

Pacific rat *Rattus exulans* eradication on Dekehtik Island, Federated States of Micronesia, Pacific Ocean

Alexander Wegmann^{1*}, Jalene Braun¹ & Rachel Neugarten²

¹*Island Conservation, Island Conservation, Center for Ocean Health, University of California, 100 Shaffer Road, Santa Cruz, California 95060, USA*

²*The Nature Conservancy, 821 SE 14th Avenue Portland, OR 97214, USA*

*Corresponding author e-mail: alex.wegmann@islandconservation.org

SUMMARY

As part of a larger project attempting to reduce predation pressure from introduced rats *Rattus* spp. on native fauna and flora on several islands off Pohnpei main island (Pacific Ocean), a rat eradication program was undertaken on the small island of Dekehtik (2.63 ha) where Pacific rats *R. exulans* were present. The island was systematically hand-broadcast with rodenticide bait at a pre-determined application rate of 50 kg/ha over one day. Radio-tracking revealed that rats spent a significant amount of time in the forest canopy. Therefore, to ensure that rats living in the canopy had a good chance of encountering bait, bait clusters (bolo baits) were fabricated and catapulted into one third of the palm trees on the island. Pre-bait application trap success (rat captures/trap nights) was 52%. Post-bait application trap success (as recorded 12-15 days after bait application) was 0%. Although rat chew marks were found on one wax indicator block 12 days after the bait application, subsequent monitoring detected no rats. No non-target species appeared adversely effected by the rodenticide bait.

BACKGROUND

Considered the “emerald” of Micronesia, Pohnpei, including its surrounding smaller islands, is a lush, green oceanic island formed five million years ago by turbulent volcanic activity. The islands are home to a wide variety of natural marine and terrestrial habitats including barrier reefs, lagoons, mangrove forests and upland forests. It is one of the wettest places on earth, with an average annual rainfall in excess of 1,000 cm (400 inches). Pohnpei’s dwarf cloud forests are altitudinally among the lowest in the world at 450 m, and the volcanic bowl of the island boasts the largest intact lowland tropical forest in the world. These habitats support a remarkable abundance of unique flora and fauna, with 16% of species being endemic, including the Serehd or Pohnpei lory *Trichoglossus rubiginosus*, and the tiny Pohnpei mountain skink *Emoia ponapea*. Unfortunately, over the past 25 years, deforestation for agricultural purposes has

reduced the interior rainforest of Pohnpei by more than 25%, and as well as habitat loss and degradation, native plant and animals are being further threatened through predation and competition from introduced non-native species, e.g. alien rats *Rattus* spp., feral pigs *Sus scrofa*, feral cats *Felis catus*, and Philippine sambar *Cervus mariannus*. Tropical oceanic islands represent some of Earth’s most biologically unique ecosystems, yet the very remoteness that fuels high levels of endemism and fantastic species radiations also renders such systems vulnerable to invasive species (Mooney & Cleland 2001, Rodriguez *et al.* 2006). Invasive mammal eradications are a proven, effective method of restoring damaged ecosystems and preserving biodiversity (Townes & Broome 2003, Zavaleta *et al.* 2001).

Within the scope of a larger study, The Conservation Society of Pohnpei (CSP) and Island Conservation (IC) selected three of five small islands for rat eradication which

constituted the Pohnpei Rat Eradication Research Project: Dekehtik (2.63 ha), Pein Mal (2.17 ha) and Nahkapw (1.58 ha) (Fig. 1). A fourth island, Nahpoli, was selected as a control where no rat eradication attempt was undertaken. Island selection was based on the following criteria: presence of rats, lack of human habitations, a distance of no less than 0.5 km from Pohnpei, and accessibility to the project team undertaking the work. This case study describes attempts to eradicate Pacific rats *Rattus exulans* on Dekehtik Island.

ACTION

Study area: The rat eradication attempt took place in 2007 on Dekehtik Island (2.63 ha), one of several small islands adjacent to Pohnpei (Fig. 1), Federated States of Micronesia, Pacific Ocean. Dekehtik is flat (maximum elevation 3 m a.s.l.) and hosts a mixed forest of coconut palm *Cocos nucifera* and several tropical broadleaf tree species. It lies 1 km from Pohnpei. Only one rat species was found on Dekehtik, i.e. Pacific rat, although curiously ship rats *R. rattus* occurred on nearby Nahkapw (only 150 m away) where likewise the only rat species present.

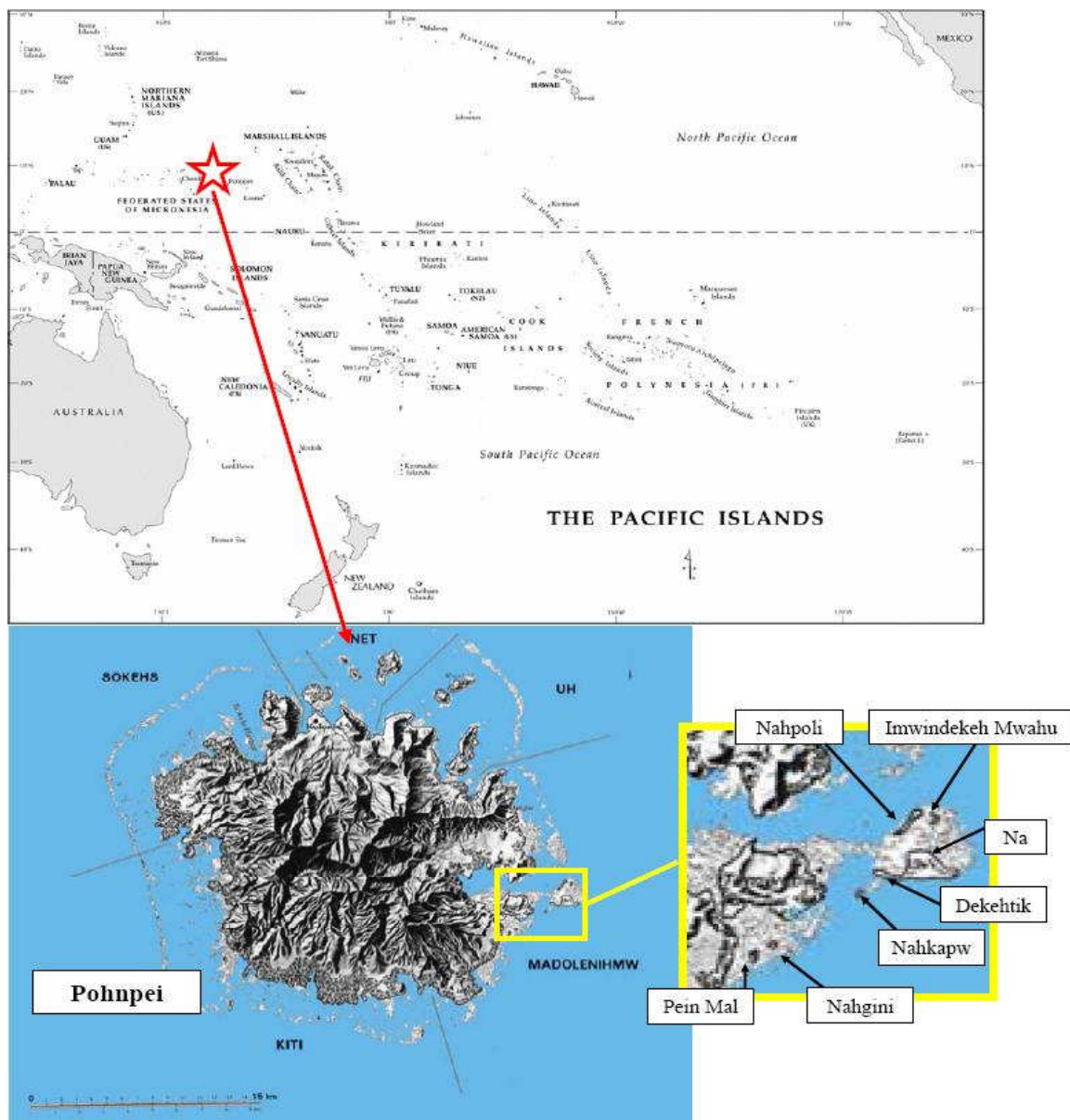


Figure 1. Map of study area; Dekehtik lies 1 km from Pohnpei main island.

Pre-treatment trial: Prior to applying active rodenticide bait on the treatment islands, an inactive (placebo) bait replicate was used in a bait application calibration study on Imwindekeh Mwahu (1.18 ha). This placebo was hand-broadcast across the entire island and the bait uptake rate was measured. From this calibration study, researchers inferred a general application rate of 50 kg/ha to be applicable for the other islands.

Treatments: The Dekehtik bait application (treatment) occurred on 14 and 15 February 2007. Project timing was driven by funding deadlines rather than biological/geophysical criteria as there is very little to no seasonality on Pohnpei. On the ground, nine 50 m x 1 m (50 m²) fixed uptake plots were randomly established on Dekehtik 1 day prior to bait application, and were then monitored for bait removal activity for 6 days after the bait application. Rodenticide bait containing 25 ppm brodifacoum (PI-25, Bell Laboratories, Inc, Madison, Wisconsin) was hand-broadcast at an application rate of 50 kg/ha. PI-25 is highly palatable to *R.rattus*, and therefore considered applicable to *R.exulans*, and is also structurally resilient in a wet tropical environment. Bait was applied using a 6-person baiting line where each person was spaced 5 m apart, and walked parallel transects across the width of the island, stopping every 5 m to apply bait to successive 5 m x 5 m (25 m²) areas. The entire island was treated with a single, one-day bait application.

During the course of the project, radio-collared *R.exulans* (n = 10) were found to spend a significant amount of time in the forest canopy. To try and ensure that rats living in the canopy would encounter bait, waxy bait clusters were fabricated and attached to biodegradable string (bolo baits) (Fig. 2). The bolo baits were catapulted into one third of the palm trees (260 trees) on Dekehtik (Fig. 3).

Effect of bait on non-target species: During the course of the project, three methods were used to assess any associated effect of the rat bait on non-target species, including bats, birds and land crabs. Pre- and post-application index of abundance surveys were performed, in combination with observations and carcass searches to assess if there were direct effects of the rodenticide bait on native wildlife.



Figure 2. A bolo bait.



Figure 3. Bolo bait being catapulted into the forest canopy.

Monitoring: To monitor eradication efficacy, three methods were used: live-trapping, wax chew blocks, and radio-telemetry. Live trap transects paired with wax chew blocks were randomly established and opened prior to and post bait application to monitor trap success and the condition of any captured rats. Post bait application efficacy monitoring began 12 days after bait was spread on the island; traps and

chew blocks were kept open for 3 days. Ten randomly trapped rats were also fitted with radio-collars in order to track rat movement for behavioral studies, and to help identify the circumstance of mortality if applicable.

CONSEQUENCES

Pacific rats were detected in live traps on the island prior to bait application. No other rat species were encountered during the course of the eradication. Non-target interference with traps was low (0.65%). Pre-bait application trap success (rat captures/trap nights) was 52%. Post-bait application trap success (as recorded 12-15 days after bait application) was 0%. Rat traps on Nahpoli (the reference island) were opened at the same time as traps on Dekehtik. After the active bait-station period on Nahkapw, the traps on Nahpoli caught rats, while no rats were caught on Dekehtik. The trap success on Nahpoli indicated that the lack of rat detection on the Dekehtik was therefore a likely result of the eradication efforts.

Pre-bait application wax indicator success was 47%. Post-bait application wax indicator success was 1%. Rat chew marks were found on one wax indicator block 12 days after the bait application. Rat eradication indicator success on Dekehtik is summarized in Table 1.

All 10 radio-collared rats on the island were active prior to bait application and 100% of the radio-collared rats were found dead within 6 days of the hand-broadcast bait application. At six months post bait application, the live trap and wax indicator stations were reactivated and kept open for 3 days; no rats were detected.

Effect of bait on-target species: Landbirds, shorebirds and bats that forage on land could potentially be at risk of exposure to the

rodenticide bait. However, 63 person hours spent searching for carcasses failed to detect any dead or moribund non-target species. Land crabs, which commonly interfered with the live traps and bait, were not affected by the bait.

Conclusions and discussion: The hand-broadcasting of rodenticide pellets containing 25ppm brodifacoum proved an effective method for eradicating Pacific rats from this small tropical island. This method may equally be applicable to other similar islands if the following assumptions are met:

- i) Risk to non-target species (including humans) is eliminated, or properly mitigated;
- ii) All regulatory mandates are followed;
- iii) Highly palatable bait is uniformly applied to the entire island in as short a time period as possible and at a high enough density to ensure that every rat will have access to bait for at least 4 days.

Multiple measures of eradication efficacy maximize the probability that post-eradication rat presence will be detected. On Dekehtik after the bait application, 100% mortality of radio-collared rats and 0% live trap success suggested that rats were no longer present on the island. However, the 1% indicator success proved that a very low density of rats might have survived the eradication attempt. Subsequently though, monitoring 6-months post bait application (with live trap and wax indicator stations reactivated and kept open for 3 days) detected no rats, suggested that the eradication was successful. Ongoing monitoring is being undertaken on Dekehtik to assess if any rats are still present, or to identify if reinvasion has occurred; due to its

Table 1. Rat eradication indicator success on Dekehtik.

Bait period and indicator technique	% trap/indicator success or rat survival
Pre-bait application trap success	52%
Post-bait application trap success	0%
Pre-bait application indicator success	47%
Post-bait application indicator success	1%
Pre-bait application radio-collared rat survival	100%
Post –bait application radio-collared rat survival	0%

close proximity to Pohnpei where both Pacific and ship rats occur, reinvasion is considered a real possibility.

While adherence to such proven practices can increase the probability of success for a given eradication project, each eradication project will entail idiosyncratic ecological conditions, non-target and environmental risks, and regulatory stipulations. Therefore each eradication project should be viewed as an opportunity to amend tested methodologies to a novel situation.

Ongoing initiatives: Through the Pohnpei Rat Eradication Research and Demonstration Project, The Conservation Society of Pohnpei (CSP), Island Conservation (IC), and the Pacific Invasives Initiative (PII) are working together to enhance the biosecurity of Pohnpei's island ecosystems, and that of other similar ecosystems throughout the Pacific. It is hoped that this research and demonstration project will help NGO and government conservation organizations develop the capacity to plan, fund, and implement subsequent rat eradications in other threatened island ecosystems. CSP, IC, and PII also partnered with the following organizations to carry out this pioneering conservation project: the Pacific Invasives Learning Network, The Nature Conservancy, the Pohnpei State Government, the Micronesia Conservation Trust, Micronesians in Island Conservation, local government officials, and local landowners.

REFERENCES

- Mooney H.A. & Cleland E.E. (2001) The evolutionary impact of invasive species. *Proceedings of the National Academy of Sciences of the United States of America*, **98**, 5446-5451.
- Rodriguez C., Torres R. & Drummond H. (2006) Eradicating introduced mammals from a forested tropical island. *Biological Conservation*, **130**, 98-105.
- Towns D.R. & Broome K.G. (2003) From small Maria to massive Campbell: forty years of rat eradications from New Zealand islands. *New Zealand Journal of Zoology*, **30**, 387-398.
- Wegmann A., Braun J. & Neugarten R. (2008) Ship rat *Rattus rattus* eradication on Nahkapw Island, Federated States of Micronesia, Pacific Ocean. *Conservation Evidence*, **5**, 18-22.
- Wegmann A., Marquez R., Howald G., Curl J., Helm J., Llewellyn C. & Shed P. (2007) *Pohnpei Rat Eradication Research and Demonstration Project, Pohnpei, Federated States of Micronesia - 16 January to 7 March, 2007*. Unpublished report. 39 pp.
- Zavaleta E.S., Hobbs R.J. & Mooney H.A. (2001) Viewing invasive species removal in a whole-ecosystem context. *Trends in Ecology & Evolution*, **16**, 454-455.