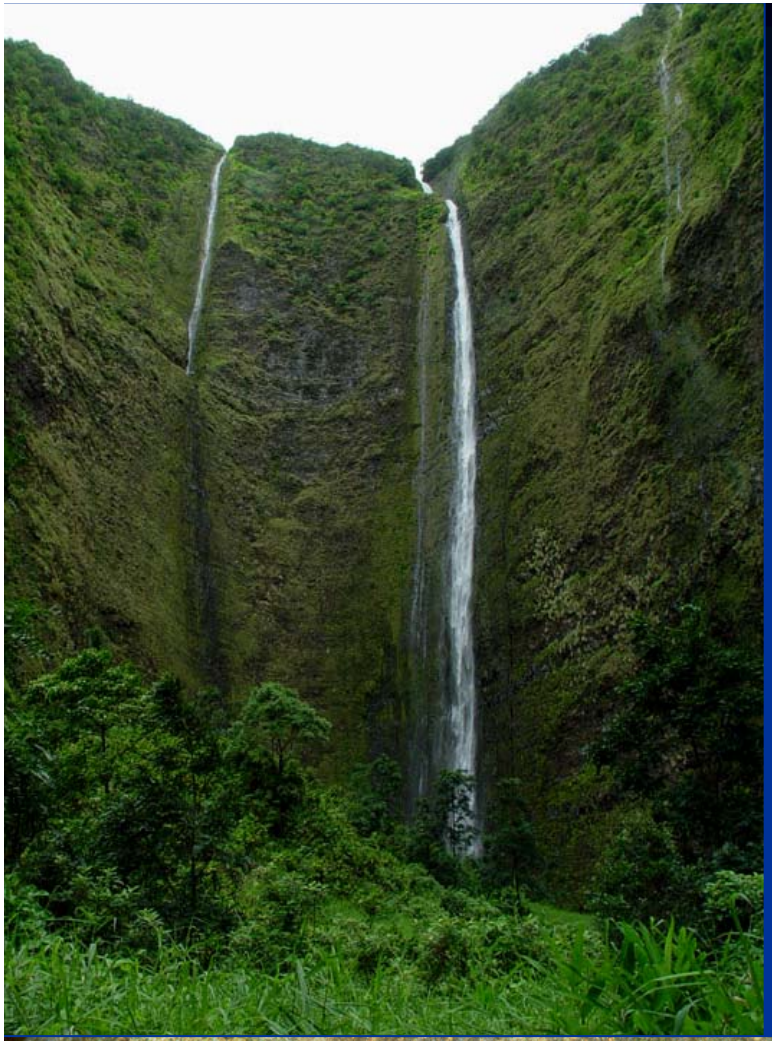


Atlas of Hawaiian Stream Animals – a tool for determining distribution and habitat use

Dr. James E. Parham

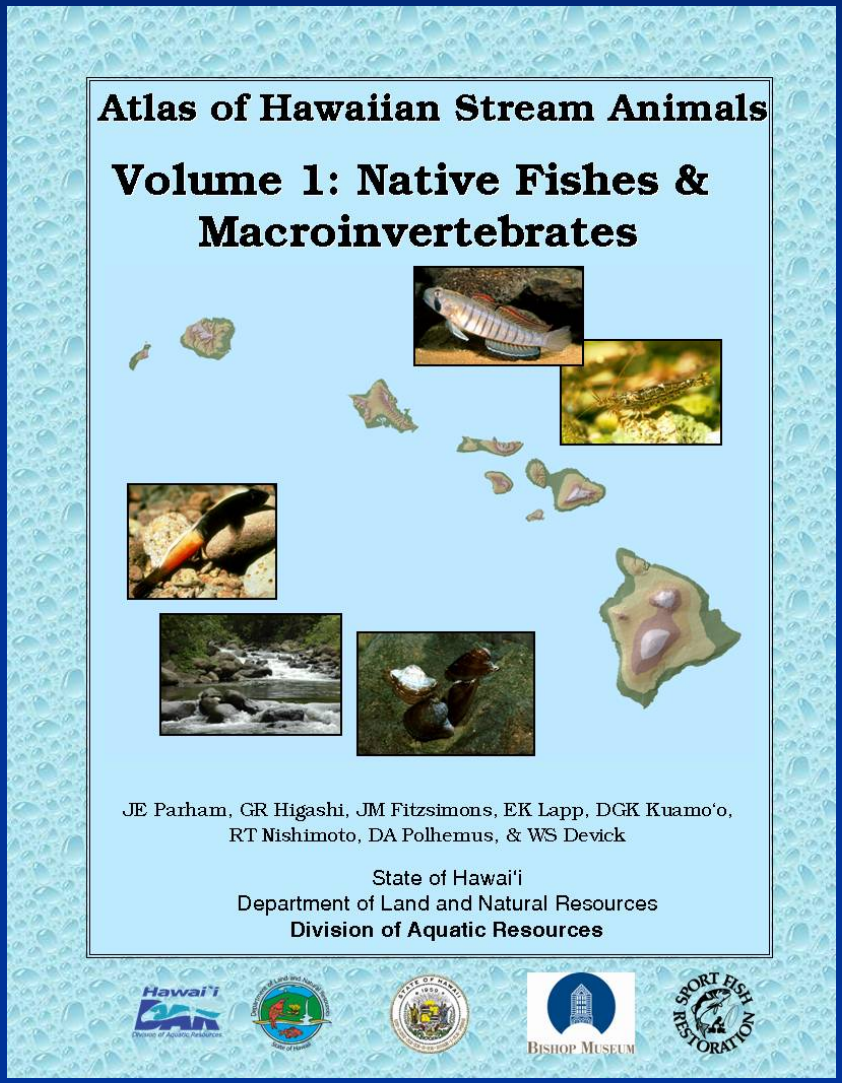
Bishop Museum

A fundamental question in any restoration project:

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)

Scope

- 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  - 200+ Published & Unpublished papers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

Probable Species Descriptions

Awaous guamensis

Eleotris sandwicensis

Kuhlia xenura

Lentipes concolor

Mugil cephalus

Sicyopterus stimpsoni

Stenogobius hawaiiensis

Atyoida bisulcata

Macrobrachium grandimanus

Neritina granosa

Neritina vespertina

Clarias fuscus

Gambusia affinis

Hypostomus watwata

Micropterus dolomieu

Misgurnus anguillicaudatus

Oreochromis mossambicus

Poecilia lattipina

Poecilia reticulata

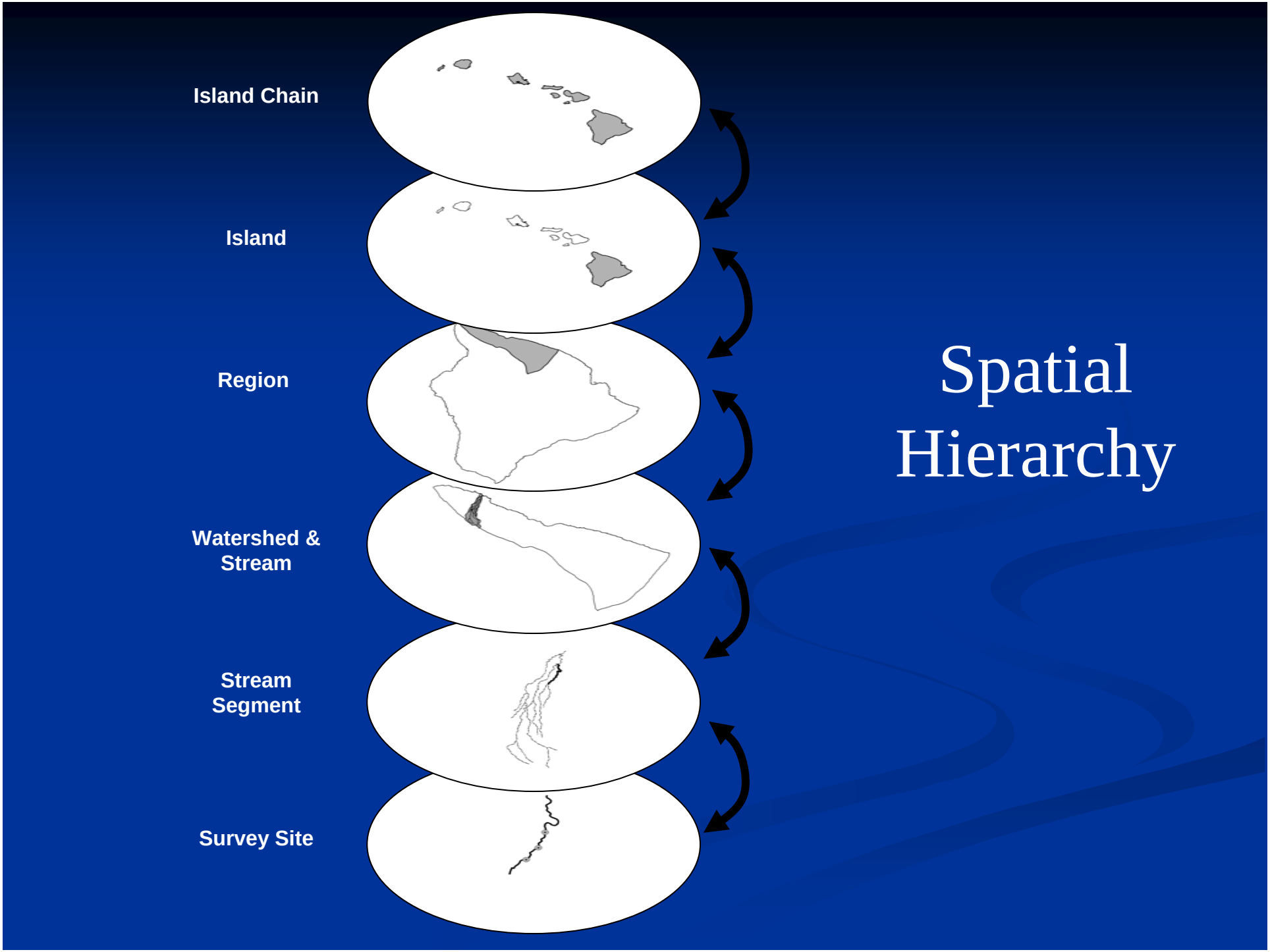
Sarotherodon melanotheron

Tilapia sp.

Xiphophorus helleri

Macrobrachium lar

Procambarus clarkii


Island Chain
Island
Region
Watershed & Stream
Stream Segment
Survey Site
Spatial Hierarchy

Native Fishes: *Lentipes concolor*

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Perciformes
Family: Gobiidae
Genus: *Lentipes*
Species: *Lentipes concolor* (Gill, 1860)

Common name:
'o'opu hi'ukole (males), 'o'opu alamo'o (females)

Status:
Endemic.

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 *Sicyopterus stimpsoni* 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

Example – *Lentipes concolor*

- Name
- Picture
- Taxonomy
- Common Names
- Status
- Identification
- Similar Species
- Life History and Reproduction
- Feeding

recruitment of larvae returning from the ocean and the reproductive behavior of adults indicate that fish of this species breed all year round.

***Feeding*:**
Lentipes concolor are omnivorous, but readily capture stream invertebrates encountered 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**
Lentipes 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.

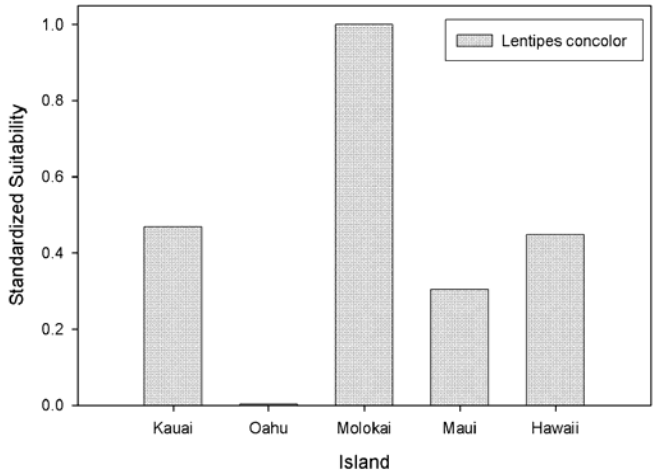
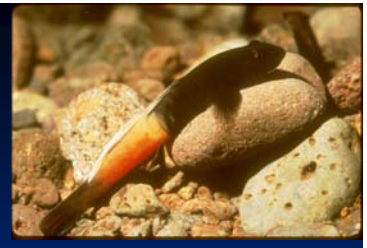


Figure 1. Standardized suitability scores for the islands where *Lentipes concolor* has been observed.

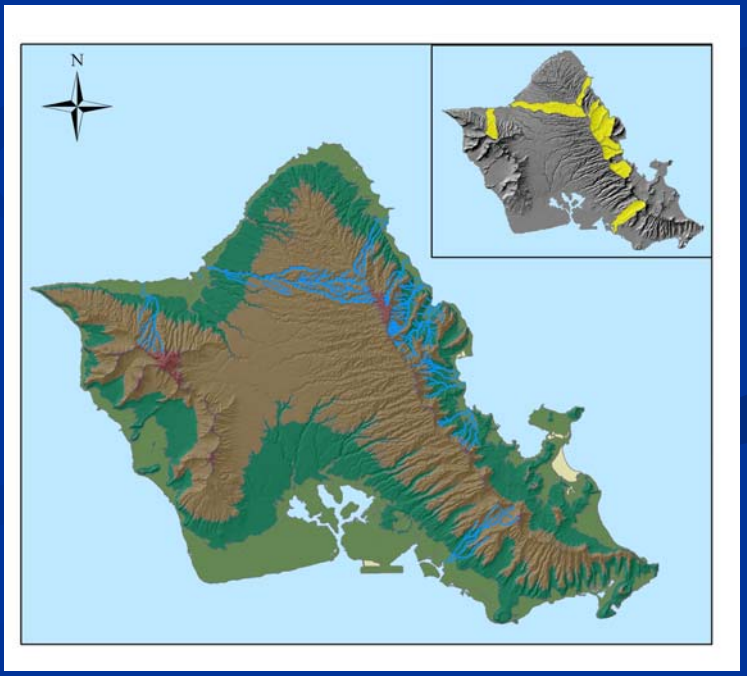


Distribution – Island

Maps

Stream Lists

Suitability



***Distribution*: Watersheds**

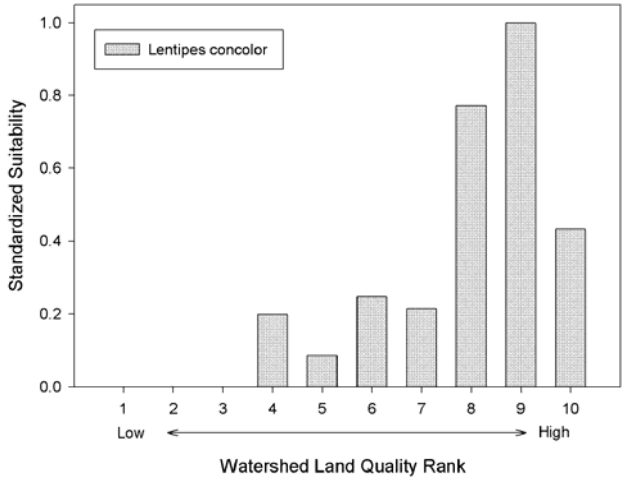


Figure 2. Standardized suitability scores for watershed land quality where *Lentipes concolor* has been observed.

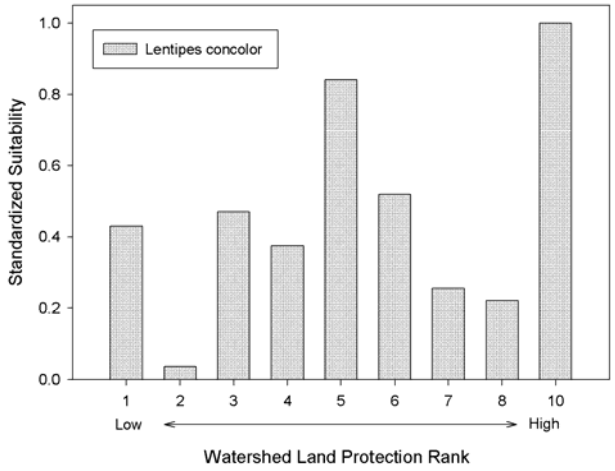
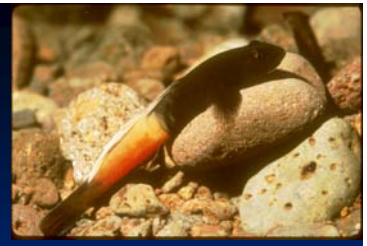


Figure 3. Standardized suitability scores for watershed land protection status where *Lentipes concolor* has been observed.



Distribution – Watershed

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

***Distribution*: Instream**

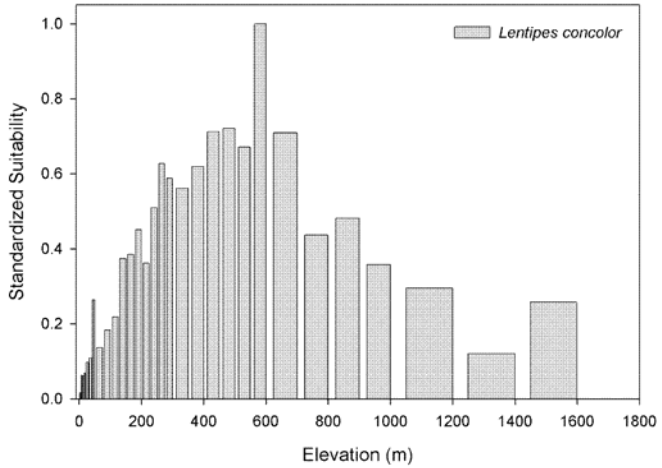


Figure 14. Standardized suitability scores for elevation where *Lentipes concolor* has been observed.

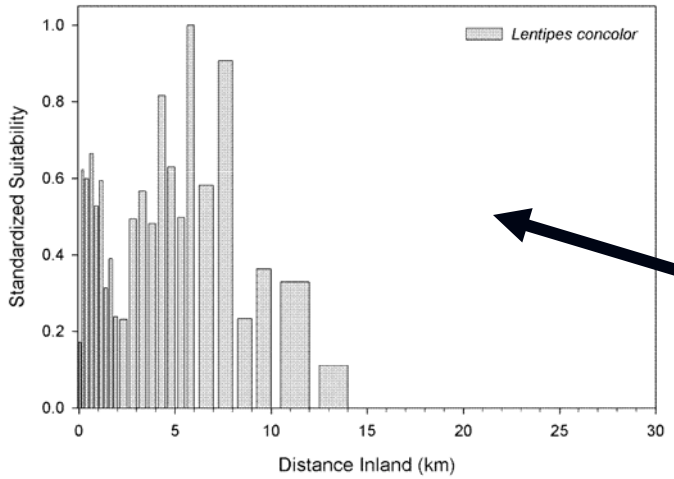


Figure 15. Standardized suitability scores for distance inland where *Lentipes concolor* has been observed.

Distribution – Instream

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

# of survey sites = 8,373
# of sites with *Lentipes* = 1,686

***Distribution*: Site**

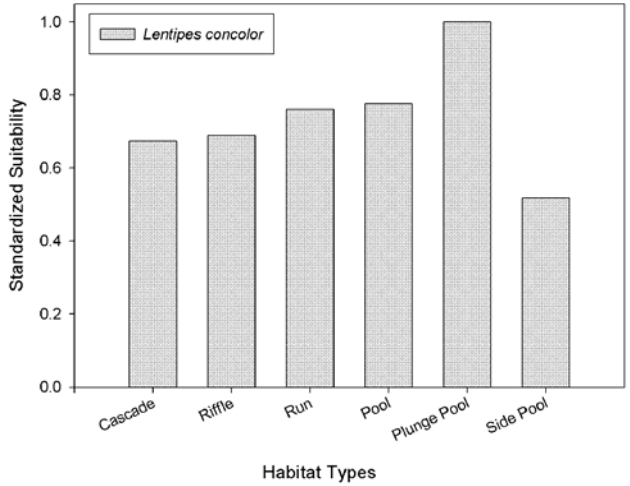


Figure 17. Standardized suitability scores for habitat types where *Lentipes concolor* has been observed.

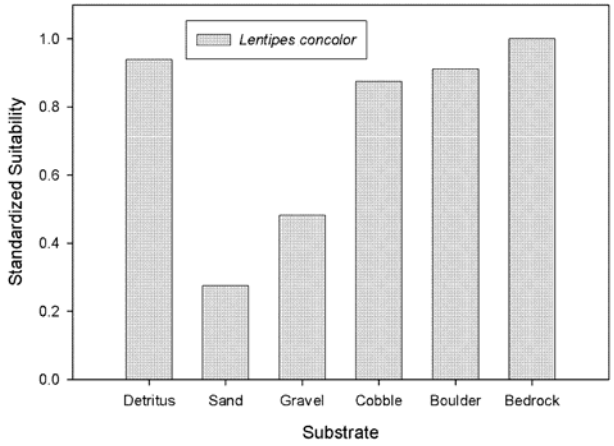
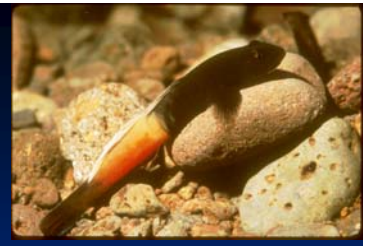


Figure 18. Standardized suitability scores for substrate where *Lentipes concolor* has been observed.



Habitat Use – Site

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

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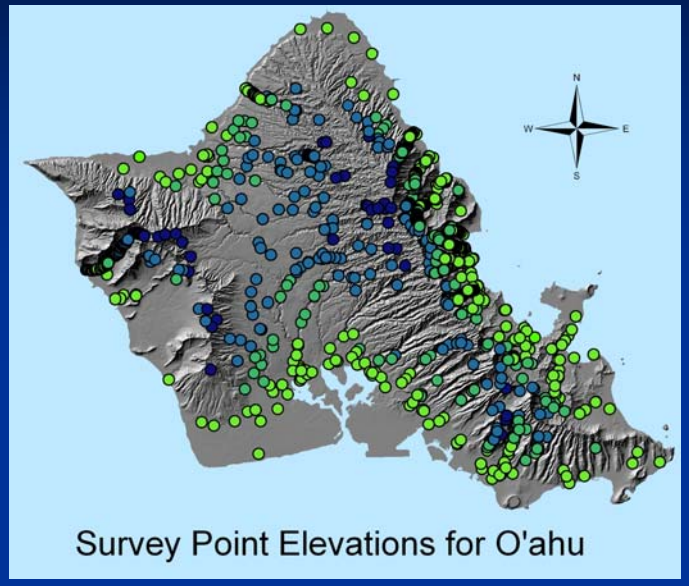
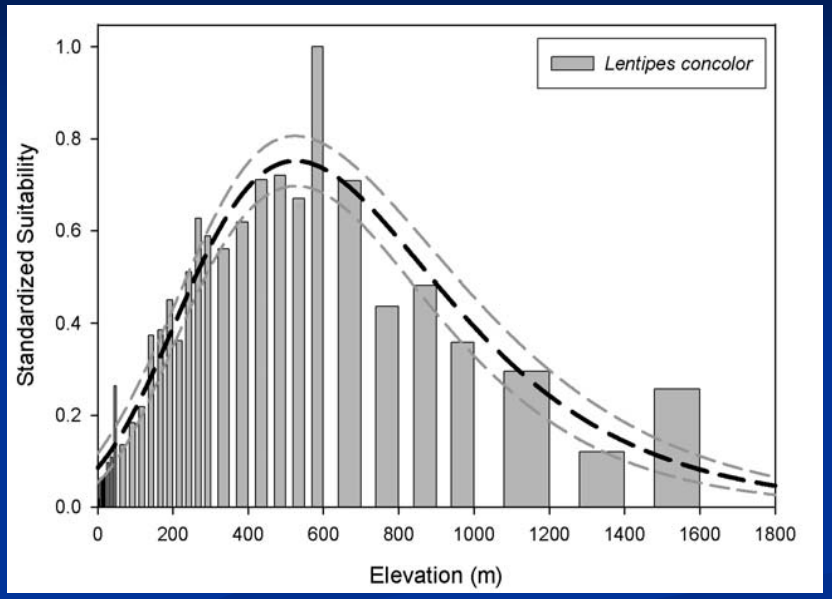
Atlas of Hawaiian Stream Animal 21

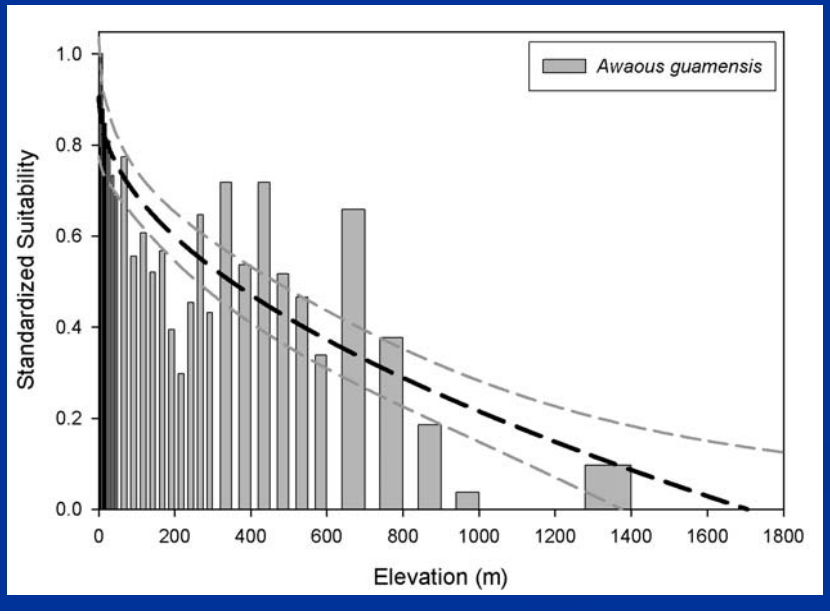
- 95 references with some amount of information for *Lentipes concolor*
- All papers and associated metadata are digitized and stored for easy fact checking.
- *Please let us know if we are missing information*

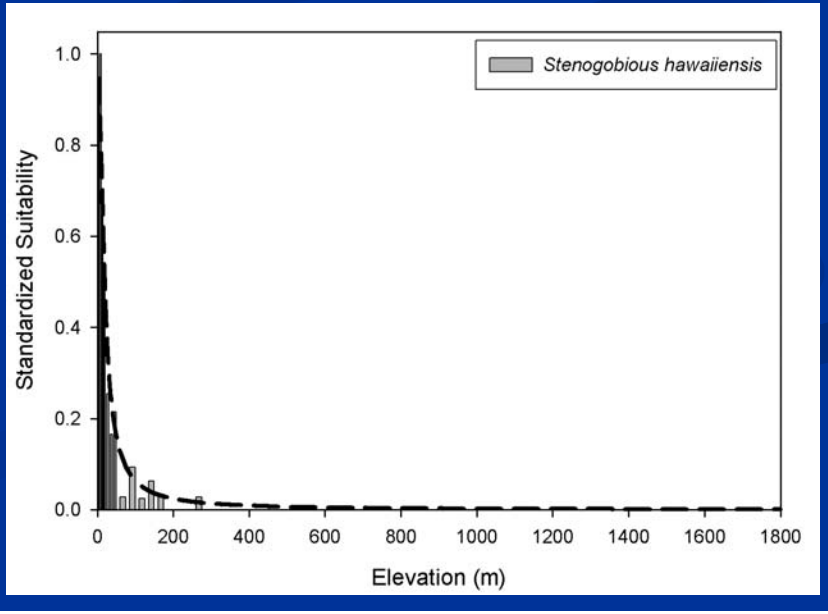
Elevation Suitability Comparison



Survey Point Elevations for O'ahu



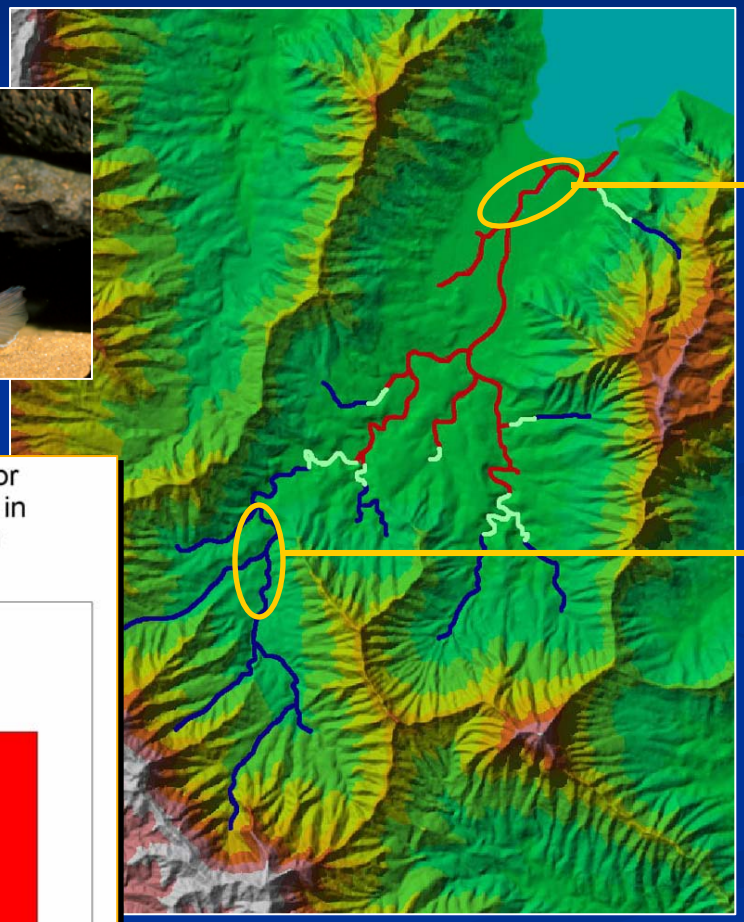




Use in stream restoration, management, and conservation

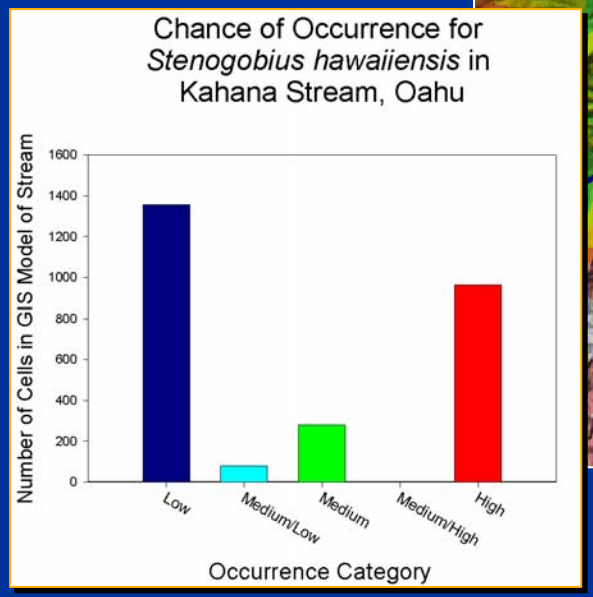
- Description is based on a statewide view of the animal
- This can be compared to the current distribution and habitat use of the animal in the stream
- Provide an estimate of where and how restoration may improve the current situation.

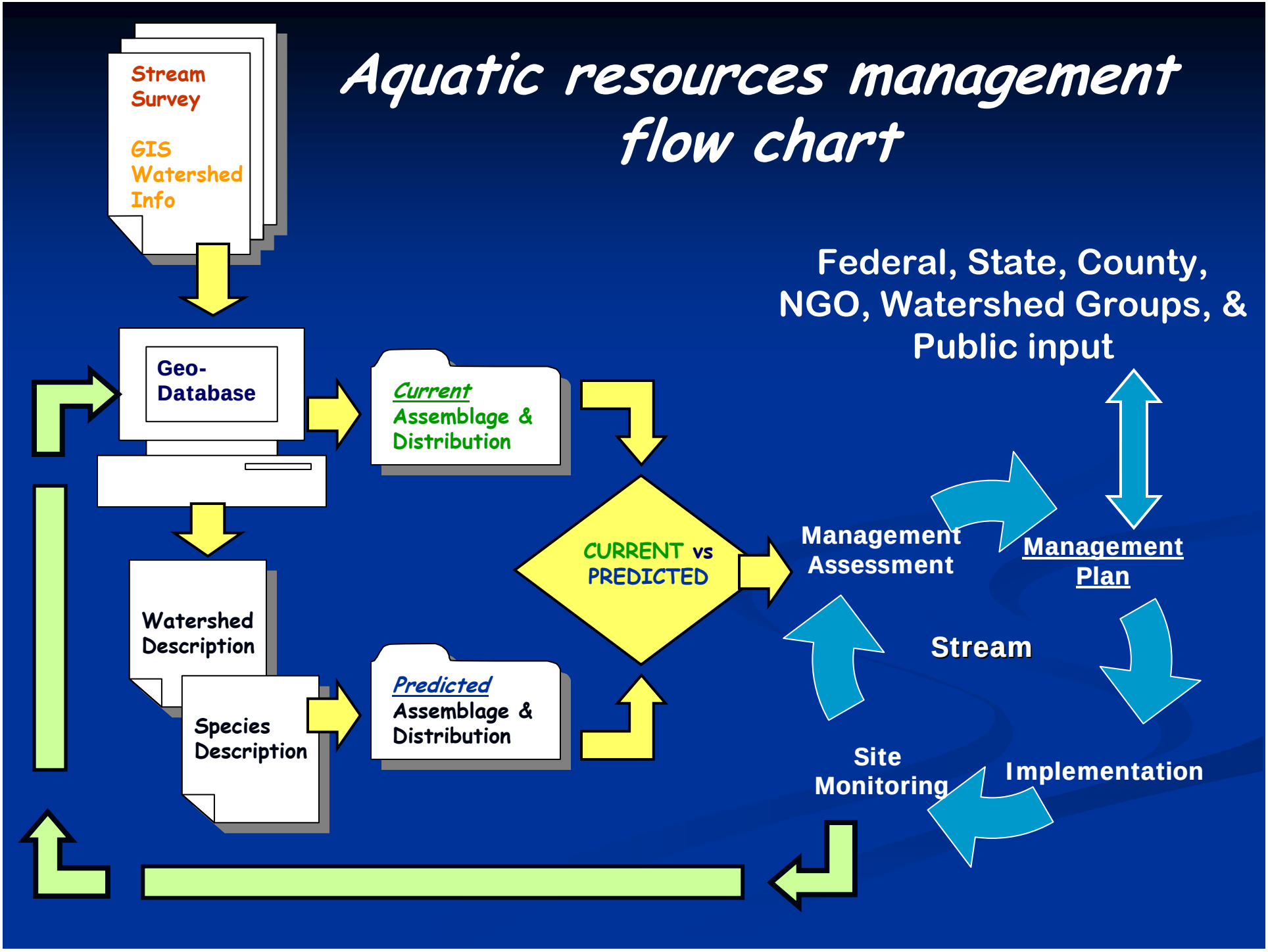
Assessing likely animal responses to restoration actions



Habitat improvement here likely benefit this species

Habitat improvement here likely little benefit to this species




Aquatic resources management flow chart
Stream Survey
GIS Watershed Info
Federal, State, County, NGO, Watershed Groups, & Public input
Geo-Database
Current Assemblage & Distribution
CURRENT vs PREDICTED
Management Assessment
Management Plan
Watershed Description
Species Description
Predicted Assemblage & Distribution
Stream
Site Monitoring
Implementation

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?