Atlas of Hawaiian Stream Animals – a tool for determining distribution and habitat use

Dr. James E. Parham
What is your definition of restored?

- The stream looks pretty…
- Some fish in the stream…
- All 5 native o’opu present?
- The natural compliment of animals in their normal distribution and habitats displaying normal behaviors.
Stream Animal Atlas is a collaboration between Hawai‘i Division of Aquatic Resources\(^1\) and Bishop Museum\(^2\)

James E. Parham\(^2\)
Glenn R. Higashi\(^1\)
J. Michael Fitzsimons\(^2\)
Eko K. Lapp\(^1\)
Darrell G.K. Kuamo‘o\(^1\)
Robert T. Nishimoto\(^1\)
Skippy Hau\(^1\)
Dan A. Polhemus\(^1\)
William S. Devick\(^1\) (retired)
The Atlas provides a description of the distribution and habitat use for commonly observed stream animals based on the information contained in the DAR Aquatic Surveys Database. It is a “living document” that will be able to be updated as new information is collected. Will probably come out in 3 volumes, Native fishes and macroinvertebrates, Introduced fishes and macroinvertebrates, and Insects.

Volume 1: Expected out in Fall of 2008
Data Sources

- Includes information in the DAR Aquatics Surveys Database.
  - Recent and historical State surveys
  - 200+ Published & Unpublished papers
  - 13,264 different survey sites
  - 90,704 different animal observations
<table>
<thead>
<tr>
<th>Probable Species Descriptions</th>
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<tbody>
<tr>
<td><strong>Awaous guamensis</strong></td>
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<tr>
<td><strong>Eleotris sandwicensis</strong></td>
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<tr>
<td><strong>Kuhlia xenura</strong></td>
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<td><strong>Lentipes concolor</strong></td>
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<td><strong>Mugil cephalus</strong></td>
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<td><strong>Sicyopterus stimpsoni</strong></td>
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<td><strong>Stenogobius hawaiensis</strong></td>
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<td><strong>Atyoida bisulcata</strong></td>
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<td><strong>Macrobrachium grandimanus</strong></td>
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<td><strong>Neritina granosa</strong></td>
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<td><strong>Neritina vespertina</strong></td>
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<td><strong>Clarias fuscus</strong></td>
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<td><strong>Gambusia affinis</strong></td>
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<td><strong>Hypostomus watwata</strong></td>
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<td><strong>Micropterus dolomieu</strong></td>
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<td><strong>Misgurnus anguillicaudatus</strong></td>
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<td><strong>Oreochromis mossambicus</strong></td>
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<td><strong>Poecilia lattipina</strong></td>
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<td><strong>Poecilia reticulata</strong></td>
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<td><strong>Sarotherodon melanotheron</strong></td>
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<td><strong>Tilapia sp.</strong></td>
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<td><strong>Xiphophorus helleri</strong></td>
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<td><strong>Macrobrachium lar</strong></td>
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<tr>
<td><strong>Procambarus clarkii</strong></td>
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Spatial Hierarchy
Native Fishes: *Lentipes concolor*

*Lentipes concolor* was once considered a candidate for listing as threatened or endangered, but it is now known from all major islands including O’ahu where this species was previously regarded as extinct.

**Identification:**
As in most gobies, the pelvic fins of *Lentipes concolor* are fused into a sucking disk. Breeding males are jet black on the head and body anterior to the leading edge of the second dorsal fin and bright red-orange on posterior body and tail. Males not in breeding color resemble females but have faint red on the lower third of the caudal peduncle. Females have a pale brown or yellow-green base color with darker mottling on the head, nape, and back. A single median notch in the upper lip distinguishes this species from other Hawaiian stream gobies which have three or none.

Larvae 13-15 mm SL have a prominent spot on the tip of the chin formed by a single large melanophore, the beginnings of the upper lip notch, and a forked caudal (tail) fin. A single midventral row of melanophores extends from the base of the pectoral fins posteriorly to the end of the pelvic disk. Two rows of melanophores extend backward from about the middle of the pelvic disk to the urogenital area and on each side of the anal fin. At 20 mm SL, the fish no longer have a chin spot, but the lip notch is well developed and the caudal fin is truncate.

**Similar Species:**
Juvenile *L. concolor* superficially resemble *Stegastes simpsoni* of similar size but have a terminal mouth rather than an inferior mouth.

**Life History and Reproduction:**
Like the other species of stream fishes and larger invertebrates (macroinvertebrates) living in Hawaiian streams, *L. concolor* has an amphidromous life cycle. The pattern of
recruitment of larvae returning from the ocean and the reproductive behavior of adults indicate that fish of this species breed all year round.

**Feeding:**
*Lenipes concolor* are omnivorous, but readily capture stream invertebrates opportunistically. The most common food items are often the larvae of the extremely abundant chironomid flies that lay their eggs on dampened parts of rocks near the water line.

**Distribution: Island**
*Lenipes concolor* are known from all high islands, including O'ahu where they were once thought to be extinct because of man's activities. The fish are acclaimed for their phenomenal climbing ability. They move farther inland than other stream fishes and are capable of climbing waterfalls with a sheer drop of over 1,100 feet. At elevations above 1,500 feet, o'opu alamo'o is likely to be the only fish present.

![Graph showing standardized suitability scores for different islands](image)

*Figure 1. Standardized suitability scores for the islands where *Lenipes concolor* has been observed.*
Distribution: Watersheds

Figure 2. Standardized suitability scores for watershed land quality where *Lenitpes concolor* has been observed.

Figure 3. Standardized suitability scores for watershed land protection status where *Lenitpes concolor* has been observed.

**Distribution – Watershed**

- Stream Type
- Land Quality
- Land Protection Status
- Shallow Nearshore Waters
- Watershed Size
- Watershed Wetness
- Total Watershed Rank
Distribution: Instream

- Reaches
- Elevation
- Distance Inland
- Maximum Downstream Slope (Barrier Height)

# of survey sites = 8,373
# of sites with Lentipes = 1,686
**Habitat Use – Site**

- **Habitat Type**
- **Depth**
- **Substrate**
- **Mean Column Velocity**
- **Bottom Velocity**
- **Water Temperature**
- **Water quality (DO, pH, etc.)**
Data Sources


Braisher, A.M., 1997. Habitat Use by Fish ("Opio), Smith ("Iliahui), Shrimps ("Opae) and Frogs in Two Streams on the Island of Molokai.


Continued...


Peolena, B., 1992. Occurrence of Native Aquatic Species, Island of Moloka'i.


Tate, D.C., 1996. Effect of Larval and Postlarval Fish Behavior in Determining the Instream Distribution of Adult-Avian community and Lepisurus concolor in Haleakalā Stream, Hawai'i. 137-147.


Tinbó, A.S., 1990. A Descriptive Study of Selected Physicochemical and Biological Characteristics of Waikolu River, Kaua'i.

Tinbó, A.S., 1990. A Descriptive Study of Selected Physicochemical and Biological Characteristics of Waikolu Stream, Kaua'i.


95 references with some amount of information for *Lentipes concolor*

- All papers and associated metadata are digitized and stored for easy fact checking.

- Please let us know if we are missing information.
Elevation Suitability Comparison

Survey Point Elevations for O'ahu

Graphs showing standardized suitability for different species:
- Lentipes concolor
- Alocus guamensis
- Stenogobius hawaiiensis
Use in stream restoration, management, and conservation

- Description is based on a statewide view of the animal
- This can be compared to the current distribution and habitat use of the animal in the stream
- Provide an estimate of where and how restoration may improve the current situation.
Assessing likely animal responses to restoration actions

Habitat improvement here likely benefit this species

Habitat improvement here likely little benefit to this species

Chance of Occurrence for *Stenogobius hawaiiensis* in Kahana Stream, Oahu

Number of Cells in GIS Model of Stream

Occurrence Category
Aquatic resources management flow chart

Federal, State, County, NGO, Watershed Groups, & Public input

Management Plan

Stream

Site Monitoring

Implementation

Current vs Predicted

Current Assemblage & Distribution

Species Description

Watershed Information

Geo-Database

GIS Watershed Info

Stream Survey

Management Assessment

Current Assemblage & Distribution

Predicted Assemblage & Distribution

Watershed Description

CURRENT vs PREDICTED
Additional applications

- Provides information when engineering new habitats and passageways
- Aids in designing conservation reserves
- Can be linked together with riparian and terrestrial species in whole watershed approach
- Tries to provide “best available information”
Thanks

- Wide range of working biologists
  - Everyone who sent in papers or data to our request last year

- Numerous local citizens

- Commission on Water Resources Management

- Division of Aquatic Resources

For more information contact us at:
DLNR.AR.Stream@hawaii.gov
Questions?