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Reframing the sustainable seafood narrative

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Abstract

The dominant sustainable seafood narrative is one where developed world markets catalyze practice improvements by fisheries and aquaculture producers that enhance ocean health. The narrow framing of seafood sustainability in terms of aquaculture or fisheries management and ocean health has contributed to the omission of these important food production systems from the discussion on global food system sustainability. This omission is problematic. Seafood makes critical contributions to food and nutrition security, particularly in low income countries, and is often a more sustainable and nutrient rich source of animal sourced-food than terrestrial meat production. We argue that to maximize the positive contributions that seafood can make to sustainable food systems, the conventional narratives that prioritize seafood's role in promoting 'ocean health' need to be reframed and cover a broader set of environmental and social dimensions of sustainability. The focus of the narrative also needs to move from a producer-centric to a 'whole chain' perspective that includes greater inclusion of the later stages with a focus on food waste, by-product utilization and consumption. Moreover, seafood should not be treated as a single aggregated item in sustainability assessments. Rather, it should be recognized as a highly diverse set of foods, with variable ecological impacts, edible yield rates and nutritional profiles. Clarifying discussions around seafood will help to deepen the integration of fisheries and aquaculture into the global agenda on sustainable food production, trade and consumption, and assist governments, private sector actors, NGOs and academics alike in identifying where improvements can be made.

Introduction

'Seafood' includes fish and other aquatic organisms originating from fisheries and aquaculture in both marine and freshwater environments. In the late 1990s, a movement started to lessen what was widely seen as the negative impacts of seafood production activities on source ecosystems . Academics, NGOs, the private sector and policy makers created a narrative to achieve sustainable seafood where developed world markets desired improvements by fisheries and aquaculture producers with the outcome being to help improve ocean health (Ward and Phillips, 2008). Two decades into this movement, seafood remains poorly integrated into public and private food policy and research (Béné et al., 2015).

National food security policies, goals and strategies rarely incorporate seafood (Little et al., 2018). Seafood is, however, increasingly considered as a source of protein and micronutrients (Hicks et al., 2019) with lower environmental impacts than competing terrestrially-based proteins (Parker et al., 2018; Poore and Nemecek, 2018). It has also been shown to make substantial contributions to local economies and human nutrition, particularly in low income countries (Asche et al., 2015; Bene et al., 2015; Belton et al., 2018; Beveridge et al., 2013; Hlpe, 2014; Röös et al., 2017a, 2017b). Yet, policy visions for 'blue growth' often focus solely on production, rather than benefits from trade or consumption (e.g. SAPEA, 2017). Developed markets (and the NGOs and certification programs supporting them) advocate for sustainable seafood as a means for improving the health of the ocean ecosystems (Stokstad, 2011). Paying little attention to other aspects of aquaculture and fisheries beyond the production phase (FAO, 2018) prevents seafood from being discussed within a wider food systems and food security context (National Academies Press, 2015). These diverse and partial policy positions blur both environmental sustainability concerns and the contributions seafood makes to food security, human health and wellbeing (Avadí et al., 2018; Jonell et al., 2013; Kurokawa et al., 2011; Pelletier et al., 2007; Ziegler et al., 2013). Yet this is not solely a policy oversight issue. NGOs working on this narrative have joined together as the focused Conservation Alliance for Seafood Solutions (www.solutionsforseafood.com) which has reinforced an environmental agenda for seafood over sustainable seafood's role in local and global food systems. Conversely, research on 'food systems', a field that highlights the integrated nature of production and consumption (see Béné et al., 2019), has also largely ignored the role and contribution of seafood (Halpern et

al., 2019). As evidence, only 4% of 'food systems' papers (n = 4,130) listed in Web of Science include the terms aquaculture, fish or seafood.[1]

In this paper we argue the sustainable seafood narrative needs to be reframed to more accurately represent the present and future role of seafood in global food systems. Doing so can create greater coherence between state and NGO attempts to steer seafood sustainability. Sustainability in a broad sense is operationally defined as production that balances socio-economic benefits while maintaining environmental integrity now and into the future (Asche et al., 2018; Kuhlman and Farrington, 2010; Tlusty and Thorsen, 2016). However, the study and measure of sustainability is often reduced to a narrow, and usually environmental, single-factor dimensionality (Béné et al., 2019, Fig. 1), such as stock status and management effectiveness, or habitat impacts of fish farming. Such reduction opens up opportunity for strategic positioning, where the sustainability claims will differ based on the definitions and metrics specific to NGO, industry, and / or national interest groups. The political nature of such decisions means that completely overcoming such conflicts is unlikely. Nevertheless reframing some of the misleading narratives that shape the choices of different sustainability metrics can help redirect sustainability agendas (and their metrics) to be more aligned and ultimately more effective. In the rest of this paper we reframe three key misleading narratives for sustainable seafood. First, seafood's role in creating a healthy ocean needs to be reframed into a vision that integrates seafood sustainability within a broader global food system framework (Fig. 1). Second, the focus of improvement needs to be reframed beyond the narrow scope of producer practices and extended to broad issues that may arise at other or multiple nodes of the value chain (Fig. 1). Third, 'seafood' is a broad category, and this needs to be acknowledged as a heterogeneous category of food with equally heterogeneous environmental, nutritional and social impacts. The rest of this perspective paper discusses the role, focus, and categories of seafood, emphasizing how they need to reframed to best integrate fisheries and aquaculture products into the global agenda on sustainable food production, trade and consumption.

1. Avoid the 'healthy oceans' trap

[1] Using the search string 'food systems' AND 'aquacultur* OR fish* OR seafood'

Ocean health is a global public environmental good. Although marine fish stocks and a large portion of aquaculture are dependent on healthy oceans (Kleisner et al., 2013; Naylor et al., 2000), it is unrealistic for the seafood narrative to create a direct causal link between the implementation of better practices by fishers and fish farmers alone and improved ocean health. We argue that framing seafood sustainability primarily in terms of 'ocean health' can blur the role of seafood in global food systems in two ways.

First, NGO performance indicators largely target the effects of fishing and fish farming that include unregulated and unreported fishing, destructive fishing methods, the conversion/loss of coastal habitat, and use of marine ingredients in aquaculture (see for e.g. Agnew et al., 2009; Naylor et al., 2009). While critical, the ocean has a myriad of increasing threats beyond, but impactful to, seafood including but not limited to dead zones, plastic litter, acidification and climate change, and changes in ocean circulation (Vázquez-Rowe, 2020). We argue that the sustainable seafood movement, and all its actors, needs to broaden its scope regarding sustainability dimensions included in standards, assessments and campaigns, in order to substantively contribute to ocean health and food systems. In recent years, some NGOs and certification standards have begun to expand their focus to include indirect environmental impacts or social sustainability (e.g. MSC now considering social dimensions and the Monterey Bay Aquarium Seafood Watch has an energy metric). However, given the need for immediacy of action (Lamontagne et al., 2019), this pace of change has not been enough for these schemes and programs to rightfully claim that their governance model is leading to ocean health. An important step in this direction is to move from a targeting a single issue (ocean health) to consider a broader set of environmental and socioeconomic impacts (Kittinger et al., 2017; Vázquez-Rowe, 2020, see Fig 1). This does not mean exempting seafood from applying good practices for reducing its negative environmental impacts. Rather, it should be considered as any other activity impacting the ocean and leading to trade-offs that need to be evaluated on a case-by-case basis.

Second, the ocean health narrative draws attention away from a suite of non-ocean-health issues, including the linkages between aquatic and terrestrial food production systems and impacts from freshwater aquaculture. The most prominent of these are aquatic-terrestrial linkages are through feed. Agricultural products are used in aquaculture (Froehlich et al., 2018;

Newton and Little, 2018; Troell et al., 2014), and conversely, marine ingredients provide inputs for terrestrial livestock production (Shepherd and Jackson, 2013). Similarities in land feed-crop use, water use, and effluent impacts mean that fed aquaculture has more in common with terrestrial animal agriculture than with capture fisheries (Roberts et al., 2015). Fuller recognition of the links to terrestrial systems and their environmental implications will require us to move NGOs and policy makers to move beyond 'ocean health' perspectives. As we argue in the following section, this will also require a more systemic understanding of seafood sustainability that extends far beyond the practices of fishers and fish farmers alone.

2. Improvements throughout the entire value chain

The sustainable seafood narrative has been overly narrow in its approach by offloading action for improvement on the shoulders of producers (Bailey et al., 2018; Bush, 2017). This productionist bias (Fouilleux et al., 2017) places a major burden on fishers and farmers frequently located in low-income countries, while actors located throughout the rest of the seafood value chain receive far less attention and pressure to improve (Bailey et al., 2018; Bailey and Egels-Zandén, 2016; Bush et al., 2013; Roheim et al., 2018). The lack of coordinated messaging of the theory of change for seafood sustainability (Roheim et al., 2018) also places the control of messaging in the hands of high-income (consuming) countries, while change through action is required by low or middle income (producing) countries (Bailey et al., 2018; Bailey and Egels-Zandén, 2016). While the sustainability of both wild and fed aquatic production require a wider set of indicators of sustainability (Ziegler et al., 2016), as discussed above (Fig. 1), a food system approach would extend responsibility to all actors in the value chain and include placing more focus on service/input providers, processors, distributors, retailers, and consumers.

Across the value chain, a broader sustainable seafood narrative would include considerations of energy across production and distribution (Tlusty and Lagueux, 2009), processing efficiency (Stevens et al., 2018), food loss (FAO, 2011; Love et al., 2015), and social justice issues (Bailey and Egels-Zandén, 2016) related to production, trade and ultimately consumption (Bush, 2018; Pelletier and Tyedmers, 2008). Waste of various types permeates this list, and all wasted food represents embodied energy, nutrients, and water (Grizzetti et al., 2013; Liu et al., 2013; Vittuari et al., 2016). Any sustainability gains brought about by better

production will be lost if downstream actors do not value the food. The seafood sustainability narrative should adopt the mantra that *it is not sustainable if it is thrown away*.

To better address the full range of issues related to seafood sustainability the attention of the narrative should follow the efforts developed by the Global Initiative on Food Loss and Waste Reduction (FAO, 2011). This would align the seafood narrative with efforts at a larger, food system perspective. Minimizing waste is important post-production for seafood given the estimated 40-47% of edible product in the U.S. that ends up as food waste (Love et al., 2015), with North America seemingly wasting more food than any other region (FAO 2011). More attention also needs to be given to the circular use of by-products from seafood processing (Cao et al., 2015; Newton et al., 2014; Rustad et al., 2011; Stevens et al., 2018). These by-products have value for human consumption, terrestrial livestock and nutraceutical and pharmaceutical products (Newton et al., 2014). Recent estimates are that a third of global fishmeal is now from by-product sources but could be significantly increased if processing of seafood was more efficient (Jackson and Newton, 2016). Overconsumption of protein is in itself a form of food waste, as excess consumption is functionally excreted as opposed to being stored (Tlusty and Tyedmers, 2015; Wu et al., 2014). Over-consumptive waste at the consumer level has the potential to cancel any sustainability gains made at the producer level. This ultimately calls into question the equity of food distribution. Given the rich micronutrient profile of most seafood, efforts should be invested to improve access to seafood across socio-economic communities and encourage groups that commonly suffer from nutrient deficiency to adopt more seafood in their diets.

3. Embrace the diversity of seafood

The 'seafood' in the sustainable seafood narrative encompasses around 2,500 species (FAO, 2018; Hornborg et al., 2016) across all trophic levels from filter feeders to top carnivores, spanning finfishes, mollusks, crustaceans, cnidarians, echinoderms, amphibians, and reptiles, that can all be harvested from the wild or farmed on land, including freshwater or in the sea. This multitude of species is typically represented in reports as crude sectoral categories (e.g. fish, farmed fish, trawl fisheries) or as a single animal-source food (fish) next to beef, pork, and/or chicken (Clark and Tilman, 2017; Poore and Nemecek, 2018; Tilman and Clark, 2014). The

reality is that assessing the environmental impact and/or nutritional benefits of seafood requires a more detailed consideration of different combinations of species, production, and processing techniques (Hallström et al. 2019; Pelletier et al., 2007; Troell et al., 2014; Ziegler et al., 2013).

The bulk of research and advice by sustainable seafood programs is focused on those few species groups traded on international markets largely destined for consumption in high income countries (Ward and Phillips, 2008). Likewise, consumption patterns within high income countries do not follow global production patterns (Jonell et al., 2019). In the U.S., ten species account for 84% of all seafood consumed (National Marine Fisheries Service, 2018). Within aquaculture, shrimp, pangasius, tilapia, and salmon, are the groups that are particularly popular in high income countries (Belton and Bush, 2014) yet represent only ~24% of global aquaculture production by mass (FAO, 2018). A broader system perspective would address species dominant in the global market. Here, 44 species represent 90% of global aquaculture production (Troell et al., 2017), with seven of the top ten globally cultured species by mass being carps (FAO, 2018). Taking this larger spectrum of aquatic products into account across the global food system would enable greater recognition of those species that contribute to supplies of animal-source food, rather than only those that are dominant in markets in high income countries.

One consequence of 'lumping' seafood into a single category is illustrated by exploring the metrics used to make such comparisons. Using the common currency of energy, measured as the edible energy return on investment, seafood can vary from specific case extremes of carp (0.70) to shrimp (0.014) (Tyedmers, 2004). These values span the range of all terrestrial animal proteins (Parker et al., 2018; Pelletier et al., 2011, 2007; Roberts et al., 2015). When averaged (typically unweighted), the result is a value for seafood that homogenizes species, stock, production technology and product form, and is as misleading as presenting a single average for all terrestrial animal production systems. Lumping species as seafood leads to increased substitutability of various forms and species (Asche, 2008), resulting in masking where price signals indicating ecosystem change are not relayed to consumers (Crona et al., 2016; Deutsch et al., 2011).

To advance food systems thinking for seafood production, more attention needs to be given to generating and reporting data that highlight both the benefits and the challenges of each

species and how they are produced and processed. Illuminating the full range of species involved by more precise indicators of environmental and nutritional performance can better highlight the role seafood plays relative to other animal source foods. It can also demonstrate the relative importance of different fish within and across fisheries and aquaculture (Hallström et al., 2019). This approach will also have the direct effect of identifying the most impactful species to produce and that need improvement as well as discouraging poor performance that erodes confidence in aquaculture and fisheries at large.

A similar lumping is also observed nutritionally, through two broad oversimplifications. On one hand, seafood is typically seen simply as a source of 'protein', which overshadows its important role in providing micronutrients and essential fatty acids (Béné et al., 2015; Beveridge et al., 2013). On the other, the strong emphasis placed on essential fatty acids (EFA), particularly in high income countries, obscures the role of fish and shellfish in providing a wide range of micronutrients beyond EFAs - such as highly bioavailable micronutrients, including iodine, selenium, and vitamins B12 and D. However, micronutrient composition varies markedly between seafood products (Bimbo, 2007; Hallström et al., 2019; Vaitla et al., 2018). Furthermore, the contribution that seafood consumption makes to human nutrition is also dependent on the intersection of health and fisheries/aquaculture policies (Love et al., 2017) that must meet the needs of specific requirements of different types of consumers (e.g. children, pregnant women, the elderly), and for other social-economic factors known to impact nutritional security.

The mechanisms through which various types of seafood complement other ingredients to make for an optimal diet in different contexts is critical, especially for essential dietary nutrients in short supply to key demographics (women during pregnancy, children, etc.). The nutritional implications of substituting wild fish for farmed fish has been identified as an area of increasing concern for human nutrition (Belton et al., 2014; Little et al., 2010). Moreover, recent intentional reductions in EFA levels in farmed salmon (Shepherd et al., 2017; Sprague et al., 2016) is an example of how sustainability efforts to limit the fish inputs for aquaculture feeds (Naylor et al., 2009) may drive a global trend towards a less than optimal health outcome. Alternatives (algae, and engineered crops and yeast) are being developed, but a conscious decision is required to prevent any tradeoffs that reduce human nutritional benefit.

Ultimately, food systems can best achieve resilience and provisioning security by addressing the multifunctionality (economic, ecological, and social) of food (Hodbod and Eakin, 2015). This will allow for sustainable intensification (socially and environmentally sustainable responses that are economically efficient, Little et al., 2018) with the benefit that these systems will track environmental price signals (Godfray, 2015). This is occurring in Sweden (Brugård Konde et al., 2015) and elsewhere (Gonzalez Fischer and Garnett, 2016) where environmental performance of seafood production has been integrated into models of population-level food impact assessments, national food security planning and dietary guidelines. This demonstrates that terrestrial and aquatic food systems can work synergistically to address food systems sustainability.

Conclusion - reframing the sustainable seafood narrative for greater inclusion into the global agenda on ecosystem and human health

By highlighting the interdependence between aquatic and terrestrial ecosystems and placing seafood in the wider food system we can better understand and act in response to the varied role that fisheries and aquaculture production plays in the equitable delivery of high quality low-impact food for human consumption. This is a specific case of a broader call to equally address impacts of all food production to determine linkages underlying a better understanding of the true cumulative impact of our current food system (Halpern et al., 2019). Applying a food systems approach to seafood could enable the development of more effective state regulations and private-voluntary tools to promote more sustainable production along the entire supply chain (Bailey et al., 2018). This would help NGOs, industry, government and academia alike to move beyond the simple equating ‘sustainable seafood’ with ‘ocean health’ and allow for integration of seafood into wider policy debates centering on planetary health, food equity, and human nutrition.

Overall, we identify three direct benefits of taking a ‘seafood systems approach’, building on our arguments above.

First, conventional narrow narratives that prioritize ocean health need to be replaced with broader, more comprehensive visions of sustainable seafood production. NGOs and businesses

communicating improvements in sourcing need to address outcomes honestly. Importantly, a systemic approach will move research and policy alike beyond proximate impacts of seafood production. Instead it can enable us to understand the contributions that a full seafood system makes, alongside those from agriculture, to a set of common challenges including climate change, eutrophication, etc. along with linkages of seafood production to the wider context of each other (i.e. fisheries and aquaculture) and inter-connected terrestrial systems. From this perspective species/production/supply system combinations of seafood should move to appropriate metrics that facilitate comparison not only with one another, but also with terrestrial animal and crop production.

Second, there is a need to broaden the focus to advance beyond the productionist agenda that identifies producers, primarily in low income countries, as being mainly responsible for seafood sustainability. Instead, research and policy should expand sustainability problems and solutions away from a fixation on production and producers, to include trade and traders, processing and processors, and consumption and consumers. In that sense, a food systems perspective would highlight better the interlinkages between these practices and actors, showing that positive social economic and environmental changes can be made along the value chains that can affect sustainability.

Third, seafood should not be treated as a single broad aggregated category in sustainability assessments, but rather should be recognized as being differentiated based on varying production systems, edible yields and nutritional profiles. Communication of the benefits and impacts of seafood must adopt a nuanced approach that better accounts for the potential environmental and social consequences of this important food, and the ways in which environmental externalities can be reduced through the consumption of lower impact foods. Discussing fisheries and aquaculture products as part of a food system will increase our ability to develop lower impact future food solutions and create a more food and nutrition secure future (Hicks et al., 2019).

This paper is not the first to call for consideration of seafood within a food systems context (Béné et al., 2015; Olson et al., 2014). However, the continued lack of food system approaches to seafood sustainability continues to raise concern among the seafood research community. Many of these production systems and supply chains have laudable attributes that can be leveraged to help improve the environmental and social impact performance of food

systems globally. By developing a seafood systems approach, fisheries and aquaculture can be mainstreamed into the global agenda on ecosystem and human health. While such inclusion is not a panacea for all impacts that arise from producing food, it will contribute toward a more food-secure future.

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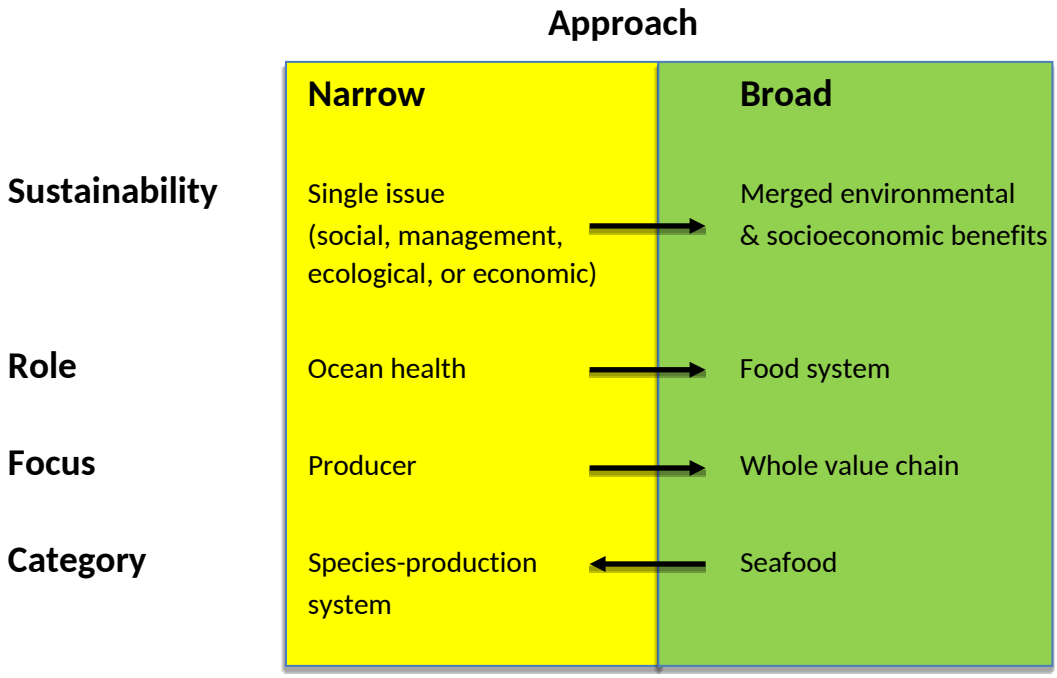
Figure 1. The broad to narrow approach for sustainability, and how that influences the narrative for sustainable seafood. Broadening the approach for the role and focus of sustainability initiatives while narrowing the approach to species – production system categories will clarify the narrative for sustainable seafood.



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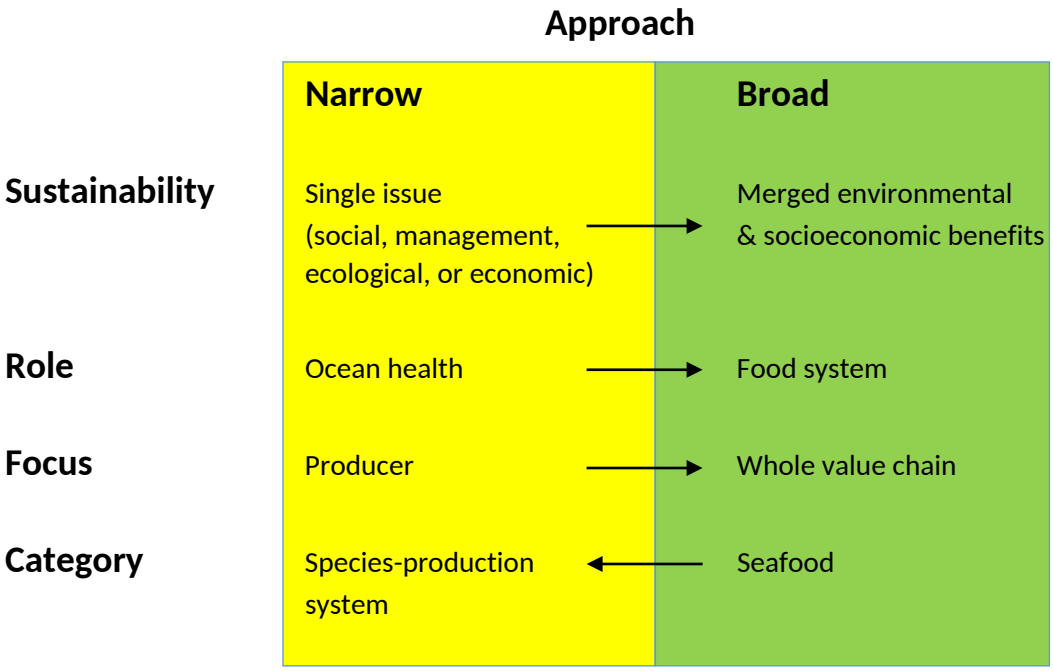

Conflict of Interest statement

For the submission *Reframing the sustainable seafood narrative*

No potential conflict of interest was reported by the authors.