

ASSESSMENT OF EFFECTS OF RODENT REMOVAL ON ARTHROPODS, AND
DEVELOPMENT OF ARTHROPOD MONITORING PROTOCOLS, ON CONSERVATION
LANDS UNDER US ARMY MANAGEMENT

Annual Statement of Work, November 2013

Dr. Paul Krushelnycky
Dept. of Plant and Environmental Protection Sciences
University of Hawaii
3050 Maile Way, Gilmore 310
Honolulu, HI 96822
Phone: 808-956-8261
Email: pauldk@hawaii.edu

Background

Invasive black rats are believed to exert severe predatory pressure on native arthropod species, but the effects of this pressure on arthropod populations has not been quantified in the field. Because rats are now nearly ubiquitous in natural areas of Hawaii, the most effective way to assess their impacts on arthropod species and communities is to monitor the response of arthropods to rat removal. The Oahu Army Natural Resource Program (OANRP) has implemented rat removal operations in several areas in the Waianae Mountains. In conjunction with these efforts, I have been conducting standardized, quantitative arthropod sampling before and after rat removal in two of these areas (Kahanahaiki and Palikea), as well as in adjacent control sites where rats will not be immediately removed, to measure arthropod responses and estimate the impacts of rats on native and introduced arthropod populations. This sampling will also serve as an arthropod inventory, providing important information on the biodiversity of these management areas. Thirdly, the sampling conducted in this project will be used to help develop broader arthropod monitoring protocols for the OANRP management units, as desired under the Makua and Oahu Implementation Plans.

FY13 progress

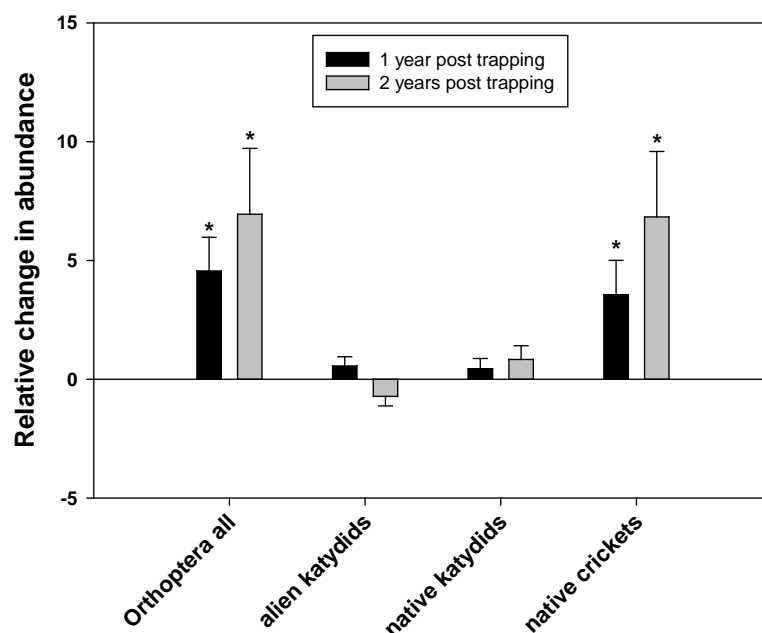
During fiscal year 2013, work on this project transitioned from seasonal sampling to annual sampling at Palikea. This transition was made to meet the goal of developing a more efficient monitoring protocol for longer-term tracking of arthropod community trends at this site. Sampling at Kahanahaiki was terminated in late FY12, as new rat trapping technology was implemented at the adjacent control site (Pahole Natural Area Reserve) for the Kahanahaiki monitoring.

Sampling at Palikea during FY13 was conducted in November 2012, representing the last seasonal monitoring event at this site, and in July 2013 as the first once-annual monitoring event at this site. A total of 288 standardized samples were collected in the course of the two monitoring events, including pitfall traps, leaf litter extraction, daytime vegetation sweeping and nighttime vegetation sweeping. This sampling was conducted within OANRP's vegetation monitoring plots, allowing analysis of relationships between plant community composition and arthropod community composition. In addition, *Rhynchogonus* beetle monitoring was conducted at 50 points during each monitoring event.

Sample sorting and specimen identification progressed during FY13. All samples from FY12 monitoring and from November 2012 have been sorted at least to taxonomic order, and specimen identification to lower taxonomic levels has proceeded for much of this material. All specimens from samples prior to November 2012 have now been identified to the lowest target taxonomic level (species or morphospecies for many groups, family or order for remaining groups), and all of these specimens have been fully databased. Specimens from the November 2012 monitoring event have been fully sorted, most of the material has been identified to the lowest target taxonomic level, and much has been databased. The remaining specimens still need final determination of taxonomic identity and subsequent databasing. Samples from the July 2013 monitoring event are currently being sorted; this process is more than half completed.

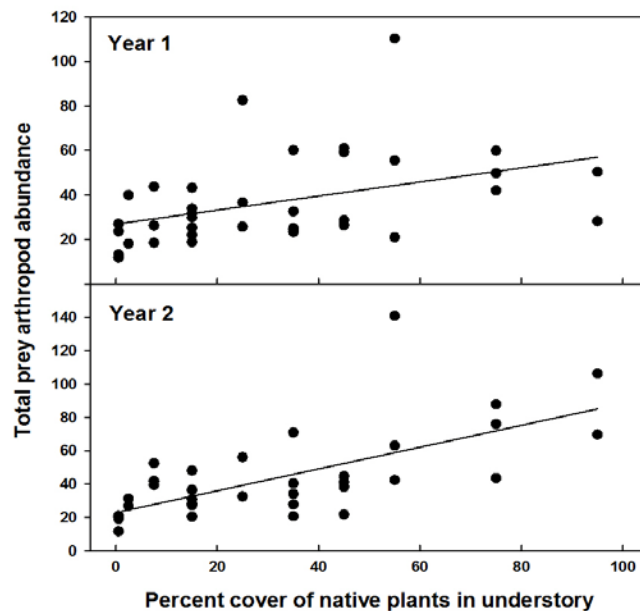
In addition to sample sorting and specimen identification, a large amount of specimen curation was completed in FY13. Measurements of specimens were also made for all species, which will allow estimates of biomass and analyses of shifts in trophic structure.

Results to date allow preliminary assessments of the effects of rodent trapping on arthropod communities, as well as the relationships between plant and arthropod communities. At Palikea, it appears that the greatest evidence for population recovery following rodent trapping is with the Orthoptera, the crickets and katydids (see Figure). This is consistent with results from Kahanahaiki, as well as with studies from elsewhere that have found that rodents target these relatively large bodied insects.



In contrast to the Kahanahaiki site, where spiders appear to have increased in number after rodent trapping, so far spiders show evidence of declining at Palikea following trapping. This discrepancy may also be related to the contrasting patterns seen with Hemiptera (plant sucking bugs): these insects declined at Kahanahaiki but increased at Palikea, possibly resulting from increased predation pressure from spiders at the former site and decreased predation pressure from spiders at the latter site. The reason for the different responses among spiders (and possibly other arthropod predators) at the two sites is unclear, but could be related to differential roles of birds among sites.

Results at the Palikea site also reveal a clear relationship between the degree of plant invasion and arthropod richness and abundance: the higher the percent cover of alien plants in the forest understory, the lower the richness and abundance of the associated arthropod community. This is true for both native and introduced arthropods, possibly indicating that alien plants have better defenses against herbivory. These results suggest that alien plant control and native plant restoration should directly benefit native arthropods, and may indirectly improve habitat quality for insectivorous birds such as the endangered elepaio: abundance of estimated elepaio prey arthropods also increases with increasing native plant cover (see Figure below).



FY14 plans

Funding for FY14 will allow continued sorting and identification of the July 2013 annual monitoring event, as well as the execution of the July 2014 annual monitoring event and initial sample processing. Goals for FY14 include complete analysis of the first two years of seasonal post-trapping sampling at both Kahanahaiki and Palikea, and analysis of annual trends for three years post trapping at Palikea. Analyses will examine taxonomic groups that appear to respond to rodent trapping, changes in diversity of native and alien species, and potential changes in trophic structure.