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Dear Ms. Young:

The Habitat Conservation Division of the National Oceanic Atmospheric Administration's National Marine Fisheries (NMFS) Pacific Islands Regional Office has reviewed the Final Environmental Assessment Lehua Island Ecosystem Restoration Project July 2017 (EA) submitted for the Lehua Island Ecosystem Restoration Project. The applicant, the U.S. Fish and Wildlife Service is proposing to undertake the eradication of non-native rats from Lehua Island through the use of rodenticides, Diphacinone (50 ppm) followed by Brodifacoum (25 ppm), if necessary.

The action area is the island of Lehua, its immediate surrounding waters, and the staging area on the north end of the island of Ni'ihau. Lehua is approximately 30 km west of the island of Kaua'i, Hawaii, and approximately 1.2 km north of Ni'ihau. Lehua is a federal property administered by the U.S. Coast Guard and was set aside for public purposes by the Territorial Governor on August 10, 1928, under Executive Order No. 343. The waters around Lehua, including the intertidal zone, are State property. Lehua is zoned as a Conservation District and is also a Hawaii State Seabird Sanctuary.

The proposed activity would be the aerial broadcast of rodenticide bait pellets to eliminate rats from Lehua Island during the summer of 2017. The project calls for the use of diphacinone (50 ppm), with the potential to use brodifacoum (25 ppm) the following year in the event of a failure of the first effort with diphacinone.

Diphacinone would be applied 3 times across the entire island up to the high tide line at a maximum rate of 30 kg/ha. Whole-island coverage would be attempted using a helicopter and a specialized bait-spreading bucket. Supplemental hand application of bait pellets would be conducted in areas where use of a helicopter would be limited or not feasible. Each application would be separated by approximately 5 – 7 days. If necessary, brodifacoum would be applied the following year at a maximum rate of 18 kg/ha followed approximately 5 – 7 days later by a second application of 9 kg/ha.



We offer the following comments in accordance with the Essential Fish Habitat (EFH) provision of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (50 C.F.R. § 600.905 - 930), also the National Environmental Policy Act (42 U.S.C. § 4321 et seq.), the Fish and Wildlife Coordination Act (16 U.S.C. § 662(a)), the Coral Reef Executive Order 13089, and the Clean Water Act (33 U.S.C. §1251 et seq.).

Environmental Impacts of Rodenticides

The active ingredients in diphacinone and brodifacoum have low or extremely low solubility in water, respectively, and bind tightly to organic matter in soil where the rodenticide would be degraded by soil micro-organisms and exposure to oxygen and sunlight. The half-life in soil is approximately 30 to 60 days for diphacinone, and approximately 84 to 175 days for brodifacoum. Trials on Lehua indicate pellets in the terrestrial environment would break down and be undetectable in 35-40 days when under vegetation and around 65 days on rock or bare ground (Mazurek 2015).

Bait pellets may inadvertently fall into the ocean, but typically only a small amount of the amount dispersed. This conclusion has been illustrated from monitoring efforts from two past rodent eradication projects using brodifacoum. On Anacapa Island, divers and land-based observers monitored bait for entry at seven separate locations (Rowald et al. 2009). The application rate on the project was 15 kg/ha and no bait was observed to directly enter the water, though small quantities indirectly entered at three locations and densities were estimated at 0.15 pellets/m². On Isabel Island, Mexico, where the application rate was 20.6 kg/ ha, divers monitoring the operation documented bait in the sub-littoral zone at < 1 pellet/10 m² (0.1/m²) (Samaniego-Herrera et al. 2014). However, examples exist where large quantities of bait enter the marine environment. During the Palmyra rat eradication, where the bait application was extremely high (80 kg/ha, 1st application and 75 kg/ha, 2nd application), the average density of bait entering the water was as high as 44.7 kg/ha during the first application and 46.3 kg/ha during the second application (Engeman et al. 2013). A variety of factors are thought to have contributed to the high quantity of bait entering the marine environment at Palmyra, which include: an irregular coastline, baits drifting in the wind, pilot difficulty locating the shoreline due to overhanging palm trees, and an ineffective and broken bait deflector.

Complete breakdown of pellets in the water would be quick, especially in rough water conditions. During the inert bait trials on Lehua in 2015, data collected shows that pellets disintegrated within 30 minutes after application to seawater and no pellets were found after 24 hours (Mazurek 2015). Disintegrating pellets would consist of suspended cereal grain flocculants and dissolution of the active ingredient into seawater. In trials on Kapiti Island, New Zealand, inert bait pellets were seen to disintegrate within 15 minutes (Empson and Miskelly 1999) and on Isabel Island, pellets "sank immediately and disintegrated by wave action within a few minutes" (Samaniego-Herrera et al. 2014). On Anacapa Island, bait that entered the ocean completely dissolved within 5 hours (Howald et al. 2009). Sampling of seawater 24 and 48 hours post-application conducted in conjunction with the Anacapa project tested negative for brodifacoum residues.

In the process of breaking down, pellets would consist of suspended flocculants and dissolution of the active ingredient into seawater. The solubility of brodifacoum in water is 0.24 mg /l and the solubility of diphacinone is 0.3mg/L (US EPA 1998). Any effect of salt water on solubility has not been reported. For the rat eradication on Mokapu, Hawai'i and the previous attempt on Lehua seawater samples were collected five and seven days after the last application of rodenticide baits. No diphacinone was detected in the seawater samples from either operation (Gale, Tanner, and Orazio 2008; Orazio et al. 2009).

Research has shown that the active ingredient in rodenticide may persist in the environment for extended periods of time, and be taken up by many different marine species. One such instance was an effort from August 2011 to eradicate Norway rats (*Rattus norvegicus*) from Ulva Island, New Zealand. Residual concentrations of brodifacoum were detected in 3 of 10 species of coastal fish or shellfish sampled 43 - 176 days after bait application commenced (Masuda *et al* 2015). Residual brodifacoum concentrations were found in liver, but not muscle tissue, of 2 of 24 samples of blue cod (0.026 and 0.092 $\mu\text{g I g}$; *Parapercis colias*) captured live then euthanized for tissue sampling (Masuda *et al* 2015). Residual brodifacoum concentrations were also found in whole-body samples of 4 of 24 mussels (range 0.001-0.022 $\mu\text{g I g}$; *Mytilus edulis*) and 4 of 24 limpets (range 0.001-0.016 $\mu\text{g/g}$; *Cellana ornata*) (Masuda *et al* 2015). Measured residue concentrations in all three species were assessed as unlikely to have eventually caused mortality of the sampled individuals.

Although the findings confirm the potential for coastal marine wildlife to be exposed to brodifacoum following island rodent eradications using aerial bait application, the risk of mortality to exposed individual fish or shellfish was determined to be very low. There was also a very low risk of adverse effects on humans that consume fish or shellfish containing residual concentrations in the ranges reported.

Magnuson-Stevens Act

Pursuant to the Magnuson-Stevens Act, the Secretary of Commerce, through NMFS, is responsible for the conservation and management of fishery resources found off the coasts of the United States (16 U.S.C. 1801 et seq.). Section 1855(b)(2) of the Magnuson Act requires federal agencies to consult with NMFS, with respect to "any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency that may adversely affect any Essential Fish Habitat identified under this Act." The statute defines EFH as "those waters and substrates necessary to fish for spawning, breeding, feeding or growth to maturity" (16 U.S.C. § 1802(10)).

Adverse effects on EFH are defined further as "any impact that reduces the quality and/or quantity of EFH," and may include "site-specific or habitat-wide impacts, including individual, cumulative or synergistic consequences of actions" (50 C.F.R. § 600.810(a)). The consultation process allows NMFS to make a determination of the project's effects on EFH and provide Conservation Recommendations to the lead agency on actions that would adversely affect such habitat (16 U.S.C. § 1855(b)(4)(A)).

Essential Fish Habitat

The marine water column and seafloor in the proposed project area is designated as EFH and supports various life stages for the management unit species (MUS) identified under the Western Pacific Regional Fishery Management Council's Pelagic and Hawaii Archipelago Fishery Ecosystem Plans (FEPs). The MUS and life stages that may be found in these waters include: eggs, larvae, juveniles and adults of Coral Reef Ecosystem MUS; eggs, larvae, juveniles and adults of Bottomfish MUS; eggs, larvae, juveniles and adults of Crustacean MUS; and juveniles and adults of Pelagic MUS.

The proposed action would be conducted sometime during the months of July – September 2017 to coincide with the dry season on the island. The summer months would be the optimum time to conduct the action as it should coincide with a population minimum of rats (due to the yearly shortage of food and water), and would also be the optimum time to minimize risk to non-target species, as the breeding season for black-footed and Laysan albatross would be near an end. The summer dry season also provides the best opportunity to avoid rainfall that would reduce the effectiveness and delivery of the bait pellets.

There are two staging areas being considered for the action, the island of Ni'ihau and Kaua'i. The preferred staging area on Ni'ihau would be located on the north end of the island, approximately 1.2 km from Lehua. The alternative staging site on Kaua'i would be on the west side of the island. A temporary camp would be established on Ni'ihau, which would be used to stage staff, fuel, bait and equipment. A temporary field camp would also be established on Lehua for up to 10 people to conduct monitoring of the aerial-delivery and to conduct hand-delivery of the bait, as necessary.

Bait would be delivered in shipping containers directly from the manufacture in the US. Bait would be shipped in either 23 kg bags, or in 318 kg bags, and transported in pods on skids. The shipping containers would remain locked and staged at the staging site on Ni'ihau or Kaua'i. Fuel would be stored in 208 L drums, and held in a separate site in close proximity to the base of operations. The site where the fuel would be held would meet EPA-approved Spill, Prevention, Control, and Countermeasure rules.

According to the EA, the most abundant coral species documented around Lehua were cauliflower coral (*Pocillipora meandrina*), lobe coral (*Porites lobate*), and rice coral (*Montipora capitata*). In addition, a large bed of soft coral (*Sinularia* sp.) was observed off the northwestern horn of the island (NOAA-PIFSC 2008). The EA also indicates that there are no data to indicate that corals have been impacted by anticoagulant rodenticides from previous eradication projects. On Palmyra Atoll, no impact to corals was documented after the application of bait containing brodifacoum applied at the total rate of 155 kg/ha which greatly exceeds the rate of 30 kg/ha proposed for Lehua (Wegmann 2017).

In order to minimize the impact to the environment from the proposed action, the USFWS would implement the following Best Management Practices:

1. Prior to the application of bait pellets with rodenticide, the bait delivery system (bait bucket, controller, GPS units, and helicopter) would be tested and calibrated to ensure an accurate application rate.
2. An onboard computer linked to a GPS and light bar would guide the pilot along pre-programmed flight lines over the island at a prescribed airspeed, which would ensure an even application rate.
3. Aerial application of bait pellets would not occur during wind speeds in excess of 35 mph.
4. Aerial application of bait pellets would not occur when heavy rains are forecast to occur within 72 hours.
5. The hopper would be fitted with a deflector that spreads bait out to only one side (120° pattern) to minimize bait application directly into the water. Every reasonable effort would be made to minimize the risk of bait drift into the water; however, it is inevitable that a small number of pellets would roll or bounce into the ocean. The pilot and on-the-ground observers would visually monitor the application of bait and if a malfunction is detected operations would cease until the problem is corrected.
6. Bait would be applied at the lowest rate possible to achieve eradication and any bait spilled would be collected and disposed of according to label instructions.
7. The operation would be conducted during the dry summer months
8. The compressed grain bait pellets are manufactured to ensure that no active seeds are embedded into the baits to ensure that no active seeds are accidentally introduced onto the island.

Based on the chemical properties of the active ingredients in the rodenticides and the limited amount of information available on the potential for long-term impact provided, the proposed action has the potential to have a negative impact on MUS species found in the nearshore waters around Lehua, while there are unknown potential impacts to coral species found in the waters around the island. Because of the potential and unknown impacts to MUS and corals, NMFS has determined that the proposed action may adversely affect EFH. We provide the following EFH Conservation Recommendations aimed at avoiding/minimizing and offsetting impacts to EFH.

EFH Conservation Recommendations

1. In order to further minimize the number of rodenticide pellets that will enter the marine environment, NMFS suggest that the USFWS locate any ephemeral streams and install screens or curtains that will be able to catch any pellets before they make into the marine environment.
2. To determine if there were any impacts to non-target marine species, NMFS request that surveys be done around the island after the applications to look for any incidental kills that may have been caused by exposure to the rodenticide. Any incidental kills should be tested for presence of diaphacinone (or brodifacoum).
3. One of NMFS primary concerns is the possible mortality of corals exposed to the rodenticide. NMFS suggest that surveys be conducted after the second treatment to look for evidence of impacts to corals that might be related to exposure to the rodenticides. It

would be best if a survey were done prior to the proposed treatments, so the baseline condition can be determined.

NMFS realizes that the geography of Lehua Island would make surveys like the ones we suggest to be problematic, NMFS suggest that the surveys might be done on a portion of the island which is relatively calm and where corals are abundant. Such an area would allow for the safety of those entering the water, and would be the most likely areas where corals could be exposed to the rodenticide.


4. In the event that the dipahcinone treatment fails to eradicate rats on Lehua Island, and the USFWS follows through with the brodifacoum treatment after a year's time, NMFS request notification of the treatment, at which time we will provide additional requests (surveys, etc.) to ensure the protection of MUS and EFH found in the waters around Lehua Island.
5. NMFS has already stated that one of our primary concerns with the use of rodenticides are the unknowns with regards to potential impacts to EFH, especially on coral reefs. Since the USFWS may be using rodenticides to eradicate rats around the Pacific, NMFS suggest that the USFWS study the effects of rodenticides on corals. NMFS recommends that a controlled study be performed in a laboratory that exposes a few common species of corals found in Hawaiian waters to different levels of rodenticides to see the impact on the colonies.

Please be advised that regulations (Section 305(b)(4)(B)) to implement the EFH provisions of the MSA require that Federal action agencies provide a written response to this letter within 30 days of its receipt and at least 10 days prior to final approval of the action. A preliminary response is acceptable if final action cannot be completed within 30 days. The final response must include a description of measures to be required to avoid, mitigate, or offset the adverse impacts of the activity. If the response is inconsistent with our EFH Conservation Recommendations, an explanation of the reason for not implementing the recommendations must be provided.

Conclusion

After reviewing the supporting documents for Lehua Island Ecosystem Restoration Project, which is an attempt to eradicate non-native rats using rodenticides; the NMFS Habitat Conservation Division for the Pacific Islands Regional Office has determined that there are still a number of environmental unknowns with the use of rodenticides, and for that reason our office has determined that this project may adversely affect EFH due to the potential for harm to the marine environment from the active ingredient in Diphacinone (and Brodifacoum). In order to avoid, mitigate, and offset any loss of EFH, NMFS provides the EFH Conservation Recommendations above.

Sincerely,


Geravis
Assistant Regional Administrator
Habitat Conservation Division

cc:

References

- Empson, R., and C. Miskelly. 1999. *The Risks, Costs and Benefits of Using Brodifacoum to Eradicate Rats from Kapiti Island, New Zealand*. New Zealand Journal of Ecology, 241-254.
- Engeman, R., W. Pitt, A. Berentsen, and J. Eisemann. 2013. *Assessing Spatial Variation and Overall Density of Aerially Broadcast Toxic Bait during a Rat Eradication on Palmyra Atoll*. Environmental Science and Pollution Research 20 (1): 480-87. doi: 10.1007/s11356-012-1050-6.
- Gale, R., W. Tanner, and C. Orazio. 2008. *Determination of Diphacinone in Sea Water, Vertebrates, Invertebrates, and Bait Pellet Formulations Following Aerial Broadcast on Mokapu Island, Molokai, Hawaii*. Open File 1285. USGS.
- Rowald, G., C. Donlan, K. Faulkner, S. Ortega, H. Gellerman, D. Croll, and B. Tershy. 2009. *Eradication of Black Rats (Rattus rattus) from Anacapa Island*. Oryx 44 (1): 30-40. doi: 10.1017/S003060530999024X.
- Masuda, B., P. Fisher, and B. Beaven. 2015. *Residue profiles of brodifacoum in coastal marine species following an island rodent eradication*. Ecotoxicol Environ Saf: 113, 1-8.
- Mazurek, M. 2015. *Lehua Island Inert Bait Study September 2015 Final Report*. Island Conservation. Honolulu, HI.
- NOAA-PIFSC. 2008. Unpublished cruise report 09-004.
- Orazio, C., M. Tanner, C. Swenson, J. Herod, P. Dunlevy, and R. Gale. 2009. *Results of Laboratory Testing for Diphacinone in Seawater, Fish, Invertebrates, and Soil Following Aerial Application of Rodenticide on Lehua Island, Kauai County, Hawaii*. 2009-1142. USGS.
- Samaniego-Herrera, A., J. Russell, D. Choquenot, A. Aguirre-Munoz, and M. Clout. 2014. *Invasive Rodents on Tropical Islands: Eradication Recommendations from Mexico*. 26th Vertebrate Pest Conference, Davis University, California.
- Wegmann, Alexander S. 2017. "Risk to Coral from Brodifacoum, Personal Communication."

