Protecting Hawai'i's Groundwater Benefits Native Marine Macroalgae

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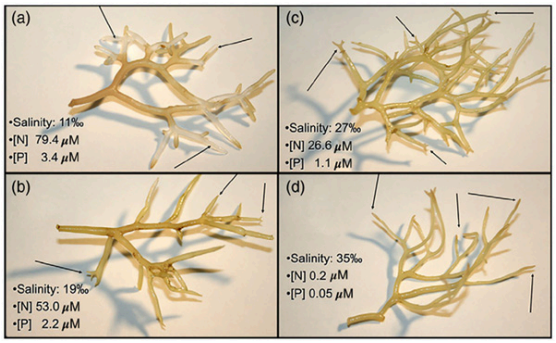
The native marine macroalgae or limu (seaweed) is an important part of the Hawaiian culture (e.g., food, medicines, traditional practices) and an integral part of a healthy groundwater dependent ecosystem (GDE). Limu thrives in coastal waters enriched by nutrients from pristine groundwater discharge, however, with the encroachment of urban development, climate change, and other issues, native species of limu have been challenged to the increased nutrient loads in submarine groundwater discharge (SGD) as well as less freshwater (e.g., higher salinity composition). In situations where SGD is compromised by nutrient pollution from wastewater, invasive algae can overtake the surrounding biota of coastal springs. It is imperative that steps are implemented to prevent further negative impacts on the abundance of the precious limu.



Limu growth rate under various SGD conditions (photo by Daniel Amato).

As part of a WRRC project lead by Leah Bremer, a team of University of Hawai'i at Mānoa researchers, including Henrietta Dulai and Celia Smith, compiled results of previous hydrological and algal studies to investigate the relationship between SGD and algal species in southeast O'ahu and used those findings to illustrate the urgent need to improve the situation and prevent further coastal ecosystem deterioration.* Dr. Dulai (Dept. of Earth Sciences professor and WRRC affiliate researcher) said, "Recharge can be improved by land-use choices through having more permeable urban surface and by restoring native forests. Lower groundwater withdrawal rates can be achieved by better management of water resources and water re-use. Additionally, upgrades to our wastewater infrastructure in light of impending sea level rise should be one of the primary goals."

Removing land-based sources of wastewater from SGD (e.g., cesspools) are likely to benefit our communities in the short term as shallow reefs are likely to return to overall healthier water qualities in these now impacted coastal regions. In the long term there is a strong possibility that the native limu will return and can thrive.

Celia Smith (Botany professor and Co-Director of the Marine Biology Graduate program) said, "The bottom line is if we want to sustain native macroalgae, we need to protect and conserve submarine groundwater discharge flow and keep additional nutrient loads in check. Keeping the discharged groundwater as close to pristine as possible needs to be a goal. Otherwise, we risk setting the stage for persistent, multi-year invasive algal dominance."

The objectives of future studies by the team—which also includes Veronica Gibson and Daniel Amato (Botany), and Leah Bremer (WRRC and UHERO)—are to (1) determine the responses by native and invasive algae to the full range of groundwater discharge—pristine to tainted, (2) inform biocontrol efforts that outplant native algae, and (3) gain insight into sea level rise impacts on these plants.

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*Dulai, H., C. Smith, V. Gibson, D. Amato, and L. Bremer. Risk to native marine macroalgae from land-use and climate change-related modifications to groundwater discharge in Hawai'i. 2021. *Limnology and Oceanography Letters*, https://doi.org/10.1002/lol2.10232

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