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Blue Food Sovereignty Benefits Social-Ecological Resilience: A Case Study of Small-Scale Fisheries Co-Management and Mariculture in Samoa

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Abstract

"Blue" (aquatic) food systems have a vital role in providing nutrition, livelihoods, and food security for coastal communities, but addressing and evaluating issues of equity and social resilience continue to challenge small-scale fisheries management. We examine how marine aquaculture and co-management approaches that integrate traditional institutions can support food sovereignty for more equitable blue food systems. Interviews with stakeholders in 11 fishing communities in Samoa indicate that several benefits associated with food sovereignty are derived from co-managed village fish reserves. Reserves support biodiversity health and are a source of culturally valued seafoods that build food security, social capital, and sustainable livelihood opportunities for women. Local values, food systems, providers, and consumers are centered, though traditional hierarchies present challenges for equitable decision-making. Our findings demonstrate how incorporating food sovereignty into the operation and evaluation of fisheries co-management can aid in addressing equity and resilience.

Keywords Resilience · Food sovereignty · Food security · Aquaculture · Fisheries co-management · Samoa · Pacific Islands · South Pacific

Introduction

The intersection of sustainability, social equity, and community resilience in small-scale fisheries has recently gained scholarly attention (Bennett, 2018; Cisneros-Montemayor et al., 2021). Small-scale fisheries feed millions globally, and in the island nations of the Pacific, finfish, invertebrates, and other marine species offer critical local sources of protein and other key nutrients (Farmery et al., 2020; Hibi et al., 2018). Faced with growing threats from climate change and commercial and illegal capture fisheries, policy makers have increased attention on the social dimensions of sustainable fisheries management. For example, a coalition was formed at the 2021 UN Food Systems Summit to raise awareness and mobilize support at regional and global scales for sustainable blue (aquatic) foods that support nutrition, community resilience, sustainable livelihoods, and gender equality (Leape, 2022). These efforts build on the FAO Code of Conduct for Responsible Fisheries, Small-Scale Fisheries Guidelines, and other frameworks designed to integrate local institutions, cultural values, and decision-making power into marine governance.

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One approach for promoting sustainable small-scale fisheries is co-management, in which local communities share responsibility and authority with government agencies for managing stocks and ecological habitats (Cinner et al., 2012; Gutierrez et al., 2011). Co-management has been lauded as a flexible, site-specific framework for locally focused approaches to natural resource management that is intended to improve both socio-economic and ecological conditions. At the same time, researchers and practitioners acknowledge that fisheries co-management efforts face numerous political, social, economic, ecological, and logistical challenges in implementation (Levine & Richmond, 2014). These can result in unintended power redistributions to the detriment of local resource users (Béné et al., 2009), and barriers for equity and community participation (Quimby & Levine, 2018). In particular, the role of women in decision-making, governance, and economic opportunities has remained problematic (Freitas et al., 2020; Staples & Natcher, 2015; Weeratunge et al., 2010). The ecosystem services perspective that underpins many models of small-scale fisheries co-management has also been criticized by Indigenous scholars for conceptualizing the non-human environment in ways that do not adequately represent the intimate connections between humans and aquatic life, including reciprocal responsibilities (Fischer et al., 2021; Reid et al., 2020; Spencer et al., 2020; Todd, 2014, 2017, 2018). An ongoing challenge for the implementation of co-management programs is moving beyond a reliance primarily on quantitative indicators of program outcomes (such as fish yield, species biomass, or household income) to account for qualitative cultural, social, and political outcomes for communities.

Responding to these challenges, some have suggested moving away from conceptualizations of fisheries primarily as natural resources and toward a focus on fish as food (Bennett et al., 2021; Levkoe et al., 2017). Levkoe et al. (2017) approach this shift through food sovereignty, a politically situated action framework that centers food producers, local communities, and their rights in food systems decision-making. It recognizes asymmetries in global food systems and seeks to improve food security and social justice outcomes (Walsh-Dilley et al., 2016). Shifting from a focus on fisheries yields towards the rights, health, and well-being of fishing communities also reframes the relationship and rights of small-scale and commercial fishers (Baker-Médard & Faber, 2020). Although fisheries were included in the earliest declarations for food sovereignty (La Via Campesina, 2007), research on blue food systems has lagged far behind "green" terrestrial food production; case studies examining food sovereignty or blue food systems, and their outcomes for community and ecological resilience, are sparse (Simmance et al., 2021).

We apply a food sovereignty framework to a case study of small-scale fisheries and marine aquaculture co-management in the Pacific Island nation of Samoa. Catching, gleaning (collecting shellfish on the shoreline during low tide or in shallow waters), harvesting and managing aquatic life in lagoons, mangroves, and reef systems contribute significantly to local nutrition in Pacific Island nations. They are also a fundamental part of cultural practices and identity (Grafeld et al., 2017; Hau'ofa, 1998; Hicks et al., 2021), making food sovereignty frameworks potentially very relevant. In response to calls for greater attention to the social and cultural dimensions of blue food systems and coastal marine resource governance (Aswani, 2019; Baker-Médard & Faber, 2020; Coté, 2016; Kittinger, 2013; Levkoe et al., 2017; Simmance et al., 2021), we analyze qualitative data to evaluate how fisheries co-management can support food sovereignty. We also explore how a food sovereignty framework might be incorporated into assessments of co-management to center the social and cultural dimensions of resilience and equity that economic and ecological focused approaches often overlook. Our research thus contributes to a rapprochement of fisheries co-management practices and food sovereignty and food security approaches toward the goal of equitable blue food systems.

Background

Food Sovereignty, Food Security, and Small-Scale Fisheries Co-Management

Food sovereignty is, as noted, a political movement and framework that aims to center food producers and local communities and their rights in food systems decision-making. The transnational food sovereignty movement began in 1993 with the organization of a global agrarian/peasant movement, La Via Campesina, which in 1996 criticized food security programs for overlooking power asymmetries between small-scale producers and transnational corporations, and presented six principles of food sovereignty that emphasized decentralization and local control (Alonso-Fradejas et al., 2015; Patel, 2009). In 2007, the Nyéléni Declaration formulated the most commonly cited definition of food sovereignty as "the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agricultural systems." Scholars and activists continue to develop the key principles of food sovereignty, which include centering the nutritional and cultural needs of food producers and consumers, the right for local communities to control resources and processes for food production, and a commitment to environmental sustainability and respect for nature (Box 1).

Food sovereignty frameworks can help address critiques by political ecologists (e.g., Cote & Nightingale, 2011; Cutter, 2016; MacKinnon & Derickson, 2013) that social-ecological resilience is sometimes framed as a state of stability and lacks attention to situated social relations and power. Scholars have

increasingly pushed for a conceptualization of resilience as a dynamic process shaped by inequality, adaptive capacity, and environmental unpredictability (Pfefferbaum et al., 2017), with greater focus on actors' agency and ability to self-organize (Berkes & Ross, 2013; Folke et al., 2021) Food sovereignty frameworks support this reorientation by foregrounding the dynamics of power and control over the environment. Walsh-Dilley et al. (2016) articulate many parallels between food sovereignty and resilience frameworks employed by development institutions, and note that while definitions of resilience are often broad, many include the rights-based approach, emphasis on actors' agency in decision-making, and local-scale focus advocated in food sovereignty.

Small-scale fisheries co-management approaches that incorporate resilience frameworks have emphasized quantitative measures of biomass and yield; these align with resilience objectives of food security and biodiversity conservation (Fabinyi et al., 2017; Foale et al., 2013; Glamann et al., 2017). However, these narrow criteria create blind spots to the cultural and social dimensions of resilience, with consequences for social equity and sustainability (Islam, 2021). Food security is achieved when individuals and communities have economic and physical access to food that is safe, nutritious, and adequate for their dietary needs and food preferences (FAO, 2001; World Food Summit, 1996). While this understanding of food security has evolved to incorporate health, nutrition, and social dimensions, Indigenous activists critique the lack of attention to cultural food preferences in food security research, as well as common framings of food and environmental resources as commodities (Cidro et al., 2015; Gupta, 2015). Culture has been poorly studied and integrated in food security policies and development interventions—even though it is recognized that culture influences all four dimensions of food security, and that power relations, family, and gender shape how culture influences food security (Alonso et al., 2018). In this way, food security and food sovereignty are not competing frameworks (Clapp, 2014); rather, food sovereignty can be seen as a political process that can be incorporated into and aligned with the processes for fisheries co-management in order to address the cultural and power dimensions of achieving food security.

In the Pacific Islands, resilience and food security are frequently linked (Lebot & Siméoni, 2015); however, livelihoods and direct nutritional value of catch are most frequently centered, obscuring the benefits of trade for diet diversification and food security strategies (Fabinyi et al., 2017), and dimensions of well-being, cultural continuation, and equity (Quimby et al., 2020). The meaning and value derived from engaging with the environment, sharing knowledge, and socializing with peers is critical for more just and sustainable fisheries management (Grantham et al., 2020).

Box 1: Principles of Food Sovereignty

The six principles of food sovereignty based on the Nyéléni Declaration include: 1) the rejection of food as a commodity and the right for healthy, culturally appropriate food for all; 2) respect and recognition for men and women who produce, harvest, and process foods 3) food providers and food consumers are at the center of decision-making on food issues with localized approach; 4) control of fish populations and territories is in the hands of local people, their right to use and share in socially and environmentally sustainable ways is respected; rejection of privatization of natural resources, promotion of positive networks of food providers across sectors and territories; 5) capacity building, reliance on local skills and knowledge; and 6) working with nature for healthy ecosystems and in order to improve resilience and adaptation. Sources: (Akram-Loi, 2015; La Via Campesina, 2007).

Small-Scale Fisheries Co-Management and Mariculture in the Pacific

Small-scale fisheries co-management takes many forms in practice, but is guided by a framework for collaborative environmental management that includes key principles of community involvement and initiative, shared responsibility between local and external actors, and the integration of traditional and local institutions and values, in order to integrate goals of biodiversity conservation and local community needs and values (Armitage et al., 2009; Berkes, 2002). The creation of no-take reserves within comanaged marine areas is a common strategy for balancing human use and conservation goals. While these areas usually allow limited take for small-scale and subsistence fishers, no-take reserves within these areas are expected to provide a sanctuary for marine species to reproduce and grow, with "spill-over" benefiting both fishing stocks and biological diversity (Di Lorenzo et al., 2020). In some places, including Fiji, Samoa, and the Solomon Islands, these reserves have included mariculture (marine aquaculture) of endangered giant clams (*Tridacna gigas* and other species). Giant clams represent a traditional high-value food in the Pacific, and in the 1980s were also seen as a potential source of economic development to supply Asian markets. Giant clams never became a profitable international export; however, the thriving mariculture programs do provide social and cultural benefits to island communities (Moorhead, 2018). Giant clams support local livelihoods, particularly of women who process and sell clam products; however, their primary local value is not as a commodity, but as the material culture of Pacific peoples.

Samoan Food Systems

The independent island nation of Samoa is located in the South Pacific (Map 1). *Fa'a Samoa*, "the Samoan Way," encompasses Samoa's traditional institutions, social protocols, and cultural identity, and continues to be strong, especially compared with other parts of the Pacific where traditional systems have been highly disrupted (Macpherson, 1997). Samoan villages remain organized around the *matai* system, in which higher status (and usually-male) *matai* ("chiefs") in each extended family govern together through a village council.

As in many post-colonial contexts, food has been integral to efforts at cultural continuation and colonial resistance in Samoa over the past century. Colonial regimes and the international development platforms that followed focused on developing agricultural exports, primarily for European and American market demands (Hardin & Kwauk, 2015; Plahe et al., 2013). In recent decades, trade globalization also increased pressure on Pacific nations to reduce protections on local production and increase food imports, leading to a nutrition transition in the Pacific that has centered on refined starches, oils, sugars and processed meats (Charlton, 2016). Despite these pressures, studies indicate that locally caught fish remain an important staple food in the Pacific, contributing to household food security through direct consumption and income-generation for purchasing other foods. In Samoa, 41% of households depend on locally-caught seafood for subsistence (Tiitii et al., 2014). Local fisheries are also seen as a critical factor in addressing non-communicable disease, such as obesity and diabetes, and supporting childhood nutrition and development (Charlton et al., 2016; Farmery et al., 2020).

Sharing food with visitors is a vital part of Samoan life and traditional systems of exchange. Missionaries and colonial authorities tried to discourage traveling parties and other large social events marked by food sharing, and the practice became a form of resistance to colonial hegemony (Linnekin, 1991). Today, official visits from government personnel, church leadership, and traditional leaders from neighboring villages are recognized and celebrated with the current iterations of these protocols, specifically the 'ava ceremony and meals. This "circular mobility" of Samoans extends across international borders (Lilomaiava-Doktor, 2009).

The food sovereignty approach aligns with the values and structure of Samoa's political economy of food. With close relationships between food producers and consumers, even urban residents, through community markets, the absence of global commodification of Samoan sea foods reduces the barriers to food sovereignty (Paulson & Rogers, 1997). While Samoa's hybridized political setting is complex, the support for traditional *matai* authority encoded in the Village Fono Acts of 1990 and 2016 also connects with food sovereignty's emphasis on local control.

Samoa's Community-Based Fisheries Management Programme (CBFMP)

In response to decreasing health and diversity in coastal marine environments (Bell, 1985), and with support from Australia Aid, the Fisheries Division of the Ministry of Agriculture and Fisheries initiated the Community-Based Fisheries Management Programme (CBFMP) in 1995, making it one of the oldest coastal co-management programs in the Pacific. Through the CBFMP, the Fisheries Division provides technical and legal expertise to support community-led development of a coastal management plan for traditional village tenure areas. Village rules and authority can be recognized by the state through by-laws legislation, creating a hybridized governance structure (Quimby & Levine, 2021). Villages that adopt management plans can request resources and assistance for establishing no-take reserves; where suitable, this can include assistance in developing giant clam mariculture, including juvenile giant clam brood stock at no direct cost.

Although originally intended to create income from an export commodity while simultaneously increasing the population of an endangered species, clams are currently only consumed locally; we could find no data on the CBFMP's effects on giant clam abundance. Yet the program remains popular: today there are 73 villages with active fish or giant clam ("faisua") reserves out of about 200 coastal villages (Sinclair-Esau, 2018). Following the 2009 tsunami event that claimed lives and destroyed coastal infrastructure on the southern coast of Upolu, the Fisheries Division targeted efforts to revitalize community-based management areas and increase sustainable fisheries in affected villages (Quimby & Levine, 2021). No-take and fish and giant clam reserves and surrounding buffer zones creates an exclusive use area for village members; guidance on reserves allows for the village *fono* (traditional leadership council) to permit occasional fishing and gleaning and to prohibit non-members from access.

Methods

We collected qualitative data during a four-month field study conducted in 2018 in Samoa. Qualitative methods are frequently used in small-scale fisheries research and enable us to center our analysis on local actors' perceptions and experiences (Johnson et al., 2014; Partelow et al., 2021). Our study focuses on 11 communities in the southwest of the island of Upolu (Map 1). We chose three rural districts with high past and present participation in the former Marine Protected Area program and current CBFMP. Communities here have a high reported dependence on local subsistence fishing and high risk (level) of food insecurity (Tiitii et al., 2014).

We conducted a total of 35 interviews: 10 with past and present Fisheries Division and conservation NGO staff, and 25 semi-structured interviews with local key informants, including elected village leaders (mayors), traditional leaders/chiefs (*matai*), women identified as community leaders (i.e., President of the Women's Committee), and men and women who identified as fishers and gleaners. Sample sizes for management practitioners and community informants are consistent with averages for meaning saturation (Hennink & Kaiser, 2022), in which the variation and nuances in thematic meaning can be fully described. Interviews lasted between 20 min to one hour. We asked interviewees questions about their perceptions of the health and value of no-take zones, mariculture, and their participation in the CBFMP management. Two of the authors conducted the interviews in English and Samoan at the Fisheries Division offices, interviewee homes, and village meeting areas (*fale*). Interviews in Samoan were interpreted during the interview process (Williamson et al., 2011) and recorded, transcribed, and translated into English by a native Samoan speaker. Data collection also included informal interviews and conversations and participant observation, including participation in two management meetings between villagers and Fisheries division staff (see Quimby & Levine, 2021). We also conducted archival research of reports and publications by the Fisheries Division of MAF and the Environment and Conservation Department of the MNRE using libraries, online repositories, and products shared by staff.

We analyzed interview transcripts using reflexive thematic analysis, a flexible open coding approach for qualitative data (Braun & Clarke, 2006, 2021) and inductively coded with NVivo 12 software to identify themes. This consisted of initial theme identification performed during in-person interviewing, with line-by-line coding occurring after interviews were translated into English and transcribed. We identified two key themes: giant clams (FAISUA), and no-take fish reserves (FAASAO), and manually analyzed interview passages identified with these themes with additional line-by-line coding linked to a subset of themes related to the use and value of the reserves. Four subthemes were analyzed using this process: environmental health, personal consumption, hosting guests, and livelihoods. Observational notes from meetings between village leaders and Fisheries Division staff were then analyzed for references to these subthemes and to aid interpretation.

Findings

Respondents from all sectors noted that the benefits received from reserve areas and giant clam mariculture were motivating factors for participating in the CBFMP. Out of 25 interviews, 23 discussed benefits of the reserves and 19 specifically mentioned giant clams, primarily in response to questions about the benefits of having a no-take reserve. We recognize four distinct benefits mentioned by interviewees: (1) providing hospitality for important guests; (2) women's livelihoods; (3) local consumption, and (4) biodiversity health. Perhaps surprisingly, there were no negative comments made about the reserves and aquaculture, apart from fear of its failure or need to restock. We discuss each of these benefits and how they relate to food sovereignty.

Using No-Take Reserves for Guests, Building Social Capital

Food sovereignty supports the rights of local food producers to decide how and when to use their resources. Our interviews revealed that village leadership controls access and use of no-take reserves and clam aquaculture, specifically for providing meals for special guests, including the official government or church delegations that visit regularly, up to a few times every month. For example, when asked if the reserves were ever opened for fishing, respondents noted that this occurred at the direction of the village *matai* specifically for the purpose of hosting guests.

> "We have a reserve and no one is allowed to go near it or go fish in it, only when guests come then the village men will go and collect seafood from the reserve." (Interview 1)
> "No one was allowed to go near [the reserve] unless told by the *matais* and *pulenuu* [mayor] to collect seafood like aliao [trochus] for the guests." (Interview 8)
> "There are times [that the reserve is open] but only when the village guests come over, like guests from the government and church, so that's the time the reserve is only allowed to be open." (Interview 9)
> "… the reserve opens only when guests come over. The aumaga [young men] are ordered by the matai to get stuff from the village's reserve for guest food and other important events" (Interview 10).

Building networks and strengthening community capacity for food production are also principles of food sovereignty. Moorhead (2018) notes that in Samoa and Fiji, the benefits of giant clam aquaculture for building relationships and social capital between villages and fisheries agencies was "explicitly recognized." The quotes above provide implicit evidence that the CBFMP communities also recognize the importance of building relationships, specifically with government ministers and church officials. Hosting these important guests enables villages to gain technical expertise, share concerns, and request assistance, such as the free broodstock (mature individuals of a species needed

for propagation for aquaculture). As one interviewee notes: "So there are clams, corals, resting places for fishes [in the reserve] … We are just waiting for financial help to maintain these areas" (Interview 23). That kind of request occurs while hosting these important visitors.

Drawing on the reserves is important for offsetting the village's financial burden when hosting. When important visitors come, "we just get that stuff and no money is spent to buy other food" (Interview 9); otherwise, the visit would be supported by village households. In some instances, villages may use funds from development grants to purchase the food (pers. Comm and observation), however more frequently funds come from donations solicited from the village members by their *matai*. While young men and women must still contribute their labor to collecting and preparing food, food resources from the reserves reduces the direct monetary costs.

Participation in the CBFMP and aquaculture program is free, however protocols for providing meals for visitors also produce incidental costs for villages. Even short visits by the Fisheries Division staff to check on the reserve or bring supplies obligates the community to provide food. Villages near the urban center of Apia may purchase food from restaurants or catering services, but in rural areas food is more frequently prepared by members of the village (increasingly by women). This is viewed as reciprocity for the benefits they receive from the agency's staff, in a hybridized state-traditional system.

Sustainable Livelihoods for Women

Food sovereignty includes opportunities for all members of society to receive economic benefits, and considering gendered employment in fisheries is key to understanding how those benefits are distributed (Gustavsson, 2020; Weeratunge et al., 2010). Gaining income or trade capital from fisheries is also critical for food security, enabling small-scale fishers to purchase or trade for other food products (Fabinyi et al., 2017). While aquaculture in the Pacific has created gendered economic opportunities specifically benefiting men (Schoeffel, 1985), we find that Samoan women are benefiting economically from spill-over from the CBFMP reserve areas. In our interviews, women discussed how they harvested, processed, and sold clams and other invertebrates as part of their livelihoods. A few interviewees mentioned harvesting faisua spill-over outside of the reserves for sale, particularly women, who bottle the meat with salt water or other seafood and sell it to neighbors or at the market in Apia:

> "I sell a bunch of fishes… Yes, we sell them cheaply, we also sell bottles of vaga [sea urchin] and faisua… Me and my sister collect sea urchins and faisua, aliao [trochus], and vaga and other things" (Interview 6).

Women also reported harvesting lobsters for sale to restaurants catering to tourists. This represents both traditional and novel fishing practices for women entrepreneurs, as they respond to the needs of local markets.

Local Consumption

The right to "healthy, culturally appropriate food for all" is the first pillar of the Nyeleni Declaration. In Samoa, "good food" is recognized both as foods valued by global health discourse (i.e., "nutritious") and traditionally valued foods (Hardin & Kawauk, 2019). Surveys have also shown that while Samoan food systems are dominated by imported processed foods, Samoans particularly value fish and perceive it to have protective benefits (Kammholz et al., 2021).

In our interviews, we found that consuming locally caught seafood was considered an important benefit for both health and cultural preference, with "spill-over" effects described by eight interviewees. As one speaker told us:

> "We need more faisua and other sea urchins for our reserve because that is the Samoan delicacies to keep the good health" (Interview 12).

Others noted they preferred these foods in contrast to imported and processed options:

> "…we are tired of eating chickens and canned fish but back in the day we ate fish and it made us healthy…" (Interview 1).

One speaker specifically mentioned a preference for aquaculture clams, stating that:

> "faisua from Australia [broodstock] is so soft unlike the Samoa faisua, which is so hard to eat" (Interview 7).

After the 2009 tsunami, local reserves were also a critical source of food, as devastated communities coped with lost agriculture and disrupted roads limiting food imports.

Biodiversity Health

Food sovereignty approaches emphasize that food production must "work with nature" to support ecological health and sustainability. Both village interviewees and Fisheries Division staff identified ecological benefits from the no-take zones and aquaculture, including increase in biomass, species diversity, and "healthy coral" (Interview 9). A 2018 assessment of biodiversity health in Falealili District by the Fisheries Division observed high species biodiversity, but also noted decline in live corals attributed to the 2009 South Pacific Tsunami (Sinclair-Esau, 2018). However, more empirical studies are needed to determine how participation in the program is affecting biodiversity and ecological health, a common challenge when judging biodiversity outcomes of community engagement programs (Sterling et al., 2017).

Table 1 A comparison of the goals of food sovereignty and the CBFMP

Pillars of Food Sovereignty	CBFMP Goals and Outcomes
Right to sufficient, healthy, and culturally appropriate food; rejects food as just a commodity	Food security through availability and access to nutritious and culturally-appropriate blue foods for local consumption.
Values food providers	Men and women of all social levels, especially fishers, are included in management plan design process; however, traditional hierarchies and gender discrimination inform power imbalance, and food producers may not have representational equity.
Localizes food systems, providers and consumers are at the center of decision-making	Local communities fully participate in planning processes for aquaculture production, fishing practices and use or harvesting restrictions facilitated by Fisheries Division. Village leadership (*fono*) also choose and control aquaculture projects intended for local consumption (not export).
Local control of the means of production, (e.g., natural resources), right to inhabit and use territories, promotes interaction between food providers in different territories, use and share in socially and environmentally sustainable ways	In consultation with community members and Fisheries Division advisors, village leaders decide when/how to use food sources from reserve areas. By-laws program ensures village has legal authority over traditional tenure areas and decision-making power over access and use. CBFMP sponsors exchange between villages for learning.
Capacity building, applies local skills and knowledge for food production	Builds and supports village's capacity for management, monitoring, and enforcement; Incorporates local institutions and knowledge
Works with nature to maximize contribution of ecosystems and improve resilience and adaptation	Prohibits unsustainable fishing practices, supports biodiversity conservation for ecological resilience through establishment of reserves

Participation in the program also requires communities to develop a management plan for their tenure areas, which enables the Fisheries Division to engage with communities on conservation issues, such as removing invasive species.

Discussion

Our findings demonstrate that small-scale fisheries co-management can support processes for food sovereignty. Although it was not explicit to its design, in practice, the CBFMP's co-management goals aligned with and facilitated food sovereignty outcomes, including the availability of healthy culturally preferred foods, decision-making processes that included and valued food providers, local authority over production and food-producing spaces, and ecologically responsible and adaptable methods (Table 1).

Interviewees confirm the benefits of fish and clam reserves for food availability, from both spill-over and occasional extraction. Observations and interviews confirm that traditional village leadership has authority over no-take fish and clam mariculture reserves. Food producers, including women, were observed in decision-making in meetings facilitated by the Fisheries Division, although full representation wanes and is replaced by traditional hierarchies without intervention (Quimby & Levine, 2021). Although they create power asymmetries, traditional Samoan institutions are important for Samoan food sovereignty. Traditional tenure is recognized as a key component of food sovereignty in the Pacific (Plahe et al., 2013). Tenure ensures local communities - as opposed to the state or other external actors - have decision-making power about food production and harvesting, as well as the right to access, use, and control territories and resources they need for that process. The CBFMP reinforces legal recognition of traditional tenure and local authority, while also providing technical and scientific expertise to support the community's capacity for establishing and monitoring coastal environments.

Using the framework of food sovereignty to assess the processes and outcomes of co-management also brings greater attention to dimensions of power and resilience. In our case, attention to food sovereignty principles highlighted how social capital building to support resilience was enabled by the CBFMP program. Using resources from fish and clam reserves, Samoan villages can fulfill traditional obligations of hospitality and reciprocity, hosting visitors and government officials with culturally valued dishes without having to purchase costly imported foods. These exchanges facilitate the growth of social capital, broadly defined as "investment in social relationships with expected returns in the marketplace" (Lin, 2001: 19). Through the relationships and the resources embedded in these relationships, social capital is expected for individuals or communities to advance specific goals (Lin, 2001), such as knowledge-sharing.

Social capital is also a key factor in supporting community resilience (Ostrom, 2005; Pretty & Smith, 2004; Roque et al., 2021) and a critical component to supporting the viability and adaptive capacity of fisheries co-management programs (Gutierrez et al., 2011) and small-scale fisheries and aquaculture more broadly (Short et al., 2021). While the literature suggests that prohibiting any human use of these areas provides the strongest benefits for ecological resilience (Costello & Ballantine, 2015; Di Lorenzo et al., 2020), our

findings about the valuable cultural uses of small-scale fisheries suggest that allowing limited use for food sovereignty is vital to social resilience and the long-term sustainability of the reserves.

Critically, as we show the importance of food sovereignty, we do not view it as incompatible with the concept of food security. Both approaches can help us understand, critically think about, and formulate efficient food policies to promote social justice in the global food systems and end hunger (Clapp, 2014). Prioritizing food security in small-scale fisheries co-management has foregrounded local-scale social and economic well-being; adding a food sovereignty perspective that further emphasizes power relations and cultural meaning may serve as a catalyst towards achieving greater social equity and resilience. Incorporating these into co-management frameworks can further promote local and traditional knowledge and food production, equitable access, and decreased reliance of vulnerable communities on food aid and imports.

Conclusion

As global forums consider how to transform blue food systems for greater resilience and equity, they must prioritize the needs and values of local and Indigenous fishing communities. Here, we demonstrate that food sovereignty can be aligned with food security and social-ecological resilience approaches in small-scale fisheries management to better recognize dimensions of culture and power. Food sovereignty frameworks can be used to evaluate fisheries co-management and identify how it supports local control, sustainable livelihoods, gender equity, and food security in practice. Further, food sovereignty can help to address current gaps in recognizing fisheries as culturally valued food systems, and addressing the dynamics of power in local and global food systems.

Processes for food sovereignty can be supported by existing systems of fisheries co-management; for example, the CBFMP formalizes the rights of Samoan fishing communities to exercise control over access and use of coastal marine environments, from which they can derive culturally relevant foods. However, evaluations of the CBFMP and similar co-management programs have traditionally conceptualized fisheries primarily as natural resources rather than food, undervaluing, and potentially disrupting, the benefits of blue foods to participating communities, including cultural meaning and value, women's livelihoods, and equity. The incorporation of food sovereignty into fisheries co-management can also enable the integration of Indigenous and traditional knowledge (Poto et al., 2022), specifically about preferred or valued blue foods. In all, integrating food sovereignty frameworks with co-management design and evaluation can support principles of equity and resilience.

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Data Availability The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethical Approval This study was reviewed and approved by the San Diego State University Institutional Review Board (HS-2017-0308) and the University Research and Ethics Committee at the National University of Samoa (approved March 27, 2018).

Informed Consent The study was completed in compliance with Institutional Review Board (IRB) Guidelines for studies of human subjects and the research standards of the University Research and Ethics Committee at the National University of Samoa.

Conflict of Interest The authors have no conflicts of interest to declare.

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