

# Nā Wai 'Ekolu: Stream outreach education and bioassessment in the Ala Wai Watershed

'Iolani School and University of Hawai'i at Mānoa CCRT

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As a stream outreach and restoration project, to educate the public about Hawai'i's native unique freshwater species and the effect of human influence on their populations, a collaborative effort was established between the University of Hawai'i at Mānoa Center for Conservation Research and Training (UH-CCRT) and 'Iolani School. Together, classroom curriculum and field protocols were developed for use in K-12 public and private schools in the Honolulu area, emphasizing environmental awareness through four sequential freshwater stream and watershed lessons (Figure 1).

Lesson 1 begins with a classroom lecture that introduces participants to native / non – native stream animals and how they are indicators of stream health. Participants are then able to view live native / non-native animals from their watershed, as well as engage in hands-on activities. The entire lesson ranges between 30 to 60 minutes, and depends on the age of participants or the length of time allotted for a class period (Figure 1).

STAGE 1 - DESIRED RESULTS	
Unit Title: Investigating the health of the stream through freshwater biodiversity	
Established Goals:	
<p><b>Understandings:</b> Students will understand that...</p> <ul style="list-style-type: none"> <li>An index is used to assess a combination of physical, chemical, and biological factors that contribute to overall ecosystem health</li> <li>Scientific measurements are taken with consistent and repeatable protocols. These measurements can then be used to compare different locations, allowing scientists to assess differences over space and time.</li> </ul>	<p><b>Essential Questions:</b></p> <ul style="list-style-type: none"> <li>How healthy is this stream ecosystem?                             <ul style="list-style-type: none"> <li>Which streams in the watershed are healthiest?</li> </ul> </li> <li>How can data be interpreted to draw different conclusions?</li> </ul>
<p><b>Students will know:</b></p> <ul style="list-style-type: none"> <li>Hawai'i's native stream biodiversity consists of 5 species of freshwater gobies, 2 species of freshwater shrimp, and 2 species of freshwater snail.</li> <li>Native Hawaiian stream animals have an amphidromous life cycle in which they spend part of their lives in the ocean but live and breed in Hawai'i's streams.</li> <li>Non-native species are introduced into the ecosystem by humans and can have negative impacts on native species and the ecosystem.</li> <li>Organisms have species-specific habitat requirements concerning physical, chemical, and biological properties of their environment - this makes some animals indicators of ecosystem health.</li> <li>Stream health can</li> </ul>	<p><b>Students will be able to:</b></p> <ul style="list-style-type: none"> <li>Analyze data and draw conclusions based on scientific evidence</li> <li>Calculate the Hawaii Stream Index of Biological Integrity, assess the health of the stream and compare health across sites and over time.</li> </ul>

Figure 1. Four sequential lessons offered to K-12 public and private schools from UH-CCRT / 'Iolani partnership

For Lesson 2, students learn how to work together to capture stream fishes and macro-invertebrates in a standardized method. Since professional procedures are neither safe nor practical for K-12 students to perform, a modified pa'ēpa'ē procedure was adapted for student groups. After being assigned to specific teams, where various seines, A-framed nets ('Ōpae nets), and PVC pipes are used to herd and trap animals in a predetermined length of a modeled stream (Figure 1). Participants familiarize themselves with the appropriate field equipment for their team, as well as the roles of other teams, in preparation for field application. The lesson requires 30 - 45 minutes per class, but may require more time if multiple classes participate. After rehearsing their field methods, participants are taken to a nearby stream site for field application, as Lesson 3. The stream biodiversity survey requires at least 45

minutes per replicate, and performing the survey twice is strongly encouraged if time permits. Once captured, animals are identified to species, counted and measured. If the animal is native, they are released after being recorded / measured, but if invasive, the animal is removed from the site (Figures 1 and 2). Data from the activity is then used to score the stream site using the Hawaiian Stream Index of Biological Integrity (HS-IBI, [nawaiekolu.org/s/Kido-2012-Hawaiian-IBI.pdf](http://nawaiekolu.org/s/Kido-2012-Hawaiian-IBI.pdf)) and then stored in an online database maintained by UH-CCRT personnel ([nawaiekolu.org/stream-biodiversity-database-google-sheet](http://nawaiekolu.org/stream-biodiversity-database-google-sheet)).



Figure 2. Stream animal identification, counts, and removal of invasive species for composting

The field activity concludes with a summary about what animals are found and what they tell us about the health of the stream / habitat. After the activity, invasive species are euthanized with ice, and taken to Ho'oulu 'Āina (a nearby forest restoration, sustainability, and cultural education center, ([hoouluaina.com](http://hoouluaina.com))) to be used for composting (Figure 2 and 3). Lesson 4, a science curriculum that has been designed to fit the next generation science standards in four modules ([nawaiekolu.org/n-wai-ekolu-curriculum](http://nawaiekolu.org/n-wai-ekolu-curriculum)) and to be used in tandem with an Hawaiian Stream biodiversity ArcGIS story map ([nawaiekolu.org/arcgis-storymap-stream-animals](http://nawaiekolu.org/arcgis-storymap-stream-animals)):

*K-2: What's In a Number? Students explore and visualize numbers, deepening their number sense, more fully understanding their impact on stream health via invasive species removal.*

*3-5 Exploring the Possible! Long-term effects of invasive species removal and their contribution to the health of the watershed.*

*6-8 Find Your Soapbox! Analyze, interpret, and use data to support an argument.*

*9-12 Calculating a Biodiversity Index to Assess Stream Health.*

## SAFETY AND OTHER CONCERNS

As far as safety/health of students, no one is "required" to go into the stream. Leptospirosis is present in at least some amounts in almost all streams in Hawai'i. We can do our best to prevent anyone from becoming ill by not letting anyone into the stream that have open cuts. No one will be swimming, submerging the head, or intentionally getting wet above the knee. Students will be reminded to not splash excessively and horseplay is not acceptable in this activity. While in the water, they should not open their mouths unless absolutely necessary (for communication, etc.), to prevent water from splashing into it. If students choose to touch fish shown to them, they will be given antibacterial hand wipes and/or hand sanitizer. If parents do not want their children touching stream animals, please let the instructor know before the activity. In the event of any general first aid is needed, we will have first aid kits on hand. In the case of more serious injury, we will call 911 immediately. If weather forecast predicts heavy rain for the day of the field trip, and if real-time stream gages indicate problematic stream heights, the activity will be cancelled and/or postponed to a later date, when stream heights and weather are safer. Restrooms may not be nearby some of our study sites; teachers will remind students to use the bathroom before arriving on-site, and will also be responsible for escorting student participants to an appropriate location in the case of an emergency.

We do have limited felt-bottomed footwear (which grip wet rocks well) and other waterproof footwear for students that do not have any. If a student has their own felt-bottomed footwear, please bring them! An old pair of socks can also be used to cover rubber-soled shoes. Students can also participate in other parts of the activity that do not require getting wet, like counting fish or carrying nets.

Your instructor will inform you of the location of the field trip, listed on the map below:



Figure 3. Pa'ēpa'ē o Nā Wai 'EkoLu Study Sites in Mānoa, Pālolo, and Makiki; Ala Wai Watershed.