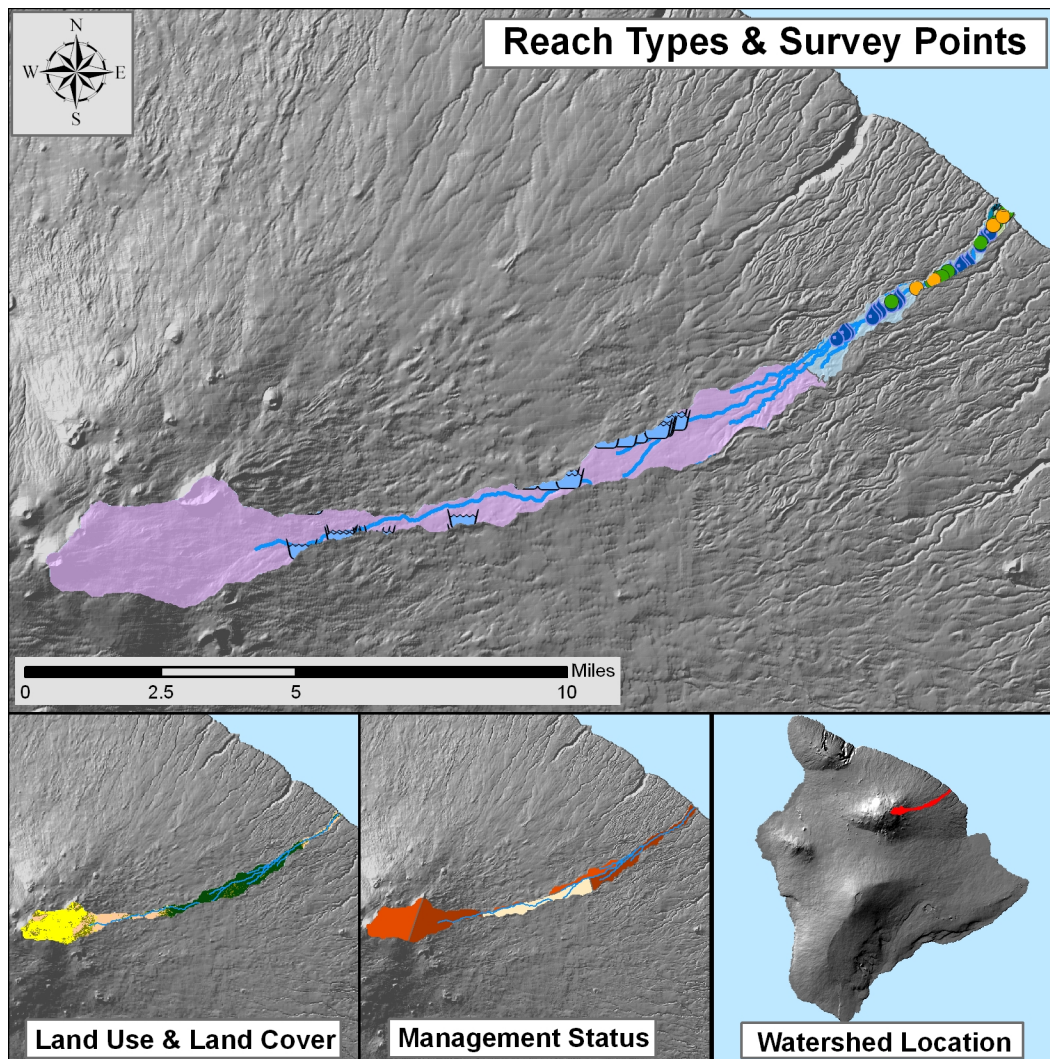


Nānue, Hawai‘i



WATERSHED FEATURES

Nānue watershed occurs on the island of Hawai‘i. The Hawaiian meaning of the name is unknown. The area of the watershed is 14.8 square mi (38.3 square km), with maximum elevation of 12418 ft (3785 m). The watershed’s DAR cluster code is not yet determined. The percent of the watershed in the different land use districts is as follows: 19.5% agricultural, 80.5% conservation, 0% rural, and 0% 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	19.1	35.6	25.5	0.0	0.0		19.8

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>
19.1	0.0	35.6	45.3

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	0.0	0.00	0.01
Cultivated	0.0	0.00	0.00
Grassland	19.8	2.93	7.58
Scrub/Shrub	12.6	1.87	4.83
Evergreen Forest	36.5	5.40	13.98
Palustrine Forested	0.0	0.00	0.00
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	31.0	4.57	11.85
Unconsolidated Shoreline	0.0	0.00	0.00
Water	0.0	0.00	0.01
Unclassified	0.0	0.00	0.00

STREAM FEATURES

Nānue is a perennial stream. Total stream length is 23.2 mi (37.3 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	0.9	4.6	28.9	65.6

The following stream(s) occur in the watershed:

Ka'ahina Nānue Painiu

BIOTIC SAMPLING EFFORT

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

1967 1980 1986 1987 1990 1992 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>
DAR Point Quadrat	0	19	0	14	0
HDFG	0	1	1	2	0
Published Report	2	1	3	5	0

BIOTA INFORMATION

Species List

Native Species

Crustaceans	<i>Atyoida bisulcata</i> <i>Macrobrachium grandimanus</i>
Fish	<i>Awaous guamensis</i> <i>Eleotris sandwicensis</i> Gobiid sp. <i>Kuhlia xenura</i> <i>Lentipes concolor</i> <i>Sicyopterus stimpsoni</i>
Snails	<i>Ferrissia sharpi</i> <i>Neritina granosa</i>
Worms	Hirudinean sp.

Native Species

Insects	<i>Anax junius</i> <i>Bradysia bishopi</i> <i>Dasyhelea platychaeta</i> <i>Limonia jacobus</i> <i>Megalagrion blackburni</i> <i>Megalagrion hawaiiense</i> <i>Megalagrion sp.</i> <i>Nesogonia blackburni</i> <i>Procanace constricta</i> <i>Sigmatineurum chalybeum</i> <i>Telmatogeton sp.</i>
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Introduced Species

Crustaceans	<i>Macrobrachium lar</i>
Fish	<i>Poecilia reticulata</i> Poeciliid sp.
Snails	Lymnaeid sp. Thiarid sp.
Worms	<i>Camallanus cotti</i>

Introduced Species

Insects	<i>Aedes albopictus</i> <i>Aedes sp.</i> <i>Cheumatopsyche analis</i> Chironomid larvae <i>Limonia advena</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>Macrobrachium lar</i>	Introduced	1	12	3.1
<i>Eleotris sandwicensis</i>	Endemic	1.5	7	3.3
<i>Kuhlia xenura</i>	Endemic	1.5	6	2.4
<i>Lentipes concolor</i>	Endemic	1	1	1.0
<i>Sicyopterus stimpsoni</i>	Endemic	0.75	6	2.1
<i>Awaous guamensis</i>	Indigenous	1	12	4.0
Gobiid sp.	Indigenous	0.5	1	0.7
<i>Neritina granosa</i>	Endemic	0.25	1.5	0.7

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>Eleotris sandwicensis</i>	Endemic		0.74			
<i>Kuhlia xenura</i>	Endemic		0.74			
<i>Lentipes concolor</i>	Endemic				0.04	
<i>Neritina granosa</i>	Endemic		2.48		0.73	
<i>Sicyopterus stimpsoni</i>	Endemic		3.02		0.56	
<i>Awaous guamensis</i>	Indigenous		0.99		0.09	
Gobiid sp.	Indigenous		2.48		0.6	
<i>Macrobrachium lar</i>	Introduced				0.04	

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	
<i>Eleotris sandwicensis</i>	Endemic		P			
<i>Kuhlia xenura</i>	Endemic		P			
<i>Lentipes concolor</i>	Endemic	P		P	P	
<i>Sicyopterus stimpsoni</i>	Endemic	P	P	P	P	
<i>Dasyhelea platychaeta</i>	Endemic				P	
<i>Limonia jacobus</i>	Endemic				P	
<i>Megalagrion blackburni</i>	Endemic				P	
<i>Megalagrion hawaiiense</i>	Endemic				P	
<i>Megalagrion sp.</i>	Endemic		P	P	P	
<i>Nesogonia blackburni</i>	Endemic				P	
<i>Procanace constricta</i>	Endemic				P	
<i>Sigmatineurum chalybeum</i>	Endemic				P	
<i>Ferrissia sharpi</i>	Endemic				P	
<i>Neritina granosa</i>	Endemic		P	P	P	
<i>Awaous guamensis</i>	Indigenous		P	P	P	
Gobiid sp.	Indigenous		P		P	
<i>Anax junius</i>	Indigenous				P	
<i>Telmatogeton sp.</i>	Indigenous			P	P	
<i>Macrobrachium lar</i>	Introduced		P		P	
<i>Poecilia reticulata</i>	Introduced		P			
Poeciliid sp.	Introduced			P		
<i>Aedes albopictus</i>	Introduced				P	
<i>Aedes sp.</i>	Introduced				P	
<i>Cheumatopsyche analis</i>	Introduced				P	
Chironomid larvae	Introduced		P		P	
<i>Limonia advena</i>	Introduced				P	

Lymnaeid sp.	Introduced	P
Thiarid sp.	Introduced	P
<i>Bradysia bishopi</i>	Undetermined	P
Hirudinean sp.	Undetermined	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): Yes

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.

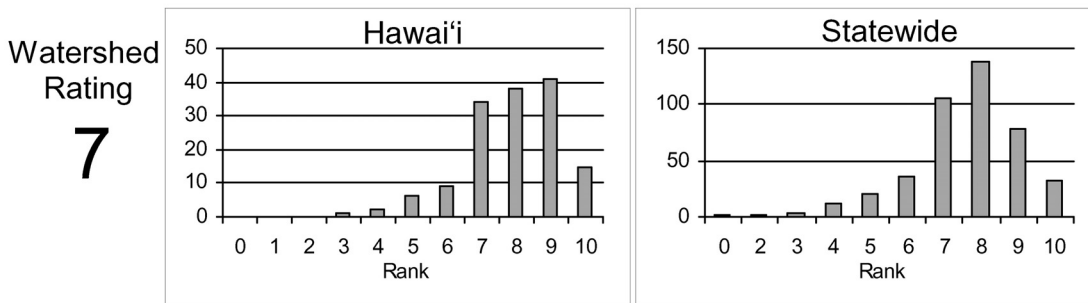
Native Insect Diversity <u>> 19 spp.</u>	Native Macrofauna <u>Diversity > 5 spp.</u>	Absence of Priority 1 <u>Introduced</u>
No	Yes	No
Abundance of Any <u>Native Species</u>	Presence of Candidate <u>Endangered Species</u>	Endangered Newcomb's <u>Snail Habitat</u>
No	No	No

CURRENT WATERSHED AND STREAM RATINGS

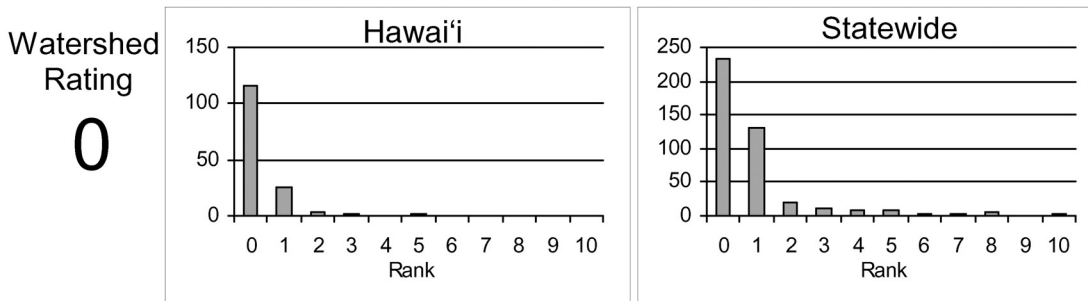
The current watershed and stream ratings are based on the data contained in the DAR Aquatic Surveys Database. The ratings provide the score for the individual watershed or stream, the distribution of ratings for that island, and the distribution of ratings statewide. This allows a better understanding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

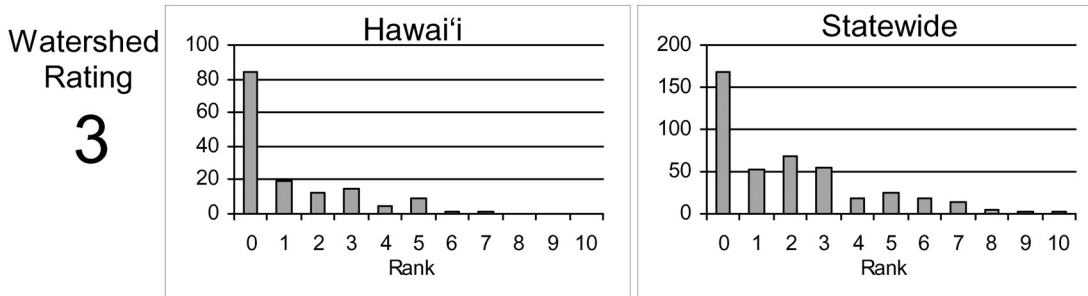
Land Cover Rating: Rating is based on a scoring system where in general forested lands score positively and developed lands score negatively.



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

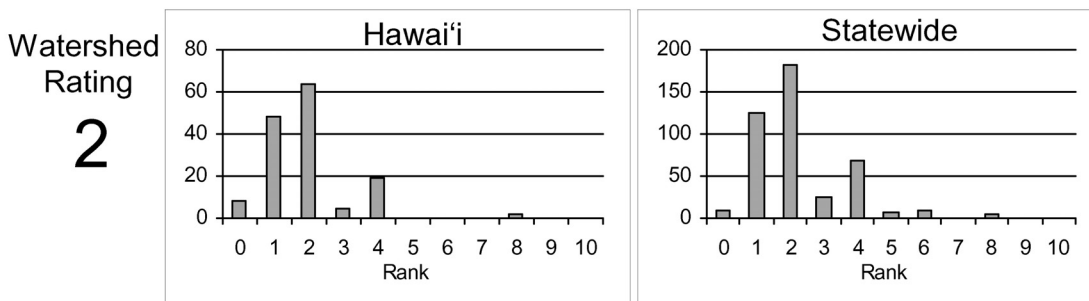


Stewardship Rating: Rating is based on a scoring system where higher levels of land and biodiversity protection within the watershed score positively.

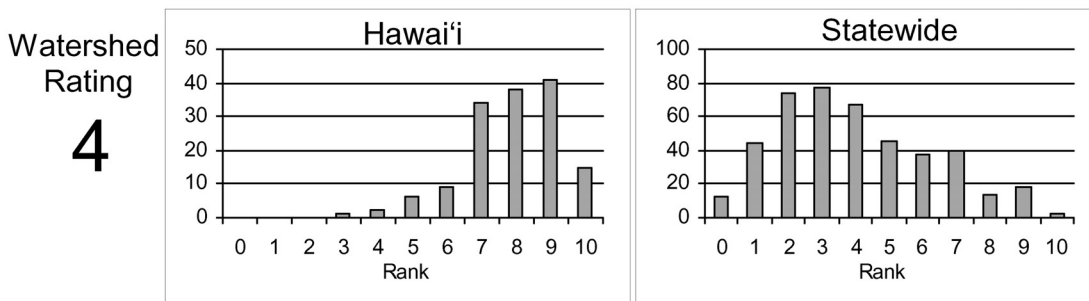


WATERSHED RATING (Cont): Nānue, Hawai'i

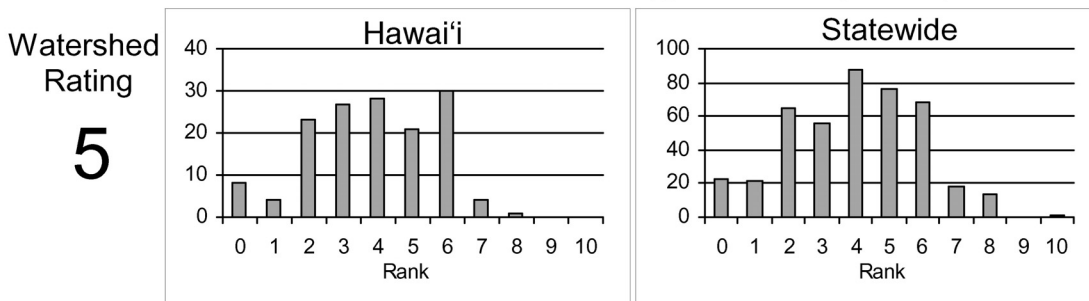
Size Rating: Rating is based on the watershed area and total stream length. Larger watersheds and streams score more positively.



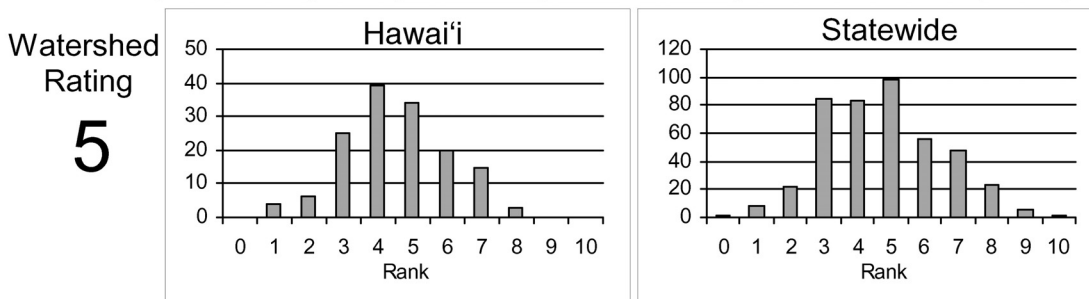
Wetness Rating: Rating is based on the average annual rainfall within the watershed. Higher rainfall totals score more positively.



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.



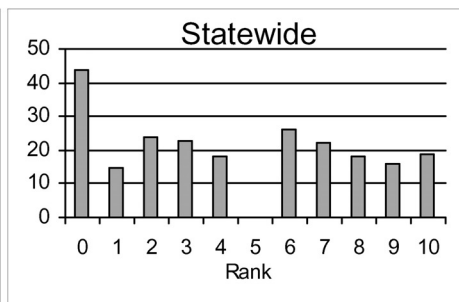
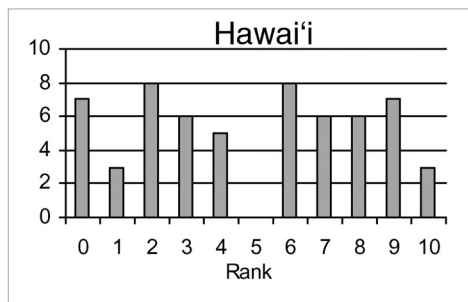
Total Watershed Rating: Rating is based on combination of Land Cover Rating, Shallow Waters Rating, Stewardship Rating, Size Rating, Wetness Rating, and Reach Diversity Rating.



BIOLOGICAL RATING: Nānue, Hawai'i

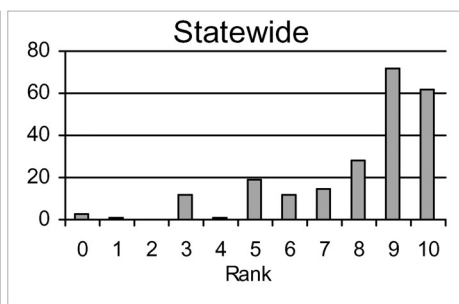
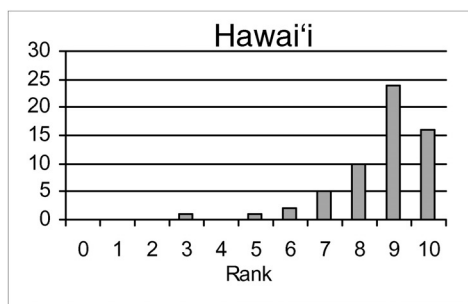
Native Species Rating: Rating is based on the number of native species observed in the watershed.

Stream Rating
9



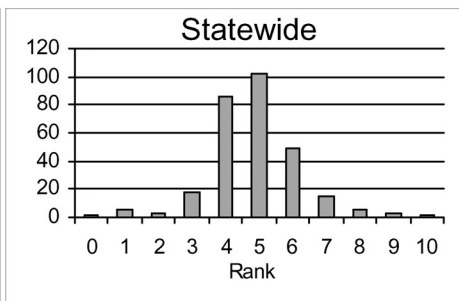
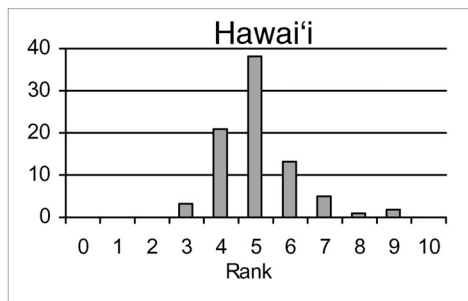
Introduced Genera Rating: Rating is based on the number of introduced genera observed in the watershed.

Stream Rating
9



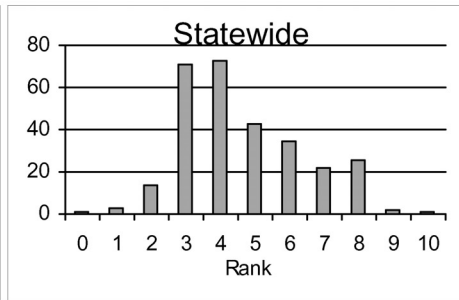
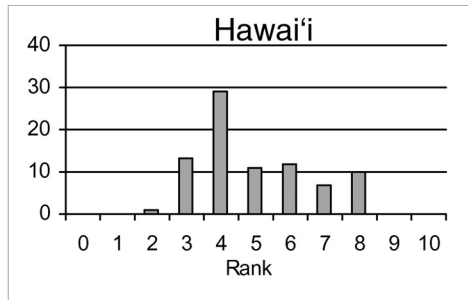
All Species' Score Rating: Rating is based on the Hawaii Stream Assessment scoring system where native species score positively and introduced species score negatively.

Stream Rating
6



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

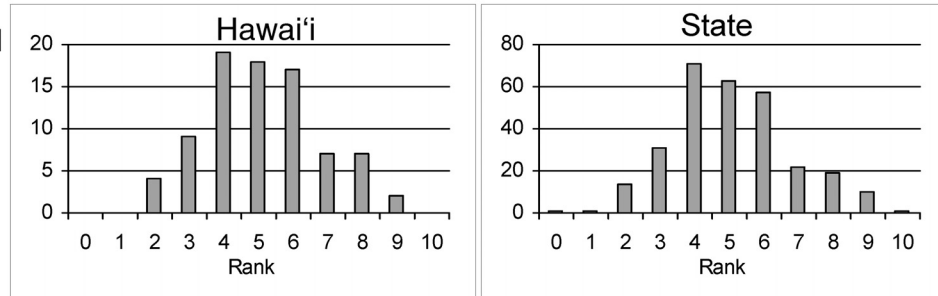
Stream Rating
8



OVERALL RATING: Nānue, Hawai'i

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

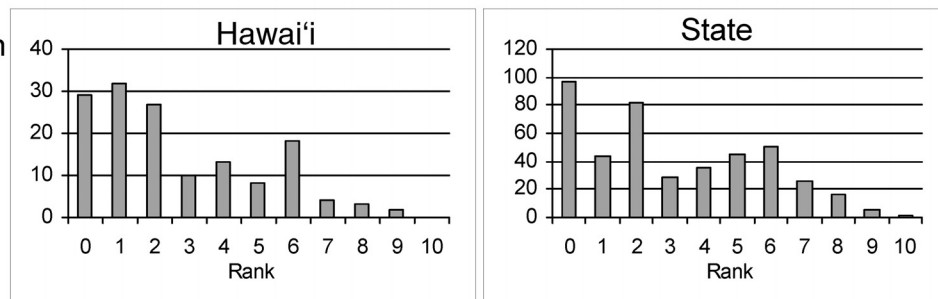
Watershed
Rating
7



RATING STRENGTH: Nānue, Hawai'i

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
8



REFERENCES

1966. Shima, S.I. Limnological Survey for Introduction of Exotic Species of Fish.

1980. Timbol, A.S., Sutter, A.J. and J.D. Parrish. Distribution and Relative Abundance of the Endemic Freshwater Goby, *Lentipes concolor* in Hawaii. Hawaii Cooperative Fishery Research Unit.

1986. Kinzie III, R.A.I, Ford, J.I., Yuen, A.R. and S.J.L. Chow. Habitat Modeling of Hawaiian Streams. Technical Report No. 171.

1988. Kinzie III, R.A. Habitat Utilization by Hawaiian Stream Fishes with Reference to Community Structure in Oceanic Island Streams. Environmental Biology of Fishes, Vol. 22, No. 3. 179-192.

1991. Baker, J.A. Sampling Hawaiian Stream Gobies. Proceedings of the 1990 Symposium on Freshwater Stream Biology and Fisheries Management. 238-278.
1991. Nishimoto, R.T. and D.G.K. Kuamo'o. The Occurrence and Distribution of the Native Goby (*Lentipes concolor*) in Hawai'i Island Streams with Notes on the Distribution of other Native Fish Species. Proceedings of the 1990 Symposium on Freshwater Stream Biology and Fisheries Management. 77-95.
1991. Zink, R.M. Genetic Variation Within and Between Populations of *Lentipes concolor* from Hawai'i and Kaua'i. Proceedings of the 1990 Symposium on Freshwater Stream Biology and Fisheries Management. 96-105.
1992. Baker, J.A. and S.A. Foster. Estimating Density and Abundance of Endemic Fishes in Hawaiian Streams.
1993. Kinzie III, R.A. Reproductive Biology of an Endemic, Amphidromous Goby, *Lentipes concolor* in Hawaiian Streams. Environmental Biology of Fishes, Vol. 37. 257-268.
1996. Font, W.F., Tate, D.C. and D.W. Llewellyn. Colonization of Native Hawaiian Stream Fishes by Helminth Parasites. Will Stream Restoration Benefit Freshwater, Estuarine, and Marine Fisheries? 94-111.
2001. Radtke, R.L, Kinzie, III, R.A. and D.J. Shafer. Temporal and Spatial Variation in Length of Larval Life and Size Settlement of the Hawaiian Amphidromous Goby *Lentipes concolor*. The Journal of Fish Biology, Vol. 59. 928-938.
2003. Fitzsimons, J.M., McRae, M.G., Schoenfuss, H.L. and R.T. Nishimoto. Gardening Behavior in the Amphidromous Hawaiian Fish *Sicyopterus stimpsoni* (Osteichthyes: Gobiidae). Ichthyol. Explor. Freshwaters, Vol. 14, No. 2. 185-191.
2008. Hawai'i Division of Aquatic Resources. DAR Point Quadrat Survey Data from the DAR Aquatic Surveys Database.