

**USDA APHIS Wildlife Services  
National Wildlife Research Center  
Hawaii Field Station**

**FY22 Annual Report:  
Investigating Infection Levels of Wild Rats for Rat Lungworm**

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Report to Hawaii Invasive Species Council

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## **FY 2022 Update**

In fiscal year 2022 we experienced administrative delays in the availability of funding, which did not become available in the APHIS system until after January 2023. Consultation in accordance with section 7 of the Endangered Species Act with the US Fish & Wildlife Service was lengthy because of the number of T&E species in the habitat at the proposed study site. All compliance has been completed and field work will be conducted the Upper Limahuli Fancy Camp study site on Kaua'i later in 2023.

- Although the agreement 22-7415-1628-RA between NWRC and HIDLNR was executed 13 May 2022, funds did not become available in the APHIS system until after January 2023.
- Informal consultation in accordance with section 7 of the Endangered Species Act with the US Fish & Wildlife Service for the Proposed *Angiostrongylus cantonensis* (Rat Lungworm) Study on Kaua'i 2022-0082586-S7-002 was completed 2 March 2023.
- The Work Initiation Document (WID) that grants Wildlife Services NWRC right of access to the Upper Limahuli Fancy Camp study site was finalized 25 April 2023.
- Protocol QA-3495 Investigating *Angiostrongylus cantonensis* infection levels of wild rats (*Rattus* spp.) for the management and surveillance of rat lungworm disease in Hawai'i was submitted 25 April 2023 (Protocol and compliance documents in Appendix 1).

## **Executive Summary**

Previous HISC-supported research has helped identify factors influencing rat lungworm (RLW) infection in rats, such species and age, and also season, however this data has been limited to one year and one site. Furthermore, information is severely lacking regarding using rat-infection data as indicators of differences (between sites/islands) or changes (over time) in disease patterns, including any effects of rat control may have on RLW levels in the landscape. Long-term monitoring of the infection levels in the rat definitive host in Hawai'i is needed to better understand, and possible manage, this emerging infectious disease.

The life cycle of the rat lungworm is complex, requiring both gastropod intermediate hosts (e.g. snails and slugs) and rat (*Rattus* spp.) definitive hosts. Although infections in humans and domestic animals usually result from the ingestion of an infected gastropod, sexual reproduction of the parasite occurs in the lungs of the rat hosts (hence the name “rat lungworm”), which makes rats a key component in disease transmission. It is likely that any large-scale and/or long-term management approaches to this disease would involve control of wild rat populations. Therefore, it is only prudent that any of these management decisions be properly informed by up-to-date research on the role wild populations of rats are playing in the epidemiology of rat lungworm in Hawai'i.

Without any baseline data which can be used to compare infection levels over time, any detections moving forward won't inform us if infections levels are increasing or decreasing. Here we propose to conduct RLW surveys in rats to collect baseline infection level data, while emphasizing the establishment of both long-term monitoring sites and standardized sampling protocols. This work supports the mission of HISC to enhance invasive species prevention, control, outreach, and research.

The study will incorporate field work (e.g. trapping and collecting of rats) and laboratory work (e.g. dissections, worm counts). Baseline data would be collected from a previously established site on Hawai‘i Island, as well as new sites (most likely Kaua‘i). Standardized trapping protocols will be developed, that are both repeatable and can be followed by non-scientists (e.g. HIDNLR or Hawai‘i DOH employees) moving forward.

By establishing standardized protocols that can be repeated by personnel of various backgrounds and experience, any long-term data collected can be used to compare over time and between sites. This could be expanded to other diseases beyond RLW, since rats are reservoirs of numerous disease that infect humans, domestic animals, and wildlife (e.g. leptospirosis). A scientific approach to better understanding of factors influencing disease levels in the wild can also help prioritize any future monitoring and control efforts directed towards reducing transmission in the wild.

Objective 1: Collect baseline data for 2022

- Trap and sample wild rats from up to 3 major islands (e.g., Hawai‘i and Kaua‘i)
- Choose sampling season, based on previous research (e.g., Feb-May).
- Trap rats for  $\leq 7$  days, to achieve appropriate minimum numbers (to be determined based on previous research, local knowledge, and power analyses (e.g., 30 adult *Rattus rattus* per site)
- Measure RLW infection levels in rat carcasses in the BSL-2 laboratory.

Objective 2: Establish long-term sampling sites

- Choose sites from up to 2 additional islands (as previously done with Hawai‘i Island)
- Choose 1 site per island, based on preferred habitat for RLW
- Choose transects for trapping rats (e.g., 2) at each site that can be accessed repeatedly over time

Objective 3: Establish trapping protocols for long-term sampling

- Standardize trapping methods (e.g., trap placement, bait type, pre-bait technique) and types of traps).
- Establish data collection protocol to measure trapping effort (e.g., record number of trap nights, including number of closed or “tripped” traps at time of trap check).

A completion report will be provided with the following:

1. The collection sites on Kaua‘i (for repeated future surveys)
2. Trap results/ species
3. Laboratory necropsy results including identification of RLW (total adult worms per rat).
4. Comparative analysis with abundances of previous Big Island surveys.

In addition, a detailed methods and trapping protocol will outline the roles, locations, and tasks to repeat the Kaua‘i survey by others. This protocol will include photos, maps, and data collection forms. This is to be delivered at the end of the period of performance.

## **Budget and Progress**

Because Hawaii DLNR intended to provide the funds in advance for this project, the agreement was created as a “ROWA” (prepaid) in USDA’s financial management system (FMFI) rather than a “ROWE” (pay after the work is done) account. ROWAs as prepaid agreements do not have a functioning accounting code until the payment is received and applied, therefore work on this project could not begin. Agreement 22-7415-1628-RA for the amount of \$17,550.01 was executed on 13 May 2022, however a functioning accounting code did not become available to NWRC after January 2023. All compliance for the project has been completed and field work will commence later in 2023.

**FY 2022**

<b>Category</b>	<b>Amount</b>
Salary & Benefits	\$8,000.00
Travel	\$4,500.00
Supplies	\$1,302.60
<b>Total Direct Expense</b>	<b>\$13,802.60</b>
Overhead	\$3,747.40
<b>TOTAL</b>	<b>\$17,550.01</b>

Additional expenses for salaries, materials, vehicles, facilities, shipping, etc., including future completion of the study, will be supplied by WS-NWRC.

**Related Products**

Jacob, J. A. Steel, L. Kaluna, S. Hess, I. Leinbach, C. Antaky, R. Sugihara, L. Hamilton, P. Follett, K. Howe, S. Jacquier, S. Wongwiwatthananut, and S. Jarvi. 2022. In Vivo Efficacy of Pyrantel Pamoate as a Post-exposure Prophylactic for Rat Lungworm (*Angiostrongylus cantonensis*). International Journal for Parasitology: Drugs and Drug Resistance 19: 1–5. <https://doi.org/10.1016/j.ijpddr.2022.04.002>