Initial Success of Reintroduction Efforts for the Orangeblack Hawaiian Damselfly (*Megalagrion xanthomelas)* on O‘ahu

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Background

The orangeblack Hawaiian damselfly (*Megalagrion xanthomelas)* is an endangered damselfly (pinapinao) endemic to Hawai‘i. It is a lowland species, historically breeding in ponds and wetlands on most of the Hawaiian Islands, but its range has been greatly reduced, primarily due to loss of habitat and the widespread introduction of invasive fish that prey on damselfly naiads (the aquatic immature stage). Small populations of orangeblack Hawaiian damselfly still occur on the islands of Hawai‘i, Maui, Moloka‘i, and O‘ahu.

The only known wild population on O‘ahu is in a short (100 m) stretch of stream at Tripler Army Medical Center (TAMC), where it was discovered by Bishop Museum scientists in 1994 (Englund 2001). Streamflow at this site is maintained by a faucet running constantly, and the population is vulnerable to flooding or introduction of invasive species. Establishing additional populations of this species on O‘ahu is considered a top priority to reduce the risk of extirpation.

Since the discovery of the TAMC population, there have been several attempts to establish new O‘ahu populations via direct transportation of individuals from TAMC to new sites (Johnson 2001, Preston et al. 2007). The first attempt was at a lowland, spring-fed stream at Dillingham Military Reservation (DMR) on the North Shore of O‘ahu (Figs. 1 and 2). This site is naturally free of invasive fish. In 1999, a total of 97 naiads and adults were translocated directly from TAMC to DMR (Johnson 2001). Although some translocated males were observed defending territories, and a few females were observed laying eggs, no evidence of a second generation was observed, and the reintroduction was ultimately not successful. However, DMR appeared to be one of the most promising of the attempted reintroduction sites. Here we report on a second reintroduction at DMR using recently developed methods for captive rearing, which enable us to release much higher numbers of damselflies.

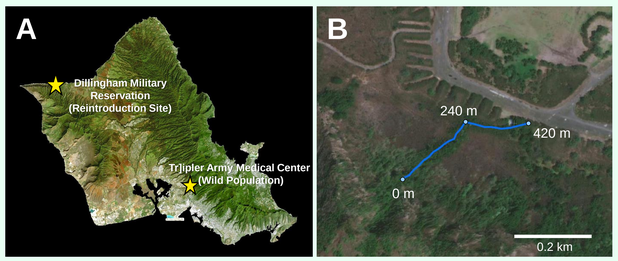

Figure 1. (A) Locations of source population and reintroduction site for orangeblack Hawaiian damselflies. (B) Monitoring transect following the stream at DMR.

Figure 2. The spring-fed stream at DMR varies in steepness and substrate type. In the upper section (A) it is steep and rocky, while the lower section (B) flows along a muddy trench. Pigs were active in both sections.

Methods

A captive population of orangeblack Hawaiian damselflies was established and maintained at a captive rearing facility run by the Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife (DLNR-DOFAW). For a full year (June 2020 to June 2021), lab-reared, adult damselflies were released on a weekly basis at DMR. Prior to release, one wing of each lab-reared damselfly was marked with a unique identification number using a fine-tipped black marker. Over the year, a total of 4,720 lab-reared damselflies were released at DMR.

The stream was monitored weekly along a 420 m transect divided into 20 m sections. Any individual adult or tandem pair observed was recorded. Wild-born damselflies (which were unmarked) were captured (if not currently in tandem) and marked with a unique number using a red pen.

Figure 3. A wild-born male (front, marked in red) and lab-reared female (rear, marked in black) mating in “wheel formation”.

Results

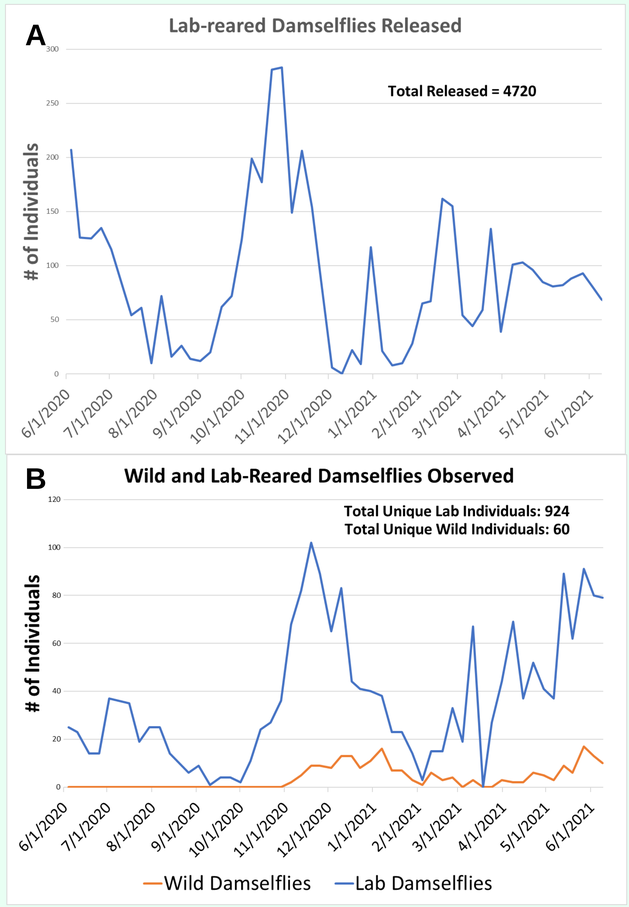

Figure 4. Total counts of damselflies released (A) and observed (B) at DMR weekly between 6/4/2021 and 6/9/2021.

After releases, adult orangeblack Hawaiian damselflies were consistently observed at DMR each week. Males were observed defending territories, and females were observed mating (Fig. 3) and laying eggs in vegetation and sediment in the stream. Of the 4,720 damselflies released at the site over the course of the year, at least 924 unique individuals (19.6%) were resighted during weekly monitoring (Fig. 4).

Beginning in November 2020, we observed wild-born damselflies defending territories and mating at DMR (Fig. 5). This marks the first time a wild generation has been observed after a translocation effort for this species. Since November 2020, wild damselflies have been consistently observed, though in modest numbers. As of June 2021, at least 60 wild-born damselflies have been observed at the site.

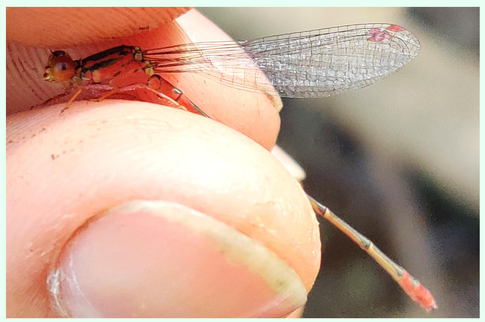

Figure 5. An unmarked wild-born male *M. xanthomelas.*

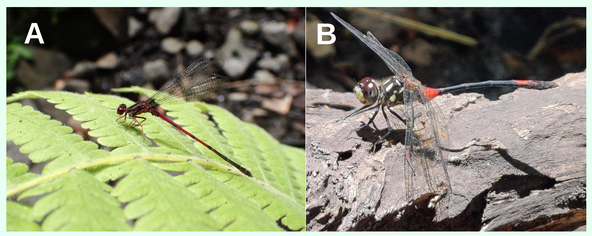

Figure 6: Two other endemic odonates (A) *Megalagrion hawaiiense* and (B) *Nesogonia blackburni* are occasionally observed at DMR.

Discussion

The continued emergence of wild-born damselflies at DMR suggests that this may be a successful reintroduction, but it is too soon to determine long-term establishment. As of July 2021, we have stopped releasing lab-reared damselflies to test whether the wild population can sustain itself without continuous releases. Continued monitoring of the site will assess the long-term viability of the population.

Although only about 20% of the damselflies released were later confirmed to be resighted at the stream during weekly monitoring, this is a conservative estimate. Many of the lab-reared damselflies observed did not have fully legible IDs and were therefore not counted in the total of unique individuals.

The site appears to provide acceptable conditions to maintain adult damselflies. Their individual ID numbers allowed us to determine the age of each individual sighted. Based on the date they were last sighted, we could calculate a minimum life span for each individual sighted. The average minimum life span for resighted lab-reared damselflies was 30.5 days, while many lived much longer than this. The longest-lived adult damselfly resighted at the stream was 103 days old. Because orangeblack Hawaiian damselflies reach sexual maturity when they are about 16-20 days old, 30 days is an adequate amount of time for adults to mate and lay eggs.

Naiad habitat may be a limiting factor to wild population size. The site has few pools, and prey availability in the stream appears to be relatively low. We are currently considering fencing a section of the stream and adding artificial pools, which we suspect will enhance the habitat for naiads and hopefully increase carrying capacity at the site.

The initial reintroduction success at this site is an exciting breakthrough. The use of captive rearing may be a turning point for conservation of the species. However, scarcity of viable reintroduction sites remains a limiting factor; identification of additional sites is crucial for long-term success of the species. Ideal reintroduction sites are low elevation (less than 500 m) pools or slow-flowing streams that are free of invasive fish such as mosquito fish (*Gambusia* spp.).

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