

Chapter 4

Fish and Food Security in Small-Scale Fisheries

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Abstract Fish is among the most eaten foods and traded commodities in the world, and small-scale fisheries provide food, jobs, and life satisfaction to billions of people worldwide. Yet, they are rarely recognized for these facts in global-level discussions about food systems and security. In this chapter, we argue that any discussion of food security, global or local, is incomplete if fisheries, and small-scale fisheries specifically, are not included. In this chapter, we discuss the many ways that small-scale fisheries contribute to local and global food security and to sustainable livelihoods in coastal communities. These include fish as an object of exchange and a marker of culture identity, and fisheries as a context in which people can connect their own health and well-being to the health of marine and freshwater ecosystems. The chapter begins with an introduction to the concepts of food systems and food security, the latter entailing more than just whether food is available, but also whether people have access to foods that are nutritious and culturally preferred. We conclude by discussing how a rights-based approach to food systems effectively brings these various ways that people engage with fisheries to the fore.

Keywords: Food Security • Food Systems • Nutritional Security • Fisheries Sustainability • Small-Scale Fisheries

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Introduction

It may seem difficult to imagine, given that fish is generally harvested for consumption, that the majority of fisheries research in the past 50 years or more has disregarded the role that fisheries play in local, regional, and global food systems (Loring et al. 2013; Olson et al. 2014). From the perspective of environmental conservation, fisheries have been treated primarily as populations of species of concern, with the act of fishing constituting a “pressure” that managers must limit accordingly. From the perspective of economics and state-level policy, fisheries are largely treated as production systems for marketable commodities or as livelihood systems for coastal peoples. Yet, these segmented views of fisheries miss the important connections between them, connections made by fish and the roles that it plays in people’s lives as food—not merely for consumption but also celebration and cultural heritage (Lyons et al. 2016; Bennett et al. 2018;). This oversight, and perhaps lack of perspective on fisheries from the context within which they are most meaningful, has impacted the ability of governing bodies worldwide to achieve outcomes in fisheries management that are both environmentally sustainable and socially just.

Our aim with this chapter is to help address this oversight, to draw attention to the numerous ways that communities and landscapes and seascapes are linked through fish as food. Fish as food is arguably the most important lens for thinking about the sustainability of fisheries and fishing communities, given how many people live next to or near bodies of water, and how many rely on fish for some or most of their daily protein consumption. Understanding fish as food, and fisheries systems as food systems, enables a transdisciplinary perspective—meaning that it enables us to look beyond any specific disciplinary framing of fisheries in an attempt to capture the diverse and nuanced ways that people interact with fish, and through fish, with each other.

The role that fish plays in food and food security is possibly most prominent in small-scale fishing communities (Bennett et al 2018; Teh and Pauly 2018). According to the Food and Agriculture Organization of the United Nations (FAO), the majority of the world fisheries are small-scale, providing income, livelihoods and food to the global population, over 4.5 billion people rely on fish for 15% or more of their protein (Béné et al. 2015). In remote places like the North American Arctic, as much as 80% of people’s protein comes from subsistence fisheries (e.g., Fall 2014). Globally, demand for fish and other aquatic food products is growing, and for multiple reasons. As we will discuss below, fisheries provide an excellent, if not unmatched, source of nutrition. Fisheries are increasingly being thought of as ‘local’ alternatives to the global food system, and can also have a much lower carbon footprint than agricultural protein production, making them desirable from a climate change and global sustainability perspective (Béné et al. 2015). Finally, small-scale fisheries are also emerging as a venue through which many communities are asserting or trying to assert their rights and reclaim sovereignty, including food sovereignty, through initiatives that take control over how fisheries are managed, prosecuted, and marketed (e.g., Jones et al. 2016; Levkoe et al. 2017). These different production systems vary in terms of their contribution to local and global food security and have various consequences and implications that need to be taken into consideration when discussing fisheries sustainability.

A ‘food systems’ approach can be useful for understanding the myriad important roles that fish, as food, plays in local communities, and how fish links communities to regional and global systems. The concept of a food system is an analytical one, which attempts to capture all aspects of how people produce, transform, distribute, and consume food (Ericksen et al. 2010). At the local level, this can include a complex assemblage of local practices for agriculture, hunting, or fishing,

as well as how foods are processed, shared, marketed, and eventually, consumed and celebrated, whether at home or in a restaurant, with family or alone. These local systems likewise are embedded within equally complex and complicated regional and global systems, connected through lines of trade, commodity and fuel markets, and global networks for transportation and shipping.

Here, the concept of a food system helps us to understand how fish, as food, moves and is transformed as it changes hands, from person to person, and plate to plate, taking on new meanings and significance at each step. The language of food systems is an open and conciliatory language, capable of facilitating engagement among fisheries professionals and researchers in different disciplines and sectors: economists working on global trade, political scientists interested in rights and dispossession, managers interested in ecosystem-based effects of fishing behaviors, and policy-makers interested in securing trade; all of these perspectives have a home in a food systems approach. Hence, any discussion of food systems inherently crosses disciplinary and political boundaries and provides a broad framework to effectively integrate a holistic consideration of the very essence of life.

Below, we bring into focus a small handful of the diverse ways that fisheries interact with global and local food systems. While this does not aim to paint a comprehensive picture of small-scale fisheries in countries around the world, because this would be exceedingly ambitious, it is an attempt to illustrate why thinking about fish as food is such an important and powerful lens for addressing numerous fisheries- and fishing community-related concerns. An overarching premise of this book is that small-scale fisheries matter, also in a normative sense, both locally and globally: locally in terms of the ways that they contribute to health, well-being, and sustainable development for impoverished and marginalized communities, and globally as a venue for transforming the global, unsustainable, and unjust food system into something that works better for people. The focus on fish as food in this chapter exemplifies the need for a broad and holistic perspective when thinking about the connections among small-scale fishers, fish and fishers, beyond workers converting capital for global markets. The sections below offer some of the much-needed justification for this premise, as well as guidance regarding how to put these ideas and values into practice.

Fisheries and Food Security

Fisheries around the world play essential roles in providing food security for many local communities, and they also contribute a fair share to food security globally. According to published articles in the 'Information System on Small-scale Fisheries' (ISSF²) of the Too Big To Ignore Global Partnership on Small-Scale Fisheries (TBTI³), small-scale fisheries are essential in providing access to fish as food for global population especially in Africa and Asia and Oceania regions. Notably, in these two regions, small-scale fisheries are predominantly discussed at a sub-national and national scales, which suggests that the relevance of subsistence fishing extends beyond local, community level where small-scale fisheries are more visible (Fig. 4.1). In Asia alone, small-scale fisheries contribute 25 million tons annually, which is more than half of the world's small-scale fisheries marine production, and 8 million tons or 70 percent of inland global

² <https://issfcloud.toobigtoignore.net>

³ toobigtoignore.net

production (Mills et al. 2011; FAO 2016). In Africa, 85 percent of fish harvesters are involved in small-scale fisheries and contribute 47 percent of the landed value (Sea Around Us 2016). About 90 percent of inland and marine fisheries catches in these two regions go directly to human food consumption. Additionally, fisheries provide jobs to 120 million people involved directly and indirectly in fisheries and 90 percent of these are related to small-scale fisheries, which take place mostly in developing countries (Mills et al. 2011). Hence, at a global level, increased access to small-scale fisheries could be an essential way to increase people's food security, as a large portion of income in developing nations goes to obtaining food needs (Banerjee and Duflo 2007). Based on the FAO (2016)'s most recently available data, fish accounts for a significant amount of the total protein available in many nations, as much as 21% in China, 23% in Japan, and 14% in Norway. The number is lower in the United States and Canada, but often much higher than these averages in North America's remote and rural areas. Fish's contribution to food systems is also much higher in small and developing coastal or island nations; for example, Maldives and Kiribati have a consumption rate of 180 and 72 kg per person per year respectively (FAO 2016).

Insert Fig. 4.1 here

Demand for seafood globally is also on the rise and expected to continue to rise for a number of reasons: fish are highly nutritious as we will discuss below, and dietary advisories in developed nations are increasingly recommending that people eat multiple large portions of seafood each week. Globally, seafood markets generally move the highest quality seafood away from smaller coastal communities and nations, to wealthy, developed nations (Watson et al. 2017). As such, lower-income fisheries dependent states rely on lower-quality seafood products, whether locally harvested or imported, to meet their own food needs (Watson et al. 2017).

The relationship among fisheries and food security often takes on dramatically different forms in the academic literature, depending on the scale and discipline of analysis. At a very high level, analyses might focus simply on the amount of fish that could be harvested sustainably from a fishery, and compare this to demand (Merino et al. 2012). But this is a rather superficial approach to food security, which as we discuss below, conflates production, or the availability of food, with food security. The latter generally has more to do with whether people have access to foods, whether they are safe, and whether they are the foods that people prefer, than it is simply a matter of how much food exists. By comparison, household- and community-level approaches to food security are often far more multifaceted. In other words, it is not only a measure of how much food is being harvested or produced, food security at these levels is also understood to be an emergent property of a food system – the totality of activities, social institutions, material inputs and outputs, and cultural beliefs within a social group that are involved in the production, distribution and consumption of food.

Like conservation, food security can be discussed only in general terms at the global level, for example in terms of the total number of people living with food insecurity or hunger. At the local level, food security takes on a much more complex meaning and application, with multiple interacting factors – such as income, climate and climate change, socioeconomics, community infrastructure, and systems of land tenure – determining whether or not people can put healthy and culturally preferred food on their tables. Research in such places as Volta Basin in Africa and Mekong Basin in Southeast Asia shows, for instance, that poverty and food insecurity may not

only be a consequence of resource overexploitation but is related also to other factors such as geographical and political isolation (Béné and Friend 2009).

A common framework used for household and community food security proposes that food security is a function of four interacting features (Ericksen et al. 2010): 1) availability, meaning whether or not sufficient food is produced and harvested; 2) access, meaning whether those foods are being distributed and marketed to those who need it, and if so, whether they can afford to purchase them; 3) utilization, meaning whether the food is safe and meets consumers' biophysical, psychological, and social and cultural needs; and 4) stability, a temporal dimension that recognizes that each of the first three features will fluctuate over time because of the influence and interaction of seasonality, weather, changes in employment, and other socioeconomic, cultural and ecological factors.

Food security can be undermined in any of these dimensions by multiple causes, and as such, it is best achieved via strategies that plan for and adapt to changes in food availability over time. Security, in this sense, is clearly more than just food production alone. Food production does have a bearing on food security, but so do the foods that are being produced, how, where, when, and by whom they are produced, how they are distributed and marketed, and whether all people have equal access.

More than simple commodities, it is essential to think about the benefits of fisheries as central to fishing people's rights—specifically, the right to food. The United Nations defines the right to food as,

“Regular, permanent and unrestricted access, either directly or by means of financial purchases, to quantitatively and qualitatively adequate and sufficient food corresponding to the cultural traditions of the people to which the consumer belongs, and which ensure a physical and mental, individual and collective, fulfilling and dignified life free of fear.” (Ziegler 2008, 2).

This right, which is codified, at least most notably, by Article 25 of the Universal Declaration of Human Rights (United Nations 1948), underpins what has become known as a 'rights-based' approach to food systems (Chilton and Rose 2009). While parallel in many ways to the concept of food security, shifting the discourse from security to rights changes how people and governments must engage with food and food security. Specifically, it requires three kinds of action: respect for people's right to acquire food, protection of that right, and ensuring that people, through their own agency, have the opportunity fulfill that right in the ways that they see fit (Chilton and Rose 2009). A rights-based approach to food systems, and as such, to the fisheries within them, contends that multiple human rights, including the right to individual health, to food security, to pursue safe and fulfilling livelihoods, to gender equity, and to healthy and thriving ecosystems, can all be pursued through improvements to local food systems (Anderson 2008).

In rural Alaska, for example, Alaska Natives rely heavily on wild fish for a large component of their food system, and these are precisely the culturally preferred foods that contribute to a food secure situation (See Box 1) (Fall 2014). Although still abundant in many parts of Alaska, fish and game resources in some regions appear to be in decline, such as King salmon in rivers across the state (Lewis et al. 2015). Historically, Alaska Natives have been able to respond effectively to variability and change in the availability of fish and game through mobility and a flexible and seasonally specific strategy that includes multiple food options. More recently, this flexibility has been constrained by the increased cost of fuel necessary to power riverboats, all-terrain vehicles,

and snowmobiles, by permanent settlement in fixed communities rather than seasonally shifting residential patterns, by a complicated patchwork of state, federal, and private land tenure regimes, and by policies for fish and game management that are out of sync with the land and seascape changes caused by climate change (Gerlach et al. 2011). More and more rural people are eating the high cost, nutritionally bankrupt foods available at small village stores, and while the availability of these foods does indeed provide a measure of protection against hunger in the strictest sense, they nevertheless provide little in the way of supporting individual and community health (Loring and Gerlach 2009; see section 6 below). We use Alaska as the example here, but these circumstances mirror those being experienced for remote, natural resource dependent communities across the high latitude North and elsewhere around the globe.

Box 1 Country food and food security in the rural North

Communities in rural Alaska and northern Canada face much higher rates of food security than do those in other parts of the two developed nations. As of 2016 for the US and 2011 for Canada (the most recent years for which data are available), 12.3% and 8.4% of households are food insecure; by comparison, food insecurity rates are as high as 25% in Western Alaska and 69% in Nunavut, Canada. (Council of Canadian Academies, 2014; Feeding America, 2013). These stark inequities are arguably rooted in histories of exploitation and disempowerment, and systematically disadvantage historically colonized and exploited peoples in North America (P. Allen 2010). That being said, circumstances would be far worse for the indigenous residents of these places had they not maintained access to fish as a part of their traditional ‘foodways’ (Loring and Gerlach 2009; Kofinas et al. 2016).

Traditionally, the cultural, social and economic autonomy of these rural communities was centered on a flexible subsistence food system that, depending on region, included sea mammals, terrestrial mammals, birds, fish, and plant resources from formal or informal gardens (referred to in the North, generally, as ‘country foods’, see e.g., Gerlach et al., 2011). The portfolios of species harvested different from region to region, culture to culture (Wolfe and Walker 1987), yet, fish such as salmon, herring, and grayling, and arctic char, were and are a ubiquitous component (Nuttall et al. 2004). Many fish, like salmon and herring, are also cultural keystone species that are essential to the cultural health and survival of northern peoples (Thornton 1998; Loring and Gerlach 2009). Although northern foodways have been altered by multiple forces and stressors over the years, country foods today are still (albeit to various degrees) governed by traditional and localized patterns, and it is through subsistence hunting and fishing that many Indigenous people keep their cultures and traditions alive.

Country foods fit in to what scholars call a “mixed subsistence market economy”: one characterized by a reinforcing combination of subsistence activities and cash generating paid employment (i.e. tourism, guided hunting, service sector). Typically, families invest a small portion of their household incomes (which are usually low) towards technologies and supplies for harvesting country foods, such as equipment fuel. These reinforcing systems are increasingly disrupted, however, by high costs of fuel for heating and transportation and of low quality store-bought foods (Gerlach et al. 2011; Council of Canadian Academies 2014). Nevertheless, country food harvests are extensive: in Alaska, for example, most rural residents (which form 17% of the state’s population as of 2012) take part in the harvesting of wild game (60%) and fish (83%), and a still-higher portion uses these subsistence harvests (86% and 95% respectively) (see table

below). This is due to the common practice of sharing harvests with extended family and the community, especially with households unable to fish or hunt, such as elders, the disabled, as well as single parents with young children (Fall 2014; Kofinas et al. 2016). Multiple scholars have estimated that only 30% of a community's households are responsible for 70% of its wild foods supply, specifically to have the ability to provide for those that are unable to do so (Wolfe and Walker 1987; Kofinas et al. 2016).

Table 4.1 Percentage of households relying on country foods in rural Alaska. From Fall (2014).

Area	Harvesting game (%)	Using game (%)	Harvesting fish (%)	Using fish (%)
Arctic	63	92	78	96
Interior	69	88	75	92
South-central	55	79	80	94
Southeast	48	79	80	95
Southwest	65	90	86	94
Western	70	90	98	100
Total rural	60%	86%	83%	95%

Linking Fish Nutrition to Food Security

Increasingly, the high nutritional value of fish is recognized as an important aspect of how to build and maintain food security at local and national levels (Kawarazuka and Béné 2010; High Level Panel of Experts [HLPE] 2014; Isaacs 2016;). Fisheries NGOs such as the World Forum of Fisher People (WFFP), the World Forum on Fish harvesters and Fisher workers (WFF), the International Collective in Support of Fish workers (ICSF), La Via Campesina (LVC), and Food First Information and Action Network (FIAN) have been instrumental in advocating the importance of acknowledging fish nutrition as an essential component of food security and social justice. This is reflected in a number of international policy documents adopted by the Committee on Fisheries of the Food and Agriculture Organization of the United Nations (FAO), including the *Voluntary Guidelines on Responsible Governance of Tenure of Land, Fisheries and Forests in the context of National Food Security (Tenure Guidelines)*, the *Voluntary Guidelines on the Progressive Realization of the Right to Adequate Food in the Context of National Food Security (Right to Food Guidelines)*, and *Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty (Small-Scale Fisheries Guidelines)*. The Committee on Food Security (CFS/FAO)'s HLPE report on *Sustainable Fisheries and Aquaculture for Food Security and Nutrition* likewise underscores the importance of small-scale fisheries in contributing to food security and nutrition (HLPE 2014). International instruments such as this help to create space for fish to play a dominant role in the contributing to many poor fishing communities' in marine, inland, riparian dependent on the rich nutrition provided by small-fish.

Consumption patterns of poor people show that people in underdeveloped and impoverished regions tend to eat the same foods every day, as dietary diversity is constrained due to the food availability, food access, and food affordability (Khor 2008). As Amartya Sen and others have shown, it is not that existing food systems do not produce enough food to feed the

world's population, but that many people simply lack access, for a variety of social and political reasons, to healthful foods (Sen 1983; George 1986). Food insecurity, in the form of malnutrition, is often linked to consuming foods lacking in essential minerals and vitamins, and can manifest both in undernutrition (hunger) and overnutrition (obesity) (Popkin and Gordon-Larsen 2004; Khor 2008; Fazzino 2012). More and more, poor people are nutrient poor, even they live in food-rich areas. Market foods are often highly processed, high in sugar, salt, carbohydrates, and fats (Popkin and Gordon-Larsen 2004; Price 1939); they are easy accessible, cheap, often nutrient poor, made to taste good often contribute to the nutrient poor in vulnerable populations.

Increased access to fish could address several diet-related health problems for the poor. Fish, including small pelagic fish species such as sardines, and larger species such as salmon and herring, are rich in macro- and micronutrients, easily-digestible protein that contains all the essential amino acids, lipids with essential omega-3 fatty acids, key minerals and vitamins (Isaacs 2016). The lipid composition of these fish, especially small pelagics, is different from that of other proteins due to the long-chain, polyunsaturated fatty acids have a number of potential health benefits (Ramsden et al. 2009; Loring et al. 2010; Isaacs 2016). Only 150 mg of small pelagic fish per day contains the optimal amount of omega-3 docosahexaenoic (DHA) believed to be important during pregnancy, breastfeeding and infancy for neurodevelopment (Mozaffarian and Rimm 2006). Similarly, non-communicable diseases like heart diseases are common amongst urban and rural poor due to consuming unhealthy, cheap and processed foods (Seedat 2007); the omega-3 oils found in fish have also been found to reduce unhealthy cholesterol and triglycerides as well as increase healthy cholesterol (Ramsden et al. 2009; HLPE 2014).

Small pelagic fish also contain significant amounts of essential micronutrients, including lysine, methionine, Vitamins A, D, B1 and B2, as well as iron, phosphorous and calcium (High Level Panel of Experts 2014). Vitamin A is present in fish as retinol and anhydroretinol, which is more easily preserved through the cooking process, and more readily absorbed by humans than the form of Vitamin A found in vegetables (Thilsted et al. 1997). In addition, when fish is digested with bones and organs it can be slightly more effective source of calcium than milk (Titchenal and Dobbs 2007). Fish is likewise a rich source of iron, and also aids the bioavailability of iron of other foods in a meal, such as rice (Thilsted et al. 1997). Over 30% of people in the world are reported to be iron deficient, including up to 50% of pregnant women and children in developing countries, with approximately two billion being anaemic (HLPE 2014). Lack of iron impairs cognitive development, growth, and immune function, very often resulting in sub-optimal performance at school and in adulthood (Thompson 2011).

Fish, added to the traditional blend of staple diets, will therefore increase the utilization of micronutrients, indirectly boosting people's immune systems; this could be especially important for vulnerable populations such as young children, the aged and immune-compromised persons living with HIV and Aids (Thompson 2011). Finally, while fish in the food security literature is often discussed separately from the consumption of land-based foods, there may be important reasons to explore these together. Rice, maize and grains, for example, can be fortified with fish oil as a way to bring necessary nutrients to the poor (Isaacs 2016).

One noteworthy caveat to the many nutritional benefits of fish is that many fishes are now potentially contaminated with such toxicants as persistent organic pollutants (POPs), dioxins, and methylmercury (Corsolini et al. 2005; FDA 2006; Sunderland 2007). Mercury levels are high, for example, in fish and other marine animals in northern waters (Jewett and Duffy 2007), in part because of climate change and the northward atmospheric transport of mercury from coal burning at lower latitudes. However, it is difficult to develop straightforward or uniform guidance for

whether the risks outweigh the benefits of consuming seafood, given regional variation in contamination levels and also the multiple benefits that fish can have to health (Egeland and Middaugh 1997; Loring and Duffy 2011). In one study focusing on methylmercury in food fish in Alaska, for example, Loring and colleagues (Loring et al. 2010) showed that benefits of high levels of omega-3 fatty acids in fish can outweigh the negative impacts of mercury with respect to both cardiovascular health and infant neurological development.

Fish, Food, and Culture

Nutrition, of course, is just one of many ways that food contributes to people's health and well-being. In many parts of the world, fish are extremely important aspects of local cultural identity and traditions. Salmon in the US Pacific Northwest and Alaska is considered to be a "cultural keystone species" for its importance to local life and culture (Wolf and Zuckerman 2003; Amberson et al. 2016). Fishing, and sharing fish, are a way that many Indigenous peoples maintain social ties, both within and among families and with elders and other community leaders. Fish and seafood in general is ubiquitous in cultural iconography and art all around the world, from the Totem poles in Haida Gwaii, British Columbia to the carving of the Mao'ri in Ao'tea'roa (New Zealand). Several countries indicate the importance of fish by depicting them in their bank notes, coins and stamps. Fish and fishing people are also major themes in stories, folklore and songs. Fish may be the most commonly used non-human form represented in all culture, including in contemporary arts and design. Thailand, for instance, has an old saying, which has been turned into songs and dances, to signify the traditional role that fish plays in food security and the nation's prosperity, as a key accompaniment to rice, 'there are fish in the waters, there is rice in the fields.'

In many coastal and rural inland communities, where fishing and fish intertwine with food and culture, fishing activities contribute to maintaining social solidarity in the community (Freeman 2005; Stewart 2005; Kittinger et al. 2015). In the Hawaiian Islands, 20 percent of seafood obtained by small-scale fishers goes to socio-cultural activities as a way to keep social cohesion (Kittinger et al. 2015). In some of the Pacific Islands, about half of the small-scale fishers catch goes to household consumption, and cultural events and ceremonies, as well as to give away to friends and relatives. Shared fish can be in the form of contribution or service to one's family (or *tautua* commonly practiced by Samoans), mutual kin assistance, or general support (Severance et al. 2013). Hence, fishing for food is a practice in which people find meaning, through which they learn from their elders, and ultimately establish their place in their community. In places where colonialism and development has displaced people from their traditional fishing roles, numerous negative health outcomes have emerged, including declines in physical health associated with a western diet—patterns of depression, substance abuse, family violence, and suicide in colonized places have all been attributed in various ways to the psychological impacts of not being able to fish or hunt (Kral 2012; J. Allen et al. 2014).

There can also be important gendered aspects of the various roles that fish, as food, play in supporting individual and community well-being, though these are typically overlooked in assessments of how small-scale fisheries contribute to food security (Harper et al. 2013). Women are often involved in pre- and post-harvest activities such as mending gears, packaging, processing, and selling the fish. This type of involvement of women can be done in their homes or in the community where they live, which means that these activities do not necessarily sacrifice their family-related responsibilities (*R. Biswal, personal communication*). At the same time, it can

contribute to the family's income which enhances the ability of the household to purchase other food needs. In many parts of the world, fishing is a way that women contribute to household and community food consumption, for example fisherwomen in Melanesia supply about 80% of the subsistence requirement of their communities (Kronen and Vunisea 2009).

Lastly, it is important to note that food preparation and value-adding play important roles in food security, especially in the context of accessing nutritious, culturally preferred, and affordable food. Various cultures have unique ways to prepare food, typically, influenced by resources available to them (see Box 2). Traditional preparation of fish and fish products uses fish that are available locally, which is in most cases, are from small-scale fisheries. Drying, salting, fermenting, smoking, and canning are useful methods to prolong the shelf life of fish and fish products. Also, dried, fermented, and canned fish are transported with ease to nearby towns or other parts of the country, thereby, increasing access to fish by communities away from the coasts and urban centers (Isaacs 2016). In some parts of the world, a powder form of fish increases distribution and consumption, and has been especially beneficial in addressing malnutrition in rural communities in Cambodia.

Box 2 Food and culture: appreciating fermented fish sauce in the Philippines

In Southeast and East Asia, fermented fish sauce is deeply integrated into people's daily cuisines (Beddows 1998). Fermented fish sauce, also called *patis* in the Philippines, is regularly used in cooking or as condiments. *Patis* can add flavor to virtually all dishes and are also used in place of salt to enhance the flavor of many Philippine dishes. Hence, it is commonly observed in restaurants to keep fish sauce in the dining table, a reflection of how fish has become embedded in appreciating food in general (Rattagool 1985). The use of fermented fish in the Philippines has originated from the ways Filipinos have broadly depended on fish as food. Fish is relatively more affordable than other sources of proteins; hence about 70% of protein sources in the Philippines are from fish caught in small-scale fisheries (Muallil et al. 2013).

Although industries have become the major suppliers of fish sauce in urban areas, in the country, the practice of making fermented fish sauce has been, and still is, culturally significant in many coastal areas in the Philippines. An example is a town of Luna in La Union, where about 80% of fermented fish sauce, made mostly by families directly engaged in fishing (20% of the working population) goes to household consumption and the remaining 20% are shared with relatives and friends. The traditional process of fermentation is typically carried out by older women who have learned the know-how passed down to them by their parents and grandparents. In general, the homemade fermented fish sauce acquires exceptional taste and smell, thus considered high quality and the locals or connoisseur would know the difference (*M. Lim, personal communication*).

Another important aspect of fermented fish sauce is that this typically makes good use of abundant small pelagic fish (e.g., varieties of mackerel, anchovies), which are relatively low-value compared with big fish species and are available year round. The preparation of fermented fish also makes use of locally available materials such as an earthen jar called Burnaj jars. The jar containing the fresh fish are sealed and kept buried, at least three-fourths of the jar, in the soil for three months to one year. The longer the fermentation is, the better it becomes (*M. Lim, personal communication*). Although this may take a long time, it guarantees that this naturally induced fermentation process does not require additives or harmful chemicals that may be

present in industrially made fermented fish sauce (Lopetcharat et al. 2001). As such, locally made fish sauce represents cultural and nutritional values of fish, as well as supports local economy and sustainability of the fisheries ecosystem.

Fish as a Linkage Between Ecosystem Health and Human Well-Being

In addition to the many ways that small-scale fisheries support community food security, taking a food systems approach to fisheries can also enhance efforts to conserve natural resources such as rangelands, fisheries, and other wild food resources. This is the case especially when explicitly linked to the precept that healthy ecosystems and sustainable harvests of natural resources are both part and parcel to sustainable food production systems, including relevant regulatory, management, cultural and social components of the system. However, often, this connection between sustainable harvest and food security are not explicitly defined (Foale et al. 2013; Loring 2013).

Therefore, as a start, food security goals should be explicitly defined, in the context of fish as food and its connection between ecosystem health and human well-being. This can be accomplished in part by tightening the connections between people and their ecosystems through their food choices (Sundkvist et al. 2005), i.e., by empowering people to be better stewards of the resources (Bennett et al 2018), by conducting social analysis and inter-sectoral policy and governance (Foale et al. 2013), and by providing a context within which people can respond to variability and change in the availability of resources by with a diverse portfolio of food options (Loring and Gerlach 2010; Kofinas et al 2010).

An example is the case of the Pacific Island countries showing that fish is essential to health and well-being of people. With the changes in the diet of the Pacific Islanders, as a result of the influx of processed imported foods, the population has suffered from high rates of diabetes and obesity problems. However, if the Islanders would increase their fish consumption, these health issues would be minimized. Estimates show that for the Pacific Island population to be food secure, one avenue is to increase the supply of tuna by 12% in 2020 and 25% by 2025. Relatively, this required increase in domestic supply and is equivalent only to 2.1 and 5.9% respectively of the current industrial catch. However, to make the Pacific Islands population food secure is not straightforward. It would require an explicit goal ensuring that fish especially tuna is readily available for coastal communities. In the context of the Pacific Islands, this will require intervention specific to small-scale fishers to catch more tuna such as assisting them with the efficient use of the fish aggregating device (FADs). Another is by creating policy support at the regional level (e.g., ban on discarding small tuna and land this fish at regional ports) and country-level (e.g., increase distribution and access to affordable canned tuna for the inland population) (Bell et al. 2009).

An important step to making food security goals explicit is by examining the two-way relationship between resource governance and food security (Foale et al. 2013). There is a need to recognize that the process of achieving food security dimensions will have an impact on the ecosystem and may result in tradeoff and challenges. Box 3 shows examples where food security may align or conflict with sustainable fisheries harvests. A valuable lesson is that when the goals of resource management gear toward making people food secure, fish is seen not only a source of nutrition to support human health but also a provision of a healthy and well-managed environment.

Box 3 Food security vs. sustainable fishery

Juan Fernandez Lobster fishery in Chile The Juan Fernandez lobster fishery has supported a small community but strongly dependent on the small-scale lobster fishery for more than 100 years. The users and boats have remained relatively stable from 41 to 57 boats from 1947 to date. A traditional tenure system called *marcas* has managed the fishery. The use of small boats and ownership of fishing spots are governed by unwritten rules under the *marcas* tenure system and have provided fishers with perceived equal access to the resource. The lobster fishery has remained sustainable to date for these additional reasons: (1) lobster stock is productive, (2) high compliance among fishers of the unwritten and formal rules, (3) the *marcas* tenure system is able to implement simple rules to protect reproductive female lobster, and (4) local engagement of fishers. Fishers' engagement led to positive responses and outcomes such as local fishers being actively involved and trained in collecting and maintaining fisheries datasets. Since fishers take an active role in management decisions, fishers cooperate with monitoring and implementing harvesting size regulations. Some fishers have also established marketing cooperative that allows them to participate in ecolabeling and get the support of Slow-Food movement which makes local fish consumed locally (Ernst et al. 2010, 2013).

Small-scale fishery in Solomon Islands: Food security vs. conservation The Solomon Islands population has been dependent on the small-scale fishery for food. However, the fishery is facing an increasing number of people reliant on fish as a major source of protein causing mounting pressure on the fisheries. Based on current trends of exploitation, the sea-cucumber and reef fisheries will not have the capacity to elevate the population above its local poverty situation while the fisheries will also be significantly degraded. Hence it will be a real challenge to both keep the community food secure and maintain environmental sustainability. However, a responsive governance system can help alleviate this problem by explicitly recognizing this tradeoff. A strategy may entail reducing the pressure on reef fisheries by developing the less exploited inshore tuna fishery to provide the required protein for the Island's population. This approach, however, would need policy support and behavioral and cultural adjustment among the communities actively engaged in fishing (Hardy et al. 2013).

Conclusion

The goal of this chapter has been to provide a sense of the many ways people can and do benefit from small-scale fisheries. Far more than just systems economic production, small-scale fisheries are essential to people's food and livelihood security and quality of life. They are a locus of cultural value and meaning, a setting for the transmission and sharing of knowledge and heritage, and a platform through which people connect with and steward their local ecosystems. The concept of the food system provides a unifying framework for these various interdependencies; in so doing, it also brings the discussion of fisheries into contact with other important aspects of people's livelihoods and food security. A successfully managed fishery, when recognized as part of a food

system, involves more than just the prudent management of how many fish are taken, and gives equal credence to the multiple ways that fisheries enrich people's lives.

Food sovereignty, just as it is transforming how people view small-scale agriculture, can be just as transformative for how policy attends to small-scale fisheries. As already noted, food sovereignty means more than just food security—it means that people are in control of their food systems. In the case of small-scale fisheries, food sovereignty aligns directly with the three tenets of rights-based approaches to food systems noted above: respect, protection, and fulfilment of people's many human rights. Moving forward, we argue that fisheries management and governance discourses need to bring these issues of human rights and sovereignty to the fore, if fisheries, whether small or large scale, are to be both sustainable and just.

References

- Allen J, Mohatt GV, Fok CCT, et al (2014) A Protective Factors Model for Alcohol Abuse and Suicide Prevention Among Alaska Native Youth. *Am J Community Psychol* 54:125–139. doi: 10.1007/s10464-014-9661-3
- Allen P (2010) Realizing justice in local food systems. *Camb J Reg Econ Soc* 3:295–308. doi: 10.1093/cjres/rsq015
- Amberson S, Biedenweg K, James J, Christie P (2016) “The Heartbeat of Our People”: Identifying and Measuring How Salmon Influences Quinault Tribal Well-Being. *Soc Nat Resour* 29:1389–1404. doi: 10.1080/08941920.2016.1180727
- Anderson MD (2008) Rights-based food systems and the goals of food systems reform. *Agric Hum Values* 25:593–608. doi: 10.1007/s10460-008-9151-z
- Banerjee AV, Duflo E (2007) The Economic Lives of the Poor. *J Econ Perspect J Am Econ Assoc* 21:141–167. doi: 10.1257/jep.21.1.141
- Beddows CG (1998) Fermented fish and fish products. In: *Microbiology of fermented foods*. Springer, pp 416–440
- Bell JD, Kronen M, Vunisea A, et al (2009) Planning the use of fish for food security in the Pacific. *Mar Policy* 33:64–76. doi: 10.1016/j.marpol.2008.04.002
- Béné C, Barange M, Subasinghe R, et al (2015) Feeding 9 billion by 2050 – Putting fish back on the menu. *Food Secur* 1–14. doi: 10.1007/s12571-015-0427-z
- Béné C, Friend RM (2009) Water, poverty and inland fisheries: lessons from Africa and Asia. *Water Int* 34:47–61
- Bennett NJ, Kaplan-Hallam M, Augustine G, et al (2018a) Coastal and Indigenous community access to marine resources and the ocean: A policy imperative for Canada. *Mar Policy* 87:186–193. doi: 10.1016/j.marpol.2017.10.023
- Bennett NJ, Whitty TS, Finkbeiner E, et al (2018b) Environmental Stewardship: A Conceptual Review and Analytical Framework. *Environ Manage* 1–18. doi: 10.1007/s00267-017-0993-2
- Chilton M, Rose D (2009) A Rights-Based Approach to Food Insecurity in the United States. *Am J Public Health* 99:1203–1211. doi: 10.2105/AJPH.2007.130229
- Corsolini S, Ademollo N, Romeo T, et al (2005) Persistent organic pollutants in edible fish: a human and environmental health problem. *Microchem J* 79:115–123. doi: 10.1016/j.microc.2004.10.006
- Council of Canadian Academies (2014) *Aboriginal Food Security in Northern Canada: An Assessment of the State of Knowledge*. Council of Canadian Academies, Ottawa, ON

- Egeland GM, Middaugh JP (1997) Balancing Fish Consumption Benefits with Mercury Exposure. *Science* 278:1904–1905. doi: 10.1126/science.278.5345.1904
- Ericksen PJ, Stewart B, Dixon J, et al (2010) The Value of a Food System Approach. In: *Food Security and Global Environmental Change*. Earthscan, London, UK, pp 25–45
- Ernst B, Chamorro J, Manríquez P, et al (2013) Sustainability of the Juan Fernández lobster fishery (Chile) and the perils of generic science-based prescriptions. *Glob Environ Change* 23:1381–1392. doi: 10.1016/j.gloenvcha.2013.08.002
- Ernst B, Manríquez P, Orensanz JM, et al (2010) Strengthening of a traditional territorial tenure system through protagonism in monitoring activities by lobster fishermen from the Juan Fernández Islands, Chile. *Bull Mar Sci* 86:315–338
- Fall J (2014) Subsistence in Alaska: A 2012 Update. Alaska Department of Fish and Game, Juneau, AK
- FAO (2016) *The State of World Fisheries and Aquaculture: Contributing to Food Security and Nutrition for All*. Food and Agriculture Organization of the United Nations, Rome, Italy
- Fazzino D (2012) The Will to end Hunger in the Age of Security. In: Coulter K, Schumann WR (eds) *Governing Cultures*. Palgrave Macmillan US, pp 183–208
- FDA (2006) *Mercury Levels in Commercial Fish and Shellfish*. US Food and Drug Administration
- Foale S, Adhuri D, Aliño P, et al (2013) Food security and the Coral Triangle Initiative. *Mar Policy* 38:174–183. doi: 10.1016/j.marpol.2012.05.033
- Freeman MM (2005) Just one more time before I die: securing the relationship between Inuit and whales in the arctic regions. *Indig Use Manag Mar Resour* 67:59–76
- George S (1986) *How the Other Half Dies: The Real Reasons for World Hunger*. Penguin Books, Harmondworth, Middlesex
- Gerlach SC, Loring PA, Turner AM, Atkinson DE (2011) Food Systems, Climate Change, and Community Needs. In: Lovecraft AL, Eicken H (eds) *North by 2020*. University of Alaska Press, Fairbanks, AK, pp 111–134
- Hardy P-Y, Béné C, Doyen L, Schwarz A-M (2013) Food security versus environment conservation: A case study of Solomon Islands' small-scale fisheries. *Environ Dev* 8:38–56. doi: 10.1016/j.envdev.2013.04.009
- Harper S, Zeller D, Hauzer M, et al (2013) Women and fisheries: Contribution to food security and local economies. *Mar Policy* 39:56–63. doi: 10.1016/j.marpol.2012.10.018
- High Level Panel of Experts (2014) *Sustainable fisheries and aquaculture for food security and nutrition*. Committee on World Food Security, Food and Agriculture Organization of the United Nations, Rome
- Isaacs M (2016) The humble sardine (small pelagics): fish as food or fodder. *Agric Food Secur* 5:27. doi: 10.1186/s40066-016-0073-5
- Jentoft S, Chuenpagdee R, Barragán-Paladines MJ, Franz N (2017) *The Small-Scale Fisheries Guidelines: Global Implementation*. Springer
- Jewett SC, Duffy LK (2007) Mercury in fishes of Alaska, with emphasis on subsistence species. *Sci Total Environ* 387:3–27
- Jones R, Rigg C, Pinkerton E (2016) Strategies for assertion of conservation and local management rights: A Haida Gwaii herring story. *Mar Policy*. doi: 10.1016/j.marpol.2016.09.031
- Kawarazuka N, Béné C (2010) Linking small-scale fisheries and aquaculture to household nutritional security: an overview. *Food Secur* 2:343–357. doi: 10.1007/s12571-010-0079-y

- Khor GL (2008) Food-based approaches to combat the double burden among the poor: challenges in the Asian context. *Asia Pac J Clin Nutr* 17:111–115
- Kittinger JN, Teneva LT, Koike H, et al (2015) From Reef to Table: Social and Ecological Factors Affecting Coral Reef Fisheries, Artisanal Seafood Supply Chains, and Seafood Security. *PLoS ONE* 10:e0123856. doi: 10.1371/journal.pone.0123856
- Kofinas GP, BurnSilver S, Magdanz J, et al (2016) Subsistence Sharing Networks and Cooperation: Kaktovik, Wainwright, and Venetie, Alaska. School of Natural Resources and Extension, University of Alaska Fairbanks., Fairbanks, AK
- Kofinas GP, Chapin FS, BurnSilver S, et al (2010) Resilience of Athabaskan subsistence systems to interior Alaska's changing climate. *Can J For Res* 40:1347–1359. doi: 10.1139/X10-108
- Kral MJ (2012) Postcolonial Suicide Among Inuit in Arctic Canada. *Cult Med Psychiatry* 36:306–325. doi: 10.1007/s11013-012-9253-3
- Kronen M, Vunisea A (2009) Fishing impact and food security—Gender differences in finfisheries across Pacific Island countries and cultural groups. *SPC Women Fish Inf Bull* 19:3–10
- Levkoe CZ, Lowitt K, Nelson C (2017) “Fish as food”: Exploring a food sovereignty approach to small-scale fisheries. *Mar Policy* 85:65–70. doi: 10.1016/j.marpol.2017.08.018
- Lewis B, Grant WS, Brenner RE, Hamazaki T (2015) Changes in Size and Age of Chinook Salmon *Oncorhynchus tshawytscha* Returning to Alaska. *PLoS ONE* 10:e0130184. doi: 10.1371/journal.pone.0130184
- Lopetcharat K, Choi YJ, Park JW, Daeschel MA (2001) Fish sauce products and manufacturing: a review. *Food Rev Int* 17:65–88
- Loring PA (2013) Alternative Perspectives on the Sustainability of Alaska's Commercial Fisheries. *Conserv Biol* 27:55–63. doi: 10.1111/j.1523-1739.2012.01938.x
- Loring PA, Duffy LK (2011) Managing environmental risks: the benefits of a place-based approach. *Remote Rural Health* 11:1800
- Loring PA, Duffy LK, Murray MS (2010) A risk-benefit analysis of wild fish consumption for various species in Alaska reveals shortcomings in data and monitoring needs. *Sci Total Environ* 408:4532–4541. doi: 10.1016/j.scitotenv.2010.07.013
- Loring PA, Gerlach SC (2009) Food, Culture, and Human Health in Alaska: An integrative health approach to food security. *Environ Sci Policy* 12:466–478
- Loring PA, Gerlach SC (2010) Food Security and Conservation of Yukon River Salmon: Are We Asking Too Much of the Yukon River? *Sustainability* 2:2965–2987. doi: 10.3390/su2092965
- Loring PA, Gerlach SC, Harrison H (2013) Seafood as Local Food: Food Security and Locally Caught Seafood on Alaska's Kenai Peninsula. *J Agric Food Syst Community Dev* 3:13–30. doi: 10.5304/jafscd.2013.033.006
- Lyons C, Blount B, Carothers C, et al (2016) Considering communities in fisheries management. *Mar Policy*. doi: 10.1016/j.marpol.2016.05.006
- Merino G, Barange M, Blanchard JL, et al (2012) Can marine fisheries and aquaculture meet fish demand from a growing human population in a changing climate? *Glob Environ Change* 22:795–806. doi: 10.1016/j.gloenvcha.2012.03.003
- Mills DJ, Westlund L, de Graaf G, et al (2011) Under-reported and undervalued: small-scale fisheries in the developing world. *Small-Scale Fish Manag Framew Approaches Dev World* 1–15

- Mozaffarian D, Rimm EB (2006) Fish Intake, Contaminants, and Human Health: Evaluating the Risks and the Benefits. *JAMA* 296:1885–1899. doi: 10.1001/jama.296.15.1885
- Muallil RN, Cleland D, Aliño PM (2013) Socioeconomic factors associated with fishing pressure in small-scale fisheries along the West Philippine Sea biogeographic region. *Ocean Coast Manag* 82:27–33
- Nuttall M, Berkes F, Forbes BC, et al (2004) Hunting, Herding, Fishing, and Gathering: Indigenous Peoples and Renewable Resource Use in the Arctic. In: *Arctic Climate Impact Assessment (ACIA)*. Cambridge University Press, Cambridge, UK, pp 649–690
- Olson J, Clay PM, Pinto da Silva P (2014) Putting the seafood in sustainable food systems. *Mar Policy* 43:104–111. doi: 10.1016/j.marpol.2013.05.001
- Popkin BM, Gordon-Larsen P (2004) The Nutrition Transition: Worldwide Obesity Dynamics and their Determinants. *Int J Obes* 28:S2–S9
- Price W (1939) *Nutrition and Physical Degeneration: On the problems of the western diet and the obsession with nutrients*. McGraw-Hill Book Company, Inc, New York
- Ramsden C, Faurot K, Carrera-Bastos P, et al (2009) Dietary fat quality and coronary heart disease prevention: A unified theory based on evolutionary, historical, global, and modern perspectives. *Curr Treat Options Cardiovasc Med* 11:289–301. doi: 10.1007/s11936-009-0030-8
- Rattagool P (1985) Fermented fish products of South East Asia. *Trop Sci* 25:61–73
- Sea Around Us (2016) *Sea Around Us | Fisheries, Ecosystems and Biodiversity*. In: *Sea Us Fish. Ecosyst. Biodivers.* <http://www.seaaroundus.org/>. Accessed 23 Jan 2018
- Seedat Y (2007) Impact of poverty on hypertension and cardiovascular disease in sub-Saharan Africa. *Cardiovasc J Afr* 18:316–320
- Sen A (1983) *Poverty and Famines: An Essay on Entitlement and Deprivation*. Oxford University Press
- Severance C, Franco R, Hamnett M, et al (2013) Effort Triggers, Fish Flow, and Customary Exchange in American Samoa and the Northern Marianas: Critical Human Dimensions of Western Pacific Fisheries. *Pac Sci* 67:383–393. doi: 10.2984/67.3.6
- Stewart H (2005) The fish tale that is never told: a reconsideration of the importance of fishing in Inuit societies. *Senri Ethnol Stud*
- Sunderland EM (2007) Mercury Exposure from Domestic and Imported Estuarine and Marine Fish in the U.S. Seafood Market. *Environ Health Perspect* 115:235–242
- Sundkvist A, Milestad R, Jansson A (2005) On the importance of tightening feedback loops for sustainable development of food systems. *Food Policy* 30:224–239
- Teh LCL, Pauly D (2018) Who Brings in the Fish? The Relative Contribution of Small-Scale and Industrial Fisheries to Food Security in Southeast Asia. *Front Mar Sci* 5.: doi: 10.3389/fmars.2018.00044
- Thilsted SH, Roos N, Hassan N (1997) The role of small indigenous fish species in food and nutrition security in Bangladesh. *Naga ICLARM Q* 20:82–84;102
- Thompson B (2011) 15 Combating Iron Deficiency: Food-based Approaches. *Combat Micronutr Defic Food-Based Approaches* 268
- Thornton TF (1998) Alaska Native subsistence: A matter of cultural survival. *Cult Surviv Q* 22:29–34
- Titchenal CA, Dobbs J (2007) A system to assess the quality of food sources of calcium. *J Food Compos Anal* 20:717–724. doi: 10.1016/j.jfca.2006.04.013

United Nations (1948) Universal declaration of human rights

Watson RA, Nichols R, Lam VWY, Sumaila UR (2017) Global seafood trade flows and developing economies: Insights from linking trade and production. *Mar Policy* 82:41–49. doi: 10.1016/j.marpol.2017.04.017

Wolf EC, Zuckerman S (2003) *Salmon nation*. Ecotrust, Portland, OR

Wolfe RJ, Walker RJ (1987) Subsistence Economies in Alaska: Productivity, Geography, and Development Impacts. *Arct Anthropol* 24:56–81

Ziegler J (2008) Report of the Special Rapporteur on the right to food. UN Hum Rights Counc GE 08–10098

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