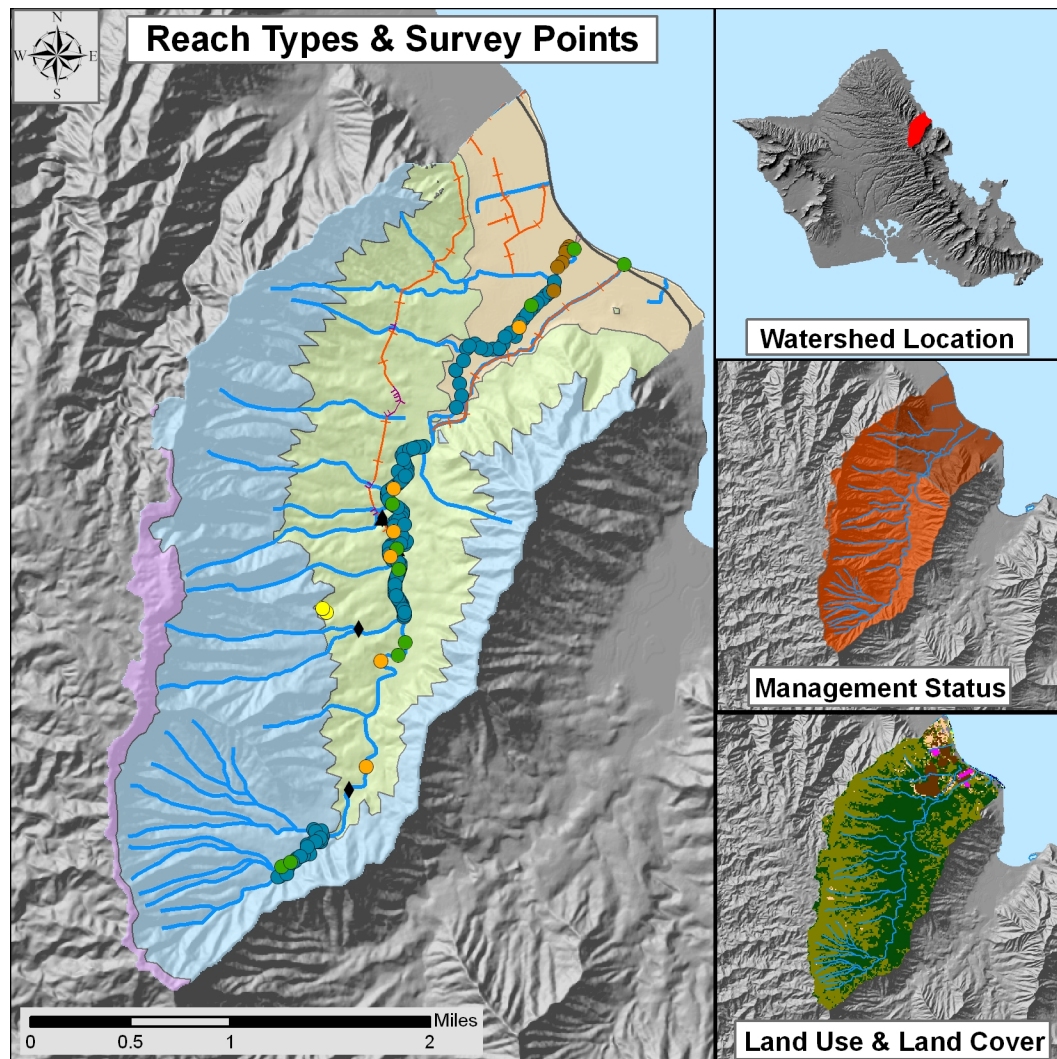


Punalu'u, O'ahu



WATERSHED FEATURES

Punalu'u watershed occurs on the island of O'ahu. The Hawaiian meaning of the name is "coral dived for". The area of the watershed is 6.6 square mi (17.2 square km), with maximum elevation of 2808 ft (856 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: 19.2% agricultural, 78.3% conservation, 0% rural, and 2.4% 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 Private</u>
0.2	0.0	2.5	0.0	69.4	0.0	27.8

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

<u>Permanent Biodiversity Protection</u>	<u>Managed for Multiple Uses</u>	<u>Protected but Unmanaged</u>	<u>Unprotected</u>
0.0	0.0	72.2	27.8

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	0.0	0.00	0.00
Low Intensity Developed	0.9	0.06	0.15
Cultivated	3.8	0.25	0.66
Grassland	2.0	0.13	0.34
Scrub/Shrub	42.3	2.81	7.28
Evergreen Forest	50.1	3.33	8.63
Palustrine Forested	0.0	0.00	0.00
Palustrine Scrub/Shrub	0.0	0.00	0.00
Palustrine Emergent	0.5	0.03	0.08
Estuarine Forested	0.0	0.00	0.00
Bare Land	0.1	0.01	0.02
Unconsolidated Shoreline	0.1	0.01	0.02
Water	0.2	0.02	0.04
Unclassified	0.0	0.00	0.00

STREAM FEATURES

Punalu'u is a perennial stream. Total stream length is 21.5 mi (34.7 km). The terminal stream order is 4.

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>
0.3	0.0	42.2	57.4	0.0

The following stream(s) occur in the watershed:

ditch to ocean Kapano Maipuna Punalu'u

BIOTIC SAMPLING EFFORT

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

1937	1961	1969	1976	1989	1990	1992
1999	2001	2002	2003			

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	5	0	0
DAR General Surveys	0	0	1	0	0
DAR Observation	0	0	0	1	0
DAR Point Quadrat	0	35	121	30	0
DAR Report	0	0	1	0	0
HDFG	0	1	5	0	0
Published Report	0	3	7	2	0
Unpublished Report	0	6	0	0	0

BIOTA INFORMATION**Species List****Native Species**

Crustaceans	<i>Atyoida bisulcata</i>
	<i>Macrobrachium grandimanus</i>
	<i>Macrobrachium sp.</i>
Fish	<i>Awaous guamensis</i>
	<i>Eleotris sandwicensis</i>
	Gobiid sp.
	<i>Kuhlia sandwicensis</i>
	<i>Kuhlia xenura</i>
	<i>Lentipes concolor</i>
	<i>Sicyopterus stimpsoni</i>
	<i>Stenogobius hawaiiensis</i>
Snails	<i>Neritina granosa</i>
Sponges	Sponge sp.
Worms	Hirudinean sp.
	<i>Oligochaete sp.</i>
	<i>Prostoma sp.</i>

Native Species

Insects	<i>Anax junius</i>
	<i>Anax strenuus</i>
	<i>Campsicnemus bicoloripes</i>
	<i>Campsicnemus brevipes</i>
	<i>Campsicnemus miritibialis</i>
	Collembola sp.
	<i>Dasyhelea digna</i>
	Empidid sp.
	Ephydrid sp.
	<i>Hemerodromia sp.</i>
	<i>Hydroptila sp.</i>
	<i>Hyposmocoma sp.</i>
	<i>Limonia jacobus</i>
	<i>Limonia perkinsi</i>
	<i>Limonia sp.</i>
	<i>Megalagrion hawaiiense</i>
	<i>Megalagrion nigrohamatum</i>
	<i>nigrolineatum</i>
	<i>Megalagrion oceanicum</i>
	<i>Megalagrion sp.</i>
	<i>Microvelia vagans</i>
	<i>Procanace acuminata</i>
	<i>Procanace bifurcata</i>
	<i>Procanace sp.</i>
	<i>Procanace wirthi</i>
	<i>Saldula exulans</i>
	<i>Saldula oahuense</i>
	<i>Scatella cilipes</i>
	<i>Scatella clavipes</i>
	<i>Scatella hawaiiensis</i>

Scatella oahuense
Telmatogeton hirtus
Telmatogeton sp.

Introduced Species

Clams	<i>Corbicula fluminea</i>
Crustaceans	<i>Macrobrachium lar</i>
Fish	<i>Archocentrus nigrofasciatus</i> <i>Clarias fuscus</i> <i>Gambusia affinis</i> <i>Hemichromis fasciatus</i> <i>Oncorhynchus mykiss</i> <i>Poecilia reticulata</i> <i>Poeciliid sp.</i> <i>Tilapia sp.</i> unidentified poeciliid <i>Xiphophorus helleri</i>
Snails	<i>Cipangopaludina chinensis</i> <i>Gastropod sp.</i> <i>Lymnaeid sp.</i> <i>Melania sp.</i> <i>Melanoides tuberculata</i> <i>Physid sp.</i> <i>Tarebia granifera</i> <i>Thiarid sp.</i>
Worms	<i>Dugesia sp.</i>

Introduced Species

Insects	<i>Cheumatopsyche analis</i> <i>Cheumatopsyche pettiti</i> Chironomid larvae <i>Chrysotus longipalpus</i> <i>Condyllostylus longicornis</i> <i>Cricotopus bicinctus</i> <i>Crocothemis servilia</i> <i>Culex annulirostris</i> <i>Dolichopus exsul</i> <i>Hydroptila potosina</i> <i>Ischnura posita</i> <i>Ischnura ramburi</i> <i>Limonia advena</i> <i>Mesovelgia amoena</i> <i>Mesovelgia mulsanti</i> <i>Orthemis ferruginea</i> <i>Oxythira maya</i> <i>Pantala flavescens</i> <i>Trichocorixa reticulata</i>
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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	2	1.3
<i>Macrobrachium grandimanus</i>	Endemic	1	3	1.8
<i>Macrobrachium lar</i>	Introduced	0.75	6.5	3.2
<i>Eleotris sandwicensis</i>	Endemic	4	4	4.0
<i>Kuhlia xenura</i>	Endemic	2	5	3.4
<i>Lentipes concolor</i>	Endemic	3	3	3.0
<i>Stenogobius hawaiiensis</i>	Endemic	1.5	2.5	1.9
<i>Awaous guamensis</i>	Indigenous	1	6	3.3
<i>Archocentrus nigrofasciatus</i>	Introduced	2	2	2.0
<i>Gambusia affinis</i>	Introduced	0.75	1.25	1.0
<i>Hemichromis fasciatus</i>	Introduced	1.5	3	2.3
<i>Poecilia reticulata</i>	Introduced	0.75	1	0.9
<i>Poeciliid sp.</i>	Introduced	0.25	0.25	0.3
unidentified poeciliid	Introduced	0.5	2.5	1.4
<i>Xiphophorus helleri</i>	Introduced	0.5	4.5	1.2
<i>Neritina granosa</i>	Endemic	0.75	0.75	0.8
<i>Melanoides tuberculata</i>	Introduced	0.1	1	0.4
<i>Tarebia granifera</i>	Introduced	0.25	0.375	0.3

<i>Dugesia sp.</i>	Introduced	0.25	0.75	0.3
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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			0.55		
<i>Eleotris sandwicensis</i>	Endemic		0.06			
<i>Kuhlia xenura</i>	Endemic		1			
<i>Lentipes concolor</i>	Endemic			0.02		
<i>Macrobrachium grandimanus</i>	Endemic		0.06	0.03		
<i>Neritina granosa</i>	Endemic			0.02		
<i>Stenogobius hawaiiensis</i>	Endemic		0.24			
<i>Awaous guamensis</i>	Indigenous		0.18	0.56	0.33	
<i>Archocentrus nigrofasciatus</i>	Introduced		0.06			
<i>Corbicula fluminea</i>	Introduced		0.06			
<i>Dugesia sp.</i>	Introduced		1.77	1.95		
<i>Gambusia affinis</i>	Introduced			0.12		
<i>Hemichromis fasciatus</i>	Introduced		0.35			
<i>Macrobrachium lar</i>	Introduced		0.18	0.7	2.83	
<i>Melanoides tuberculata</i>	Introduced		120.			
<i>Poecilia reticulata</i>	Introduced			0.03		
Poeciliid sp.	Introduced			0.05		
<i>Tarebia granifera</i>	Introduced		0.24			
unidentified poeciliid	Introduced		2.72			
<i>Xiphophorus helleri</i>	Introduced			3.82		

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	P	P	
<i>Macrobrachium grandimanus</i>	Endemic		P	P		
<i>Eleotris sandwicensis</i>	Endemic		P	P		
<i>Kuhlia xenura</i>	Endemic		P			
<i>Lentipes concolor</i>	Endemic			P		
<i>Sicyopterus stimpsoni</i>	Endemic			P	P	
<i>Stenogobius hawaiiensis</i>	Endemic		P	P	P	
<i>Anax strenuus</i>	Endemic			P	P	
<i>Campsicnemus bicoloripes</i>	Endemic		P			
<i>Campsicnemus brevipes</i>	Endemic				P	
<i>Campsicnemus miritibialis</i>	Endemic		P			
<i>Dasyhelea digna</i>	Endemic		P	P		
<i>Hyposmocoma sp.</i>	Endemic		P	P	P	

<i>Limonia jacobus</i>	Endemic	P	P	P
<i>Limonia perkinsi</i>	Endemic	P		
<i>Megalagrion hawaiiense</i>	Endemic		P	
<i>Megalagrion nigrohamatum nigrolineatum</i>	Endemic		P	P
<i>Megalagrion oceanicum</i>	Endemic		P	
<i>Megalagrion sp.</i>	Endemic	P	P	P
<i>Microvelia vagans</i>	Endemic	P	P	
<i>Procanace acuminata</i>	Endemic	P		
<i>Procanace bifurcata</i>	Endemic			P
<i>Procanace wirthi</i>	Endemic	P	P	P
<i>Saldula exulans</i>	Endemic		P	P
<i>Saldula oahuense</i>	Endemic			P
<i>Scatella cilipes</i>	Endemic	P	P	P
<i>Scatella clavipes</i>	Endemic	P	P	P
<i>Scatella hawaiiensis</i>	Endemic	P		
<i>Scatella oahuense</i>	Endemic	P		P
<i>Telmatogeton hirtus</i>	Endemic	P		P
<i>Neritina granosa</i>	Endemic	P	P	
<i>Awaous guamensis</i>	Indigenous	P	P	P
Gobiid sp.	Indigenous	P	P	
<i>Kuhlia sandvicensis</i>	Indigenous	P	P	
<i>Anax junius</i>	Indigenous	P		
<i>Limonia sp.</i>	Indigenous		P	
<i>Procanace sp.</i>	Indigenous		P	
<i>Telmatogeton sp.</i>	Indigenous		P	
Sponge sp.	Indigenous		P	
<i>Corbicula fluminea</i>	Introduced	P		
<i>Macrobrachium lar</i>	Introduced	P	P	P
<i>Archocentrus nigrofasciatus</i>	Introduced	P		
<i>Clarias fuscus</i>	Introduced	P		
<i>Gambusia affinis</i>	Introduced		P	
<i>Hemichromis fasciatus</i>	Introduced	P		
<i>Oncorhynchus mykiss</i>	Introduced	P	P	
<i>Poecilia reticulata</i>	Introduced	P	P	
Poeciliid sp.	Introduced		P	

<i>Tilapia sp.</i>	Introduced	P		
unidentified poeciliid	Introduced	P	P	
<i>Xiphophorus helleri</i>	Introduced	P	P	
<i>Cheumatopsyche analis</i>	Introduced	P	P	P
Chironomid larvae	Introduced	P	P	
<i>Chrysotus longipalpus</i>	Introduced	P		
<i>Condylostylus longicornis</i>	Introduced		P	
<i>Cricotopus bicinctus</i>	Introduced	P	P	
<i>Crocothemis servilia</i>	Introduced	P		
<i>Culex annulirostris</i>	Introduced			P
<i>Dolichopus exsul</i>	Introduced		P	
<i>Hydroptila potosina</i>	Introduced	P	P	P
<i>Ischnura posita</i>	Introduced	P	P	
<i>Ischnura ramburi</i>	Introduced	P		
<i>Limonia advena</i>	Introduced	P		
<i>Orthemis ferruginea</i>	Introduced	P		
<i>Oxythira maya</i>	Introduced		P	
<i>Pantala flavescens</i>	Introduced			P
Gastropod sp.	Introduced			P
<i>Melania sp.</i>	Introduced		P	
<i>Melanoides tuberculata</i>	Introduced		P	
Physid sp.	Introduced	P	P	
<i>Tarebia granifera</i>	Introduced	P		
Thiarid sp.	Introduced		P	
<i>Dugesia sp.</i>	Introduced	P	P	
Empidid sp.	Undetermined		P	
Ephydrid sp.	Undetermined		P	
<i>Hydroptila sp.</i>	Undetermined		P	
Hirudinean sp.	Undetermined		P	
<i>Oligochaete sp.</i>	Undetermined	P	P	P
<i>Macrobrachium sp.</i>	Unknown	P	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): Outstanding

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.

Yes

Native Macrofauna
Diversity > 5 spp.

Yes

Absence of Priority 1
Introduced

No

Abundance of Any
Native Species

Yes

Presence of Candidate
Endangered Species

Yes

Endangered Newcomb's
Snail Habitat

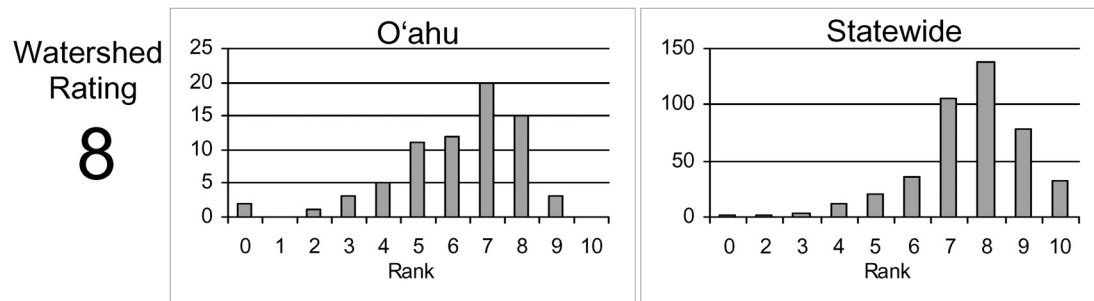
No

CURRENT WATERSHED AND STREAM RATINGS

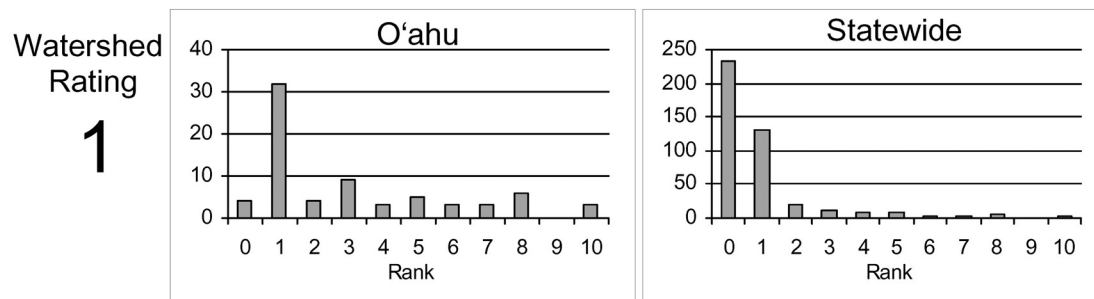
The current watershed and stream ratings are based on the data contained in the DAR Aquatic Surveys Database. The ratings provide the score for the individual watershed or stream, the distribution of ratings for that island, and the distribution of ratings statewide. This allows a better understanding 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: Punalu'u, O'ahu

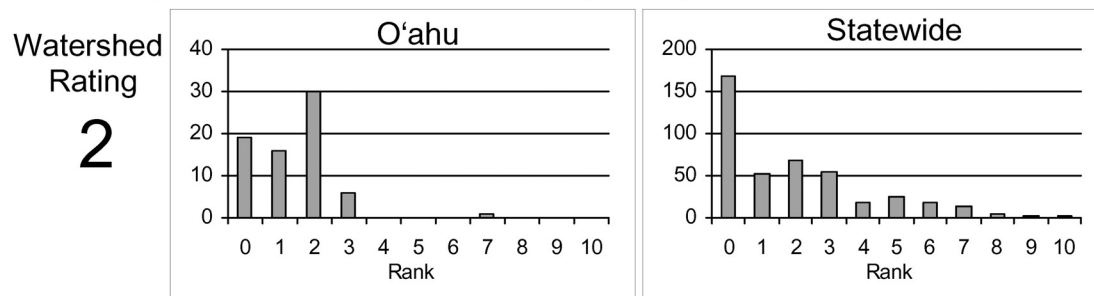
Land Cover Rating: Rating is based on a scoring system where in general forested lands score positively and developed lands score negatively.



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



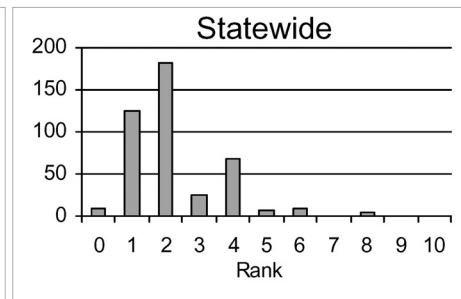
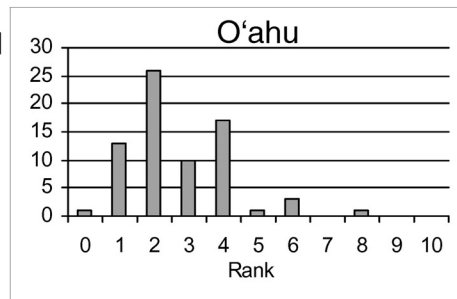
Stewardship Rating: Rating is based on a scoring system where higher levels of land and biodiversity protection within the watershed score positively.



WATERSHED RATING (Cont): Punalu'u, O'ahu

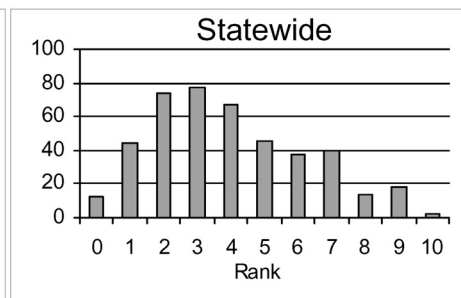
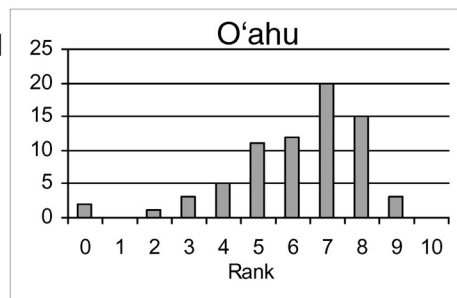
Size Rating: Rating is based on the watershed area and total stream length. Larger watersheds and streams score more positively.

Watershed
Rating
4



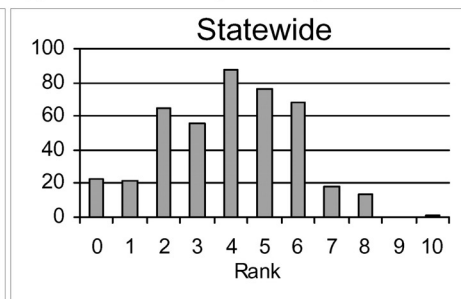
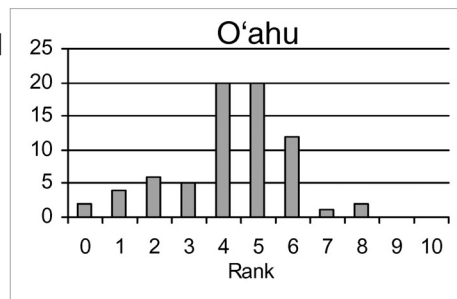
Wetness Rating: Rating is based on the average annual rainfall within the watershed. Higher rainfall totals score more positively.

Watershed
Rating
6



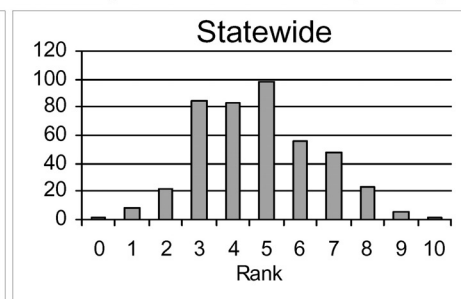
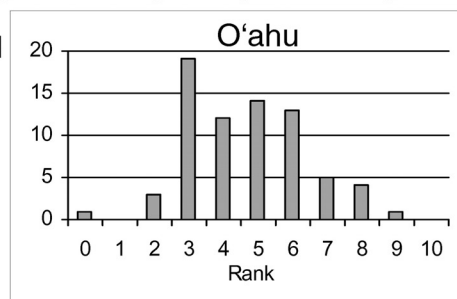
Reach Diversity Rating: Rating is based on the types and amounts of different stream reaches available in the watershed. More area in different reach types score more positively.

Watershed
Rating
4



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.

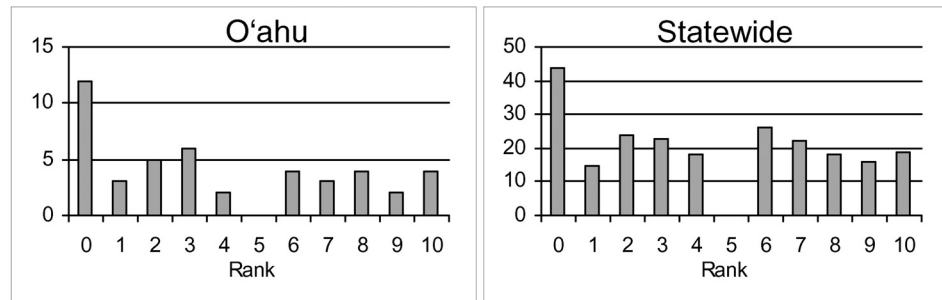
Watershed
Rating
6



BIOLOGICAL RATING: Punalu'u, O'ahu

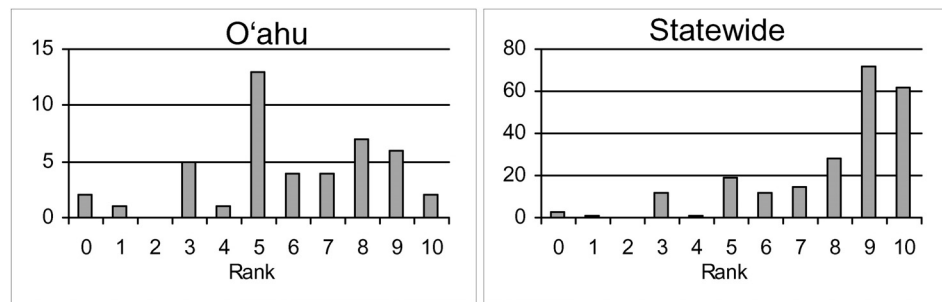
Native Species Rating: Rating is based on the number of native species observed in the watershed.

Stream
Rating
10



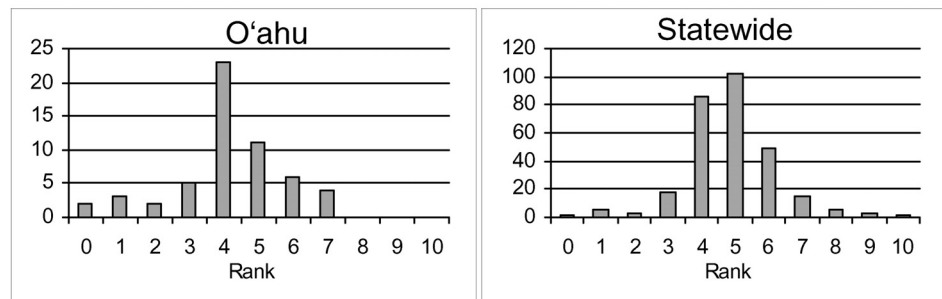
Introduced Genera Rating: Rating is based on the number of introduced genera observed in the watershed.

Stream
Rating
5



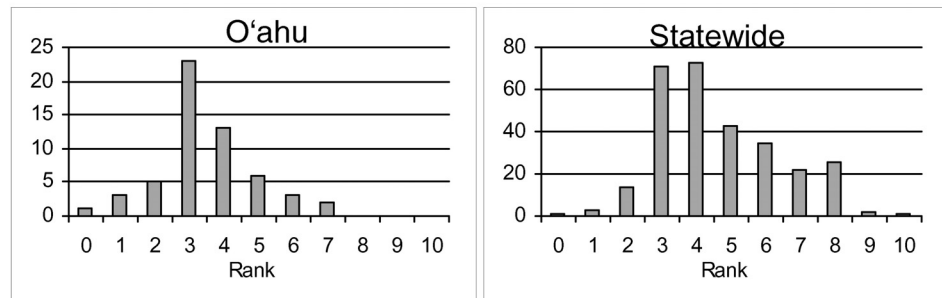
All Species' Score Rating: Rating is based on the Hawaii Stream Assessment scoring system where native species score positively and introduced species score negatively.

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
6

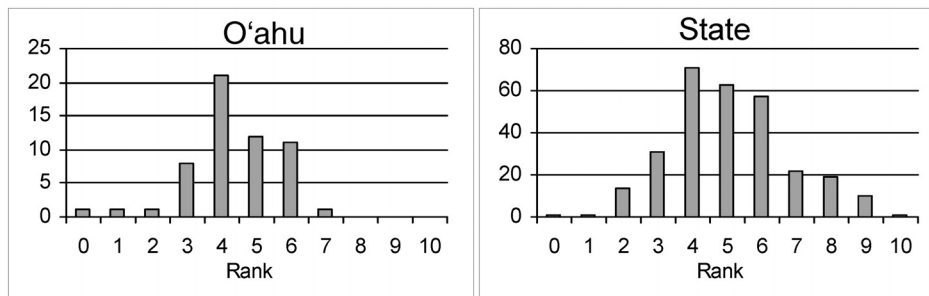


OVERALL RATING: Punalu'u, O'ahu

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

Watershed
Rating

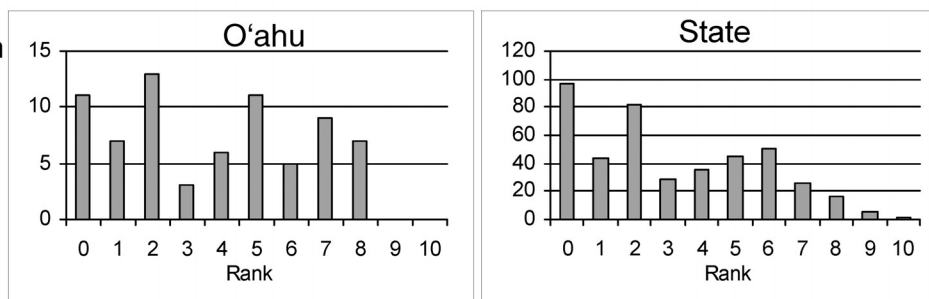
6

**RATING STRENGTH: Punalu'u, 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

7

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