2012-13 Monitoring of the Orange-Black Damselfly *Megalagrion xanthomelas* (Sélys-Longchamps), (Zygoptera: Coenagrionidae)

Hawaii Biological Survey

Final Report **December 2013**

2012 -13 Monitoring of the Orange-Black Damselfly *Megalagrion xanthomelas* (Sélys-Longchamps) (Zygoptera:Coenagrionidae)

FINAL REPORT

Prepared for:

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Background

Since 1994 researchers at the Bishop Museum have been monitoring the last remaining population of *Megalagrion xanthomelas* (Sélys-Longchamps). This endemic damselfly inhabits a 100-meter reach of stream located on the grounds of Tripler Army Medical Center (TAMC), O‘ahu. Because of construction activities planed for in areas upslope of and near the stream it has been considered imperative to establish a second population to prevent *M. xanthomelas* from going extinct on O‘ahu. We estimated the population size of *M. xanthomelas* at the TAMC in 2013 by capture-mark-recapture and concluded that the TAMC population continues to be stable. Because suitable natural habitat has become difficult to locate and after multiple attempts to successfully establish a second population on O‘ahu, it became necessary to explore other avenues available in the form of artificial habitats. Biologists from Waimea Valley Hi‘ipaka LLC suggested that we attempt a translocation to ponds located on their grounds. These ponds were drained and alien predators removed. Water intake pipes were screened to prevent predators re-entering from the adjacent stream. The vegetation surrounding the ponds were augmented with native plants and overhead canopy conditions created to simulate the general habitat located at the TAMC site. The pond refurbishment has been completed and these ponds are being maintained. However, due to a curtailment of funding, efforts to translocate the OrangeBlack damselfly to Waimea this monitoring season has been put on hold. Current monitoring has been augmented with an increase habitat maintenance and erosion monitoring

Male *Megalagrion xanthomelas*
Photograph by D.J. Preston , HBS

due to more frequent stream flashing.

Project objectives

The objectives of the current damselfly monitoring and mark-recapture sampling efforts at TAMC are to 1) document recruitment of new individuals to the population between sampling efforts; 2) assess the relative abundance of damselflies between monitoring periods using a standardized methodology; 3) provide a quick means of determining if the TAMC damselfly population is threatened by stream dewatering, human or natural disturbances; and 4) determine if the TAMC damselfly population would be impacted by removing a subset of the population during translocation efforts to establish a second population on O‘ahu.

TAMC

The TAMC stream is located on leeward O‘ahu at 79 m elevation, and flows for 95 m through a forest of introduced plants. The stream is less than 1 m wide for most of its length, and has several pools that are 15-20 cm deep, though most of the stream is less than 10 cm in depth. A detailed description and map of the TAMC Stream study area can be found in Evenhuis *et al*. (1995), Polhemus (1996), and Pangelinan (1997). The TAMC stream continues to require augmented water flow because construction in 1995 of a large Veterans Administration facility upslope of the TAMC stream disrupted the stream's normal hydrology. The last known O`ahu population of *M. xanthomelas* has been monitored since 1995 with intensive mark-recapture studies conducted periodically since 1997 and continued spot counts made during site visits to the present. We have concluded that the population size of *M. xanthomelas* at TAMC is a direct result of usable habitat size, and because this habitat is extremely limited, a second population

must be established elsewhere. The continued survival of the current *M. xanthomelas* population has been due to an astonishing series of events, but stochastic events such as large rainstorms or chemical spills could eventually eliminate the TAMC damselfly population. The continued existence of the TAMC population of *M. xanthomelas* in < 100 m of stream habitat illustrates the fact that large areas of native stream habitat are not required for this species' survival. Past and current distribution of *M. xanthomelas* on O'ahu is shown in **Figure 1**.

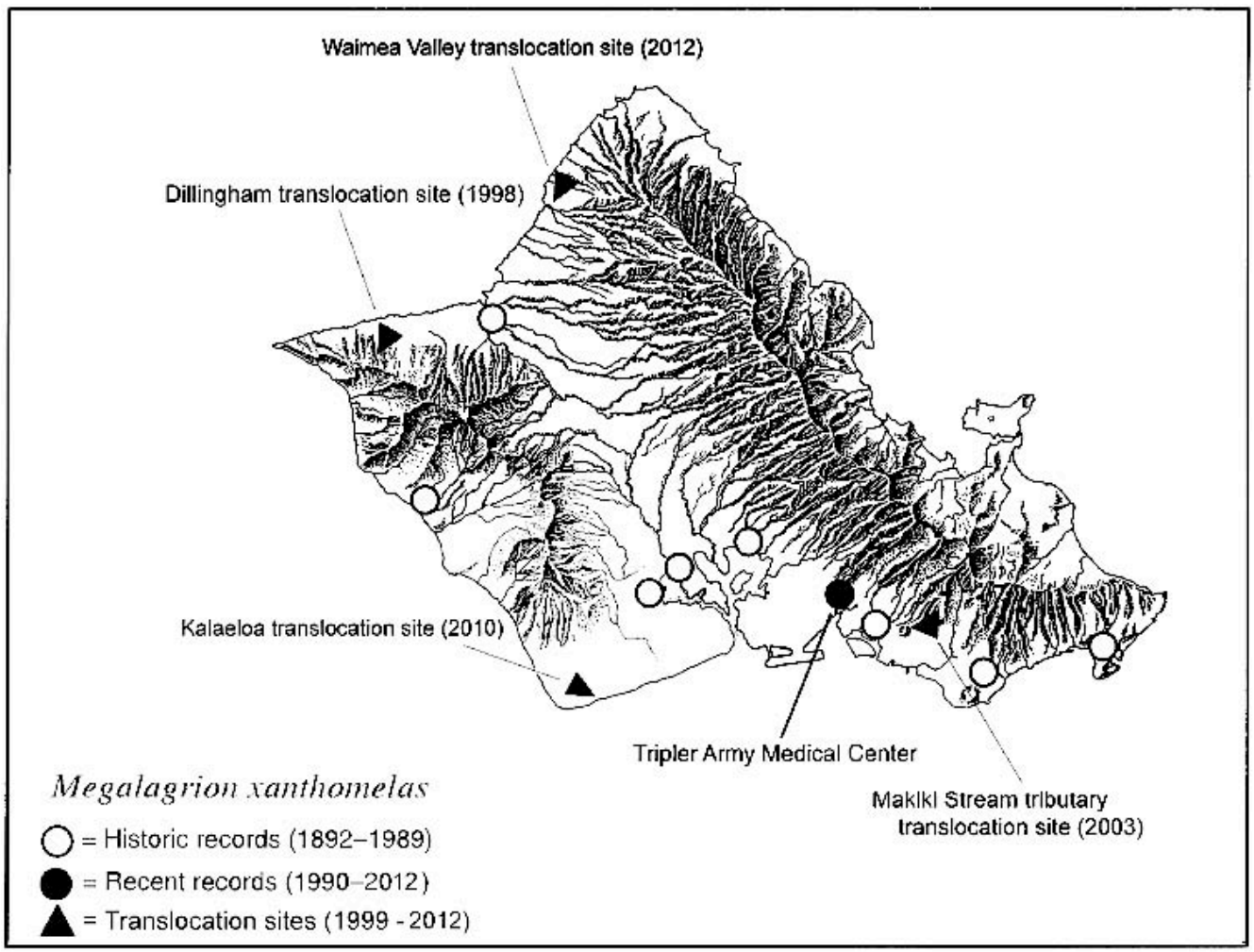

Figure 1. Historic and Recent Records for *Megalagrion xanthomelas*

HABITAT OBERSERVATIONS DURING THE 2012-2013 MONITORING YEAR

Habitat monitoring at TAMC consisted of weekly site visits beginning in December of 2012, continuing through August 2013. A thorough walkthrough of the site was conducted on each visit. Weather conditions were noted with air and water temperatures recorded. Stream flow was monitored and recorded for normal, low, or high flow. Canopy and stream bank vegetation was assessed on each visit with periodic trimming of bank and overhead weeds done to maintain appropriate sunlight levels. Stream bank conditions were monitored for erosion and soil bank changes. Periodic clean up and removal of trash in the area was made on each visit.

MONITORING FOR POTENTIAL THREATS

Bulbuls

Threats to the damselflies are monitored with attention paid to two species of bulbuls present at the site. The Red-Vented Bulbul (*Pycnonotus cafer*) and Red-Whiskered Bulbul (*Pycnonotus jocosus*) were observed foraging along the damselfly stream catching insects while hopping from rock to rock in the stream. On one occasion a Red-Whiskered Bulbul was observed catching and eating a newly emerged *M. xanthomelas* adult. In 2012 a request was made to the United States Fish and Wildlife Service's invasive species staff to assess the situation at the TAMC stream site. A decision was made by them to remove some of the bulbuls to mitigate any potential threat they posed to the damselflies. Predator removal was coordinated between Bishop Museum, United States Fish and Wildlife Service, TAMC, and Army environmental staff.

Jackson's Chameleons

Jackson's Chameleons are still present at TAMC and they pose potential threat to the damselflies. A periodic nighttime check of the stream site should be conducted to search for and remove this invasive predator from the area.

Ants

Next to dewatering of the stream at TAMC, ants are probably the next greatest threat to the damselflies. Listed below are 17 non-native invasive ant species collected and vouchered by Bishop Museum between 1995 and 2013.

***Anoplolepis gracilipes* F. Smith, 1857**

Anoplolepis gracilipes was first recorded in Hawai‘i in 1952 (Zimmerman 1953). The first specimens collected at TAMC were in 2009. Now known as the Crazy Yellow Ant, it was formerly called the Long legged Ant due to its extremely long legs. This ant is very common in the area feeding primarily on honeydew produced by scales and mealy bugs that are abundant at this site. They will also feed on disabled or dead damselflies. Although of concern, healthy damselflies are able to detect the ant's presence and fly off before the ants can get close enough to attack them. It appears that the *A. gracilipes* does not impact the damselfly population at this time.

Distribution in Hawai‘i: Kaua‘i, O‘ahu, Maui and Hawai‘i islands (Nishida 2002).

***Cardiocondyla emery* Forel, 1881**

Cardiocindyla emeryi was first recorded in Hawai‘i in 1943 (Swezey 1944). This ground nesting

species is an omnivorous predator-scavenger (Creighton and Snelling, 1974). It was moderately abundant at the stream site, seen singly or in trailing groups of a few to a dozen or more. They are often seen walking along twigs and branches on the ground and on tree trunks. The damselflies seem to be able to detect these ants and avoid them and therefore these ants do not pose a threat to the damselflies at this time.

Distribution in Hawai‘i: Kaua‘i, O‘ahu, Moloka‘i, Lana‘i, Mau‘i, Hawai‘i, Laysan, and Pearl and Hermes Atoll (Nishida 2002).

***Hypoponera punctatissima* (Roger), 1859** First recorded in Hawai‘i in 1896 (Emery, 1899)

Distribution in Hawaii: Kaua‘i, Oah‘u, Moloka‘i, French Frigate Shoals, and Laysan

***Leptogenys falcigera* Roger, 1861**

Recorded from Hawai‘i for the first time in 1879 (Smith, 1879). This rather large black species is seen regularly at the stream site usually when solitary workers are out foraging. This species feeds mainly on live isopods (Kirschenbaum & Grace 2008).

Distribution in Hawai‘i: Nihihau, Kaua‘i, O‘ahu, Moloka‘i, Kaho‘olawe, Lana‘i, Maui, and Hawai‘i Islands (Nishida, 2002, Starr et al. 2004)

***Ochetellus glaber* (Mayr, 1862)**

The Black House Ant was first recorded from Hawai‘i in 1977 (Beardsley1980). This is the most abundant ant species at the TAMC site. It feeds mainly on honeydew that it collects from scales, mealybugs, cuban psyllids, and other homopteran insects that infest many of the trees and shrubs there. They are also seen carrying small prey items from time to time. We have not observed any interaction between this ant and *M. xanthomelas* to indicate that they may be threat to them.

Distribution in Hawai‘i: Kaua‘i, O‘ahu, Kaho‘olawe, Maui, and Hawai‘i Islands (Nishida, 2002, Starr et al. 2004)

***Paratrechina longicornis* (Latreille, 1802)**

The Crazy Ant was first collected in Hawai‘i in 1899 (Forel 1899). This species is a generalized scavenger scurrying about with no apparent sense of direction, hence it's common name. This was not a particularly abundant species at TAMC but readily noticeably by it's erratic movements that distinguish it from the long legged ant.

Distribution in Hawai‘i: Nihoa, Kaua‘i, O‘ahu, Moloka‘i, Lana‘i, Kaho‘olawe, Maui, Hawai‘i, Midway Atoll, and French Frigate Shoals (Nishida 2002, Starr et al. 2004).

***Pheidole megacephala* (Fabricius, 1793)**

The Bigheaded Ant was first found in Hawai‘i in 1879 (Smith 1879). The Big Headed Ant is omnivorous feeding on carbohydrates (honeydew, flower nectar) and proteins (arthropods, animal meat, carrion, leftover human food). They will also attack nesting seabirds and their chicks driving them off or even killing them (Plentovich, 2009). At the present time only a few specimens of the Bigheaded Ant have be collected at the TAMC site but every attempt should be made to monitor for any increased presence or negative interaction with the damselflies.

Distribution in Hawai‘i: Ni‘ihau, Kaua‘i, O‘ahu, Moloka‘i, Kaho‘olawe, Maui and Hawai‘i Islands, Midway Atoll, Kuri Atoll, Pearl and Hermes Atoll, and Laysan including many of the main island's offshore islets (Nishida 2002, Starr et al. 2004, Eijzenga and Preston 2008).

***Plagiolepis alluaudi* Emery, 1894**

The Little Yellow Ant was first discovered in Hawai‘i in 1913 (Gulick 1913). The Little Yellow

Ant was locally abundant frequenting the edges of the wetted stream. We collected several in pitfall traps filled with low toxic antifreeze. It most likely feeds on sweets provided by scales and mealy bugs but may also scavenge. This small ant poses no threat to *M. xanthomelas* at TAMC.
Distribution in Hawai‘i: Kaua‘i, O‘ahu, Moloka‘i, Lana‘i, Mau‘i, Hawai‘i, Midway Atoll, and Laysan (Nishida 2002).

***Pseudomyrmex gracilis* (Fabricius, 1804)**

The Elongate Twig Ant was common and observed on almost every site visit. This ant species was observed frequently approaching perching *M. xanthomelas*. The ant would never get closer than a centimeter to the damselfly before it would fly off and return to almost the same spot to resume perching. By this time the ant had moved along looking for easier prey.
The sting of this ant is extremely painful and although common in the area of the stream site they are usually only encountered one at a time and should be avoided.
Distribution in Hawaii: Oahu.

***Solenopsis geminata* (Fabricius, 1804)**

The Tropical Fire Ant was first discovered in Hawai‘i in 1879 (Smith 1879). This species is known for it's painful sting. It is attracted to protein baits and may be a potential threat to the damselflies. We only collected a few specimens and do not believe there is large colony established at the stream site yet. This species may have the potential to increase its presence and therefore it is recommended that regular monitoring of this species be conducted.
Distribution in Hawaii: Kaua‘i, O‘ahu, Moloka‘i, Lana‘i, Kaho‘olawe, Mau‘i, Hawai‘i, and Midway Atoll (Nishida 2002, Starr et al. 2004).

***Solenopsis papuana* (Emery, 1900)**

The Papuan Thief Ant was first discovered in Hawai‘i in 1967 (Huddleston and Fluker 1968). This is a small ground nesting species is associated with rotting wood (Harris et al. 2005). This ant is not known to sting humans (Gruner 2000). Although this ant is a predator scavenger, we believe this ant species does not pose a threat.

Distribution in Hawaii: Kaua‘i, O‘ahu, Moloka‘i, Lana‘i, Mau‘i, and Hawai‘i Isl. (Nishida 2002).

***Strumigenys* sp. nr. *rogeri* Emery, 1890**

Strumigenys rogeri was first recorded in Hawai‘i in 1933 (Wilson and Taylor 1967). Most of the species in the genus *Strumigenys* feed on entomobryoid collembola and other small arthropods (Brown 1954, Brown and Wilson 1959). We do not believe this ant is a threat to *M. xanthomelas*.

Distribution in Hawai‘i for *S. rogeri*: Kaua‘i, O‘ahu, Moloka‘i, Maui, and Hawai‘i Islands Nishida 2002)

Tapinoma melanocephalum (Fabricius, 1793)

The Ghost ant was first recorded in Hawai‘i in in 1899 (Forel 1899). This ant is fond of sugars and is attracted to honeydew produced by scales, mealybugs, psyllids, and aphids. We first collected this species at TAMC in 2009 and it is still present at the stream site. This species is not a threat to *M. xanthomelas*.

Distribution in Hawai‘i: Nihoa, Kaua‘i, O‘ahu, Moloka‘i, Lana‘i, Maui, Hawai‘i, Kure Atoll, Midway Atoll, and Laysan (Nishida 2002).

***Technomyrmex albipes* (Smith), 1861**

This ant was first recorded in Hawai‘i in 1911 (Swezey, 1915). We first collected this species of ant at TAMC in 2011. The White-footed ant is a pest of gardens and homes and where ever there is a plentiful food source. At TAMC there is a robust population of homopteran insects that provide an ample supply of carbohydrates. These ants will also feed on plant and flower secretions as well as scavenge on other food items. Although one of the most abundant ant species found at the TAMC stream site, they have no discernable impact on the damselfly population.

Distribution in Hawai‘i: Kaua‘i, O‘ahu, Moloka‘i, Kaho‘olawe, Maui, and Hawai‘i (Nishida 2002, Starr et al. 2004).

***Technomyrmex difficilis* Forel, 1892**

The Difficult White-footed ant was first recorded in Hawai‘i in 1994 (Starr and Starr 2012). In 2008 specimens of T. difficilis were collected at the damselfly stream site. This species is often confused with *T. albipes* and many specimens are misidentified in entomology collections throughout the world. Habits of this species closely mirror those of *T. albipes*. This species poses no threat to *M. xanthomeles*.

Distribution in Hawaii: O‘ahu, Maui Kaho‘olawe, and Moloka‘i (Nishida 2002, Starr and Starr 2012).

***Tetramorium insolens* (F. Smith, 1861)**

First recorded in Hawaii in 1993 (Krushelnycky 2005). Specimens of this ant were collected at the damselfly stream site for the first time in 2012.

Distribution in Hawai‘i: Hawai‘ian Islands - specific island distribution unknown.

***Tetramorium similimun* (F. Smith, 1851)**

First recorded in Hawai‘i in 1934 (Wheeler 1934). We collected specimens of this ant in 2008 and 2009. Distribution in Hawai‘i: Kauai, O‘ahu, Lana‘i, Kaho‘olawe, Maui, and Hawai‘i islands (Nishida 2002, Starr et al. 2004).

Stream Bank Erosion and Soil Runoff

Soil runoff and soil erosion should be monitored periodically for any negative stream habitat alteration.

Trash

Periodic trash removal from the stream habitat should be maintained. A complete walkthrough of the entire length of stream habitat will also alert you to other potential problems so they can be addressed in a timely manner.

Stream bank erosion at upper pool below culvert

TAMC DAMSELFLY POPULATION ASSESSMENT CONDUCTED

DECEMBER 2012 - AUGUST 2013

Population estimates were obtained by using the Lincoln-Petersen estimate of population size (Caughley, 1980). Although the Lincoln-Petersen estimate will in the long run result in an overestimation of population size (Caughley, 1980), we use it here because our mark-recapture studies are relatively short in duration, and they provide a relatively good estimate of damselfly population size. A high of 59 individuals were collected on 11 April 2013 and a low of 12 captured on 17 January 2013. Capture success was determined by the weather with results being better on clear, sunny days. Low catch rates were expected on days that were rainy or cloudy and cooler. Males were collected in higher numbers than females because their bright orange color made them easier to see and they were more inclined to fly and be noticed when approached. Males stayed closer to the water and would perch on rocks, twigs and branches in or near the water. Females are more cryptically colored and tend to sit still on vegetation or rocks when approached. Single females were not readily seen unless flying about, however tandem pairs were very noticeable, thus we collected most females when they were in tandem with a male. Females tended to perch at greater distances from the water than the males and only came to the water to mate and lay eggs. All adults collected were marked using a fine-tipped felt marker. Individual numbers were recorded with their sex noted and abdomen lengths measured. Collection times averaged 3 hours on each site visit. On return visits, new captures were marked, specimens sexed, measured, and held at the sections they were collected at to be released later that day. Recaptures were recorded and tandem pairs were noted as to weather any were previously marked. Marking ceased on 1 August 2013.

TAMC POPULATION STUDY RESULTS FOR THE 2012-2013 MONITORING SEASON

From December of 2012 - August of 2013, 718 damselflies were marked, with 77 recaptures made during the study period (**Table 1**). *Megalagrion xanthomelas* population estimates ranged from a low of 144 to a high of 800 individuals (**Fig. 2**).

Table 1. **Sample dates and recaptures during the 2012 - 2013 mark-recapture study at TAMC Stream**

Date	No. recaptures / day	No. new captures / day	Total captures / day	# of Males/Females	Population est.
27 Dec 2012	0	24	24	22/2	none
10 Jan 2013	1	12	13	11/2	312
17 Jan 2013	1	11	12	12/0	156
31 Jan 2013	2	30	32	29/3	192
07 Feb 2013	1	24	25	22/3	800
14 Feb 2013	3	17	20	19/1	167
28 Feb 2013	4	30	34	32/2	170
07 Mar 2013	1	17	18	15/3	612
13 Mar 2013	6	42	48	44/4	144
21 Mar 2013	4	26	30	23/7	360
11 Apr 2013	5	59	59	52/7	354
17 Apr 2013	2	18	20	19/1	590
24 Apr 2013	5	46	51	41/10	204
02 May 2013	2	27	29	25/4	739
09 May 2013	4	46	50	42/8	362
16 May 2013	5	23	28	23/5	280
23 May 2013	3	26	29	25/4	270
05 Jul 2013	1	23	23	21/2	667
12 Jul 2013	4	23	27	24/3	155
18 Jul 2013	8	41	49	42/7	165
25 Jul 2013	9	33	42	40/2	229
01 Aug 2013	8	27	35	32/3	184
08 Aug 2013	4	16	20	16/4	175
TOTAL	**77**	**641**	**718**	**631/87**	**395 average**

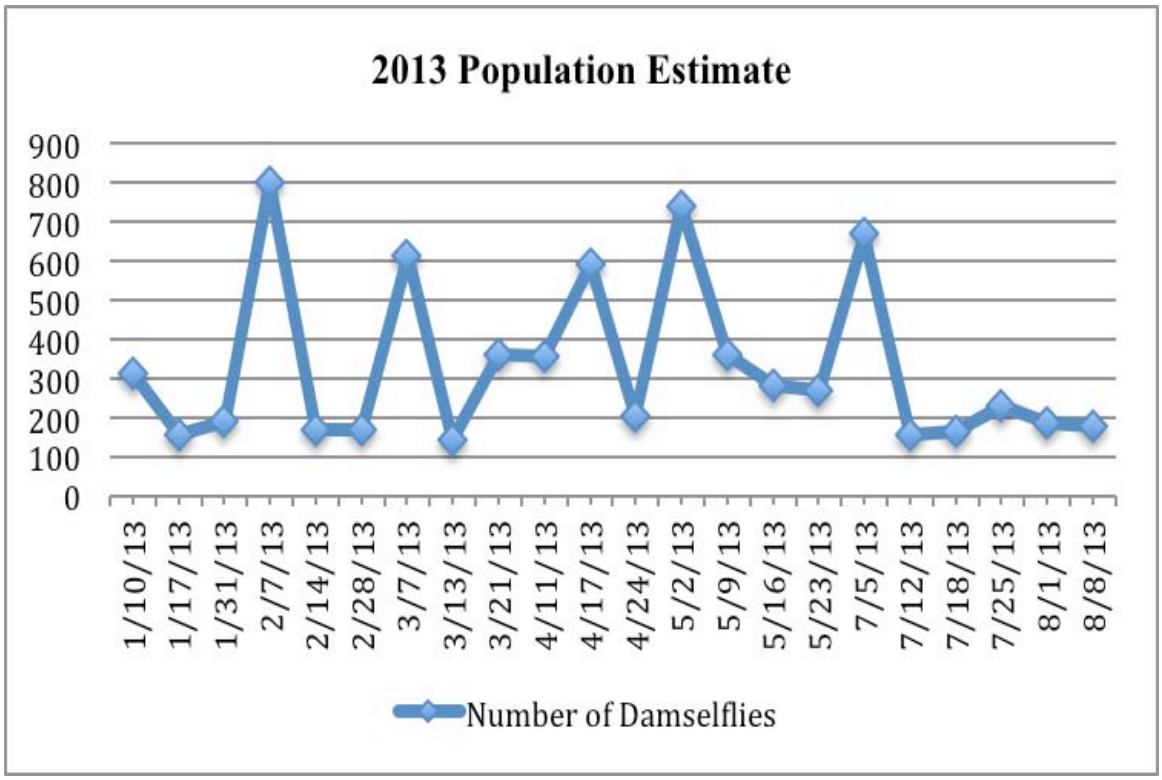

Figure 2. Population estimates from 2013 mark-recapture study at TAMC Stream

TAMC AND FUTURE TRANSLOCATION SITE ASSESMENTS

Stream Site Assessment, Arthropod and Plant Inventories

Arthropod and plant inventories should be conducted periodically at TAMC and at chosen translocation sites prior to any translocation effort. Stream condition at any potential translocation site should be assessed for the presence of non-native predators (fish, crayfish, prawns, etc.) General stream bank conditions should be evaluated for potential erosion issues and a general assessment of stream bank plant species and overhead canopy cover should be conducted. Arthropod inventory results for the current and past surveys at TAMC are presented in Appendix I. Plant species inventories for TAMC are presented in Appendix II.

APPENDIX I: Arthropod Inventories conducted at TAMC, O‘ahu

Table 2. TAMC Army Hospital Stream, O'ahu, Hawai'i Arthropod Inventories Conducted between 1995 and 2013. **Continued**

TAXA	STATUS[I]
Subclass: ACARI (Mites) **ORIBATIDA:** **Carabodidae** *Carabodes* sp.	Adv
Cepheidae Undetermined genus sp.	?
Hydrozetidae *Hydrozetes* sp.	Adv
Liacaroidea *Liacarus* sp.	?
Oppiidae *Oppia* sp.	End?
Otocepheidae *Dolicheremaeus* sp.	"
Phthiracaridae *Atropacarus* sp.	?
Scheloribatidae *Scheloribates* spp.	many are native but a few are Adv
Tryhypochthoniidae *Hydronothrus cripus* Aoki	Adv
MESOSTIGMATA **Ameroseiidae** *Ameroseius* sp.	Adv
Ascidae *Asca* spp.	Adv
Laelapidae *Echeronyssus* sp.	Adv
Parasitidae *Parasitus* sp.	Adv
Podocinidae *Podocinum pacificus* Leonardi	Adv
Phytoseiidae *Phytoseius* sp.	Adv
Uropodidae Undetermined genera spp.	?
Prostigmata **Cheleytidae** *Bak deleoni* Yunker	Adv
Hemicheyletia bakeri (Ehara)	Adv
Cryptognathidae *Favognathus pictus* Summers & Chaudhri	Adv
Cunaxidae *Neocunaxoides andrei* (Baker & Hoffmann)	Adv
Erynetidae *Ceenus* sp.	?
Eupodidae Undetermined genus sp.	?

Table 2. TAMC Army Hospital Stream, O'ahu, Hawai'i Arthropod Inventories Conducted between 1995 and 2013. **Continued**

TAXA	STATUS[I]
Subclass: ACARI (Mites) **MESOSTIGMATA** **Stigmaeidae** *Storchia robusta* Berlaese	Adv
ASTIGMATA **Acaridae** *Tyrophagus putrescentiae* (Schrank)	Adv
ARANEAE (spiders) **Linyphiidae** Undetermined genus sp.	?
Salticidae Undetermined genus sp.	?
DIPLOPODA (millipedes) **Cambalopsidae** *Calyphyiulus granulatus* (Gervais)	Adv
Julidae Undetermined genus sp.	Adv
Paradoxomatidae *Oxidus* sp.	Adv
Polyxenidae *Polyxenus* sp.	Adv
CHILOPODA (centipedes) **Geophilidae** Undetermined genus sp.	?
Scolopendridae *Scolopendra subspinipes* Leach	Adv
ISOPODA (sow bugs, pill bugs) **Styloniscidae** *Styloniscus* sp.	Adv
AMPHIPODA (scuds, lawn shrimp) Undetermined family	?
OSTRACODA (seed or mussel shrimp) Undetermined family	?
COPEPODA (copepods) Undetermined family	?
BLATTARIA (roaches) **Blaberidae** *Pycnoscelus indicus* (Fabricius)	Adv
Blattellidae *Periplaneta americana* (Linnaeus)	Adv

Table 2. TAMC Army Hospital Stream, O'ahu, Hawai'i Arthropod Inventories Conducted between 1995 and 2013. **Continued**

TAXA	STATUS[I]
COLEOPTERA (beetles)	
Aglycideridae	
Proterhinus sp.	End
Canthridae	
Caccodes oceaniae (Bourgeois)	Adv
Cerambycidae	
Sybra alternans (Wiedemann)	Adv
Ciidae	
Cis sp.	End
Coccinellidae	
Curinus coeruleus Mulsant	Pur
Olla abdominalis (Say)	Pur
Corylophidae	
Corylophodes suturalis (Sharp)	Adv
Elateridae	
Conoderus exul	Adv
Scarabeidae	
Adoretus sinicus Burmeister	Adv
Protaetia fusca (Herbst)	Adv
Staphylinidae	
Neosorius rufipes (Motschulsky)	Adv
Osorius rufipes Motschulsky	Adv
COLLEMBOLA (springtails)	
Entomobryidae	
Entomobrya sp.	?
Lepidocyrtus sp.	prob. End
Tomocerus minor (Lubbock)	Adv
Neelidae	
Neelus (*Megalothorax* sp.)	?
Sminthuridae	
Dicyrtoma (*Papirioides*) *dubia* (Folsom)	End
DIPTERA (flies)	
Calliphoridae	
Chrysomya megacephala (Fabricius)	Adv
Ceratopogonidae	
Atrichopogon jacobsoni (de Meijere)	Adv
Ceratopogonidae	
Forcipomyia hardyi Wirth & Howarth	End
Chironomidae	
Chironomus hawaiiensis Grimshaw	End
Chloropidae	
Rhodesiella sp.	Adv
Culicidae	
Aedes albopictus (Skuse)	Adv
Toxorhynchites amboinensis (Doleschall)	Pur

Table 2. TAMC Army Hospital Stream, O'ahu, Hawai'i Arthropod Inventories Conducted between 1995 and 2013. **Continued**

TAXA	STATUS[I]
DIPTERA continued	
Dolichopodidae	
Chrysosoma globiferum (Wiedemann)	Adv
Chrysotus longipalpis Aldrich, 1886	Adv
Diaphorus parthenus Hardy & Kohn	End
Pelastoneurus lugubris Loew, 1861	Adv
Syntormon flexibile (Becker)	Adv
Drosophilidae	
Drosophila sp. prob. *melanogaster* Meigen	Adv
Ephydridae	
Brachydeutera hebes Cresson	End
Brachydeutera ibari Ninomiya	Adv
Scatella bryani (Cresson)	
Lauxaniidae	
Poecilominettia sp.	Adv
Phoridae	
?*Spiniphora* sp.	Adv
Psychodidae	
Psychoda sp.	?
Sphaeroceridae	
Leptocera sp.	?
Poecilosomella punctipennis (Wiedemann)	Adv
Syrphidae	
Allograpta exotica (Weidemann)	Adv
Allograpta oblique (Say)	Adv
Simosyrphus grandicornis (Macquart)	Adv
Tachinidae	
Trichopoda pilipes (Fabricius)	
Tephritidae	
Bactrocera cucurbitae (Coquillett)	Adv
Tipulidae	
Limonia advena (Alexander)	End
EMBIIDINA (web-spinners)	
Oligotomidae	
Oligotoma saundersii (Westwood)	Adv
Oligotimidae	
Aposthonia oceania (Ross)	Adv
Kerriidae	
Paratachardina pseudolobata Kondo & Gullan, 2007	Adv
Lygaeidae	
Botocudo marianensis (Usinger, 1946)	Adv
Notonectidae	
Buenoa pallipes (Fabricius)	Adv
Notonecta indica Linnaeus	Adv
Pentatomidae	
Brochymena quadripustulata (Fabricius)	Adv

Table 2. TAMC Army Hospital Stream, O'ahu, Hawai'i Arthropod Inventories Conducted between 1995 and 2013. **Continued**

TAXA	STATUS[I]
Pentatomidae cont.	
Nezara viridula (Linnaeus)	Adv
Reduviidae	
Zelus renardii Kolenati	Adv
Tingidae	
Leptodictya tabida (Herrich-Schaeffer)	Adv
HOMOPTERA	
Agallidae	
Agalliopsis sp.	Adv
Cicadellidae	
Homalodisca coagulata (Say)	Adv
Clastopteridae	
Clastoptera sp.	Adv
Flatidae	
Melormenis basalis Walker	Adv
Psyllidae	
Heteropsylla cubana Crawford	Adv
HYMENOPTERA (ants, bees, & wasps)	
Agaonidae	
Odontofroggattia sp.	Adv
Anthophoridae	
Xylocopa sonorica Smith	Adv
Apidae	
Apis mellifera Linneaus	Adv
Aphelinidae	
Undetermined genus sp.	?
Braconidae	
Apanteles trifasciatus Muesebeck	Adv
Eulophidae	
Undetermined genus sp.	?
Eurytomidae	
Eurytoma sp.	Adv
Formicidae	
Anoplolepis gracilipes F. Smith, 1857	Adv
Camponotus sp.	Adv
Cardiocondyla emery Forel, 1881	Adv
Ochetellus glaber (Mayr, 1862)	Adv
Leptogenys falcigera Rogers, 1861	Adv
Paratrechina longicornis (Latreille, 1802)	Adv
Pheidole megacephala (Fabricius, 1793)	Adv
Plagiolepis alluaudi Emery, 1894	Adv
Pseudomyrmex gracilis (Fabricius, 1804)	Adv
Solenopsis geminata (Fabricius, 1804)	Adv
Solenopsis papuana (Emery, 1900)	Adv
Strumigenys sp. nr rogeri Emery, 1890	Adv
Tapinoma melanocephalum (Fabricius, 1793)	Adv
Technomyrmex albipes (Smith), 1861	Adv
Technomyrmex difficilis Forel, 1892	Adv
Tetramorium insolens (F. Smith, 1861)	Adv

Table 2. TAMC Army Hospital Stream, O'ahu, Hawai'i Arthropod Inventories Conducted between 1995 and 2013. **Continued**

TAXA	STATUS[1]
Formicidae cont. *Tetramorium similimun* (F. Smith, 1851)	Adv
Proctotrupidae Undetermined genus sp.	?
Sphecidae *Scelipheron caementarium* (Drury)	Adv
Trichogrammatidae Undetermined genus sp.	?
Vespidae *Delta curvatum* (Saussure)	Adv
ODONATA **Coenagrionidae** *Ischnura posita* (Hagan)	Adv
Megalagrion xanthomelas (Sélys-Longchamps)	End
Libellulidae *Orthemis ferruginea* (Fabricius)	Adv
Pantala flavescens (Fabricius)	Adv
Tramea abdominalis (Rambur)	Adv
Tramea lacerata Hagan	Adv
ORTHOPTERA **Acrididae** *Oxya japonica* (Thunberg, 1815)	Adv
Schistocerca nitens (Thunberg)	Adv
Tettigoniidae *Conocephalus saltator* (Saussure)	Adv
Elimaea punctifera (Walker)	Adv

[1] = Status**: End=Endemic to HIs, Ind=indigenous to HIs, Adv=Adv, Pur=purposefully introduced, ?=Unkno**

APPENDIX II: Plant Inventories conducted at TAMC, O‘ahu from 2010 - 2013

PLANT SURVEYS OF TAMC ARMY MEDICAL CENTER ORANGEBLACK HAWAIIAN DAMSELFLY SITE

As part of ongoing monitoring of Orangeblack Hawaiian Damselfly *(Megalagrion xanthomelas)* populations at the TAMC Army Medical Center (TAMC) site, plant inventories at both the upper and lower damselfly sites were done in January 2010 by Clyde Imada and Barbara Kennedy, Bishop Museum and 2012-13 by the authors.

TAMC Army Medical Center Orangeblack Hawaiian Damselfly site Plant Checklist

The following is a list of vascular plant species noted during walkthrough surveys of approximately 250 linear yards of partially channelized streambed and surrounding banks that support a population of the rare Orangeblack Hawaiian Damselfly *(Megalagrion xanthomelas)*.

Biogeographic Status **(from Wagner et al. 1999)**

ind Indigenous: native, occurring naturally in the archipelago but also outside of Hawai‘i
ind? Questionably indigenous: probably indigenous, possibly naturalized
nat Naturalized: introduced to the archipelago directly or indirectly by humans since Western contact and reproducing and spreading vegetatively or by seed
pol? Questionably Polynesian-introduced: perhaps introduced by original Polynesian settlers, but possibly introduced in historic times
cult Cultivated or a remnant of former cultivation
cult? Possible escape from cultivation

SUPERFAM	FAMILY	FULL NAME	STATUS	COMMON NAME
Dicot	Acanthaceae	Asystasia gangetica (L.) T. Anderson	nat	Chinese violet
Dicot	Acanthaceae	Justicia betonica L.	nat	white shrimp plant
Dicot	Amaranthaceae	Amaranthus lividus L. ssp. polygonoides (Moq.) Probst	nat	
Dicot	Anacardiaceae	Mangifera indica L.	cult	mango
Dicot	Apiaceae	Hydrocotyle sibthorpioides Lam.	nat	marsh pennywort
Dicot	Apocynaceae	Thevetia peruviana (Pers.) K. Schum.	nat	be-still tree, yellow oleander
Dicot	Araliaceae	Schefflera actinophylla (Endl.) Harms	nat	octopus tree, umbrella tree
Dicot	Asteraceae	Ageratum conyzoides L.	nat	maile hohono
Dicot	Asteraceae	Calyptocarpus vialis Less.	nat	

SUPERFAM	FAMILY	FULL NAME	STATUS	COMMON NAME
Dicot	Asteraceae	Cyanthillium cinereum (L.) H. Rob.	nat	little ironweed
Dicot	Asteraceae	Eclipta prostrata (L.) L.	nat	false daisy
Dicot	Asteraceae	Emilia coccinea (Sims) G. Don	nat	Flora's paintbrush
Dicot	Asteraceae	Emilia sonchifolia (L.) DC.	nat	Flora's paintbrush
Dicot	Asteraceae	Pluchea carolinensis (Jacq.) G. Don	nat	sourbush, marsh fleabane
Dicot	Asteraceae	Sphagneticola trilobata (L.) Pruski	nat	wedelia
Dicot	Asteraceae	Youngia japonica (L.) DC.	nat	Oriental hawksbeard
Dicot	Bignoniaceae	Kigelia africana (Lam.) Benth.	cult	sausage tree
Dicot	Bignoniaceae	Spathodea campanulata P. Beauv.	nat	African tulip tree, fountain tree
Dicot	Bixaceae	Cochlospermum vitifolium (Willd.) Spreng.	cult	buttercup tree
Dicot	Buddleiaceae	Buddleia asiatica Lour.	nat	huelo ‘ilio, dog tail, butterfly bush
Dicot	Caricaceae	Carica papaya L.	nat	papaya
Dicot	Convolvulaceae	Ipomoea obscura (L.) Ker Gawl.	nat	
Dicot	Convolvulaceae	Ipomoea ochracea (Lindl.) G. Don	nat	morning glory
Dicot	Convolvulaceae	Ipomoea triloba L.	nat	little bell
Dicot	Cucurbitaceae	Coccinia grandis (L.) Voigt	nat	ivy gourd, scarlet-fruited gourd
Dicot	Cucurbitaceae	Momordica charantia L.	nat	balsam pear, bitter melon
Dicot	Euphorbiaceae	Chamaesyce hirta (L.) Millsp.	nat	hairy spurge, garden spurge
Dicot	Euphorbiaceae	Chamaesyce hypericifolia (L.) Millsp.	nat	graceful spurge
Dicot	Euphorbiaceae	Ricinus communis L.	nat	castor bean
Dicot	Euphorbiaceae	Synadenium grantii Hook.	cult	African milkbush
Dicot	Fabaceae	Leucaena leucocephala (Lam.) de Wit	nat	koa haole
Dicot	Fabaceae	Pithecellobium dulce (Roxb.) Benth.	nat	Manila tamarind, ‘opiuma
Dicot	Fabaceae	Samanea saman (Jacq.) Merr.	nat	monkeypod, rain tree
Dicot	Fabaceae	Senna pendula (Humb. & Bonpl. ex Willd.) H. S. Irwin & Barneby var. advena (Vogel) H. S. Irwin & Barneby	nat	
Dicot	Fabaceae	Senna surattensis (Burm. f.) H. S. Irwin & Barneby	nat	scrambled eggs, kalamona
Dicot	Goodeniaceae	Scaevola taccada (Gaertn.) Roxb.	ind	naupaka kahakai
Dicot	Malvaceae	Abutilon grandifolium (Willd.) Sweet	nat	hairy abutilon
Dicot	Malvaceae	Hibiscus rosa-sinensis L.	cult	

SUPERFAM	FAMILY	FULL NAME	STATUS	COMMON NAME
Dicot	Malvaceae	Malvastrum coromandelianum (L.) Garcke ssp. coromandelianum	nat	false mallow
Dicot	Moraceae	Ficus benjamina L.	cult	Benjamin fig, weeping fig
Dicot	Moraceae	Ficus macrophylla Desf. ex Pers.	cult	Moreton Bay fig
Dicot	Moraceae	Ficus microcarpa L. f.	nat	Chinese banyan
Dicot	Myrtaceae	Syzygium cumini (L.) Skeels	nat	Java plum
Dicot	Ochnaceae	Ochna thomasiana Engl. & Gilg	nat	Mickey Mouse plant
Dicot	Oxalidaceae	Oxalis corniculata L.	pol?	yellow wood sorrel, ‘ihi ‘ai
Dicot	Passifloraceae	Passiflora edulis Sims	nat	purple granadilla, liliko‘i
Dicot	Passifloraceae	Passiflora suberosa L.	nat	huehue haole
Dicot	Phytolaccaceae	Rivina humilis L.	nat	coral berry, rouge plant
Dicot	Plumbaginaceae	Plumbago auriculata Lam.	cult	Cape leadwort
Dicot	Rhamnaceae	Colubrina asiatica (L.) Brongn.	ind	‘ānapanapa
Dicot	Rubiaceae	Hedyotis callitrichoides (Griseb.) W. H. Lewis	nat	
Dicot	Rubiaceae	Paederia foetida L.	nat	maile pilau
Dicot	Rutaceae	Murraya paniculata (L.) Jack	nat	Mock orange
Dicot	Sapindaceae	cf. Harpullia pendula Planch. ex F. Muell.	cult	tulipwood
Dicot	Sapindaceae	indet. Sapindaceae	cult	
Dicot	Solanaceae	Solanum americanum Mill.	ind?	glossy nightshade, pōpolo
Dicot	Solanaceae	Solanum lycopersicum L. var. cerasiforme (Dunal) Spooner, G. J. Anderson & R. K. Jansen	nat	tomato, ‘ōhi‘a lomi
Dicot	Solanaceae	Solanum seaforthianum Andrews	nat	
Dicot	Urticaceae	Pilea microphylla (L.) Liebm.	nat	artillery plant, rockweed
Monocot	Agavaceae	Dracaena fragrans (L.) Ker-Gawl.	cult	corn plant
Monocot	Agavaceae	Sansevieria trifasciata Prain	cult	mother-in-law’s-tongue
Monocot	Araceae	Epipremnum pinnatum (L.) Engl.	nat	taro vine, pothos
Monocot	Araceae	Philodendron bipinnatifidum Schott ex Endl.	cult	tree philodendron
Monocot	Araceae	Syngonium podophyllum Schott	nat	nephthytis
Monocot	Arecaceae	Caryota urens L.	cult	toddy palm
Monocot	Arecaceae	indet. Arecaceae	cult?	
Monocot	Commelinaceae	Commelina diffusa Burm. f.	nat	honohono, dayflower
Monocot	Cyperaceae	Cyperus difformis L.	nat	
Monocot	Cyperaceae	Cyperus involucratus Rottb.	nat	umbrella sedge
Monocot	Cyperaceae	Eleocharis geniculata (L.) Roem. & Schult.	nat	spikerush
Monocot	Cyperaceae	Fimbristylis dichotoma (L.) Vahl	ind	
Monocot	Cyperaceae	Kyllinga brevifolia Rottb.	nat	kili‘o‘opu, kaluhā,

SUPERFAM	FAMILY	FULL NAME	STATUS	COMMON NAME
				manunēnē
Monocot	Liliaceae	Asparagus plumosus J. G. Baker	nat	climbing asparagus-fern
Monocot	Poaceae	Eleusine indica (L.) Gaertn.	nat	wiregrass, mänienie ali‘i
Monocot	Poaceae	Panicum maximum Jacq.	nat	Guinea grass
Monocot	Poaceae	Stenotaphrum secundatum (Walter) Kuntze	nat	St. Augustine grass, buffalo grass
Gymnosperm	Cycadaceae	Cycas circinalis L.	cult	queen sago
Pteridophyte	Thelypteridaceae	Christella parasitica (L.) H. Lév.	nat	

FUTURE TRANSLOCATION EFFORTS OF THE ORANGE-BLACK DAMSELFLY

Protocol For The Translocation of *M. xanthomelas*

Although in previous years adult damselflies were captured and translocated, we have determined that the adults will not stay at the release sites for more than a week or so. As such, we determined that the translocation of just eggs and larvae will not only be easier but would provide a potentially larger number of individuals without removing breeding pairs from TAMC. Several hundred *M. xanthomelas* eggs in Maile pilau or honohono grass stems should be collected at 3 intervals and a small number of late instar larvae. The larvae and stems containing eggs should be kept in large Snapcap® vials filled with water and placed in small soft-sided coolers with a small amount of ice. The coolers will prevent overheating during transportation to a chosen translocation site. Stems with up to 100 damselfly eggs in each should be placed in the water at the edges of 3 pools as a selected site and inserted into algal mats or soft wet mud at stream edges or in submerged plant roots. Concerns of the fast spreading honohono grass infesting the Waimea site can be mitigated by holding the cuttings in tubs or tanks and periodically pouring off the water containing hatchling larvae from the containers into selected pools and retaining the cuttings to allow for more eggs to hatch until it is determined that no further hatching is occurring. Larger stem cuttings can be gathered if they are to be kept in tubs

or other suitable containers. Selected translocation sites should be assessed prior to the translocation to make sure they contained enough macro-algae and a varied substrate to allow the hatchling larvae to find cover and forage for aquatic prey. Overhead canopy vegetation should approximate the habitat at TAMC to allow for sufficient shade and cover. The damselflies will venture up and away from the water when cloudy and at night. The damselflies will also forage for food away from the water in the overhead canopy. Male *M. xanthomelas* have been observed perching at sunny spots in he parking area adjacent to the stream 30 m. away from water and vegetation.

***Megalagrion xanthomelas* eggs inserted into Maile pilau (*Paederia foetida*) stem Photo by D.J. Preston**

Post Translocation Monitoring Protocol

Army Environmental staff biologists will continue monitoring at TAMC. If a translocation is attempted in the future, follow-up monitoring of the translocation site should be conducted at one to two-week intervals over a 6-7 month period to determine the establishment of *M. xanthomelas.* Any *M. xanthomelas* adults observed indicate larvae placed in the ponds have grown out and emerged or that the eggs have hatched and the larvae survived to emerge as new recruits. Population studies at TAMC indicate that adults can survive up to 70 days. Should a population *M. xanthomelas* become established at Waimea, expanded monitoring should occur.

***Megalagrion xanthomelas* larva**
Photo by R.A. Englund HBS

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