



**Stream Survey of Waikoloa and
Keanu'i'omanō Streams, Hawai'i Island
County of Hawai'i**

**Hawai'i
Biological
Survey**

Final Report

January 2002

FINAL REPORT

Stream Survey of Waikoloa and Keanu‘i‘omanō Streams, Hawai‘i Island

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January 2002

Contribution No. 2002-004 to the Hawaii Biological Survey

Table of Contents

Executive Summary 1

Introduction 2

Study Area 2

Methods 3

 Fish, Crustacean, and Mollusk Sampling 4

 Aquatic Insect Sampling..... 4

Results and Discussion..... 5

 Fish, Crustacean, and Mollusk Results 5

 Aquatic Insect Results 5

Recommendations 7

References 8

Tables

Table 1. Results of Hawaii Biological Survey, Bishop Museum surveys conducted in December 2001 for aquatic species in Waikoloa and Keanu‘i‘omanō Streams, Hawai‘i Island. See Study Area for a description of site locations..... 6

Executive Summary

The Hawaii Biological Survey of the Bishop Museum conducted a biological assessment of native and introduced aquatic animals at Waikoloa and Keanu‘i‘omanō Streams, Hawai‘i Island from 20–22 December 2001. No federally Threatened, Endangered, rare, or imminently threatened, or sensitive native species of aquatic animals were found in or around the areas of Waikoloa and Keanu‘i‘omanō Streams within the Lālāmilo Project area. Both streams examined within the Lālāmilo Project area contained very similar aquatic faunas and, during this study, had similar flows and aquatic habitat characteristics. The complete lack of algae on the rocks and no developed aquatic insect fauna indicated that streams within the project area are intermittent.

Although the watershed within and around the Lālāmilo Project area has been heavily disturbed by grazing and development for over 150 years, aquatic habitats and biota contained within this area remain relatively pristine, albeit apparently intermittent. However, efforts should be made to avoid impacting the stream channel during construction as Hawaiian migratory (amphidromous) native stream animals (fish and crustaceans) use these stream channels to access the permanently flowing upper reaches of Waikoloa and Keanu‘i‘omanō Streams. Best management practices should be employed during construction to prevent soil erosion into the stream channel that would eventually make its way into nearshore ocean areas.

Introduction

A biological assessment of native and introduced aquatic animals at Waikoloa and Keanu'i'omanō Streams, Hawai'i Island was conducted from 20–22 December 2001 by the Hawaii Biological Survey of the Bishop Museum. This assessment was conducted for the Department of Hawaiian Homelands (DHHL) Lālāmilo Project in the Waikoloa area at Waimea, Hawai'i. This survey searched for sensitive native aquatic species and communities, assessed if federally listed Species of Concern were found, and documented the constituents of the aquatic fauna found within the proposed project area. We also went considerably downstream and upstream of the proposed project area, although we did not go to the uppermost stream headwaters in the Kohala Mountains above the town of Waimea. Additionally, the impacts of proposed culvert located in Keanu'i'omanō Stream, on the western edge of the project area were assessed. In summary, the areas we assessed included candidate endangered damselflies, native and introduced fish, aquatic insects, crustaceans, and aquatic mollusks.

Study Area

Stream names were taken from USGS topographic quads. The Lālāmilo Project encompasses 265.388 acres near the town of Waimea, and the project area is bordered by two major streams, Waikoloa and Keanu'i'omanō Streams. Flowing through mostly cattle pastures at the time of this study, these streams are situated in close proximity to each other (generally within 1,000 to 2,000 ft of each other in the Lālāmilo Project area). Both of these streams were fully flowing between 20-22 December 2001 during our biological assessment. Waikoloa and Keanu'i'omanō Streams originate in the rolling hills of the upper Kohala Mountains near the northern tip of Hawai'i Island. Keanu'i'omanō Stream originates from approximately 3600 ft to 4000 ft with two smaller named intermittent tributaries, Wai'aka (which later becomes Lanikepu) and Hale'aha Gulches, while the third larger tributary, Kohākōhau Stream is perennial. Kohākōhau Stream originates at over 5000 ft, and has a USGS gaging station located on it.

Waikoloa Stream originates above Pu'u Iki at approximately 4000 ft and has numerous diversions and reservoirs upstream of Waimea town. It is unclear whether Waikoloa Stream is now intermittent, with perhaps some occasional permanent pools downstream of Waimea, because of these numerous diversions and reservoirs. Waikoloa and Keanu'i'omanō Streams flow parallel to each other throughout the project area and downstream to 1440 ft elevation, where they then join to form Wai'ula'ula Stream that then flows to the ocean. The Hawaii Stream Assessment (1990) mentions only Waikoloa Stream, and classifies it as

intermittent with year-round flow in the upper portions and intermittent flows in the lower elevations. The elevations surveyed ranged from 2405 ft in the upper most section of the Lālāmilo Project to 2225 ft in the downstream end of the proposed project area.

An additional, lower area of Waikoloa Stream at 1280 ft was also surveyed to further assess if native amphidromous (migratory Hawaiian) aquatic species were found in the stream. This area flowed through incised bedrock with stairstep pools and much less substrate than in the upper areas. A few small pools in this area apparently contain enough water year-round at this elevation to support a few hardy introduced fish (see Results). However, the main stream channel at 1280 ft elevation appears to be intermittent as evidenced by the lack of algae and little permanent aquatic insect fauna in this area.

Stream habitat in both Waikoloa and Keanu'i'omanō Streams was fairly similar and quite uniform during our assessments, with the mostly scoured, bedrock channels containing some moderately sized cobble in the upper reaches of the project area, with occasional large boulders. Favorable habitats such as relatively large waterfalls and cascades were common, and the water appeared to be slightly tannic but clear. At the upper 2400 ft elevation sites the water temperature was measured at 62 °F, while a slightly warmer 65 °F was recorded at 1280 ft elevation on Waikoloa Stream.

The primary riparian vegetation included common alien species such as Christmas berry (*Schinus terebinthifolius*) and an assortment of grasses. Christmas berry was so dense that, in some areas, access to the stream was difficult. A large, native great bulrush, 'aka'akai (*Schoenoplectus lacustris* (L.) Palla ssp. *validus* (Vahl) T. Koyama) was found growing in many areas of Waikoloa Stream, and the roots of this plant provided habitat for native dragonfly larvae such as *Anax* spp.

Methods

Sampling took place during a period of sunny weather and good conditions, with occasional cloud cover occurring only for a brief period on 20 December 2002. Clear conditions prevailed for the remainder of sampling. The entire stream corridor was hiked within the Lālāmilo Project area along both Waikoloa and Keanu'i'omanō Streams. Additionally, we hiked several hundred yards up and downstream of the Lālāmilo Project boundary area, and also sampled approximately 250 yds of stream corridor at the lower 1280 ft site on Waikoloa Stream.

Fish, Crustacean, and Mollusk Sampling

Above-water observation, hand-netting, and small seines were used to assess aquatic species composition at the various study sites. The small stream size and good water clarity at the study areas sites provided good success during netting and when conducting visual observations. Attempts to capture fish, crustaceans, and mollusks were conducted with similar methods used to collect benthic aquatic insects; that is, mainly above-water visual observations, benthic sampling, seining, and hand-netting. Netting allowed confirmation of visual above-water observations, with particular emphasis on netting in and under vegetation, rootwads, and disturbing the rock substrate.

Aquatic Insect Sampling

Aquatic insect sampling methodology followed Englund and Preston (1999). The sampling of damselflies (Odonata) was emphasized because 12 endemic Hawaiian species are currently listed as Candidate Species or Species of Concern on the Federal Register under the United States Endangered Species Act (USFWS 2000). In addition, native Hawaiian damselflies are good indicators of the relative 'health' of a stream system because they do not typically occur in highly disturbed areas (Polhemus and Asquith 1996).

Collections of both immature and adult specimens were conducted with aerial nets, dip nets, and benthic samples. Visual observations of aquatic insects were conducted as we hiked along and in the streambed. Sampling effort was focused on habitat suitable for native insects: splash zones around riffles and cascades, and wet rock faces associated with springs and seeps, cascades, waterfalls, wetland areas, and benthic sampling of stream substrates. All aquatic habitats encountered were sampled.

General collections were conducted in prime native aquatic insect habitats, with numerous aerial net sweeps taken around riffle splash-zones, cascades, seeps, and waterfall areas. Repeated benthic sampling was conducted at each sampling station by one person holding an aquatic dip net, while another person disturbed rocks upstream of the net. Benthic sampling also included collecting individual rocks and using a toothbrush to sweep off immature aquatic insects and other aquatic invertebrates from the stream rocks. All aquatic insect specimens were stored in 75% ethanol and subsequently transported to the Bishop Museum entomology laboratory for curation and identification. Voucher specimens are currently housed in the Bishop Museum collection.

Results and Discussion

No federally Threatened, Endangered, rare, or imminently threatened species of aquatic animals were found in or around the areas of Waikoloa and Keanu‘i‘omanō Streams assessed during the present study. Both streams examined within the Lālāmilo Project area contained very similar aquatic faunas, and during this study had similar flows and aquatic habitat characteristics. Surveys of these streams in the project area by botanists (W. Char, personal communication) found several species of algae growing in stream side-pools in mid-October 2001. Their surveys were conducted prior to heavy rains that started later in the fall of 2001. However, most of this filamentous algae appeared to have been flushed out by the time our survey was conducted in late December 2001. Although the streams appear to have some permanent pools down to at least 1280 ft elevation, an undeveloped aquatic insect fauna indicated that sections of stream examined within the project area are naturally intermittent, or at least do not have long enough stretches of flowing water to maintain a diverse aquatic insect population.

Fish, Crustacean, and Mollusk Results

Only one species (Table 1) of introduced fish, guppies (*Poecilia reticulata*), was found in low densities at the lower 1280 ft elevation site on Waikoloa Stream during the present survey. No other introduced or native species of fish, crustacean, or mollusk were observed or collected in the areas of Waikoloa and Keanu‘i‘omanō Streams surveyed during this study. The upper, permanently flowing reaches of these two streams were not in the scope of this project, and were not surveyed. However, the native endemic Hawaiian stream fish *Lentipes concolor* are found both upstream and downstream of the project area, inhabiting permanent pools downstream of the project area and permanently flowing sections of Keanu‘i‘omanō Stream (at 3000 ft elevation) above the project area (D. Kuamo‘o, Hawaii Division of Aquatic Resources, pers. comm.). Therefore, native fish do use the intermittent stream channel in the areas we surveyed as an access corridor to the headwater regions of upper Keanu‘i‘omanō Stream.

Aquatic Insect Results

A total of 14 species of aquatic insects were collected at the 3 study sites assessed during this survey (Table 1). With 9 native species collected, 64% of the overall aquatic insect taxa found during this survey were native. This reflects the relatively undisturbed nature and high quality of the aquatic habitats examined,

Stream Survey of Waikoloa and Keanu'i'omanō Streams, Hawai'i Island

even though the areas where our surveys occurred were in obviously intermittent sections of the examined streams. The collected aquatic insects were all species with great dispersal capabilities and the ability to

Table 1. Results of Hawaii Biological Survey, Bishop Museum surveys conducted in December 2001 for aquatic species in Waikoloa and Keanu'i'omanō Streams, Hawai'i Island. See Study Area for a description of site locations.

Taxon	Waikoloa 1280 ft	Waikoloa 2300 ft	Keanu'i'omanō 2300 ft	Geographic Status
Fish				
<i>Gambusia affinis</i>	X			Introduced
Aquatic Insects				
Anisoptera (Dragonflies)				
Aeschnidae				
<i>Anax strenuus</i>		X	X	Endemic
<i>Anax junius</i>	X	X	X	Indigenous
Libellulidae				
<i>Crocothemis servilia</i>		X	X	Introduced
<i>Orthemis ferruginea</i>		X	X	Introduced
<i>Pantala flavescens</i>	X	X	X	Indigenous
Zygoptera (Damselflies)				
Coenagrionidae				
<i>Enallagma civile</i>		X	X	Introduced
Coleoptera (Beetles)				
Dytiscidae				
<i>Rhantus gutticollis</i>		X	X	Introduced
Diptera (Flies, gnats)				
Ceratopogonidae				
<i>Forcipomyia hardyi</i>		X		Endemic
Chironomidae				
<i>Chironomus</i> sp.		X	X	Endemic (prob.)
<i>Cricotopus bicinctus</i>	X	X	X	Introduced
<i>Orthocladus grimshawi</i>		X	X	Endemic
Ephydriidae				
<i>Scatella bryani</i>		X	X	Endemic
<i>Scatella clavipes</i>		X	X	Endemic
Muscidae				
<i>Lispe</i> sp.		X	X	Endemic
Total Species	4	14	13	
Total Native Aquatic Species	2	9	8	
Percent Native Aquatic Species (%)	50%	64%	62%	

exploit ephemeral and intermittent aquatic habitats. For example, the highly vagile dragonflies are strong flyers and even exploit ephemeral rain puddles in Hawaiian forests. The smaller native insect species found, such as the native ephydrid flies are also early colonizers of Hawaiian streams, and indicative of the ephemeral nature of the sampled habitats. The introduced species of aquatic insects found within the Lālāmilo Project area are also highly dispersive, and all were species that are also found in the most remote, high quality aquatic habitats. The presence of these alien species does not necessarily indicate degraded or impaired aquatic habitats. For example, the introduced aquatic beetle *Rhantus gutticollis* was common in the Lālāmilo Project area, but is also found in bogs on Oahu's Mt. Ka'ala, one of the most important conservation areas in the Hawaiian Islands (R. Englund, Bishop Museum unpub. database).

The relatively high 64% overall native aquatic species found within the three study areas is very comparable to other high quality streams such as the Hanalei River (69%), Kaua'i and Hakalau Stream (68%), Hawai'i Island (Polhemus 1995).

Recommendations

Although the watershed within and around the Lālāmilo Project area has been heavily disturbed by grazing and development for over 150 years, aquatic habitats and biota contained within this area remain relatively pristine, albeit apparently intermittent. However, efforts should be made to avoid impacting the stream channel during construction as Hawaiian migratory (amphidromous) native stream animals, especially *Lentipes concolor* use these stream channels to access the permanently flowing, upper reaches of Waikoloa and Keanu'i'omanō Streams (D. Kuamo'o, Hawaii Division of Aquatic Resources, pers. comm.). Additionally, *L. concolor* is also found in several permanent spring-fed pools downstream of the project area in Keanu'i'omanō Stream (D. Kuamo'o, Hawaii Division of Aquatic Resources, pers. comm.). If a culvert is required in Keanu'i'omanō Stream, it is recommended that the culvert be completely flush with the streambed. This will ensure native migratory (amphidromous) aquatic animals continued access to upper areas of Keanu'i'omanō Stream, because any free space between the culvert pipe and streambed would potentially be an impassable obstacle.

Best management practices should be employed during construction to prevent soil erosion into the stream channel that would eventually make its way into nearshore ocean areas, having the potential to impact coral reef areas. If any work needs to be done in or around the stream channel during construction of the

Lālāmilo Project, it is recommended that this be conducted during the dry season when the streams are not flowing. Additionally, best management practices should be employed if a culvert crossing is required in Keanu‘i‘omanō Stream, and it is recommended that culvert construction take place during the dry summer months.

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