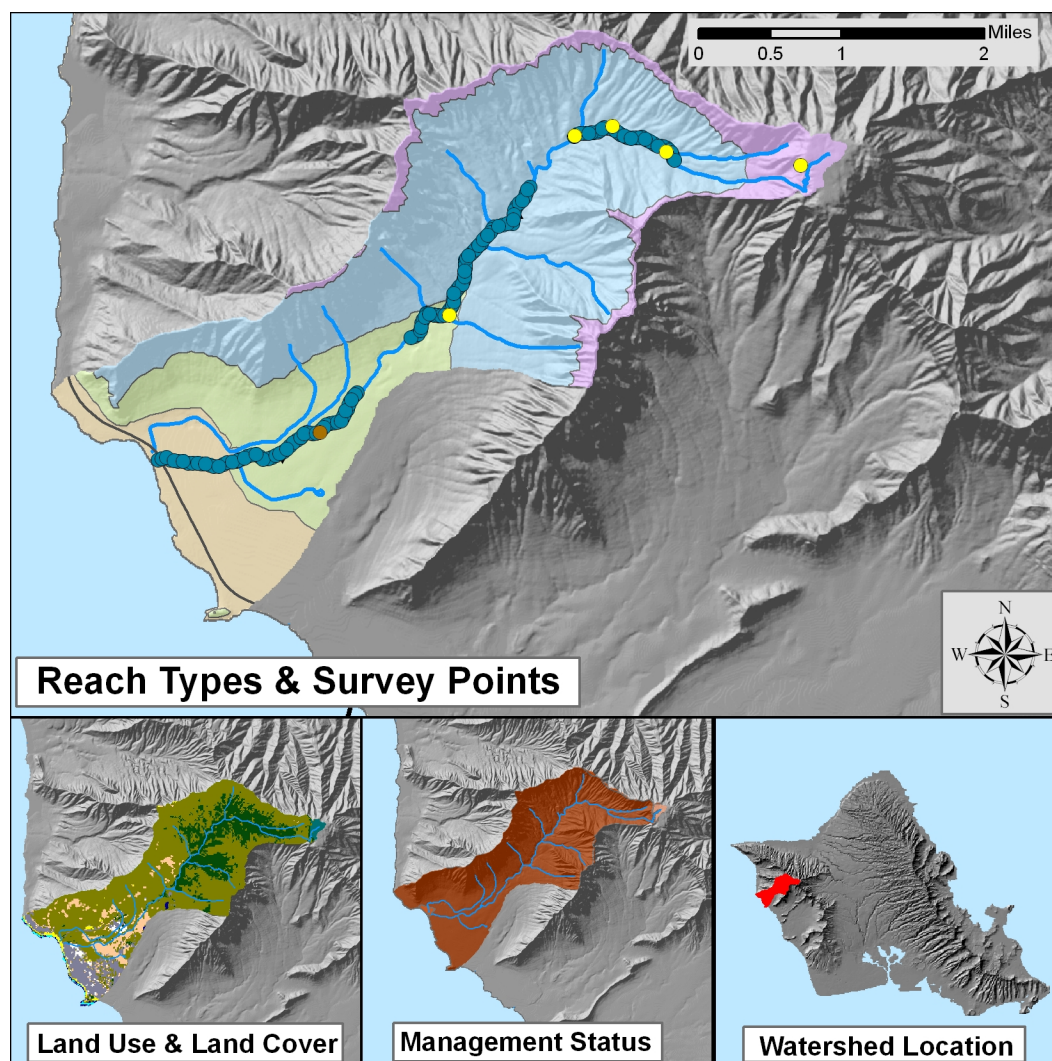


## Mākaha, O‘ahu



### WATERSHED FEATURES

Mākaha watershed occurs on the island of O‘ahu. The Hawaiian meaning of the name is “fierce”. The area of the watershed is 7.5 square mi (19.4 square km), with maximum elevation of 3976 ft (1212 m). The watershed's DAR cluster code is 5, meaning that the watershed is medium size, steep in the upper watershed, and with little embayment. The percent of the watershed in the different land use districts is as follows: 0.1% agricultural, 69.8% conservation, 0% rural, and 30.1% urban.

**Land Stewardship: Percentage of the land in the watershed managed or controlled by the corresponding agency or entity. Note that this is not necessarily ownership.**

<u>Military</u>	<u>Federal</u>	<u>State</u>	<u>OHA</u>	<u>County</u>	<u>Nature Conservancy</u>	<u>Other</u>	<u>Private</u>
0.0	0.0	1.8	0.0	0.5	0.0		97.8

**Land Management Status: Percentage of the watershed in the categories of biodiversity protection and management created by the Hawaii GAP program.**

Permanent Biodiversity <u>Protection</u>	Managed for Multiple <u>Uses</u>	Protected but <u>Unmanaged</u>	<u>Unprotected</u>
0.0	0.7	1.5	97.8

**Land Use: Areas of the various categories of land use. These data are based on NOAA C-CAP remote sensing project.**

	<u>Percent</u>	<u>Square mi</u>	<u>Square km</u>
High Intensity Developed	1.0	0.08	0.20
Low Intensity Developed	7.9	0.59	1.53
Cultivated	0.0	0.00	0.00
Grassland	6.7	0.50	1.31
Scrub/Shrub	63.1	4.74	12.26
Evergreen Forest	18.6	1.40	3.62
Palustrine Forested	0.7	0.05	0.14
Palustrine Scrub/Shrub	0.0	0.00	0.00
Palustrine Emergent	0.0	0.00	0.00
Estuarine Forested	0.0	0.00	0.00
Bare Land	0.9	0.07	0.18
Unconsolidated Shoreline	0.4	0.03	0.08
Water	0.5	0.04	0.10
Unclassified	0.0	0.00	0.00

### STREAM FEATURES

Mākaha is a perennial stream. Total stream length is 14.2 mi (22.9 km). The terminal stream order is 2.

**Reach Type Percentages: The percentage of the stream's channel length in each of the reach type categories.**

<u>Estuary</u>	<u>Lower</u>	<u>Middle</u>	<u>Upper</u>	<u>Headwaters</u>
0.0	0.0	36.4	55.7	7.8

The following stream(s) occur in the watershed:  
Mākaha

### BIOTIC SAMPLING EFFORT

Biotic samples were gathered in the following year(s):

1905      1956      1975      1991      1994      2001

**Distribution of Biotic Sampling: The number of survey locations that were sampled in the various reach types.**

<u>Survey type</u>	<u>Estuary</u>	<u>Lower</u>	<u>Middle</u>	<u>Upper</u>	<u>Headwaters</u>
Damselfly Surveys	0	0	1	4	1
DAR Point Quadrat	0	25	80	81	0
Unpublished Report	0	0	1	0	0

**BIOTA INFORMATION**

**Species List**

**Native Species**

<b>Crustaceans</b>	<i>Atyoida bisulcata</i>
<b>Fish</b>	<i>Awaous guamensis</i>

**Native Species**

<b>Insects</b>	<i>Megalagrion hawaiiense</i>
	<i>Megalagrion nigrohamatum</i>
	<i>nigrolineatum</i>
	<i>Megalagrion oceanicum</i>

**Introduced Species**

<b>Fish</b>	<i>Gambusia affinis</i>
	<i>Micropterus sp.</i>

**Species Size Data: Species size (inches) observed in DAR Point Quadrat Surveys.**

<u>Scientific Name</u>	<u>Status</u>	<u>Minimum Size</u>	<u>Maximum Size</u>	<u>Average Size</u>
<i>Atyoida bisulcata</i>	Endemic	0.75	1	1.0

**Average Density: The densities (#/square yard) for species observed in DAR Point Quadrat Surveys averaged over all sample dates in each reach type.**

<u>Scientific Name</u>	<u>Status</u>	<u>Estuary</u>	<u>Low</u>	<u>Mid</u>	<u>Upper</u>	<u>Headwaters</u>
<i>Atyoida bisulcata</i>	Endemic				0.71	

**Species Distributions: Presence (P) of species in different stream reaches.**

<u>Scientific Name</u>	<u>Status</u>	<u>Estuary</u>	<u>Lower</u>	<u>Middle</u>	<u>Upper</u>	<u>Headwaters</u>
<i>Atyoida bisulcata</i>	Endemic				P	
<i>Megalagrion hawaiiense</i>	Endemic					P
<i>Megalagrion nigrohamatum</i>	Endemic				P	
<i>nigrolineatum</i>						
<i>Megalagrion oceanicum</i>	Endemic				P	
<i>Awaous guamensis</i>	Indigenous			P		
<i>Gambusia affinis</i>	Introduced			P		
<i>Micropterus sp.</i>	Introduced			P		

## HISTORIC RANKINGS

**Historic Rankings:** These are rankings of streams from historical studies. "Yes" means the stream was considered worthy of protection by that method. Some methods include non-biotic data in their determination. See Atlas Key for details.

Multi-Attribute Prioritization of Streams - Potential Heritage Streams (1998): No

Hawaii Stream Assessment Rank (1990): Moderate

U.S. Fish and Wildlife Service High Quality Stream (1988): No

The Nature Conservancy- Priority Aquatic Sites (1985): No

National Park Service - Nationwide Rivers Inventory (1982): No

**Current DAR Decision Rule Status:** The following criteria are used by DAR to consider the biotic importance of streams. "Yes" means that watershed has that quality.

Native Insect Diversity  
> 19 spp.

No

Native Macrofauna  
Diversity > 5 spp.

No

Absence of Priority 1  
Introduced

No

Abundance of Any  
Native Species

No

Presence of Candidate  
Endangered Species

Yes

Endangered Newcomb's  
Snail Habitat

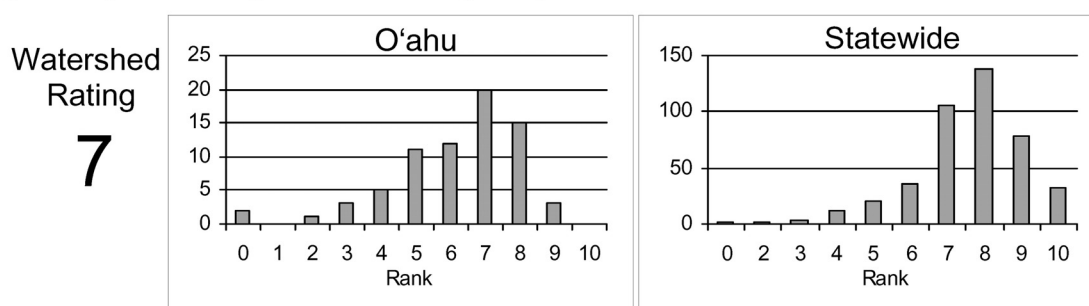
No

## CURRENT WATERSHED AND STREAM RATINGS

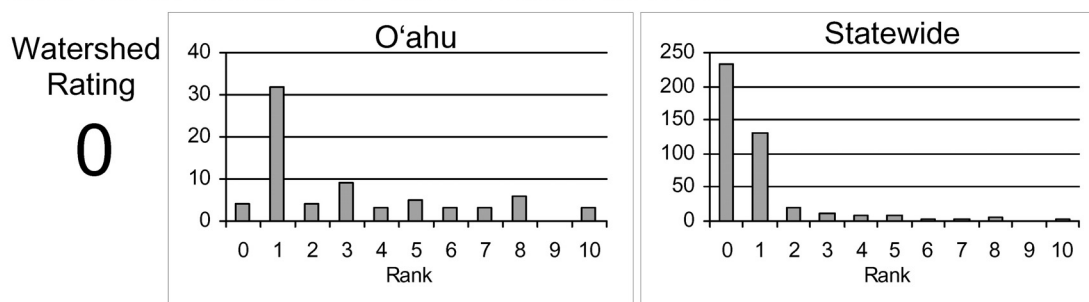
The current watershed and stream ratings are based on the data contained in the DAR Aquatic Surveys Database. The ratings provide the score for the individual watershed or stream, the distribution of ratings for that island, and the distribution of ratings statewide. This allows a better understanding of the meaning of a particular ranking and how it compares to other streams. The ratings are standardized to range from 0 to 10 (0 is lowest and 10 is highest rating) for each variable and the totals are also standardized so that the rating is not the average of each component rating. These ratings are subject to change as more data are entered into the DAR Aquatic Surveys Database and can be automatically recalculated as the data improve. In addition to the ratings, we have also provided an estimate of the confidence level of the ratings. This is called rating strength. The higher the rating strength the more likely the data and rankings represent the actual condition of the watershed, stream, and aquatic biota.

### WATERSHED RATING: Mākaha, O‘ahu

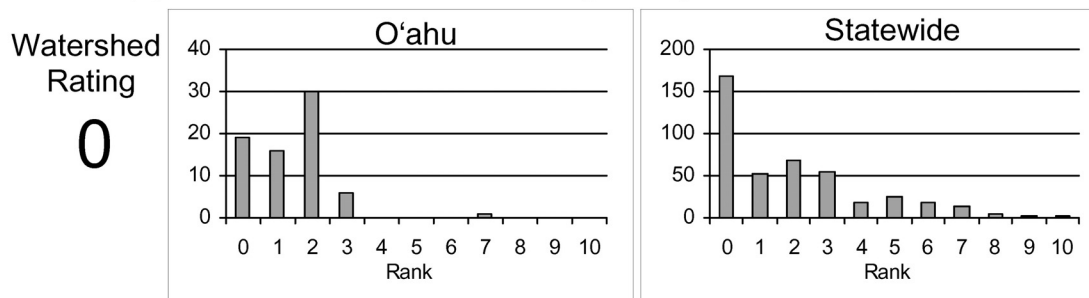
**Land Cover Rating:** Rating is based on a scoring system where in general forested lands score positively and developed lands score negatively.



**Shallow Waters Rating:** Rating is based on a combination of the extent of estuarine and shallow marine areas associated with the watershed and stream.



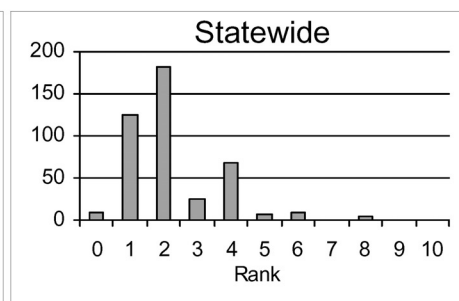
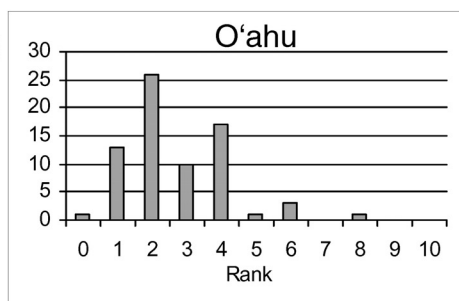
**Stewardship Rating:** Rating is based on a scoring system where higher levels of land and biodiversity protection within the watershed score positively.



**WATERSHED RATING (Cont): Mākaha, O‘ahu**

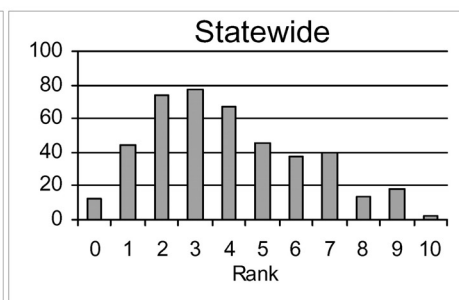
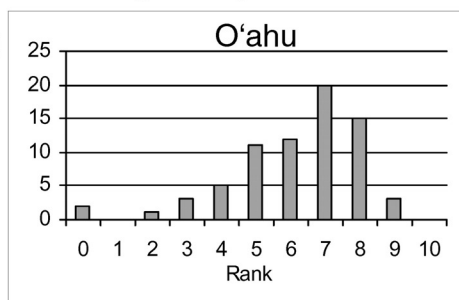
**Size Rating:** Rating is based on the watershed area and total stream length. Larger watersheds and streams score more positively.

Watershed  
Rating  
**2**



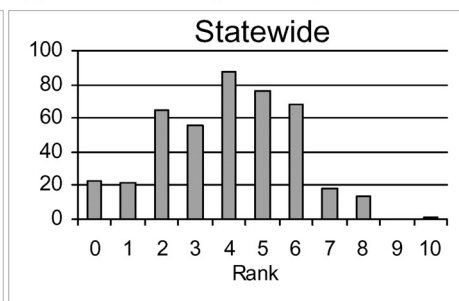
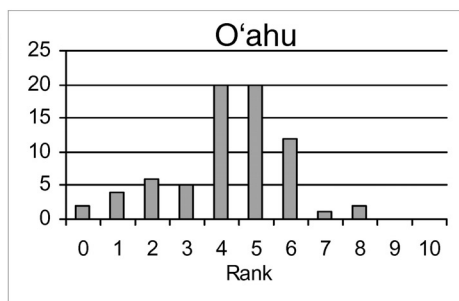
**Wetness Rating:** Rating is based on the average annual rainfall within the watershed. Higher rainfall totals score more positively.

Watershed  
Rating  
**2**



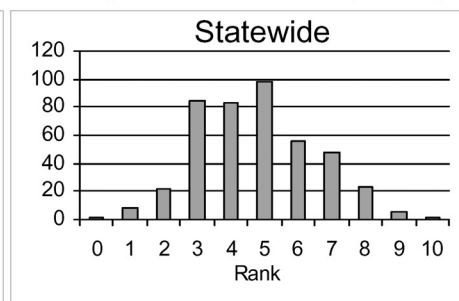
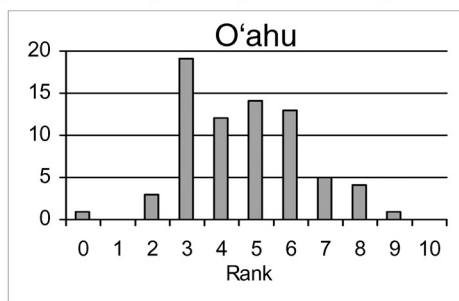
**Reach Diversity Rating:** Rating is based on the types and amounts of different stream reaches available in the watershed. More area in different reach types score more positively.

Watershed  
Rating  
**5**



**Total Watershed Rating:** Rating is based on combination of Land Cover Rating, Shallow Waters Rating, Stewardship Rating, Size Rating, Wetness Rating, and Reach Diversity Rating.

Watershed  
Rating  
**3**

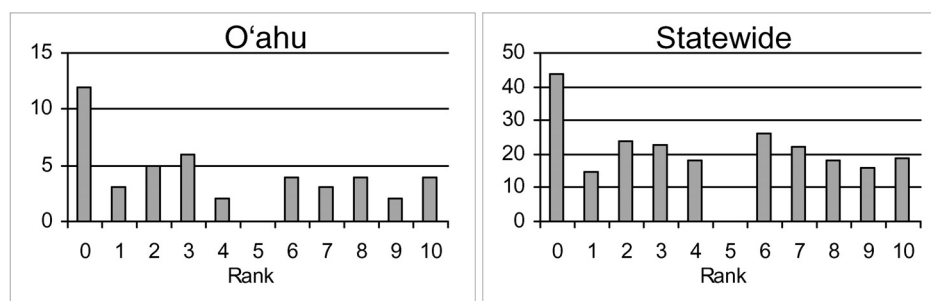


**BIOLOGICAL RATING: Mākaha, O‘ahu**

Native Species Rating: Rating is based on the number of native species observed in the watershed.

Stream  
Rating

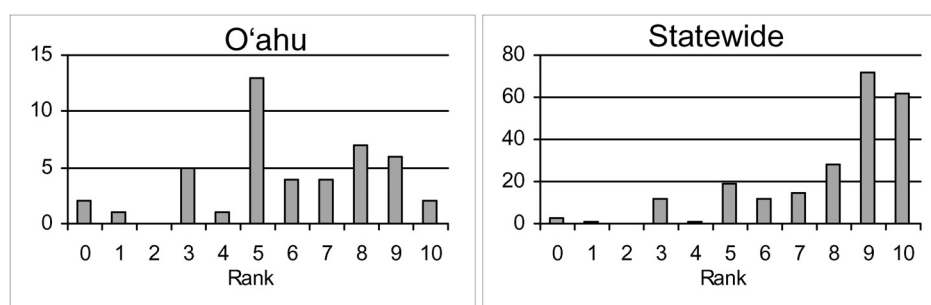
**2**



Introduced Genera Rating: Rating is based on the number of introduced genera observed in the watershed.

Stream  
Rating

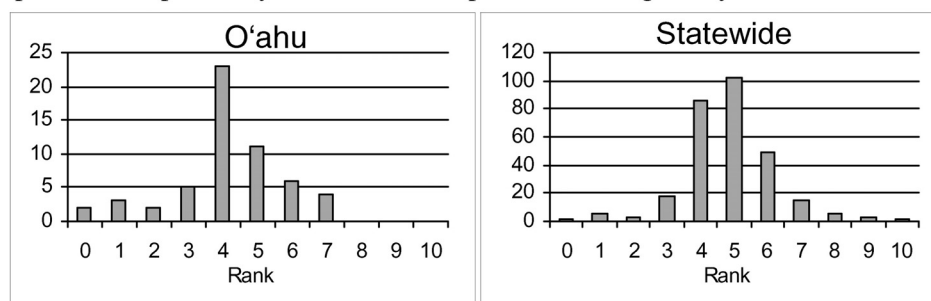
**8**



All Species' Score Rating: Rating is based on the Hawaii Stream Assessment scoring system where native species score positively and introduced species score negatively.

Stream  
Rating

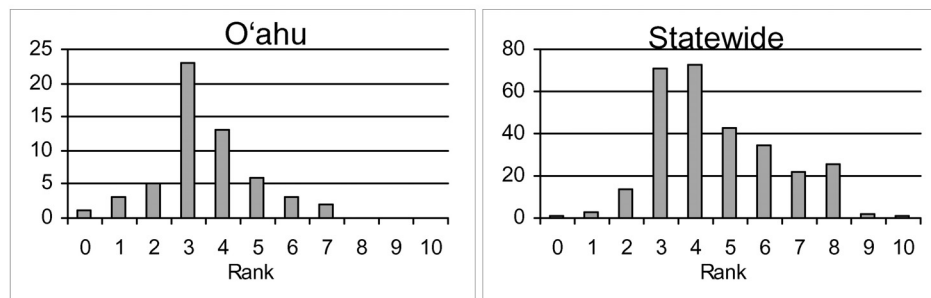
**6**



Total Biological Rating: Rating is the combination of the Native Species Rating, Introduced Genera Rating, and the All Species' Score Rating.

Stream  
Rating

**4**

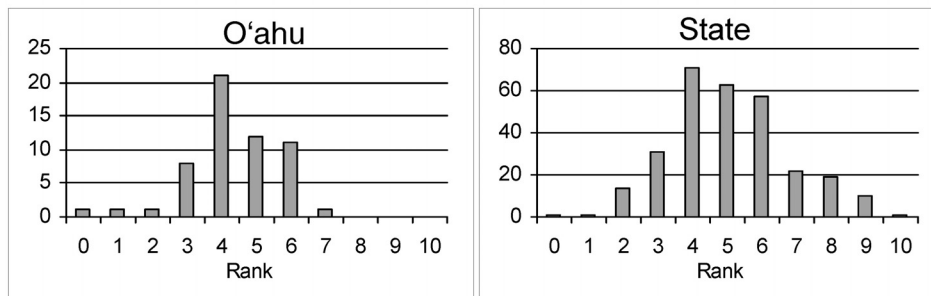


**OVERALL RATING: Mākaha, O‘ahu**

Overall Rating: Rating is a combination of the Total Watershed Rating and the Total Biological Rating.

Watershed  
Rating

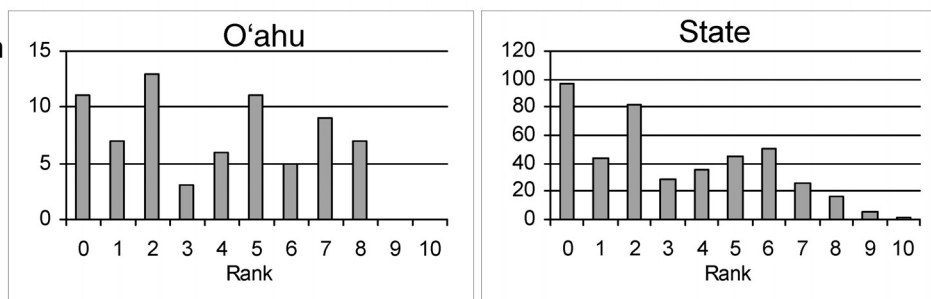
**4**

**RATING STRENGTH: Mākaha, O‘ahu**

Rating Strength: Represents an estimate of the overall study effort in the stream and is a combination of the number of studies, number of different reaches surveyed, and the number of different survey types.

Information  
Rating

**6**

**REFERENCES**

1975. Ford, J.I. Field trip to Mākaha stream, O‘ahu.
2006. Polhemus, D.A. Maps of Damselfly Locations.
2006. Polhemus, D.A. Megalagrion Survey Notes in spreadsheet form.
2008. Hawai‘i Division of Aquatic Resources. DAR Point Quadrat Survey Data from the DAR Aquatic Surveys Database.