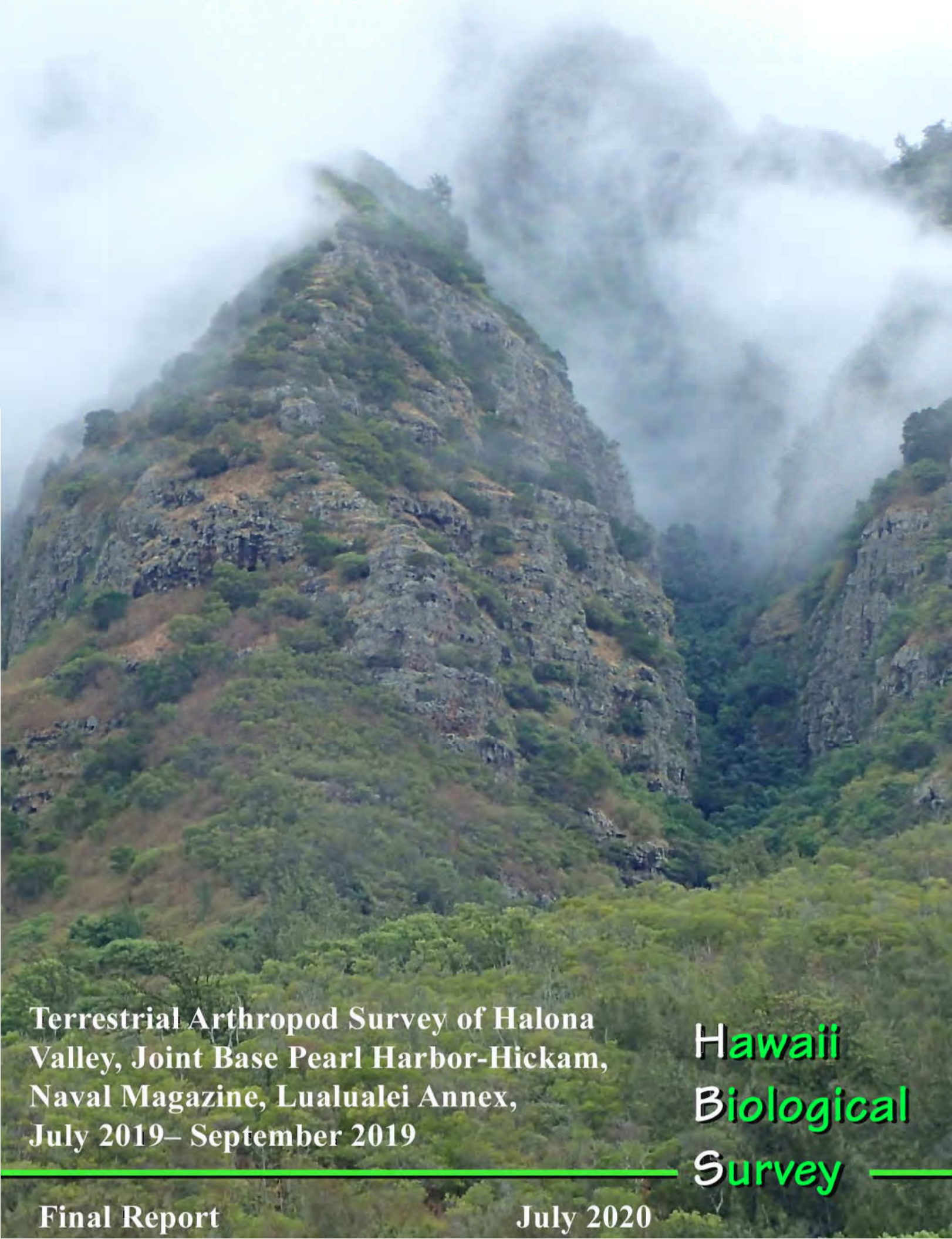

Terrestrial Arthropod Survey of Halona Valley, Joint Base Pearl Harbor-Hickam, Naval Magazine, Lualualei Annex, July 2019– September 2019

Hawaii Biological Survey

Final Report

July 2020

Terrestrial Arthropod Survey of Hālona Valley, Joint Base Pearl Harbor-Hickam, Naval Magazine Lualualei Annex, July 2019–September 2019

Neal L. Evenhuis, Keith T. Arakaki, Clyde T. Imada

Final Report prepared for the U.S. Navy

Contribution No. 2020-008 to the Hawaii Biological Survey

EXECUTIVE SUMMARY

The Bishop Museum was contracted by the U.S. Navy to conduct surveys of terrestrial arthropods in Hālona Valley, Naval Magazine Lualualei Annex, in order to assess the status of populations of three groups of insects including species at risk in those groups: picture-winged *Drosophila* (Diptera; flies), *Hylaeus* spp. (Hymenoptera; bees), and *Rhyncogonus welchii* (Coleoptera; weevils). The first complete survey of Lualualei for terrestrial arthropods was made by Bishop Museum in 1997. Since then, the Bishop Museum has conducted surveys in Hālona Valley in 2015, 2016–2017, 2017, 2018, and 2019. The current survey was conducted from July 2019 through September 2019, comprising a total of 12 trips; using yellow water pan traps, pitfall traps, hand collecting, aerial net collecting, observations, vegetation beating, and a Malaise trap. The area chosen for study was a *Sapindus oahuensis* grove on a southeastern slope of mid-Hālona Valley. The area had potential for all three groups of arthropods to be present, especially the *Rhyncogonus* weevil, which has previously been found in association with *Sapindus* trees. Trapped and collected insects were taken back to the Bishop Museum for sorting, identification, data entry, and storage, and preservation. The results of the surveys proved negative for any of the target groups. However, by-catch of 162 species of insects and other terrestrial arthropods resulted in 44 new records for Hālona Valley and 34 for the entire Naval Magazine Lualualei. A listing of all species identified from this survey is given and added to the previous survey lists of terrestrial arthropods known from Lualualei. Further surveying in additional areas of Hālona Valley should be conducted in order to better assess the presence/absence of the target taxa but also to assess potential threats to populations of such vulnerable taxa.

INTRODUCTION

In 1997, the Bishop Museum conducted a terrestrial arthropod survey of the Joint Base Pearl Harbor-Hickam, Naval Magazine Lualualei Annex (hereinafter shortened to Lualualei) (Evenhuis, 1997) in order to provide a faunal list of all terrestrial arthropods in assisting the U.S. Navy with their conservation efforts on the base. In that survey, a total of 637 taxa were collected and identified. The majority of the taxa were found in Hālona Valley, which proved to harbor a rich and diverse assemblage of both plants and animals. Recent surveys are being conducted to update that 1997 survey by focusing on Hālona Valley and to assess the populations of three target arthropod groups that include species at risk, as well as federally listed species. The Bishop Museum was contracted in 2015 to re-survey areas of high potential for three sets of target insects that were rare or endangered. That report failed to find any of the target organisms, but the by-catch resulted in 18 new records for Lualualei and for Hālona Valley (Evenhuis *et al*., 2016). The Museum was again contracted in 2016 to survey another portion of Hālona Valley, southeast of the previous year's surveying and located in a *Sapindus* grove where the last *Rhyncogonus welchii* weevil had been collected in 1997. Surveys were conducted from November 2016 through mid-February 2017, comprising a total of 12 trips with negative results for the target organisms, but by-catch resulted in 23 new records for Hālona Valley and 19 new records for Lualualei (Evenhuis *et al*., 2017). In 2017 a survey was conducted at another *Sapindus* grove a few hundred meters southeast of the previous year's survey and comprised 12 trips from mid-August through mid-November 2017. Again there were negative results for the target organisms, but the by-catch resulted not only in new records, but also a new endemic species of flightless dolichopodid, known previously from the summit bog of Mt. Ka‘ala (Evenhuis *et al.*, 2018; Evenhuis, 2018). The next survey was conducted from September 2018 to December 2018 (Evenhuis *et al.* 2019) at a spot a few hundred meters north of the 2016 survey and higher up the ridge at a spot with a large *Sapindus* grove and much native understory. Former Bishop ‘museum entomologist has indicated he has collected live *Rhyncogonus* weevils near this locality. The results for target organisms were negative but the by-catch resulted in 30 new records to Hālona Valley and 23 for Lualualei. The current survey was conducted at the same location as the 2016 survey (but in different months) in a large *Sapindus* grove. Results again proved negative for the target organisms, but the by-catch resulted in more species than in previous surveys in Hālona and a total of 44 new records for the valley and 34 for the Lualualei. With the new records obtained during the current survey, the total number of species of terrestrial arthropods for Lualualei is now 751 (an 18% increase from 1997) and for Hālona is 497 (a 48.8% increase). The percent native insects in Lualualei is 22.8%, with 70.0% adventive, and 7.2% of unknown origin. Arthropods were observed and collected specimens brought back to the Bishop Museum for identification, data entry, and preservation. Results of collection and identification work are provided in Table 2.

MATERIAL AND METHODS

Survey Site and Collection Points. Hālona Valley was chosen for survey work because it is the locality where many of the target taxa were last seen. Hālona Valley is a large basin-shaped region forming the headwaters of a major drainage feeding Niuli‘i Reservoir, originating below Pōhākea Pass. This area is today accessed via bunkers located on Dent Street and Forrestal Street.

A small grove of *Sapindus oahuensis* trees at approximately 1280 ft elev. was selected as the primary survey area since it was near a reported collecting site for the *Rhyncogonus* weevil (*R. welchii*) (Coleoptera: Curculionidae) in 1994. A flagged trail made to the site provided access through *koa haole* (*Leucaena leucocephala*) shrubland and Christmas berry (*Schinus terebinthifolius*) forest.

Surveying was done at sites within and adjacent to the *Sapindus* trees. Collecting sites were marked with a GPS to obtain latitude and longitude (Table 1).

Table 1. Collecting Sites in Naval Magazine Lualualei, Hālona Valley for the 2019 field season.

pitfall sites

Site	GPS	elev.	collecting method
1	N21.42578° W158.10320°	1284 ft.	pitfall
2	N21.42595° W158.10298°	1282 ft.	pitfall
3	N21.42594° W158.10335°	1263 ft.	pitfall
4	N21.42591° W158.10309°	1281 ft.	pitfall
5	N21.42583° W158.10304°	1284 ft.	pitfall
6	N21.42589° W158.10329°	1269 ft.	pitfall
7	N21.42580° W158.10303°	1292 ft.	pitfall
8	N21.42601° W158.10306°	1278 ft.	pitfall
9	N21.42595° W158.10289°	1285 ft.	pitfall
10	N21.42608° W158.10318°	1262 ft.	pitfall

pan trap site

	GPS	elev.	collecting method
	N21.42611° W158.10304°	1280 ft.	yellow pans

Malaise trap site

	GPS	elev.	collecting method
	N21.42610° W158.10312°	1275 ft.	Malaise trap

Collecting Methods. A number of collecting methods were employed during the survey to enable collection of as wide a variety of arthropods as possible. Some included observation only to avoid collecting of federally listed picture-winged *Drosophila*. A list of the trapping methods used included:

Yellow water pans (Fig. 1). These are used to collect a variety of flying insects that are attracted to the yellow color. The traps consist of small yellow bowls filled with water with a small amount of surfactant (usually soap), which causes trapped specimens to sink and drown. A small amount of eco-safe propylene glycol was added to repel fungal growth and reduce evaporation of the liquid. Pans were placed in a fairly open area (i.e., one that provided dappled sunlight) and in presumed flight paths to allow flying insects to better see the pans and be attracted to them.

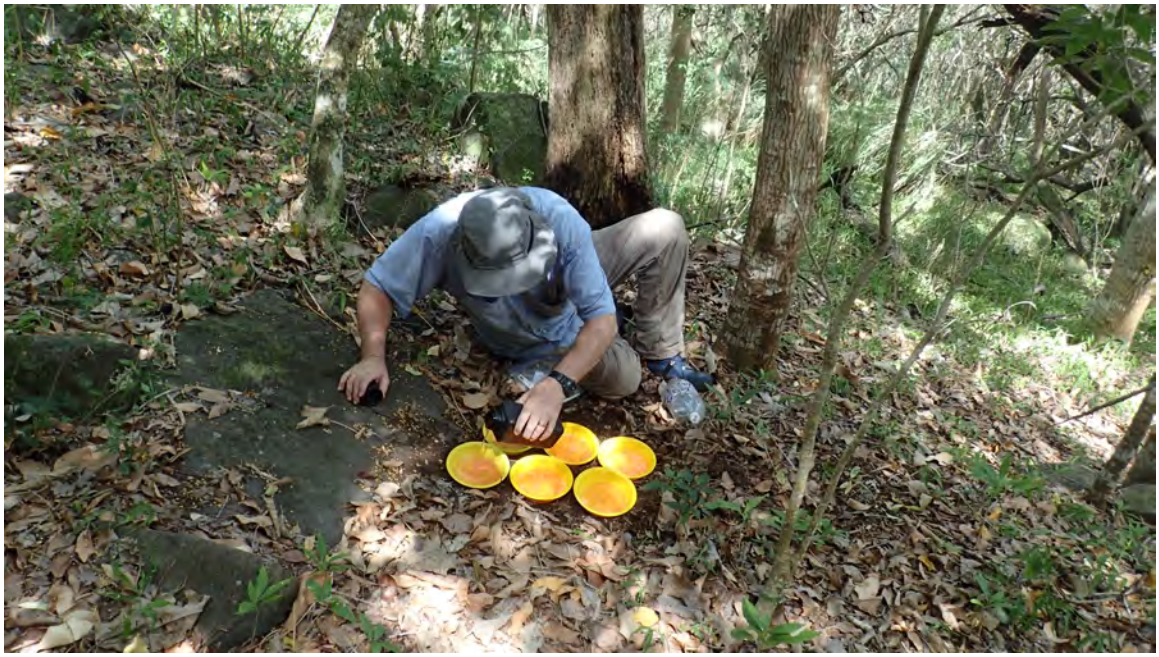

Fig. 1. Yellow Pan trap setup (non-toxic propylene glycol giving liquid a pinkish appearance). Photo: Cory Campora.

Pitfall traps (Fig. 2). These traps are designed to collect ground-dwelling arthropods and other invertebrates that fall into the traps. The traps consist of a plastic cup buried in the substrate, so as to be relatively level with the ground, and filled with a 50/50 mix of water and propylene glycol (non-toxic marine anti-freeze). Cups that were above ground level were provided with natural "ramps" of twigs. Traps were protected from rain and falling debris by placing a cap rock on top but still leaving space for crawling invertebrates to get to the cup. This survey modified the procedure of previous surveys by adding a second plastic cup that was used as a protective sleeve. When the inner cup containing the liquid was removed in order to collect specimens, the outer "protective" cup was kept in place, which kept loose soil and rocks from falling into the excavation, thus saving time in otherwise having to re-excavate.

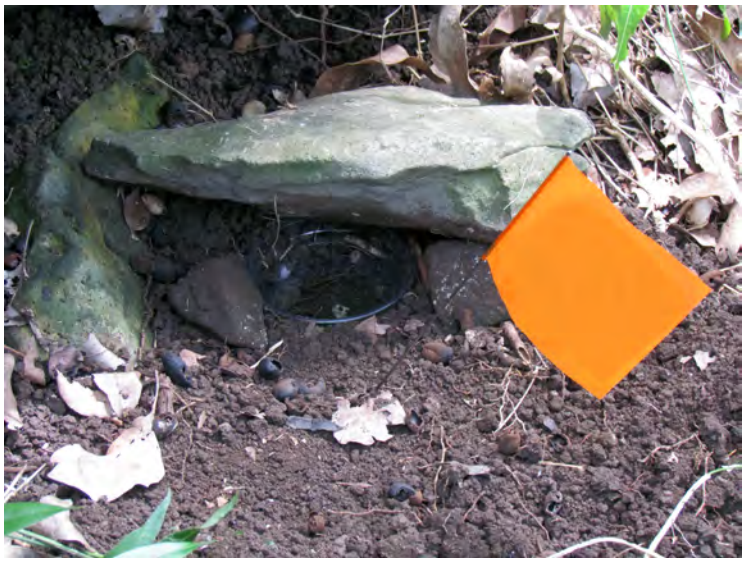

Fig. 2. Pitfall trap in place with rock protective cover. Flag used to mark location. Photo: Neal Evenhuis.

Bait traps. As in previous survey years, the unfortunate presence of Australian cockroaches recently introduced to the area bypassed the Tanglefoot® barrier (which was placed in order to keep ants from the baits) and would eat all the banana bait and much of the mushrooms so that observations of picture-winged *Drosophila* or other small flies that would otherwise be attracted to the baits could not be observed or collected.

Aerial sweep nets. Flying insects were collected with aerial sweep nets (Fig. 3) when they appeared. Often, insects were collected out of the net with an aspirator. Collected insects were placed in snap cap vials and brought back to the lab for identification and preservation.

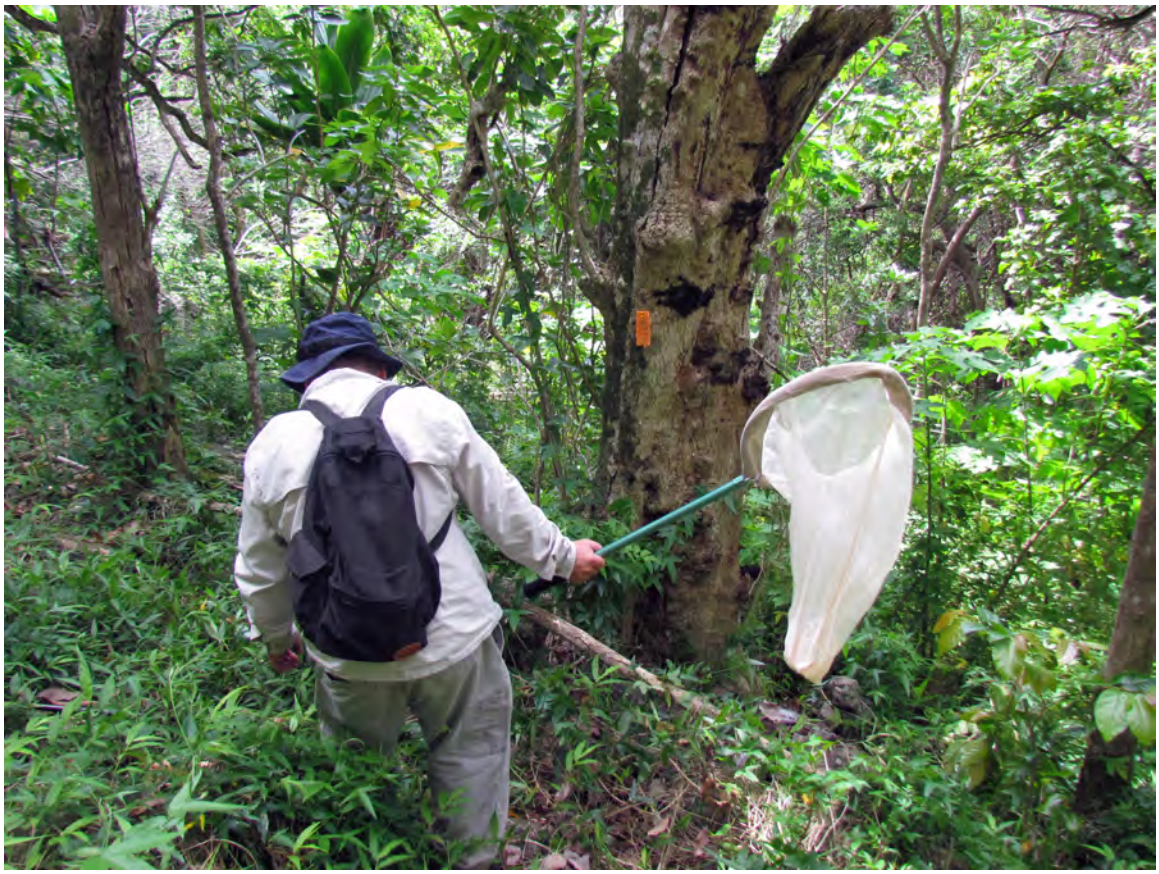

Fig. 3. Using an aerial sweep net. Photo: Neal Evenhuis.

Hand collecting. This often involved using snap cap vials for collecting hard to-reach specimens (such as flies under leaves of bushes) or insects walking on substrata (or ground-dwelling spiders and amphipods and isopods).

Malaise trapping. A small free-standing Townes-style Malaise trap (Fig. 4) was employed to better assess the flying insect fauna of the area. Results gave a good representation of the diversity of terrestrial arthropods in the area as well as substantially increasing the records of arthropods recorded from Hālona Valley and the Naval Magazine as a whole.

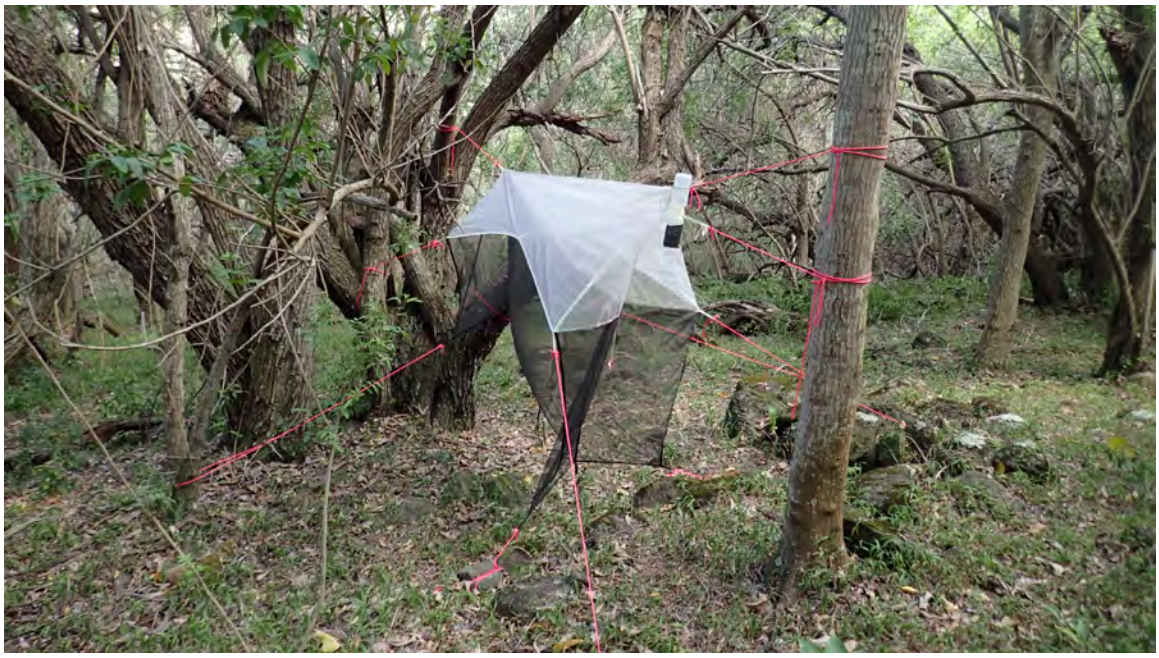

Fig. 4. Malaise trap to intercept flying insects. Photo: Neal Evenhuis.

***Vegetation Beating*.** In order to assess the arthropod fauna of the canopy and above-ground vegetation, we employed a beating technique that involved placing a large white plastic sheet below a *Sapindus* tree and shook (for trees with small trunks) or beat vegetation with a long pole (for trees with larger trunks) (Fig. 5) and scoured the plastic sheet for invertebrates that fell onto the sheet.

Fig. 5. Vegetation beating of *Sapindus* to sample canopy insects. Photo: Clyde Imada.

Collecting Times

Six trapping episodes were conducted (12 trips overall) from July through September 2019 at the main study site, with the first day of each biweekly trip focused on placing traps and collecting in the area; the second day (usually three days later to avoid evaporation of liquid in traps) involved collecting trapped specimens and conducting further on-site collecting. Forays outside of the study site were also made to ascertain potential for future collecting and to make any observations of target organisms. As weather permitted, both collecting days during each collecting episode involved searching leaf litter and vegetation for *Rhyncogonus welchii* (see Discussion below for further details).

RESULTS

A total of 162 taxa of terrestrial arthropods were identified during this survey (see Table 2), but no target organisms were seen or collected. The recorded taxa included 44 new records (a mixture of native and introduced species) for Hālona Valley and 34 new records (also a mixture of native and introduced species) for Lualualei (since Hālona is by far the most diverse of the areas in Lualualei for terrestrial invertebrates, it is no surprise that if a taxon is new to Hālona, then it would probably not have been found anywhere else in Lualualei previous to this study, thus is new to all of Lualualei too). Additionally, ten new families were added to the Lualualei list and 2 new orders. A full list is given in Table 2, which also indicates new records, taxonomic changes, and corrected spellings all in red.

A few of the collected and identified taxa resulting from this survey are highlighted here.

Spiders (Araneae): The ant-mimicking spider genus *Myrmarachne* (undetermined species) [a member of the jumping spider family Salticidae] (cf. Fig. 6) was collected again during this survey and proved to be more common than in previous years (possibly due to increasing population numbers after its recent introduction). A number of leaves were found with egg sacs and protective webbing for the egg sac with females often inside the webbing protecting it. Some curl the leaves as added protection, but most of the egg sacs appeared to be flat tent-like webs with the female and egg sac inside.

Fig. 6. *Myrmarachne* sp. (Salticidae) egg sacs on leaf. Photo: Cory Campora.

Flies (Diptera): Pan trapping results included a new species of the endemic Hawaiian keroplatid genus *Tylparua*. Originally it was thought to be a previously described species found on many islands, but a current revision being conducted on the Hawaiian species has shown it to be an undescribed species restricted to O‘ahu.

Lepidoptera (moths, butterflies). One new record for Hālona and Lualualei Naval Magazine was the finding of a particularly striking tineid moth (*Trichophaga* sp. probably *mormopsis* Meyrick) (Fig. 7), an adventive species in Hawai‘i.

Fig. 7. *Trichophaga* sp. (Tineidae) [head at right]. Photo: Cory Campora.

Book and bark lice (Psocoptera). Two undetermined endemic species of bark lice of the genus *Ptycta* were collected in our survey and mark new records for Lualualei. Bark lice are not uncommonly observed in forest environments in the Hawaiian Islands, but endemic species of the genus *Ptycta* at relatively low elevations on O‘ahu are, and this is a significant find that indicates the relative health of the collecting site.

DISCUSSION

Efforts to find *Rhyncogonus*

Since the locality chosen for this year's project was near the site of the last known live collection of the rare *Rhyncogonus welchii* in the 1990s, we made a special effort to locate any live specimens or elytra that might be in the leaf litter. Leaf litter under *Sapindus* trees were diligently searched for the beetle but with no luck. The method employed in leaf litter searching was to slowly remove leaves from the surface until the lowermost layer was exposed. Then the area was cleared and the topsoil was hand-sifted in hopes of finding larvae or adults under ground. Rocks and small boulders were also turned over. Although we obtained negative results for the beetle, this method revealed leaf-litter fauna that would have otherwise been missed, and we encourage further use of this method at other high-potential *Rhyncogonus* areas (e.g., *Sapindus* groves) in order to try and find evidence of the weevil itself, or its elytra. Elytra can persist for years and can give evidence of previous populations in the area. We also employed beating vegetation in hopes that *Rhyncogonus* that might have been in the canopy would fall onto the plastic sheet directly below. This also provided negative results for the weevil, but other insect not found using other collecting methods (e.g., a small predaceous reduviid bug [probably endemic]) was collected using this method.

Fig. 8. Feeding damage by *Rhyncogonus* weevils on young *Sapindus* leaf. Photo: Cory Campora.

Searches for evidence of feeding did show some promising results. *Rhyncogonus* weevils produce a distinctive L-shaped feeding mark on leaves (Fig. 8). A number of leaves from young *Sapindus* trees were found with such feeding marks, but subsequent searches for adults or immatures near those trees using leaf litter searches and vegetation beating proved fruitless.

Cockroaches

As with the previous year's surveys, the presence of a populations of the Australian cockroach, *Periplaneta australasiae* (Fig. 9), thwarted our efforts at using banana / mushroom baits, as flying adults would bypass the Tanglefoot® barrier and consume the banana bait and mushrooms shortly after they were put in place. We abandoned the baits, and visual observation for the picture-winged *Drosophila* was continued without baits, which was not optimal and had negative results. Note: The cockroach appears to be well established and slowly spreading throughout Hālona Valley. Its presence as a ground-dwelling scavenger could pose a threat to native ground-dwelling fauna as it outcompetes for resources.

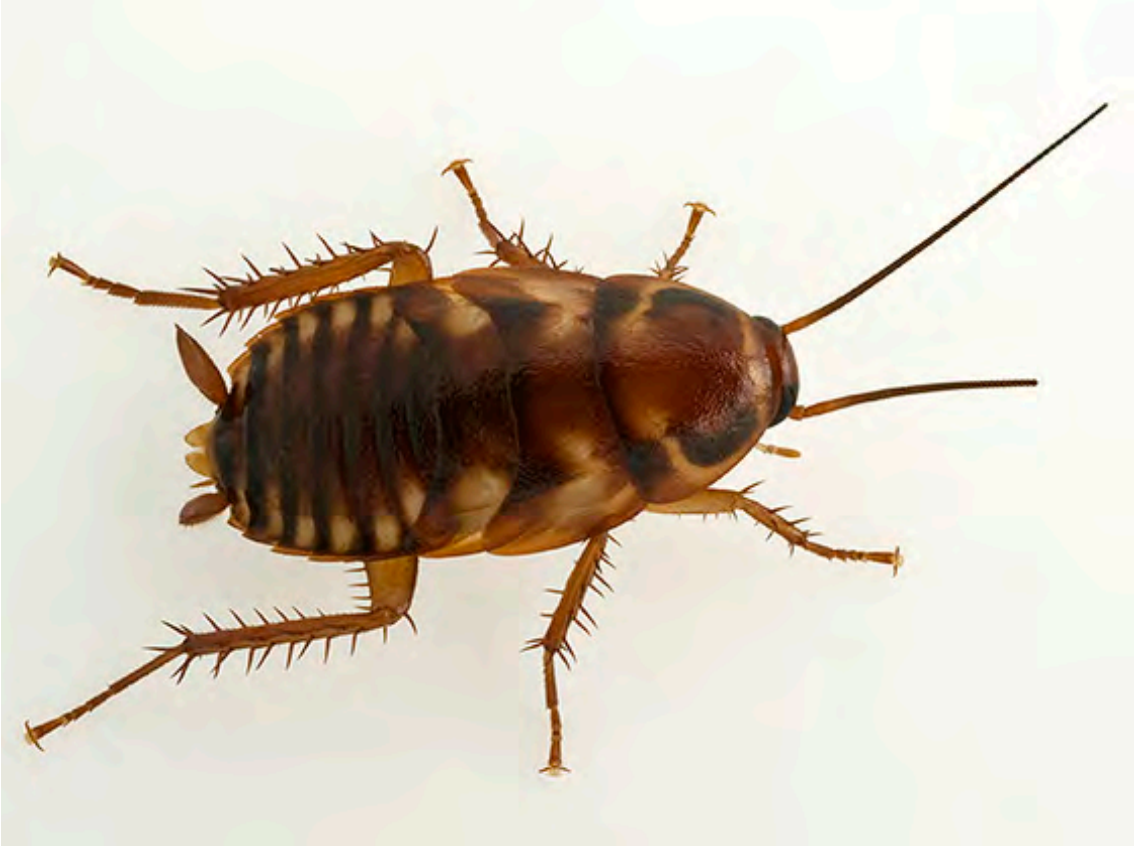

Fig. 9. The Australian cockroach, *Periplaneta australasiae*. Photo: Neal Evenhuis.

Possible threats to native invertebrate fauna

The presence of large numbers of *Anoplolepis gracilipes* (crazy ants) at the study sites in Hālona Valley could be a potential threat to any soil-dwelling or arboreal native invertebrate fauna. The *Anoplolepis* ants at the study site were part of a supercolony and could contain as many as millions of individuals. We found these ants tending scale insects for the honey they produce (Fig. 10). This means that, despite the ants decimating leaf litter prey, they still persist by surviving on the honey that the scale insects produce. The ants, along with the recent introduction of the Australian cockroach, may pose severe threats to the native ground-dwelling fauna. Sifting leaf litter, we observed only a few invertebrates that have survived both the ants and the cockroaches and possibly have chemical defenses or behavioral adaptations to allow them to co-exist.

Fig. 10. Yellow-legged crazy ants, *Anoplolepis gracilipes,* tending scale insects, *Periplaneta australasiae*. Photo: Cory Campora.

CONCLUSION

Although we had negative results for the target taxa, there is no reason to believe that they do not exist in Hālona Valley, and further surveying in other areas should hopefully bear this out. At a minimum, this survey continues to increase the baseline inventory of terrestrial arthropods in Hālona Valley and Lualualei and can assist resource managers in decision-making with regard to conservation management, protection of existing native

biota, and understanding and possibly mitigating possible threats to vulnerable taxa of plants and invertebrates in the area.

ACKNOWLEDGMENTS

James Boone is thanked for identifying the tineid moth. Cory Campora is thanked for assistance on many of the trips and photography. The senior author benefitted from discussions regarding various Heteroptera and Homoptera with Dan Polhemus. The U.S. Navy is thanked for allowing access to the Naval Magazine Lualualei Annex to conduct these surveys.

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Table 2. Arthropods collected at Hālona Valley July-September 2019 (new or corrected items in red).

	status*	Lualualei 1997	post-1997 literature	Halona 1997	Halona 2015	Halona 2016-17	Halona 2017	Halona 2018	Halona 2019
ACARI									
Acaridae									
Tyrophagus putrescentiae (Schrank)	adv	1		1					
Ascidae									
Asca aphidioides (Linnaeus)	adv	1		1					
Asca duosetosa Fox	adv	1		1					
Asca quinquesetosa Wharton	adv	1							
Bdellidae									
Bdella captiosa Atyeo	adv	1		1					
Bdella distincta Baker & Balock	adv	1		1					
Bdella mexicana Baker & Balock	adv	1		1					
Spinibdella depressa (Ewing)	adv	1		1					
Spinibdella sp. [immature]	??	1		1					
Brachycthoniidae									
Sellnickthonius sp.	end	1							
Caligonellidae									
Coptocheles solanii Swift	end	1							
Neognathus spectabilis (Summers & Schlinger)	adv	1							
Cepheidae/Andremaeidae									
gen. sp.	??	1		1					
Cheyletidae									
Hemicheyletia wellsi (Baker)	adv	1		1					
Cryptognathidae									
Favognathus goffi Swift	end	1		1					
Favognathus pictus (Summers & Chaudhri)	adv	1		1					
Ctenacaridae									
Ctenacarus araneolus (Grandjean)	adv	1							
Cunaxidae									
Pulaeus n.sp.	end	1		1					
Digamasellidae									
Dendroseius sp.	adv	1							
Ereynetidae									
Ereynetes sp.	adv	1		1					
Euphthiracaridae									
Euphthiracarus sp.	end	1		1					
Eupodidae									
Eupodes sigmoidensis Strandtmann & Goff	end	1		1					
Galumnidae									
Pergalumna hawaiiensis (Jacot)	ind	1		1					
Laelapidae									
Pseudoparasitus trincisus Hunter	adv	1		1					
Macrochelidae									
Macrocheles muscaedomesticae (Scopoli)	adv	1		1					
Macrocheles sp. nr. rodriguezi (Oliver & Krantz)	adv	1		1					
Nanorchestidae									
Nanorchestes sp. 1	adv	1		1					
Nanorchestes sp. 2	adv	1		1					
Nothridae									
Nothrus sp.	adv	1		1					

Table 2. Arthropods collected at Hālona Valley July-September 2019 (new or corrected items in red).

	status*	Lualualei 1997	post-1997 literature	Halona 1997	Halona 2015	Halona 2016-17	Halona 2017	Halona 2018	Halona 2019
Ologamasidae									
Gamasiphis sp.	end	1		1					
Oppiidae									
gen. spp. (3)	??	1		1					
Oribatidae									
gen. sp.	??	1			1	1		1	1
Paratydeidae									
Paratydeus sp.	adv	1							
Podocinidae									
Podocinum sagax (Berlese)	adv	1		1					
Polyaspididae									
gen. sp.	??	1		1					
Pygmephoridae									
Pygmephorus sp.	adv	1							
Raphignathidae									
Raphignathus n.sp.	adv	1							
Rhagidiidae									
Shibaia longisensilla (Shiba)	adv	1							
Scheloribatidae									
Scheloribates sp. nr. oahuensis Jacot	end	1		1					
Scheloribates spp.	??	1		1					
Stigmaeidae									
Eustigmaeus microsegnis (Chaudhri)	adv	1		1					
Eustigmaeus ornatus Ueckermann & Meyer	adv	1		1					
Eustigmaeus segnis grp.	adv	1		1					
Stigmaeus n.sp.	end	1		1					
Tarsonemidae									
Hemitarsonemus sp.	adv	1							
Tydeidae									
Tydeus sp.	adv	1							
Uropodidae									
gen. sp.	adv	1		1					
Veigaiidae									
Veigaia nemorensis (C.L. Koch)	adv	1							
AMPHIPODA									
Talitridae									
Talitroides topitotum Burt	adv	1		1	1	1	1	1	1
ARANEAE									
Araneidae					1				
Argiope appensa (Walckenaer)	adv	1		1					
Gasteracantha mammosa C.L. Koch	adv	1		1	1	1		1	1
Neoscona sp.	adv	1							
Clubionidae									
Cheiracanthium mordax L. Koch	adv	1		1					
Dysderidae									
Dysdera crocota C.L. Koch	adv	1		1					1
Gnaphosidae									
Camillina elegans (Bryant)	adv	1		1					
Linyphiidae									
Orsenwelles polites Hormiga [was Labulla sp.]	end	1		1				1	

Table 2. Arthropods collected at Hālona Valley July-September 2019 (new or corrected items in red).

	status*	Lualualei 1997	post-1997 literature	Halona 1997	Halona 2015	Halona 2016-17	Halona 2017	Halona 2018	Halona 2019
Nesticidae									
Eidmanella pallida (Emerton)	end	1		1					
Oonopidae									
Oonopinus hunus Suman	end	1							
Oonopinus n.sp.	end	1							
Opopaea lena Suman	end	1							
Orchestina sp.	adv	1							
Pholcidae									
Pholcus phalangioides (Fuesslins)	adv	1							1
Salticidae	adv				1	1	1	1	
Cosmophasis sp.	adv								1
Hasarius adansoni (Audouin)	adv	1							1
Phintella versicolor (C.L. Koch)	adv	1							
Myrmarachne sp.	adv							1	1
Tetragnathidae									
Tetragnatha n. sp.	end	1		1					
Theridiidae					1	1			
Argyrodes argyrodes (Walckenaer)	adv	1							
Latrodectus geometricus C.L. Koch	adv	1							
Steatoda grossa (C.L. Koch)	adv	1						1	1
Theridion melanostictum (Pickard-Cambridge)	adv	1							
Thomisidae									1
Misumenops sp. A	end	1							
Misumenops sp. B	end	1		1					
Misumenops sp. C	end	1		1					
CHILOPODA					1	1		1	
Geophilidae									
gen. sp.	adv	1							
Lithobiidae									
Lithobius sp.	??	1		1					
Scolopendridae									
gen. sp. [immatures]	adv	1							
Scolopendra subspinipes Leach	adv	1		1					1
COLEOPTERA									
Alleculidae									
Pseudocistela sp.	adv	1							
Anthribidae									
Araecerus fasciculatus (De Geer)	adv	1							
Araecerus levipennis Jordan	adv	1		1			1		
Araecerus vieillardi (Montrouzier)	adv	1							
Exillis lepidus Jordan	adv	1						1	1
gen. in subfamily Choraginae nr. Cisanthribus	adv						1		
gen. sp.	adv	1		1					
Belidae									
Proterhinus blackburni blackburni Sharp	end	1		1					
Proterhinus deceptor Perkins	end	1							
Proterhinus spp. (not blackburni group)	end	1		1					
Bostrichidae									
Amphicerus cornutus (Pallas)	adv	1							1
Xylopsocus castenoptera (Fairmaire)	adv				1				

Table 2. Arthropods collected at Hālona Valley July-September 2019 (new or corrected items in red).

	status*	Lualualei 1997	post-1997 literature	Halona 1997	Halona 2015	Halona 2016-17	Halona 2017	Halona 2018	Halona 2019
Bostrichidae (continued)									
Xylopsocus religiosus (Boisduval)	adv	1		1	1				
Bruchidae									
Acanthoscelides macrophthalmus (Schaeffer)	adv	1		1					1
Lithraeus atronotatus (Pic)	adv	1		1					
Stator pruininus (Horn)	adv	1		1					1
gen. sp.	adv	1							
Buprestidae									
Chrysobothris octocola Le Conte	adv	1							
Cantharidae									
Caccodes oceaniae (Bourgeois)	adv	1							
Carabidae									
Metacolpodes buchannani Hope	adv	1							
Gnathaphanus picipes (Macleay)	adv	1		1					
Gnathaphanus upolensis (Csiki)	adv	1		1					
Stenolophus sp.	??	1		1					
Cerambycidae									1
Ceresium unicolor (Fabricius)	adv	1		1					1
Curtomerus flavus (Fabricius)	adv	1		1					
Gelonaetha hirta (Fairmaire)	adv	1		1					
Oopsis nutator (Fabricius)	adv	1		1					
Phoracantha semipunctata (Fabricius)	adv	1		1					
Placosternus crinicornis {Chevrolat)	adv	1		1		1			1
Pterolophia camura Newman	adv	1		1					
Sybra alternans (Wiedemann)	adv	1		1			1		
Chrysomelidae									
Diachus auratus (Fabricius)	adv	1		1					
Octotoma scabripennis Guerin-Meneville	adv	1		1					
Uroplata girardi Pic	adv	1		1					
Ciidae	??							1	
gen. sp. A	end	1		1					
gen. sp. B	end	1							
Coccinellidae									
Cryptolaemus montrouzieri Mulsant	pur	1		1					
Curinus coeruleus (Mulsant)	pur	1		1		1		1	
Halmus chalybeus (Boisduval)	pur	1							
Nephaspis bicolor Gordon	pur								1
Symnobius bilucernarius (Mulsant)	pur	1		1					1
Olla v-nigrum (Mulsant)	pur	1		1	1				
Orcus australasiae (Boisduval)	pur	1		1					
Rhyzobius forestieri (Mulsant)	pur	1		1					
Scymnus sp.	pur	1		1					
Sticholotis ruficeps Weise	pur	1		1					1
Telsimia nitida Chapin	pur	1		1					
Colydiidae									
Penthelispa rufipennis (Montrouzier)	adv	1							
Corylophidae									
Gronevus rotundus (Sharp)	end	1					1	1	1
Gronevus sp.	end	1							
Orthoperini sp. (not Orthoperus aequalis Sharp)	??	1							

Table 2. Arthropods collected at Hālona Valley July-September 2019 (new or corrected items in red).

	status*	Lualualei 1997	post-1997 literature	Halona 1997	Halona 2015	Halona 2016-17	Halona 2017	Halona 2018	Halona 2019
Corylophidae (continued)									
Sericoderus pubipennis Sharp	end	1		1		1	1	1	1
Curculionidae									
Acalles sp.	end						1		1
Anotheorus sp.	end	1							
Dryophthorus distinguendus Perkins	end	1		1				1	
Oodemas punctulatissimum Perkins	end	1		1					
Oxydema fusiforme Wollaston	adv	1		1					
Pantomorus cervinus (Boheman) [was Asyonychus godmanni]	adv	1		1			1	1	1
Pentarthrum sp.	adv					1			
Pholidophorus advena Zimmerman	adv	1		1					
Rhyncogonus welchii Perkins	end	1		1					
Sibinia sp.	adv	1		1					
Dermestidae									
Orphinus terminalis (Sharp)	ind	1							
Dytiscidae									
Rhantus pacificus (Boisduval)	end	1							
Rhantus pseudopacificus Balke	end	1		1					
Elateridae									
Chalcolepidius erythroloma Candeze	end	1							1
Conoderus exsul (Sharp)	adv	1		1			1	1	1
Endomychidae									
Eidoreus minutus Sharp	end	1							
Hydrophilidae									
Cryptopleurum minutum (Fabricius)	ind	1							
Enochrus sayi Gundersen	adv	1							
Helochares sp.	adv	1							
Tropisternus lateralis humeralis Motschulsky	adv	1							
Jacobsoniidae									
Derolathrus atomus Sharp	end	1		1					
Languriidae									
Cryptophilus integer (Heer)	adv	1					1		
Lathridiidae									
Corticaria longicollis (Zetterstedt)	adv	1							
Mycetophagidae									
Litargus vestitus Sharp	ind	1							
Nitidulidae									
Carpophilus dimidiatus (F.)	adv						1	1	
Carpophilus hemipterus (Linnaeus)	adv	1							
Carpophilus humeralis (Fabricius)	adv	1		1					
Carpophilus mutilatus Erichson	adv	1							
Carpophilus oculatus Murray	adv					1	1		1
Epuraea (Haptoncus) mundus Sharp	adv	1		1					
Epuraea (Haptoncus) ocularis (Fairmaire)	adv	1		1		1			
Nesopeplus roridus Sharp	end	1							
Phenolia limbata tibialis (Boheman)	adv					1	1		1
Stelidota geminata (Say)	adv					1	1	1	1
Oedemeridae									
Thelyphassa apicata (Fairmaire)	adv								1

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	status*	Lualualei 1997	post-1997 literature	Halona 1997	Halona 2015	Halona 2016-17	Halona 2017	Halona 2018	Halona 2019
Ptiliidae									
Ptiliodes sp.	end	1							
gen. sp.	??	1							
Rhizophagidae									
Hesperobaenus capito (Fairmaire)	ind	1			1			1	
Scarabaeidae									
Adoretus sinicus Burmeister	adv	1		1					1
Copris incertus prociduus Say	adv	1		1				1	1
Onthophagus incensus Say	adv	1		1					
Scirtidae									
gen. sp.	adv	1							
Scolytidae									
Cryphalus sylvicola (Perkins)	adv						1	1	
Euwallacea fornicatus (Eichhoff)	adv				1				
Hypothenemus birmanus (Eichhoff)	adv	1			1				
Hypothenemus crudiae (Panzer)	adv	1							
Hypothenemus eruditus (Westwood)	adv	1							
Hypothenemus seriatus (Eichhoff)	adv						1		
Wallacellus denticulatus (Motschulsky)	adv					1			
Xyleborinus andrewsi (Blandford)	adv				1	1	1	1	1
Xyleborinus saxeseni (Ratzeburg)	adv	1			1				
Xyleborus affinis Eichhoff	adv	1					1	1	
Xyleborus ferrugineus (Fabricius)	adv	1		1			1		
Xyleborus interjectus Blandford	adv	1					1		
Xyleborus lanaiensis Perkins	end	1		1	1				
Xyleborus perforans (Wollaston)	adv	1		1	1		1	1	
Xyleborus spinulosus Blandford	adv				1		1		
Xylosandrus compactus (Eichhoff)	adv				1		1	1	
Xylosandrus crassiusculus (Motschulsky)	adv						1	1	
Silvanidae									
Cryptamorpha desjardinsi (Guérin-Méneville)	adv	1		1	1			1	1
Psammoechus sp.	adv	1							
Staphylinidae									1
Aleocara sp.	adv					1			
Anotylus sp. prob. nitidifrons (Wollaston)	adv				1		1	1	
Atheta coriaria (Kraatz)	adv	1							
Atheta sp. (not coriaria)	??	1					1		
Coproporus sp.	adv	1							
Ctenandropus sp.	adv	1							
Philonthus discoideus (Gravenhorst)	adv	1							
Philonthus longicornis Stephens	adv	1		1					
Philonthus sp.	adv	1							
Philonthus sp. (Newton sp. 1)	adv	1							
Philonthus turbidus Erichson	adv	1		1					
Sunius sp.	adv	1		1			1	1	
Thyreocephalus albertisi (Fauvel)	adv	1		1					1
gen. sp.	??	1							
gen. sp. (Piestinae)	??	1		1					

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	status*	Lualualei 1997	post-1997 literature	Halona 1997	Halona 2015	Halona 2016-17	Halona 2017	Halona 2018	Halona 2019
Tenebrionidae									
Blapstinus dilatatus Le Conte	adv	1							
Gnathocerus cornutus (Fabricius)	adv	1							
Microcrypticus obscurus (Sharp)	adv								1
Platydema subfascia (Walker)	adv	1							
Trogositidae									
Neaspis ?variegata (Macleay)	adv	1		1	1				
COLLEMBOLA									
Dicyrtomidae									
Dicyrtoma (Papirioides) dubia (Folsom)	end								1
Entomobryidae									
Entomobrya nyhusae Christiansen & Bellinger	end	1							
Salina celebensis (Schäffer)	adv				1	1		1	1
Hypogastruridae									
Neanura sp.	??	1							
Neelidae									
Neelus minutus Folsom	adv	1						1	1
Sminthuridae									
gen. spp. (2)	??	1			1		1	1	
DERMAPTERA	adv					1			
Carcinophoridae									
Euborellia annulipes (Lucas)	adv	1		1				1	1
Euborellia eteronoma (Borelli)	end	1		1			1		1
Chelisochidae									
Chelisoches morio (Fabricius)	adv	1							
Labiidae									
Sphingolabis hawaiiensis (Bormans)	adv	1							
Spirolabia dubronyi (Hebard)	adv	1		1			1		
DICTYOPTERA									
Blaberidae									
Diploptera punctata (Eschscholtz)	adv	1		1					
Pycnoscelus indicus (Fabricius)	adv	1					1		1
Blattellidae					1				
Balta noctulata (Stål) [= Onchostylus notulatus]	adv					1	1	1	1
Balta similis (Saussure)	adv	1		1				1	
Balta sp. (not similis)	adv	1		1					
Blattella germanica (Linnaeus)	adv	1		1					
Blattella lituricollis (Walker)	adv	1							
Lobopterella dimidiatipes (Bolivar)	adv					1	1	1	1
Blattidae									
Periplaneta americana (Linnaeus)	adv	1							
Periplaneta australasiae (Fabricius)	adv	1					1	1	1
Platyzosteria soror (Brunner)	adv	1		1					
Polyphagidae									
Euthyrrhapha pacifica (Coquebert)	adv	1							
DIPLOPODA	??					1			
Cambalidae									
Nannolene sp.	end	1		1					

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	status*	Lualualei 1997	post-1997 literature	Halona 1997	Halona 2015	Halona 2016-17	Halona 2017	Halona 2018	Halona 2019
Paradoxosomatidae									
Asiomorpha coarctata (Saussure)	adv	1							
Oxidus gracilis (C.L. Koch)	adv	1							
Polyxenidae									
Polyxenus sp.	??	1					1	1	1
Pyrgodesmidae									
Aporodesminus wallacei Silvestri	adv	1					1	1	
Spirobolidae									
Spirobolellus immigrans (Chamberlain)	adv	1							1
DIPTERA									
Agromyzidae									
Amauromyza maculosa (Malloch)	adv	1							
Calycomyza sp.	adv							1	1
Liriomyza sp.	adv							1	
Liriomyza sp. nr. sativae Blanchard	adv	1		1					
Melanagromyza metallica Thomson	adv	1							
Phytoliriomyza montana Frick	adv	1		1					
Pseudonapomyza spicata (Malloch)	adv	1							
Anthomyiidae									
Anthomyia vicarians Schiner	adv	1							
Anthomyzidae									
Amygdalops nigronotum Sueyoshi & Roháček	adv							1	
Asteiidae									
Asteia sabroskyi Hardy & Delfinado	end	1		1					
Calliphoridae									
Calliphora vomitoria (Linnaeus)	adv	1						1	1
Chrysomya megacephala (Fabricius)	adv	1		1	1				1
Dyscritomyia cuprea James	end	1		1					
Dyscritomyia fasciata (Grimshaw)	end	1		1					
Dyscritomyia limbipennis (Thomson)	end	1		1					
Lucilia sp. nr. cuprina (Wiedemann)	adv	1							
Lucilia sericata (Meigen)	adv	1							
Melinda pusilla (Villeneuve)	adv	1							
Cecidomyiidae								1	
Dasineura mangiferae Felt	adv	1			1				1
Lestodiplosis obtusilobata Hardy	end							1	1
Gen. sp.	???								1
Ceratopogonidae									
Forcipomyia brevis (Johannsen)	adv							1	1
Forcipomyia hardyi Wirth & Howarth	end	1		1	1				
Chironomidae	??							1	
Chironomus hawaiiensis Grimshaw	end	1							
Corynoneura sp.	adv	1							
Cricotopus bicinctus (Meigen)	adv	1							
Orthocladius sp. nr. wirthi Hardy	end	1							
Orthocladius williamsi Hardy	end	1		1					
Pseudosmittia maculiventris (Edwards)	adv							1	1
Chloropidae									
Cadrema pallida (Loew)	adv					1	1	1	
Conioscinella formosa (Becker)	adv	1		1					

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	status*	Lualualei 1997	post-1997 literature	Halona 1997	Halona 2015	Halona 2016-17	Halona 2017	Halona 2018	Halona 2019
Chloropidae (continued)									
Gaurax bicoloripes (Malloch)	adv	1		1				1	
Rhodesiella scutellata (Meijere)	adv	1		1	1		1	1	1
Tylopterna sp.	adv								1
Cryptochetidae									
Cryptochetum iceryae (Williston)	pur	1		1					
Culicidae									
Aedes albopictus (Skuse)	adv	1			1	1	1	1	1
Dixidae									
Dixa longistyla Takahashi	adv	1							
Dolichopodidae									
Amblypsilopus pallidicornis (Grimshaw)	adv								1
Campsicnemus gloriosus Van Duzee	end	1							
Campsicnemus halonae Evenhuis	end	1		1					1
Campsicnemus hao Evenhuis	end						1		
Campsicnemus miser Parent	end	1		1					
Campsicnemus patellifer Grimshaw	end	1		1				1	
Campsicnemus planitibia Parent	end	1							
Chrysosoma globiferum (Wiedemann)	adv	1		1	1		1		1
Chrysotus longipalpis Aldrich	adv	1			1				
Dolichopus exsul Aldrich	adv	1							
Eurynogaster sp.	end	1							
Medetera grisescens Meijere	adv	1							
Pelastoneurus lugubris Loew	adv	1		1					
Syntormon flexibile Becker	adv	1							
Tachytrechus sp.	adv	1							
Drosophilidae									
Chymomyza procnemis (Williston)	adv	1							
Dettopsomyia formosa Lamb	adv	1						1	
Drosophila cf. ?hydei Sturtevant	adv					1			
Drosophila immigrans Sturtevant	adv	1			1	1	1	1	1
Drosophila nasutoides Okada	adv					1			
Drosophila cf. ?repleta Wollaston	adv					1			
Drosophila simulans Sturtevant	adv					1		1	
Drosophila sulfurigaster bilimbata Bezzi	adv	1				1			
Drosophila suzukii (Matsumura)	adv	1		1		1	1		
Drosophila tamashiroi Hardy	end	1		1					
Scaptomyza buccata Hackman	end	1							
Stegana sp.	??	1							
Zaprionus indianus Gupta	adv					1	1	1	1
Empididae									
Hemerodromia stellaris Melander	adv	1							
Ephydridae									
Brachydeutera hebes Cresson	end	1							
Donaceus nigronotatus Cresson	adv	1							
Hydrellia williamsi Cresson	end	1							
Nostima niveivenosa Cresson	adv	1							
Scatella hawaiiensis Grimshaw	end	1							
Heleomyzidae									
Trixoscelis ornata (Johnson)	adv								1

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	status*	Lualualei 1997	post-1997 literature	Halona 1997	Halona 2015	Halona 2016-17	Halona 2017	Halona 2018	Halona 2019
Keroplatidae									
Tylparua hawaiiensis (Grimshaw)	end	1						1	
Tylparua "apicalis" Evenhuis, n. sp. MS	end								1
Lauxaniidae									
Homoneura hawaiiensis (Grimshaw)	end						1	1	1
Homoneura unguiculata (Kertész)	adv	1		1	1		1		
Poecilominettia sexseriata Hendel	adv	1		1			1	1	
Limoniidae	end								1
Dicranomyia hawaiiensis Grimshaw	end	1		1	1			1	
Dicranomyia jacoba Alexander	end	1							
Dicranomyia nigropolita Alexander	end							1	
Dicranomyia stygipennis Alexander	end				1			1	
Dicranomyia swezeyi Alexander	end	1			1			1	
Libnotes perkinsi (Grimshaw)	end	1		1					
Lonchaeidae									
Lonchaea polita Say	adv	1							
Micropezidae									
Taeniaptera angulata (Loew)	adv	1							
Milichiidae									
Desmometopa inaurata Lamb	adv	1		1					
Muscidae									
Atherigona orientalis Schiner	adv	1		1					
Atherigona reversura Villeneuve	adv	1		1					
Brontaea quadristigma (Thomson)	adv	1		1					
Haematobia irritans (Linnaeus)	adv	1							
Lispocephala sp.	end	1							1
Musca sorbens Wiedemann	adv							1	1
Stomoxys calcitrans (Linnaeus)	adv	1							
Neriidae									
Telostylinus lineolatus (Wiedemann)	adv	1			1	1	1	1	1
Phoridae									1
Chonocephalus sp.	end	1							
Diplonevra peregrina (Wiedemann)	adv					1	1		1
Dohrniphora cornuta (Bigot)	adv	1							
Megaselia (Megaselia) sp.	??	1						1	
Megaselia furcatilis Beyer	end					1		1	1
Puliciphora sp.	adv	1		1	1	1	1	1	1
Psychodidae									
Psychoda sp. nr. wirthi Quate	end	1			1				
Psychoda sp. (?new to Hawaii)	adv							1	1
Rhiniidae									
Rhinia apicalis (Wiedemann)	adv	1							
Sarcophagidae									
Helicobia morionella (Aldrich)	adv	1		1					
Lepidodexia elegans (Coquillett) [was Johnsonia]	adv	1		1				1	1
Sarcophaga peregrina (Rohdendorf)	adv								1
Sarcophaga princeps Wiedemann	adv	1							
Sarcophaga ruficornis (Fabricius)	adv	1							
Tricharaea occidua (Fabricius) [was Sarcophagula]	adv	1		1				1	

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	status*	Lualualei 1997	post-1997 literature	Halona 1997	Halona 2015	Halona 2016-17	Halona 2017	Halona 2018	Halona 2019
Scatopsidae									
Holoplagia guamensis (Johanssen)	adv				1				
Scenopinidae									
Scenopinus adventicius Hardy	ind	1		1					
Scenopinus lucidus Becker	adv	1				1	1		1
Sciaridae									2
Bradysia molokaiensis (Grimshaw)	end	1							
Bradysia spatitergum (Hardy)	adv							1	
Corynoptera prominens Hardy	adv								1
Ctenosciara hawaiiensis (Hardy)	end	1						1	
Epidapus pallidus (Séguy)	adv								1
Hyperlasion magnisensoria (Hardy)	end							1	
Scatopsciara nigrita Hardy	end							1	
Scaptosciara sp. (not nigrita)	??							1	
Sepsidae									
Sepsis sp.	adv	1		1					
Sepsis thoracica (Robineau-Desvoidy)	adv	1							
Sphaeroceridae									
Coproica sp.	adv	1		1					
Leptocera erythrocera (Becker)	adv	1							
Poecilosomella punctipennis (Wiedemann)	adv	1		1	1	1	1	1	1
Pseudopterogramma brevivenosum (Tenorio)	adv							1	
Spinilimosina rufifrons (Duda)	adv					1			
Stratiomyidae									
Gobertina picticornis Bigot	adv	1							
Hermetia illucens (Linnaeus)	adv	1		1			1		1
Merosargus sp.	adv	1					1	1	
Syrphidae									
Allograpta exotica (Wiedemann)	adv	1							
Allograpta obliqua (Say)	adv	1		1			1	1	1
Copestylum apicale (Loew)	adv	1		1					
Copestylum tamaulipanum (Townsend)	adv	1							
Eristalinus arvorum (Fabricius)	adv	1							
Eumerus aurifrons (Wiedemann)	adv	1							
Ocyptamus dimidiatus (Fabricius)	adv				1				
Ornidia obesa (Fabricius)	adv	1		1	1	1			1
Syritta sp.	adv				1			1	
Toxomerus marginatus (Say)	adv	1		1					
Tachinidae									
Archytas cirphis Curran	pur	1		1					
Chaetogaedia monticola (Bigot)	pur	1							
Eucelatoria armigera (Coquillett)	adv	1		1					
Lespesia archippivora (Riley)	pur	1		1					
Trichopoda pilipes (Fabricius)	pur	1		1					
Tephritidae									
Acinia picturata (Snow)	adv	1		1					
Bactrocera cucurbitae (Coquillett)	adv	1		1			1	1	
Bactrocera dorsalis (Hendel)	adv				1				
Ensina sonchi (Linnaeus)	adv	1							
Eutreta xanthochaeta Aldrich	adv	1							

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	status*	Lualualei 1997	post-1997 literature	Halona 1997	Halona 2015	Halona 2016-17	Halona 2017	Halona 2018	Halona 2019
Tephritidae (continued)									
Procecidochares alani Steyskal	pur	1						1	
Tetraeuaresta obscuriventris (Loew)	adv	1							
Ulidiidae					1				
Acrosticta apicalis (Williston)	adv	1		1					
Euxesta stigmatais Loew	adv	1		1					
Notogramma cimiciforme Loew	adv	1							
Xylomyidae									
Solva sp.	adv					1	1		1
EMBIIDINA									
Oligotomidae									
Oligotoma saundersii (Westwood)	adv	1		1		1	1		1
HETEROPTERA									
Anthocoridae									
Paratriphleps laeviusculus Champion	adv	1							
Cydnidae									
Geotomus pygmaeus (Dallas)	adv	1		1					
Rhytidoporus indentatus Uhler	adv	1		1	1				1
Lasiochilidae									
Lasiochilus denigratus (White)	end								1
Lygaeidae									
Metrarga nuda White	end	1		1					
Nysius communis Usinger	end	1							
Pachybrachius sp.	adv	1		1					
Miridae									
Halticus bractatus (Say)	adv	1		1					
Hyalopeplus pellucidus (Stal)	end	1		1					
Kamehameha n.sp.	end	1							
Koanoa n.sp.	end	1							
Lygus (prob.) sp. (not elisae)	adv	1		1					
Nesidiorchestes hawaiiensis Kirkaldy	end	1		1					1
Orthotylus n.sp. A [sensu Asquith]	end	1							
Orthotylus n.sp. B [sensu Asquith]	end	1							
Orthotylus n.sp. C [sensu Asquith]	end	1							
Orthotylus n.sp. D [sensu Asquith]	end	1							
Orthotylus spp.	end	1							
Rhinacloa forticornis Reuter	adv	1							
Stenotus sp. (not binotatus)	adv	1		1					
Taylorilygus apicalis (Fieber)	adv	1		1					1
Nabidae									
Nabis blackburni White	end	1		1					
Nabis sp.	??	1		1					
Pentatomidae									
Nezara viridula (Linnaeus)	adv	1		1				1	
Plautia stali Scott	adv	1		1					
Plataspidae									
Coptosoma xanthogramma (White)	adv	1		1					
Reduviidae									1
Empicoris rubromaculatus (Blackburn)	adv	1		1					1
Gallobelgicus saevus Bergroth	adv				1				1

Table 2. Arthropods collected at Hālona Valley July-September 2019 (new or corrected items in red).

	status*	Lualualei 1997	post-1997 literature	Halona 1997	Halona 2015	Halona 2016-17	Halona 2017	Halona 2018	Halona 2019
Reduviidae (continued)									1
Haematoloecha rubescens Distant	adv	1		1					
Zelus renardii Kolenati	adv	1							
Rhopalidae									
gen. sp.	??	1		1					
Tingidae									
Corythucha morrilli Osborn & Drake	adv	1		1					1
Leptobyrsa decora Drake	pur	1		1					
Teleonemia scrupulosa Stal	pur	1		1					
Veliidae									
Microvelia vagans White	end	1							
HOMOPTERA									
Aleyrodidae									
Aleurodicus dispersus Russell	adv								1
Aphididae									
Aphis gossypii Glover	adv	1							
Aphis sp.	adv	1			1		1	1	1
Neotoxoptera formosana (Takahashi)	adv							1	
Aphrophoridae									
Clastoptera xanthocephala Germar	adv	1		1	1				
Cicadellidae									
Cameocephala sagittifera (Uhler)	adv	1		1					
Linnavouriella sp.	adv	1							
Nesosophryne sp. nr. myrsines Kirkaldy	end	1		1			1		
Nesosophryne sp. A	end								1
Nesosophryne sp. B	end								1
Scaphytopius loricatus (Van Duzee)	adv								1
Sophonia rufofascia (Kuoh & Kuoh)	adv	1		1			1	1	1
Cixiidae									
Oliarus discrepans Giffard	end	1							
Oliarus kaiulani Giffard	end	1		1					
Oliarus sp. prob. olympus Giffard	end	1		1					
Oliarus sp.	end	1		1			1	1	1
Oliarus myoporicola Giffard	end							1	
Coccidae									
Ceroplastes rubens Maskell	adv	1			1		1		1
Delphacidae									
Aloha artemisiae (Kirkaldy)	end	1							
Aloha campylothecae Muir	end	1							
Aloha swezeyi Muir	end	1							
Dictyophorodelphax mirabilis Swezey	end	1							
Nesosydne sp.	end	1							
Nesothoe terryi Kirkaldy	end	1		1					
Perkinsiella saccharicida Kirkaldy	adv	1							
Flatidae									
Melormenis basalis (Walker)	adv	1		1	1			1	1
Siphanta acuta (Walker)	adv	1		1					
Membracidae									
Vanduzeea segmentata (Fowler)	adv	1							

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	status*	Lualualei 1997	post-1997 literature	Halona 1997	Halona 2015	Halona 2016-17	Halona 2017	Halona 2018	Halona 2019
Psyllidae	??							1	1
Heteropsylla mimosae Crawford	adv	1							
Heteropsylla sp.	adv	1		1					
Kuwayama pisonia Caldwell	end	1							
Trioza sp.	end	1							
Tropiduchidae					1				
Kallitaxila granulata (Stal)	adv				1				1
HYMENOPTERA									
Agaonidae									
Pleistodontes sp.	adv	1					1	1	1
gen. sp. (Epichrysomallinae)	adv	1		1					
Ampulicidae									
Ampulex compressa (Fabricius)	pur	1		1	1		1		1
Dolichurus stantoni (Ashmead)	pur	1			1				1
Anthophoridae									
Xylocopa sonorina F. Smith	adv	1							
Aphelinidae									
Aphelinus sp.	??	1		1					
Aphidiidae									
Aphidius smithi Sharma & Rao	pur	1		1					
Lysiphlebus testaceipes (Cresson)	pur	1		1					
Apidae									
Apis mellifera Linnaeus	pur	1		1	1		1	1	1
Bethylidae									
Epyris extraneus Bridwell	adv	1		1					
Epyris sp. (not extraneus)	adv	1							
Sierola sp.	end	1		1			1		
Sierola laupapa Magnacca (MS)	end							1	1
gen. sp.	??	1							
Braconidae									
Apanteles sp.	??	1							
Apanteles trifasciatus Muesebeck	adv	1		1				1	
Aphaereta pallipes (Say)	adv	1							
Glyptocolastes texanus Ashmead	adv	1							
Heterospilus sp.	??							1	
Macrocentrus calacte Nixon	adv	1		1				1	
Meteorus laphygmae Viereck	pur	1		1					1
Ontsira palliatus (Cameron)	adv	1		1					
Opius dissitus Muesebeck	pur	1		1					
Opius lantanae Bridwell	adv	1							
Phanerotoma hawaiiensis Ashmead	pur	1		1				1	1
Phanerotoma myeloisae Fullaway	adv	1		1					
Psyttalia incisi Silvestri	pur	1		1					
Rhaconotus vagrans (Bridwell)	adv	1		1				1	1
Spathius prusias Nixon	adv	1		1					1
Stenocorse bruchivora (Crawford)	pur	1		1					
gen. sp. A (Agathidinae)	??								1
gen. sp. B (Euphorinae)	??								1
Ceraphronidae									
Ceraphron plebeius Perkins	adv	1							

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	status*	Lualualei 1997	post-1997 literature	Halona 1997	Halona 2015	Halona 2016-17	Halona 2017	Halona 2018	Halona 2019
Chalcididae									
Antrocephalus apicalis (Walker)	adv	1							
Conura sp.	adv	1		1					
Dirhinus anthracia Walker	pur	1		1					
Dirhinus sp.	??	1		1					
Chrysididae									
Trichrysis triacantha (Mocsary)	adv	1			1				
Colletidae									
Hylaeus spp.	end	1		1					
Diapriidae									
Stylaclista sp.	adv	1							
Trichopria sp.	end	1		1			1		1
Encyrtidae									
Aenasius advena Compere	pur	1		1					
Anagyrus sp.	??	1							
Blepyrus sp.	??	1							
Cheiloneuromyia javensis Girault	adv	1							
Cheiloneurus sp.	??								1
Copidosoma sp.	??	1		1					
Encyrtus sp.	adv	1		1					
Homalotylus sp.	adv	1							
Microterys flavus (Howard)	adv	1							
Prochiloneura rex (Girault)	adv	1							
Eulophidae									
Aprostocetus cf hagenowii (Ratzeburg)	adv						1		1
Euderus sp. nr. metallicus (Ashmead)	adv	1		1					
Euplectrus platyhypenae Howard	pur	1		1			1		
Setelacher fasciatus Boucek	??	1							
Symplesis sp.	??	1							
gen. sp. (Entedoninae)	??	1							
gen. sp. (Tetrastichinae)	??	1		1					
Eupelmidae									
gen. #1 sp.	??	1							
gen. #2 sp.	??	1							
gen. #3 sp.	??	1							
Anastatus sp.	??	1		1					1
Eupelmus sp.	end?	1		1				1	
Reikosiella melina Yoshimoto	adv	1		1					
Eurytomidae									
Eurytoma tephritidis Fullaway	adv	1		1					
Sycophila sp.	??	1							
Evaniidae									
Evania sp. prob. appendigaster (Linnaeus)	adv	1			1				1
Figitidae (was Eucoilidae)									
gen. sp.	??	1							
Formicidae									
Anoplolepis gracilipes [was longipes]	adv	1		1	1	1	1	1	1
Camponotus variegatus (Smith)	adv								1
Cardiocondyla emeryi Forell	adv				1				
Leptogenys falcigera Roger	adv				1		1		

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	status*	Lualualei 1997	post-1997 literature	Halona 1997	Halona 2015	Halona 2016-17	Halona 2017	Halona 2018	Halona 2019
Formicidae (continued)									
Pheidole megacephala (Fabricius)	adv	1		1	1		1		
Pseudomyrmex gracilis mexicanus (Roger)	adv	1							
Solenopsis papuana Emery	adv				1	1	1	1	1
Technomyrmex albipes (F. Smith)	adv	1		1	1			1	
Technomyrmex difficilis Forel	adv					1	1	1	1
gen. sp. A	adv	1		1					
gen. sp. B	adv	1							
Halictidae					1				
Halictus sp.	adv	1							
Lasioglossum impavidum (Sandhouse)	adv						1		1
Heloridae									
Helorus ruficomis Foerster	adv	1		1					
Ichneumonidae									
Barichneumon califomicus Heinrich	adv	1		1					
Casinaria infesta (Cresson)	adv	1		1					
Diadegma blackbumi (Cameron)	adv	1		1					
Echthromorpha agrestoria fuscator (Fabricius)	end	1		1					
Echthromorpha sp. (not fuscator)	end	1		1					
Enicospilus sp.	end	1		1					
Gotra sp.	adv	1		1					
Hyposoter exiguae (Viereck)	adv	1		1					
Megastylus sp. prob. flavopictus (Gravenhorst)	adv							1	
Pachysomoides stupidus (Cresson)	adv	1							
Pimpla punicipes Cresson	adv	1		1			1		
Pristomerus sp.	??	1							
Rubicundiella perturbatrix Heinrich	adv	1							
Trathala flavoorbitalis (Cameron)	adv	1		1				1	
Tromatobia ovivora (Boheman)	adv	1		1					
gen. sp. (Gelinae)	??	1							
Megaspilidae									
Dendrocerus sp.	adv							1	
Mymaridae					1				
Gonatocerus dolichocerus Ashmead	adv	1					1	1	1
Polynema sp.	??	1		1			1		
Erythmelus (Parallelaptera) funiculi (Annecke & Doutt)	adv		1						
Chaetomymar sophoniae Huber	adv								1
Alaptus sp. 3 [of Beardlsy & Huber 2000]	adv		1						
Schizophragma bicolor (Dozier)	adv		1						
Gonatocerus californicus Girault	adv		1						
Dicopus sp. nr. psyche Girault	adv								1
Chaetomymar sp. [not sophoniae]	adv								1
Platygastridae									
gen. #1 sp.	adv	1							
gen. #2 sp.	adv	1							
gen. #3 sp.	adv	1							
gen. #4 sp.	adv	1		1					
Aphanomerus sp.	??							1	

Table 2. Arthropods collected at Hālona Valley July-September 2019 (new or corrected items in red).

	status*	Lualualei 1997	post-1997 literature	Halona 1997	Halona 2015	Halona 2016-17	Halona 2017	Halona 2018	Halona 2019
Pompilidae									
Anoplius Juctuosus (Cresson)	adv	1							
Tachypompilus analis (Fabricius)	adv	1		1					
Proctotrupidae									
Brachyserphus hawaiiensis (Ashmead)	adv	1				1			
Pteromalidae									
Callocleonymus swezeyi (Yoshimoto & Ishii)	adv	1							
Pteromalus sp.	??	1							
Trichomalopsis sp.	adv	1		1					
Scelionidae									
Anteromorpha dubiosa (Perkins)	adv	1							
Aporophlebus sp.	adv	1							
Baryconus sp.	adv	1							
Caenoteleia elegans (Perkins)	adv	1							
Dyscritobaeus comitans Perkins	adv						1		
Telenomus sp. A	??	1		1					
Telenomus sp. B	??	1							
Trissolcus basalis (Wollaston)	pur	1		1					
Sphecidae									
Chalybion bengalense (Dahlbom)	adv	1							
Ectemnius sp. A	end	1		1					
Ectemnius sp. B	end	1		1					
Ectemnius sp. C	end	1		1					
Isodontia mexicana (Saussure)	adv	1							
Pison insulare F. Smith	adv	1		1	1				
Pison iridipenne F. Smith	adv	1		1					
Tachysphex apicalis Fox	adv	1							
Tachysphex morosus (F. Smith)	adv	1		1					
Trypoxylon bicolor F. Smith	adv	1							
Trypoxylon philippinense Ashmead	adv	1							
gen. sp. (Pemphredoninae)	??	1							
Torymidae									
Megastigmus transvaalensis (Hussey)	adv	1		1				1	
Megastigmus sp.	adv	1		1					
Torymus advenus (Osten Sacken)	adv	1		1					
Trichogrammatidae									
gen. sp.	??	1							
Vespidae									
Delta campaniforme campaniforme (Fabricius)	adv	1							
Delta curvata (Saussure)	adv	1							
Delta pyriformis philippinense (Bequaert)	adv	1					1		1
Nesodynerus pseudochromoides Perkins	end	1		1					
Nesodynerus sp.	end	1		1					1
Nesodynerus sp. nr. waianaeanus	end	1							
Pachyodynerus nasidens (Latreille)	adv	1							
Polistes aurifer Saussure	adv	1		1					
Polistes exclamans Viereck	adv				1		1		
ISOPODA									
Armadillidae									
Reductoniscus costulatus Kesselyak	adv	1							

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	status*	Lualualei 1997	post-1997 literature	Halona 1997	Halona 2015	Halona 2016-17	Halona 2017	Halona 2018	Halona 2019
Philosciidae									
Australophiloscia societatis (Maccagno)	ind	1		1		1			
Burmoniscus meeusi (Holthuis)	adv	1							
Burmoniscus okinawaensis (Nunomura)	adv	1		1					
Platyarthridae									
Trichorhina tomentosa (Budde-Lund)	adv	1		1					
Porcellionidae									
Porcellio laevis Latreille	adv	1		1	1	1	1	1	1
Porcellio scaber Latreille	adv	1				1			
Porcellionides pruinosus (Brandt)	adv	1		1				1	
Styloniscidae									
Clavigeroniscus riquieri (Arcaneli)	adv	1		1					
Styloniscus spinosus (Patience)	adv	1		1					
Trachelipodidae									
Nagurus cristatus (Dollfus)	adv	1							
ISOPTERA									
Kalotermitidae									
Neotermes connexus Snyder	adv	1		1			1	1	1
Rhinotermitidae									
Coptotermes formosanus Shiraki	adv	1							
LEPIDOPTERA									
Alucitidae									
Alucita objurgatella (Walsingham)	adv	1		1				1	1
Cosmopterigidae									
Hyposmocoma sp. A	end	1						1	1
Hyposmocoma sp. B	end	1							1
Hyposmocoma sp. C	end	1							1
Crambidae									
Euchromius ocelleus (Haworth}	adv	1		1					
Eudonia geraea (Meyrick)	end	1							
Eudonia n. sp. 1 [of Munroe]	end	1		1					
Eudonia n. sp. 2 [of Munroe]	end	1		1					
Eudonia n. sp. 3 [of Munroe]	end	1							
Eudonia ombrodes (Meyrick)	end	1							
Glyphodes sp. nr. cyanomichla Meyrick	end	1		1					
Herpetogramma licarsisalis (Walker)	adv	1		1					
Mestolobes sp. prob. minuscula (Butler)	end	1		1					
Nomophila noctuella (Denis & Schiffermueller)	adv	1		1					
Orthomecyna sp. nr. exigua (Butler)	end	1							
Orthomecyna spp.	end	1		1					
Salbia haemorrhoidalis Guenee	pur	1		1					
Spoladea recurvalis (Fabricius)	adv	1		1					
Tamsica sp. nr. oxyptera (Meyrick)	end	1							
Tamsica sp.	end	1		1					
Gelechiidae									
Crasimorpha infuscata Hodges	pur	1							
Stoeberhinus testaceus Butler	adv	1		1					
Geometridae									
Anacamptodes fragilaria (Grossbeck)	adv	1		1					
Cyclophora nanaria (Walker)	adv	1							

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	status*	Lualualei 1997	post-1997 literature	Halona 1997	Halona 2015	Halona 2016-17	Halona 2017	Halona 2018	Halona 2019
Geometridae (continued)									
Euacidalia brownsvillea Cassino	adv	1		1					
Eupithecia sp.	end	1							
Psamatodes abydata (Guenée)	adv	1		1					1
Hesperiidae						1			
Hylephila phyleus (Drury)	adv	1							
Lycaenidae					1	1			
Lampides boeticus (Linnaeus)	adv							1	1
Strymon bazochii (Godart)	adv	1					1		
Udara blackburni {Tuely)	end	1		1					
Noctuidae									
Achaea janata (Linnaeus)	adv	1		1					
Agrotis ipsilon (Hufnagel)	adv	1		1					
Anomis flava (Fabricius)	adv	1		1					
Ascalapha odorata (Linnaeus)	adv	1							
Athetis thoracica (Moore)	adv	1		1					
Callopistria maillardi Guenee	adv	1							
Chrysodeixis eriosoma (Doubleday)	adv	1		1					
Elaphria nucicolora (Guenee)	adv	1		1					
Hypena laceratalis Walker	pur	1		1					
Hypocala deflorata (Fabricius)	adv	1		1					
Leucania striata Leech	adv	1		1					
Lycophotia porphyrea (Denis & Schifferrnueller)	adv	1		1					
Megalographa biloba (Stephens)	adv	1							
Melipotis indomita (Walker)	adv	1		1					
Neogalea sunia (Guenee)	pur	1		1					
Ophiusa disjungens (Walker)	adv	1		1					
Pandesma anysa Guenee	adv	1		1					
Penicillaria jocosatrix Guenee	adv	1		1					
Spodoptera mauritia (Boisduval)	adv	1		1					
Nymphalidae									
Agraulis vanillae (Linnaeus)	adv	1					1	1	1
Danaus plexippus (Linnaeus)	adv	1		1					
Vanessa sp. (cardui or virginiensis)	adv	1		1					
Vanessa cardui (Linnaeus)	adv	1		1					
Vanessa tameamea Eschscholtz	end	1							
Oecophoridae									
Thyrocopa sapindiella Swezey	end	1							
Thyrocopa sp.	end	1							
Olethreutidae									
Cryptophlebia illepida (Butler)	adv	1		1					
Cydia sp.	??	1							
Papilionidae									
Papilio xuthus Linnaeus	adv	1		1					
Pieridae									
Pieris rapae (Linnaeus)	adv	1		1				1	1
Psychidae									
Brachycyttarus griseus De Joannis	adv	1							

Table 2. Arthropods collected at Hālona Valley July-September 2019 (new or corrected items in red).

	status*	Lualualei 1997	post-1997 literature	Halona 1997	Halona 2015	Halona 2016-17	Halona 2017	Halona 2018	Halona 2019
Pterophoridae									
Anstenoptilia marmorodactyla (Dyar)	adv	1		1					
Stenoptilodes littoralis littoralis (Butler)	adv	1		1					
Pyralidae									
Homoeosoma albosparsum (Butler)	end	1		1					
Sphingidae									
Agrius cingulata (Fabricius)	adv	1		1					
Deilephila nerii (Linnaeus)	adv				1				
Hyles calida (Butler)	end	1		1				1	
Hyles lineata (Fabricius)	adv	1							
Hyles wilsoni perkinsi (Swezey)	end	1		1					
Macroglossum pyrrhostictum (Butler)	adv	1		1					
Psilogramma menephron (Cramer)	adv	1		1					
Tineidae									
Erechthias simulans (Butler)	adv	1		1					
Opogona omoscopa (Meyrick)	adv	1							
Opogona sp.	??	1							
Trichophaga sp. prob. mormopis Meyrick	adv								1
Tortricidae									
Amorbia emigratella Busck	adv	1		1					
Eccoptocera sp.	end	1		1					
Episimus unguiculus Clark	end	1		1	1			1	
Platynota stultana Walsingham	adv	1		1					
Spheterista sp.	end	1							
MANTODEA									
Mantidae									
Brunneria borealis Scudder	adv	1			1				
Tenodera australasiae (Leach)	adv								1
NEUROPTERA									
Chrysopidae									
Anomalochrysa sp.	end	1		1					
Anomalochrysa sylvicola Perkins	end	1		1					
Mallada basalis (Walker)	adv	1		1				1	1
Hemerobiidae									
Micromus timidus Hagen	pur	1		1					
Micromus vagus (Perkins)	end	1							
ODONATA									
Aeshnidae									
Anax junius (Drury)	ind	1							
Anax strenuus Hagen	end	1							
Coenagrionidae									
Ischnura posita (Hagen)	adv	1							1
Ischnura ramburii (Selys-Longchamps)	adv	1							
Libellulidae									
Orthemis ferruginea (Fabricius)	adv	1							
Pantala flavescens (Fabricius)	ind	1			1		1	1	1
Tramea abdominalis (Rambur)	adv	1							

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	status*	Lualualei 1997	post-1997 literature	Halona 1997	Halona 2015	Halona 2016-17	Halona 2017	Halona 2018	Halona 2019
ORTHOPTERA									
Acrididae									
Oedaleus abruptus {Thunberg)	adv	1							
Schistocerca nitens (Thunberg)	adv	1							
Gryllidae	??								
Gryllus bimaculatus DeGeer	adv	1							
Laupala sp. nr. hapapa Otte	end	1							
Tetrigidae									
Paratettix mexicanus (Saussure)	adv	1							
Tettigoniidae									
Conocephalus saltator (Saussure)	adv	1		1					
Elimaea punctifera (Walker)	adv	1							
Euconocephalus nasutus {Thunberg)	adv	1		1				1	
Phaneroptera furcifera Stal	adv	1							
Xiphidiopsis lita Hebard	adv	1		1					
PSEUDOSCORPIONIDA									
Undetermined family									
gen. sp.	??	1		1		1			1
PSOCOPTERA	??				1	1			
Ectopsocidae									
Ectopsocus sp.	adv	1							
Elipsocidae									
Kilauella micramura (Perkins)	end								1
Lepidopsocidae									
Lepidopsocus marmoratus (Banks)	adv								1
Psocidae									
Ptycta sp. A	end								1
Ptycta sp. B	end								1
Ptycta kaala Thornton	end							1	
SCHIZOMIDA									
Schizomidae									
Schizomus siamensis (Hansen)	adv	1							
SIPHONAPTERA									
Pulicidae									
Ctenocephalides felis	adv								1
STREPSIPTERA									
Elenchidae									
Elenchus sp.	adv	1		1					
THYSANOPTERA									
Fam. Undet.									
Gen. sp. A	??								1
Gen. sp. B	??								1
Gen. sp. C	??								1
TRICHOPTERA									
Hydropsychidae									
Cheumatopsyche analis (Banks)	adv	1							
Hydroptilidae									
Oxyethira maya Denning	adv	1						1	1
totals		**638**	**4**	**334**	**77**	**53**	**88**	**126**	**162**

Table 2. Arthropods collected at Hālona Valley July-September 2019 (new or corrected items in red).

	status*	Lualualei 1997	post-1997 literature	Halona 1997	Halona 2015	Halona 2016-17	Halona 2017	Halona 2018	Halona 2019
new species records for Lualualei			4		21	19	11	23	34
new species records for Halona			0		41	23	25	30	44

Plus new records		Lualualei		Halona
post-1997 literature		4		0
2015		22		41
2016-2017		19		23
2017		11		25
2018		23		30
2019		34		44
totals		**751**		**497**

* Abbreviations: adv = adventive; end = endemic; ind = indigenous; pur = purposeful introduction; ?? = unknown

Status totals	Lualualei	%	Halona	%
Native (endemic + indigineous)	171	22.8%	78	15.7%
Non-native (adventive + purposeful intro)	526	70.0%	384	77.3%
unknown status	54	7.2%	35	7.0%
	751		497	