

Alternative seafood networks during COVID-19: Implications for resilience and sustainability

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ABSTRACT

Export-oriented seafood trade faltered during the early months of the COVID-19 pandemic. In contrast, our research shows that alternative seafood networks (ASNs), which deliver seafood locally and direct to consumers, surged in the United States and Canada. The juxtaposition between ASNs and the broader seafood system raises important questions about the role that local food systems may play, paradoxically, in supporting global seafood trade during crises and highlights the need for functional diversity in supply chains.

MAIN

Seafood is the most traded food commodity in the world ¹. In 2018, 37% of the global fish supply was exported at a value of US\$164 billion ². By value, this represents an inflation adjusted increase of 95% in the last 40 years. Multiple factors are contributing to the continued globalization of the seafood system, including neoliberal trade policies that incentivize export of seafood and advancements in technological capacity that enable wide distribution of highly perishable products ³. The expansion of seafood trade has resulted in a range of socioeconomic benefits, including increased employment opportunity and food security ⁴. However, it also makes the seafood system more vulnerable to systemic shocks that disrupt the flow of product ⁵. The global financial crisis of 2007-2008, for example, resulted in an estimated 7% decline in global seafood exports ⁶; in the United States and Canada, the value of seafood exports declined by US\$632 million (9%) (Fig. 1a). A decade later, the seafood system again faces a global shock, this time due to the COVID-19 pandemic ⁷. Shocks like these, which are becoming an increasingly common feature of seafood systems ⁵, have major implications for the well-being of the 60 million people worldwide who are directly employed by fisheries and aquaculture and those who are involved in the interconnected processing, distribution, and service sectors ⁸. Acknowledging this emerging vulnerability, systemic shocks like the COVID-19 pandemic provide an important opportunity to study food system resilience and learn from segments of the food system that have been shock-tolerant.

The focus of this research is on a segment of the seafood system called alternative seafood networks (ASN), which deliver product locally and directly to consumers. ASNs are an umbrella term to describe a range of seafood distribution models that serve local food systems and deliver seafood directly to consumers, including community supported fisheries ⁹. ASNs exist worldwide and have been identified as a “bright spot” in both high- and low-income countries during the COVID-19 pandemic ¹⁰⁻¹³. For example, in a global survey of more than 150 fishing organizations from 21 countries, Pita et al. ¹⁴ found that 48% of respondents had shifted to direct to consumer sales through ASNs. Even some multinational corporations pivoted towards local and direct models¹⁵.

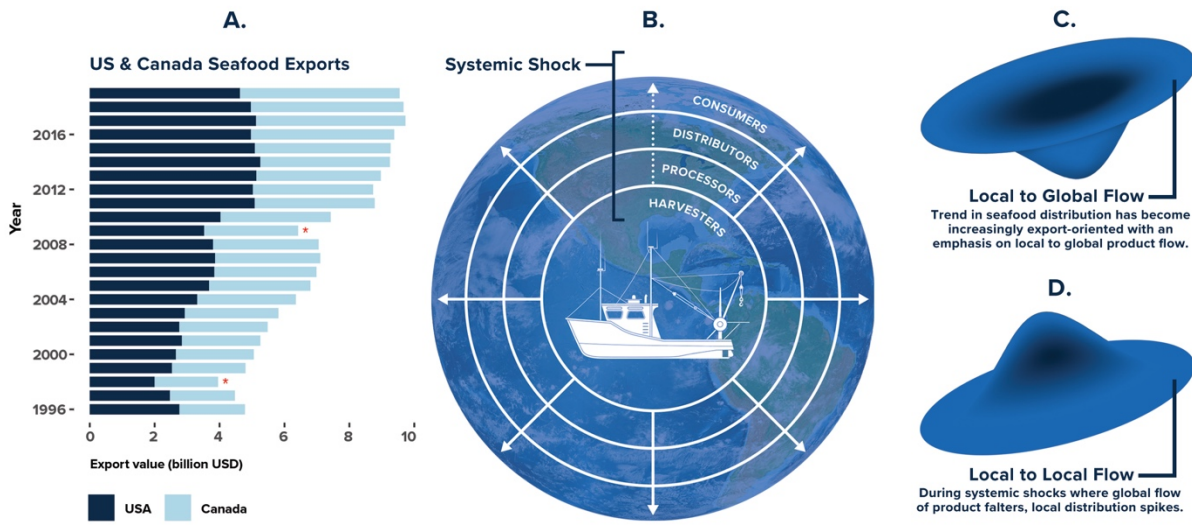


Figure 1. (A) Fisheries in the United States and Canada have become increasingly trade-oriented, but in the last 25 years, multiple systemic shocks have caused global trade to drop sharply, including during the ongoing COVID-19 pandemic. Asterisks correspond to global recessions²³. (B) Systemic shocks impact all levels of the food system, from producers to consumers, leading to what Garnett et al.¹⁷ refer to as "deadlock" in the system. (C) Globalization in the seafood system leads to a local-to-global pattern where product is distributed out and away from the places where it is caught, creating a void of seafood. (D) During the early months of COVID-19 pandemic, however, global seafood supply chains faltered, leading to greater dependence on local food systems and a surge or "bump" in local and direct distribution.

Our research shows that the pandemic triggered a short-term re-localizing phenomenon in the seafood system in the United States and Canada, at a time when many other segments of the broader food system were disrupted¹⁶. To make our case, we draw on three lines of quantitative and qualitative evidence: Google search term data, website analytics, and interviews with actors involved in ASNs. We find that Google searches for terms related to local and direct seafood distribution surged in the beginning of March. For example, from mid-March until the end of June, the terms "direct seafood" (not shown) and "seafood delivery" increased by 88% and 209% respectively (Fig. 2). This pandemic "bump" is also reflected in Google searches for terms related to the local food system more broadly such as "local food" (+47%) and "community supported agriculture" (+124%), but not general terms like "seafood" (-6%) (Fig. 2). These results are consistent with user traffic on ASN websites across the United States and Canada. Across a geographically distributed but non-random subset of ASNs ($n = 8$), we find no

statistical year-over-year difference in ASN website traffic in January or February 2020 compared to the previous year. However, corresponding with the implementation of government ordered health measures related to COVID-19, there is a significant year-over-year increase from March to June (p -value < 0.001) (Fig. 2).

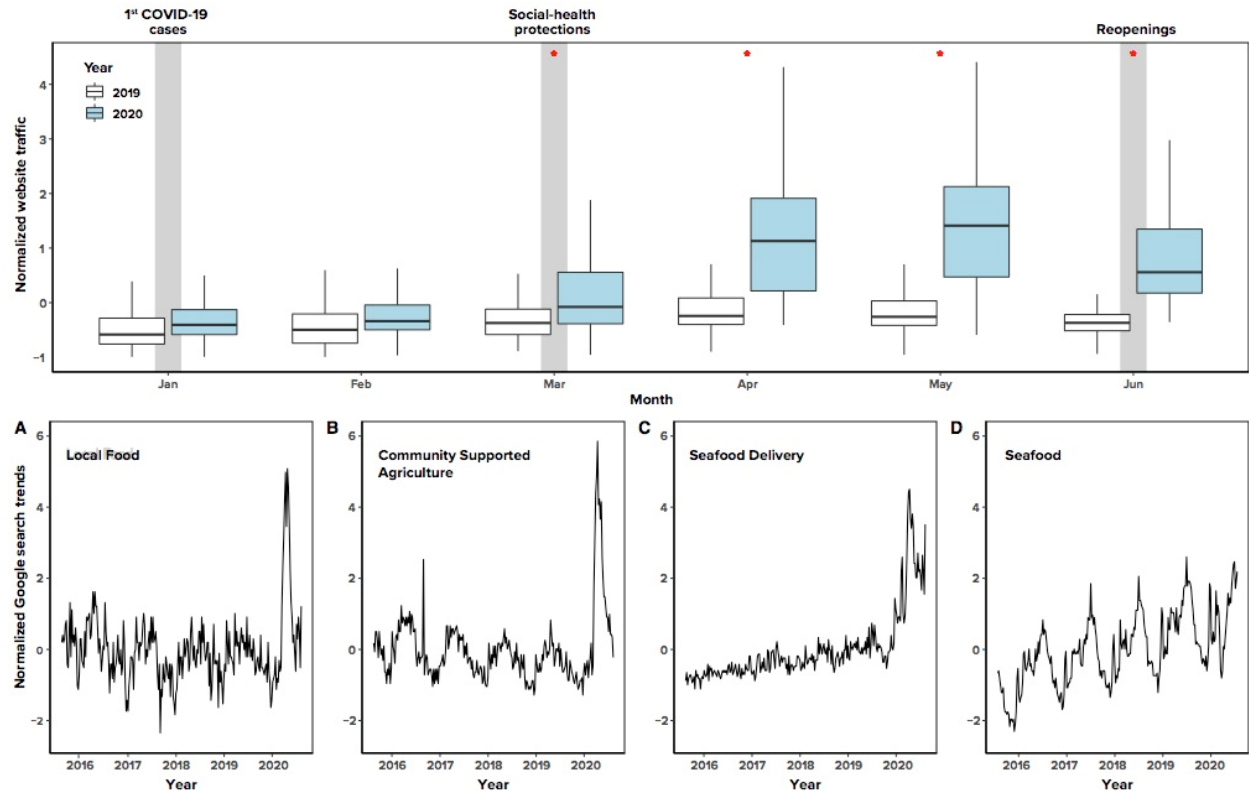


Figure 2. (Top) Google Analytics web traffic data for select alternative seafood networks ($n=8$). Asterisks denote a statistical difference between years. **(Bottom)** Google search trends for example phrases related to local food systems and direct producer-to-consumer sales White et al.²⁴ similarly describe an increase in web searches for the term “seafood recipes”. **(A-C)**. Note that a similar pattern does not exist for the more general term “seafood” **(D)**.

Interview data with ASNs further corroborate our findings. A total of 41 interviews were conducted with 15 ASNs. In total, 14 of 15 ASNs (93%) reported a significant increase in demand for their products through both in-person and online outlets. As one respondent observed: “In the beginning I think a lot of us were nervous that we weren’t going to be able to get rid of [our product] ... And then the thing was for a couple of weeks, people started kind of panic buying in the beginning, and it was like ‘Oh no, we actually can’t keep up with what people are wanting’. But then once it started to level out we’ve been able to get rid of everything.” (Participant 1, April 28, 2020). Although ASNs are optimistic that demand for local

and directly sourced seafood will be sustained, some ASNs began reporting a decline in the initial “bump” in demand in June and July as retail locations reopened more broadly.

Our research shows that a temporary re-localizing phenomenon in the seafood system occurred during the early months of the COVID-19 pandemic, in which demand for local and directly sourced seafood surged. To date, ASNs have been described as an important strategy for small- and mid-size seafood operations to build firm-level resilience^{17,18}. However, the relative shock-tolerance that ASNs exhibited during the COVID-19 pandemic also suggests that they contribute to the “systemic resilience” of the broader seafood economy¹⁹. That is, ASN participants may be uniquely capable of mobilizing the necessary response diversity that allows producers and consumers to circumvent supply chain deadlocks during times of stress²⁰. Indeed, it is worth noting that the pattern of re-localization during shocks that was observed during the early months of the current pandemic is not a new phenomenon. For example, in 1917, during World War I, the Canadian Ministry of Agriculture encouraged citizens to establish “victory gardens” as part of the tactical strategy to increase food sovereignty and win the war. Woodrow Wilson, president of the United States between 1913 and 1921, launched a similar campaign. More contemporary examples also exist. For example, Mestres and Lien²¹ have previously observed that the global financial crisis of 2007-2008 played a critical role in catalyzing local food distribution in southern Europe.

To more fully understand the role that ASNs play in the broader seafood system, better data on the sector are critically needed. At present, there are no national-level data in either the United States nor Canada to describe the number of ASNs, their geographic distribution or their total socioeconomic contribution. However, sales associated with parallel types of agricultural distribution in the United States alone are estimated to be US\$9 billion, including US\$2.8 billion direct to consumers²². Addressing this data gap is not beyond the realm of possibility as parallel data for the agricultural sector have been collected since 1976 in the United States through the Farmer-to-Consumer Direct Marketing Act. Such data are critical to further understand the role of ASNs in shock-tolerance and the importance of functional diversity in supply chains, as demonstrated during the COVID-19 pandemic.

METHODS

We mixed methods to show the short-term re-localizing of the seafood economy in the United States and Canada during the early months of the COVID-19 pandemic. In gathering and analyzing data for this study, we also convened a mixed authorship team, composed of academic and practitioner knowledge holders. This team was composed deliberately, recruited with intentions to conduct research with, instead of on, ASNs, and in recognition that knowledge emerges from society and the specific relationships we, as researchers, have to people and the environment. To acknowledge these differences in how communities and communities-of-practice create and disseminate knowledge, the standard set for authorship on this manuscript was based on intellectual contribution rather than particular types of labor (e.g., writing, revising, etc.) (see Castleden et al. ²⁵).

To understand consumer behavior, daily website traffic for 8 ASNs in the United States and Canada was collected for the time period of January 1, 2019 to June 30, 2020. Businesses were selected purposefully to ensure geographic coverage across the United States and Canada and to account for the different types and scales of direct producer-to-consumer seafood models (see: Bolton et al. ⁹ for a typology of ASNs). Because they are a non-random sample, results are intended to show a qualitative trend. Data were downloaded from Google Analytics and Squarespace Analytics (n = 8) and analyzed in R (Version 3.6.1). Data were normalized to allow for business-to-business comparison using a z-score calculation ($z = (x-\mu)/\sigma$), where x represents the raw data, μ represents the population mean, and σ represents the population standard deviation. Change in consumer interest was calculated on a month-over-month basis. Google search term data associated with seafood and food systems were also analyzed for a 5-year period from June 2016 to July 2020.

In total, 42 semi-structured interviews were conducted with 15 people via telephone or online video conferencing between March and August of 2020 as part of the production of a podcast about the impacts of COVID-19 on the seafood economy called *Coastal Routes Radio*. Interview participants were solicited via recruitment through the Local Catch Network listserv and other similar outreach channels. All participants were selected due to their involvement in an

ASN. Interviews were recorded and transcribed, then analyzed according to the analytical steps laid out by Attride-Stirling²⁶ using NVIVO qualitative analysis software.

CONTRIBUTION STATEMENT

JSS, HLH, EDS, and PAL conceived of the study. HLH, EDS, and PAL performed qualitative interviews. HLH and EDS analyzed qualitative data. JSS performed quantitative analysis. JSS, HLH, EDS, and PAL drafted the manuscript. DC, MC, KH, BJ, JK, EK, SK, AL, SS, TS, BT, AT, and TY contributed web analytics and interview data, and reviewed and commented on the manuscript.

COMPETING INTEREST STATEMENT

JSS is the co-founder of Local Catch Network and owner of Georgetown Island Oyster Company. HLH is Co-PI on the Coastal Routes project. PAL is PI on the Coastal Routes project. DC is a co-owner of the Walking Fish Cooperative. MC is a commercial fisherman and co-owner of West Coast Wild Scallops. KH is Chief Fisheries Officer with Sitka Salmon Shares. BJ is the marketing director for the Columbia River Inter-Tribal Fish Commission. JK is a commercial fisherman and co-manager for Tuna Harbor Dockside Market. EK is a commercial fisherman and the co-owner of Straight to the Plate. SK is co-founder and CEO of Wild for Salmon, Inc. AL is a co-founder and CEO of Real Good Fish. SS is the co-founder and CEO of Skipper Otto Community Supported Fishery. TS is a commercial fisherman fishmonger at Wooden Island Wild. AT is the general manager of New Hampshire Community Seafood. TY is the co-founder and director of Fishadelphia Community Seafood Program.

REFERENCES

1. Delgado, C. L., Wada, N., Rosegrant, M. W., Meijer, S. & Ahmed, M. The Future of Fish: Issues and Trends to 2020. 1–6 (2003).
2. Food Agricultural Organization of the United Nations. *The State of World Fisheries and Aquaculture 2020*. 1–224 (2020). doi:10.4060/ca9229en
3. Anderson, J. J., Asche, F. & Tveteras, S. in *Handbook of Marine Fisheries Conservation and Management* (eds. Grafton, R. Q., Hillborn, R., Squires, D., Tait, M. & Williams, M.) Oxford University Press (2010).

4. Asche, F., Bellemare, M. F., Roheim, C., Smith, M. D. & Tveteras, S. Fair enough? Food security and the international trade of seafood. *World Development* **67**, 151–160 (2015).
5. Cottrell, R. S. *et al.* Food production shocks across land and sea. *Nature Sustainability* **2**, 130–137 (2019). doi:10.1038/s41893-018-0210-1
6. Food Agricultural Organization of the United Nations. *The State of World Fisheries and Aquaculture 2010*. 1–218 (2010).
7. Love, D. *et al.* Emerging COVID-19 impacts, responses, and lessons for building resilience in the seafood system. *SocArXiv* 1–20 (2020). DOI: 10.31235/osf.io/x8aew. Available at: <https://osf.io/preprints/socarxiv/x8aew/>. (Accessed: August 21, 2020)
8. Rotz, S. & Fraser, E. D. G. Resilience and the industrial food system: analyzing the impacts of agricultural industrialization on food system vulnerability. *Journal of Environmental Studies and Science* **5**, 459–473 (2015).
9. Bolton, A. E., Dubik, B. A., Stoll, J. S. & Basurto, X. Describing the diversity of community supported fishery programs in North America. *Marine Policy* **66**, 21–29 (2016).
10. Bennett, N. *et al.* The COVID-19 pandemic, small-scale fisheries and coastal fishing communities. *Coastal Management* **48**, 336–347 (2020).
11. Gephart, J. *et al.* Covid-19 Seafood Impacts (Version 1.0). (2020). DOI: 10.5281/ZENODO.3866189
12. Loring, P., De Sousa, E., Harrison, H. & Stoll, J. As coronavirus threatens seafood economy, community fisheries find ways to stay afloat. *The Conversation* (2020).
13. O'Malley, J. How COVID-19 is threatening Alaska's wild salmon fishing season. *New York Times* (2020).
14. Pita, C. People, COVID-19 and beyond: impacts, adaptation, and innovation among small-scale fisheries. *Small is Bountiful Conference* (2020). Available at: <http://toobigtoignore.net/opportunity/join-us-for-world-ocean-day-2020/>. (Accessed: June 9, 2020)
15. Cooke Aquaculture. Cooke reeling-in customers online by delivering unique seafood boxes. *Cooke Aquaculture* (2020). Available at: <https://www.cookeseafood.com/2020/05/25/cooke-reeling-in-customers-online-by-delivering-unique-seafood-boxes/>. (Accessed: July 21, 2020)
16. Garnett, P., Doherty, B. & Heron, T. Vulnerability of the United Kingdom's food supply chains exposed by COVID-19. *Nature Food* **1**, 315-318 (2020). doi:10.1038/s43016-020-0097-7
17. Kittinger, J. N. *et al.* From reef to table: social and ecological factors affecting coral reef fisheries, artisanal seafood supply chains, and seafood security. *PLoS ONE* **10**, e0123856–24 (2015).
18. Stoll, J. S., Bailey, M. & Jonell, M. Alternative pathways to sustainable seafood. *Conservation Letters* **13**, 1–7 (2020).
19. Ungar, M. Systemic resilience: principles and processes for a science of change in contexts of adversity. *Ecology and Society* **23**, 1-17 (2018).
20. Leslie, P. & McCabe, T. Response diversity and resilience in social-ecological systems. *Current Anthropology* **54**, 114-143.

21. Mestres, S. G. & Lien, M. E. Recovering food commons in post industrial Europe: cooperation networks in organic food provisioning in Catalonia and Norway. *Journal of Agricultural and Environmental Ethics* **30**, 625–643 (2017).
22. USDA. *2017 Census of Agriculture*. **1**, 1–820 (2019).
23. United Nations. *UN Comtrade Database*. (2020).
24. White, E. *et al.* Early effects of COVID-19 interventions on US fisheries and seafood. *SocArXiv* 1–7 (2020). Available at: <https://osf.io/preprints/socarxiv/x8aew/>. (Accessed: August 21, 2020)
25. Castleden, H., Morgan, V. S. & Neimanis, A. Researchers' perspectives on collective/community co-authorship in community-based participatory indigenous research. *Journal of Empirical Research on Human Research Ethics* **5**, 23–32 (2010).
26. Attride-Stirling, J. Thematic networks: an analytic tool for qualitative research. *Qualitative Research* **1**, 385–405 (2001).