Customary Access: Sustaining Local Control of Fishing and Food on Kaua‘i’s North Shore

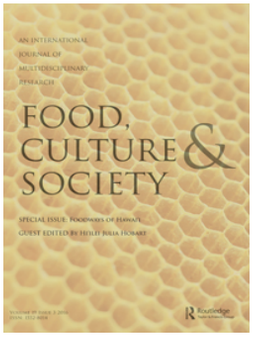
Article *in* Food Culture and Society An International Journal of Multidisciplinary Research · September 2016

DOI: 10.1080/15528014.2016.1208339

2 authors, including:

Adam Ayers
University of Hawai‘i at Mānoa
5 PUBLICATIONS **22** CITATIONS

SEE PROFILE



Routledge
Taylor & Francis Group

Food, Culture & Society
An International Journal of Multidisciplinary Research

ISSN: 1552-8014 (Print) 1751-7443 (Online) Journal homepage: http://www.tandfonline.com/loi/rffc20

Customary Access: Sustaining Local Control of Fishing and Food on Kaua'i's North Shore

Mehana Blaich Vaughan & Adam L. Ayers

To cite this article: Mehana Blaich Vaughan & Adam L. Ayers (2016) Customary Access: Sustaining Local Control of Fishing and Food on Kaua'i's North Shore, Food, Culture & Society, 19:3, 517-538

To link to this article: http://dx.doi.org/10.1080/15528014.2016.1208339

Published online: 05 Sep 2016.

FOOD, CULTURE & SOCIETY

VOLUME 19 | ISSUE 3 | SEPTEMBER 2016

Customary Access: Sustaining Local Control of Fishing and Food on Kaua'i's North Shore

Mehana Blaich Vaughan and Adam L. Ayers
University of Hawai'i at Mānoa

Abstract
Where Hawai`i's land and sea once supported a population close to contemporary times, today 90 percent of food consumed in Hawai'i is imported and delivered on container ships. Once plentiful in the bays and coral reefs surrounding these islands, fish is now frequently shipped in and store bought. Yet, local families in parts of Hawai`i have maintained self-sufficiency in part of their food system through communal surround net fishing, employing ancestral knowledge, mobilizing community effort, and sharing catch from these collective harvests. This article examines the role of access in perpetuating surround net harvests and sharing through hō'ihi (respectful reciprocity); konohiki (inviting ability); and kuleana (rights based on responsibilities). It concludes by considering the implications of the findings for food systems and food security.
Keywords: access, food systems, small-scale fisheries, indigenous, customary practice

Introduction

> This place will feed you if you know how to take care of it. (Young Halele'a fisherman, 2012)

The old man [name of *konohiki*] would sit up on the hill by the house and watch for the ball of *akule*. During the season, he'd just watch every day until the ball would come in, just this huge, huge massive ball of fish that would come and spawn in the bay. The [sugar plantation bell would] alarm and the entire town would run down to the beach. We had these big wooden

DOI: 10.1080/15528014.2016.1208339

> boats and we'd go out and he had 30-foot deep nets and you'd row and row and row. The guy out the back would be throwing out the net. Then the boats would circle the ball of fish and the whole ball would be circled and it wouldn't realize it yet. Then all of a sudden they'd realize it and hell would break loose. Fish just jumping everywhere into the boat, hitting you in the head. And everything's in there. Whatever was chasing the fish, the shark that was chasing the fish, turtles, everything in there—and so you have to [dive down to] try to get out the things like that. Then you'd bring the net closer and closer together, tighter and tighter. And so you dive down and sections of the net would come out and you'd have those hooked together with little bamboo chopsticks sort of. And you'd take out a section and get it tighter and tighter. By this time, the entire population of [the area] is on the beach. Everybody—man, woman, and child—everybody. And then the big bag net gets put in the water.… And you'd go dive down and sew that into one of those joints in the net. Then you'd pull the main net together until all the fish swam in this bag, as big as half this room. And then you'd bring the boats together, the nets together with the huge bag of fish and somebody would swim in the big rope and then they'd yell, "huki [pull]!"(Kilauea area community member)

Over three centuries of demographic, social and economic change, large catches from surround net fishing, locally referred to as *hukilau* (pulling together), have continued to provide an important source of sustenance that can be stored and shared throughout Halele`a, Kaua'i communities. Surround net fishing requires cooperation, social ties, cultural, and ecological knowledge sustained across generations. We examine how Halele'a families have continued this culturally important fishing practice into the present day, maintaining access to the benefits of near shore fisheries despite dramatic changes in property rights and governance. We explain changes in both land and coastal tenure systems under the Hawaiian kingdom, western contact, US annexation, and later statehood; then describe more recent changes in Halele'a. Using access analysis, we demonstrate how community members have perpetuated surround net harvests and sharing through *hō'ihi* (respectful reciprocity); *konohiki* (inviting ability); and *kuleana* (rights based upon responsibilities). We conclude by considering the implications of our findings for access and policy in near shore fisheries, and for food systems and food security in Hawai'i and beyond.

Food security is one of the most salient issues facing humans in the twenty-first century. Food security can be defined as "physical and economic access to food that meets people's dietary needs as well as their food preferences" (World Health Organization 2015). Food systems are a vital component of food security, encompassing the production, processing, distribution and consumption of food. Defined more broadly, food systems can include impacts on social welfare, the biophysical environment, and national security (Ericksen 2008). Globally, food systems are stressed by population growth, climate change, and economic uncertainty, placing the food security of billions of people at risk (Brown 2012; Godfray et al. 2010). Strategies are needed to enhance and

support food systems at multiple scales (Born and Purcell 2006). Local-scale solutions are particularly important in Pacific islands, where locally sourced food is socially and culturally important and food systems are vulnerable to rising food costs, import prices, changes in land tenure, and increasing urbanization (McGregor et al. 2009). Indigenous groups such as Pacific Islanders are especially threatened by shocks or changes in food systems, in which are embedded indigenous culture, language, and ancestral knowledge (Kuhnlein, Erasmus, and Spigelski 2009). Hawai'i faces many of the threats to food systems described elsewhere in the Pacific. The archipelago's isolation and large population of Native Hawaiians make it an ideal place to examine indigenous knowledge, food systems, and food security. The closest landmass to Hawai`i, California, is 2,400 miles away and approximately 85–90 percent of food consumed in Hawai'i is imported (Leunga and Lokeb 2008), compared with a national average of 15 percent for the rest of the United States (Jerardo 2008), making the islands' food system vulnerable to both economic shocks and natural disasters. At any given time, Hawai`i food markets retain just a seven-day supply of food (USDA FSA 2014) for over 1.43 million residents (US Census Bureau 2015).

Coral reef fisheries provide a culturally significant source of protein and micronutrients across the Pacific and in Hawai`i, where they play a crucial role in food security (Bell et al. 2009). Seafood was a primary source of protein in pre-contact Hawai`i (Kittinger et al. 2011). Today, 90 percent of Hawai'i residents frequently consume fish, spending over twice the US national average annually to purchase fish (Geslani, Loke, Takenaka, and Leung 2012). Coral reef fish (caught near shore with nets, pole and line, or free-diving) continue to be a very important component of community food systems (Kittinger et al. 2015; Vaughan and Vitousek 2013). Further, recent studies suggest that 90 percent of Hawai`i coastal fisheries are subsistence-oriented, with most of the catch either consumed within fishers' households or shared, rather than sold commercially (McCoy 2015). However, overfishing has decreased the size and biomass of reef fish across the main Hawaiian islands (Friedlander, Brown, and Monaco 2007; Friedlander and DeMartini 2002), reducing the supply of locally sourced seafood. Reef fish, once found on over 60 percent of restaurant menus in Hawai`i, today are present on 5 percent or less (Friedlander, Shackeroff, and Kittinger 2013). Lack of enforcement and clearly defined harvesting rights have created de facto open access to most coral reef fisheries in Hawai`i (Finkbeiner et al. 2015). Studies show near 75 percent depletion of biomass in near shore coastal fisheries over the past decade (Friedlander et al. 2008; Maly and Maly 2003).

Before western contact, sophisticated tenure systems underpinned management of coral reef fisheries and food systems in Hawai`i. Harvest rights were well defined to enhance resource production and prevent resource exploitation (Beamer 2014). *Konohiki* (administrators of an *ahupua`a* land division appointed by the chief) made decisions to manage and distribute coastal resources at the local level and shared harvest rights with area residents (Higuchi 2008). Landmark historical events, including the introduction of western property

rights, depopulation due to introduced disease, demographic change, and eventually annexation by the United States in 1900, eroded local-level coastal management.

Today, resources are managed by a centralized state resource management agency that is underfunded and understaffed (Jokiel et al. 2011). This agency implements uniform state-wide regulations, even though Hawai`i's coastal and marine areas exhibit tremendous diversity due to differences in geological age, rainfall, and wave exposure (ibid.). For example, state rules close harvest of single species at the same time across Hawai'i, though recent studies show different spawning times at different locations (Schemmel 2014). Ineffective state management affects fish assemblages and abundance (Friedlander and DeMartini 2002; Friedlander, Brown, and Monaco 2007), placing Hawai`i food systems at risk, and increasing user conflicts (Ayers and Kittinger 2014).

Access to fish, hunt, and gather local foods, key to food security in pre-contact Hawai'i, is becoming increasingly difficult. Development restricts entry to customary gathering areas despite Hawai'i Supreme Court rulings protecting Native Hawaiian gathering rights (Jarman and Verchick 2002). Control of fresh water critical to supporting health of near-shore fisheries through both ground and surface flows is also contested (Gopalakrishnan et al. 2005).

Despite management challenges, declining resource health, and access conflicts, some Hawai`i communities have maintained local control of a critical component of their food system, by retaining access to the benefits of coastal resources they have depended on for centuries. Narrow economic definitions of access focus on property rights to enter an area (Schlager and Ostrom 1992). Drawing on the field of political ecology, we present a broader definition of access as:

> … the ability to benefit from things—including material objects, persons, institutions, and symbols. By focusing on ability, rather than rights as in property theory, this formulation brings attention to a wider range of social relationships that can constrain or enable people to benefit from resources without focusing on property relations alone. (Ribot and Peluso 2003, pp. 153–154)

One area where communities have maintained local access to seafood is the Halele`a *moku*[1] (district) on northwestern Kaua`i. Here, communities perpetuate a cultural fishing method, surround net fishing, often referred to as *hukilau*, as a key component of their food supply. Fishing families in Halele'a Kaua'i continue to employ ancestral knowledge, mobilize community effort, and share fish from these collective harvests. We apply the broader framework of access analysis to these surround net fisheries to understand how resources are being used and by whom, as well as why some receive benefits from resources and others do not (Ribot and Peluso 2003). Mechanisms of access include capital, markets, technology, identity, labor, social relations, knowledge, and authority (ibid.). Access analysis can be useful in small-scale fisheries, where studies of

fishing effort, market rates, or formal fishing rights may not capture the dynamic flow of benefits (Seto et al. Forthcoming).

This study employs an embedded case study approach (Cox 2015) in which the main "case" aggregates data from several communities within the Halele`a *moku* on the north shore of Kaua`i island gathered over the past ten years (2006–2016). The lead author grew up within the study area and worked with community members on place-based education and resource management efforts for ten years prior to beginning formal study of area fisheries (Vaughan 2014). This study employed a mixed method approach (Tashakkori and Teddlie 2003) combining interviews, focus groups, participant observation, oral histories of *kūpuna* (elders), observation of community meetings, beach surveys and catch logging by *lawai`a*, archival searches of Hawaiian-language newspapers, and analysis of legal and policy documents. Interviews, oral histories, and meeting minutes were transcribed and coded using HyperRESEARCH™ (ResearchWare Inc., Randolph, MA, USA) analytical software. Initial findings were critiqued by community members and then analyzed using Ribot and Peluso's (2003) mechanisms of access framework. How have local communities in Halele'a, Kaua'i maintained access to near-shore fisheries and the key source of food they provide? Three themes emerge as key to perpetuation of surround net fishing and sharing: *hō'ihi* (respectful reciprocity); *konohiki* (inviting ability); and *kuleana* (rights based on responsibilities).

History of Near Shore Fisheries Governance

Land tenure in the Hawaiian Kingdom

In Hawaiian Kingdom times (1795–1893), a complex land tenure system supported food production for several hundred thousand Native Hawaiians, comparable to contemporary population levels on every Hawaiian island except O`ahu (Dye 1994; Kirch and Rallu 2007; Stannard 1989). Islands in Hawai`i were divided into *moku* containing many *ahupua`a* (land sections). *Ahupua`a* were a "culturally appropriate, ecologically aligned, and place specific unit with access to diverse resources" (Gonschor and Beamer 2014, 71). This system of land division was devised by key *ali`i* (chiefs) to enhance resource productivity following population increases across the archipelago (Beamer 2014). Annual tribute or taxes from each *ahupua'a* helped to sustain central government (Beamer 2014; Gonschor and Beamer 2014) and provided for a high level of resource productivity across Hawai`i (Kirch 1997, Vitousek et al. 2004). *Okana* (subdistricts within or apart from *mokus*) and *ahupua'a*, along with their subdivisions, such as *ili* (an *ahupua`a* subdivision consisting of individual farming parcels) established *palena* (boundaries or delineated place-based rights) to utilize natural resources (Gonschor and Beamer 2014). Trade between mountain and coastal areas within *ahupua'a* ensured food diversity as well as local-level self-sufficiency. Well-respected *konohiki* were selected to oversee and allocate key resources within an *ahupua`a* such as fisheries and water resources among *hoa`āina* (*ahupua`a* residents) (Kirch 1990; McGregor 1996).

Near shore fisheries tenure in the Hawaiian Kingdom

Ahupua'a fisheries encompassed "certain areas of the sea, from the reefs and, where there happen to be no reefs, from the distance of one geographic mile seaward to the beach at low watermark…" (Kosaki 1954, 3). *Ahupua'a fisheries* were reserved for exclusive use of the hoa'āina and *konohiki* of that *ahupua'a* (ibid.). The earliest written kingdom laws continued to protect local-level rights to near-shore fisheries. The first constitution written by Kamehameha III in 1839 and the laws of 1842 officially recognized exclusive local-level rights to near-shore fisheries and ensured seafood access (Higuchi 2008; Jokiel et al. 2011). These laws conserved resources, while maintaining a defined social and religious system (Friedlander, Shackeroff, and Kittinger 2013). Most seafood harvested within the boundaries of an *ahupua`a* was reserved for *hoa'āina* and the *konohiki* residing within the *ahupua`a* boundaries (Higuchi 2008; Kosaki 1954). Certain fish species were *kapu* (restricted) and reserved for the *ali'i* (chief).

The *ali'i* appointed a *konohiki* and entrusted them with the right to make resource decisions. For their service to the *ali`i* and the *hoa`āina*, *konohiki* were entitled to one-third of the catch from the entire fishery, or the right to exclusively harvest one species of fish (Higuchi 2008). Upon consultation with *hoa`āina*, *konohiki* made decisions to open, close or place harvest restrictions on particular species (Akutagawa Forthcoming, Kosaki 1954). *Konohiki* could come from outside an *ahupua'a*, and their appointments were subject to changes in the larger political landscape. *Kilo* (master fishermen, fish spotters) from the area retained significant responsibility, serving as a counsel to the *konohiki*, leading communal fishing efforts, and ensuring equitable share of harvests (Jokiel et al. 2011; McGregor 2007). Some accounts reference shared management and decision-making across multiple *ahupua`a*, often at the *moku* level (Beamer 2014). For example, adjoining *ahupua'a* might alternate closures on a given species, allowing residents of both areas to continue harvesting in the *ahupua'a* where the species was open, while providing for replenishment of the other area.

Changes in land tenure: the Great Mahele

Three-quarters of a century after western contact, and one-quarter century after the arrival of the first missionaries in Hawai'i, King Kamehameha III co-created "The Great Mahele" with his advisors in 1848. The Mahele abolished the existing communal property system in favor of fee simple private land ownership, distributing land in Hawai`i to four groups: the *Mō`ī* (ruling King), the *ali`i* (chiefly class), *maka`āinana* (commoners), and foreigners living in Hawai`i. Although the Great Mahele may have paved the way for dispossession, foreign land ownership, and colonialism, King Kamehameha III and his advisors conceived of the division as a way to embed Native Hawaiian rights into the land within the changing property system (Perkins 2013). Shortly after the Great Mahele, agricultural plantations were established to cultivate large-scale crops such as sugarcane for export. Decimated by western-brought disease, the Native Hawaiian population was reduced to 82,000 by 1850, less than one-quarter of its pre-contact levels (Dye 1994). Thousands of foreign immigrants arrived between 1852 and 1924 to fill the plantation labor requirements. Many

intermarried with Native Hawaiian families. Despite these demographic, social, and economic upheavals, *konohiki* continued to fulfill an important role in productive fishing areas by mobilizing labor—Native Hawaiians and immigrants alike—for communal harvests (Seto et al. Forthcoming).

Changes in near-shore fisheries tenure following US annexation

In 1893 the Hawaiian Kingdom was illegally overthrown by a small group of influential foreigners, including some American plantation owners, with military support from the US Government (Chock 1995). Following the illegal overthrow (Boyle 1994), a provisional government presided over Hawai`i from 1893 to 1900. In 1900, the Organic Act (1900) proclaimed Hawai`i a US territory and sought to open near-shore fisheries to public access by nullifying their associated "exclusive," or community-level rights (Kosaki 1954; Murakami and Tanaka 2015). However, a process for vesting private rights to near-shore fisheries allowed registration of *konohiki* fisheries within two years. Of nearly 400 "*konohiki* fisheries" across Hawai`i counted by the Territorial Government in 1900, just one-quarter (101) were officially registered by 35 owners (Higuchi 2008).[2]

The territorial government pursued systematic condemnation of these remaining registered *konohiki* fisheries through payment of "just compensation," "for the declared purpose of making all fisheries in the sea waters of the Territory free to the citizens of the United States" (Kosaki 1954, 5). One motivation was the perception that public access to fisheries was crucial to food security in Hawai'i, particularly in times of shortage such as the Depression or World War II. During that war, the commanding officer on the island of Kaua'i temporarily suspended *konohiki* fishing rights to give island residents more access to fresh fish (Kosaki 1954 citing *Honolulu Star Bulletin*, July 23, 1942). Though proponents of *konohiki* fishing rights argued that local-level management enhanced conservation of a declining inshore marine food supply, opponents countered that conservation was best achieved by uniform, large-scale government management (Kosaki 1954). There was also debate as to whether *konohiki* fishing rights were appurtenant rights, remaining attached to the lands of an *ahupua'a*, regardless of who owned them, or if they only applied to owners at the time fishing rights were vested with the Organic Act of 1900. These issues were legislated in a series of Hawai'i and US Supreme court cases in the first half of the twentieth century. Most involved not Hawaiian *konohiki* families, but American businessmen and missionary descendants who acquired *konohiki* fishing rights through purchase of adjoining *ahupua'a* lands. By 1953, the territorial government had condemned 37 *konohiki* fisheries on Maui and O'ahu (including multiple fisheries purchased to facilitate construction of Pearl Harbor) and the Attorney General had initiated condemnation of nine more on Maui and Kaua'i. Some of the last registered konohiki "*fisheries*" in all of Hawai'i exist in *ahupua`a* within our study site. *Konohiki* fishing rights remain an unresolved legal issue with aspects of these rights reaffirmed in Hawai'i's state constitution and other present-day laws (Murakami and Tanaka 2015).

Though Hawai‘i kingdom, territorial, and state laws also state that *konohiki* share fishing rights with *hoa‘āina* (ahupua‘a residents) (Murakami and Tanaka 2015), the issue of *ho‘aina* rights in *ahupua‘a* fisheries remained largely unaddressed even as *konohiki* rights were slowly being eroded. Halele‘a community members continued to respect *konohiki* families’ rights to regulate harvest of particular species and exclusive near-shore fishing rights for *ahupua‘a* residents well into the 1970s and later. Today, most *ahupua‘a* near shore fisheries in Hawai‘i are open to the public. Fishery regulations are largely uniform across the state despite variation in geology, habitat, fish-spawning seasons, and generations of place-specific knowledge. Most meetings and decisions regarding natural resources on the rural outer islands such as Kaua`i are made in the capital city of Honolulu, on O`ahu, by the Division of Aquatic Resources, which resides within the Department of Land and Natural Resources.

Study Site: Halele‘a, Kaua‘i

This study takes place in the *moku* of Halele‘a, on Kaua‘i’s north shore (Figure 1), which comprises nine *ahupua‘a* (Hā`ena, Wainiha, Lumahai, Waikoko, Waipā,

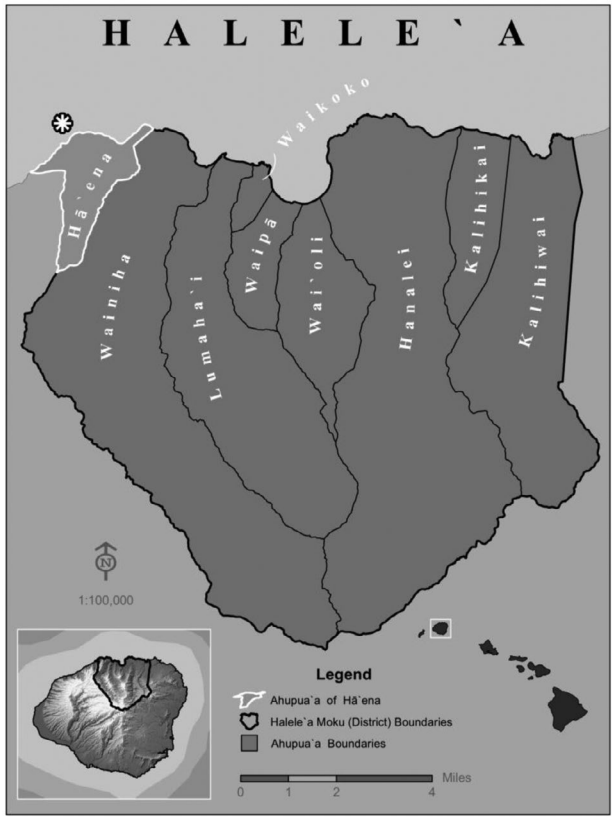


Fig. 1: Location of the Halele‘a *moku* on the Island of Kaua‘i, Hawai‘i.
Source: H. Peter King.

Waioli, Hanalei, Kahlihikai, and Kalihiwai). Kaua‘i is geologically the oldest of the main Hawaiian Islands, and the coastal and marine areas along its north shore are unique. Two of the largest fringing reef systems in the main Hawaiian Islands are found within the Halele`a Moku: Hā`ena and Anini. Several large bays provide seasonal spawning areas and habitat for culturally and economically important schooling fish species targeted in surround net fishing, such as *Akule* (bigeye scad, *Sela crumenophthalmus*).

Description of surround net fishing in Halele'a: hukilau

There are many different types of net fishing in Hawai'i. Historically, most targeted specific fish species using nets of varying sizes woven from the fiber of endemic trees or shrubs such as *olonā* (Kahaulelio, Nogelmeier, and Kahaulelio 2005). *Hukilau* is a Hawaiian surround net fishing method that is labor-intensive, highly efficient, and yields large catches (Friedlander and Parrish 1997). The word "*hukilau"* comes from *huki*, to pull, and *lau*, leaves. The name refers to dried *ti* leaves (*Cordyline minalis*) tied to a long rope pulled across the surface of the ocean to herd schooling fish.[3] The shadows and movement of the leaves served to scare the fish into the shallows where a short length of hand-woven net could be used to surround and harvest part of the school (Kahaulelio, Nogelmeier, and Kahaulelio 2005). Over time, surround techniques, in which longer lengths of net were substituted for the rope and *ti* leaves, were also referred to as "*hukilau*" or simply "surrounds," with nylon then monofilament nets replacing those woven from fiber. Today, *lawai'a* in Halele'a continue this practice, using hundred-foot lengths of net to surround, herd, and harvest schools. They use small boats launched from shore to deploy nets, spotters on land to direct the boats, divers to disentangle rocks or untargeted marine species, and groups of people on the beach to help pull in the nets. It is important to distinguish between community-led surround net fishing and industrial commercial fishing techniques that indiscriminately capture entire schools of *akule* further offshore or when they arrive to spawn in Hawaiian bays. Some of these industrial fishing enterprises employ seine net fishing vessels and spotter planes, both launched from outside Halele'a. Their catch is sold in distant commercial markets rather than shared communally.

Economic and demographic change in the Halele'a Moku

Today, Kaua`i's rural north shore beaches within the *moku* of Halele`a are visited by upwards of 2000 tourists a day, mainly to swim and snorkel (Vaughan and Ardoin 2014). International recognition of the area's natural beauty has caused an influx of luxury coastal development. Increased demand for coastal property has forced many local families to move due to inability to pay taxes tied to rising property values (Andrade 2008). Many new homeowners from outside of Hawai'i have gated their properties or shut off informal easements to access public beaches, some of which were used to launch boats for surround net fishing. A large number of homes are vacant or primarily used as vacation

rentals. For example, in one area community, Hā‘ena, just half of 322 homes in 2010 were owner-occupied (US Census Bureau 2010). Likewise, over half of Hā`ena's population (431 residents) relocated to the area since 2002 (US Census Bureau 2010). These demographic and economic changes have caused local families to move away from their ancestral lands and fishing grounds, while simultaneously decreasing coastal access. Despite changes in land tenure and demographics, government efforts to terminate local-level *konohiki* management, and imposed centralization of state agency control, some features of local-level near-shore fisheries management are now being reinvigorated in parts of Halele‘a. Though near-shore fisheries regulation is now centralized and overseen by the State of Hawai`i, *kilo* and *lawai`a* (fishermen and women) in many areas continue to employ ancestral knowledge and organize area families for surround net fishing.

Perpetuating social and cultural ties through surround net fishing

This article opens with one community member's account of how surround net fishing took place within one Halele‘a bay in the 1970s, overseen by the area *konohiki ‘ohana*. In some Halele‘a *ahupua‘a*, the species captured through surround net fishing were reserved exclusively for *konohiki* harvest. Through the 1970s, *konohiki* families maintained and deployed the nets, served as *kilo*, and distributed the harvest. Though in current times other area families now also surround in areas formerly reserved for *konohiki*, surround net harvests continue using the same methods in multiple bays each summer in Halele‘a. Our analysis uncovered three major themes related to the longevity and perpetuation of surround net fishing: *hō‘ihi* (respectful reciprocity), *konohiki* (inviting ability), and *kuleana* (rights based on responsibilities).

Respectful reciprocity: Hō‘ihi

Fishing in Halele‘a was based on respectful reciprocal relationships between people and their natural environment. In this study, interviewees recalling excellent fishermen and women, including *konohiki* and *kilo*, frequently discussed their relationship with fish. For example, the daughter of one respected Hā‘ena *lawai'a* explained that he always released and named the first fish caught in a surround. When it was time to surround the school again, he called that fish by name and it brought the rest of the school to him. Respected *kilo* were described not only observing the movement of schools, but moving these schools towards nets through *oli* (chant) or other manifestations of *mana* (spiritual power). Remembering one area *konohiki*, a community member stated, "He asked the fish to move, they move." The idea that fish were participants in the fishing practice, choosing whether or not to come to the nets of certain *lawai`a*, was common. Some stories described area *lawai`a* working with *‘aumakua* (ancestral guardians), departed family members that had taken the shape of particular sharks, who assisted by herding schools of fish into their descend-

ants' nets. Instead of viewing humans as separate from nature, these accounts exemplify the importance of respectful reciprocal relationships with marine life and the food it provided.

Respectful reciprocal relationships, not only with resources, but also among people, were critical to sustaining surround net fishing in Halele'a. *Konohiki* families helped one another surround in each other's local areas. They also assisted with large tasks, maintenance, and recovery after disasters, including hurricanes and two tsunamis that inundated the area in 1946 and 1957. The 1946 tsunami washed away all but one home in one Halele'a bay, including the area *konohiki's* boathouse and surround nets. The *konohiki* family from another part of Kaua`i came to help dive to retrieve the irreplaceable nets key to providing food for the community. Further, *konohiki* families could not conduct surround net fishing alone. They relied on other area fishing families to fill crucial roles during harvests such as diving to maneuver the nets. Descendants of one fishing family that long served as expert divers for the *konohiki* family in one *ahupua'a* continue to dive for surrounds throughout Halele'a today. Contemporary surround net fishing crews in Halele'a still rely on highly valued relationships of mutual respect and reciprocity, through which area families continue to work together and help one another across generations.

Inviting ability: Konohiki

The word *konohiki* means to invite ability or willingness. This refers to the ability of a *konohiki* to organize people for collective endeavors no one family could achieve alone, such as maintenance of irrigation systems to sustain taro patches or surround net harvests (Andrade 2008). In Hawaiian Kingdom times, the *konohiki* mobilized *hoa`āina* to assist with deploying and pulling in the large nets. Twentieth-century *konohiki* families could not conduct surround net fishing without helpers from the community to provide labor, including expert divers as described earlier. While a few divers might be sufficient to navigate the nets and school safely to shore, many more hands were needed to pull the nets laden with fish to the beach, and then extract the fish, one at a time. In recalling surround net harvests in one Halele'a bay, community members frequently recounted how the area sugar mill rang its bell when the *konohiki* surrounded a school of fish, alerting workers to go to the beach to help pull in the nets.

By organizing and overseeing collective harvests, *konohiki* facilitated community ability to access an important source of protein, targeting schooling species that can only be caught for a few months during the summer. Through surround net fishing, which yields large harvests ranging from 300 to over 1000 lb, *konohiki* "would feed all the families." One respondent whose *'ohana* (family) served as *konohiki* for a coastal area in Halele'a explained, "The people who came to help us … grandpa would give them a share, *mahele*. If you came to work, everyone would get fish."

Equitable and generous distribution of fish, in some cases by large bamboo basketfuls, helped particular *konohiki* and *kilo* to maintain authority and ability

to mobilize labor. Describing one Hā‘ena area *kilo* known for his generosity, a community member recalled, “There was no limit to the *mahele*. His idea was to share his fish with everybody” (Maly and Maly 2003, 404). In interviews with Halele‘a elders, most say that their families never had to purchase groceries from the store because seafood and other locally produced food was so abundant. Before refrigeration, *akule* from surrounds was dried so that it could be stored and eaten year round. Interviewees recalled fish hanging from sticks stuck in the sand along the length of the beach after a surround, drying in the ocean breeze that kept away flies. One community member recalls a visceral feeling from her childhood of the social process of fishing, fish processing, and sharing:

> But we had enough, or at least enough, and there was a lot of sharing, like most rural communities. There was always the smell of the ocean and fish blood. And I like that because it tells me we are gonna have that kind of fish. It helped us to learn how to process fish as well and how to really enjoy it, and how to eat it, and how to express enjoyment, how to give thanks without saying thank you. How you socialize around food.

Today, Halele‘a *lawai‘a* continue to *mahele* shares of fish to helpers and throughout the community. Many *lawai‘a* share fish with elders who can no longer fish for themselves or assist with pulling in the nets (Vaughan and Vitousek 2013). *Mahele* are now shared by the cooler or in gallon-size Ziploc® bags, instead of bamboo baskets and metal *pākini* (washbasins). Anyone who assists in a surround net effort receives a share of the catch, which they then distribute and share further (Vaughan and Vitousek 2013). All of the *lawai`a* in one key area fishery were documented distributing their catch from both throw net and surrounds, among families or friends or for *pā`ina* (large social gatherings; ibid.).

Equitable and generous distribution of fish continues to underpin ability to mobilize labor. Today, *lawai‘a* communicate via phone or text to quickly organize small groups of eight to ten fishers to assist with deploying and pulling in the monofilament nets. Although the nets are made of different material, labor is gathered via cell phones rather than bells, and authority to surround is no longer limited to *konohiki* families, expert Halele‘a fishermen maintain ability to mobilize labor for surround net fishing. Through overseeing collective surrounds and sharing *mahele* from the harvest, contemporary *lawai‘a* continue to feed large segments of the Halele‘a population, facilitating ongoing community ability to access an important food source.

Responsibility: Kuleana

Today, responsibility to manage near-shore fisheries lies with the State of Hawai`i and the Division of Aquatic Resources (DAR). Since management rights formally reside with the DAR, fisheries are open to the public, prohibiting exclusive harvest rights. In Hawaiian Kingdom times, *konohiki* held authority

to restrict harvests, rest areas or species in consultation with area *hoa'āina*, reserve certain species for their exclusive harvest or retain one-third of the catch (Higuchi 2008). However, *konohiki* rights were based upon fulfillment of substantial responsibilities. In addition to feeding the community through *mahele* of catch, these responsibilities included caring for gear required for surrounds, and ensuring resources were managed to assure future harvests. Although *lawai'a* today do not retain the same formal rights and authority once given *konohiki*, they maintain many of the same responsibilities.

One responsibility continued over time is maintenance of nets. Historically, nets made of *olonā* fiber were passed down through families. These nets required much care and effort to make, mend, maintain, and dry. *Olonā* left wet would rot and break (Maly and Maly 2003). In the plantation era, nets were transported to nearby beach parks or town baseball fields and spread out to dry before being folded carefully and stored for the next surround. Today, monofilament nets still require cleaning to remove seaweed, coral and debris as well as constant mending, drying, and careful storage. Rowboats are maintained, stored, loaded with heavy nets and towed to the beach for surrounds by *kilo* and their families.

Konohiki responsibilities and authority to make decisions regarding resources also hinged on in-depth knowledge of fish behavior in order to sustain large harvests. In one *ahupua'a* within our study area, knowledgeable *konohiki* watched for the changing color of schools of *akule* to signal the fish had finished spawning before deploying their nets. As one area *kupuna* (elder) described *konohiki* management, "The management was in the harvesting, and in respecting the seasons. They knew the spawning cycles. They never took out of season." Some interviewees worried that once community members stopped respecting exclusive *konohiki* rights to oversee surrounds, *lawai`a* with less in-depth knowledge began surrounding schools of *akule* before they had a chance to spawn. Multiple interviewees linked termination of exclusive *konohiki* fishing rights to declines in the size and frequency of schools over the past two decades.

Contemporary *lawai`a* responsibilities include educational efforts to teach the next generation knowledge they learned from their *kūpuna*. Current educational efforts include *lawai'a* camps where elder *lawai`a* teach ancestral harvest techniques, and fishing skills such as how to sew and repair nets, how to determine the gender of fish and recognize when they are spawning, how to observe lunar and tidal cycles, and other seasonal changes that affect fish behavior. As important as skills are values, such as *lawa pono* (taking only what you need), values which are also imparted through *lawai'a* camps and everyday fishing with area youth.

In these ways, the knowledgeable authority, rights, and ability of head *lawai`a* of Halele'a to surround fish continue to be based on responsibilities. These responsibilities include caring for, storing and mobilizing gear, fishing in a manner that sustains future harvests, educating future generations, and feeding the community. Social ties within the community are in turn reinforced

through *mahele*, as people come together to participate in collective harvests, and to consume fish from surrounds at community *lū'au* (feasts) and other gatherings. By fulfilling their responsibility to share and feed, Halele'a *lawai'a* reinforce community relationships that tie people to one another, to their food, and to their home, even in the face of rapid change (Vaughan and Vitousek 2013).

Implications for Access in Near Shore Fisheries

Coastal fisheries are increasingly critical components of food security and healthy communities worldwide (Bell et al. 2009; Béné, Macfadyen, and Allison 2007). There is also a growing awareness of the contribution of coastal fisheries to livelihoods (Allison and Ellis 2001), particularly in coral reef systems (Hicks and Cinner 2014; Kittinger et al. 2012). Access theory is a useful tool for examining the complex array of interactions between people and food systems, particularly for near-shore fisheries (Peluso 1992; Seto et al. Forthcoming; Sikor and Lund 2009). While property rights analysis focuses on formal rights and what resource users are allowed to do, access analysis examines what individuals actually do. Access analysis can explain how and why people benefit even without possessing formal rights. Access analysis is particularly useful for understanding indigenous food systems due to their complexity, the prevalence of informal rights, and the importance of social and power relations. As in similar studies of fishing persistence and motivation (Pollnac, Bavinck, and Monnereau 2012), mechanisms of access are interrelated and difficult to disentangle. In the case of Halele'a, Kaua'i, access analysis revealed three key ways through which community members have maintained a critical local food source: *hō'ihi*, maintaining respectful reciprocal relationships; *konohiki*, inviting ability by mobilizing labor through ancestral knowledge and authority deployed in contemporary ways; and *kuleana*, cultivating balance of rights based on responsibilities. These are all social, rather than economic or technological mechanisms.

Access theory and social relationships

In access theory economic (markets, technology and capital) and social factors (knowledge, authority, identity, ability to mobilize labor) can all mediate benefits people receive from ecosystems (Hicks and Cinner 2014; Seto et al. Forthcoming). In small-scale fisheries, particularly those relied on by indigenous communities, social factors may be more important than economic ones in determining distribution of benefits (Seto et al. Forthcoming). This study highlights how one community's use of a particular fishing method is embedded in and helps to reinforce complex social relationships, knowledge, and values systems. Customary norms that continue to govern behavior are crucial to maintaining local control over an important aspect of the community food system. Fish are seen as food, but *lawai`a* also feel responsibility to care for and maintain respectful balanced relationships with them. In this case, viewing

fishery resources not just as food but also, in some cases, as family has helped to sustain resources over time. While access theory often categorizes benefits in terms of social relationships (Ribot and Peluso 2003), this case demonstrates that relationships can extend beyond human interactions to include respectful relationships between people and the environment. In this case, as in other indigenous communities, reciprocity and responsibility govern complex human–environmental interactions (Garibaldi and Turner 2004).

This study supports past literature suggesting the need to amend access theory to account for sociocultural perspectives (Scholte, van Teeffelen, and Verburg 2015), cultural bequest values (Oleson et al. 2015) and cultural ecosystem services (Plieninger, Dijks, Oteros-Rozas, and Bieling 2013). Our study illuminates multiple "immaterial benefits," such as perpetuation of ancestral roles and authority, respectful relationships, social cohesion, and balance of rights and responsibilities, all provided by surround net fisheries, that are not captured by mainstream ecosystem services accounting methods (Chiesura and de Groot 2003; Vaughan and Vitousek 2013). Other study locations, resources, and food systems may offer many others.

Access, planning, and policy change

Much of this study was undertaken during one Halele'a *ahupua'a*'s decade-long effort to restore local-level management of their near-shore fishery by developing state law to govern coastal use based on customary practices for the area. Legislation passed in 2006 designated Hā`ena as a community-based subsistence fishing area (CBSFA), recognizing the importance of the fishery for "reaffirming and protecting fishing practices customarily exercised for purposes of Native Hawaiian subsistence, culture, and religion" (Hawai`i Revised Statutes, Chapter 188, Section 22.6). Although legislation designated the area for local-level management, the community still had to work with the state resource management agency to co-develop fishing regulations, and secure their approval through the same onerous public process as any administrative rules promulgated by state government agencies. These rules became law in August 2015 after nearly ten years of planning and negotiation, over seventy meetings, fifteen rules drafts, three public hearings, and multiple studies undertaken to document visitor impacts, user groups, fishery health and the importance of locally caught fish within and beyond the Hā`ena community (Vaughan and Vitousek 2013). Ancestral norms guided the creation of rules (Vaughan et al. Forthcoming) and three of these norms: *hō'ihi*, respectful reciprocity; *konohiki*, inviting ability; and *kuleana*, rights based on responsibilities, were based on indigenous access mechanisms. These indigenous access mechanisms were an integral component of the creation of new law. Passage of these rules made Hā`ena only the second active CBSFA in the state of Hawai`i and the first coastal area in Hawai`i to be permanently governed by community developed, local-level rules based on ancestral knowledge and practice. Many communities across Hawai`i view this effort as the cusp of a larger community movement to

increase self-sufficiency and reestablish formal local-level control over ocean resources as a food source. This case illustrates how perpetuation of customary mechanisms of access can provide a powerful foundation for policy change and restoration of local control of food systems.

Importance of perpetuating ancestral practices for local control of Hawai`i food systems

The continued importance of surround net fishing across three centuries in the Halele`a *moku* on Kaua'i Island demonstrates the value of preserving ancestral, place-based knowledge and practices in maintaining local control over food systems. Much work has documented the importance of *kua`āina* (those living and embodying Native Hawaiian culture, particularly in rural areas of Hawai'i) in perpetuating cultural practices related to food and resource harvest (McGregor 2007). It is important for communities seeking to enhance food sovereignty to maintain communal, intergenerational, cultural harvest, distribution, and consumption practices because they create "a social environment that cultivates community and kinship ties, emotional interdependency and support" (McGregor 2007, 17). Perpetuating ancestral practices related to food provides roles for individuals of all ages within a society, while maintaining relationships and balance with the natural world in specific areas (McGregor 2007; Turner et al. 2013). Customary food systems continue through formal education programs and camps but also through daily perpetuation of cultivation and harvest practices (Vaughan and Caldwell 2015).

As important as maintaining ancestral practices such as communal surround net fishing may be, global environmental changes beyond the scale of local control will likely require future adaptation. Research has documented the effectiveness of ancestral knowledge and Hawaiian near-shore marine management approaches in increasing fishery health. Traditionally managed community fisheries have exhibited higher biomass than even no-take marine protected areas (Poepoe et al. 2003; Friedlander et al. 2013). However, past management practices and levels of sustainable harvest may not be effective in future near-shore fisheries impacted by ocean acidification, decreased fresh water flow, changing wind patterns and currents, coral bleaching, sea-level rise, and increases in temperature (Mora et al. 2013). Historically, Native Hawaiians have been quick to adopt useful innovations in governance, technology and society (Beamer 2014). Future innovation will continue to be necessary as climate change increasingly impacts Hawai'i (Anderson et al. 2015; Keener 2013). Local-level governance and decision-making offers potential to observe and adapt effectively to future changes in fisheries. If existing harvesting practices become unsustainable (Turner et al. 2013), local communities will need to use the ancestral values underlying these older practices to guide development of new ones. Engaging communities to perpetuate the values, relationships and responsibilities underlying food systems is crucial to long-term food security and resilience.

Acknowledgements

The authors would like to thank Malia and Victor Nobrega-Olivera, Malia Akutagawa, Kaui Fu, Billy Kinney, Kamealoha Forrest, Bethany Wylie, the students of Kaiaulu, transcriptionists of Stanford's Hui o Hawai'i and LAMA, for helping to bring these interviews to life. Mahalo to Hi`ilei Hobart for her patience and insights throughout the editorial process, to all reviewers; to funders NSF SEES (1216109), Emmett Interdisciplinary Program for Environment and Resources, Community Forestry and Environmental Research Partnerships, Heinz, and Switzer fellowships; Peter Vitousek, Barton Thompson, Meg Caldwell, Nicole Ardoin, Jack Kittenger, Louise Fortmann and lab members. Mahalo to KUA, HCSN, and E Alu Pū, Waipā Foundation, Limahuli Gardens, Hā`ena Community Members, Hui Maka'ainana o Makana, our families, and everyone who helped to contribute to this article and effort. Thank you especially to the fishing families and kūpuna (elders) of Ko'olau and Halele'a: Hā'ena, Wainiha, Hanalei, Wanini, Kalihikai, and Kalihiwai for your generous sharing and aloha for your 'āina, your home.

Mehana Blaich Vaughan is an Assistant Professor in the Department of Natural Resource and Environmental Management at the University of Hawai'i at Mānoa. She holds a joint appointment with Hui 'Āina Momona, and The UH Seagrant College Program, working to enhance the capacity of rural Hawai'i communities to care for and govern natural resources. Mehana comes from the island of Kaua'i, where she taught 'āina based education programs for ten years. She is the mother of three keiki (mehana@hawaii.edu).

Adam L. Ayers is a PhD candidate in the Department of Urban & Regional Planning at the University of Hawai'i at Mānoa. Adam is a Social Scientist for the Joint Institute of Marine and Atmospheric Research (JIMAR) in the Socioeconomics Program at the NOAA Pacific Islands Fisheries Science Center.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes

1. This article makes extensive use of Hawaiian terms to describe Native Hawaiian culture and practices. We define and italicize each term the first time it is introduced.
2. Newer research suggests that the actual number of *konohiki* fisheries was far higher than 400 (Akutagawa Forthcoming), with one map from 1923 delineating close to 100 *ahupua'a* fisheries on the island of O'ahu alone (Friedlander, Shackeroff and Kittinger, 2013; Murakami and Tanaka, 2015).
3. The name may also refer to the many (*lau*) people needed to pull the catch to shore.

References

Akutagawa, Malia. *The Return of the Konohiki*. Forthcoming.

Allison, E. H., and F. Ellis. 2001. "The Livelihoods Approach and Management of Small-scale Fisheries." *Marine Policy* 25 (5): 377–388.

Anderson, T., C. Fletcher, M. Barbee, L. N. Frazer, and B. Romine. 2015. "Doubling of Coastal Erosion under Rising Sea Level by Mid-century in Hawaii." *Natural Hazards* 78 (1): 75–103. http://doi.org/10.1007/s11069-015-1698-6.

Andrade, C. 2008. *Haena: Through the Eyes of the Ancestors*. Honolulu: University of Hawai'i Press.

Ayers, A. L., and J. N. Kittinger. 2014. "Emergence of Co-management Governance for Hawai'i Coral Reef Fisheries." *Global Environmental Change* 28: 251–262. http://doi.org/10.1016/j.gloenvcha.2014.07.006.

Beamer, K. 2014. *No Mākou ka Mana: Liberating the Nation*. Honolulu: Kamehameha Publishing. Accessed 20 July 2016. http://kpstore.deliveryhawaii.com/KS/product/978-0-87336-293-1.html.

Bell, J. D., M. Kronen, A. Vunisea, Nash W. J., G. Keeble, A. Demmke, S. Pontifex, and S. Andréfouët. 2009. "Planning the Use of Fish for Food Security in the Pacific." *Marine Policy* 33 (1): 64–76. http://doi.org/doi: DOI: 10.1016/j.marpol.2008.04.002.

Béné, C., G. Macfadyen, and E. H. Allison. 2007. *Increasing the Contribution of Small-scale Disheries to Poverty Alleviation and Food Security*. Rome: Food and Agriculture Organization of the United Nations.

Born, B., and M. Purcell. 2006. "Avoiding the Local Trap: Scale and Food Systems in Planning Research." *Journal of Planning Education and Research* 26 (2): 195–207. http://doi.org/10.1177/0739456X06291389.

Boyle, F. A. 1994. "Restoration of the Independent Nation State of Hawaii Under International Law: Back to the Future." *St. Thomas Law Rev.* 7: 723–756.

Brown, L. R. 2012. *Outgrowing the Earth: The Food Security Challenge in an Age of Falling Water Tables and Rising Temperatures*. Florence, KY: Taylor & Francis.

Chiesura, A., and R. de Groot. 2003. "Critical Natural Capital: A Socio-Cultural Perspective." *Identifying Critical Natural Capital* 44 (2–3): 219–231. http://doi.org/10.1016/S0921-8009(02)00275-6.

Chock, J. M. 1995. "One Hundred Years of Illegitimacy: International Legal Analysis of the Illegal Overthrow of the Hawaiian Monarchy, Hawai'i's Annexation, and Possible Reparations." *University of Hawaii Law Review* 17: 463–512.

Cox, M. 2015. "A Basic Guide for Empirical Environmental Social Science." *Ecology and Society* 20 (1). http://doi.org/10.5751/ES-07400-200163.

Dye, T. 1994. "Population Trends in Hawai'i before 1778." *Hawaiian Journal of History* 28: 1–20.

Ericksen, P. J. 2008. "Conceptualizing Food Systems for Global Environmental Change Research." *Global Environmental Change* 18 (1): 234–245.

Finkbeiner, E., A. Ayers, J. N. Kittinger, and L. Crowder. 2015. "A comparison of small-scale fisheries governability: Baja California Sur, Mexico and the Hawaiian Islands." In *Interactive Governance for Small-Scale Fisheries: Global Reflections*, edited by Svein Jentoft and Ratana Chuenpagdee, 199–221. Cham, Switzerland: Springer.

Friedlander, A., G. Aeby, R. Brainard, E. Brown, K. Chaston, A. Clark, P. McGowan, T. Montgomery, W. Walsh, and I. Williams. 2008. "The State of Coral Reef Ecosystems of the Main Hawaiian Islands." NOAA Technical Memorandum NOS NCCOS 73. Silver Spring, MD: NOAA/NCCOS Center for Coastal Monitoring and Assessment's Biogeography Team. https://coastalscience.noaa.gov/research/docs/CoralReport2008.pdf.

Friedlander, A., E. Brown, and M. Monaco. 2007. "Defining Reef Fish Habitat Utilization Patterns in Hawaii: Comparisons between Marine Protected Areas and Areas open tyo Fishing." *Marine Ecology Progress Series* 351 (December): 221–233. http://doi.org/10.3354/meps07112.

Friedlander, A. M., and J. D. Parrish. 1997. "Fisheries harvest and standing stock in a Hawaiian Bay." *Fisheries Research* 32 (1): 33–50. http://doi.org/10.1016/S0165-7836(97)00038-6.

Friedlander, A. M., E. K. Brown, P. L. Jokiel, W. R. Smith, and K. S. Rodgers. 2003. "Effects of Habitat, Wave Exposure, and Marine Protected Area Status on Coral Reef Fish Assemblages in the Hawaiian Archipelago." *Coral Reefs* 22 (3): 291–305. http://doi.org/10.1007/s00338-003-0317-2.

Friedlander, A. M., and E. E. DeMartini. 2002. "Contrasts in Density, Size, and Biomass of Reef Fishes between the Northwestern and the Main Hawaiian Islands: The Effects of Fishing Down Apex Predators." *Marine Ecology Progress Series* 230: 253–264.

Friedlander, A. M., J. M. Shackeroff, and J. N. Kittinger. 2013. "Customary Marine Resource Knowledge and Use in Contemporary Hawai'i 1." *Pacific Science* 67 (3): 441–460. http://doi.org/10.2984/67.3.10.

Garibaldi, A., and N. Turner. 2004. "Cultural Keystone Species: Implications for Ecological Conservation and Restoration." *Ecology and Society* 9 (3). http://www.ecologyandsociety.org/vol9/iss3/art1/.

Geslani, Cheryl, Matthew Loke, Brooks Takenaka, and PingSun Leung. 2012. "Hawaii's Seafood Consumption and its Supply Sources." SOEST 12 -01. JIMAR 12-0379. Honolulu: University of Hawaii at Manoa. http://www2.hawaii.edu/~geslani/files/Leung_HIseafood.final.pdf.

Godfray, H. C. J., J. R. Beddington, I. R. Crute, L. Haddad, D. Lawrence, J. F. Muir, J. Pretty, S. Robinson, S. M. Thomas, and C. Toulmin, 2010. "Food Security: The Challenge of Feeding 9 Billion People." *Science* 327 (5967): 812–818. http://doi.org/10.1126/science.1185383.

Gonschor, L., and K. Beamer. 2014. "Toward an Inventory of Ahupua'a in the Hawaiian Kingdom: A Survey of Nineteenth- and Early Twentieth-century Cartographic and Archival Records of the Island of Hawai'i." *Hawaiian Journal of History* 48: 53–87.

Gopalakrishnan, C., J. Levy, K. W. Li, and K. W. Hipel. 2005. "Water Allocation among Multiple Stakeholders: Conflict Analysis of the Waiahole Water Project, Hawaii." *International Journal of Water Resources Development* 21 (2): 283–295.

Hicks, C. C., and J. E. Cinner. 2014. "Social, Institutional, and Knowledge Mechanisms Mediate Diverse Ecosystem Service Benefits from Coral Reefs." *Proceedings of the National Academy of Sciences* 111 (50): 17791–17796. http://doi.org/10.1073/pnas.1413473111.

Higuchi, J. 2008. "Propogating Cultural Kipuka." *University of Hawaii Law Review* 31: 193–224.

Jarman, M. C., and R. R. M. Verchick. 2002. "Beyond the Courts of the Conqueror: Balancing Private and Cultural Property Rights under Hawai'i Law." *Scholar: St. Mary's Law Review on Minority Issues* 5: 201.

Jerardo, A. 2008. "What Share of U.S. Consumed Food Is Imported?" *Amber Waves* 6 (1): 36–37.

Jokiel, P. L., K. S. Rodgers, and D Kahaulelio. 2011. "Marine Resource Management in the Hawaiian Archipelago: The Traditional Hawaiian System in Relation to the Western Approach." *Journal of Marine Biology* 2011: 1–16. http://doi.org/10.1155/2011/151682.

Kahaulelio, A. D., P. Nogelmeier, and D. Kahaulelio. 2005. *Ka Oihana Lawaia: Hawaiian Fishing Traditions*. Honolulu: Bishop Museum Press.

Kahaulelio, A. D., P. Nogelmeier, W. J. Walsh, D. A. Polhemus, and T. A. Wilhelm. 2005. *Ka Oihana Lawaia: Hawaiian Fishing Traditions*. Honolulu: Bishop Museum Pr.

Keener, V. 2013. *Climate Change and Pacific Islands: Indicators and Impacts: Report for the 2012 Pacific Islands Regional Climate Assessment*. Island Press.

Kirch, P. V. 1990. "Monumental Architecture and Power in Polynesian Chiefdoms: A Comparison of Tonga and Hawaii." *World Archaeology* 22 (2): 206–222.

Kirch, P. V., and Rallu, J. L. 2007. *The Growth and Collapse of Pacific Island Societies: Archaeological and Demographic Perspectives*. University of Hawaii Press.

Kittinger, J. N., E. M. Finkbeiner, E. W. Glazier, and L. B. Crowder. 2012. "Human Dimensions of Coral Reef Social-ecological Systems." *Ecology and Society* 17 (4): 17.

Kittinger, J. N., J. M. Pandolfi, J. H. Blodgett, T. L. Hunt, H. Jiang, and K. Maly, L. E. McClenachan, J. K. Schultz, and B. A. Wilcox. 2011. Historical Reconstruction Reveals Recovery in Hawaiian Coral Reefs. *PLoS ONE* 6 (10): e25460. http://doi.org/10.1371/journal.pone.0025460.

Kittinger, J. N., L. T. Teneva, H. Koike, K. A. Stamoulis, D. S. Kittinger, and K. L. L. Oleson, and A. M. Friedlander. 2015. "From Reef to Table: Social and Ecological Factors Affecting Coral Reef Fisheries, Artisanal Seafood Supply Chains, and Seafood Security." *PLoS ONE* 10 (8): e0123856. http://doi.org/10.1371/journal.pone.0123856.

Kosaki, R. 1954. *Konohiki Fishing Rights, Hawaii Legislature*. Honolulu: Legislative Reference Bureau.

Kuhnlein, H. V., B. Erasmus, and D. Spigelski. 2009. *Indigenous Peoples' Food Systems: The Many Dimensions of Culture*. Rome: Food and Agriculture Organization of the United Nations Centre for Indigenous Peoples' Nutrition and Environment.

Leunga, PingSun, and Matthew Lokeb 2008. "Economic Impacts of Increasing Hawaii's Food Self Sufficiency." EI-16. Economic Issues. Honolulu: Cooperative Extension Service, College of Tropical Agriculture and Human Resources, University of Hawaii at Manoa. http://www.ctahr.hawaii.edu/oc/freepubs/pdf/EI-16.pdf.

Maly, Kepa, and O. Maly. 2003. "'Hana Ka Lima, Ai Ka Waha' a Collection of Historical Accounts and Oral History Interviews with Kama'Aina Residents and Fisher-People of Lands in the Halele'A-Napali Region." Prepared for the Nature Conservancy and The National Tropical Botanical Gardens - Limahuli Gardens. Hilo, HI: Kumu Pono Associates LLC. http://www.ulukau.org/elib/collect/maly4/index/assoc/D0.dir/book.pdf.

McCoy, K. 2015. "Estimating nearshore fisheries catch for the main Hawaiian Islands." Master's thesis, University of Hawai'i at Manoa.

McGregor, A., R. M. Bourke, M. Manley, S. Tubuna, and R. Deo. 2009. "Pacific Island Food Security: Situation, Challenges and Opportunities." *Pacific Economic Bulletin* 24 (2): 24–42.

McGregor, D. P. 2007. *Na Kua'aina: Living Hawaiian Culture*. Honolulu: University of Hawaii Press.

McGregor, D. P. 1996. "An Introduction to the Hoa'aina and Their Rights." *Hawaiian Journal of History* 30: 1–27.

Mora, C., A. G. Frazier, R. J. Longman, R. S. Dacks, M. M. Walton, E. J. Tong, J. J. Sanchez, et al. 2013. "The Projected Timing of Climate Departure from Recent Variability." *Nature* 502 (7470): 183–187.

Murakami, A. T. and W. C. Tanaka. 2015. *Native Hawaiian Law—A Treatise, Chapter 10: Konohiki Fishing Rights*. Honolulu: Kamehameha Publishing.

Oleson, K. L. L., M. Barnes, L. M. Brander, T. A. Oliver, van I. Beek, B. Zafindrasilivonona, and P. Van Beukering. 2015. "Cultural Bequest Values for Ecosystem Service Flows among Indigenous Fishers: A Discrete Choice Experiment Validated with Mixed Methods." *Ecological Economics* 114 (June): 104–116. http://doi.org/10.1016/j.ecolecon.2015.02.028.

Peluso, N. L. 1992. "Teak and Temptation on the Extreme Periphery: Cultural Perspectives on Forest Crime." *Rich Forests, Poor People: Resource Control and Resistance in Java*, 201–232. Berkeley: University of California Press.

Perkins, M. U. 2013. "Kuleana: A Genealogy of Native Tenant Rights." PhD diss., University of Hawai'i at Manoa.

Plieninger, T., S. Dijks, E. Oteros-Rozas, and C. Bieling. 2013. "Assessing, Mapping, and Quantifying Cultural Ecosystem Services at Community Level." *Land Use Policy* 33 (July): 118–129. http://doi.org/10.1016/j.landusepol.2012.12.013.

Poepoe, K., P. K. Bartram, and A. M. Friedlander. 2003. "The Use of Traditional Hawaiian Knowledge in the Contemporary Management of Marine Resources". In *Fisher's Knowledge in Fisheries Science and Management*, edited by N. Haggan, C. Brignall, and L. Wood, 328–339. Vancouver: Fisheries Centre, University of British Columbia.

Pollnac, R., M. Bavinck, and I. Monnereau. 2012. "Job Satisfaction in Fisheries Compared." *Social Indicators Research* 109 (1): 119–133.

Ribot, J. C., and N. L. Peluso. 2003. "A Theory of Access." *Rural Sociology* 68 (2): 153–181.

Schemmel, E. 2014. "Integrating Local Ecological Knowledge with Novel Scientific Tools to Refine Traditional Community Based Fishing Moon Calendars." Hawaii Department of Land and Natural Resources. Accessed 13 July 2016. http://dlnr.hawaii.gov/coralreefs/files/2014/11/HCRS_2pager_Moon-calendar_2014.pdf.

Schlager, E., and E. Ostrom. 1992. "Property-Rights Regimes and Natural Resources: A Conceptual Analysis." *Land Economics* 68 (3): 249–262.

Scholte, Samantha S. K. Astrid J. A. van Teeffelen, and Peter H. Verburg. 2015. "Integrating Socio-cultural Perspectives into Ecosystem Service Valuation: A Review of Concepts and Methods." *Ecological Economics* 114 (June): 67–78. http://doi.org/10.1016/j.ecolecon.2015.03.007.

Seto, Katherine Adam Ayers, Merrill Baker-Medard, Clare Fitzsimmons, Christina Hicks, Kirsten Oleson, Rachel Turner, and Mehana Blaich Vaughan. Forthcoming. *Sustaining Small-scale Fisheries: A Multi-country Comparison of Fisheries Access*.

Sikor, T., and C. Lund. 2009. "Access and Property: A Question of Power and Authority." *Development and Change* 40 (1): 1–22. http://doi.org/10.1111/j.1467-7660.2009.01503.x.

Stannard, D. E. 1989. *Before the Horror: The Population of Hawaii on the Eve of Western Contact*. Honolulu: University of Hawaii Press.

Tashakkori, A., and C. Teddlie. 2003. *Handbook of Mixed Methods in Social & Behavioral Research*. Thousand Oaks, CA: SAGE.

Turner, N., F. Berkes, J. Stephenson, and J. Dick. 2013. "Blundering Intruders: Extraneous Impacts on Two Indigenous Food Systems." *Human Ecology* 41 (4): 563–574. http://doi.org/10.1007/s10745-013-9591-y.

United States Department of Agriculture Farm Service Agency. 2014. p. 2. https://www.fsa.usda.gov/Internet/FSA_File/hi_facts_v6.pdf.

US Census Bureau. 2010. *Hā'ena CDP, Hawai'i: Profile of General Population and 2010 Demographic Profile Data*. Accessed 13 July 2016. http://files.hawaii.gov/dbedt/census/Census_2010/demographic/demo_profile_cdp_NI/Haena.pdf.

US Census Bureau. 2015. Quickfacts: Hawaii, July 1. Accessed 13 July 2016. http://www.census.gov/quickfacts/table/PST045215/15.

Van Houtan, K. S., L. McClenachan, and J. N. Kittinger. 2013. "Seafood menus reflect long-term ocean changes." *Frontiers in Ecology and the Environment* 11 (6): 289–290.

Vaughan, M. B. 2014. "'Āina (Land), That Which Feeds: Researching Community Based Natural Resource Management at Home." *Journal of Research Practice* 10 (2): 1–5.

Vaughan, M. B., and N. M. Ardoin. 2014. "The Implications of Differing Tourist/Resident Perceptions for Community-Based Resource Management: A Hawaiian Coastal Resource Area Study." *Journal of Sustainable Tourism* 22 (1): 50–68. http://doi.org/10.1080/09669582.2013.802326.

Vaughan, M. B., and M. R. Caldwell. 2015. "Hana Pa'a: Challenges and Lessons for Early Phases of Co-management." *Marine Policy* 62: 51–62. http://doi.org/10.1016/j.marpol.2015.07.005.

Vaughan, M. B., B. Thompson, and A. Ayers. Forthcoming. "Pāwehe ke kai a'o Hā'ena: Integrating Informal Local Norms of Coastal Management into Law." *Society and Natural Resources.*

Vaughan, M. B., and P. M. Vitousek. 2013. "Mahele: Sustaining Communities through Small-scale Inshore Fishery Catch and Sharing Networks." *Pacific Science* 67 (3): 33.

Vitousek, P. M., T. N. Ladefoged, P. V. Kirch, A. S. Hartshorn, M. W. Graves, S. C. Hotchkiss, S. Tuljapurkar, and O. A. Chadwick. 2004. "Soils, Agriculture, and Society in Precontact Hawai`i." *Science* 304 (5677): 1665–1669. doi:10.1126/science.1099619.

World Health Organization. 2015. Food Security. Accessed 1 October 2015. http://www.who.int/trade/glossary/story028/en/.