inhabited and eight of these 11 – Hawai`i, Maui, Lana`i, Moloka`i, O`ahu, Kaua`i, Kaho`olawe, and Ni`ihau – are part of the "main" Hawai`ian Islands and support more than 99.9% of the archipelago's human population (State of Hawai`i Data Book 2002).

Lehua Island is located three-fourths of a mile off the northern shore of Ni`ihau (a privately owned 46,080 acre island), and roughly 19 miles west of Mana Point on the island of Kaua`i (Figure 2). Lehua is a crescent-shaped volcanic crater open to the sea on its north side (Figure 3). It is approximately 284 acres in total area, with a maximum elevation of 699 ft (State of Hawai`i Data Book 2002).

Figure 2. Location of Lehua Island, Kaua`i County, Hawai`i.

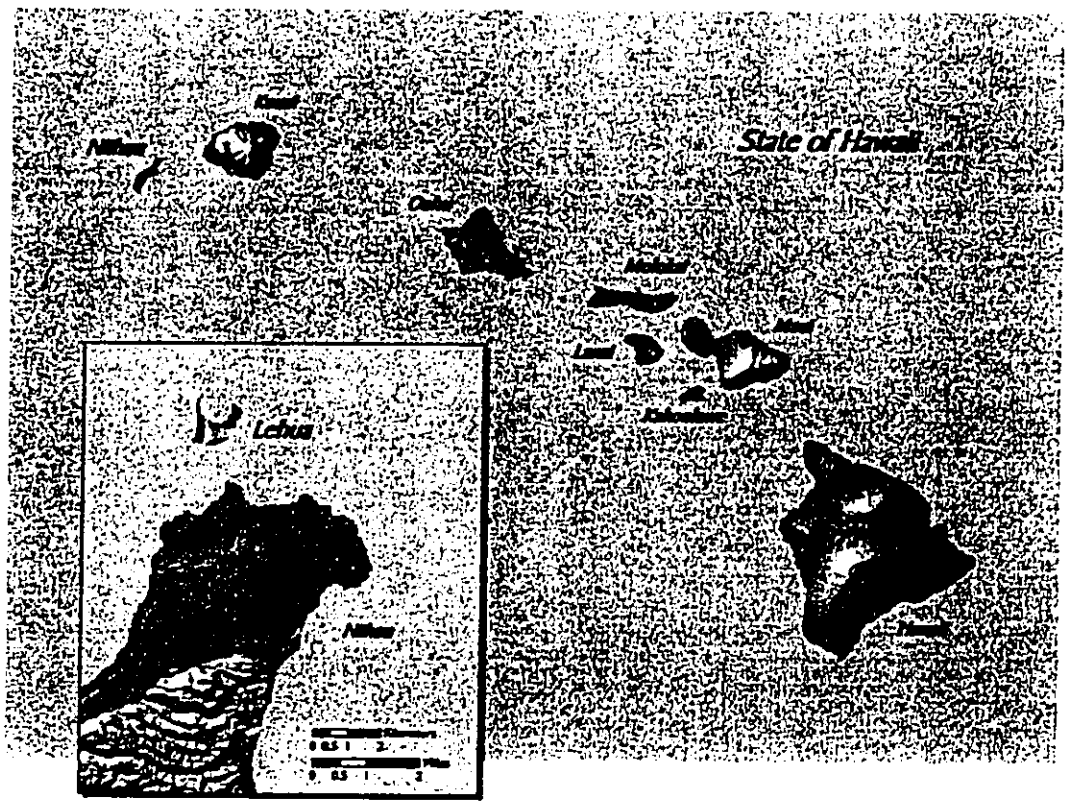
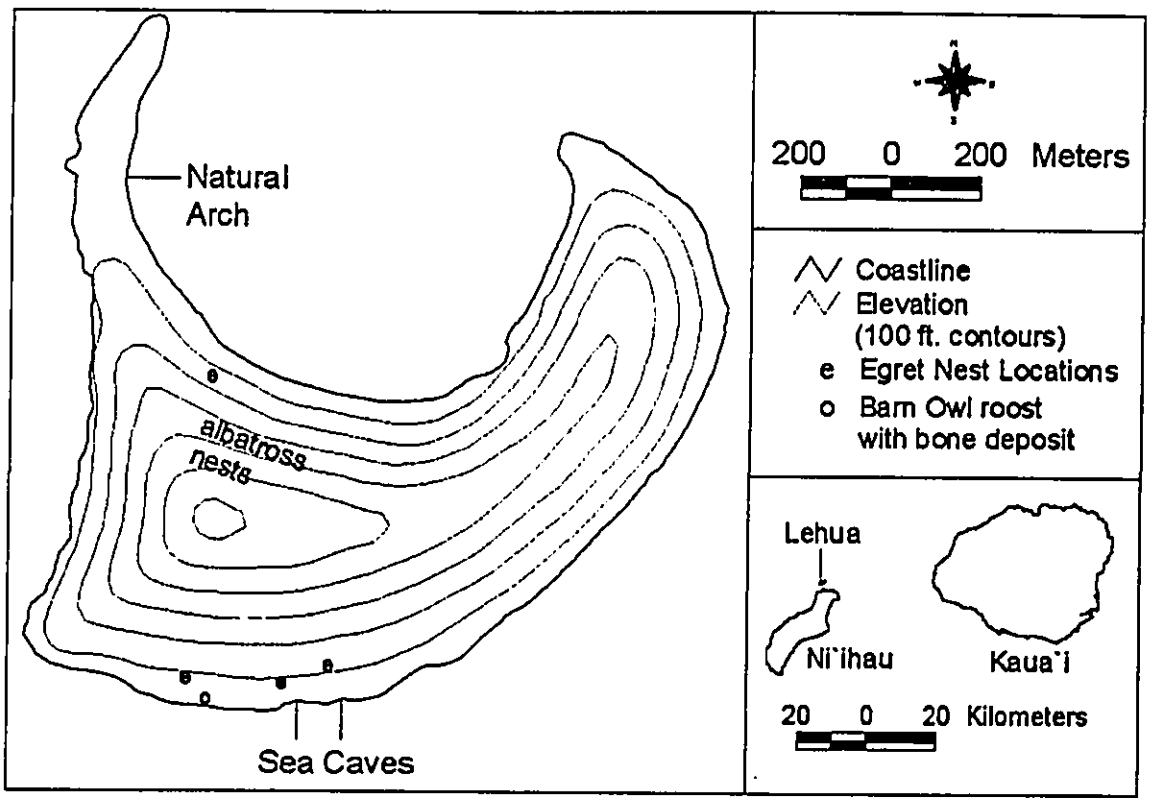


Figure 3. Map of Lehua Island



Geology

The entire Hawai`ian island chain has been formed by volcanic activity. As the Pacific Plate drifted roughly northwestward, magma periodically perforated the plate and formed each of the islands in the Hawai`ian chain in turn (Carson and Clague 1995). While Ni`ihau, among the oldest of the major Hawai`ian islands, was formed about 4.89 million years ago (Carson and Clague 1995), Lehua emerged through a series of secondary eruptions during the Pleistocene period between 10,000 and 1.6 million years ago (Stearns 1946). The island is composed of tuff, a porous material consisting of consolidated fine-grained volcanic particles that were expelled during Lehua's formation.

Lehua's tuff is gray to brown in color, with stratifications that are particularly visible on the inner crescent wall. The porous rock has weathered to form numerous cavities on exposed surfaces, which provide nesting habitat for crevice-nesting seabirds including Wedge-tailed Shearwaters and Bulwer's Petrels (Wood *et al.* 2004). Rock is exposed on vertical cliffs throughout the island, and has eroded to form deeply carved fissures that are especially common near sea level on the inner crescent. Higher up the slopes of the inner crescent, parallel stratified beds are exposed to form a series of relatively level shelves, appearing somewhat like a natural amphitheatre. Portions of Lehua's shoreline are composed of benches that are at least partially above sea level. The bench on the shoreline of the island's inner crescent contains large tidepools (Palmer 1937;Wood *et al.* 2004).

Climate

The Hawai`ian chain experiences a generally warm, tropical climate. In general, daytime temperatures at sea level remain between 70°F and 80°F throughout the islands, similar to the consistent average temperature of the air above the surrounding ocean. The most influential element of Hawai`i's climate is the persistent flow of the trade winds that blow from the east throughout the Pacific's subtropical latitudes. Hawai`i's climate can be divided roughly into two seasons. The season from May through September is somewhat hotter and drier, with nearly constant trade winds. The season from October through April, on the other hand, sees more rainfall, cooler temperatures, and trade winds that are more frequently interrupted by other wind patterns. However, the tropical latitude of the islands provides for seasonal climate fluctuations that are very slight compared with those of the mainland United States. Below an elevation of 1,000 ft, the interseasonal fluctuation in average temperature rarely exceeds 9°F.

The most significant climatic fluctuations on the main islands of Hawai`i are *spatial rather* than temporal. The trade winds blow up against the mountainous interiors of the main Hawai`ian islands (ranging from 3,000 to 14,000 feet in elevation) causing the windward eastern sides of the Hawai`ian islands to receive much more severe weather than the leeward western sides, which lie in the rain shadow of the inland mountains. In fact, the gradient of average annual rainfall between the windward and leeward sides of the major Hawai`ian islands is often as much as 25 inches per mile and can be as much as 118 inches per mile as seen on one 2.5 mile stretch on Kaua`i. Additionally, average temperatures decrease with increased elevation, and the summits of Mauna Kea and Mauna Loa on the island of Hawai`i, 13,780 ft in elevation, receive snow during many winters (climate information from Western Regional Climate Center website accessed 2004).

Ni`ihau and Lehua lie in the 'rain-shadow' of the island of Kaua`i, where average annual rainfall on Mt. Waialeale exceeds 472 inches, said to be the wettest place on Earth. Lehua's climate is thus generally typical of leeward Hawai`i, with sunny skies and relatively little precipitation. Storms that do not follow the trade-wind trajectory, however, can hit the island with considerable force, especially when arriving on the exposed north side.

Air Quality

The State of Hawai`i continues to have levels of air quality that are among the best in the nation, with criteria pollutant levels well below Federal ambient air quality limits. Measurements of particulate matter of 10 microns or less in diameter in a commercial and residential area of the city of Lihue, Kaua`i, showed an annual mean concentration of 1.6 $\mu oz/ft^3$ in 2002, well below the State and Federal limit of 5.8 $\mu oz/ft^3$ and the second-lowest annual mean of the ten stations that monitored this criterion in 2002 in the State of Hawai`i. What little air pollution is present is generally flushed by the persistent trade winds (State of Hawai`i Annual Air Quality Data Summary 2002). While there are no direct air quality measurements available for Ni`ihau or Lehua, there is no industrial development and little or no motor vehicle traffic on either of these islands and, therefore, the air quality is very likely significantly better than that of Lihue.

Terrestrial Environment

Fossil evidence excavated from the south shores of Kaua`i indicates that a high rate of extinction of plants and birds was likely precipitated by the arrival of the Polynesians and the introduction of birds and mammals, including *R. exulans*. This was followed by the arrival of Europeans, who introduced an additional assemblage of non-native plants and animals, including two more species of rats (Burney *et al.* 2001). The fossil evidence indicates that the Hawai`ian biotic landscape was dramatically different prior to the arrival of humans.

Invertebrates

Current Status and Trend

The Hawai`ian Islands originally possessed a great diversity of endemic insects and arachnids, many highly specialized and limited to very small ranges (Carlquist 1980). However, widespread habitat degradation and introductions of alien species have resulted in steady declines in populations and numbers of species, including several extinctions. Unfortunately, the lack of historical data on Lehua's invertebrate fauna prevents a comprehensive analysis of trends among invertebrate populations. Surveys conducted in 2001 and 2003 identified 1 indigenous, 12 endemic species and 48 non-native species (Wood *et al.* 2004; Appendix A). The persistence of some endemic species on Lehua is encouraging and indicates potential for invertebrate restoration. Among the non-native species identified, the most significant is the Big-headed Ant, which has been shown to have a significant impact on arthropod fauna native to Hawai`i (Liebherr and Polhemus 1997; LaPolla *et al.* 2000; Jahn and Beardsley 2000). An alien grasshopper, *Schistocerca nitens*, which has eaten native vegetation on Nihoa Island, was also found on Lehua.

Avifauna

Terrestrial Passerines and Predatory Birds

Since 1931, five ornithological surveys of Lehua have been conducted (Caum 1936; Fisher 1951; Richardson 1963; Walker unpubl. data; Wood *et al.* 2004; Appendix A). No native Hawai`ian landbirds have been reported on Lehua. Four non-native passerines have been recorded in low numbers: Zebra and Rock Doves, House Finches and Chestnut Mannikens. Non-native Barn Owls are also present and have been documented to prey on at least some of the terrestrial vertebrates on Lehua. Pellets found in the vicinity of a Barn Owl roost on Lehua contained remains from rats, rabbits, and at least four species of seabirds including Wedge-tailed Shearwaters, Bulwer's Petrels, and Brown Noddies, the latter species now nearly extirpated from the island. Cattle Egrets, another non-native predatory bird, are also present and consistently attempt to nest on Lehua. They are suspected of preying on seabird chicks and competing for roost space (Wood *et al.* 2004). None of these introduced bird species are rare.

Shorebirds

Small numbers of migratory shorebirds have been consistently seen on Lehua, usually foraging along shorelines. Pacific Golden Plover, Wandering Tattler and Ruddy Turnstone

are present in winter months and leave in the spring and summer to breed elsewhere. The numbers of shorebirds in Hawai`i have declined over the years but none of these species are considered endangered. However, the Pacific Golden Plover is considered a Species of Concern by the Federal government.

Seabirds

Current status

Sixteen species of seabirds have been recorded during the five known surveys of Lehua (Wood *et al.* 2004; Appendix A). At least eight species of seabirds currently breed on the island. Among these, two are listed in the IUCN Red List of Threatened Species and are also Federal Species of Concern – the Black-footed Albatross (Endangered) and the Laysan Albatross (Threatened). The only Black-footed Albatross breeding colonies on the major Hawai`ian islands are on Lehua and Ka`ula Islands, and both of these species nest in relatively few sites worldwide, making these colonies significant for conservation of this species (Wood *et al.* 2004). At least three additional species are suspected but not confirmed to nest on Lehua. One suspected nester, Newell's Shearwater, is listed by both the IUCN (Vulnerable) and the USFWS (Threatened). Band-rumped Storm-petrels (a candidate for listing by the USFWS) may also be attempting to nest. The Hawai`ian Petrel, listed by USFWS as Endangered, has also been seen at Lehua and may be attempting to nest.

Lehua is home to the largest breeding colonies of Brown Boobies and second largest for Red-Footed Boobies in the Hawai`ian Islands, the fifth-largest Hawai`ian breeding ground for Wedge-tailed Shearwaters, and an important large colony of Red-tailed Tropicbirds. The island contains the westernmost colony of Hawai`ian Black Noddies, and if nest sites are confirmed for Newell's Shearwaters and Band-rumped Storm-petrels, Lehua would also be the westernmost breeding site for both of these species.

Threats

Hawai`ian seabirds have suffered a series of historical events that have done varying degrees of damage to their populations. Indigenous Hawai`ians considered the chicks of Bulwer's Petrels and Newell's Shearwaters delicacies, and the bones of these and numerous other seabird species have been found in archeological sites throughout Hawai`i. It is likely that many seabirds that now nest only on offshore islets once nested throughout the main islands before being extirpated by early Polynesians and their introduced non-native mammals such as rats, dogs, and pigs. Current populations are likely significantly reduced from historical numbers. The arrival of Westerners to the islands brought numerous additional threats. Traders exploring the Northwest Hawai`ian Islands killed albatross chicks for their down and adults for their feathers. They mined guano from Laysan, Lisianki, and other islands, and collected seabird eggs to sell as food. This exploitation caused the populations of numerous Hawai`ian seabird species to plummet to dangerously low levels by the turn of the 20th century. Europeans also brought cats and two additional species of rats, all of which prey on seabirds.

While many seabird populations are protected on State and Federal wildlife refuges, other seabird populations are not protected and are at risk. Currently, the three main threats to seabird populations on the Hawai`ian Islands are historical and current habitat loss and

degradation, mortality at sea from interactions with fishing gear, and the impacts of introduced mammals that eat adults, eggs, and chicks of seabird species. Alteration of nesting habitat and disturbance by human residents of the Hawai`ian Islands remains a critical factor limiting seabird populations. A particular threat to seabirds, especially nocturnal species, is use of bright lights in coastal areas at night. Birds that are attracted to lights suffer high rates of mortality when they collide with illuminated structures. Human disturbance threatens seabirds beyond the border of developed areas as well. Birds become entangled by fishing nets and lines, and often swallow floating debris mistaking it for food. The most significant threat facing many seabird species, however, is introduced species. Introduced insects such as mosquitoes spread diseases such as avian pox through seabird colonies. Introduced predators such as cats, dogs, and rats continue to take huge tolls on vulnerable nesting birds, and introduced herbivores such as rabbits have the ability to alter nesting habitat significantly (Ainley *et al.* 1997).

Rare Seabird Species on Lehua

Black-footed and Laysan Albatross

Three species of albatross breed in the North Pacific: the Laysan, Black-footed, and Short-tailed. Both the Laysan and Black-footed occur on Lehua (Wood *et al.* 2004). These long-lived species (the lifespans of some individuals are documented at well over 60 years) are monogamous and maintain their pair bond with intricate social displays at the colonies. The vast majority of Laysan and Black-footed Albatross breed in the Northwestern Hawai`ian Islands, though there are also colonies in Japan and Mexico (Tickell 2000). Both Black-footed and Laysan Albatross have been expanding their breeding range over the past several decades as populations have grown to replace the huge number of birds lost during the first 60 years of the 1900s to human harvesting and military activities at breeding sites. However, recent trends have shown a decline in Black-footed and Laysan Albatross. Both are listed by IUCN and also considered Federal Species of Concern. Declining numbers throughout the Hawai`ian Islands are due in large part to birds killed in the longlining operations across the Pacific (BirdLife International 2003). They are also at risk from non-native predators, such as rats. In fact, adult nesting Laysan Albatross on Kure Atoll, prior to rat eradication, had been attacked and fatally wounded by rats as they sat on their nests (Kepler 1967; other information from Harrison 1990).

Newell's Shearwater

Newell's Shearwaters, listed as Threatened by the USFWS and Vulnerable by the IUCN, are nocturnal seabirds that breed primarily among forested slopes on Kaua`i. Their total breeding population is estimated at between 4,000 and 6,000 pairs, although their habits are cryptic and surveying them is difficult. Newell's Shearwaters are very vocal on land, but are awkward, hardly able to walk and able to land only by crashing into vegetation and tumbling to the forest floor. Thought to be near extinction before their largest colony was discovered on Kaua`i in 1967, they are still under threat from introduced predators such as rats. As nocturnal seabirds, they also suffer high mortality from brightly illuminated structures with which they collide (information from Harrison 1990).

Band-rumped Storm-petrel

The Band-rumped Storm-petrel is one of the rarest and smallest breeding seabird in the Hawai`ian archipelago. It is listed as endangered in the State of Hawai`i, and is a candidate for listing by the USFWS. A nocturnal seabird that breeds only in remote locations, it is extremely difficult to study and very little is known about the species. It has been recorded breeding on remote Japanese islands, in the Galápagos, and in the Eastern Atlantic, and it breeds in Hawai`i, but no nests have been found in many years. Threats to Band-rumped Storm-petrels include collisions with artificial structures affixed with bright lights, degradation of their remote island habitats, and predation on nests by mammals. Additionally, flotsam is often found in their stomachs when they are captured (Harrison 1990; Slotterback 2002; Wood *et al.* 2002).

Hawai`ian Petrel

The Hawai`ian Petrel is very rare and is listed as Endangered by the USFWS. They are currently known to nest in rocky, high elevation habitats on Haleakala, Maui and Mauna Loa, Hawai`i. They had not previously been recorded from Lehua until an individual was seen circling offshore with other seabirds in July 2004. Introduced species such as cats and rats are the most serious threats to these species.

Trend of Lehua's Seabirds

The lack of baseline, or pre-introduction data from Lehua makes it difficult to analyze the trend in seabird population changes. Nonetheless, in the absence of that data, the USFWS and DOFAW look to the Northwest Hawai`ian Islands, the paleoecological fossil record, and relatively intact coastal areas in Hawai`i to give an idea of what a healthy, diverse seabird colony should look like.

Seabird populations on Lehua have changed somewhat over the period of occasional monitoring from 1931 to the present. Specifically, the colony of Wedge-tailed Shearwaters has probably grown significantly, and colonies of Laysan and Black-footed Albatross have recently appeared, while the historical colony of Brown Noddies has disappeared (Wood *et al.* 2004). The explanations for these changes are unclear. However, predation from non-native animals is a likely component in the disappearance of the Brown Noddy, while Laysan Albatross are making a general recovery worldwide from severe population declines in the early 1900s (Harrison 1990; Whittow 1993).

While Lehua is already an important seabird breeding location in Hawai`i, it has the potential to support a greater diversity of species and larger populations of many of these species. The major threat facing many of the seabirds on Lehua is currently the presence of non-native predators such as rats. As discussed in Chapter One, if rats and rabbits are successfully removed from the island, Lehua would be able to reach its full potential as a globally important seabird island.

Native Mammals

Due to poor ability of mammals to disperse to remote islands without human assistance, indigenous and endemic mammals are poorly represented on many island ecosystems

(Darwin 1859), especially remote archipelagos such as Hawai`i. Only two mammals are native to the archipelago, the Hawai`ian Monk Seal (*Monachus schauinslandi*) and the Hoary Bat (*Lasiurus cinereus*) (Tomich 1986). There are no records of the Hoary Bat and only the Monk Seal has been recorded on Lehua. Monk Seals will be discussed later in this chapter under "Marine Environment."

Herpetofauna

The island supports no amphibians and only one reptile – the non-native Snake-eyed Skink. The skink is a native to the Western Pacific and Indian Ocean, and is believed to have been introduced to the Hawai'ian Islands by the Polynesians. The skink is widespread in Hawai'i, commonly found along rocky areas along coastlines. The skink can be frequently found in the littoral zone, foraging in the intertidal zone, commonly taking sand flies, insects, and other arthropods. Green Sea Turtles, listed as a Threatened species under the Endangered Species Act, are sometime seen in waters around Lehua (see Marine Environment section below) but there are no records of sea turtles crawling out onto the rocky shelves around Lehua and there is no suitable turtle nesting habitat on Lehua.

Flora

Current Status

Surveys by Caum (1936) and Wood *et al.* (2004) found a total of 11 endemic plant species on Lehua, although Wood's 2001-2003 surveys were unable to locate two of endemics identified by Caum, making an extant total of nine endemic species (Appendix A). Wood et al. (2004) found an additional 13 native (indigenous) plant species extant on the island in small numbers, and a total of 27 non-native species (Wood *et al.* 2004). The non-native plant species dominate most of the island's vegetation communities, which are shaped in large part by the foraging habits of Lehua's rabbit population (Wood *et al.* 2004).

Trends

Wood *et al.*'s recent survey (2004) detected 18 more non-native plant species than Caum's survey about 70 years ago, indicating a marked trend of plant invasions onto Lehua. Four native plant species seen by Caum could not be re-located during the most recent surveys. Decades of pressure from rabbits has allowed for the flourishing only of plants that are either highly resistant to grazing pressure or so ephemeral that they can undergo their entire reproductive life cycle rapidly enough to avoid herbivory. As long as rabbits remain on the island, they will be the primary determinant of the plant communities. Because the floral species accounts were taken after Lehua had already been degraded from invasive rabbits, the USFWS and DOFAW look to the Northwest Hawai`ian Islands and the paleoecological fossil record from coastal areas in Hawai`i to give an idea of what a healthy, diverse island ecosystem should look like.

Marine Environment

Marine Mammals

Current Status

The Hawai`ian Monk Seal is a highly endangered (IUCN and USFWS) pinniped that resides primarily in the Northwest Hawai`ian Islands, with occasional sightings on the main islands (Zevin 1995). The Monk Seal population is estimated at only 1400 animals (Ragen and Lavigne 1999). They generally breed on islands that have little or no human presence, and encroachment by humans into their natural territories is one of the threats facing this endemic mammal (Tomich 1986). Entanglement in debris from human activities such as fishing is a major danger as well (Boland and Donohue 2003). The small numbers of seals in some of the populations, combined with a sex ratio heavily skewed towards males, has led to 'mobbing' of female seals by males competing to mate, which has caused severe injuries and some fatalities among female seals (Hiruki *et al.* 1993). Disease and predation by sharks have also taken their toll on the species in recent years (Craig and Ragen 1999).

Trend

The Monk Seal population is still at risk. Recent declines in juvenile survivorship, possibly due to low prey availability, have not abated, especially in the French Frigate Shoals breeding colony (Gilmartin *et al.* 1993, Craig and Ragen 1999). However, increasing numbers of Monk Seals have been sighted in the main Hawai`ian Islands. Adult Monk Seals are sometimes seen resting on Lehua's rocky shelves, with an average of two individuals per trip (trips last 1-4 days) sighted on 10 visits from 2001-2004 (Wood *et al.* 2004). Monk Seal pups have not been observed on Lehua Island (Wood *et al.* 2004).

Sea Turtles

Current Status

The green sea turtle is listed as Threatened under the Endangered Species Act throughout its Pacific range. Approximately 90% of green turtle nesting occurs in the French Frigate Shoals of the Northwest Hawai`ian Islands, totaling 200-700 females breeding annually (NMFS and USFWS 1998). Lehua's rocky and steep shoreline makes sea turtle access very difficult and prevents any attempts to excavate nests. On 10 visits in 2001-2004, no sea turtles were sighted on Lehua Island, but one individual was spotted swimming in the surrounding waters (Wood *et al.* 2004).

Trend

Hawai`ian populations appear to be increasing due to protection of nesting areas and enforcement of regulations preventing their take. However, additional threats have recently become a cause for concern. Increases in the occurrence of the disease fibropapillomatosis, as well as increased human development threaten their population recovery. (NMFS and USFWS 1998).

Marine Fishes and Algae

See Table 11 in Appendix A for a list of fishes seen off the shores of Lehua during snorkeling surveys conducted in 2004 and Table 7 Appendix A for a list of marine algae collected on Lehua shorelines. None of the species listed in the appendices are known to be particularly rare.

Human Uses and Values

Archaeological Value

The remains of stone platforms and cairns are present on Lehua, which may have been built by Hawai`ian bird hunters or fishermen (Palmer 1937, Yent and Carpenter 2004). Archaeologists from the State Division of Parks located and mapped 65 sites of archaeological significance on Lehua (Yent and Carpenter 2004). Most of these sites are small and do not indicate any permanent settlements existed on Lehua. The lack of fresh water, poor soils for supporting agriculture, and steep, rugged and exposed topography likely account for the lack of evidence of permanent occupation of Lehua Island by Hawai`ians. The sites on Lehua suggest that the early Hawai`ians landed on the island, probably to fish and collect birds, while living on adjacent Ni`ihau or Kaua`i.

Cultural and Recreational Uses

The following steps were taken to determine the cultural uses of the project area: (1) a general literature review was conducted to determine if there were any published studies or reports of the cultural uses of the island; (2) letters requesting comments on the Draft EA for the Lehua Island Ecosystem Restoration Project were sent to the following organizations: Office of Hawai`ian Affairs, Hui Malama I Na Kupuna O Hawai`i Nei, Kahea, and Kaua`i Burial Council; and (3) five residents of Kaua`i identified as having potential knowledge about cultural uses related to Lehua were interviewed by DOFAW staff.

No studies were found regarding the culture uses of Lehua Island. No comments regarding cultural uses were received in response to the request for comments on the Draft EA for the Lehua Island Ecosystem Restoration Project. Responses gathered during the DOFAW interviews were consistent. All interviewees reported that residents from both Kaua`i and Ni`ihau visit the waters around Lehua. All interviewees said that the residents of Ni`ihau visit the island "all the time" or whenever "the water is good"; residents of Kaua`i apparently visit Lehua less frequently, most likely due to the distance from Kaua`i. All respondents reported that people visit the island to fish and to collect opihi (marine limpets) and limu (seaweed or algae).

Although the importance of subsistence fishing and gathering has not been documented on Ni`ihau, it has been found to be important in Hawai`ian communities on other islands. In the Puna District of the island of Hawai`i, 66% and 62%, respectively, of respondents engaged in fishing and shoreline gathering (Puna Hui `Ohana 1982). On Moloka`i, 51% of respondents reported that

subsistence resources were "very important" to their family and 25% reported them to be "somewhat important"; only 13% reported that subsistence resources were "not important at all." Hawai`ian residents of Moloka`i reported that 38% of their food was derived from resources that were caught, gathered or grown (Matsuoka et al. 1994).

The waters around Lehua are also a destination for SCUBA trips departing from Kaua`i. Lehua's remoteness makes this trip a full-day undertaking, so use is light compared to most dive sites in Hawai`i. Sportfishing, bird watching, snorkeling, and eco-tourism also occur in the waters around Lehua. All these activities tend to occur in the calm Summer season when the waters between Kaui`i and Lehua are not as rough.

Ownership and Management

Lehua Island is Federal property administered by the USCG. It was set aside for public purposes by Territorial Governor Wallace R. Farrington on August 10th, 1928, under Executive Order No. 343. It was placed under the management and control of the U.S. Department of Commerce for use as a United States Lighthouse Station. Following this, President Calvin Coolidge issued a Proclamation on September 14th, 1928, stating that the land would be owned by the United States government for use as a lighthouse station.

The guidelines for the USCG management of natural resources are listed in Commandant Instruction M5090. It states the USCG shall inventory, preserve, restore, and enhance natural resources on its administered lands to the maximum extent practicable and in the best public interest. The USCG has been limited by the lack of funding and from conducting these activities on Lehua.

The waters around Lehua, including the intertidal zone, are State property. Lehua Island itself is zoned as a Conservation District and is also a Hawai`i State Seabird Sanctuary. State regulations prohibit overnight camping, hunting or disturbing wildlife. State management activities on Lehua have consisted primarily of conducting occasional seabird surveys.

CHAPTER 3 – ALTERNATIVES

Introduction

This chapter will describe the three alternatives that were considered for implementation in the Draft EA, including the preferred alternative (Alternative 2) that has been selected for implementation. This chapter identifies the environmental issues used to formulate the alternatives. The issues were developed as a result of extensive scoping conducted for the development of this analysis. The actions conducted for scoping are described in detail. Methods or alternatives that were considered but dismissed from further consideration are described. A comparison of the potential environmental effects of the alternatives is found in Chapter 4.

Alternative Development

Section 102(e) of NEPA states that all Federal agencies shall "study, develop, and describe appropriate alternatives to recommend courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources." In addition to responding to unresolved conflicts, an environmental analysis must "rigorously explore and objectively evaluate all reasonable alternatives" [40CFR 1502.14(a)].

The proposed action, as outlined in Chapter One, was the result of a resource analysis done by USFWS and DOFAW resource management staff in collaboration with members of the Offshore Islet Restoration Committee (OIRC). OIRC is a multi-agency group that plans and coordinates statewide islet survey and restoration projects in Hawai`i. The analysis identified actions necessary to respond to negative impacts from rats and rabbits in the Lehua Island ecosystem.

The alternatives detailed below were developed to focus on the issues identified by USFWS and DOFAW biologists, invasive mammal control experts, rat eradication specialists, State and Federal regulatory agencies, and the general public. Chapter Five lists all individuals, organizations and agencies that were invited to provide comments regarding the proposed action.

Scoping and Public Involvement

The NEPA scoping process [40CFR 1501.7] was used to determine the scope of the analysis and identify potential issues and alternatives to the proposed action. This section summarizes the scoping that was conducted to identify environmental issues to be considered.

Internal Scoping

The USFWS and DOFAW have conducted site visits, and funded and conducted scientific studies that focus on the ecology and control of rats and rabbits on Lehua Island. The knowledge gained from these studies and site visits was used to formulate the proposed actions of the Draft EA.

External Scoping

The external scoping refers to the effort the USFWS and DOFAW made to solicit input from the public, State and Federal regulatory agencies, and non-governmental organizations. This includes public review of the Draft EA.

- The USFWS and DOFAW published a Notice of Intent (NOI) in the Federal Register (on May 17, 2004) and the State of Hawai'i OEQC Bulletin (on May 23, 2004), announcing the intent to conduct an environmental analysis for the Lehua project. It also described the project's purpose and need and the proposed action. The USFWS also sent press releases to local newspapers, resulting in four articles in two local newspapers announcing the public meeting date and location.

- On May 21, 2004, a scoping letter describing the proposed action was mailed out to individuals and organizations that had previously expressed interest in USFWS/DOFAW management, other State and Federal agencies that may have oversight or regulatory concerns about the project. The scoping letter and the seven responses received are included in this document as appendices.

- A public scoping meeting was held in Lihue, Kaua`i, June 9, 2004. The Federal Register Notice of Intent and announcements in a local Kaua`i newspaper specified the date, time and location of the meeting. Project biologists gave a presentation at the meeting that outlined the purpose and need and the proposed action. Thirteen people attended the meeting and none of them opposed the project.

- The USFWS and DOFAW met with regulatory government agencies that have oversight or regulatory concerns regarding the project, including the U.S. Coast Guard, National Marine Fisheries Service, U.S. Department of Agriculture, Hawai`i Department of Human Health, and U.S. EPA. Chapter 5 provides a list of all individuals and organizations contacted.

- On June 8, 2005, the Draft EA was posted on the Service's Pacific Islands Office website and a notice requesting comment was published in the State of Hawaii's Office of Environmental Quality Control Bulletin. Letters were also sent notifying interested parties of the availability of the Draft EA and requesting comments. A list of all the parties who were notified is included in this document. The 30-day comment period closed on July 8, 2005. Four letters were received. One from The Nature Conservancy, and three from State of Hawaii agencies: the Historic Preservation Division, the Department of Health, and the Office of Environmental Quality Control. These letters and the responses to them are included in this document as appendices. None of the letters opposed the project but two requested additional information. These letters and the two responses sent are included as appendices in this document. Responses to comments are incorporated into this document in bold type.

Important Environmental Issues

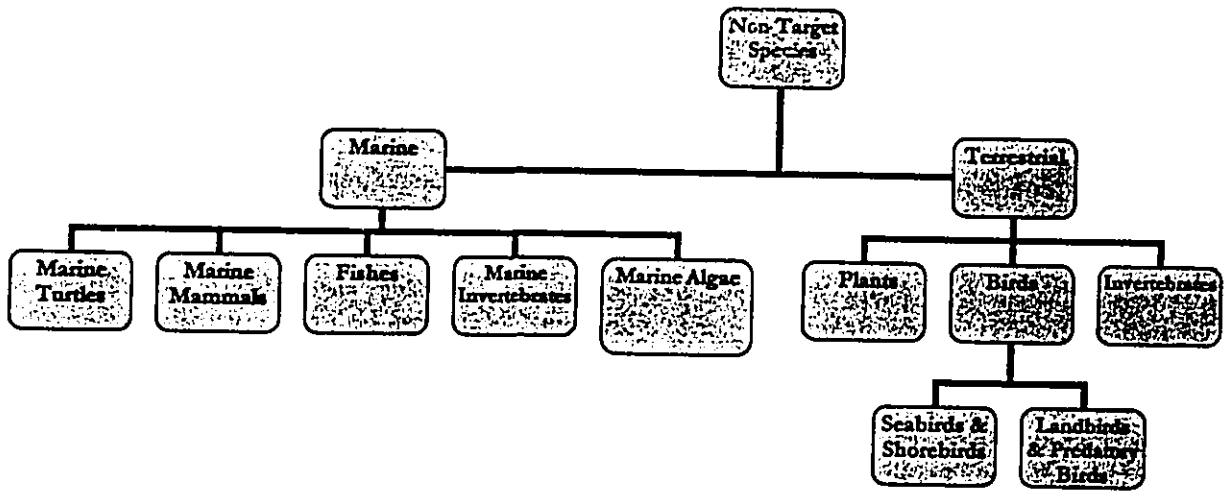
Important environmental issues are those that may require project specific alternatives, mitigation measures or design elements to address potential effects of the proposed activities. The following important environmental issues were identified during the public involvement and scoping process.

Issue 1: Restoration Efficacy
How well will the various alternatives meet the goals of restoration of the island?

Issue 2: Non-Target Species Impacts
What are the potential impacts of the various alternatives on non-target animals (see Figure 4)? Are there threatened or endangered species at risk from project activities? What impacts may occur to the nearshore marine ecosystem?

Issue 3: Increase in Weed Abundance
What potential effects on weed abundance do the various alternatives present? Will the release of rabbit grazing pressure result in an increase of weeds that put native flora at risk?

Figure 4. Conceptual model of non-target species that could be affected by different alternatives.



Issue 4: Impacts on Cultural Resources
What are the potential impacts of the various alternatives on the Lehua's cultural sites?

Issue 5: Impacts on Human Health and Safety
How safe are the alternatives to the public, biologists and field crews?

Issue 6: Introduction of Non-Native Species
Will the project activities lead to further introduction of non-native species? Will measures be implemented to prevent species from reaching the island during the implementation of the proposed action? Will there be measures implemented to detect and respond to any future introductions of invasive, non-native species?

Alternatives Considered:

This section describes the alternatives considered for implementation, including the "No-Action" alternative.

Alternative 1: No Action

Analysis of the no action alternative is required under NEPA. Rats or rabbits would not be eradicated under this alternative nor would native plant restoration take place. The negative impacts of rats and rabbits on native flora and fauna would continue on Lehua under this alternative, as outlined in Chapter 1.

Alternative 2 (Preferred Alternative Selected for Implementation): Rat Eradication with Diphacinone, followed by Brodifacoum if Necessary; Rabbit Eradication; and Native Plant Restoration

Rabbit Eradication

Under this preferred alternative, both rabbits and rats will be eradicated from Lehua Island, and a native plant restoration program would follow. A sustained program of reducing the rabbit population on Lehua Island to zero would be carried out during the winter season to avoid breeding seabirds. A team of professional hunters, under the on-island supervision of hunters with experience in rabbit eradications from offshore islands, will visit the island and initiate and sustain the eradication effort using various techniques including hunting with firearms and trapping. Hunters will use shotguns and rifles. Shot used in shotgun shells will not contain lead. Traps will be placed in areas around the island that exhibit the highest rabbit activity and monitored daily. Trapped rabbits would be removed from traps promptly and euthanized on site using appropriate techniques.

After the initial population reduction, trained hunting dogs would be used to locate the remaining rabbits and flush animals out to be trapped or shot. Hunting efforts would be sustained until no rabbits are detected on the island. Follow up visits with hunters and dogs, as necessary, will be made until the eradication is confirmed successful. Hunters will only use dogs that have been trained to hunt in seabird colonies without harming birds. All dogs will be removed from the island when the project is completed.

Rat Eradication

Toxicant: Following rabbit eradication, rats will be removed during the summer dry season with the use of bait containing the first generation anticoagulant rodenticide diphacinone at 50 ppm. If follow-up monitoring indicates that all rats had been killed, there would be no need to use the alternative rodenticide, brodifacoum. However, if rats persist, bait containing 25 ppm brodifacoum could be used to eradicate rats if it is deemed that the bait containing diphacinone is unable to achieve eradication. Brodifacoum generally kills rodents after only one feeding, as compared to diphacinone which generally requires multiple feedings. Brodifacoum could be appropriate for use if rats are not consuming enough diphacinone to complete the eradication.

However, the preference is to accomplish restoration using only diphacinone, thus avoiding potential non-target poisoning issues associated with the higher toxicity of brodifacoum. In addition, using only diphacinone would allow resource agencies in Hawai`i to demonstrate the efficacy of diphacinone aerial broadcast in the field as a viable and comparatively safe conservation tool for other areas in Hawai`i.

Application: Application will be completed by hand or aerial broadcast, and/or bait stations across 100% of the area of the island. Hand broadcast and bait stations would be carried out under the supervision of licensed pesticide applicators. Aerial broadcast will be carried out utilizing a hopper suspended from a helicopter. To ensure as even an application rate as possible, ground truthing, an onboard GPS in the helicopter, and computerized mapping would document the application area. Aerial baiting would be carried out under the direct, on-site supervision of a licensed pesticide applicator.

Cliffsides and Marine Ecosystem: Every reasonable effort would be made to minimize the risk of bait from being broadcast into the marine ecosystem. The hopper will be fitted with a deflector that spreads bait out to only one side, in an approximately 120 degree pattern, to minimize the risk of bait spread into the ocean when flying along cliffs and shoreline. In some cases, bait will be spread by hand in shoreline areas and/or placed directly in burrows or other areas deemed to be high quality rat habitat. This will help prevent bait spread into the ocean.

Application Rate: Diphacinone bait will be broadcast at up to 12.5 lbs/acre per treatment or as outlined by the label requirements, in compliance with FIFRA. Bait stations, if used, would be filled with bait continuously for approximately two years, allowing rats free access. As the eradication progresses, bait removal from stations by rats would decrease, approaching zero within months after initial application.

Application of brodifacoum bait would comply with FIFRA label requirements, and would be applied at up to 13.5 lbs/acre or less as required.

Number of Applications: It is anticipated that two diphacinone applications will be required, approximately 5-7 days apart, in compliance with FIFRA and the rodenticide label.

If necessary, a single application of brodifacoum could be applied if the diphacinone application did not eradicate the rats.

Efficacy Monitoring: If efficacy monitoring indicates that the two diphacinone applications failed in eradicating rats, brodifacoum would be applied at application rates in compliance with FIFRA.

Native Plant Restoration

Following rabbit and rat eradication, plant restoration would begin. Habitat and plant restoration are standard USFWS activities authorized by the Fish and Wildlife Act of 1956, the Fish and Wildlife Coordination Act of 1934, and the Endangered Species Act (ESA) of 1973, as amended. Restoration would be guided by a Lehua plant restoration plan. This plan would address appropriate sources of plants brought to Lehua, genetics issues, and the

historic ranges of plants considered for re-introduction. In the case of any listed plants that might be re-introduced to Lehua, this would be carried out in accord with species recovery plans prepared by USFWS under the authority of the ESA and State laws. These plans receive extensive Federal and State agency review and public input prior to finalization. The use of USFWS funds to carry out plant restoration is guided by the aforementioned legislation and recovery plans and is implemented through a variety of programs, including the Coastal Program based in the USFWS Pacific Islands Office. The purpose of the Coastal Program is to work with a variety of project partners to conserve and restore native species and habitats in Hawai'i and other Pacific islands.

Alternative 3 Rat Eradication with Brodifacoum, Rabbit Eradication, and Native Plant Restoration

Under this alternative, both rabbits and rats would be eradicated from Lehua Island and a native plant restoration program would follow. However, rats would be eradicated only with the use of brodifacoum, a more toxic, second generation rodenticide that generally works with a single feeding. In all other respects, this alternative is the same as Alternative 2. Additional details of Alternative 3 are hereby incorporated by reference to the Draft EA issued June 2005.

Summary of Alternatives

Table 1 summarizes the major features of each alternative. The environmental impacts of implementing each alternative are discussed in Chapter Four. The alternatives differ in the toxicity and active ingredients of the rodent baits, and whether rabbit and rat eradication and plant restoration are included.

Table 1. Summary of alternatives considered for implementation on Lehua Island.

Alternative	Rabbits	Rats	Plants
1	No Action	No Action	No Action
2	Hunt and Trap	Diphacinone, followed by Brodifacoum if necessary	Restore native plants
3	Hunt and Trap	Brodifacoum	Restore native plants

Actions Common to Alternatives 2 and 3

Timing

The proposed eradication of rabbits and rats would be determined by local biological, logistical and safety considerations including weather and sea conditions, to ensure safety for project personnel, the general public and to ensure success of the project. The rabbit eradication would be initiated first, and the rabbit population would be reduced or

eliminated before initiating rat eradication. Native plant restoration would follow the confirmation of successful removal of rabbits and rats.

Rabbits - The rabbit eradication proposed in Alternatives 2 and 3 would be implemented during the late fall/winter season to minimize disturbance to native species and minimize disturbance and safety risks to the public and tourists. Typically, in late fall/winter:

- Burrow nesting seabirds (*e.g.*, Wedge-tailed Shearwaters) are at their lowest annual numbers on island.
- The lowest annual numbers of ground nesting seabirds (such as boobies) are on eggs or have very young chicks.
- There are relatively few boat trips and tourist activities around the island, thereby minimizing disturbance and maximizing public safety to visitors and tourism operators alike.

Rats – Rat eradication is also a component of Alternatives 2 and 3. Typically the best time to eradicate rats from island ecosystems is when the rat population is either in decline or approaching a low point in its annual cycle. On Lehua Island, food abundance (vegetation, invertebrates), availability of water, and rat activity is high during the winter/rainy season (October – April). Food availability and rat abundance decreases as the dry season progresses. In addition, timing the eradication with the dry season would minimize the chances of rain storms washing rodenticide pellets into the ocean. Thus, the best time to eradicate rats from Lehua would be during the dry season (May-September) (Tamarin and Malecha 1971).

Native Plant Restoration – Native plant restoration is a component of Alternatives 2 and 3. After confirmation of successful rabbit and rat eradication, plant restoration activities would take place. Plant restoration cannot occur before successful eradication since there would be limited or no success due to herbivory by rats and/or rabbits.

Methods of Removal

Rabbits

The proposed methodology for rabbit removal uses techniques that have been employed elsewhere successfully. A fundamental requirement is that every rabbit on the island be eradicated. Leaving a single pregnant female or pair of rabbits could result in repopulation of the island and failure to eradicate. Successful rabbit removals from islands worldwide have included the use of hunting with firearms and trained dogs, and trapping.

Hunters would euthanize rabbits following the American Veterinary Medical Association Guidelines for Euthanasia (2001).

Rats

The proposed methodology for rat removal would include techniques that have been employed elsewhere successfully. A fundamental requirement for rat eradication is that every rat on the island be killed or removed. Leaving a single pregnant female or a male and

female rat could result in repopulation of the island and failure to eradicate, negating the financial and time investment into removal efforts. Rats have been removed successfully from over 240 islands worldwide (Island Conservation Database) with the use of rodenticides. In each case, rodenticide was delivered into every potential rat territory either with the use of bait stations laid out on a grid pattern, broadcast by hand or helicopter or a combination of the two. In each of the alternatives proposed, rat eradication would be achieved by distribution of rat bait containing a rodenticide into every potential rat territory on Lehua by broadcast (helicopter and hand placement) and/or bait stations.

Native Plant Restoration

Habitat and plant restoration, which are standard USFWS and DOFAW activities, would be carried out following rabbit and rat removal. It would be futile to restore native plants in alternatives that do not remove both rabbits and rats, as the program would have limited success due to rat and rabbit herbivory. A Lehua plant restoration would be written to guide the project. This plan would address appropriate sources of plants brought to Lehua, genetics issues, and the historic ranges of plants considered for re-introduction. In the case of any listed plants that might be re-introduced to Lehua, this would be carried out in accord with species recovery plans prepared by USFWS under the authority of the ESA and State law. The use of USFWS funds to carry out plant restoration is guided by the aforementioned legislation and species recovery plans and is implemented through a variety of programs, including the Coastal Program based in the USFWS Pacific Islands Office. The purpose of the Coastal Program is to work with a variety of project partners to conserve and restore Hawai`i's native species and habitats.

Protection of Species Listed Under the Endangered Species Act

Four species listed under the Federal Endangered Species Act (ESA) of 1973, as amended, are present on or near Lehua: Hawai`ian Monk Seal, Green Sea Turtle, Newell's Shearwater and Hawai`ian Petrel. Consultations under section 7 of the ESA have been completed and are presented in Appendix E. NOAA has concluded that "given the mitigation measures put in place under the Draft EA, we conclude that any effects of the proposed action on monk seals or sea turtles from the proposed restoration on Lehua Island would be discountable. NOAA Fisheries Service therefore concurs with [the] determination that the project may affect but is not likely to adversely affect ESA listed species under [NOAA's] jurisdiction".

The USFWS has concurred that "with the implementation of the [mitigation] measures, it is anticipated that this project may affect, but is not likely to adversely affect, listed species or designated critical habitat including primary constituent elements. In addition to provide measures to reduce short term effects, this project is expected to create long term benefits for listed species," including the Newell's Shearwater and Hawaiian Petrel. The USFWS has concurred that the project will have no negative effect on the Band-rumped Storm-petrel.

Non-native Species Prevention and Response Plans

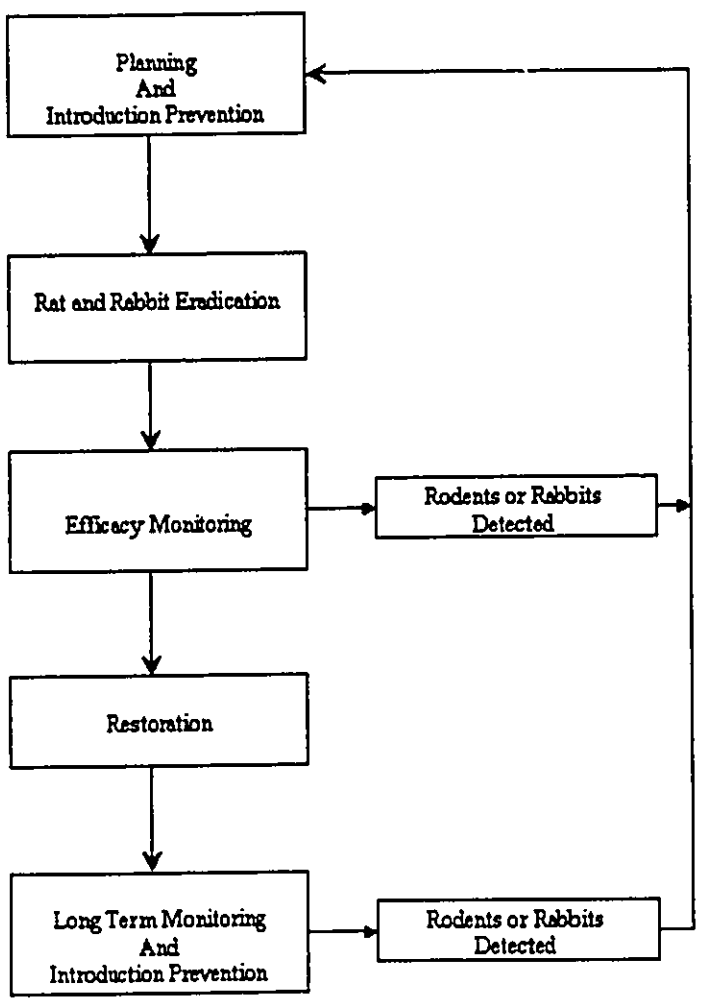
An integral component of the project is to prevent other non-native species (in particular rats and rabbits) from reaching the island during or after eradication, monitoring or research

activities. It would also be critical to be able to respond to any accidental introduction of new alien species, should the prevention measure fail.

Implementation of the project activities would follow the Offshore Islet Restoration Committee (OIRC) guidelines and recommendations to prevent the accidental introduction of non-native species onto offshore islands (see Lehua Island Alien Species Prevention Plan in Appendix D).

The ability to respond to an accidental introduction of any non-native species requires a rapid response to reduce the risk that a species becomes established on the island. In the event that a non-native species is detected on the island, the USFWS and DOFAW have the authority to respond appropriately to the introduction under Hawai`i Revised Statutes 195D-5, Hawai`i Revised Statutes 183D-4, Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j, not including 742 d-l; 70 Stat. 1119), as amended, Endangered Species Act of 1973 (16 U.S.C. 1531-1544; 87 Stat. 884), as amended, and Executive Order 13112 on Invasive Species (February 3, 1999). Figure 5 shows a conceptual flowchart for response actions.

Figure 5. Conceptual flowchart for the response to the detection of non-native rodents and rabbits that reach Lehua after the proposed project is completed.



Protection of Cultural Resources

Formal consultation with archaeologists in the State Historic Preservation Division (SHPD) of the Hawaii Department of Land and Natural Resources is required and will be completed prior to starting any of the proposed operations. Conditions set forth as a result of consultation will be incorporated into standard operating procedures and all project personnel will be required to comply with them. Informal discussions with SHPD archaeologists have been ongoing since the beginning of the project and they have made a field visit to Lehua. Archaeologists from the State Division of Parks have completed field surveys of Lehua and conducted data recovery from appropriate areas. All sites have been marked as requested by SHPD. All project personnel will be briefed on how to recognize and avoid historic sites. SHPD recommendations to date have all been incorporated into project mitigation measures and any additional requirements resulting from formal consultation will be incorporated as well.

Water Quality and Marine Ecosystem Protection

Project leaders will implement appropriate mitigation to prevent bait spread into the surrounding waters of Lehua Island. These include:

- Aerial application will be carried out by a pilot certified in aerial application of pesticides.
- The helicopter will be fitted with an onboard differential GPS and computer to monitor the application and effectively place the bait on the island.
- The bait-dispensing hopper will be fitted with a deflector that spreads bait to only one side of the helicopter, allowing precise bait spread in sensitive areas while avoiding the ocean.
- A 'no aerial drop' zone will be established beginning offshore and extending slightly into the island interior, to ensure bait would not be broadcast into the ocean.
- Bait pellets will be broadcast by hand in certain shoreline areas to avoid broadcast into the ocean.
- Dry season application will reduce the chances that rain would wash rodenticide into the ocean and application would not occur if rain was forecast within the next 48 hours.
- Bait application will not occur during high wind conditions.

Validation and Effectiveness Monitoring

To ensure that the chosen alternative is meeting the goal of restoration and the environmental impacts are below the criteria for significance, a validation and effectiveness monitoring program will be developed and implemented. Effectiveness monitoring will be done to ensure that the alternative is meeting the stated goal of restoration. Validation monitoring will be conducted to ensure that any potentially negative environmental effects of implementing the alternative are avoided or minimized.

Evaluation of monitoring results will determine whether further restoration activities are needed and/or alter mitigation strategy and/or continue with proposed management action.

Monitoring results that lead to a major modification of the proposed project could require a supplemental environmental analysis. The supplemental analysis and subsequent decision might need to be prepared prior to resumption of eradication activities. A supplemental assessment is necessary when substantial new information is discovered, and/or when a change of activities results in substantial change in environmental effects that were not previously analyzed in the Draft EA.

Alternatives Considered for Inclusion in the Draft EA but Rejected

During the scoping process, a number of alternatives were identified in addition to those considered for implementation. These alternatives were considered but rejected because they were not feasible to implement or they could not meet the project purpose and need.

Live Trap and Translocate Rabbits

The live trapping and translocation of rabbits was also deemed not feasible to implement. The rabbits on Lehua are feral and all animals would not readily enter traps. Use of live traps would result in the selection for animals that are less and less likely to enter traps (trap shy) and would require increasingly greater efforts to trap. In addition, it would be difficult and dangerous to place traps in areas that are inaccessible to field crews, due to steep and unstable cliffs and slopes. Because of the remoteness of Lehua, 19 miles offshore from Kaua`i, live trapped rabbits would be held for long periods between trapping on island, transportation to Kaua`i and arrival at a subsequent release site. Many of the rabbits in cages could succumb to the stress of transportation and holding. Additionally, the rabbit is a non-native mammal in Hawai`i, so the capture of an invasive mammal at one site in Hawai`i and subsequent release at another site in Hawai`i would defeat the purpose of restoring Hawai`i's native ecosystems. In fact, Hawai`i Revised Statute Chapter 197-3 prohibits the deliberate transport and release of wildlife harmful to the indigenous species of Hawai`i, and thus, translocation and release would be illegal.

Use Only Bait Stations to Eradicate Rats

The steep, rugged, and unstable slopes and cliffs of Lehua preclude the exclusive use of bait stations for rat eradication. To successfully eradicate rats from the island requires the placement of rodenticide into every potential rat territory or foraging area. Successful eradication would require the placement of stations at 164 ft intervals or closer. The topography of the island precludes the safe placement, and regular servicing of bait stations over a period of two years. Bait station placement and maintenance, including bait replacement, would be too dangerous for field personnel.

Poison Rabbits

Although rabbit toxicants have been used elsewhere in the world, no bait for controlling rabbits is registered with the US EPA for use in non-agricultural areas. Therefore, the use of a toxicant was not deemed feasible because the proposed project activities would not be able to comply with FIFRA.

Eradicate Rats but not Rabbits

A management program that eradicated rats but not rabbits was considered and rejected because the persistence of rabbits would continue to damage the plant community, secondarily impacting seabirds, insects and marine water quality. Allowing continued

damage to occur to these essential components of the ecosystem would not meet the stated purpose and need for action.

Introduce Disease to Control Rabbits

The introduction of rabbit-specific diseases in other countries not been proven to eradicate 100% of a rabbit population, a requirement for achieving the project goal of restoration. Also, the use of biocontrol agents would require an extensive agency review and permitting process. Thus, the use of disease was not deemed feasible.

CHAPTER 4 – ENVIRONMENTAL CONSEQUENCES AND MITIGATION

Introduction

This chapter analyzes the environmental consequences of implementing each alternative described in Chapter 3. The environmental consequences, or environmental effects, will be categorized into three broad areas: direct, indirect, and cumulative. These "effect" categories will form the basis of the effects analysis in this chapter. Direct and indirect effects will be discussed in sections 4.1 through 4.3, and cumulative impacts will be summarized in Section 4.4.

Direct effects, as defined by the Council on Environmental Quality, are those that are caused by the action and occur at the same time and place. Indirect effects are those which are caused by the action and are later in time or farther removed in distance. Cumulative effects are those that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collective actions taking place over a period of time.

A summary of the potential environmental consequences by alternative can be found in Table 2. A summary of mitigation actions that could be implemented for each alternative can be found in Table 3.

Table 2. Potential Environmental Risks of Alternatives 1 - 3

	Does not meet purpose and need of ecosystem restoration	Effectively meets purpose and need of ecosystem restoration; diphacinone requires two applications and brodifacoum only one; a successful eradication with the use of diphacinone alone (the less toxic of the two rodenticides) would demonstrate its value as a relatively safe conservation tool in Hawai'i	Effectively meets purpose and need of ecosystem restoration; compared to diphacinone, brodifacoum is cheaper and easier to apply (only a single application is needed) and has a more extensive history for use in island rat eradication, but it is more toxic than diphacinone and poses a greater risk to non-target species
	Continue to be impacted by rats and rabbits	Limited disturbance from hunters, dogs and the helicopter; low risk of direct or indirect, non-lethal exposure of alien species to rodenticide; net positive effect	Limited disturbance from hunters, dogs and the helicopter; low risk of direct or indirect exposure to brodifacoum but risk of mortality to exposed birds is high; net positive effect
	Continue to be impacted by rats and rabbits	Limited disturbance from hunters, dogs and the helicopter; unlikely direct or indirect exposure to rodenticide; net positive effect	Limited disturbance from hunters, dogs and the helicopter; unlikely direct or indirect exposure to brodifacoum; net positive effect
	No net change	Limited disturbance from hunters, dogs and the helicopter; possible indirect exposure to rodenticide through scavenging of poisoned rats and granivorous/insectivorous birds exposed; unlikely mortality.	Limited disturbance from hunters, dogs and the helicopter; possible indirect exposure to brodifacoum through scavenging of poisoned rats; possible exposure to brodifacoum from exposed granivourous/insectivorous landbirds; possible mortality

		Continue to be impacted by rats and rabbits	Limited disturbance from hunters and dogs; possible direct or indirect exposure to rodenticide; net positive effect from reduced predation	Limited disturbance from hunters and dogs; possible direct or indirect exposure to brodifacoum and mortality; net positive effect from reduced predation
		Continue to be impacted by rats and rabbits	Net positive effect	Net positive effect
		Continue to be impacted by rats and rabbits	Loss of a few individual plants due to trampling; net positive effect	Loss of a few individual plants due to trampling; net positive effect
		Continue to be impacted by rats and rabbits	Limited disturbance from hunters, dogs and the helicopter; net positive effect from reduced sedimentation	Limited disturbance from hunters, dogs and the helicopter; net positive effect from reduced sedimentation
		Continue to be impacted by rats and rabbits	Low risk of exposure to low concentration of rodenticide; net positive effect from reduced sedimentation	Low risk of exposure to low concentration of brodifacoum; net positive effect from reduced sedimentation
		Plant community continues to be impacted by rat and rabbit herbivory	Reduction of herbivory by rats and rabbits may lead to increase in non-native weeds; effects will be monitored	Reduction of herbivory by rats and rabbits may lead to increase in non-native weeds; effects will be monitored
		Continue to be threatened by rats and rabbits	Low risk of site disturbance from human activity; net benefit from stabilizing soils around sites	Low risk of site disturbance from human activity; net benefit from stabilizing soils around sites
		Not Applicable	Low risks of primary exposure to bait applicators and of secondary exposure to people eating intertidal invertebrates	Low risks of primary exposure to bait applicators and of secondary exposure to people eating intertidal invertebrates
		Not Applicable	Low risk that activity could lead to introduction of additional non-native species	Low risk that activity could lead to introduction of additional non-native species

Table 3. Mitigation Measures for Alternatives 1 - 3

[illegible]	[illegible]	Alternative 1 (No Action)	Alternative 2 (preferred): Rat Eradication with Deterrence, Predator Control, and Native Plant Restoration	Alternative 3: Rat Eradication, Predator Control, and Native Plant Restoration
[illegible]	Shorebirds	Not applicable	Rodenticide pellets will be dyed green	Rodenticide pellets will be dyed green
	Seabirds and Shorebirds	Not applicable	Limit timing of rabbit project to when nesting seabird numbers are at their lowest; set rabbit traps away from nesting birds; check rabbit traps daily; use hunting dogs trained to avoid birds; time bait broadcast to avoid shorebird season and juvenile albatross.	Limit timing of rabbit project to when nesting seabird numbers are at their lowest; set rabbit traps away from nesting birds; check rabbit traps daily; use hunting dogs trained to avoid birds; time bait broadcast to avoid shorebird season and juvenile albatross.
	Predator Prey	Not applicable	Broadcast bait in summer	Broadcast bait in summer
	[illegible] Seal	Not applicable	No mitigation necessary	No mitigation necessary
	Terrestrial Invertebrates	Not applicable	No mitigation necessary	*No mitigation necessary*
	Native Plants	Not applicable	No mitigation necessary	No mitigation necessary
	Monk Seal	Not applicable	Rabbit Eradication - 100 ft buffer between hunters/dogs and/or bait applicators and seals hauled out on shoreline; Hunting dogs will go through quarantine, vaccine, and treatment regimes such as deworming; dogs will be under voice control of hunters and will not roam freely; dogs will have been specially trained and experienced in working around island wildlife; dogs will be confined when not hunting and their feces will be kept out of intertidal area.. All personnel will be briefed on proper conduct on the island and in seal avoidance. Rat Eradication – The helicopter will be equipped with a deflector device to ensure the bait is spread only to one side when the helicopter is flying near the shoreline; the helicopter will fly inland from the shoreline when distributing bait pellets; small bait pellets will be used to reduce bounce into the ocean; hand bait applicators will maintain a 100 ft buffer from seals; the helicopter will avoid flying over hauled out seals and no bait will be spread on or around seals; bait will be applied during the summer dry season to avoid being washed into the ocean; bait will be broadcast when no rain is in the forecast for at least 48 hours. Bait will not be applied in high wind conditions. Further monitor marine tissues for toxicants; use certified pesticide applicators and follow label directions	Rabbit Eradication - 100 ft buffer between hunters/dogs and/or bait applicators and seals hauled out on shoreline; Hunting dogs will go through quarantine, vaccine, and treatment regimes such as deworming; dogs will be under voice control of hunters and will not roam freely; dogs will have been specially trained and experienced in working around island wildlife; dogs will be confined when not hunting and their feces will be kept out of intertidal areas. All personnel will be briefed on proper conduct on the island and in seal avoidance. Rat Eradication – The helicopter will be equipped with a deflector device to ensure the bait is spread only to one side when the helicopter is flying near the shoreline; the helicopter will fly inland from the shoreline when distributing bait pellets; small bait pellets will be used to reduce bounce into the ocean; hand bait applicators will maintain a 100 ft buffer from seals; the helicopter will avoid flying over hauled out seals and no bait will be spread on or around seals; bait will be applied during the summer dry season to avoid being washed into the ocean; bait will be broadcast when no rain is in the forecast for at least 48 hours. Bait will not be applied in high wind conditions. Further monitor marine tissues for toxicants; use certified pesticide applicators and follow label directions

[redacted]	Not applicable	Use small bait pellets to reduce bounce into the ocean; dry season application to reduce threat of rain washing pellets into ocean; broadcast bait only when no rain is forecast for at least 48 hours; no bait application in high wind conditions; use bucket deflector fitted on hopper to prevent spread of bait in ocean; establish coastal no-fly buffer for bait application; hand application in some shoreline areas; use certified pesticide applicators and follow label directions	Use small bait pellets to reduce bounce into the ocean; dry season application to reduce threat of rain washing pellets into ocean; broadcast bait only when no rain is forecast for at least 48 hours; no bait application in high wind conditions; use bucket deflector fitted on hopper to prevent spread of bait in ocean; establish coastal no-fly buffer for bait application; hand application in some shoreline areas; use certified pesticide applicators and follow label directions
[redacted]	Not applicable	Monitor plant communities before, during, and after eradication efforts; implement a weed management program, if needed	Monitor plant communities before, during, and after eradication efforts; implement a weed management program, if needed
[redacted]	Not applicable	Complete archaeological survey and do data recovery; tag all sites; educate project staff on location, appearance, and fragile nature of archeological sites and artifacts, and how to avoid impacts. Prohibit disturbance of sites.	Complete archaeological survey and do data recovery; tag all sites; educate project staff on location, appearance, and fragile nature of archeological sites and artifacts, and how to avoid impacts. Prohibit disturbance of sites.
[redacted]	Not applicable	Use professional hunters trained in safe handling and discharge of firearms; conduct hunting in winter; use small bait pellets to reduce bounce into the ocean; dry season application to reduce threat of rain washing pellets into ocean; use bucket deflector fitted on hopper to prevent spread of bait in ocean; establish coastal no-fly buffer for bait application; hand application in some shoreline areas; monitor marine tissues for toxicants; use certified pesticide applicators and follow label directions	Use professional hunters trained in safe handling and discharge of firearms; conduct hunting in winter; use small bait pellets to reduce bounce into the ocean; dry season application to reduce threat of rain washing pellets into ocean; use bucket deflector fitted on hopper to prevent spread of bait in ocean; establish coastal no-fly buffer for bait application; hand application in some shoreline areas; monitor marine tissues for toxicants; use certified pesticide applicators and follow label directions
[redacted]	Not applicable	Comply with OIRC recommendation for preventing non-native species introductions; implement non-native vertebrate re-introduction response plan	Comply with OIRC recommendation for preventing non-native species introductions; implement non-native vertebrate re-introduction response plan

4.1 Alternative 1 – No Action Alternative

4.1.1 Restoration Efficacy

Under the no action alternative, rats and rabbits would have been allowed to persist on Lehua Island, subject to the natural processes of the island ecosystem. Native plant restoration would not be implemented. There would be no use of rodenticides to control rats, and no hunting or trapping of rabbits on Lehua. With no action on the island, the rat and rabbit populations would not be controlled, and population sizes would fluctuate within an annual cycle – population levels increasing during the rainy season, and declining during the dry season. Also, with no action, plant communities would continue to be dominated by rat and rabbit herbivory, and would not be representative of a healthy native plant community. Adoption of the no-action alternative would not meet the objective of restoring the Lehua Island ecosystem.

Rabbits herbivory would continue to damage the vegetation communities on the island. Native vegetation in general would continue to be negatively impacted, and the seabirds and invertebrates that depend on vegetation would still suffer from poor-quality habitat that would limit populations of native animals on Lehua. Furthermore, the risk of erosion due to a lack of vegetation would continue to pose a risk to the nearshore marine ecosystem, including coral, which is a critical resource for the marine life surrounding the island. This potential harm to the nearshore environment would extend throughout the trophic levels of Lehua's marine ecosystem, potentially reducing habitat quality for the federally listed endangered Hawai`ian Monk Seal, sea turtles, fishes, and marine invertebrates.

Introduced rats would continue to prey on nesting seabirds on the island, preventing them from reaching their full population potentials. Rats would also still pose a threat to certain plant species that are sensitive to herbivory, and are likely important seed predators limiting the regeneration of plant communities on Lehua.

4.1.2 Non-Target Species Impacts

There would be no effects to non-target species under this action.

4.1.3 Increase in Weed Abundance

Weed distribution would be dictated by herbivory pressure from rabbits and rats on island.

4.1.4 Impacts on Cultural Resources

Rats and rabbits would continue to constitute a threat to any subterranean archaeological resources, both discovered and undiscovered, due to the de-stabilization of soils caused by their herbivory.

4.1.5 Impacts on Human Health and Safety

Alternative 1 would contain no specific actions that would impact human health and safety. The public waters around the island would continue to be at risk from soil erosion due to lack of vegetation cover onshore. This erosion is unlikely to affect the health of divers and snorkelers that visit the island, but would continue to threaten the health of the marine ecosystem that makes Lehua's waters a valuable ecotourism destination.

4.1.6 Non-native Species Introduction

Each visit to the island presents a risk of introducing non-native species. With no-action, there would be no risk of introducing non-native species because of project activities. However, there would be ongoing monitoring on the island that would require visits to the island and presenting a risk of introduction. Individuals that come to the island are typically either USFWS or DOFAW sponsored scientists who voluntarily comply with the OIRC guidelines for preventing introductions.

4.2 Alternative 2 (Preferred Alternative Selected for Implementation) - Rat Eradication with Diphacinone, followed by Brodifacoum if Necessary; Rabbit Eradication; and Native Plant Restoration

This is the proposed action that has been selected to implement the Lehua Island Ecosystem Restoration Project. Diphacinone is the preferred rodenticide for use in Hawai`i because it is less toxic to non-target birds than other rodenticides, and its successful use on Lehua could help demonstrate its potential uses for restoration of rodent-impacted ecosystems in other areas of Hawai`i. Under this alternative, both rabbits and rats would be eradicated from Lehua Island and a native plant restoration program would be implemented following their removal. Rabbits would be removed using a combination of hunting and trapping. Rats would be removed through the use of bait containing diphacinone, an anticoagulant rodenticide, placed into every rat's territory with the use of a helicopter equipped with a bait hopper to aerially broadcast pellets supplemented with the use of bait stations, and hand placement of bait. Brodifacoum, a stronger, single-feeding rodenticide, could be used if diphacinone did not achieve eradication. Native plants would be restored following State of Hawai`i and USFWS guidelines.

4.2.1 Restoration Efficacy

4.2.1.1 Rabbit Eradication

Under this alternative, the removal of rabbits and rats and subsequent native plant restoration would meet the objective to remove the last non-native mammals and improve the quality of native plant communities, leading to the goal of restoring the Lehua Island ecosystem.

The use of hunting and trapping techniques has been successful in removing rabbits from island ecosystems (Donlan *et al.* 2002). Applying the techniques of hunting and trapping in a systematic and persistent fashion would lead to the successful removal of rabbits from the Lehua ecosystem.

4.2.1.2 Rat Eradication

The eradication of rats using rodenticides has been successfully carried out on over 240 islands worldwide (IC unpub. data). For islands that share similar topography or are of comparable size to Lehua, rats have been eradicated by the placement of bait containing a rodenticide into every potential rat territory with the use of a helicopter aerially broadcasting pellets, and in some cases, supplemented by the placement of bait by hand and bait stations.

Diphacinone, the primary rodenticide proposed in this alternative, is the rodenticide of choice for controlling introduced rodents for conservation purposes throughout the State of Hawai`i (Swift 1998). Diphacinone is an anticoagulant rodenticide that causes death by internal bleeding. One advantage of the anticoagulant rodenticides is that rats die several days after eating the bait, which decreases the possibility that rats would associate anticoagulant symptoms with the bait and would continue to feed. Thus, bait shyness

(deliberate avoidance of the bait due to the toxic rodenticide) does not occur, and rats can be successfully eradicated.

A number of laboratory and field studies have evaluated the efficacy of broadcast baiting with diphacinone for rodent control for conservation purposes in Hawai`i. A laboratory trial found that 100% of 20, wild caught Hawai`ian *R. exulans* that were fed bait containing 50 ppm diphacinone, died after consuming an average of 25 grams of bait (about 10 bait pellets) per animal over 8 days (Swift 1998). A hand broadcast trial using Ramik Green containing 50 ppm diphacinone resulted in a 100% kill of Polynesian Rats, Black Rats and Norway Rats in two, 4 hectare study areas (Lindsey and Forbes 2000). Follow up hand broadcast trials in the same study areas were also highly effective in knocking down the rat population (Spurr *et al.* 2003). Early studies indicated that the broadcast baiting of Ramik Green containing 50 ppm diphacinone would have a high efficacy rate on wild rats in Hawai`ian forests. A subsequent trial of Ramik Green, containing 50 ppm diphacinone broadcast into a 45.5 hectare forested area in Hawai`i killed 100% of the 21 radio-collared rats, within one week of bait application (Spurr *et al.* 2003). Within three weeks of bait application, there was a 99% drop in rat live trap success and teeth marks on chew blocks (used to measure rodent abundance), relative to the non-treatment area.

In addition, two island eradications used diphacinone placed in bait stations to eradicate rats (Island Conservation Database). For one of these, diphacinone blocks (50 ppm) were used successfully on one of the islets of Isla San Jorge, Mexico (Donlan *et al.* 2002). These successful eradications with diphacinone, and the efficacy of the laboratory and Hawai`ian field broadcast trials, strongly suggest that the broadcast of 50 ppm diphacinone would have a high likelihood of eradicating rats on Lehua Island. However, an aerial broadcast of diphacinone has never been used to achieve an island rodent eradication. If this strategy were effective on Lehua, it would be the first time and would demonstrate the efficacy of this technique, lessening reliance on more toxic baits, such as brodifacoum, which have a longer track record of successful use on islands.

If aerial broadcast of diphacinone on Lehua failed to eradicate rats, Alternative 2 proposes to conduct a single, follow-up aerial and hand broadcast of bait pellets containing 25 ppm of brodifacoum.

4.2.1.3 Native Plant Restoration

Habitat and plant restoration, which are standard USFWS activities, would be carried out following rabbit and rat removal. The use of USFWS funds to carry out plant restoration is implemented through a variety of programs, including the Coastal

Program based in the USFWS Pacific Islands Office. The purpose of the Coastal Program is to work with a variety of project partners to conserve and restore native species and habitats in Hawai`i and other Pacific Islands.

4.2.2 Non-Target Species Impacts

4.2.2.1 Rabbit Eradication

Terrestrial Species

Seabirds and Shorebirds – The island of Lehua supports a diverse array of seabirds and some shorebird species (Wood *et al.* 2004). The primary direct impact from the rabbit eradication activity would be disturbance of nesting seabirds by individual hunters and dogs walking around on the island. In some cases, the seabirds would tolerate some presence of human and dog activity as long as the disturbance is temporary, and in other cases birds would temporarily leave the roost site or nesting territory. The disturbance would be temporary and fleeting, giving the opportunity for the birds to return to their roost or nesting territory after the hunters have passed. For the few individual seabirds that are flushed from roost sites, there is ample alternative habitat throughout the island of Lehua that would not have hunting activity at any given point in time. The disturbance from the use of firearms would be temporary, of short duration, and would decline over time. Trapping would have negligible direct or indirect impact on seabirds since the traps would be set in areas away from nesting or roosting birds, but may incidentally live capture individuals of the larger seabirds, such as Brown Boobies. Traps would be checked daily and any trapped birds released. The traps would be set such that the smaller seabirds would be unable to set off traps because of their smaller body weight relative to rabbits. The potential exists for the incidental mortality of adult seabirds in the process of emerging from their burrows from dogs mistaking their behavior for that of rabbits. The primary reason for adult seabirds on Lehua leaving their burrows during hunting activities would be if they were flushed by rabbits entering the burrow. The displacement of seabirds by rabbits has been identified as one of the significant negative impacts to seabirds from rabbits on islands.

The impact to shorebirds is expected to be negligible because the birds are not nesting and prefer to forage in areas of the shoreline that are typically inaccessible to hunters and dogs. Thus, the potential for disturbance to individual birds is limited to areas of the shoreline that are accessible by foot, in particular on the south side of the island, near the landing points for island access. Any birds in this area would have the option of temporarily moving to alternative habitat on the island, or the adjacent island of Niʻihau.

Mitigation – The incidental disturbance and potential mortality of individual birds would be limited in space and time well below the level of significance for any population of the species of seabirds or shorebirds that would be found on the island during the proposed eradication activities. To further minimize or avoid the potential impact of the hunting activities on the seabirds and shorebirds, project implementation would be limited to the winter, when the lowest numbers of seabirds are present on the island. Burrowing Wedge-tailed Shearwaters, which make up the majority of Lehua's seabird population, would be gone during this time. Hunting dogs would be trained to avoid nesting seabirds and focus on rabbits. Traps would be set in locations away from nesting birds, and the traps would be checked at least daily. Trapped birds would be released.

Because two seabird species on Lehua are listed under the Endangered Species Act (Newell's Shearwater and Hawaiʻi Petrel) an internal consultation under section 7 of the Endangered

Species Act would have to be completed with USFWS before any project activities could occur. USFWS is the Federal agency responsible for protection of threatened and endangered seabirds. Internal USFWS concurrence would be required before the project could move forward. Any additional mitigation requirements arising out of this consultation would be incorporated into the proposed project.

Landbirds and Predatory Birds – The island of Lehua supports few individual landbirds, none of which are native to Hawai`i (Wood *et al.* 2004). Species present include Zebra and Rock Doves, House Finches and Nutmeg Mannikens. Predatory birds on the island include Barn Owls and Cattle Egrets. The direct impact from the rabbit eradication would be disturbance from hunters and hunting dogs hiking on the island. However, the disturbance would be restricted to a very small area at any given time, with the opportunity for the birds to move to alternative habitat on the island, or to the much larger island of Ni`ihau, approximately 1 km across the channel, which is overall better habitat for landbirds. Trained hunting dogs to be used on Lehua would be trained to target rabbits only and would pose negligible disturbance or predation risk to landbirds. It is anticipated that 2-3 hunters would use firearms to hunt rabbits at any given time, and would have a temporary, localized disturbance impact. Initially, the number of firearm shots may be frequent, but would decline rapidly within the first few weeks of the eradication. As the eradication activity progresses, the number of firearm shots would be infrequent to near zero as the eradication is completed. The traps are designed to capture rabbits, and would not inadvertently capture landbirds. In summary, the consequence of implementing rabbit hunting activity would be limited to temporary disturbance and would not have lasting effects on individuals or bird populations. No mitigation would be needed.

The indirect impact of removing rabbits and rats from Lehua would likely be a net positive effect on landbird populations. The renewed vegetation growth that would occur in the absence of rabbits and rats would improve quality of habitat for landbirds, including more nesting habitat, more food resources for herbivorous birds, and a greater abundance of invertebrates to support insectivorous birds.

Terrestrial Invertebrates – Terrestrial invertebrates would not be negatively affected by the rabbit eradication activities. The hunters and dogs would not have a significant impact on this group of animals. No mitigation would be needed.

The indirect impact of removing rabbits would be a net benefit to terrestrial invertebrates, caused by increasing the abundance and variety of vegetation which serves as food and habitat.

Plants – Lehua has extensive slopes of rock and bare soil interspersed with pockets of both native and non-native plants, mainly plants that are not preferred for feeding by rabbits. The relatively sparse vegetation on the island is likely due to severe herbivory by rabbits. Hunting and trapping activities would result in the trampling of some individual plants on Lehua Island, as the rabbits appear to rest and forage in these vegetated areas. The incidental mortality of non-native plants is of no consequence and supports the ongoing weed control efforts. The native plants on Lehua belong to common species and the loss of a few individuals would be insignificant. No mitigation would be needed.

The indirect impact would be a net benefit to plants on Lehua because removing rabbits will reduce herbivory and increase the abundance and variety of vegetation.

Marine Species

*Hawai`ian Monk Seals* – Lehua Island is a haul out for adult Hawai`ian Monk Seals. The potential direct consequence of rabbit eradication activities on the Monk Seal is disturbance from people and dogs walking and hunting rabbits, and without any mitigation, there is the potential for inter-specific transmission of disease from dogs to seals. Canine distemper has been documented in a population of seals in Europe, possibly caused by direct contact between dogs and seals. (Grachev *et al.* 1989).

The numbers of Monk Seals that may be hauled out on the intertidal rocky shelves of Lehua during the proposed implementation window is not expected to exceed two to three at any given point in time, due to the few points that they could haul out onto the island (Wood *et al.* 2004). The adjacent island of Ni`ihau, approximately 1 km across the channel from Lehua, has more extensive, sandy beaches for seals. The rocky shelves on which seals have been observed on Lehua are mainly located in areas around the island that are only accessible from the ocean, so no dogs or hunters would have overland access to the seals. In addition, the hunters and dogs would be separated from seals because rabbits are not found in the intertidal zone and hunting would occur on the island interior, not in the intertidal zone. The only area that the dogs and hunters may encounter seals is traveling to or from the boat landing points, on the south side of the island.

Mitigation – Several mitigation measures would be implemented to ensure no disturbance to resting seals. Avoiding seals would be the primary strategy and hunters would maintain a 100 ft buffer from any seal hauled out on the rocks.

The dogs that would be used to hunt rabbits on Lehua would be trained to focus on hunting rabbits and to avoid both seabirds and seals. The dogs would be under the voice control of the handler at all times and will not be allowed to go near seals. During resting periods, the dogs would be tied up to prevent roaming on the island. Further, the dogs used would have extensive training and experience working in sensitive wildlife areas, including on islands with marine mammal haul outs. This would ensure that there would be no harassment of seals hauled out on the island.

Even though the dogs would not likely come in direct contact with seals, to further reduce the risk and prevent the inadvertent disease and parasite transmission to seals from dogs, the dogs would undergo extensive quarantine, vaccine and treatment regimes. Any dogs that are brought in from the mainland would need to be in compliance with the State of Hawai`i Animal Quarantine Laws to prevent the spread of rabies into Hawai`i. In addition, the dogs would be vaccinated against Canine Distemper Virus (CDV), and treated appropriately for any potential internal or external parasites (including deworming and dusting with a powdered insecticide). All treatment would be undertaken under the supervision of a veterinarian. In addition to the extensive treatment program, the dogs would not be allowed regular access onto the rocky shelves around the camp location. Any dog feces in this location, or at risk from reaching the intertidal zone, would be removed immediately.

Before any of the proposed actions could occur, a consultation under section 7 of the Endangered Species Act would be completed with NOAA Fisheries, the Federal agency responsible for protection of Monk Seals. Concurrence by NOAA would be required before the project could move forward. Any additional mitigation requirements arising out of this consultation would be incorporated into the proposed project.

Intertidal Invertebrates, Fishes, Marine Algae and Sea Turtles – Rabbit eradication activities would have no direct impact on intertidal invertebrates, fish, marine algae and sea turtles. There would be little access into the intertidal zone by hunters and dogs alike, limited only to landing and leaving the island a few times during the eradication period at one or two points on the island. No mitigation would be needed.

The indirect impact of rabbit removal would be a net positive benefit to the nearshore marine community in the long term. The removal of rabbits would increase plant productivity, leading to larger seabird populations and reduced erosion processes. Erosion of sediments into the ocean would be reduced, improving water quality. The larger seabird populations would positively affect the productivity of the nearshore marine ecosystem through fertilization (Anderson and Polis 1998; Polis and Hurd 1996), which would have a net positive benefit to intertidal invertebrates, fish and sea turtles from increased productivity.

4.2.2.2 Rat Eradication

The successful removal of introduced rats from island ecosystems is achievable with a short term use of rodenticides dispersed into every potential rat territory on the island. On completion of the eradication, there would be no need for further application of bait into the ecosystem because the island is isolated and rats would not be able to repopulate the island on their own, unless intentionally or accidentally reintroduced by human activity.

The proposal to use a pesticide to eradicate rats from Lehua requires an evaluation of the potential exposure and consequence of that exposure to individual animals that may use Lehua or the waters that surround Lehua.

The relative risk of poisoning of non-target animals on Lehua is determined by a number of variables including the toxicity of the rodenticide and an individual's exposure to the rodenticide. Exposure is determined by the availability of the rodenticide in both space and time. Primary poisoning can occur when species feed directly on the bait. Secondary poisoning can occur when animals feed on primarily poisoned organisms that have rodenticide residues in their tissue. For the purpose of this analysis, the risks of primary and secondary exposure to the rodenticides will be investigated as per Record and Marsh (1988), and will consider:

- Toxicological properties of the rodenticide
- Bait composition and delivery into the ecosystem
- Non-target species behavior, seasonal presence and foraging strategy

- Target species behavior and location of death
- Local environmental factors

Potential Impacts of Diphacinone and Mitigation
Terrestrial Species

Seabirds – Seabirds are considered to be at low to no risk of primary exposure to the baits they might encounter on land because they feed at sea, are predatory and prefer live fish, and would not likely be attracted to compressed grain bait pellets. Basic mitigations (listed below) would be implemented to prevent bait pellets from being spread into the ocean and would therefore limit the potential for exposure to seabirds. Seabirds would not be attracted to bait pellets that may fall into the ocean for a number of reasons. Any errant pellets would fall close to the island, far from the typical pelagic foraging areas of most seabirds. Furthermore, the bait pellets do not float and would fall through the water column quickly, degrade rapidly after absorbing moisture, and break up due to the strong wave action and currents. In addition, the timing of the baiting is scheduled to be when the numbers of seabirds on and around the island are relatively low. In a similar rat eradication on Anacapa Island, California, seabirds were never observed to eat bait pellets that fell on the island during aerial application of bait pellets (G. Howald *pers. comm.*).

Nearshore fish-feeding seabirds would not be exposed indirectly (secondarily) because of mitigation to prevent pellets being spread into the ocean and because the fish around Lehua would not likely consume any bait pellets that incidentally fall into the ocean (see data in Table 4).

It is possible but unlikely that a few juvenile Black-footed and Laysan Albatross could still be on island during the proposed summer bait application period on Lehua Island. Albatross chicks are known to be very curious and will 'play' with rocks, sticks and other objects they find on the ground (Finkelstein *et al.* 2003; R. Henry *pers. comm.).* They could potentially pick up individual bait pellets that may be broadcast onto the island. Although this activity is presumed to be due to sheer curiosity and not a feeding attempt, it is possible that chicks may inadvertently swallow individual bait pellets. There would likely be no significant risk to the young birds due to the low density of pellets available for them to find and the low toxicity of diphacinone to birds. In addition, albatross chicks routinely regurgitate indigestible material fed to them by their parents, such as squid beaks and plastics. This behavior further decreases their chance of exposure to diphacinone.

The indirect impact of removing rats would be a significant net benefit to seabirds due to decreased rat predation on eggs and juvenile birds. These benefits were discussed in detail earlier in this document.

Mitigation – To avoid impacts to juvenile albatross, rat eradication will be conducted in the summer. Observations by Wood et al. (2004) and VenderWerf (in prep.) indicate that virtually all juvenile albatross have left by the end of June.

To avoid broadcasting bait pellets into the ocean and preclude their availability to seabirds, the helicopter would not distribute bait during high wind periods. Bait would be distributed in the dry summer season and would not be distributed when rain was forecast within the next 48 hours, to avoid rain washing pellets into the ocean before rats had a chance to consume them. In addition, the bait hopper used to aerially distribute pellets would be fitted with a deflector device that would cast the bait to only one side, thus allowing the pilot to fly near shorelines while distributing pellets only to the land side and away from the ocean. In order to minimize bouncing of pellets off of steep areas, small bait pellets (about 2.5 grams) would be used to minimize bounce and maximize the chance of pellets getting caught in vegetation and small cracks, and on irregularities in the rock. Pilots would also be instructed to fly inland from the shoreline while distributing bait, creating a buffer zone around intertidal and marine areas. Any areas above the tide line that the helicopter could not bait would be baited by crews on shore or in boats distributing bait by hand or in bait boxes.

Because two seabird species on Lehua are listed under the Endangered Species Act (Newell's Shearwater and Hawai`i Petrel) an internal consultation under section 7 of the Endangered Species Act has been completed with USFWS. USFWS is the Federal agency responsible for protection of threatened and endangered seabirds. USFWS has concurred that no adverse effect to these species are likely to occur.

Shorebirds – Shorebirds documented on Lehua include Pacific Golden Plover, Ruddy Turnstone, and Wandering Tattler, which are common winter visitors throughout the Hawai`ian Islands. During the proposed bait application period in the summer season, most if not all of these birds would be on their nesting territories on the mainland and would not be on Lehua. Thus, they would not be exposed to the rodenticide.

The indirect impact of removing rats would be a net benefit to shorebirds since rats may potentially prey on small shorebirds and also may compete with them for food sources, such as intertidal invertebrates.

Mitigation – Rat eradication would be conducted in the summer.

Landbirds – Landbirds are defined here as the small, non-native passerines observed infrequently on Lehua by Wood *et al.* (2004), including Rock and Zebra Doves, House Finches and Nutmeg Mannikens. Birds introduced to the United States from foreign countries, including Rock Doves, Zebra Doves, and Nutmeg Mannikens, are exempted from protection under the Migratory Bird Treaty Act. House Finches are subject to ongoing control programs in Hawai`i and would not be present on the island at the time rodenticides were applied, thus precluding any potential for exposure to rodenticides.

The landbirds that would be present on Lehua at the time of rodenticide application are primarily seed eaters (Hawai`i Audubon Society 1993). The toxicity of diphacinone is unknown for these species, but diphacinone is classed as moderately to minimally toxic to birds (U.S. EPA). Following the EPA approach to risk assessment, a 25 gram songbird would have to consume 80-631 2.5 gram pellets for 50% chance of poisoning. This represents about 8-63 times its body weight. It would be impossible for individual birds to find enough pellets and consume them to be acutely poisoned. Thus, using diphacinone would not likely result in acute toxicity to birds that feed directly on the bait. To further

reduce the risk of exposure, the bait would be formulated into a bait pellet (approximately 2.5 g) large enough that it would be difficult for a small, seed-eating bird to consume. The pellet would also be dyed green, a color that birds are known to avoid (Day and Matthews 1999; H. Gellerman unpub. data), and the bait application rate would be calibrated to deliver the only the amount of bait needed to ensure that all rats would be exposed to the bait (Dunlevy *et al.* 2000).

The indirect impact of rat eradication would be a net positive benefit to land birds, due to decreased rat predation on birds and decreased competition between birds and rats for seeds and other food sources.

Mitigation – Bait pellets will be dyed green to make them unattractive to birds.

Predatory birds – Predatory birds on Lehua include non-native Barn Owls and Cattle Egrets, which may prey on or scavenge rats as part of their diet. However, both these species are subject to control programs in Hawai`i and are regularly removed from Lehua as part of this statewide effort. Any individuals of these species observed on Lehua immediately prior to or during rodenticide application would be removed by USDA Wildlife Services, thus precluding any potential for secondary exposure to rodenticides. Even if Barn Owls or Cattle Egrets remain, it is unlikely that these birds would be able to find and ingest enough poisoned rodents to accumulate lethal doses of diphacinone. Barn Owls, like other birds, are not very susceptible to diphacinone (Mendenhall and Pank 1980). Furthermore, most rodents die underground in their burrows (Spurr *et al.* 2003), and those that remain above ground do not appear to be of interest to avian predators (Lindsey and Mosher 1994). No mitigation for these species would be needed.

The Peregrine Falcon is a rare winter visitor to the Hawai`ian Islands (Pyle 2002). A single Peregrine was reported flying past Lehua but was never observed to land on the island (VanderWerf in prep.). Peregrine Falcons have never been reported in Hawai`i in the summer, when rat eradication would occur. Furthermore, Peregrines hunt live birds and would not likely scavenge or prey on dead or dying rats so there is no likely opportunity for exposure to rodenticide.

Mitigation – Rat eradication would be conducted in the summer when Peregrine Falcons are not present.

Rabbits – The proposed action includes rabbit eradication, which would be scheduled to be completed prior to rat baiting. Therefore, it is expected that there would be no rabbits left on the island. However, if rabbits are not completely removed prior to rat removal, there is a possibility that rabbits would be attracted to and eat bait pellets. Because diphacinone is a vertebrate toxicant, it is possible that if rabbits remained and if they could find enough diphacinone pellets, that they would die as a result. The toxicity of diphacinone to rabbits is reported as 555 oz/lb (Pelfrene *et al.* 1991), resulting in a 50% chance of lethal poisoning. A lethal does would be equivalent to about 280 pellets for an adult rabbit. It is unlikely that a rabbit could find and eat that many bait pellets. Only four of the 36 successful rabbit eradications worldwide (completed and underway) have used poisons exclusively and none of these have used diphacinone, due to its relatively low toxicity (Island Conservation analysis of known rabbit eradications).

Snake-eyed Skink – Only one species of terrestrial reptile, the non-native Snake-eyed Skink (*Cryptoblepharus poecilopleurus*), is documented from Lehua. It is believed to be a Polynesian introduction. This insectivorous skink may be exposed to the rodenticide by consuming insects that may have fed on the bait or rat carcasses. The exposure window would be limited in time and would have limited consequence for the population of skinks on the island even though individual animals may be susceptible to exposure to the rodenticide. There are no documented reptile mortalities caused by diphacinone. No mitigation would be needed.

It is expected that the indirect impact of the removal of rats on Lehua would be an increase in skink populations due to the release from rat predation pressure.

Terrestrial Invertebrates – The anticoagulant rodenticides, such as diphacinone, are not known to affect terrestrial invertebrates, likely because of their blood clotting mechanisms are different from those of mammals (Shirer 1992). Extensive field and lab trials have shown that beetles (Morgan *et al.* 1996; Eason and Spurr 1995; Stejskal *et al.* 1994; Tershy *et al.* 1992), cockroaches (Godfrey 1985), crickets (Morgan *et al.* 1996), land crabs (Pain *et al.* 2000; D. Veitch *pers. comm.*), snails, slugs, orthopterans, millipedes (Howald 1997), and ants (Godfrey 1985; Tershy *unpub. data*) are attracted to rodent baits and can survive on a diet of 20-50 ppm brodifacoum, a more toxic anticoagulant rodenticide than diphacinone. Johnston *et al.* (in prep) fed diphacinone bait to gastropods over a period of seven days with no apparent toxicity, confirming that the anticoagulants, including diphacinone, are not toxic to invertebrates. The terrestrial invertebrates would likely play a role in the removal of residual bait that is not consumed by rats, but would not be affected by the rodenticide. No mitigation would be needed.

The indirect impact of removing rats would be a net benefit to terrestrial invertebrates, due to the elimination of predation by rats.

Marine Species

Hawai`ian Monk Seal – Adult Monk Seals haul out on rock ledges at Lehua in low numbers (Wood *et al.* 2004). The diet of Monk Seals consists of reef fishes, eels, octopi and spiny lobsters which are distributed around coral structures and extensive offshore banks and steep slopes (Gilmartin 1983). Because of their dietary preference for fish, seals would not likely be attracted to the compressed grain bait pellets. Monk Seal dive data indicate that seals regularly feed in deeper waters and outer reefs of islands (Gilmartin 1983), thereby avoiding any potential secondary exposure to the rodenticide near Lehua. Further, nearshore fish at Lehua did not consume any placebo bait pellets during a study in 2004, indicating that any bait pellets that fell into the ocean would not be consumed by fish and not present a secondary exposure risk to Monk Seals (see Table 4). Assuming a worst case scenario, where seals would feed on the bait exclusively (a highly unlikely scenario), and assuming that they are as sensitive as rats to the toxicant, an adult seal would have to find and consume between 3,345 – 10,181 of the 2.5 gram pellets (about 18.5 – 56 pounds of bait) for a 50% chance of lethal poisoning.

However, mitigation measures are warranted because Monk Seals are listed as an endangered species and they are sensitive to human disturbance, including helicopters delivering

rodenticide. With the mitigation described below, the few monk seals that may be present on or around the island are at low risk of disturbance from helicopter and hand baiting activity along the shoreline.

Mitigation -- Mitigation would focus on minimizing human disturbance to the seals and on preventing bait pellets from being distributed near seals or in the ocean. All project personnel on the ground would maintain a 100 foot buffer from seals during any hand placement of bait or other project activities. During aerial bait distribution operations, helicopters would adjust course to avoid flying over seals, would not hover near seals, and would not distribute pellets over seals on the shore. Helicopter activity over any point on the island would be brief as the flight speed would be greater than 25 knots.

To avoid broadcasting bait pellets into the ocean, the helicopter would not distribute bait during high wind periods. Bait would be distributed in the dry summer season and would not be distributed when rain was forecast within the next 48 hours, to avoid rain washing pellets into the ocean before rats had a chance to consume them. In addition, the bait hopper used to aerially distribute pellets would be fitted with a deflector device that would cast the bait to only one side, thus allowing the pilot to fly near shorelines while distributing pellets only to the land side and away from the ocean. In order to minimize bouncing of pellets off of steep areas, small bait pellets (about 2.5 grams) would be used to minimize bounce and maximize the chance of pellets getting caught in vegetation and small cracks, and on irregularities in the rock. Pilots would also be instructed to fly inland from the shoreline while distributing bait, creating a buffer zone around intertidal and marine areas. Any areas above the tide line that the helicopter could not bait would be baited by crews on shore or in boats distributing bait by hand or in bait boxes.

A consultation under section 7 of the Endangered Species Act has been completed with NOAA Fisheries, the Federal agency responsible for protection of Monk Seals. NOAA concurred that with the mitigation measures listed in this document, that there would be no likely adverse effects to Monk Seals.

Green Sea Turtles -- The rocky, steep shorelines on Lehua are poor habitat for sea turtles. Sea turtles prefer sandy beaches for hauling out and resting, and they require sandy beaches for nesting. Sandy beaches are non-existent on Lehua. Therefore, it is very unlikely that activities on island will disturb any turtles. Boat traffic may cause temporary disturbance to turtles in the water, but turtles do not appear to be numerous in the waters directly around Lehua.

Should turtles be present around Lehua at the time of eradication, it is not likely that they would be exposed to the rodenticide because of the mitigations to prevent bait from being spread into the ocean. Turtles would not likely eat any of the bait pellets as over 99% of the diet of adult greens sea turtles is algae and seagrasses (Forbes 1994). The few bait pellets that could drift into the ocean would sink to the bottom, absorb moisture, and degrade rapidly. The incessant wave action and currents would expedite the breakdown and dispersion of the bait pellets, further reducing the risk of exposure of turtles to the rodenticide through direct consumption or through contamination of algae. Thus, it is highly unlikely that turtles would be exposed to bait associated with rat eradication activities.

Nonetheless, because Green Sea Turtles are listed as a threatened species under Federal law, every effort will be made to prevent bait pellets from getting into the ocean.

Mitigation – To avoid broadcasting bait pellets into the ocean, the helicopter would not distribute bait during high wind periods. Bait would be distributed in the dry summer season and would not be distributed when rain was forecast within the next 48 hours, to avoid rain washing pellets into the ocean before rats had a chance to consume them. In addition, the bait hopper used to aerially distribute pellets would be fitted with a deflector device that would cast the bait to only one side, thus allowing the pilot to fly near shorelines while distributing pellets only to the land side and away from the ocean. In order to minimize bouncing of pellets off of steep areas, small bait pellets (about 2.5 grams) would be used to minimize bounce and maximize the chance of pellets getting caught in vegetation and small cracks, and on irregularities in the rock. Pilots would also be instructed to fly inland from the shoreline while distributing bait, creating a buffer zone around intertidal and marine areas. Any areas above the tide line that the helicopter could not bait would be baited by crews on shore or in boats distributing bait by hand or in bait boxes.

A consultation under section 7 of the Endangered Species Act has been completed with NOAA Fisheries, the Federal agency responsible for protection of sea turtles when they are in the water. NOAA concurred that with the mitigation measures listed in this document, that there would be no likely adverse effects on sea turtles.

Fishes - Several species of marine fishes inhabit the waters surrounding Lehua Island (see Table 11 in Appendix A for a partial list). The nearshore areas of Lehua are generally rocky and have a low percentage of coral cover relative to many other locations in Hawai`i. Disturbance to fish would be virtually non-existent since rat eradication activities would be terrestrially based. It is not likely that fish would be exposed to the rodenticide because of the mitigations to prevent bait from being spread into the ocean. Even if pellets did get into the water, a 2004 study on Lehua, evaluating the interest of fish in placebo (non-toxic) bait pellets, indicated that fish would not be interested in consuming any pellets falling through the water column (see Table 4). Even though project activities would not likely have any negative consequences for fish, the goal would be to prevent the spread of any bait into the ocean.

Mitigation – To avoid broadcasting bait pellets into the ocean, the helicopter would not distribute bait during high wind periods. Bait would be distributed in the dry summer season and would not be distributed when rain was forecast within the next 48 hours, to avoid rain washing pellets into the ocean before rats had a chance to consume them. In addition, the bait hopper used to aerially distribute pellets would be fitted with a deflector device that would cast the bait to only one side, thus allowing the pilot to fly near shorelines while distributing pellets only to the land side and away from the ocean. In order to minimize bouncing of pellets off of steep areas, small bait pellets (about 2.5 grams) would be used to minimize bounce and maximize the chance of pellets getting caught in vegetation and small cracks, and on irregularities in the rock. Pilots would also be instructed to fly inland from the shoreline while distributing bait, creating a buffer zone around intertidal and marine areas. Any areas above the tide line that the helicopter could not bait would be baited by crews on shore or in boats distributing bait by hand or in bait boxes.

Table 4. Attraction of nearshore marine fishes to placebo Ramik Green rat bait pellets (2 - 3 gram size) at Lehua Island, Hawai'i, September 18-19, 2004 (USFWS unpublished data)

Common Name	Species Name	Total Number of Fish	Number of bait interactions observed (some individuals interacted multiple times)			Number of bait interactions per species
			Inspected Bait	Touched Bait	Consumed bait	
Orangespine Unicornfish	*Naso literatus*	13	10	8	0	18
Convict Tang	*Acanthurus triostegus*	8	0	0	0	0
Whitebar Surgeonfish	*Acanthurus leucopareius*	85	19	0	0	19
Orangeband Surgeonfish	*Acanthurus olivaceous*	7	3	5	0	8
Achilles Tang	*Acanthurus achilles*	2	0	0	0	0
Ringtail Surgeonfish	*Acanthurus blochii*	1	0	0	0	0
Eyestripe Surgeonfish	*Acanthurus dussumieri*	1	0	0	0	0
Lagoon Triggerfish	*Rhinecanthus aculeatus*	1	1	0	0	1
Black Durgon	*Melichthys niger*	6	21	13	0	34
Pinktail Durgon	*Melichthys vidua*	5	13	9	0	22
Moorish Idol	*Zanclus cornutus*	1	0	0	0	0
Ornate Butterflyfish	*Chaetodon ornatissimus*	1	0	0	0	0
Longnose Butterflyfish	*Forcipiger longirostris*	1	0	0	0	0
Cornetfish	*Fistularia commersonnii*	1	0	0	0	0
Gray Reef Shark (juv)	*Carcharhinus amblyrynchos*	1	1	0	0	1
Blackspot Sergeant	*Abudefduf sordidus*	1	3	0	0	3

Manybar Goatfish	*Parupeneus multifasciatus*	2	0	0	0	0
Blue Goatfish	*Parupeneus cyclostomus*	3	0	0	0	0
Yellowstripe Goatfish	*Mulloidichthys flavolineatus*	1	0	0	0	0
Hawai'ian Hogfish	*Bodianus bilunulatus*	1	1	1	0	2
Parrotfish spp.	Family *Scaridae*	2	0	0	0	0

Marine Invertebrates and Marine Algae – It is unlikely that exposure of marine invertebrates to diphacinone would have significant effects on them due to the generally low toxicity of diphacinone to invertebrates and the fact they would not be likely to encounter rodenticide in the ocean. Diphacinone, designed as a vertebrate anticoagulant, has no known toxicity to marine algae.

The concentration of diphacinone that could potentially go into solution in the ocean around Lehua would be so low as to be likely immeasurable and would be of no toxicological consequence. This is partially due to the fact that diphacinone has low solubility in water (Eisemann *in prep.*). The proposed project action and the mitigations to prevent bait spread into the ocean would ensure that very little, if any bait would get into the water. Should any bait pellets drift into the ocean or intertidal zone, the bait pellets would absorb water, break up and be disintegrated by the wave action and currents.

Any bait in the intertidal zone would be likely be quickly removed by rats and possibly shore crabs. There would be no anticipated impacts to individual invertebrates because their blood clotting mechanisms are different than mammals (Shirer 1992). Crabs would not likely carry significant levels of diphacinone residues after the diphacinone passed through the gut of the organism (Pain *et al.* 2000, Morgan *et al.* 1996). However, gastropods could carry some residues, as Johnston *et al.* (in prep.) report that terrestrial gastropods would retain some diphacinone residues for longer than 7 days after exposure for 7 days. It is not likely that any bait would be available to scavengers for more than a few hours, and the mitigations outlined above would be sufficient to reduce the risk to low or negligible. During the aerial bait application on Anacapa Island in 2001 and 2002, monitoring of ocean water, fish, and intertidal invertebrates, including the filter feeders and shore crabs, detected no rodenticide residues, indicating that no rodenticide entered the marine food chain (Howald *et al.* 2001, 2005).

Mitigation – To avoid broadcasting bait pellets into the ocean, the helicopter would not distribute bait during high wind periods. Bait would be distributed in the dry summer season and would not be distributed when rain was forecast within the next 48 hours, to avoid rain washing pellets into the ocean before rats had a chance to consume them. In addition, the bait hopper used to aerially distribute pellets would be fitted with a deflector device that would cast the bait to only one side, thus allowing the pilot to fly near shorelines while

distributing pellets only to the land side and away from the ocean. In order to minimize bouncing of pellets off of steep areas, small bait pellets (about 2.5 grams) would be used to minimize bounce and maximize the chance of pellets getting caught in vegetation and small cracks, and on irregularities in the rock. Pilots would also be instructed to fly inland from the shoreline while distributing bait, creating a buffer zone around intertidal and marine areas. Any areas above the tide line that the helicopter could not bait would be baited by crews on shore or in boats distributing bait by hand or in bait boxes.

Potential Impacts of Brodifacoum and Mitigation
Terrestrial Species

Birds in General – The toxicity of brodifacoum is unknown for species that are found on Lehua, but the compound is classed as highly toxic to birds (US EPA). A conservative estimate of the toxicity of brodifacoum to birds was estimated following a probabilistic model to be above 0.56 mg/kg for any unknown bird (Howald *et al.* 1999). Unlike diphacinone that requires multiple feedings over several days to induce the toxic effect, brodifacoum could induce poisoning of birds after a single feeding if enough of the rodenticide was consumed. Following the Environmental Protection Agency model of evaluating Risk Quotients against the 0.5 Level of Concern (LOC) for non-listed non-target species (Johnston *et al.* 2002), the risk to these non-target birds would be above the 0.5 LOC, indicating that brodifacoum would likely result in acute toxicity to birds that feed on the bait or poisoned rodents. Because of the potential toxicity of brodifacoum to birds, the key to mitigating potential effects would be to prevent exposure of birds to bait pellets containing brodifacoum.

Seabirds – Seabirds are considered to be at low to no risk of primary exposure to the baits because they only feed at sea, are predatory and prefer live prey, and would not likely be attracted to compressed grain bait pellets. Basic mitigations (listed below) would be implemented to prevent bait pellets from being spread into the ocean and would therefore limit the potential for exposure to seabirds. Seabirds would not be attracted to bait pellets that may fall into the ocean for a number of reasons. Any errant pellets would fall close to the island, far from the typical foraging areas of Lehua's seabirds. Furthermore, the bait pellets do not float and would sink quickly, degrade rapidly after absorbing water, and break up due to the wave action and currents. In addition, the timing of the baiting is scheduled to be when the numbers of seabirds on and around the island are relatively low. In a similar rat eradication on Anacapa Island, California, seabirds were never observed to be attracted to pellets that landed on the island during aerial application of bait (G. Howald *pers. comm.*).

Fish-eating seabirds would not be exposed indirectly (secondarily) because of mitigation to prevent pellets being spread into the ocean and because the fish around Lehua are not anticipated to consume any bait pellets that incidentally fall into the ocean (see data in Table 4). In addition, brodifacoum is insoluble in water and could not be absorbed by fish through their skin or gills.

It is possible but unlikely that a few juvenile Black-footed and Laysan Albatross could still be on island during the proposed summer bait application period on Lehua Island. Albatross chicks are known to be very curious and will 'play' with rocks, sticks and other objects they find on the ground (Finkelstein *et al.* 2003; R. Henry *pers. comm.).* They could potentially pick

up individual bait pellets that may be broadcast onto the island. Although this activity is presumed to be due to sheer curiosity and not a feeding attempt, it is possible that chicks may inadvertently swallow individual bait pellets. However, this is unlikely due to the low density of pellets available. In addition, albatross chicks routinely regurgitate indigestible material fed to them by their parents, such as squid beaks and plastics. This behavior further decreases their chance of exposure.

The indirect impact of removing rats would be a significant net benefit to seabirds due to decreased rat predation on eggs and juvenile birds. These benefits were discussed in detail earlier in this document.

Mitigation – To avoid impacts to juvenile albatross, rat eradication will be conducted in the summer. Observations by Wood et al. (2004) and VenderWerf (in prep.) indicate that virtually all juvenile albatross have left Lehua by the end of June.

To avoid broadcasting bait pellets into the ocean and becoming available to seabirds, the helicopter would not distribute bait during high wind periods. Bait would be distributed in the dry summer season and would not be distributed when rain was forecast within the next 48 hours, to avoid rain washing pellets into the ocean before rats had a chance to consume them. In addition, the bait hopper used to aerially distribute pellets would be fitted with a deflector device that would cast the bait to only one side, thus allowing the pilot to fly near shorelines while distributing pellets only to the land side and away from the ocean. In order to minimize bouncing of pellets off of steep areas, small bait pellets (about 2.5 grams) would be used to minimize bounce and maximize the chance of pellets getting caught in vegetation and small cracks, and on irregularities in the rock. Pilots would also be instructed to fly inland from the shoreline while distributing bait, creating a buffer zone around intertidal and marine areas. Any areas above the tide line that the helicopter could not bait would be baited by crews on shore or in boats distributing bait by hand or in bait boxes.

Because two seabird species on Lehua are listed under the Endangered Species Act (Newell's Shearwater and Hawai`i Petrel) an internal consultation under section 7 of the Endangered Species Act has been completed with USFWS. USFWS is the Federal agency responsible for protection of threatened and endangered seabirds. USFWS concurred that the project, as described, is not likely to adversely affect these species.

Shorebirds – Shorebirds documented on Lehua include Pacific Golden Plover, Ruddy Turnstone, and Wandering Tattler, which are common winter visitors throughout the Hawai`ian Islands. During the proposed bait application period in the summer season, most if not all of these birds would be on their nesting territories on the mainland and would not be on Lehua. Thus, they would not be exposed to the rodenticide.

The indirect impact of removing rats would be a net benefit to shorebirds since rats may potentially prey on small shorebirds and also may compete with them for food sources, such as intertidal invertebrates.

Mitigation – Rat eradication would be conducted in the summer when shorebirds are not present.

Landbirds – Landbirds are defined here as the small, non-native passerines observed infrequently on Lehua by Wood *et al.* (2004), including Rock and Zebra Doves, House Finches and Nutmeg Mannikens. Birds introduced to the United States from foreign countries, including Rock Doves, Zebra Doves, and Nutmeg Mannikens, are exempted from protection under the Migratory Bird Treaty Act. House Finches are subject to ongoing control programs in Hawai'i and would not be present on the island at the time rodenticides were applied, thus precluding any potential for exposure to rodenticides.

The species that could be present on Lehua are primarily seed eaters (Hawai'i Audubon Society 1993). To reduce the risk of exposure, the bait would be formulated into bait pellets (approximately 2.5 g) large enough that it would be difficult for a small, seed-eating (graniverous) bird to consume. The pellets would also be dyed green, a color that many birds are known to avoid (Day and Matthews 1999; H. Gellerman unpub. data), and the bait application rate would be calibrated to deliver the minimum amount of bait needed to ensure that all rats would be exposed to the bait (Dunlevy *et al.* 2000). Assuming a maximum application rate for brodifacoum pellets of 13.5 lbs/acre, using 2.5 gram pellets, aerial broadcast would result in a density of fewer than 6 pellets every 100 sq. feet. Given the low density of pellets and the low number of landbirds present on Lehua at any one time, there would be a low risk of birds encountering pellets. Over the course of several visits, Wood *et al.* (2004) never encountered more than 40 landbirds on the island per visit.

However, individual birds present could pick up bait pellets (Dunlevy *et al.* 2000). If landbirds did ingest brodifacoum pellets, there would be a high risk of toxicity. Exposure to bait pellets and some mortality has been observed for the several bird species during aerial and bait box application of brodifacoum (Empson and Miskelly 1999; Dowding *et al.* 1999; Eason and Spurr 1995; Morgan *et al.* 1996; Howald *et al.* 2005). Exposure to brodifacoum could result in mortality of individual landbirds.

The indirect impact of rat eradication would be a net positive benefit to landbirds, due to decreased rat predation on birds and decreased competition between birds and rats for seeds, insects and other food sources.

Mitigation – Bait pellets will be dyed green to make them unattractive to birds.

Predatory birds – Predatory birds on Lehua include non-native Barn Owls and Cattle Egrets, which may prey on or scavenge rats as part of their diet. However, both these species are subject to control programs in Hawai'i and are regularly removed from Lehua as part of this statewide effort. Any individuals of these species observed on Lehua immediately prior to or during rodenticide application would be removed by USDA Wildlife Services, thus precluding any potential for secondary exposure to rodenticides. Furthermore, most rodents die underground in their burrows (Spurr *et al.* 2003), and those that remain above ground do not appear to be of interest to avian predators, which prefer live prey (Lindsey and Mosher 1994). No mitigation for these species would be needed.

The Peregrine Falcon is a rare winter visitor to the Hawai'ian Islands (Pyle 2002). A single Peregrine was reported flying past Lehua but was never observed to land on the island (VanderWerf *in prep.*). Peregrine Falcons have never been reported in Hawai'i in the summer, when rat eradication would occur. Lastly, Peregrine Falcons preferentially feed on

live birds so their diet on Lehua would likely be seabirds, which would not be exposed to the rodenticide. Evidence for this is the fact that no Peregrine Falcons died as a result of the 2002 aerial bait application of brodifacoum to Anacapa Island, California.

Mitigation – Rat eradication would occur in the summer, when Peregrine Falcons are not present.

Rabbits – The proposed action includes rabbit eradication, which would be scheduled to be completed prior to rat baiting. It is anticipated that there would be no rabbits left on the island. However, if rabbits are not completely removed prior to rat removal, there is a possibility that rabbits would be attracted to and eat bait pellets. Because brodifacoum is a vertebrate toxicant, it is possible that if rabbits remained and if they could find enough pellets, that they would die as a result. Only four of the 36 successful rabbit eradications worldwide (completed and underway) have used poisons exclusively and have instead used the more reliable methods of hunting and trapping (Island Conservation analysis of known rabbit eradications).

Snake-eyed Skink – One species of terrestrial reptile, the non-native Snake-eyed Skink, is documented from Lehua. It is believed to be a Polynesian introduction. This insectivorous skink may be exposed to the rodenticide by consuming insects that may have fed on the bait or rat carcasses. The exposure window would be limited in time and would have limited consequence for the population of skinks on the island even though individual animals may be susceptible to exposure to the rodenticide. However, after application of brodifacoum during a rodent eradication on a New Zealand island, skinks were found dead and confirmed to have been exposed to the rodenticide (see Eason and Spurr 1995). Nonetheless, the populations of skinks and other reptiles rebounded to higher levels than prior to eradication because predation pressure by rats was removed. On Anacapa Island in California, the survivorship of juvenile Side-blotched Lizards (*Uta stansburiana*) doubled after the aerial application of bait containing brodifacoum to remove introduced rats (T. Comendant, *pers. comm.*), with no apparent negative impact to salamanders (*Batrachoseps pacificus*) or Alligator Lizards (*Elgaria multicarinata*) (G. Howald, *pers. comm.*). No mitigation would be needed.

It is expected that the indirect impact of the removal of rats on Lehua would be a net increase in skink populations due to the release from rat predation pressure.

Terrestrial Invertebrates – Anticoagulant rodenticides, such as brodifacoum, are not known to affect blood clotting in terrestrial invertebrates, likely because of their different blood clotting mechanisms (Shirer 1992). Extensive field and lab trials have shown that beetles (Morgan *et al.* 1996; Eason and Spurr 1995; Stejskal *et al.* 1994; Tershy *et al.* 1992), cockroaches (Godfrey 1985), crickets (Morgan *et al.* 1996), land crabs (Pain *et al.* 2000; D. Veitch *pers. comm.*), snails, slugs, orthopterans, millipedes (Howald 1997), and ants (Godfrey 1985; Tershy *unpub. data*) are attracted to rodent baits and can survive on a diet of 20-50 ppm brodifacoum. No terrestrial gastropods (slugs or snails) have been observed on Lehua so it is not likely that there is a possibility of exposure for them. The terrestrial invertebrates present on the island would likely play a role in the removal of residual bait that is not consumed by rats, but would not be affected by the rodenticide. No mitigation would be needed.

The indirect impact of removing rats would be a net benefit to terrestrial invertebrates, due to a release from predation by rats.

Marine Ecosystems

Hawai`ian Monk Seal - Adult Monk Seals haul out on rock ledges at Lehua in low numbers (Wood *et al.* 2004). The diet of Monk Seals consists of reef fishes, eels, octopi and spiny lobsters which are distributed around coral structures and extensive offshore banks and steep slopes (Gilmartin 1983). Because of their dietary preference for fish, seals would not likely be attracted to the compressed grain bait pellets. Monk Seal dive data indicate that seals regularly feed in deeper waters and outer reefs of islands (Gilmartin 1983), thereby avoiding any potential secondary exposure to rodenticide around Lehua. Further, nearshore fish at Lehua did not consume any placebo bait pellets during a study in 2004, indicating that any bait pellets that fell into the ocean would not be consumed by fish and not present a secondary exposure risk to Monk Seals (see Table 4).

However, mitigation measures are warranted because Monk Seals are listed as an endangered species and they are sensitive to human disturbance, including helicopters delivering rodenticide. With the mitigation described below, the few monk seals that may be present on or around the island are at low risk of disturbance from helicopter and hand baiting activity along the shoreline.

Mitigation -- Mitigation would focus on minimizing human disturbance to the seals and on preventing bait pellets from being distributed near seals or in the ocean. All project personnel on the ground would maintain a 100 foot buffer from seals during any hand placement of bait or other project activities. During aerial bait distribution operations, the helicopter would adjust course to avoid flying over seals, would not hover near seals, and would not distribute pellets over seals on the shore. Helicopter activity over any point on the island would be brief as the flight speed would be greater than 25 knots.

To avoid broadcasting bait pellets into the ocean, the helicopter would not distribute bait during high wind periods. Bait would be distributed in the dry summer season and would not be distributed when rain was forecast within the next 48 hours, to avoid rain washing pellets into the ocean before rats had a chance to consume them. In addition, the bait hopper used to aerially distribute pellets would be fitted with a deflector device that would cast the bait to only one side, thus allowing the pilot to fly near shorelines while distributing pellets only to the land side and away from the ocean. In order to minimize bouncing of pellets off of steep areas, small bait pellets (about 2.5 grams) would be used to minimize bounce and maximize the chance of pellets getting caught in vegetation and small cracks, and on irregularities in the rock. Pilots would also be instructed to fly inland from the shoreline while distributing bait, creating a buffer zone around intertidal and marine areas. Any areas above the tide line that the helicopter could not bait would be baited by crews on shore or in boats distributing bait by hand or in bait boxes.

A consultation under section 7 of the Endangered Species Act has been completed with NOAA Fisheries, the Federal agency responsible for protection of Monk Seals. NOAA concurred that with the mitigation measures listed in this document, that there would be no likely adverse effects to Monk Seals.

Green Sea Turtles - The rocky, steep shorelines on Lehua provide poor habitat for sea turtles. Sea turtles prefer sandy beaches for hauling out and resting, and require sandy beaches for nesting. Sandy beaches are non-existent on Lehua. Therefore, it is very unlikely that activities on island will disturb any turtles. Boat traffic may cause temporary disturbance to turtles in the water, but turtles do not appear to be numerous in the waters directly around Lehua (Wood *et al.* 2004).

Should turtles be present around Lehua at the time of eradication, it is not likely that they would be exposed to the rodenticide because of the mitigations to prevent bait from being spread into the ocean. Turtles would not likely eat any of the bait pellets as over 99% of the diet of adult greens sea turtles is algae and seagrasses (Forbes 1994). The few bait pellets that could drift into the ocean would sink to the bottom, absorb moisture, and degrade rapidly. The incessant wave action and currents would expedite the breakdown and dispersion of the bait pellets, further reducing the risk of exposure of turtles to the rodenticide through direct consumption or through contamination of algae. Thus, it is highly unlikely that turtles would be exposed to bait associated with rat eradication activities. Nonetheless, because Green Sea Turtles are listed as a threatened species under Federal law, every effort will be made to prevent bait pellets from getting into the ocean.

Mitigation – To avoid broadcasting bait pellets into the ocean, the helicopter would not distribute bait during high wind periods. Bait would be distributed in the dry summer season and would not be distributed when rain was forecast within the next 48 hours, to avoid rain washing pellets into the ocean before rats had a chance to consume them. In addition, the bait hopper used to aerially distribute pellets would be fitted with a deflector device that would cast the bait to only one side, thus allowing the pilot to fly near shorelines while distributing pellets only to the land side and away from the ocean. In order to minimize bouncing of pellets off of steep areas, small bait pellets (about 2.5 grams) would be used to minimize bounce and maximize the chance of pellets getting caught in vegetation and small cracks, and on irregularities in the rock. Pilots would also be instructed to fly inland from the shoreline while distributing bait, creating a buffer zone around intertidal and marine areas. Any areas above the tide line that the helicopter could not bait would be baited by crews on shore or in boats distributing bait by hand or in bait boxes.

A consultation under section 7 of the Endangered Species Act has been completed with NOAA Fisheries, the Federal agency responsible for protection of sea turtles when they are in the water. NOAA concurred that with the mitigation measures listed in this document, that there would be no likely adverse effects to sea turtles.

Fishes - Several species of marine fishes inhabit the waters surrounding Lehua Island (see Table 11 in Appendix A for a partial list). The nearshore areas of Lehua are generally rocky and have a low percentage of coral cover relative to many other locations in Hawai'i. Disturbance to fish would be virtually non-existent since rat eradication activities would be terrestrially based. It is not likely that fish would be exposed to the rodenticide because of the mitigations to prevent bait from being spread into the ocean. Even if pellets did get into the water, a 2004 study on Lehua, evaluating the interest of fish in placebo (non-toxic) bait pellets, indicated that fish would not be interested in consuming any pellets falling through the water column (see Table 4). No brodifacoum residues were detected in ocean water or marine fish after aerial bait application of bait containing brodifacoum on Anacapa Island,

California for rat eradication (Howald, *et al.* 2005). Even though project activities would not likely have any negative consequences for fish, the goal would be to prevent the spread of any bait into the ocean.

Mitigation – To avoid broadcasting bait pellets into the ocean, the helicopter would not distribute bait during high wind periods. Bait would be distributed in the dry summer season and would not be distributed when rain was forecast within the next 48 hours, to avoid rain washing pellets into the ocean before rats had a chance to consume them. In addition, the bait hopper used to aerially distribute pellets would be fitted with a deflector device that would cast the bait to only one side, thus allowing the pilot to fly near shorelines while distributing pellets only to the land side and away from the ocean. In order to minimize bouncing of pellets off of steep areas, small bait pellets (about 2.5 grams) would be used to minimize bounce and maximize the chance of pellets getting caught in vegetation and small cracks, and on irregularities in the rock. Pilots would also be instructed to fly inland from the shoreline while distributing bait, creating a buffer zone around intertidal and marine areas. Any areas above the tide line that the helicopter could not bait would be baited by crews on shore or in boats distributing bait by hand or in bait boxes.

Marine Invertebrates and Marine Algae - It is unlikely that exposure of marine invertebrates to brodifacoum would have significant effects on them due to the generally low toxicity of brodifacoum to invertebrates and the fact they would not be likely to encounter high concentrations of the rodenticide in the ocean. Brodifacoum, designed as a vertebrate anticoagulant, has no known toxicity to marine algae.

Because brodifacoum is insoluble in water, the amount that could potentially go into solution in the ocean around Lehua would be so low as to be likely immeasurable and would be of no toxicological consequence. The proposed mitigations are designed to prevent bait pellets from getting into the water to begin with. Should any bait pellets land in the ocean or intertidal zone, the pellets would quickly absorb water, break up and be disintegrated by the wave action and currents.

Any bait in the intertidal zone would be likely be quickly removed by a combination of rats and possibly shore crabs. There would be no impacts to individual invertebrates because their blood clotting mechanisms are different than mammals (Shirer 1992). Crabs would not likely carry significant levels of brodifacoum residues after it passed through the gut of the organism (Pain *et al.* 2000, Morgan *et al.* 1996). However, gastropods could carry some residues, as Johnston *et al.* (in prep.) report that terrestrial gastropods retain some diphacinone residues for longer than 7 days after exposure for 7 days. It is not likely that any bait would be available to scavengers for more than a few hours, and the mitigations outlined above would be sufficient to reduce the risk to low or negligible. During the aerial bait application on Anacapa Island in 2001 and 2002, small amounts of bait were documented to have drifted into the intertidal zone and ocean, but monitoring of ocean water, fish, and intertidal invertebrates, including the filter feeders and shore crabs, detected no rodenticide residues, indicating that no rodenticide toxins moved into the marine food chain (Howald *et al.* 2001, 2005).

Mitigation – To avoid broadcasting bait pellets into the ocean, the helicopter would not distribute bait during high wind periods. Bait would be distributed in the dry summer season and would not be distributed when rain was forecast within the next 48 hours, to avoid rain washing pellets into the ocean before rats had a chance to consume them. In addition, the bait hopper used to aerially distribute pellets would be fitted with a deflector device that would cast the bait to only one side, thus allowing the pilot to fly near shorelines while distributing pellets only to the land side and away from the ocean. In order to minimize bouncing of pellets off of steep areas, small bait pellets (about 2.5 grams) would be used to minimize bounce and maximize the chance of pellets getting caught in vegetation and small cracks, and on irregularities in the rock. Pilots would also be instructed to fly inland from the shoreline while distributing bait, creating a buffer zone around intertidal and marine areas. Any areas above the tide line that the helicopter could not bait would be baited by crews on shore or in boats distributing bait by hand or in bait boxes.

4.2.2.3 Native Plant Restoration

Restoring native plants on Lehua would have no negative effect on non-target species. In fact, the restoration of native vegetation will help decrease erosion and thus improve nest habitat quality for breeding seabirds and other island fauna.

4.2.3 Increase in Weed Abundance

4.2.3.1 Rabbit Eradication

One direct impact of rabbit removal on native vegetation is expected to be an increase in the number and variety of native plant species growing on Lehua. The removal of rabbits will also make it possible to start a native plant restoration program. An additional impact, however, could be an increased abundance and growth of non-native plants and weeds. Consequently, if rabbits are removed from the island there would likely be significant changes in the island's vegetation due to the removal of this significant ecological pressure. The nature of these changes may be complex. The initial removal of rabbits would allow for the resurgence of vegetation the rabbits had considered palatable (e.g. Donlan *et al.* 2002; Abbott *et al.* 2000). This could include native species that are currently kept to low numbers on the island. Competitive pressure from some of the newly resurgent plants, on the other hand, may dampen the positive effects of rabbit removal on other plant species. There is a possibility that one or more non-native plant species would outcompete some native species after removal of the rabbits (see Watt 1960; Taylor 1968; Williams *et al.* 1995; Norman 1988; Copson and Whinam 1998; Abbott *et al.* 2000). As stated in Chapter 1, native plant restoration measures would be taken to ensure native plant species can thrive without being threatened by invasive weeds.

Mitigation – Both USFWS and DOFAW and other non-governmental organizations within the State of Hawai`i have a well-established infrastructure and policies for plant monitoring and response to newly introduced species and control of established weeds for the protection of native ecosystems. The USFWS and DOFAW have established transects and a vegetation monitoring program at Lehua to monitor changes in vegetation following rabbit removal. If necessary, the agencies could implement a weed control program for the benefit of the native ecosystem, if certain invasive species start to spread. The implementation of

the weed management program would be implemented under the current programs and policies of the USFWS and DOFAW, subject to availability of funds.

4.2.3.2 Rat Eradication

One direct impact of rat removal on native vegetation is expected to be an increase in the number and variety of native plant species growing on Lehua. The removal of rats will also make it possible to start a native plant restoration program. An additional impact, however, could be an increase in abundance and growth of non-native plants and weeds. Consequently, if rats are removed from the island there would likely be significant changes in the island's vegetation due to the removal of this significant ecological pressure. The nature of these changes may be complex, as discussed in detail in the preceding section on rabbits. The resulting response of the plant community to the removal of rats is also dependent on the presence or absence of rabbits. Should rabbits be removed in addition to rats, it is assumed that both native plants and weeds would grow. Although it is not clear what plants rats prefer, the weed response may be a detriment to the productivity of native plant species.

Mitigation - Both USFWS and DOFAW and other non-governmental organizations within the State of Hawai`i have a well-established infrastructure and policies for plant monitoring and response to newly introduced species and control of established weeds for the protection of native ecosystems. The USFWS and DOFAW have established a monitoring program for Lehua and would implement a weed control program, as necessary, for the benefit of the native ecosystem. The implementation of the weed management program would be implemented under the current programs and policies of the USFWS and DOFAW, subject to availability of funds.

4.2.3.3 Native Plant Restoration

Restoring native plants on Lehua would not increase weed abundance. Rather, it would replace most weeds and ensure native plants are helped to establish and comprise the predominant make-up of Lehua's flora.

4.2.4 Impacts on Cultural Resources

4.2.4.1 Rabbit Eradication

The number and distribution of sites of archeological significance have been mapped and documented (see Yent and Carpenter 2004). The proximity of Lehua to Ni`ihau, the poor soils for supporting agriculture, and steep, rugged and exposed topography likely accounts for the lack of evidence of permanent occupation of Lehua Island by Hawai`ians. The sites on Lehua suggest that the Hawai`ians were landing on the island, constructing sites and probably fishing and collecting birds, while living on adjacent Ni`ihau or Kaua`i. It would be an important goal of the project to avoid any negative impacts to cultural resources. The indirect impact of rabbit eradication would be a net benefit to cultural sites. Continued herbivory by rabbits is likely contributing to the premature erosion of the soils supporting the sites. Removal of rabbits would slow erosion rates and prolong the life of these sites.

Mitigation – Formal consultation with archaeologists in the State Historic Preservation Division (SHPD) of the Hawaii Department of Land and Natural Resources has been initiated and will be completed prior to starting any of the proposed operations. Conditions set forth as a result of consultation will be incorporated into standard operating procedures and all project personnel will be required to comply with them. Informal discussions with SHPD archaeologists have been ongoing since the beginning of the project and they have made a field visit to Lehua. Archaeologists from the State Division of Parks have completed field surveys of Lehua and conducted data recovery from appropriate areas. All sites have been marked as requested by SHPD. SHPD recommendations to date have all been incorporated into project mitigation measures and any additional requirements resulting from formal consultation will be incorporated as well. In addition to completing surveys, data recovery and marking sites, all project personnel will be briefed and familiarized with the historic sites, prohibited from walking on or disturbing any sites, and would avoid shooting at sites.

4.2.4.2 Rat Eradication

As mentioned above, the number and distribution of sites of archeological significance have been mapped and documented (Yent and Carpenter 2004), so project operations would be planned to avoid cultural sites. Aerial broadcast of bait pellets would have no impact on cultural sites, due to the small size (about 2.5 grams each) of the bait pellets. Personnel on the island conducting hand broadcast, monitoring or related activities would be subject to the same restrictions as personnel involved in rabbit removal. It would be an important goal of the project to avoid any negative impacts to cultural resources.

Mitigation – Formal consultation with archaeologists in the State Historic Preservation Division (SHPD) of the Hawaii Department of Land and Natural Resources has been initiated and will be completed prior to starting any of the proposed operations. Conditions set forth as a result of consultation will be incorporated into standard operating procedures and all project personnel will be required to comply with them. Informal discussions with SHPD archaeologists have been ongoing since the beginning of the project and they have made a field visit to Lehua. Archaeologists from the State Division of Parks have completed field surveys of Lehua and conducted data recovery from appropriate areas. All sites have been marked as requested by SHPD. SHPD recommendations to date have all been incorporated into project mitigation measures and any additional requirements resulting from formal consultation will be incorporated as well. In addition to completing surveys, data recovery and marking sites, all project personnel will be briefed and familiarized with the historic sites, prohibited from walking on or disturbing any sites, and would avoid shooting at sites.

4.2.4.3 Native Plant Restoration

Native plant restoration could entail broadcasting seed, planting seeds in the ground or (less likely) planting of sprouted plants. In addition, weed removal could involve cutting or pulling of individual plants. These activities would involve minimal and localized ground

disturbance. Because the sites have already been mapped (Yent and Carpenter 2004), these areas can be avoided during plant restoration.

Mitigation – Formal consultation with archaeologists in the State Historic Preservation Division (SHPD) of the Hawaii Department of Land and Natural Resources has been initiated and will be completed prior to starting any of the proposed operations. Conditions set forth as a result of consultation will be incorporated into standard operating procedures and all project personnel will be required to comply with them. Informal discussions with SHPD archaeologists have been ongoing since the beginning of the project and they have made a field visit to Lehua. Archaeologists from the State Division of Parks have completed field surveys of Lehua and conducted data recovery from appropriate areas. All sites have been marked as requested by SHPD. SHPD recommendations to date have all been incorporated into project mitigation measures and any additional requirements resulting from formal consultation will be incorporated as well. In addition to completing surveys, data recovery and marking sites, all project personnel will be briefed and familiarized with the historic sites, prohibited from walking on or disturbing any sites, and would avoid shooting at sites.

4.2.5 Impacts on Human Health and Safety

4.2.5.1 Rabbit Eradication

Access to Lehua is limited, and no landing is allowed unless permitted by the USCG. There would be no one from the general public present on the island during the rabbit or rat eradication efforts.

Private vessels, fishing, dive and tourist boats occasionally use the waters surrounding the island typically with peak activity during the summer season. However, the winter season, during the proposed rabbit eradication window, is often wet and windy, with frequent rough seas that reduce visitation to the surrounding waters of Lehua. The eradication activities present no risk to individual people or boats offshore from Lehua. All hunting and trapping activities on the island would be focused very narrowly on specific targets, with no risk to the general public.

Mitigation – Rabbit removal will occur during the late fall and winter months, when few boats go out to Lehua. Only professional hunters would be employed on Lehua to eradicate rabbits. Professional hunters are well versed in the safe handling and discharge of firearms to ensure no risk to any members of the general public or persons involved with the restoration project.

4.2.5.2 Rat Eradication

Rat eradication under this alternative would be carried out by a combination of aerial and hand broadcast of grain-based bait pellets containing the anticoagulant diphacinone. In the event that eradication cannot be achieved with diphacinone, pellets containing the second-generation anticoagulant brodifacoum would be used. Any rodenticide application would be done in strict accordance with label directions and with EPA and Hawai`i Department of

Agriculture regulations. Applications would be carried out under the supervision of a certified pesticide applicator.

Potential Exposure to Diphacinone

Diphacinone was first developed in 1952 by The Upjohn Company as a human pharmaceutical under the name Dipaxin (Correll *et al.* 1952). Like other anticoagulants, it was used to prevent and treat diseases associated with blood clots, such as deep-vein thrombosis, pulmonary embolism, stroke, and heart disease (The Upjohn Company 1976). Clinical trials demonstrated that it had a low incidence of side effects, and was easily counteracted with Vitamin K1 (Field *et al.* 1952, Duff *et al.* 1953, Pascale and Olwin 1953). The usual medical dosage of diphacinone was 20 to 30 milligrams the first day, followed by 10 to 15 mg the second day. The average maintenance dose was 3 to 5 mg daily (The Upjohn Company 1976). At 50 parts per million (ppm) of diphacinone, a person would need to consume 600 g of bait to ingest a dose equivalent to 30 mg. Dipaxin remained a commonly prescribed medication in the U.S. until 1978, when it was discontinued for economic reasons (D. Welsh, Pharmacia Corp, *pers. comm.*).

Exposure to the Rodenticide - It is not expected that the public would be directly exposed to the rodenticide pellets, unless they land on the island to intentionally seek out the bait on island and consume it. The bait application rate would be minimized to ensure that enough is available for all the rats on the island, but not so much that bait would be wasted. The bait would be in the environment for a short period of time, likely only days before it is consumed by rats on the island. At the proposed application rate, pellets would be sparsely distributed and in such low density that it would be difficult to find enough pellets to warrant a concern. For example, 150-pound adult would need to find and consume about 7 pounds of diphacinone bait pellets in order to have a 50% chance of lethal toxicity (see table 5 in section 4.4.5.2).

The likelihood of secondary exposure to the rodenticide via fish is very low. Mitigation measures will be in place to prevent bait pellets from getting into the ocean. If pellets did get into the ocean, field experiments performed by USFWS showed that nearshore fish on Lehua did not consume any non-toxic bait pellets presented in bait response trials (see Table 4). Even if the fish did consume the bait pellets, the amount of residues found within the consumable flesh of fish would likely be of no consequence and would not approach amounts required to cause a measurable physiological response in a person.

Diphacinone has very low water solubility. Thus, it is highly unlikely that any diphacinone that did get in the water would dissolve and become available for uptake by algae or other organisms.

People periodically visit Lehua to harvest Opihi (limpets) in the intertidal zone. The harvesting of Opihi could result in the secondary exposure to very low levels of rodenticides, but there is a low risk that this could occur. Opihi occupy the intertidal zone, feeding on algae growing on the rocks and, as mentioned above, it is highly unlikely that algae could contain significant amounts of diphacinone. Intertidal areas are exposed to wave action, tides, and currents which would quickly remove any residual bait pellets that may enter the intertidal zone and would significantly reduce the risk that Opihi would consume any

residual portions of bait pellets. Further, proposed mitigation (below) is designed to prevent broadcast of pellets into intertidal or marine areas. Following the rodenticide (brodifacoum) broadcast at Anacapa Island, California, toxicological monitoring of ocean water, fish, bivalves and shore crabs indicated that the rodenticide residues were not detectable in water or animal tissues and did not move into the nearshore ecosystem food chain (Howald *et al.* 2005).

Employees working with the rodenticide would be at limited risk to exposure since they would be certified pest applicators and would be required to follow handling instructions and take precautions to avoid exposure.

In summary, the probability of human exposure to the rodenticide is extremely small. Mitigations measures will be put in place to minimize risks for bait to drift into the marine ecosystem, although even without mitigation there is no likelihood that the rodenticide would move into the ecosystem in sufficient concentrations to be of concern. It would be very difficult for anyone to find and consume enough rodenticide to be of any toxicological consequence. In addition, the onset of toxic effects is slow and effective medical treatment, in the form of the Vitamin K1 antidote, is readily available on Kaua`i and other locations throughout the State.

Consequence of Exposure

The exposure to small amounts of diphacinone is considered to be a very low risk to humans. Diphacinone has been used quite commonly as an antithrombin medication, administered to human patients as a drug to 'thin' the blood preventing heart attacks and strokes. Diphacinone is a multi-dose drug and would require a person to be exposed to it daily to have any kind of effect. Diphacinone overexposure is easily treated with the antidote Vitamin K1, a common and readily available vitamin. Studies have documented that workers who produce and handle brodifacoum, a more potent/toxic rodenticide, over a 9 month period did not show any signs of effects suggestive of significant exposure (ICI, in Taylor 1993). Table 5 illustrates the large number of diphacinone or brodifacoum bait pellets an individual would have to seek out and eat in order to suffer potentially lethal bleeding.

Mitigation -- To avoid broadcasting bait pellets into the ocean, the helicopter would not distribute bait during high wind periods. Bait would be distributed in the dry summer season and would not be distributed when rain was forecast within the next 48 hours, to avoid rain washing pellets into the ocean before rats had a chance to consume them. In addition, the bait hopper used to aerially distribute pellets would be fitted with a deflector device that would cast the bait to only one side, thus allowing the pilot to fly near shorelines while distributing pellets only to the land side and away from the ocean. In order to minimize bouncing of pellets off of steep areas, small bait pellets (about 2.5 grams) would be used to minimize bounce and maximize the chance of pellets getting caught in vegetation and small cracks, and on irregularities in the rock. Pilots would also be instructed to fly inland from the shoreline while distributing bait, creating a buffer zone around intertidal and marine areas. In shoreline areas, bait will be distributing bait by hand or in bait boxes to avoid getting pellets in the ocean.

Even though the risk to the public is very low, public concern over the issue of contaminated seafood is understandable and would be addressed by collecting and analyzing Opihi tissues collected from Lehua for rodenticide concentrations, following aerial application of rodenticides. Results would be made available to the public.

Potential Exposure to Brodifacoum

Brodifacoum, like diphacinone, is an anticoagulant rodenticide. Anticoagulant drugs (but not brodifacoum because of its longer retention time) have been used quite commonly as an antithrombin medication, administered to human patients as a drug to thin the blood preventing heart attacks and strokes.

Exposure to the Rodenticide - It is not expected that members of the public would be directly exposed to the rodenticide pellets, unless they land on the island to intentionally seek out the bait on island and consume it. Public access to Lehua is restricted and no one should be on island during the aerial treatment. The bait application rate would be minimized to ensure that enough is available for all the rats on the island, but not so much that bait would be wasted. The bait would be in the environment for a short period of time, likely only days before it is eaten by rats on the island. At the proposed application rate, pellets would be sparsely distributed and in such low density that it would be difficult to find enough pellets to warrant a concern.

The likelihood of secondary exposure to the rodenticide via fish is very low. Mitigation measures will be in place to prevent bait pellets from getting into the ocean. If pellets did get into the ocean, experiments showed that nearshore fish on Lehua did not consume any non-toxic bait pellets presented in bait response trials (see Table 4). Even if the fish did consume the bait pellets, the amount of residues found within the consumable flesh of fish would likely be of no consequence and would not approach the amount required to cause a measurable physiological response in a person.

Brodifacoum has very low water solubility. Thus, it is highly unlikely that any brodifacoum that did get in the water would dissolve and become available for uptake by algae or other organisms.

People periodically visit Lehua to harvest Opihi (limpets) in the intertidal zone. The harvesting of Opihi could result in secondary exposure of people to very low levels of rodenticides, but there is a low risk that this could occur. Opihi occupy the intertidal zone, feeding on algae growing on the rocks and, as mentioned above, it is highly unlikely that algae could contain significant amounts of brodifacoum. Intertidal areas are exposed to wave action, tides, and currents which would quickly remove any residual bait pellets that may enter the intertidal zone and would significantly reduce the risk that Opihi would consume any residual bait pellets. Further, proposed mitigation (below) is designed to prevent broadcast of pellets into intertidal or marine areas. Following the brodifacoum broadcast at Anacapa Island, California, toxicological monitoring of ocean water, fish, bivalves and shore crabs indicated that the rodenticide residues were not detectable in water or animal tissues and did not move into the nearshore ecosystem food chain (Howald *et al.* 2005).

Employees working with the rodenticide would be at limited risk to exposure since they would be certified pest applicators and would be required to follow handling instructions and take precautions to avoid exposure.

In summary, the probability of human exposure to the rodenticide is extremely small. Mitigations measures will be put in place to minimize risks for bait to drift into the marine ecosystem, the only reasonable pathway for exposure, although even without mitigation there is no likelihood that the rodenticide would move into the ecosystem in sufficient concentrations to be of concern. It would be very difficult for anyone to find and consume enough rodenticide to be of any toxicological consequence. In addition, toxic effects appear gradually and effective medical treatment, in the form of the antidote, (Vitamin K1), is readily available on Kaua'i.

Consequence of Exposure - The exposure to small amounts of brodifacoum is considered to be a very low risk to humans. There have been no reported human poisoning incidents with the field use of brodifacoum for the purpose of island rat eradication. It is extremely unlikely that a person could encounter enough of the rodenticide to suffer ill effects. Table 5 illustrates the large number of diphacinone or brodifacoum bait pellets an individual would have to seek out and eat in order to suffer potentially lethal bleeding.

Table 5.
Number of (2 gram) bait pellets for one LD50 exposure to humans for each rodenticide (a)

Age	*Weight (kg)*	*Brodifacoum*	*Diphacinone*
Adult	70	350	1610
Child	10	50	230

(a) LD50 defined as number of pellets required for a 50% chance of lethal hemorrhaging. LD50 assumed to be 0.25 mg/kg for brodifacoum and 2.3 mg/kg for diphacinone, based on LD50 data for the Norway rat.

Brodifacoum overexposure is treatable with the antidote Vitamin K1, a common and readily available vitamin. Delayed symptoms allow enough time for the antidote to be administered (Buckle 1994). Studies have documented that workers who produce and handle brodifacoum over a nine-month period did not show any signs of effects suggestive of significant exposure (ICI, in Taylor 1993).

Mitigation -- To avoid broadcasting bait pellets into the ocean, the helicopter would not distribute bait during high wind periods. Bait would be distributed in the dry summer season and would not be distributed when rain was forecast within the next 48 hours, to avoid rain washing pellets into the ocean before rats had a chance to consume them. In addition, the bait hopper used to aerially distribute pellets would be fitted with a deflector device that would cast the bait to only one side, thus allowing the pilot to fly near shorelines while distributing pellets only to the land side and away from the ocean. In order to minimize bouncing of pellets off of steep areas, small bait pellets (about 2.5 grams) would be used to minimize bounce and maximize the chance of pellets getting caught in vegetation and small cracks, and on irregularities in the rock. Pilots would also be instructed to fly inland from

the shoreline while distributing bait, creating a buffer zone around intertidal and marine areas. In shoreline areas, bait will be distributing bait by hand or in bait boxes to avoid getting pellets in the ocean.

Even though the risk to the public is very low, public concern over the issue of contaminated seafood is understandable and would be addressed by collecting and analyzing Opihi tissues collected around Lehua for rodenticide concentrations, following aerial application of rodenticides. Results would be made available to the public.

4.2.5.3 Native Plant Restoration

Native plant restoration poses little risk to health and human safety, if field crews are properly equipped and briefed. The plant restoration team members will be trained on any risks posed by working on isolated islets in steep terrain. Water, food, communication and shelter will be provided.

4.2.6 Introduction of Non-Native Species

4.2.6.1 Rabbit Eradication

The action of moving people, animals, and equipment and supplies onto Lehua presents inherent risks of introducing non-native weeds, insects, rodents and other vertebrates. Although the island has introduced insects (such as ants), plants and rats, the introduction of new species or individuals of the same species should be avoided at all possible costs to prevent the further degradation of the island ecosystem.

Mitigation -- Hunters would be required to comply with the Offshore Islet Restoration Committee recommendations for preventing the introduction of non-native species to the island (Appendix D).

As part of this program, a plan to respond to the discovery or reintroduction of non-native vertebrates, especially rodents and rabbits, would be implemented at the adoption of this environmental analysis.

4.2.6.2 Rat Eradication

The action of moving people, equipment and supplies onto Lehua presents inherent risks of introducing non-native weeds, insects, rodents and other vertebrates to the island. Although the island has introduced insects (such as ants), plants and rats, the introduction of new species or individuals of the same species should be avoided at all possible costs to prevent the further degradation of the island ecosystem.

Mitigation -- The USFWS and DOFAW would take all reasonable steps to avoid the introduction of non-native species. The compressed grain pellets would be evaluated to ensure that no active seeds are embedded into the baits, which would result in the introduction of weed species. The bait used for the broadcast application would contain only inactive or baked grains to ensure that no active seeds are accidentally introduced onto

the island. The bait application presents very little risk of weed seed introduction with basic mitigation and working cooperatively with the bait manufacturer.

The field crews and the equipment would also comply with the recommendations of the Offshore Islet Restoration Committee in Appendix D to ensure that non-native species are not inadvertently transported and introduced onto the island and respond to any such introductions should they happen.

4.2.6.3 Native Plant Restoration

The action of moving people, equipment and supplies onto Lehua presents inherent risks of introducing non-native weeds, insects, rodents and other vertebrates to the island. Although the island has introduced insects (such as ants), plants and rats, the introduction of new species or individuals of the same species should be avoided at all possible costs to prevent the further degradation of the island ecosystem. Plant restoration activities adds additional risks of introducing non-native weeds and insects in plant soils or attached to seedlings and seeds of native species brought over for planting.

Mitigation - Any plants and soil brought to Lehua from other islands in Hawai`i would be treated and inspected to ensure that they are devoid of any pathogens, invertebrates, or weed seeds. Whenever feasible, preference would be given to bringing seeds and not sprouted plants or seedlings in soil. Special care will be taken to inspect all packaging material for non-native species. The field crews and the equipment would comply with the recommendations of the Offshore Islet Restoration Committee in Appendix D to ensure that non-native species are not inadvertently transported and introduced onto the island and respond to any such introductions should they happen.

Alternative 3 - Rat Eradication with Brodifacoum, Rabbit Eradication, and Native Plant Restoration

The details of the environmental consequences of Alternative 3 are hereby incorporated by reference to the Draft EA issued in June 2005. The difference between Alternatives 2 and 3 is that Alternative 3 would use only brodifacoum for rat eradication and Alternative 2 will attempt to achieve rat eradication with diphacinone, a less toxic rodenticide. Under Alternative 2, brodifacoum will only be used if monitoring results indicate that diphacinone has not effectively removed rats. Hence, the potential effects of Alternative 3 can be inferred from reading the discussion of brodifacoum under Alternative 2. Rabbit removal and plant restoration methods and potential impacts are identical between Alternatives 2 and 3.

4.4 Cumulative Impacts

Cumulative impacts to the environment are those that result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

The issue of the potential risk to birds from cumulative ingestion of rodenticides applied in other areas of Hawai`i is discussed below. However, no significant cumulative impacts were identified for the proposed action and none are anticipated.

Risk of Cumulative Exposure of Lehua Birds to Other (Non-project) Sources of Rodenticides

Alternative 1: No Action Alternative

Under this alternative no management would occur. Because rodenticides would not be applied, cumulative rodenticide exposure is not an issue under this alternative.

Alternatives 2 and 3

Any bird that is exposed to the rodenticides on Lehua would not be exposed to rodenticides elsewhere on adjacent islands, or over time. The use of rodenticides on Lehua would be for a very short period and after the bait and rodenticide has degraded, there is very little likelihood that birds would receive a cumulative dose of rodenticide on an adjacent island. No broadcast use of rodenticides is actively occurring on nearby islands, nor is any such project involving rodenticide currently planned. Field applications of rodenticides in Hawai`i are limited to tamper-resistant bait stations, which greatly reduce the risk of bait exposure to birds and other non-target animals. Thus, birds would not likely receive a cumulatively toxic dose after any exposure on Lehua.

CHAPTER 5 – CONSULTATION AND COORDINATION

Public Involvement

The NEPA scoping process [40CFR 150.7] was used to determine the scope of the analysis and to identify potential issues and opportunities the proposed action presents. Following scoping, a Draft EA was issued and public comments were requested. Responses to these comments were incorporated into this document.

Internal Scoping

The USFWS and DOFAW have conducted site visits, and funded and conducted scientific studies that focus on the ecology and control of rats and rabbits on Lehua Island. The knowledge gained from these studies and site visits was used to formulate the proposed actions of the Draft EA.

External Scoping

The USFWS and DOFAW have made extensive efforts to inform and seek input from the general public and government regulatory agencies, regarding the need to restore Lehua Island (see Chapter 3, internal scoping and public involvement and external scoping). In addition, members of a non-profit conservation organization, Island Conservation, were consulted and helped prepare the Draft EA. A member of the New Zealand Department of Conservation conducted a site visit to Lehua Island and provided input into the development of plans for the eradication of rabbits and rats from the island.

In addition, the Offshore Islet Restoration Committee (OIRC) was consulted and provided extensive input to this document. In order to address the need for coordinated, statewide program for islet conservation, the OIRC was formed in September 2002. The OIRC is a multi-agency group dedicated to conducting biological surveys and restoration on selected offshore islets in Hawai`i. Members include the Hawai`i Department of Land and Natural Resources' Division of Forestry and Wildlife, the U.S. Fish and Wildlife Service, the U.S. Coast Guard, the U.S. Geological Survey's Biological Resources Division, Wildlife Services from the U.S. Department of Agriculture, National Tropical Botanical Garden, Bishop Museum, National Marine Fisheries Service, Pelea Pacifica, and the University of Hawai`i. The objectives of the OIRC are to:

- Complete baseline biological inventories on selected islets
- Collect and conserve genetic material from rare plant species
- Eradicate alien mammals on selected offshore islets
- Assess efficacy of experimental eradication techniques
- Eradicate or control invasive weeds
- Control soil erosion through re-vegetation
- Re-plant native vegetation, including rare species, on selected islets
- Monitor and scientifically document results of restoration actions
- Educate the public on islet biota and conservation needs

Draft EA Issued and Public Comments Received

Based on the input gathered during the scoping process described above, a Draft EA was prepared and issued for public comment on June 8, 2005. The Draft EA was posted on the Service's Pacific Islands Office website and a notice requesting comment was published in the State of Hawaii's Office of Environmental Quality Control Bulletin. Letters were also sent notifying interested parties of the availability of the Draft EA and requesting comments. A list of all the parties who were notified is included in the Final EA. The 30-day comment period closed on July 8, 2005. Four letters were received. One from The Nature Conservancy, and three from State of Hawaii agencies: the Historic Preservation Division, the Department of Health, and the Office of Environmental Quality Control. These letters and the response letters to them are included in this document as appendices. Responses to comments in those letters are incorporated in the Final EA in bold type.

List of Preparers of Final and Draft EAs

Island Conservation (IC)
IC is a non-profit conservation group made up of American, Mexican, and Canadian conservation biologists, educators, and public officials working to protect biological communities on Mexican, Californian, Hawai'ian, Alaskan, and Canadian islands.
Gregg Howald, Director, IC Northwest
Jacob Sheppard, Project Support Coordinator
Holly Jones, Restoration Biologist

Hawai'i Department of Land and Natural Resources, DOFAW
Scott Fretz, Wildlife Program Manager
Thomas Ka'iakapu, Kaua`i Wildlife Manager
David Leonard, Biologist

U.S. Fish and Wildlife Service
Chris Swenson, Pacific Islands Coastal Program Coordinator
Katie Swift, Invasive Species Program Biologist

List of Reviewers

Julie Concannon – USFWS
Earl Campbell – USFWS
Jeff Newman – USFWS
Craig Rowland – USFWS
Shannon Hebert – USDA
Jay Silberman – USCG
Dennis Mead – USCG

List of Recipients of Letters Requesting Comment on the Draft EA

Below is a list of all agencies, organizations, and individuals who were sent letters notifying them of the availability of the Draft EA and requesting their comments. Comment letters received and responses to theses letters are included as appendices.

Government

- Kaua`i County Mayor Bryan Baptiste
- State Representative Hermina Morita
- State Senator Gary Hooser
- Honorable Neal Abercrombie; United States Representative
- Honorable Edward Case; United States Representative
- Senator Daniel Inouye
- Senator Daniel Akaka
- Hawai`i Department of Agriculture
  - Pesticide Branch
- Office of Hawai`ian Affairs
  - Kaua`i/Ni`ihau Office
  - Honolulu Office
- Hawai`i Department of Health
  - Clean Water Branch
  - Environmental Planning Office
- State of Hawai`i Department of Business, Economic Development, and Tourism
  - Coastal Zone Management Program
- County of Kaua`i
  - Planning Department
- Pacific Missile Range Facility, Barking Sands
- US Department of Agriculture
  - Animal and Plant Health Inspection Service, Wildlife Services
- US Geological Survey
  - Biological Resources Division
- Kaua`i County Council
- Hawai`i Department of Land and Natural Resources
  - Division of Aquatic Resources
  - Division of State Parks
  - State Historic Preservation Office, Honolulu
  - State Historic Preservation Office, Kaua`i
- University of Hawai`i
  - Environmental Center
  - Zoology Department, Manoa Campus
  - Sea Grant Agent, Kaua`i
- National Oceanic and Atmospheric Administration Fisheries
  - Pacific Islands Regional Office
- Naval Facilities Engineering
  - Command Pacific Division
- US Environmental Protection Agency
  - Office of Pesticide Programs

Organizations, Individuals and Businesses

- Mr. Bruce Robinson
- Kaua`i Burial Council
- Animal Rights Hawai`i
- Living Oceans
- Earth Justice Legal Defense Fund
- Envirowatch
- Ducks Unlimited, Inc.
- Kaua`i Visitors Bureau

- Hawai`i Chapter of the Wildlife Society
- Holoholo Charters
- Hui Malama I Na Kupuna O Hawai`i Nei
- National Tropical Botanical Garden
- Hawai`i Audubon Society
- Hawai`i Conservation Alliance
- The Nature Conservancy of Hawai`i
- Kaua`i Hunting Association
- People for the Ethical Treatment of Animals (PETA)
- Environment Hawai`i
- Kahea
- Pacific Seabird Group
- Fund for Animals
- Kaua`i Invasive Species Committee
- American Bird Conservancy
- Waipa Community Foundation
- Kai Makana
- Conservation Council of Hawai`i
- National Wildlife Federation
- National Audubon Society
- Kilauea Point Natural History
- Kaua`i Public Land Trust
- Humane Society of the U.S.
- The Sierra Club
- The Wilderness Society

Comments Received during Scoping Process

Appendix C includes the seven letters received in response to the Notice of Intent for the Lehua Island Ecosystem Restoration Project.

Comments Received after Release of Draft EA

Appendix F includes the letters received in response to the Draft Environmental Assessment. Four comment letters on the Draft EA were received. Two of the letters did not have comments requiring response: the letter from the Hawaii DOH specified that it had "no comments" and the letter from the Nature Conservancy had only positive comments on the project. The other two letters, both from Hawaii State agencies, requested additional information.

Response to Letters Commenting on the Draft EA

Comments received on the Draft EA are addressed in the response letters (Appendix G) and in the body of this document (in bold type).

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APPENDIX A. LEHUA ISLAND SPECIES LISTS

Table 6. Comparative Checklist of Vascular Plants on Lehua (adapted from Wood *et al.* 2004).

Symbols: End=Endemic Ind=Indigenous Nat=Naturalized V=Vulnerable P=Present on Lehua H=Historical [no longer present]

	Family	Species	Status	Presence
Angiosperms – Dicots	Aizoaceae	*Sesuvium portulacastrum*	Ind	P
	Asclepiadaceae	*Asclepias curassavica*	Nat	P
	Asteraceae	*Ageratum conyzoides*	Nat	P
		Artemisia australis	End	P
		Cirsium vulgare	Nat	P
		Conyza bonariensis	Nat	P
		Gamochaeta purpurea	Nat	P
		Pluchea carolinensis	Nat	P
		Pluchea indica	Nat	P
	Portulacaceae	*Portulaca oleracea*	Nat	P
		Portulaca pilosa	Nat	P
		Portulaca villosa	End, V	H
	Primulaceae	*Anagallis arvensis*	Nat	P
	Goodeniaceae	*Scaevola sericea*	Ind	P
	Solanaceae	*Solanum americanum*	Ind	P
	Sterculiaceae	*Waltheria indica*	Ind	P
	Urticaceae	*Pilea peploides*	Ind	P
	Verbenaceae	*Pluchea xfosbergii*	Nat	P
		Sonchus oleraceus	Nat	P
		Verbesina encelioides	Nat	P
		Xanthium strumarium	Nat	P
	Boraginaceae	*Heliotropium anomalum* var. *argenteum*	End	H
		Heliotropium curassavicum	Ind	P
	Cactaceae	*Opuntia ficus-indica*	Nat	H
	Chenopodiaceae	*Chenopodium murale* L.	Nat	P
	Convolvulaceae	*Ipomoea pes-caprae* subsp. *Brasiliensis*	Ind	H
		Jacquemontia ovalifolia subsp. *Sandwicensis*	Ind	P
	Cucurbitaceae	*Sicyos maximowiczii*	End	H
	Euphorbiaceae	*Chamaesyce hirta*	Nat	P
	Fabaceae	*Prosopis pallida*	Nat	P
		Lantana camara	Nat	H
	Zygophyllaceae	*Tribulus cistoides*	Ind	P
Angiosperms – Monocots	Cyperaceae	*Cyperus javanicus*	Ind	P
		Cyperus polystachyos	Ind	H
		Fimbristylis cymosa subsp. *umbellato-capitata*	Ind	P
	Poaceae	*Cenchrus ciliaris*	Nat	P
		Cenchrus echinatus	Nat	P

	Family	Species	Status	Presence
		Chloris radiate	Nat	P
	[Poaceae]	*Chloris virgata* Sw.	Nat	P
		Digitaria ciliaris	Nat	P
		Digitaria insularis	Nat	P
		Eragrostis amabilis	Nat	P
		Eragrostis variabilis	End	P
	Malvaceae	*Abutilon grandifolium*	Nat	P
		Sida fallax	Ind	P
	Nyctaginaceae	*Boerhavia repens*	Ind	P
	Oxalidaceae	*Oxalis corniculata* L.	Ind	P
	Papaveraceae	*Argemone glauca* var. *glauca*	End	P
		Heteropogon contortus	Ind	P
		Lepturus repens	Ind	P
		Panicum fauriei var. *latius*	End	P
		Panicum pellitum	End	P
		Panicum torridum	End	P
		Setaria verticillata	Nat	P
Pteridophytes	Dryopteridaceae	*Nephrolepis multiflora*	Nat	P
	Pteridaceae	*Doryopteris decipiens*	End	P

Table 7. **Preliminary Checklist of Lehua's Marine Algae** (adapted from Wood *et al.* 2004).

Order	Family	Species
Cyanophyta	Oscillatoriaceae	*Lyngbya majuscule*
		Lyngbya semiplena
Chlorophyta	Anadyomenaceae	*Microdictyon setchellianum*
	Caulerpaceae	*Caulerpa racemosa* var. *peltata*
	Cladophoraceae	*Cladophora laetevirens*
	Codiaceae	*Codium edule*
	Dasycladaceae	*Neomeris vanbosseae*
Phaeophyta	Chordariaceae	*Chonospora minima*
		Hydroclathrus clathratus
	Dictyotaceae	*Dictyota bartayresiana*
		Dictyota sandvicensis
		Lobophora variegate
		Padina sanctae-crucis
		Padina sp.
	Sargassaceae	*Sargassum echinocarpim*
		Turbinaria ornate
	Scytosiphonaceae	*Colpomenia sinuosa*
	Scytothamnaceae	*Asteronema breviarticulatum*
	Sphacelariaceae	*Sphacelaria tribuloides*
Rhodophyta	Bonnemaisoniaceae	*Asparagopsis taxiformis*
		Falkenbergia hillebrandii
	Ceramiaceae	*Aglaothamnion boergesenii*
		Antithamnion antillanum
		Ceramium fimbriatum
		Ceramium flaccidum
		Griffithsia subcylindrica
		Gymnothamnion elegans
	Champiaceae	*Champia parvula*
	Corallinaceae	*Amphiroa rigida*
		Jania sp.
	Dasyaceae	*Dasya iridescens*
		Dasya murrayana
	Faucheaceae	*Halichrysis coalescens*
	Gelidiellaceae	*Gelidiella machristiana*
	Phyllophoraceae	*Ahnfeltiopsis concinna*
	Plocamiaceae	*Plocamium sandvicense*
	Rhodomelaceae	*Amansia glomerata*
		Herposiphonia variabilis
		Laurencia sp.
	Rhodymeniaceae	*Botryocladia skottsbergii*
		Chrysymenia sp.

Table 8. Preliminary Checklist of Lehua's Terrestrial Arthropoda (adapted from Wood *et al.* 2004).

Symbols: End=Endemic Ind=Indigenous Adv=Adventitious Unk=Unknown

Order: Family	Species	Common Name	Status
Araneae: Clubionidae	*Chiracanthium mordax*		Adv
Araneae: Lycosidae	*Lycos sp.*	Lycosid spider	End
Blattodea: Blattellidae	*Simploce pallens*		Adv
Collembola: Entomobryidae	*Entomobrya marginata*		Adv
Collembola: Caribidae	*Aephinidius opaculus*		Adv
Collembola: Caribidae	*Gnathaphanus picipes*		Adv
Collembola: Coccinellidae	*Cryptolamus montrouzier*		Adv
Collembola: Chrysomelidae	*Systena blanda*		Adv
Coleoptera: Curculionidae	*Hypurus bertrandi*		Adv
Coleoptera: Dermestidae	*Dermestes frischi*	carnivorous beetle	Adv
Coleoptera: Dytiscidae	*Rhantus psuedopacificus*		End
Coleoptera: Phalacridae	*Phalacrus sp.*		Adv
Coleoptera: Scarabeidae	*Adoretus sinicus*		Adv
Coleoptera: Scarabeidae	*Aphodius lividus*		Adv
Coleoptera: Scarabeidae	*Protaetia fusca*	pollen beetle	Adv
Coleoptera: Tenebrionidae	*Gonocephalum adpressiforme*		Adv
Dermaptera: Carcinophoridae	*Euborellia eteronoma*		Adv
Diptera: Chloropidae	*Siphunculina striolata*		Adv
Diptera: Ephydridae	*Hecamede granifera*	shore fly	Adv
Diptera: Ephydridae	*Ephydra gracilis*	shore fly	Ind
Diptera: Ephydridae	*Scatella sexnotata*	shore fly	End
Diptera: Dolichopodidae	*Hydrophorus pacificus*	long-legged fly	End
Diptera: Canacidae	*Canaceoides hawaiiensis*	beach fly	Adv
Diptera: Canacidae	*Canaceoides angulatus*	beach fly	Unk
Diptera: Canacidae	*Canaceoides sp.*	beach fly	Adv
Heteroptera: Anthocoridae	*Orius sp.*		Adv
Heteroptera: Lygaeidae	*Graptostethus manillensis*		End
Heteroptera: Lygaeidae	*Nysius kinbergi*	seed bug	Adv
Heteroptera: Nabidae	*Nabis capisiformis*		Adv
Homoptera: Cicadellidae	*Acinopterus angulatus*		Unk
Homoptera: Cicadellidae	*Balclutha sp.*		Adv
Homoptera: Delphacidae	*Perkinsiella saccharicida*		Adv
Homoptera: Membracidae	*Vanduzeea segmentata*		Adv
Hymoneptera: Braconidae	*Chelonus blackburni*		End
Hymenoptera: Colletidae	*Hylaeus flavifrons*	yellow-faced bee	Adv
Hymenoptera: Vespidae	*Pachyodynerus nasidens*	potter wasp	Adv
Hymenoptera: Formicidae	*Camponotus variegatus*		Adv
Hymenoptera: Formicidae	*Ochetellus glaber*		Adv
Hymenoptera: Formicidae	*Pheidole megacephala*	big headed ant	Adv
Hymenoptera: Formicidae	*Tetramorium simillimum*		End
Lepidoptera: Carmbidae	*Omiodes localis*		Adv
Lepidoptera: Crambidae	*Salbia haemorrhoidalis*		Adv
Lepidoptera: Crambidae	*Spoladea recurvalis*		End
Lepidoptera: Crambidae	*Tamsica floricolens*		Adv
Lepidoptera: Gelechiidae	*Dichomeris acuminata*		

Lepidoptera: Geometridae	*Anacamptodes fragilaria*		Adv
Lepidoptera: Lycaenidae	*Lampides boeticus*		Adv
Lepidoptera: Noctuiidae	*Amyna natalis*		Adv
Lepidoptera: Noctuiidae	*Eublemma accedens*		Adv
Lepidoptera: Noctuiidae	*Heliothis virescens*		Adv
Lepidoptera: Oecophoridae	*Thyrocopa sp.*		End
Lepidoptera: Olethreutidae	*Crocidosema sp.*		End
Lepidoptera: Sphingidae	*Hipotion rosetta*		Adv
Mantodea: Mantidae	*Heirodula patellifera*	mantis	Adv
Orthoptera: Acrididae	*Schistocerca nitens*	grasshopper	Adv
Orthoptera: Gryllidae	*Gryllodes signallatus*	grasshopper	Adv
Orthoptera: Gryllidae	*Caconemobius sp.*		End
Othroptera: Gryllidae	*Trigonidomorpha sjostedti*		Adv
Orthoptera: Tettigoniidae	*Conocephalus saltator*		Adv
Orhtoptera: Tettigoniidae	*Euconocephalus nasutus*		Adv

Table 9. Checklist of bird species on Lehua (from VanderWerf et al *in prep.*).

Symbols:
End=Endemic
Ind=Indigenous
WV=Winter visitor
A=Alien
SoC=Species of Concern
T=Threatened
E=Endangered
C=Critically endangered
P=Present on Lehua
H=Historical [no longer present]

Species	Status	Presence
Black-footed Albatross (*Phoebastria nigripes*)	Ind, SoC	P
Laysan Albatross (*Phoebastria immutabilis*)	Ind, SoC	P
Wedge-tailed shearwater (*Puffinus pacificus*)	Ind	P
Christmas Shearwater (*Puffinus nativitatus*)	Ind, SoC	P
Newell's Shearwater (*Puffinus auricularis newelli*)	End, T	P
Bulwer's Petrel (*Bulweria bulwerii*)	Ind	P
Band-rumped Storm-petrel (*Oceanodroma castro*)	Ind, C	P
Red-tailed Tropicbird (*Phaethon rubricauda*)	Ind	P
White-tailed Tropicbird (*Phaethon lepturus*)	Ind	H
Masked Booby (*Sula dactylatra*)	Ind	H
Brown Booby (*Sula leucogaster*)	Ind	P
Red-footed Booby (*Sula sula*)	Ind	P
Great Frigatebird (*Fregata minor*)	Ind	P
Cattle Egret (*Bubulcus ibis*)	A	P
Peregrine Falcon (*Falco peregrinus*)	WV, SoC	P
Hawai'ian Petrel (*Pterodroma sandwichensis*)	End, E	P
Pacific Golden-plover (*Pluvialis fulva*)	WV, SoC	P
Wandering Tattler (*Heteroscelus incanus*)	WV	P
Ruddy Turnstone (*Arenaria interpres*)	WV	P
Glaucous-winged Gull (*Larus glaucescens*)	WV	P
Gray-backed Tern (*Sterna lunata*)	Ind	P
Sooty Tern (*Sterna fuscata*)	Ind	P
Brown Noddy (*Anous stolidus*)	Ind	P
Hawai'ian Black Noddy (*Anous minutus melanogenys*)	End	P
Rock Dove (*Columba livia*)	A	P
Zebra Dove (*Geopelia striata*)	A	P
Sky Lark (*Alauda arvensis*)	A	H
Northern Cardinal (*Cardinalis cardinalis*)	A	H
House Finch (*Carpodacus mexicanus*)	A	P
Nutmeg Mannikin (*Lonchura punctulata*)	A	P
House Sparrow (*Passer domesticus*)	A	H

Table 10. Breeding phenology of bird species on Lehua (Adapted from Wood *et al.* 2004).

Dashed lines indicate eggs and solid line indicates chicks. Extent of each stage of the breeding cycle was extrapolated from survey dates based on incubation and fledging periods in other areas. Additional species suspected to nest on Lehua but for which there is insufficient information to determine breeding phenology include Christmas Shearwater, Newell's Shearwater, Hawai'ian Petrel, and Band-rumped Storm-petrel.

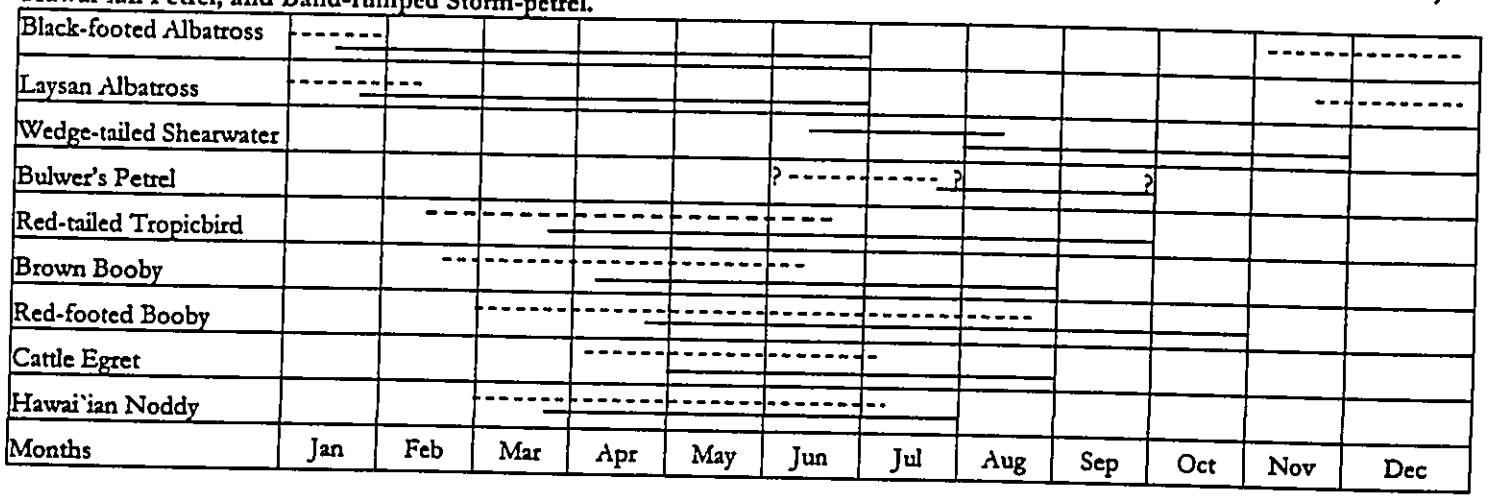


Table 11. Preliminary checklist of Lehua nearshore fishes (USFWS unpubl. data 2004).
Symbols: End=Endemic Ind=Indigenous A=Alien

Common Name	Species	Status
Orangespine Unicornfish	*Naso literatus*	Ind
Convict Tang	*A. triostegus*	End subspecies
Whitebar Surgeonfish	*A. leucopareius*	Ind
Orangeband Surgeonfish	*A. olivaceous*	Ind
Achilles Tang	*A. Achilles*	Ind
Ringtail Surgeonfish	*A. blochii*	Ind
Eyestripe Surgeonfish	*A. dussumieri*	Ind
Lagoon Triggerfish	*Rhinecanthus aculeatus*	Ind
Reef Triggerfish	*R. rectangulus*	Ind
Black Durgon	*Melichthys niger*	Ind
Pinktail Durgon	*M. vidua*	Ind
Gray Chub	*Kyphosus biggibus*	Ind
Highfin Chub	*K. cinerascens*	Ind
Bigeye Emperor	*Monotaxis grandoculis*	Ind
Yellowstriped Coris	*Coris flavovittata*	End
Blacktail Wrasse	*Hinalea lauhine*	End
Christmas Wrasse	*Thalassoma lauhine*	Ind
Saddle Wrasse	*T. duperrey*	End
Hawai`ian Hogfish	*Bodianus bilunulatus*	Ind
Moorish Idol	*Zanclus cornutus*	Ind
Ornate Butterflyfish	*Chaetodon ornatissimus*	Ind
Longnose Butterflyfish	*Forcipiger longirostris*	Ind
Cornetfish	*Fistularia commersonnii*	Ind
Manybar Goatfish	*Parupeneus multifasciatus*	Ind
Blue Goatfish	*P. cyclostomus*	Ind
Yellowstripe Goatfish	*Mulloidichthys flavolineatus*	Ind
Yellowfin Goatfish	*M. vanicolensis*	Ind
Manta Ray	*Manta birostris*	Ind
Gray Reef Shark	*Carcharhinus ambbyrynchos*	Ind
Blackspot Sergeant	*Abudefduf sordidus*	Ind
Bluefin Trevally	*Carynx melampygus*	Ind
Smalltooth Jobfish	*Aphareus furca*	Ind
Bluestripe Snapper	*Lutjanus kasmira*	A
Hawai`ian Flagtail	*Kuhlia sandvicensis*	End
Parrotfish spp.	*Family Scaridae*	Ind or End

APPENDIX B. EXTERNAL SCOPING LETTER

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850

TAKE PRIDE IN AMERICA

MAY 21 2004

Dear Interested Party:

Subject: *Lehua Island Ecosystem Restoration Project*

The U.S. Fish and Wildlife Service (Service) and the Hawaii Department of Land and Natural Resources (DLNR) are proposing an ecosystem restoration project on Lehua Island, Kauai County. Lehua is an uninhabited, 277-acre island just north of Niihau and approximately 20 miles west of Kauai. It is a Hawaii State Seabird Sanctuary and is home to at least 11 species of seabirds, as well as monk seals, native coastal plants and insects. The proposed project would eradicate non-native rats and rabbits in order to restore native seabirds, plants and other wildlife on Lehua. Native plants may also be re-introduced to Lehua in the future.

The Service and DLNR are beginning the preparation of a joint environmental document (either a Draft Environmental Assessment or Draft Environmental Impact Statement) to address the impacts of eradicating rats and rabbits from Lehua Island, implementing a prevention program to avoid accidental rodent introductions, and maintaining the ability to respond to any re-introduction of rodents to Lehua Island.

As part of the scoping process, we are requesting written comments regarding the proposed action from interested individuals, organizations, and agencies. Respondents should address concerns regarding potential environmental impacts, applicable mitigation, and reasonable alternatives that could be included in the environmental analysis. Your response will help us determine important issues that will be addressed in the joint environmental document. Please send or fax written comments to:

Chris Swenson, Project Biologist
U.S. Fish and Wildlife Service
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850
facsimile: 808/792-9580

In order to use your comments in this scoping process, they must be **postmarked by June 23, 2004.**

You are also invited to attend a public meeting on this project. The meeting will take place on June 9, 2004, from 7:00 – 9:00 pm at the Lihue Neighborhood Center, located on 3353 Eono Street in Lihue, Kauai. We will give a brief presentation on the proposed project and the rest of

the time you are invited to give us your ideas on issues, concerns, and alternatives you would like us to address when we prepare the joint environmental analysis.

Background Information on the Lehua Island Ecosystem Restoration Project

Hawaii's offshore islands are important for many native plants and animals, and for the conservation of biodiversity. Many coastal species that can no longer survive on Hawaii's main islands have found a safe haven on small offshore islets like Lehua. These islands are especially important for seabirds and marine mammals that spend the majority of time at sea, but rely on islands for a place to breed and rest. Unfortunately, our islands are losing many of their native birds, plants and insects due to the introduction and establishment of alien species such as rats, rabbits and weeds. In fact, the majority of extinctions on islands throughout the world have been caused by introduced or non-native species. However, there is an opportunity to restore Lehua Island by eradicating non-native species and allowing native species to recover.

Seventeen species of seabirds have historically been recorded from Lehua. Currently, at least eleven seabird species are present, including nesting Laysan and Black-Footed Albatross, and Newell's Shearwaters, a species listed as threatened under the Endangered Species Act of 1973. Lehua, a designated State seabird sanctuary, is also home to monk seals, native coastal plants and insects. However, non-native rats are present on the island. Rats impact seabirds through predation and are known to have eliminated many seabird species from islands around the world. They also feed on native plants and insects and can suppress or eliminate many of these species as well. In addition, non-native rabbits were introduced to Lehua during or before the 1930s. On many islands, rabbits have decimated the vegetation and even competed with seabirds for use of burrows. After conducting biological surveys of Lehua and a careful examination of known impacts of rats and rabbits on island ecosystems, Service and DLNR biologists, in consultation with other experts, have concluded that the proposed eradication of rodents and rabbits is a prudent management action. Successful eradication would allow re-colonization and restoration of several species of plants and seabirds on Lehua. Following the proposed eradication, there could still be a threat of re-introduction of non-native mammals from grounded vessels and transport of people and materials to the island. Service and DLNR wildlife managers are proposing to develop the capability to respond rapidly to any such introductions.

Options for conducting the eradication effort may include the following methods or a combination of these methods: aerial broadcast of bait pellets containing rodenticides, hand broadcast of rodenticide pellets and/or placing rodenticides in bait stations for rat eradication; and shooting and/or trapping for rabbit eradication. These methods are being considered because they have been shown to be successful on many other islands. Eradications would be followed by monitoring the success of the removal actions and the response of native biota to alien species removal.

Lehua Island is an isolated, rugged and uninhabited island. It is managed as the site of an unmanned, U.S. Coast Guard navigational beacon and as a wildlife sanctuary. Public access is restricted except with special permits and hunting is not permitted on the island. Water on the

island is scarce, generally tainted with bird guano and is not used by humans for drinking. The lack of potable water is probably one of the main reasons that there were no known permanent settlements on the island.

Archaeologists from DLNR's State Parks Division recently visited Lehua to identify and map culturally significant sites. They identified stone platforms and other smaller sites but did not find signs of permanent habitation. Their findings and recommendations, along with those of other relevant agencies and organizations, will be used to help plan habitat restoration actions and avoid any impacts to cultural sites.

If you have specific questions about this project please contact Project Biologists Chris Swenson or Katie Swift in this office at (808) 792-9400. You can also contact Thomas Kaiakapu of the Hawaii Department of Land and Natural Resources' Division of Forestry and Wildlife at (808) 274-3433. Thank you for your interest and participation in the management of Lehua Island.

Sincerely,

Jeff M. Newman
Acting Field Supervisor

APPENDIX C. RESPONSES TO SCOPING LETTER

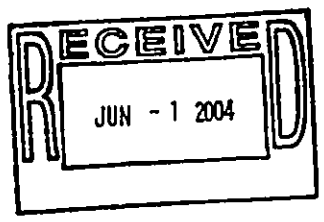
5-24-04

Dear Mr. Stevenson,

About a week ago I bought a wonderful book at the Ranger Station on Haleakalā: Isles of Refuge by Mark Rauzon. I learned so much! I wish to respond to Mr Jan TenBruggencate's column in today's "Honolulu's Advertiser" about eradication plans for rats and rabbits on the Northwestern Hawaiian Islands: get rid of the rats and rabbits by any means to restore the habitats for the seabirds, shorebirds and landbirds of those islands as well as turtles and monkseals. We humans, through ignorance or out of greed, have destroyed vast areas of this planet already;

it's good to see that there are groups that care enough about the few remaining places to try and preserve and restore them. I participate for years already in the Coastal cleanups sponsored by the California Coastal Commission and take along a group of High School students and neighbors and friends to help also. - Again, please, get rid of the rats and the rabbits on the Northwestern Hawaiian Islands, all of them, not just Lehua.
Thank you for your efforts. Wishing you and likeminded groups the ultimate success.
Me ke Aloha Margret Lobfeld of Los Angeles

MAY-29-1992 04:00 PM ANIMAL RIGHTS HAWAII 808 944 2545 P.01



From: Cheryl I. Chung
45-814 Anoi Place
Kaneohe, Hawaii
96744-3401

29 May, 2004

Attention: Chris Swenson
Project Biologist
U.S. Fish and Wildlife Service
300 Ala Moana Boulevard, Room 3-122
Honolulu, HI 96850,
Facsimile:(808) 792-9580

Dear Mr. Swenson,

I am not an expert on the matter of ethics or animal management, but I & my family do not understand why innocent rabbits or rats have to be exterminated because they are eating vegetation on the Island of Lehua We do not choose to punish our rabbit thusly because we haven't figured out how to minimize his effect on our yard without hurting him.

Please consider other more compassionate solutions which you have at your disposal. How many of each species are presently on the island?

These innocent animals were introduced to this island by humans. & did not choose to be there. They are social beings, feel pain & should have as much right to life & freedom as humans. If they are starving, maybe they could be relocated, or a garden planted just for them, & then this island used as a demonstration project in human compassion.

Why is killing the first solution to everything? Both of these species of animals are sold as pets. We do not see any animal species having more right to live than another (by being classified as indigenous) since we are all visitors on this planet!

Thank you for listening to our feelings about this issue. We would appreciate a reply. I am a 38-year resident of Oahu. And Kauai (including nearby environs) is my family's favorite haven to visit.

Sincerely,
Cheryl I. Chung & family
(808) 235-5132

Received May-28-04 04:13pm From-808 944 2545 To-US FISH WILDLIFE SER Page 001

Chris Swenson
Project Biologist
U S. Fish and Wildlife Service
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850

June 4, 2004

Comments on Lehua Island Ecosystem Restoration Project

Aloha,

We are supportive of this effort to remove non-native mammals (rats & rabbits) from Lehua Island. We have witnessed first hand the rewards to Hawaiian wildlife from similar efforts on Midway Atoll and elsewhere One species we had the joy of watching recover was the rare Bonin Petrel (*Pterodroma hypoleuca*). Once virtually extirpated on Midway by rats which ate the chicks, eggs, and adult birds, the Bonin Petrel has recovered dramatically after the removal of rats in 1997. We hope the blue-gray noddy (*Procelsterna cerulea saxatilis*) and other native Hawaiian organisms on the island of Lehua will get a similar opportunity.

Forest & Kim Starr
3572 Baldwin Ave.
Makawao, HI 96768

Chris Swenson
Project Biologist,
U.S. Fish and Wildlife Service
300 Ala Moana Boulevard
Room 3-122,
Honolulu, Hawaii 96850,

June 18, 2004

Dear Sir:
I fully support the proposed Lehua small mammal eradication efforts in order to conserve seabirds and their habitat. Rats and rabbits are notorious for their depredations on individual bird chicks, eggs and plants that hold the ground in place. As you may know, rabbits have deciminated bird resources at Laysan, Lisianski, Pearl and Hermes Islands, and of course Manana (aka Rabbit Island). Wind-blown sand results from rabbit grazing, and the loss of habitat and biodiversity is the long-term effect.

The severe slopes of Lehua need the removal of erosion causing digging and grazing by introduced mammals. The scouring rains have taken a toll on the loose volcanic soils that have further eroded seabird habitat. We believe that with eradication of rodents and lagomorphs, Lehua will become an important seabird colony on par with Moku Manu, a State seabird sanctuary off Oahu.

The recent sighting in May 2004 of a Blue Noddy (*Procelsterna cerula*) off Niihau, where they have not been seen breeding since around 1923, suggests they may be prospecting nesting sites, These smallest of terns are extremely susceptible to rodent depredation. The elimination of rats from Lehua will make this island a potential and only nesting site for them in the main Hawaiian Islands.

Island restoration as best management practice is spreading throughout the World, and in Hawaii, especially the offshore islands. Do not turn back to an emotion-based vision of the nature a la Disney. I urge you to consider the entire island ecosystem for these introduced predators; their effect on seeds, seedlings, erosion, insects, rare and endangered plants, seabirds and even coral reef sedimentation is pernicious.

Lehua Island needs and deserves the efforts outlined in this project. However, I recommend this project only go forward if full eradication is the goal. Control efforts that do not target the entire population of rodents and rabbits will only serve to stimulate their populations and that can have greater impacts on seabirds than a stable predator population.

Sincerely,

Mark Rauzon
Marine Endeavours
4701 Edgewood Ave.
Oakland, CA 94602

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

July 2, 2004

Chris Swenson
U.S. Fish and Wildlife Service
Room 3-112
300 Ala Moana Boulevard
Honolulu, Hawaii 96850

Dear Mr. Swenson:

The Environmental Protection Agency (EPA) has reviewed the Notice of Intent to prepare an environmental document for the **Lehua Island Ecosystem Restoration Project**, Kauai County, Hawaii. Our review is pursuant to the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508), and Section 309 of the Clean Air Act.

EPA has no formal comments on the Notice of Intent at this time. When the draft environmental document is released for public comment, please send two copies to the address above (mail code: CMD-2). If you have any questions, I can be reached at (415) 972-3792 or schmidt.davidp@epa.gov.

Sincerely,

David P. Schmidt
Federal Activities Office
Cross Media Division

Printed on Recycled Paper

RARE AND DEAR INC 808 332 5831 06/23 '04 16:57 NO.426 01/01

To: Chris Swenson
U.S. Fish and Wildlife Service
300 Ala Moana Blvd, #3-122
Box 50088
Honolulu, HI 96850
Fax 808 792 9580

Dear Sirs:

Thank you for your presentation in Lihue on June 9, 2004. I heartily support the proposed Lehua small mammal eradication efforts in order to conserve seabirds and their habitat.

I am a bird identification guide who frequently takes guests out near Lehua (mooring between Lehua and Ni'ihau) who have an interest in birds, wildlife, and natural history. These trips are gaining renown for the diversity of birds and wildlife seen, as we cross deep water and on/near Lehua. Successful eradication of mammals on Lehua will enhance the likelihood of this being the premier pelagic seabird and mammal trip in the Islands.

I consider it noteworthy that Lehua is unique in that the island and its seabirds are actually well-observable by the general public, without any harm to, or interruption of, the wildlife there. The public education value of your success on Lehua I feel will enhance further efforts to restore and conserve other seabird habitat in Hawaii.

I keep records of birds and other wildlife seen on these trips (available on request). Here is an example of the potential of a restored Lehua: In May 2004 I observed three Blue Noddy (Procelsterna cerula) off Nihau/Lehua where they have not been known to breed since around 1923. This is the only sighting, to my knowledge, of this species in the main islands in recent decades. These smallest of terns are extremely susceptible to rodent depredation. The elimination of rats from Lehua will make this island a potential nesting site for them in the main Hawaiian Islands.

Mahalo, and Best of Luck,

David Kuhn
Terran Tours
dkuhn99@hotmail.com
dkuhn@rare-dear.com
PO Box 1018
Waimea, Kauai, HI 96796
808 335 0398

Pacific Seabird Group

DEDICATED TO THE STUDY AND CONSERVATION OF PACIFIC SEABIRDS AND THEIR ENVIRONMENT

Daniel Roby, Ph.D.
Chair
104 Nash Hall
Oregon State University
Corvallis, Oregon 97331-3803
541-737-1955
Daniel.Roby@orst.edu

Craig S. Harrison
Vice Chair for Conservation
4953 Sonoma Mountain Road
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Robert H. Day, Ph.D
Chair-Elect
ABR, Inc.--Environmental Research & Services
P.O. Box 80410
Fairbanks, AK 99708-0410
907-455-6777
bday@abrinc.com

2 July 2004

Chris Swenson
Project Biologist
U.S. Fish and Wildlife Service
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850

RE: Proposal to Eradicate Small Mammal from Lehua Island, Hawaii

Dear Mr. Swenson:

On behalf of the Pacific Seabird Group (PSG), we offer the following comments on the scoping notice for the eradication of introduced small mammals on Lehua Island, Hawaii. PSG is an international, non-profit organization that was founded in 1972 to promote knowledge, study, and conservation of Pacific seabirds with a membership drawn from the entire Pacific basin, including Canada, Mexico, Russia, Japan, China, Australia, New Zealand, and the USA. Among PSG's members are biologists who have research interests in Pacific seabirds, government officials who manage seabird refuges and populations, and individuals who are interested in marine conservation. Collectively, our knowledge about seabirds and the effects of predation on them is considerable. We have hosted special symposia on this topic and have supported eradication efforts in Alaska, California, Mexico, and Hawaii in the past.

PSG strongly supports the proposed Lehua small-mammal eradication efforts to aid in the conservation of seabirds and their habitat. Rats are notorious for their depredations on bird chicks and eggs as well as adults of the smaller species, whereas rabbits consume the plants that provide structure to the soil. The introduction of rats on Midway during 1943 decreased seabird populations there and caused the extinction of the Laysan rail (Fisher, H. I. and P. H. Baldwin, 1946, War and the Birds of Midway Atoll, Condor 48:1-15). On a more positive note, the successful eradication of rats on Midway in the 1990s has had positive impacts on small nesting seabirds such as Bonin petrels and storm-petrels. The introduction of two species of rabbits on Laysan Island in 1903 led to the eradication of much of the native vegetation and the extinction

of many birds (Harrison, C. S., 1990, Seabirds of Hawaii: Natural History and Conservation, Cornell University Press; Rauzon, M. J., 2001, Isles of Refuge: Wildlife and History of the Northwestern Hawaiian Islands, University of Hawaii Press). We commend you for focusing on removing rats and other introduced mammals from islands offshore of the Main Hawaiian Islands. Restoring the Lehua Island ecosystem by removing introduced rats and rabbits can be very cost effective and will pay huge dividends for seabirds, endangered plants, and other creatures. For example, small and vulnerable seabird species such as blue-gray noddies, Harcourt's storm-petrels, sooty storm-petrels, and Bulwer's petrels will almost immediately benefit from the eradication of rats on Lehua. The elimination of rabbits there will benefit all species that need vegetation for nesting, shade, or the stabilization of soil for burrows. Hence the restoration of Lehua will likely allow many species to reclaim their former ranges.

USFWS' Regional Marine Bird Policy for two decades has stated that its policy is to "remove all introduced predators from marine bird colonies on all National Wildlife Refuges and encourage their removal from all other colonies" as well as to "utilize all available programs and divisions of the Fish and Wildlife Service" to maintain all marine birds "in their natural diversity and on native habitat throughout their range" on all non-Service lands (November 15, 1985). The proposed rat- and rabbit-removal project furthers that venerated policy.

PSG approves of the use of all of the techniques suggested in the notice, including the use of rodenticides. We recently have supported and encouraged similar rodenticide-based projects on Anacapa Island, California, and in the Aleutian Islands, Alaska. Although PSG recognizes that the elimination of alien predators that devastate natural communities of plants and animals and that drive some species to extinction sometimes is controversial, we have supported USFWS and other agencies in the past when groups that are ignorant about wildlife management attempt to thwart projects such as this, sometimes by force of litigation. PSG will gladly lend its name and expertise to joint press releases concerning this project to help educate anyone who may be initially opposed to this project.

Finally, we believe that the goals of this project must be full eradication. In our considerable experience, we have learned that half-measures are inefficient and simply are a waste of funds. Several members of our organization are world experts on rat and rabbit eradication ,and we will make them available if you need additional input.

Sincerely,

Craig S Harrison

Craig S. Harrison
Vice Chair for Conservation

APPENDIX D. LEHUA ISLAND ALIEN SPECIES PREVENTION PLAN

Lehua Island Alien Species Prevention Plan
October 2004

All human activities on Lehua Island have the potential to introduce new alien species. Every precaution should be taken to insure that human activities do not inadvertently result in the introduction of new, unwanted species. New alien introductions must be avoided to protect native species on Lehua and to avoid having to repeat costly and time-consuming eradication and control operations. The following precautions should be taken when visiting Lehua:

1. All soft gear, clothes, footwear, food and other supplies should be carefully inspected for seeds, insects, and rodents before bringing it onto Lehua. When possible, dedicate field gear for Lehua use only.

2. Foods with viable seeds, such as tomatoes, should not be brought onto Lehua.

3. Native plants brought to islets for restoration purposes must be weed and insect free. Plants in soil are especially risky. Seeds should also be inspected for attached and boring insects and eggs.

4. When helicopter slingloads are brought to Lehua, be careful to avoid contamination of the cargo net and its contents with seeds and insects while it's being loaded at the heliport. It is especially easy for ants to be transported this way. Slingloads should also be inspected for rodents prior to take-off.

5. Weed monitoring transects should be set up at landing and camping sites on Lehua. These transects should be inspected for new weeds every time the islet is visited.

6. Likewise, periodic rodent surveys should be conducted using snap traps, tracking stations, gnaw sticks, or other reliable indicators of rodent activity. Annual surveys during the wet season would be ideal.

7. Eaton's diphacinone bait blocks, a commonly used rodenticide, contains viable weed seeds and should not be used on Lehua.

8. Rodent introductions can also result from vessel groundings at or near Lehua. In the event of a vessel grounding, rodent monitoring on the vessel and Lehua should be initiated as soon as possible. If it is possible to reach the site soon after the grounding occurs, rodenticide should be distributed on the grounded vessel and along the shoreline near the grounding site.

APPENDIX E. USFWS AND NOAA SECTION 7 ESA CONSULTATIONS

INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION FORM

Originating Person: Chris Swenson
Originating Program: Pacific Islands Fish and Wildlife Office, Coastal Program
Telephone Number: 808-792-9400
Date: 29 March 2005
Internal Section 7 Tracking Number:1-2-2005-I-189

I. Region: Pacific Region (Region 1)

II. Service Activity (Program, Project Title, and File Code):

Coastal Program, Lehua Island Ecosystem Restoration Project.

III. Pertinent Species and Habitat:

A. Listed species and/or their critical habitat within the action area:

Newell's shearwater (*Puffinus auricularis newelli*)
Hawaiian petrel (*Pterodroma phaeopygia sandwichensis*)
No critical habitat

B. Proposed species and/or proposed critical habitat within the action area:

None

C. Candidate species within the action area:

band-rumped storm-petrel (*Oceanodroma castro*)

D. Include species/habitat occurrence on a map.

Newell's shearwater and Hawaiian petrels have been observed at sea just offshore Lehua at dusk and are suspected to nest somewhere on the island, but the exact nesting locations have not been discovered yet.

IV. Geographic area or station name and action:

Lehua Island, Ecosystem Restoration

V. Location: See attached Figures 1 and 2.

A. Ecoregion Number and Name: Pacific Islands Ecoregion

B. County and State: Kaua'i County, Hawai'i
C. Section, township, and range (or latitude and longitude): 22.1 N, 160.5 W
D. Distance (miles) and direction to nearest town: 19 miles west of Kekaha, Kaua'i.

VI. Description of proposed action:

The proposed action would help restore the native ecosystem on Lehua Island by eradicating non-native Polynesian rats (*Rattus exulans*) and European rabbits (*Oryctolagus cuniculus*). The preferred alternative for the proposed action is to eradicate Polynesian rats from Lehua Island by aerial broadcast and hand-placed ground application of bait containing the rodenticide diphacinone and/or brodifacoum, and to eradicate rabbits by trapping and hunting with firearms and specially trained dogs. Application of rodenticide would occur in the dry season (May-September) to minimize the risk of rain washing bait pellets into the ocean and to maximize efficacy by targeting rats during the low point in their population cycle. Following reduction of the rabbit population by trapping and hunting with firearms, any remaining rabbits would be removed by dogs trained to hunt in seabird colonies without harming birds. This technique has been used previously to successfully eradicate rabbits from islands off Mexico.

VII. *Determination of effects*:

A. Explanation of effects of the action on species and critical habitats in items III. A, B, and C (attach additional pages as needed):

The proposed action would aid in the recovery of the threatened Newell's shearwater (*Puffinus auricularis newelli*), the endangered Hawaiian petrel (*Pterodroma phaeopygia sandwichensis*), and the band-rumped storm-petrel (*Oceanodroma castro*), which is a candidate for listing, by reducing predation and by improving nesting habitat for these species. The proposed project also is expected to improve nesting habitat for several non-endangered migratory seabirds, improve habitat for many species of native coastal plants, and allow outplanting of endangered native plants, such as *Pritchardia* palms, to aid in their recovery. Polynesian rats are known to prey on eggs, chicks, and adult seabirds. Rabbits have destroyed native ecosystems on other islands, such as Laysan. Removal of these alien species will have a long-term positive effect on the ecosystem of Lehua Island.

B. Explanation of actions to be implemented to reduce adverse effects:

To minimize disturbance, hunting and trapping of rabbits will occur in the winter, when no listed seabirds are present and the smallest numbers of other seabirds are nesting. Newell's shearwaters, Hawaiian petrels, and band-rumped storm-petrels commute to and from their nesting sites at night. Aerial broadcast by helicopter and hand-placement of rodenticide bait would be done during the day, so no direct disturbance to listed seabirds is expected. The dogs that would be used to hunt remaining rabbits are specially trained not to harm seabirds, have been used successfully for the same purpose on islands off Mexico, and would be accompanied by

trained handlers from Mexico.

VIII. Effect determination and response requested: (* = optional)

A. Listed species/designated critical habitat:

Determination	Response requested
no effect species or critical habitat:	____*Concurrence
may affect, but is not likely to adversely affect species: Newell's shearwater (*Puffinus auricularis newelli*) Hawaiian petrel (*Pterodroma phaeopygia sandwichensis*)	__X__Concurrence

With the implementation of the above measures, it is anticipated that this project may affect, but is not likely to adversely affect, listed species or designated critical habitat including primary constituent elements. In addition to providing measures to reduce short term effects, this project is expected to create long term benefits for listed species.

may affect, and is likely to adversely affect species or critical habitat species:	____Formal Consultation

B. Proposed species/proposed critical habitat:

Determination	Response requested
no effect on proposed species or proposed critical habitat species:	____*Concurrence
is likely to jeopardize proposed species/ adversely modify proposed critical habitat species:	____Conference

C. Candidate species:

Determination	Response requested
no effect species: band-rumped storm-petrel (*Oceanodroma castro*)	__X__*Concurrence

is likely to jeopardize candidate species ___Conference
(species:

Determination by: Craig Rowland Date 4/14/05
Conservation Partnerships Program Coordinator

IX. Reviewing Ecological Services Office Evaluation:

Plant Conservation Program Leader N/A Date _____

[ ] Concur (Mark one) [ ] Do not concur

Comments:

Invertebrate Conservation Program Leader N/A Date _____

[ ] Concur (Mark one) [ ] Do not concur

Comments:

Vertebrate Conservation Program Leader [signature] Date 4/18/5

[✓] Concur (Mark one) [ ] Do not concur

Comments:

Endangered Species Assistant Field Supervisor [signature] Date 4.18.05

[✓] Concur (Mark one) [ ] Do not concur

Comments:

PIFWO TES Log # 1-2-2005-I-189

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Pacific Islands Regional Office
1601 Kapiolani Blvd., Suite 1110
Honolulu, Hawaii 96814-4700
(808) 973-2937 • Fax: (808) 973-2941

July 5, 2005

Patrick Leonard
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
300 Ala Moana Blvd., Room 3-122, Box 50088
Honolulu, HI 96850

RE: Request for Endangered Species Act Section 7 Concurrence for Proposed Ecosystem Restoration of Lehua Island, Hawaii
Please refer to Consultation No.: I-PI-03-356-MMD

Dear Mr. Leonard:

This letter responds to your letter dated May 22, 2005, that requests our Endangered Species Act Section 7 concurrence with your determination that the proposed eradication of rabbits and rats from Lehua Island, Hawaii is in not likely to adversely affect federally listed seals or sea turtles. We provide the following comments and information under NOAA Fisheries Service (NOAA) statutory authorities under the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. §1531 *et seq.*), and the Marine Mammal Protection Act of 1972, as amended (16 U.S.C. 1361 *et seq.*).

The proposed action presented in the Lehua Island Ecosystem Restoration Project Draft Environmental Assessment (EA) of June 2005 includes rat and rabbit eradication and native plant restoration. Rat eradication will be through the use of aerial and hand broadcast of a pelleted, anticoagulant rodenticide. Aerial broadcast will be accomplished through the use of a helicopter carrying a hopper of bait pellets. Rabbit eradication will be achieved through the use of a team of hunters with dogs to trap and shoot rabbits.

ESA-listed species under NOAA jurisdiction that may be present in the proposed project area include Hawaiian monk seals and green sea turtles. The U.S. Fish and Wildlife Service (USFWS) has identified a set of mitigation measures which will be implemented in order to ensure that there are no adverse impacts to seals or sea turtles. The measures proposed to avoid interactions between hunting teams and monk seals include:

- People and dogs will maintain a 100 foot buffer around seals hauled out on the shoreline.
- To avoid potential disease transfer from hunting dogs to seals, dogs will go through quarantine, vaccination and deworming.
- Hunting dogs will be under voice control of hunters and will not roam freely.
- The dogs will have been specially trained and experienced in working around island

wildlife.
- The dogs will be confined when not hunting and their feces will be kept out of intertidal areas.
- All project personnel will be briefed on proper conduct on the island and in seal avoidance.

The measures proposed to avoid impacts caused by rodenticide broadcast activities include:
- To keep pellets from being spread into the water when the helicopter is flying near the shoreline, the helicopter bait hopper will be equipped with a deflector device to ensure the bait is spread only to one side.
- The helicopter will be required to fly inland from the shoreline when distributing bait pellets.
- Any crews conducting hand broadcast of rodenticide pellets on the island will maintain a 100 foot buffer from seals.
- The helicopter will be required to alter course to avoid flying directly over hauled out seals and no bait will be spread on or around seals.
- To avoid being washed into the ocean by rain, bait will be applied during the summer dry season and only when no rain is forecast for at least 48 hours.
- Bait will not be applied in high wind conditions.

In addition to these mitigation measures, USFWS also conducted analyzes of the risk to seals and sea turtles from poisoning caused by ingestion of bait pellets. Results of these analyses indicated that the bait pellets will not present a poisoning hazard to foraging seals or sea turtles.

It should also be noted that as a result of this project there could be indirect beneficial effects to both monk seals and sea turtles arising from increased native plant cover which will stabilize soils, reduce sediment runoff into the ocean and improve marine water quality. This may result in the establishment of improved habitat for hauled out monk seals and may also result in improved nearshore foraging habitat for both monk seals and sea turtles.

Given the mitigation measures put in place under the draft EA we conclude that any effects of the proposed action on monk seals or sea turtles from the proposed ecorystem restoration on Lehua Island would be discountable. NOAA Fisheries Service therefore concurs with your determination that the project may affect but is not likely to adversely affect ESA listed species under our jurisdiction.

Thank you for working with NOAA Fisheries Service to protect our nation's living marine resources.

Sincerely,

for Tamra Faris
Assistant Regional Administrator
for Protected Resources

APPENDIX F. COMMENT LETTERS IN RESPONSE TO DRAFT EA

The Nature Conservancy

The Nature Conservancy of Hawai'i
923 Nu'uanu Avenue
Honolulu, HI 96817

tel (808) 537-4508
fax (808) 545-2019

www.nature.org/hawaii

July 8, 2005

Chris Swenson
Project Biologist
U.S. Fish and Wildlife Service
Pacific Islands Office
300 Ala Moana Blvd, Room 3-122
Honolulu, Hawaii 96850

Dear Mr. Swenson:

The Nature Conservancy of Hawaii (TNCH) supports the proposed test management actions on Lehua Island, using the aerial broadcast of diphacinone to control rats for conservation purposes. The unfortunate introduction of rodents has been one of the greatest threats to Hawaii's avifauna. Rodents are known predators of adult birds, nestlings, and eggs. In addition, they prey on native invertebrates and plants, competing with birds and other wildlife. The threat rodents pose to our rare and endangered species and ecosystems has prompted our support for aerial broadcasting of rodenticide because it is likely that this is the only tool that is going to save some native bird and plant species. Furthermore, the proposed dosage of rodenticide is no stronger than the rodenticide dosages available at a hardware store.

Aerial broadcasting of rodenticide currently seems to be the only effective means of large-scale rodent control, especially in remote areas. This method will be particularly useful where ground-based predator control is not feasible or is ineffective. The control of rats in these areas will likely offer broad benefits to native plants and invertebrates, as well as birds.

Currently, we attempt to control rodents in two of our preserves (Honouliuli and Kamakou) by placing diphacinone-bait in bait stations. However, this method is extremely labor-intensive and impractical for large, remote or rugged areas. In fact, in 1998, we canceled a rodent-baiting program at one of our more remote preserves (Kapunakea Preserve on Maui) because of our inability to access the area as frequently as was required to monitor the bait stations. Broadcasting baits aerially will result in much more cost-effective and thorough rodent control over large, remote areas.

TNCH believes that the use of aerial broadcasting of diphacinone for conservation uses, with appropriate safeguards, will provide our natural resources managers with an extremely valuable tool with which to control rodents in conservation areas. We are hopeful this project will demonstrate the efficacy of diphacinone aerial broadcast in the field as a viable and comparatively safe conservation tool for conservation areas in Hawaii.

In addition, we also support any efforts that anticipate the need to mitigate any negative effects of rat removal from Lehua Island. Negative effects may include unsuppressed growth of populations of non-native insects or plants.

If you have questions or comments, please contact our Conservation Programs Coordinator Stephanie Lu by telephone at (808) 637-4508.

Sincerely,

Suzanne Case
Executive Director

CC: Katie Swift, USFWS

LINDA LINGLE
GOVERNOR OF HAWAII

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
DEPUTY DIRECTOR - LAND

DEAN NAKANO
ACTING DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING, ROOM 555
601 KAMOKILA BOULEVARD
KAPOLEI, HAWAII 96707

RECEIVED
JUN 2 2005
U.S. FISH & WILDLIFE SVC
PACIFIC ISLANDS FWO
HONOLULU HI 96850

June 22, 2005

Mr. Patrick Leonard, Field Supervisor
US Fish and Wildlife Service
300 Ala Moana Blvd, Room 3-122, Box 50088
Honolulu, Hawaii 96850

LOG NO: 2005.1248
DOC NO: 0506NM28

Dear Mr. Leonard:

SUBJECT: **Historic Preservation Review –Draft EA for Proposed Ecosystem Restoration Project on Lehua**
Island of Kauai
TMK: 4

Thank you for submitting the above DEA for our review and approval which our Honolulu office received on June 2, 2005. In general, we concur with your restoration plan. The archaeological inventory survey report on page 23 of this DEA (Yent and Carpenter 2004) was a preliminary report. A number of shrines were also found during the survey work. Test excavations took place at a fire hearth at a habitation site which had an earlier radiocarbon date (600 A.D.) from native wood species. The report needs to be updated with this information. We believe that this site should be mitigated by having the data collected from this hearth. In addition, State Parks Archaeologists recommended that site tags be placed on all the historic properties and we concur with this.

In order for this plan to have a "no adverse effect" on significant historic sites, the following conditions should be required:

1.) Submission of an approved and completed archaeological inventory survey report.
2.) A qualified archaeologist should conduct data recovery of the fire hearth site. An approved data recovery report should be submitted to the State Historic Preservation Office for this work.
3.) Site tags should be placed on all historic properties, prior to restoration work.

If you have any questions, please call Nancy McMahon 742-7033.

Aloha,

Melanie Chinen, Administrator
State Historic Preservation Division

NM:jen

LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186
E-mail: oeqc@hawaii.gov

GENEVIEVE SALMONSON
DIRECTOR

July 7, 2005

Mr. Peter Young, Chair
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawai'i 96809

Dear Mr. Young:

Subject: Draft Environmental Assessment for the Lehua Island Ecosystem Restoration Project

Thank you for the opportunity to review the subject document. We have the following comments.

1. Please provide your reasons for supporting the Hawai'i EIS Rules "finding of no significant impact." Please see the enclosed example.

2. Please indicate whether Native Hawaiian cultural experts were consulted to determine the impacts to non-physical cultural resources (such as Native Hawaiian traditional practices) on the island.

Should you have any questions, please call Jeyan Thirugnanam at 586-4185.

Sincerely,

Genevieve Salmonson
Director

c: USFWS

LINDA LINGLE
GOVERNOR OF HAWAII

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. Box 3378
HONOLULU, HAWAII 96801-3378

In reply, please refer to:
EPO-05-049

July 7, 2005

RECEIVED
JUL 2005
U.S. FISH AND WILDLIFE SERVICE
PACIFIC ISLANDS OFFICE
HONOLULU

Mr. Patrick Leonard, Field Supervisor
U.S. Fish and Wildlife Service
Pacific Islands Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850

Dear Mr. Leonard:

SUBJECT: Draft Environmental Assessment
Lehua Island Ecosystem Restoration Project

Thank you for allowing us to review and comment on the subject document. We have no comment at this time. Please refer to our website for the Standard Comments (http://www.state.hi.us/health/environmental/env-planning/landuse/landuse.html). If there are any questions about these standard comments please contact Jiacai Liu with the Environmental Planning Office at 586-4346.

Sincerely,

June F. Harrigan-Lum

JUNE F. HARRIGAN-LUM, MANAGER
Environmental Planning Office

c: EPO
VCB

APPENDIX G. RESPONSES TO DRAFT EA COMMENT LETTERS

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850

In Reply Refer To:
CS

SEP · 8 2005

Melanie Chinen, Administrator
State Historic Preservation Division
601 Kamokila Boulevard, Room 555
Kapolei, HI 96707

Re: Response to Comments on the Draft Environmental Assessment for the Lehua Island Ecosystem Restoration Project

Dear Ms. Chinen:

Thank you for your June 22, 2005, letter commenting on the Draft Environmental Assessment (EA) for the Lehua Island Ecosystem Restoration Project. Your letter stated that in order for the proposed Lehua Island restoration to have no adverse effect on significant historic sites, the following three conditions should be met:

1) An approved and completed archaeological inventory survey report should be submitted;
2) a qualified archaeologist should conduct data recovery of the fire hearth site and submit an approved data recovery report the State Historic Preservation Division; and
3) site tags should be placed on all historic properties prior to restoration work.

We are pleased to forward to you the two enclosures with this letter that demonstrate compliance with your three conditions. These documents, a 2004 archaeological inventory of Lehua and an End of Fieldwork Report, were both prepared by archaeologists from the Division of State Parks in the Department of Land and Natural Resources. We trust that these documents, in addition to the mitigation already proposed in the Draft EA, will satisfactorily address your concerns.

We will soon be sending a separate letter to you and other interested parties requesting concurrence with our determination that the Lehua project will not have any adverse effect on historic properties.

TAKE PRIDE IN AMERICA

Thank you for your interest in the ecological restoration of Lehua Island. If you have any questions, please contact Chris Swenson, Coastal Program Coordinator, at (808) 792-9458.

Sincerely,

Patrick Leonard
Field Supervisor

enclosures (2)

LINDA LINGLE
GOVERNOR OF HAWAII

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
DEPUTY DIRECTOR

DEAN NAKANO
ACTING DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

SEP 09 2005

Ms. Genevieve Salmonson, Director
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

Dear Ms. Salmonson:

Subject: Response to Comment Letter on the Draft Environmental Assessment for the Lehua Island Ecosystem Restoration Project

Thank you for your letter dated July 7, 2005, commenting on the Draft Environmental Assessment (EA) for the Lehua Island Ecosystem Restoration Project. Your letter requested that we: 1) provide reasons for supporting the "finding of no significant impact" under Hawaii EIS Rules, and 2) indicate whether Native Hawaiian cultural experts were consulted to assess any project impacts to non-physical cultural resources.

We will incorporate full responses to both your comments in the forthcoming Final EA for the Lehua Island project. In brief, the "finding of no significant impact" was based on the 13 criteria for defining significant project impacts, as defined by the State of Hawaii Environmental Council in Hawaii Administrative Rules, Section 11-200-12. The Final EA will address each criteria individually, and explain why the project will not have significant impacts. We are also in the process of documenting consultations with Native Hawaiian cultural practitioners regarding potential project impacts to non-physical cultural resources. This information will also be included in the Final EA.

If you have any questions, please contact Scott Fretz, Wildlife Program Manager, Department of Land and Natural Resources Division of Forestry and Wildlife at (808) 587-4167.

Sincerely,

Peter T. Young
CHAIRPERSON