From sea to plate: the role of fish in a sustainable diet

Health & Medicine

In the most recent U. S. Dietary Guidelines, the USDA Advisory Committee recommended for the first time the inclusion of sustainability considerations (DGA Committee, 2015). Since the U. S. Dietary Guidelines provide standards for nutrition and targets for federal and state food programs, explicitly incorporating sustainability would advance considerably discussions of food system sustainability (Merrigan et al., 2015). However, despite broad public support, sustainability 80 concerns were ultimately jettisoned from the 2015–2020 Guidelines (Secretary Vilsack and Burwell, 2015 ; US Department of Health and Human Services and US Department of Agriculture, 2015 ; Wood-Wright, 2016). Though much of the concern around incorporating sustainability has focused on animal agriculture, the sectors most heavily impacted by sustainability policies are arguably fisheries and aquaculture. Fish have been promoted as a sustainability strategy, providing nutritious alternatives to resource intensive livestock and poultry, and a concern, given the decline of many global fish stocks (Worm et al., 2006 ; Health Council of the Netherlands, 2011 ; FAO, 2014). Yet, we regularly overlook the origins and implications of this decline due to fragmented notions of our food resources. Resources that originate in our oceans, rivers, and lakes are almost entirely omitted in our conceptions of a sustainable food system.

To understand the trade-offs from food production and consumption to sustainability, we must extend our understanding of food resources to conceive of fishery, agricultural, and livestock systems as integrally linked. Our failure to do so thus far has led to a disjointed understanding of our food system, contributed to inequalities in food access, and exacerbated overexploitation and environmental degradation. We argue here that fishery resources are of particular concern for sustainability yet often omitted in conceptions of our food system, and that such disjointed notions of food resources limit our ability to foster sustainable diets (Farmery et al., 2017).

Harvest on Land and at Sea

As aquatic and terrestrial systems both face mounting pressures, ignoring their interconnections can multiply consequences for both the resources and people who depend on them. Global fisheries support the livelihoods of 10–12% of the world's population, and fish are the primary protein source for over 1 billion people living in low-income, food-deficit countries (Toppe et al., 2012 ; FAO, 2014). Yet major efforts to address challenges to food security rarely account for this critical sector (Bene et al., 2016 ; Thilsted et al., 2016). For example, the World Bank's food security projects allocate <1% of funds to fisheries and aquaculture initiatives (The World Bank, 2014).

Our growing use of fish as animal feed perhaps best highlights the unexamined trade-offs between aquatic and terrestrial systems. Annually, 21. 7 million tons of low-value nutrient-rich fish are diverted for use as fish and livestock feed (FAO, 2012a). Converting these important marine species to agricultural inputs reduces usable biomass by 80%, leads to the simplification of marine food webs, and threatens vulnerable human populations that rely on inexpensive fish for calories and micronutrients (Tacon and Metian, 2008 ; Cury et al., 2011 ; Smith et al., 2011). The use of marine resources as an agricultural input constitutes a troubling trade-off as we fish farther down the food web in aquatic systems to produce increasingly inefficient agricultural commodities. A similar example of the tight interdependencies of agricultural and fishery systems is the pollution and eutrophication of lakes, rivers, and coastal waters from fertilizer run-off in agricultural production (Vitousek et al., 1997 ; Tilman, 1999).

Trade and Consumption

Fisheries and terrestrial food systems also face linked challenges in equitable food distribution that are exacerbated by resource declines. Like food insecurity, fish consumption is not distributed evenly throughout the world. Developing countries account for well over half of total fishery exports (FAO, 2014) and fishery commodities often depart from food insecure countries with extensive fish dependence and flow toward lucrative markets in the U. S., Europe, and Asia. Further, over 90% of fishers are part of the small-scale sector, where they often alternate with farming activities to maximize food production (Allison and Ellis, 2001 ; FAO, 2012b). In these contexts, declines in fish access can increase pressure on terrestrial systems, and vice versa. For example, fishery management that ignores the complexity of livelihood strategies can inadvertently exacerbate unsustainable fishing (Bailey and Jentoft, 1990 ; Allison and Ellis, 2001). Similar effects have occurred with hunting, where bushmeat demand increases when access to fish declines (Brashares et al., 2004). These continual adjustments among terrestrial and aquatic food strategies affect some 1. 3 billion fishers and farmers who are on the frontlines of both resource stewardship and food insecurity (FAO, 2014).

The rapid growth of aquaculture to combat these trade-offs and meet consumption demands explicitly moves fish production into the realm of agriculture. Often heralded as a solution to wild fish depletion, farmed fish are predicted to contribute two-thirds of fish consumed by 2020 (Bank, 2013). Aquaculture, however, does not necessarily alleviate pressures on our oceans and waterways, nor provide sustenance to the food insecure (Naylor et al., 2000 ; Allison, 2011). Distributional tensions between small-scale and industrial production parallel similar issues in terrestrial agriculture, limiting the potential of aquaculture as a food security panacea, and necessitating more integrative policy-making (Allison, 2011 ; Toufique and Belton, 2014). This growing, yet disjointed, focus on aquaculture underscores the urgency of addressing the interconnectedness of our food production systems.

Toward a Global Food System

Our global food system faces enormous social, economic and ecological challenges, and pressures on the entire food system continue to mount. The integration of sustainability concerns into recommendations for food consumption and production is long overdue. To formulate meaningful sustainability recommendations, however, we must understand and acknowledge the connections between aquatic and terrestrial food sources. As described here, threats to fish production are exacerbated by agricultural externalities and the diversion of essential aquatic resources to agricultural inputs. Moreover, the distributional challenges facing subsistence agriculturalists and fishers amplify the tension between these two systems and underscore the inequities of our food system. When we ignore the trade-offs and unsustainable choices we make, the consequences will ultimately be borne disproportionately by the 795 million food insecure in a world of plenty (FAO, 2015).

Author Contributions

KS and KJF jointly designed, researched, and wrote the manuscript.

Funding

Support was provided by NSF GRFP (to KJF and KS), NSF DDRI and the Cornell University Atkinson Center for a Sustainable Future (to KJF), the IIS Simpson Fellowship (to KS), and partial support from NSF-GEO grant CNH115057. Publication made possible in part by support from the Berkeley Research Impact Initiative (BRII) sponsored by the UC Berkeley Library.

Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Acknowledgments

We thank Lauren Withey, Erika Gavenus, Doug McCauley, and Justin Brashares for helpful comments on earlier versions of this manuscript.

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