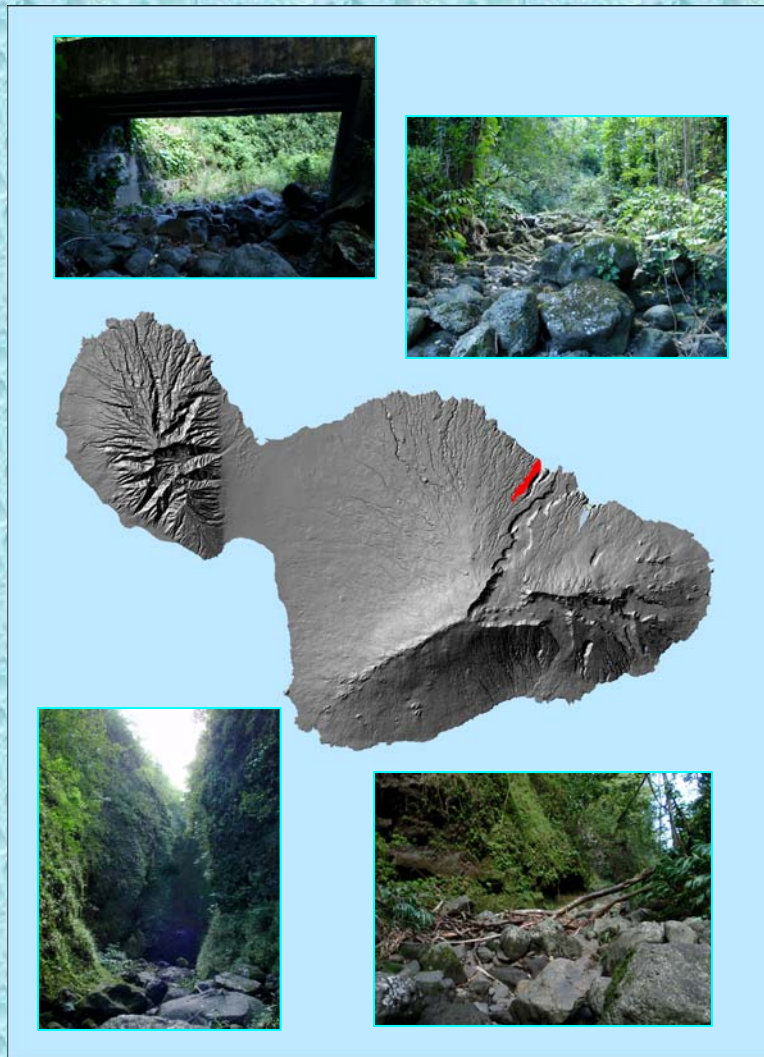


Report on Punalau Stream Maui, Hawaii



August 2009

State of Hawai'i
Department of Land and Natural Resources
Division of Aquatic Resources

and

Bishop Museum





Funded in part by the Commission on
Water Resource Management, DLNR
and



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Report on Punalau Stream Maui, Hawai'i

August 2009

Prepared for
Commission on Water Resource Management
Department of Land and Natural Resources
State of Hawai'i

Prepared by
Division of Aquatic Resources¹
Department of Land and Natural Resources
State of Hawai'i
and
Bishop Museum²

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Section 1: Introduction

Overview

On May 24, 2001, the Native Hawaiian Legal Corporation (NHLC) filed a Petition to Amend the Interim Instream Flow Standard (IIFS) for 27 streams in east Maui on behalf of resident taro farmers. Since the acceptance of the petitions in July 2001, the Commission on Water Resource Management (CWRM) has been focused on gathering information for the 27 petitioned streams. Shortly thereafter, NHLC and CWRM staff reached an agreement that efforts would focus on 8 of the 27 petitioned streams: Honopou, Hanehoi, Huelo, Waiokamilo, Kualani, Pi'ina'au, Palauhulu, and Wailua Nui Streams. Currently, the CWRM is collaborating with the State's Division of Aquatic Resources and the U.S. Geological Survey (USGS) for assistance in collecting biological and hydrologic data to determine measurable interim IFS. CWRM has also requested biological data on the remaining 19 petitioned streams which is the main purpose of this report.

This report is an accounting of the aquatic resources that have been observed in Punalau Stream, Maui from year 2000 to present. The focus of this report is on the animals and insects that live in the stream and the data collected during surveys. The report covers four main sections, including:

- Introduction
- Watershed Atlas Report
- DAR Point Quadrat Survey Report
- Photographs of stream taken during stream surveys

The introduction provides the overview for the purpose of this report, a summary of the findings on the stream and its animals, and a discussion of the importance of the findings and how stream conditions influence native species populations. The Watershed Atlas Report provides a description of the watershed and its aquatic resources from Division of Aquatic Resources (DAR) and other published/unpublished surveys, including a rating of the condition of the stream compared to other streams on Maui as well as statewide. The DAR Point Quadrat Survey Report describes the distribution, habitats, and species observed during the standardized DAR stream surveys. Finally, the photographs provide context to the conditions that the stream surveyors encountered in the stream.

This overview reports on the highlights of these findings and provides a discussion of the importance of the information presented. We hope that this format provides the reader with a simplified, general discussion and understanding of the conditions of Punalau Stream while also providing substantial evidence to support the conclusions presented.

Findings for Punalau Stream, Maui

Punalau is a small watershed (1.1 sq miles). It is totally zoned for conservation (100%) and the land cover is mostly evergreen forest (80%), scrub (12%) and grassland (7%). Numerous stream surveys of different types have been completed in Punalau Stream beginning in 1990 to the

present. This watershed rates average, based on the data contained in the DAR aquatic surveys database, in comparison to other watersheds in Maui and statewide. It has a total watershed rating of 7 out of 10, a total biological rating of 5 out of 10, and a combined overall rating of 5 out of 10.

Native species observed in the stream include the following categories and species:

Fish - *Awaous guamensis* and *Sicyopterus stimpsoni*.

Insect – *Megalagrion blackburni*, *M. hawaiiense* and *M. pacificum*

Introduced species observed in this stream includes the following categories and species:

Amphibian – *Rana catesbiana*

Crustaceans - *Macrobrachium lar*

Discussion

Punalau watershed is small and steep in the lower and middle reach entering Honomanū Bay. The stream mouth is overgrown with **California grass**, *Brachiaria mutica* and **hau**, *Hibiscus tiliaceus* with no flow. Aerial photographs show its steepness (Figure 4-2) and lack of flow, with diversions in the upper reaches (Figure 4-3).

No estuary surveys were conducted on Punalau Stream as there was no estuary created by Punalau Stream, due to lack of flow at the mouth.

The lower reach near the mouth of Punalau Stream was not surveyed due to inaccessibility caused by thick vegetation overgrowth. Punalau Stream was accessed from Hāna Highway and was surveyed in the upper section of the lower reach and middle reach, which had a steep gradient with large boulders. There was absolutely no flow and the stream segment was short which ended at the base of a dry waterfall in an evaporating stagnant pool. A total of only three point quadrat surveys were conducted. No flow measurements were taken due to lack of flow. No diversions or tributaries were encountered during surveys.

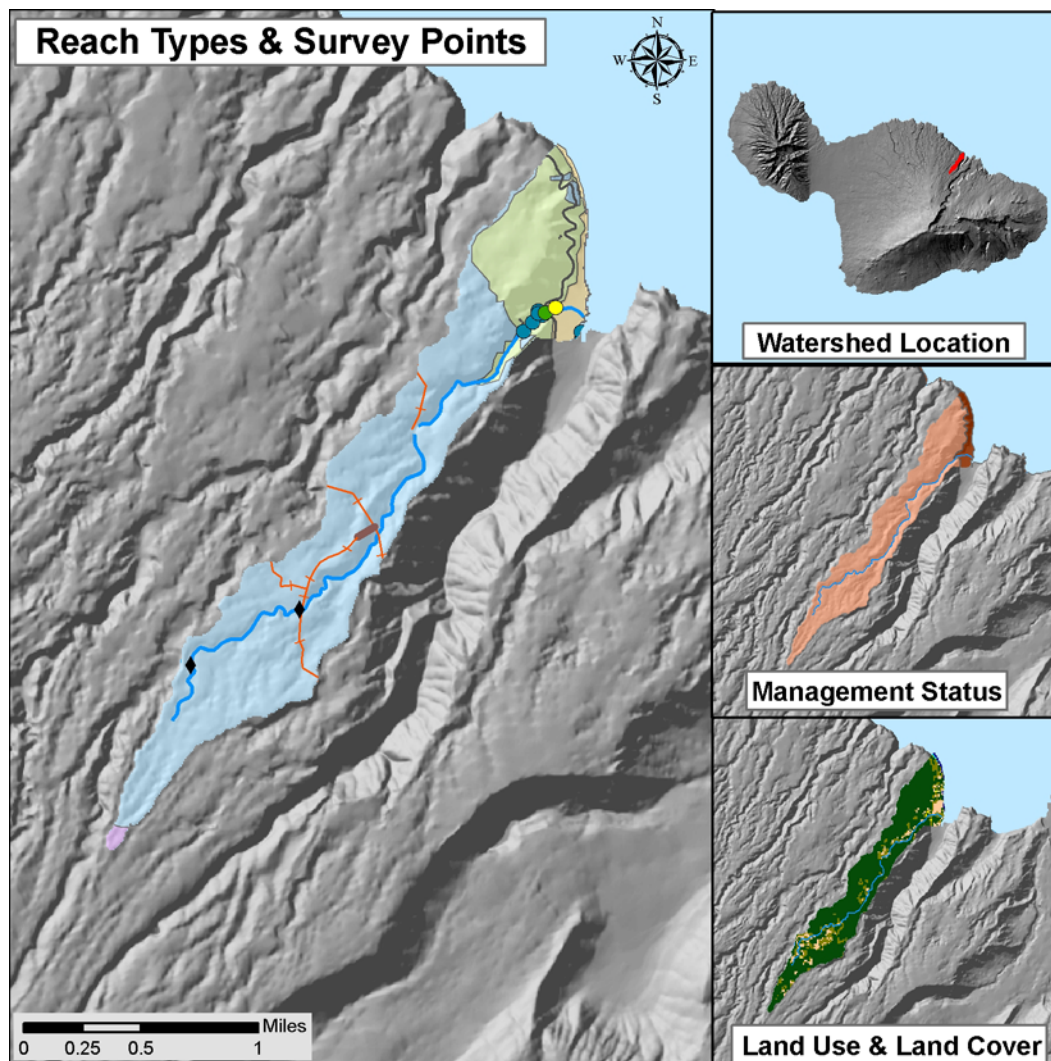
Punalau did not have any available stream animal habitat aside from the stagnant pool at the base of the dry waterfall. No stream animals were recorded in point quadrat surveys. However, **river prawns** (*Macrobrachium lar*), and **‘o‘opu nākea** (*Awaous guamensis*), were observed outside the survey sites in the stagnant pool. Water temperature in the pool was 19.8° C. During surveys conducted by USGS on May 5, 2004; **hinana**, post-larval *A. guamensis* and *M. lar* were observed at the mouth of the stream at 5 feet elevation (Gingerich and Wolff, 2005).

Overall, Punalau Stream has good potential stream habitat in the middle and upper reaches, but the majority of habitat was lost to water withdrawal. Restoration of flow downstream would therefore improve animal passage between diversions upstream and downstream and substantially increase the availability of habitat for native stream species. Restoration of flow and improvement of animal passage would have the greatest effect on **‘o‘opu alamo‘o** (*Lentipes concolor*) and **‘ōpae kala‘ole** (*Atyoida bisulcata*), and would further enhance the overall productivity of Punalau.

Section 2: Watershed Atlas

DAR Watershed Code: 64008

Punalau, Maui



Watershed Features

Punalau watershed occurs on the island of Maui. The Hawaiian meaning of the name is many springs. The area of the watershed is 1.1 square mi (3 square km), with maximum elevation of 2562 ft (781 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: 0% agricultural, 100% 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 Private</u>
0.0	0.0	93.3	0.0	0.0	0.0	6.7

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	93.3	0.0	6.7

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	0.1	0.00	0.00
Low Intensity Developed	0.1	0.00	0.00
Cultivated	0.0	0.00	0.00
Grassland	6.7	0.08	0.20
Scrub/Shrub	12.4	0.14	0.37
Evergreen Forest	79.9	0.92	2.38
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	0.3	0.00	0.01
Unconsolidated Shoreline	0.1	0.00	0.00
Water	0.4	0.00	0.01
Unclassified	0.0	0.00	0.00

Stream Features

Punalau is a perennial stream. Total stream length is 3 mi (4.8 km). The terminal stream order is 1.

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	8.1	13.2	78.7	0.0

The following stream(s) occur in the watershed:

Punalau

Biotic Sampling Effort

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

1990 2000 2004 2008

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	1	0	0	0
DAR General Surveys	0	1	1	0	0
DAR Point Quadrat	0	1	2	2	0
Published Report	0	1	0	0	0

Biota Information

Species List

Native Species

Fish *Awaous guamensis*
Sicyopterus stimpsoni

Native Species

Insects *Megalagrion blackburni*
Megalagrion hawaiiense
Megalagrion pacificum

Introduced Species

Amphibians *Rana catesbiana*
Crustaceans *Macrobrachium lar*

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>Awaous guamensis</i>	Indigenous	4.25	5	4.6

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>Lower</u>	<u>Middle</u>	<u>Upper</u>	<u>Headwaters</u>
<i>Awaous guamensis</i>	Indigenous					1.65

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>Sicyopterus stimpsoni</i>	Endemic			P		
<i>Megalagrion blackburni</i>	Endemic		P			
<i>Megalagrion hawaiiense</i>	Endemic		P			
<i>Megalagrion pacificum</i>	Endemic		P			
<i>Awaous guamensis</i>	Indigenous		P		P	
<i>Rana catesbiana</i>	Introduced		P			
<i>Macrobrachium lar</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): not ranked

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.

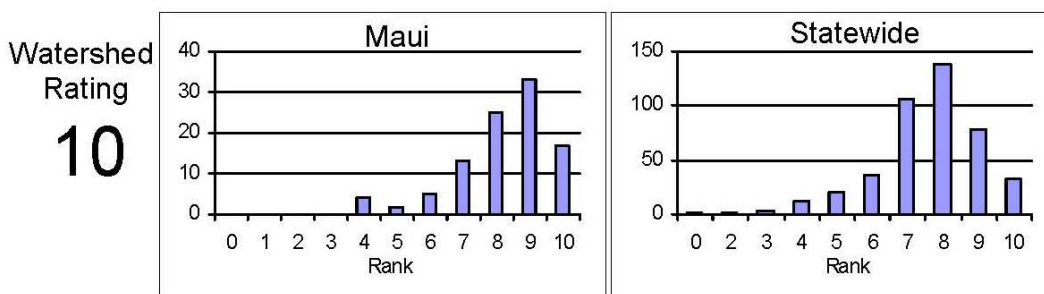
Native Insect Diversity <u>> 19 spp.</u>	Native Macrofauna <u>Diversity > 5 spp.</u>	Absence of Priority 1 <u>Introduced</u>
No	No	No
Abundance of Any <u>Native Species</u>	Presence of Candidate <u>Endangered Species</u>	Endangered Newcomb's <u>Snail Habitat</u>
No	Yes	No

CURRENT WATERSHED AND STREAM RATINGS

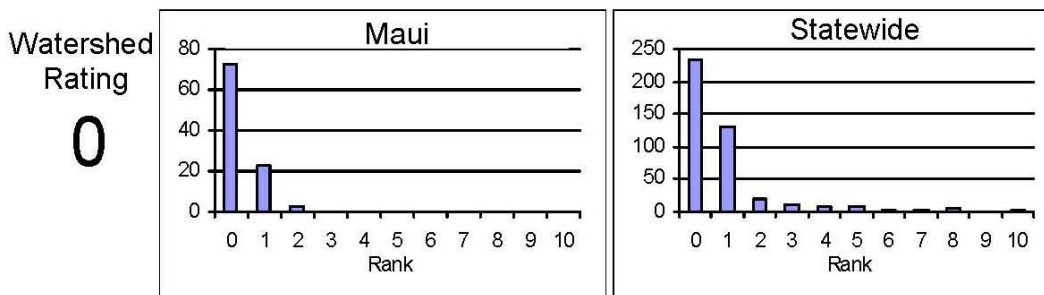
The current watershed and stream ratings are based on the data contained in the DAR Aquatic Surveys Database. The ratings provide the score for the individual watershed or stream, the distribution of ratings for that island, and the distribution of ratings statewide. This allows a better understanding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

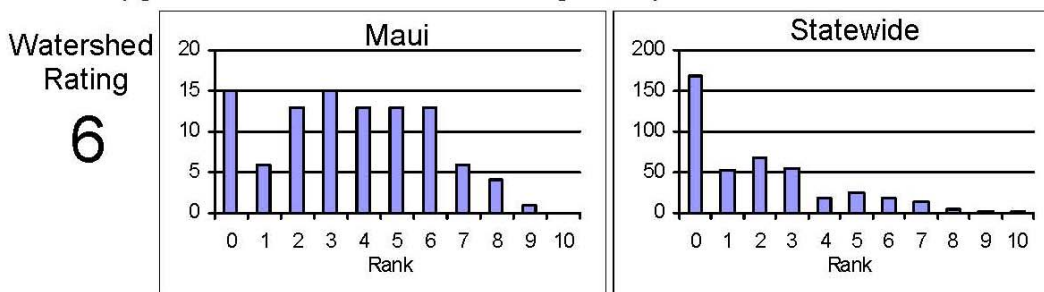
Land Cover Rating: Rating is based on a scoring system where in general forested lands score positively and developed lands score negatively.



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

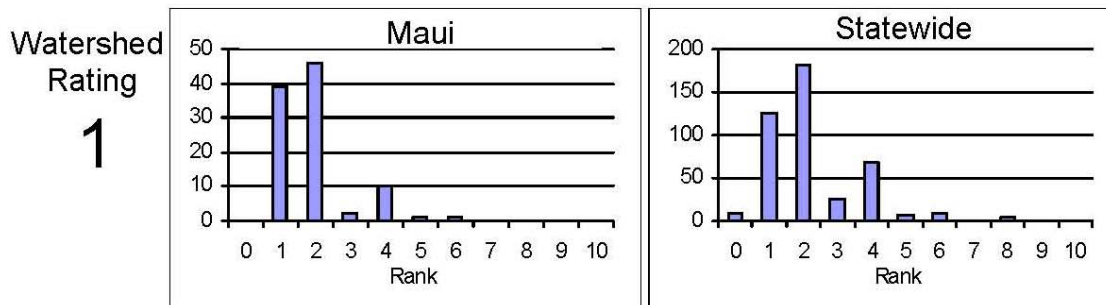


Stewardship Rating: Rating is based on a scoring system where higher levels of land and biodiversity protection within the watershed score positively.

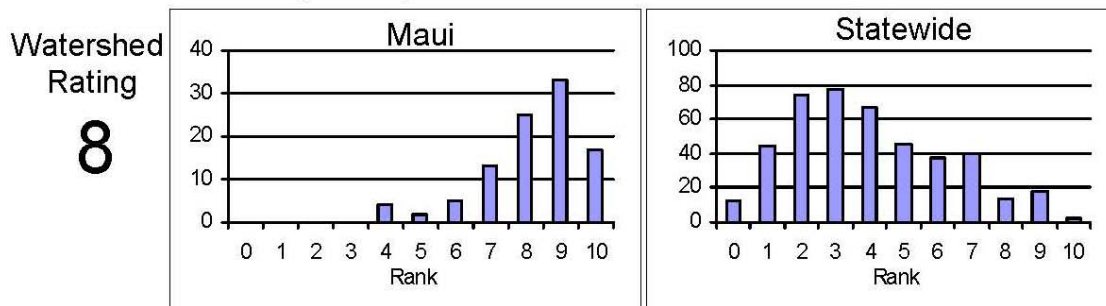


WATERSHED RATING (Cont): Punalau, Maui

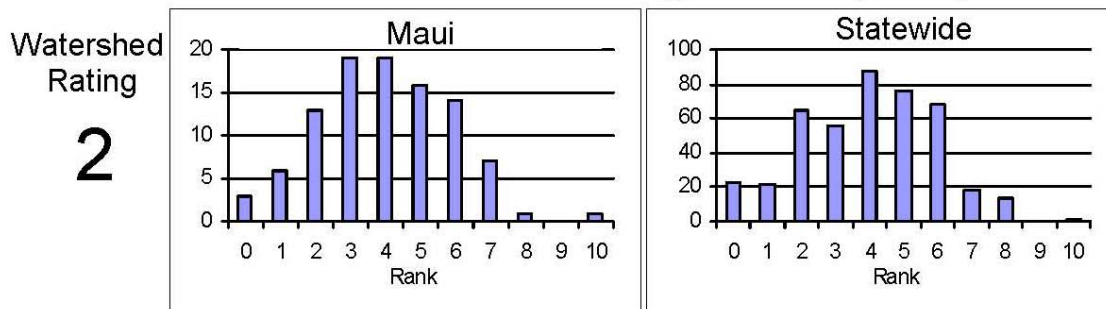
Size Rating: Rating is based on the watershed area and total stream length. Larger watersheds and streams score more positively.



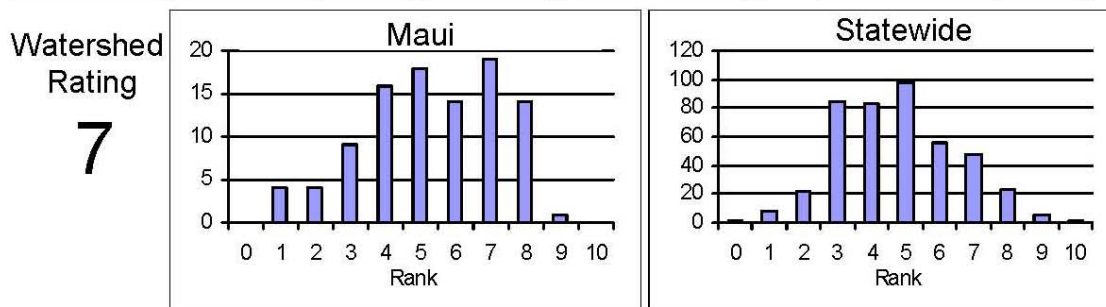
Wetness Rating: Rating is based on the average annual rainfall within the watershed. Higher rainfall totals score more positively.



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.



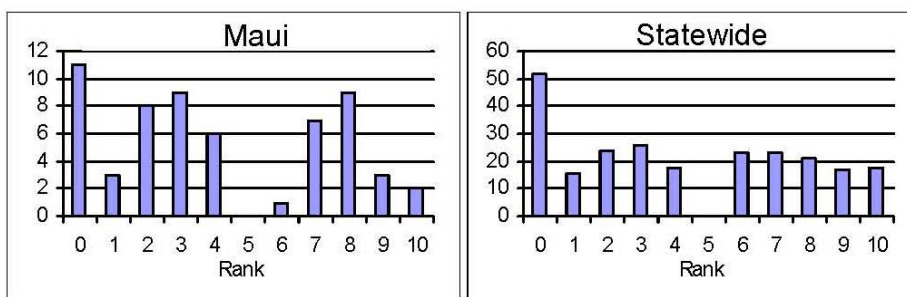
Total Watershed Rating: Rating is based on combination of Land Cover Rating, Shallow Waters Rating, Stewardship Rating, Size Rating, Wetness Rating, and Reach Diversity Rating.



BIOLOGICAL RATING: Punalau, Maui

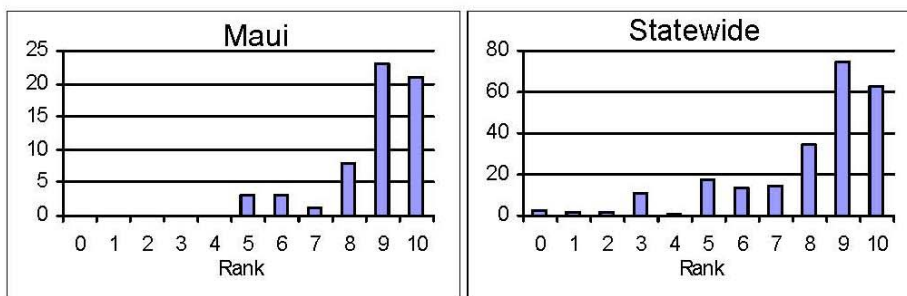
Native Species Rating: Rating is based on the number of native species observed in the watershed.

Stream Rating
2



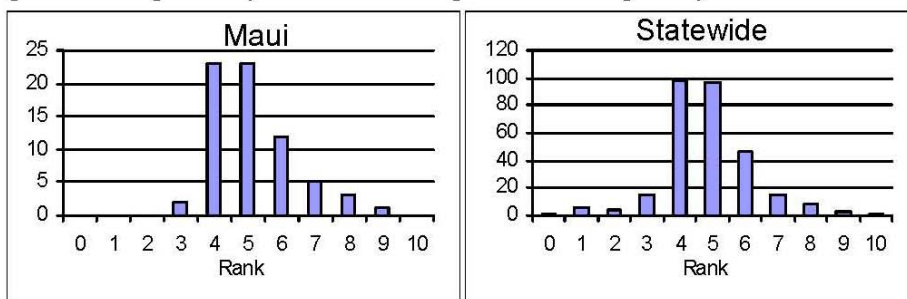
Introduced Genera Rating: Rating is based on the number of introduced genera observed in the watershed.

Stream Rating
9



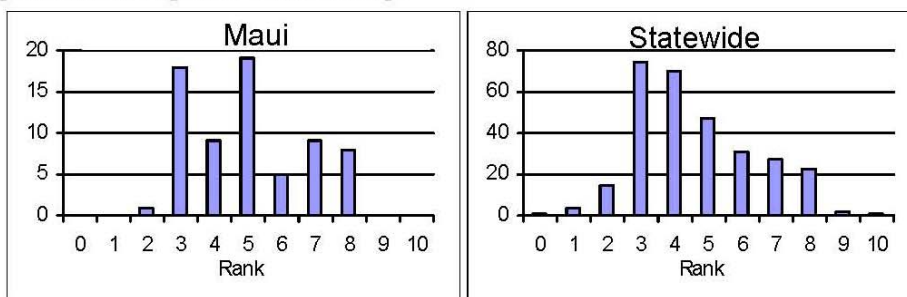
All Species' Score Rating: Rating is based on the Hawaii Stream Assessment scoring system where native species score positively and introduced species score negatively.

Stream Rating
6



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

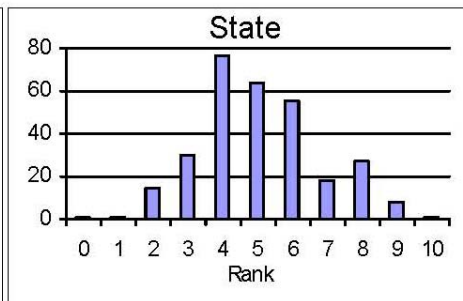
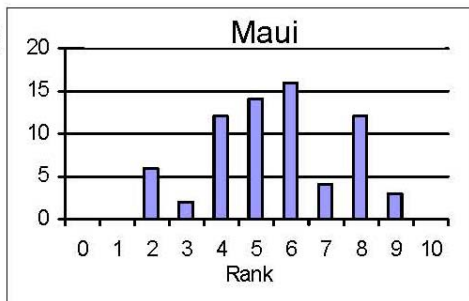
Stream Rating
5



OVERALL RATING: Punalau, Maui

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

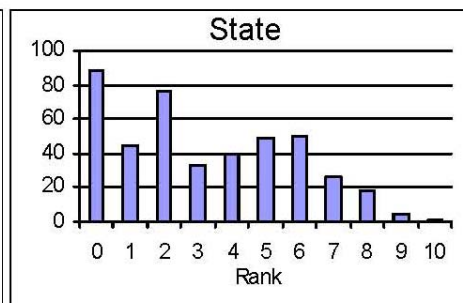
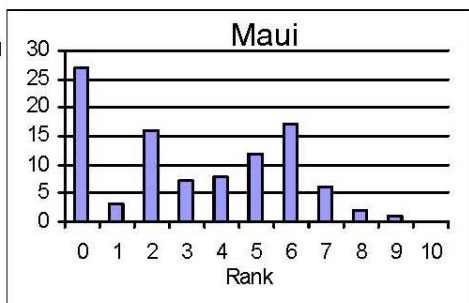
Watershed
Rating
6



RATING STRENGTH: Punalau, Maui

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
5



REFERENCES

- 1990. Hau, S. Skippy Hau Databook No. 311 Volume 3.
- 2005. Gingerich, S.B. and R.H. Wolff. Effects of Surface-Water Diversions on Habitat Availability for Native Macrofauna, Northeast Maui, Hawai'i.
- 2006. Polhemus, D.A. Maps of Damselfly Locations.
- 2008. Hawai'i Division of Aquatic Resources. DAR Point Quadrat Survey Data from the DAR Aquatic Surveys Database.

Section 3: DAR Point Quadrat Report for Punalau, Maui

For Surveys from 12/9/2008 to 12/9/2008

Introduction

This is a report of the Hawai'i Division of Aquatic Resources stream surveys using the Point Quadrat Methodology. Trained biologists and technicians survey a series of randomly located points in a stream to generate an assessment of the species and habitat in the stream. The Point Quadrat Methodology is one of several techniques that could be chosen for the surveys and is used to develop a statistically comparable stream survey. This methodology is a standardized visual survey technique involving snorkeling, and it is well suited for the physical and ecological characteristics of Hawai'i streams. The small, steep, dynamic nature of Hawaiian streams with their unique aquatic species is easily observed with this methodology. The in-stream distribution by elevation, behavior, and amphidromous life cycles are easily observed using this technique.

Methods

The point quadrat methodology requires underwater observation. Sampling was conducted using a dive mask, snorkel and two-piece wet suit with hood and glove. Spiked felt-soled wading boots or Japanese spiked **tabis** are also necessary for easy climbing on the wet, algae-covered rocks. After the initial survey site is chosen all the survey sites upstream are selected randomly to prevent any bias in habitat type selection (e.g., pools and runs) and to obtain a representative sample of all habitat types in the stream. At each site, fish and invertebrate observations are recorded and data is collected on the species present, number, size, and sex. Habitat and substrate type, depth and site dimension data are also collected. Other site observations recorded at each station include GPS coordinates and the following water quality parameters using a Hydrolab Quanta: temperature ($^{\circ}$ C), salinity (PSS), dissolved oxygen (mg/L), pH, conductivity (mS/cm) and turbidity (NTU). Stream flow measurements are collected using a Marsh McBirney Flo-Mate 2000 at the beginning and ending of each survey as well as at tributaries and diversions.

The watersheds (and watershed ID), region, and island surveyed in this report are:

Punalau (ID: 64008), Ke'anae, Maui

Surveys were conducted by these personnel:

Hau, Skippy
Shimoda, Troy
Shindo, Tim

Results

Table 3-1. The distribution of sites by reach during this survey effort.

Reach	Total number of surveys
Estuary	0
Lower	1
Middle	2
Upper	2
Headwaters	0
Unknown	0

Lower Reach

Table 3-2. Number of Habitat Types surveyed in the lower stream reach.

Reach	Total Habitats Surveyed	Plunge Pool	Cascade	Riffle	Run	Pool	Side Pool	No Water	Dirty Water	Unknown
Lower	1	0	0	0	0	0	0	1	0	0

Table 3-3. Observed Substrates (%) in point quadrat samples in the lower stream reach.

Reach	Detritus	Sediment	Sand	Gravel	Cobble	Boulder	Bedrock
Lower	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table 3-4. Observed Water Quality in point quadrat samples in the lower stream reach.

Reach	Temp (° C)	sCond (mS/cm)	DO (mg/L)	pH
Lower	n/a	n/a	n/a	n/a

Middle Reach

Table 3-5. Number of Habitat Types surveyed in the middle stream reach.

Reach	Total Habitats Surveyed	Plunge Pool	Cascade	Riffle	Run	Pool	Side Pool	No Water	Dirty Water	Unknown
Middle	2	0	0	1	0	0	0	1	0	0

Table 3-6. Observed Substrates (%) in point quadrat samples in the middle stream reach.

Reach	Detritus	Sediment	Sand	Gravel	Cobble	Boulder	Bedrock
Middle	12	0	0	22	15	50	0

Table 3-7. Observed Water Quality in point quadrat samples in the middle stream reach.

Reach	Temp (° C)	sCond (mS/cm)	DO (mg/L)	pH
Middle	n/a	n/a	n/a	n/a

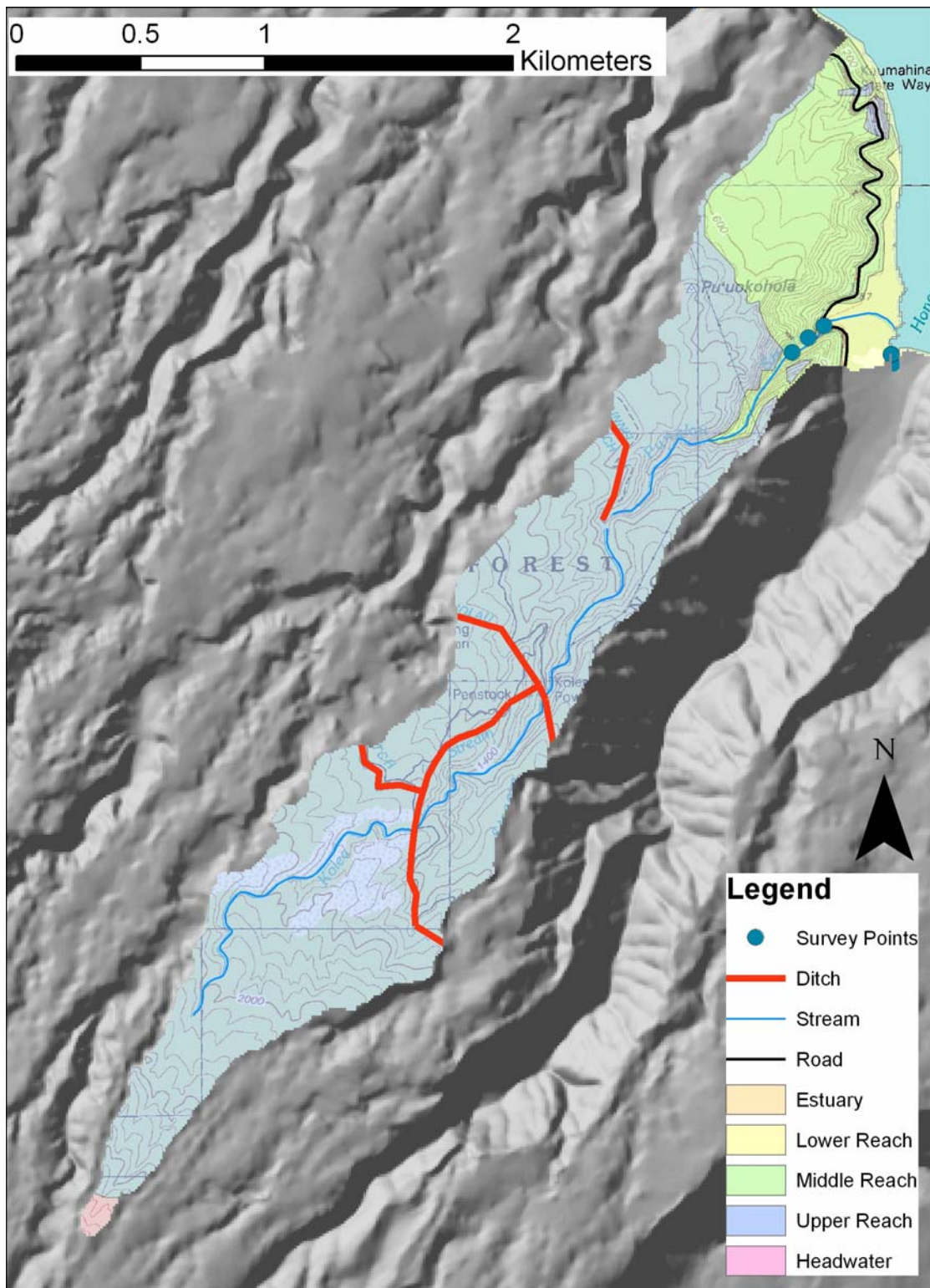


Figure 3-1. Locations of point quadrat surveys conducted in Punalau Stream.

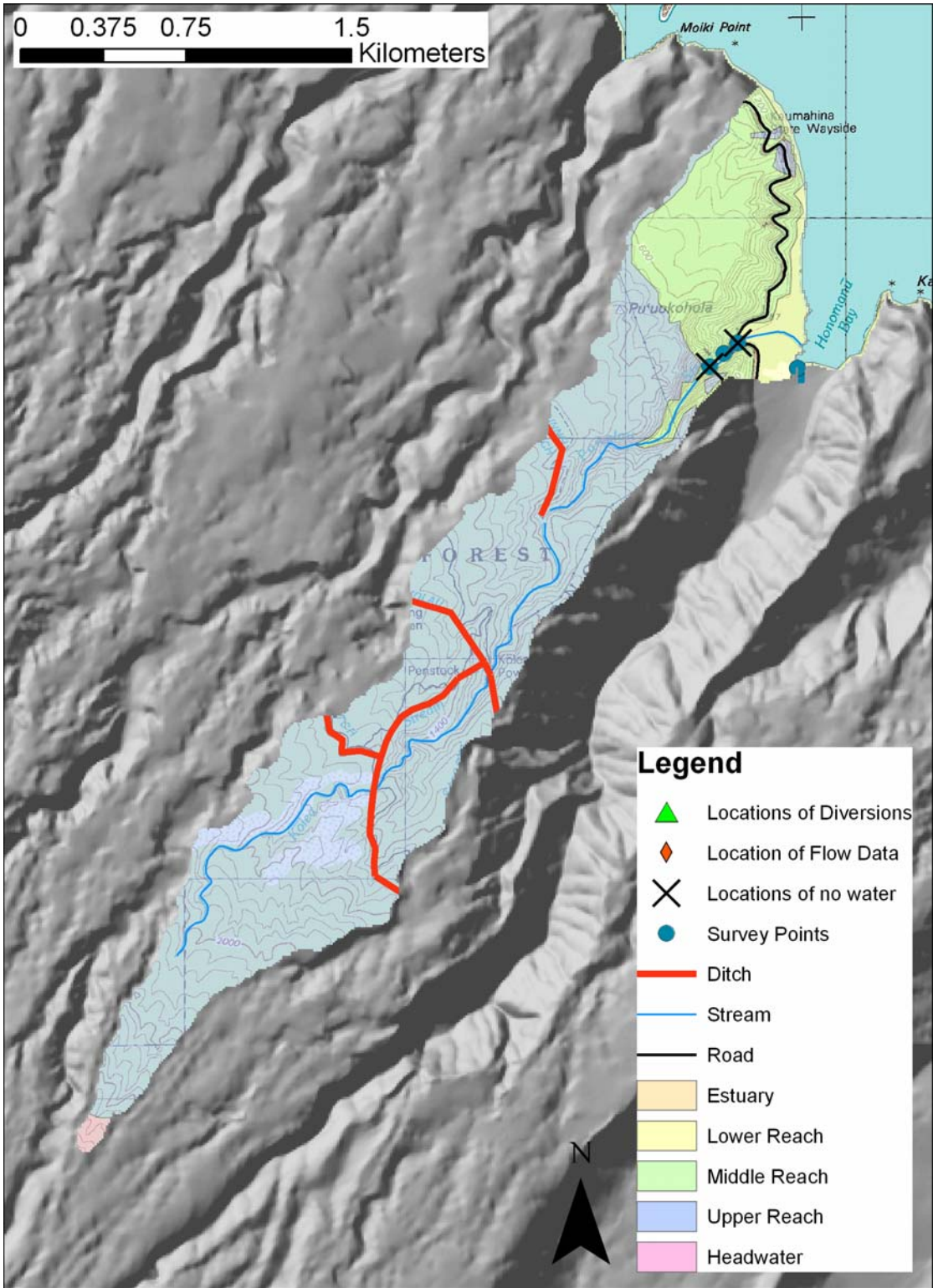


Figure 3-2. Locations of diversion, flow data and no flow conditions found in Punalau Stream.

Lower and Middle Reach

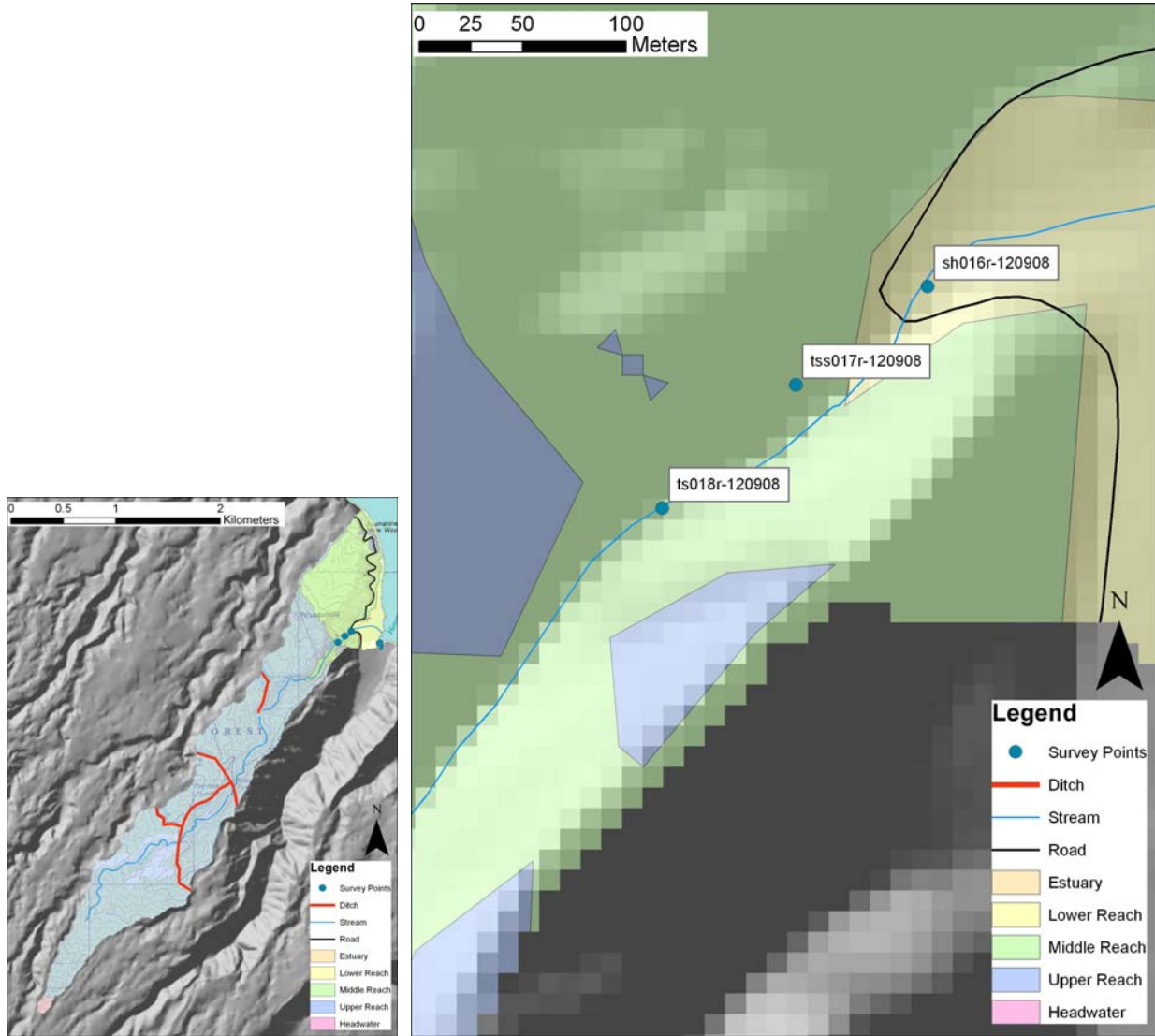


Figure 3-3. Point quadrat survey locations in the lower and middle reach of Punalau Stream.

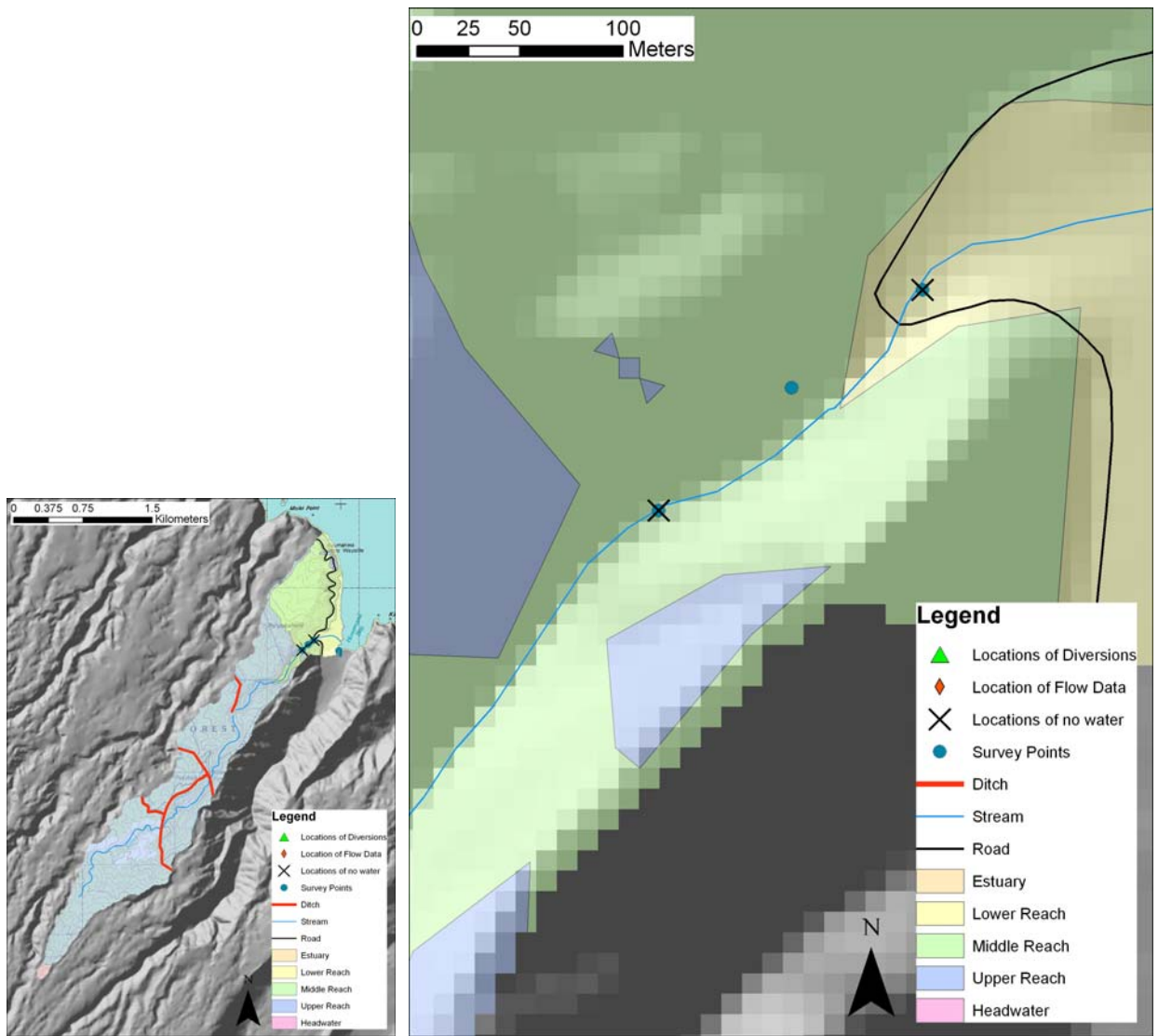


Figure 3-4. Locations of surveys with no water conditions, diversions and flow measurements in the lower and middle reach of Punalau Stream.

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Section 4: Photographs taken during stream surveys

Aerial Photographs



Figure 4-1. Photo shows Honomanū Bay and stream. Arrow depicts where Punalau Stream should be flowing into the bay. (6/28/2009; Tributary name: (64009003); PBN: sh64009003p-022-062809; Photo by: Hau, S.

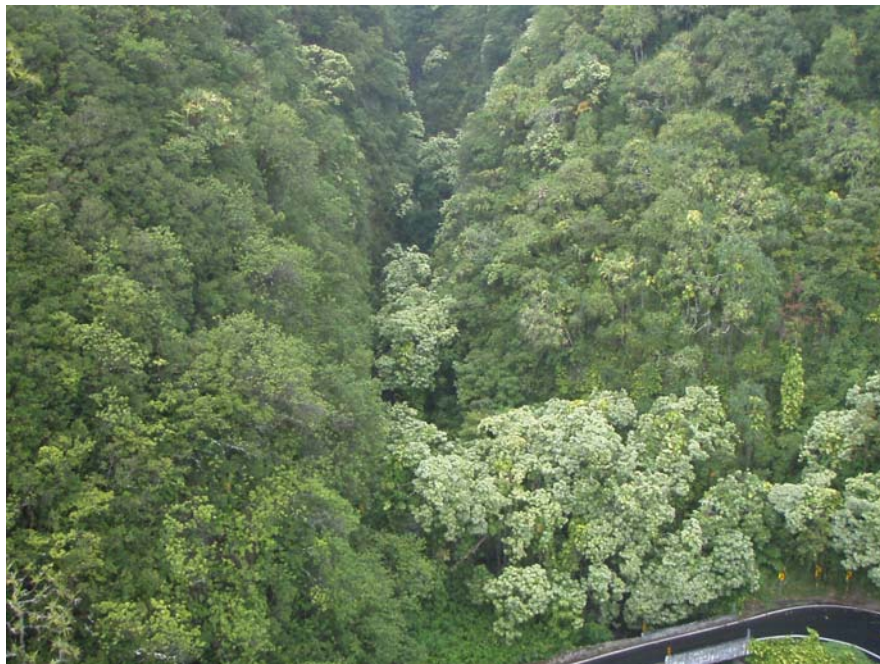


Figure 4-2. Aerial photo of the intersection between Punalau Steam and Hāna Highway. Stream bed is dry. (6/28/2009; Tributary name: Punalau (64008001); PBN: tss64008001p-000-062809; Photo by: Sakihara, T.



Figure 4-3. Aerial photo of diversion in Punalau Stream. (6/28/2009; Tributary name: Punalau (64008001); PBN: tss64008001p-012-062809; Photo by: Sakihara, T.

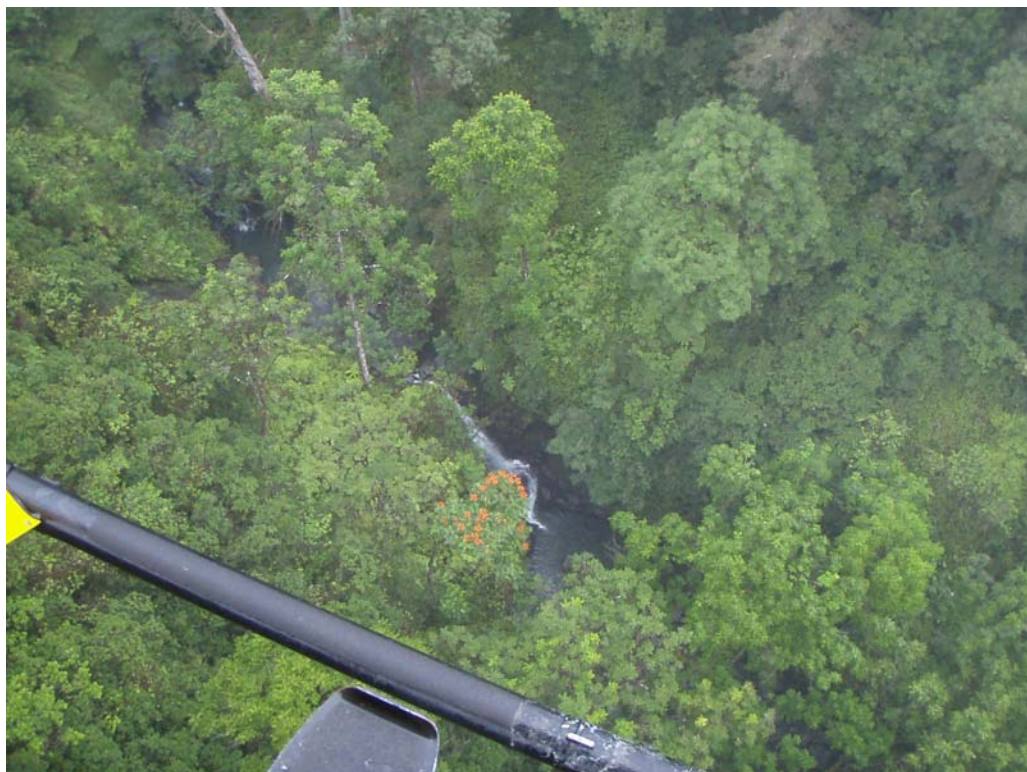


Figure 4-4. Aerial photo of flowing water above diversions in Punalau Stream. (6/28/2009; Tributary name: Punalau (64008001); PBN: tss64008001p-013-062809; Photo by: Sakihara, T.

Lower and Middle Reach Photographs

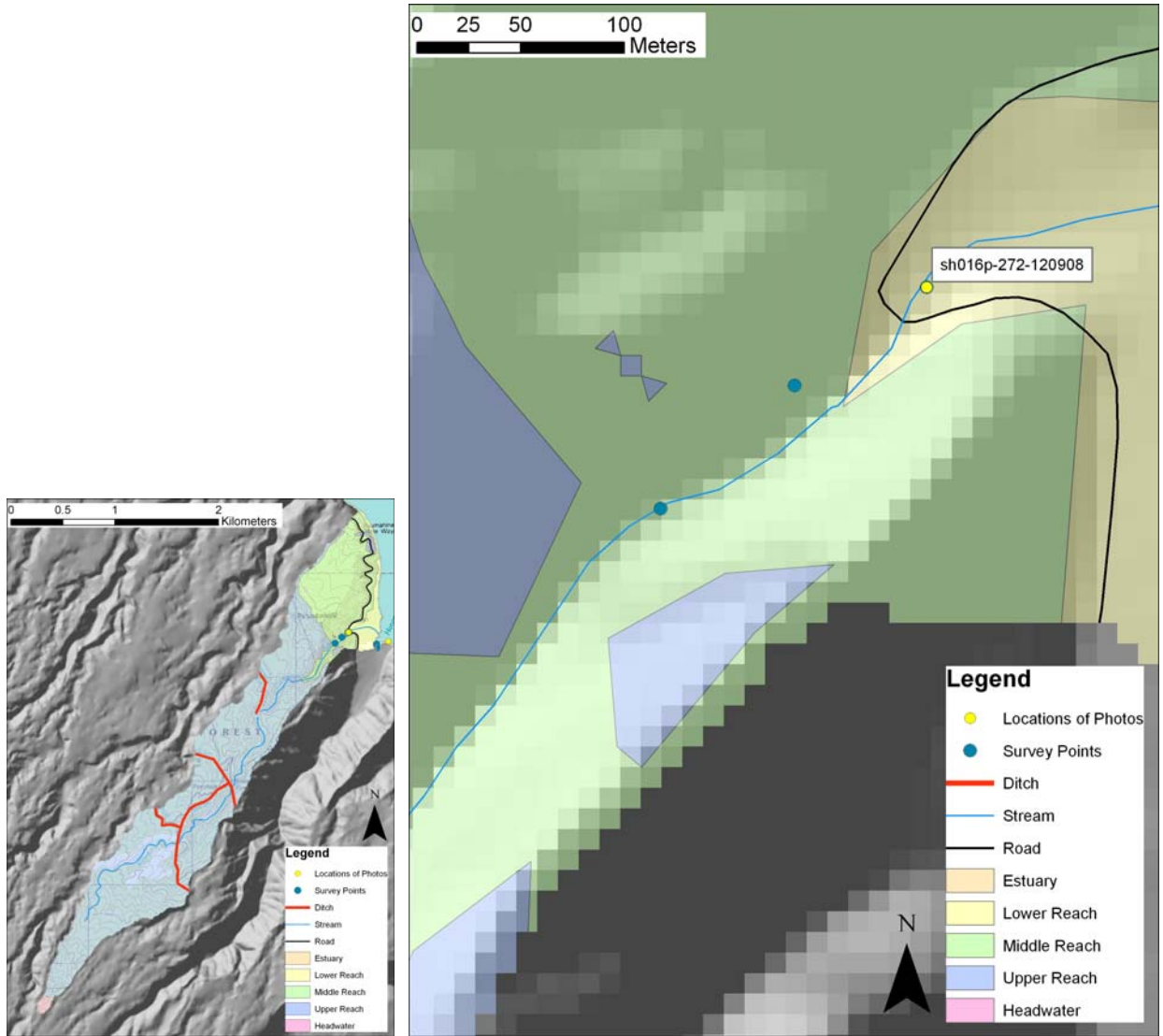


Figure 4-5. Photo locations in the lower and middle reaches of Punalau Stream.



Figure 4-6. Photo shows a dry stream bed under Hāna Highway Bridge downstream from survey site 16. (12/9/2008; Tributary name: Punalau (64008001); PBN: sh016p-272-120908; Surveyor: Hau, S.; Habitat type: No Water; SBN: sh016r-120908; Lat. (DD): 20.86171, Long. (DD): -156.16972).

References

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Appendix: Survey Sites Latitude and Longitude

Tributary	Stream	Survey Book #	Site	Surveyor	Date	Latitude	Longitude
64008001	Punalau	sh016r-120908	16	Hau, Skippy	12/9/2008	20.86171	-156.16972
64008001	Punalau	tss017r-120908	17	Shindo, Tim	12/9/2008	20.86129	-156.17034
64008001	Punalau	ts018r-120908	18	Shimoda, Troy	12/9/2008	20.86076	-156.17097
64008001	Punalau	sh019n-120908	19	Hau, Skippy	12/9/2008	20.86039	-156.17743
64008001	Punalau	sh019x-120908	19	Hau, Skippy	12/9/2008	20.86039	-156.17743

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