

Missing the Boat? Measuring and Evaluating Local Groundfish Purchases by New England Institutions

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Abstract

The development of local food markets has provided a critical economic opportunity for small farms in New England. The collapse of Gulf of Maine groundfish stocks has motivated an interest in developing similar marketing opportunities for wild-caught, locally abundant seafood. Institutions, particularly schools and colleges, have been identified as a strategic entry point in the supply chain for such products. However, there has been a dearth of research on this topic. We undertake a case study that evaluates purchases of local groundfish by schools and colleges in New England. First, we analyze recently developed secondary data to assess the propensity and frequency of local seafood purchases. We find that local seafood purchases by schools in New England are not widespread even among the subset of schools that are undertaking farm to school activities, and that schools that are purchasing local seafood are doing so infrequently. We also find that colleges have been more proactive in sourcing local seafood products. There is a high degree of state-level variation within New England, as institutions in states with relatively more prominent commercial fishing sectors are sourcing local seafood products to a relatively greater degree. Further, colleges explicitly expressed that technical assistance in sourcing sustainable seafood products would be most beneficial in regions where there was less available supply. Second, to draw further inferences about the sustainability of local seafood purchases, we report the results of seafood procurement procedures from New England colleges. We find that these colleges source a wide variety of local groundfish principally for on-campus dining and that they place high value on seafood certification schemes as guidance for making sustainable purchases. We conclude by reviewing how data collection methods for local agricultural markets could be modified with regard to seafood distribution systems.

1. INTRODUCTION

Multiple factors motivate the interest of policymakers, nonprofits, and seafood suppliers in enhancing local seafood markets in the United States. Improved nutrition is one factor, as seafood is under-consumed in the United States relative to recommended levels (USHHS-USDA 2015). Increasing the domestic market share of U.S. seafood products is a second goal, as the United States imports greater than 80% of the seafood that is consumed domestically (FishWatch 2018). Furthermore, the development of local seafood markets could have ecological benefits if providing a market for locally abundant wild-caught fish reduces harvesting pressure on seafood species with depleted stocks and/or reduces bycatch waste that would otherwise occur in multispecies fisheries (McClenachan et al. 2014).

Local markets have provided a critical economic opportunity for small farms (Low et al. 2015). They have been particularly important in the Northeast, a region in which conventional farmers have confronted challenges arising from the increasing scale and consolidation of agricultural commodity sectors. Due to the collapse of groundfish stocks, fishermen for wild-caught fish in the Northeast have also experienced economic hardships. However, the seafood sector has not capitalized on the increasing consumer interest in purchasing source-identified food products to the same degree as agriculture (Cowpoerthwaite and Clime 2015). Institutions, particularly schools and colleges, have been identified as a strategic entry point on the supply chain for purchases of locally abundant seafood products.¹ While there has been considerable outreach to these institutions about purchasing local seafood, research on this topic has been scant.

In this paper, we evaluate institutional purchases of locally abundant groundfish from the Gulf of Maine as a case study. The Gulf of Maine is an ideal place to undertake this research due to its lengthy history of overfishing (e.g., Rosenberg et al. 2005), as well as recent efforts to diversify markets away from historically overfished stocks (Witkin, Dissanayake, and McClenachan 2015). To evaluate the ways in which local institutions are supporting these goals, we synthesize information from a variety of sources. We use two secondary datasets

¹For brevity, throughout this paper we use the word “college” to refer to any type of higher education institution, including universities. Similarly, we use the word “school” to generally refer to a school food authority purchasing food on behalf of either an individual school or a collection of schools within a school district.

to assess the propensity and frequency of local seafood purchases by schools and colleges (USDA FNS 2016, FINE 2017b). These datasets were principally developed to analyze how these institutions purchase local agricultural products, although they contain information about local seafood that has not been extensively examined previously.

There are numerous similarities in the market conditions confronting agricultural and seafood producers. Both markets are susceptible to exogenous supply-side shocks (e.g., drought or flood in the case of agriculture, changes in water pollution levels, or ocean temperature in the case of seafood); commodity market price fluctuations; and productivity increases and/or distortionary government subsidies contributing to sector consolidation and overproduction. However, a critical distinction between agricultural and wild-caught seafood products are that the latter are harvested as a common-pool resource susceptible to the “tragedy of the commons.” As a result, the supply of valuable, overexploited species cannot be increased to meet demand, which must instead be shifted to more abundant and less desirable species. Thus, the ecological and economic sustainability of local seafood markets depends on aligning availability and demand. To better ascertain whether locally abundant species are being purchased by institutions, we undertake interviews of New England college food service directors and augment these with information from preexisting case studies of local seafood purchases by New England colleges (FINE 2016a). We then compare the species-specific information that we solicit from these case studies with groundfish landings data from the Portland Fish Exchange to assess the relationship between institutional purchases and overall supply. We conclude by reviewing how data collection methods for local agricultural markets could be modified with regard to seafood distribution systems.

To summarize, we find that local seafood purchases by schools in New England are not widespread, even among the subset of schools that are undertaking farm to school activities. We also find that schools that are purchasing local seafood are doing so infrequently. Colleges have been more proactive in sourcing local seafood products than K-12 schools. Also, institutions in states with relatively more prominent commercial fishing sectors source local seafood products to a relatively greater degree. Furthermore, colleges explicitly expressed that technical assistance in sourcing sustainable seafood products would be most beneficial in regions where there was less available supply. In our

case studies, we find that New England colleges source a variety of local groundfish principally for on-campus dining and that they place high value on seafood certification schemes as guidance for making sustainable purchases.

2. BACKGROUND

2.1 Overview of Local Food Systems

While defining whether a food is “local” based on geographic distance is inherently arbitrary, a recent survey by the U.S. Department of Agriculture (USDA) classified food sales as local based on the supply chains used by farmers. Food purchases directly from farmers by institutions (e.g., schools, hospitals, and colleges) and distributors that market locally-branded food products accounted for 39% of the value of local agricultural production (USDA NASS 2016). Sales by farmers at direct-to-consumer (DTC) outlets, such as farmers markets, farm stands, community supported agriculture (CSA) programs, and other direct marketing outlets accounted for 35%; and food purchases directly from farmers by retailers, like supermarkets or restaurants, accounted for 27% (USDA NASS 2016).

Local food markets have been resurrected in recent decades in the United States after disappearing throughout the 20th century. This increased demand has, for instance, contributed to a doubling of DTC agricultural sales between 1992 and 2012 (O’Hara and Low 2016). Also, the number of “farm to school” programs in K-12 schools increased from six to 5,524 between 1997 and 2014 (NFSN 2016). The resurgence in local food market activity occurred, except in recent years, largely without government support (e.g., O’Hara 2012, O’Hara and Coleman 2017). Numerous factors have contributed to the increased consumer interest in purchasing local agricultural products, although product freshness and quality attributes are among the principle reasons (e.g., Low et al. 2015). In 2015, 167,000 farms sold \$8.7 billion worth of edible agricultural products through local market channels in the United States (USDA NASS 2016). The economic size of local agricultural production in the U.S. has increased to the point at which it is now greater than the value of cotton production and almost equal to that of wheat production (USDA NASS 2017).

Enhancing local food markets has been pursued as an economic development strategy across the United States as a means of import substitution. Local sales result in greater regional economic impacts when compared to food sales via traditional retail markets (Hughes, et al. 2008; Hughes and Isengildina-Massa 2015; Jablonski, Schmit, and Kay 2016; Rossi, Johnson, and Hendrickson 2017). In addition to generating income for producers, they can also provide an economic boost to other local businesses that provide ancillary services to the sector. In the case of seafood this could include, for example, input suppliers for local fishing vessels (e.g., gear, nets, and ice), seafood processors, and seafood distributors. Local food markets have been particularly important in the Northeast. For reference, local agricultural product sales in Maine in 2015 (\$109 million) were of a similar magnitude to two of the state's most prominent conventional agricultural commodity sectors: potatoes (\$143 million) and milk sales from dairy cows (\$119 million) (USDA NASS 2016 & 2017).

2.2 Overview of Local Seafood Markets

The motivation in developing markets for locally abundant seafood in the Gulf of Maine arises due to the collapse of groundfish stocks that occurred from overharvesting (Rosenberg et al. 2005) and a transition over the past half century from a diverse fishery to one dominated by lobster production (Steneck et al. 2011). The value of commercial fishery landings in Portland, which is Maine's largest non-lobster seafood port, declined by 54% in real terms between 1993 and 2016 (Coperthwaite and Clime 2015, NOAA 2018). Groundfish sales accounted for just 1% of the state's 2016 commercial landings at \$6 million – the same magnitude as worm sales (SMDMR 2017).

Little research and data are available about seafood distribution systems (Stoll et al. 2015). This could be because of the emphasis that has been placed on the unique resource management challenges confronting fisheries, different government agencies manage agricultural and fisheries statistics, and/or the markets are considerably smaller economically than those of agricultural products. As evidence of the latter point, the majority of New England food distributors rarely received requests from institutions for New England wild-caught fish, and only 27% of New England distributors sell this product (FINE 2016b).

Perhaps the most information about local seafood marketing channels pertains to community supported fisheries (CSF) operations, which are premised on the CSA model (e.g., Brinson, Lee, and Rountree 2011; Campbell et al. 2014; McClenachan et al. 2014; Bolton et al. 2016). There are approximately 400 CSF operations and small-scale harvesters nationally (LocalCatch.org 2018), although national-level estimates of sales at those markets are not available. McClenachan et al. (2014) found that CSFs were effective at diversifying local seafood markets by distributing seafood with highly abundant stocks, some of which was previously discarded as bycatch.

While CSFs have received research attention, they may be less important than other distribution channels for locally caught seafood. Sales via CSA programs comprise only 2% of aggregate local agricultural sales (USDA NASS 2016). If CSFs have the same relative importance for local seafood products as CSAs do for local agricultural products, then they would not be a prominent distribution channel for local seafood. Less is known about other DTC channels for seafood. For instance, USDA maintains a national farmers market directory in which farmers market managers can report the products that they sell (USDA AMS 2018). Seafood is one of the products listed in the database, but there is no geographic information provided regarding where the seafood may have originated. One survey of market channels that consumers use to purchase seafood for at-home consumption found that 56% of seafood is purchased at grocery stores, 15% from community supported fisheries, 11% from local fish markets, and 9% from farmers markets (Witkin, Dissanayake, and McClenachan 2015). On the supply-side, Grafeld et al. (2017) found that direct sales to grocery stores by fisherman accounted for 66% of sales for nearshore coral reef seafood in Hawaii. They further found that retailers, wholesalers, and restaurants accounted for 19%, 14%, and 1% of sales, respectively.

Another key distribution channel pertains to food purchased for away-from-home consumption, such as at restaurants. The proportion of food expenditures occurring away-from-home has increased from 26% in 1970 to 44% in 2014 (USDA ERS 2016). So, understanding how seafood distribution systems for away-from-home purchases can accommodate locally abundant seafood products is needed if a societal objective is to increase their sales. Experimental efforts have been made to introduce locally abundant seafood at restaurants. For instance, the “Pier to Plate” initiative has resulted in fisherman in Cape Cod, MA giving

away dogfish and skate for free to local restaurants in order to stimulate demand (Wilcox 2017). However, whether this initiative will be economically viable for fishermen in the long-term is unclear.

Institutions are another important outlet for away-from-home purchases. Advocacy efforts by organizations like the National Farm to School Network and Real Food Challenge have focused on schools and colleges, respectively, as strategic venues for reorienting food purchasing patterns to better align with social objectives. One reason that these institutions are targeted is that they have a captive customer base and purchase food in large volumes. Also, schools and colleges have an educational mission. Some agricultural products sold locally may not need extensive education if consumers have a preference for them based on taste or quality attributes. For instance, some consumers may prefer heirloom tomatoes sold at a farmers market relative to conventional tomatoes sold at grocery stores. However, education may be a particularly important component in developing local seafood markets. This is because one impediment to increasing the consumption of locally abundant seafood is that while consumers may prefer local seafood relative to non-local seafood, they also have a preference for seafood species with which they are familiar (Witkin, Dissanayake, and McClenachan 2015). Thus, if purchases of locally abundant seafood by schools and colleges were combined with outreach and education then it could potentially be effective at influencing long-lasting changes in dietary patterns.

3. LOCAL SEAFOOD PURCHASES BY SCHOOLS

“Farm to school” is a general phrase that refers to schools undertaking any combination of the following three activities: local food procurement, school gardening, and/or education regarding culinary and/or agricultural issues. Motivating factors behind the development of farm to school programs include providing income to local farmers, improving child nutrition, fostering community engagement, and creating interactive educational opportunities. However, schools confront tensions when designing menus between the nutritional content of foods, food costs, and incentivizing students to purchase the foods. School food authorities are required to operate on a cost-recovery basis, although in practice some maintain a deficit (Ralston and Newman 2015).

Farm to school policy support has been developed due to both the desirability of the programs and impediments schools confront in implementing them. At the federal level, the Healthy Hunger-Free Kids Act of 2010 directed USDA to establish a grant program to assist schools implementing farm to school programs, and further to disseminate data and research on the topic. To comply with this directive, USDA's Food and Nutrition Service administered the first Farm to School Census in 2013 to every public school district participating in the National School Lunch Program. USDA administered a second Census in 2015 that was expanded to encompass private and charter schools. In order to solicit a high response rate, the questions were non-standard (e.g., 'local' was self-defined by survey respondents²) and not granular. In 2015, 12,585 school food authorities submitted usable responses for a response rate of 70% (USDA FNS 2016). Local school food purchases nationally were estimated to equal \$789 million (USDA FNS 2016). The Farm to School Census represents the most comprehensive national-level effort to-date that solicits institutional information about local food purchases.

For schools participating in farm to school programs, the Farm to School Census included questions about whether they purchased certain types of food products – including seafood – locally, the frequency at which they made such purchases, and the types of suppliers used for local purchases. Buying local food products from distributors is the market channel that schools used most frequently, although making local food purchases directly from farmers and processors/manufacturers was also common (Christensen, Jablonski, and O'Hara 2017). Questions in the Farm to School Census did not solicit disaggregated information about which supply chains were used for specific food products. However, other surveys have found that in the case of seafood, local purchases in New England are undertaken almost exclusively from intermediaries as opposed to occurring directly from an individual fisherman (Purslow, Page, and Horwitz 2016).

Of the New England schools that were undertaking farm to school activities in 2013-14, 69 (14%) reported that they were purchasing local seafood and 416 (86%) reported that they were not. Of the schools buying local seafood, 28 were located in Maine and 23 were located in Massachusetts (Figure 1). Thus, 28% and

² Of schools participating in farm to school programs in 2013-14, 45% considered local to be within the same city/county, within 50 miles, or within 100 miles (O'Hara and Benson 2017).

15% of schools participating in farm to school programs in Maine and Massachusetts, respectively, were buying local seafood. These percentages were comparable in Rhode Island and New Hampshire (22% and 12%, respectively). Just one school each in Connecticut and Vermont reported purchasing local seafood. Vermont is not contiguous to the ocean and Connecticut does not have any major commercial fishing ports, so there are likely fewer opportunities by schools in those states to purchase local seafood. This is consistent with a similar finding with regard to agricultural production. Specifically, local milk and local non-milk purchases at schools increased in response to greater increases in local dairy and DTC agricultural production, respectively (O'Hara and Benson 2017). Nonetheless, using the Farm to School Census question about local seafood purchases as a proxy for Gulf of Maine seafood purchases by New England schools has shortcomings. First, New England schools, particularly those in Connecticut and Vermont, may be purchasing Gulf of Maine seafood but not considering it local. Second, New England schools could be buying seafood from the Gulf of Maine but could be unaware that they are doing so.

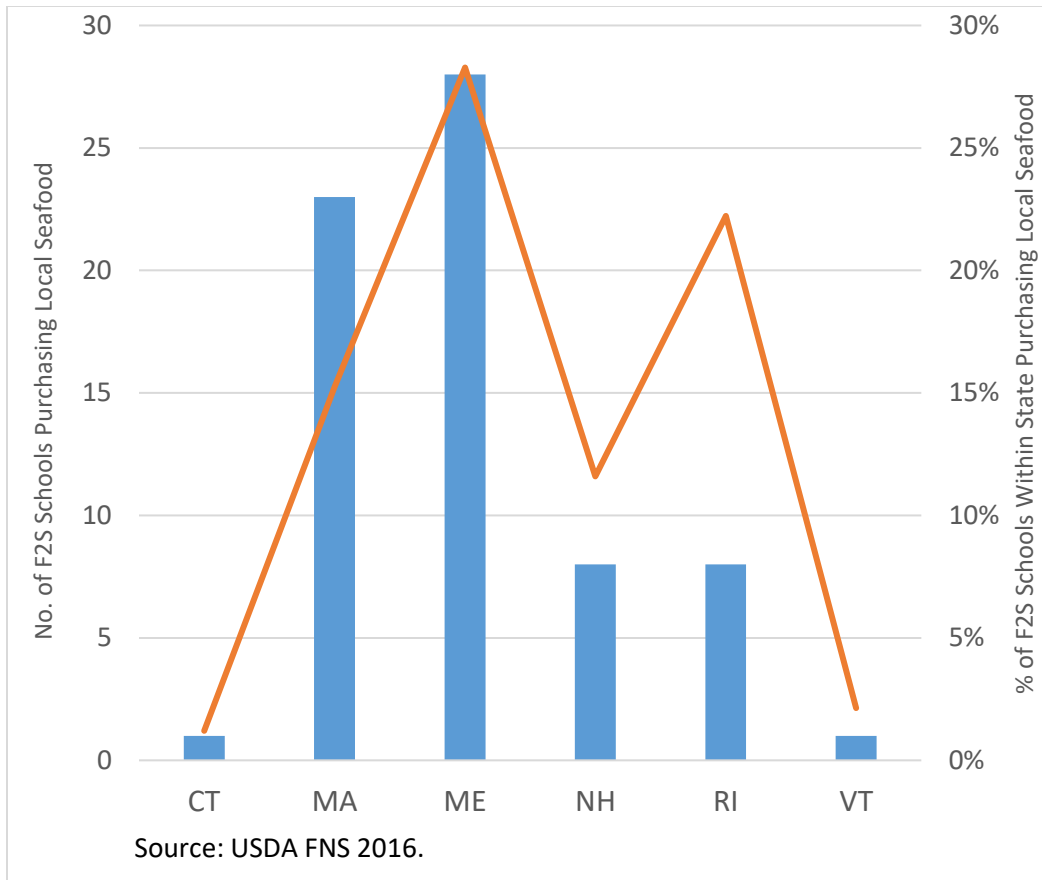


Figure 1. New England Schools Purchasing Local Seafood by State.

The number of New England schools buying local seafood is at least in part a function of their distance from the coast (Figure 2). The average distance of schools purchasing local seafood is 10 miles, with 67% of the schools located within 9 miles of the coast and 95% located within 35 miles. The clustering of these schools at such short distances from the coast suggests that there are other explanations for their propensity to buy local seafood besides the issue that schools further from the coast may be less likely to classify seafood purchases as local. Transportation costs of local seafood to schools near the coast may be lower. Furthermore, it may be easier for schools near the coast to incorporate interactive seafood educational efforts into their curriculum that would complement local sourcing, such as having a fisherman visit their classroom and/or taking a field trip to a fishing port. Similarly, there may be greater cultural preferences by schools near the coast to support local fishermen. Yet another

possible factor is that schools near the coast have relatively higher socioeconomic levels than schools that are more distant and can afford to spend more money purchasing seafood. According to the 2015 Farm to School Census, the percentage of students on free and reduced-price lunch for New England schools buying local seafood was 30%, whereas this percentage was 36% for schools participating in farm to school activities but not buying local seafood.

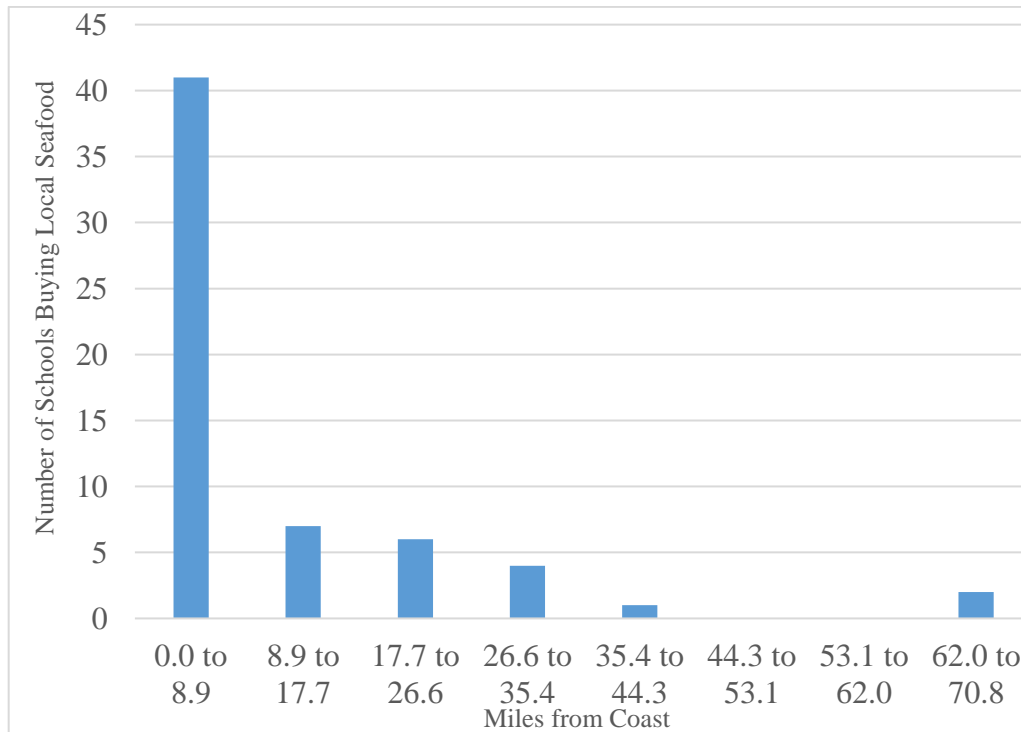


Figure 2. Distance from Coast of New England Schools Buying Local Seafood.

The most common response provided by New England schools buying local seafood with regard to the frequency of their purchases was ‘occasionally’. Only 5% were doing so on at least a weekly basis, with 28% doing so on at least a monthly basis. This finding is consistent with Purslow, Page, and Horwitz (2016). They found in a more detailed survey of 20 school nutrition directors in Maine, New Hampshire, and Massachusetts that among the schools buying local seafood, they were typically doing so once per month.

4. LOCAL SEAFOOD PURCHASES BY COLLEGES

USDA has not administered an analogous survey of colleges regarding local food procurement as with K-12 schools. However, Farm to Institution New England (FINE) undertook a survey of New England colleges about their local food procurement patterns in 2014-15. They received responses from 105 of the 209 colleges that they contacted and made de-identified individual responses publicly available (FINE 2017b). The food budget of 93 New England colleges was \$292 million. The use of food service management companies by schools is uncommon (Christensen, Jablonski, and O'Hara 2017). In contrast, 73% of New England colleges use food service management companies like Sodexo, while 27% have self-operated dining operations (FINE 2017a).

Sixteen percent of New England colleges identified seafood as one of the top five products that they purchase locally in terms of value (FINE 2017a). While this is a lower percentage than apples, milk, potatoes, and baked products, it is a greater percentage than eggs and chicken. In Figure 3, we report the number of respondents by state that indicated whether sourcing sustainable seafood would be a service that would be useful to their campus. Relative to other New England states, colleges in Connecticut expressed the greatest need for such a service (59%). The usefulness of such a service ranged between 29% and 36% in Massachusetts, Maine, New Hampshire, and Vermont.

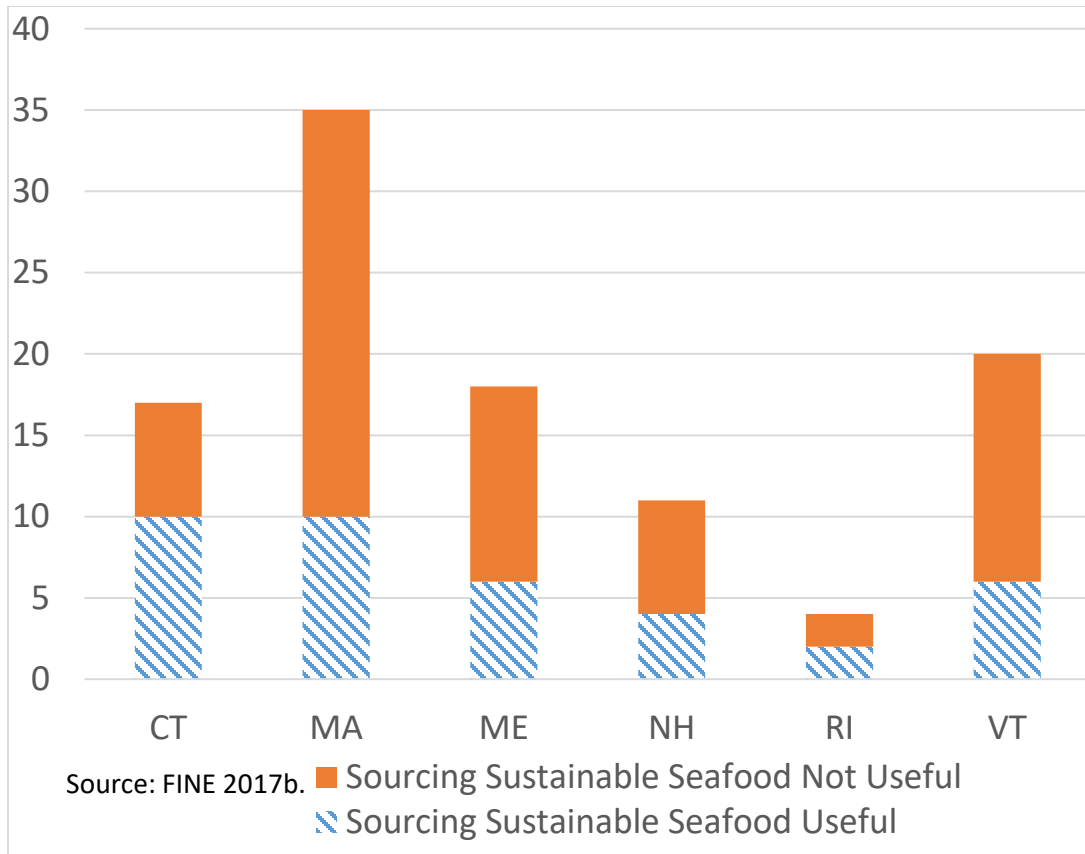


Figure 3. Usefulness of Sustainable Seafood Sourcing for New England Colleges by State.

Furthermore, 28% and 39% of New England colleges were successful in sourcing “many” and “a few” seafood products locally, respectively. The remainder of colleges either experienced difficulties, made no effort, or are uninterested in local seafood sourcing. New England colleges experienced less success in purchasing local seafood relative to fruits and vegetables, but experienced greater success in doing so when compared with poultry and meat. These relative patterns by food product are consistent with the responses provided to the top product purchased. In Figure 4 we report the percentages for these responses disaggregated by state. Colleges in Connecticut and Vermont experienced the greatest challenges with purchasing local seafood, which is consistent with the pattern that emerged with schools. The challenges that colleges in Connecticut confront provide an explanation as to why a relatively

high percentage of them would benefit from assistance with sourcing seafood. At least 73% of the colleges in each of the other four New England states experienced some success in sourcing local seafood.

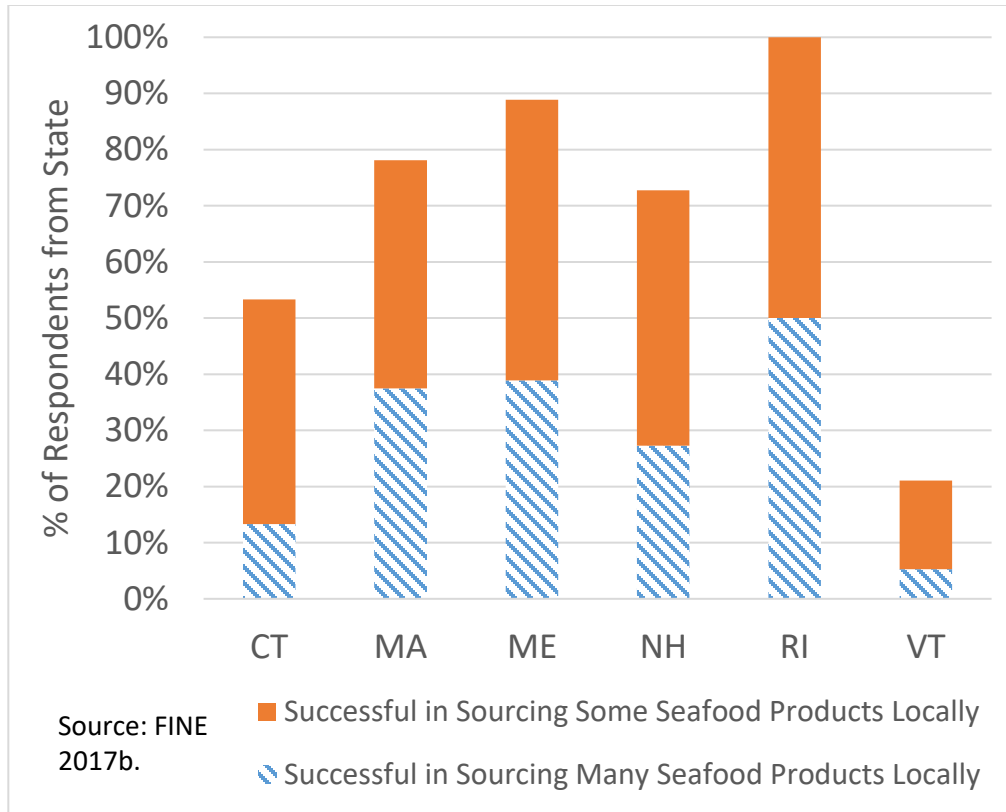


Figure 4. Success of New England Colleges in Sourcing Local Seafood by State.
Note: Calculation based on 99 responses, since 6 did not provide a response.

5. LOCAL SEAFOOD SPECIES PURCHASED

5.1 Local Seafood Purchasing Practices by New England Colleges

The institutional surveys developed by USDA's Food and Nutrition Service and FINE about local food procurement did not solicit specific questions about the types of seafood products purchased. Thus, they do not inform about the sustainability of local seafood purchases by New England institutions. Some information about the species of local seafood purchased by schools is available from Purslow, Page, and Horwitz (2016). They found variety in the types of

seafood that were served in schools, including kelp, lobster, clams, and pollock. They further found that baked haddock was the most commonly served local seafood product.

Analogous information has not been solicited from colleges to the same extent. This is an impediment to our understanding of these markets since colleges are purchasing local seafood to a greater degree than schools. To rectify this shortcoming, we undertook a brief survey about local seafood procurement practices of dining service managers at Maine colleges, as well as an additional college in Rhode Island that had a reputation for sourcing Gulf of Maine seafood. The survey asked colleges to provide information about which suppliers they use to procure seafood, if they are aware of the geographic source of their seafood, which species they purchase (both in general as well as from the Gulf of Maine), and their level of knowledge with regard to the ecological sustainability of the seafood that they purchase.

We received responses from Bowdoin College (ME), Unity College (ME), University of Southern Maine, University of Maine at Farmington, University of Maine at Machias, St. Joseph's College (ME) and Roger Williams College (RI). We augment our primary survey responses with preexisting case studies regarding local seafood sourcing of an additional three New England colleges: Colby College (ME), Harvard University, and the University of New Hampshire (FINE 2016a). FINE selected these three colleges due to the variation that they have in size, proximate population density, and management structure. Hence, the colleges that we reviewed do not represent a random sample, and it is likely that colleges that have placed a greater emphasis on sourcing local seafood products would have a higher probability of responding to the survey.

College dining services purchase food for a variety of purposes. The seafood products served via college catering programs tend to be shellfish and salmon (FINE 2016a). Thus, college purchases of locally abundant groundfish principally occur to serve in on-campus dining halls.

These ten colleges differ in the quantity of seafood that they purchase and the percentage that they source locally (Table 1). Some of the colleges serve seafood frequently; for instance, Colby and Harvard serve seafood at least five times per week. Our data also reveal that, in general, smaller schools appear to be purchasing a greater quantity of seafood locally than schools that purchase

seafood in greater quantities. In particular, five colleges purchase at least 75% of their seafood from the Gulf of Maine. One of the colleges – Roger Williams College – is geographically southwest of the Gulf of Maine. Thus, Roger Williams College indicated that they support fisheries throughout the Atlantic Ocean in addition to the Gulf of Maine. Other fisheries that they identified include Georges Bank, Cape Cod Bay, Block Island Sound, Point Judith, and Narragansett Bay.

In general, the college food service directors were highly engaged in trying to ascertain both the location of where the fish originated and the sustainability of their purchase. They used certification schemes as guidance to inform the latter issue for both their local and non-local seafood purchases. Nonetheless, the use of certification schemes by colleges did not imply that 100% of the seafood that they purchased was sustainably certified. These colleges also utilize different certification schemes for sustainability (Table 1). All of the colleges located near the Gulf of Maine use the Gulf of Maine Research Institute's (GMRI) Responsibility Harvested certification scheme. The Marine Stewardship Council's certification scheme is also commonly used since most of colleges are not purchasing local seafood exclusively.

5.2 Comparison of College Purchase Patterns with Overall Supply

Among locally abundant seafood species, there is a high degree of variation in the quantity that is landed. We further investigate whether colleges are purchasing locally abundant seafood that is more commonly marketed, like pollock, or whether they are instead purchasing species that are less commonly consumed, like dogfish. This comparison will inform the degree to which college food service directors are undertaking experimental efforts to introduce new species or instead serve species in which students may already have some degree of familiarity. This is informative to understand the ecological implications of local seafood markets because in a multispecies fishery, locally abundant species with low market demand may otherwise be discarded as bycatch.

Table 1. Summary of Seafood Purchased and Certification Schemes Employed.

	Quantity of Seafood Purchased	Location of Seafood	Use of Certification Schemes:			
			GMRI Responsibly Harvested	Marine Stewardship Council	Sodexo's Sustainable Seafood Policy	Monterey Bay Seafood Watch
Bowdoin College (ME)	40,840 lbs / year	63% Gulf of Maine	X	X		
Colby College (ME)	39,000 lbs / year (white fish)	25% Gulf of Maine	X	X	X	
Harvard University (MA)	11,000 lbs / month	25% Red's Best (100% local); 75% North Coast Seafood (some local)	X	X		
Roger Williams College (RI)	400 lbs / week	Throughout Atlantic Ocean				X
St. Joseph's College (ME)	200 lbs / week	80% Gulf of Maine	X	X		
Unity College (ME)	N.A.	100% Gulf of Maine	X			
University of Maine at Farmington (ME)	2,020 lbs / year	75% / 80% Gulf of Maine	X		X	X
University of Maine at Machias (ME)	N.A.	83% Gulf of Maine (goal is 100% by 2019)	X			
University of New Hampshire (NH)	12,318 lbs / year	28% Gulf of Maine	X			
University of Southern Maine (ME)	2,250 lbs / year	100% Gulf of Maine	X	X	X	X

Note: The University of New Hampshire also uses Best Aquaculture Practices and Alaska Responsible Fisheries Management Program certification schemes.

We compare which locally abundant groundfish are purchased by colleges with 2016 landings data from the Portland Fish Exchange (PFEX). We use the GMRI Responsibly Harvested classification scheme as a proxy for whether a species is 'locally abundant' for this comparison (GMRI 2018), though note that not all stocks designated as locally abundant are equally abundant (Table 2). The PFEX auctions are the predominate market location for Maine's groundfish, which are either landed by boat or trucked in from another harbor in Maine (Brewer 2014, Cowpoerthwaite and Clime 2015). PFEX publically disseminates species-specific price and quantity market data as a quasi-public, non-profit entity. Some of the PFEX buyers, such as Harbor Fish Markets, PJ Merrill Seafood, and Red's Best, sell seafood locally to institutions like schools and colleges (PFEX 2018). However, approximately 70% to 90% of the seafood sold at PFEX leaves Maine (Cowpoerthwaite and Clime 2015; Jongerden pers. comm.). Thus, in the aggregate, the composition of the fish species sold at PFEX would not be extensively influenced by local market activity.

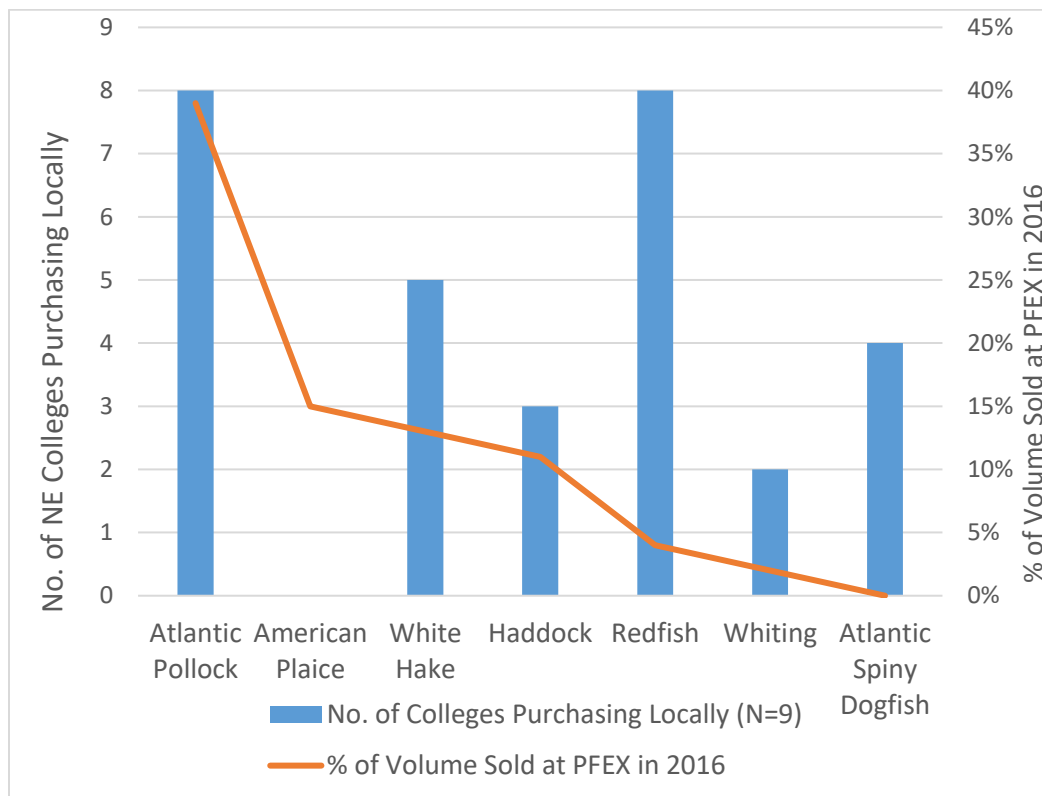


Figure 5. GMRI Responsibly Harvested Groundfish Purchases by New England Colleges. Note: one of the responding colleges did not provide species-specific detail.

Atlantic pollock accounted for 39% of the volume of fish landed at PFEX in 2016, and it was also purchased by eight of the nine New England colleges in our case study that reported species-specific information (Figure 5). White hake and redfish are also commonly purchased by New England colleges; however, they comprise a smaller proportion of PFEX landing volume than pollock (13% and 4%, respectively). Haddock, which was the most common local seafood purchased by schools, was purchased by three of the colleges and accounted for 11% of the volume of PFEX landings. Gulf of Maine haddock is highly abundant, with stocks estimated at 2.23 times the management target (Table 2). Furthermore, while American plaice comprised 15% of the volume of PFEX landings, it was not purchased by local colleges. Whiting and dogfish were not landed at PFEX in significant volumes and were not among the most commonly purchased species by New England colleges. Notably, whiting is the most locally abundant of these stocks, with stock sizes estimated at 2.45 times the management target (Table 2). To summarize, colleges tended to purchase locally abundant groundfish that were landed in greater volumes at a greater frequency. Thus, while they were making an effort to source locally, they also appeared to focus on more familiar species. As well, the stocks in highest local abundance were not always those in demand. However, there were exceptions to this generalization, particularly in the case of redfish.

Table 2. Summary of stock status of locally abundant stocks.

Stock	Stock status (B/Bmsy)
Whiting, Gulf of Maine / Northern Georges Bank	2.45 (above target)
Haddock, Gulf of Maine	2.23 (above target)
Haddock, Georges Bank	1.39 (above target)
Pollock, Gulf of Maine / Georges Bank	1.47 (above target)
Redfish, Gulf of Maine / Northern Georges Bank	1.17 (above target)
White hake, Gulf of Maine / Georges Bank	0.88 (below target; year 14 of 10 year rebuilding plan)
Spiny dogfish, Atlantic Coast	0.87 (below target)
Plaice, Gulf of Maine / Georges Bank	0.84 (below target; year 4 of 10 year rebuilding plan)

Source: NMFS (2017).

6. CONCLUSION

We conclude that New England colleges have been more proactive than schools at incorporating local seafood into dining hall menus. One explanation is that the student bodies of colleges are generally larger than that of schools. Thus, colleges may be able to offer a broader array of food options. Furthermore, local seafood may be a relatively expensive purchase for a school relative to its overall food budget, particularly for schools operating their budget at a deficit. This could constrain schools that are buying local seafood from doing so frequently. Similarly, schools with limited resources that are implementing farm to school programs primarily for nutritional purposes may prioritize culinary education and local procurement around other food products, like fruits and vegetables, relative to seafood.

A fundamental difference between an agricultural commodity and wild-caught seafood is that the latter is a common-pool resource susceptible to overharvesting. Thus, if local seafood markets are going to be economically and ecologically sustainable over time, the type of seafood species being marketed and the information available to purchasers to inform whether a species is “locally abundant” becomes uniquely important. We found that institutional purchasers are using certification schemes as guidance to a considerable extent. Thus, the methods used for developing these criteria are important to prevent stimulating demand for a seafood species that is currently being sustainably harvested but could subsequently be overharvested. However, there is no readily accepted standard for ecological sustainability. In particular, some species, like white hake and American plaice, are certified as GMRI Responsibly Harvested even though the stocks are below their management target (Table 2; McClenachan et al. 2014). Hence, greater efforts to establish consensus around the criteria for developing these standards is a priority. Similarly, while Acadian redfish have been rebuilt and are currently locally abundant, this fishery has a history of collapse and life history characteristics that make it vulnerable to overfishing (Mayo 1998). Therefore, creating markets for species that are currently locally abundant creates a risk of contributing to future collapse (Lobo et al. 2010).

While sustainable food purchases can occur from any geographic location in principle, supporting local food production has emerged as an economic development priority in the United States. Data collection regarding supply chains

in local agricultural markets has undergone considerable improvement in recent years (e.g., USDA FNS 2016, USDA NASS 2016); however, analogous advances have not occurred with regard to seafood distribution systems. Our case study of New England groundfish reveals that many questions about the efficacy and scale of local seafood market channels remain unanswered. Thus, surveys of institutions, restaurants, fishing cooperatives, seafood distributors, and seafood processors with regard to their involvement in local seafood marketing would be valuable in demonstrating the social impacts that such marketing opportunities provide.

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