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Fisheries of the middle: building collaborations between seafood and agriculture to revitalize and enhance mid-scale food production

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Introduction

The US seafood system is in critical need of revitalization, especially pathways for mid-scale fisheries. With the significant conservation-based downsizing of US fisheries since the early 1980s, commercial fishing communities have experienced a steady decline in infrastructure and support businesses (Culver et al., 2007; Pomeroy et al., 2011; Colburn and Jepson, 2012; Speir et al., 2014; Richmond et al., 2019; Cook et al., 2024; Smith et al., 2022). Seafood processing and distribution have become more consolidated, with a small number of buyers dominating the industry and, in some cases, a single buyer controlling seafood handling at a given port (Gephart and Pace, 2015). Due to some combination of such consolidation, high overhead costs, unfavorable markets, regulatory challenges, and/or resource conditions, there has been an uptick in closures of processing plants throughout the US (e.g., White, 2024; Frankowicz, 2024; Burns, 2024; Chase, 2024; Seaman, 2024). Some ports (e.g., Eureka, California; King Cove and Larsen Bay, and Alaska) have even lost their only major seafood processor. Local seafood processing, cold storage, and distribution are important for coastal community resilience, providing fisheries-related jobs, economic activity, and a variety of market pathways for selling one's catch (Cramer et al., 2023; Pomeroy et al., 2020; Nieman et al., 2021).

We believe that these marked shifts in the seafood system necessitate both scholarly and practical responses. To date, responses have focused on the development of direct marketing strategies that primarily suit small-scale fishery operations. Here we call for the development of a complementary agenda focused on revitalizing and enhancing mid-scale fishery operations and market pathways—"fisheries of the middle" (FOTM)—as an essential component of a resilient seafood system. Further, the agenda invites

collaborations with the agriculture sector which has experienced similar challenges and gained insights on possible solutions coalescing around an “agriculture of the middle.” While this agenda is oriented by the California context, it describes challenges and potential solutions that pertain across the US and beyond.

Seafood system context

US-based seafood processing and distribution have increasingly relied on a long-supply-chain model, with the catch unloaded, then often handled by multiple entities, whether as live product or processed into seafood products (e.g., filets, cooked and canned), frozen or refrigerated, and distributed to various domestic and foreign markets—typically far from the communities where the catch was landed (Kelling et al., 2023; Pomeroy et al., 2020; Talley et al., 2016; Fissel et al., 2023). Large quantities of US-landed catch are exported for processing and re-imported for sale and consumption (Gephart et al., 2019). This model has been criticized for its detrimental environmental, economic and social impacts, particularly for failing to support the communities and markets where the catch originates (Kelling et al., 2023; Greenberg, 2015; Campbell et al., 2014).

Many have been exploring direct-marketing strategies as an alternative or complement to this long-supply-chain model. Under these strategies, fishermen (and often their families) take on one or more of these post-harvest functions, selling their catch directly to consumers, restaurants and/or retailers (Johnson, 2007; Culver et al., 2015; Stoll et al., 2015; Brinson et al., 2011). In some cases, they also take on processing functions, preparing, packaging, and storing their products. While many of these efforts have been successful, direct marketing is not a panacea (Culver et al., 2015; Tookes and Yandle, 2021; Godwin et al., 2017; Pomeroy et al., 2020). Fishermen have identified numerous challenges in developing and sustaining such marketing arrangements. Moreover, direct marketing may not be practical or effective for mid- to large-scale fishing operations. Especially in rural communities, there may not be enough consumers, retailers or restaurants to absorb all the catch. Thus, while direct marketing provides a valuable alternative, it cannot alone fill the gap left by the loss of larger-scale seafood processing, storage, and distribution functions.

Agriculture and fisheries of the middle

For researchers studying land-based agricultural food systems, the story unfolding in the seafood system may seem strikingly familiar. Kirschenmann et al. (2008) describe the US agricultural food system as having evolved along two distinct paths. One entails small-scale farms and food businesses flourishing by tapping into direct-to-consumer markets. The other involves large, consolidated agribusinesses building global supply chains focused primarily on advancing their corporate interests through the movement of bulk commodities. They note, “this pattern of food systems has had a disastrous effect on independent family farmers—it has led to a disappearing *agriculture of the middle*.”

Throughout the 2000s, US scholars and practitioners began to coalesce around a theoretical framework and solutions related to

revitalizing an “agriculture of the middle” (AOTM; Brekken et al., 2016; Clancy, 2010; Lyson et al., 2001). AOTM includes “farms and ranches that are declining because they are too small to be served well by commodity markets and too large or otherwise unsuited to be served well by direct markets” (University of Wisconsin – Madison (UW), 2025). Research shows that compared to large-scale operations, small- and mid-scale agricultural operations may have fewer environmental impacts and contribute more to the social fabric of their communities (e.g., Lyson et al., 2001; Hinrichs and Welsh, 2003; Leonard et al., 2011). Many AOTM solutions revolve around restoring or reconfiguring the “mid-system” food pathway functions between production and consumption including buying, aggregating, processing, storing, marketing, and distributing food products. Solutions include the development of “values-based food supply chains” (University of Wisconsin – Madison (UW), 2025), defined as food pathways “that preserve the social, environmental, and community values that are incorporated into production” (University of California – Davis (UC), 2025).

We propose the development of a parallel and intertwined research and advocacy agenda related to “fisheries of the middle” (FOTM). We suggest a preliminary definition of FOTM as fishery operations that likewise are too large or otherwise unsuited to be served fully by direct markets, but due to scale, circumstance, or values are unsuitable for long supply chain or commodity-based channels (Figure 1). FOTM can incorporate both local and non-local sales of catch and operate at various scales; the primary distinction is that FOTM operations cannot perform all functions in-house and require auxiliary aggregation, processing, storage, and/or distribution entities to facilitate the sale of their products to consumers. Many FOTM operations have a place-based identity with strong connections to their port community.

Agenda

Typically, research and policy related to the seafood and agricultural sectors have been siloed (Olson et al., 2014; Tlusty et al., 2019). However, there is tremendous opportunity for the seafood industry to learn from the agricultural sector (and vice versa) and to collaborate on solutions. A broad agenda related to FOTM could include:

Information Gathering and Analysis—Robust datasets and analyses are needed to inform the development of precise definitions for FOTM based on operation size, production level, or market pathway configuration. Researchers should continue to investigate the changing seafood systems landscape in the US and beyond, expanding on local, statewide (e.g., California Sea Grant) and nationwide (e.g., NMFS, 2024) efforts to provide much-needed baseline data. Potential questions include: what has been the scope of loss and change in mid-system functions? What has caused these? Why have new businesses not replaced many that have closed? How have these losses and changes affected fishing communities? How have they adapted? To what extent is there evidence of a disappearing or at-risk “middle” scale in seafood production? What positive impacts do revitalized port infrastructure and/or supply chain components have on adjacent communities?

Hypothetical “Fisheries of the Middle” Seafood System Including areas for possible collaboration with agriculture

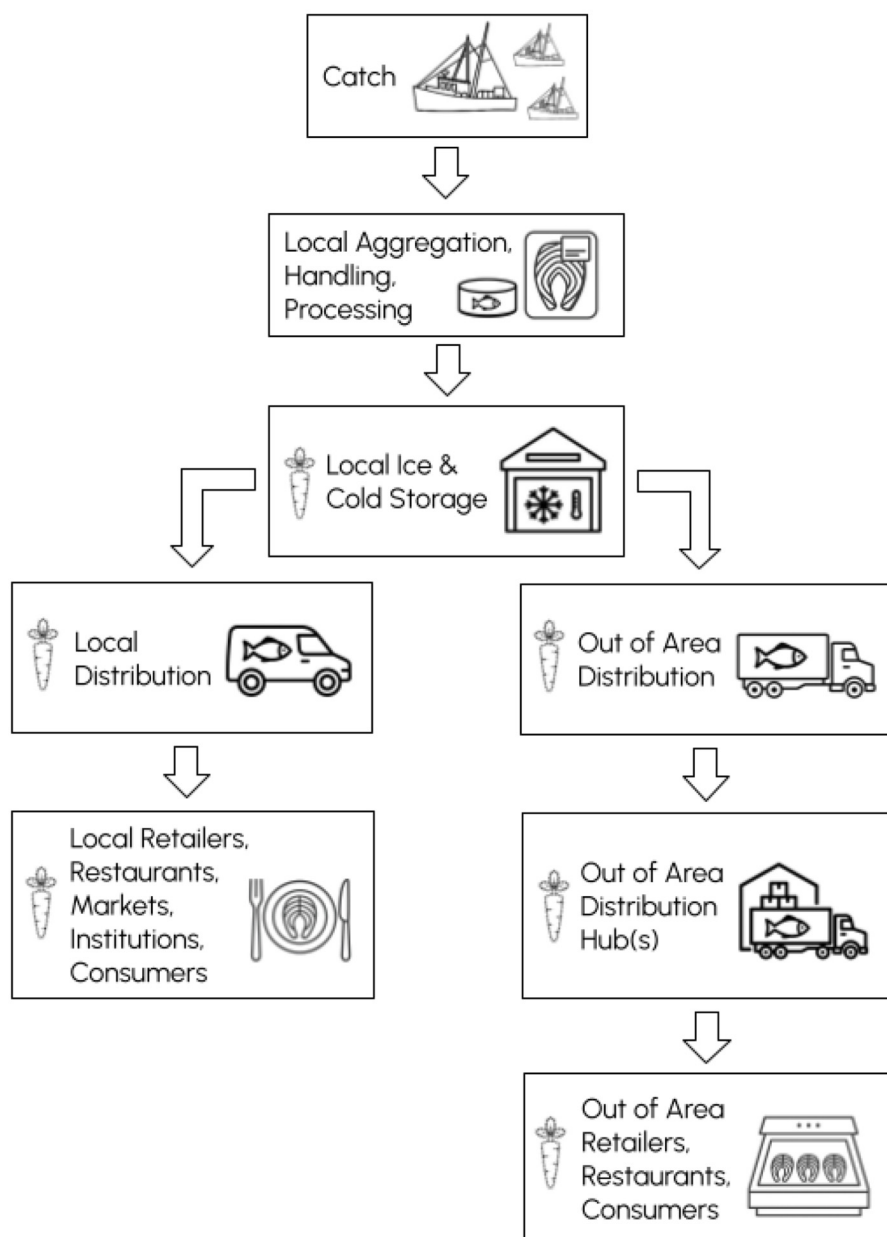


FIGURE 1

Diagram of a hypothetical “fisheries of the middle” seafood system. In this model, robust local aggregation, processing, and cold storage capacity at fishing ports can support both local and out-of-area distribution of the catch. Direct-marketing pathways are less reliant on independent processing and cold storage, but they are limited in the potential scale, seasonality, and location of sales. Long-supply-chain models often rely on aggregation, processing, storage, and distribution out of the port region (and even out of the country), increasing environmental impacts and limiting the benefits to the community such as employment and fish sales. Steps with a carrot icon next to them show areas for potential collaboration with agriculture. Food health and safety requirements may limit opportunities for collaboration in aggregation, processing, and handling.

Identifying Business Strategies—Efforts should address the loss of mid-system functions such as processing, storage, and distribution at ports and identify strategies that can help these businesses flourish.

- **Ownership:** explore types of ownership models that support the viability and values of mid-system functions. Non-corporate ownership models including cooperative, non-profit, port/local government, or small/family business

could provide alternatives (e.g., Rice and Phillips, 2008; Feenstra et al., 2011).

- **Financing:** explore options for financing the development and maintenance of mid-system businesses and functions. Initial government or philanthropic investment may be needed.
- **Regulation:** assist emerging businesses with navigating complex environmental, health, and safety regulations for food handling businesses and advocate for regulatory reform when necessary (e.g., Seiler, 2015; Culver et al., 2015, 2022a,b).
- **Sustainability/Viability:** identify the scale(s) of operation that support viable mid-system businesses. Encourage development of business support programs for potential new operations (e.g., Ecotrust's *Ag of the Middle Accelerator*; Alaska Sea Grant's *Fish Biz*).
- **Innovation:** support the establishment and expansion of regional incubators as has been done in the US Midwest agriculture sector (e.g., *Food Finance Institute*; *Agricultural Incubator Foundation*), to provide opportunities to grow middle-scale food businesses and, where possible, connect seafood and agriculture. Innovations in marketing and distribution from middle-scale seafood operations could use values- or place-based approaches as is done for AOTM. Lessons learned and innovations developed in programs to support direct marketing for seafood (e.g., California Sea Grant's *Market Your Catch*, Positively Groundfish's *Catch + Create Accelerator*, Local Catch Network's *Seafood Accelerator and Innovations Lab*) could be adapted to accommodate larger seafood operations.
- **Community-driven design:** center those affected by fisheries infrastructure in project design, decision-making, and implementation.

Building Collaborations—These challenges can be more effectively addressed through collaborations and partnerships within and across sectors and regions. Fisheries interests should network with agricultural interests, including aquaculture, to develop joint strategies such as sharing infrastructure and supply chain pathways that afford year-round capacity and functionality for both, recognizing individual operational requirements such as product seasonality, perishability, and regulatory frameworks (e.g., HACCP health and safety requirements).

Discussion

Fishing communities across California have been developing innovative solutions to support mid- and small-scale fishery ventures. They also have begun to see benefits from seafood and agricultural producers coming together to address common issues. For example, the North Coast Growers' Association (NCGA) has been partnering with Ashley's Seafood to address common challenges in Humboldt County. The region's food system has been hit hard over the last 15 years. In 2010, the seafood ice and cold storage plant in Eureka closed; throughout the 2010s there was major contraction of processing capacity for local dairy; in 2021 an additional cold storage facility in the region shuttered; and in 2024 the region's only USDA-certified slaughterhouse and Eureka's only remaining year-round seafood processing facility

ceased most operations. Seafood-agricultural collaboration has led to the community's first dockside seafood market, with an innovative mobile food facility permitted for fish cleaning and other food preparation, and is facilitating the development of a flexible local cold storage facility to serve seafood, agricultural, and other producers. In addition, NCGA has been connecting local fishermen with its "Harvest Hub" wholesale buyers including schools and food banks. In Mendocino County, the Noyo Harbor District has developed a publicly-owned ice facility and is exploring ways to develop cold storage and processing facilities that could serve as models to address FOTM challenges (Fishman, 2023; Linder, 2025). Promising efforts to protect and strengthen infrastructure for small- and mid-scale seafood producers and foster connections across food system sectors are also evident in Southern California (SDFSFA, 2021; *Get Local Fish*, 2024; *Port of San Diego*, 2024). For example, the San Diego Food System Alliance, as part of its San Diego County Food Vision 2030, hosted a discussion in 2024, "investing in the next generation of farmers and fishermen" and continues to bring seafood and agricultural producers together to discuss common issues and joint solutions (SDFSFA, 2021).

A FOTM agenda would be complementary to the remarkable efforts and progress in seafood direct-marketing and small-scale fisheries, supporting a larger goal of diversified markets and supply chains. Stronger mid and small-scale fisheries pathways will provide important economic, social, and cultural benefits to communities including helping maintain fishing jobs and ways of life (Cramer et al., 2023; Pomeroy et al., 2020; Witter and Stoll, 2017). The consolidation and loss of traditional seafood system functions and infrastructure is profoundly affecting fishing communities. Yet these losses also provide an opportunity to build new functions that better address current and future needs of fishermen and their communities. Experiences in the agricultural sector show that overcoming entrenched food system pathways will be challenging (Conway, 2024). But individually and in collaboration, seafood and agriculture can chart a more resilient and community-centered path for mid- and small-scale food systems.

Author contributions

LR: Writing – review & editing, Writing – original draft, Conceptualization, Supervision. CC: Conceptualization, Writing – original draft, Writing – review & editing. CP: Writing – review & editing, Writing – original draft, Conceptualization. MM: Conceptualization, Writing – original draft, Writing – review & editing. EM: Writing – review & editing, Writing – original draft, Conceptualization. AT: Writing – original draft, Conceptualization, Writing – review & editing. AV: Writing – original draft, Conceptualization, Writing – review & editing. MK: Writing – review & editing, Writing – original draft, Conceptualization. MH-A: Writing – review & editing, Writing – original draft. EM: Writing – review & editing, Writing – original draft. AN: Writing – original draft, Writing – review & editing. AR: Writing – review & editing, Conceptualization, Writing – original draft. TS: Writing – review & editing, Writing – original draft. TT: Writing – original draft, Writing – review & editing. CW: Writing – original draft, Writing – review & editing.

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Conflict of interest

AV was employed by company Ashley's Seafood.

The remaining author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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