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KAHOOLAWE ISLAND RESERVE COMMISSION  
LAND  
STATE PARKS

Testimony of  
DAWN N. S. CHANG  
Chairperson

Before the House Committee on  
WATER & LAND

Thursday, February 9, 2023  
9:30 AM

State Capitol, Conference Room 430 & Videoconference

In consideration of  
HOUSE BILL 1405  
RELATING TO NATURAL RESOURCES

House Bill 1405 proposes that the Commission on Water Resource Management (Commission) and the Division of Aquatic Resources (DAR) of the Department of Land and Natural Resources (Department), in partnership with the University of Hawai'i (UH), shall conduct research on limu (seaweed) to understand the impacts of groundwater use on groundwater-dependent ecosystems. The measure also appropriates \$250,000 in general funds to the Department for the purposes of this bill. **The Department supports this measure, provided that its passage does not replace or adversely impact priorities indicated in the Executive Budget request, and offers the following comments and one amendment.**

Groundwater-dependent ecosystems (GDEs) rely on fresh water from springs and submarine groundwater discharge. Native species such as limu are particularly vulnerable to changes in discharge and are an important indicator of coastal ecosystem health. Limu holds cultural significance, not only as an important food source, but also for the continuation of Native Hawaiian traditional and customary practices. Unfortunately, as more water is pumped from aquifers and removed from streams, and there is less rainfall due to climate change, these ecosystems are impacted in ways that we are just beginning to understand.<sup>1</sup> The few studies we do have suggest that native limu thrive in brackish conditions and rely

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<sup>1</sup> Dulai, H., Smith, C.M., Amato, D.W., Gibson, V., Bremer, L.L. (2021), Risk to native marine macroalgae from land-use and climate change-related modifications to groundwater discharge in Hawai'i, *Limnol. Oceanogr. Lett.*, doi: 10.1002/lol2.10232

on freshwater input, whereas invasive macroalgae are less adapted to these conditions.<sup>2</sup> Recent studies by researchers at the University of Hawai‘i at Mānoa have identified the importance conserving the quality and quantity of groundwater flows to coastal regions to allow for the vitality of a native limu (limu palahalaha) over a non-native seaweed *Hypnea musciformis*.<sup>3</sup>

To better understand the impacts of water use, well development, pumping, and water quality on limu and GDEs, the Commission recommends building on prior studies by utilizing the \$250,000 in general funds for a pilot study that focuses on the south shore of Moloka‘i where native and invasive limu are part of the subsistence lifestyle of many on the island.<sup>4</sup> Building on the U.S. Geological Survey’s (USGS) report titled “SIR 2019-5150: Numerical Simulation of Groundwater Availability in Central Moloka‘i, Hawai‘i,” which quantifies the impacts of various scenarios of future groundwater pumping on nearshore water quality, the Commission and its partners will link changes in water quality to limu health and abundance. To do so, a collaborative partnership including the Commission, DAR, the Department of Health (DOH), and the University of Hawai‘i Water at Mānoa (Water Resources Research Center and The School of Life Sciences), will grow and physiologically characterize select native species of Moloka‘i limu under conditions ranging from healthy reef conditions to those impacted by changes in salinity due to increased pumping. These data combined with groundwater modeling results of various pumping scenarios will allow the research-practitioner team to gain insight into the sensitivity that limu have to changes in coastal waters such as changes in salinity, nutrients and temperature. This work will engage the Moloka‘i community of fishpond and limu practitioners in species choices as well as discussions of outcomes.

Such a study aligns with the State Water Code (Hawaii Revised Statutes Section 174C-31), which states the Commission must develop and update the Hawai‘i Water Plan in accordance with the Hawai‘i Water Plan Framework. This includes the completion of studies to inform the allocation of water resources and mitigate the effects of pumping, etc. on those resources and public trust uses.<sup>5</sup>

The Commission and Department of Health (DOH) have coordinated review of HB1405 and recommend amending Section 1. (a) of the bill to include DOH as a listed partner. DOH has primary jurisdiction and responsibility for the State’s water quality control programs. Historically, the Commission has deferred to DOH on most water quality related matters. However, as co-trustees of water there is an increasing need for the Commission and DOH to work in partnership rather than operating in silos. DOH can contribute valuable data on water quality and nutrient loads to the Moloka‘i pilot study. In addition, funding from the Clean Water State Revolving Fund (CWSRF), which is administered by DOH, could be tapped to assist with future implementation actions.

SECTION 1. (a) The commission on water resource management and division of aquatic resources of the department of land and natural resources, in partnership with the University of Hawai‘i and the Department of Health, shall conduct research on limu to understand the impacts of groundwater use on groundwater-dependent ecosystems.

Mahalo for the opportunity to provide testimony in support of this measure.

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<sup>2</sup> Amato, D.W., Smith, C.M., Duarte, T.K. (2018), Submarine groundwater discharge differentially modifies photosynthesis, growth, and morphology for two contrasting species of *Gracilaria* (Rhodophyta), *Hydrology*, 5, 65, doi: 10.3390/hydrology5040065

<sup>3</sup> Okuhata, B.K., Delevaux, J.M.S, Richards Dona, A., Smith, C.M., Gibson, V.L, Dulai, H., El-Kadi, A.I., Stamoulis, K., Burnett, K.M., Wada, C.A, & Bremer, L.L. In Review. Effects of multiple drivers of environmental change on native and invasive macralgae in nearshore groundwater dependent ecosystems. Submitted to *Water Resources Research*

<sup>4</sup> <https://scholarspace.manoa.hawaii.edu/server/api/core/bitstreams/e96d5318-ff46-4f66-bd5e-3758988877a0/content>

<sup>5</sup> Section 174C-101, HRS



**Testimony of  
the Water Resources Research Center  
University of Hawai'i at Mānoa (Director Dr. Thomas Giambelluca)**

**Supports HB 1405 Relating to Natural Resources  
House Committee on Water and Land  
Thursday, February 9, 2023, 9:30 AM,  
State Capitol, Room 430 & Videoconference**

House Bill 1405 proposes that the Commission on Water Resource Management (Commission) and the Division of Aquatic Resources (DAR) of the Department of Land and Natural Resources, in partnership with the University of Hawai'i, conduct research on limu (seaweed or macroalgae) to understand how groundwater dependent ecosystems are influenced by groundwater use and management. The bill also appropriates funds to the Department of Land and Natural Resources to support this research. **The University of Hawai'i at Mānoa, Water Resources Research Center, supports this measure, and has the interdisciplinary research capacity to carry out the proposed research in collaboration with the Commission and others.**

Nearshore ecosystems, anchialine pools, and fish ponds, are examples of important groundwater dependent ecosystems (GDEs) that rely on clean and ample flows of submarine groundwater discharge.<sup>1</sup> As important cultural and ecological resources, GDEs are protected under the public trust doctrine. Accordingly the Commission and others require information on how changes in groundwater use affect GDEs and their linked ecological, social, and cultural value. Native limu are excellent indicators of nearshore GDE health, have important nutritional value, and are critical for the perpetuation of Native Hawaiian traditional and customary practices. As such, understanding how changes in groundwater discharge (due to pumping, climate change, and other factors) influence native limu provides critical information for better understanding the tradeoffs between groundwater pumping and GDEs as a public trust resource. However, research on these linkages is scarce and requires interdisciplinary teams of researchers and practitioners committed to applied research in complex social-ecological systems.

Over the past several years, a Water Resources Research Center (WRRC)-funded project, including a team of interdisciplinary researchers from WRRC, the School of Life Sciences, the University of Hawai'i Economic Research Organization (UHERO), and the School of Earth Sciences has collaborated closely with the Commission to understand linkages between groundwater use GDE health in Kona, Hawai'i Island. Specifically, our team has analyzed how climate change and groundwater use and management influences the growth and distribution of a

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<sup>1</sup> Gibson, V.L., Bremer, L.L., Burnett, K.M., Keaka Lui, N., Smith, C.M. (2022), Biocultural values of groundwater dependent ecosystems in Kona, Hawai'i, *Ecology & Society*, 27(3):18, doi: 10.5751/ES-13432-270318

native limu (limu palahalaha; *Ulva fasciata*) and an invasive seaweed or macroalgae (*Hypnea musciformis*) that is not yet present in Kona, but has bloomed on Maui. Findings suggest that reductions in groundwater discharge to the coast likely reduce habitat for native limu, but improve suitability for the invasive *Hypnea*. These findings have important implications for policy decisions regarding groundwater, including the setting of sustainable yield estimates that truly protect public trust resources, including limu, in the face of change.<sup>2</sup>

Our research team is committed to continuing and expanding this work, particularly on Moloka‘i, which has been historically underserved by the University of Hawai‘i. Moloka‘i is also a priority area for the Commission to improve water resource management decisions to protect public trust resources, including limu which has particular importance in cultural and subsistence lifeways on Moloka‘i. We support the proposed plan to build off of the U.S. Geological Survey’s (USGS) groundwater modeling study in South Moloka‘i, which included an assessment of the impacts of various future groundwater pumping scenarios on groundwater discharge at the coastline.<sup>3</sup> This data could inform a study design that examines how a range of nutrient and salinity affects the growth of selected native limu and invasive macroalgae. We will select species based on interest from limu practitioners, loko i‘a (fishpond) caretakers, and other community groups and members connected to GDEs on Moloka‘i.

Despite the importance of limu, it has been challenging to identify funding for applied research on groundwater-limu interactions, particularly given that much of federal marine science research funding is directed exclusively towards corals. Over the past years, we have solidified our research team and interdisciplinary land-sea framework. Our research team includes limu scientists (led by Dr. Celia Smith of the School of Life Sciences), groundwater and land-sea modelers, a submarine groundwater discharge expert, and social scientists (led by UHERO). We are committed to partnering closely with the Commission on Water Resource Management and the Division of Aquatic resources within the Department of Land and Natural Resources, community groups, and other relevant stakeholders to carry out impactful research with direct application to improved water resource management in the face of climate and land-use change.

We thank you for the opportunity to provide testimony in support of this measure.

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<sup>2</sup> Okuhata, B.K., Delevaux, J.M.S, Richards Dona, A., Smith, C.M., Gibson, V.L, Dulai, H., El-Kadi, A.I., Stamoulis, K., Burnett, K.M., Wada, C.A, & Bremer, L.L. In Review. Effects of multiple drivers of environmental change on native and invasive macroalgae in nearshore groundwater dependent ecosystems. Submitted to *Water Resources Research*.

<sup>3</sup>Oki, D.S., Engott, J.A., and Rotzoll, K., 2020, Numerical simulation of groundwater availability in central Moloka‘i, Hawai‘i: U.S. Geological Survey Scientific Investigations Report 2019–5150, 95 p., <https://doi.org/10.3133/sir20195150>.



Testimony Before The  
House Committee on Water and Land  
**IN SUPPORT OF HB 1405**  
February 9, 2023, 9:30AM, Room 430

We are Malia Heimuli, Brenda Asuncion and Kevin Chang, Limu Hui, Hui Malama Loko I'a Coordinators and Executive Director, respectively, of [Kua'āina Ulu 'Auamo \(or KUA\)](#). KUA works to empower grassroots rural and Native Hawaiian mālama 'āina groups to celebrate their places and pass on their traditions to better Hawai'i and achieve 'āina momona— an abundant, productive ecological system that supports community well-being.

KUA employs a community-driven approach that currently supports a statewide network of 36 mālama 'āina community groups collectively referred to as E Alu Pū (moving forward together), 40 fishpond projects and practitioners called the Hui Mālama Loko I'a, and a growing group of over 60 Limu practitioners and supporters called the Limu Hui.

**KUA supports HB 1405 as an incremental step on a pathway towards 'āina momona.**

One of the founding kupuna of our first network E Alu Pū, Uncle Henry Chang Wo Jr., a recognized loea limu (limu expert) grew up in 'Ewa Beach and personally witnessed the decline of limu there. He worked to create a Limu Management Area (LMA) in 'Ewa, a place legally designated for traditional limu gathering. Uncle Henry taught us that one of the main causes of the loss of limu is the loss of groundwater that once flowed abundantly along the shoreline. As the flow of groundwater decreased, limu abundance decreased. One of Uncle Henry's famous sayings was "No limu, no fish". Unfortunately, Uncle Henry passed away in 2015. He left a legacy which includes the Limu Hui, the 'Ewa LMA and the struggle to bring limu back to 'Ewa the way it once was. KUA works to perpetuate his legacy and the legacy of the many kupuna before and now after him. This bill is part of that legacy we wish he were here to testify on and help continue.

KUA supports HB 1405 which seeks to answer questions long asked by kupuna and Native Hawaiian community members who have long testified to our state of bearing witness to changes and the diminishing sea life on certain shorelines. This bill allocates funds in the amount of \$250,000.00 to DLNR to support a pilot study on the south shores of Moloka'i. Native Hawaiian fishponds and species like limu are particularly vulnerable to changes in discharge and are an important indicator of coastal ecosystem health. Unfortunately, as development increases and more water is pumped from our aquifers, diverted from streams, and with less rainfall due to climate change, these ecosystems are impacted in ways that we do not fully understand.

Mahalo for this opportunity to testify and support this important study.

Aloha 'Āina Momona, E Ola Limu!

**HB-1405**

Submitted on: 2/7/2023 2:03:08 PM

Testimony for WAL on 2/9/2023 9:30:00 AM

<b>Submitted By</b>	<b>Organization</b>	<b>Testifier Position</b>	<b>Testify</b>
Caroline Azelski	Individual	Support	Written Testimony Only

Comments:

Support. Thank you.

46-025 Kuneki Pl  
Kāneʻohe HI. 96744  
2/7/23

**Testimony of Celia Smith in support of HB 1405 Relating to Natural Resources, House  
Committees on Water and Land, Thursday, February 9, 2023, 9:30 AM, State Capitol,  
Room 430 & Videoconference**

Aloha all. My name is Celia Smith. While I have worked for over three decades as a marine botanist and Professor in the School of Life Sciences, at the University of Hawaiʻi, my comments today represent my own views and are not views of the University of Hawaiʻi.

I strongly support Bill 1405 because it will enable our collaborative partnership of limu scientists, groundwater and land-sea modelers, a submarine groundwater discharge expert, and social scientists to integrate studies of limu and their growth in relation to field conditions found in Molokaʻi's coastal waters. It may come as a shock to the committee that only two native species, limu manaua and limu palahalaha have been studied under the range of conditions found in healthy native habitats in Hawaiian nearshore groundwater dependent ecosystems.

Such studies have already revealed significant links between these limu manaua (*Gracilaria coronopifolia*) or limu pālahalaha (*Ulva lactuca*) with the submarine groundwater discharge (SGD) characteristics of intact ecosystems. Unexpectedly, both of these native limu have higher rates of photosynthesis and grow faster under native SGD conditions. Results from new studies working with other unstudied native limu species will likely assist the Commission on Water Resource Management in future policy decisions regarding groundwater quality and volume. I welcome the opportunity to work with the Molokaʻi community and the Water Resources Research Center in this endeavor.

Thank you for the opportunity to provide testimony in support of this measure.