Estimating the scope, scale, and contribution of direct seafood marketing to the United States seafood sector

Abstract

Different seafood supply chain pathways contribute to or conversely detract from the resilience and adaptive capacity of the fishing sector. Direct seafood marketing strategies shorten the link between seafood harvesters and consumers. These strategies appear to be relatively resistant to systemic food system disruptions, making them a potentially important segment of a resilient food system providing benefits to consumers and harvesters. However, little is known about the scale and diversity of the direct seafood marketing sector in the United States. This paper outlines the advantages of collecting data on direct seafood marketing in the US. Additionally, we describe our methodology for creating a sampling frame of direct seafood marketers. We provide initial results from the first national assessment of direct seafood marketing practices, including results from a questionnaire distributed to 39,511 commercial seafood harvesters. Direct seafood marketing was a common strategy among respondents, and the most popular strategy involved selling to a source-identified distributor, i.e. intermediaries who identify the harvester at the point of sale. When combined with data on direct seafood marketing permits, it is estimated that 12% of US seafood harvesters engage in direct seafood sales. These findings suggest that direct marketing is a ubiquitous practice in the commercial fishing sector in the US. Understanding scale and diversity of direct seafood marketing in the US can provide information needed for targeted investments in policies, funding, and technical assistance programs that build diverse, resilient seafood supply chains, and benefit the fishing sector and food security of the nation.

1. Introduction

The seafood economy in the United States and worldwide has become increasingly globalized [1], making it prone to systemic disturbances caused by natural disasters, geopolitical conflict, contagious diseases, and other shocks [2]. The COVID-19 pandemic has highlighted the risks associated with an extensive reliance on global trade in the seafood sector [3,4], leading to a multitude of policy reports in the United States and worldwide that call for strategic efforts to reduce the fragility of the nation's food systems by diversifying supply chains [5–8]. The 2023 National Seafood Strategy (details below) is meant to enhance the US seafood sector's resilience to climate change and other shocks. Acknowledging that different supply chains can contribute to or, conversely, detract from the resilience and adaptive capacity of the fishing sector to shocks, this paper explores the characteristics of direct seafood marketing strategies in the United States in the context of adaptation, resilience and the food system.

Direct seafood marketing is a seafood distribution pathway in which harvesters sell their catch directly to consumers, restaurants, institutions, and other outlets by partnering with or bypassing seafood distributors and processors (i.e., removing the "middleman") [9–11] and often by identifying the harvester. In contrast, conventional seafood marketing in the US is often characterized as being vertically integrated or consolidated [12]. Many seafood processing companies own or lease several fishing vessels or quotas, which makes it complicated to know who caught the seafood or owns the catch. As a result, they act as middlemen when selling the seafood, and it's rare for the actual harvesters to be identified.

Direct marketing strategies have received attention for their role in helping seafood harvesters earn more for their catch in comparison to other harvesters who do not direct market [13,14]. They also play an important role in building social networks and social capital in coastal communities [15], supporting well-being and food security [16], and perpetuating culture and fishing traditions [17]. Additionally, direct marketing practices appear to buffer the localized seafood economy against food system disruptions. This buffering was observed during the COVID-19 pandemic when other supply chains faltered or became untenable [18–21] and during the global financial crisis of 2007–2008 [22], and following the World Trade Center attack in 2001 when many seafood supply chains were disrupted [23]. In the wake of hurricanes, direct seafood marketing is an adaptation strategy used by coastal communities to maintain livelihoods and provide seafood locally [24,25].

Climate change is predicted to affect catches of fish stocks in the US [26] and increase the vulnerability of coastal communities [27]. Experts highlight that fisheries management should adapt to and mitigate climate change impacts to locally available seafood and support the intersecting goals of food security and economic productivity [28]. Surveys of the Australian seafood sector identified changing marketing practices and improving consumer knowledge about seafood options as effective climate change adaptation strategies for the fishing industry [29,30]. While some US states, like Maine, are promoting the expansion of diverse and resilient direct seafood marketing channels [31], data on diverse seafood supply chains and other resilience strategies could inform management decisions as all states consider adaptation policies.

Transformations in the food retail sector due to changing consumer behavior and online marketing during the COVID-19 pandemic also underscore the need to better understand the scope and scale of direct marketing in the US seafood sector. Although disruptions like Hurricane Katrina [32], the H1NI flu [33], and the pandemic may have led to "transitory" changes in consumers' buying practices [34], the food retail sector appears to be preparing for a shift that will be lasting. For example, online food delivery purchasing is expected to reach $270 billion in sales by the end of 2023 (a 24% increase) [35], and projections suggest that online grocery shopping will account for 35% ($600 billion) of food retail purchases in the next five years [36]. These changes have significant implications for all segments of the food system, but may have particular relevance to seafood harvesters who are well positioned to engage with online shoppers using direct marketing strategies. Indeed, while direct marketing is traditionally associated with bucolic images of small-scale harvesters selling their day's catch to the public from a wharf or fishing boat, in actuality, direct marketing encompasses a diverse assemblage of activities and practices that increasingly utilize complex and sophisticated logistics, technology, and communications that dovetail well with online food purchasing.

Improved national data on different marketing pathways, including direct seafood marketing, would be beneficial to US fisheries management and aligns closely with federal mandates and future plans. Only 35 to 38% of seafood consumed in the US is domestically caught and processed [37], but little is known about how seafood is distributed within the US [38]. While national-level data on retail sales of seafood offer insights into utilization of seafood

types and regional patterns [39], lack of data on direct seafood sales (among other knowledge gaps) continue to constrain efforts to account for seafood distribution and consumption nationally [40]. The National Marine Fisheries Service (NMFS) collects data mostly focused on the harvesting of fish stocks as well as ex-vessel prices through fishing trip tickets, federal logbooks, and seafood dealer weigh out reports. These data are most often used to determine population health, set harvest allocations and regulations, and for socio-economic analyses. The Magnuson-Stevens Fishery Management and Conservation Act of 1976 and its accompanying National Standards require NMFS to also consider seafood production and the sustained participation of fishing communities. The principle of optimum yield in National Standard 1 emphasizes, among other factors, "the benefits of food production [to the nation] derived from providing seafood to consumers." National Standard 8 requires that impacts of management measures account for the importance of fishery resources to fishing communities by utilizing the best available social and economic data, including the history, scale, and type of participation in the fishery. National direct seafood marketing data could not only provide insights on the scale and diversity of domestically produced and distributed seafood, but also help fisheries managers understand the impact of regulations, like permits for seafood sales, on fishing communities and seafood businesses.

In August 2023, NMFS released its National Seafood Strategy which outlines plans to support the seafood sector while enhancing its resilience to future shocks. Key to this vision of a resilient US seafood sector are promoting a diverse and growing seafood sector, domestic seafood markets, and equitable seafood trade. Efforts to improve data on direct seafood marketing, as undertaken by this research, directly support these goals.

In light of future food system shocks, the rapidly changing food retail landscape, and the need for and interest in seafood marketing data, collecting data on the direct seafood marketing sector is vital. The United States Department of Agriculture (USDA) data collections on direct marketing of agricultural products offer valuable lessons. USDA has been surveying farmers about their marketing practices since the mid-1970s through the direction of the 1976 Farmer-to-Consumer Marketing Act. To improve its understanding of the direct marketing sector, USDA administered the Local Food Marketing Practices Survey (LFMPS) in 2015 and 2020 [41,42]. These data have been instrumental in informing funding and technical assistance programs that

support small- and mid-sized farming operations. For instance, data from USDA surveys of direct marketing practices of agricultural products helped allocate $90 million in funding assistance to small- and mid-sized farms and ranches in 2021 [43].

The objective of this research is to provide the first national estimate of the number of direct seafood marketers in the US and to outline steps to collect data on the contribution of direct seafood marketing to the US seafood sector. This study aims to 1) describe the different types of direct seafood marketing channels in the US; 2) identify the total number of seafood harvesters involved in direct marketing and their geographic distribution across the US; 3) share preliminary findings of common direct seafood marketing channels. This collaboration leverages USDA's direct marketing survey experience, NOAA Fisheries' fisheries data expertise, and the University of Maine's food system expertise and connection to direct seafood marketers. Additionally, we discuss the policy implications of this research and how the work can be expanded in the future.

2. Methods

The research presented in this paper is part of a broader and mixed-methods initiative to understand seafood marketing strategies in the United States and is thus divided into two phases. Phase 1 of this national direct seafood marketing assessment addressed the aims described above through the development and implementation of a short questionnaire of commercial seafood harvesters across the country. The questionnaire helped estimate the total population of harvesters engaged in direct seafood marketing in the US. These methods are described below and informed the creation of the sampling frame for the detailed survey in Phase 2 of the research.

2.1. Survey tool design

The different direct seafood marketing strategies are not well defined in the literature. While descriptions of direct marketing channels for food products have been formalized within

USDA surveys [44], they do not translate to the unique characteristics of perishable seafood marketing and distribution. To address this and to identify how to ensure the highest response rate for the questionnaire (phase 1) and future survey (phase 2), focus groups with seafood harvesters from across the United States were conducted. The focus groups helped answer these questions: (1) what constitutes direct marketing in the context of US commercial fisheries; (2) what are the future directions in the direct marketing sector; and (3) what are important outreach and engagement channels that could be used to communicate about the questionnaire. In total, five 2-hour focus groups were convened in early 2022 with participation from 26 people based in 9 states. Focus groups were held via an online meeting platform (Zoom) and recorded with the consent of participants. Each focus group included a brief welcome by the research team and opening remarks from a representative from NOAA Fisheries describing the relevance of the project. This was followed by ensuring informed consent for recording the session and a facilitated discussion about direct marketing as it related to the three aforementioned topics. NOAA Fisheries representatives did not participate in the discussion (and logged out of the meeting) to ensure that participants felt comfortable expressing their views and opinions. Focus groups were facilitated by an external moderator and recordings were transcribed using Zoom's automatic transcription service and then manually cleaned by the research team. Transcript data were coded in NVivo v.12 [45] using a grounded theory approach to identify different types of direct marketing strategies and emergent themes [46]. The different terminologies and descriptions that focus group participants used to describe their seafood marketing and distribution practices were coded and synthesized to create a typology of direct seafood marketing in the US (Table 2).

The direct marketing typology developed through the focus groups was used to design a short, postcard-length questionnaire asking seafood harvesters to 1) confirm their status as an active harvester and 2) to identify which, if any, of the five types of direct marketing strategies they have been involved in during the past three years (Table A.2). Paper and online versions of the questionnaire were made available. Resulting data were used to inform Phase 2 of the national direct seafood marketing assessment – a subsequent more detailed survey that was

implemented in 2023. Results from this detailed survey will be presented in future research articles.

2.2. Identifying seafood harvesters

Our brief questionnaire targeted commercial seafood harvesters and/or businesses involved in state and federal fisheries in the United States. Aquaculture businesses were not included as those data are captured in USDA's Census of Aquaculture survey. Data on active commercial fish harvesters in US territories (such as Guam, American Samoa, US Virgin Islands, and Puerto Rico) are uncertain due to evolving licensing programs and the diverse motivations associated with fishing in these regions and because of this, they were not included in this study. Because fisheries data are most often collected at the regional level, a national database of commercial fishing permits did not exist to serve as a sampling frame. To build this, the research team worked with regional Fisheries Information Networks (FINs), state fisheries' departments, and NOAA Fisheries regional science centers. FINs are regional data management systems that play an important role in linking state and regional data collection programs, serving as liaisons between several agencies, and providing data for authorized requests. Due to the sensitive nature of personal information being sought, nearly every fishery-associated state and NOAA Fisheries regional office was contacted and approval sought for use of permit holders' data, even if the data were ultimately retrieved from a FINs database. The database was built using 2019 permit data to avoid potential bias caused by the COVID-19 pandemic in 2020 (e.g., fishing latency during the first year of the pandemic). A database of seafood harvesters who were known to participate in direct marketing was also compiled, where that information was available. This was possible only in instances where a state requires a specific permit to direct market or information about direct marketing is collected at the state level (Table 1). Information on federal and state fishing permit holders were compiled, and individual respondents were deduplicated based on their name and mailing address, however, some duplicates remained (such as when multiple LLCs and individuals were listed under one mailing address). This process resulted in a complete database of seafood harvesters from across the United States with active 2019 fishing permits. Using permit information, the database was

1 further parsed into two categories: 1) permitted direct seafood marketers and 2) harvesters whose
2 involvement in direct seafood marketing was unknown. This latter group was the target
3 population for the questionnaire (Table A.2) presented in this paper.
4
5 **Table 1**: Regional and State data sources of seafood harvesting permits compiled for this study's
6 list frame. Note that information from US territories and sovereign indigenous nations is not
7 included.

Region State	Federal Permits (inclusive of all harvesters)	State Permits (inclusive of all harvesters)	State Permits (direct marketers)	Data Source
Alaska				
Alaska	Y		Y	Alaska Federal Fishing Permits; Alaska Dept. of Fish & Game
West Coast				
Washington, Oregon, California	Y		Y	West Coast Regional Office (WCRO); Washington Dept. of Fish & Wildlife; Oregon Dept. of Fish & Wildlife; California Dept. of Fish & Wildlife
Pacific Islands				
Hawaii			Y	Pacific Islands Fisheries Science Center
New England				
Maine, Vermont, Connecticut, Rhode Island	Y	Y		Greater Atlantic Regional Fisheries Office (GARFO); Atlantic Coastal Cooperative Statistics Program (ACCSP)

New Hampshire, Massachusetts	Y		Y	GARFO; New Hampshire Fish & Game Dept.; Massachusetts Dept. of Fish & Game
Great Lakes				
Minnesota, Wisconsin, Michigan, Illinois, Indiana, Ohio, Pennsylvania	Y		Y	GARFO; Great Lakes Sea Grant Fish Finder
Mid Atlantic				
New York, New Jersey, Delaware, Maryland, Virginia	Y	Y		GARFO, ACCSP
South East				
N & S Carolina, Georgia, Alabama, Mississippi, Louisiana, Texas	Y	Y		South East Regional Office (SERO); Gulf States Marine Fisheries Commission (GulfFIN)
Florida	Y		Y	SERO; Florida Fish & Wildlife Conservation Commission
Interior				
Idaho, Montana, Wyoming, N & S Dakota, Nebraska, Iowa, Nevada, Utah, Colorado, Kansas, Missouri, Kentucky, Arizona, New Mexico, Oklahoma, Arkansas, Tennessee, West Virginia	Y			WCRO; GARFO; SERO

1

2.3. Survey implementation

The commercial fishing sector is a challenging sector to survey due to the nature of seafood harvesters' work. Surveys of the sector have received varying response rates over time and across regions. Indirect factors like the survey topic and perceived benefits or impacts from the survey can also influence response rates. For instance, fisheries economic surveys on the West Coast in 2017 and 2020 received response rates of more than 50% [47], while economic surveys of pot and trap gear on the East Coast saw response rates decline from 29% in 2011 to 6.4% in 2015 [48]. Survey response rates, in general, are declining across most sectors [49 and references within]. Recognizing these challenges, a mixed-mode tailored survey design was used [49]. This methodology is situated in social exchange theory, which posits that respondents' willingness to participate in surveys is based on their anticipated gains [Blau 1964, Homans 1961, and Thibaut and Kelly 1959 as described in 49]. The survey recruitment documents that were provided to questionnaire recipients described the following gains: survey data would be valuable in strengthening domestic seafood systems through supporting policies and in highlighting regional direct seafood marketing strategies.

Several established surveying techniques were used to encourage responses to the survey [49]. First, all participants were offered the option to respond via mail or a near-identical online questionnaire. The online questionnaire was hosted on Qualtrics [50] and accessed via a shortened web link and unique identity code included in each contact letter. Second, responding to the mailed questionnaire was made easy and secure by designing a tear-away postcard questionnaire with return postage paid and no personal details of respondents included (Appendix B). Third, participants were contacted multiple times (see Table A.3 for details) to remind them about participation while also altering the language to emphasize the importance of responding and potential outcomes of the research. Lastly, communications about the questionnaire were coordinated through a variety of media channels, such as Local Catch Network, National Fisherman Magazine, and NOAA Fisheries newsletters to help encourage participation. Information about the survey was also circulated to the fishing industry through fishing industry leaders in our networks through multiple rounds of communications.

2.4. Statistical analysis

The paucity of data on characteristics of the US seafood marketing sector led us to use a census approach when contacting state or federal fishing permit holders whose involvement in direct marketing strategies was unknown. Through the census approach and communications about the questionnaire highlighting the need for this information, it was assumed that direct seafood marketers would have a higher probability of responding. Respondents identified themselves as direct seafood marketers through the questionnaire, and the number of direct marketers with the associated margins of error was then estimated using the formula

$$Margin\ of Error\ for\ a\ Count = z * \sqrt{n * p * (1 - p)}$$

Where, z is the 95% confidence interval with a z-score of 1.96,

n is the number of valid responses

p is the proportion of self-identified direct seafood marketers to the number of valid questionnaire responses, and

Combining the upper estimates of the number of self-identified direct seafood marketers in each state with the number of permitted direct seafood marketers determined the first ever estimate of the maximum number of direct seafood marketers in the US. Non-response bias adjustments could not be made due to the uncertain number of direct seafood marketers in each state as well as the number of commercial seafood harvesters who possessed permits for direct marketing or federal or state fishing. This population of direct marketers identified through the questionnaire and permit database compilation exercise formed the sampling frame for the recently completed national survey of direct seafood marketing practices.

3. Results

3.1 Types of direct marketing channels in the US

Five types of direct marketing channels were identified through the focus groups, namely: Direct to Consumer, Direct to Retail, Direct to Restaurant, Direct to Institutions, and Source-Identified Distributors (SID) (see Table 2 for details). These marketing channels apply to both permitted direct marketers and seafood harvesters in states where direct marketing permits are not required. SID are distinct from conventional seafood middlemen or intermediaries, based on their emphasis on seafood supply chain traceability to the original fisher or fishing vessel who caught it. Our focus group participants emphasized this distinction when describing seafood intermediaries involved in direct sales, an aspect highlighted by participants in other studies of alternative seafood marketing [11]. Similarly, in the USDA survey of marketing of local foods (LFMPS), intermediate markets are included as a marketing channel only if they brand the product as locally or regionally produced [44]. SID are likely an important middle-space between direct and conventional seafood marketing, by transparently connecting fishers with end consumers while offering better revenue.

Table 2: Types of direct seafood marketing channels and practices identified through focus groups and described in the literature.

Types of Direct Seafood Marketing	**Direct Seafood Marketing Practices**	**Related References**
Direct to Consumer Typically, products sold are live, whole, or minimally processed. Sales of this nature may involve close family members and be facilitated by other businesses or	Off-the-boat / Off-the-dock Sales: Direct sales to consumers at the dock, usually without pre-orders or pre-payments	[51,52]
	Fishermen's / Farmers' Markets: Direct sales to consumers as part of established community markets	[53–55]
	Community Supported Fisheries (CSFs): Consumers or CSF members purchase a 'catch share' or 'subscription' to order a variety of seafood over the	[13,14,56]

organizations that provide services or infrastructure (e.g., farmers market or public pier), but the ownership of product does not change hands.	course of a year. Membership fees and catch shares collected before fishing begins help fishermen and CSFs prepare for the upcoming fishing season. Deliveries at predetermined locations with a set schedule.	
	Online Sales, Direct Shipping, and Seafood Buying Clubs: Consumers purchase seafood electronically with seafood delivered to their doorstep or to the coordinator of a seafood buying club.	[9,11,57]
Direct to Retail Seafood products are typically processed by the retailers. Ownership of product changes hands.	Fishmongers, independently owned grocery stores, and supermarkets: Sales to retailers, who in turn sell it to the public	[58]
	Seafood / Fishermen's Co-Ops: Collaborations with other fishermen to overcome hurdles like marketing and processing catch	[59,60]
Direct to Restaurant Seafood sales to businesses that prepares food.	Foodservices: Including fast food outlets, food trucks, seafood shacks, etc. Often based on pre-determined schedules and volumes.	[11]
Direct to Institutions Seafood sales to businesses or organizations that do not primarily prepare food.	Schools, Universities, Prisons, Hospitals, and Foodbanks: Seafood sales to institutions that will prepare and serve seafood to customers	[61–63]
Source-Identified Distributors (SID) Businesses that are not owned by the harvester (or immediate family) that caught the product.	Wholesalers / Seafood Aggregators / Brokers / Distributors/ Fish houses: Businesses or organizations in the middle of the supply chain that sell and deliver large volumes of seafood to other businesses like retailers and institutions and rarely sell directly to a consumer. Unlike the supply chains	[11,60]

An important feature of SID is that they identify the person(s) that harvested the seafood.	of conventional seafood companies, seafood sold through these channels is traceable back to the vessel or fisher who caught it.	

3.2 Identifying the number of seafood harvesters engaged in direct marketing

In total, 56,149 seafood harvesters in the United States were identified with active fishing permits in 2019. Of these, 72% held state-issued commercial seafood harvesting permits and the remainder (28%) had federal-issued seafood harvesting permits only (Table 3). Approximately 30% of all seafood harvesters (n = 16,638) were based in states where direct marketing permits are required and/or the state collects data on direct marketing sales. The remaining 70% of seafood harvesters (n = 39,511) were based in states or had federal permits where these data do not exist, and were the target population for the first phase of the national direct seafood marketing assessment.

Table 3: Number of US commercial seafood harvesters and direct seafood marketers with details of federal- and state-issued permits

Types	Seafood Harvesters	Seafood Harvesters contacted for Questionnaire	Self-Identified Direct Seafood Marketers (Questionnaire)	Permitted Direct Seafood Marketers	Total Direct Seafood Marketers
Federal	15,856	15,856	1,617	--	1,239
State	40,293	22,799	1,906	3,534	5,275
Federal & State	[1]	856	110	103	111
Total	56,149	39,511	3,633	3,637	6,625 [2]

[1] Unknown number; [2] Lower sum total due to removed duplicates.

A total of 5,160 valid responses to our questionnaire (response rate =13%) were received in the first phase of the national assessment of direct seafood marketing practices. With a margin of error $\pm$ 1.2%, we report with 95% confidence that 71% (n = 3,633, LL = 3,367, UL = 3,899) of respondents identified themselves as direct seafood marketers based on their involvement in at least one type of direct marketing strategy. This suggests that were this survey conducted again, the high proportion of responses from self-identified direct seafood marketers would lead to a similar estimate of 3,633 $\pm$ 266 self-identified direct seafood marketers. The margin of error estimate of self-identified direct seafood marketers varies by state, ranging from $\pm$4 (95% CI 4, 12) in Delaware to $\pm$25 (95% CI 652, 703) in Maine (Figure 1a). This variability is likely due to the number of responses and population of seafood harvesters within each state, and also why we are using the wider cumulative margin of error estimate rather than the narrower error estimate for the overall population ($\pm$64, 95% CI 3,569, 3,697).

Through the compilation of permitted direct seafood marketers' databases, an additional 3,637 seafood harvesters that have direct marketing permits in several US states were also identified (Figure 1b). This brings the total to 6625 $\pm$266 (95% CI, adjusted for duplicates) known individuals or businesses that engage in direct seafood marketing across the United States, or about 12% of all seafood harvesters nationally (Table 3, Figure 1c). Of these, 19% hold federal fishing permits, 79% have state permit holders, and 2% have both federal and state permits. By state, the number of harvesters potentially engaged in direct marketing ranges from 30% in Hawaii to 9% in Maine (Figure 1d). The data suggest that direct marketing is more prevalent in Hawaii, on the west coast and in Alaska compared to other parts of the United States.

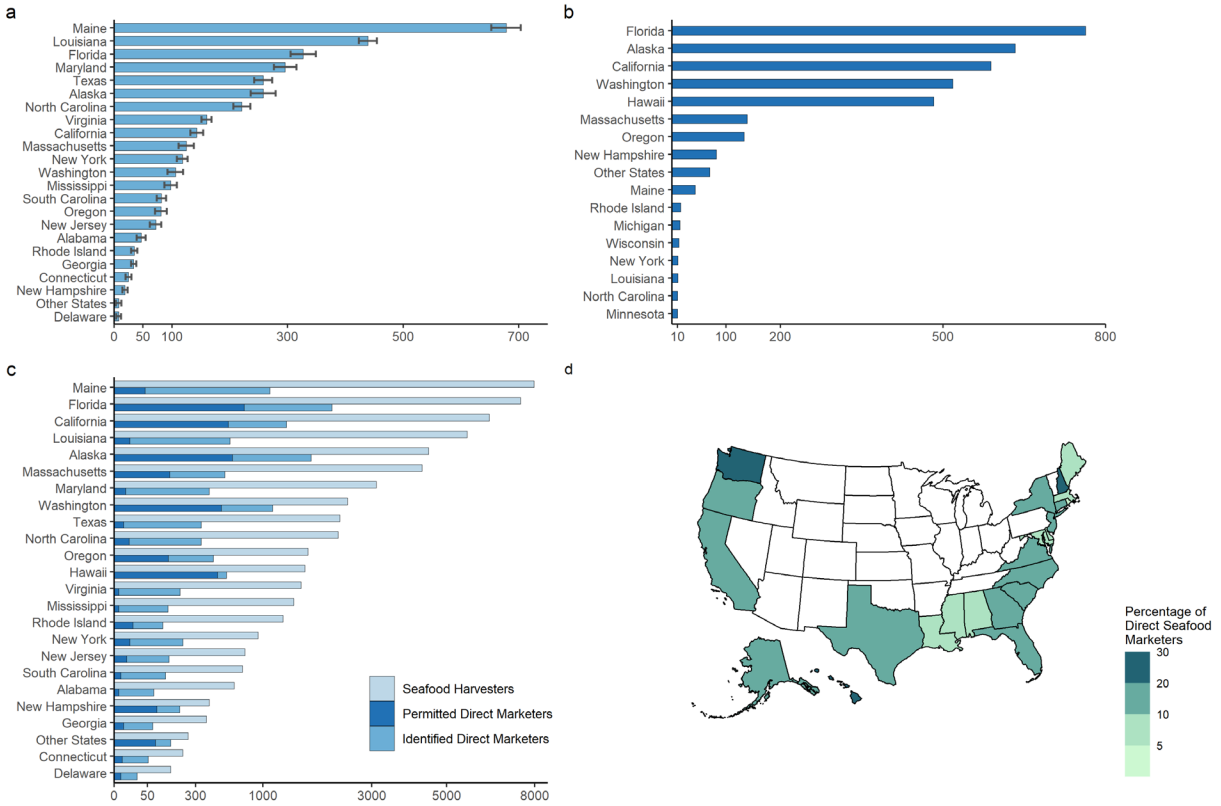

Figure 1: The number of direct seafood marketers in the US based on a) estimated numbers (95% CI) of self-identified direct seafood marketers (2022 questionnaire) and b) numbers of direct seafood marketing permit holders. The state-wise comparison of c) the number of commercial seafood harvesters in 2019 and the upper estimates of the number of self-identified direct seafood marketers and permit holders, informs our estimate of d) the percentage of direct seafood marketers in coastal states. Data from non-coastal states not represented due to low numbers. All axes were square-root transformed to improve interpretability.

However, uncertainty about the total number of American direct seafood marketers still exists. The upper limit of the estimated self-identified direct marketers (through the questionnaire) in each state indicates that there may be up to 3,899 (95% CI Upper Limit) direct seafood marketers in the US for whom there was no prior data on direct marketing practices or permits. Additionally, not all permitted direct seafood marketers may engage in direct marketing.

Thus, the estimated number of direct seafood marketers in the US could be as high as 7,536, but is likely lower.

3.3 Common direct seafood marketing channels

Our questionnaire also yielded insights into the direct seafood marketing channels that respondents engaged with. Forty-eight percent of respondents indicated that they sell seafood in more than one direct marketing channel, with only 2% indicating that they use all five marketing strategies. Nearly 36% of respondents sold seafood only to SID, with the next popular combination of marketing channels engaged with being direct to consumer and SID (11%). Only 8% of respondents sold seafood either solely to retail or directly to consumers. The majority (75%) of those involved in direct marketing strategies indicated that they sell to SID who identified them as the harvester at the point of sale, while nearly 46% sold direct-to-consumers and 40% to retailers (Figure 2).

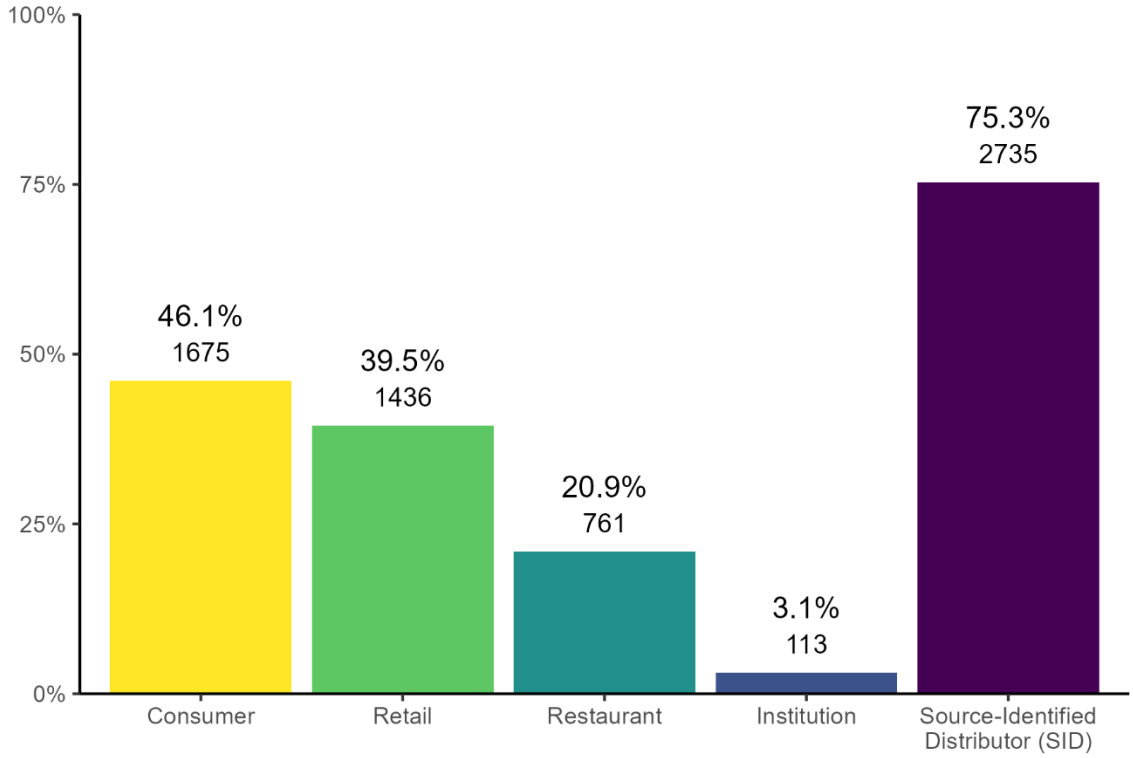

Figure 2: Percentage (and number) of direct seafood marketing channel engagement by questionnaire respondents. Note that 48% of respondents engaged with multiple channels.

4. Discussion

While additional detail will emerge from the second in-depth survey, this study provides the first estimate of the number of direct seafood marketers in the US and describes a typology of direct seafood marketing channels and respondent's engagement with these channels. Direct seafood marketing is commonly used as an alternative to conventional seafood sales by commercial harvesters across the US. This study estimated that over 12% of seafood harvesters participate in different types of direct marketing across US states (not including territories or sovereign indigenous nations). By comparison, in the agricultural sector, the USDA estimates that 7% of the 2 million American farms in 2020 participated in direct sales [64]. These results underscore the need for robust data collection efforts of the direct seafood marketing sector to improve comparisons with other sectors of the food system.

The questionnaire's results also highlight the diversity and propensity of certain direct seafood marketing channels. Much of direct seafood literature has to-date focused on the direct-to-consumer model [14,56] (Tables A.1 and A.2). In some instances, direct-to-retail models [58] and direct-to-institution arrangements [63] have been highlighted, but these have had a regional focus. This study's findings indicate that across the US seafood harvesters engage with a variety of direct seafood marketing channels. A higher proportion of seafood harvesters engage with direct-to-intermediary marketing channels ("conventional marketing channels"), which could be a result of the prevalence of conventional US seafood supply chains involving seafood dealers and fish houses. The complicated nature of ownership arrangements across the US seafood supply chain [11] makes it difficult to differentiate between conventional seafood intermediaries and SID which identify and benefit seafood harvesters. Given that a third (36%) of self-identified direct marketers sold seafood only to SID and 75% engaged with SID, this marketing channel requires further investigation. In the detailed Phase 2 survey, we specifically ask additional questions about the type of SID direct marketers are engaging with and their level of knowledge regarding vessel and harvester traceability within these supply chains. Compared with the prevalence of direct-to-consumer sales of agricultural products [64], our results highlight that extrapolating patterns from surveys of farms/ranches to seafood is problematic.

Future efforts to expand this work should be attentive to the challenge of building a national list frame of seafood harvesters. The central challenge is that federal permits are issued to vessels, while most states issue licenses to individuals, thereby making it difficult to seamlessly integrate data into a single database, and some US territories lack robust licensing programs for seafood harvesters. Additionally, future research in this space should include US territories including Guam, the Commonwealth of the Northern Mariana Islands, American Samoa, the Virgin Islands, and Puerto Rico, as well as sovereign indigenous nations. Non-probabilistic surveys conducted on small boat fisheries in the Pacific Islands Region suggest that harvesters in these island fishing communities rely almost exclusively on direct marketing channels [65–67]. An intercept-based survey strategy, alongside key informant interviews, were effective in understanding how Puerto Rican fishermen engaged in direct seafood sales before and during the pandemic [25,68] and could be useful in the future, especially in collaboration with fishing communities and Tribal governments. In addition, online marketing channels might

have been overlooked among other conventional seafood distribution systems, particularly when relying on permit data to generate sample frames. Web-scraping approaches akin to USDA's LFMPS [69] are helping improve our sample frame of direct seafood marketers engaged primarily in online sales.

Several factors may have contributed to our questionnaire's response rate and the sources of error within our estimate of the number of direct seafood marketers in the US. The target population of our national questionnaire was commercial seafood harvesters who were actively fishing in 2019. When the survey was conducted in 2022, 17% of questionnaire respondents (883 out of 5160) indicated that they had not fished within the last three years. Respondents indicated through comments that this was either due to retirement, selling their vessels, or in some cases because the respondent had deceased. This highlights that our sampling frame had errors within it, and the number of no-longer active commercial seafood harvesters could be much higher since 2019 due to factors related to the pandemic and the greying of the fleet [70,71].

Some invalid returned questionnaires (n= 64) were also received, where respondents had not answered any of the questions but had instead included unsolicited comments. Many of these invalid questionnaires (46%) were from Maine and consisted mostly of negative comments about closures of the lobster fishery, conflict with North Atlantic Right Whale conservation efforts, and wind farms. These comments are being thematically analyzed for a forthcoming publication. Additionally, our large non-response rate (87%) may be because the questionnaire was designed to learn more about the relatively niche direct seafood marketing sector, leading conventional seafood harvesters to ignore the questionnaire. During the questionnaire's implementation, it was also assumed that direct seafood marketers would be positively biased to respond, an aspect which is reflected by the 71% of respondents self-identifying as direct seafood marketers despite the low overall response rate. Considering declining survey response rates in general, it is unlikely to expect to get response rates comparable to some required USDA and NOAA Fisheries surveys without also making it required.

To boost the resilience of US food systems, and particularly seafood systems, improved data collections need to leverage diverse expertise while also considering the implications for existing policies and future ones. Phase 2 of this research involves a detailed survey of the direct seafood marketers identified through the questionnaire and the database of permitted direct

marketers. This survey closely parallels USDA's survey of agricultural direct marketers (LFMPS), uses NOAA Fisheries seafood permit data, and has been refined through insights gathered from the focus groups and input from the direct seafood sector. This detailed national survey will not only yield greater insights into marketing channel engagement, but will provide additional information on commonly sold seafood products, direct seafood sales revenue and expenses, and the demographics of direct marketers among other data. However, data collection efforts should account for additional coordination and data collection harmonization between agencies as well as how data is translated by policies into support for the sector. For instance, data collections for the Census of Aquaculture have gaps and discrepancies as the census is conducted by the USDA but NOAA Fisheries is responsible for the majority of permitting and regulation considerations [72]. Additionally, while seafood harvesters are eligible for USDA program support, direct marketing practices of seafood harvesters are not covered by current producer surveys. Programming to facilitate entry into fisheries is poorer or not as developed as compared to those for entry into farming [73]. Seafood harvesters' insufficient access to and lower participation in direct marketing assistance programs results in an incomplete estimate of the market size and impacts [of perturbations], and thus limited justification for USDA, and other federal agencies, to support seafood harvesters either financially or with technical assistance. Improved national level data could be used to identify market trends and opportunities, thereby assisting seafood harvesters and other related seafood businesses with planning and marketing strategies as well as attracting investors. States, counties, regional food hubs and other practitioners could use this information to understand how seafood is marketed in their regions and how to support these efforts to achieve economic goals as well as goals related to food security and sovereignty. Advancing the goals of the National Seafood Strategy, the data could be used to better elucidate the benefits of seafood production for U.S. consumers from this sector and how it may be optimized. However, our understanding of the direct seafood sector and its marketing practices is still limited, and this paucity of information has major implications for the development of policies that support this sector and the larger fishing industry.

5. Conclusion

Disaggregating seafood supply chain pathways is essential for understanding the distribution and type of benefits derived from US fisheries. In order to begin to characterize the role of direct seafood marketing in the US this study reconnected federal and state data to create a national list frame and implemented an initial questionnaire to determine the scope and basic characteristics of participants. The results of this questionnaire suggest that direct marketing is widely used and that within this sector several different direct marketing strategies exist. As a next step, a more in-depth national survey of direct seafood marketers identified by this study will provide additional detail and allow for greater comparison between the fishing and farming direct marketing sectors in the US. The paucity of data about this sector is a barrier to policy development, technical assistance, and funding. Existing policies and federal agency mandates support collection of relevant data about seafood production and agricultural marketing practices. While more data is needed, these studies represent an important next step in further understanding the characteristics of direct seafood marketing in the US and the contribution of this sector to the US food system.

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Appendices

Table A.1: Summary of recent research on direct seafood marketing, with details on the number and type of respondents, study region, and methodological focus.

Article	Respondents	Sample Size	Method	Study Region and Focus
[14]	Staff	7	Interviews	US East Coast. CSF barriers and opportunities
[74]	Staff	15	Survey	North America. Assessing CSF sustainability
[75]	Fishers	21	Interviews	Georgia. Fishers' perceptions of obstacles to direct marketing
[56]	Staff	22	Interviews	USA. Diversity of CSF models
[57]	Staff	24	Survey	North America. Features important for financial performance of CSFs
[11]	Direct Marketers	30	Interviews	North America. Values and challenges of alternative seafood marketing enterprises
[13]	Consumers	245	Survey	North America. Motivations and commitments of CSF members
[75]	Consumers – Farmers Markets	367	Intercept Survey	Georgia. Demand for local and sustainable seafood
[76]	Consumers – Retail	378	Intercept Survey	Oregon. Consumer preferences for seafood labels

[77]	Consumers – Retail	464	Online Survey	South Carolina. Factors influencing probability of CSF subscription
[16]	Households	490	Mail Survey	Alaska. Contributions of local seafood to food security

Table A.2: Questions included in the short questionnaire sent to US commercial seafood harvesters

Have you commercially fished in the past three years?	Yes / No
If YES, did you or a close family member sell any of the seafood you harvested to the following?	
Consumer / public (via off-the-boat sales, roadside markets, home deliveries, farmers' markets, community supported fisheries, etc.)	Yes / No
Retail outlet (including fishmongers, grocery stores, online retailers, seafood cooperatives. etc.)	Yes / No
Restaurant (including fine dining, fast food, seafood shacks, food trucks, etc.)	Yes / No
Institution (including K-12 schools, colleges or universities, hospitals, foodbanks, prisons, etc.)	Yes / No
Distributor / buyer who identifies you as the harvester to the consumer	Yes / No

Table A.3: Details of when and how respondents were contacted for the short questionnaire

Recruitment Phase	Date	Details
1st Contact Mailed	June 17, 2022	All participants mailed an invitation to the questionnaire, consent form, questionnaire form, and a link to access online questionnaire
2nd Contact Emailed	July 7, 2022	Participants with available email addresses emailed questionnaire reminders and an access link
3rd Contact Emailed	July 18, 2022	Participants with available email addresses emailed questionnaire reminders and an access link

4th Contact Mailed	July 28, 2022	Participants who were yet to respond were mailed a postcard reminder to participate in the questionnaire
5th Contact Mailed	September 28, 2022	Participants who were yet to respond were mailed a final reminder to participate in the questionnaire, the consent form, questionnaire form, and a link to access online questionnaire

1