



**Report on Long-Term Aquatic Insect Monitoring
by Hawaii Biological Survey, Bishop Museum
in Pelekunu Valley, Moloka'i, Hawai'i**

**Hawaii
Biological
Survey**

Final Report

July 2001



Report on Long-Term Aquatic Insect Monitoring
by Hawaii Biological Survey, Bishop Museum
in Pelekunu Valley, Moloka'i Hawaii

Submitted to:
TNCH Moloka'i
P.O. Box 220 Kualapu'u, Hawaii

Contribution No. 2001-010
to the Hawaii Biological Survey
July 2001



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Hawaii Biological Survey



Key To Photographs:

Photograph 1: Lanipuni tributary at 600 ft elevation

Photograph 2: Rototilling by feral ungulates in wetlands near ocean

Photograph 3: *Megalagrion pacificum* side-pool habitat, Lanipuni tributary 600 ft

Photograph 4: Lower elevations of Pelekunu Stream

Photograph 5: Immature *M. pacificum* found in grass along stream channel here (ca. 120 ft elevation)

Photograph 6: Introduced caddisfly (*Cheumatopsyche pettiti*)

Photograph 7: Native dragonfly *Anax junius*

Photograph 8: Area where Pelekunu Stream joins with the ocean

Photograph 9: Terminal flowing reach of Pelekunu Stream at the ocean

Photograph 10: Nature Conservancy and Hawaii Division of Aquatic Resources personnel conducting fish/invertebrate point counts

Photograph 11: Same as Photo 10, point counts near the ocean

Photograph 12: White silky cases of the rare native midge, *Telmatogeton japonicus*, in ocean splash zone/river mouth of Pelekunu Stream

Photograph 13: Large pool formed by rock berm at ocean, habitat for *Megalagrion pacificum* and *Megalagrion xanthomelas*.

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Introduction

Aquatic insect surveys of Pelekunu Stream (and its tributaries), Moloka'i, were conducted from 22-23 May 2001 by Ron Englund of the Hawaii Biological Survey, Bishop Museum. Collections of aquatic insects were made in elevations ranging from sea level to approximately 600 ft in elevation. This sampling was in conjunction with fish surveys conducted by biologists from the Hawaii Division of Aquatic Resources and The Nature Conservancy. Insect sampling consisted of aerial netting of adult aquatic insects, visual observations, and benthic sampling in and along riffles. Monitoring of Pelekunu Stream was also conducted one year ago, and the results of the present survey are compared to Bishop Museum surveys conducted then and in 1991. R. Englund, N.L. Evenhuis, and K. Arakaki of the Hawaii Biological Survey, Bishop Museum, made aquatic insect species determinations.

Study Area

Located in the central portion of the north shore Moloka'i, Pelekunu Stream originates at nearly 1300 m as a series of small tributaries on both the eastern and western sides of a large amphitheater-shaped basin. The uppermost area of the main Pelekunu Stream sampled during the 2001 survey was located upstream of the Pilipililau tributary and the TNC Papa'iki Camp. Habitat in the upper reaches of the deeply incised main Pelekunu Stream consists of high-gradient riffles and large (3-8 ft cascades) connected by shallow (1-2 ft deep) runs and pools that are generally shallow but are occasionally 5-6 ft in depth.

Near the ocean the stream gradient lessens somewhat. Pelekunu Stream bifurcates into two branches at the rock-cobble berm formed by wave action, with the larger eastern branch currently receiving most of the flow. The stream in this area meanders and occasionally changes course during high flow events. The pool at the ocean formed by the smaller impounded western branch provides important still-water habitat for two species of native damselfly, *Megalagrion pacificum* and *M. xanthomelas*.

Related aquatic habitats sampled in the Pelekunu watershed included the large wetland area near the ocean, and Lanipuni and Pilipililau tributaries. The wetland area at the ocean is formed behind the large cobble bar at the ocean, and numerous small springs emerge in this area, with abandoned taro fields and many of the old rock walls still visible. The area near the ocean is heavily grazed by feral ungulates, with many large wallows evident. Walking in the portion of the wetland near the ocean is relatively easy, but the mud becomes increasingly deeper and more difficult to traverse in the upstream sections, especially near the old

taro terrace area at the upstream end of the wetland. The wetland area was surveyed for native damselflies during the 2000 and 2001 surveys.

Lanipuni tributary was sampled from its confluence with Pelekunu Stream near Papaiki camp to upstream of its first major waterfall. The Lanipuni watershed remains in excellent condition with a wet and predominately native *Metrosideros polymorpha* forest in its upper reaches, and low impacts from feral ungulates resulting in clearer waters than found in the mainstem Pelekunu. In contrast, Pilipililau tributary has a lower flow, draining a drier watershed dominated by introduced dry to mesic plant species such as sisal (*Agave sisalana*). Lanipuni tributary was sampled above the first major waterfalls to approximately the 500 ft elevation level, and numerous seeps and smaller side-channel aquatic habitats were observed. Although stream discharge was not measured, the Lanipuni tributary inputs a large amount of water flow into Pelekunu Stream, and the high gradient cascades, waterfalls, and seeps provide a wide diversity of habitats for freshwater vertebrates and invertebrates.

Pilipililau was sampled upstream of the trail that connects the TNC Papa'iki Camp to the USGS station. This area is at approximately 560 ft elevation, and was sampled to an 8-9 ft bedrock stairstep cascade, which provided a small amount of splash-zone habitat. Immediately downstream of this cascade was a 40-50 ft high mossy seep running along the northern face of the tightly incised Pilipililau Stream channel. A small amount of water dripping on the canyon wall (downstream of the cascade) created an aquatic rheocrene seep covered by a light green species of algae.

Results

Weather conditions were rainy and cloudy during the morning of 22 May sampling of lower Pelekunu Stream and wetlands near the ocean, but were clear and sunny after 1330 hrs. Conditions were uniformly clear and sunny for the day of 23 May 2001. Native damselflies, particularly *Megalagrion xanthomelas* and *M. pacificum*, were not observed in the lower stream area near the ocean during the poor weather conditions. However, *M. pacificum* was abundant in the sampled mid-reaches (200-600 ft elevations) when the weather cleared. Native damselflies were not observed in the large wetlands/old taro field area near the ocean during either the 2000 or 2001 surveys. However, poor weather conditions in 2001 likely accounted for only one species of Odonata, *Pantala flavescens*, being observed in areas near the ocean.

During the 2001 monitoring, a total of 25 aquatic insect species were collected or observed in Pelekunu Stream and its associated tributaries and wetlands, in approximately 16 hours of sampling from 22-23 May 2001. Areas sampled included Lanipuni (to nearly 500 ft elevation) tributary, Pilipililau tributary (560 ft elevation), and the extensive wetland area near the ocean. Of the aquatic insect taxa collected in 2001, 80% were native species (Figure 1 and Table 1). The most important finding of this survey was the discovery along seep habitats of an undescribed native species of large aquatic insect, *Sigmatineurum* n. sp. in Pilipililau tributary at 560 ft elevation. This native aquatic fly species was collected during sweep-net sampling of the large rheocrene seep area of Pilipililau Stream described in the Study Area section. This new *Sigmatineurum* species most closely resembles *Sigmatineurum englundii* (Evenhuis 2000b) found in Waimanu and Waipio Valleys on Hawaii Island; both physically (N.L. Evenhuis, pers. comm.) and in its rheocrene seep habitat preference.

One individual *Campsicnemus ridiculus*, an aquatic fly, was found in a turbulent cascade of Lanipuni tributary immediately below the first major falls on this stream. Another rare species, *Megalagrion xanthomelas*, (collected in 1991 and 2000) was not observed in 2001. This was likely because of poor weather conditions near the Pelekunu Stream area at the ocean during the 2001 surveys, as *M. xanthomelas* will only be found during sunny conditions.

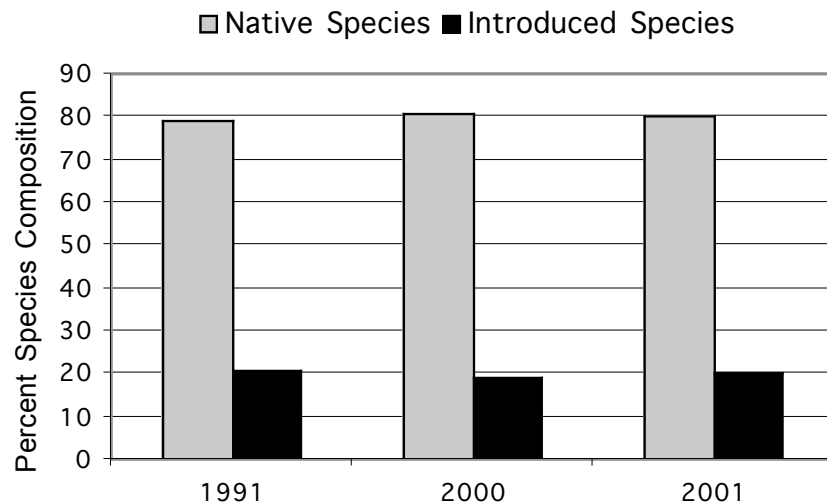


Figure 1. Percent native and introduced aquatic insect species found during long-term Bishop Museum monitoring of Pelekunu Stream.

Table 1. Results of long-term Hawaii Biological Survey, Bishop Museum monitoring of aquatic insect species in Pelekunu Stream including results from the current study of 22-23 May 2001.

| Taxon | Polhemus (1991) | Englund (2000) | Current Study | Geographic Status |
|--------------------------------------------------------------------|-----------------|----------------|-------------------------------|-------------------|
| Anisoptera (Dragonflies) | | | | |
| Aeschnidae | | | | |
| <i>Anax junius</i> | | X | | Indigenous |
| <i>Anax strenuus</i> | X | | X (400-500 ft) | Endemic |
| Libellulidae | | | | |
| <i>Orthemis ferruginea</i> | X | | | Introduced |
| <i>Pantala flavescens</i> | X | X | X (0-500 ft) | Indigenous |
| Zygoptera (Damsel flies) | | | | |
| Coenagrionidae | | | | |
| <i>Ischnura ramburii</i> | | X | | Introduced |
| <i>Megalagrion xanthomelas</i> | X | X | | Endemic |
| <i>Megalagrion pacificum</i> | X | X | X (0-600 ft) | Endemic |
| <i>Megalagrion blackburni</i> | X | X | X (100-600 ft) | Endemic |
| <i>Megalagrion calliphya</i> | | X | X (487 ft-Lanipuni) | Endemic |
| <i>Megalagrion hawaiiense</i> | X | X | X (400-600 ft) | Endemic |
| Heteroptera | | | | |
| Veliidae | | | | |
| <i>Microvelia vagans</i> | X | | X (0-600 ft) | Endemic |
| Mesoveliidae | | | | |
| <i>Mesovelia amoena</i> | X | | X (0-300 ft) | Introduced |
| Saldidae | | | | |
| <i>Saldula exulans</i> | X | X | X (0-600 ft) | Endemic |
| Diptera (true flies) | | | | |
| Canacidae | | | | |
| <i>Procanace acuminata</i> | X | X | X (0-600 ft) | Endemic |
| <i>Procanace confusa</i> | | | X (0-100 ft) | Endemic |
| Chironomidae | | | | |
| <i>Chironomus hawaiiensis</i> | | | X (0 ft) | Endemic |
| <i>Telmatogeton japonicus</i> | | | X (ocean/stream) ¹ | Indigenous |
| <i>Telmatogeton torrenticola</i> | X | X | X (40-600 ft) | Endemic |
| Dolichopodidae | | | | |
| <i>Campsicnemus ridiculus</i> | X | X | X (Lanipuni 487 ft) | Endemic |
| <i>Thambemyia acrosticalis</i> (formerly <i>Paraphrosylus</i> sp.) | X | | | Indigenous |
| <i>Dolichopus exsul</i> | | | X (wetland at ocean) | Introduced |
| <i>Sigmatineurum</i> new sp. | | | X (Pilipililau 560 ft) | Endemic |
| Ephydriidae | | | | |
| <i>Scatella cilipes</i> | | | X (Lanipuni 487 ft) | Endemic |
| <i>Scatella clavipes</i> | | | X (0-600 ft) | Endemic |
| <i>Scatella warreni</i> | | | X (Lanipuni 487 ft) | Endemic |
| <i>Scatella</i> sp. | X | | | Endemic |

¹Collected on wave swept boulders where freshwater entered ocean at Pelekunu Stream mouth

Table 1 (cont). Results of long-term Hawaii Biological Survey, Bishop Museum monitoring of aquatic insect species in Pelekunu Stream including results from the current study of 23-24 May 2001.

| Taxon | Polhemus (1991) | Englund (2000) | Current Study | Geographic Status |
|-------------------------------------|------------------------|-----------------------|----------------------|--------------------------|
| Tipulidae | | | | |
| <i>Limonia advena</i> | X | X | X (0-600 ft) | Introduced |
| <i>Limonia jacobae</i> | | | X | Endemic |
| Trichoptera (Caddisflies) | | | | |
| Hydropsychidae | | | | |
| <i>Cheumatopsyche pettiti</i> | X | X | X (0-600 ft) | Introduction |
| Hydroptilidae | | | | |
| <i>Hydroptila icona</i> | | | X (0-100 ft) | New Introduction |
| Lepidoptera (Aquatic Moths) | | | | |
| <i>Hyposmocoma</i> sp. 1 | X | X | X | Endemic |
| <i>Hyposmocoma</i> sp. 2 | X | | | Endemic |
| Number of Native/Introduced Species | 15/4 | 13/3 | 20/5 | |
| Total Insect Species | 19 | 16 | 25 | |
| Percent Native Species (%) | 79% | 81% | 80% | |

A new and potentially harmful species of nonindigenous aquatic insect, the caddisfly *Hydroptila icona* was collected during the 2001 surveys. This small case-building species of caddisfly was collected in stream habitats just above the ocean to approximately the 100 ft elevation level, but no higher. The center channel areas were the primary habitat preferred by this species, in the mid-channel areas of the most heavily flowing water. Of particular concern is the ability of this *Hydroptila icona* to tolerate the high water velocities found in the v-shaped area at the beginning, or upstream end of cascades in riffles; these are areas that contain the greatest water volume and the highest water velocities. These caddisfly specimens were positively identified by Dr. Oliver Flint of the Smithsonian Institution.

Discussion and Recommendations

The 80% native taxa found in Pelekunu Stream during this survey is similar to the 81% native taxa found during the 2000 surveys (Englund 2000), and 79% native species found during the 1991 Bishop Museum surveys (Polhemus 1991) (Figure 1). For comparison, only lower elevations (below 60 ft) of Pelekunu Stream were surveyed during the 1991 Bishop Museum surveys (Polhemus 1991), while the surveys conducted in 2000-2001 ranged from 0 to nearly 600 ft. During the ten years that Pelekunu Stream has been

monitored Bishop Museum staff have found aquatic insect species assemblages to be quite stable over time in this nearly pristine stream. The number of native aquatic species collected at Pelekunu Stream ranged from a low of 13 species in 2000 to a high of 20 in 2001, and may also be somewhat related to sample effort, with more time and a wider variety of aquatic habitats sampled in 2001 than in the 1991 and 2000 studies.

Because of a low number of introduced aquatic species and no fish introductions, Pelekunu Stream is one of the most important watersheds for the preservation of native biodiversity in Hawaii. For instance, native species of damselflies that have become extinct or had their ranges severely restricted on Oahu (Englund 1999) remain abundant in Pelekunu Stream. Because many rare native aquatic insect species are found there, Pelekunu Stream should be given the highest level of protection from disturbance and species introductions.

Campicnemus ridiculus is currently known to exist elsewhere from only Waiehu Stream, Maui (Evenhuis 2000a), and is one of the most rare aquatic insects in Hawaii. Native damselflies such as *Megalagrion pacificum* are extinct on islands such as O'ahu and Kaua'i, yet remain abundant in Pelekunu Stream. Native damselflies are considered sensitive to disturbance and are a good indication of the health of the native aquatic ecosystem (Polhemus and Asquith 1996).

The continued absence of alien fish species in 2001 in the Pelekunu watershed is a hopeful finding, with the crustacean *Macrobrachium lar* the only species of introduced macrofauna occurring in Pelekunu Stream. Prior to the sampling of 2001, the introduced aquatic insect species found in Pelekunu Stream was considered relatively innocuous. The most distressing finding of the 2001 surveys was the collection of a new species nonindigenous hydroptilid caddisfly in the lowest elevations of the main Pelekunu Stream. This caddisfly did not resemble any of the hydroptilid species currently known to exist in Hawaii and was not observed or collected during either the 1991 or 2000 Bishop Museum surveys. Of great concern is that the new introduction was found in fast water habitats such as riffles; these areas are preferentially used by native aquatic insect species. Thus, the new species of aquatic insect has a great potential to harm sensitive and rare native taxa, especially if it can colonize upper elevation and higher gradient sections of the Pelekunu watershed. Although access is difficult, it is recommended aquatic insect surveys of higher elevation sections (above the current maximum surveyed elevation of approximately 600 ft) of the

Pelekunu Stream be undertaken prior to the full-scale watershed invasion by this caddisfly. Unfortunately, there is little that can be done to stop the spread of this highly invasive species of nonindigenous aquatic insect.

The finding of this new species of potentially harmful alien aquatic insect species highlights the importance of annual monitoring of this stream. The monitoring of Pelekunu Stream has provided extremely valuable information on one of the most intact aquatic ecosystems remaining in the Hawaiian Islands. On the other hand, the discovery of one new native endemic species of aquatic insect during these surveys has yielded exciting new information on the evolution and ecology of Hawaiian streams. It is hoped that at least one new species of aquatic insect will be found in the upper elevation areas of the Pelekunu watershed, once these areas can be accessed.

At a minimum, annual monitoring of aquatic invertebrates in Pelekunu Stream should be conducted in conjunction with annual native fish monitoring to help effectively manage and preserve native aquatic biodiversity. Additionally, attempts should be made to minimize feral ungulate disturbance, especially in the lower watershed as native aquatic species usually fare poorly in heavily sedimented streams and disturbed wetlands. Heavy pig damage and “rototilling” impacts were observed in lower Pelekunu wetland area near the ocean, and correspondingly no native damselflies have been observed in this wetland area during Bishop Museum surveys.

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