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Source: Pacific Science, 67(3):329-344. 2013.

Published By: University of Hawai'i Press

DOI: <http://dx.doi.org/10.2984/67.3.3>

URL: <http://www.bioone.org/doi/full/10.2984/67.3.3>

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# Mahele: Sustaining Communities through Small-Scale Inshore Fishery Catch and Sharing Networks<sup>1</sup>

Mehana Blaich Vaughan<sup>2,4</sup> and Peter M. Vitousek<sup>3</sup>

**Abstract:** Throughout the Pacific, “subsistence” fishing feeds not only individual fishers and their families but a much broader network of people through the noncommercial distribution, or sharing, of fish. This study evaluated the current importance of this sharing, through tracking subsistence fish catch and distributions (mahele) in one small Hawai‘i fishery over an 18-month period. We found that the traditional and customary system of sharing fish, like subsistence activities in other mixed-economy settings, provides benefits beyond provisioning of food. These benefits include perpetuation of traditional and customary skills and practices, social status, social networks, reciprocal exchange, and collective insurance. Taken together these benefits enhance resilience of community-level social and ecological systems.

THROUGHOUT THE Pacific, “subsistence” fishing feeds not only individual fishers and their families, but a much broader network of people through the noncommercial distribution, or sharing, of fish. Subsistence fishing, hunting, and gathering are all forms of self-provisioning or “activities that produce material goods . . . consumed domestically or shared among households, but not sold for cash” (Teitelbaum and Beckley 2006:115). Sharing of harvests from subsistence fishing is poorly accounted for in academic literature

and in marine governance and policy, especially in developed economies. Consequently, little is known about the contemporary extent and cultural significance of subsistence fishing and the noncommercial distribution, or “sharing,” of the resulting catch.

Subsistence fishing and sharing in economically developed societies may be important for the health and management of marine resources as well as the health and sustainability of local cultures. In many Pacific island fisheries, even in developed contexts such as Hawai‘i, subsistence catch may be larger than commercial (Friedlander and Parrish 1997). However, most fishing data in Hawai‘i focus on commercial fisheries (Cesar and Van Beurker 2004), even though noncommercial fishing can substantially affect the ecological health of fisheries (Coleman et al. 2004). Subsistence fishing is also relevant for marine resource decision making, affecting, for example, the implementation of marine protected areas (Effron et al. 2011, Fox et al. 2012).

Individuals frequently choose to engage in subsistence activities such as fishing, hunting, and gathering, even when these activities are not economically advantageous or incur economic costs (Brown et al. 1998, Teitelbaum and Beckley 2006). Literature on subsistence and self-provisioning emphasizes the importance of other benefits, sometimes described as lifestyle benefits, beyond the actual food products provided (Teitelbaum and Beckley

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<sup>1</sup> This article is part of a special issue of *Pacific Science* (vol. 67, no. 3) on the Human Dimensions of Small-Scale and Traditional Fisheries in the Asia-Pacific Region, guest editors John N. (Jack) Kittinger and Edward W. Glazier. Manuscript accepted 20 August 2012.

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2006). These benefits include cultural perpetuation (Hinrichs 1998, Panelli and Tipa 2009), self-reliance (Tigges et al. 1998), social status (Bliege-Bird and Smith 2005), social networks (Brown et al. 1998, Severance 2010), and reciprocal exchange (Teitelbaum and Beckley 2006). Many of these community-level benefits are inseparable from the act of provisioning itself (Garibaldi and Turner 2004, Panelli and Tipa 2009). These lifestyle benefits can also be described as cultural ecosystem services, or the nonmaterial benefits that human communities derive from ecosystems. They are difficult to measure and thus to understand; therefore, they often are not taken into account in decision making (Chan et al. 2011).

Studies on the benefits of subsistence hunting and gathering activities generally focus on individuals in mixed economies, where subsistence activities supplement wage labor (Teitelbaum and Beckley 2006). On the other hand, research on the sharing of products from hunting and gathering primarily focuses on geographically and economically isolated indigenous groups for whom these activities are the major means of economic support and obtaining food (Gurven et al. 2004, Smith et al. 2010). Explanations for sharing food within nonmarket contexts include kin selection (Nolin 2010), reciprocal altruism (Gurven 2006), signaling theory (Bliege-Bird and Smith 2005), and tolerated scrounging (Gurven 2004), all of which rely upon economic and/or evolutionary explanations in which sharing is viewed as a more effective survival strategy than keeping all the products of one's harvest.

Few studies have applied the broader lens of lifestyle benefits, or cultural ecosystem services, to the sharing of products obtained through subsistence activities such as fishing, to understand noneconomic benefits of sharing within a mixed-economy setting (Brown et al. 1998). Here we address this gap by investigating the following research questions within the context of a small coastal fishery on the island of Kaua'i, Hawai'i: (1) What is the contemporary extent and cultural significance of subsistence fishing and sharing? (2) How does the traditional and customary practice of

sharing fish work in a mixed-economy setting? Specifically, where are fish distributed, to whom, and for what purposes? (3) What nonmaterial benefits does this sharing provide to both fishers and recipients? We address these questions within the context of Hā'ena, Kaua'i, because Hā'ena represents a long-standing, culturally important subsistence fishery and a tractable case in which to explore broadly applicable questions. In addition, the Hā'ena community is engaged in a community-based rule-making effort for the inshore fishery (described in the next section), and the results of this study bear on that natural resource planning process.

#### *Study Site*

This study was conducted in the ahupua'a of Hā'ena, a rural community located within the moku (district) of Halele'a on the island of Kaua'i's North Shore (Figure 1). Ahupua'a are traditional land divisions that often stretched from the mountains into the ocean; they were used by Hawaiians to delineate rights to utilize natural resources (McGregor 1996). Natural resource management decisions were made at the ahupua'a or moku (larger district) level, with harvest in each ahupua'a largely limited to area residents (Maly and Maly 2003, McGregor 2007). Master fishermen within each ahupua'a were responsible for overseeing collective fishing and distribution of catch and in some cases for advising local chiefs on management decisions such as when to close a certain species (McGregor 2007, Jokiel et al. 2011). Most fishing knowledge was considered privileged and handed down within families (Jokiel et al. 2011).

Before Western contact, sharing of fish and other food products between fishers and farmers was critical to community resilience at the ahupua'a level (McGregor 2007). Well into historical times, Hā'ena families have sustained themselves from the natural resources of their ahupua'a, mainly through taro farming and fishing the area's multiple fringing reefs and two sandy lagoon areas (Andrade 2008). Kūpuna (elder) interviews conducted in Hā'ena recall mahele, or distri-

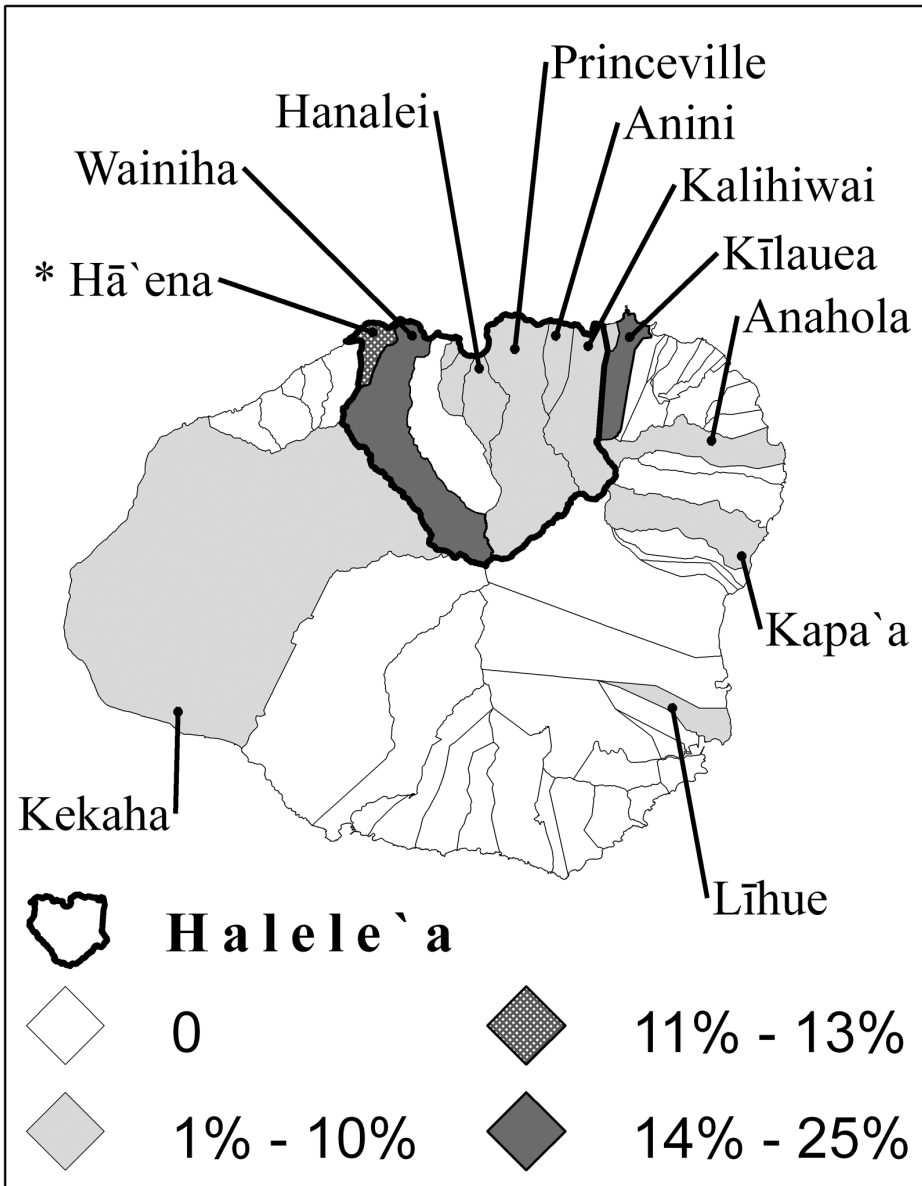


FIGURE 1. Kaua'i distribution map showing Hā'ena and other areas receiving fish from Hā'ena. Lines designate historical ahupua'a boundaries, and names indicate towns or smaller settlement areas within particular ahupua'a. Shading indicates the fraction of fish shared from Hā'ena that went to each area. In addition, small distributions went to the islands of O'ahu and Hawai'i and to California and Oregon. (Created by H. Peter King.)

butions of catch to family and neighbors, after both small harvests by an individual fisher and after collective community fishing events (e.g., "surround" fishing) (Maly and Maly

2003). In surround net fishing, head fishermen climbed certain cliffs to view the school, then signaled fishers in a rowboat when and where to lay the net. The entire community

helped pull the nets to shore and extricate fish. The head fisherman then apportioned the catch, giving each family their mahele, or share (Maly and Maly 2003).

Today Hā'ena is a popular visitor destination, with up to 2,000 tourists per day using the coast (C. Stepath, 1999, unpubl. marine biological survey report). In the past 50 years, land privatization (Andrade 2008) and extensive coastal development of vacation and luxury homes in Hā'ena have driven escalating property values and declining beach access, leading many longtime Hā'ena families to move out of the area. Only half of Hā'ena's 322 homes are occupied (U.S. Census Bureau 2010), with the rest utilized as vacation rentals. Half of the area's 431 residents have moved to the area within the last 10 years (U.S. Census Bureau 2010).

As in other parts of the Pacific, Hawaiian natural resource management has moved from the local or ahupua'a level to centralized government control, under the Hawai'i State Department of Land and Natural Resources (DLNR). In keeping with the renaissance of community-based management in other parts of the Pacific (Johannes 2002, Cinner and Aswani 2007) and in response to perceived declines in inshore fisheries under state-level management, residents of rural Hawai'i communities who depend on local marine resources for sustenance have been advocating restoration of community-based management in keeping with traditional and customary practices (Poepoe et al. 2006, Higuchi 2008, Friedlander et al. 2013 [this issue]). Initial evidence suggests that in certain cases, including a pioneering community-managed inshore fishery at Mo'omomi on Moloka'i, customary management can result in more fish biomass and species richness than government-managed marine reserves that prohibit all take of marine species (Friedlander et al. 2003, Friedlander et al. 2013 [this issue]). In response to community pressure, Hawai'i enacted legislation in 1994 allowing DLNR to designate community-based subsistence fishing areas (CBSFAs) for "reaffirming and protecting fishing practices customarily and traditionally exercised for purposes of Native Hawaiian subsistence, culture, and re-

ligion" (Hawai'i Revised Statutes 1994). The legislation defined subsistence as "the customary and traditional native Hawaiian uses of renewable ocean resources for direct personal or family consumption or sharing" [L1994, c271,&1]. Nineteen Hawai'i communities have taken steps toward becoming CBSFAs (Higuchi 2008), with eight submitting bills for legislative designation (Kittinger et al. 2012). However, only two of those areas have been permanently designated, and Hā'ena is the first to submit CBSFA rules (Higuchi 2008). These legislatively mandated rules, created in collaboration with the state's aquatic resource management agency, are based on traditional and customary fishing and coastal management practices specific to Hā'ena (S.B. 2501, 23rd Leg., Reg. Sess., Hawai'i, 2006). Hā'ena's rules and resulting changes in management of the inshore subsistence fishery are seen as a model for communities across Hawai'i (Higuchi 2008).

This study focuses on the inshore fishery in Hā'ena. Hā'ena's coastal marine resources are relatively healthy (Jokiel and Brown 2000), with biomass at one site among the highest in the state of Hawai'i (Friedlander 2000). In Hā'ena, as in many other parts of Hawai'i (Cesar and Van Beukering 2004), subsistence take from this small coastal fishery is larger than either commercial or recreational harvest. Community studies identified no commercial fishing and a catch per unit effort of only 0.35 kg of fish per hour for the average fisher, although regular fishers from Hā'ena did substantially better (2.1 kg of fish per hour) (Hawai'i Community Stewardship Network and M.B.V., 2011, unpubl. data).

#### MATERIALS AND METHODS

This participatory research began as part of community efforts to conduct baseline studies of Hā'ena's inshore fishery before implementation of new rules for community-level management. In community rule-making meetings, fishers and community members expressed interest in understanding how fish harvested from the Hā'ena fishery were uti-

lized, including customary sharing and patterns of spatial distribution. This community-generated inquiry began a participatory research process in which a 10-person team of both students and Hā'ena community members worked with fishers to refine research questions, recruit study participants, pilot and employ quantitative data collection forms, and then conduct analysis and sharing of results. This research team included seven individuals with previous community ties to Hā'ena, five of whom were descendants of Hā'ena-area fishing families.

Community research assistants helped to increase fisher participation, access to information, and both the quantity and quality of data collected. In Hā'ena, as in many parts of Hawai'i, people are reluctant to speak openly about fishing to avoid betraying knowledge of secret fishing spots, appearing boastful, or spoiling one's luck (Maly and Maly 2003; M.B.V. and Thompson, unpubl. data). Community researchers fostered trust in the research team and study goals, making it possible to overcome cultural barriers to participation. These individuals also provided information on community events, along with fishers' fishing patterns, family obligations, and work schedules, helping the research team plan if, when, and how to respectfully approach fishers to collect data. Family members were often present at a catch or its distribution and helped fishers to fill out data sheets, increasing both the quantity and quality of collected data. In addition, because knowledge of fishing is transmitted within Hawaiian families (Jokiel et al. 2011), conducting interviews with family members present, when possible, was more appropriate and comfortable for all participants, while also contributing to cultural perpetuation. Last, working with community research assistants built local capacity to conduct follow-up studies.

During a 2-month pilot period, the research team observed Hā'ena fishing activities (while assisting with two other area fishing studies including catch per unit effort and a survey of human activities in nearshore waters) and worked with five fishers to develop and pilot data sheets for recording

their catch and distribution. These forms were modified five times over the pilot period in response to fishers' suggestions to improve ease of use, relevance of data collected, and protection of sensitive information such as specific harvest locations.

#### *Participant Recruitment*

Researchers identified the target population of 15 regular Hā'ena-area subsistence fishers by combining a list of individuals observed fishing during the pilot period with those consistently named by knowledgeable sources (lifeguards, fishers, coastal residents, community members). At community events, on the beach, and in home visits to each of the 15 fishers, researchers explained the study, invited participation, and distributed forms. Fishers also helped to distribute forms and recruit other participants. Ten different fishers (67% of the target population) returned forms, two others participated in fishing events reported by other fishers, and one apparently did not fish during the study period, leaving two fishers (13% of the target population) unrepresented. All participants had family ties to Hā'ena, and most shared Native Hawaiian ethnicity; fishers ranged in age from 19 to 77, were all male, and encompassed variations in Hā'ena family lineages, ahupua'a of residence, gear types, and regular fishing locations. Other individuals also fish the area, but the fisher population surveyed in this study harvests in Hā'ena more frequently (an average of twice per month versus twice per year) and has a higher catch rate than fishers without family ties to Hā'ena (Hā'ena CPUE survey, 2011, unpubl. data).

#### *Quantitative Data Collection*

During the data-collection period, researchers regularly visited fishers to follow up, often helping to fill in forms based on fishers' recollections. To ensure reliability of catch data and full representation of distribution, researchers collected data from as many fishers as possible in cases where multiple individuals participated in the same fishing event, though



catch data were entered only once to preclude double counting. Data were collected for a year and a half, encompassing two summer fishing seasons and one winter season. Fishers logged weather data, fishing start and end time, and catch (quantity, length, weight, species name, stomach contents, and presence of milt or eggs), along with distribution information including fish recipients' names, relationship to fisher, residence location, and intended use of the fish. This study tracked sharing through "distributions," the number of times fish are caught and transferred from fishers to other individuals, rather than the number or weight of fish transferred. It excluded any further sharing by the first-order recipients, those who initially received fish from fishers. We assumed that some portion of each catch was consumed within the fisher's immediate households, an assumption that fishers confirmed as generally true.

#### *Qualitative Data Collection*

Quantitative data were supplemented by regular informal discussions with fishers and through participant observation of community fishery meetings, fishing activities, pā'ina or large social gatherings, and other events. These interactions informed the final phase of research, shaping questions for 20 semistructured summary interviews: 10 with the participating fishers, and 10 with nonparticipating fishers, regular fish recipients, area elders, and/or expert cooks. One researcher who was already known to interviewees conducted all of the interviews, which averaged an hour and a half. Interview topics included fishing methods; fish consumption and preparation; how fishers learned and teach; informal rules guiding "responsible" harvest; and descriptions of how, why, and to whom catch is regularly distributed. Each interview was recorded, transcribed, and analyzed using a grounded-theory approach (Glaser and Strauss 1967). Each interview was coded using HYPE-Research qualitative coding software. Broader themes were derived from an initial round of coding (Miles and Huberman 1994) and then used to recode data. Researchers further veri-

fied data and engaged community members in participatory analyses by sharing preliminary findings through four community meetings, two focus groups, and multiple informal discussions with fishers and regular fish recipients.

## RESULTS

### *Characterization of Fishing Patterns*

This study logged over 50 catch events, totaling 4,231 kg of fish and 200 catch distributions. The most frequently caught species were *Kyphosus* spp. (nenu or chub, a complex of species of which most are indistinguishable in the field), and *Selar crumenophthalmus* (akule or bigeye scad) was most frequently distributed. Though some fishing occurred year-round, the summer fishing season of May–September accounted for the majority of catch (65%) and, to an even greater degree, distribution (82%). During summer months, schooling species such as akule and *Albula glossodonta* (ō'io or smallmouth bonefish) aggregate in nearshore waters, and in the winter high surf can make access to the ocean difficult and dangerous.

The most commonly used fishing gears reported in this study were cast ("throw") nets and gill ("surround") nets. Throw nets are funnel shaped, opening 15 to 20 ft (4.6 to 6.1 m) in diameter when flung on top of a school feeding on the reef; they can be used by an individual fisher. Surround nets, joining hundreds of feet of straight net lengths, are set using a rowboat to encircle schooling species in sandy-bottom lagoon areas. Surround fishing events require a team of individuals, including a kilo (spotter), boatman, divers maintaining the net under water, and a team to pull the net into shore and then extricate each fish (Maly and Maly 2003). Although Hā'ena fishers also use other methods such as Hawaiian sling or handheld spears, and pa'ipa'i, in which groups of fishers drive fish into a set length of net, each of these gears only showed up once in this study.

In this study, throw nets were used year-round and more frequently than surround nets (33 times versus 13 times); surround nets

were used only during the summer months. These two gear caught different species, with surround nets used to catch akule and occasionally 'ō'io, whereas throw nets caught fewer individuals of a wider variety of species including nenu and *Acanthurus triostegus* (manini or convict tang). Though surround nets were used less, this gear resulted in larger catches than throw net (average, 151 versus 20.4 kg) and more distributions per catch (average, 8.2 versus 2.8 distributions). Data collected through semistructured interviews revealed the importance of throw nets for procuring fish year-round, even during the high-surf season of October–April. In contrast, surround nets yielded larger harvests of the prized schooling species during summer.

#### Characterization of Distribution Patterns

**SELF-PROVISIONING:** Interviewees described Hā'ena fish as an important food source for fishing families and their mahele recipients, whether fresh caught or frozen and stored for later consumption. The family of one fisher described finishing the summer catch of akule from its freezer in February. In that case, three surround harvests contributed to 6 months of protein for one family of four and many of their friends and extended family, representing a potentially substantial saving in grocery bills. Throw nets provided more diversity in meals, with fishers typically describing throw netting on the weekend to catch a variety of reef fish for their immediate or extended family's dinner. In every interview, fishers expressed the importance of being able to feed their families without reliance on grocery stores. Interviewees describe mahele as key to surviving major disturbances, such as past hurricanes that cut off food supplies to the island of Kaua'i.

**SHARING:** Consumption at home represented just under 25% of fishing distributions, whereas sharing represented over 75% (63% sharing to other individuals or families, plus 12% shared specifically for pā'ina, large social gatherings commemorating community events such as graduations or funerals) (Figure 2). Interviews reinforced the historical, cultural responsibility of fishers to feed

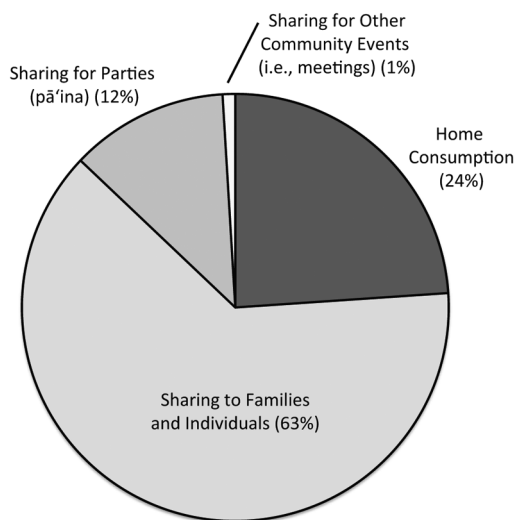


FIGURE 2. Purpose of distribution ( $n = 209$ ): 76% of all catch was shared (i.e., mahele).

not just their family but the entire ahupua'a community. Multiple interviewees described dropping off fish at each house on the way back from a fishing trip, arriving home with just enough fish to feed the family or even giving it all away before reaching home. Interviewees also frequently recalled the generosity of head fishers of past generations (for example, filling large bamboo baskets with mahele for each family after a surround event). Mahele in this study ranged in size from 1 to 220 kg; common means of distribution included gallon-size (3.8 liters) plastic self-sealing bags, 5-gallon (18.9-liter) buckets, and 100- to 700-liter coolers.

#### Relationships Between Fishers and Fish Recipients

Fish were shared in roughly equal amounts among fishers' immediate families (24%), extended families (21%), people who helped with harvest (22%), friends or other community members (20%), as well as with kūpuna (elders) (11%) (Figure 3). Shares to elders recognized their respected cultural status, ongoing contributions as advisors and teachers, and past contributions of physical labor, in some cases teaching current generations of fishers. Many interviewees expressed the



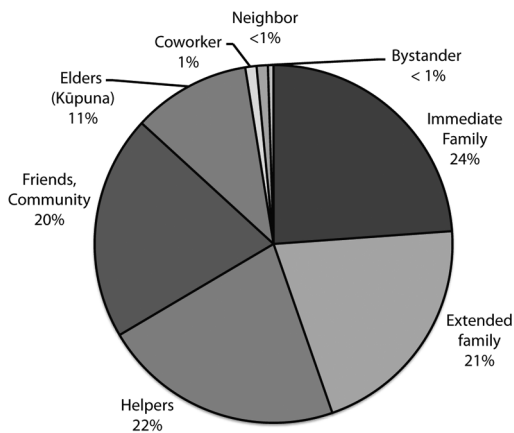


FIGURE 3. Recipient relationship to fisherman ( $n = 197$ ). Immediate family includes parents, children, and siblings living in the same household. Extended family includes all other family members and relatives. Helpers are individuals who assist with a catch. Elders are individuals given fish exclusively on the basis of their age, who are not members of fishers' extended or immediate family. Bystanders are individuals who happen to be present on the beach during the catch.

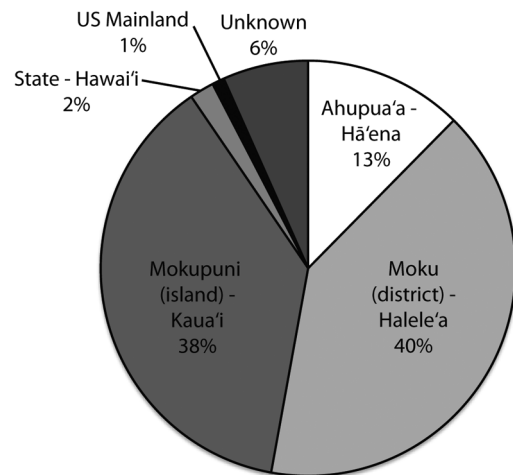


FIGURE 4. Geographic distribution of fish ( $n = 210$ ). Note: Each category on the chart is mutually exclusive. The distributions for Halele'a include Halele'a ahupua'a other than Hā'ena, Kaua'i distributions include all districts other than Halele'a, and Hawai'i state distributions include all islands other than Kaua'i.

importance of ensuring that elders continue to have fish, a taste of their childhood, even after they can no longer procure it for themselves. Interviews describe surround-net helpers in this study receiving large mahele (100–200 kg) that they then shared with many others. Interviews also revealed the concern that fish not be wasted. Fishers distribute fish to families that they know will prepare and eat them, avoiding giving mahele to homes likely to receive the same species from multiple people. Less than 1% of fishers' distributions went to coworkers, neighbors, and bystanders on the beach during a harvest (Figure 3).

### Geographic Distribution

In this study, only 13% of distributions of Hā'ena fish stayed within the ahupua'a, and 53% stayed within the Halele'a moku (district) (Figure 4). Nearly half of all distributions were to two ahupua'a: the neighboring ahupua'a of Wainiha (25%) and the closest town, Kīlauea (25%), which lies just outside Halele'a (Figure 1). Interviewees attributed the high volume of distributions to those two

locations to the fact that most fishers with ancestral ties to Hā'ena live in Wainiha and Kīlauea, communities where housing costs are lower than in Hā'ena. Some interviewees included Wainiha, which borders Hā'ena, within Hā'ena's traditional and customary fishing grounds. Fishers and helpers received over half of the distributions to these areas and within Hā'ena (Table 1). Hā'ena fish were also distributed to areas of Kaua'i beyond Halele'a, with slightly more distributions to Anahola Hawaiian Home Lands and Kapa'a, areas with higher concentration of families with Hā'ena roots, than to farther areas such as Līhu'e and Kekaha (Figure 1, Table 1). Although 91% of distributions stayed on Kaua'i, mahele also went to two other Hawaiian islands (O'ahu [1.5%] and Hawai'i [0.5%]) and as far as the West Coast of the United States (1%) (Figure 4). Distribution differed by species, with less-frequently surrounded species such as 'ō'io shared to more distant parts of Kaua'i. Focus group participants also attributed the wide distribution of 'ō'io to the location of families skilled in its preparation, who return some of the fish to fishing families in

TABLE 1  
Recipients' Relationship to Fishers by Geographic Area ( $n = 210$ )

Destination	No. of Distributions	Immediate Family (%)	Extended Family (%)	Helpers (%)	Friends, Community (%)	Kūpuna (%)	Other <sup>a</sup> (%)
1. Ahupua'a: Hā'ena	26		19	65	4	4	8
2. Moku (district): Halele'a							
Wainiha	53	38	28	13	19	2	
Hanalei	12				58	33	8
Princeville	2					100	
'Anini	6		33		67		
Kalihiwai	12		8	17	58	8	8
District total	111 (53%)						
3. Island: Kaua'i							
Kīlauea	51	49	10	22	14	6	
Anahola	10		30	20	30	20	
Kapa'a	11	18	9	9	55		9
Līhu'e	5		20		80		
Kekaha	2				50		50
Island total	190 (90%)						
4. State: Hawai'i							
O'ahu	3		100				
Hawai'i	1		100				
Non-Kaua'i state total:	4 (2%)						
5. Country: U.S.A.							
California	1		100				
Oregon	1				100		
Non-Hawai'i country total:	2 (1%)						
6. Unknown	14 (7%)	20		33	47		

Note: Categories of relationships between fish recipients and fishers are shown as percentages of the total number of distributions to each area ( $n = 210$ ).

<sup>a</sup> Coworkers, neighbors, and bystanders at the harvest.

the form of a local delicacy (fish cake). The main determinants of the geographic distribution of sharing of fish appear to be spatial proximity to Hā'ena and its customary fishing grounds, location of pā'ina, fishers' homes, and residences of families with ties to Hā'ena or Hā'ena area fishers.

#### DISCUSSION

Traditional and customary practices of subsistence fishing in Hā'ena continue in contemporary times in spite of historic and economic changes in land tenure and development patterns. Due to these changes, most families with Hā'ena roots no longer live in their traditional land division (ahupua'a); however they continue to harvest and to receive fish

from Hā'ena's inshore fishery through customary sharing networks. Customary sharing of fish, even from a small subsistence fishery, provides multiple linked benefits including perpetuating traditional and customary practices, maintaining socially significant roles for fishers, strengthening social networks of extended family and community ties, distributing natural resource abundance through reciprocal exchange, providing self-reliance and collective insurance, and contributing to community resilience.

#### *Cultural Perpetuation: Traditional and Customary Practices*

This study illustrates the contemporary importance of place-based cultural practices

in sustaining ongoing relationships between Native Hawaiians and particular natural resources or “‘āina” (Kana‘iaupuni and Malone 2006, McGregor 2007, Andrade 2008, Kikiloi 2010), as is true for other indigenous groups (Berkes 1999, Sepez 2008, Panelli and Tipa 2009). The cultural significance of traditional and customary subsistence fishing practices (Panelli and Tipa 2009) extends to sharing the products of those harvests (Severance 2010). In interviews fishers described mahele to the kūpuna who taught them to fish, as well as to the broader community, as a way of remembering their teachers and showing respect and gratitude by using skills shared. As one interviewee explained, he never went to school, and he does not speak his Hawaiian language, but he can fish and feed people, and perpetuate those parts of the culture in his life. Through mahele, Hā‘ena fishers fulfill a cultural responsibility to feed the entire ahupua‘a community within contemporary times, as well as to provide fish for cultural and ceremonial occasions where certain species play a crucial role (Sepez 2008, Severance 2010).

The cultural importance of species such as akule in Hā‘ena is reflected in mahele sent to family members living as far away as California. As for salmon in the Pacific Northwest (Garibaldi and Turner 2004), the multiple cultural practices associated with these species (their sharing, preparation, collective harvest, consumption, and associated transmission of knowledge) are as vital to cultural perpetuation and identity as the nutritional and economic value of the fish themselves. This study thus supports the concept of ‘āina, or natural resources, as that which feeds a community, not just physically but spiritually, culturally, and intellectually as well (Andrade 2008; M.B.V., unpubl. data). Provisioning of food is inextricable from other lifestyle benefits accruing from subsistence activities in mixed economies (Garibaldi and Turner 2004, Panelli and Tipa 2009).

#### *Social Status: Roles and Responsibilities*

This study supports previous work showing that the motivation to give fish relates to a

fisher’s role and reputation in the community (Severance 2010). Fishers interviewed in this study expressed pride at being able to give generously and feed their extended families, fishing helpers, friends, and community members. Many interviewees expressed the belief that “the more you share, the more you catch.” Sharing of fish also highlights privileged knowledge of fishing spots passed within families, cultural perpetuation through practice, skill in using certain gear, and fishing “luck” thought to evidence balanced relationships with fish: all attributes that confer respect to individuals and their families. In Hawaiian society, attribution of respect is linked to generosity and fulfillment of collective responsibility (Andrade 2008).

Many studies postulate that subsistence gathering activities provide needed food for low-income families but become less important in mixed economies where more families are supported by wage labor (Brown et al. 1998). This study suggests the opposite. In indigenous populations integrated within mixed economies, wage labor decreases time for the perpetuation of traditional and customary skills such as fishing, contributing to the specialized nature and value of once-common skills. This is especially salient for indigenous cultures within mixed economies where many cultural roles, particularly for males, are disrupted or devalued by colonization and economic shifts to menial opportunities for wage labor (Kana‘iaupuni and Malone 2006, Tengan 2008).

#### *Social Networks: Extended Family and Community*

Mahele also strengthen community cohesion, building connections between families and individuals from harvest, to distribution, to collective consumption. Interviews revealed how the largest categories of giving (extended family, friend, and community member) recognize and strengthen existing connections between individuals within the community. For example, one fisherman recounted that he always gives mahele to the woman who cared for his baby son so he and his wife could work. Though that child is now 10, his father’s ma-

hele continues to express his gratitude and memory of their families' connection. Sharing networks also often reflect extended family ties between those engaged in subsistence harvest and their recipients (Nolin 2010). In this study, delivering fish to the homes of extended family members strengthens family ties by providing a reason to visit, remember, and renew connections. This study supports other work showing that customary sharing contributes to maintaining strong social networks even within diverse communities. Customary sharing and exchange of fish in the Pacific "often means that fish flows across ethnic and cultural boundaries and brings people of quite different backgrounds together" (Severance 2010:2). Examples include surround harvests, which commonly engage 10 to 40 individuals, and pā'ina, where fish are consumed by hundreds of celebrants; such events regularly bring together large, diverse groups within Kaua'i's Halele'a community. Strong social networks such as those fostered and sustained by the customary harvest and sharing of fish are, in turn, associated with multiple benefits (Putnam 1993), including the potential for collective action to manage natural resources (Crona and Bodin 2006, Janssen and Ostrom 2006). Although linkages between community groups and other levels of management such as government seem key to determining management performance (Marin et al. 2012), bonding linkages that strongly connect individuals within a given community can also increase the ability of local fishers to maintain sustainability of their fishery (King 2000).

#### *Reciprocal Exchange: Collective Insurance*

Social networks within extended families and community further provide informal economies of exchange and reciprocal sharing that have been documented within both Hawaiian (Matsuoka et al. 1998) and other indigenous contexts (Panelli and Tipa 2009). Fishers in this study described mahele recipients returning a variety of goods, from smoked meat, to homemade bread, to Filipino food, to mangoes the week after a surround. Mahele also facilitate exchange of skills (e.g., child care,

the ability to make fishing nets, preparation of a culturally important dish) as well as goods. Mahele continue the ahupua'a function of distributing abundance, both in terms of natural resources and human skills, through informal sharing networks.

These goods and skills that mahele recipients share with fishers support past work describing the "obligatory nature" of exchange between Hawaiian families within an ahupua'a (McGregor 1996). Recipients of shared products of subsistence harvest have an informal, but nonetheless powerful, obligation to reciprocate (McGregor 1996), creating a non-market exchange system based on generalized reciprocity (Bliege-Bird and Smith 2005). Unlike barter and trade, or balanced reciprocity, where there is "some expectation of a return gift of some equivalency within a shorter time frame" (Severance 2010:1), generalized reciprocity is sharing knowing that gifts will be repaid, even if not by recipients themselves, without tracking time or amounts (Bliege-Bird and Smith 2005, Severance 2010). For example, in the recent economic recession fishers regularly took fish to families where one or more parent had recently lost a job or been furloughed. Such sharing extends the benefit of self-reliance emphasized in past studies of subsistence harvest (Hinrichs 1998, Tigges et al. 1998, Teitelbaum and Beckley 2006) from the immediate family to community level. Generalized reciprocity at the societal level acts as a form of collective insurance, helping even those families without individuals who fish to withstand economic disturbances and natural disasters, thus building community resilience.

#### *Community Resilience*

Taken together, the benefits described in the preceding sections help to maintain long-term relationships between communities and natural resources in the face of pronounced social and economic change. These relationships contribute to ongoing resilience, or "the capacity of a social-ecological system to absorb disturbance and reorganize . . . to still retain . . . the same structure, function and identity" (Walker et al. 2004:2). Demographic

and economic shifts such as rising land taxes and coastal development make it harder for community members to reside in or access the physical ahupua'a of Ha'ena, and engagement in wage labor usurps time for traditional and customary practices and with extended family. Customary sharing provides a source of resilience through all these changes. Although dispersed, Ha'ena's human community today continues to exist in a "modern day ahupua'a," remaining connected through familial and social ties and through natural resource flows from an area that remains an ongoing source of physical, economic, cultural, and social well-being (Andrade 2008). Past studies described subsistence fishing promoting resilience at the individual family level by providing food security in uncertain economic conditions where wage labor is erratic (Marschke and Berkes 2006). We suggest that the sharing of natural resources from subsistence fishing also promotes resilience, not only for the individual family but also at the extended family and community level, providing a means of perpetuating vital functions of disrupted social-ecological systems, including access to customary food sources, cultural perpetuation, social roles and responsibility, strong social networks, and collective insurance through reciprocal exchange.

#### *Lifestyle Benefits: Cultural Ecosystem Services*

In this study we highlight the importance of nonmaterial benefits people obtain from ecosystems, while adding to knowledge of challenges of measuring these benefits (Chan et al. 2011). First, the benefits of practices such as the customary sharing of fish accrue at the community level rather than the individual level. Second, these benefits are place specific and difficult to generalize. Third, practices such as mahele create multiple overlapping and linked benefits such as cultural perpetuation and social cohesion, for which separation and individual valuation is impossible (Chan et al. 2011). Attempts to quantify the benefits of mahele through indices such as harvest rate or quantity, fish distributed, individuals fed, or the economic value of food

provided could capture the benefits of food provisioning services while missing other categories of value evidenced in this study. Indicators such as relationships built, responsibilities fulfilled, or skills transmitted, though difficult to characterize (much less quantify), represent more meaningful assessments of the benefits of fish sharing and possibly other traditional and customary practices related to subsistence harvest.

#### *Policy Implications*

The ongoing social and cultural significance of sharing products of subsistence harvest has several policy implications. First, even small subsistence fisheries may provide substantial benefits to a larger population than fishers themselves. Marine policy implementation efforts may be more successful in areas where subsistence fishing takes place if they account for community sharing networks and incorporate those networks in their planning through expanded outreach efforts that engage regular fish recipients in decision-making processes alongside fishers themselves. Culturally, fishing and sharing fish from a particular place is important. The same species caught in a different location or distributed through different means than these sharing networks would not provide the same benefits. Therefore, where policies close a given fishery, allowances for ongoing, limited subsistence harvest may be more effective than economic compensation or promoting opportunities to harvest the same species in another location.

Second, processes of social change and cultural erosion common to mixed economies may enhance rather than reduce the non-material benefits of customary sharing. For example, when people are engaged in wage labor, sharing may become less important for food security, but its contributions to benefits such as cultural perpetuation and social networks become more valued. Furthermore, cultural ties to particular land and natural resources, along with the benefits they provide, are vital and ongoing though they may operate in new forms and on more extended geo-



graphic scales than in historic times. It is important that policy makers not overlook the ongoing practice and benefits of traditional and customary place-based practices simply because they have adapted to a changed economic and geographic context.

Finally, research to understand subsistence fishing and sharing patterns, along with other resource-based traditional and customary practices, requires engaging fisher people and community members. Such research requires respect, flexibility, commitment to protecting sensitive information, and time to build trust and cooperation. Investing time in site-specific development of research relationships is necessary to document often-overlooked benefits of customary practices related to subsistence harvest because these benefits are difficult to generalize or measure in a quantitative way but are nonetheless important to the life and well-being of communities.

#### ACKNOWLEDGMENTS

We thank each of the following individuals and groups for their contributions to this work. Research funders and partners for their support: Teresa Heinz, Switzer, Harold Castle, and Hawai'i Community Foundations; Woods Institute and Emmett Interdisciplinary Program for Environment and Resources at Stanford; William C. and Jeanne M. Landreth Fellowship; Rudolf and McGee-Levorsen Research Grants; Community Forestry and Environmental Research Partnerships; University of Hawai'i PIPES Program; Hawai'i Community Stewardship Network; Debbie Gowensmith; Limahuli Gardens; and Hui Maka'āinana o Makana. Research team of community members and students for being such a joy to work with and learn from: Lahlala Correa, Noa Ka'aumoana-Teixeira, Tasia Chase, Atta Forrest, Miki'oi Wichman, Kau'i Fu, Beth Wylie, Elaine Albertson, and Lucia Hennelly. Carlos Andrade, Nicole Ardoin, Shankar Aswani, Meg Caldwell, Louise Fortmann, Alan Friedlander, H. Peter King, Jennifer Luck, Gail Tipa, Buzz Thompson, three anonymous reviewers, and the editors of this issue for thoughtful comments and invaluable

assistance in developing the manuscript. Our families for making our work possible. Special thanks especially to Hā'ena's fishermen and families for their generous sharing of time and knowledge.

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