Maine's Seafood Baseline

SEA Maine

Seafood Economic Accelerator

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Prepared by

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About this report

Maine's Seafood Baseline was commissioned by the Marine Resources & Benchmarking subcommittee of SEA Maine, the seafood economic accelerator. The subcommittee is charged with understanding the current and future natural, economic, and demographic 'seascapes' of Maine's marine resource economy and providing data inputs to the broader work of SEA Maine.

The goal of this project is to provide Maine seafood industries and stakeholders with a detailed, accurate, and integrated understanding of the current baseline information of the seafood economy sector and demographic data. Through this project, the subcommittee is fulfilling its charge to identify and assess existing and anticipated resource reports and datasets, identify current gaps in resource analysis, and inform the data used in SEA Maine's roadmap. The subcommittee is also identifying capacity and targets for growth and economic impact in order to help align SEA Maine with other complementary marine resource economy efforts.

This project was funded by

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Executive summary

Maine's seafood industry has experienced extraordinary changes over the last decade, including climate change-driven market disruptions, unprecedented supply and labor challenges during the COVID-19 emergency, and record-high overall value statewide in 2021. A warming Gulf of Maine promises to bring continued uncertainty and dynamicism to the state's seafood productivity, and demographic shifts combined with economic turmoil could significantly impact overall value and reshape the approaches businesses must take to adapt and prosper. Underlying these general trends are significant differences in the characteristics and outlook of the industry's diverse segments, and myriad new and longstanding challenges are being encountered by stakeholders and policymakers.

Nonetheless, the state is well-positioned to continue its recent history of success and resilience. Recognizing this, Seafood Economic Accelerator for Maine (SEA Maine), a consortium of seafood industry professionals, policymakers, and marine resources thought leaders have charted a course to develop a roadmap for the establishment of policies, initiatives, and investments to secure a prosperous future for all segments of the marine resource economy. From licensing and permitting to logistics to interstate and international exports, SEA Maine's roadmap will provide solutions that address challenges and opportunities wherever Maine's iconic seafood is found, from harvest and production to point of sale.

Two important prerequisite steps in developing SEA Maine's roadmap are the development of an inventory and initial curation of the current data available to assist in decision making and the establishment of seafood industry baseline

against which to measure progress and impact. In order to take these steps, SEA Maine contracted with Gardner Pinfold Consultants, Homarus Strategies, and the University of Maine's Office of Innovation and Economic Development to work with seafood industry stakeholders to develop this baseline assessment. This report, along with the data and information included in the accompanying online dashboard, present the results of this benchmarking enterprise.

There are dozens of species harvested for seafood markets in Maine, and hundreds more marine species are available for purchase by collectors for aquaria or other purposes. In order to efficiently and effectively reflect Maine's seafood economic baseline SEA Maine's Data & Benchmarking Subcommittee identified thirteen species or species complexes, reflecting culturally, ecologically, and/or financially important market segments, for this analysis. In this report, key quantitative and qualitative elements of each market segment were analyzed and presented using publicly available data, and domestic and international marketing opportunities were estimated for each based on an analysis of import/export data. The analysis used Harmonized Tariff System (HTS) codes reflecting SEA Maine focal species for international and state-level imports and exports (discussed in detail in the Market Opportunity section, pp. 31). Overall, this analysis estimates a minimum of $425.6 million market development opportunity for Maine production of the 13 focal species in domestic and international markets (Table 1.1). These market opportunity estimates are based on market demand and not on increased production.

Table 1.1. SEA Maine focal species' domestic and international marketing growth opportunities.

Species	US market opportunity ($ million)	Int'l market opportunity ($ million)	Total market opportunity ($ million)
Lobster	74.0	20.3	94.3
Bait	4.0	Unknown	4.0
Oyster	4.7	1.4	6.1
Mussel	1.2	0.1	1.3
Scallop	10.3	1.3	11.6
Soft-shell clam	0.6	6.8	7.4
Atlantic salmon	230.0	6.8	236.8
Groundfish complex	10.3	1.0	11.3
Atlantic halibut	7.9	1.5	9.4
Bluefin tuna	7.1	0.5	7.6
American eel (elvers only)	0.2	1.6	1.8
Kelp & seaweeds	14.0	20.0	34.0
Jonah crab	Unknown	Unknown	Unknown
Total	*364.3*	*61.3*	*425.6*

In order to supplement raw data with human context and stakeholder expertise across industry segments, the project team conducted one-on-one or small group telephonic semi-structured interviews, allowing the report to capture the perspectives of seafood business owners and thought leaders. Semi-structured interviews are conducted using a predesigned set of questions while providing subjects the opportunity to expand their answers and to share additional information, opinions, and perspective. We developed an interview guide, and questions that were relevant to each stakeholder were presented to each participant (see Appendix C).

In order to further supplement raw data with human context and stakeholder expertise across industry segments, the project team convened seafood sector members in a facilitated workshop discussion format. The objective of the workshop was to learn about ways SEA Maine can enable and invest in the prosperity of Maine's living marine resource economy. The February 17, 2022 workshop brought together fisheries, aquaculture, and seafood supply chain stakeholders to identify the strengths, weaknesses, opportunities, and threats ("SWOT") of the industry.

Based on the interviews and workshop, five themes for growth with 13 core strategic actions are presented for further consideration across SEA Maine:

Theme 1: Full resource utilization

- Adopt quality grading standards and pricing differentials
- Specify and pursue by-product opportunities

Theme 2: Maximizing value

- Review seasons to improve raw material quality
- Strategic integration within market segments

Theme 3: Maximizing prices

- Gain greater control over the value chain
- Take steps to differentiate product

Theme 4: Marketing and market timing

- Invest in the Maine seafood brand
- Invest in U.S. seafood brand
- Develop accessible market intelligence
- Market access challenges/solutions
- Resolving obstacles to market responsiveness

Theme 5: Labor and logistics

Addressing the workforce challenge

Coordinating transportation and cold storage logistics

Additional species and species complex-specific analyses and recommendations for access, permitting, and market development are contained in the respective focal species subsections within Section 5.

I. Introduction

Background and Purpose

Maine's seafood industry has experienced extraordinary changes over the last decade, including climate change-driven market disruptions, unprecedented supply and labor challenges during the COVID-19 emergency, and record-high overall value statewide in 2021. A warming Gulf of Maine promises to bring continued uncertainty and dynamicism to the state's seafood productivity, and demographic shifts combined with economic turmoil could significantly impact overall value and reshape the approaches businesses must take to adapt and prosper. Underlying these general trends are significant differences in the characteristics and outlook of the industry's diverse segments, and myriad new and longstanding challenges are being encountered by stakeholders and policymakers.

Nonetheless, the state is well-positioned to continue its recent history of success and resilience. Recognizing this, Seafood Economic Accelerator for Maine (SEA Maine), a consortium of seafood industry professionals, policymakers, and marine resources thought leaders have charted a course to develop a roadmap for the establishment of policies, initiatives, and investments to secure a prosperous future for all segments of the marine resource economy. From licensing and permitting to logistics to interstate and international exports, SEA Maine's roadmap will provide solutions that address challenges and opportunities wherever Maine's iconic seafood is found, from harvest and production to point of sale.

Two important prerequisite steps in developing SEA Maine's roadmap are the development of an inventory and initial curation of the current data available to assist in decision making and the establishment of seafood industry baseline against which to measure progress and impact. In order to take these steps, SEA Maine contracted with Gardner Pinfold Consultants, Homarus Strategies, and the University of Maine's Office of Innovation and Economic Development to work with seafood industry stakeholders to develop this baseline assessment. This report, along with the data and information included in the accompanying online dashboard, present the results of this benchmarking enterprise.

Benchmarking Approaches - Data Inventory

The seafood production baseline for Maine presented here used publicly available datasets from state, regional, and federal agencies including the Maine Department of Marine Resources (DMR), the Atlantic Coast Cooperative Statistics Program (ACCSP), and the United States Census Bureau. In order to present relevant information in a uniform manner, the period of record from the years 2010 to 2020 were selected and is used throughout this report.

There are at least 200 marine species that can be purchased from licensed dealers and collectors in Maine. Of these, 11 individual species and 2 species groups were selected that represent the majority of seafood economic activity in Maine as well as the diversity of geographies and harvest or cultivation methodologies. Information concerning access, production, market opportunity, and benchmarking recommendations are included for each.

Seafood landings and value data were accessed and compiled from ACCSP and DMR online databases. DMR fisheries license and aquaculture lease data

were used to provide demographic and spatial information. We classified three regions of the state (Eastern, including Washington and Hancock counties; Midcoast, including Waldo, Knox, and Lincoln counties, and Southern, including Sagadahoc, Cumberland, and York counties), which are referred to periodically throughout the report. DMR shellfish dealer licenses were used to provide dealer location information.

Benchmarking Approaches - Stakeholder Interviews

In order to supplement raw data with human context and stakeholder expertise across industry segments, the project team conducted one-on-one or small group telephonic semi-structured interviews, allowing the report to capture the perspectives of seafood business owners and thought leaders. Semi-structured interviews are conducted using a predesigned set of questions while providing subjects the opportunity to expand their answers and to share additional information, opinions, and perspective. We developed an interview guide, and questions that were relevant to each stakeholder were presented to each participant (see Appendix C). Prospective participants were contacted via email and asked to self-schedule an interview. The interviews were designed to last approximately one hour.

Benchmarking Approaches - SWOT Workshop

In order to further supplement raw data with human context and stakeholder expertise across industry segments, the project team convened seafood sector members in a facilitated workshop discussion format. The objective of the workshop was to learn about ways SEA Maine can enable and invest in the prosperity of Maine's living marine resource economy. The February 17, 2022 workshop brought together fisheries, aquaculture, and seafood supply chain

stakeholders to identify the strengths, weaknesses, opportunities, and threats ("SWOT") of the industry.

A SWOT analysis is used to assess competitiveness and to lay the foundation for strategic planning and roadmap development. The four elements of the SWOT are briefly explained as follows:

- **Strengths** – usually within your control and give you advantages to succeed.
- **Weaknesses** – usually within your control, where drawbacks or limitations must be addressed to succeed.
- **Opportunities** – usually external, competitive, and must be approached strategically in order to be developed.
- **Threats** – usually outside your control, but awareness of risks and competition can minimize threats.

SWOT elements can relate to any part of the **value chain** including: resource sustainability, access, infrastructure and capital, handling and quality, maximum utilization, high value products and markets, regional considerations throughout Maine, and price optimization.

As mentioned, SWOT analysis is a key step toward strategic planning and roadmap development. The workshop allowed participants to begin this process by suggesting **strategies** that draw on strengths to address opportunities and threats. These are also summarized in Appendix B and are developed further in Section 3, which focuses on SWOT synthesis and looking ahead.

Four workshop sessions were conducted through the day, each with a focus on key seafood species groups as follows:

- **Session 1:** Elver/American eel, finfish aquaculture, & kelp **(32 participants)**
- **Session 2:** Groundfish and pelagics **(25 participants)**
- **Session 3:** Mollusks & sea urchins (wild & cultivated) **(32 participants)**
- **Session 4:** Lobster, crab, and baitfish **(25 participants)**

The sessions were hosted online with participant input captured on a mural board (see Appendix). Participant comments are summarized and organized with limited editing to preserve authenticity of the comments. Each comment is numbered for tracing back to original comments on the mural board. None of the comments are attributed to specific individuals, however the lists of registered participants are presented in the Appendix.

II. Maine's seafood resource - statewide data and trends

Access

Maine's commercial fishermen and aquaculture professionals access the state's living marine resources through a permitting system outlined in state law and implemented through a licensing system administered by the Department of Marine Resources (DMR). There are 98 DMR permit categories in Maine (see Figure 2.1 and Table 2.1). The Eastern region of the state is home to the most license holders, followed by Midcoast and then the South. The most common DMR issued permits provide access to the lobster resource.

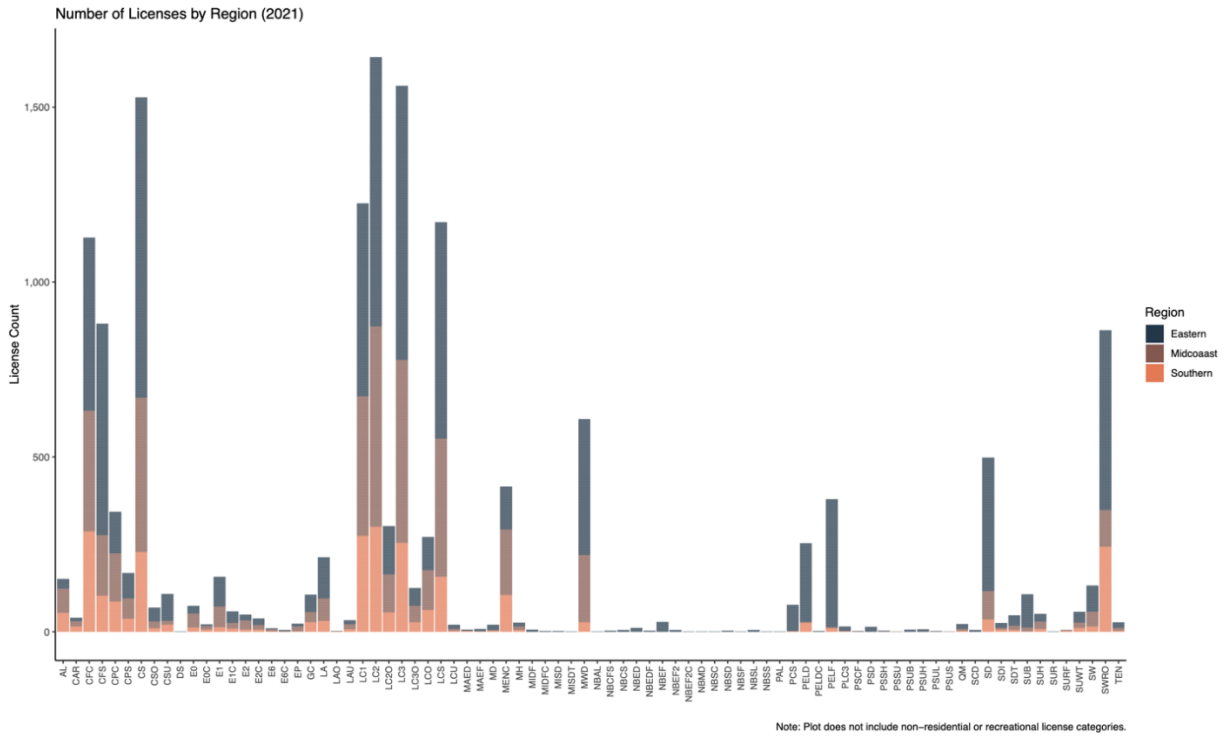


Figure 2.1. Number of licenses issued by the Maine Department of Marine Resources, by license category and region.

Table 2.1. Maine DMR license codes and counts of license holders over time.

Code	License	2021	2020	2019	2018	2017	2016
AL	Aquaculture (AL)	151	157	139	123	1	0
CAR	Carrier (CAR)	40	0	0	0	0	0
CFC	Commercial Fishing Crew (CFC)	1127	1095	1087	1069	1086	960
CFS	Commercial Fishing Single (CFS)	881	767	937	934	962	875
CPC	Commercial Pelagic and Anadromous Crew (CPC)	343	645	475	196	180	108
CPS	Commercial Pelagic and Anadromous Single (CPS)	168	319	295	217	194	107

CS	Commercial Shellfish (CS)	1528	1531	1536	1400	1463	1715
CSO	Commercial Shellfish +70 (CSO)	69	68	62	64	70	64
CSU	Commercial Shellfish Under 18 (CSU)	108	108	106	74	82	118
DS	Demo Scuba (DS)	1	1	1	1	1	1
EP	Eel Pot/Hoop Net (EP)	23	18	23	25	19	20
E1	Elver 1 Fyke Net (E1)	157	159	148	149	148	132
E1C	Elver 1 Fyke Net Crew (E1C)	58	63	68	57	56	55
E2	Elver 2 Fyke Nets (E2)	49	47	44	46	46	48
E2C	Elver 2 Fyke Nets Crew (E2C)	38	44	48	45	42	41
E0	Elver Dip Net (E0)	74	77	75	86	79	105
E6	Elver Dip Net 1 Fyke Net (E6)	10	10	8	14	15	20
E6C	Elver Dip Net 1 Fyke Net Crew (E6C)	5	6	8	4	5	4
E0C	Elver Dip Net Crew (E0C)	21	16	17	19	20	15
GC	Green Crab (GC)	106	134	113	111	107	110
LCO	Lobster/Crab +70 (LCO)	271	287	262	268	259	254
LA	Lobster/Crab Apprentice (LA)	213	205	263	296	344	387
LAO	Lobster/Crab Apprentice +70 (LAO)	2	2	1	1	4	2
LAU	Lobster/Crab Apprentice Under 18 (LAU)	33	33	23	20	26	21
LC1	Lobster/Crab Class 1 (LC1)	1225	1271	1275	1239	1195	1258
LC2	Lobster/Crab Class 2 (LC2)	1643	1695	1708	1777	1848	1946
LC2O	Lobster/Crab Class 2 +70 (LC2O)	302	309	304	305	299	274
LC3	Lobster/Crab Class 3 (LC3)	1561	1474	1505	1514	1512	1435
LC3O	Lobster/Crab Class 3 +70 (LC3O)	125	117	122	123	118	110
LCS	Lobster/Crab student (LCS)	1171	1107	1178	1209	1259	1217
LCU	Lobster/Crab under 18 (LCU)	20	33	25	31	37	24
MAEF	MAL ELVER 1 FYKE (MAEF)	8	9	9	8	8	8
MAED	MAL ELVER DIP (MAED)	6	4	5	5	6	5
MWD	Marine Worm Digging (MWD)	608	804	775	812	896	896
MENC	Menhaden Commercial (MENC)	415	2	0	0	0	0

MICS	MIC COMM SHELLFISH (MICS)	0	0	0	2	4	0
MIDF	MIC ELV DIP 1 FYKE (MIDF)	6	5	6	6	1	7
MIDFC	MIC ELV DIP 1 FYKE CREW (MIDFC)	2	0	0	0	0	1
MIEF	MIC ELVER 1 FYKE (MIEF)	0	0	0	0	7	0
MLC1	MIC LOB/CRAB CLASS 1 (MLC1)	0	2	4	2	2	2
MIMWD	MIC MARINE WORM (MIMWD)	0	0	0	1	2	0
MISDT	MIC SCALLOP DIVER WITH TENDER (MISDT)	1	1	1	0	0	2
MISD	MIC SCALLOP DRAGGER (MISD)	2	3	3	3	2	2
MD	Mussel Dragger (MD)	20	25	17	20	21	22
MH	Mussel Hand (MH)	26	18	16	28	30	26
PAL	PASS APPR LOBSTER (PAL)	1	1	0	0	0	0
PCFC	PASS COMM FISH CREW (PCFC)	0	5	0	5	15	0
PCFS	PASS COMM FISH SINGLE (PCFS)	0	37	0	56	95	109
PCPS	PASS COMM PELAGIC SINGLE (PCPS)	0	0	0	0	0	1
PCS	PASS COMM SHELLFISH (PCS)	77	27	71	46	72	159
PELF	PASS ELVER 1 FYKE (PELF)	379	394	339	224	181	147
PELFC	PASS ELVER 1 FYKE CREW (PELFC)	0	0	0	0	2	0
PELD	PASS ELVER DIP (PELD)	253	339	395	471	523	544
PELDC	PASS ELVER DIP CREW (PELDC)	2	3	0	0	2	0
PLC1	PASS LOB/CRAB CLASS 1 (PLC1)	0	0	0	1	0	3
PLC2	PASS LOB/CRAB CLASS 2 (PLC2)	0	0	0	0	0	1
PLC3	PASS LOB/CRAB CLASS 3 (PLC3)	15	11	8	9	16	7
PSDI	PASS SCALLOP DIVE (PSDI)	0	0	0	0	1	4
PSD	PASS SCALLOP DRAGGER (PSD)	14	10	10	12	19	19
PSW	PASS SEAWEED (PSW)	0	0	0	1	1	0
PSCF	PASS SUST COMM FISH (PSCF)	2	0	0	9	15	1
PSUL	PASS SUST LOBSTER (PSUL)	2	3	4	9	18	0
PSUS	PASS SUST SCALLOP (PSUS)	1	2	5	8	13	1
PSSU	PASS SUST SEA URCHIN (PSSU)	1	0	4	6	9	1

PSSH	PASS SUST SHELLFISH (PSSH)	3	2	8	9	17	11
PTEN	PASS URC/SCAL TENDER (PTEN)	0	0	0	1	1	1
PSUH	PASS URCHIN DIVER (PSUH)	7	3	2	3	5	6
PSUB	PASS URCHIN DRAGGER (PSUB)	6	6	6	9	14	11
NBAL	PENOB APPR LOBSTER (NBAL)	1	0	0	0	0	1
NBCFS	PENOB COMM FISH SINGLE (NBCFS)	3	2	2	4	3	0
NBCS	PENOB COMM SHELLFISH (NBCS)	5	0	0	2	5	0
NBEF	PENOB ELVER 1 FYKE (NBEF)	28	26	19	28	26	21
NBEF2	PENOB ELVER 2 FYKE (NBEF2)	5	7	6	7	7	7
NBEF2C	PENOB ELVER 2 FYKE CREW (NBEF2C)	1	0	0	0	0	0
NBED	PENOB ELVER DIP (NBED)	11	12	11	12	14	20
NBEDF	PENOB ELVER DIP 1 FYKE (NBEDF)	3	3	11	1	1	0
NBMD	PENOB MUSSEL DRAGGER (NBMD)	1	2	0	2	1	0
NBMH	PENOB MUSSEL HAND (NBMH)	0	1	0	0	0	0
NBSD	PENOB SCALLOP DRAGGER (NBSD)	3	2	0	2	2	0
NBSF	PENOB SUST FISH (NBSF)	1	0	0	0	0	0
NBSL	PENOB SUST LOBSTER (NBSL)	5	0	4	0	0	0
NBSC	PENOB SUST SCALLOP (NBSC)	1	0	2	0	0	0
NBSS	PENOB SUST SHELLFISH (NBSS)	1	0	1	0	0	0
QM	Quahog Mahogany (QM)	22	21	24	27	25	20
SWRO	Recreational Saltwater Fishing Operator (SWRO)	862	679	193	211	179	132
SDI	Scallop Diver (SDI)	25	22	23	21	22	25
SDT	Scallop Diver with Tender (SDT)	47	48	51	53	55	52
SD	Scallop Dragger (SD)	498	499	505	514	519	525
SCD	Sea Cucumber Drag (SCD)	5	5	6	8	8	8
SUH	Sea Urchin Diver (SUH)	51	56	53	63	66	66
SUB	Sea Urchin Dragger (SUB)	107	120	122	123	131	137
SUR	Sea Urchin Raking (SUR)	1	1	1	1	1	1
SUWT	Sea Urchin with Tender (SUWT)	57	62	73	74	75	80

SW	Seaweed (SW)	132	124	132	137	133	134
SURF	Surf Clam Boat (SURF)	5	3	4	4	2	3
TEN	Tender (TEN)	27	30	27	35	38	34

Participatory management is viewed as a hallmark and source of pride in Maine fisheries, and participatory engagement in decision making across industry segments and through market channels is likely to be a continued feature and asset of Maine's seafood economy. Aquaculture leases issued by DMR based on interest from individuals and businesses, and opportunity to produce seafood via aquaculture production is provided by access to a lease. DMR's leasing program is governed by Maine statute and the agency's own regulations and procedures. In order to provide equitable access to Maine's wild capture seafood resources while preventing their depletion, DMR and/or regional fishery management entities sometimes cap the number of fishing licenses/permits within each category. Some fishing permits are issues at the town level, which determine appropriate harvester numbers themselves. Other permits are not capped (open access). The fisheries licensing programs are governed by Maine statute, regulations, and procedures, and in some cases, participatory engagement with stakeholders.

As a result of these systems and driven by fishery productivity and harvester interest, the number of wild capture fishing permits issued across the focal species differ significantly (Figure 2.2). The geographic distribution of these licenses varies across the focal species, although a majority are more heavily distributed toward the Eastern region. Conversely, the number and distribution of aquaculture leases (Figures 2.10a-c & 11) are driven by site suitability, business interest, and constraints on the leasing system, which is facing significant bandwidth challenges. The issues stakeholders identified as slowing access to additional aquaculture lease sites were described in detail by interview and workshop participants. These include processing backlog

driven by budget and staffing challenges at DMR, structural issues with the permitting system (e.g., permitting requirements for gear changes), and political pressure brought by landowners and other interests opposed to aquaculture development.

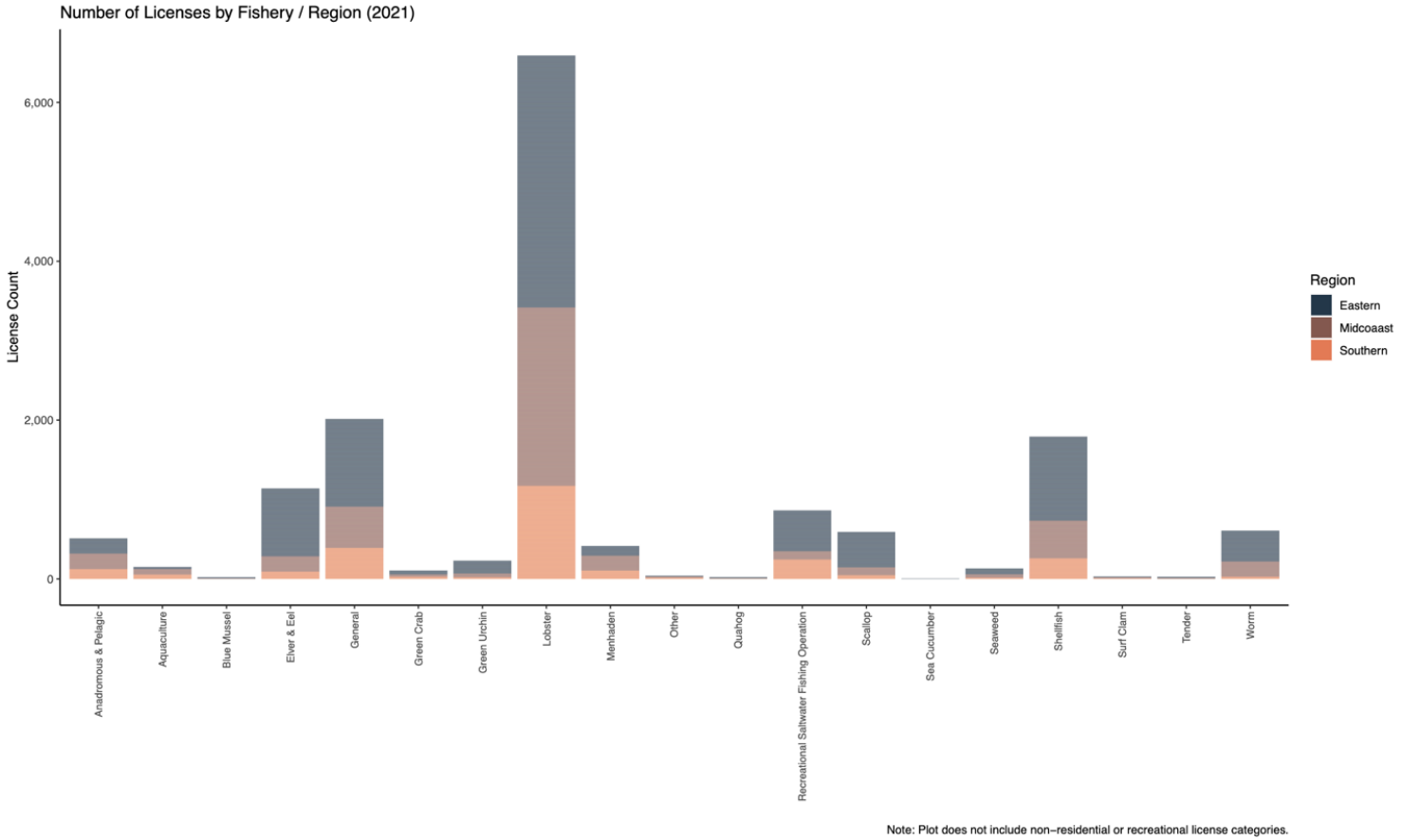


Figure 2.2. Number of licenses issued by the Maine Department of Marine Resources providing access to SEA Maine focal species and others, by region.

A significant majority of Maine's fishery and aquaculture participants possess a single permit (Figure 2.3). Maine's aquaculture permits and several commercial fishing permits allow the permitholder to grow/access multiple species. In 2021 there were 15,288 people possessing DMR issued permits, over 12,000 of whom were permitted to access a single fishery. During periods of decline or environmental disturbance, single permit holders may be less able to secure alternative means of employment within Maine commercial fisheries.

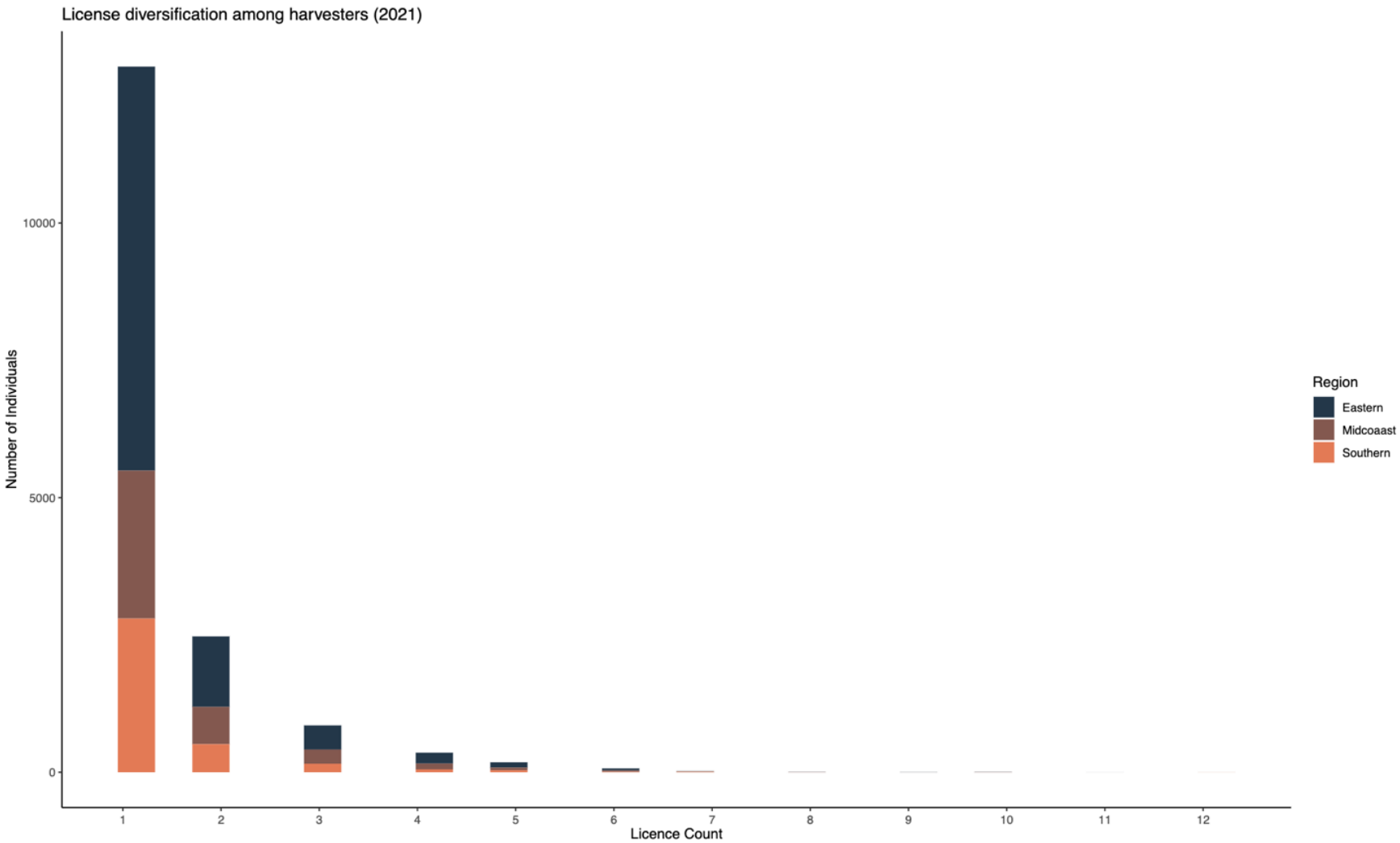


Figure 2.3. Number of individuals possessing counts of licenses issued by the Maine Department of Marine Resources, by region.

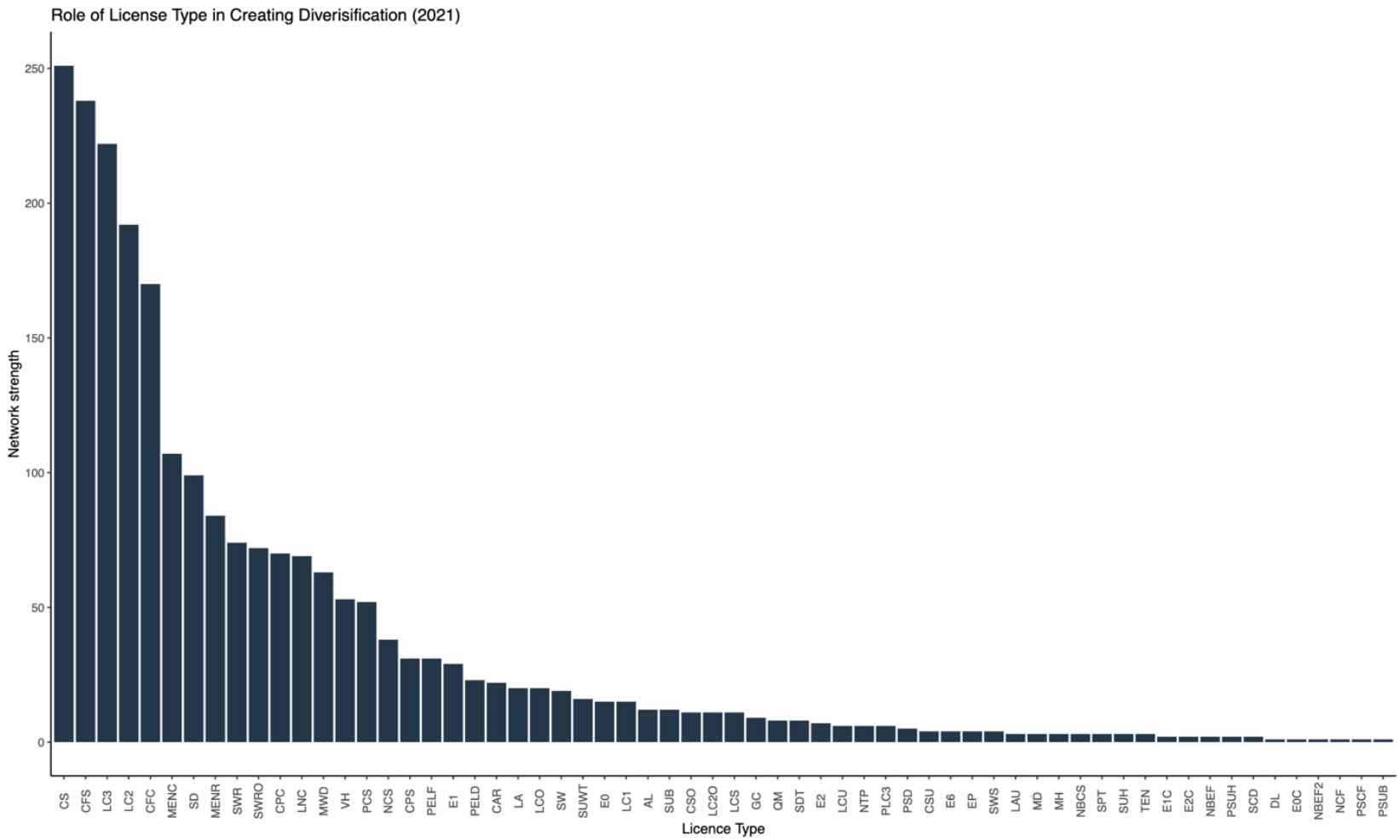


Figure 2.4. Relative likelihood (network strength) of a license to be paired with any other license, by DMR license category. Higher network strength means that there is a higher likelihood that the permit is paired with another by its holder. Network strength is an indicator of the relatedness of licenses that people hold, which is determined by license diversification. It is an indicator of degree centrality, where higher values

indicate the likelihood that a license category is paired with any other license category. The permit categories most likely to be paired with other permits are commercial shellfish, commercial fishing single, lobster class 2 and 3, and commercial fishing crew.

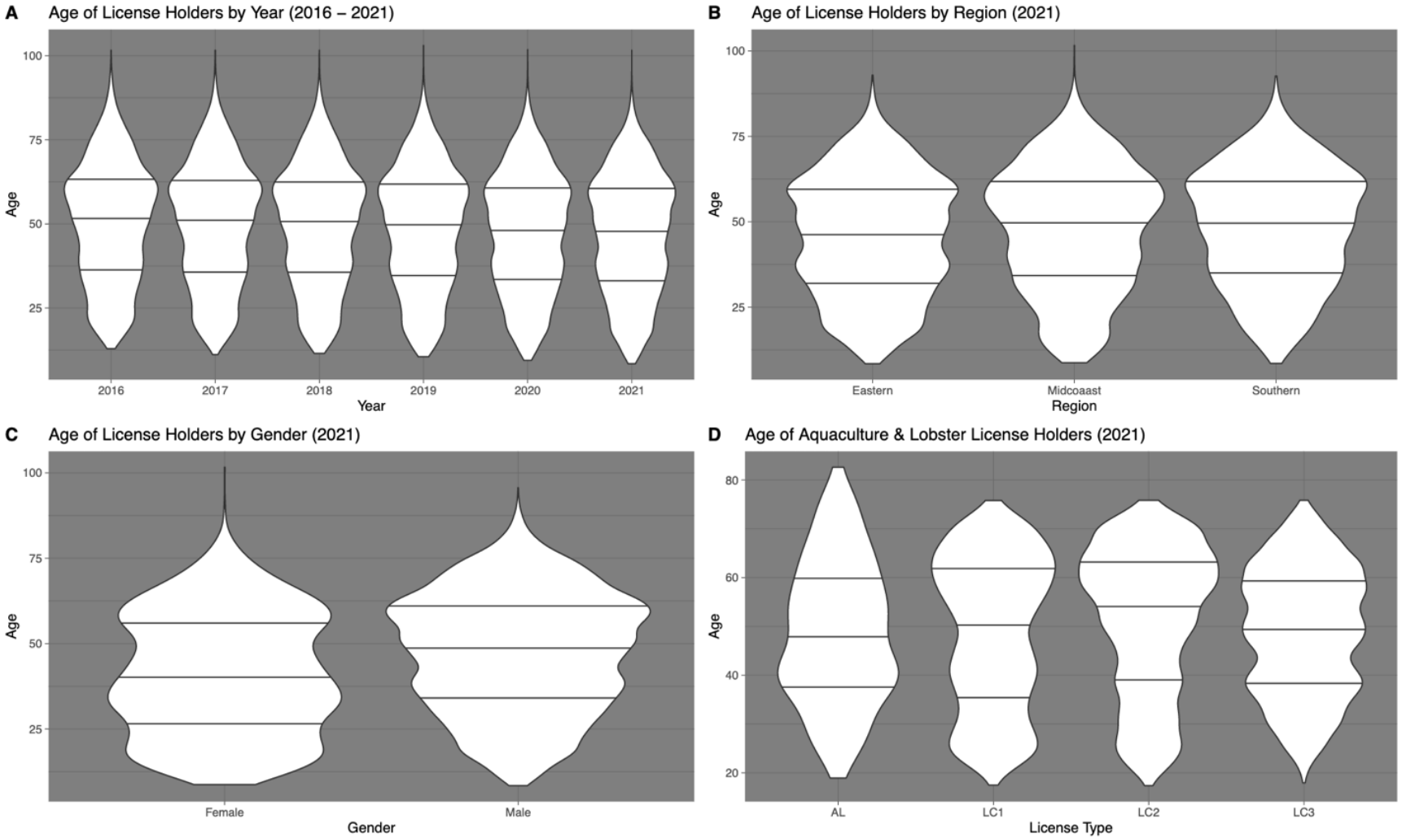


Figure 2.5. Violin charts indicating selected demographics of DMR license holders. Wider areas indicate greater proportion of the population listing selected demographic or indicators including location, gender, or license type at a particular age.

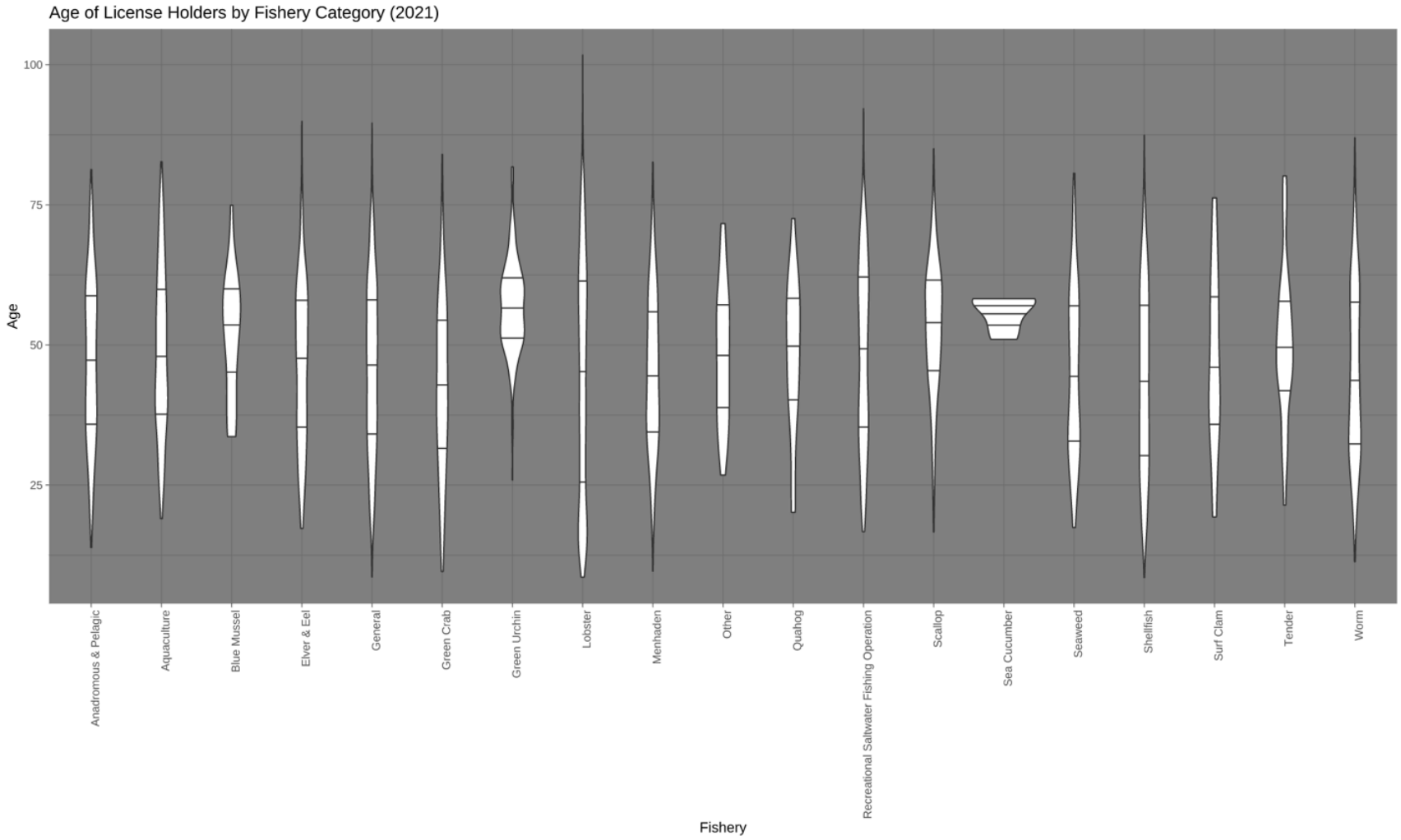


Figure 2.6. Violin charts indicating age of license holders across DMR permit categories for SEA Maine focal species and other industry segments. Wider areas indicate greater proportion of the population at a particular age. Several Maine fisheries have few or no younger participants, while fisheries, particularly lobster, with cultural or institutional support for young participants show diverse permit holder age.

Production

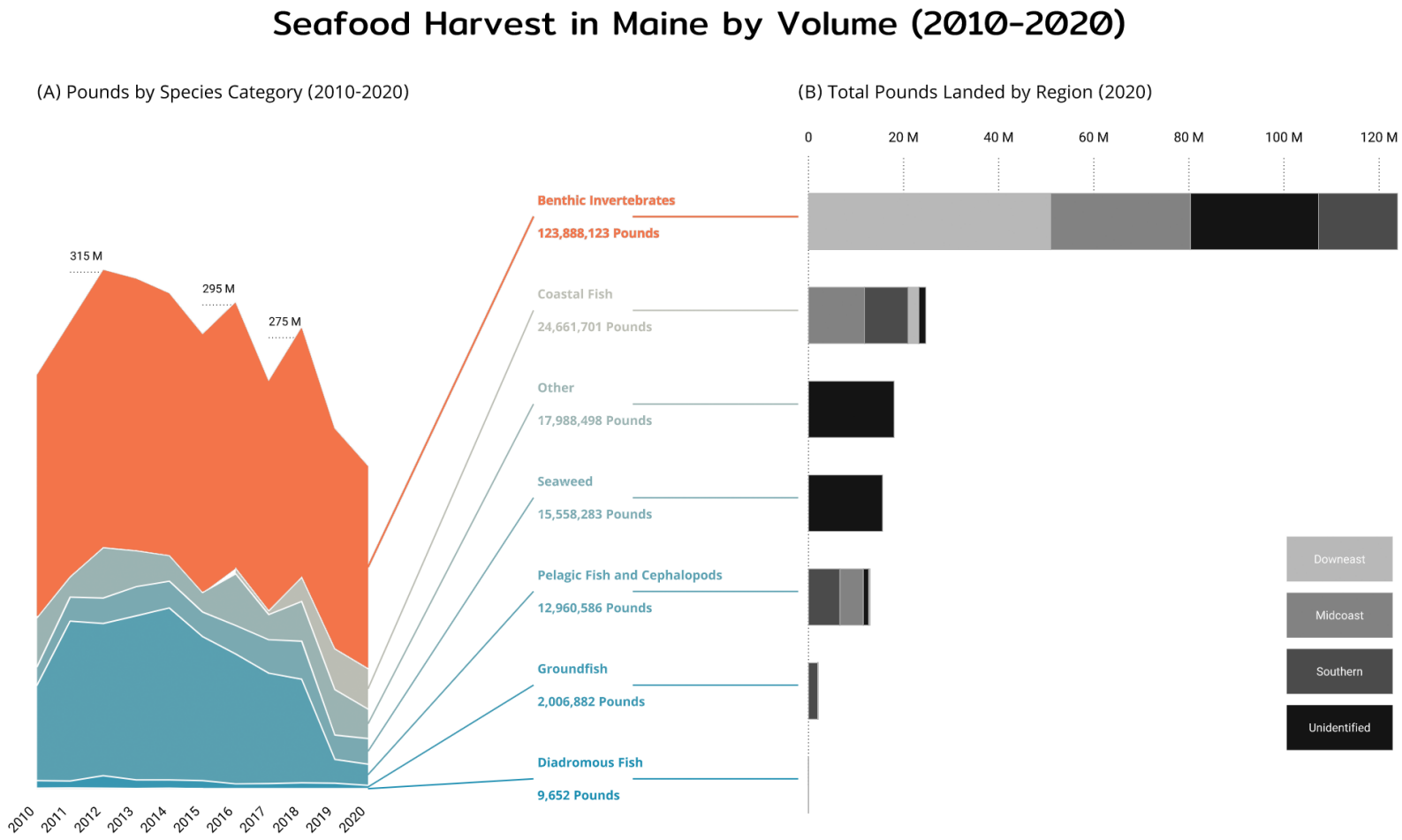


Figure 2.7. Seafood landings in Maine by volume over time & by species category (left panel) and 2020 volume across species category across Maine regions (right panel). Landings volume declined over the

period of record, driven in large part by declines in baitfish fisheries and to a degree by declines in lobster landings volume.

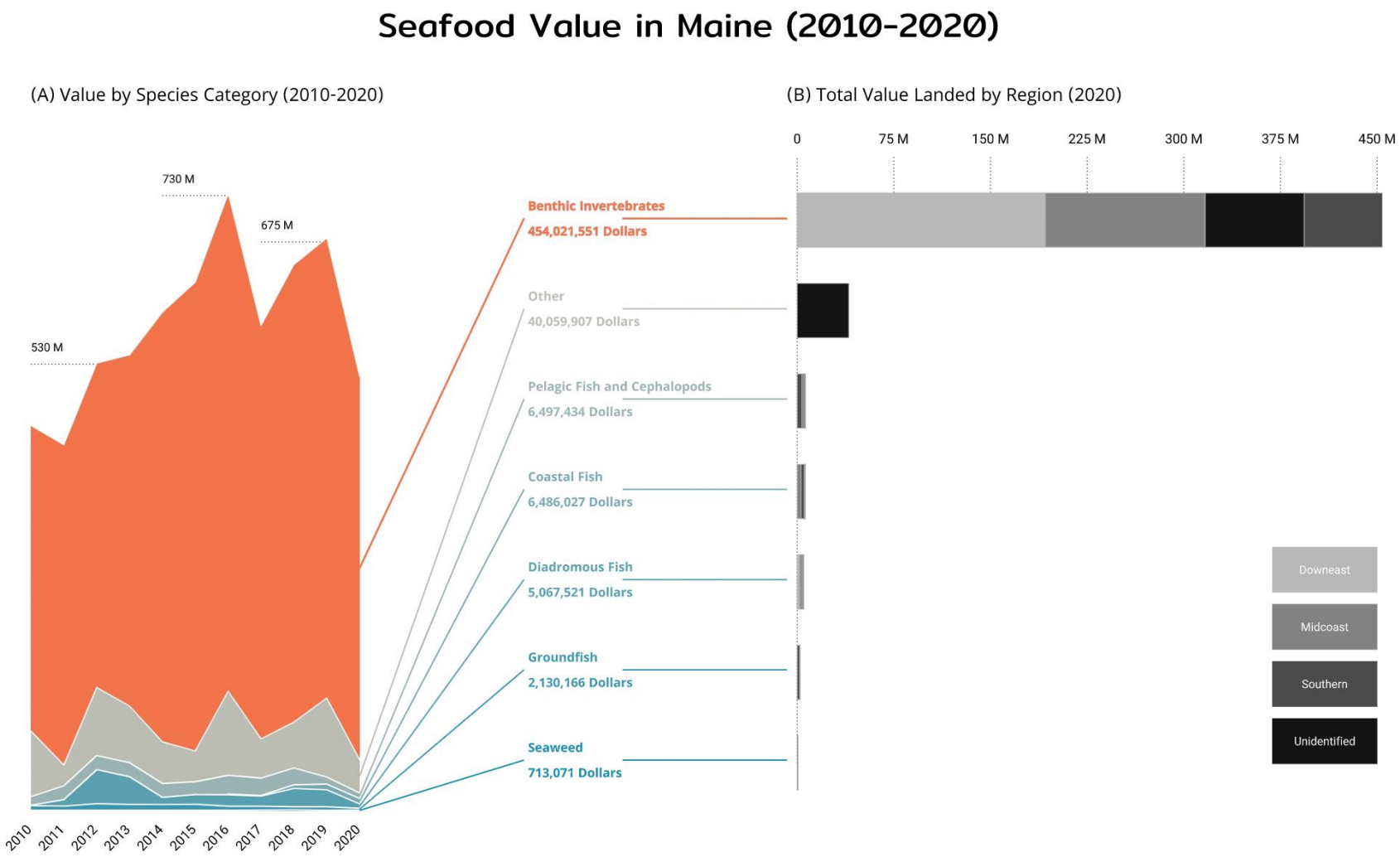


Figure 2.7. Seafood harvest in Maine by total value over time & by species category (left panel) and 2020 value across species category across Maine regions (right panel). Landings values increased over the period of record, peaking in 2016. Overall value in 2021 exceeded 2016 levels, buoyed by increased post-COVID-19 emergency demand and related high prices.

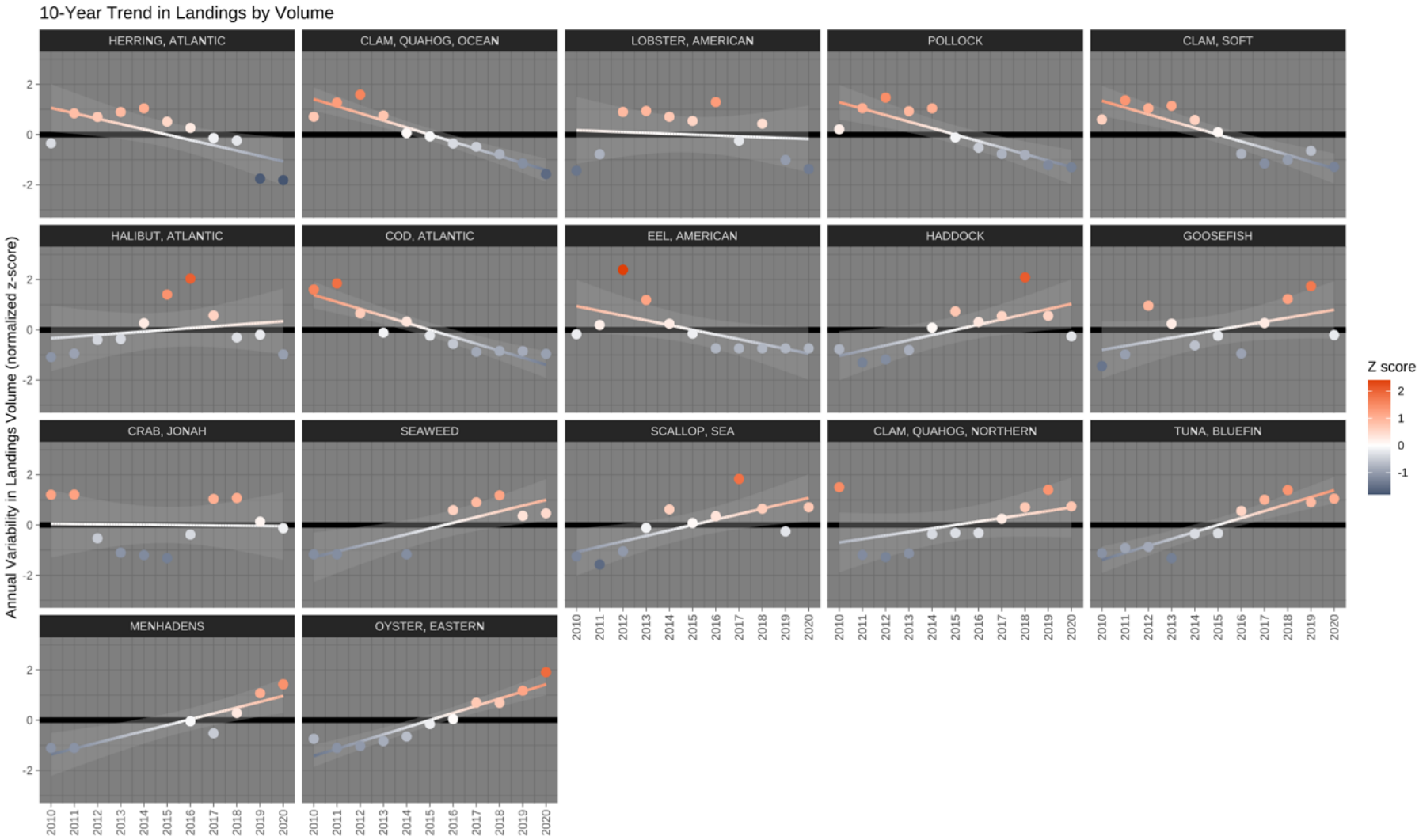


Figure 2.8. Annual variability in focal species landings volume in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-

scores indicate annual volume relative to the ten-year average. A majority of the focal species experienced steady or increasing volume over the period of record.

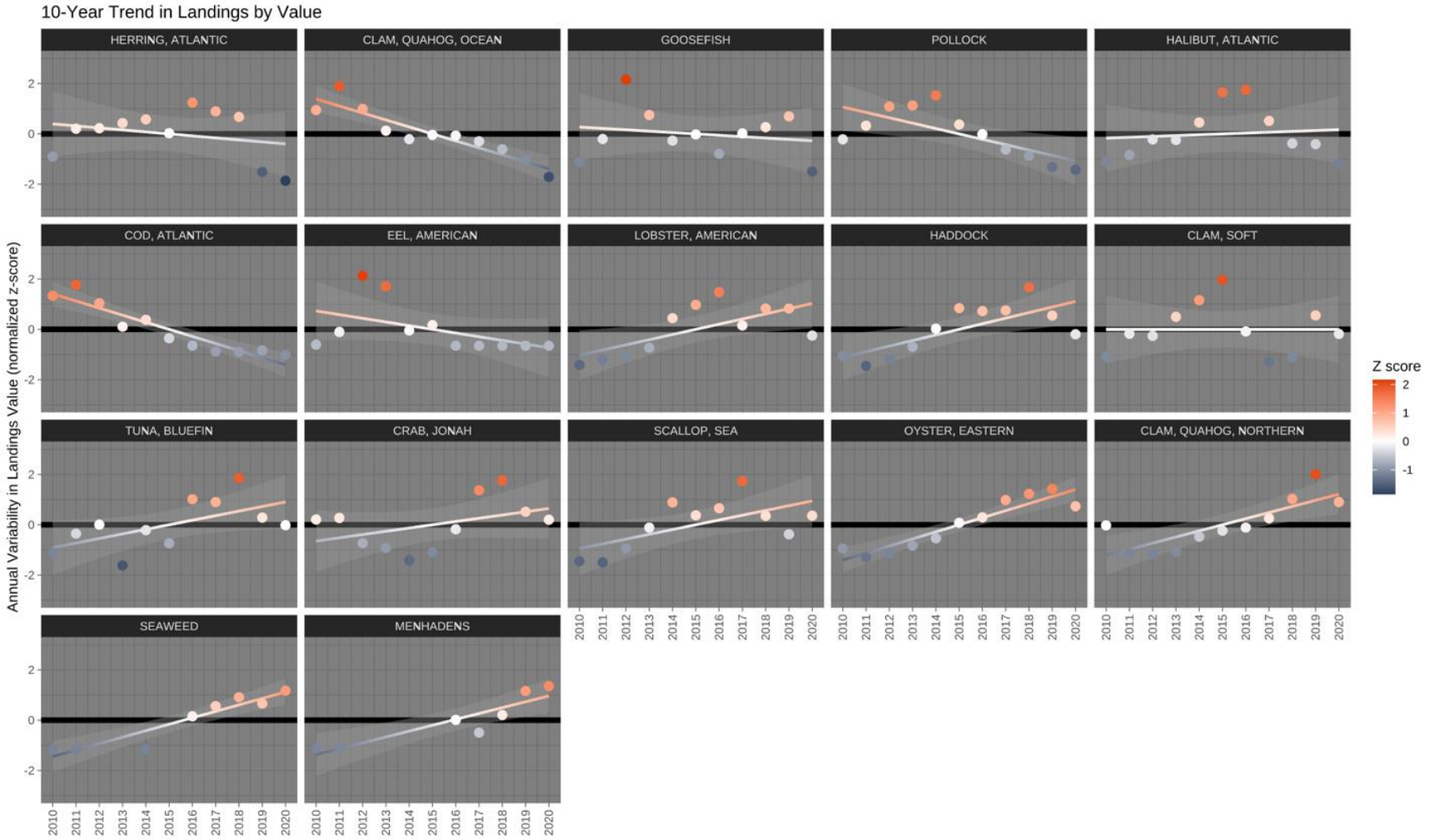


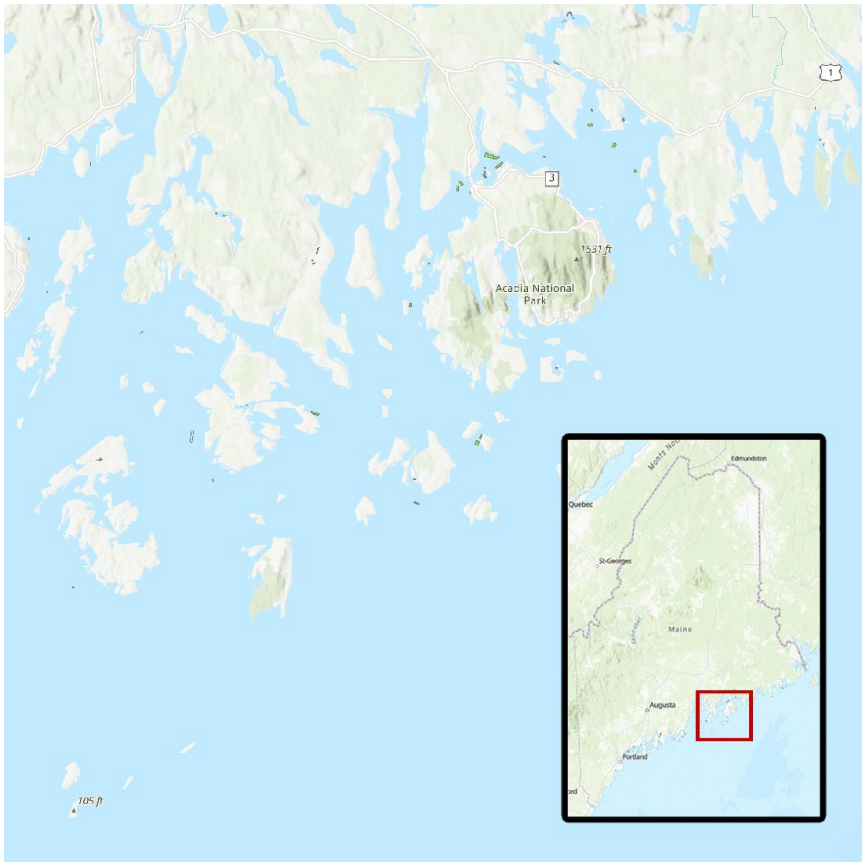
Figure 2.9. Annual variability in focal species landings value in Maine over the period of record from 2010-

2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual volume relative to the ten-year average. A majority of the focal species experienced steady or increasing value over the period of record.

Aquaculture Leases

Maine DMR issues leases for standard and experimental aquaculture leases of various sizes (Figure 2.10), and it issues Limited Purpose Aquaculture (LPA) leases of no greater than 400 square feet (Figure 2.11). In 2020 there were 187 standard and experimental aquaculture leases listing mussels, oysters, clams, Atlantic salmon, kelp and other marine algae, scallops, halibut, steelhead trout, cod, haddock, arctic char, and sea urchins as primary species, totaling 1768.5 acres under cultivation, and there were 769 LPA leases in the state. Most LPA leases are concentrated in Casco Bay and the Midcoast, while most standard and experimental aquaculture leases are clustered in Casco Bay, the Damariscotta River area, Frenchman Bay, and Cobscook Bay & Machias.

According to the US Department of Labor Statistics' Quarterly Census of Employment and Wages, in 2020 (the most recent complete reporting year) there were 39 aquaculture operations reporting wages in Maine, employing 361 people, and providing $15,943,568 in wages. Limited purpose aquaculture operations and other aquaculture leases that are operated by small businesses also brought significant income to the state, although they do not report wage data to the Department of Labor.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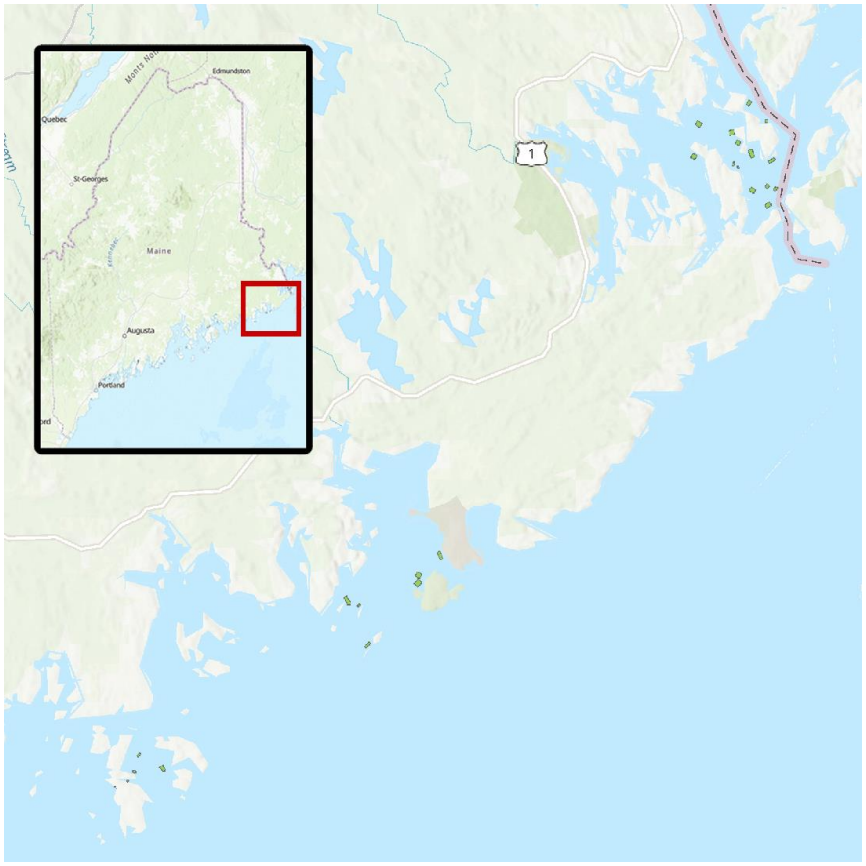


Figure 2.10a. Locations of Maine's aquaculture lease areas in the Frenchman Bay (left) and Cobscook Bay/Bold Coast regions of the state. Dark shaded areas indicate lease locations at scale. Source: Maine DMR.

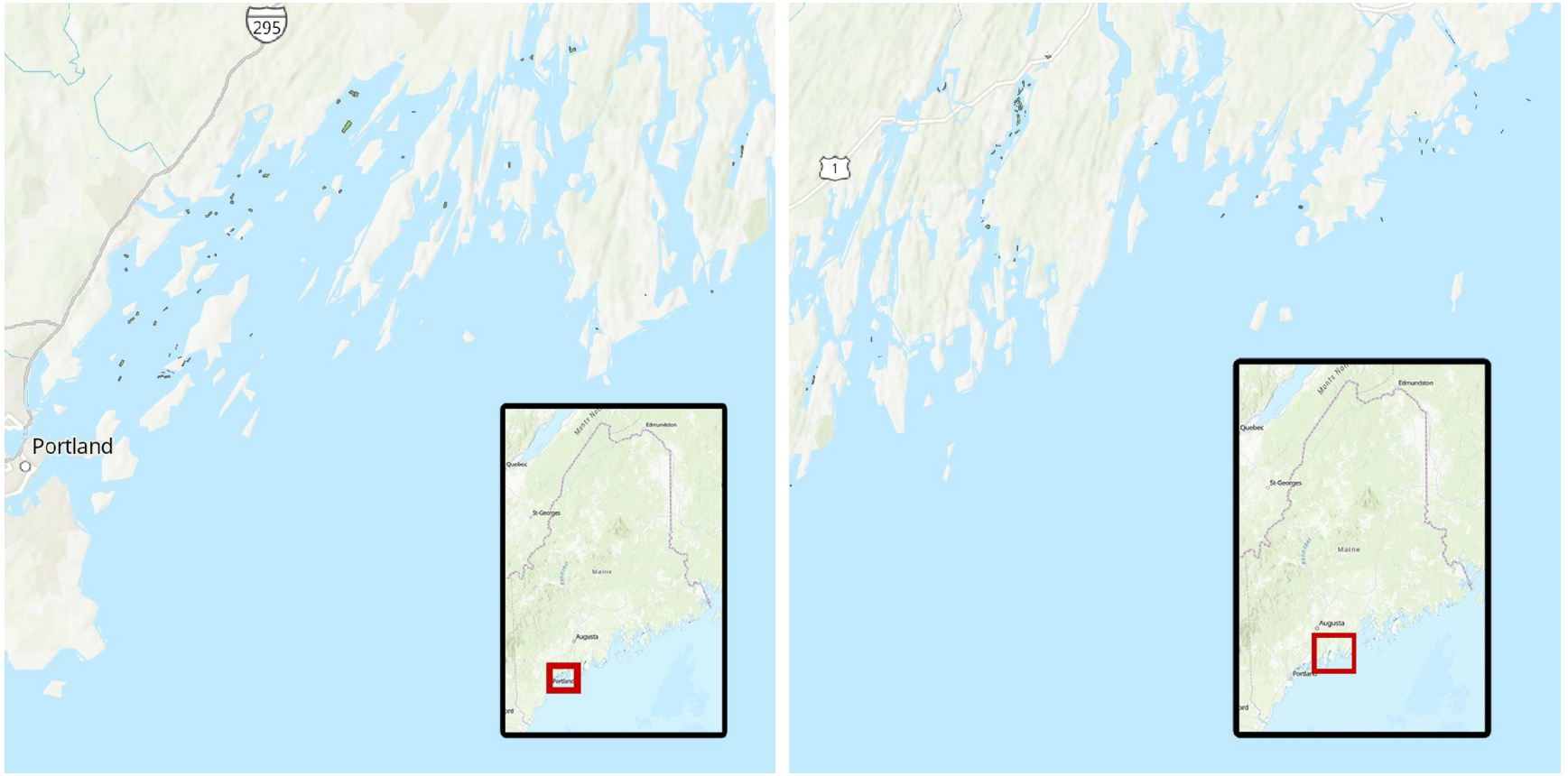


Figure 2.10b. Locations of Maine's aquaculture lease areas in the Casco Bay (left) and Damariscotta River/Muscongus Bay regions of the state. Dark shaded areas indicate lease locations at scale. Source: Maine DMR.

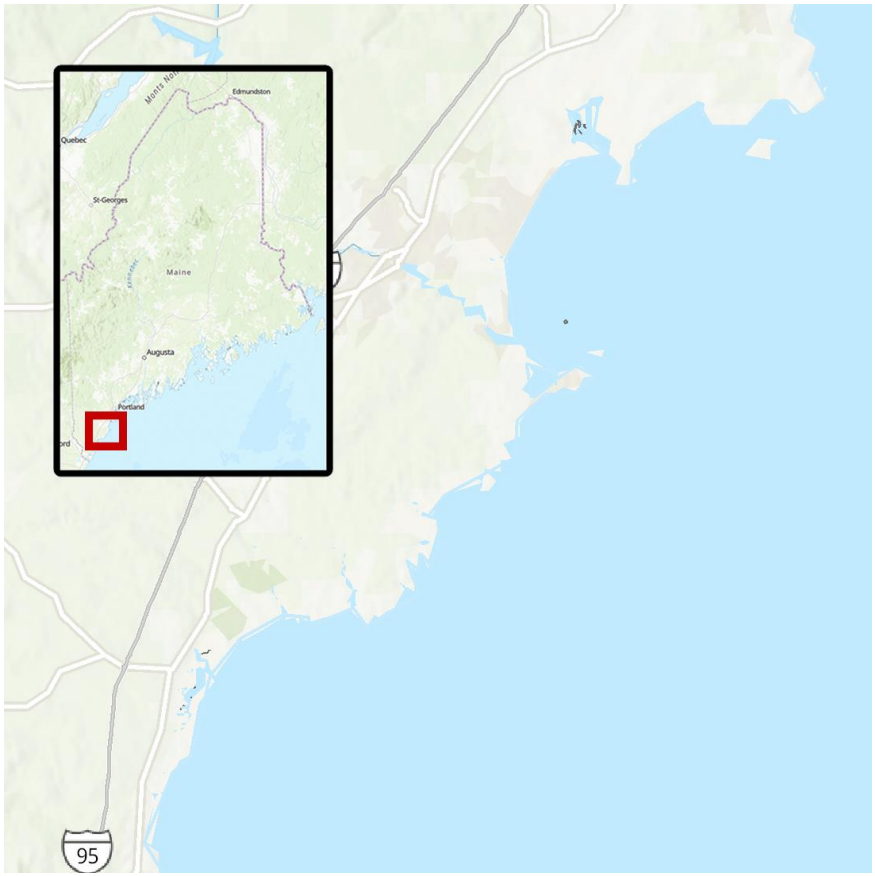


Figure 2.10a. Locations of Maine's aquaculture lease areas in Southern region of the state. Dark shaded areas indicate lease locations at scale. Source: Maine DMR.

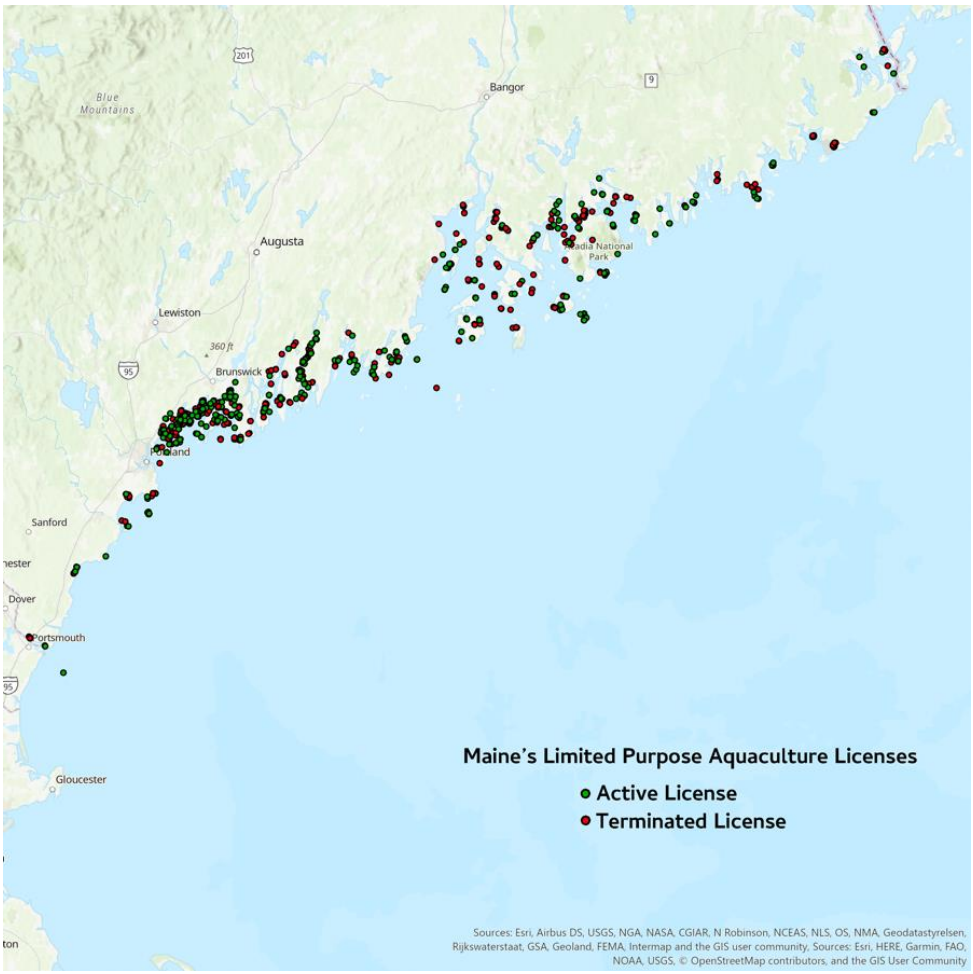


Figure 2.11. Locations of Maine's limited purpose aquaculture license areas in 2021. Source: Maine DMR.

Processing and Wholesaling

Maine issues licenses to shellfish dealers across 11 categories. These businesses are evenly distributed across the state's coastal communities (Figure 2.12). According to the US Department of Labor Statistics' Quarterly Census of Employment and Wages, in 2020 (the most recent complete reporting year) there were 29 seafood processors located in Maine employing 690 people and providing $29,154,841 in wages; there were 177 fish and seafood merchant wholesalers located in Maine employing 1,212 people and providing

$54,810,470 in wages; and there were 52 fish and seafood markets located in Maine employing 356 people and providing $11,063,025 in wages.

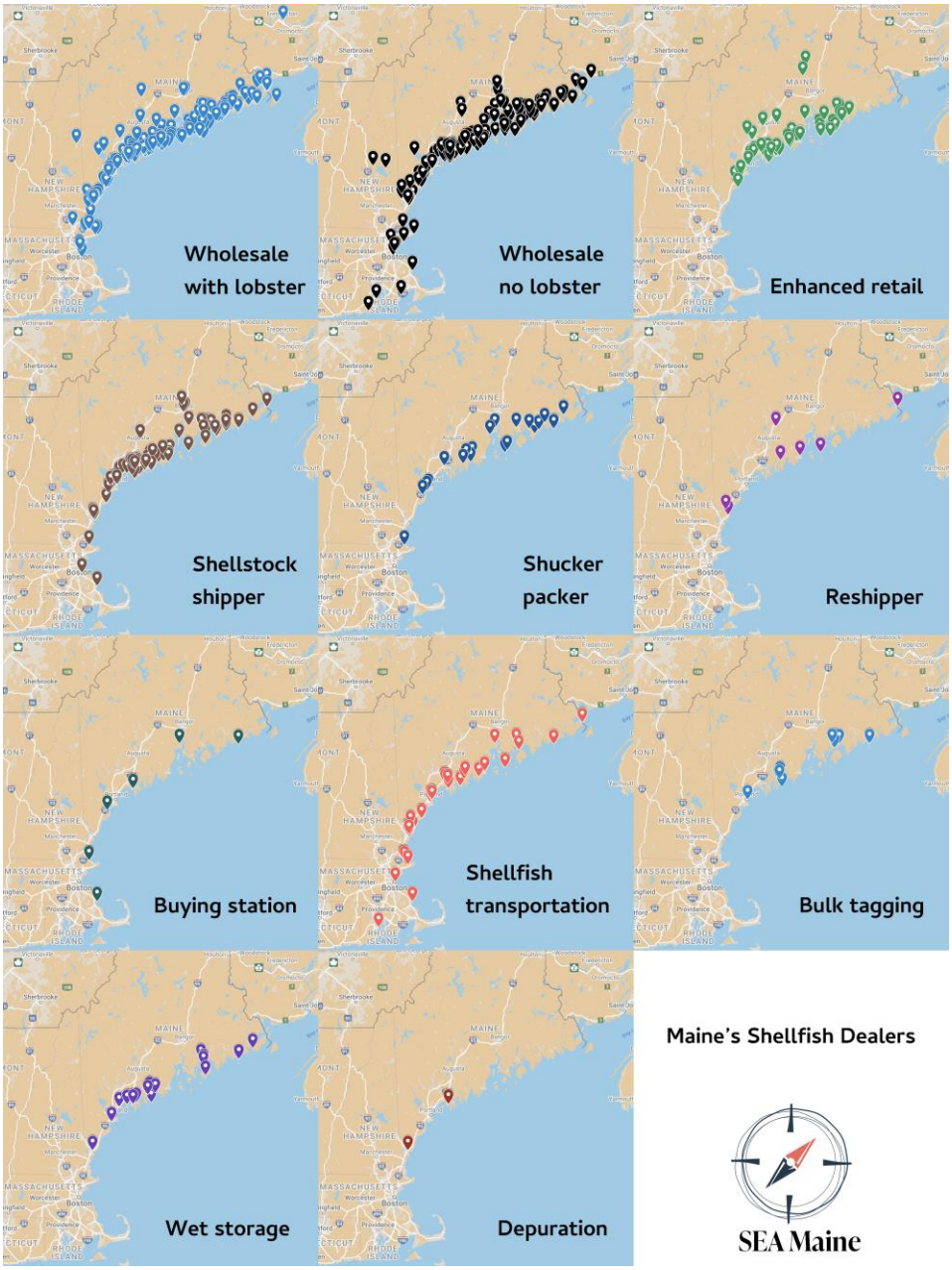


Figure 2.12. Locations of Maine's shellfish dealers, by license type. Source: Maine DMR.

Market Opportunity

The 2020 total Maine landings value of $525 million and 2021 value grew to $891 million in 2021. Maine international seafood exports in 2020 were worth $376 million and then $608 million in 2021. The $232 million growth in exports increased Maine's share of U.S. international exports from 13% to 17%. All of this occurred without drops in prices that would signal an over-supplied market. The following shows 2020 breakdowns of exports to correspond with the latest available landings data. This serves as the backdrop to the market analysis that utilizes international trade data to assess both domestic and international market opportunities with a combined total value of $625 million.

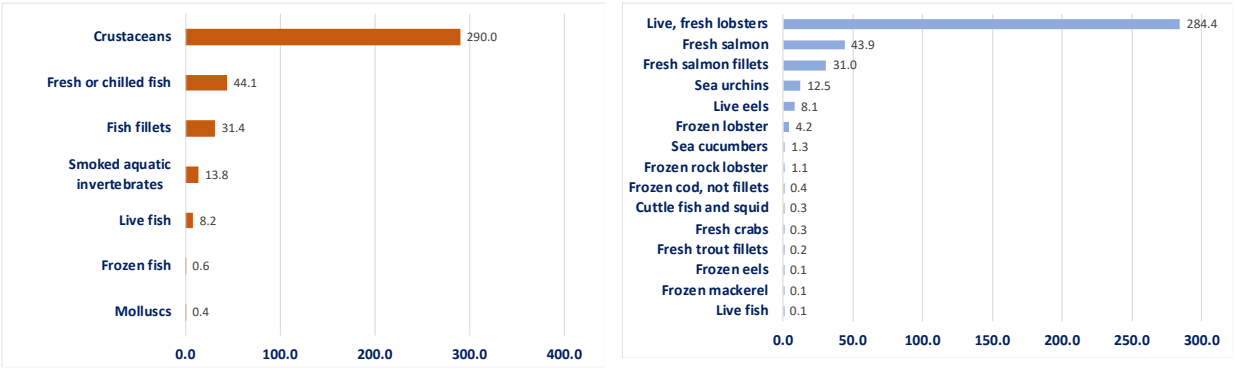


Figure 2.14. Maine international export values by top 4-digit (left) and 6-digit (right) harmonized system product codes in 2020 ($millions)

Source: U.S. Census Bureau.

It is important to recognize that about 72% of all Maine seafood exports are destined for Canada where lobster and some other species are processed then re-exported to the U.S. and other countries. The international exports from Maine are shown separately for Canada and other top countries in the figure below.

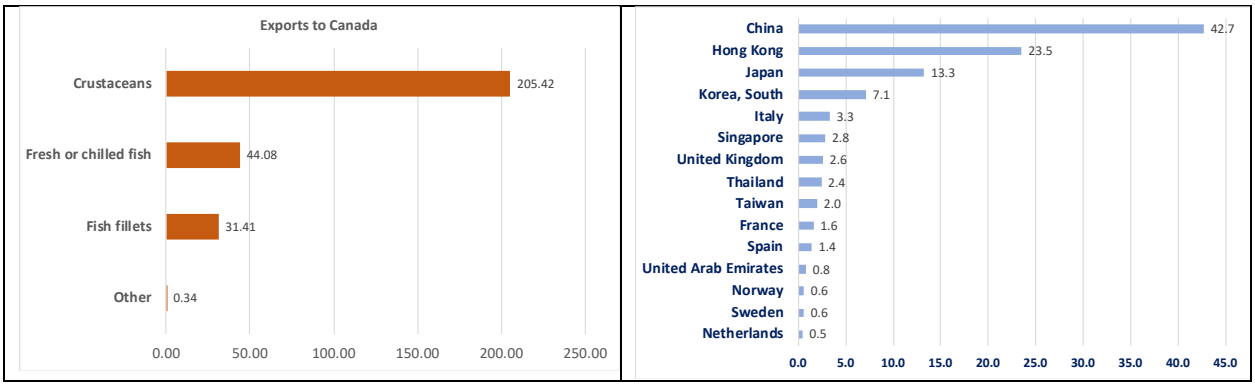


Figure 2.15. Maine international export values to Canada (left) and to other countries (right) in 2020 ($millions)

Source: U.S. Census Bureau.

In the last ten years Maine has already demonstrated capacity to grow exports with a 57% increase in the key crustacean category, and substantial increases across other categories except mollusks and fresh or chilled fish.

Keeping in mind Canada's disproportionate role as an export destination, Canada has been the largest market for aggregate volume and value growth with a 19% increase over the last decade. Greater than ten-fold increases have been captured in Hong Kong (947%), Singapore (1,182%), Thailand (2,942%), Taiwan (11,665%), and China (16,749%).

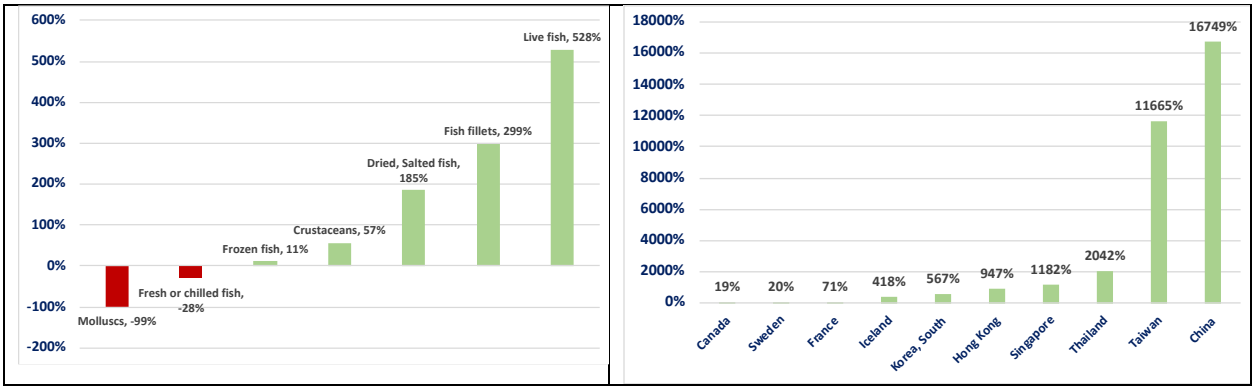


Figure 2.16. Maine international export % changes by product (left) and by top country (right), 2010-2020

Source: U.S. Census Bureau.

Building on Maine's demonstrated capacity to grow markets, the following examines the growth opportunity in domestic (U.S.) and international markets. There is at least a $570 million domestic growth opportunity, and a $61 million international export growth opportunity targeting a modest 10% increase in exports to key countries. The domestic and international opportunities for marine living resource markets are assessed as follows:

- **Domestic markets** - Interstate trade and state-level consumption data are not available therefore international import data is used as an indicator of growth opportunities in the U.S. The import data signals where states are not able to satisfy their needs with local supply and trends over the last decade show where growth is occurring. Maine products can out-compete international suppliers based on key advantages as long as target states are within reasonable transportation distances. Trust in Maine products, "buy-local" consumer trends, superior quality, and shorter supply-chains avoiding international borders all contribute to Maine potential. Import substitution is a desirable strategy for economic development, although this does not preclude competition with other U.S. suppliers as well.

- **International markets** – Export data examines Maine exports relative to U.S. exports to determine where Maine could capitalize on strengths and opportunities. For some products, international markets are more attractive than domestic markets given higher prices are achievable, as long as the product quality meets markets requirements, and the logistics are not prohibitive. The primary export markets for key products are explored to

identify the top countries where marketing and development should be focused.

Domestic

Based on growth in U.S. seafood imports over the last decade, there has been a $570 million net increase per year on average (including both growing and declining states). The figure below shows that Atlantic salmon ($235 million per year) is the largest growth opportunity, followed by lobster ($74 million). Although other species growth rates are smaller, relative to Maine's landings for these species, each one represents a significant domestic market opportunity. Within each species group there have been some shifts in product form (e.g., fresh/chilled, frozen, fillets, other) that are described in the species sections below. On one hand these estimates are conservative since this is based on annual import growth rather than all imports that could be displaced, and it does not include gaining market share from other domestic suppliers. On the other hand, targeting product growth in some parts of the U.S. may not be possible, particularly crab and salmon market growth for some states (e.g., Alaska and Florida respectively).

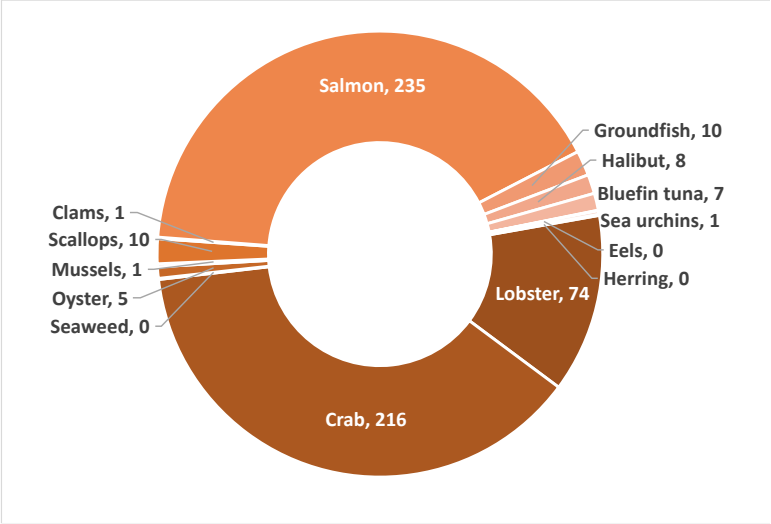


Figure 2.17. U.S. seafood import growth by species group, 2012 - 2021 ($570 million/yr)

Source: U.S. Census Bureau.

The next figure illustrates where growth has occurred in the U.S. by state with the annual average import growth over the last decade. Florida is on top with $150 million per year, followed by Massachusetts ($77 million), Alaska ($67 million), California ($62 million), and Alabama ($60 million). The highest value products imported into these five states is salmon for Florida, lobster for Massachusetts, crab for Alaska, salmon for California, and crab for Alabama. These do not all represent ideal markets opportunities for Maine due to species and location factors, but the species-level analyses delve into the best opportunities in each case.

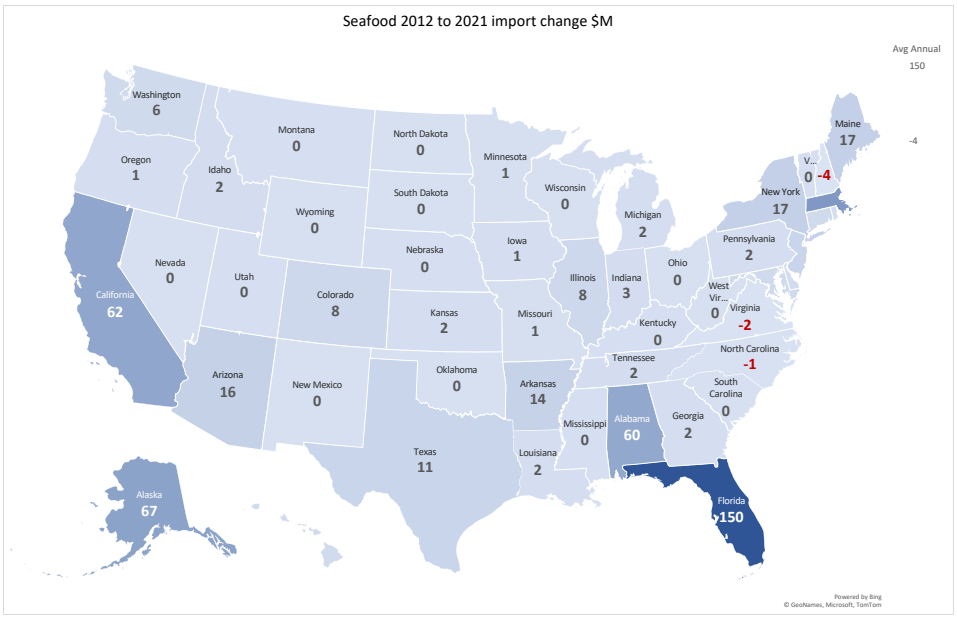


Figure 2.18. U.S seafood import growth by state, 2012 - 2021 ($570 million/yr).

Source: U.S. Census Bureau

International

There is at least a $61 million export growth opportunity for Maine just by combining the top three existing market prospects ($46 million) and the top three potential markets ($9 million). The top existing markets are where the U.S. currently ships the largest amounts for each species. The top potential markets are where there is the highest growth in U.S. exports, highest growth of imports in the target market, and logistical and trade factors are favorable. The value of the market opportunity is based on a modest 10% increase in the U.S. exports to those countries. Keep in mind this is also just the top three countries, while opportunities in other countries could be cultivated as well.

The figure below shows how the $61 million export opportunity is divided by priority species group. Lobster presents the biggest opportunity at $20.3 million, followed by crab ($11.2 million), then clams at $6.8 million. Although salmon

also shows a $6.8 million opportunity, it is recognized that salmon aquaculture developments are largely focused on the U.S. domestic market.

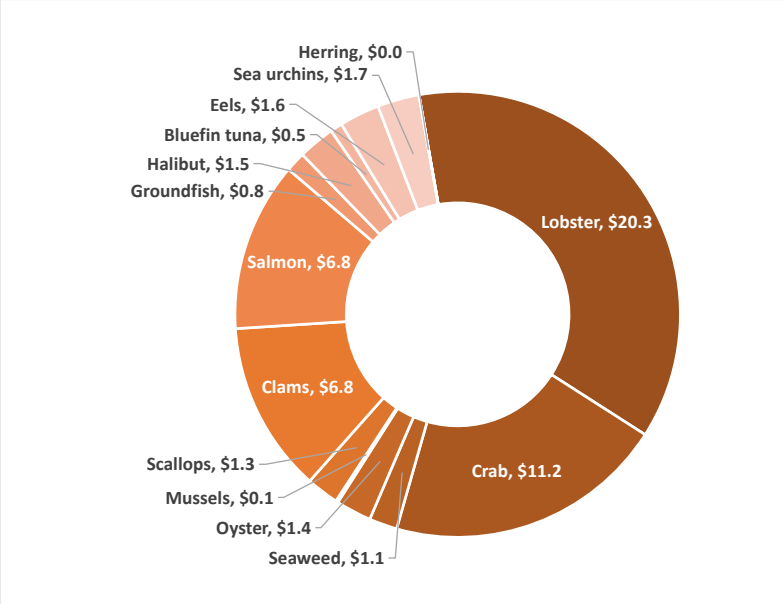
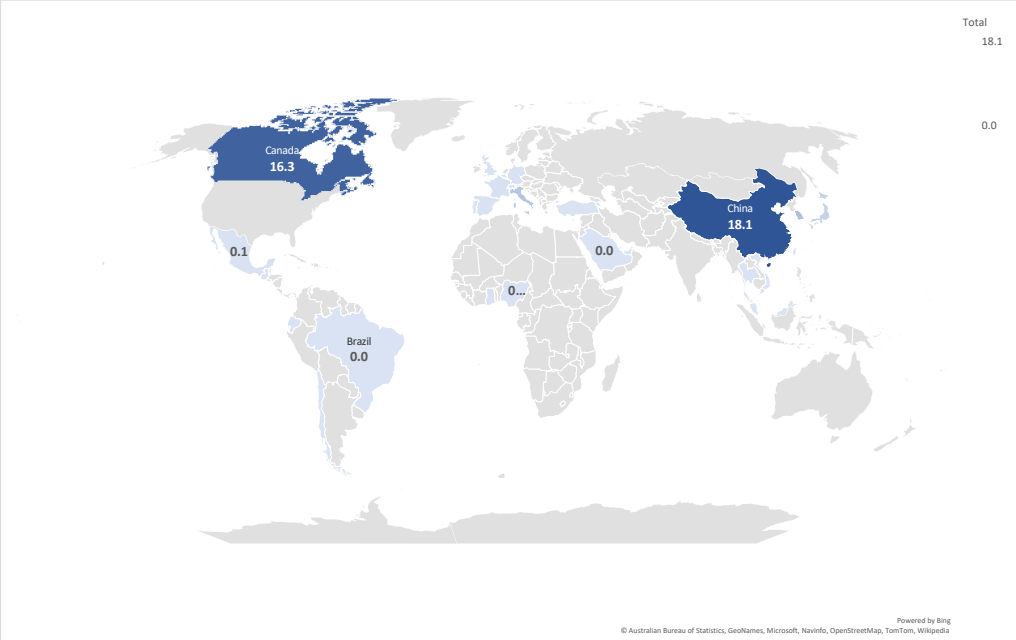


Figure 2.19 International seafood export species opportunities in existing and potential markets ($55 million).

Source: International Trade Centre (ITC), UN Comtrade data.

Combining the opportunities across the priority species groups, the following figure shows how the $55 million opportunity is divided by target country. China is the largest opportunity at $18.1 million, followed by Canada ($16.3 million), then Hong Kong ($8.1 million) and South Korea ($4.7 million). The top products in these countries are: lobster in China, salmon in Canada, clams in Hong Kong, and crab in South Korea.

Figure 2.20. International seafood export opportunities in existing and potential markets ($55 million)



Source: International Trade Centre (ITC), UN Comtrade data.

Turning to each priority species, it is important to recognize that some Maine products are more suited to domestic or international markets. Furthermore, detailed market analysis should consider volumes of production and timing (seasonality), price trends, trade dynamics, consumer preferences in the target markets, and other factors. Also recognize that some domestic and international destinations identified as opportunities represent seafood trade hubs (e.g., Florida, Hong Kong) that re-export or distribute to various regional market destinations.

Themes for Growth

The following themes for growth build on workshop, interview, and seafood sector insights gathered through numerous sources. They are provided for the Data & Benchmarking Subcommittee's consideration in order to assist in the development of SEA Maine's seafood roadmap and other applications. This section organizes key initiatives and action items according to the value

maximizing framework across the value chain. The recommendations start with resource management and access, then products and processing, and then through to reaching the best markets and maximum prices.

Themes for Growth

The following themes for growth build on workshop, interview, and seafood sector insights gathered through numerous sources. They are provided for the Data & Benchmarking Subcommittee's consideration in order to assist in the development of SEA Maine's seafood roadmap and other applications. This section organizes key initiatives and action items according to the value maximizing framework across the value chain. The recommendations start with resource management and access, then products and processing, and then through to reaching the best markets and maximum prices.

- **Theme 1: Full resource utilization**

1. **Adopt quality grading standards and pricing differentials**: Poor handling practices and inadequate holding facilities on vessels lead to lower quality landings resulting in lower quality product options and, in the case of some species, high mortality levels and revenue loss. Landing top quality fish should be a high priority for all harvesters. But port markets sometimes fail to create lasting incentives to improve quality; buyers and processors have insufficient influence with harvesters to be able to impose quality standards.

   Action: government and industry should develop and implement quality and grading standards, with associated price differentials for grade levels. Such standards (e.g., bleeding and gutting at sea, temperature-controlled holding systems) are mandatory in most developed fishing nations. Investing in Maine's seafood research enterprise to enhance quality, developing tools for harvesters, and leveraging research and development

capacity in public and private sector organizations to help facilitate coordination on quality across segments could bring significant benefits.

2. **Specify and pursue by-product opportunities**: Potential opportunities for by-product creation are well-documented. This aligns with SEA Maine residuals analysis underway and is included here for consistency and completeness.

   Action: there is a need to quantify by-product feedstock volumes available at the species and regional level, and to develop a better understanding of requirements for technical and financial feasibility. This includes such things as product specifications, process technology, minimum scale (input volume), raw material characteristics, other inputs, logistical requirements, capital and operating costs, and markets and prices. Government and industry take the lead, with support from regional research institutions.

- **Theme 2: Maximizing value**

3. **Review/modify seasons to improve raw material quality**: Climate change will impact marine systems, resulting in changes in intrinsic quality in some fisheries in some areas. Modifying the seasons in these fisheries could reduce landings of poor-quality fish, thereby limiting waste, reducing mortality risk, and enhancing product options and value. Adjusting seasons can be contentious, but there would appear to be a case in some fisheries to at least discuss the matter to identify pros and cons and a path forward. There are potential positive impacts of climate change, so this requires examination of various outcomes by fishery and area.

   Action: Government and industry (harvesters/processors) would identify changing fisheries. A joint committee would assess adjustment options and recommend a preferred option (e.g., shift the season by a specified period; move the season from fall to spring). Evaluate the impact and modify if necessary. Make recommendations for action.

4. **Strategic integration**: The choice of harvesting technology, on-board handling practices, and the timing and rate of raw material supply combine to influence raw material quality and the product options available to processors. In some market segments, particularly those in which Maine is less competitive than other domestic or international players, it may be valuable and appropriate to facilitate higher levels of integration or develop cooperative models for value-added product development. In other food producing sectors there is the ability to influence quality of product brought to processors and/or processors are (at least partially) involved in the acquisition of raw materials (e.g., traditional agriculture, aquaculture, forestry). In the absence of harvesting protocols and quality grade standards, one option that would allow processors to influence raw material specifications and rate/timing of supply they deem necessary to maximize product value would be to coordinate this with harvesters.

   Action: Recognizing this is not easy to change coordination is the best short-term goal. An initial step could be to select a pilot project: identify a fishery that is susceptible to innovative thinking, and where a level of trust exists between harvesters and processors. This could be a specific lobster or crab fishing area, or a groundfish fishery, but preferably a small one composed of well-organized harvesters and progressive processor(s). The goal would be to simulate how coordination would operate by agreeing to meet raw material specifications (handling, holding, delivery) in return for an agreed price premium.

- **Theme 3: Maximizing prices**

5. **Gain greater control over the value chain**: Industry fragmentation and internal competition present major obstacles to industry (harvesting and processing) being able to extract maximum value from the resource. Gaining greater control over the value chain does not necessarily

mean vertical integration – owning all the assets and integrating their operation. Rather, it means being able to exercise sufficient control over the timing, volume and quality of raw material supplied to processing plants and markets so as to control costs; determine optimal products; provide a basis for achieving product differentiation and specialization; and provide greater ability to enter longer-term arrangements with customers, resulting not only in improved market access, but in higher prices and greater revenue stability. While it may be advantageous to integrate harvesting, processing, and marketing operations, it is not essential. Independent interests can achieve the same advantages by simulating vertical integration through greater coordination of harvesting and processing operations. This does not require an industry-wide initiative but can be achieved through negotiation between harvesters and individual processing companies.

Action: see #3.

6. **Take steps to differentiate product**: Several products fall into the commodity category including lobster, crab, Atlantic salmon and groundfish. The larger companies supplying commodity products to distributors may rely on labelled packaging to distinguish their offerings from those of competitors, but this falls short of product differentiation in a way that would appeal to final consumers. Perhaps this is a matter of trading on place of origin or other characteristics that might distinguish the product from its commodity look-alikes (some familiar examples: Malpeque oyster, Digby scallop, Icelandic cod/haddock, Faroe Is. Atlantic salmon, Maine lobster).

   Action: industry cooperation in developing sector-wide approaches to seafood market development has proven elusive. But in a world of commodity offerings, some attempt to differentiate Maine's products from others' through a marketing campaign that draws on positive national and international image would seem to be the minimum industry and government could do to promote value.

- **Theme 4: Marketing and market timing**

7. **Invest in the Maine seafood brand**: Maine's brand stands for quality, freshness, community, taste, and tradition. Virtually all stakeholders engaged for this project believe that specific investments in Maine's seafood brand should be expanded, and these investments should focus on legacy products as well as new and emerging market segments. This sentiment is reflected throughout various other seafood marketing surveys and development initiatives, including a recent CEI survey and market report. Survey participants indicated a willingness to participate in the financing of a Maine seafood marketing initiative, expecting significant return on investment. Several products fall into the commodity category including lobster, crab, Atlantic salmon and groundfish. The larger companies supplying commodity products to distributors may rely on labelled packaging to distinguish their offerings from those of competitors, but this falls short of product differentiation in a way that would appeal to final consumers. Maine is well positioned to enhance its brand standing across market segments including aquaculture and wild capture.

   Action: Industry cooperation in developing sector-wide approaches to seafood market development has proven elusive. But in a world of commodity offerings, some attempt to differentiate Maine's products from others' through a marketing campaign that draws on positive national and international image would seem to be the minimum industry and government could do to promote value. Establishing a Maine Seafood Marketing Council modeled after successful initiatives elsewhere (e.g., the Alaska Seafood Marketing Institute) would provide significant opportunities for coordination, brand development, and marketing awareness.

8. **Invest in U.S. seafood brand**: Not all initiatives need to be solely Maine focused and depending on the fishery, especially smaller ones, there may be benefit in coordinating with other states or regions under

a national banner. National branding pays dividends for producers of Icelandic cod and haddock, Scottish smoked salmon, or Norwegian Atlantic salmon and groundfish. This is because behind these national/regional brands exist well-funded and broadly-based industry organizations whose mandate is to advance the market position of their members. An industry funded organization with U.S. brand development as its mandate would complement other strategic initiatives aimed at elevating the seafood industry's market position and the value if its products, as well as the robust and trusted world-leading fishery management institutions. Ensuring representatives with expertise in Maine seafood continue to work at the Marine Fish Advisory Committee (MAFAC), the newly established American Fisheries Advisory Committee, and other existing or emerging national seafood promotion councils is imperative.

Action: Ensure Maine seafood is well-represented at national marketing collaboratives. Of highest priority, explore the development of a US seafood marketing and public awareness initiatives focused on integrity, quality, and low carbon footprint for the domestic market.

9. **Accessible market intelligence**: There is evidence that companies do a good job of selling to the highest value markets. Nonetheless, there is room for improvement in Maine, and access to reliable up-to-date information is key. The industry is composed of large and small companies, many with limited resources to conduct basic market research or engage in market development. For these companies, access to basic market intelligence could prove invaluable to support their efforts to identify opportunities as well as potential obstacles to market access.

   Action: U.S. economic and trade services provide market reports for important export destinations. Ideally, these reports would be modified where necessary to follow a standard format that includes: details on

seafood imports quantity and value by species and exporting nation; trend data (quantity, price, format) by species; factors affecting demand (e.g., price, freshness, place or origin, food safety); market channels and contacts; competitors; currency used for trade; exchange rate trends; tariff regime as it affects Canada; upcoming trade shows. Providing up-to-date information on implementation of trade agreements is essential.

10. **Market access challenges/solutions**: Non-tariff barriers often pose the greatest challenge in accessing particular markets. Food safety issues feature prominently in the list of barriers. Any such barriers should be flagged in reports, with proposed steps to be taken to avoid them.

    Action: see #8.

11. **Resolving obstacles to market responsiveness**: Modifying fishing patterns or holding product off the market to time supply to coincide with higher demand/prices makes abundant sense, and yet as a marketing strategy is difficult to implement. Export patterns for most species show high degrees of seasonality linked directly to fishing patterns (e.g., lobster, crab). Cash flow constraints explain the relationship. Unless companies are able to attract substantial levels of inventory financing (generally available to only the very largest), then this obstacle to market responsiveness is likely to persist. In light of these constraints, the best that could be expected from a strategic perspective is that companies arm themselves with price data so that they can respond to seasonal swings to the extent harvesting circumstances allow.

    Action: The factors defining the relationship between harvesting, processing, and marketing patterns are complex and not easily modified in response to price opportunities. In any event, responses operate very much at the company level, so increased focus should be placed on how to best support information and decision-making needs.

- **Theme 5: Labor and logistics**

12. **Addressing the workforce challenge:** There is a chronic workforce issue for aquaculture operators and seafood processors throughout Maine. Seafood and aquaculture companies are facing a significant labor pool deficit, preventing successful scaling of operations. Housing workers is a major challenge across industries, particularly seasonal workers in processing and hospitality. HR services for smaller operators are difficult to manage in a challenging environment.

    Action: Explore establishing and funding technical and vocational training programs for "opportunities in seafood" for new Mainers to teach new skills and connect new participants in the workforce to seafood businesses. Continue to support aquaculture and fisheries training programs at research institutions and the University of Maine System and community/technical colleges. Establish a fund for seafood housing for new Mainers entering the seafood workforce around processing and growing hubs. Provide support for a program to provide HR services to educate/manage employees and increase retention.

13. **Coordinating transportation and cold storage logistics:** Maine is close to major domestic markets and international shipping hubs. However, shipping and logistics in Maine's distributed supply chain is a major challenge that is inhibiting growth, according to SEA Maine stakeholder participants. Investing in enterprises or services that can provide and coordinate logistics for less-than-truckload ("LTL") quantities of product from multiple producers could address these challenges while reducing costs and making Maine seafood transportation more efficient.

    Action: Explore creating a seafood transportation coordinator position at the Maine Department of Transportation or Maine DMR to align cold chain trucking from shoreside facilities to major markets. Ensure that cold storage investments and ice production capacity are appropriately

sited and scaled throughout the state and provide financing for smaller-scale ice machines at remote sites where gaps are identified.

SWOT Top Ten

The following top ten SWOT comments emerged from the workshop across the four species groups throughout the day. These were identified in multiple sessions and in most cases also became components of the strategies identified by participants. The detailed comments in the Appendix show where these are applicable to certain species versus general applicability to the marine living resource sector.

Table 3.1. Top ten workshop comments for each SWOT element across all species groups

Strengths	Weaknesses
• Maine's world-class seafood brand & recognition • R&D capacity • Natural assets and growing conditions • Highly skilled workforce • Strong regulatory programs • Global sales experience • Keen focus on sustainable practices • High resilience & capacity to respond to change • Proximity to valuable markets • Strong networks of diverse businesses	• Loss of working waterfront • Loss/lack of social license • Limited opportunity for entry & expansion • Assessment and diagnostics backlogs/capacity • Logistics & transportation • Complex state/federal regulatory landscape • Lack of support for smaller ports & infrastructure • Processing modernization & scale • Low volume = lack of premium market position • Low levels of fiscal support, capital, & political challenges

Opportunities	Threats
• Marketing/branding integration across segments • Specialized products at low volume/high value • Tapping global demand & high price • Maine product differentiation • Developing value-added products • Closer linkages between seafood and tourism • Blue-tech investment • Workforce training programs • Adding volume in key segments to secure high value market position • Tech applications for real-time data/monitoring	• Weakening community connection to working waterfront • Low youth & labor force recruitment • Polarizing campaigns & lobbying/pol. exposure • High volume/low price products (imports) • High energy costs • Competition for ocean space • Climate change impacts to marine environment • Evolving regulatory constraints (import/export & conservation) • Invasive species & biosecurity • Oyster seed production capacity/diversity

Source: SEA Maine Workshop February 17, 2022

Top Strategies - Using Strengths

Building on the identification of SWOT elements, the workshop participants suggested ways that strengths could be used to address opportunities and threats. Again, the top strategies are extracted in the two tables below,

highlighting those that cut across species group sessions and which were raised by multiple participants.

Table 3.2. Top strategies using strengths to address opportunities across all species groups

Using strengths to address opportunities
Branding and marketing seafood sector - • The story about Maine products and working waterfronts to build the Maine brand - huge opportunity to position in the marketplace • Build on Maine branding, expanding to more species • Professional marketing of seafoods with joint private-public funding, while maintaining a view to lobster collaborative, USDA programs, and ASMI model (Alaska). **Strengthening seafood network -** • Building on SEA Maine strength continue to connect and integrate the seafood network to leverage opportunities within and beyond Maine **Policy and investment for infrastructure -** • Policy makers investing in coastal access, infrastructure, vessels and equipment, ice making machines, transportation network • Building on working waterfronts coalition as a template for future collaborative work on policy **Training and business growth support -** • Build on strengths of education institutions by allocating funding for entrepreneurship and safety based on needs assessment for young fishers training gaps • Based on strong market demand, provide greater support for the stage where people want to expand. Start-up phase support is good in Maine, then next level of expansion is a challenge, but the market will be there for those who can make that step • Use education system to develop robust training program that supports the full value chain of seafood industry

Collaborative monitoring, research, and development (R&D) -

- Building on new technologies becoming widely available, comprehensive science monitoring can incorporate better data collection, reporting, and spatial info to improve our understanding of fishery dynamics
- Using R&D capacity in Maine to develop value-added products
- Building on history and collaborative research, revitalize collaboration for research and science capacity

Table 3.3. Top strategies using strengths to address threats across all species groups

Using strengths to address threats
Understanding changing oceans -
• Building on science capacity and ability to observe changes in oceans, get better at anticipating impacts before they occur so the sector can plan accordingly
• Using technology to address climate change threats by improving ocean observation and collecting better data
• Hard-working and resourceful fishers with diverse fleet is a strength for adaptation to issues like climate change and new species, innovate and adapt in the face of emerging threats (e.g., demonstrated ability to pivot quickly for pandemic)
Transitioning to low-carbon economy -
• Strategic use of incentive programs reducing fossil fuels in the sector where efficiencies can be gained while maximizing emissions reductions
• Using R&D capacity to reduce carbon footprint
Social license and working waterfronts -
• Using Maine story as a strength to address coastal threats and social license

- Make use of previous work on social license for roadmap and tools including best practices and case studies for aquaculture and fisheries

Addressing infrastructure needs -

- Invest in infrastructure for long-term success of the sector where small scale and large-scale need help equally
- Invest in decaying working waterfront infrastructure - see seafood as rural economic development and support processing sector, can't just rely on private equity to seriously tackle State goals for growth

Marine spatial planning and conservation -

- Trying to use sector and research strengths to address whale conservation, offshore wind development, and mitigate impact of conservation framework (avoid overburdensome regs)

Addressing labor force shortages -

- Working with key institutions, undertake a comprehensive workforce needs assessment to develop training curriculums, link institutions, and look at apprenticeships
- Building on sector-wide coordination of needs, make training programs sustainable, then attract students from Maine, other states, and other countries

Adaptation and disease prevention -

- Building on R&D capacity with funding for state-of-the-art selective breeding programs to address shellfish diseases and better adaptive species

IV. SWOT - Supporting Roadmap Development

Pathway to roadmap

The SWOT analysis and workshop success is a key step toward roadmap development. In a limited time, well-informed participants articulated the current state of the sector and identified key issues. More of this is needed to complete the steps for roadmap development. The following outlines key steps on the pathway to a roadmap:

- **Adopting a framework** - that encapsulates the sector goal is a critical next step and we provide an example below to help envision this. A framework focused on "maximizing value" along the marine living resource value-chain has merit. This captures all participants in the sector so everyone "sees themselves" contributing to sector growth, but more importantly this ensures a comprehensive approach that is well thought through. It then helps to steer ideas and contributions toward a common purpose that is widely supported, namely that all efforts must maximize value for the sector.
- **Organizing stakeholder input** – from the SEA Maine workshop is the starting point for additional workshops in future that provide more time (full-day instead of two-hour sessions) for each species group. Channeling the discussion and outputs according to the framework will be highly productive. This does not preclude other means of gathering stakeholder input other than a workshop format. What may initially appear to be disjunct ideas will more clearly become part of a coherent and integrated approach. Each player in the sector such as harvesters, processors, brokers, transport, retail, and foodservice will identify areas for improvement that together will make the most of Maine's marine living resources.
- **Assessing and prioritizing** – key ideas for maximizing value along the value chain. Implementing ideas will require different levels of effort and will provide different levels of value (return). Organizing ideas into low, medium,

and high levels of effort, as well as low, medium, and high levels of value will allow these to be prioritized. Those having relatively higher return compared to effort are prioritized.

- **Roadmap and taking actions** – With a prioritized list of ideas along the value chain that will maximize value for the sector, this step culminates in the roadmap where timelines and responsibilities are assigned and ultimately the required resources are allocated for implementation. The roadmap allows everyone to know their role, be accountable for timely delivery, and address any gaps or challenges that arise.
- **Tracking success** – Although a key sign of success will be the completion of all tasks by those who are responsible, the outcomes will ultimately bear out in the benchmarking data. Landings and values for commercial fisheries, aquaculture production, market share, higher prices for Maine products, diversification of products and markets, and other indicators will move in positive directions.

Maximizing Value Framework

In order to visualize this, the following illustrates the maximizing value framework in more detail. Sustainability is the foundation upon which the value chain maximizes value moving to the right across the table. Key issues and impediments are identified in the top row, the desired outcomes of addressing these are in the second row, and the third row identifies priority actions to realize the desired outcomes. This table is a general combined fisheries and aquaculture table, and specific versions can be developed for each species group (i.e., groundfish, shellfish, aquaculture, and pelagics). Once the actions are identified, the roles of value chain and government participants are identified with timelines and resource allocation in a roadmap to move the sector forward.

Table 4.1. Consistently Securing Maximum Value from Maine's Fishery & Aquaculture Resources.

Goal: Maximum value derived from the resource; Stable/transparent scientific & economic approach to resource access/allocation; Internationally competitive sector

	1. Sustainability	2. Harvest & Production Quality and Full Utilization	3. Highest Value of Products: Best Use of the Catch	4. Highest Value Markets	5. Maximum Prices
Issues & Impediments	• Environmental factors/fish health • Stock assessments • Regulations (local, state & federal) • By-catch volume and incidence • Ecosystem changes • Coastal/marine spatial planning • Predator/prey relationships • Fishing practices/gear • Low carbon operations	• Expedited aquaculture lease review • Raw material/ quality: storage/handling • Seasonality/timing/gluts • Supply coordination • Labor / demographics • Resource utilization (space for leasing/emerging or underutilized species/bycatch) • Waste stream utilization • Best fishing practices/gear	• Raw material/ quality: storage/handling • Extracting the best use of the catch • Labor /demographics including foreign workers for processing • Automation/technology • By-product innovation & capacity • Regulations (e.g., licensing of aquaculture/processors) must be supportive • Access to capital	• Selling in the highest value markets and at times of year when prices are highest • Specific market intelligence requirements are met • Tariff and non-tariff barriers • Global factors/trends • Regulations	• Obtaining the highest prices • Maine branding • Seasonality/timing/gluts • By-product innovation & capacity • Public/consumer trust • Product differentiation • Consumption trends • Need for specific market intelligence • Global factors/trends
	Better coordination of efforts throughout the value chain. Better coordination between government jurisdictions and departments, and with industry to capture opportunities.				
Desired Outcomes	Objective and robust science-based decision-making processes that encompass economic considerations lead to the creation of governance systems and structure/processes required to enable continued growth of marine living resource sector in a sustainable, and predictable manner.	An improvement in utilization has been realized, with improvements in regulatory systems and permitting/leasing & the predictability and consistency of quality being achieved through optimizing harvest/culture with, better handling and storage practices.	An innovative, flexible and economically viable sector is landing/growing the best quality raw material in strong coordination with shore-based processing sector to achieve maximum value of the catch. Labor shortages have been diminished. Percentage of processing/value has increased.	Diversification and innovation have reduced reliance on certain species/markets. Maine has achieved a top 5 position as a seafood producer. There is increased awareness of the Maine Brand, and Maine is a world-leading producer of innovative value-added seafood products and bi-products.	Prices have been maximized. The Maine Brand has been leveraged in domestic and export markets. Key opportunities have been exploited; market intelligence has been enhanced.
	Players have a common purpose of ensuring solution-driven collaboration and progress is being made to realize opportunities.				

Priority Actions					
	1.1 Strengthen science-based, strategic, and economically viable decision-making processes. 1.2 Adequately resourced stock/resource assessments for decisions to enable and secure commercial investments. 1.3 Requiring that all policies and regulations be measured against achieving strategic economic value chain outcomes. 1.4 Ensure coastal and marine spatial planning incorporates social & economic considerations for fisheries and aquaculture. 1.5 Actions to address predators/invasive species. 1.6 Adequate strategic investment in science research vessels; current fleet falling apart, old technology. 1.7 Conduct a global scan of best practices on the integration of technology into fishery science. 1.8 Improve science: take advantage of new technologies. 1.9 Implement traceability systems.	2.1 Develop and advance aquaculture leasing reforms & requisite budget increases to the legislature 2.2 Align harvesting & production timing to occur at optimal life stage and quality in target species and avoid supply gluts. 2.3 Full utilization: mandatory measurement of by-catch by harvesters; monitor rate of loss and waste on sea and land. 2.4 Update aquaculture gear & vessel regs to be objective/outcome based. 2.5 Ensure science-based market-driven decisions on diversifying species caught. 2.6 Adoption of raw material pricing mechanisms that incentivize highest quality landings. 2.7 Maintain quality/value by coordinating landing of freshest possible fish with onshore capacity. 2.8 Assessment of demographic labor-related issues and barriers to new entrants. 2.9 Collaborative research coordinated through academic institutions and with entrepreneurs to develop new uses for by-products and waste.	3.1 Use outcome-based policies & regulations to coordinate supply and demand along value chain. 3.2 Improve labor mobility and facilitate inter-state and international labor recruitment. 3.3 Consistency across food sector programs and support for agriculture, fisheries, and aquaculture 3.4 Regulation to ensure enterprise access to capital from traditional & non-traditional lenders. 3.5 Timely electronic export certificates. 3.6 Support for implementation of automation/innovation/further processing. 3.7 Maine seafood innovation center with full product development capabilities. 3.8 Focus support on programs/groups that seek to enhance value chain collaboration by the sharing of and acting upon market intelligence.	4.1 Strengthen associations' capacity to address strategic value chain issues and impediments, e.g., market access and product value/availability. 4.2 Diversification of markets and collaboration to chase opportunities by promoting Maine brand in lucrative markets. 4.3 Include anchor companies as critical members of market development activities including those for SMEs. Embrace their strengths to enhance Maine. 4.4 Enhance Maine/U.S. government support to address market access issues / impediments. 4.5 Maine seafood center of excellence to drive innovation & new products. 4.6 Target top three to five (non-US) seafood markets by size and growth, with efforts focused on marketing the Maine brand. 4.7 Establish a multi-year, co-funded seafood market intelligence program, targeting top five current and top three emerging markets.	5.1 Strategic market-driven collaboration between industry-government programs/initiatives. 5.2 Develop a Maine seafood nutrition education and awareness program that mirrors the US seafood nutrition partnership program. 5.3 Focus Maine brand promotional activities on sector specific campaigns. 5.4 More publicity to increase knowledge of Maine products carrying Maine brand. 5.5 Initiate a project to improve access to export sales/product value data, for purposes of better measuring returns for fisheries & aquaculture resources. 5.6 Domestic and international Maine brand education/marketing campaign.

Value Chain Approach

The concept of a value chain is used in industry to describe the process by which companies receive raw material, add value through various processes to create a product, and sell that product to customers. The aim of any company should be to supply the right product with the right specifications to the right customers at the right time. Doing this as efficiently as possible is how a company maximizes value (or profits). The process ordinarily involves several highly coordinated steps, not all of which lie within the control of the producing company. Markets typically provide the coordinating function, with prices playing a key role in guiding product and destination decisions in response to customer preferences.

In its simplest form, the seafood value chain consists of five activities, each encompassing a set of interactions between a buyer and seller:

- **Raw material procurement:** In capture fisheries, harvesters produce raw material for processing. In aquaculture, growers perform the same function. The harvester/grower may be independent of the processing company or form part of an integrated operation. Where the sectors are independent, the market through pricing incentives needs to function effectively to ensure a steady supply of high-quality raw material that processors need to meet customer requirements. Where companies own their own vessels, they would manage operations to ensure their raw material criteria are met. In culture fisheries there are opportunities to control production and create stable supply, but challenges can still exist where there are closures of growing areas due to health concerns.
- **Processing:** this incorporates all the activities needed to convert raw material into finished products. Ideally, product decisions would be driven

by customer specifications regarding quality, form, timing, and destination. This applies equally to capture and culture fisheries, and other products derived from marine living resources.

- **Marketing and sales:** this covers all strategies and activities to identify, attract and retain customers including channel selection (one or all of distributor, food service, retail), advertising and pricing. Marketing initiatives would inform product and sales decisions.
- **Logistics:** transportation and storage can be one of the most challenging activities, given distances between processor and customer, and especially when supplying premium markets for fresh and live product. Also, the emphasis on just in time delivery can create obstacles to serving some markets.
- **Customer service:** responsiveness to customer concerns or requirements strengthens relationships and market position. There is increasing demand for product information, where traceability and certifications play an important role in responding to consumer demands.

Coordination to Achieve Maximize Value

The aim is for all players along the value chain to strive for maximum value since there is both individual and collective benefits to be gained. Each player doing their part will help the next link in the chain achieve better product utilization, highest value products, optimal timing in best markets and obtain highest prices. In-keeping with the maximizing value framework the following elaborates on the desired outcomes moving from the foundation of sustainability along the value chain to achieve the best prices in top markets.

- **Foundation of sustainability**: In order for the value chain to maximize value there must be constant attention to ensure sustainability since this underpins overall success. Understanding changes in Maine's marine waters, shifting marine living resource dynamics, and anticipating

seasonal and year to year outcomes will be important for value chain members to make wise decisions and investments. Making sure the viability of marine living resources is not undermined will help to ensure sustainable value over the long-term.

- **Fully utilizing raw material to produce marketable products:** finfish and shellfish are valuable sources of animal protein for human consumption. But what's left after the main product or products are extracted offers further potential ranging from fish meal and oil to pharmaceuticals. The evidence indicates that too rarely is this potential fully or even partially realized. This is not because of any failure to recognize the potential, but rather in many cases, because of weak economics and a failure to develop industry-wide approaches. Post-harvest mortality also has the potential to reduce resource value for certain species (e.g., lobster, crab). Improving at-sea handling practices will reduce mortalities post-harvest and result in higher quality raw material offering a wider range of product options and increased value.
- **Producing products that generate the highest value:** for most species, it is possible to extract a suite of products for which the market pays different prices. Halibut, for example, may be sold head-on gutted (HOG), in fresh or frozen fillet form, or as fresh or frozen steaks. The fresh fillet or steak would command the highest prices and would generate the highest gross value. Yet, halibut sold by processors is often marketed in HOG form because this is the most profitable product (generates the highest net value). Ultimately, the decision of what products to produce comes down to a question of economics: yes, the fillet fetches a higher price, but if the additional cost incurred in producing it exceeds the difference in price (adjusting for yield), then this would diminish profit. This means the value-adding activity would occur in a lower cost location (e.g., overseas). Product selection is also affected by raw material quality and supply conditions. Poor handling practices on vessels may undermine quality and limit product options. Similarly, supply gluts may preclude processing higher valued products.

- **Obtaining maximum prices for its products:** This is a matter of comparing product prices received by Maine's industry with those obtained by competitors. Export data are used for these comparisons, ideally capturing product prices in the same markets.
- **Selling in the highest value markets and at times of year when prices are highest:** Maine processors may sell in the highest value markets, but also in developing markets where prices may not yet be the highest. The ability to sell at times of year when prices are highest depends on several factors including seasonal supply patterns, cash flow constraints, competing fishing opportunities, product form, and customer arrangements. While balancing the need to diversify markets, cultivate emerging markets, and make the most of top markets, there is always room for improvement where top markets may not be known or understood sufficiently to exploit them. Coordinated and comprehensive approaches to gathering market intelligence, developing the Maine brand, and professional marketing are key to success.

V. Focal species

Lobster

Access

The American lobster fishery is managed under a complex regulatory framework implemented under state and federal laws. Lobster fishing in state waters is licensed by the Department of Marine Resources, while fishing in federal waters requires a state license and a federal permit. The fishery is managed under the Atlantic States Marine Fisheries Commission's lobster fishery management plan and its addenda.

In 2021 there were 6590 lobster fishing licenses issued by Maine DMR (all categories). 3173 permits were based in the Eastern region; 2246 were based in the Midcoast region; 1171 were based in the Southern region. The average age of a lobster license holder, excluding student and apprentice licenses, was 51.25 years. Federal permits are issued by the National Marine Fisheries Service. An overwhelming majority of Maine's federal permittees fish within Lobster Management Area 1, which extends from the maritime border with New Brunswick to Cape Cod and offshore approximately 45 miles.

Production

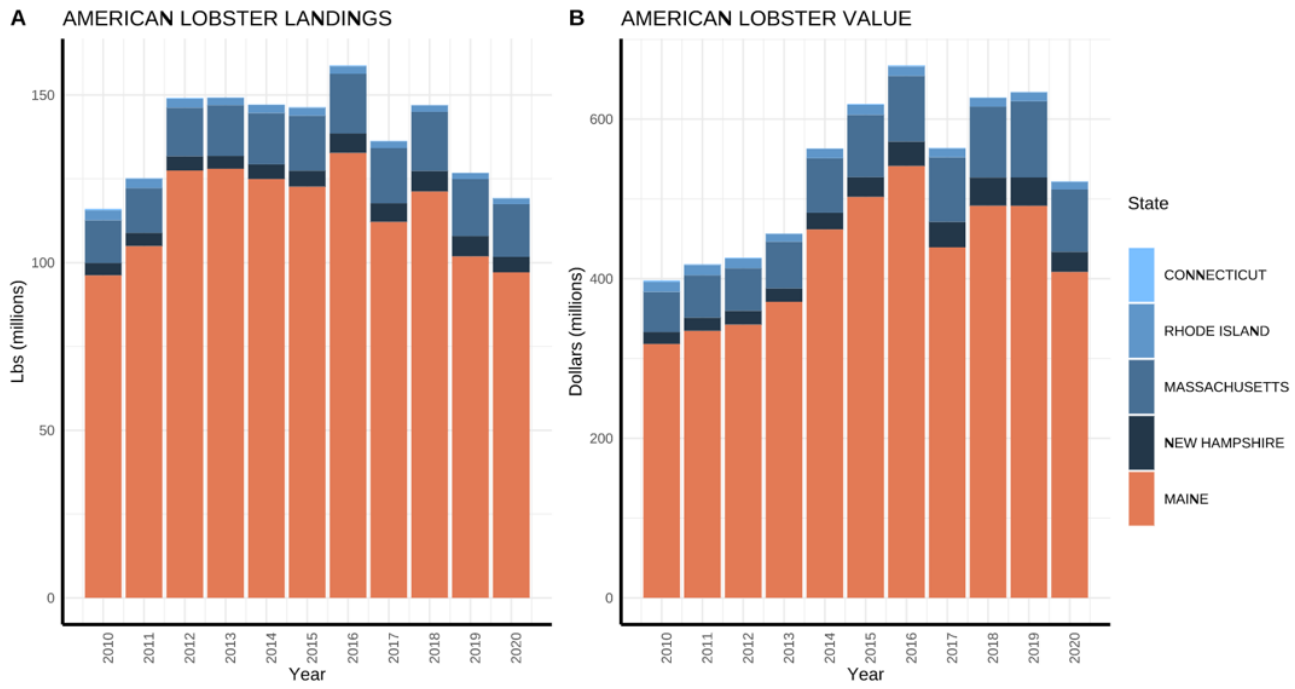


Figure 5.a.1. American lobster landings (panel A) and value (panel B) across New England states.

Maine's lobster production in both volume and value over the period of record increasingly trended towards the Eastern region. Increasingly higher volumes in the northeastern Gulf of Maine are driven by shifting lobster demographics and other climate-driven factors.

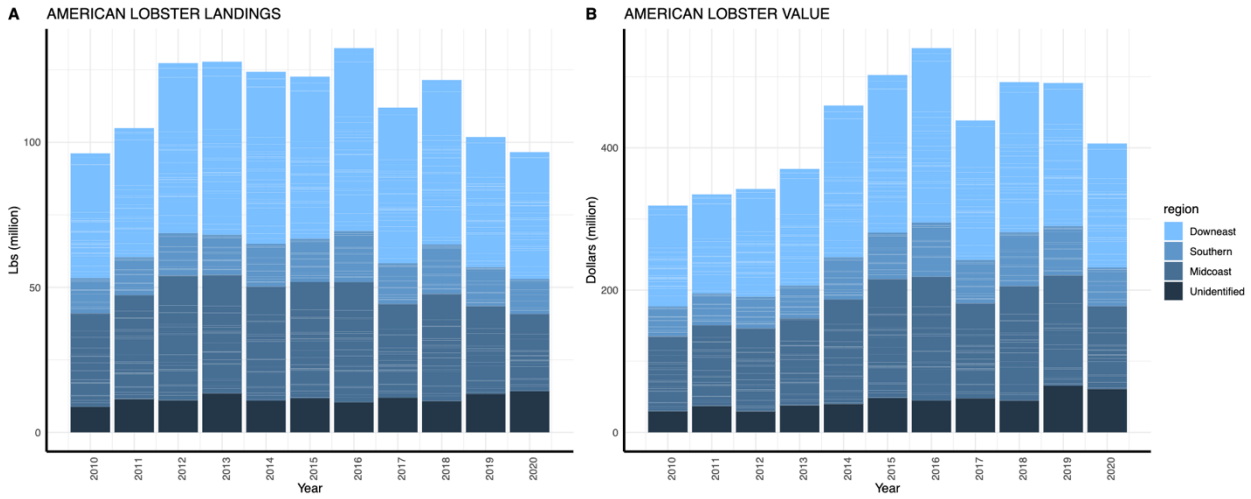


Figure 5.a.2. American lobster landings (panel A) and value (panel B) across Maine regions.

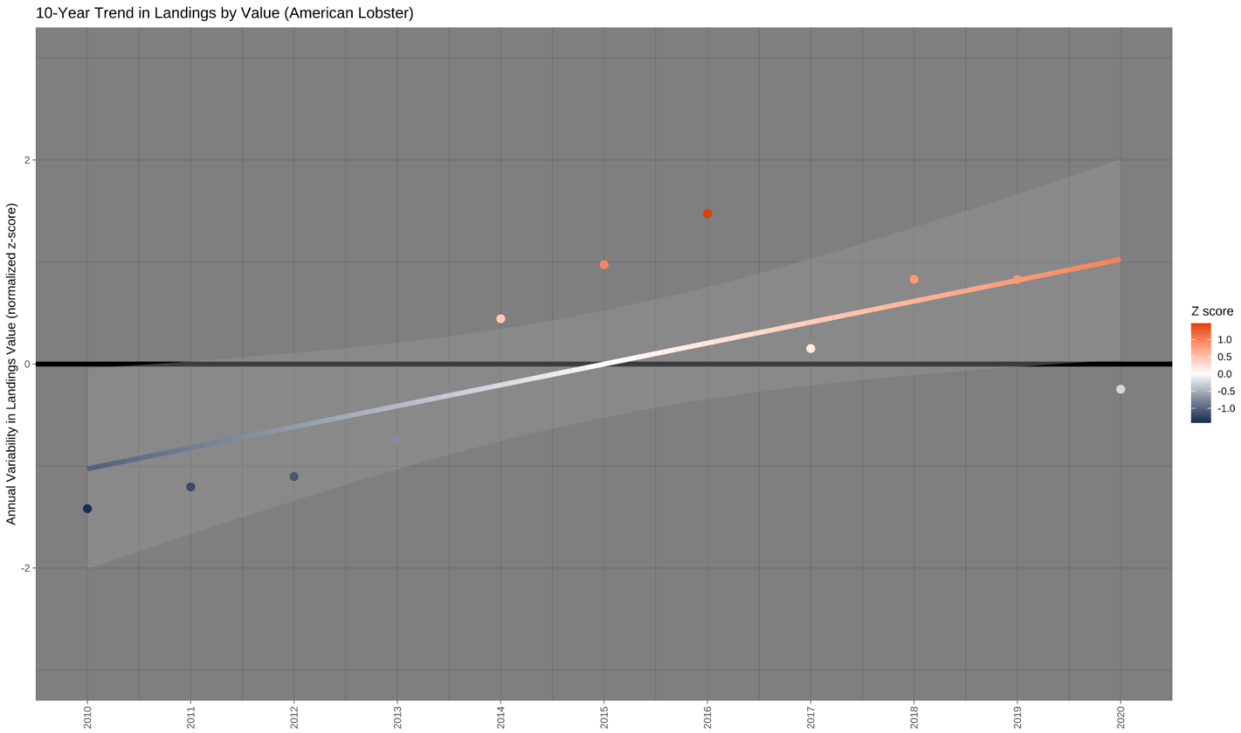


Figure 5.a.3. Annual variability in American lobster landings value in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual value relative to the ten-year average.

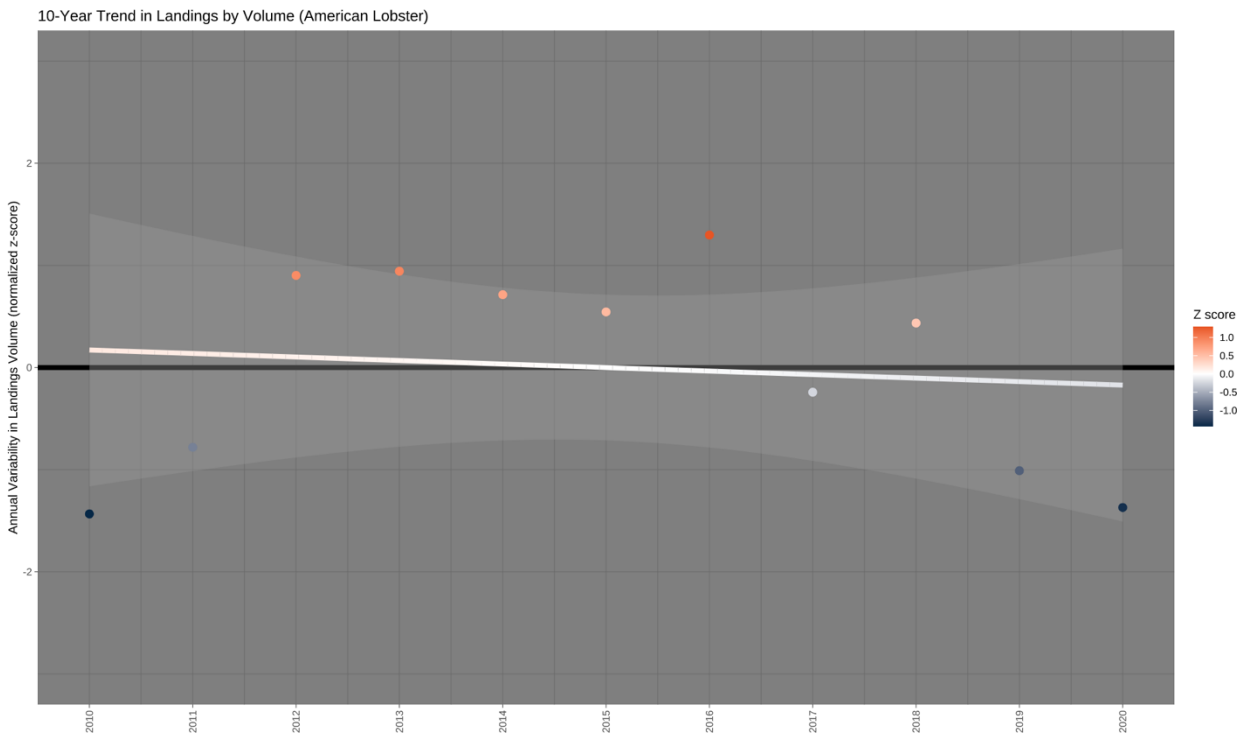


Figure 5.a.4. Annual variability in American lobster landings volume in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual volume relative to the ten-year average.

Market Opportunity

There is a minimum $74 million per year lobster market growth opportunity in the U.S. domestic market based on the ten-year trend in state imports. There has been a noticeable increase in demand for frozen lobster as its share of national imports rose from 69% to 74%, while fresh and chilled lobster import share rose from almost none to 26% of all imports. The top five states with the largest growth in demand are Massachusetts ($45 million per year), followed by Florida ($9.2 million), New Jersey ($33.5 million), Illinois ($30.5 million), and Georgia ($19.6 million).

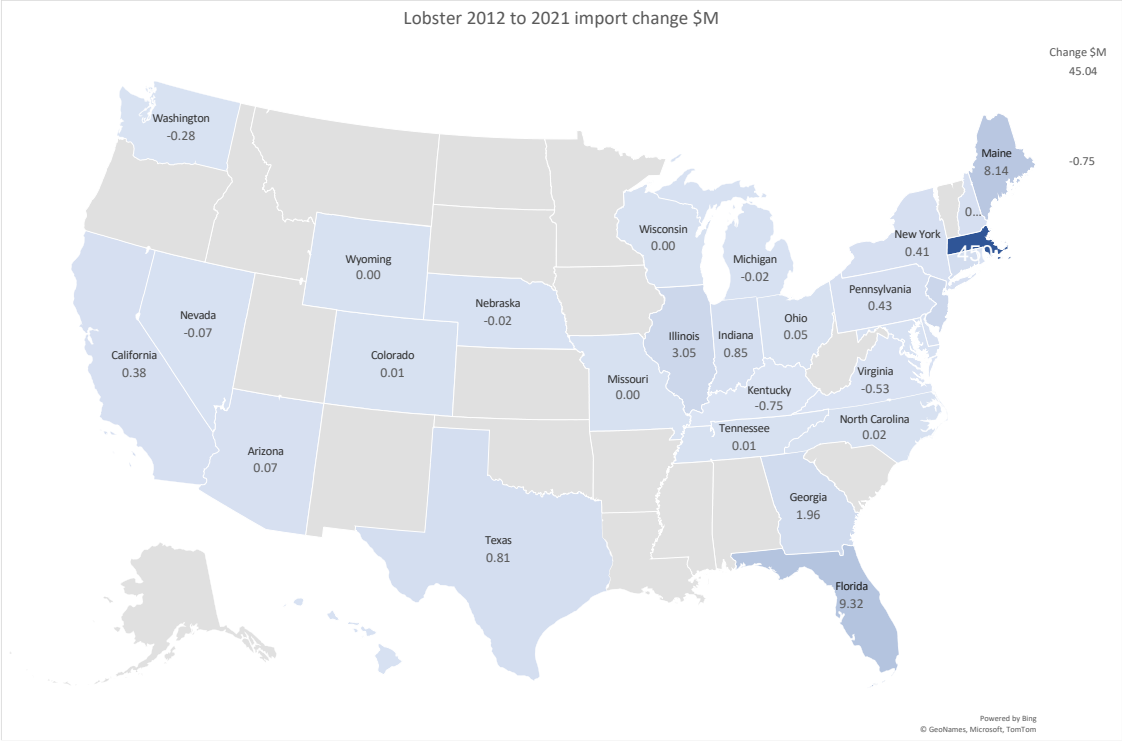


Figure 5.a.5. Lobster import growth by state, 2012 - 2021 ($74 million/yr).

Source: U.S. Census Bureau

Note: Includes HS codes: 030611, 030612, 030615, 030621, 030622, 030625, 030631, 030634, 030691, 030692, 030694.

Driving a 10% increase in U.S. lobster exports to the main existing markets will build on shipments to Canada, China, and Hong Kong. Maine is already the top supplier to Canada, but increases are possible unless processing capacity expands in Maine. Maine supplies a lower share of U.S. exports to China and Hong Kong suggesting there is room to grow in countries that are already familiar with U.S. products.

The ITC ranks Italy, Hong Kong, and South Korea as the top potential new and expanding markets based on a combination of factors shown on the next table. The 12-year historical pattern in U.S. exports is shown for context where 2020 exports are back down to historical norms after a peak in 2016-2018. The

bubble plot shows blue circles where the U.S. is gaining market share faster than other countries, and yellow circles indicate where the U.S. export growth is trailing other countries. Larger circles mean the target country represents are larger share of world imports for this product.

Table 5.a.1. Top three existing and potential growth U.S. export markets for lobster ($20.3 million)

Existing Markets 2020				Potential New / Expanded Markets			
Top US Export Destinations	US Export Value ($)	Maine Exported Value to Top Destinations ($)	Maine % of US Exports to Top Destinations	Export Destination Ranking	Average Imports from US ($)	US Import Share (%)	US Import Growth (%)
Canada	212,909,081	202,862,540	95%	Italy	34,696,645	61	- 10
China	127,828,687	42,696,250	33%	Hong Kong	21,890,277	40	- 7
Hong Kong	21,890,277	14,999,405	63%	South Korea	18,521,940	25	- 6

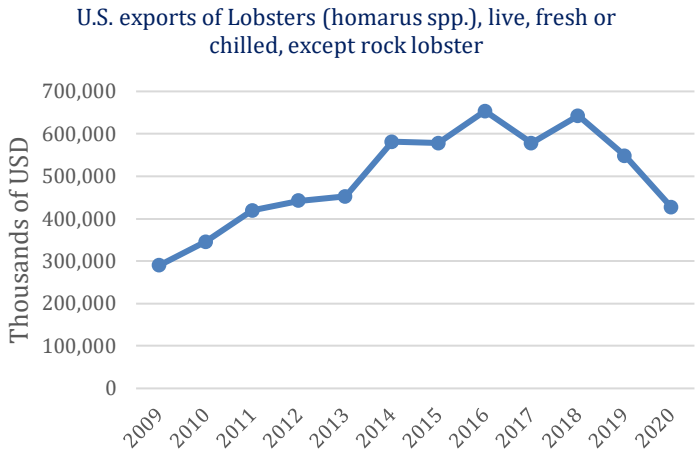
Source: International Trade Centre (ITC), UN Comtrade data.

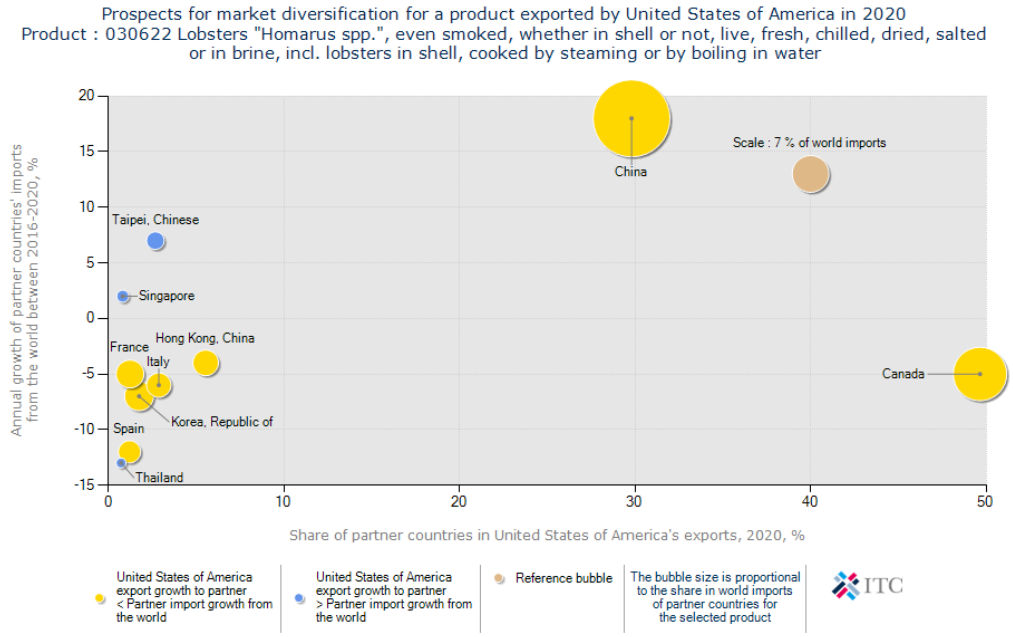
Note: Includes HS code: 030321.

Table 5.a.2. Lobster international opportunity metrics (HS030632).

Country	Total Score	Avg Imports from the US ($)	Max Avg Tariff (%)	Avg Imports from the World	US Import Share (%)	Import Share Gap	Import Growth (%)	GDP Growth (%)	Distance (km)	International Logistics Performance Index Score	Language Match	FTA with US	Landlocked
Italy	76.8	34,696,645	6	57,015,157	60.9	0	-9.9	0.1	6,895	3.74	NO	NO	NO
Hong Kong	62.8	21,890,277	0	55,248,918	39.6	0	-6.5	1.9	12,970	3.92	YES	NO	NO
South Korea	60.7	18,521,940	0	73,492,284	25.2	0.3	-6.4	2.1	11,066	3.61	NO	YES	NO
France	58.2	12,982,721	6	61,385,219	21.1	8.6	-6.4	1.6	5,838	3.84	YES	NO	NO
Spain	57.4	19,011,121	6	49,233,604	38.6	0	-13.9	1	5,770	3.83	NO	NO	NO
Taiwan	46	9,793,750	15	19,063,919	51.4	0	6.4	2.8	12,533	3.6	YES	NO	NO
Singapore	44	4,592,224	0	9,569,813	48	0	0.8	1.6	15,351	4	YES	YES	NO
Belgium	42.3	220,121	6	24,673,502	0.9	28.9	-0.9	2	5,892	4.04	YES	NO	NO

United Kingdom	41.4	4,150,505	15.8	19,207,710	21.6	8.2	-19.5	0.1	5,570	3.99	YES	NO	NO
Netherlands	37.2	747,616	6	10,012,845	7.5	22.3	6.8	3.9	5,866	4.02	NO	NO	NO





Roadmap Recommendations

The ten-year trend in landings by volume is relatively stable combined with a $74 million per year domestic market opportunity and a $20.3 million international market opportunity. The demand “pull” for lobster is clear and there is a relatively stable resource supply. The specific markets for growth should be examined to identify higher value opportunities than current shipments are earning. Shifting to higher value markets and timing markets according to the highest prices through the year would be a means to tap into growth.

Bait complex

Access

Small pelagic fisheries are critically important for the supply of bait to Maine's lobster and other fixed gear fisheries, which are their primary market. Atlantic herring (*Clupea harengus*) is the most important of these, followed by menhaden (*Brevoortia tyrannus*) and alewife (*Alosa pseudoharengus*). Precipitous declines in herring abundance have driven commensurate declines in herring fishery allocations, leaving fishery stakeholders and managers scrambling to secure alternative sources of bait. Menhaden fisheries allocations have also declined overall in recent years, although less precipitously than herring, and Maine's proportion of the overall allocation has increased. Controlling input costs while ensuring the biosecurity of any bait supply alternatives remain top priorities for the state's seafood industry.

Maine's bait fisheries are managed under a variety of systems. Maine DMR issues a pelagic fishery license to commercial fishermen prosecuting bait fisheries and issues a license for menhaden specifically. The herring fishery is managed under a quota system under the New England Fishery Management Council's Atlantic herring fishery management plan, and by the Atlantic States Marine Fisheries Commission under its interstate fishery management plan governing spawning closures, prescribed landing days, and a fixed gear set-aside. Federal permits are issued by the National Marine Fisheries Service.

The menhaden fishery is also managed under the Atlantic States Marine Fisheries Commission's interstate fishery management plan, which sets commercial quotas across jurisdictions.

The alewife fishery is managed jointly by DMR and local municipalities. Individual towns submit harvesting plans to DMR each year, and escapement periods are required. Alewife runs that are not jointly managed by towns are governed by a take prohibition taking place over three days of each week.

Production

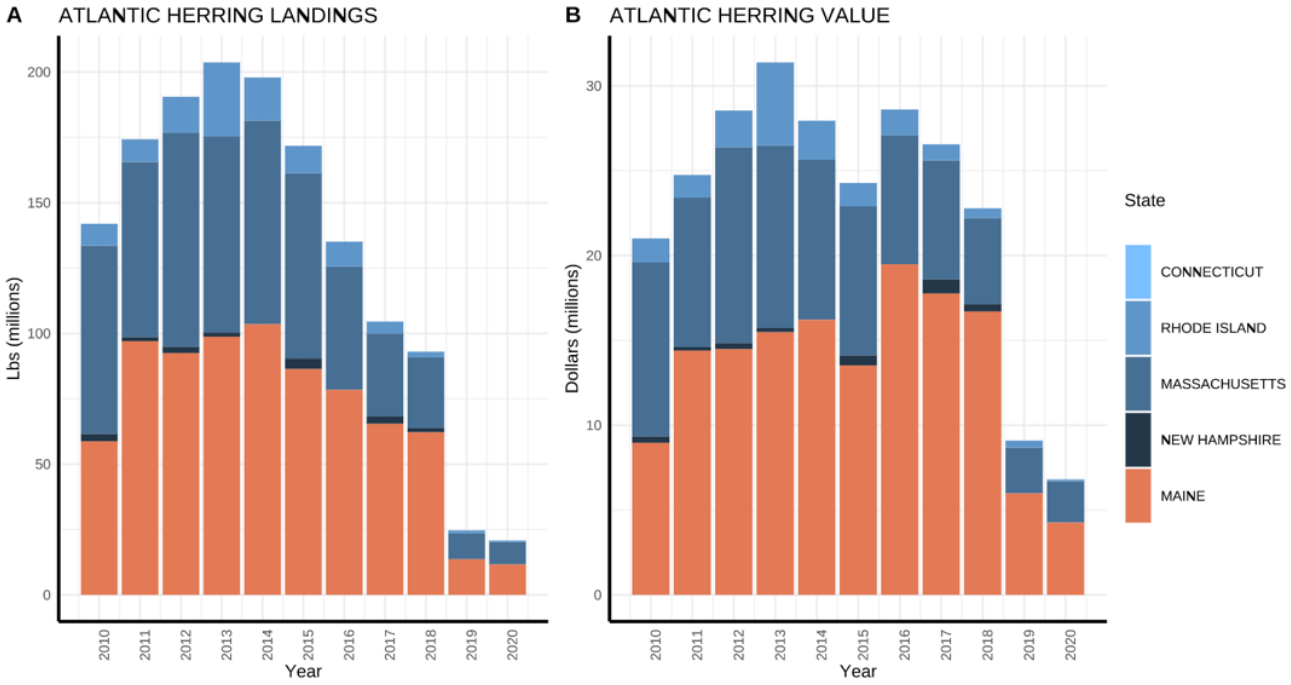


Figure 5.b.1. Atlantic herring landings (panel A) and value (panel B) across New England states.

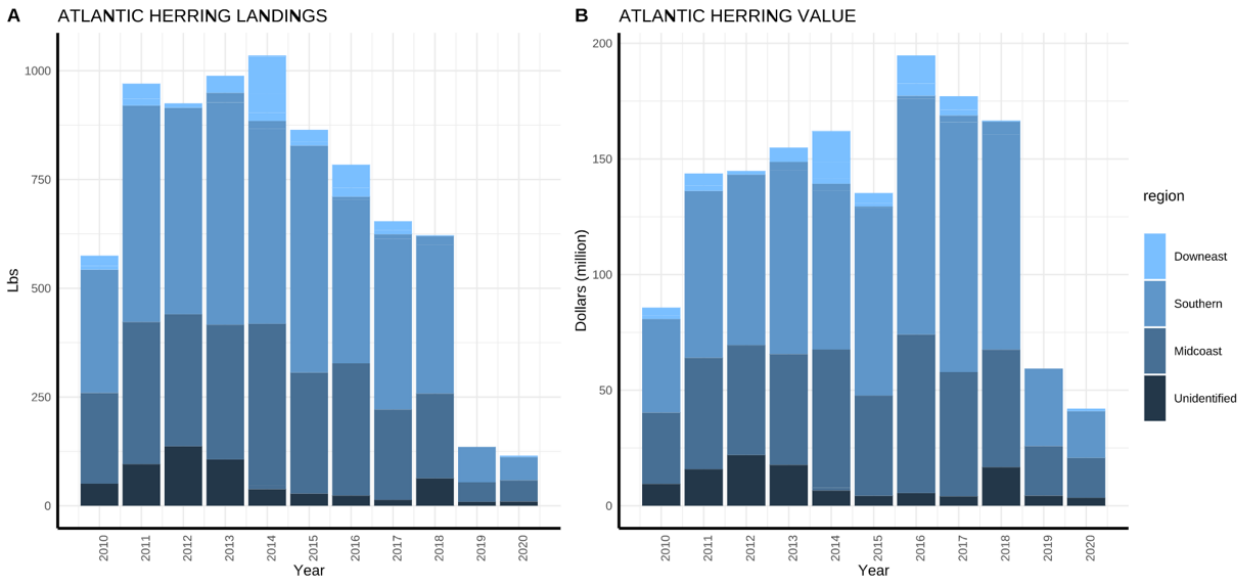


Figure 5.b.2. Atlantic herring landings (panel A) and value (panel B) across Maine regions.

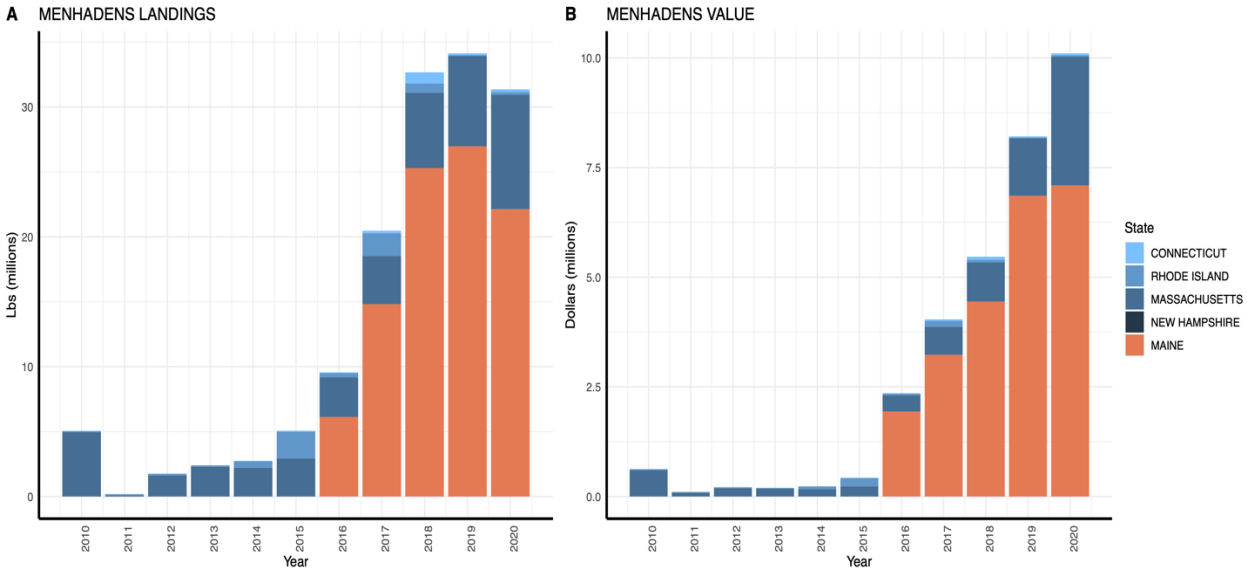


Figure 5.b.3. Menhaden landings (panel A) and value (panel B) across New England states.

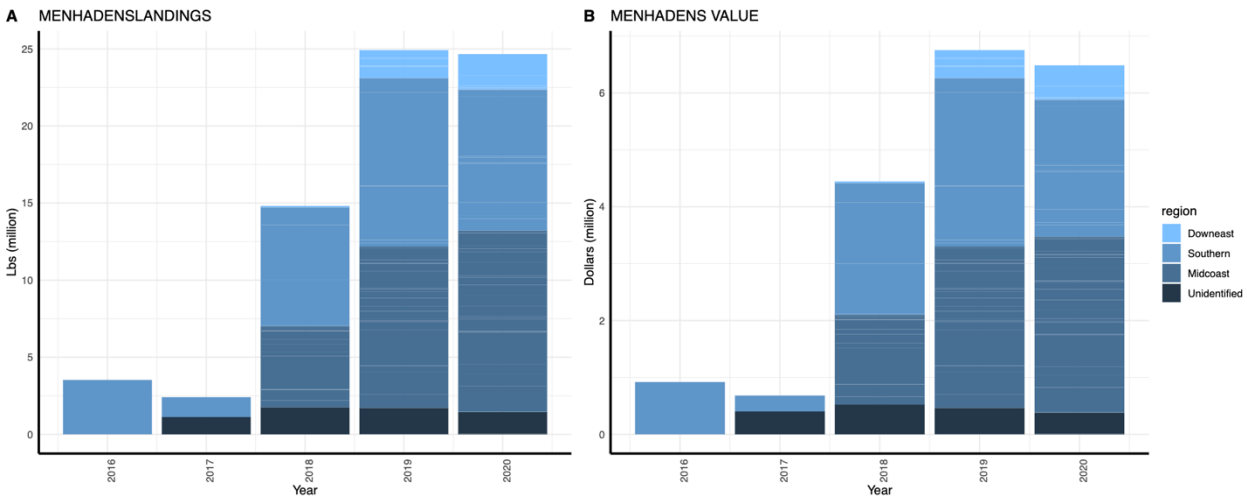


Figure 5.b.4. Menhaden landings (panel A) and value (panel B) across Maine regions.

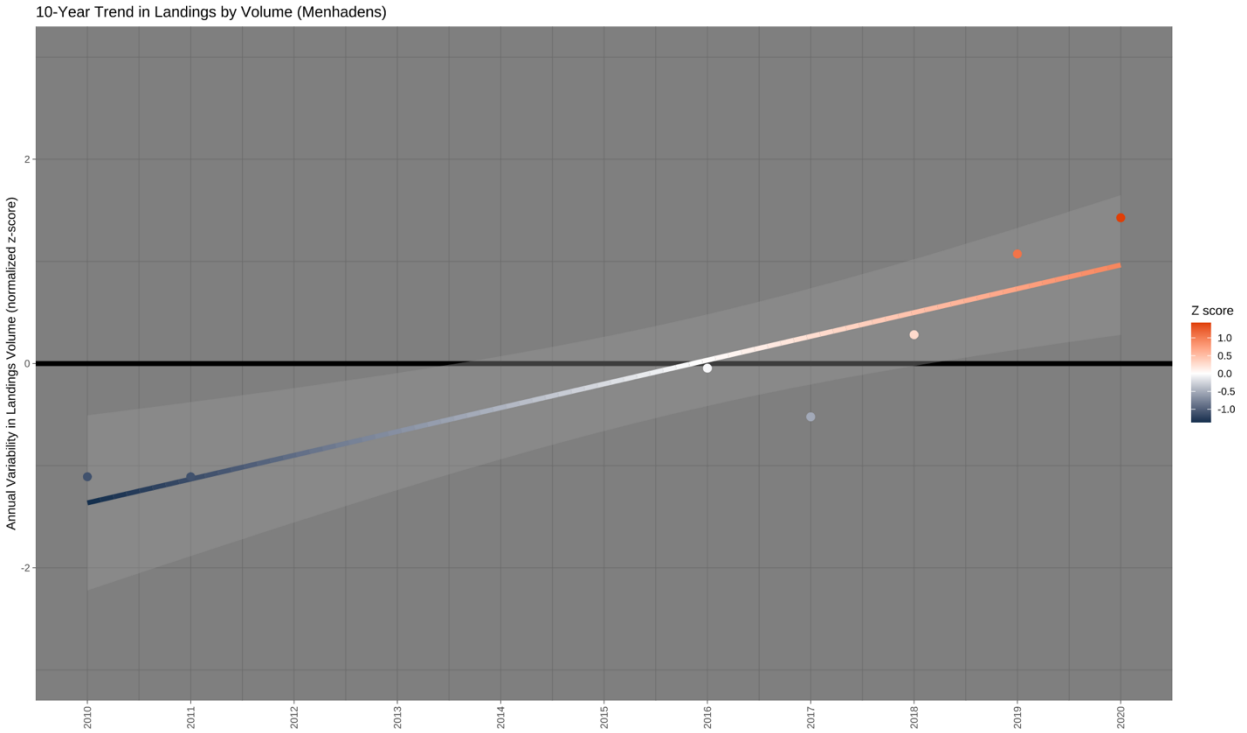


Figure 5.b.5. Annual variability in menhaden landings value in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual value relative to the ten-year average.

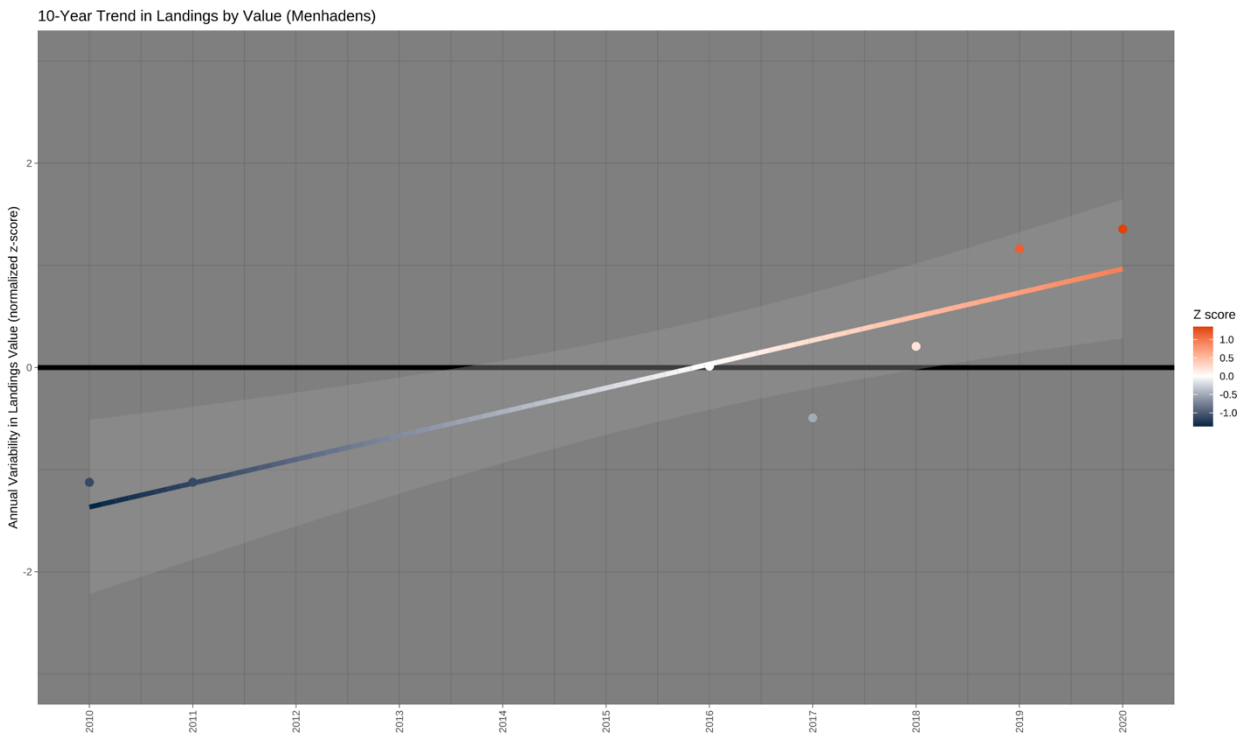


Figure 5.b.4. Annual variability in menhaden landings volume in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual volume relative to the ten-year average.

Market Opportunity

Bait species are primarily used in Maine's fisheries, however examining alternative values for these species dovetails with discussions regarding alternative bait options. Relieving pressure on current bait fisheries will enhance stock rebuilding efforts and recognizing the alternative value of restored populations may be helpful to those efforts. Herring is an example where it could fetch higher prices as a food or feedstock to another value-added product. The higher weight conversion ratio to human food compared to bait conversion to food (e.g., lobster) increases its market value.

There is a minimum $4.3 million per year herring market growth opportunity in the U.S. domestic market based on the ten-year trend in state imports. There has been a shift from frozen herring (80% of market down to 49%), while smoked and other cured herring products rose from almost zero to 42% of all imports. The top five states with the largest growth in demand are Massachusetts ($1.6 million per year), followed by California ($1.5 million), Maryland ($0.7 million), Virginia ($0.4 million), and Texas ($0.2 million).

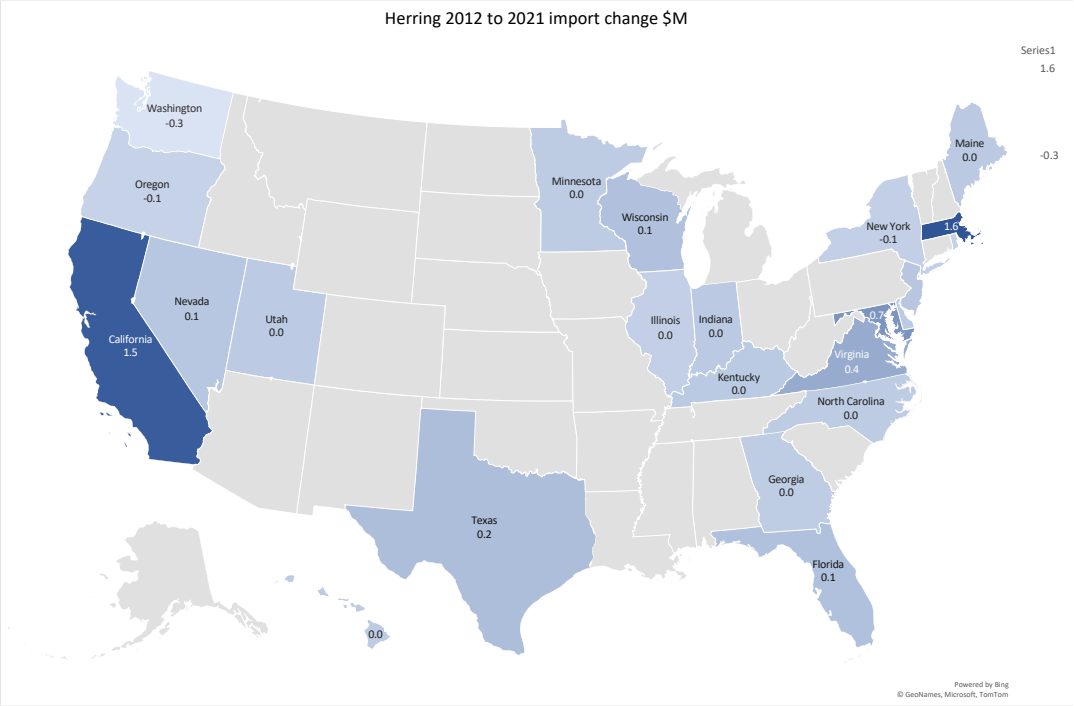


Figure 5.b.7. Herring import growth by state, 2012 - 2021 ($4.3 million/yr)

Source: U.S. Census Bureau

Note: Includes HS codes: 030240, 030241, 030351, 030486, 030554.

A 10% increase in U.S. herring exports to the main existing markets could build on existing exports to Canada, although they too are exploring alternative bait solutions.

The ITC ranks Singapore, Guatemala, and the Bahamas as the top potential new and expanding markets based on a combination of factors shown on the next table. These would move herring into food product forms that could fetch higher prices. The 12-year historical pattern in U.S. exports is shown for context where 2010 saw a peak in exports followed by low volumes since. This is not surprising since herring is intended mainly for local bait use and stocks have weakened substantially in the last decade. The bubble plot shows just one yellow circle indicating where the U.S. herring export growth to Canada is trailing other countries.

Table 5.b.1. Top three existing and potential growth U.S. export markets for herring

Existing Markets 2020				Potential New / Expanded Markets			
Top US Export Destinations	US Export Value ($)	Maine Exported Value to Top Destinations ($)	Maine % of US Exports to Top Destinations	Export Destination Ranking	Average Imports from US ($)	US Import Share (%)	US Import Growth (%)
Canada	176,423	26,326	15%	Singapore	2,266	8	+ 9
Mexico	30,004	0	0%	Guatemala	1,438	51	0
Dominican Republic	12,012	0	0%	Bahamas	1,251	100	0

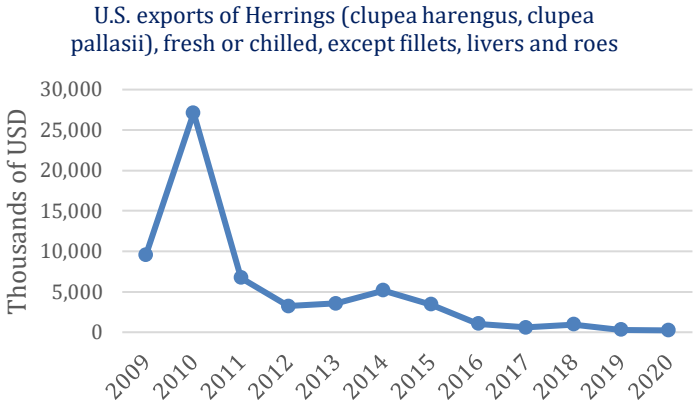
Source: International Trade Centre (ITC), UN Comtrade data.

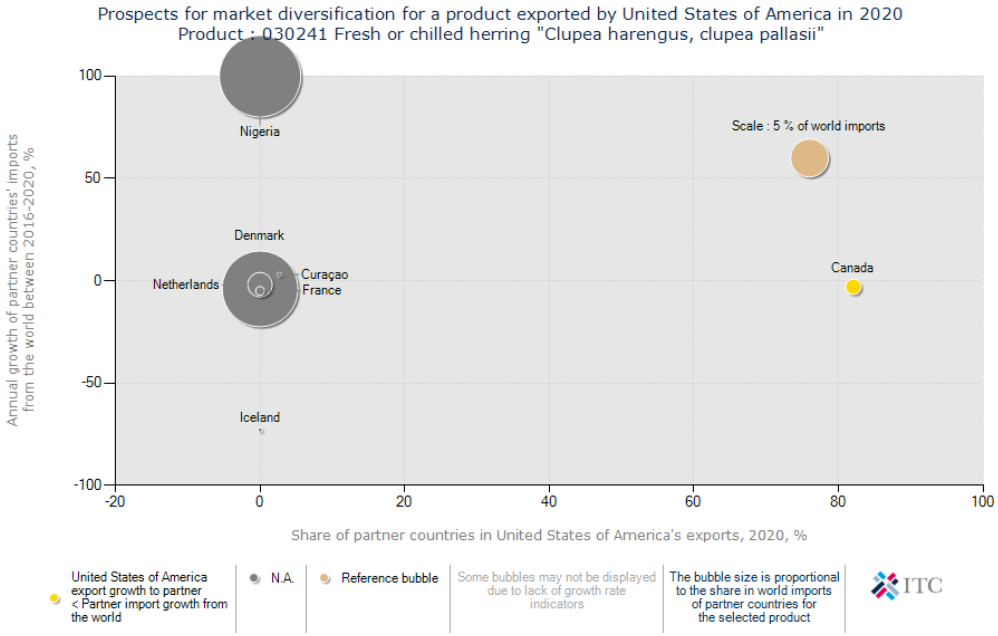
Note: Includes HS code: 030241.

Table5.b.2. Herring international opportunity metrics (HS030241),

Country	Total Score	Avg Imports from the US ($)	Max Avg Tariff (%)	Avg Imports from the World	US Import Share (%)	Import Share Gap	Import Growth (%)	GDP Growth (%)	Distance (km)	International Logistics Performance Index Score	Language Match	FTA with US	Landlocked
Singapore	83.2	2,266	0	29,379	7.7	0	9.4	1.6	15,351	4	YES	YES	NO
Guatemala	69.6	1,438	0	2,827	50.9	26.1	0	4.1	3,318	2.41	NO	YES	NO
Bahamas, The	50.6	1,251	30	1,251	100	0	0	-1.5	1,771	2.53	YES	NO	NO
Israel	34.9	0	0	84,653	0	0	-100	6	9,120	3.31	YES	YES	NO
Belgium	33.5	0	15	1,559,527	0	0	19.6	2	5,892	4.04	YES	NO	NO
Iceland	33.4	0	0	1,145,172	0	0	-74.7	1.1	4,202	3.23	YES	NO	NO
France	33.3	0	15	347,161	0	0	-4.9	1.6	5,838	3.84	YES	NO	NO
Ireland	31.9	0	15	32,845	0	0	1.9	9.3	5,118	3.51	YES	NO	NO

Panama	31.9	0	0	222	0	77	0	-2.2	3,581	3.28	NO	YES	NO
Norway	31.9	0	0	23,593,776	0	0	-4.1	-0.4	5,917	3.7	NO	NO	NO





Roadmap Recommendations

The ten-year trend in baitfish landings by volume shows a decline in recent years while the main market opportunity is the domestic $4 million in growth identified. The main consideration is whether alternative bait can be developed that would allow herring and other species used for the bait supply to be used for higher value products such as smoked product for human consumption that will fetch higher prices. This must only be pursued in the context of supportive fish stocks and a stable or positive outlook for harvests. Maine places a high value on biosecurity, reflected both in its relatively restrictive bait import regulatory program and in stakeholder sentiment. The elevated importance of this issue in continuing to facilitate a productive lobster fishery and reduce input costs may warrant additional budgetary investment in studying alternative baits and researching their effectiveness in the fishery.

Oyster

Access

Oyster mariculture is managed by DMR's aquaculture program. DMR issues leases for standard and experimental aquaculture leases of various sizes, and it issues Limited Purpose Aquaculture (LPA) leases of no greater than 400 square feet. In 2020 there were 115 standard and experimental aquaculture leases growing oysters as a primary species, totaling 707 acres under cultivation, and there were 769 LPA leases in the state, many of which cultivate oysters.

Production

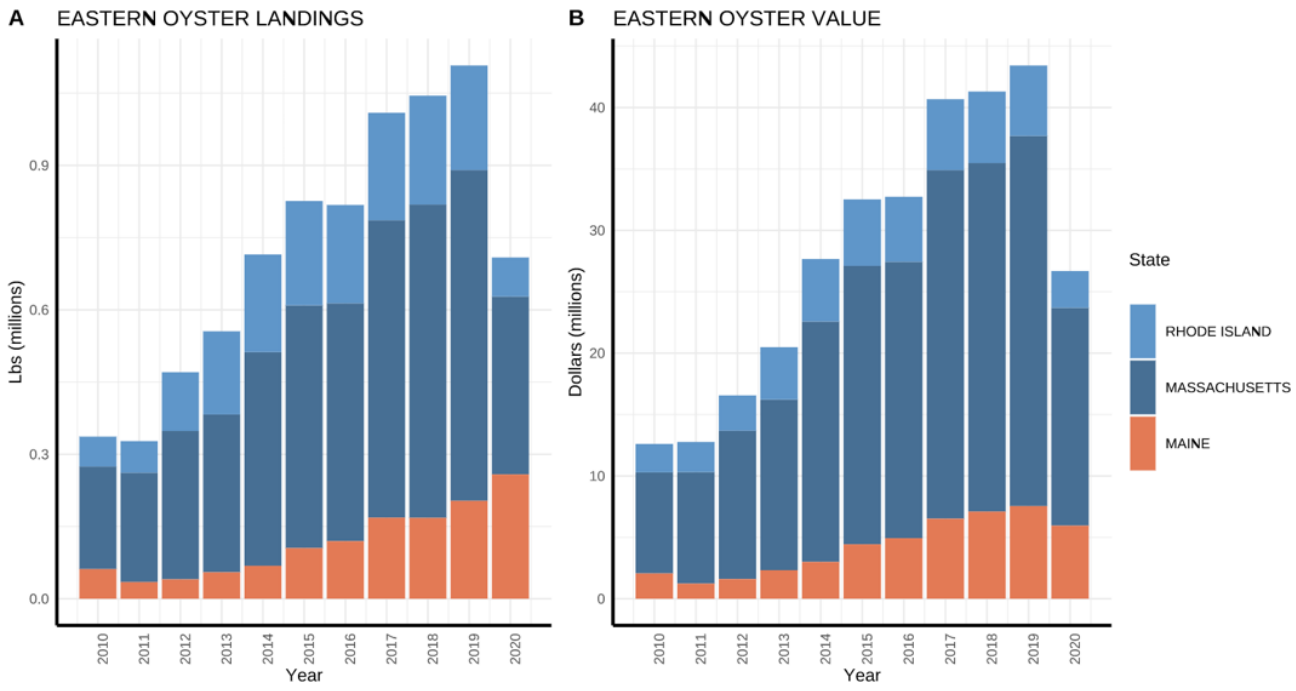


Figure 5.c.1. Oyster landings (panel A) and value (panel B) across New England states.

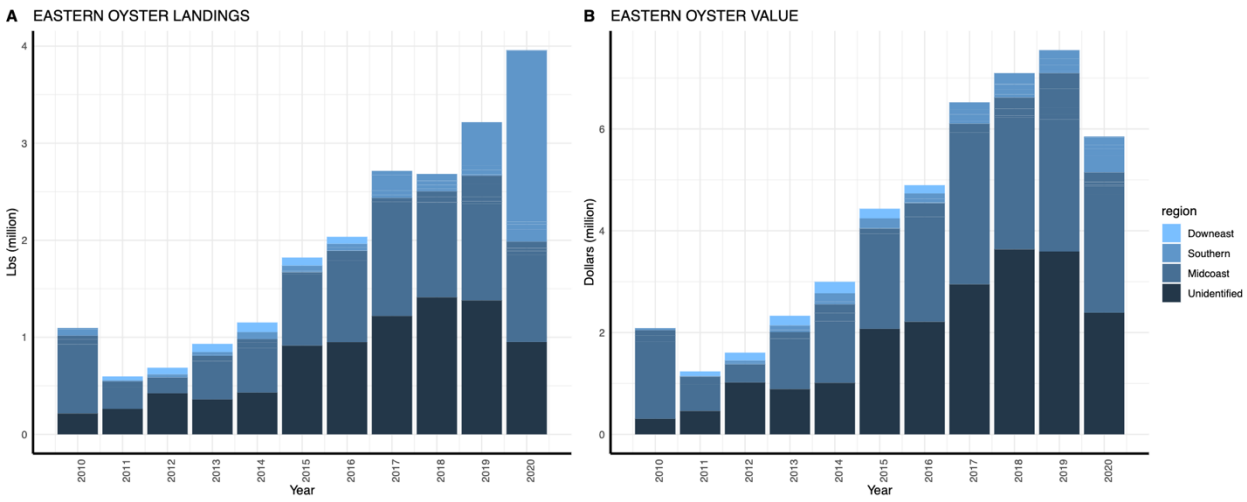


Figure 5.c.2. Oyster landings (panel A) and value (panel B) across Maine regions.

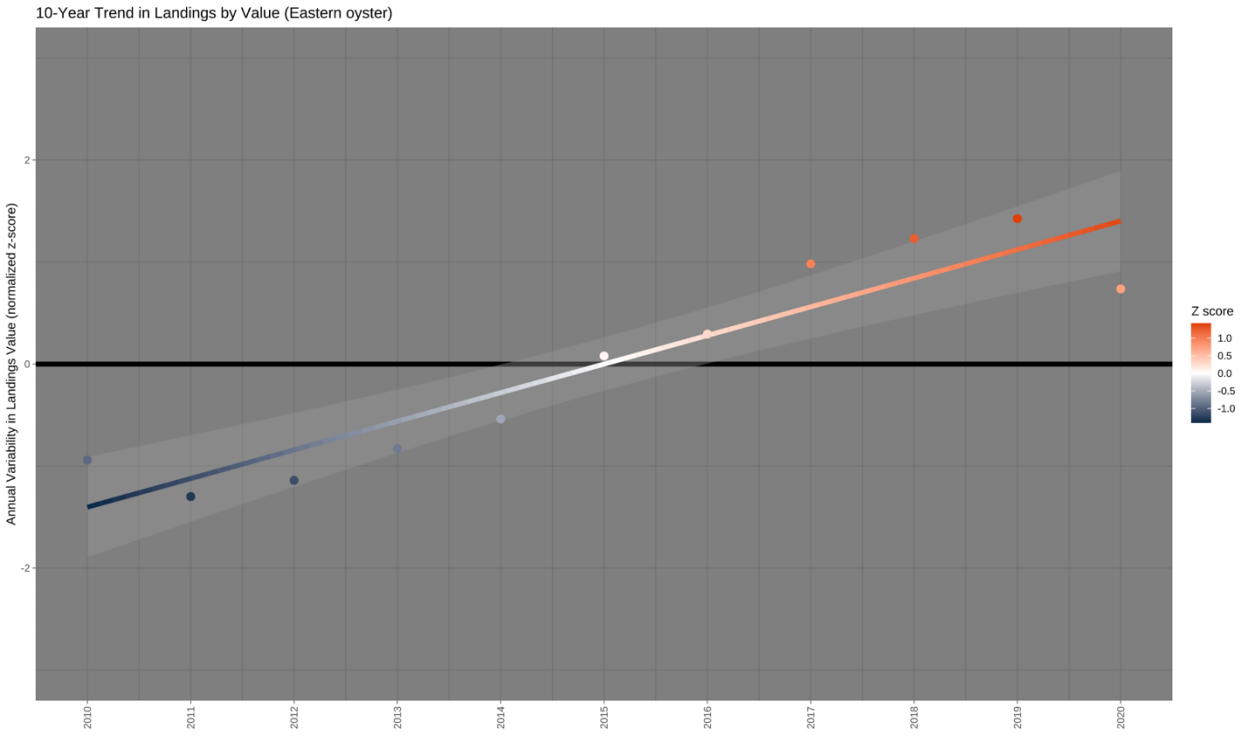


Figure 5.c.3. Annual variability in oyster landings value in Maine over the period of record from 2010-2020. Trendline indicates linear regression and

shaded area indicates 95% confidence interval. Z-scores indicate annual value relative to the ten-year average.

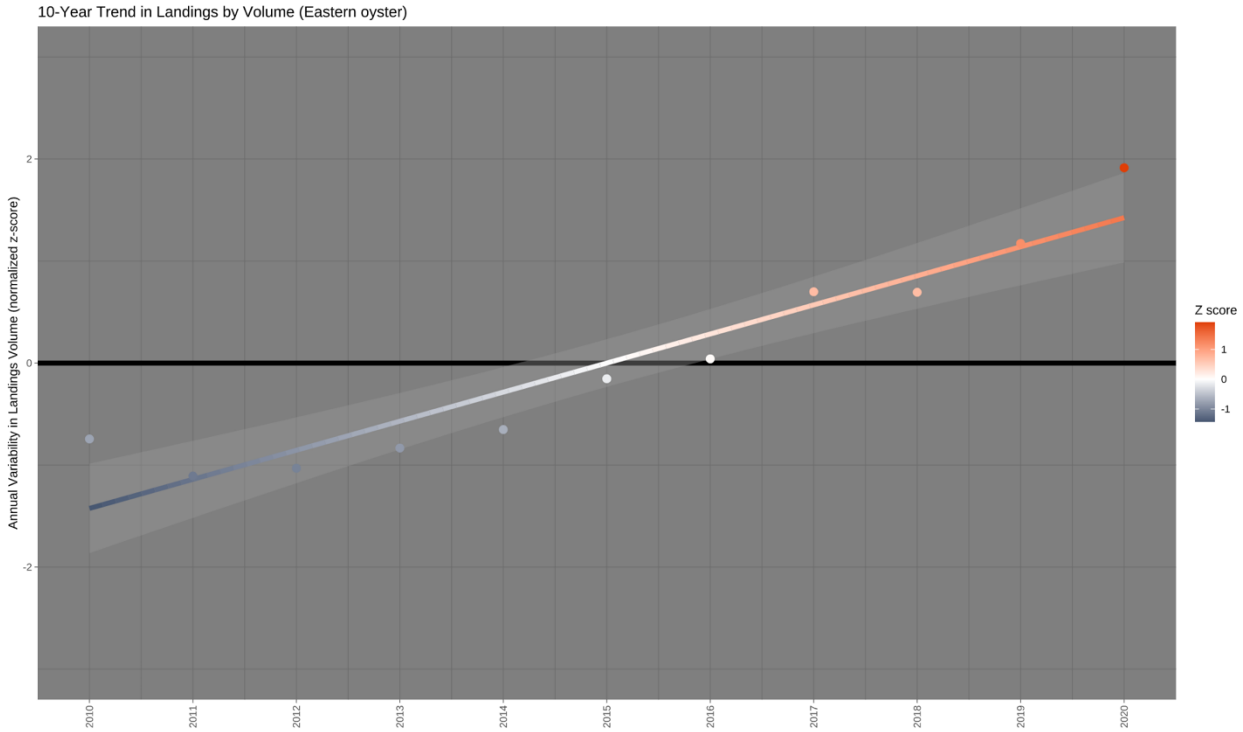


Figure 5.c.4. Annual variability in oyster landings volume in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual volume relative to the ten-year average.

Market Opportunity

There is a minimum $4.7 million per year oyster market growth opportunity in the U.S. domestic market based on the ten-year trend in state imports. Fresh oyster demand has remained steady as market share ranged from 76% to 79% over the last decade, while frozen oysters have risen from near zero to 19% of imports. The top five states with the largest growth in demand are California ($1.8 million per year), followed by Massachusetts ($1.3 million), New Jersey ($0.4 million), Washington ($0.3 million), and New York ($0.1 million).

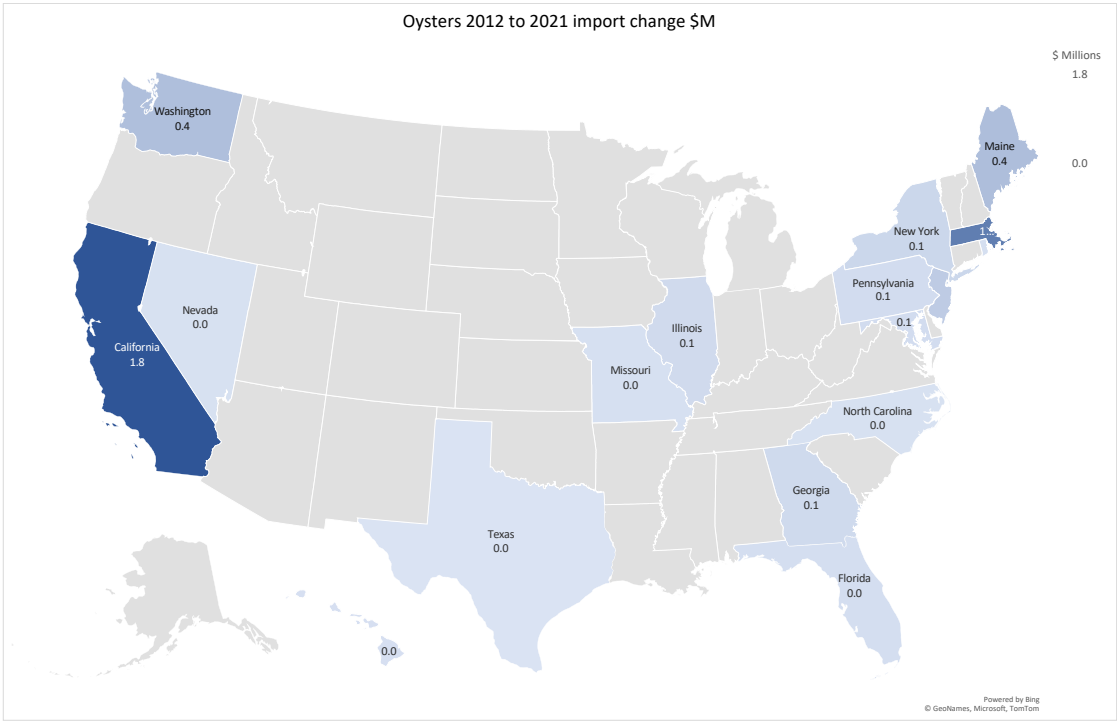


Figure 5.c.5. Oyster import growth by state, 2012 – 2021 ($4.7 million/yr).

Source: U.S. Census Bureau

Note: Includes HS codes: 030710, 030711, 030712, and 030719.

Driving a 10% increase in U.S. oyster exports to the main existing markets will rely on exports to Canada, Hong Kong, and Singapore. Maine could begin shipping oysters to these countries, particularly to Hong Kong and Singapore, which are not oyster producing countries like Canada.

The ITC ranks Singapore, China, and Vietnam as the top potential new and expanding markets based on a combination of factors shown on the next table. The 12-year historical pattern in U.S. exports shows a steady decline over the period with 2020 exports down to about half of the peak in 2009. The bubble plot shows blue circles where the U.S. is gaining market share faster than other countries, and yellow circles indicate where the U.S. export growth is

trailing other countries. Larger circles mean the target country represents are larger share of world imports for this product.

Table 5.c.1. Top three existing and potential growth U.S. export markets for oyster ($1.4 million).

Existing Markets 2020				Potential New / Expanded Markets			
Top US Export Destinations	US Export Value ($)	Maine Exported Value to Top Destinations ($)	Maine % of US Exports to Top Destinations	Export Destination Ranking	Average Imports from US ($)	US Import Share (%)	US Import Growth (%)
Canada	8,054,573	0	0%	Singapore	1,306,800	22	- 11
Hong Kong	3,644,302	0	0%	China	586,452	2	- 4
Singapore	1,306,800	0	0%	Vietnam	603,653	43	+ 40

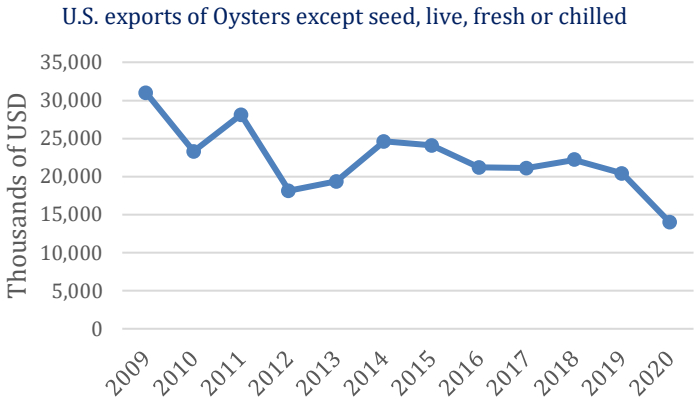
Source: International Trade Centre (ITC), UN Comtrade data.

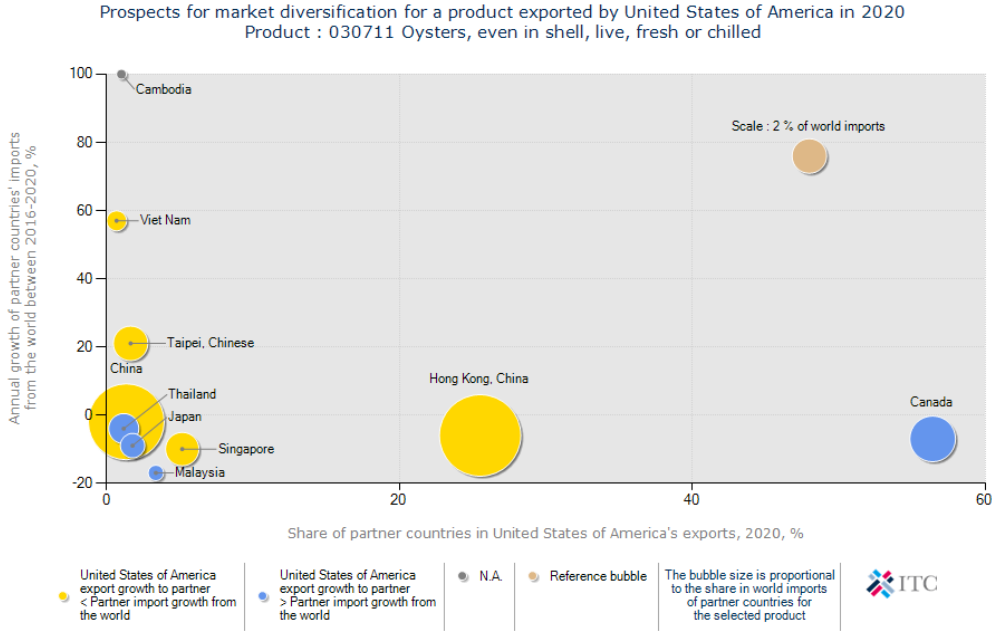
Note: Includes HS code: 030711.

Table 5.c.2. Oyster international opportunity metrics (HS030711).

Country	Total Score	Avg Imports from the US ($)	Max Avg Tariff (%)	Avg Imports from the World	US Import Share (%)	Import Share Gap	Import Growth (%)	GDP Growth (%)	Distance (km)	International Logistics Performance Index Score	Language Match	FTA with US	Landlocked
Singapore	83.4	1,306,800	0	5,952,729	22	0	-11	1.6	15,351	4	YES	YES	NO
China	56.8	586,452	3.5	32,198,621	1.8	1	-4.2	7	10,994	3.61	YES	NO	NO
Vietnam	50.2	603,653	0	1,391,930	43.4	0	40.4	7.2	13,159	3.27	NO	NO	NO
Malaysia	46.9	538,822	0	1,434,309	37.6	0	-16.8	2.8	15,130	3.22	YES	NO	NO
Thailand	45.6	319,714	0	4,396,613	7.3	11.3	-5	5	13,943	3.41	NO	NO	NO
Bahamas, The	40.3	289,677	30	327,700	88.4	0	178.2	-1.5	1,771	2.53	YES	NO	NO
Taiwan	39.9	227,523	12.5	2,605,996	8.7	0	24.5	2.8	12,533	3.6	YES	NO	NO
Japan	38.5	261,179	7	2,645,833	9.9	0	-13.6	-0.1	10,856	4.03	NO	NO	NO

Israel	35.7	0	0	270,800	0	0	-6	6	9,120	3.31	YES	YES	NO
Belgium	34.6	0	4.5	10,350,255	0	0	13.6	2	5,892	4.04	YES	NO	NO





Roadmap Recommendations

The ten-year trend in landings by volume is very positive with clear growth in production to go with the $4.7 million per year domestic market opportunity and the $1.4 million international market opportunity. The demand “pull” for oysters is strong and Maine appears poised to increase supply. Starting with the highest value markets, Maine can fill orders in a number of states and potential countries.

Mussel

Access

Maine's mussel production is derived from a wild capture fishery and aquaculture production. Both wild capture and aquaculture production are managed by DMR. The wild capture fishery is managed under a set of regulations that limit harvest to daytime hours, limit the size of mussel drags, limit seed mussel harvest (via volume restrictions), and establish seed mussel conservation areas.

In 2021 there were 21 mussel dragger licenses and 26 mussel hand licenses issued by Maine DMR. The average age of a mussel license holder was 49.5 years. 27 mussel licenses were based in the Eastern region; 13 were based in the Midcoast region; 7 were based in the Southern region.

Mussel mariculture is managed by DMR's aquaculture program. DMR issues leases for standard and experimental aquaculture leases of various sizes, and it issues Limited Purpose Aquaculture (LPA) leases of no greater than 400 square feet. However, there are currently no LPA leases for mussels. In 2020 there were 32 standard and experimental aquaculture leases growing mussels, totaling 350 acres under cultivation.

Production

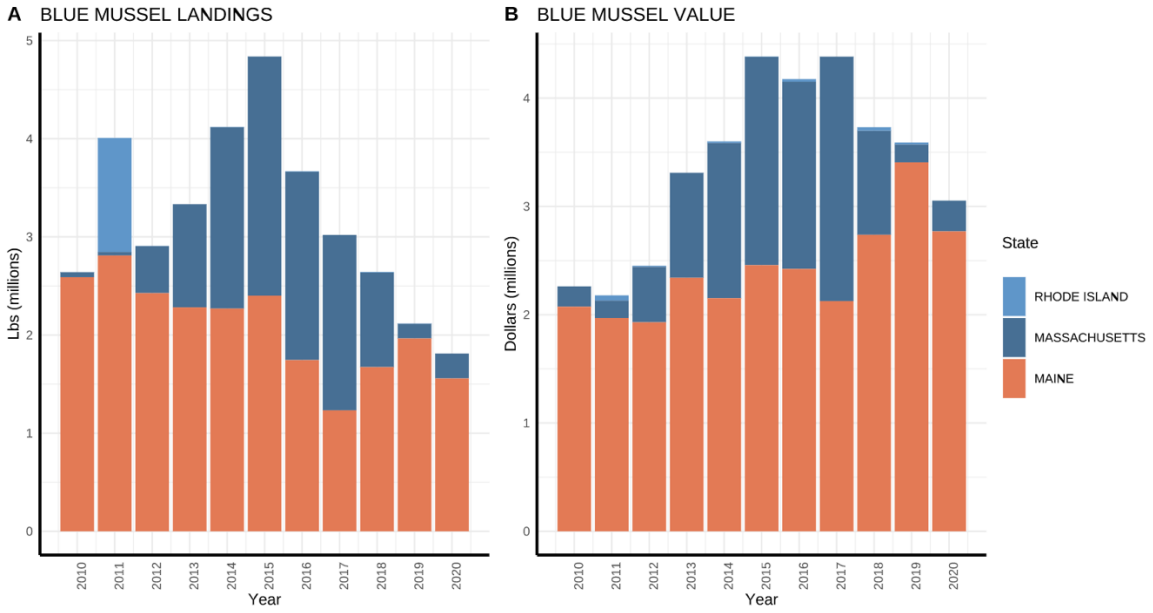


Figure 5.d.1. Mussel landings (panel A) and value (panel B) across New England states.

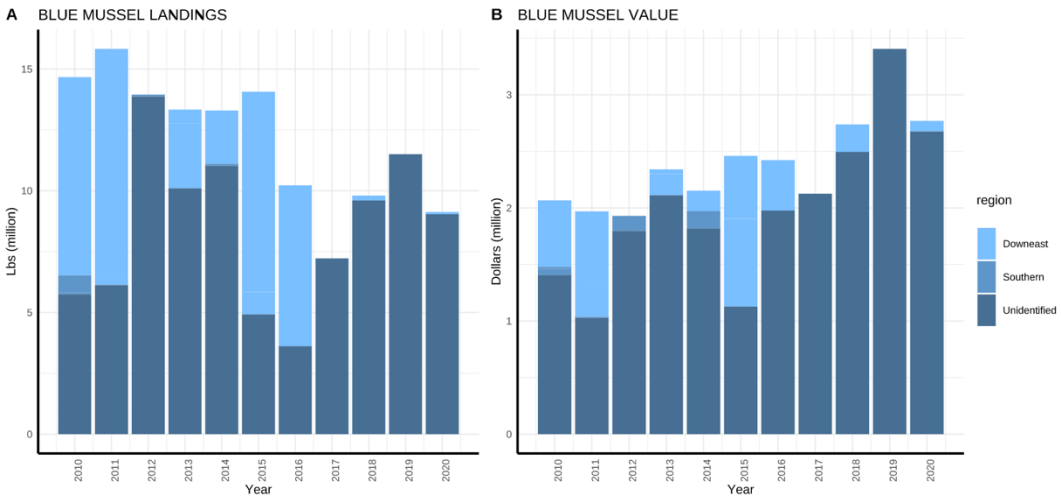


Figure 5.d.2. Mussel landings (panel A) and value (panel B) across Maine regions.

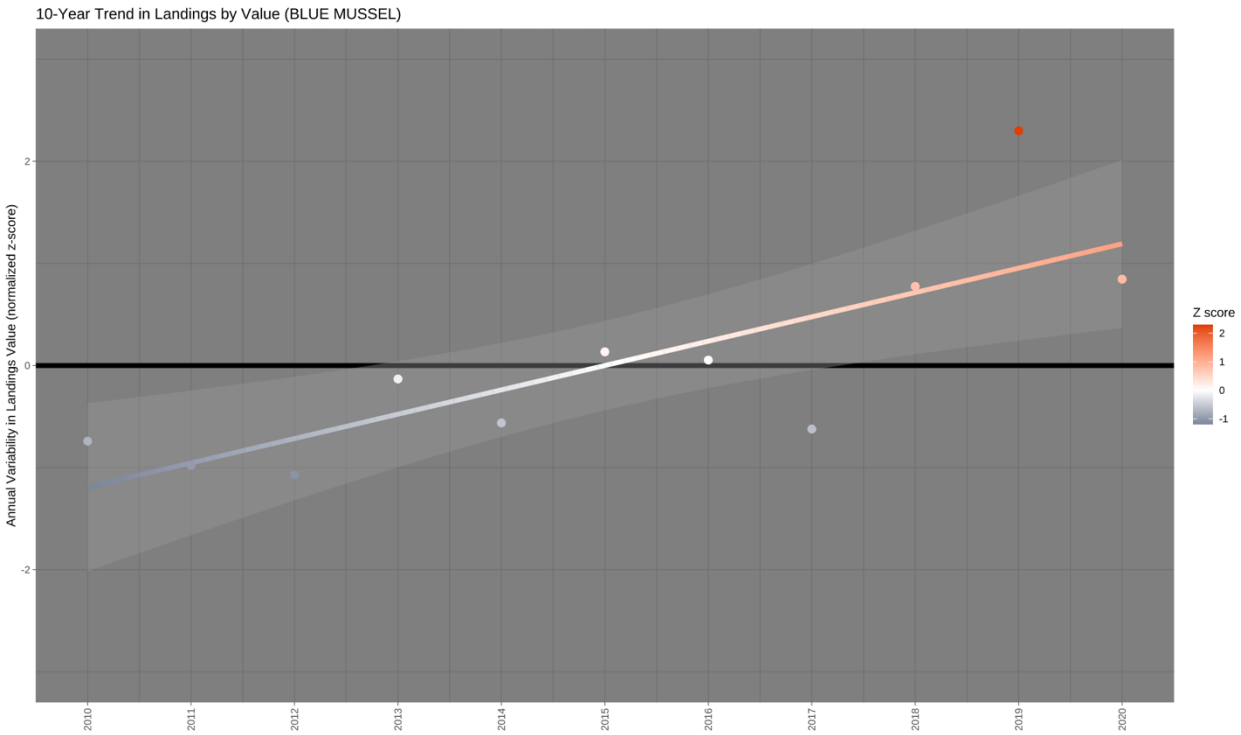


Figure 5.d.3. Annual variability in mussel landings value in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual value relative to the ten-year average.

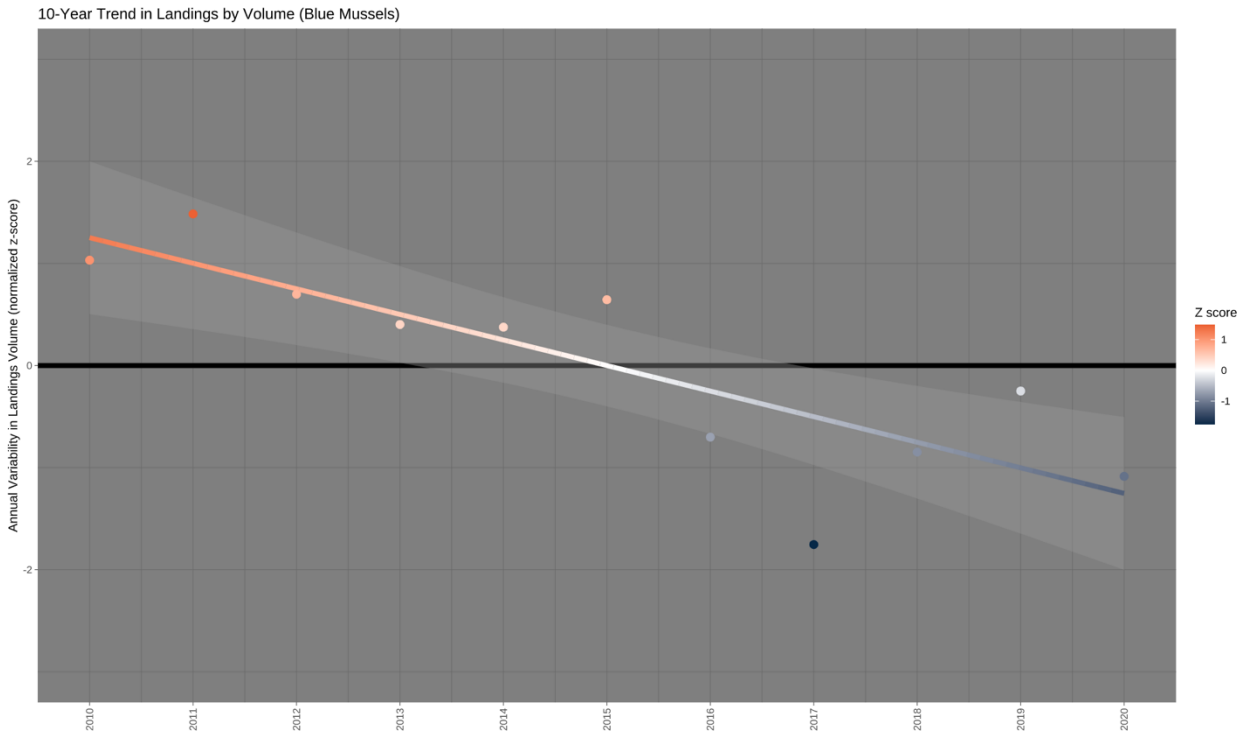


Figure 5.d.4. Annual variability in mussel landings volume in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual volume relative to the ten-year average.

Market Opportunity

There is a minimum $1.2 million per year mussel market growth opportunity in the U.S. domestic market based on the ten-year trend in state imports. Frozen mussel demand rose from near zero to 52% of imports, while the share of fresh and other forms declined. The top five states with the largest growth in demand are California ($2.7 million per year), followed by New Jersey ($0.8 million), Pennsylvania ($0.3 million), Vermont ($0.1 million), and New Hampshire ($0.1 million). These were partially offset by declines in other states such as New York, Massachusetts, and Florida.

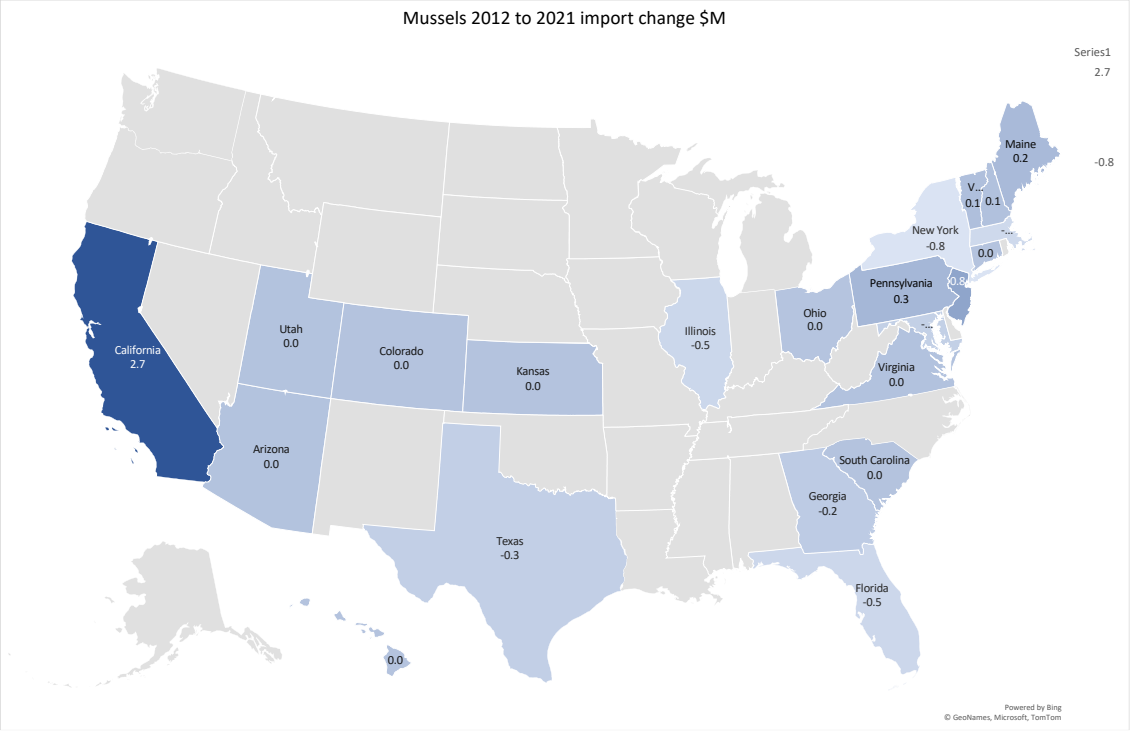


Figure 5.d.1. Mussel import growth by state, 2012 - 2021 ($1.2 million/yr).

Source: U.S. Census Bureau

Note: Includes HS codes: 030731, 030732, and 030739.

Driving a 10% increase in U.S. mussel exports to the main existing markets will rely on exports to Canada, Japan, and Saudi Arabia. Maine could begin shipping mussels to these countries, particularly to Japan and Saudi Arabia since there is ample room to grow.

The ITC ranks Guatemala, the Bahamas, and the Dominican Republic as the top potential new and expanding markets based on a combination of factors shown on the next table. The 12-year historical pattern in U.S. exports shows a sharp rise in 2017 with otherwise variable exports over the period. The bubble plot shows yellow circles where the U.S. export growth is trailing other countries. Larger circles mean the target country represents are larger share of world imports for this product.

Table 5.d.1. Top three existing and potential growth U.S. export markets for mussels ($100,000)

Existing Markets 2020				Potential New / Expanded Markets			
Top US Export Destinations	US Export Value ($)	Maine Exported Value to Top Destinations ($)	Maine % of US Exports to Top Destinations	Export Destination Ranking	Average Imports from US ($)	US Import Share (%)	US Import Growth (%)
Canada	309,913	0	0%	Guatemala	263,819	100	+ 2
Japan	143,150	0	0%	Bahamas	184,191	82	+ 166
Saudi Arabia	32,000	0	0%	Dominican Republic	3,944	0	+ 7

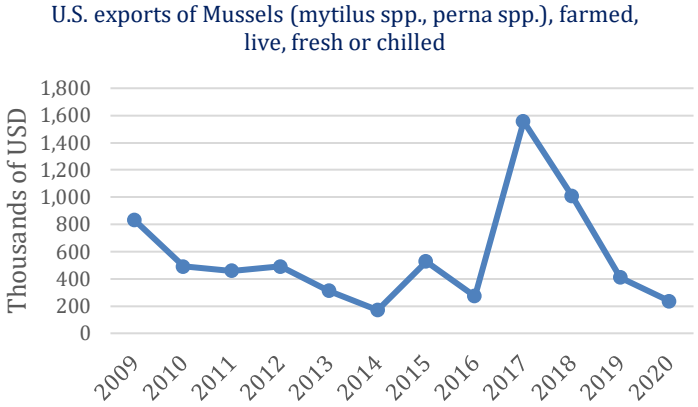
Source: International Trade Centre (ITC), UN Comtrade data.

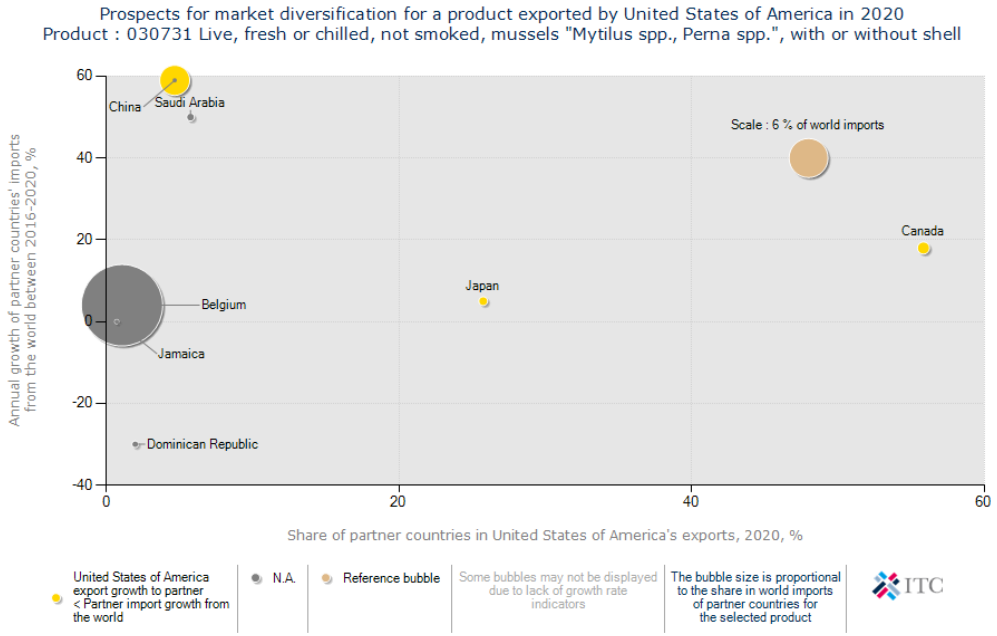
Note: Includes HS code: 030731.

Table 5.d.2. Mussels international opportunity metrics (HS030731)

Country	Total Score	Avg Imports from the US ($)	Max Avg Tariff (%)	Avg Imports from the World	US Import Share (%)	Import Share Gap	Import Growth (%)	GDP Growth (%)	Distance (km)	International Logistics Performance Index Score	Language Match	FTA with US	Landlocked
Guatemala	78.8	263,819	0	264,939	99.6	0	2.3	4.1	3,318	2.41	NO	YES	NO
Bahamas, The	63.2	184,191	30	224,405	82.1	0	166	-1.5	1,771	2.53	YES	NO	NO
Dominican Republic	39.8	3,944	0	946,351	0.4	27.4	7.1	1	2,509	2.66	NO	YES	NO
Czech Republic	33.9	69,846	9	401,298	17.4	0	-0.5	5.7	6,574	3.68	NO	NO	YES
Singapore	33.7	586	0	28,922	2	0	13.3	1.6	15,351	4	YES	YES	NO
Israel	33.4	800	0	323,800	0.2	0	-14.8	6	9,120	3.31	YES	YES	NO
Belgium	32.3	0	9	82,945,051	0	0	5.5	2	5,892	4.04	YES	NO	NO

France	31.9	0	9	47,754,459	0	0	-5.6	1.6	5,838	3.84	YES	NO	NO
Australia	31.7	0	0	1,417,012	0	0.3	7.4	2.4	16,009	3.75	YES	YES	NO
United Kingdom	31.6	0	5.2	1,020,382	0	0	-0.5	0.1	5,570	3.99	YES	NO	NO





Roadmap Recommendations

The ten-year trend in landings by volume is relatively stable combined with a $1.2 million per year domestic market opportunity and a $100,000 international market opportunity. The demand exists for growth and there is a relatively stable resource supply. The specific markets for growth should be examined to identify higher value opportunities than current shipments are earning. Shifting to higher value markets and timing markets according to the highest prices through the year would be a means to tap into growth.

Scallop

Access

Maine's scallop fisheries are managed by the Maine Department of Marine Resources within state waters and the New England Fishery Management Council/National Marine Fisheries Service in federal waters. The state waters fishery is managed under Maine's scallop fishing laws and regulations that limit harvesting to specific areas, limit the size of scallops that may be landed, limit the volume that can be caught per day, limit the days over which dive, and drag segments of the fishery may operate, and provide for the establishment of dynamic in-season emergency closures. The federal waters fishery is managed under the New England Fishery Management Council's scallop fishery management plan. Maine's federally permitted scallop fishermen sometimes travel to Southern New England to fish; recently, the Northern Gulf of Maine set-aside quota has been increased, providing additional opportunity for Northern Gulf of Maine permitted, Maine-homeported scallop fishing vessels to fish closer to home.

In 2021 there were 519 scallop dragger licenses and 73 scallop diver licenses issued by Maine DMR. The average age of a scallop license holder was 53 years. 447 licenses were based in the Eastern region; 99 were based in the Midcoast region; 46 were based in the Southern region.

Scallop aquaculture in Maine has been an area of research and limited commercial enterprise focus for decades. 37 standard and experimental leases issued by DMR list scallops as a primary species; however, it is unclear whether there is significant scallop production at any of these facilities, and

only a few are currently producing scallops for commercial sales. A proportion of the state's Limited Purpose Aquaculture leases are focused on scallop production.

Production

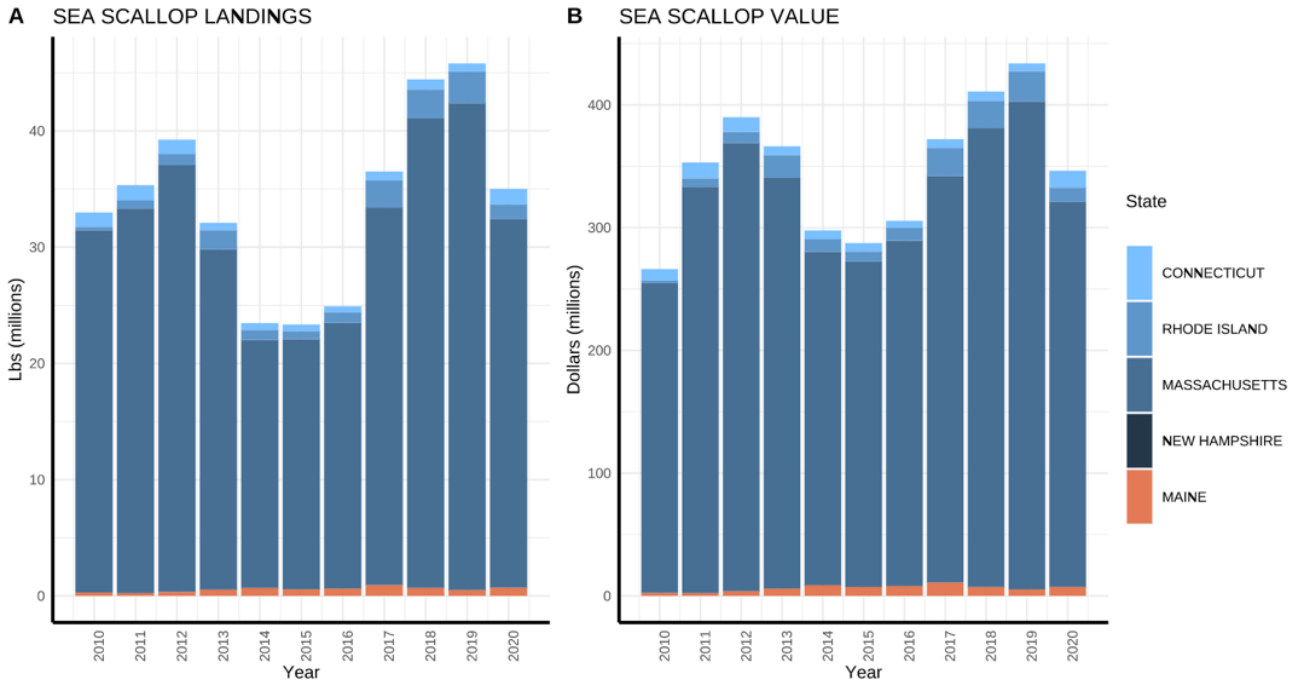


Figure 5.e.1. Scallop landings (panel A) and value (panel B) across New England states.

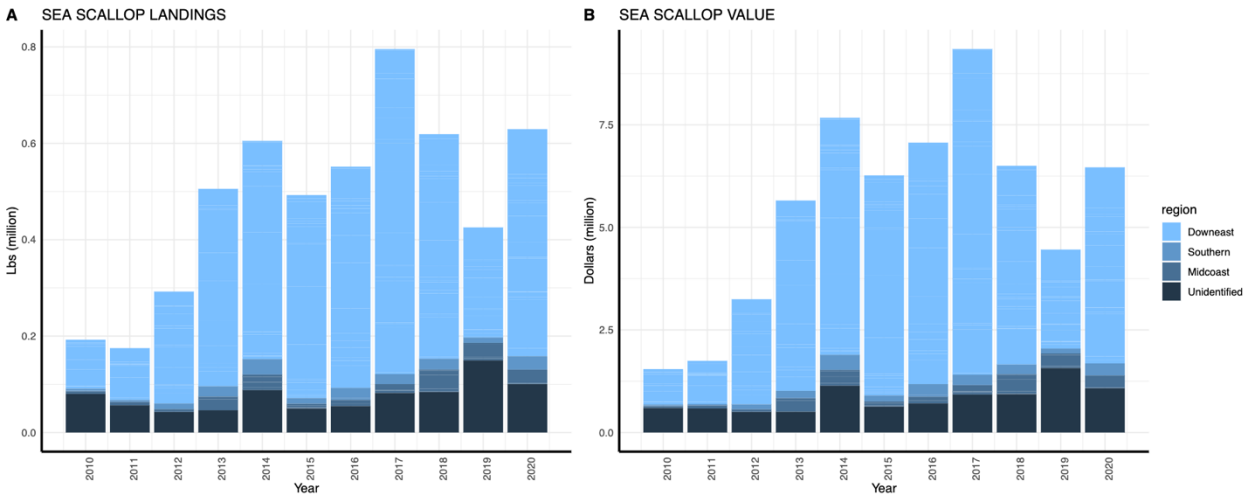


Figure 5.e.2. Scallop landings (panel A) and value (panel B) across Maine regions.

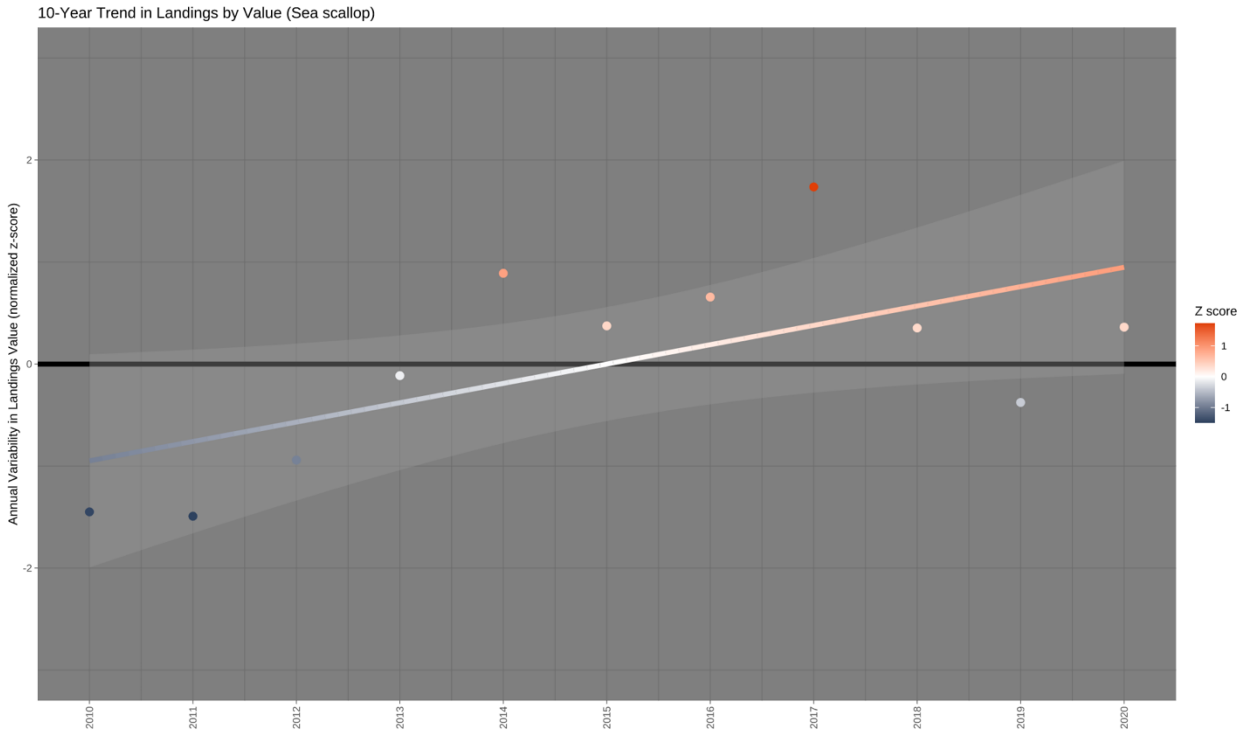


Figure 5.e.3. Annual variability in oyster landings value in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual value relative to the ten-year average.

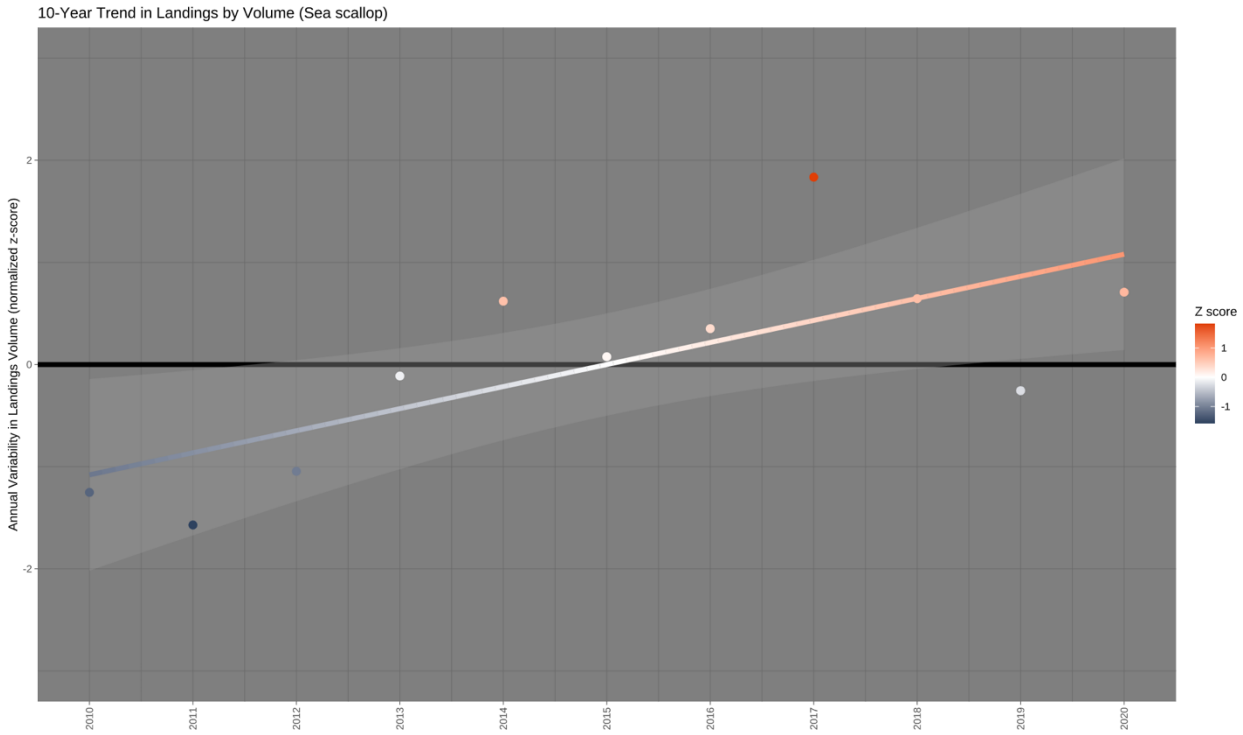


Figure 5.e.4. Annual variability in scallop landings volume in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual volume relative to the ten-year average.

Market Opportunity

There is a minimum $10.3 million per year scallop market growth opportunity in the U.S. domestic market based on the ten-year trend in state imports. In the last decade, fresh scallop demand rose slightly from 17% to 22% of imports, while the share of frozen and other forms declined accordingly. The top five states with the largest growth in demand are California ($4.4 million per year), followed by Washington ($1.9 million), New Jersey ($1.8 million), Oregon ($0.4 million), and Louisiana ($0.4 million).

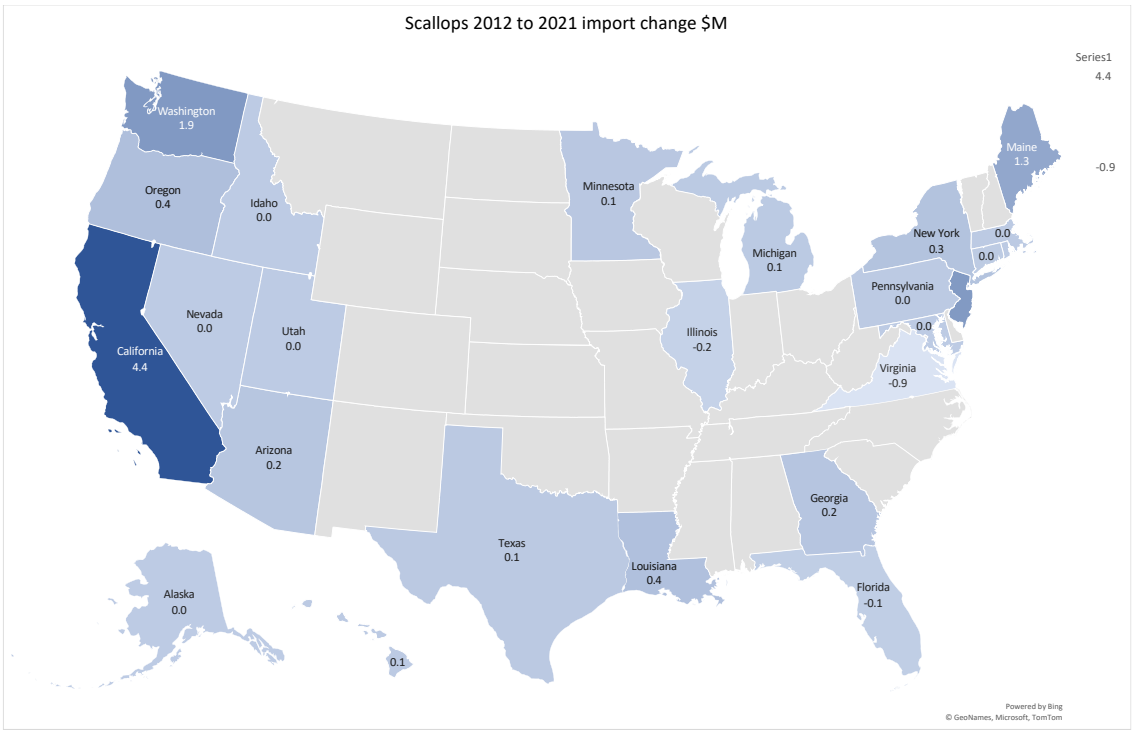


Figure 5.e.5. Scallop import growth by state, 2012 - 2021 ($10.3 million/yr).

Source: U.S. Census Bureau

Note: Includes HS codes: 030721, 030722, and 030729.

A 10% increase in U.S. scallop exports to the main existing markets will build on exports to Canada, France, and Switzerland. Maine only supplies scallops to Canada and France in small quantities, and none to Switzerland. There is certainly room to grow in all three countries and particularly those already familiar with U.S. products.

The ITC ranks Germany, Switzerland, and Spain as the top potential new and expanding markets based on a combination of factors shown on the next table. The 12-year historical pattern in U.S. exports is shows steady decline to one-third of the in 2011. The bubble plot shows blue circles where the U.S. is gaining market share faster than other countries, and yellow circles indicate

where the U.S. export growth is trailing other countries. Larger circles mean the target country represents are larger share of world imports for this product.

Table 5.3.1. Top three existing and potential growth U.S. export markets for scallop ($1.3 million)

Existing Markets 2020				Potential New / Expanded Markets			
Top US Export Destinations	US Export Value ($)	Maine Exported Value to Top Destinations ($)	Maine % of US Exports to Top Destinations	Export Destination Ranking	Average Imports from US ($)	US Import Share (%)	US Import Growth (%)
Canada	6,155,738	10,001	0.2%	Germany	1,832,456	29	- 11
France	2,534,463	6,545	0.3%	Switzerland	1,729,806	35	- 4
Switzerland	1,729,806	0	0%	Spain	699,093	4	+ 12

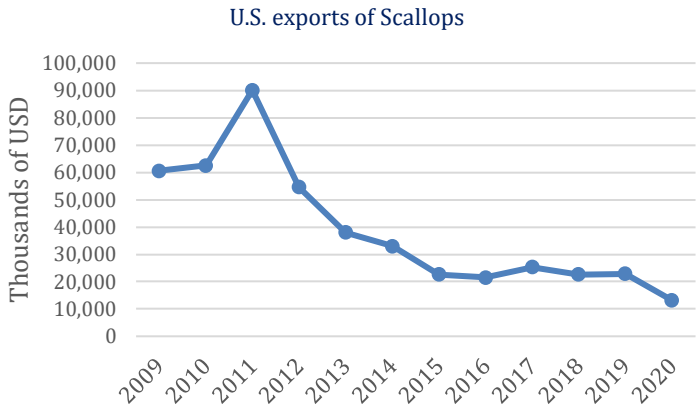
Source: International Trade Centre (ITC), UN Comtrade data.

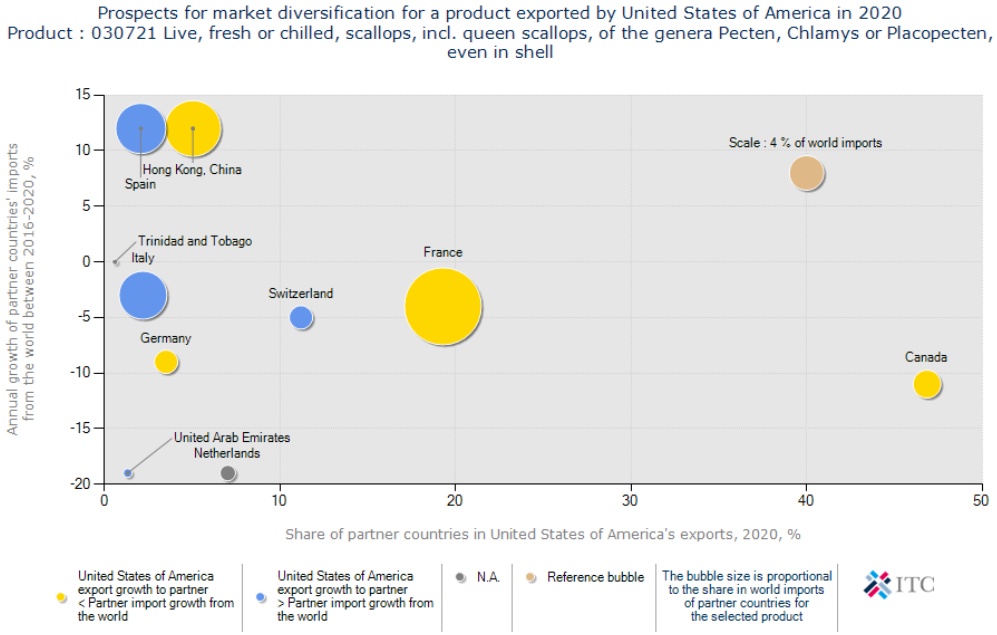
Note: Includes HS code: 030721.

Table 5.e.2. Scallops international opportunity metrics (HS030721).

Country	Total Score	Avg Imports from the US ($)	Max Avg Tariff (%)	Avg Imports from the World	US Import Share (%)	Import Share Gap	Import Growth (%)	GDP Growth (%)	Distance (km)	International Logistics Performance Index Score	Language Match	FTA with US	Landlocked
Germany	80	1,832,456	8	6,257,706	29.3	0	-10.7	2.6	6,035	4.2	NO	NO	NO
Switzerland	72.6	1,729,806	0	4,870,638	35.5	0	-4.3	2	6,272	3.9	YES	NO	YES
Spain	57.3	699,093	8	18,827,210	3.7	5.7	12.2	1	5,770	3.83	NO	NO	NO
Italy	53.7	617,585	8	21,447,121	2.9	6.5	-3.3	0.1	6,895	3.74	NO	NO	NO
Dominican Republic	42.5	427,317	0	585,802	72.9	4.8	10.6	1	2,509	2.66	NO	YES	NO
Luxembourg	41.6	568,289	8	2,088,017	27.2	0	-7	4.8	6,063	3.63	YES	NO	YES
United Arab Emirates	39.4	402,112	5	937,771	42.9	0	7	5.7	11,030	3.96	YES	NO	NO

Belgium	38.1	18	8	8,990,694	0	9.4	-12.7	2	5,892	4.04	YES	NO	NO
Singapore	36.9	73,206	0	749,608	9.8	0	-3.7	1.6	15,351	4	YES	YES	NO
United Kingdom	34.9	17,793	4.3	3,137,847	0.6	8.8	-10.8	0.1	5,570	3.99	YES	NO	NO





Roadmap Recommendations

The ten-year trend in landings by volume is very strong with a tripling in growth over the last decade combined with a $10.3 million per year domestic market opportunity and a $1.3 million international market opportunity. The demand “pull” for scallops is strong and the direction of landings signals Maine can support increased shipments. Starting with the highest value (price) markets, timing suited to Maine landings, and favorable logistics, domestic and international markets have high potential. While Maine’s scallop production is lower than other New England states, the quality of Maine’s product is exceptionally high.

Currently, it is difficult to differentiate Maine’s product in the consumer market, although the white tablecloth market and some higher end markets recognize and pay for increased quality. Creating additional market opportunities to differentiate Maine’s scallop product and command a premium price was frequently highlighted as the top priority for the segment in Maine.

Soft-shell clam

Access

Maine's soft-shell clam fishery is managed at the municipal level. Towns wishing to manage their clam fisheries promulgate ordinances that allow for the management of the fishery in their jurisdictions using measures including licensing, limiting entry, restricting harvest time and area, establishing size limits, limiting daily bag limits, and establishing conservation areas. Many towns establish Shellfish Conservation Committees that engage in the management of the fishery. These programs are coordinated closely with DMR.

Maine soft-shell clam fishermen must obtain a Commercial Shellfish (CS) license from DMR. In 2021 there were 1791 CS licenses issued. The average age of a CS license holder was 43.9 years. 1059 licenses were based in the Eastern region; 473 were based in the Midcoast region; 259 were based in the Southern region.

Production

Figure 5.f.1. Soft-shell clam landings (panel A) and value (panel B) across New England states.

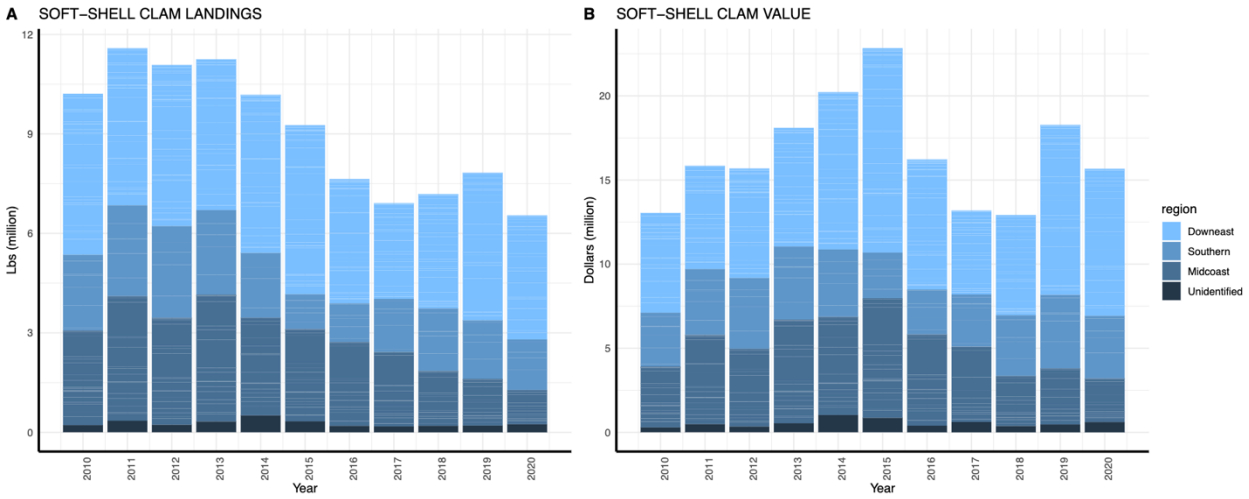


Figure 5.f.2. Soft-shell clam landings (panel A) and value (panel B) across Maine regions.

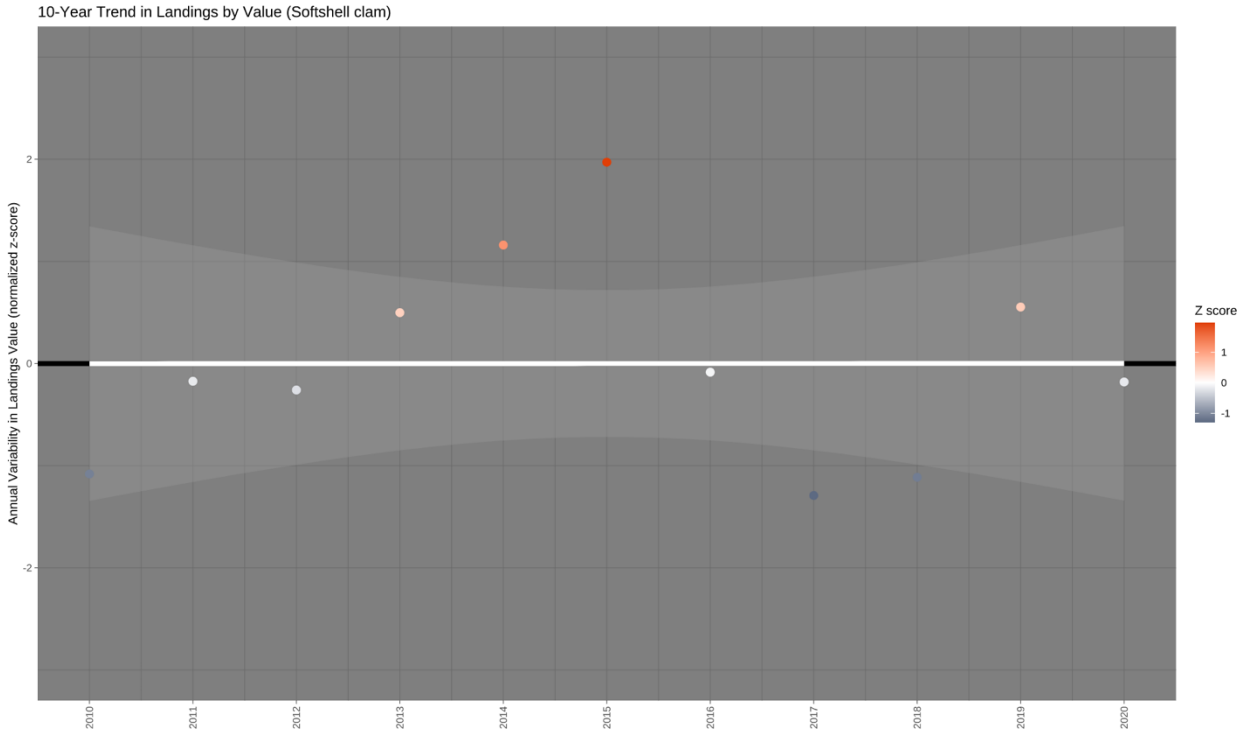


Figure 5.f.3. Annual variability in soft-shell clam landings value in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual value relative to the ten-year average.

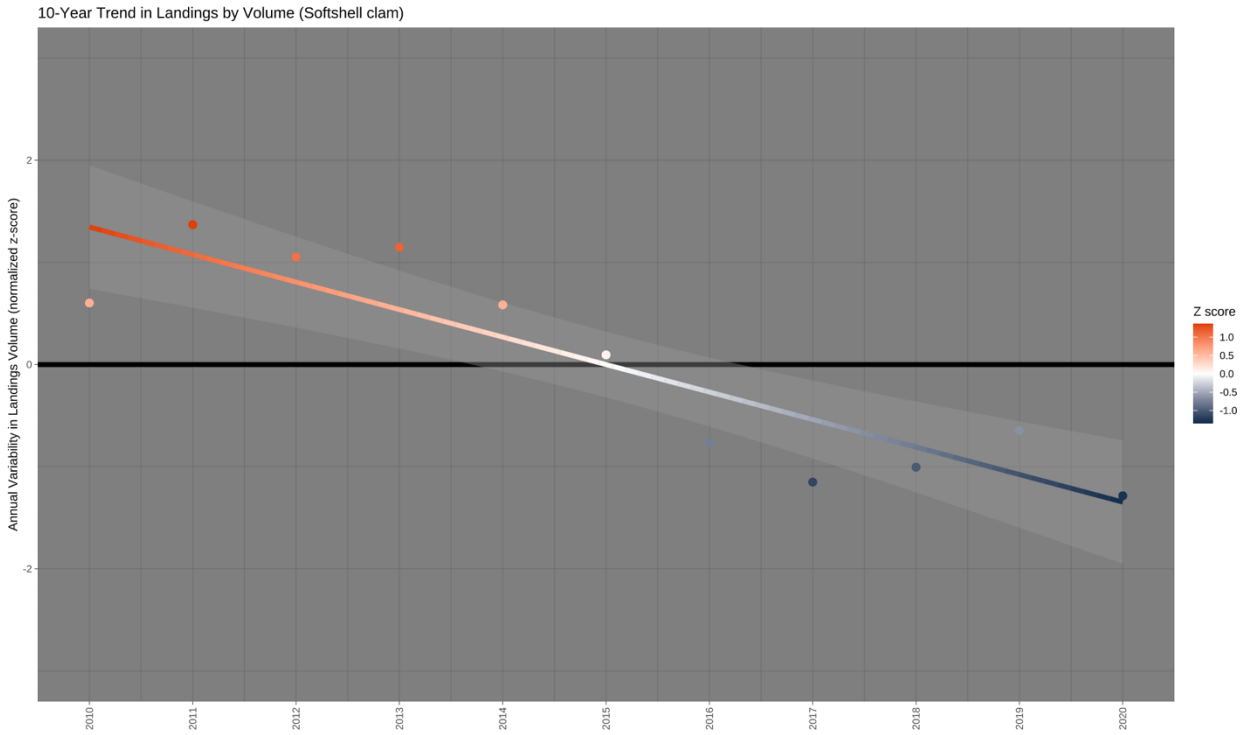


Figure 5.e.4. Annual variability in soft-shell clam landings volume in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual volume relative to the ten-year average.

Market Opportunity

There is a minimum $600,000 per year clam market growth opportunity in the U.S. domestic market based on the ten-year trend in state imports. In the last decade, frozen product demand rose to 44% of imports, while the fresh products declined from 59% to 45%. The top five states with the largest growth in demand are Illinois ($0.3 million per year), followed by California ($0.2 million), Massachusetts ($0.2 million), Rhode Island ($0.1 million), and New York ($0.1 million).

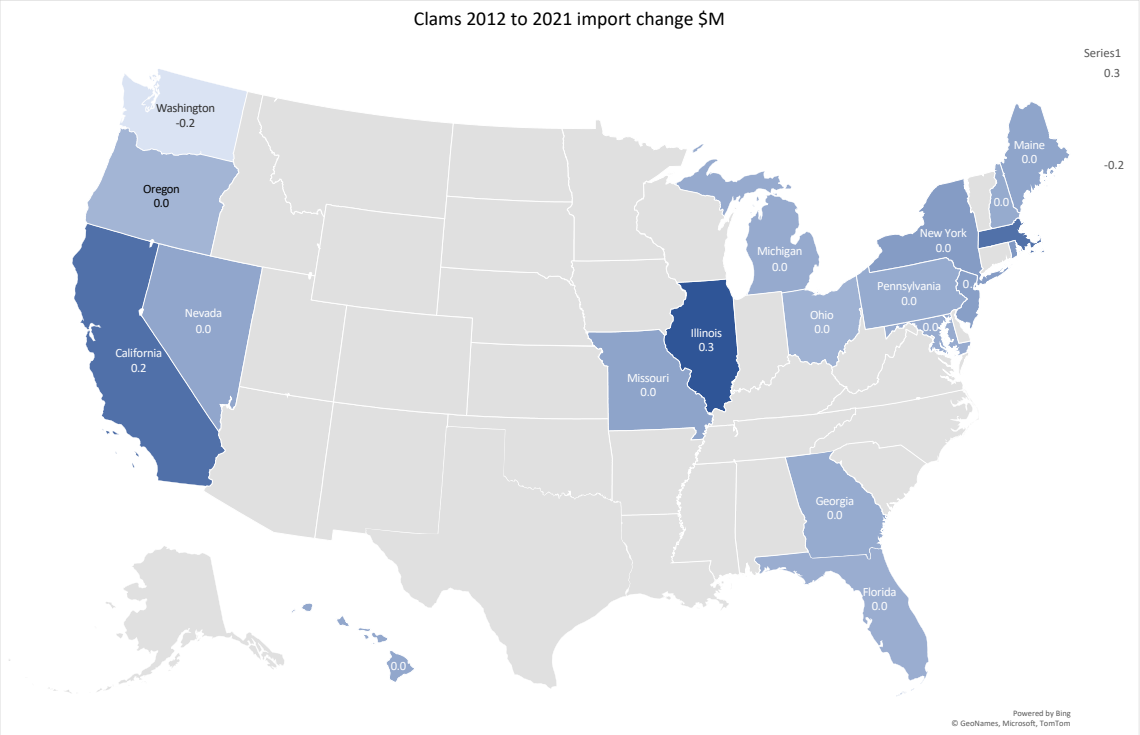


Figure 5.f.5. Clam import growth by state, 2012 - 2021 ($600,000/yr).

Source: U.S. Census Bureau

Note: Includes HS codes: 030771, 030772, and 030779

Driving a 10% increase in U.S. clam exports to the main existing markets will rely on exports to Hong Kong, China, and Canada. Maine has not been supplying these countries recently so there is room to grow where importers are already familiar with U.S. products.

The ITC ranks Singapore, Italy, and Thailand as the top potential new and expanding markets based on a combination of factors shown on the next table. The 12-year historical pattern in U.S. exports is show relatively steady exports except for a peak almost double the trend in 2013. The bubble plot shows blue circles where the U.S. is gaining market share faster than other countries, and yellow circles indicate where the U.S. export growth is trailing other countries.

Larger circles mean the target country represents are larger share of world imports for this product.

Table 5.f.1. Top three existing and potential growth U.S. export markets for clam ($6.8 million).

Existing Markets 2020				Potential New / Expanded Markets			
Top US Export Destinations	US Export Value ($)	Maine Exported Value to Top Destinations ($)	Maine % of US Exports to Top Destinations	Export Destination Ranking	Average Imports from US ($)	US Import Share (%)	US Import Growth (%)
Hong Kong	45,985,191	0	0%	Singapore	830,052	13	- 8
China	18,568,597	0	0%	Italy	391,970	4	- 8
Canada	2,380,202	0	0%	Thailand	220,936	2	+ 83

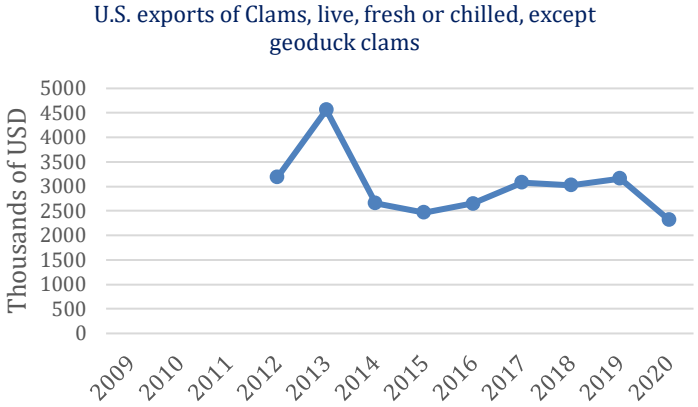
Source: International Trade Centre (ITC), UN Comtrade data.

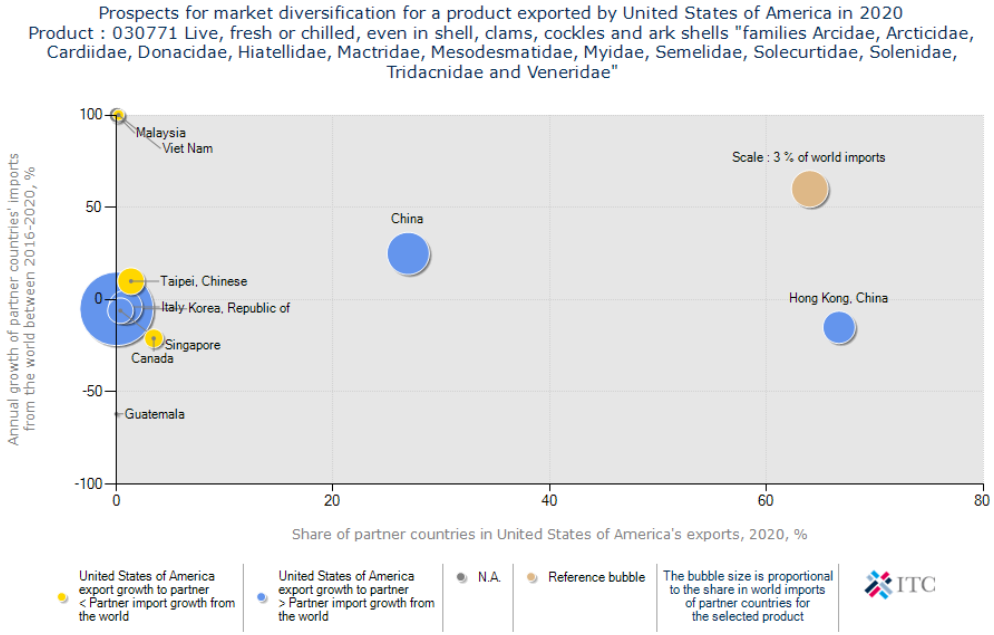
Note: Includes HS code: 030771.

Table 5.f.2. Clams international opportunity metrics (HS030771).

Country	Total Score	Avg Imports from the US ($)	Max Avg Tariff (%)	Avg Imports from the World	US Import Share (%)	Import Share Gap	Import Growth (%)	GDP Growth (%)	Distance (km)	International Logistics Performance Index Score	Language Match	FTA with US	Landlocked
Singapore	83.4	830,052	0	6,609,819	12.6	0	-7.6	1.6	15,351	4	YES	YES	NO
Italy	51.6	391,970	11	10,082,286	3.9	0	-8.1	0.1	6,895	3.74	NO	NO	NO
Thailand	44.5	220,936	2.5	14,931,603	1.5	0.5	83	5	13,943	3.41	NO	NO	NO
Spain	38.5	0	11	92,529,219	0	0.3	5.3	1	5,770	3.83	NO	NO	NO
Costa Rica	35.2	0	0	376	0	71.4	-100	1.1	3,565	2.79	YES	YES	NO
Israel	35.1	0	0	31,400	0	0.3	0	6	9,120	3.31	YES	YES	NO
Malaysia	34.8	93,102	0	1,082,027	8.6	0	110.8	2.8	15,130	3.22	YES	NO	NO
South Korea	34.6	26,418	0	54,332,560	0	0	-5.5	2.1	11,066	3.61	NO	YES	NO

Belgium	34.2	0	11	2,796,717	0	0.3	6.9	2	5,892	4.04	YES	NO	NO
France	34.2	16	11	5,220,157	0	0.3	4.2	1.6	5,838	3.84	YES	NO	NO





Roadmap Recommendations

The ten-year trend in landings show recent years about one-third off the peak in 2011-2013 while there is a $600,000 per year domestic market opportunity and a $6.8 million international market opportunity. The demand “pull” for clams is clear, but this would be more feasible with a return to peak production. There are still opportunities to exploit specific markets for revenue growth by seeking higher value (prices) than current shipments are earning.

Atlantic salmon

Access

Atlantic salmon aquaculture is managed by DMR's aquaculture program. DMR issues leases for standard and experimental aquaculture leases of various sizes. In 2020 there were 25 standard and experimental aquaculture leases growing salmon as a primary species, totaling 634.25 acres under cultivation. The majority of salmon production in Maine is located in the Downeast region.

There are currently multiple proposed salmon aquaculture operations that would be based in recirculating aquaculture system (RAS) facilities onshore. Salmon aquaculture using RAS systems would be permitted by DMR as well as the Maine Department of Environmental Protection under the Maine Pollutant Discharge Elimination System's Waste Discharge License. Additional general and shoreland zoning requirements under local (municipal) and state (Bureau of Public Lands, etc.) pertain to these projects as well, and RAS projects must obtain permits under the state's Site Location of Development Act, Natural Resources Protection Act, and its air emission licensing process.

Production

Salmon aquaculture production numbers have not been published by Maine DMR since 2010 due to statutorily mandated confidentiality protection. According to the Maine Aquaculture Association, salmon production in the state is valued at between $65 million and $85 million per year (farmgate price). In 2010, the final year of reporting, 24,530,940 pounds were produced at a value of $76,781,842. Current farmgate prices have increased to record levels, and the value of Maine's aquaculture production has the potential to exceed $200

million in 2022 if production levels remain steady. Two proposed recirculating aquaculture facilities (RAS) are currently in review under various state and federal regulatory programs. If permitted, these facilities could yield significant increases in Atlantic salmon production in the state.

Market Opportunity

There is a $230 million per year salmon market growth opportunity in the U.S. domestic market based on the ten-year trend in state imports. In the last decade, salmon fillet product demand rose from 53% to 68% of imports, while the fresh and chilled products declined from 46% to 31%. The top five states with the largest growth in demand are Florida ($136 million per year), followed by California ($34 million), Massachusetts ($17 million), New York ($16 million), and Texas ($10 million). The significant import growth in these states is the foundation for the establishment of other land-based salmon facilities there. Like the two expected in Maine, these are being built to displace imports and produce salmon locally. It must be recognized that Maine facilities will primarily serve a regional market while other facilities meet demand in other key locations.

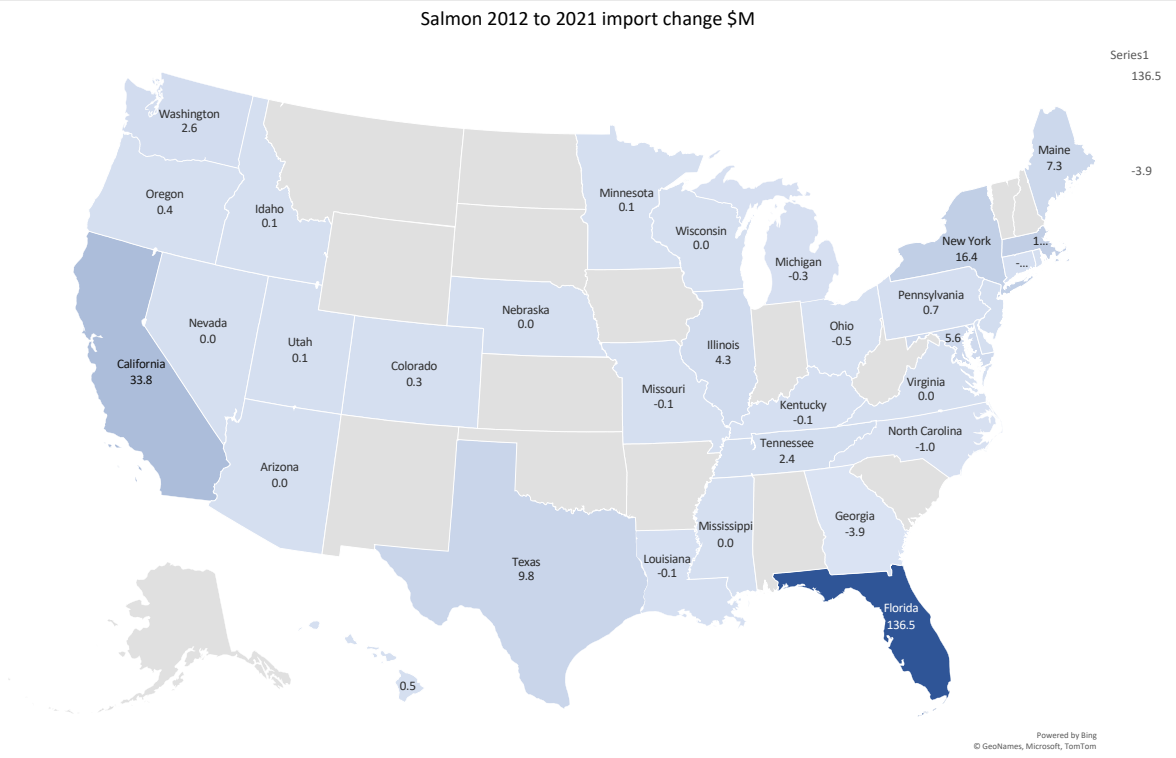


Figure 5.g.X Salmon import growth by state, 2012 - 2021 ($230 million/yr).

Source: U.S. Census Bureau

Note: Includes HS codes: 030241, 030313, 030322, and 030441.

Keeping in mind Maine salmon production is primarily focused on the U.S. market, there are still some countries unable to meet their salmon demand. Driving a 10% increase in U.S. salmon exports to the main existing markets will rely on exports to Canada, Japan, and Israel. Maine supplies a high share of U.S. exports to Canada and could continue to capitalize on strong commercial relations there. Maine is not currently participating in U.S. exports to Japan or Israel where opportunity exists.

The ITC ranks the Bahamas, Hong Kong, and Columbia as the top potential new and expanding markets based on a combination of factors shown on the next table. The Columbian market likely imports from Chile where there are more low-cost producers and, although there may be possibilities, the Bahamas

is likely the best new opportunity. The 12-year historical pattern in U.S. exports has been fluctuating since 2012 with no clear trend up or down. The bubble plot shows blue circles where the U.S. is gaining market share faster than other countries, and yellow circles indicate where the U.S. export growth is trailing other countries. Larger circles mean the target country represents are larger share of world imports for this product.

Table 5.g.1. Top three existing and potential growth U.S. export markets for Atlantic salmon ($6.8 million).

Existing Markets 2020				Potential New / Expanded Markets			
Top US Export Destinations	US Export Value ($)	Maine Exported Value to Top Destinations ($)	Maine % of US Exports to Top Destinations	Export Destination Ranking	Average Imports from US ($)	US Import Share (%)	US Import Growth (%)
Canada	64,751,189	43,948,874	68%	Bahamas	142,324	96	+ 114
Japan	2,153,632	0	0%	Hong Kong	57,690	0	- 10
Israel	554,413	0	0%	Columbia	0	0	- 11

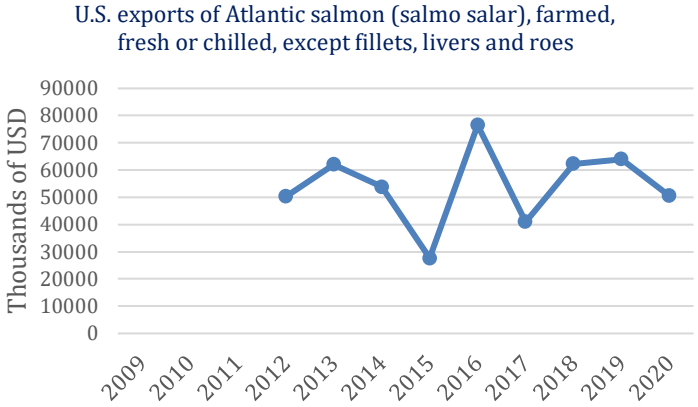
Source: International Trade Centre (ITC), UN Comtrade data.

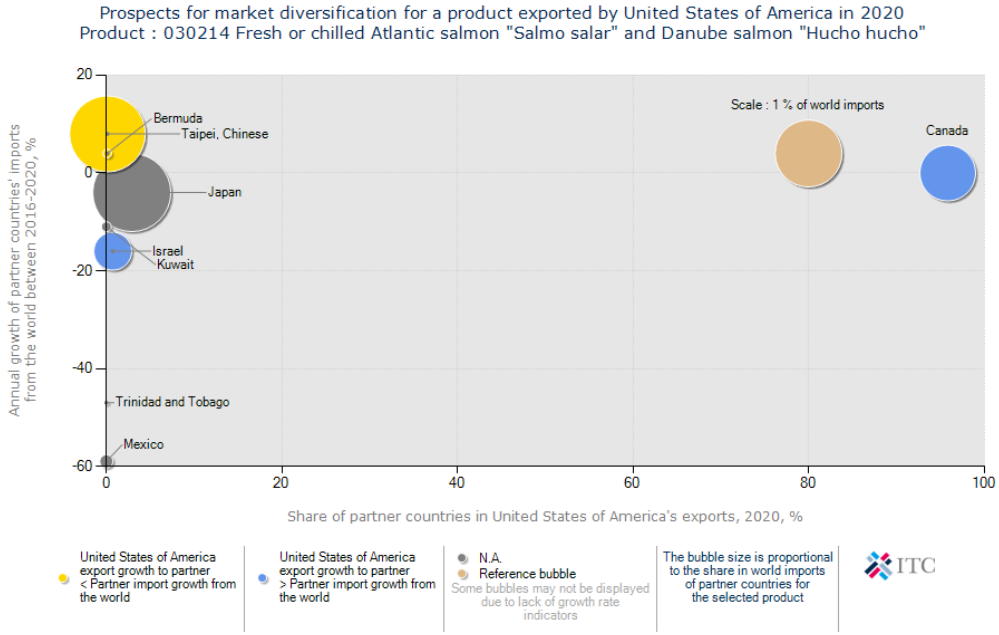
Note: Includes HS code: 030214.

Table 5.g.2. Atlantic salmon international opportunity metrics (HS030214).

Country	Total Score	Avg Imports from the US ($)	Max Avg Tariff (%)	Avg Imports from the World	US Import Share (%)	Import Share Gap	Import Growth (%)	GDP Growth (%)	Distance (km)	International Logistics Performance Index Score	Language Match	FTA with US	Landlocked
Bahamas, The	79.8	142,324	30	147,436	96.5	0	113.7	-1.5	1,771	2.53	YES	NO	NO
Hong Kong	49.3	57,690	0	88,609,126	0.1	0	-10.4	1.9	12,970	3.92	YES	NO	NO
Colombia	38.5	0	0	1,746,126	0	10.4	-11.4	-1	4,021	2.94	NO	YES	NO
Spain	36.2	19,041	2	289,333,629	0	0	6.6	1	5,770	3.83	NO	NO	NO
Singapore	36.1	5,270	0	29,151,139	0	0	10.1	1.6	15,351	4	YES	YES	NO
Mexico	35.8	0	0	560,516	0	10.4	0	-0.1	3,369	3.05	NO	YES	NO
France	34.1	4,337	2	913,238,735	0	0	2.1	1.6	5,838	3.84	YES	NO	NO
Costa Rica	33.9	0	0	998	0	10.4	-100	1.1	3,565	2.79	YES	YES	NO

Israel	33.9	0	0	53,570,272	0	0	-15.5	6	9,120	3.31	YES	YES	NO
Belgium	32.8	0	2	34,409,955	0	0	-12.1	2	5,892	4.04	YES	NO	NO





Roadmap Recommendations

Strength in marine salmon aquaculture along with the realization of land-based salmon production will enable Maine to tap some of the $230 million per year domestic market opportunity and the $6.8 million international market opportunity. The demand “pull” for salmon is very clear and Maine will be positioned to supply market growth. Maine products will certainly out-compete international suppliers based on trusted, local, lower carbon footprint, and fresh salmon delivered through a shorter supply-chain.

Groundfish complex

Access

Maine's groundfish fishery is managed under the New England Fishery Management Council's Northeast multispecies fishery management plan. Federal groundfish vessels are permitted by the National Marine Fisheries Service. Individual permits are either part of a common pool, receiving a set proportion of annual quotas, or are enrolled in a Sector, receiving quota allocations accordingly. Numerous management measures are in place including time area closures, gear restrictions, trip limits, and reporting/monitoring requirements. Permit holders can elect to join a groundfish sector, enabling cooperative management; there are two sectors based in Maine working with fishermen throughout New England.

DMR does not issue licenses for groundfish complex-specific fishing (except Atlantic halibut); groundfish fishermen must hold a DMR issued commercial fishing license. DMR issues state-specific groundfish management regulations including gear restrictions, conservation areas, and size limits for particular species.

Production

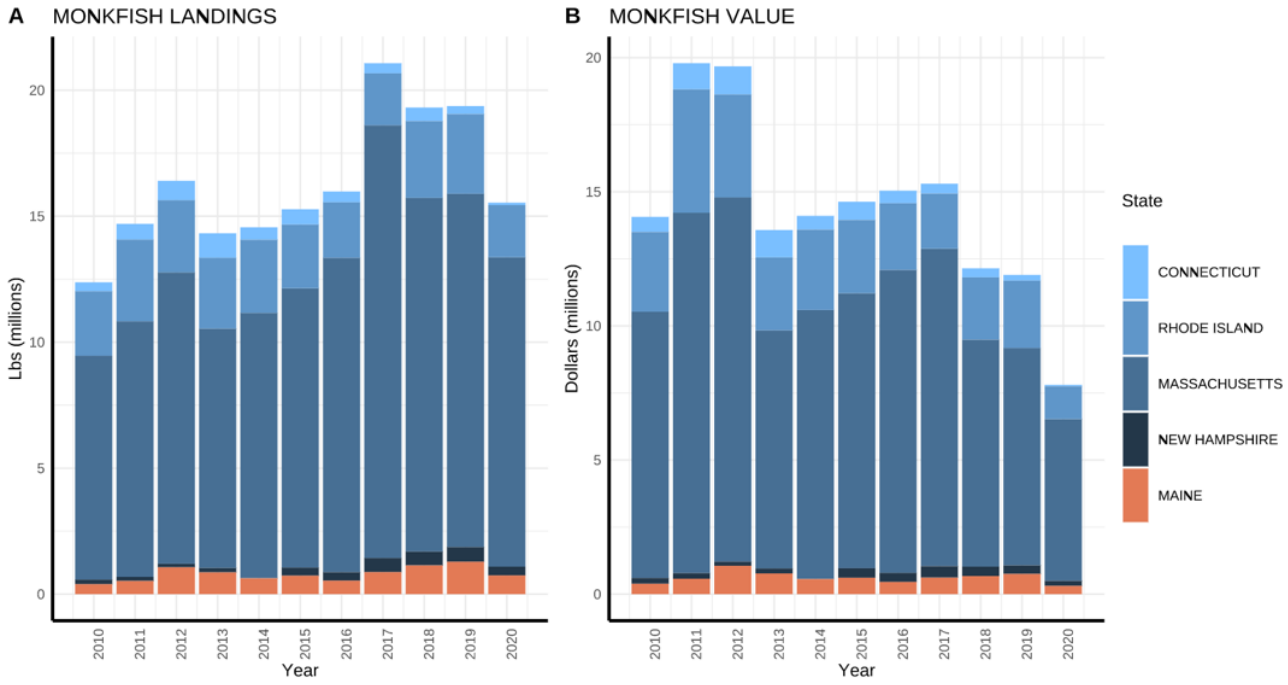


Figure 5.h.1. Monkfish landings (panel A) and value (panel B) across New England states.

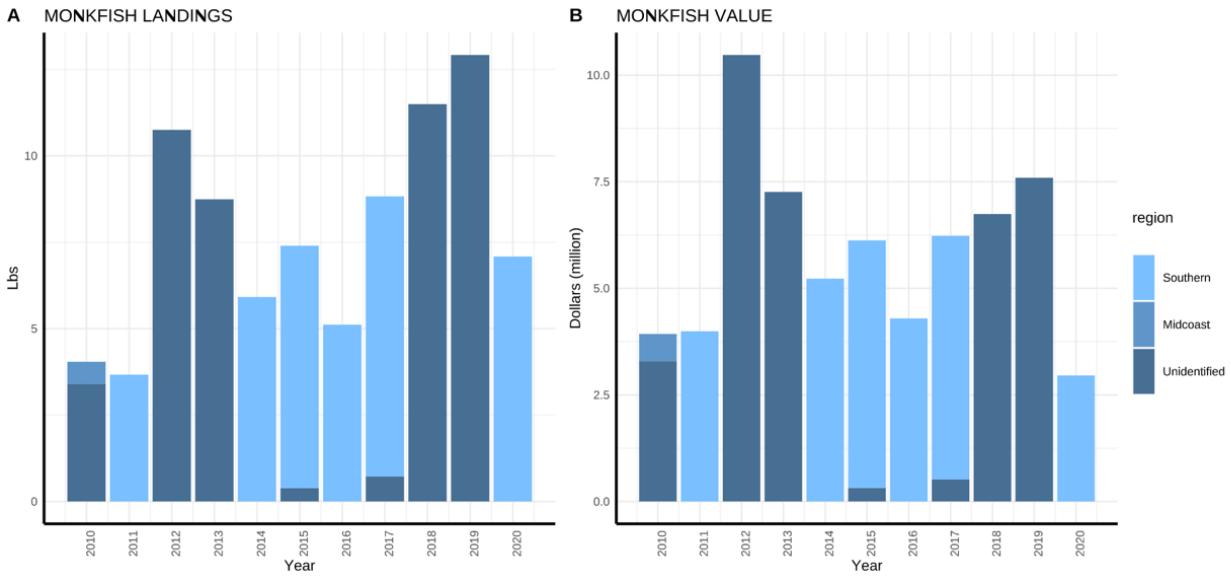


Figure 5.h.2. Monkfish landings (panel A) and value (panel B) across Maine regions.

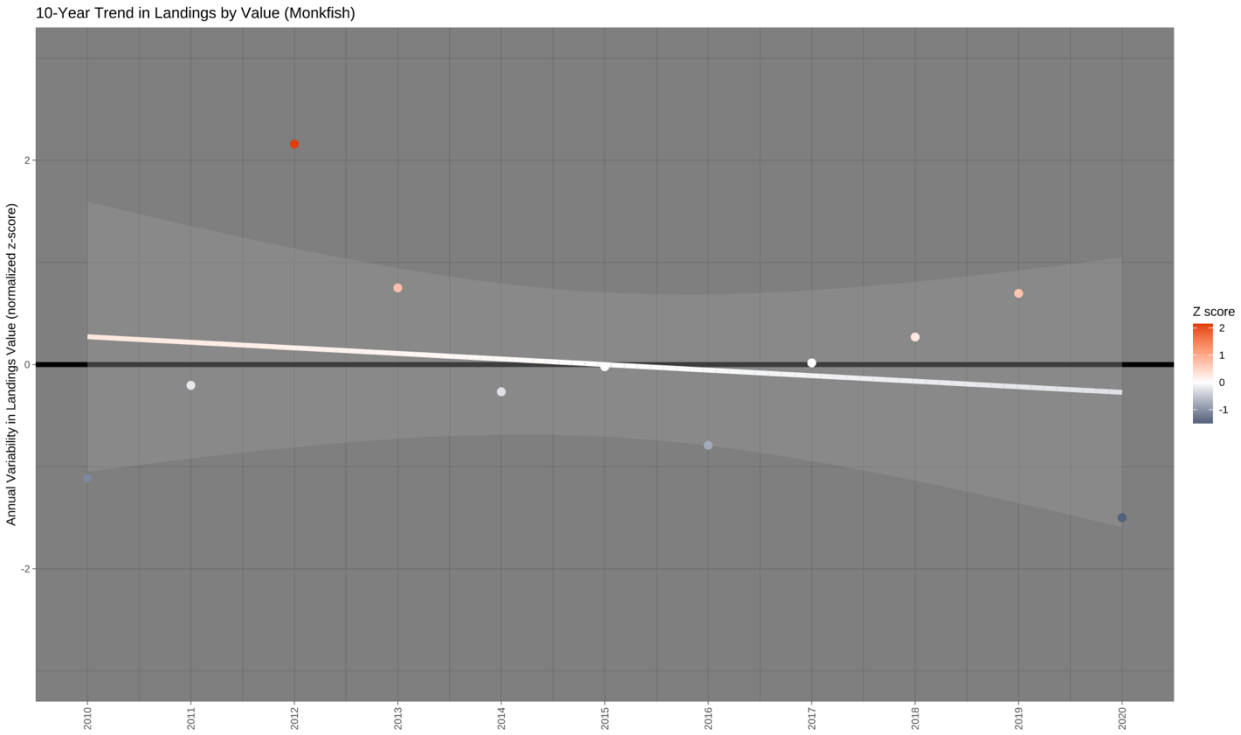


Figure 5.h.3. Annual variability in monkfish landings value in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual value relative to the ten-year average.

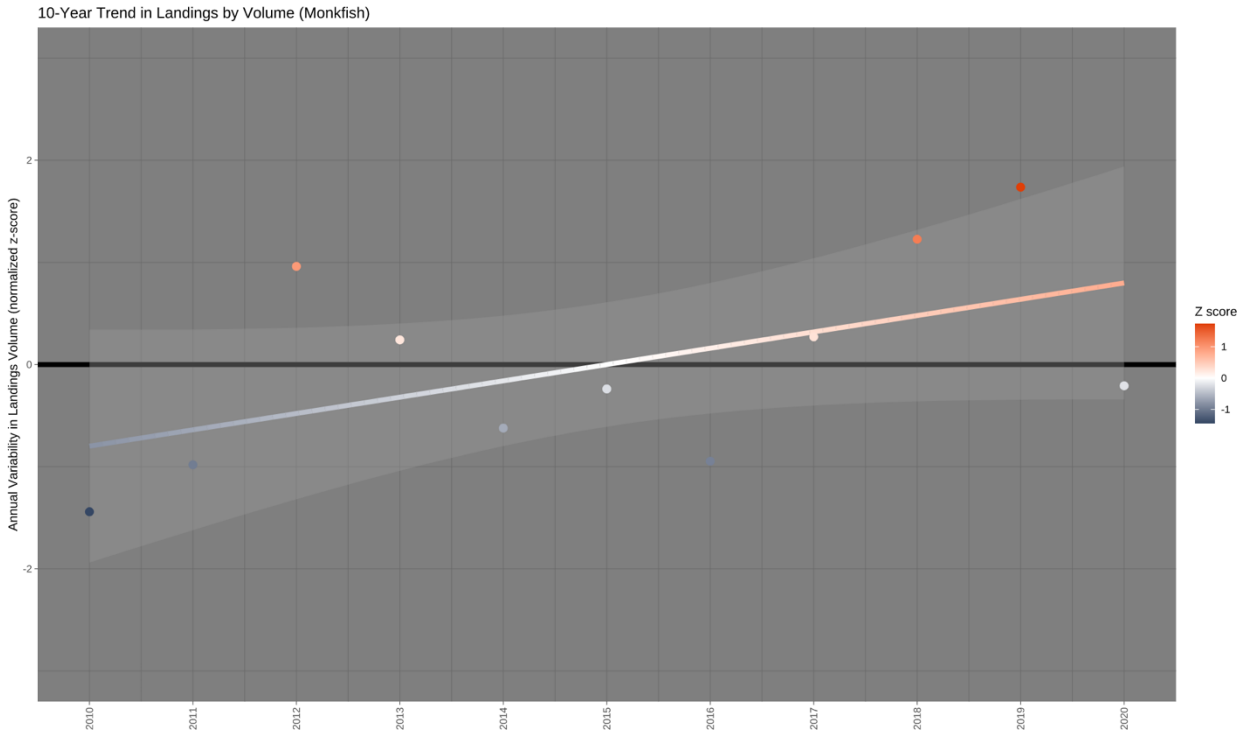


Figure 5.h.4. Annual variability in monkfish landings volume in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual volume relative to the ten-year average.

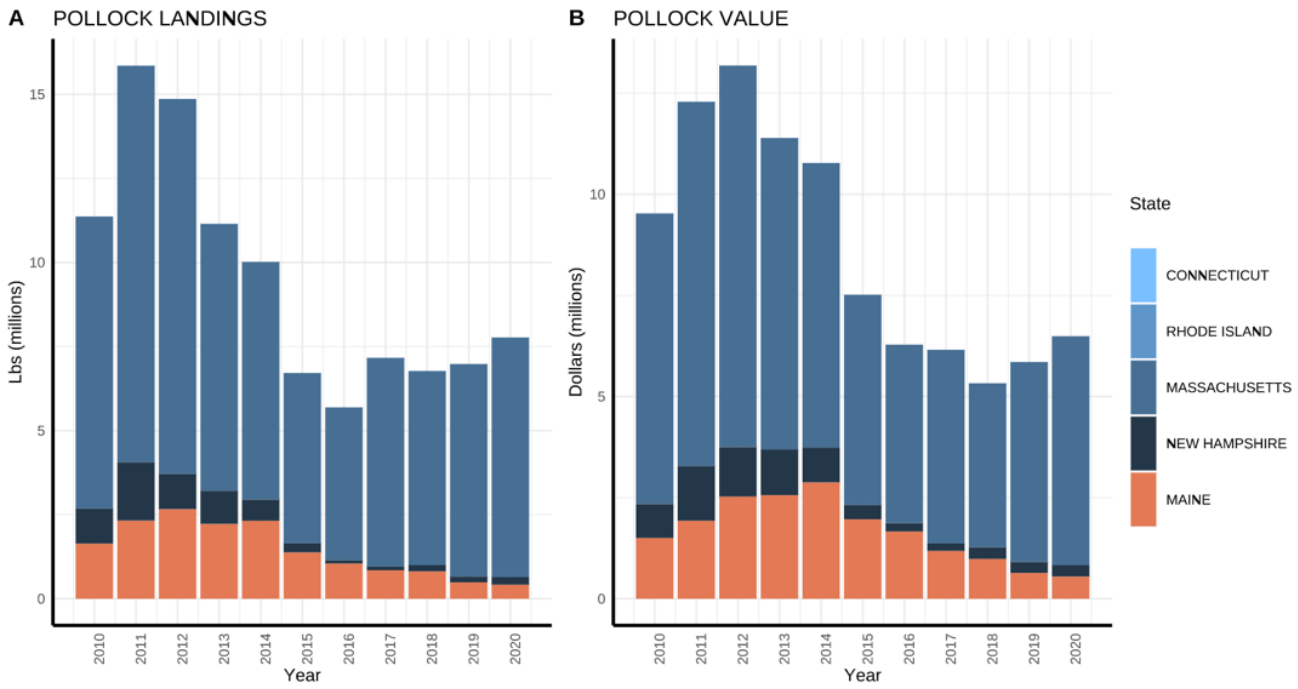


Figure 5.h.5. Pollock landings (panel A) and value (panel B) across New England states.

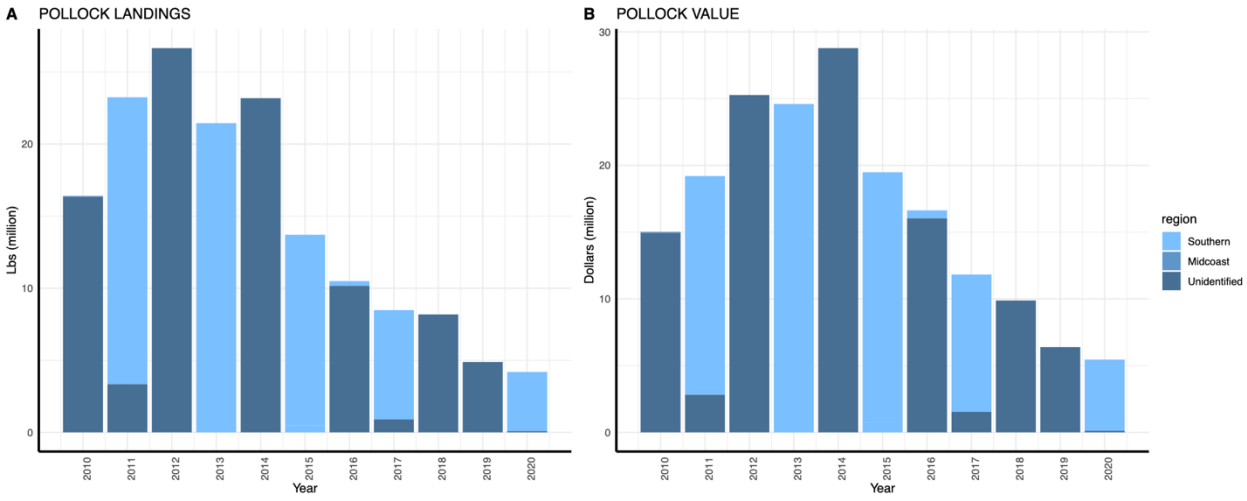


Figure 5.h.6. Pollock landings (panel A) and value (panel B) across Maine regions.

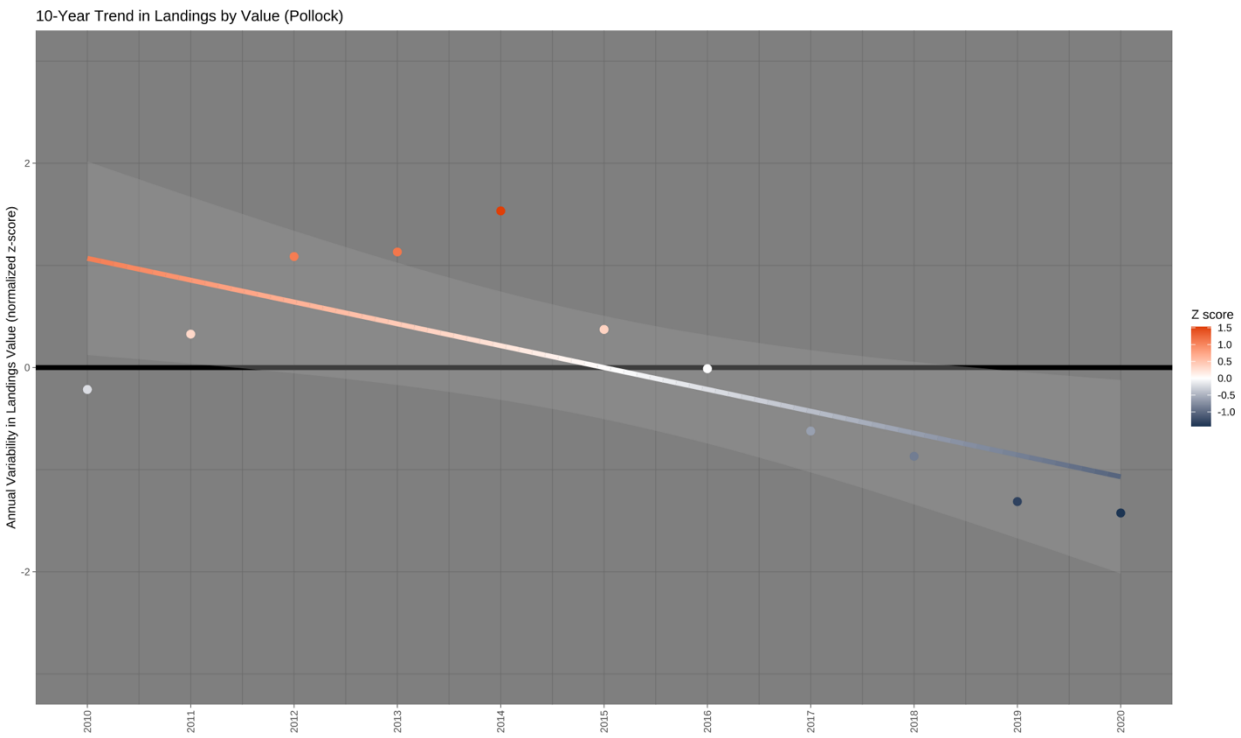


Figure 5.h.7. Annual variability in pollock landings value in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual value relative to the ten-year average.

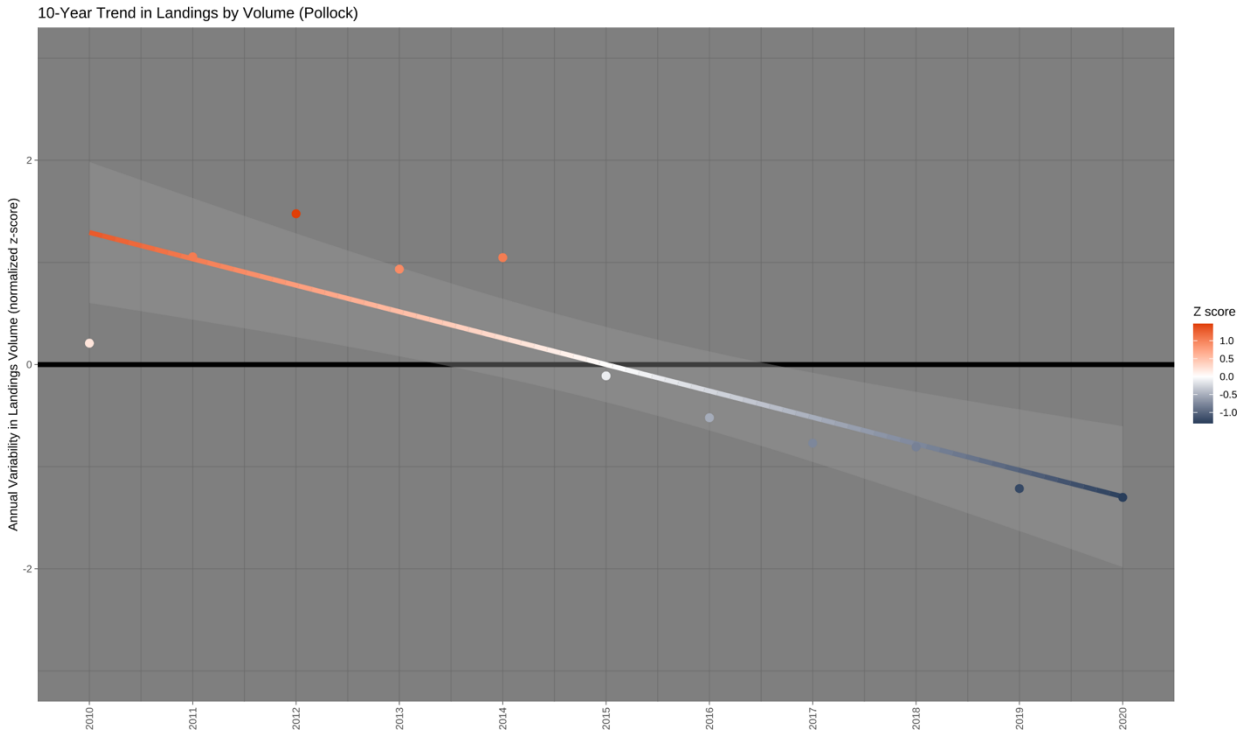


Figure 5.h.8. Annual variability in pollock landings volume in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual volume relative to the ten-year average.

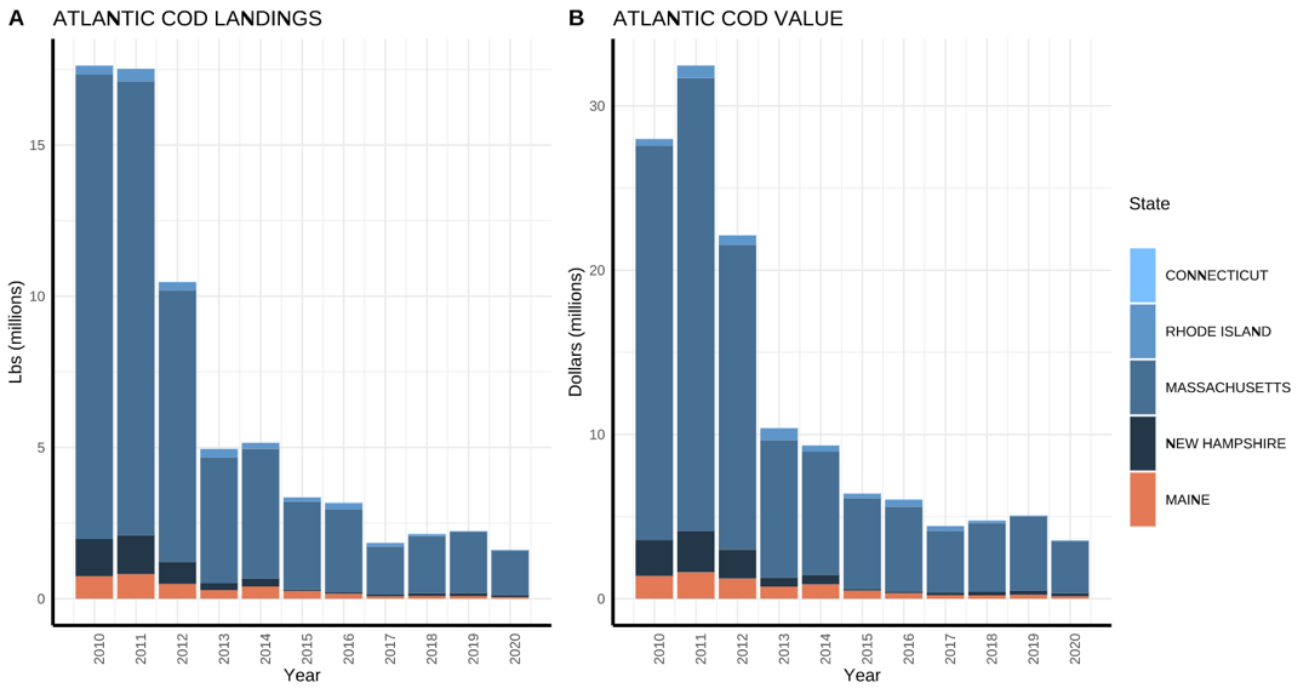


Figure 5.h.9. Atlantic cod landings (panel A) and value (panel B) across New England states.

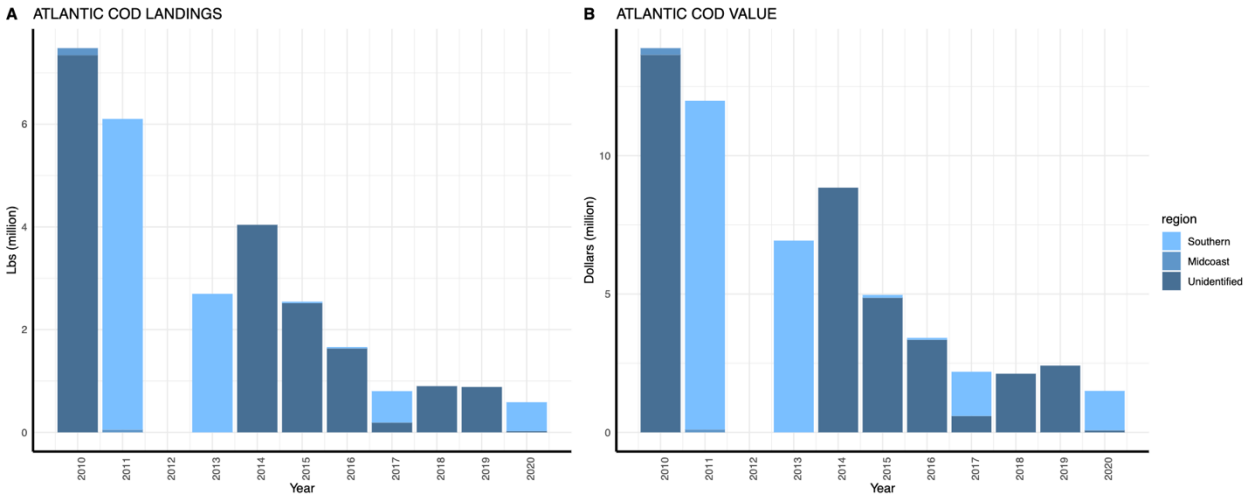


Figure 5.h.10. Atlantic cod landings (panel A) and value (panel B) across Maine regions.

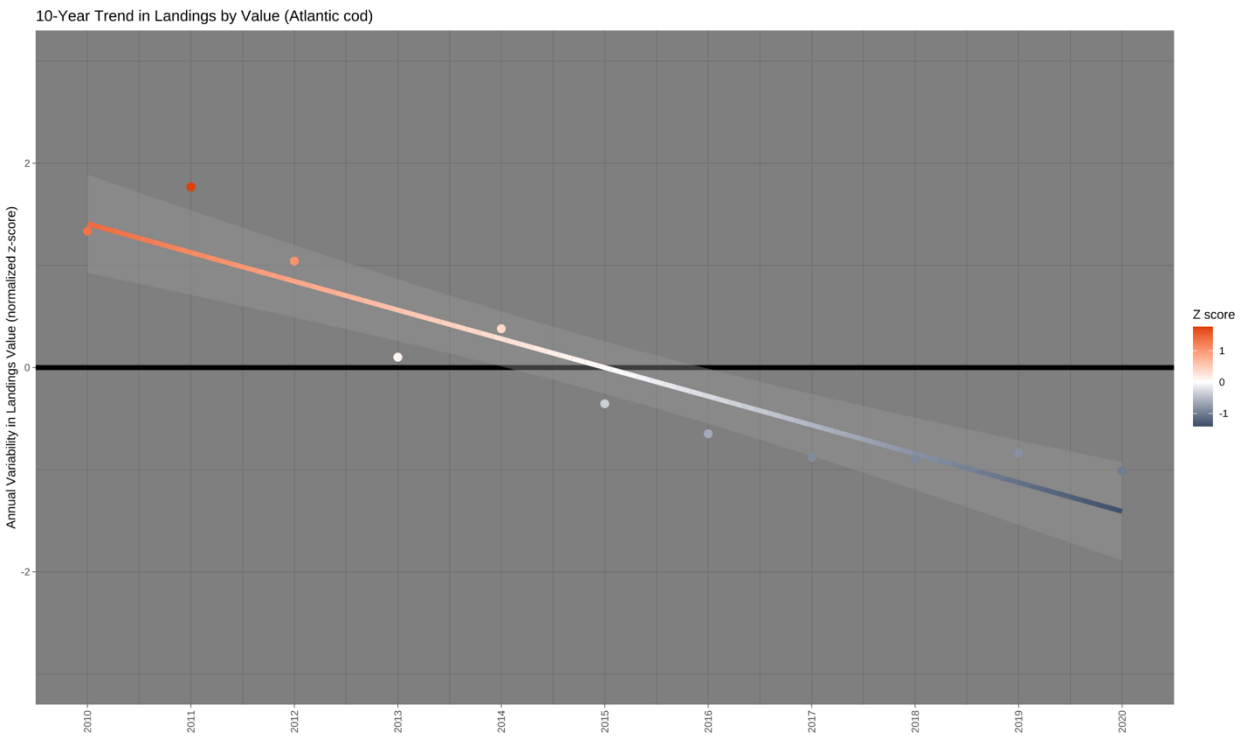


Figure 5.h.11. Annual variability in Atlantic cod landings value in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual value relative to the ten-year average.

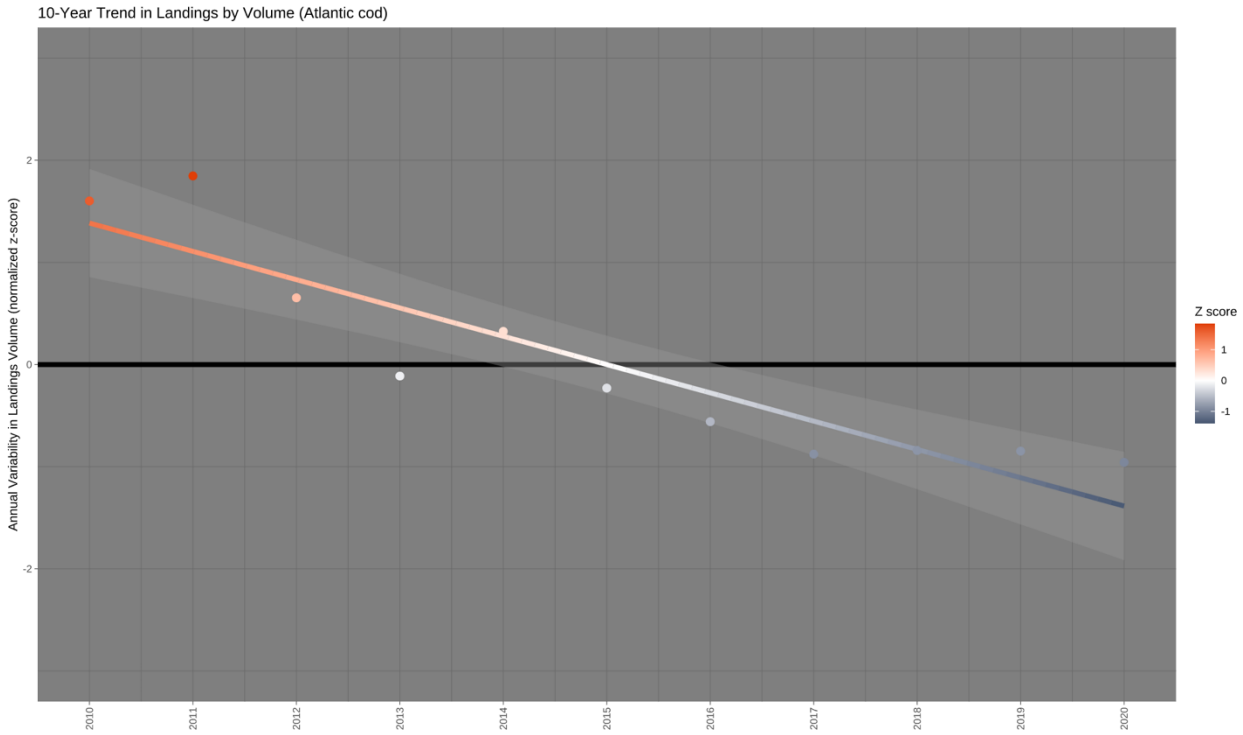


Figure 5.b.12. Annual variability in Atlantic cod landings volume in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual volume relative to the ten-year average.

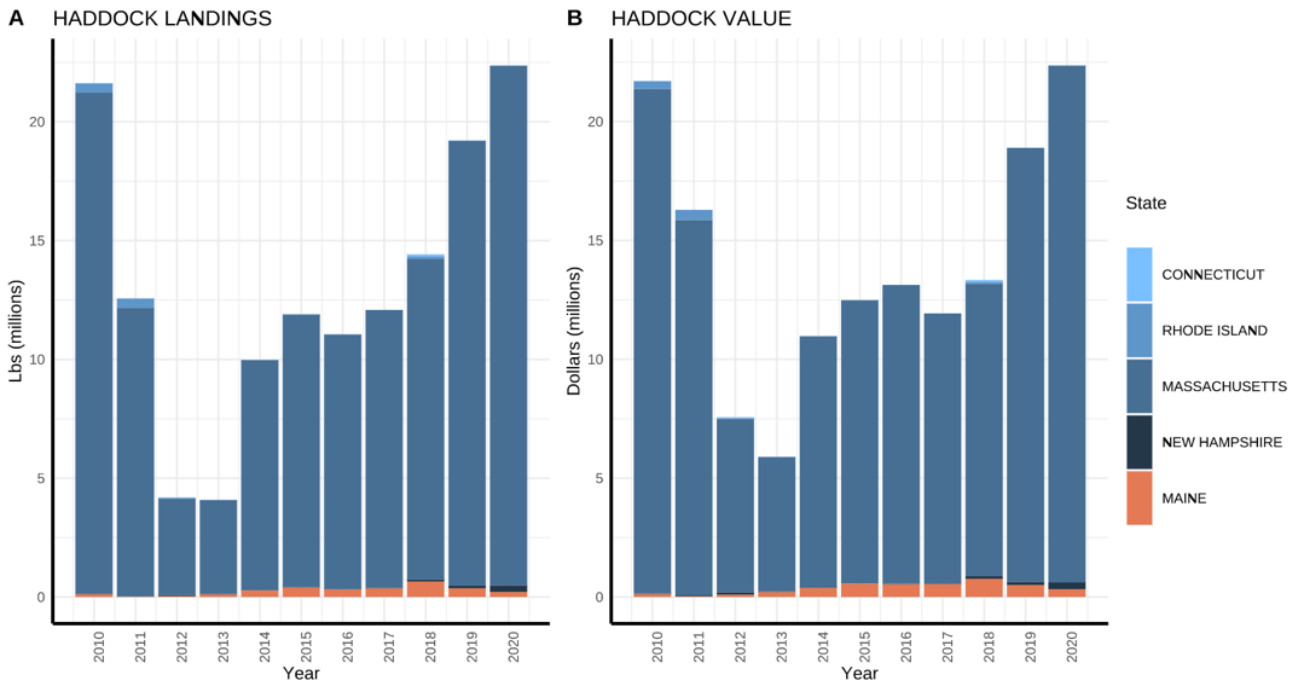


Figure 5.h.13. Haddock landings (panel A) and value (panel B) across New England states.

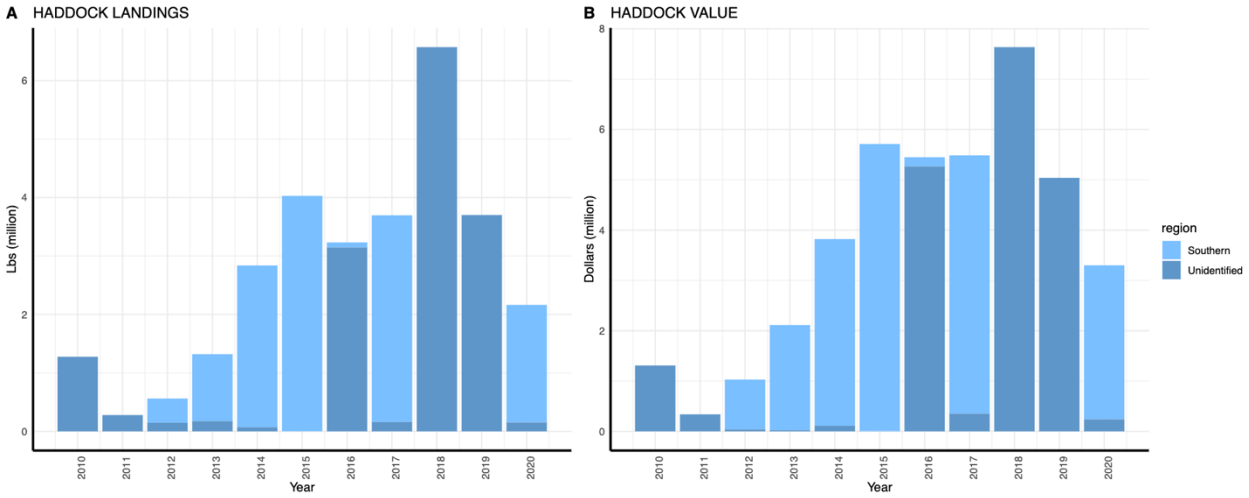


Figure 5.h.14. Haddock landings (panel A) and value (panel B) across Maine regions.

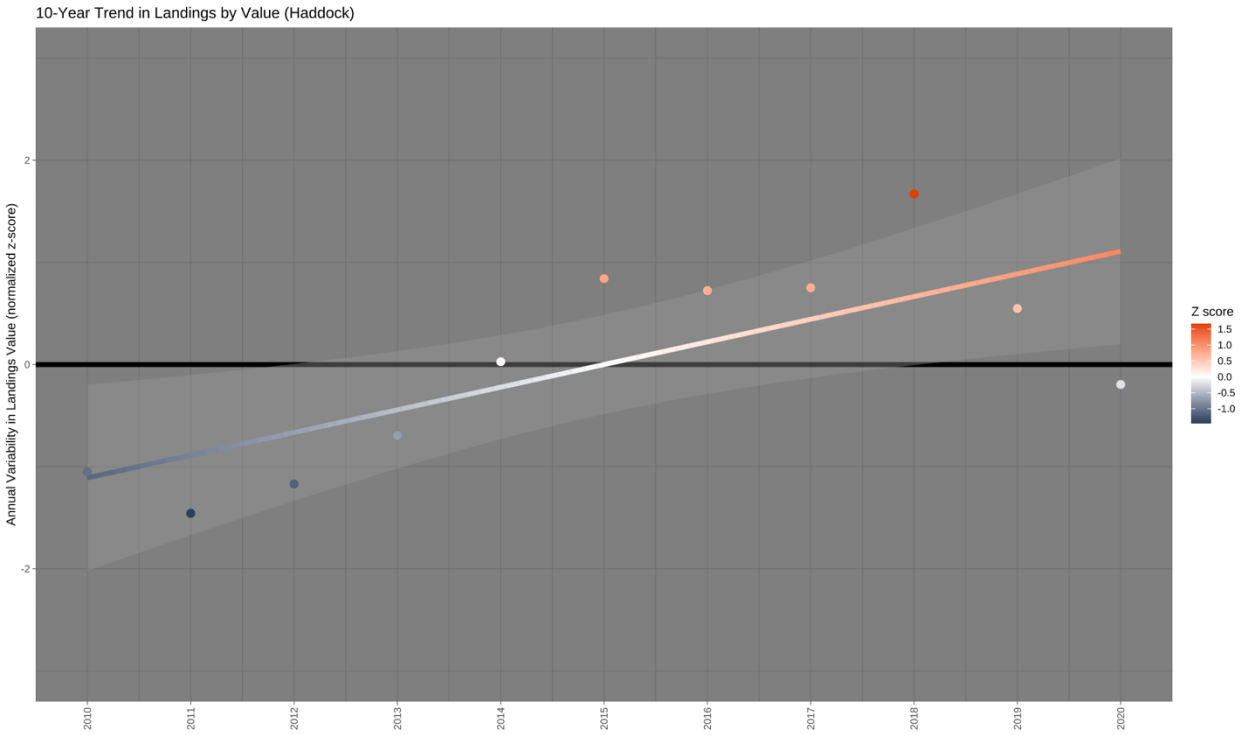


Figure 5.h.15. Annual variability in haddock landings value in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual value relative to the ten-year average.

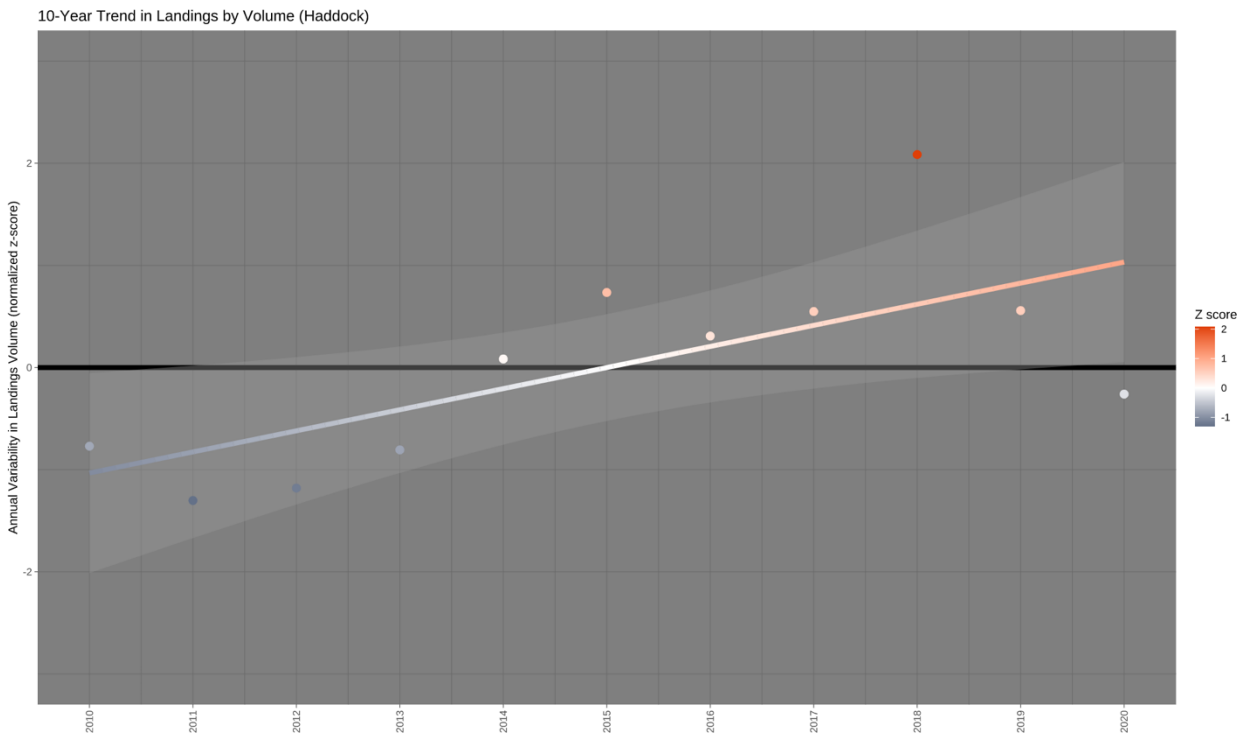


Figure 5.h.16. Annual variability in haddock landings volume in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual volume relative to the ten-year average.

Market Opportunity

There is a $10.3 million per year groundfish market growth opportunity in the U.S. domestic market based on the ten-year trend in state imports. This only reflects three species within the groundfish complex, so additional growth exists. In the last decade, import shares across the three species and various product segments remained relatively steady with only a notable 15% rise in cod fillets and a 9% decline in haddock fillets. The top five states with the largest growth in demand are Massachusetts ($7.7 million per year), followed by Michigan ($1.6 million), Rhode Island ($1.6 million), California ($1.4 million), and Illinois

($1.3 million). These were partially offset by declines in other states such as New Hampshire, Connecticut, and Virginia.

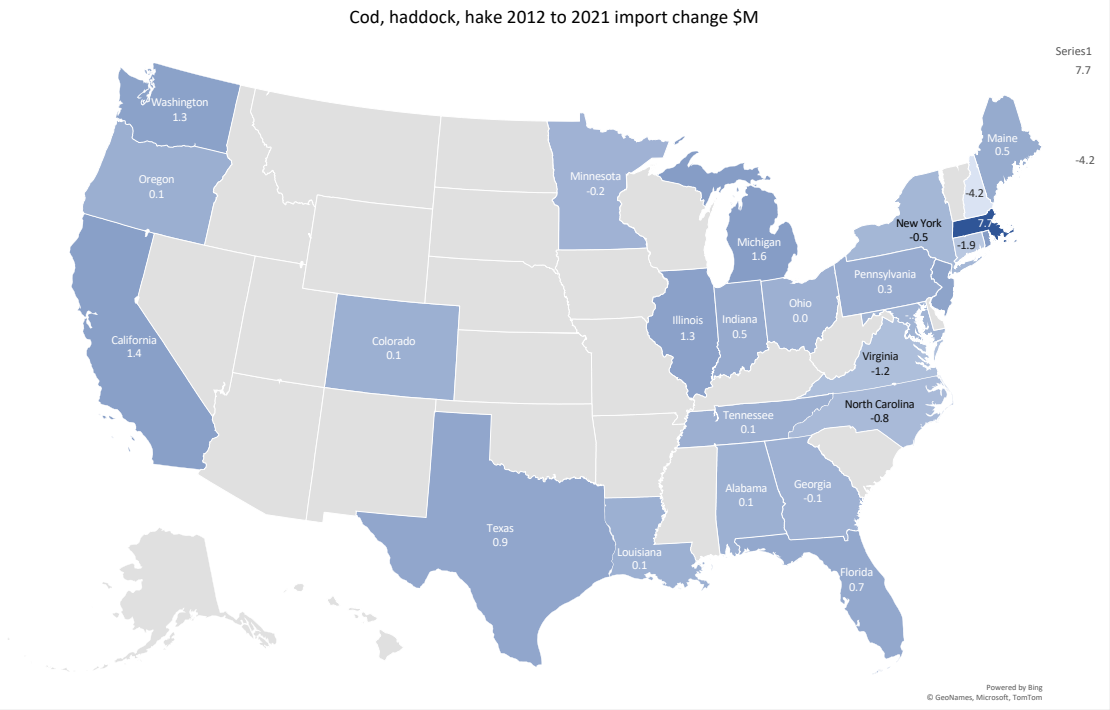


Figure 5.h.17. Cod, haddock, and hake import growth by state, 2012 - 2021 ($10.3 million/yr).

Source: U.S. Census Bureau

Note: Includes HS codes: Fresh/chilled - 030250, 030251, 030252, 030254, 030262, Frozen - 030352, 030363, 030364, 030366, 030372, Fillets - 030471, 030472, 030474, Dried/salted - 030551, 030562.

A 10% increase in U.S. groundfish exports to the main existing markets will rely on exports to Canada, Japan, and China. Maine supplies very low (under 1%) shares of U.S. exports to these countries suggesting there is room to grow.

The ITC ranks Nigeria, Ghana, and the UAE as the top three potential new and expanding markets based on a combination of factors shown on the next

table. There are three sets of market diversification tables and figures, one for each species examined (i.e., cod, haddock, and hake).

- **Cod** - The 12-year historical pattern in U.S. cod exports shows a steep decline from peak exports in 2009 to just one-sixth of the peak by 2013. There is one yellow circle for Canada indicating where the U.S. export growth is trailing other countries.

- **Haddock** - The 12-year historical pattern in U.S. haddock exports shows a drop from peak exports in 2009 to just about one-third by 2011. There is one yellow circle for Canada indicating where the U.S. export growth is trailing other countries.

- **Hake** - The 12-year historical pattern in U.S. cod exports is shows a steady decline from peak exports in 2012 to one-quarter of the peak by 2020. There is one yellow circle for Canada indicating where the U.S. export growth is trailing other countries.

Table 5.h.1. Top three existing and potential growth U.S. export markets for cod, haddock, and hake ($1 million).

Existing Markets 2020				Potential New / Expanded Markets			
Top US Export Destinations	US Export Value ($)	Maine Exported Value to Top Destinations ($)	Maine % of US Exports to Top Destinations	Export Destination Ranking	Average Imports from US ($)	US Import Share (%)	US Import Growth (%)
Cod							
Canada	4,513,031	37,457	1%	UAE	44,548	5	- 9
Japan	960,000	0	0%	Bahamas	10,710	92	+ 262
China	60,000	0	0%	Singapore	4,213	1	- 6

Existing Markets 2020				Potential New / Expanded Markets			
Top US Export Destinations	US Export Value ($)	Maine Exported Value to Top Destinations ($)	Maine % of US Exports to Top Destinations	Export Destination Ranking	Average Imports from US ($)	US Import Share (%)	US Import Growth (%)
Haddock							
Canada	964,717	10,545	1%	Saudi Arabia	7,044	100	0
-	-	-	-	UAE	0	0	- 2
-	-	-	-	Singapore	52	1	- 100
Hake							
Canada	564,478	3,558	1%	Nigeria	655,708	56	+ 105
-	-	-	-	Ghana	169,193	47	- 6
-	-	-	-	South Africa	0	0	+ 1,559

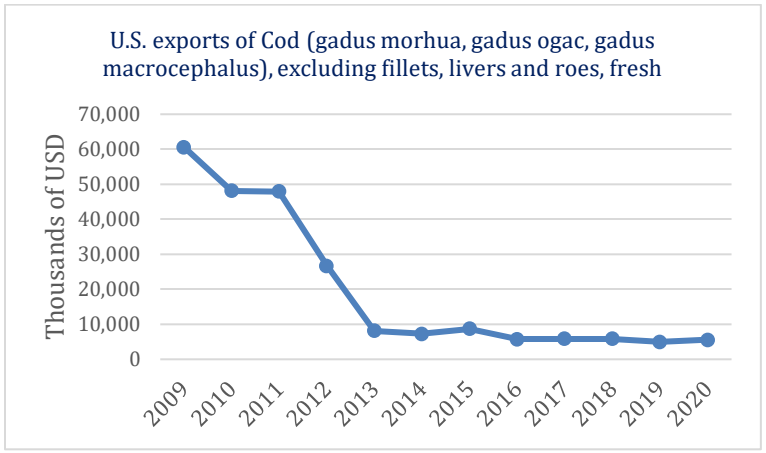
Source: International Trade Centre (ITC), UN Comtrade data.

Note: Includes HS codes: 030251 (cod), 030502 (haddock), and 030254 (hake).

Table 5.h.2. Atlantic cod international opportunity metrics (HS030251).

Country	Total Score	Avg Imports from the US ($)	Max Avg Tariff (%)	Avg Imports from the World	US Import Share (%)	Import Share Gap	Import Growth (%)	GDP Growth (%)	Distance (km)	International Logistics Performance Index Score	Language Match	FTA with US	Landlocked
United Arab Emirates	76.8	44,548	0	889,349	5	0	-9.4	5.7	11,030	3.96	YES	NO	NO
Bahamas, The	42.9	10,710	30	11,635	92	0	261.5	-1.5	1,771	2.53	YES	NO	NO
Singapore	39	4,213	0	310,426	1.4	0	-6.4	1.6	15,351	4	YES	YES	NO
Oman	34.9	0	0	457,214	0	3.1	-52.2	5.3	11,357	3.2	NO	YES	NO
Israel	34.4	0	0	19,687	0	0	-6.7	6	9,120	3.31	YES	YES	NO
Belgium	32.8	0	12	12,982,562	0	0	6.6	2	5,892	4.04	YES	NO	NO
France	32.8	210	12	75,132,342	0	0	-0.4	1.6	5,838	3.84	YES	NO	NO

South Korea	32.7	216	0	1,657,695	0	0	2.5	2.1	11,066	3.61	NO	YES	NO
Iceland	32.6	0	0	5,031,795	0	0	-12.2	1.1	4,202	3.23	YES	NO	NO
Panama	32.5	967	0	6,580	14.7	28.6	0	-2.2	3,581	3.28	NO	YES	NO



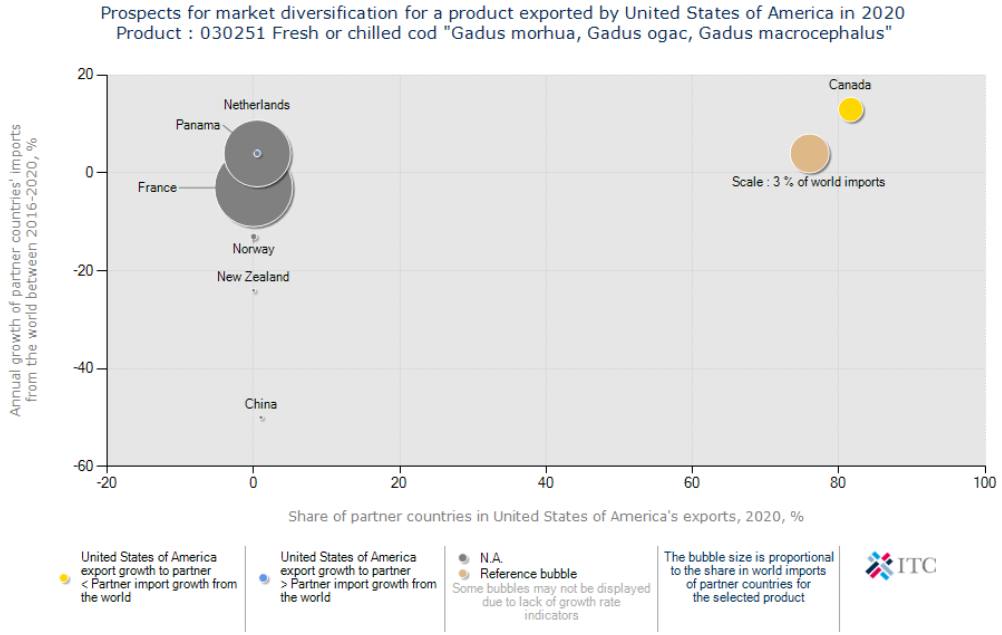
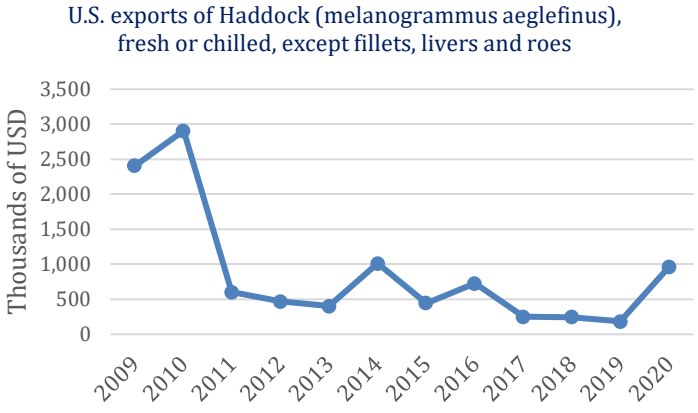


Table 5.h.3. Haddock international opportunity metrics (HS030252).

Country	Total Score	Avg Imports from the US ($)	Max Avg Tariff (%)	Avg Imports from the World	US Import Share (%)	Import Share Gap	Import Growth (%)	GDP Growth (%)	Distance (km)	International Logistics Performance Index Score	Language Match	FTA with US	Landlocked
Saudi Arabia	74.6	7,044	0	7,044	100	0	0	2.1	10,527	3.01	NO	NO	NO
United Arab Emirates	35.7	0	0	131,304	0	4.9	-2.4	5.7	11,030	3.96	YES	NO	NO
Singapore	33.1	52	0	8,222	0.6	0	-100	1.6	15,351	4	YES	YES	NO
Israel	32.4	0	0	1,868	0	0	-100	6	9,120	3.31	YES	YES	NO
Belgium	31.8	0	7.5	1,061,224	0	0	16.6	2	5,892	4.04	YES	NO	NO
France	31.6	0	7.5	9,260,784	0	0	10.2	1.6	5,838	3.84	YES	NO	NO
Iceland	31.2	0	0	250,398	0	0	-85.9	1.1	4,202	3.23	YES	NO	NO

South Korea	30.5	0	0	57	0	0	0	2.1	11,066	3.61	NO	YES	NO
Finland	30.2	0	7.5	47,466	0	0	123.2	2.9	6,626	3.97	NO	NO	NO
Ireland	30.1	0	7.5	1,273,172	0	0	1.7	9.3	5,118	3.51	YES	NO	NO



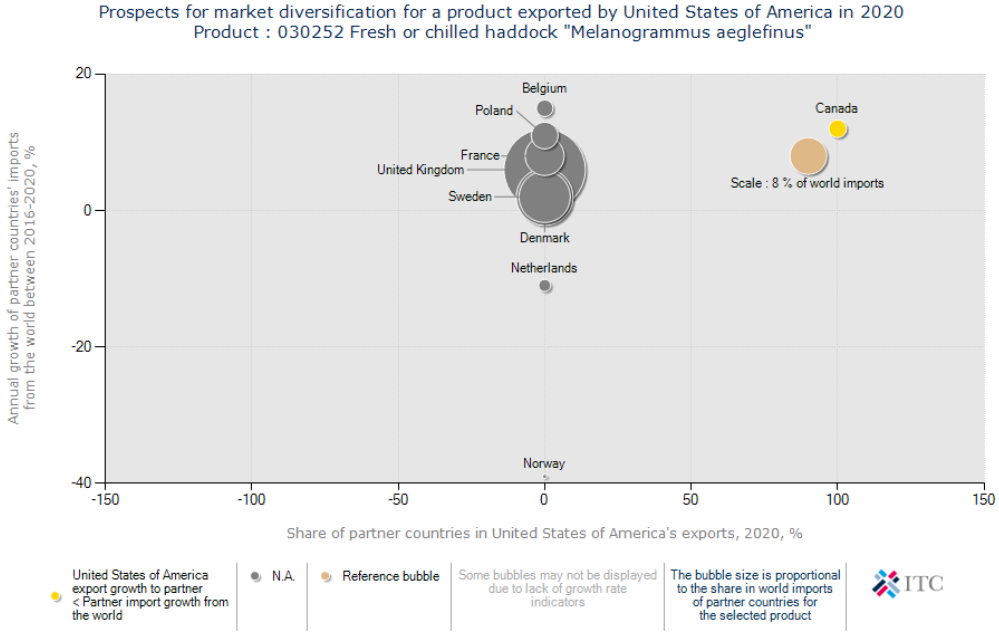
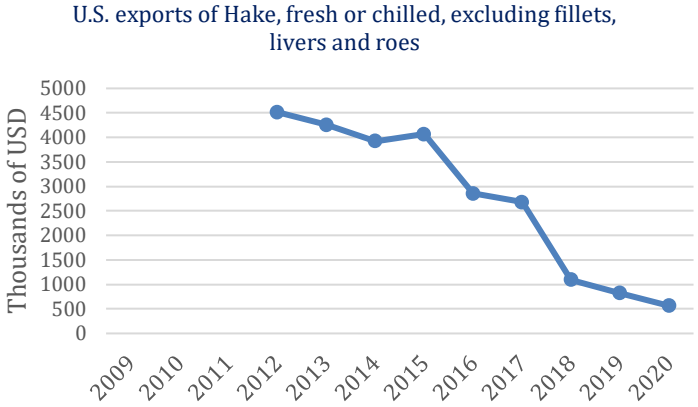
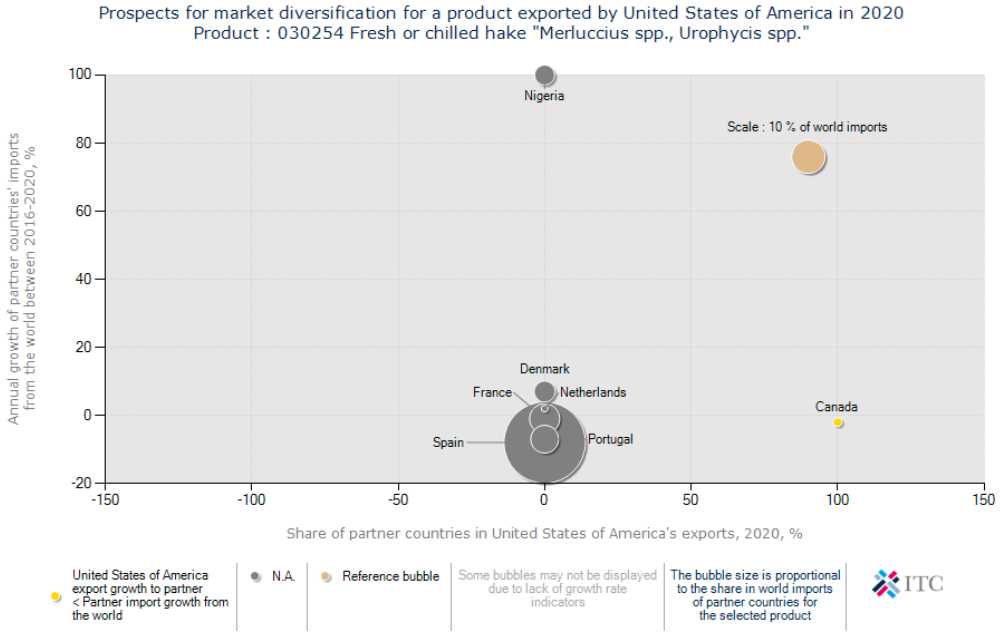


Table 5.h.4. Hake international opportunity metrics (HS030254)

Country	Total Score	Avg Imports from the US ($)	Max Avg Tariff (%)	Avg Imports from the World	US Import Share (%)	Import Share Gap	Import Growth (%)	GDP Growth (%)	Distance (km)	International Logistics Performance Index Score	Language Match	FTA with US	Landlocked
Nigeria	72.2	655,708	10	1,169,752	56.1	0	104.6	1.7	8,493	2.53	YES	NO	NO
Ghana	36.5	169,193	10	360,292	47	0	-5.8	7.3	8,246	2.57	YES	NO	NO
South Africa	33.4	0	0	490,793	0	27.8	1558.8	0.5	12,582	3.38	YES	NO	NO
Singapore	33.2	2	0	10,440	0	0	20.6	1.6	15,351	4	YES	YES	NO
Israel	32.9	0	0	57,221	0	0	-16	6	9,120	3.31	YES	YES	NO
Belgium	31.8	0	15	890,338	0	0	-4.7	2	5,892	4.04	YES	NO	NO
France	31.5	147	15	16,061,669	0	0	-1.4	1.6	5,838	3.84	YES	NO	NO
Australia	31.1	0	0	9,344	0	0	-16.9	2.4	16,009	3.75	YES	YES	NO

South Korea	31	0	0	6	0	0	-100	2.1	11,066	3.61	NO	YES	NO
Chile	31	0	0	134	0	0	-100	0.2	8,271	3.32	NO	YES	NO





Roadmap Recommendations

The ten-year trend in landings by volume is mixed for the groundfish complex with a positive trend for monkfish (up about 10 million lbs), decline in pollock (down about 10 million lbs), decline in cod (by about 4 million lbs), and an increase in haddock (up about 4 million lbs). Meanwhile there is a $10.3 million per year domestic market opportunity and a $1 million international market opportunity. The demand “pull” for groundfish is relatively strong while groundfish production as a complex is stable, but the relative volumes by species are shifting. There are opportunities for groundfish markets as long as the logistics can be managed, and Maine producers are nimble. Capturing highest value (price) markets will be strategic regardless of species production shifts.

Atlantic Halibut

Access

Maine's Atlantic halibut fishery is managed in state waters by the DMR, and in federal waters as part of the New England Fishery Management Council's Northeast multispecies fishery management plan. Federal groundfish vessels are permitted by the National Marine Fisheries Service under the Northeast multispecies permitting program. Federal multispecies permitholders are allowed a single halibut per trip. Numerous management measures are in place including in the state waters fishery including time area closures, gear restrictions, trip limits, and reporting/monitoring requirements.

DMR does not issue licenses for groundfish complex-specific fishing; groundfish fishermen must hold a DMR issued commercial fishing license. However, DMR requires a halibut endorsement for state waters halibut fishing, and the agency promulgates management regulations including a limited number of tags per licensed fisherman, a set fishing season (May 18 – June 13), gear restrictions and marking requirements, and size limits.

Production

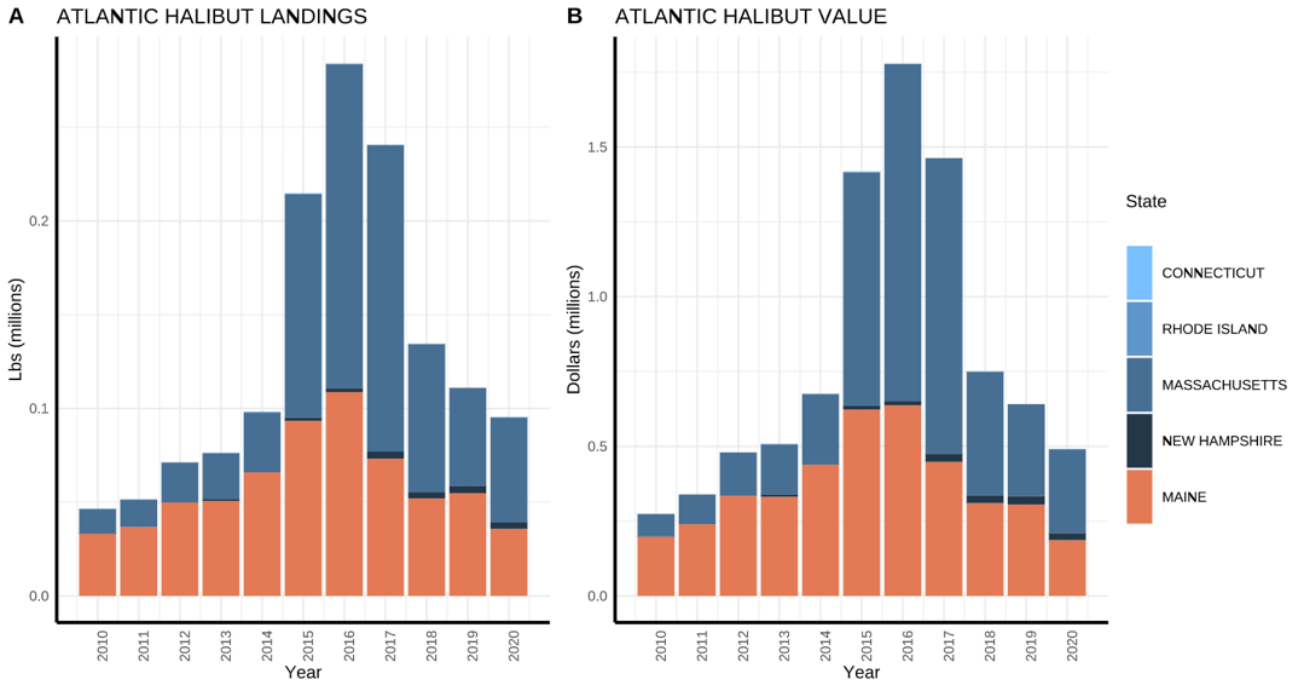


Figure 5.i.1. Atlantic halibut landings (panel A) and value (panel B) across New England states.

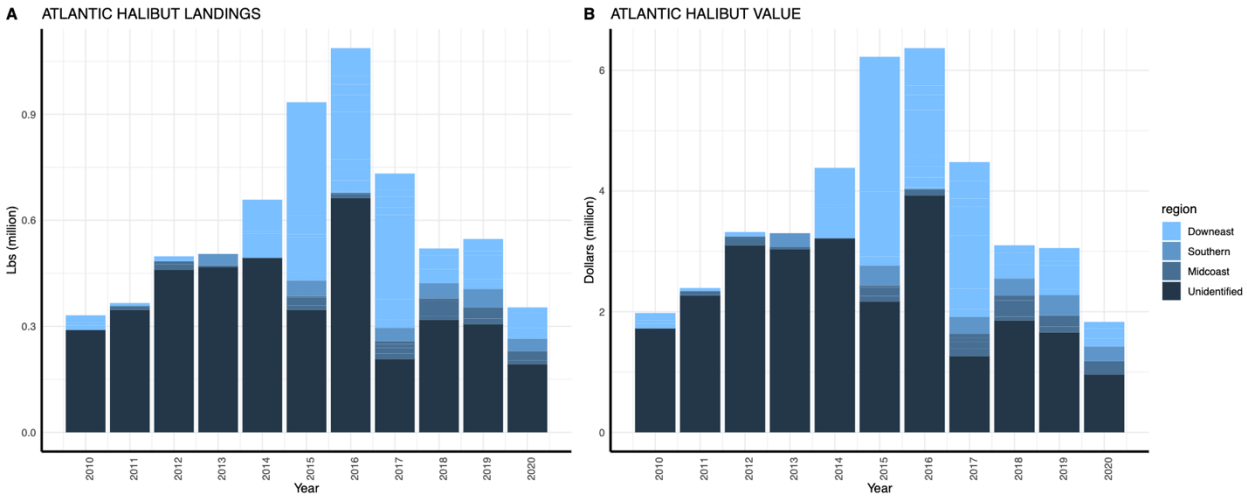


Figure 5.i.2. Atlantic halibut landings (panel A) and value (panel B) across Maine regions.

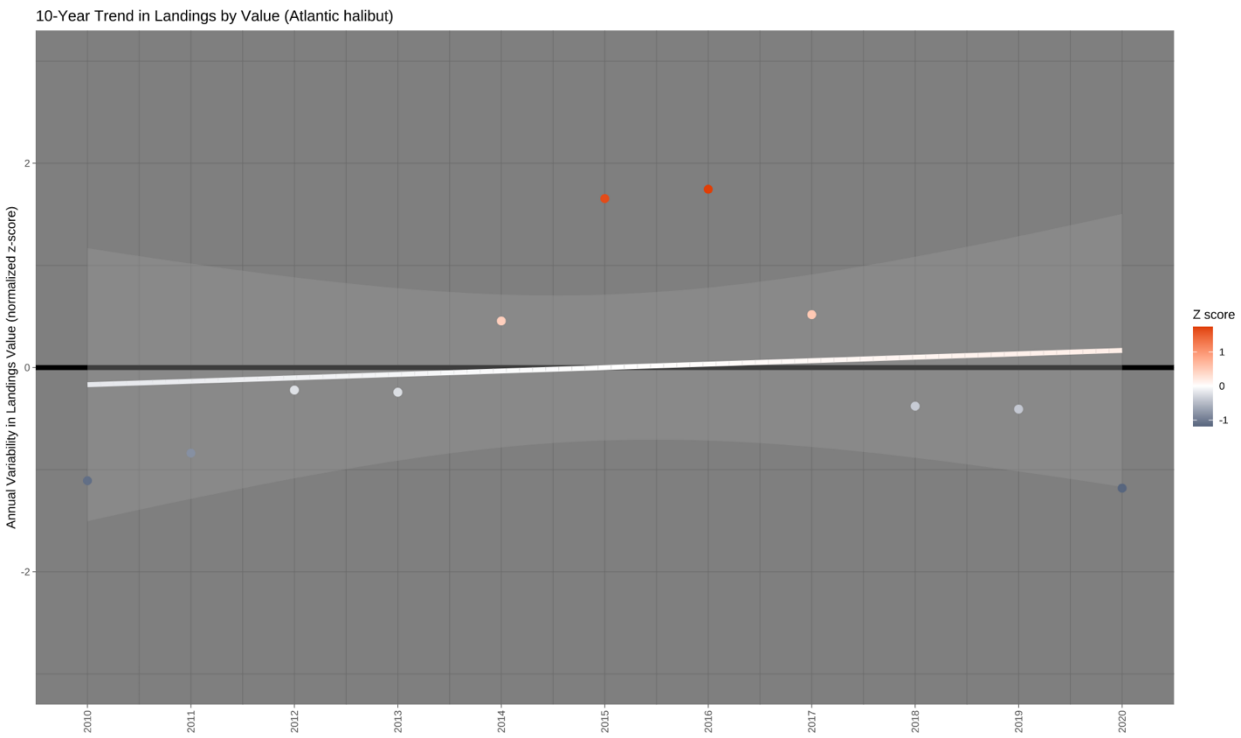


Figure 5.i.3. Annual variability in halibut landings value in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual value relative to the ten-year average.

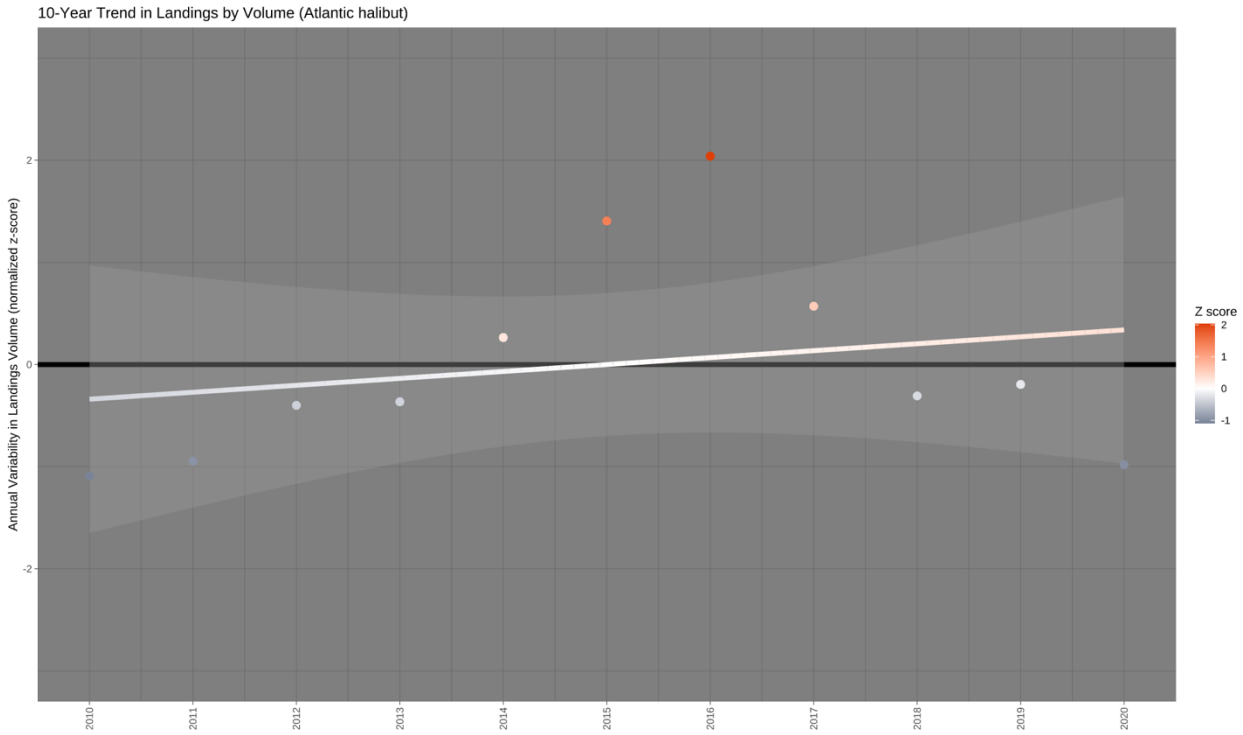


Figure 5.i.4. Annual variability in halibut landings volume in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual volume relative to the ten-year average.

Market Opportunity

There is a $7.9 million per year halibut market growth opportunity in the U.S. domestic market based on the ten-year trend in state imports. In the last decade, fillet product demand rose by 5%, while frozen product fell by 5%. The top five states with the largest growth in demand are Massachusetts ($5.7 million per year), followed by California ($1.0 million), North Carolina ($0.3 million), Washington ($0.3 million), and Oregon ($0.3 million).

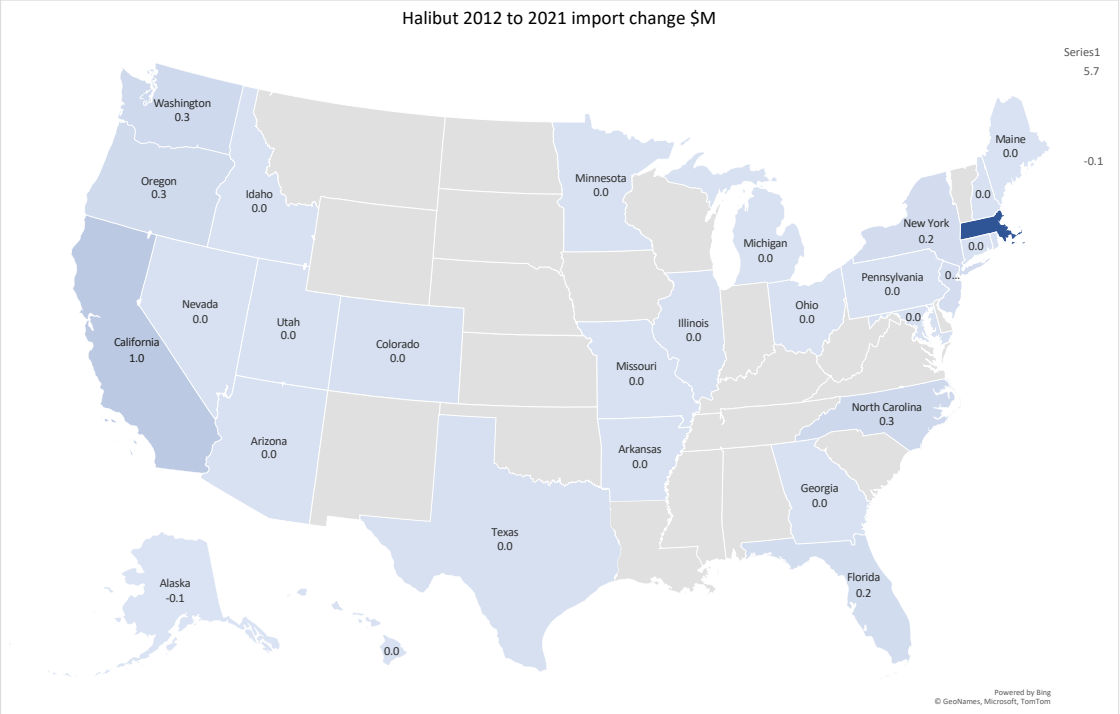


Figure 5.i.5. Halibut import growth by state, 2012 - 2021 ($7.9 million/yr).

Source: U.S. Census Bureau

Note: Includes HS codes: 030221, 030331.

Driving a 10% increase in U.S. halibut exports to the main existing markets will rely on exports to Canada, and Brazil. Maine does not currently export to these countries, but there is room to grow since they are already familiar with U.S. products.

The ITC ranks Singapore and the Dominican Republic as the top potential new and expanding markets based on a combination of factors shown on the next table. The 12-year historical pattern in U.S. exports is shown for context where exports stabilized in 2014 after a decline to about one-third of the peak. The bubble plot shows a yellow circle for Canada indicating where the U.S. export growth is trailing other countries so there is import strength Maine could capture.

Table 5.i.1. Top three existing and potential growth U.S. export markets for halibut ($1.5 million).

Existing Markets 2020				Potential New / Expanded Markets			
Top US Export Destinations	US Export Value ($)	Maine Exported Value to Top Destinations ($)	Maine % of US Exports to Top Destinations	Export Destination Ranking	Average Imports from US ($)	US Import Share (%)	US Import Growth (%)
Canada	14,664,598	0	0%	Singapore	28,955	12	- 6
Brazil	2,603	0	0%	Dominican Republic	24,823	20	- 1

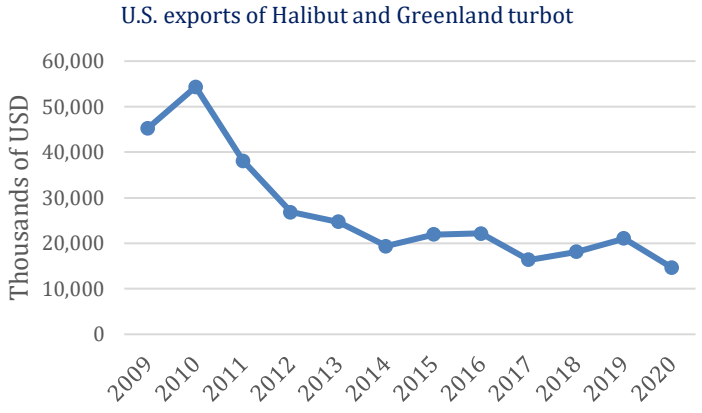
Source: International Trade Centre (ITC), UN Comtrade data.

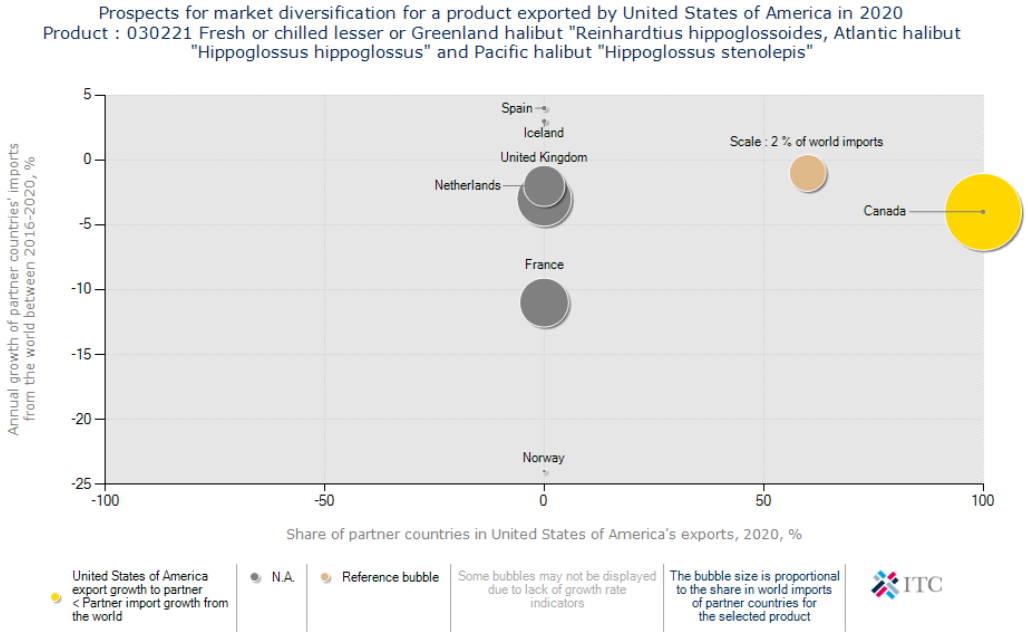
Note: Includes HS code: 030221, 030331,

Table 5.i.2. Halibut international opportunity metrics (HS030221).

Country	Total Score	Avg Imports from the US ($)	Max Avg Tariff (%)	Avg Imports from the World	US Import Share (%)	Import Share Gap	Import Growth (%)	GDP Growth (%)	Distance (km)	International Logistics Performance Index Score	Language Match	FTA with US	Landlocked
Singapore	87.6	28,955	0	232,184	12.5	0	-5.5	1.6	15,351	4	YES	YES	NO
Dominican Republic	75.4	24,823	0	123,974	20	1.3	-1.2	1	2,509	2.66	NO	YES	NO
Israel	39.3	0	0	23,358	0	0	-100	6	9,120	3.31	YES	YES	NO
Belgium	38.6	0	10.3	945,561	0	0	-16.2	2	5,892	4.04	YES	NO	NO
France	38.4	0	10.3	9,409,069	0	0	-10.8	1.6	5,838	3.84	YES	NO	NO
Iceland	37.8	0	0	12,306	0	0	-5.7	1.1	4,202	3.23	YES	NO	NO
Australia	37.6	0	0	28,047	0	0	-100	2.4	16,009	3.75	YES	YES	NO

South Korea	37.5	0	0	2,681	0	0	0	2.1	11,066	3.61	NO	YES	NO
Germany	37.2	335	10.3	3,990,630	0	0	-23.1	2.6	6,035	4.2	NO	NO	NO
Panama	37.1	1,130	0	1,130	100	0	0	-2.2	3,581	3.28	NO	YES	NO





Roadmap Recommendations

The ten-year trend in landings by volume is relatively stable with a peak in 2015-2016 and a return to trend recently, while there is a $7.9 million per year domestic market opportunity and a $1.5 million international market opportunity. There is strong demand “pull” for halibut and Maine enjoys a relatively stable resource supply. The specific markets for growth should be examined to identify higher value opportunities than current shipments are earning. Shifting to higher value markets and timing markets according to the highest prices through the year would be a starting point for tapping into growth.

Bluefin tuna

Access

Maine's bluefin tuna fishery is managed under the Atlantic Tunas Convention Act and the federal Consolidated Atlantic Highly Migratory Species Management Plan (2006), implemented by regulations at 50 CFR part 635. In 2021 NOAA published a final rule advanced at the request of Maine DMR adding Maine state waters tuna fisheries to the list of state fisheries to which federal requirements apply. These requirements include closed seasons, retention limits, gear restrictions, size restrictions, and permitting requirements. Maine does not issue a tuna-specific license. Tuna abundance in the Gulf of Maine is thought to have increased somewhat over the period of record, and fishermen based in Maine are gaining increased market share relative to their Southern New England counterparts as steaming distance to fishing grounds reduces commensurately.

Production

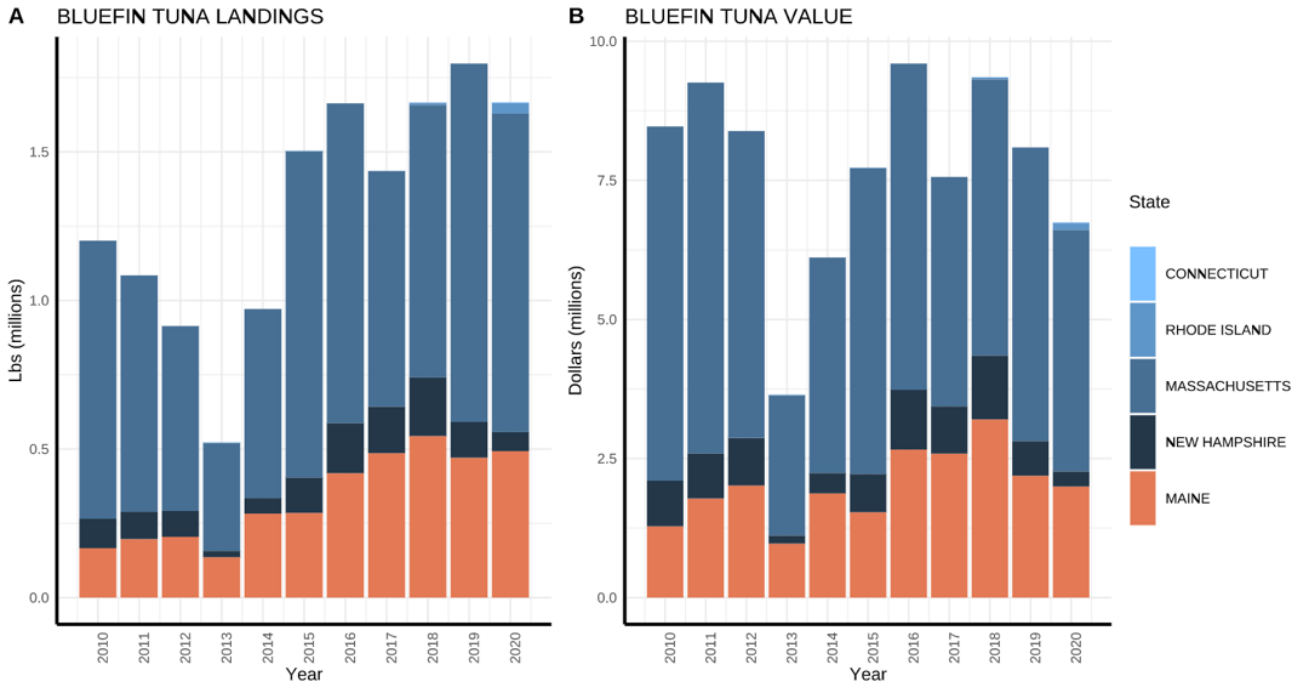


Figure 5.j.1. Bluefin tuna landings (panel A) and value (panel B) across New England states.

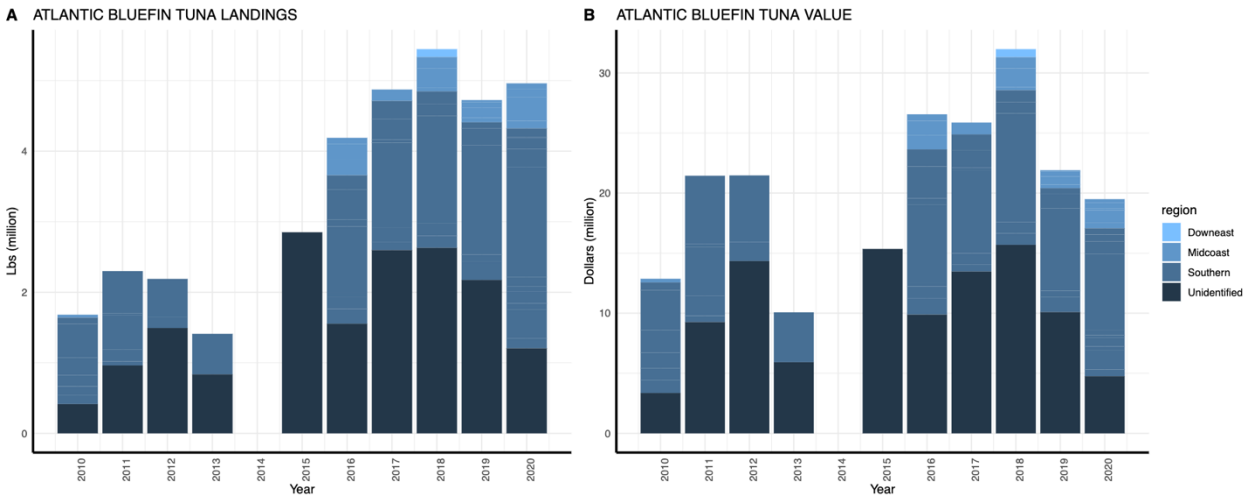


Figure 5.j.2. Bluefin tuna landings (panel A) and value (panel B) across Maine regions.

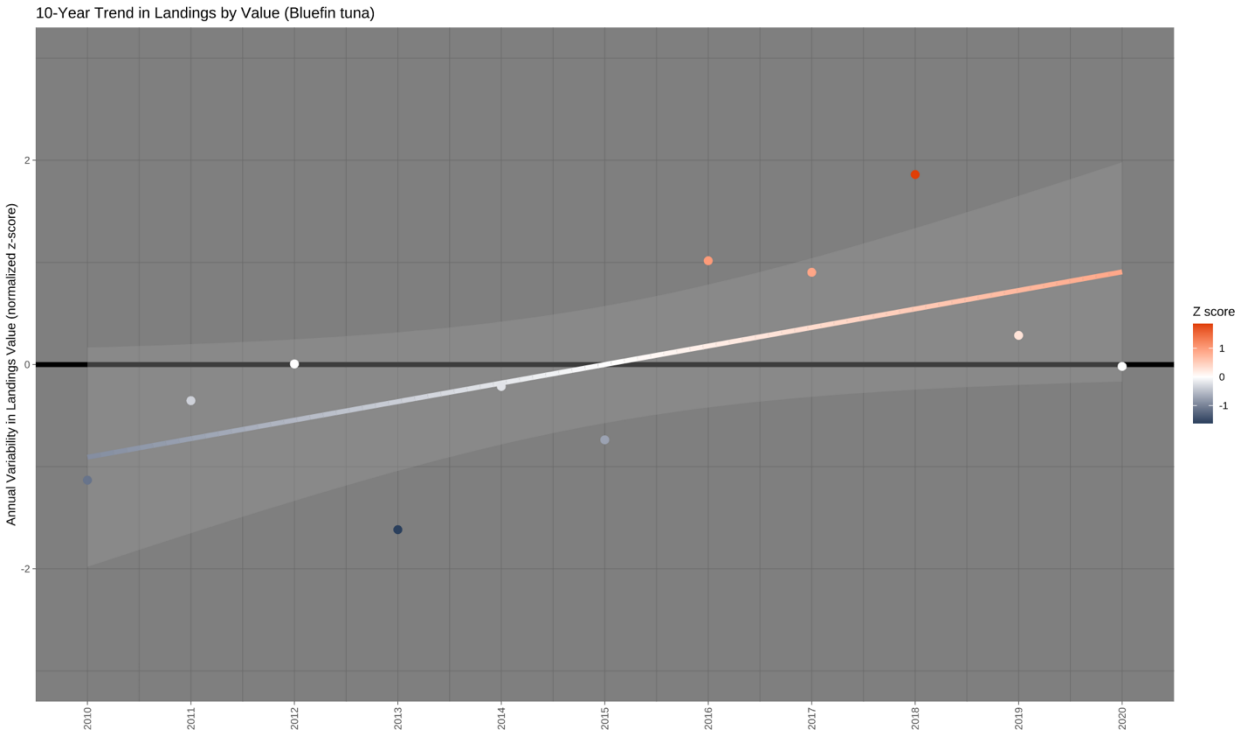


Figure 5.j.3. Annual variability in bluefin tuna landings value in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual value relative to the ten-year average.

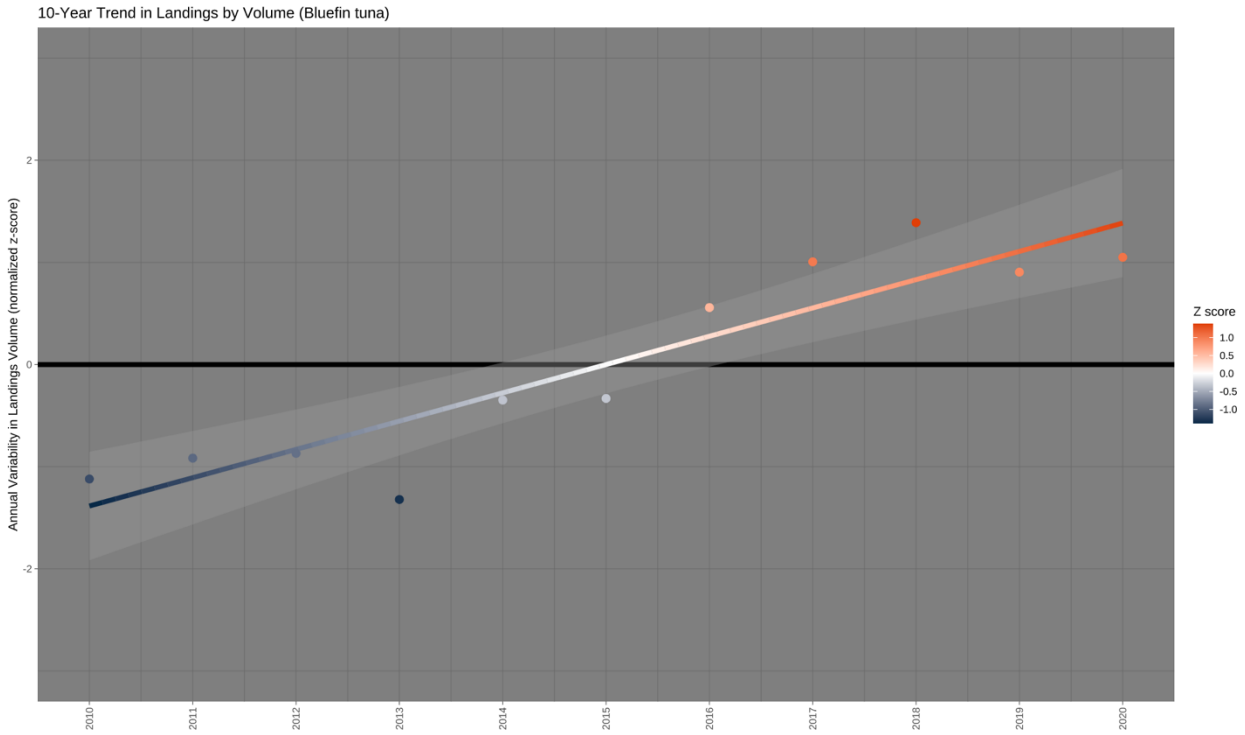


Figure 5.j.4. Annual variability in bluefin tuna landings volume in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual volume relative to the ten-year average.

Market Opportunity

There is a $7.1 million per year tuna market growth opportunity in the U.S. domestic market based on the ten-year trend in state imports. In the last decade, fresh and fillet product demand rose by 11%, while frozen and other product fell by the same amount. The top five states with the largest growth in demand are California ($4.6 million per year), followed by New Jersey ($1.1 million), New York ($0.5 million), Florida ($0.4 million), and Texas ($0.1 million).

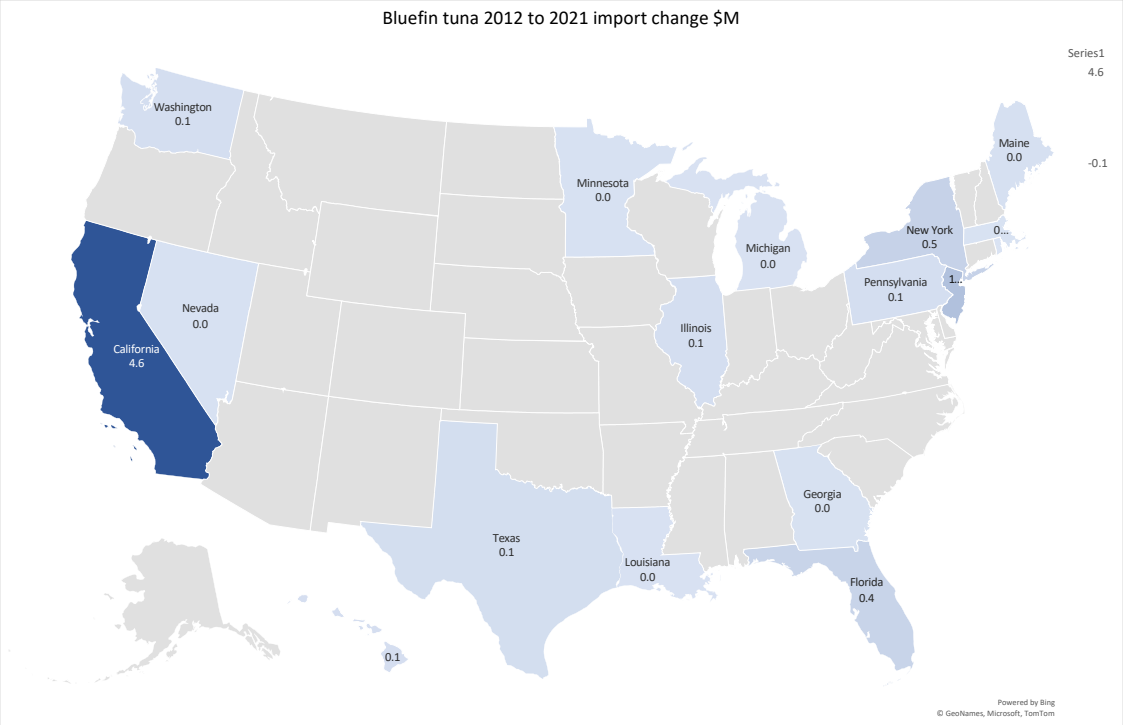


Figure 5.j.5. Tuna import growth by state, 2012 - 2021 ($7.1 million/yr).

Source: U.S. Census Bureau

Note: Includes HS codes: Live - 030194, 030195, Fresh - 030235, 030236, Frozen - 030345, 030346.

Gaining a 10% increase in U.S. tuna exports to the main existing markets will rely on exports to Japan, Canada, and South Korea. Maine does not currently supply these countries with bluefin directly, so, although not new for U.S. exporters, this would be a new venture for Maine.

The ITC ranks South Korea, Singapore, and Trinidad and Tobago as the top potential new and expanding markets based on a combination of factors shown on the next table. The U.S. has very low shares of imports in these countries where import demand is strong. The 12-year historical pattern in U.S. exports is shown for context where exports have been variable with some strengthening in the past 5 years. The bubble plot shows blue circles where the U.S. is gaining

market share faster than other countries. Larger circles mean the target country represents are larger share of world imports for this product.

Table 5.j.1. Top three existing and potential growth U.S. export markets for bluefin tuna ($500,000).

Existing Markets 2020				Potential New / Expanded Markets			
Top US Export Destinations	US Export Value ($)	Maine Exported Value to Top Destinations ($)	Maine % of US Exports to Top Destinations	Export Destination Ranking	Average Imports from US ($)	US Import Share (%)	US Import Growth (%)
Japan	3,598,865	0	0%	South Korea	33,251	1	+ 3
Canada	1,189,219	0	0%	Singapore	2,653	1	- 25
Korea, South	33,251	0	0%	Trinidad and Tobago	7,825	8	0

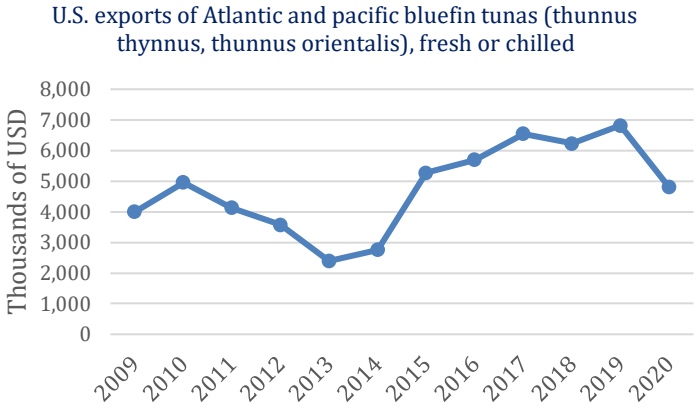
Source: International Trade Centre (ITC), UN Comtrade data.

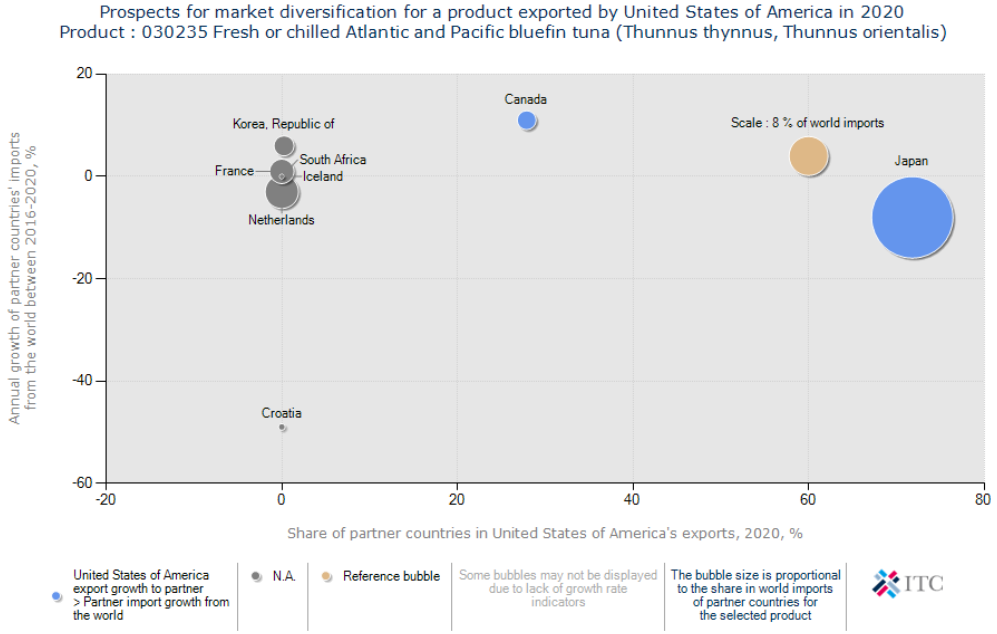
Note: Includes HS code: 030235.

Table 5.j.2. Bluefin tuna international opportunity metrics (HS030235).

Country	Total Score	Avg Imports from the US ($)	Max Avg Tariff (%)	Avg Imports from the World	US Import Share (%)	Import Share Gap	Import Growth (%)	GDP Growth (%)	Distance (km)	International Logistics Performance Index Score	Language Match	FTA with US	Landlocked
South Korea	83.3	33,251	0	2,858,898	1.2	6.3	2.6	2.1	11,066	3.61	NO	YES	NO
Singapore	37.8	2,653	0	522,600	0.5	6.9	-24.5	1.6	15,351	4	YES	YES	NO
Trinidad and Tobago	35.1	7,825	40	98,994	7.9	2.8	0	-1	3,569	2.42	YES	NO	NO
Bahamas, The	34.9	8,441	30	8,441	100	0	211.8	-1.5	1,771	2.53	YES	NO	NO
China	34.5	0	7	10,468,697	0	7.4	13.2	7	10,994	3.61	NO	NO	NO
Costa Rica	33.5	0	0	49,824	0	10.7	0	1.1	3,565	2.79	YES	YES	NO
Israel	33.3	0	0	179,400	0	0	0	6	9,120	3.31	YES	YES	NO

Belgium	32.1	0	11	551,697	0	0	-9.3	2	5,892	4.04	YES	NO	NO
France	31.8	0	11	4,258,327	0	0	4.2	1.6	5,838	3.84	YES	NO	NO
Chile	31.7	252	0	1,376	18.3	0	-100	0.2	8,271	3.32	NO	YES	NO





Roadmap Recommendations

The ten-year trend in landings by volume shows a rise of about 2 million lbs over the period combined with a $7.1 million per year domestic market opportunity and a $500,000 international market opportunity. The demand for lobster is clearest in domestic markets and there is potential to build on rising resource supply. The small international opportunity should not be overlooked as this can represent higher value opportunities than current shipments are earning.

American eel

Access

American eel fisheries target juvenile (elver) and subadult (yellow eel) life stages, respectively. Following a lull from the 1970s to the early 1990s, interest in elver fishing in Maine increased in the 1990s, and has since skyrocketed from the beginning of the period of record. The eel fisheries are managed by under Addendum V of the Atlantic States Marine Fisheries Commission's Fishery Management Plan, which sets an annual total allowable catch level. Only two states, Maine and North Carolina, harvest elvers. Under state law, Maine caps the number of elver licenses at 425, and access to the fishery is controlled via a lottery.

The majority of elvers harvested in Maine are sold to the international export market. However, a new enterprise, American Unagi, is currently in the process of installing grow-out aquaculture facilities for Maine-caught elvers. In addition, the Passamaquoddy Tribe harvests elvers on its territory and is working with American Unagi on its own grow-out venture.

Production

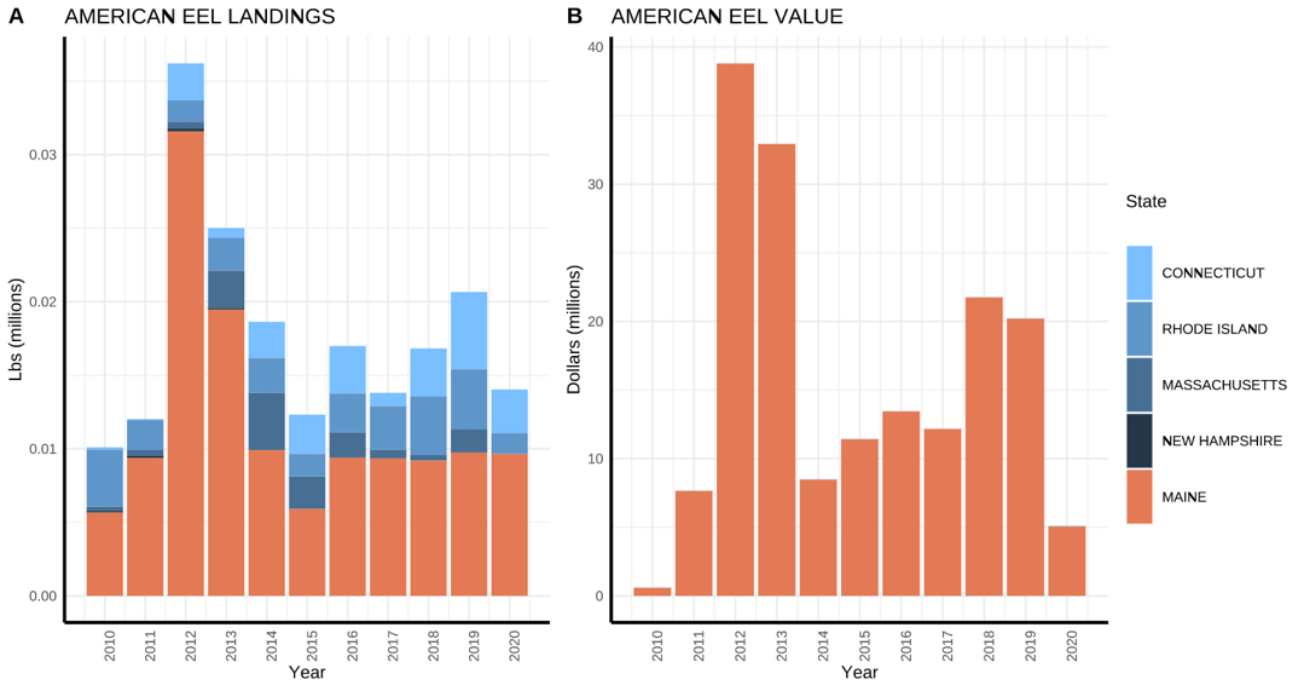


Figure 5.k.1. American eel landings (panel A) and value (panel B) across New England states.

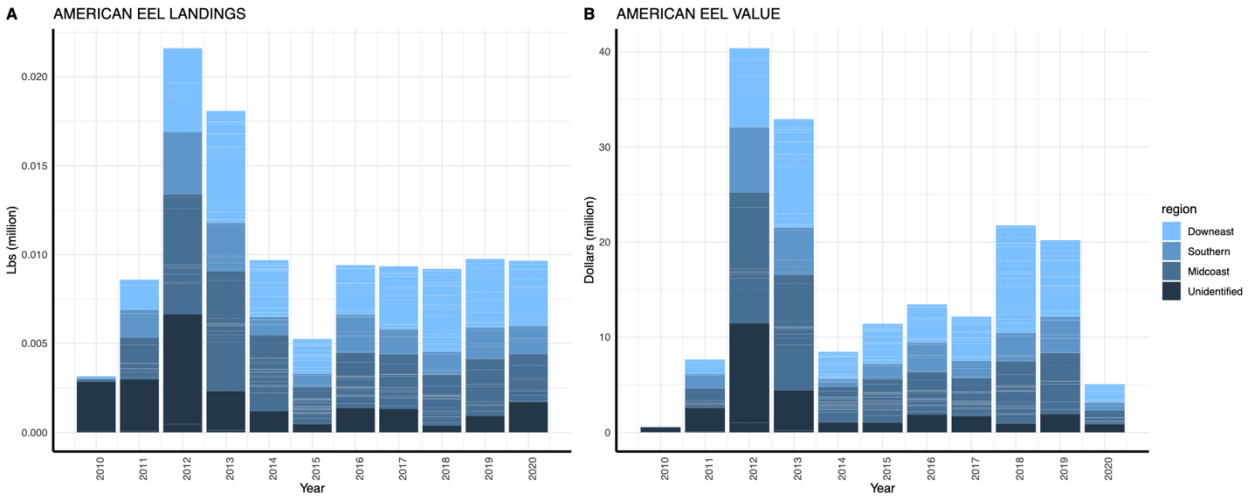


Figure 5.k.2. American eel landings (panel A) and value (panel B) across Maine regions.

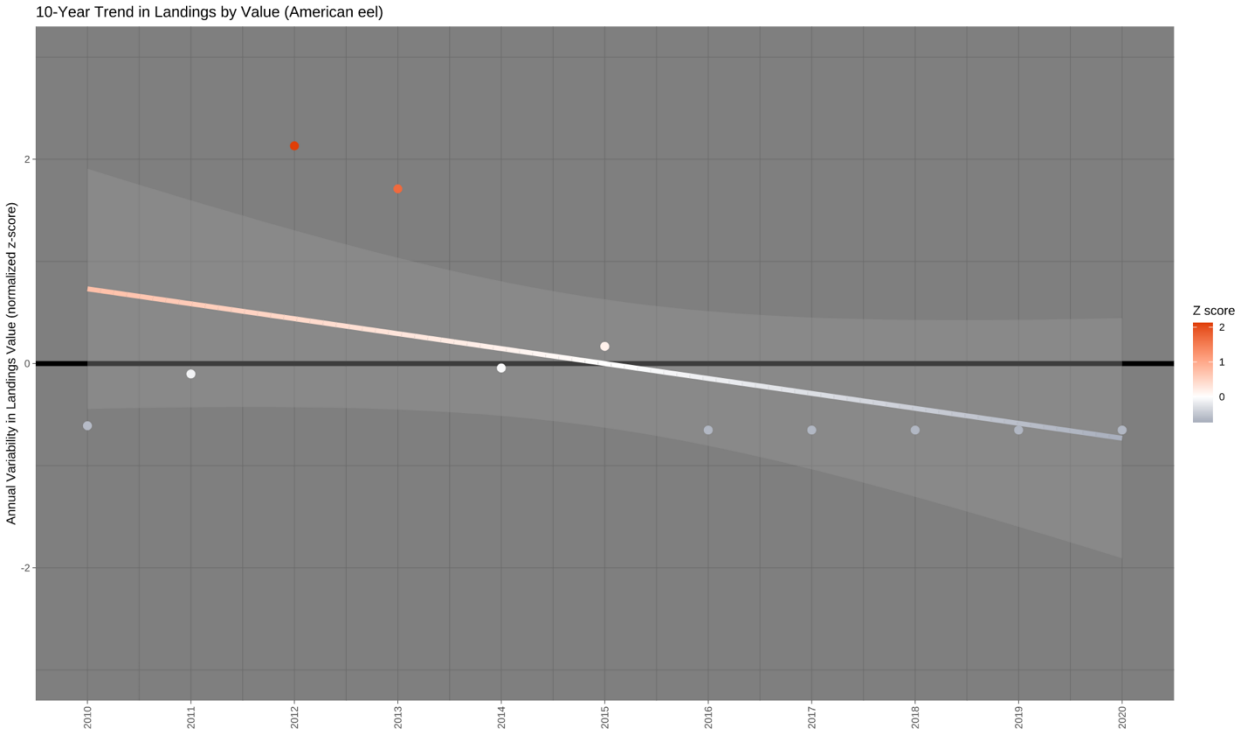


Figure 5.k.3. Annual variability in American eel landings value in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual value relative to the ten-year average.

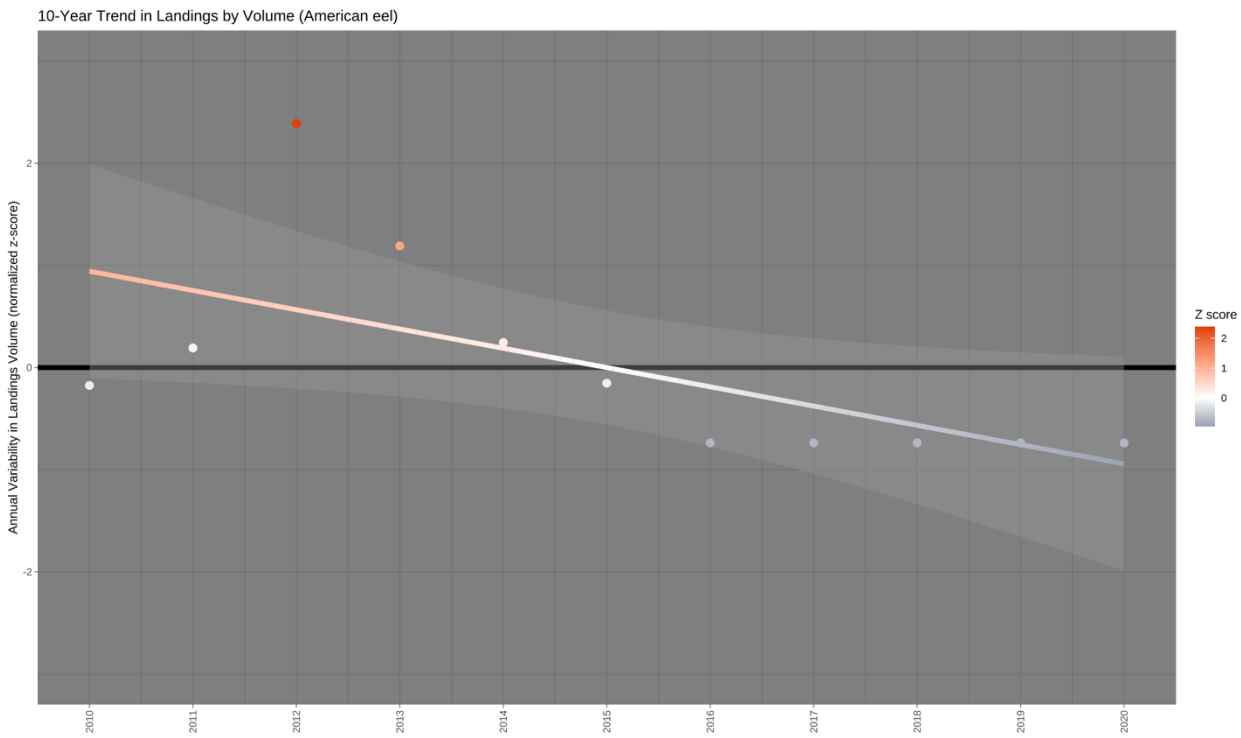


Figure 5.k.4. Annual variability in American eel landings volume in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual volume relative to the ten-year average.

Market Opportunity

Eels are really destined for international markets that place high values on elvers for grow-out in aquaculture systems abroad and full-grown eels for consumer markets. There may however be growing interest within the U.S. and tracking developments over time could be useful. There is a $230,000 per year juvenile eel market growth opportunity in the U.S. domestic market based on the ten-year trend in state imports. In the last decade, live product demand rose from 60% to 84% of imports, while fresh or chilled product fell from 40% to 16%. The top three states with the largest growth in demand are New York, Massachusetts, and California for a combined total of $220,000 per year. It

should be noted that this market growth potential does not account for the possibility of domestic adult American eel production, which is possibly orders of magnitude higher.

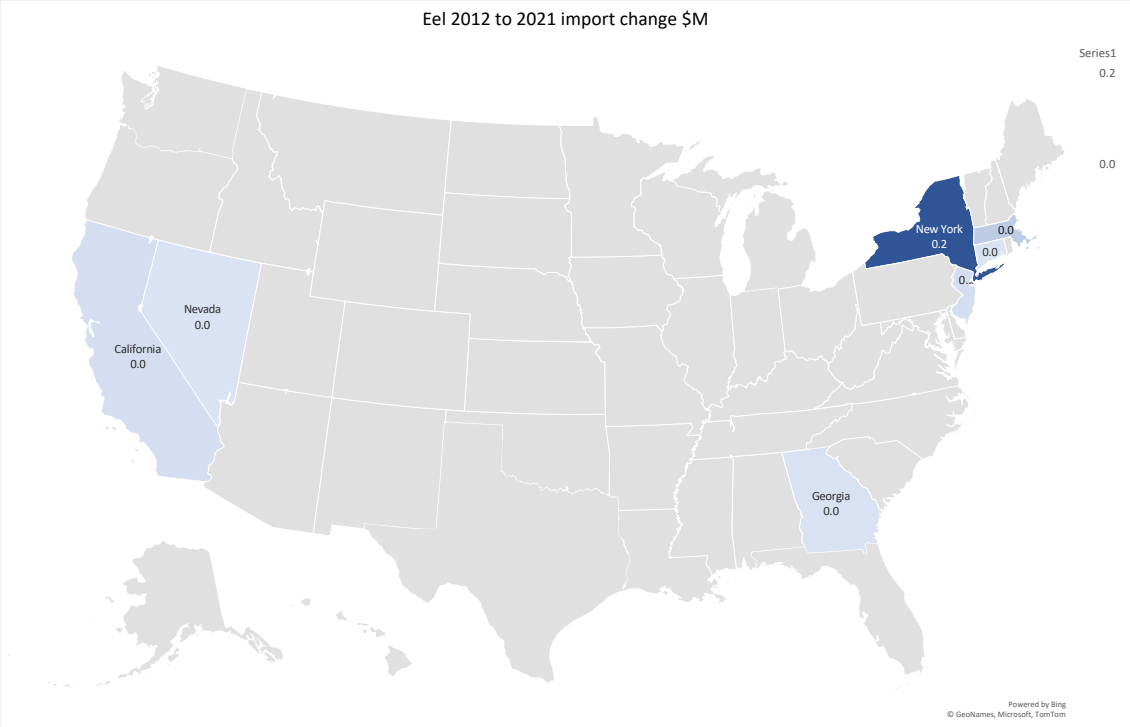


Figure 5.k.5. Eel import growth by state, 2012 - 2021 ($230,000/yr).

Source: U.S. Census Bureau

Note: Includes HS codes: 03

Driving a 10% increase in U.S. American eel exports to the main existing markets will rely on exports to Hong Kong, South Korea, and Canada. Although the U.S exports to all three, Maine has not shipped to South Korea recently. Maine supplies a relatively low share of U.S. exports to China and Hong Kong suggesting there is room to grow in countries that are already familiar with U.S. products.

The ITC ranks Belgium, Portugal, and the Netherlands as the top potential new and expanding markets based on a combination of factors shown on the next table. The 12-year historical pattern in U.S. exports is show a sharp peak in 2013 followed by relatively steady at about two-thirds of the peak. The bubble plot shows yellow circles where the U.S. export growth is trailing other countries. Larger circles mean the target country represents are larger share of world imports for this product.

Table 5.k.1. Top three existing and potential growth U.S. export markets for eels ($1.6 million).

Existing Markets 2020				Potential New / Expanded Markets			
Top US Export Destinations	US Export Value ($)	Maine Exported Value to Top Destinations ($)	Maine % of US Exports to Top Destinations	Export Destination Ranking	Average Imports from US ($)	US Import Share (%)	US Import Growth (%)
Hong Kong	8,377,020	7,908,570	94%	Belgium	1,030,219	29	- 15
Korea, South	6,147,675	0	0%	Portugal	390,311	27	- 5
Canada	106,870	106,870	100%	Netherlands	0	0	- 6

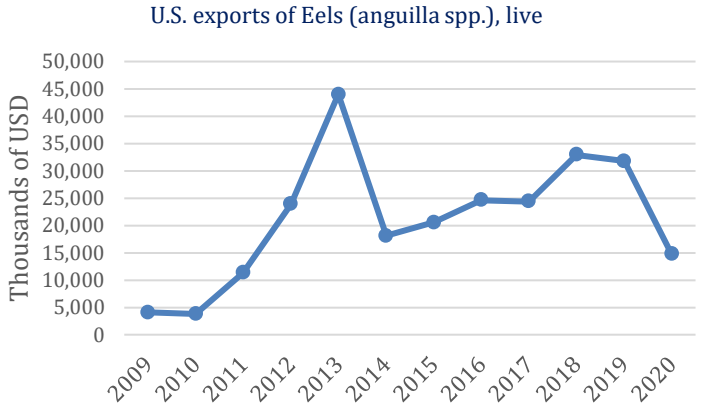
Source: International Trade Centre (ITC), UN Comtrade data.

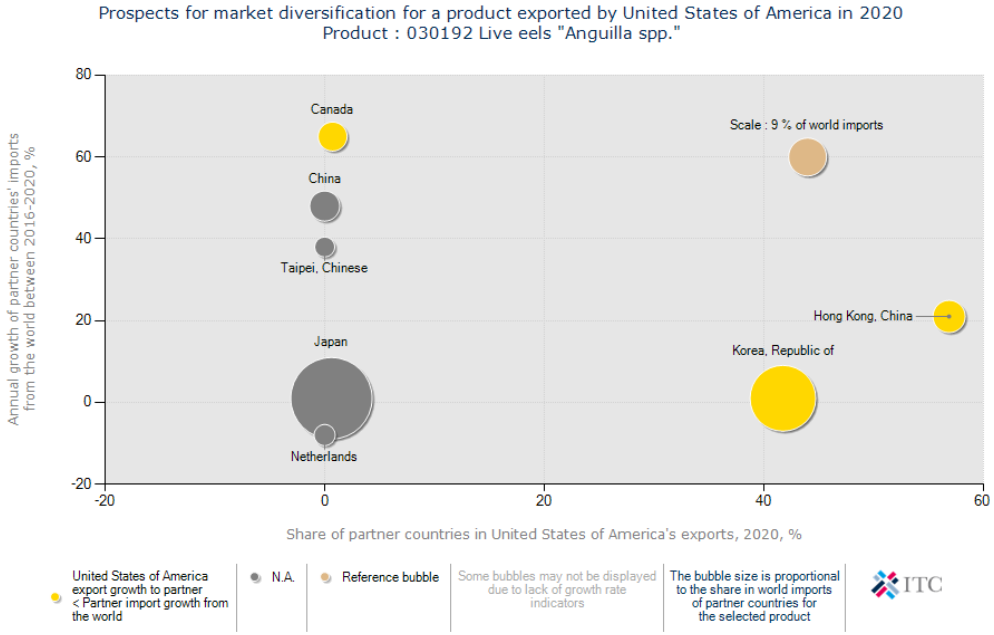
Note: Includes HS code: 030192.

Table 5.k.2. American eel international opportunity metrics (HS030192).

Country	Total Score	Avg Imports from the US ($)	Max Avg Tariff (%)	Avg Imports from the World	US Import Share (%)	Import Share Gap	Import Growth (%)	GDP Growth (%)	Distance (km)	International Logistics Performance Index Score	Language Match	FTA with US	Landlocked
Belgium	82.2	1,030,219	0	3,556,166	29	0	-14.5	2	5,892	4.04	YES	NO	NO
Portugal	49.9	390,311	0	1,425,785	27.4	0	-4.7	2.9	5,425	3.64	NO	NO	NO
Netherlands	40.1	0	0	15,063,514	0	4.1	-5.9	3.9	5,866	4.02	NO	NO	NO
Spain	35.9	42,696	0	5,397,535	0.8	3.3	19.7	1	5,770	3.83	NO	NO	NO
Germany	35.6	0	0	6,644,341	0	4.1	-9.6	2.6	6,035	4.2	NO	NO	NO
Costa Rica	35	36	0	36	100	0	0	1.1	3,565	2.79	YES	YES	NO
France	34.2	0	0	206,943	0	4.1	-11.1	1.6	5,838	3.84	YES	NO	NO
Denmark	33.9	29,603	0	1,759,720	1.7	2.4	-37.9	3.3	6,192	3.99	NO	NO	NO

Italy	33.5	71,004	0	4,366,448	1.6	2.4	-16.8	0.1	6,895	3.74	NO	NO	NO
Norway	32.2	0	0	29	0	4.1	0	-0.4	5,917	3.7	NO	NO	NO





Roadmap Recommendations

The ten-year trend in landings by volume show stable supply except a peak in 2012-2013 while there is a $230,000 per year domestic market opportunity and a $1.6 million international market opportunity. Efforts in Maine to grow-out eels in addition to the steady harvest will enable producers to primarily take advantage of international market opportunities. In fact, the international market opportunity will be even greater for successful grow-out operations as consumer-ready product will have much more value.

Kelp & other seaweeds

Access

Maine's algae production is derived from cultured kelp (chiefly winged kelp (*Alaria esculenta*), horsetail kelp (*Laminaria digitata*), and sugar kelp (*Saccharina latissima*) & wild harvested rockweed (*Ascophyllum nodosum*). Rockweed harvest is managed under DMR's fishery management plan for rockweed and permitted by DMR. There are249 sectors across 10 zones. Conflict between rockweed harvesters and coastal landowners has emerged as a significant access challenge for harvesters. Current litigation seeking to settle the issue of intertidal access for the purposes of harvesting (fishing) for rockweed may ultimately determine these key access issues for the state's rockweed harvesters in the coming years.

Kelp aquaculture is managed by DMR's aquaculture program. DMR issues leases for standard and experimental aquaculture leases of various sizes. In 2020 there were 46 standard and experimental aquaculture leases listing kelp as a primary species, totaling 283.2 acres under cultivation, and there were 769 LPA leases in the state, many of which cultivate kelp.

Production

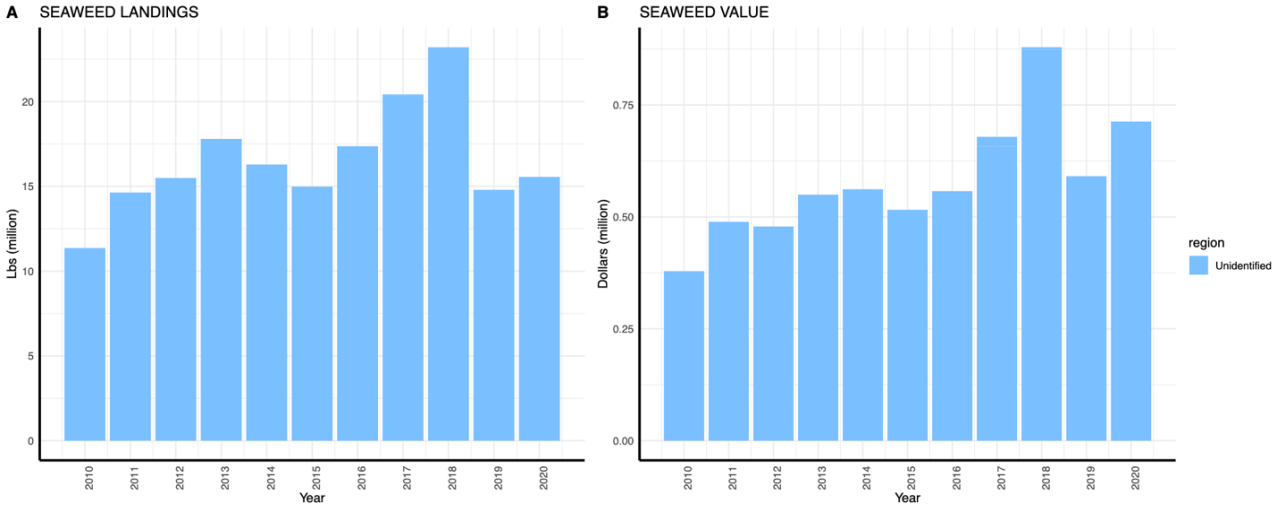


Figure 5.I.1. Seaweed (*A. nodosum*) landings (panel A) and value (panel B) in Maine. Harvest location by region is not available for this analysis.

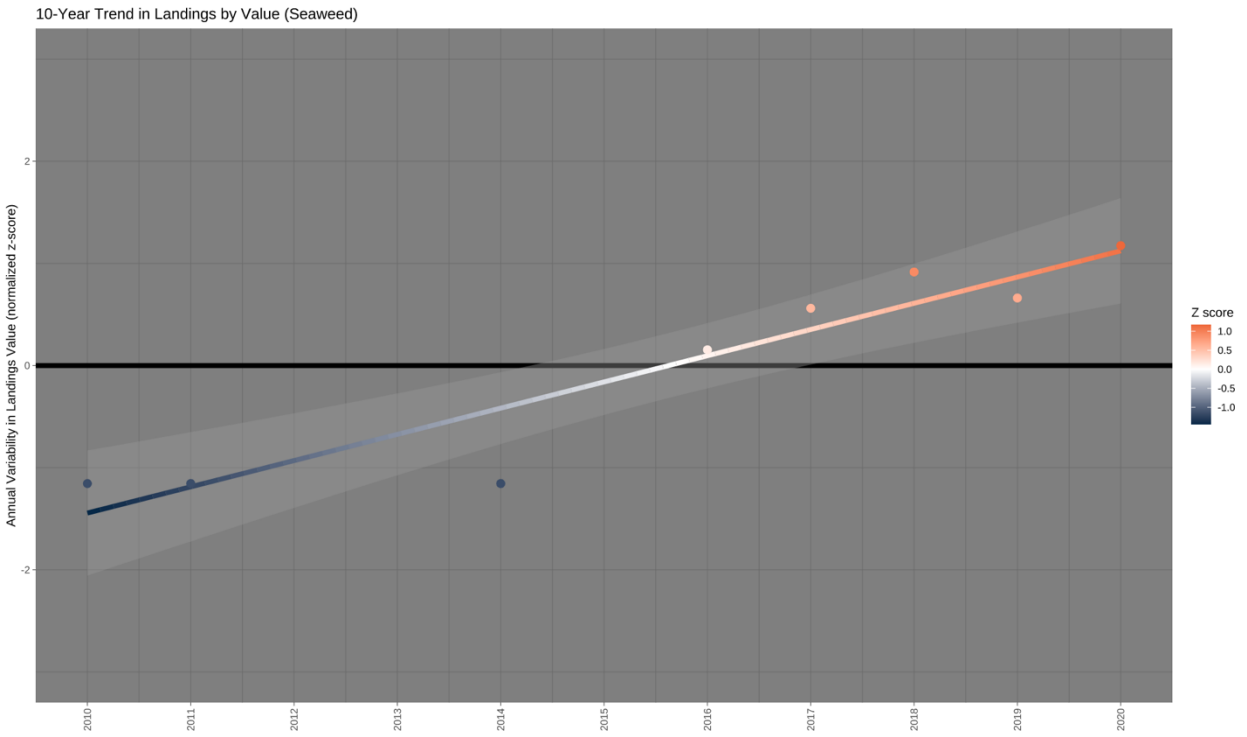


Figure 5.I.2. Annual variability in seaweed (*A. nodosum*) landings value in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual value relative to the ten-year average.

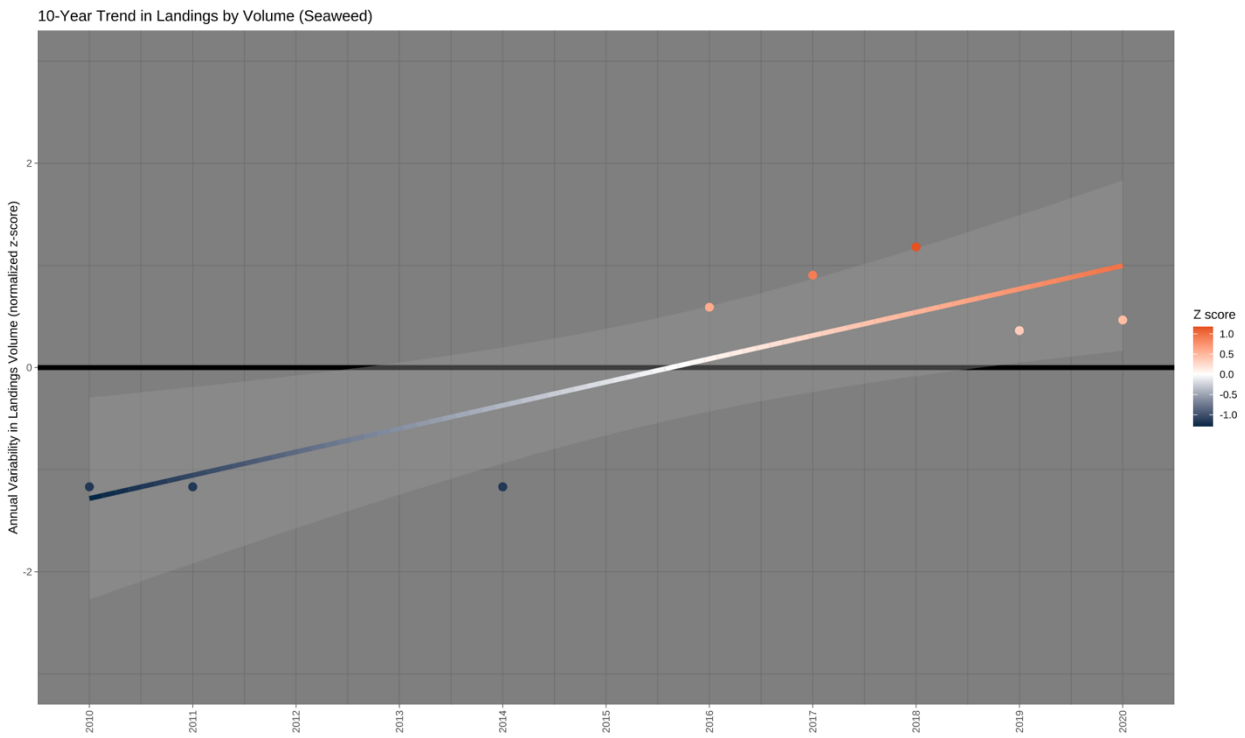


Figure 5.I.3. Annual variability in seaweed (*A. nodosum*) landings volume in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual volume relative to the ten-year average.

Market Opportunity

There is an estimated minimum $14 million per year ($30-$40 million over the next 3 years) domestic U.S. market growth "pull" for seaweed products, and a minimum $20 million annual international (Asian) market demand for seaweed ($50-60 million over next 3 years). The combined opportunity is at least $34 million per year or $80 to $100 million over the next three years.

Seaweed products are broadly divided into food and non-food products, and these reflect different types of seaweed, namely sugar kelp (food) and rockweed (non-food). It is important to recognize that rockweed is primarily

collected in the intertidal zone so shoreline access to the resource is critical, whereas sugar kelp may be grown on lines away from shore. Land-based tanks are also now being used to grow a small portion of seaweed for food products.

Food products are the dominant part of the market including food ingredients for processed foods, soups, snacks, nutritional supplements, sushi, and others. Seaweed for non-food applications include animal and aquaculture feeds, soil amendments, and personal care products among others. There is such a diverse array of seaweed product applications that are very different from general seafood markets and each product is subject to different market dynamics, therefore producers in Maine recognize the lack of data and basis for market assessment. We therefore combine insights from three sources:

- **Market reports** that are publicly available**,**
- **Insights** from Maine producers, and
- **Import-export analysis** as done for other species in this report but highlighting how this reflects only a small portion of the market.

Market reports published by Grand View Research Inc. assess the global seaweed industry including specific data for North America and the U.S. The estimated U.S. market size in 2015 was $1.3 billion[1], about 90% of which is food product, and the balance is seaweed products for agriculture and soil amendments. In 2019, they indicated market growth was averaging 8.8% in

[1] Maine Biz, 2018. Ocean Bounty Tolef Olson has a knack for turning seaweed into products that are in demand (www.mainebiz.biz/article/ocean-bounty-tollef-olson-has-a-knack-for-turning-seaweed-into-products-that-are-in-demand)

North America[2], so the U.S. market expanded to about $15.7 billion by 2021. Grand View Research asserts this growth rate is projected to continue through 2027. At 8.8% growth, this represents $139 million annual increases in the U.S. market. A 10% share of this growth is $14 million representing the annual market "pull" opportunity for seaweed producers, but this currently exceeds Maine capacity to meet demand in the near or medium term.

Insights from Maine producers and processors targeting the range of different products and markets all agree there is growing demand for their products, and they are mainly constrained by supply. U.S. seaweed production is currently a small portion of the global total where Asian countries and South American countries have the largest production capacity. Maine producers recognize those countries are the primary international suppliers to the U.S., but there are quality concerns including health and safety issues periodically raised by buyers and regulators (e.g., US Food and Drug Administration). U.S. producers are more stringently regulated and trusted for quality and safety so there is great interest in Maine seaweed, but Maine must increase production substantially to take advantage of the growing market in the U.S. and export opportunities that exist primarily in Asia. Successful growth into international markets would substantially exceed the U.S. market opportunity, however we conservatively estimate another minimum $20 million annual growth opportunity since a number of competitive factors are required for expansion into distant Asian markets.

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[2] PR Newswire, 2021. Commercial seaweed market size worth $37.8 billion by 2028 (https://www.prnewswire.com/news-releases/commercial-seaweed-market-size-worth-37-8-billion-by-2028-grand-view-research-inc-301437675.html)

Import-export analysis for seaweed is shown below based on the same approach as for other species. The market opportunity is much smaller because this does not reflect the wide array of seaweed products and inputs to other products (animal feeds, cosmetics, processed foods, soil amendments, etc.). However, this limited analysis indicates there is currently a $500,000 per year kelp and other seaweed market growth opportunity in the U.S. domestic market based on the ten-year trend in state imports. In the last decade, seaweeds for food consumption rose by 10%, while other seaweed products fell by the same amount. The top five states with the largest growth in demand are Florida ($0.7 million per year), followed by Massachusetts ($0.6 million), Missouri ($0.5 million), New York ($0.3 million), and Delaware ($0.3 million). These were partially offset by declines in states such as Illinois, California, and New Jersey.

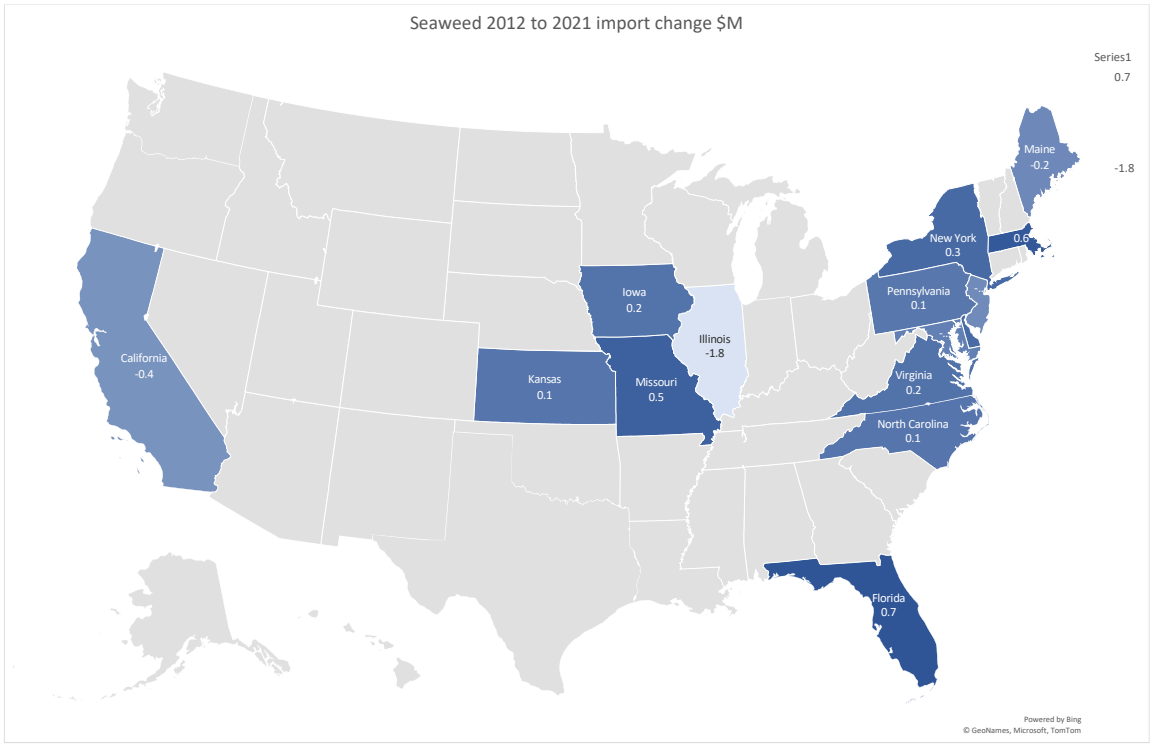


Figure 5.I.4. Seaweed import growth by state, 2012 - 2021 ($500,000/yr).

Source: U.S. Census Bureau

Note: Includes HS codes: 121220, 121221, and 121229.

Recognizing most seaweed production is destined for local U.S. products, the following offers international potential where U.S. exporters are already active. Driving a 10% increase in U.S. seaweed exports to the main existing markets will rely on exports to Singapore, Canada, and Italy among others. Maine only supplies Canada at a relatively low share of U.S. exports and does not currently supply any of the other top prospects.

The ITC ranks Canada, Mexico, and Malaysia as the top potential new and expanding markets, primarily as food for human consumption, based on a combination of factors shown on the next table. Singapore, Chile, and Ecuador could represent opportunities for other types of seaweed products. The 12-year historical patterns in U.S. exports for food and other products are shown separately. Both have relatively steady export levels over the period, with an upswing in 2018 and 2019 for non-food seaweed exports. The bubble plots for both types of seaweed products show numerous blue circles where the U.S. is gaining market share faster than other countries, and numerous yellow circles indicating where the U.S. export growth is trailing other countries. Larger circles mean the target country represents are larger share of world imports for this product.

Table 5.I.1. Top three existing and potential growth U.S. export markets for seaweeds ($1.1 million).

Existing Markets 2020				Potential New / Expanded Markets			
Top US Export Destinations	US Export Value ($)	Maine Exported Value to Top Destinations ($)	Maine % of US Exports to Top Destinations	Export Destination Ranking	Average Imports from US ($)	US Import Share (%)	US Import Growth (%)
Seaweeds for food							
Singapore	2,812,338	0	0%	Canada	1,669,359	13	+ 2
Italy	1,751,625	0	0%	Mexico	909,993	14	- 7
Canada	1,669,359	95,295	6%	Malaysia	1,119,223	12	- 15
Seaweeds, other							
United Kingdom	937,998	0	0%	Singapore	346,594	35	+ 23
Canada	811,724	2,655	0.3%	Chile	330,930	9	- 11
Turkey	236,895	0	0%	Ecuador	321,606	92	+ 31

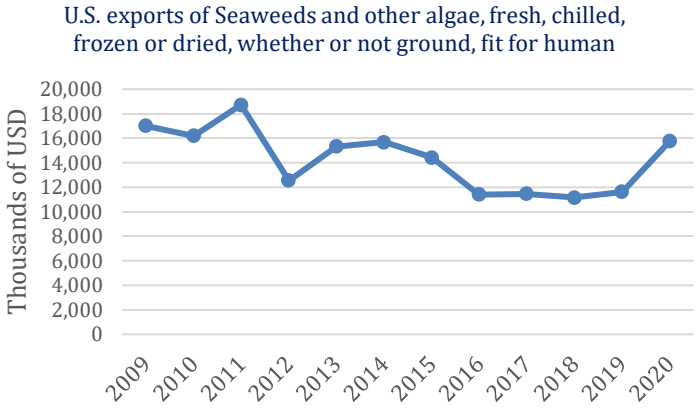
Source: International Trade Centre (ITC), UN Comtrade data.

Note: Includes HS code: 121221 (food), and 121229 (other).

Table 5.I.2. Seaweeds - human consumption international opportunity metrics (HS121221).

Country	Total Score	Avg Imports from the US ($)	Max Avg Tariff (%)	Avg Imports from the World	US Import Share (%)	Import Share Gap	Import Growth (%)	GDP Growth (%)	Distance (km)	International Logistics Performance Index Score	Language Match	FTA with US	Landlocked
Canada	83.5	991551.4	0	7545626.6	13.1	0	1.6	1.8	548.4	3.73	YES	YES	NO
Mexico	76	909993.2	0	6679778.8	13.6	12.4	-6.6	-0.1	3369.1	3.05	NO	YES	NO
Malaysia	75.7	1119223.8	0	9580061.4	11.7	0	-15.2	2.8	15130.1	3.22	YES	NO	NO
United Kingdom	73.3	934852.4	0	12662974.6	7.4	0	-9.8	0.1	5570.2	3.99	YES	NO	NO
Germany	57.2	561379.2	0	8243725.2	6.8	0	13.9	2.6	6035.3	4.2	NO	NO	NO
France	55.6	573982.4	0	9489118.2	6	0	-11.9	1.6	5838.2	3.84	NO	NO	NO
Netherlands	49.2	380773.4	0	3868312.6	9.8	0	14.9	3.9	5866	4.02	NO	NO	NO

Australia	42.4	207423.4	0	23536240.4	0.9	0	5.6	2.4	16008.8	3.75	YES	YES	NO
Costa Rica	40.2	121005.4	0	364318.8	33.2	0	15.2	1.1	3564.9	2.79	YES	YES	NO
Chile	35.6	55380.8	0	10713835	0.5	0.3	28.9	0.2	8271	3.32	NO	YES	NO



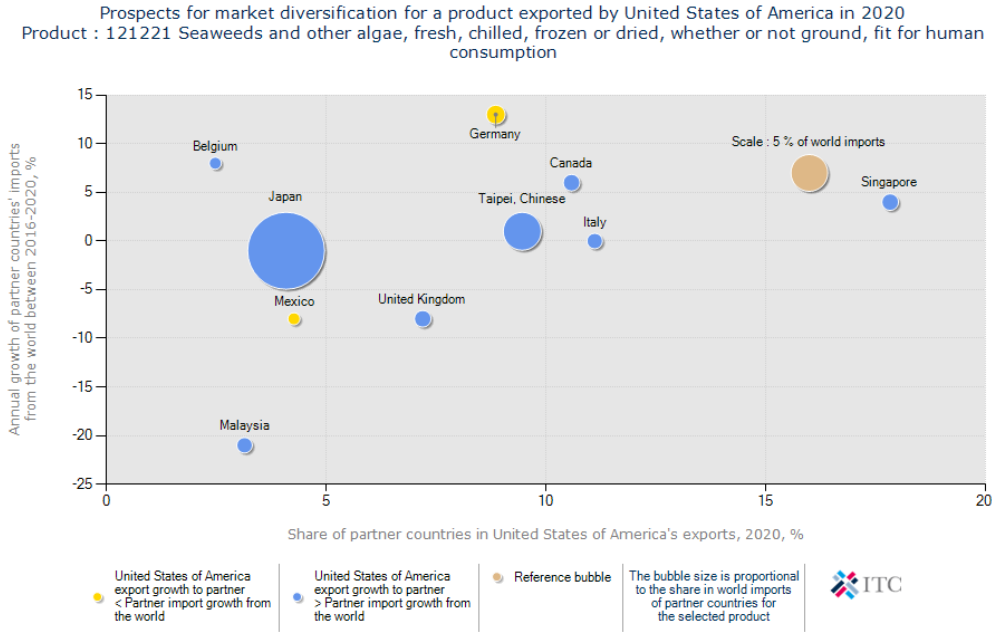
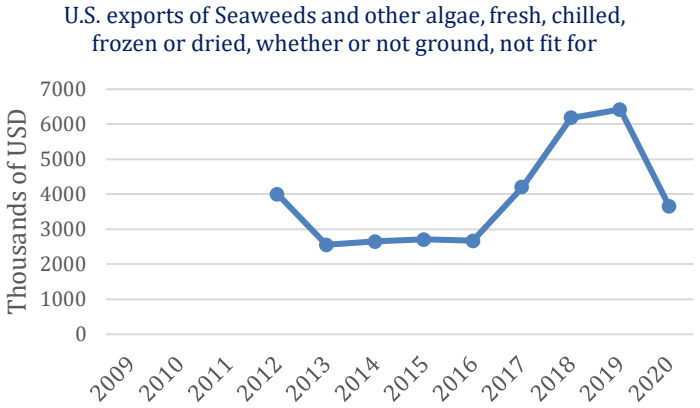
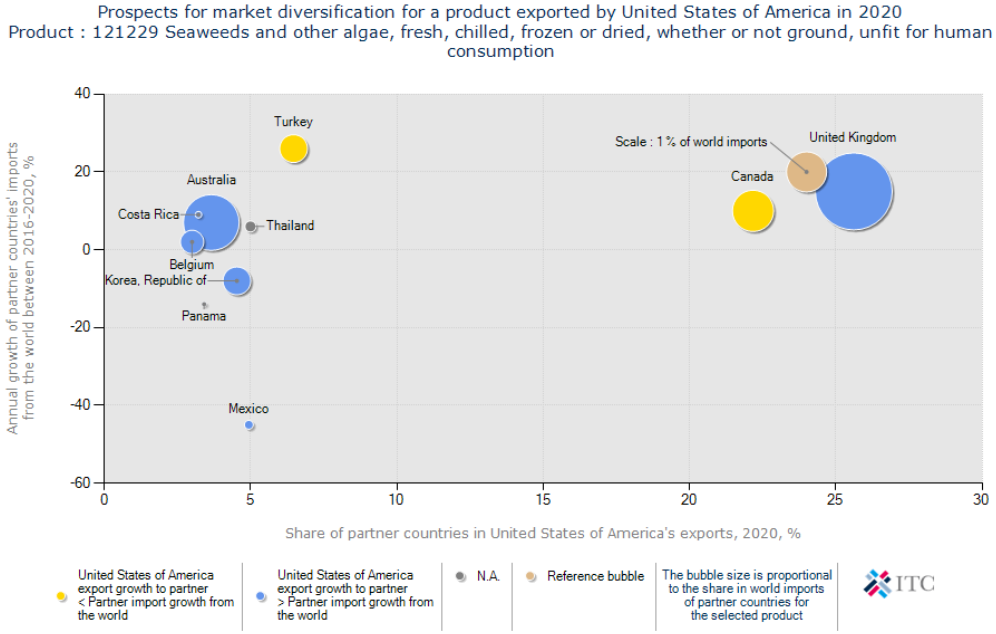


Table 5.I.3. Seaweeds - not for human consumption international opportunity metrics (HS121229).

Country	Total Score	Avg Imports from the US ($)	Max Avg Tariff (%)	Avg Imports from the World	US Import Share (%)	Import Share Gap	Import Growth (%)	GDP Growth (%)	Distance (km)	International Logistics Performance Index Score	Language Match	FTA with US	Landlocked
Singapore	85.4	346593.6	0	1002275.8	34.6	0	23.1	1.6	15350.5	4	YES	YES	NO
Chile	79.9	330930	0	3508685.8	9.4	0	-11	0.2	8271	3.32	NO	YES	NO
Ecuador	72.9	321606.4	5	348384.8	92.3	0	31.3	-0.3	4584.1	2.88	NO	NO	NO
Mexico	63.4	238266.8	0	655157.2	36.4	0	-49.6	-0.1	3369.1	3.05	NO	YES	NO
Belgium	58.7	176014.6	0	737784.6	23.9	0	-6.7	2	5891.7	4.04	YES	NO	NO
France	54.9	90666.8	0	2297547.6	0.4	3.4	11.5	1.6	5838.2	3.84	YES	NO	NO
Australia	53.3	141452.4	0	6113845.6	2.3	0	9.6	2.4	16008.8	3.75	YES	YES	NO

United Arab Emirates	47.9	136614	5	396435.4	34.5	0	10.7	5.7	11029.5	3.96	YES	NO	NO
Qatar	45.9	143137.6	5	294047.4	48.7	0	0	-0.9	10782.5	3.47	NO	NO	NO
Germany	44.4	90468.2	0	2358549	3.8	0	-11.8	2.6	6035.3	4.2	NO	NO	NO





Roadmap Recommendations

The ten-year trend in landings by volume shows increases of 5-10 million lbs with some variability since the start of the last decade. Meanwhile there is a minimum $14 million per year domestic market opportunity and another $20 million international market opportunity ($34 million combined annual). There is clear and growing demand for seaweed products coupled with stable or increasing resource supply. Keeping in mind seaweed products have a wide range of applications and producers can cultivate supply arrangements with manufacturers of food products, pet foods, aquaculture feeds, cosmetics and health care products, nutraceuticals, and fertilizer producers. Tapping this growth will rely on more rapid processing of lease and licensing applications (all types of harvest and culture), and access to the intertidal zone along the coast for harvesting. Providing regulators (i.e., DMR) with the resources and capacity to process applications is key to realizing substantial growth in production and economic returns to the State.

Jonah crab

Access

The Jonah crab fishery is managed under the Atlantic States Marine Fisheries Commission's Jonah crab fishery management plan and addenda. Most Jonah crab catch Maine is incidental catch in the lobster fishery. Some harvesters in Southern New England have begun targeting Jonah crabs as lobster harvest there has decreased or become more seasonal. Maine DMR does not issue a crab-specific license, and the state's Jonah crab fishery is prosecuted by lobster license holders.

Production

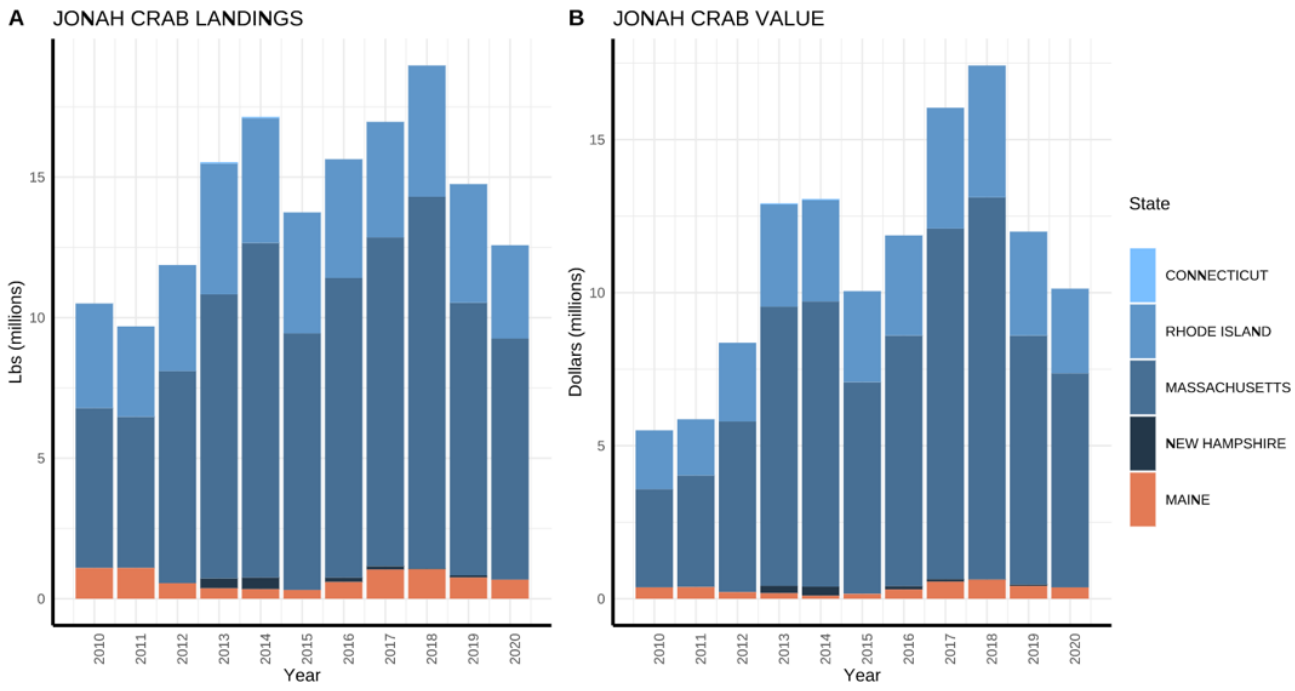


Figure 5.m.1. Jonah crab landings (panel A) and value (panel B) across New England states.

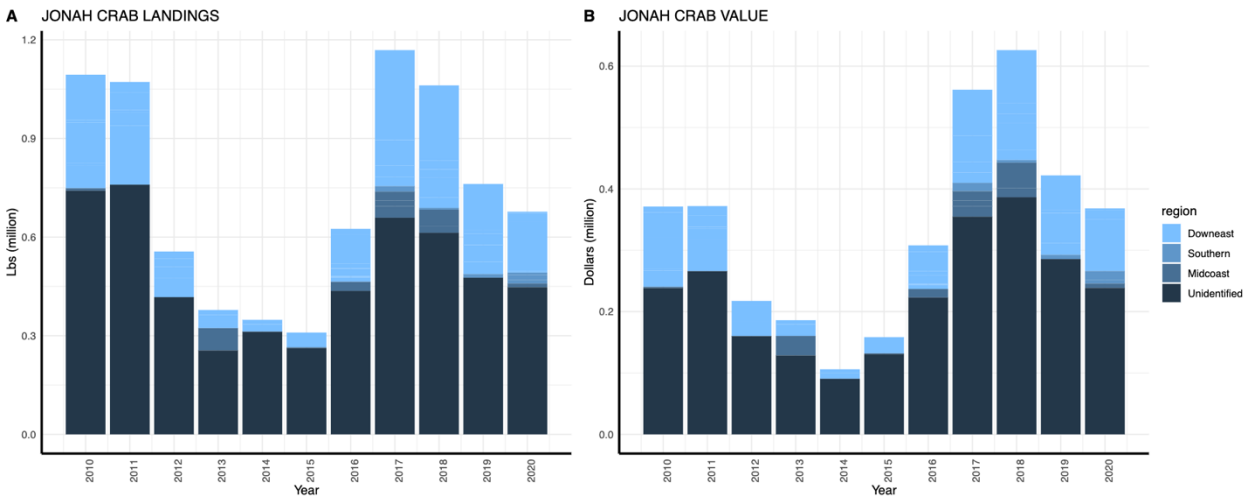


Figure 5.m.2. Jonah crab landings (panel A) and value (panel B) across Maine regions.

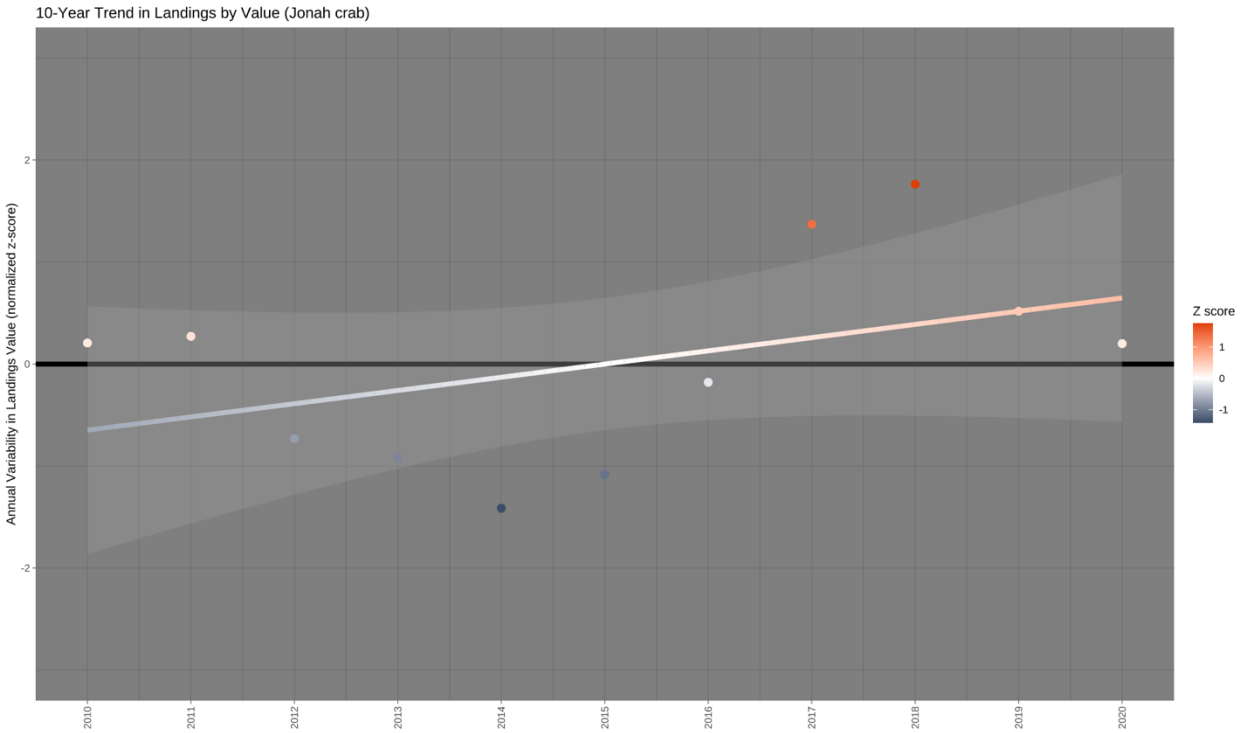


Figure 5.m.3. Annual variability in Jonah crab landings value in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual value relative to the ten-year average.

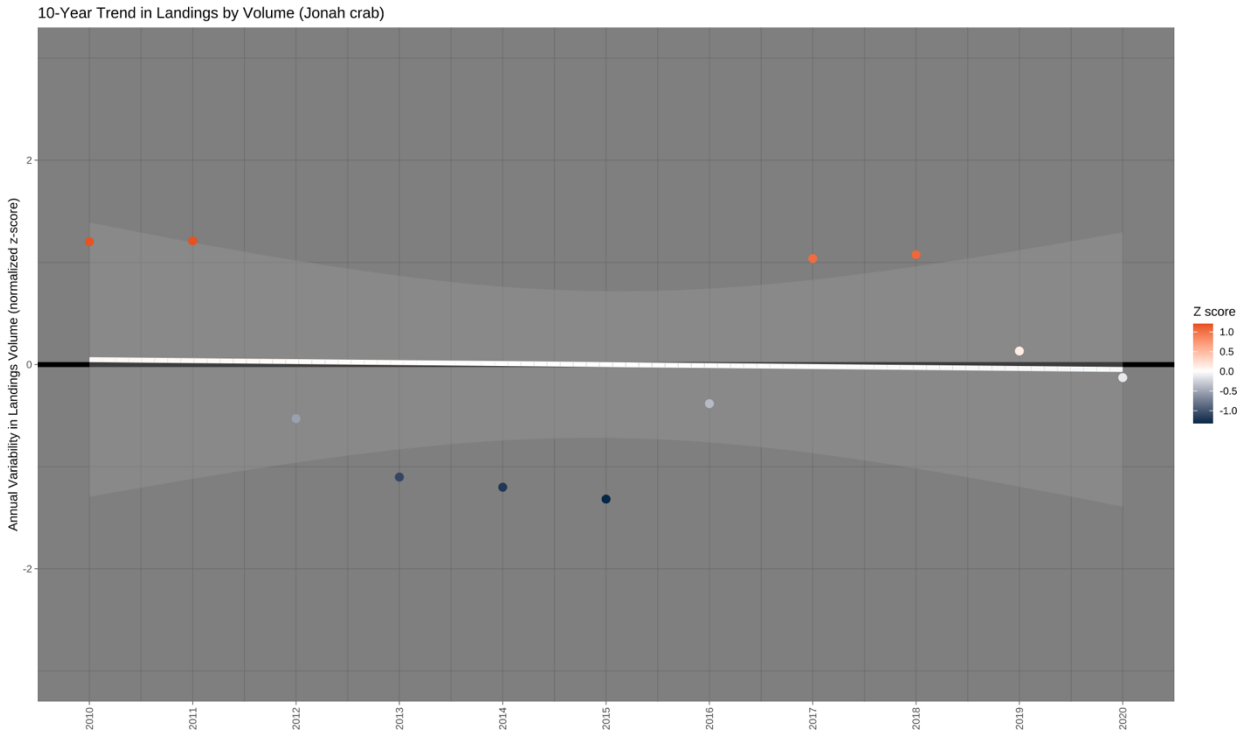


Figure 5.m.4. Annual variability in Jonah crab landings volume in Maine over the period of record from 2010-2020. Trendline indicates linear regression and shaded area indicates 95% confidence interval. Z-scores indicate annual volume relative to the ten-year average.

Market Opportunity

There is a $216 million per year crab market growth opportunity in the U.S. domestic market based on the ten-year trend in state imports across species. Maine's production of Jonah crabs is likely to represent a very small proportion of this opportunity, but it is demonstrative of the potential to increase value, volume, and price for this underutilized resource. In the last decade, the market shares of crab live, fresh, frozen, and cooked product forms have remained fairly stable. The top five states with the largest growth in demand are Alaska ($67 million per year), followed by Alabama ($60 million), Arizona ($16 million), Arkansas ($14 million), and California ($11 million). Alaska is not a target

opportunity for Maine producers, however the next 15 states with market growth represent a combined $46 million per year opportunity.

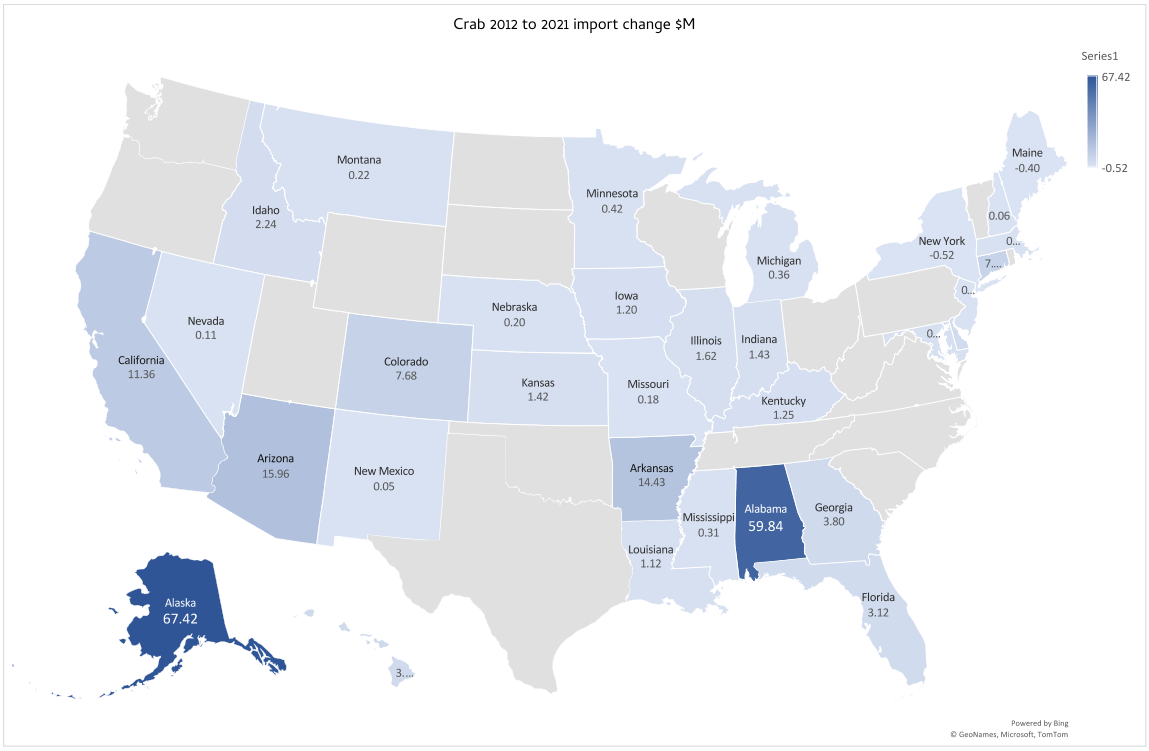


Figure 5.m.5. Crab import growth by state, 2012 - 2021 ($216 million).

Source: U.S. Census Bureau

Note: Includes HS codes: 03064, 030624, 030633, and 030693.

Driving a 10% increase in U.S. crab exports to the main existing markets will rely on exports to Canada, China, and South Korea. Maine only supplies a very low share of U.S. exports to Canada (1%) and none to the other countries where U.S. exporters are active.

The ITC ranks Singapore, Hong Kong, and Taiwan as the top potential new and expanding markets based on a combination of factors shown on the next table. The 12-year historical pattern in U.S. exports is shown for context where exports climbed steadily to a peak in 2018 and are now back to the average level for the period. The bubble plot is not available from ITC for this product.

Table 5.m.1. Top three existing and potential growth U.S. export markets for crab ($11 million).

Existing Markets 2020				Potential New / Expanded Markets			
Top US Export Destinations	US Export Value ($)	Maine Exported Value to Top Destinations ($)	Maine % of US Exports to Top Destinations	Export Destination Ranking	Average Imports from US ($)	US Import Share (%)	US Import Growth (%)
Canada	55,846,000	286,106	1%	Singapore	865,564	2	- 5.8
China	33,254,000	0	0%	Hong Kong	667,700	1	+ 12.5
South Korea	20,985,000	0	0%	Taiwan	402,217	2	-4.9

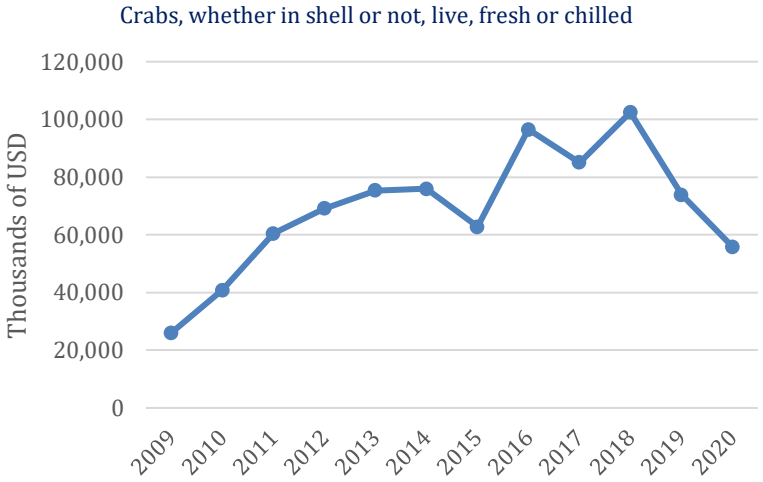
Source: International Trade Centre (ITC), UN Comtrade data.

Note: Includes HS code: 030633.

Table 5.m.2. Crab international opportunity metrics (HS030633).

Country	Total Score	Avg Imports from the US ($)	Max Avg Tariff (%)	Avg Imports from the World	US Import Share (%)	Import Share Gap	Import Growth (%)	GDP Growth (%)	Distance (km)	International Logistics Performance Index Score	Language Match	FTA with US	Landlocked
South Korea	88.5	824,753	0	339,718,331	0.2	6.6	17.6	2.1	11,066	3.61	NO	YES	NO
Singapore	84.2	865,564	0	52,343,372	1.7	5.2	-5.8	1.6	15,351	4	YES	YES	NO
Hong Kong	68.5	667,700	0	60,028,996	1.1	5.8	12.5	1.9	12,970	3.92	YES	NO	NO
Taiwan	50.8	402,217	20	25,113,878	1.6	5.3	-4.9	2.8	12,533	3.6	YES	NO	NO
Vietnam	34.9	227,342	0	7,801,842	2.9	0	453	7.2	13,159	3.27	NO	NO	NO
Costa Rica	33	2,044	0	2,044	100	0	29	1.1	3,565	2.79	YES	YES	NO
Israel	32.9	0	0	6,000	0	0.1	0	6	9,120	3.31	YES	YES	NO

Germany	32.4	41,517	7.5	2,730,823	1.5	0	-2.7	2.6	6,035	4.2	NO	NO	NO
Belgium	32	935	7.5	1,629,541	0.1	0	-30	2	5,892	4.04	YES	NO	NO
France	31.8	460	7.5	32,712,373	0	0.1	-5.7	1.6	5,838	3.84	YES	NO	NO



***Plot of global prospects for diversification not available from ITC for this HS code**

Roadmap Recommendations

The ten-year trend in landings by volume has been variable with 5 years from 2012 to 2015 50% off peak landings. There is a $216 million per year domestic market opportunity for and an $11 million international market opportunity for crabs across all species, pointing to significant opportunity for Maine Jonah crab to fill in some of this demand. The demand “pull” for crab is clear, especially on the domestic side, although not all U.S. states would be prime opportunities for Maine shippers. Significant declines in Bering Sea crab production and challenges facing West Coast Dungeness producers further increase these opportunities for Maine. With stable supply or continuation of production at the levels seen in the last five years this would be solid foundation for tapping growth. Strategic shifts to higher value markets and timing markets according to the highest prices through the year would be important to pursue, as would creating markets and ensuring a place for Jonah crabs in the supply chain.

VI. Appendix A – Workshop Comments and Participant Lists

Workshop Session 1 – American eel/elver, finfish aquaculture & kelp

Strengths

General -	Species specific -
1. Outstanding growing conditions 2. Proximity to market 3. Maine brand 4. Strong research infrastructure 5. Space to establish facilities 8. Universities support skilled workforce 10. Coastal communities value working waterfronts (bonds) 15. Most diverse aquaculture of any U.S. state 16. Local interest in progressive heritage seafood 17. Maine's unique standing due to government institutions 18. Engaged regulatory agency 20. Maine waters variation in depth, temp, salinity, exposure, etc.	6. Eel and elver strengths - only sizable fishery in U.S. + strong regulatory scheme 7. One of few states with strong regulatory program for finfish, industry familiar with this culture system 9. Strong regulatory environment for finish especially, robust biosecurity measures for finish 12. Only state with eel or elver production (wild resource) producing full size product 13. Strong potential for kelp aquaculture, lobster boat and equipment ready (national leader) 14. Seaweed national leader in wild and farmed 18. On the east coast, for seaweed aquaculture Maine is the only state with appropriate geography and ocean ecosystem that will support robust production and a high-quality product.

Weaknesses

General -	Species specific -
1. Losing working waterfront 2. Aquaculture not viewed as an econ development priority	8. Haven't closed the lifecycle loop from hatchery to full eels 10. Eel competition against lower cost imports

3. Regulatory framework is lacking (see EU) 4. Transport issues from wharf to transport hubs 5. Insufficient trucking, particularly for smaller farms 6. Lack of networking, especially among small growers (kelp) 7. Limited water testing (DMR resource challenge) 9. Maine producer volumes are smaller than for competitors 15. Lack of value-added opportunities 17. Many small farms creates logistical challenges 18. Lack of social license to scale up 20. Cost of three-phase power and electricity	11. There is relatively high cost of production in Maine vs imports (e.g., Korea) 12. There may be challenges with sourcing and supply of juvenile American eels in Maine 13. Lack of post-harvest processing capacity for seaweed 14. Lack of local familiarity with kelp and seaweed products 16. Some seaweed operators are encountering scaling challenges in the regulatory process 19. Limited kelp species, need to produce a diverse range

Opportunities

General -	**Species specific -**
1. Integrating all seafood in Maine 2. Building SEA Maine to explore sector opportunities 3. Branding products as “natural” or “organic” 4. Supporting national organic standards for aquaculture 5, 10, 18. Using State’s R&D capacity for opportunities, value-added products, science, and workforce training 6. Collectively marketing Maine brand in seafood 9. Using seafood infrastructure to build on existing initiatives 11. Increasing volume to capture more market incl. Canada 12. Aligning with climate induced opportunities	7. Seaweed sector product development 8. Identifying products that need seaweed 13. Coldwater seaweed species 15. Carbon/nutrient credits that may be developed in future (kelp) 19. Engaging with NGOs that see kelp and aquaculture as a solution for food security and environmental benefits

14. Differentiating Maine product quality advantages 16. DMR broadening outreach and education about aquaculture potential and benefits 17. Improving scale, methods, and species to compete with other proteins based on affordability 20, 21. Scaling toward biorefinery developments with aquaculture feed development, feeds to reduce methane and maintain growth of animals (e.g., cattle) 22. Engaging students in water testing	Flipped weakness: 8. Closing the lifecycle loop for hatchery to full eels

Threats

General -	**Species specific -**
1. New residents lack historical linkage and see waterfronts differently 2. Loss of social license from coastal communities 3. General public's lack of understanding of food sources 4. Campaigns that polarize wild and culture fisheries 5. Cost of energy - fossil fuel and electricity 6. Climate change and ecosystem change affecting growing conditions, wild harvest, coastal infrastructure 8. Declining R&D investment tied to shifts in policy 9. Lack of qualified workforce and training 10. Invasive species and biosecurity threats 11. Low price international imports 12. Affordable housing for workers in the sector 13. Spread of pathogens and invasive species 14. Wild harvest access issues and lawsuits 15. Real-estate market forces affecting working waterfronts and facilities 16. Changes in state/federal regulations potentially impacting the sector 17. Regulatory structure inhibiting development of species that are not currently used in Maine/region	7. Decline in wild populations (elver and others)

18. Poor demographics not helping 20-40 age group	

Using strengths for opportunities

General -	**Species specific -**
1. Using R&D science capacity for value-added opportunities 2. Supporting commercial kitchen capacity to develop new products 5, 6, 7, 8. Professional marketing of seafoods with proper private/public funding (e.g., lobster collaborative, USDA programs, ASMI model) 10. SEA Maine continuing connecting and integrating the networks to leverage opportunities within and beyond state 11. Enhancing support of strong entrepreneurial network & programs 12. Diversifying commercial fisheries familiar with boats and coast 13. Focusing engineering program at U. Maine on processing and automation, machinery, and artificial intelligence in the sector 14. Using trade associations (LMA, MAA) to work on and between sectors 15. Linking tourism with the seafood industry (e.g., Maine oyster trail) 16. Restaurant server training on Maine products 17. Marketing and telling Maine story, third party verification of practices, building on quality and ecosystem services strengths 18. Continuing to show Maine is harvesting sustainably	3. Building on R&D to close the life cycle for American eel to avoid need for wild sourcing 4. Tech / R&D working on food formulations for finfish aquaculture

Using strengths to reduce threats

General -	**Species specific -**

1. Building on ability to observe changes in oceans, get better in order to anticipate impacts before they occur 2. Incentive programs reducing fossil fuels in the sector 3. Using R&D capacity to reduce carbon footprint 6. University specialists applying life-cycle analysis and energy analysis to production on land or water 7. Using Maine story (strength) to address coastal threats and social license 8. Educating and involving people to learn about new developments 9. Make use of work on social license for roadmap and tools including best practices and case studies for farmers 10. Using strengths for community conversations at the municipal level (officials and communities) building on interests to learn/understand more 11. Good management, science, and collaborative fisheries research (harvesters and scientists) for sustainable harvesting 12. Comprehensive workforce needs assessment to develop training curriculums, link institutions, and look at apprenticeships 13. Making training programs sustainable, filling them with students, and attracting students from Maine, other states, and other countries 14. Competing with forestry, manufacturing for the limited number of students/youth available to recruit	4. Using R&D to reduce energy use by land-based finfish sites 5. Forecasting 15–20-year outlook supporting grower site selection (e.g., mussels and seaweed) 15. Using Maine international trade expertise for lobster, urchin, eels

Workshop Session 2 – Groundfish and pelagics

Strengths

General -	Species specific -
1. Great Maine brand built on lobster extends to other fisheries 2. Clean cold waters of Maine and strong working waterfronts 3. Really good infrastructure to move fish (e.g., vessel services and fish exchange) 4. Ability to pivot and move quickly when fish are available in different locations (e.g., fishing out of MDI) 5. Coastline and access supports optimism for fishing outlook meeting demand for quality seafood protein 8. Many harvesters in Maine (human capital) that know how to work on the water 9. Strong fleet not reliant on distant markets 10. Local market knows how to use seafood 11. Diverse fleet in sizes and types of vessels 12. Nature Conservancy work with Maine Fishermen's Assoc. to buy permits to anchor those in Maine 17. Portland area restaurant demand is strong 18. Good transport with regular travel between key points/hubs so product can get there quickly	6. "Lean into" groundfish as part of regular diet, not just for special occasions 7. Publicly owned infrastructure for groundfish is well maintained so lower risk compared to private assets 13. Monkfish backs up gillnetter businesses with strong markets 14. Halibut state water landings in Maine are unique compared to other states (May-June carry-over helps) 15. Bluefin tuna limited access permit is allowing fishermen to move into the fishery when prices are good 16. Research science at U. Maine and GMRI supports bluefin fishery

Weaknesses

General -	Species specific -
1. Need Maine science capacity for stock assessments etc. 2. Great infrastructure in large ports, but not all others, need to diversify across state (e.g., Ice machines)	6. Groundfish are part of a global commodity market, and we don't differentiate Maine fish from other products in U.S. or even Iceland

3. Fishers in areas other than main ports can be challenged to transport product to the larger hubs 4. Declining landings in Maine presents challenges for fish exchange with small volumes 5. Missing products/markets for small volume high quality 7. Small boats and small businesses in commodity market 8. Special product moving across docks that can't be differentiated in marketplace 10. Need for funding for researchers to focus their work on these issues 11. Underutilizing the available quota for these species for a number of reasons 12. Substantial swings in stock assessments have affected consistent business planning 13. Need for greater focus on lower volume, higher quality, challenge is for smaller companies accessing the fish exchange 14. Due to challenges in fisheries over years and disaster declarations, there is exhaustion in political realm and funding community 16. Lack of businesses that want to innovate and disrupt - due to negative outlook and narrative 18. Funding may not be fully used (e.g., USDA) 19. Note our infrastructure can't handle larger boats that work further south Other idea: A. People get easily confused around what groundfish are good/safe to eat then turn away 20. Inconsistency of supply to develop markets 21. Not looking at collaboration on market opportunities to compete against Norway or Europe 23. Lose small day boats to Gloucester, steaming out of Portland is further	9. Decline in groundfish landings related to prices, but not as high as for other species 15. A struggle with media narrative around groundfish collapse, yet there is abundant hake, relish etc. hard to stimulate innovation when people have given up on groundfish 17. Story is stuck on past experience with cod 22. Halibut stock assessment is weaker (data issues) and there are finite resources to work on stock assessments 27. Landing a lot of "weird" species vs. processors trying to automate (capacity and cutting facilities) and there are seasonal swings rather than e.g., steady flounder landings historically 28. Trawl caught lobster cannot be landed in Maine as a weakness 31. Get more fish landed in Maine that currently is landed further south (tied to lobster issues)

24. Depending on where boats are fishing, it can be a weakness relative to location of fisheries 25. Aging of fleet, especially in terms of innovating 26. Boat manufacturing does not help innovations 29. Risks of sea level rise, increased storms, other climate impacts to working waterfront infrastructure 30. Need to define "local" (Gulf of Maine vs. Maine) to encourage people to eat more seafood, need funding in state to align with this	

Opportunities

General -	**Species specific -**
1. Tapping markets in high population centers (e.g., NY, Boston) 2. Growth opportunity for seafood in food supply, need to take advantage of this 3. Marketing Maine smaller boats with better quality based on NY buyer reputation for quality and freshness 6, 7. Matching demand for quality with ice equipment investment 8. Underutilized / under-harvested applies across the board - mackerel, dogfish are undervalued products 9. Addressing market and infrastructure issues so new entrants are not frustrated as they grow & diversify 10. Focusing on smaller scale really high quality so we don't compete against big suppliers such as Norway 13. Competing on a more consistent basis with retail Norway products, but also restaurant and other product channels 14. Promoting underutilized species 15, 16. Continuing/funding restoration of upland rivers and streams for food web supporting fisheries	4. Building toward long-term strategies with short-term federal relief funds targeted at the GF sector (e.g., rebates, ice, fuel etc.) 5. Looking at Portland infrastructure investments benefitting tuna sector (hoist) and others can access this 11. Groundfish and tuna, really all will benefit from small volume high quality development 12. Replicating Truefin new model for the state

17. Bend some funding toward ports and harbors, potentially $billions 18. Delivering consistent supply for Sodexo & U. Maine who would love to purchase local seafood 19. Meeting global demand/trends for good food and high-quality protein from seafood 20. Maturing fisheries science and management - turning toward good management and better stocks in future 21. Pursuing large global scale or small boutique sales 22. Focusing on undervalued species and maximizing value of every lb. caught 23. There is opportunity to tap USDA funding	

Threats

General -	**Species specific -**
1. Aging fishers and lack of younger entrants 2. Inability to find crew leaves captains and boats unable to make trips 4. Shoreside businesses also struggle to get cutters at peak season 5. Amendment 23 effects on - quota prices, fishery decisions, markets 6, 7. Climate change affecting ability to find fish and shifting fish behavior affects business planning - processing capacity ramping up at right/wrong times 8. Capacity within support structure around industry is struggling - DMR and other organizations are busy "putting out fires" 9. Changing use of the oceans e.g., large scale offshore aquaculture, wind development are concerns regarding access to areas and transiting 10. Disruptive narrative around the last wild caught food and what is appropriate to eat	3. Rapidly changing regulatory world (e.g., right whale rules for gill netters), or mackerel where Maine does not have a vote at the Mid-Atlantic Council 13, 14, 15. Significance of other fisheries (e.g., lobster) make it difficult to focus policy and political attention on smaller fisheries such as groundfish/tuna, sometimes this leads to a more precautionary approach 17. Need to flag the loophole allowing tuna fishing in state waters outside federal regs, now state regs mirror federal

11. Lack of funding to collect and make use of data collection and analysis - data hungry management systems are struggling to keep up due to lack of federal funds supporting fisheries science 12. Lack of champions for the seafood sector in Congress and other levels of government 16. Massive fisheries and farms in other parts of the world are a big threat on a volume basis Other idea: A. Careful with use of terms "underutilized" and "underharvested"	and we need to see how this constrains the fishery 18. Be careful with a lot of people entering tuna fishery and quality being affected, have programs to address this

Using strengths for opportunities

General -	**Species specific -**
1. Working with tourism to harness fisheries opportunities using Maine brand 2. Support growth of incubators for aquaculture, groundfish and pelagics businesses 3. Build on Maine branding, expanding to more species 4. Build a program to support new entrants like for lobster, addressing high learning curve for groundfish with training or apprenticeships 5. There are younger Maine entrants unlike other states, so fishers grow and diversify 6. Do not underestimate opportunities as in Alaska with similar fleet dynamics 7. Allocating funding for entrepreneurship and safety based on needs assessment for young fishers training gaps 8. Policy makers investing in coastal access, infrastructure, vessels, and equipment 11. Working with local processors in Portland to supply larger volumes of locally sourced fish	9. Marketing something different based on "weird" variety of species as consumers get tired of salmon and tilapia 10. Monkfish opportunities, particularly in winter (whole fish utilization) 12. Differentiating Maine bluefin from other tuna around the world, and marketing different fish parts 13. OpporTUNAty!

Using strengths to reduce threats

General -	Species specific -
1. Abolishing permit baselines to avoid holding them back from buying bigger boat, helping to address safety issue of small boats going further offshore 2. Using technology to address climate change threats by improving ocean observation and collecting better data 4. Tapping the new Mainers community for skills that are applicable to workforce challenges 5. Develop countermeasures to the narrative of groundfish decline (media perception) 7. Leveraging research on perceptions of aquaculture for application in groundfish and pelagic sector 8. Staying with consistent and positive messages	3. Reviving abandoned canneries for groundfish processing Other idea: A. Careful regarding statements about declining groundfish, mainly a consistency/stability issue

Workshop Session 3 – Mollusks and sea urchins (wild and cultivated)

Strengths

General -	Species specific -
1. We have a highly skilled and nimble population of harvesters 3. Clean cold water maintained by state water quality monitoring. well respected 4. We are close to large urban populations so can harvest to order for mussels, and that gives Maine an edge on producers further away in the live mussel market 6. Fantastic cooperative relationship between State, researchers, industry etc. 7. Also overlap between capture and culture fisheries with good knowledge sharing plus strong young group which is unique in Maine (aging in other coastal communities) 8. Clean waters do not need depuration, lower costs for shellfish producers. Maine brand is very strong and builds on this 9. Youth and others are attracted to setup aquaculture in Maine for clean and healthy resource access - also good place to live/lifestyle 10. Aquaculture is working to fit in along the waterfront/coast with other activities so they can be complimentary 11. Research capacity has a long history of working with the industry on applied research issues 12. Water quality monitoring for PSP and bacteria - other states envy this (links to #3) 13. Maine is a vacation destination where people enjoy the seafood then return home and seek out Maine products	2. The municipal management for softshell clam and quahogs (intertidal) that is essential for our work 5. Potential to manage based on local conditions (mostly softshell clams, but others possible) 20. Narrow drag width of 10 ft (dredge size limit) is a selling point for our fleet (scallops)

14. Maine has opportunities for seafood farm expansion leading to economic stability where it is needed as long as economic development is a priority 15. Maine has opportunity to expand aquaculture in a sustainable manner and it is an environmentally friendly food source 16. Many educational institutions are attracting people from outside Maine and local residents (e.g., U. Maine) punching above weight 17. Very good hatcheries in Maine vs. other states, could use more for depth 18. Added value of extension services tied to training strengths has helped success of shellfish sector 19. Hatcheries and research work on different species working with aquaculture companies to identify higher value species, what are future opportunities	

Weaknesses

General -	**Species specific -**
1. Technical capacity with respect to shellfish disease - lack intellectual capital to diagnose, control, and manage it - one or two more PhD level specialists would help 2. The number of overboard discharges, closures of coastline that result, holds back the sector - automatic closures through NSSP can be up to 1,500 areas, need to open up more areas 3. Lack of ability to label mussel products re: “organic" 4. Affordable housing needed for workers coast-wide	12. Not doing well enough marketing outside the state even though we have great quality (e.g., mussels or oysters further south), need a cohesive marketing strategy 21. Not as much young entrants on capture side compared to culture side of this sector - major concern especially softshell clams and quahogs (wild fishery)

5. Coastal infrastructure, docks, offloading equipment, and get to processors and markets etc. 6. Marine bio-toxin labs is top in the country, but the risk has necessitated this - need good and timely analysis 7. We are close to large centers, but individual harvesters Downeast need better access to dealers in order to get product out - affects prices 8. Huge loss at private labs to do biosecurity testing for shellfish diseases 9. Lots of areas where harvesters are losing access points along the coast due to changes in shoreline properties 10. Access to enough volume of product, could sell a lot more, some markets we can only access on a seasonal basis and in general (not just seasonal) could double output and sell it all easily 11. Lack of value-added partly due to lack of continuity of supply, need to re-build value-added processing and catch up to capacity in other states - still some that do it, HACCP controls had an effect, expensive to get certified for value-added processing 13. Shared use of water and social license - people don't want to see a farm in front of their house/seasonal residence, but we need to find a way to make this work while the coastline is increasingly developed 14. Trucking and distribution routes are dismal in Maine for seafood and also for agricultural farmers 15. It's a limited supply, year round	22. Very hard to get a license for scallops or clams, only easy entrance is on aquaculture side 23. Scale also depends on species grown, price for species. Mussels need more grown to be economically viable

16. Need to be nice to neighbors, build relationships, manage gear best way 17. We do lots of community outreach for license applications, but town meetings and traditional approaches are being displaced by lobby efforts and other tactics (no longer good-hearted, professional opposition) and we need help to address this 18. Lack of capacity for clam management at local and state level - funding, staff, especially during pandemic - fishermen end up happy making more money on high prices, but there has been attrition as clam populations have declined - climate effects on supply 19. Maine is hung up on scale, insisting that we remain small-scale despite competing in national and international markets - will get out-competed 20. We have a diversity of company scales, just need to avoid thinking that “big is bad" 24. The leasing program has been hamstrung by lack of personnel - hard to process applications in a timely manner and that holds back aquaculture development	

Opportunities

General -	**Species specific -**
1. Volume of product can be increased and will bring economic benefits to Maine 3. Food accelerators are bringing a great educational resource that is helping people tap into new markets, market development and market education have potential 4. Reliable, high quality, consistent volume coast-wide is needed by everyone stepping up so the	2. National market including sushi and restaurant for urchins are strong and present opportunities 17. Different mollusk species and different production methods can access new markets (e.g., sea scallops or growing spat-on-shell oysters for the shucked meats market).

market can bank on Maine producers to meet their needs/menus 5. Value-added tends to be for extra volume that isn't easy to move at peak production, or sometimes what can't be moved on the live market - reliability is key to investment (volume) 6. Primary focus is on domestic markets rather than exports keeping in mind carbon footprint advantage we have there 7. Maine is on the map re: blue tech and investment and there are signs of good developments 8. Need to make sure we have product/market diversification since we don't know what is coming in the future 9. Value-added could go to retail instead of food service, allows you to respond to market changes (e.g., pandemic closure of food service) - having your foot in each door allows you to pivot quickly 10. Value-added can help make your product less perishable, also helps to reach new customers 11. Expand on our strength of cooperation between industry, research to develop new opportunities 12. People have learned to cook seafood at home through pandemic, 70-90% of Maine mussels formerly consumed in restaurants have moved to people learning to do this at home - door is open so work on keeping it open and supply it 13. Major competitor PEI does both retail and food service, and we can see that farmers are	18. Scallop opportunity for diver-based fishers (independent of dredge-based fishery) could split so they are entirely independent (10% of total catch) and open a separate season 19. Similar for sea urchins - now a swipe card system unlike scallops, and there is possibility for timing of harvest (season) recognizing conflicts between fixed gear and mobile gear, also spatial issues 20. Mollusk culture for bioremediation or other ecosystem services 21. Big landings increase off Mass. but as waters warm scallops will move into Guff so we should look to diversify and acquire expensive permits - could be a positive outcome of climate change Good idea: A. Number of dealers and processors, aging of fleet are important to urchins

not processors, should look at that model of specialization in tasks 14. Have seen that farmer in PEI and Netherlands that the farmer gets a bad deal, ideally it would work, but in practice it does not 15. A family-owned and operated business doing all aspects of business - still issues, need more discussion around best arrangements 16. Need for scale is still adding a number of medium-sized firms as there are already in Maine rather than PEI model so need to scale up in the right way	

Threats

General -	**Species specific -**
1. Global climate change and ocean acidification 2. Social license has trouble keeping up with speed of adaptation 4. Emergence of paid political agitators to pit one working waterfront group against another, who are preventing the evolution of working waterfronts (new challenge) 5. Access to permits and science/management is not something we can control 6. Climate change affecting federal waters will impact inshore sector 7. False information from well financed sources are challenging to deal with - they are going to towns promoting moratorium on aquaculture 8. The use of space, loss of area for farming is a threat, need to optimize how wild and culture operators use different spaces	3. Clam and wild mussel fishery are suffering increased predation due to climate change; we are not adapting fast enough to these changes to protect mollusks from predators 9. Mollusk culture for bioremediation or other ecosystem services 11. Threats: Age of fleet. Opportunity of diversity balanced with opportunities in lobster fishery. why clam when you can make $$$ as crew on a lobster boat 13. Raw mollusk issue with fiber requires keeping them cool and post processing, and requirements lead to raw dead

10. Loss of working waterfront and coastal access points to private property owners/gentrification 12. Trip limits make it difficult to balance profitability on harvest and culture sides 14. Diminished commercial access points and in some cases directly trying to share spaces with recreational users 15. New pathogens and invasive species moving north due to climate change is a threat 16. At least two groups are funded by out of state organizations/wealthy property owners - trying to use the commercial fishery community against the aquaculture community by scaring them with falsehoods and partial truths 17. Also taking advantage of offshore aquaculture, offshore wind, and right whale issues to help pit one against the other 18. Threats regarding discharges (new) from land-based salmon facilities, really makes you uncertain to invest because an issue could require you to purge a toxin for up to a year	oyster rather than raw live oyster. We minimize this with icing, and want to avoid major closures

Using strengths for opportunities

General -	**Species specific -**
1. Collaborative research is a powerful combination... do more of it! 2. Try to grow a new thing or grow it in a new way based on our strengths 4. Use expertise to pinpoint opportunities geographically and by sector 6. Maine has good relationships between commercial fisheries and aquaculture and need to protect each other by collaborating on working waterfronts	3. An example is trying to make a business model growing in deeper water (scallops) in a way that a lobster fisher could take it over as a chance to diversify their income - need science collaboration with business 5. Maine has good access along the coast and need to

7. Find ways for aquaculture to help while commercial fishery currently has less investment, but opportunity to reciprocate 8. The story about Maine products and working waterfronts to build the Maine brand - huge opportunity to position in the marketplace 9. Seafood from Maine website has been funded and supported with marketing resources - build on this with producers connecting to the marketplace, leveraging marketing and market development opportunities 10. Lots of marketing on lobster, still untapped potential for other products to build on tie-in to lobster success 11. SEA Maine intends to look at marketing through a seafood marketing council, recognize the website as a starting point 12. Need the size of company required to "ride the storms", must get beyond doing everything by hand and mechanize some tasks, be realistic about the jobs people want and offer better jobs that recognize what machines do best and what people do best 13. Supply year-round is key, grow from our tiny piece of U.S. market share, win back from key competitors like PEI 14. Lots to be proud of and continue to provide something good to eat that people enjoy, and deliver consistently 15. Must support the stage where people want to expand, start-up phase is good in Maine, but scary to take it to the next level, need supports for this and the market will be there	protect waterfronts by creating value (e.g., scallops)

16. Good product, consistent supply, plus good service are the core with a lot of other details as well 17. Tough battle on policy front needs to be addressed, we're simply trying to grow food, not lay pipelines 18. Collaborative research is a great way to take advantage of the knowledge and expertise of the industry to identify and address research priorities to benefit different industries and areas. Maine has a large day boat industry which lends well to localizing assessments to optimize management strategies across a coastline that has a diverse substrate and biodiversity. 19. Must be collaborative given our small size - will help get Maine on the map (hard to recover since Boston Seafood effort to promote Maine ended 20. We have a lot of space so we simply need more lease sites, without lease sites, we can't grow the product 21. Working waterfronts coalition as a template for future collaborative work on policy 22. Collaborative research on commercial vessel platforms	

Using strengths to reduce threats

General -	**Species specific -**
3. Need to leverage research capacity to better understand how climate change affects certain species, producers need to understand in order to react 4. R&D capacity for state-of-the-art selective breeding programs can help, but funding is	1. Localized management system strength can be used to adapt to climate change impacts on clams - protecting clams from predators, swamping out predation

required to make it happen (address shellfish diseases and better adaptive species) 5. Communication between working waterfront trade associations has a tremendous power and we need to strengthen that through joint projects (unify the working waterfront around issues important to all of us - social license, access) 6. Concerns regarding sharing space for wild and aquaculture so let's build relationships and collaborate on these issues	2. Do have provisions for intertidal leasing, but runs against issues, this would be a major step to address population declines vs. predators

Workshop Session 4 – Lobster, Crab, and baitfish

Strengths

Lobster -	**Other species -**
1. World class iconic seafood with brand recognition nationally and internationally 2. The fishery is well-managed with strong resilience of the stock 3. Maine lobster marketing collaborative and Maine Lobstermen's Association provide strong support/advocacy 4. Durable and resilient fishery with a long history 5. Commitment to sustainable fishing practices such as v-notching 6. Diversity within the fleet of businesses - size of business, size of boats, inshore and offshore all within Maine 7. Strong community support 8. There is inherent value in number of participants, ports, communities, buyers etc. 9. Owner-operator permitting approach 10. Processing and value-add have strengthened in recent years 15. Access to students and younger license holders, good program to help entrants to fishery (rare in modern fisheries) 16. Robust research enterprise in the academic and government spheres 17. Generations of experience in domestic and international sales experience through diverse channels - retail, food service - good for getting through challenges like the pandemic	11. Bait fishing - herring, menhaden management environmentally friendly approaches taken - good for marketing 12. Crab harvest practices are relatively lightly regulated (license and size requirements) and these match well with the biology of species - positive zone for harvest 13. Maine is advanced regarding sustainability of baitfish management, and current bait usage 14. Maine has more diversification of bait options, recovery of Alewife will contribute to bait supply 19. Diversity of markets for crab - increasing domestic and international interest in Jonah crab - sustainable practices of the fishery help traction

18. Some very good infrastructure, but only some. Concentrated in Portland and a few other ports. 20. Co-management framework with councils is useful process for communication both top-down and bottom-up 21. Good to be cautious about alternative species used for bait that may not be safe - thorough review in Maine is good model 22. Lobster dinner used to be simple classic dinner, now culinary is really pushing everything a lobster can be used for	

Weaknesses

Lobster -	**Other species -**
1. Lots of policies affect ability to operate (9 fed agencies oversee export) is extremely challenging (possibly a threat where some is out of control) 2. Resistance to change - diversity and scale of this fishery make it difficult to change direction for climate change or other externalities (e.g., right whales) - so many people 3. There are silos of distrust around certain subjects such as whales, and this flows over into other topics, and this is a problem that needs to be addressed 4. Poor infrastructure and no funding to support renewal - wharves, ice makers, bait storage 5. When funding is allocated - too little and too piecemeal 6. Lack of cold storage to bring in alternative bait supply 7. Lack of people, storage, distributors are also a barrier to supplying alternative bait	10. Low bait availability can be a weakness at times (e.g., herring quota reductions, menhaden challenges) unreliable supply 11. Cost of bait is also a challenge along with all other costs going up (trap building, equipment, labor, boats, maintenance etc.) 16. Jonah crab is somewhat undeveloped (by-catch only) and suffers from misidentification, dealers call it rock crab then mis-labelled - affects stock assessments 17. Lack of processing capacity for Jonah crab products

8. Value-added products in lobster and crab focused on using whole animal (e.g., minced lobster and crab meat), but we don't have value-added processing in Maine, so this gets out-sourced 9. Labor supply challenges, not enough people, can't bring people into the state -delayed access to jobs 12. Lobster fishery putting stress on other resources 13. Lack of spatial information - historical footprint of the fishery, puts us behind in conversations re: wind power and whales 14. Strong domestic emphasis during pandemic, challenging for food export to pivot back to international sales (pricing has doubled or tripled on containers due to supply chain issues) 15. Lobster fishery is dependent on the lobster fishery - if things change and can't support coastal communities, then we do need other opportunities to keep growing 18. Zone councils don't live up to their potential as a collaborative opportunity 19. Linking crab and lobster permitting puts effort focus on more valuable species, other species are underutilized 20. End of Northeast Research Consortium was a disservice to the sector - greater disconnect between researchers and value-chain (distrust of scientific research when we need it more than ever) 21. Often tech is developed by people who don't understand the seafood supply chain	

Opportunities

Lobster -	**Other species -**
1. Workforce training starting in public schools through to life-long learning (comprehensive) 2. Need more than just harvesters, need workers across supply-chain, currently rely on word-of-mouth and in-house training 3. Use State R&D structure to develop more products, especially value-added products 6. Tech and infrastructure development (equipment for processing) such as Norway-Halifax innovation for monitoring temperature, salinity etc. for lobster 7. Enhance value by improving quality and handling starting on the boat 8. Create more nimble marketing funding to address emerging issues/opportunities 9. Micro-processing facilities at smaller wharves (e.g., 20 boats instead of 200 boats) 10. Export market still has room to grow 11. Growing demand for seafood in general domestically, opportunity for Maine seafood / lobster to fill that demand (threat of initiatives elsewhere increasing competition) 12. With spatial resolution data there will likely be assessments of opportunities 13. Having real-time landings data would be really helpful for supply-chain to decide how they handle their products 14. Role of collaborative research with sensor technology and remote sensing to engage fishermen in collecting data of use to them and fishery management 15. Industry-driven initiatives, rather than invited after process/initiative already underway (e.g., pre-proposals by govt)	4. Alternative bait options exist to phase-out animal hide bait - no one wants hair in their lobsters 5. Reduce input protein per lb. of output protein and help keep fish in the water 18. Using discards from ground fishery as bait - ratio of harvested to kept indicates discards are sizeable 19. Baitfish is a big economic driver of the overall fishery, probably more than any other non-lobster wild fishery in Maine 20. Canned herring used to be a big industry in Maine, may be possible to develop smoked or sashimi mackerel, small scale now, but could be more value than just lobster bait

16. More applied research with people on the water included earlier and more often 17. Opportunity to unite across industry segments and institutions to collaboratively solve problems where there is currently distrust or disagreement re: framing problems	

Threats

Lobster -	**Other species -**
1. Whale entanglement regulations 2. By-catch in lobster fishery (e.g., groundfish potentially overfished) could affect the fishery 3. Climate change is so far okay, but not sure of future 4. Changing demographics in coastal communities - gentrification of the working waterfront 6. Local community elected officials with no experience in seafood making decisions that have negative impacts 7. Sea level rise and climate change affecting ports and harbors 8. Climate change impacts driving shell disease or other diseases 9. Reliance on eco-certification by some buyers and potential for de-certification of the industry could undermine market access 10. Not just labor shortage, cannot access temporary workers, lot of regulatory hurdles at federal level primarily 11. Many agencies don't talk to each other, don't understand the sector, and they have a big impact on the sector	5. Reduced quotas for traditional bait species - one celebrity endorsement of bait species for food changes the value quickly 17. Climate change impacting the availability of bait species - seconded 18. Investment in Alewives has helped anadromous species for bait (e.g., fish ladders, habitat restoration) 19. Impacts to ecosystem, biosecurity associated with inferior bait (non-native species) 23. Threat using animal hides as bait for example

12. Wind power where we are asking fishermen to share parts of the ocean, concerns about cumulative impacts 13. Well-funded ENGOs that can undertake legal challenges and media campaigns 14. Changing distribution of the lobster population and potential changes in fishing effort (e.g., deeper offshore waters) Only 3,500 of 5,000 licenses to offshore waters, that could leave inshore fisheries stranded 15. Potential for impact on supply will affect shore-side industry component that needs volume to work 16. Competition for market share such as Alaska, Louisiana, and other states with their own seafood marketing initiatives 20. Increasing costs due to bureaucratic requirements 21. Offshore energy development 22. Non-native species (outside region) under review but sometimes after the fact/issue arises 24. If current addendum gets approved, we will need to respond to this Other: A. Traceability is tricky and there is interest in boat to plate, but very expensive, imposed on Maine by EU and legislation - likely a threat	

Using strengths for opportunities

Lobster -	**Other species -**
1. Comprehensive science monitoring and could use new information coming (better reporting,	

spatial info) will improve our understanding of fishery dynamics 2. Management as a strength to better use the Zone Council process to address threats/opportunities 3. Build markets for Maine seafood products for domestic and international markets (vs. competition from Alaska and Louisiana) 4. Using R&D to develop value-added products (UMaine's and others) 5. Resource is still above historic levels (lobster), positions sector well 6. Use education system to develop robust training program that supports the full value chain of seafood industry 7. Building on history and collaborative research, revitalize collaboration for research and science capacity 8. This fishery has history of strong conservation ethic to innovate for the future opportunities 9. Control the narrative, build a story that needs to get out there, public would love to hear it and understand it better	

Using strengths to reduce threats

Lobster -	**Other species -**
1. Invest in infrastructure for long-term success of these sectors - small scale and large-scale need help equally 2. Invest in decaying working waterfront infrastructure - see seafood as rural economic development (e.g., Canada) and support processing sector, can't just be private equity, need state to take this seriously	

3. Covid relief coming to Maine is not enough, agriculture consistently gets more than seafood, need to advocate better for funding 4. Strong community support for fisheries vs. coastal gentrification needs a dialogue to bring these together - highlight value of sustainable profitable fisheries for communities 5. Trying to use strengths to address whale issue, but not yet successful (seems like an impossible challenge) 6. Strong science team at DMR, scientific approach to regs, could do better to avoid shotgun approach to regs and be more strategic - mitigate impact of conservation framework (avoid overburdensome regs) 7. Need to apply strong scientific and collaborative approach more like approach to wind development - work with industry to come up with questions and way to find answers so there is trust in outcomes 8. Fishermen are hard-working, resourceful and this is a strength for adaptation to issues like climate change and new species	

Workshop Session 1 – American eel/elver, finfish aquaculture & kelp

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Workshop Session 2 – Groundfish and pelagics

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Workshop Session 3 – Mollusks and sea urchins (wild and cultivated)

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VII. Appendix B – Market Diversification Tool

A number of data-driven tools were used to develop the Export Potential Profiles in Section ##. The following outlines these tools and describes how they were employed in this analysis.

B.1 International Trade Administration Market Diversification Tool

The Market Diversification Tool (MDT)3 can help identify potential new export markets using exporters' current trade patterns. Based on the products exported and the markets currently exported to, the tool uses an algorithm to rank potential markets exporters may want to consider as future export markets.

The algorithm used to develop the ranking achieves three main objectives:

1. Compares potential export markets to the market where you are already exporting, based on the premise that it may be easier to export to similar countries
2. Examines product-specific trade data to see whether potential markets are primed for more exports from the US of the product(s) in question; and
3. Considers data that reflects whether potential export markets are generally good markets for exporting and doing business

The Market Diversification Tool was developed by the Industry and Analysis unit within the International Trade Administration.

[3] https://beta.trade.gov/MarketDiversificationTool#1

The MDT has potential applicability to SEA Maine's objective of identifying seafood export growth opportunities. The MDT can provide several high-level indicators of export growth potential at the 6-digit Harmonized System (HS) code level, including the US' import share gap, countries with import growth in specified US exports, and the rating of other trade factors, such as import costs, logistics performance, and whether free trade agreements are in place.

Application of the MDT

The following methodology was employed when applying the MDT to the species of interest to SEA Maine:

- Top-two export markets (countries) for each SEA Maine species of interest were identified using International Trade Centre (ITC)[4] data for 2020.
- These countries were entered into the Current Markets field and were therefore excluded from the Export Destination Ranking.
- Results produced included a ranking of the top-ten potential export markets for SEA Maine species of interest (see Section ##).

B.2 International Trade Centre - Export Growth and Trade Indicators

The International Trade Centre (ITC) - joint agency of the World Trade Organization (WTO) and United Nations - was created to support the internationalization of small and medium-sized enterprises (SMEs). The agency

[4] https://www.intracen.org/itc/about/

provides innovative, cutting-edge market information to enable improved business decision-making.

Application of ITC Data

ITC data were used in the following ways:

- ITC data on US exports of species of interest were used to identify the top-two export destination countries as inputs in the Market Diversification Tool (above).
- ITC timeseries data were used to identify 10-year trends in US exports of SEA Maine species of interest.
- ITC-generated Trade Indicators were used to help identify the potential for entering new or expanding existing export markets for SEA Maine species of interest.

B.3 USA Trade Online

USA Trade Online[5] is a data tool provided by the US Census Bureau that provides access to current and cumulative US export and import data. The goal of USA Trade Online is to assist exporters and importers from a wide range of industries to identify new markets, evaluate existing markets, and conduct other market research. The data available through USA Trade is also useful in interpreting economic trends, conducting academic research, and analyzing domestic and international trade policies.

[5] https://usatrade.census.gov/

Timeseries data from USA Trade Online were used in the development of Export Potential Profiles. 10-year global exports of SEA Maine species of interest from the state of Maine were collected and analyzed to understand historical performance, forecast future trends, and identify export markets of interest.

B.4 Definitions

The following defines the category headings used in the export potential summary tables:

Metric	Definition
Avg Imports from US	The market's average imports of the product from the United States. This is the most heavily weighted indicator in the standard weights and is worth 50% of the country's overall score if you use the standard weights.
Max Avg Tariff (%)	The average tariff rate among the national lines the six-digit subheading.
US Import Share	The percentage of the country's imports of the selected products that has typically come from the US.
Import Share Gap	Looks at whether the US is overperforming or underperforming in terms of its import share in a market. It is the difference between the US import share of the product in the country and in a larger region (a group of similar countries, usually in the same geographical area). If the US has a greater import share in the region than the country, then there is an import share gap.
Import Growth	Shows whether the country has been importing more or less of the product(s) selected. It is an average of two annual growth rates for the imports of the selected products: the compound annual growth rate (CAGR) for the full five-year period and a partial CAGR of the

	growth between the final year and the 5-year average over two periods.
GDP Growth	The compound annual growth rate (CAGR) for the country's economy over the full five-year period.
Distance	Bilateral US distance measurement between the United States and the country.
International Logistics Performance Index Score	Uses a survey of operators on the ground working in trade. The 2016 LPI ranks 160 countries on six aspects of trade that are important factors when exporting to a country. The score can range from 1 to 5 with a higher score being better.
FTA with US	Countries with a free trade agreement (FTA) with the United States.
Landlocked	The implication is that it is more costly to export to landlocked countries for logistical reasons.

VIII. Appendix C – Interview Guide

SEA Maine Interview Questions - Menu

Introduction (allow 5 minutes for start-up)

The Seafood Economic Accelerator for Maine, called SEA Maine, has commissioned Homarus Strategies and Gardner Pinfold to complete an economic benchmarking analysis of the seafood value chain in Maine. This information will help SEA Maine and businesses/organizations like yours address challenges and develop opportunities.

All of your responses will remain strictly confidential. Your personal information will not be provided in the research report. Only summary information combining all responses will be provided in the report to SEA Maine.

During this conversation, we are hoping to hear from you about your own experience and the nature of your business/association as well as your knowledge about the general business environment you operate in. This interview should take one hour to complete, depending on your answers.

Do you have any questions for us before we begin?

A. Administrative (2.5 minutes)

1. Survey participant name
2. Company / organization
3. Position / role
4. Site location(s)

B. Supply (5 minutes)

5. What species do you work with?
6. On average, around what percent of your revenues come from these species respectively?
7. How has this changed over the past 10 years?
8. What challenges do you face in securing seafood or wholesale product caught or landed in Maine?
9. Do you source any catch, bait, feed, etc. from outside Maine, if so what and from where?
10. Do you encounter quality issues? If so, what has to change to remedy these?
11. What are the prospects for supply growth?
12. Any other comments regarding supply?

A. Business operations & regulation (7.5 minutes)

13. What is your company's annual revenue?
    a. $0 - $500,000
    b. $500,000 - $1M
    c. $1M - $5M
    d. $5M - $25M
    e. Over $25M
14. How many people does your company employ?

15. Are there any challenges meeting your labor needs?
16. How is regulation affecting your operations?
    a. Licensing/permitting
    b. Business operations/compliance
    c. Fisheries management (closures, permit distribution, quotas/allowable catch)
    d. Operating costs (administrative time for compliance)
    e. Investment
    f. Trade barriers
    g. QMP, traceability
17. What can government do to address any of these regulatory issues?
18. Any other comments regarding business operations & regulation?

B. Markets and products (10 minutes)

19. Describe the products that you sell for each species.
20. What proportions do you sell to: distributors, retail, food service?
21. Where do your products go (approx. % by local/off the boat, state, country, continent, etc.)?
22. What product forms do you sell: bulk commodity, retail pack, branded pack?
23. What are the major market challenges and trends (e.g., price, exchange rate)?
24. Are you preparing for a post-COVID market landscape? If so, how?
25. Do you have any difficulty meeting international standards?
26. What transportation logistics challenges do you encounter? What transportation cost challenges do you encounter?
    a. How much does it cost per ton per mile, or by some other metric, to move product within your supply chain?
27. Any other comments regarding markets and products?

A. Investing in the future (5 minutes)

28. What parts of your business are you investing in?
    a. If you are not investing, why not: risk, uncertainty, capital?
    b. What sources of capital did you access to support these investments?
29. How have the investments affected your operating costs, employment, training?
30. What are the drivers for investment: competition, labor shortage, standards?
31. What environmental challenges/constraints do you face?
    a. What changes are you going to need to make to meet environmental challenges? What costs do you anticipate encountering?
32. Any other comments regarding environmental impacts or investment?

B. General (25 minutes)

33. What are Maine's greatest competitive strengths/weaknesses?
34. What are Maine's greatest competitive opportunities/threats?
35. What do you think Maine harvesters should focus on over next 2-3 years?
36. What do you think Maine processors should focus on over next 2-3 years?
37. What do you think Maine government should focus on over next 2-3 years?
38. What more could be done to maximize the value of Maine marine resources:
    a. Better management of marine resources (stocks)
    b. Improved access to the resource
    c. Harvesting practices / handling

d. Seasonality and stable supply

e. Labor force development / technical training

f. Waste utilization / by-product & residuals development

g. Optimized storage and processing

h. Innovation and investment (harvest/product/process/market development)

i. Access to capital

j. Targeting highest value products/markets

k. Market intelligence

l. Tarif and non-tariff barriers

m. Product differentiation and marketing

n. Branding (company/state)

39. All these issues are very important, but in your opinion, what are the top three issues or main takeaways about the issues and challenges facing the seafood industry today that should be focused on in our report?

Thank you very much for your valuable time. This information is going to be extremely helpful as we continue to develop this work. Please be on the lookout for a workshop invitation, the event will be held in February. If you would like to submit detailed answers to these questions in writing or add any detail we missed today, please do not hesitate to do so. Thank you!