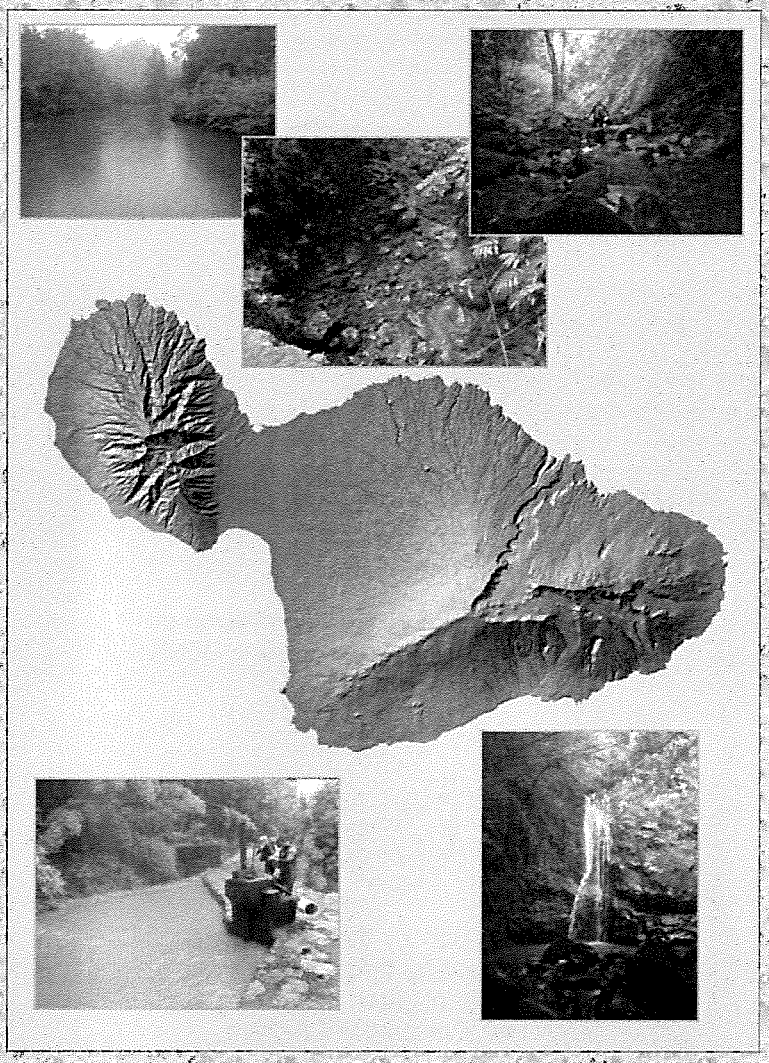
Report on Kōlea Stream
Maui, Hawaii



August 2009

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

and

Bishop Museum

0546

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

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Report on Kōlea 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
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Table of Contents

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 Kōlea 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 Kōlea Stream while also providing substantial evidence to support the conclusions presented.

Findings for Kōlea Stream, Maui

Kōlea is a very small (0.6 sq miles). It is mostly zoned for conservation (74%) and has some agriculture (26%). The land cover is mostly evergreen forest (70%), grassland (23%), scrub (4%) and bare land (1%). Kōlea Stream has only been surveyed by DAR staff in 2009. This

watershed rates low, 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 5 out of 10, a total biological rating of 3 out of 10, and a combined overall rating of 4 out of 10.

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

Insect – Anisoptera sp.

Discussion

Kōlea watershed is small and steep in the lower reach with a terminal waterfall entering the ocean. No diversions or tributaries are present in the lower reach or middle reach below Hāna Highway. A steep gradient continues from the middle to upper reach.

Surveys were not conducted at the stream mouth or lower reach due to inaccessibility by truck or helicopter. Kōlea Stream was accessed from Hāna Highway in the middle reach where point quadrat surveys were conducted in the middle to upper reaches. Two flow measurements were conducted, one in the middle reach and one in the upper reach below Kōlea Reservoir. Point quadrat surveys started from Hāna Highway until a waterfall with little flow was reached. Surveys continued above the waterfall, which was accessed via Jeep trails above Hāna Highway. One diversion was recorded above the waterfall in the upper reach, which diverted most of the water from Kōlea Stream into Kōlea Reservoir. Water flowing downstream below the diversion was likely surface run-off from rainy conditions during surveys. Point quadrat surveys were aborted due to rising stream levels and heavy rains.

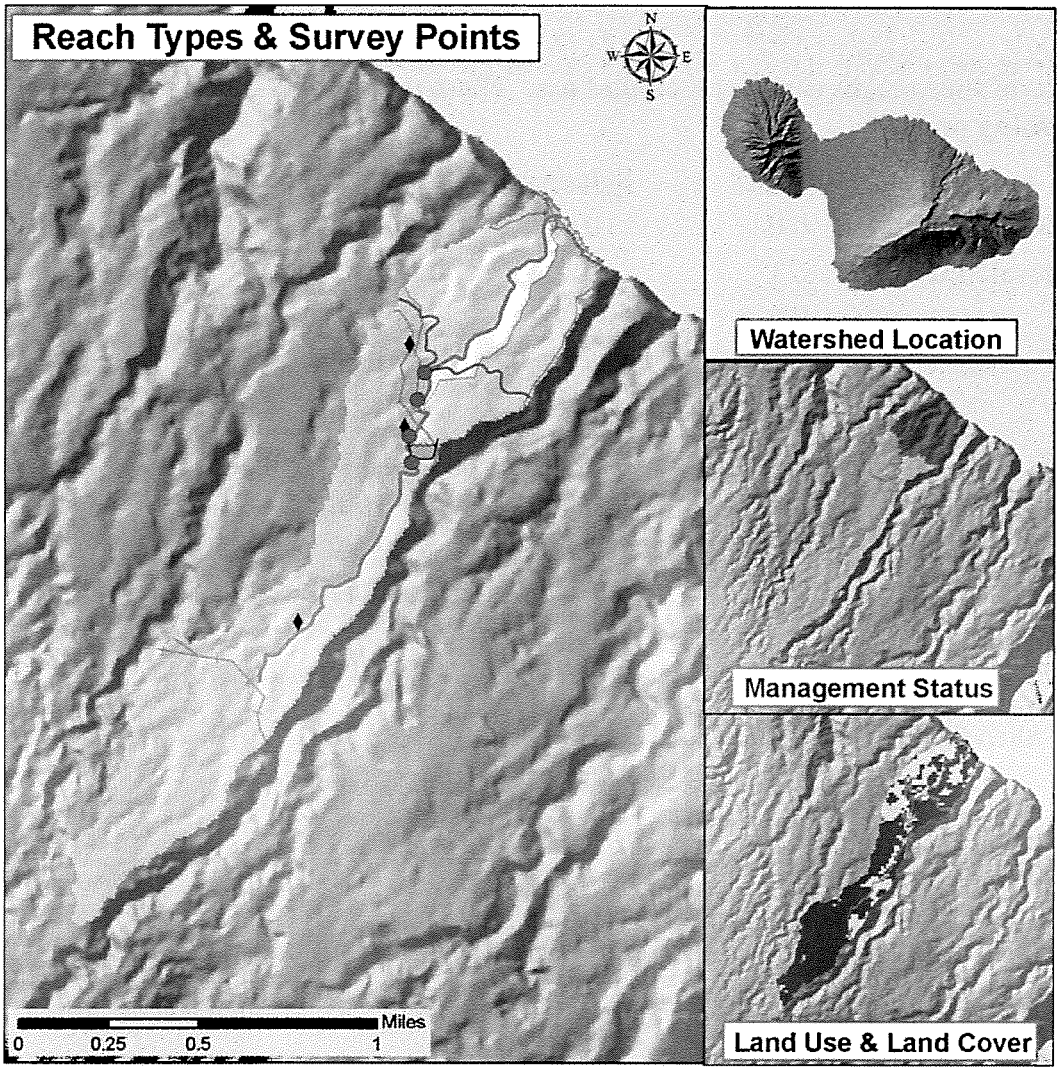
Kōlea Stream did not have water depths or flow that would provide suitable habitat for native stream animals. Only one Anisoptera species was observed at site 4 below the reservoir. No other stream animals, native or non-native, were observed during our point quadrat surveys.

Kōlea Stream is one of the smaller streams, but nonetheless has a large amount of potential habitat in the middle and upper reach for *Lentipes concolor* and a moderate amount for *Awaous guamensis*, *Atyoida bisulcata* and *Neritina granosa*. Restoration of flow to increase animal passage between diversions would greatly improve the productivity of the stream and increase the availability of potential habitat to native species.

Section 2: Watershed Atlas

DAR Watershed Code: 64003

Kōlea, Maui



Watershed Features

Kōlea watershed occurs on the island of Maui. The Hawaiian meaning of the name is unknown. The area of the watershed is 0.6 square mi (1.6 square km), with maximum elevation of 1864 ft (568 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: 26.1% agricultural, 73.9% 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.

Military	Federal	State	OHA	County	Nature Conservancy	Other Private
0.0	0.0	72.8	0.0	0.0	0.0	27.2

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

Permanent Biodiversity Protection	Managed for Multiple Uses	Protected but Unmanaged	Unprotected
0.0	72.8	0.0	27.2

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

	Percent	Square mi	Square km
High Intensity Developed	0.0	0.00	0.00
Low Intensity Developed	0.1	0.00	0.00
Cultivated	0.0	0.00	0.00
Grassland	23.0	0.14	0.36
Scrub/Shrub	4.4	0.03	0.07
Evergreen Forest	70.5	0.43	1.11
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	1.3	0.01	0.02
Unconsolidated Shoreline	0.3	0.00	0.00
Water	0.5	0.00	0.01
Unclassified	0.0	0.00	0.00

Stream Features

Kōlea is a perennial stream. Total stream length is 1.8 mi (2.9 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.

Estuary	Lower	Middle	Upper	Headwaters
0.1	0.9	43.5	55.5	0.0

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

Biotic Sampling Effort

Biotic samples were gathered in the following year(s):
2009

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

Survey type	Estuary	Lower	Middle	Upper	Headwaters
DAR Point Quadrat	0	0	2	2	0

Biota Information

Native Species

Insects Anisoptera sp.

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

Scientific Name	Status	Estuary	Lower	Middle	Upper	Headwaters
Anisoptera sp.	Unknown				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 > 19 spp.	Native Macrofauna Diversity > 5 spp.	Absence of Priority 1 Introduced
No	No	Yes
Abundance of Any Native Species	**Presence of Candidate Endangered Species**	**Endangered Newcomb's Snail Habitat**
No	No	No

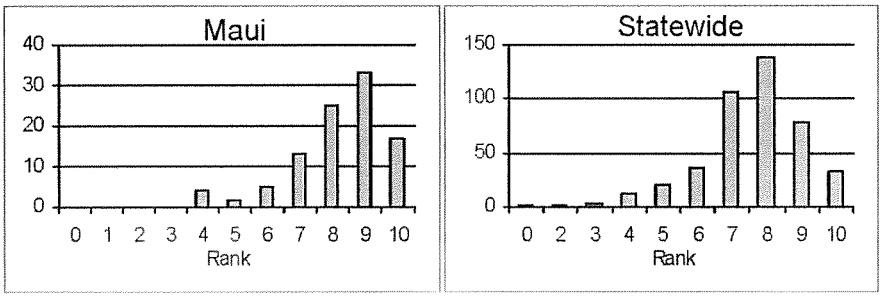
CURRENT WATERSHED AND STREAM RATINGS

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: Kōlea, Maui

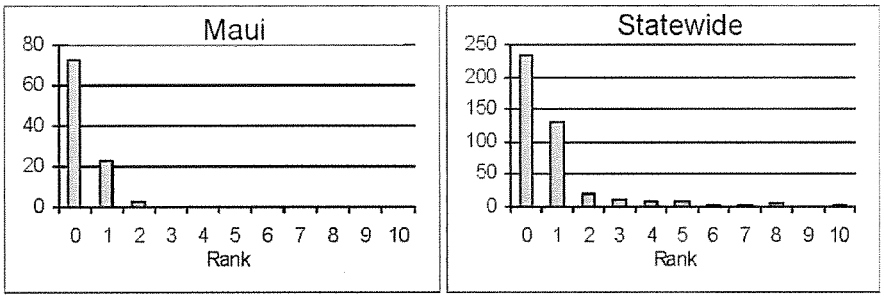
Land Cover Rating: Rating is based on a scoring sytem where in general forested lands score positively and developed lands score negatively.

Watershed Rating
9



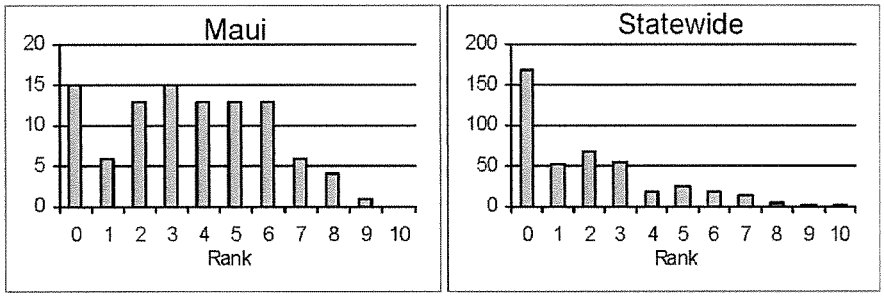
Shallow Waters Rating: Rating is based on a combination of the extent of estuarine and shallow marine areas associated with the watershed and stream.

Watershed Rating
0



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

Watershed Rating
5

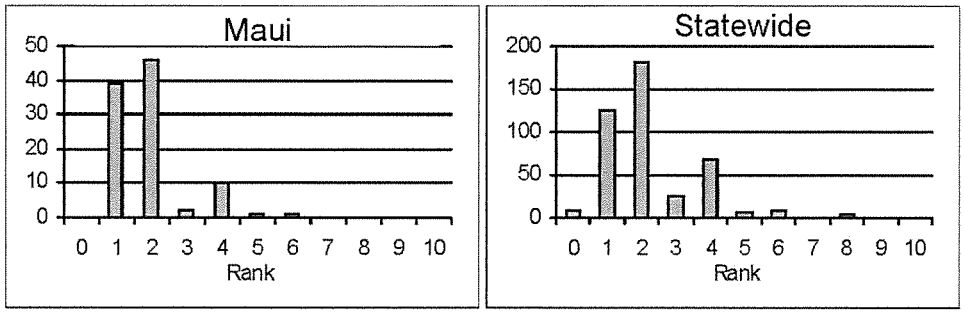


WATERSHED RATING (Cont): Kōlea, Maui

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

Watershed Rating

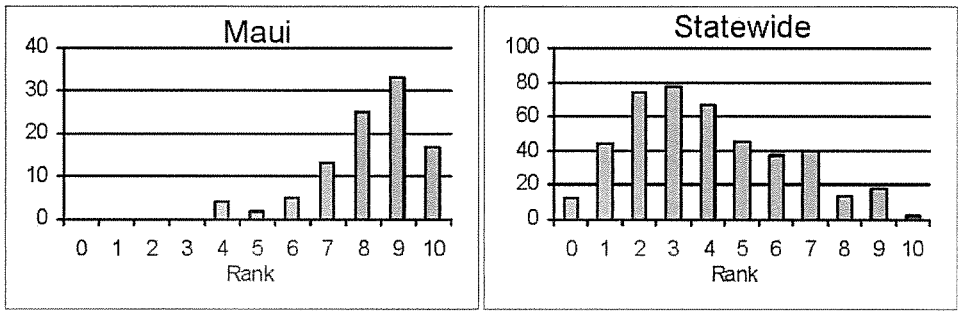
1



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

Watershed Rating

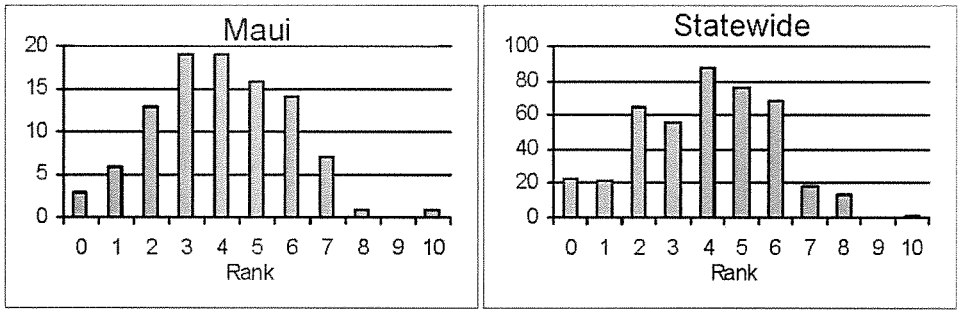
6



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

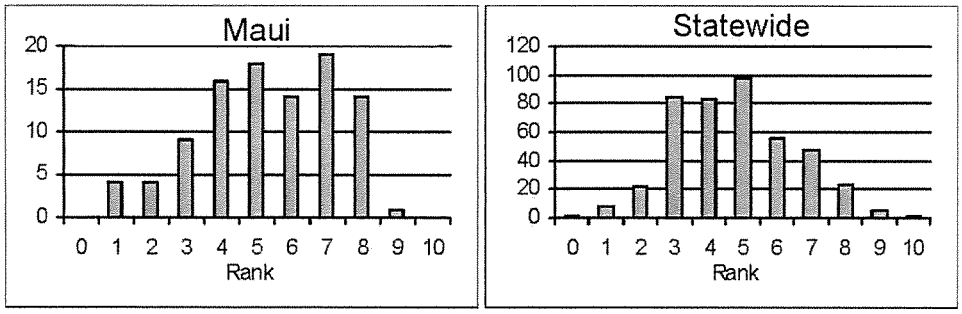
2



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

5

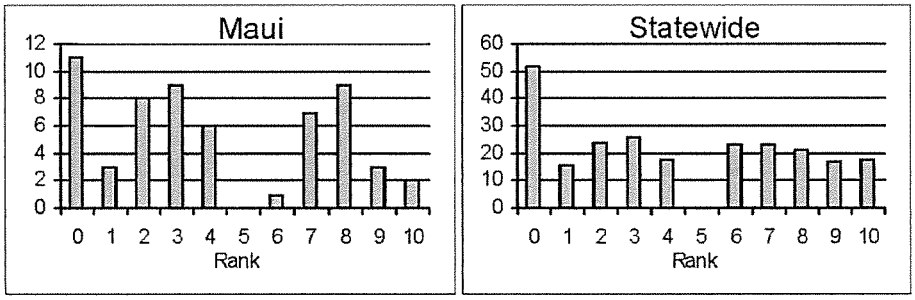


BIOLOGICAL RATING: Kōlea, Maui

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

Stream Rating

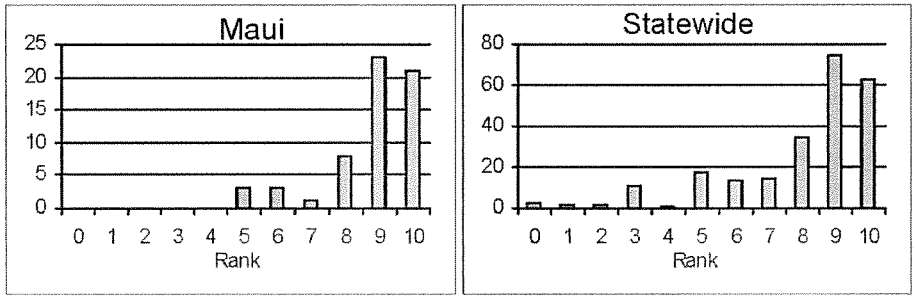
NR



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

Stream Rating

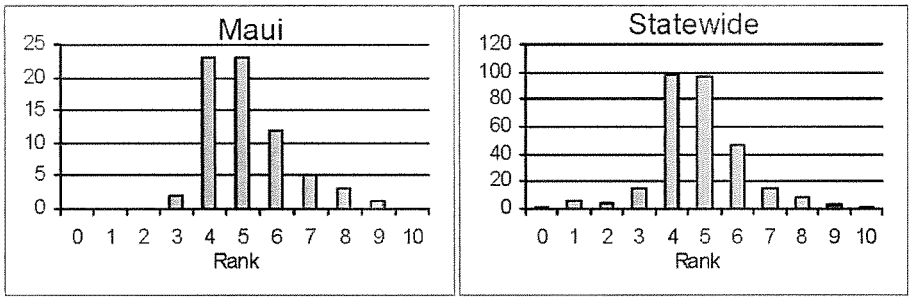
NR



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

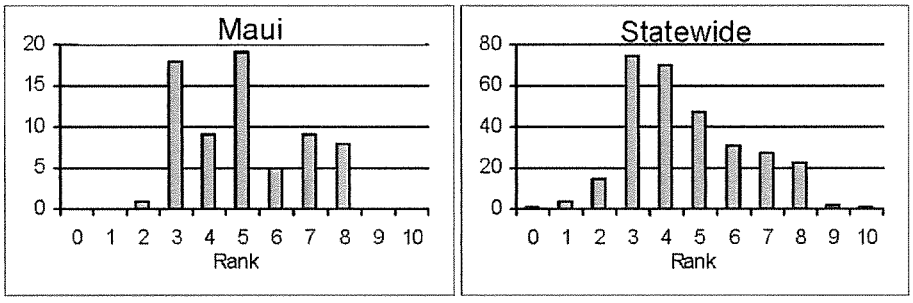
4



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

Stream Rating

3

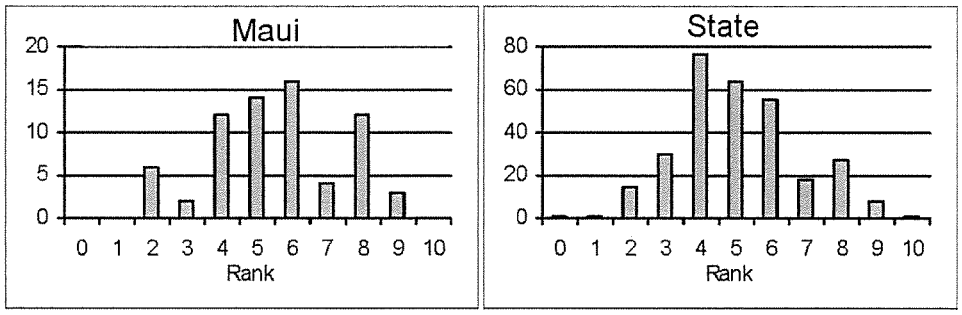


OVERALL RATING: Kōlea, Maui

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

Watershed Rating

4

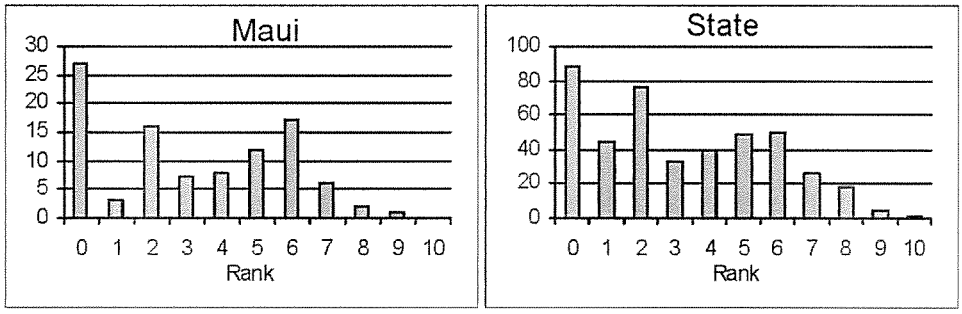


RATING STRENGTH: Kōlea, Maui

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

2



REFERENCES

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 Kōlea Stream, Maui

For Surveys from 3/12/2009 to 3/12/2009

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 (° 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:

Kōlea (ID: 64003), Ke'anae, Maui

Surveys were conducted by these personnel:

Hau, Skippy
Kuamo'o, Darrell
Sakihara, Troy

Results

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

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

Middle Reach

Table 3-2. 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	1	0	1	0	0	0	0	0	0

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

Reach	Detritus	Sediment	Sand	Gravel	Cobble	Boulder	Bedrock
Middle	5	0	0	0	30	65	0

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

Reach	Temp (° C)	sCond (mS/cm)	DO (mg/L)	pH
Middle	18.09	0.074	8.31	7.515

Upper Reach

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

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

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

Reach	Detritus	Sediment	Sand	Gravel	Cobble	Boulder	Bedrock
Upper	0	0	0	0	0	30	70

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

Reach	Temp (° C)	sCond (mS/cm)	DO (mg/L)	pH
Upper	17.975	0.054	48.11	7.385

Table 3-8. Summary of species observed in the upper reach of the watershed.

Category	Status	*Scientific Name*
Insect	Unknown	Anisoptera sp.

Table 3-9. Flow data taken during point quadrat surveys in the middle and upper reaches.

Reach	Latitude	Longitude	Total CFS	MGD
Middle	20.87535	-156.18936	0.39	0.25
Upper	20.87175	-156.18997	6.96	4.5

Table 3-10. Locations of the diversions found within the upper reach and their corresponding tributary.

Latitude	Longitude	Tributary
20.87282	-156.19005	64003001
20.87175	-156.18997	64003001

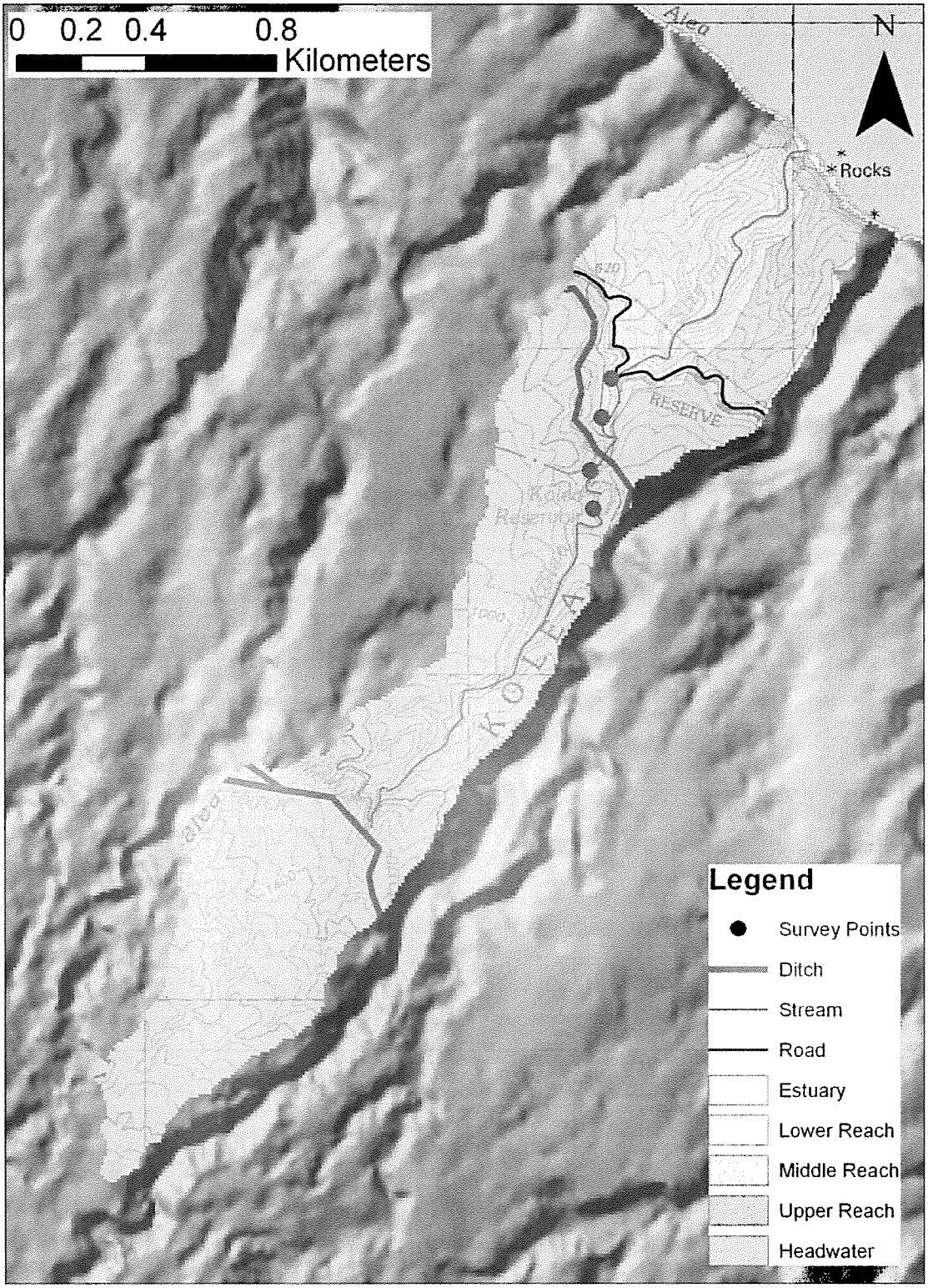


Figure 3-1. Point quadrat surveys conducted in Kōlea Stream.

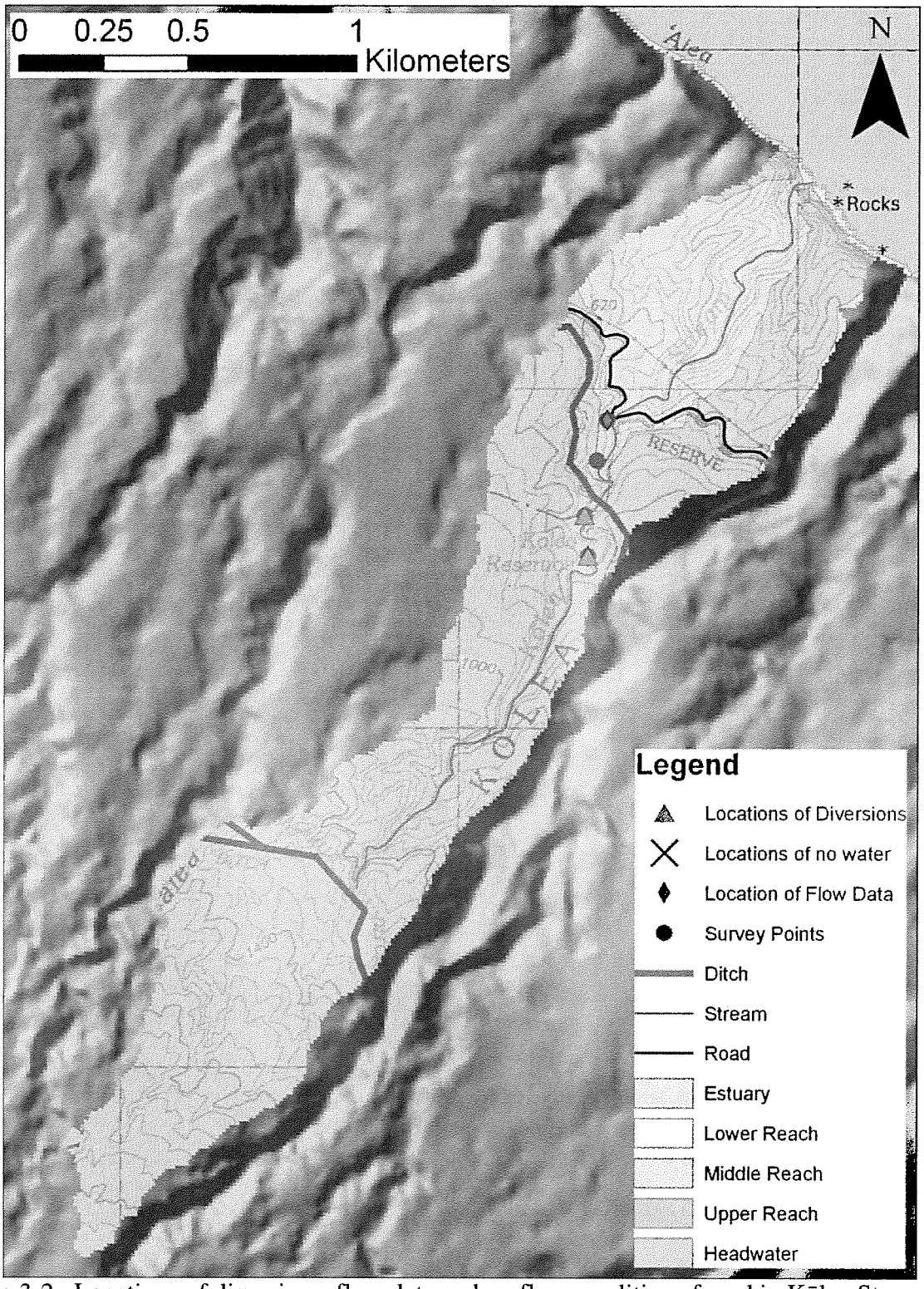


Figure 3-2. Locations of diversions, flow data and no flow conditions found in Kōlea Stream.

Middle Reach

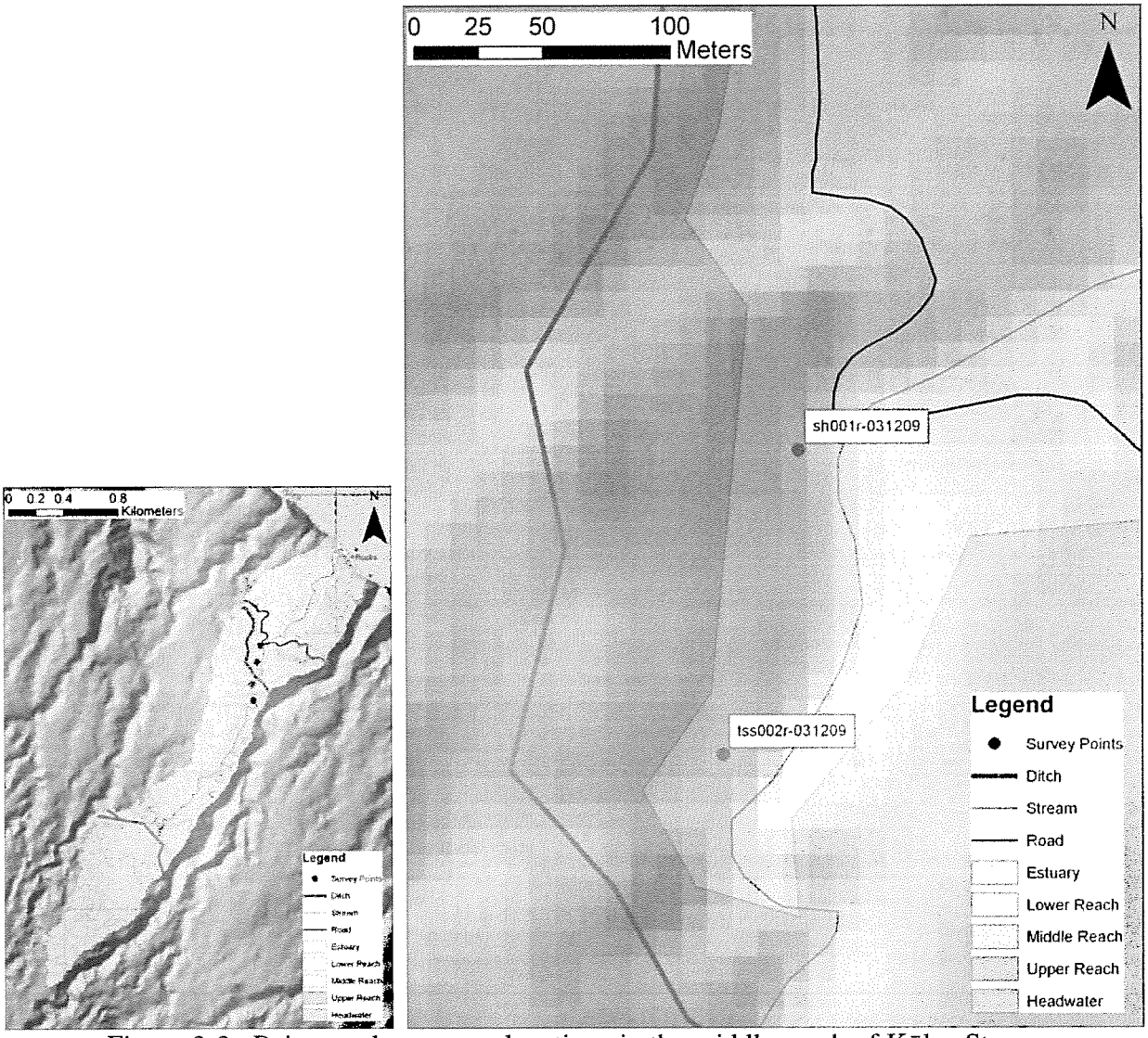


Figure 3-3. Point quadrat survey locations in the middle reach of Kōlea Stream.

Upper Reach

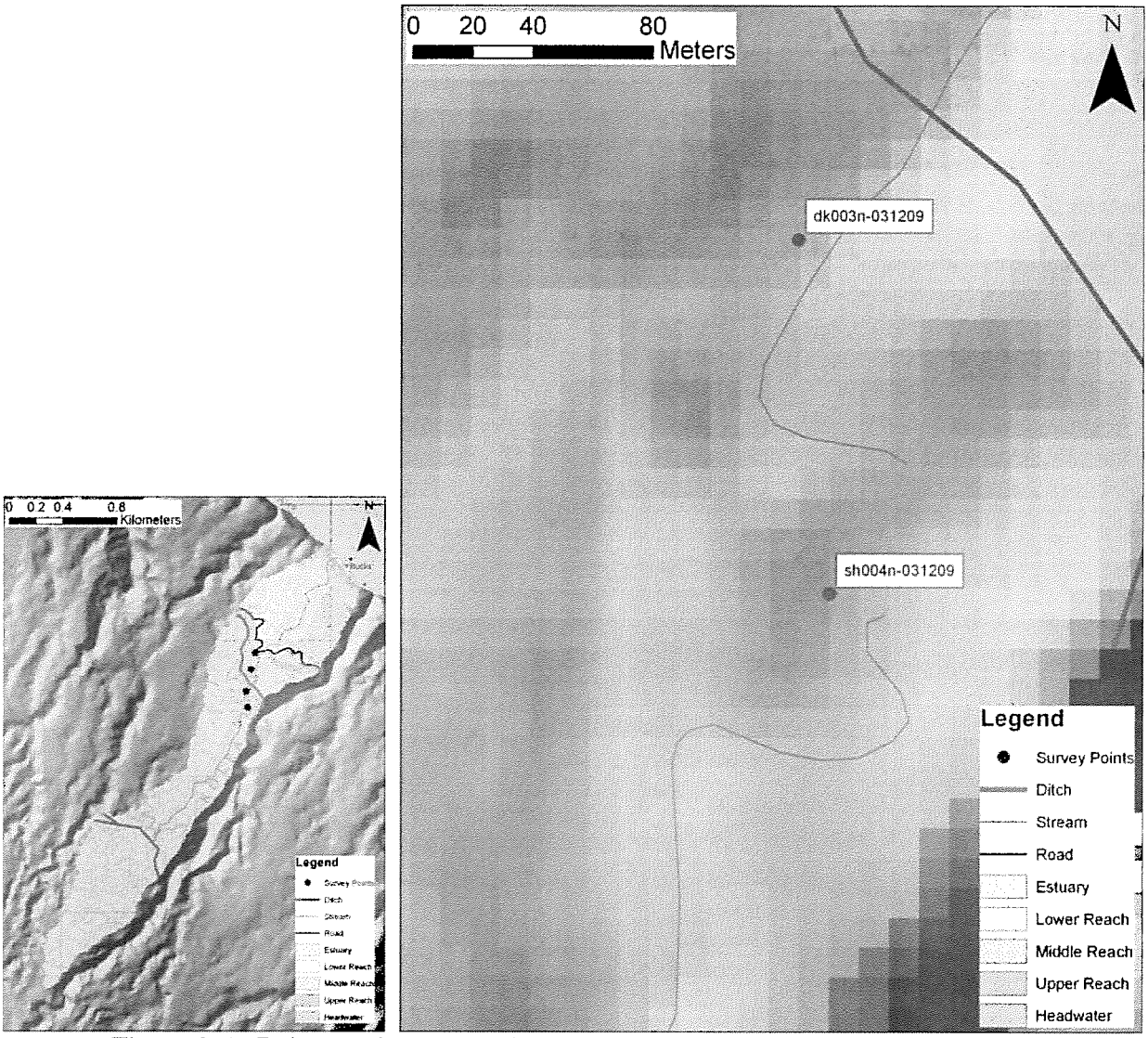


Figure 3-4. Point quadrat survey locations in the upper reach of Kōlea Stream.

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Section 4: Photographs Taken During Stream Surveys

Middle Reach

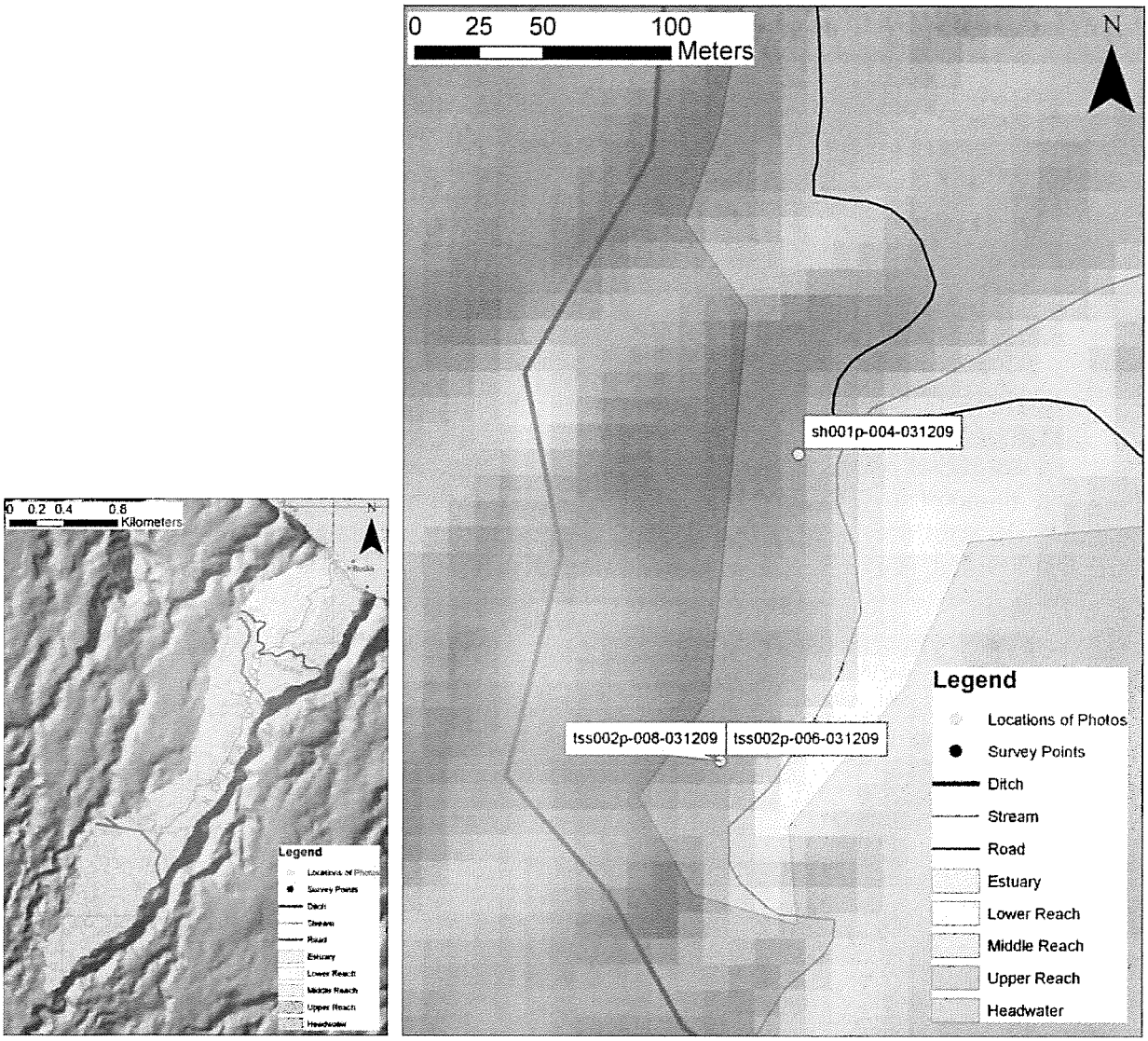

Figure 4-1. Photo locations in the middle reach of Kōlea Stream.

Figure 4-2. Photo of survey site 1. Water was extremely shallow. (3/12/2009; Tributary name: Kōlea (64003001); PBN: sh001p-004-031209; Surveyor: Hau, S.; Habitat type: Riffle; SBN: sh001r-031209; Lat. (DD): 20.87535, Long. (DD): -156.18936).

Figure 4-3. DAR staff surveying at site 2. (3/12/2009; Tributary name: Kōlea (64003001); PBN: tss002p-008-031209; Surveyor: Sakihara, T.; Habitat type: Plunge Pool; SBN: tss002r-031209; Lat. (DD): 20.87428, Long. (DD): -156.18967).

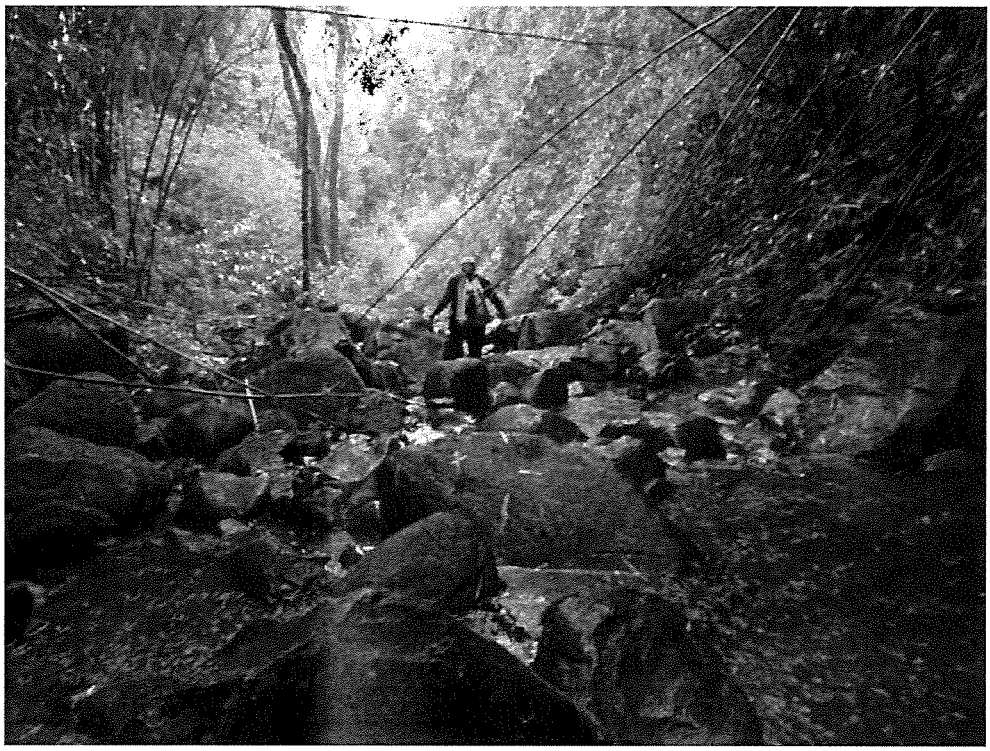

Figure 4-4. Photo is taken downstream from survey site 2. (3/12/2009; Tributary name: Kōlea (64003001); PBN: tss002p-006-031209; Surveyor: Sakihara, T.; Habitat type: Plunge Pool; SBN: tss002r-031209; Lat. (DD): 20.87428, Long. (DD): -156.18967).

Upper Reach

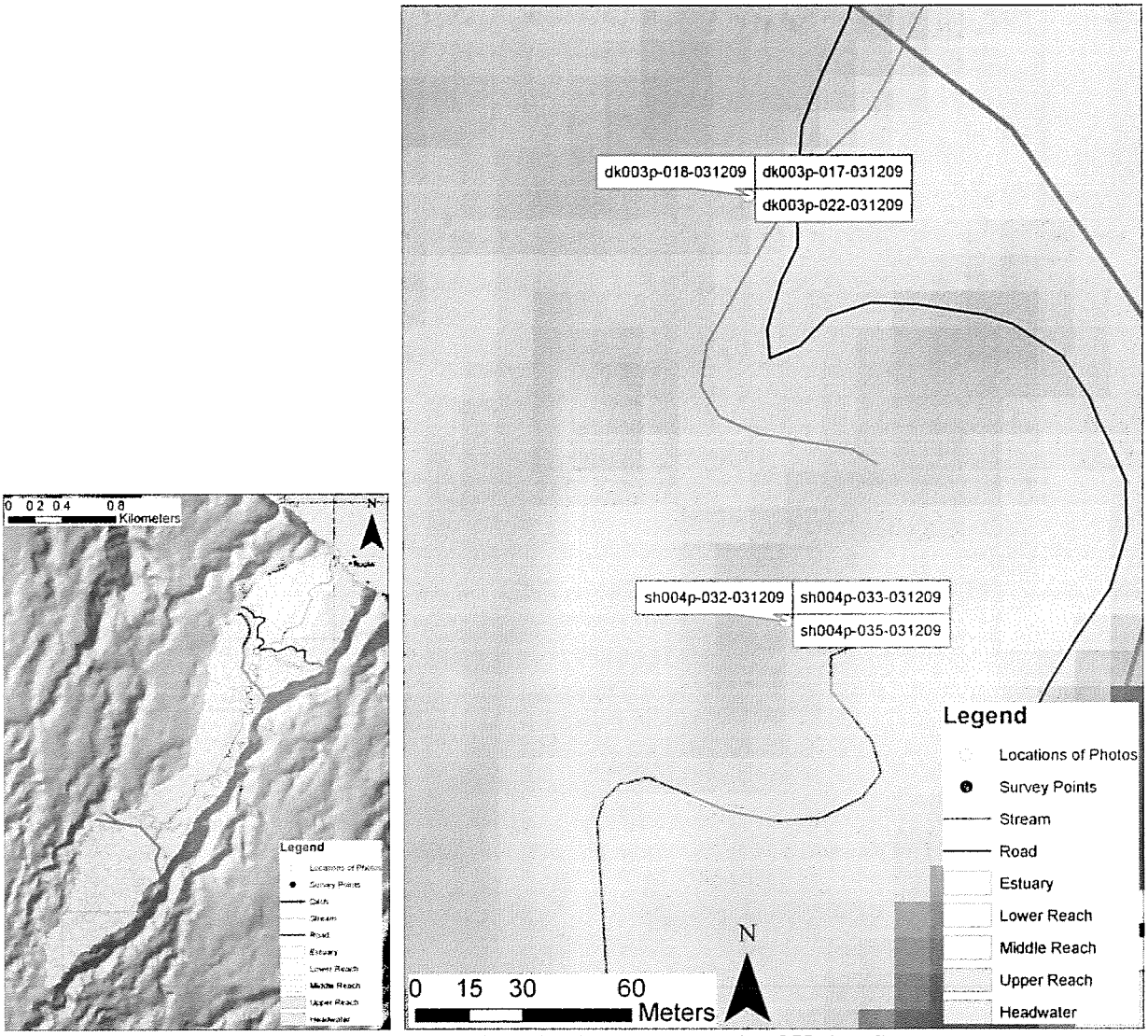

Figure 4-5. Photo locations in the upper reach of Kōlea Stream.

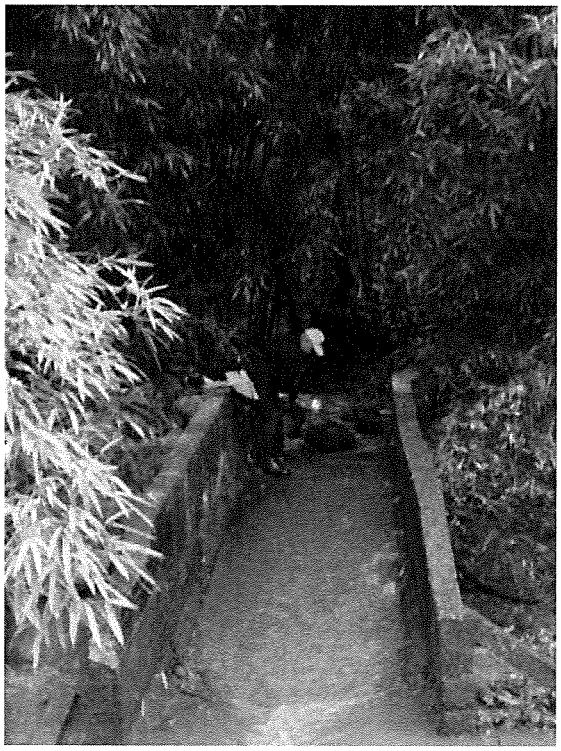

Figure 4-6. DAR staff conducting a survey where the stream is diverted into the ditch system. Photo is taken in an upstream direction. (3/12/2009; Tributary name: Kōlea (64003001); PBN: dk003p-022-031209; Surveyor: Kuamo'o, D.; SBN: dk003n-031209; Lat. (DD): 20.87282, Long. (DD): -156.19005).

Figure 4-7. Photo shows below the diversion and is taken across the stream. Note there is only a trickle flowing from the gate. (3/12/2009; Tributary name: Kōlea (64003001); PBN: dk003p-017-031209; Surveyor: Kuamo'o, D.; SBN: dk003n-031209; Lat. (DD): 20.87282, Long. (DD): -156.19005).

Figure 4-8. Image shows the stream below the diversion. Photo is oriented downstream. (3/12/2009; Tributary name: Kōlea (64003001); PBN: dk003p-018-031209; Surveyor: Kuamo'o, D.; SBN: dk003n-031209; Lat. (DD): 20.87282, Long. (DD): -156.19005).

Figure 4-9. DAR staff measuring flow at the survey site 4. Photo is taken downstream. (3/12/2009; Tributary name: Kōlea (64003001); PBN: sh004p-033-031209; Surveyor: Hau, S.; Habitat type: Run; SBN: sh004n-031209; Lat. (DD): 20.87175, Long. (DD): -156.18997).

Figure 4-10. Photo shows water from the reservoir flowing into the ditch. (3/12/2009; Tributary name: Kōlea (64003001); PBN: sh004p-032-031209; Photo by: Hau, S.; SBN: sh004d-031208; Lat. (DD): 20.87175, Long. (DD): -156.18997).

Figure 4-11. Photo of Kōlea reservoir. (3/12/2009; Tributary name: Kōlea (64003001); PBN: sh004p-035-031209; Photo by: Hau, S.; SBN: sh004d-031208; Lat. (DD): 20.87175, Long. (DD): -156.18997).

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Appendix: Survey Sites Latitude and Longitude

Tributary	Stream	Survey Book #	Site	Surveyor	Date	Latitude	Longitude
64003001	Kōlea	sh001r-031209	1	Hau, Skippy	3/12/2009	20.87535	-156.18936
64003001	Kōlea	tss002r-031209	2	Sakihara, Troy	3/12/2009	20.87428	-156.18967
64003001	Kōlea	dk003n-031209	3	Kuamo'o, Darrell	3/12/2009	20.87282	-156.19005
64003001	Kōlea	sh004n-031209	4	Hau, Skippy	3/12/2009	20.87175	-156.18997