

## Supplement Commentary

### Integrating Native Hawaiian tradition with the modern technology of aquaponics

Ilima Ho-Lastimosa<sup>1,3,4</sup>, Jane J. Chung-Do<sup>2,3,4</sup>, Phoebe W. Hwang<sup>2,3</sup>,  
Theodore Radovich<sup>1,3,4</sup>, Ikaika Rogerson<sup>3,4</sup>, Kenneth Ho<sup>3,4,5</sup>,  
Samantha Keaulana<sup>2,3</sup>, Joseph Keawe‘aimoku Kaholokula<sup>6</sup>  
and Michael S. Spencer<sup>7</sup>

**Abstract:** Prior to western arrival in 1778, Native Hawaiians possessed a sophisticated culture and resource management system conducive to an island ecosystem. However, disenfranchisement from ancestral lands and traditional food sources as a result of colonization led to Native Hawaiians being forced to abandon many of their traditional practices. Today, many Native Hawaiians experience food insecurity, placing them at further risk for obesity and other nutrition-related chronic diseases. Consequently, there is a growing need for place-based and culturally relevant strategies rooted in Hawaiian epistemology to address these issues. This paper describes the history and development of one such intervention – the MALAMA study – in the community of Waimānalo that innovatively merges the modern technology of aquaponics with traditional Native Hawaiian practices and values. (Global Health Promotion, 2019; 26(Supp. 3): 87–92)

**Keywords:** Native Hawaiian, Indigenous, food systems, community health, nutrition, aquaponics, family, culture/ethnicity

#### ‘Āina (Land) – The history and values of Native Hawaiians

Native Hawaiians are the Indigenous people of Hawai‘i whose ancestors settled in the Hawaiian archipelago over 1600 years ago. Native Hawaiians developed systems of aquaculture (loko i‘a), irrigated terraces for planting (lo‘i), and other forms of food cultivation situated in a land division system known as an ahupua‘a. Ahupua‘a is a form of land division that extends from the

mountain to the sea to ensure access to natural resources needed for daily living (1). This system reinforced the relationship Native Hawaiians have to their ‘āina (land) and its cultivation. The intimate relationship between Native Hawaiians and their natural world is expressed through the cultural value of mālama ‘āina, which means ‘taking care of the land’ (1). To mālama ‘āina for a Native Hawaiian is analogous to taking care of one’s elder sibling, and, in turn, the ‘Āina will take care of its younger siblings.

1. College of Tropical Agriculture and Human Resources, University of Hawai‘i at Mānoa, Honolulu, Hawai‘i, USA.
2. Office of Public Health Studies, University of Hawai‘i at Mānoa, Honolulu, Hawai‘i, USA.
3. God’s Country Waimānalo. Honolulu, Hawai‘i, USA.
4. Ke Kula Nui O Waimānalo, Waimānalo, Hawai‘i, USA.
5. University of Southern California, Los Angeles, California, USA.
6. Department of Native Hawaiian Health, University of Hawai‘i at Mānoa, Honolulu, Hawai‘i, USA.
7. School of Social Work and Indigenous Wellness Research Institute, University of Washington, Seattle, Washington, USA.

Correspondence to: Jane J. Chung-Do, Office of Public Health Studies, 1960 East-West Rd Biomed D104D, Honolulu, Hawai‘i 96825, USA. Tel: 1-808-956-4548. Email: chungjae@hawaii.edu

*(This manuscript was submitted on 16 September 2018. Following blind peer review, it was accepted for publication on 22 January 2019)*

Starting with the arrival of Captain James Cook in 1778 to the illegal overthrow of the Hawaiian Kingdom in 1893 and subsequent U.S. occupation, Native Hawaiians have been forced to abandon many of their cultural practices and preferred modes of living (2,3). They were disenfranchised from their lands and traditional food sources, disrupting their ancestral relationship with the 'āina and ability to practice their ancestral kuleana (responsibility) of mālama 'āina. Land in Hawai'i was privatized through what is known as the Māhele of 1848. However, land privatization was a foreign concept that was completely at odds with Native Hawaiian traditional perspectives of relationship to land. Therefore, many Native Hawaiians did not stake claim to ancestral lands, resulting in large scale land alienation and disconnection from traditional food sources (1). The Māhele benefited foreigners who acquired large tracts of land to develop a profitable plantation system. This separation from land has led to the current health disparities faced by Native Hawaiians in the present day.

### Native Hawaiian health today

Prior to western intrusion in 1778, the British explorer Cook and his expedition first encountered healthy and vibrant Native Hawaiians. Today, as a result of land alienation, Native Hawaiians tend to live in areas that lack healthy food retail outlets, and face higher rates of nutrition-related chronic diseases, such as childhood and adulthood obesity, type II diabetes, and cardiovascular disease (4,5), compared with other major ethnicities in the state. As a result of historical and structural factors, Native Hawaiian nutrition and eating habits fall short of the recommended guidelines. Native Hawaiian health promotion interventions that reintegrate traditional practices may be impactful in reducing risks of nutrition-related disease among Native Hawaiians (6).

In the last few decades, tremendous efforts to revitalize traditional cultural practices have been made to address inequities in areas such as self-governance, education, and research. Many traditional practices that include food production, including kalo (taro) farming and restoration of

ancient loko i'a (fish ponds), and exercising their kuleana of mālama 'āina (7) have been revitalized. There has been a call for place-based and culturally relevant strategies to promote Native Hawaiian health that is based on Hawaiian epistemology (8,9).

### Waimānalo

Waimānalo is a rural community that is located on the eastern side of the island of O'ahu and is home to approximately 7000 residents (10). Nearly one-third of the residents are Native Hawaiian, which is twice the state average (11). The community is designated as a medically underserved population by the U.S. federal government, which indicates a shortage of personal health services and high rates of economic, cultural, and/or linguistic barriers to receiving health care. Similar to other communities with high proportions of Native Hawaiian residents, more than 30% of Waimānalo households are food insecure due to socioeconomic and other barriers (12). Despite these challenges, many strengths and assets reside in this close-knit community including a high number of grassroots efforts to revitalize health and education through Native Hawaiian practices.

### The MALAMA program

The MALAMA (Mini Ahupua'a for Lifestyle And Mea'ai [food] through Aquaponics) program was conceptualized to build on previous community grassroots efforts related to backyard aquaponics in order to address the pervasive burden that Native Hawaiians currently face with regards to high rates of nutrition-related diseases. This is the first known aquaponics health intervention to date. Consistent with Indigenous Health Promotion ideals, the goal of the MALAMA program is to restore cultural practices and food sovereignty through modern agricultural technology and Hawaiian cultural values in Waimānalo. Aquaponics was attractive to the community because it mimics the ahupua'a system where fish and plants symbiotically grow in a sustainable and ecological system. Aquaponics systems optimize water and nutrient use efficiency by combining hydroponics (soil-less horticulture) and aquaculture (raising fish in tanks) that uses a fraction of the water and nutrients that traditional terrestrial systems do (13).



**Figure 1.** Photo from MALAMA demonstration build day.

The aquaponics systems were constructed as backyard models to provide families and communities with a consistent source of vegetables, fruit, and fish (Figure 1).

This MALAMA program consisted of eight community workshops and gatherings throughout the 3 months of the program, which ranged from 2 to 5 hours and occurred twice a month. Workshops focused on skills related to building and maintaining aquaponics systems, gardening (planting, growing, and harvesting plants), growing and caring for fish, nutrition education, cooking, traditional medicine demonstrations using produce grown in aquaponics systems, and strategies for making healthy eating choices. See Table 1 for the list of topics and learning outcomes. All workshops used a family-based model with a community of inquiry approach. This approach utilizes cognitive apprenticeship, shared inquiry, peer learning, and collaboration, and addresses the needs of culturally diverse learners (14). The hands-on family-based collective learning approach of this intervention aligned with Native Hawaiian educational pedagogy. Workshops integrated Native Hawaiian cultural practices, including *lā'au lapa'au* (Native Hawaiian

traditional healing through plants and spirituality) (15) and *'ai pono* (nourishing foods).

### Future directions

Currently, the MALAMA program has completed its initial series of workshops and the mixed-methods data is being analyzed to determine the feasibility and effectiveness of the program. The MALAMA researchers have partnered with other local organizations that support Native Hawaiian health and cultural practices to train other community groups across the islands on building and maintaining backyard aquaponics systems (Figure 2 for a fully functioning aquaponics system). The MALAMA program plans to develop a certification training in aquaponics, including integrating an educational pathway that would train youth to be aquaponics trainers while earning both high school and college credits. Promoting backyard aquaponics systems equips individuals and communities with the capacity and power to have autonomy over their food supply. The MALAMA program embraces the true essence of Hawai'i, which is to take care of one another by sharing, giving, learning and teaching for the next 100 generations.

**Table 1.** MALAMA (Mini Ahupua'a for Lifestyle And Mea'ai [food]) through Aquaponics) community sessions.

| Session # | Topics covered   | Learning outcomes  |
|-----------|--|--|
| 1         | <ul style="list-style-type: none"> <li>Overview of MALAMA study</li> <li>Strengths of Native Hawaiian health</li> <li>What is aquaponics?</li> <li>Understanding aquaponics apparatus</li> </ul>   | <ol style="list-style-type: none"> <li>Identify the strengths in Native Hawaiian health throughout history.</li> <li>Understand the key components of a basic aquaponics system.</li> <li>Explain the relationship between fish and plants in an aquaponics system.</li> <li>Recall the parts needed for an aquaponics system.</li> </ol>  |
| 2         | <ul style="list-style-type: none"> <li>How to build aquaponics apparatus part I: Building tables, building bell siphon, cutting pipes</li> </ul>   | <ol style="list-style-type: none"> <li>Understand how a bell siphon works.</li> <li>Demonstrate knowledge on building tables and bell siphons by producing 10 sets of aquaponics tables and bell siphons.</li> </ol>   |
| 3         | <ul style="list-style-type: none"> <li>How to build aquaponics apparatus part II: Putting together tables, grow beds, and fish tank</li> </ul>   | <ol style="list-style-type: none"> <li>Demonstrate knowledge of the aquaponics apparatus by setting up an aquaponics.</li> </ol>   |
| 4         | <ul style="list-style-type: none"> <li>Tips for planting, growing, and harvesting in aquaponics system</li> <li>How to raise tilapia in aquaponics system</li> <li>How to test and maintain water quality</li> <li>Lā'au lapa'au demonstration: Herbal oil infusion</li> </ul>                                 | <ol style="list-style-type: none"> <li>Understand best practices for planting, growing, and harvesting plants in an aquaponics system.</li> <li>Understand best practices for raising tilapia in an aquaponics system.</li> <li>Demonstrate knowledge on how to make an herbal oil infusion.</li> <li>Understand the medicinal uses of herbal oil infusion in Native Hawaiian medicine.</li> </ol> |
| 5         | <ul style="list-style-type: none"> <li>'Ai pono demonstration: Scaling, gutting, cooking your tilapia</li> <li>Native Hawaiian history: Story of Hāloa</li> <li>Q&amp;A session: Troubleshooting your aquaponics system</li> <li>Lā'au lapa'au demonstration: Insecticide and disinfectant solution</li> </ul> | <ol style="list-style-type: none"> <li>Demonstrate knowledge of scaling, gutting, and preparing tilapia.</li> <li>Learn how to cook tilapia soup, deep fry tilapia, and lawalu tilapia.</li> </ol>   |
| 6         | <ul style="list-style-type: none"> <li>'Ai pono discussion: Poi 'awa'awa</li> <li>Lā'au lapa'au demonstration: Using herbal oil infusion to make lip balm and salve</li> </ul>   | <ol style="list-style-type: none"> <li>Identify the types of poi 'awa'awa.</li> <li>Understand the health benefits of poi 'awa'awa.</li> <li>Demonstrate knowledge on how to make a remedy lip balm and salve using herbal oil infusion.</li> </ol>  |
| 7         | <ul style="list-style-type: none"> <li>Hō'ike: Tilapia cooking contest</li> </ul>  | <ol style="list-style-type: none"> <li>Develop and demonstrate a recipe to cook tilapia.</li> <li>Apply the recipe in a tilapia cooking contest.</li> </ol>  |
| 8         | <ul style="list-style-type: none"> <li>Last day celebration potluck</li> <li>Program discussion/feedback</li> </ul>  | <ol style="list-style-type: none"> <li>Reflect on experiences in MALAMA</li> <li>Brainstorm ideas for sustainability and future direction</li> </ol>   |



**Figure 2.** A functioning backyard aquaponics system in Waimānalo.

### *Declaration of conflicting interest*

The authors declare that there is no conflict of interest.

### *Funding*

The project described was supported by grant number #2U54MD007601-31 from the National Institute on Minority Health and Health Disparities (NIMHD), a component of the National Institutes of Health (NIH) and its contents are solely the responsibility of the author and do not necessarily represent the official view of NIMHD or NIH.

### *Author biography*

**Ilima Ho-Lastimosa** is a strong proponent of food sovereignty and sustainability, she is passionate about giving Pacific Island communities the tools, knowledge and skills they need to grow food in their backyards. Ilima received her BA in Hawaiian Studies, MSW from the Myron B. Thompson School of Social Work, and MoA from World Medicine Institute. Presently employed as the Community Coordinator for the College of Tropical Agriculture and Human Resources Waimānalo Learning Center. She is a founding member of God's Country Waimānalo and Ke Kula Nui O Waimanalo, and continues to offer programs to the Waimānalo and Native Hawaiian Communities.

**Dr. Jane Chung-Do** is an Associate Professor with the University of Hawai'i Office of Public Health Studies. She currently teaches and advises public health graduate students at the University of Hawai'i. Her research focuses on using community-based participatory research approaches and culturally-grounded programming to promote wholistic and restorative health by addressing the interconnections between mental health, food, and family. She strives to use by forming partnerships with communities to ensure that all research and health programming are grounded in the values, needs, and strengths of the community. Jane loves to surf and spend time in the ocean with her family.

**Dr. Phoebe Hwang** is a faculty member at the University of Hawai'i at Mānoa Office of Public Health Studies. She graduated from the University of Hawai'i with her doctorate in Public Health, with a specialization in community-based participatory research and life course epidemiology, masters in Molecular Biosciences and Bioengineering with a specialization in cancer cell biology and tropical alternative medicines. She currently teaches Public Health Biology, and works as a health research consultant for various organizations. Phoebe lives in Moili'i with her family and is also a yoga and Tai Chi instructor and massage therapist.

**Dr. Ted Radovich** is an Associate Professor/Extension Specialist in the College of Tropical Agriculture and Human Resources at the University of Hawai'i at Mānoa (UHM). Ted leads the Waimanalo Learning Center at the UHM Waimanalo Research Station, featuring 4 acres of certified organic land and an aquaponics facility. He co-coordinates the Sustainable and Organic Agriculture Program at UHM and is principal investigator of the Sustainable and Organic Farming Systems Laboratory. The primary focus of his lab's research are the links between ecological farming practices, yield, and crop quality. Ted lives in Waimanalo with his wife and four children.

**Ikaika Rogerson** graduated from Kamehameha Kapālama and the University of Hawai'i with a bachelor of Hawaiian Studies, and currently pursuing his Master's Degree. Ikaika is the owner of Rocky Farms, LLC specializing in Hawaiian Lā'au Lapa'au. He is a graduate of the GoFarm Program at the University of Hawai'i, an established aquaponics farmer, and a senior instructor at 101 Financial. Ikaika serves on the board of directors for O'ahu Hawaiian Canoe Racing Association as the Recording Secretary, and as a board member for both the Waimānalo Market Co-Op board and the Hawaiian Canoe Racing Association board. Ikaika lives in Waimānalo.

**Kenneth Ho Jr.** is a firefighter with certifications in water safety, emergency medical technician, and personal training. He is the executive director of OLA KINO, a program that addresses health disparities, social injustices, and historical traumas Kānaka Maoli endure. He is a founding member of God's Country Waimānalo (GCW) and Ke Kula Nui O Waimānalo (KKNOW) and the Safety Officer for Waimānalo Limu Hui, a limu restoration group. A graduate of the Kamehameha Schools, received his BS from Wayland Baptist University, completed the MS of Operations Management at the University of Arkansas and is currently in doctoral studies at the University of Southern California.

**Samantha Keaulana** is a PhD student studying community-based and translational research at the University of Hawai'i at Mānoa. She is also a Robert Wood Johnson Health Policy Research scholar. As a Kānaka Maoli (Native Hawaiian), Samantha is committed to maui ola (Native Hawaiian health) through research, advocacy, and policy. Her research interests include finding culturally congruent and community-based interventions for Wāhine (Native Hawaiian women) health. As an emerging scholar, Samantha heeds the call of Hawai'i's last reigning queen,

Lili'uokalani, who in the face of injustice, resisted with poise and grace. Onipa'a. Be steadfast.

**Dr. Joseph Keawe'aimoku Kaholokula** is a Professor and Chair of Native Hawaiian Health in the John A. Burns School of Medicine at the University of Hawai'i at Mānoa. He is a National Institutes of Health funded investigator whose community-based participatory research (CBPR) involves developing sustainable community- and worksite-based health promotion strategies and programs to

#### References

1. Kame'eleihiwa L. Native land and foreign desires. Honolulu, HI: Bishop Museum Press; 1992.
2. Marshall WE. Remembering Hawaiian, transforming shame. *Anthropol Humanism* 2006; 31: 185–200.
3. Pukui MK, Elbert SH, Mookini ET. *Placenames of Hawaii*. Honolulu, HI: University of Hawaii Press; 1974.
4. Johnson DB, Oyama N, LeMarchand L, Wilkens L. Native Hawaiians mortality, morbidity, and lifestyle: comparing data from 1982, 1990, and 2000. *Pac Health Dialog* 2004; 11: 120–130.
5. OHA. Diseases Native Hawaiian health fact sheet. Honolulu, HI: Office of Hawaiian Affairs; 2015.
6. Kaholokula JK, Mau MK, Efird JT, Leake A, West M, Palakiko D-M, et al. A family and community focused lifestyle program prevents weight regain in Pacific Islanders: a pilot randomized controlled trial. *Health Educ Behav* 2012; 39: 386–395.
7. Goodyear-Ka'ōpua N, Hussey I, Wright EK. *A nation rising: Hawaiian movements for life, land, and sovereignty*. Durham: Duke University Press; 2014.
8. Meyer MA. Our own liberation: reflections on Hawaiian epistemology. *Contemp Pac* 2001; 13: 124–148.
9. Mokuau N. Culturally based solutions to preserve the health of Native Hawaiians. *J Ethn Cult Divers Soc Work* 2011; 20: 98–113.
10. Sterling EP, Summers CC. *Sites of Oahu*. Revised. Honolulu, HI: Department of Anthropology, Department of Education, Bernice P. Bishop Museum; 1978.
11. Mau MK, Wong KN, Efird J, West M, Saito EP, Maddock J. Environmental factors of obesity in communities with native Hawaiians. *Hawaii Med J* 2008; 67: 233.
12. Davis JN, Ventura EE, Cook LT, Gyllenhammer LE, Gatto NM. LA Sprouts: a gardening, nutrition, and cooking intervention for Latino youth improves diet and reduces obesity. *J Am Diet Assoc* 2011; 111: 1224–1230.
13. Tokunaga K, Tamaru C, Ako H, Leung P. Economics of commercial aquaponics in Hawaii. In: *Aquaponics in Hawaii Conference*, Windward Community College, Kāne'ohe, O'ahu, Hawaii, 25 May 2013.
14. McLoughlin C. Culturally responsive technology use: developing an on-line community of learners. *Br J Educ Technol* 1999; 30: 231–243.
15. Abbott IA. *La'au Hawai'i: traditional Hawaiian uses of plants*. Honolulu, HI: Bishop Museum Press; 1992.