OCTOBER
2019 UPDATE

ECONOMIC CONTRIBUTIONS OF OREGON'S COMMERCIAL MARINE FISHERIES

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ACKNOWLEDGMENTS

OCTOBER 2019 – ECONorthwest prepared this analysis for the Oregon Department of Fish and Wildlife. It received assistance from Jerry Leonard at the Northwest Fisheries Science Center as well as staff from the Pacific Fisheries Information Network, Oregon Employment Department, and others. Other firms, agencies, and staff contributed to other research that this analysis relied on. That assistance notwithstanding, ECONorthwest is responsible for the content of this report. The staff at ECONorthwest prepared this report based on their general knowledge of economics, and on information derived from government agencies, private statistical services, the reports of others, interviews of individuals, or other sources believed to be reliable. ECONorthwest staff who contributed to this report include Adam Domanski, Joel Ainsworth, Laura Marshall, Luna Ou, Virginia Wiltshire-Gordon, and others. ECONorthwest has not independently verified the accuracy of all such information and makes no representation regarding its accuracy or completeness. Any statements nonfactual in nature constitute the authors' current opinions, which may change as more information becomes available. All photographs for this report were provided by the Oregon Department of Fish and Wildlife.

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TERMINOLOGY

ECONOMIC OUTPUT: The gross value of goods and services produced. This value is an annual production estimate equivalent to sales plus or minus changes in inventory. For retail and wholesale trade sectors output is equivalent to gross margins (not gross sales).

JOBS: Employment measured in terms of full-year-equivalents (FYE). One FYE job equals work over twelve months in each industry (this is the same definition used by the federal government's Bureau of Economic Analysis). For example, two jobs that last six months each count as one FYE job. A job can be full-time or part-time, seasonal or permanent.

HARVESTERS: This term is interchangeable with fishermen. It is inclusive of both captains and crew members who participate in the marine commercial fishing industry.

EX-VESSEL VALUE: The dollar amount received by fishermen for their catch when delivered to a processor.

LANDINGS: The amount in pounds of fin fish and shellfish, such as crab and shrimp harvest, that are brought ashore (net of discards) and recorded at the port of landing.

PRICE PER POUND: Calculated as the ex-vessel value (dollars) divided by the landing weight (pounds) for each species.

PROCESSORS: Companies that process seafood for resale. Includes only industries within the category "NAICS 3117 Seafood Product Preparation and Packaging" who that reports to the Quarterly Census of Employment and Wages (QCEW) program administered by the Bureau of Labor Statistics.

ONSHORE: Marine commercial fishery harvest landed at an Oregon harbor port.

AT-SEA: Marine commercial fishery harvest of Pacific whiting delivered to an at-sea processor (mothership) by Oregon harvesters.

DISTANT WATER: Harvest landed by Oregon residents at a shoreside port outside of Oregon. Distant water landings in this report include only landings in Alaska and are for multiple species. Although harvest by Oregonians also occurs in other states (e.g. Washington and California), the information needed to include these values was not available and is not included in the data for the distant water fishery.

BRIEFING REPORT

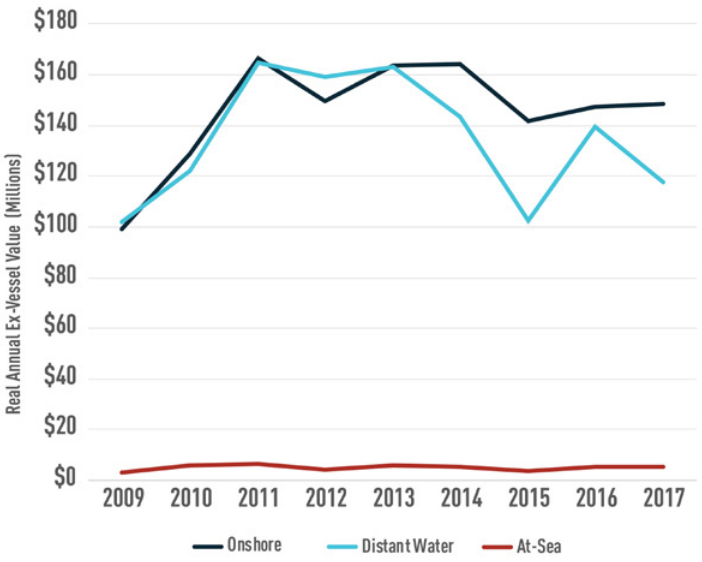
Oregon's commercial marine fisheries contribute to local, state, and regional economies by providing a source of jobs and revenue to seafood harvesters, buyers, and processors, as well as additional economic activity associated with fishery spending. This report provides an update on the economic impacts of commercial marine fishing and seafood processing activity to Oregon for the 2016 and 2017 fishing seasons.

THE COMMERCIAL FISHING INDUSTRY ON THE OREGON COAST

Oregon's marine commercial fishing industry includes vessels, captains, and crew that deliver catch to an onshore Oregon port or an at-sea mothership, as well as those that harvest in distant water fisheries in Alaska.[1] It also includes onshore processors and buyers who purchase catch from harvesters. Over 100 species of fish and shellfish are harvested off the Oregon coast. The primary fisheries in 2016 and 2017 were for Dungeness crab, pink shrimp, Pacific whiting, other groundfish, albacore tuna, salmon, and Pacific halibut. Oregon-based vessels primarily harvest groundfish, Dungeness crab, and salmon in distant water fisheries.

REAL ANNUAL EX-VESSEL VALUES

Oregon's Marine Commercial Onshore, At-Sea, & Distant Water Fisheries (2017$)



Source: ECONorthwest with data from PacFIN
Note: Ex-vessel values for Dungeness Crab have been reallocated so that catch during December is allocated to the subsequent calendar year to reflect catch for the annual season.

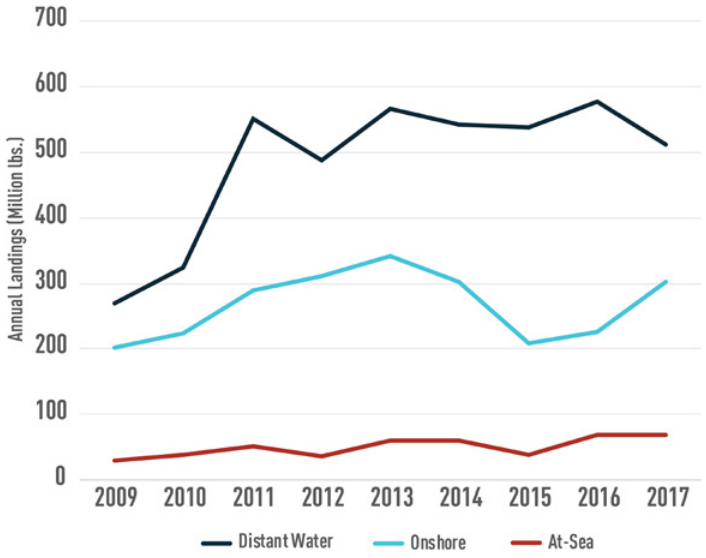
TRENDS IN VOLUME AND VALUE OF MARINE COMMERCIAL FISH LANDINGS

Trends in landed volume (pounds) vary by sector and species. For onshore fisheries in 2017, pink shrimp had the lowest landings since 2009, and salmon landings were the lowest since before 1989. In contrast, in 2017 Pacific halibut landings were the highest since 2005. Dungeness crab landings were particularly low during the 2014-2015 season, but during the subsequent two seasons landings increased to levels comparable to several seasons prior to 2014.

[1] Although harvest by Oregonians also occurs in other states (e.g. Washington and California), the information needed to include these values was not available and is not included in the data for the distant water fishery.

ANNUAL LANDINGS

Oregon's Marine Commercial Onshore, At-Sea, & Distant Water Fisheries (2017$)

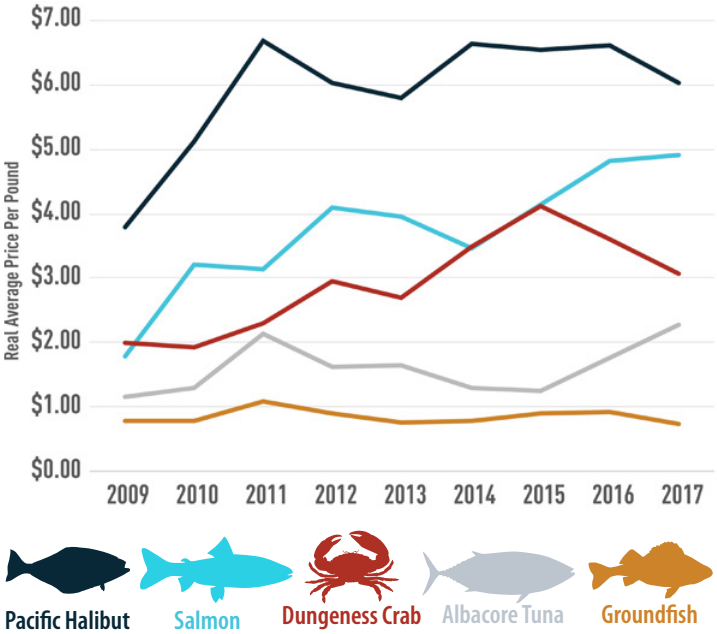


Source: ECONorthwest with data from PacFIN

Note: Ex-vessel values for Dungeness Crab have been reallocated so that catch during December is allocated to the subsequent calendar year to reflect catch for the annual season.

REAL AVERAGE ANNUAL PRICE

Per Pound for Select Species (2017$)



Source: ECONorthwest with data from PacFIN

Offshore landings by Oregon vessels to an at-sea mothership is exclusively for the harvest of Pacific whiting. At-sea landings increased in 2016 and 2017, as did revenues. Landings by Oregon vessels in the distant water fishery increased in 2016 but declined in 2017, primarily due to a lower groundfish harvest.

Ex-vessel values, or the value that harvesters receive for their landed catch, depend on volume and prices. Trends in real ex-vessel values during 2016 and 2017 vary by species, but are generally higher than recent prior years for Oregon's marine commercial fishing industry overall. In 2016 and 2017 prices for Dungeness crab and Pacific halibut declined, while prices for salmon and Albacore tuna increased.

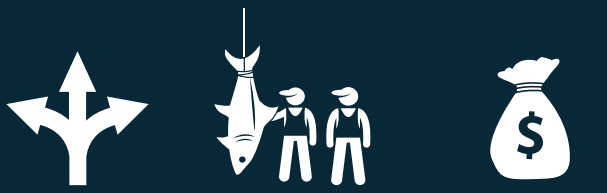
BY THE NUMBERS: Key Metrics for Oregon's Commercial Onshore, At-Sea, and Distant Water Fisheries (2017)

	ECONOMIC OUTPUT	EX-VESSEL VALUE	LANDINGS (MILLIONS OF POUNDS)	VESSELS	TOTAL JOBS SUPPORTED (FYE)	NUMBER OF OREGON PROCESSORS	NUMBER OF OREGON PROCESSOR EMPLOYEES
ONSHORE	$555.6 M	$148.2 M	303.5 M LBS.	1,151	5,826	32	1,172
AT-SEA	$6.8 M	$5.4 M	68.4 M LBS.	7	49	N/A	N/A
DISTANT WATER	$135.5 M	$117.5 M	512.1 M LBS.	371	973	N/A	N/A
TOTAL	$697.9 M	$271.2 M	884.0 M LBS.	1,529	6,848	32	1,172

Source: ECONorthwest using data from NOAA and Oregon Employment Department.

BRIEFING REPORT

ANNUAL STATEWIDE IMPACTS
of Oregon's Commercial Fishing Industry



$697.9 M
IN TOTAL ECONOMIC OUTPUT

6,848
JOBS

$356.2 M
LABOR INCOME

SEAFOOD HARVESTERS AND PROCESSORS

In 2017, there were 1,027 commercial fishing vessels that made onshore landings, 7 vessels that delivered to at-sea motherships off Oregon, and 371 permits fished in distant water fisheries. Approximately 1,364 commercial fishing vessel captains and crew participated in harvesting activities that delivered to onshore ports. Some of these same harvesters likely participated in at-sea and distant water fishing as well.

The majority of commercial landings by volume are delivered to processors who prepare the seafood for resale by cleaning, packaging, canning, freezing, and other methods. Since 2007 there has been consolidation in the processing industry, but in 2015 this trend began to reverse. Two processors were added in both 2016 and 2017, bringing the total number of processors in 2017 to 32.[2] These 32 processors employed over 1,172 employees in Oregon in 2017. In 2018 two more processors were added, bringing the total processors to 34.

There were 171 buyers that purchased catch from an onshore harvester in 2017. This number includes the 32 commercial processors. In addition to processors, catch is distributed to wholesale bait dealers, retail fish sellers (harvests who sell directly to restaurants and stores), and dockside fish sellers (harvesters who sell their catch to the public). Because many buyers fall into the wholesale or retail sector, not enough information is known to directly calculate jobs and economic output for those businesses.

ECONOMIC CONTRIBUTIONS OF OREGON'S COMMERCIAL FISHING INDUSTRY

The economic contributions of Oregon's commercial fishing industry represent the direct impact of the ex-vessel values paid to harvesters and the downstream secondary impacts (indirect and induced) that the revenue supports: crew jobs and compensation, vessel owner income, as well as the jobs and compensation to processing employees, the non-seafood suppliers to the processors, and their ripple effects.

OTHER ECONOMIC CONTRIBUTIONS

In addition to the jobs, compensation, and income supported by the marine fishing industry in Oregon, there are other ways that marine fisheries support Oregon's economy. These other factors include:

- In 2017, **Oregon exported $62.9 million in seafood products** to foreign markets. Pacific whiting, salmon, and crab are the top exported commodities. Frozen fish products account for recent growth in Oregon exports since 2015. The primary countries importing Oregon seafood products include Canada, the United Kingdom, Ukraine, Japan, and China.
- The commercial fishing industry in Oregon is an important source of **quality of life and community** for commercial and recreational anglers. The people who make their living in the commercial fishing industry are undertaking personal risk and uncertainty to ensure high-quality food products are available dockside, at local restaurants, throughout Oregon, and beyond.
- Oregon Department of Fish and Wildlife **promotes sustainable fisheries** by managing for ecosystem health,

[2] Processors, as defined and used here, represents industries within the category "NAICS 3117 Seafood Product Preparation and Packaging" who report to the Quarterly Census of Employment and Wages (QCEW) program administered by the Bureau of Labor Statistics. For more information on how OED classifies fish processors, please see https://www.qualityinfo.org/-/in-cod-and-crab-we-trust-oregon-s-seafood-processing-industry

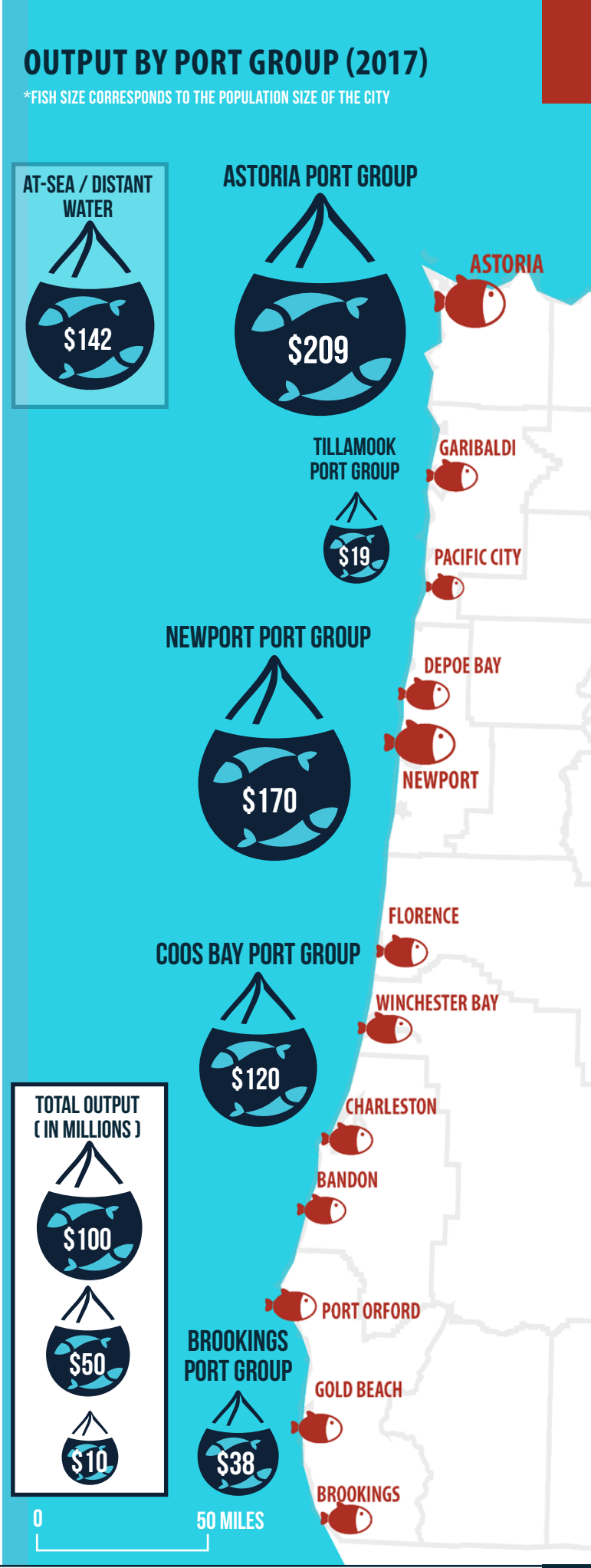
developing bycatch reduction measures, conducting research to answer key questions on fish stocks, and supporting industry-acquired sustainability certifications (for example, by the Marine Stewardship Council).

ECONOMIC CONTRIBUTIONS
of Oregon's Commercial Fishing Industry (2017)

IMPACT TYPE	JOBS	LABOR INCOME ($M)	OUTPUT ($M)
On-Shore	1,364	$62.5	$148.2
At-Sea	-	$2.7	$5.4
Distant Water	-	$43.5	$117.5
Total Direct	**1,364**	**$108.7**	**$271.2**
Total Secondary	**5,483**	**$247.4**	**$426.7**
Total Contribution	**6,848**	**$356.2**	**$697.9**

Source: ECONorthwest calculations using data from NOAA, NMFS, and AK CFEC
Note: Direct jobs were provided by OED and adjusted for Dungeness crab landing years so that catch during December is allocated during the subsequent calendar year to reflect catch for the annual season

Source (right): Created by ECONorthwest
Note: Total economic output includes both direct and secondary impacts

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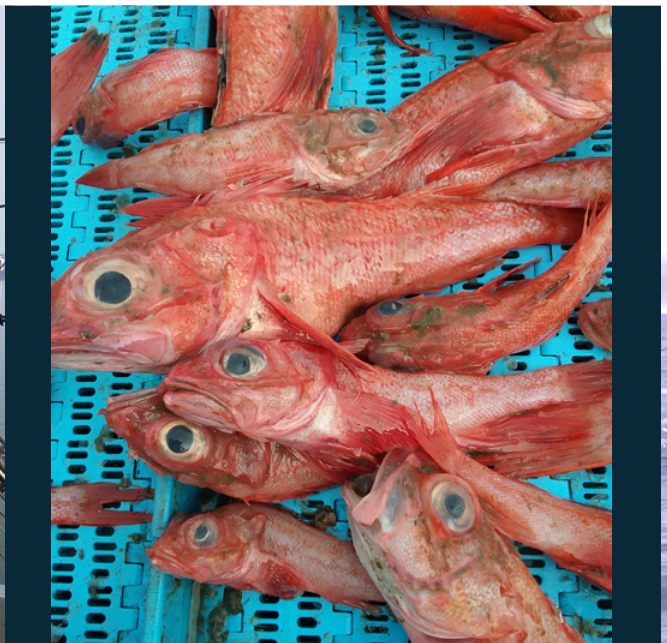

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INTRODUCTION

This report updates previous studies that have examined the economic contributions of Oregon's marine commercial fisheries to the state's economy. Marine commercial fishing plays an important cultural and economic role in many coastal communities in the state. The industry's importance, however, extends beyond Oregon's coast by supporting economic activity in the retail, wholesale, and tourism sectors.

The purpose of this report is to document the recent trends in Oregon marine commercial fisheries and quantify the economic footprint of marine commercial fisheries in the state. Using data collected by regulatory agencies, this report seeks to answer three central questions:

1. **What are the recent trends in Oregon's marine fishing industry?**
2. **What are the annual economic contributions of commercial fishing industry to Oregon's economy and to local coastal economies?**
3. **What other economic benefits do marine fisheries provide in Oregon?**

To answer the first question, this report begins with an overview of the marine commercial fishing industry in Oregon, including recent trends in seafood harvest and processing by location and commodity. These trends are separated by catch that is landed at an Oregon port ("onshore") and for Oregon boats who deliver catch to either at-sea motherships ("at-sea") or ports outside of Oregon ("distant water").

The second question is answered through an economic contributions analysis for the commercial ocean fishing industry. Economic contributions studies measure how the economic activity of a business or industry cycles through the economy to support jobs, income, and gross regional product. Commercial ocean fishing enterprises that deliver to onshore entities support coastal economies by harvesting fish in Oregon waters, then selling that harvest to local processors. Additionally, onshore, at-sea, and distant water commercial harvesters purchase goods and services from local businesses, such as bait, maintenance services, and provisions for vessel crews. These purchases generate revenue for those businesses that supports local workers.

The third question is answered by summarizing the additional economic benefits associated with marine fishing. As a high-protein food source, sustainable fisheries are also an important contributor to food security, both in Oregon and internationally through the export market. Exports from Oregon's commercial

fisheries also play an important role in supporting jobs in fishing, processing, and wholesale. For coastal residents, ocean fisheries provide a sense of identity and pride, as well as community support through fishing associations. Recreational ocean fishing is another benefit of marine resources in Oregon.

ABOUT ODFW

The Oregon Department of Fish and Wildlife (ODFW) manages commercial and recreational fishing in Oregon. The agency's mission is, "to protect and enhance Oregon's fish and wildlife and their habitats for the use and enjoyment by present and future generations."[3] ODFW's Marine Resources Program monitors fisheries, develops marine policies, conducts research on habitat and species, and provides expertise on marine issues to the State of Oregon. Marine staff are located at offices in all major coastal ports. For more information please visit www.dfw.state.or.us/MRP.

ABOUT ECONORTHWEST

ECONorthwest staff specialize in the application of economic and financial principles and methods to the evaluation of public policies and investments. Since 1974, ECONorthwest has completed more than 2,500 projects for public and private clients. ECONorthwest have several decades of experience conducting economic contributions analysis from the zip code level through national-level models. For more information please visit econw.com.

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DATA SOURCES AND METHODS

The study team used a combination of data sources to prepare this report. ECONorthwest worked with ODFW, the National Oceanic and Atmospheric Administration (NOAA), Pacific Fisheries Information Network (PacFIN), Alaska Commercial Fisheries Entry Commission (CFEC), and Oregon Employment Department (OED) to obtain data sets, information, and photos for this project. The data used for this analysis include:

- **CFEC:** Distant water data for harvest in Alaska fisheries by Oregon residents by year and species, including the number of fishermen, permits fished, pounds landed, and estimated earnings from 2009 to 2017.
- **OED:** OED provided data for both commercial fishing employment and the processing industry. Oregon commercial fishing employment is by species and month for 2018. Processing data includes the number of processors, level of employment, and total labor income by coastal region for 2018. To match the timeframe of the impact analysis we use the 2017 employment data from OED to report job impacts.
- **PacFIN:** Commercial fish ticket data from 1981 to 2017 for harvest delivered onshore to entities in Oregon ports and at-sea, including revenue and harvest information by species, port group, and gear type.

[3] https://www.dfw.state.or.us/agency/

OREGON'S COMMERCIAL FISHERY MANAGEMENT

Sound fishery regulations and stakeholder partnerships are a critical component of sustaining fish stocks, which allow for commercial operations. Oregon's fisheries are nationally known as success stories for maintaining healthy stocks. This success depends on collaboration among multiple agencies and industry itself.

- **Oregon Department of Fish and Wildlife** (ODFW) uses funds from commercial fishing license and permit fees, as well as "ad valorem" fees collected from wholesale fish dealers and bait dealers to manage, monitor, and study commercial fish stocks and fisheries.
- **National Marine Fisheries Service** (NMFS) is a branch of the National Oceanic and Atmospheric Administration within the U.S. Department of Commerce. The West Coast Region of NMFS regulates fisheries in Oregon, California, Washington, and Idaho. The agency uses a science-based approach to maintain the productivity of fisheries and the communities supported by commercial and recreational fishing activity.
- **Pacific Fishery Management Council** (PFMC) is one of eight regional fishery management councils under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), signed by the US Congress in 1976. The PFMC oversees species included in federal fishery management plans and harvested in the West Coast's federal waters (from 3 miles offshore to 200 miles offshore, also known as the Exclusive Economic Zone). The PFMC's membership includes representatives of both commercial and sport fisheries, federal management agencies, state management agencies, and Tribal governments. The PFMC meets five times annually to set management measures for the species included in its five fishery management plans (salmon, groundfish, highly migratory species, coastal pelagic species, and fishery ecosystem plan).

- **The International Pacific Halibut Commission** (IPHC) is involved in the management and stock assessment of Pacific halibut throughout the North Pacific, including the West Coast and Gulf of Alaska waters.

SEAFOOD COMMODITY COMMISSIONS

The State of Oregon has four seafood commodity commissions, within the Oregon Department of Agriculture, developed primarily to assist the commercial fishing industry and broader seafood industry in marketing quality Oregon products. Over time, the commodity commissions have also been involved in representing their fleets in management discussions, supporting research on key fisheries topics, and pursuing sustainability certifications (such as the Marine Stewardship Council). Each has an executive director and multiple industry representatives serving as commissioners:

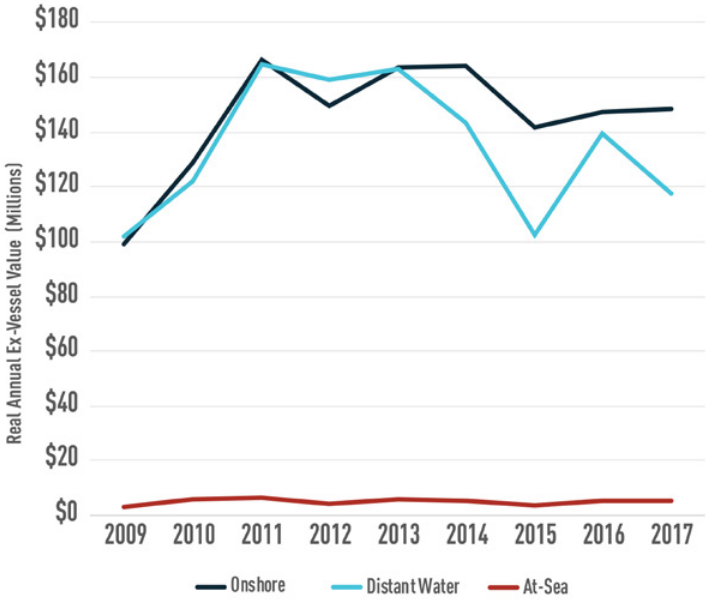
- **Oregon Albacore Commission (OAC)**
- **Oregon Dungeness Crab Commission (ODCC)**
- **Oregon Salmon Commission (OSC)**
- **Oregon Trawl Commission (OTC)**

COMMERCIAL FISHERIES INDUSTRY OVERVIEW

The marine commercial fishing industry is an important source of economic activity for Oregon's coastal communities, by supporting jobs and labor income on fishing vessels, ports, processing plants, and support facilities. The marine coastal fishing industry includes seafood harvested by Oregon residents and delivered either onshore, to at-sea processing vessels, or in distant water locations. Trends since 2009 for these three types of fisheries are displayed in Exhibit 1 for real ex-vessel value and Exhibit 2 for annual landings.

- **Onshore Fishing Industry:** Marine commercial fishery harvest landed at an Oregon port.
- **At-Sea Fishing Industry:** Harvest of Pacific whiting delivered to an at-sea processor (mothership) by Oregon catcher vessels.
- **Distant Water Fishing Industry:** Harvest landed by Oregon residents at a shoreside port in Alaska[4]

EXHIBIT 1. Annual Real Ex-Vessel Values for Oregon's Marine Commercial Onshore, At-Sea, and Distant Water Fisheries (2017$)

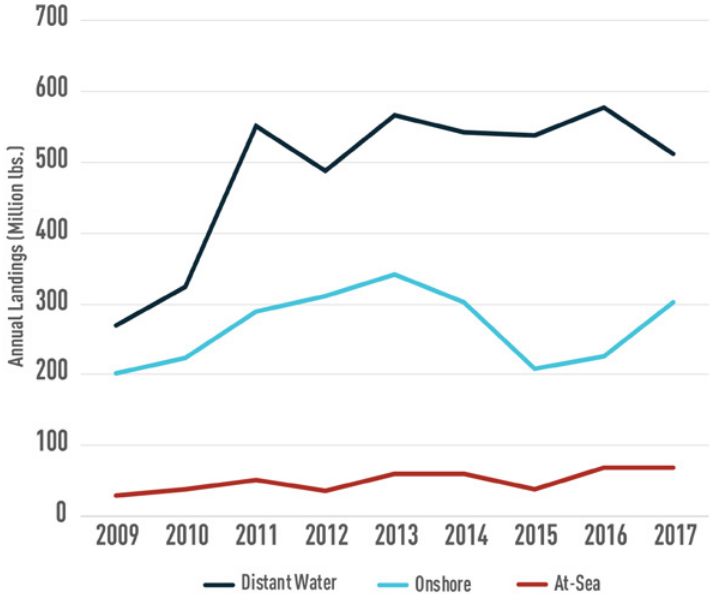


Source: ECONorthwest with data from PacFIN
Note: Landings for Dungeness Crab have been reallocated so that catch during December is allocated to the subsequent calendar year to reflect catch for the annual season.

ONSHORE FISHERY

In 2017, the total ex-vessel value paid to Oregon commercial onshore harvesters was more than $148.2 million. The commercial onshore landings that year totaled 303.5 million pounds of catch. For scale, this amount is equal to approximately 72 pounds per Oregonian, but much of that harvest was actually exported out of the state. The majority of landings are purchased by processors who then prepare and package the seafood to be sold in markets in Oregon, to other domestic U.S. markets, or exported to other countries. The 32 processors in Oregon employed over 1,172 employees in 2017. Exhibit 3 summarizes these values for the onshore fishery for 2017.

EXHIBIT 2. Annual Landings for Oregon's Marine Commercial Onshore, At-Sea, and Distant Water Fisheries (2017$)



Source: ECONorthwest with data from PacFIN
Note: Landings for Dungeness Crab have been reallocated so that catch during December is allocated during the subsequent calendar year to reflect catch for the annual season.

The revenue commercial harvesters receive for their catch depends on a variety of market forces, including the abundance of the species being caught, level of effort involved in the catch, consumer preferences, available distribution opportunities, and other factors. Combined the market forces result in the prevailing market price per pound, and the amount of fish the seafood buyers are willing to buy.

Onshore annual landings, measured as millions of pounds of catch per year, have averaged 268 million pounds per year since 2009 (Exhibit 4). The 303.5 million pounds caught in 2017 is the third highest volume year since 2009 for onshore landings. Ex-vessel value is determined by both level of catch and market

[4] Although harvest by Oregonians also occurs in other states (e.g. Washington and California), the information needed to include these values was not available and is not included in the data for the distant water fishery

COMMERCIAL FISHERIES INDUSTRY OVERVIEW

EXHIBIT 3. KEY METRICS FOR OREGON ONSHORE COMMERCIAL FISHERIES (2017)

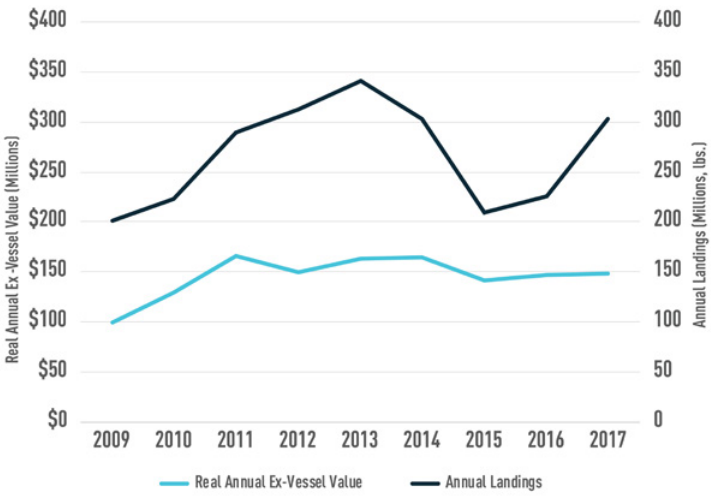
CATCH (MILLIONS OF LBS.)	REVENUE (EX-VESSEL VALUE, MILLIONS)	TOTAL VESSELS	TOTAL COMMERCIAL FISHERS	# OF PROCESSORS	# OF PROCESSOR EMPLOYEES
303.5 M LBS.	$148.2 M	1,151	1,364	32	1,172

Source: ECONorthwest using data from NOAA and Oregon Employment Department

prices. Since 2009, real ex-vessel value was at its lowest level in 2015, but has since begun to increase. After adjusting for inflation, ex-vessel values in 2016 and 2017 were similar, at approximately $148 million each year.

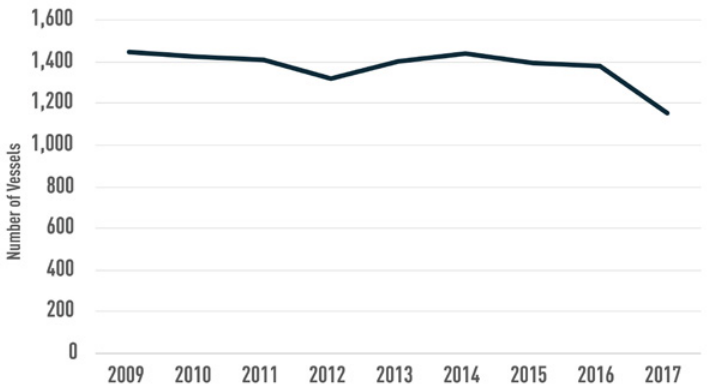
The number of vessels in the onshore marine commercial fishing sector in Oregon has averaged 1,374 vessels per year since 2009. In 2017, 1,152 vessels made onshore landings, a decline of approximately 16 percent from 2016 (Exhibit 5).

EXHIBIT 4.
Marine Commercial Onshore Fishery: Total Annual Landings (lbs.) and Real Annual Revenue in Oregon, All Species Combined (2017$)



Source: ECONorthwest with data from PacFIN
Note: Landings for Dungeness Crab have been reallocated so that catch during December is allocated during the subsequent calendar year to reflect catch for the annual season. "Real" dollars have been adjusted for inflation. In this case adjusted to 2017 dollars.

EXHIBIT 5.
Number of Vessels Participating in the Onshore Fishery



Source: ECONorthwest with data from PacFIN
Note: The number of vessels for Dungeness Crab have not been reallocated to reflect the annual season, so the vessels all represent the actual calendar year of harvest.

EXHIBIT 7.
Onshore Landings by Port Group (2017)

LOCATION	LANDINGS (MILLIONS)	PERCENT OF LANDINGS	VESSEL LANDINGS
Astoria	154.49 LBS	51%	5,113
Tillamook	2.06 LBS	1%	1,225
Newport	114.92 LBS	38%	3,804
Coos Bay	21.03 LBS	7%	3,493
Brookings	10.96 LBS	4%	3,708
Total	303.46 LBS	100%	17,343

Source: ECONorthwest using data from PacFIN
Note: Landings for Dungeness crab represent the 2016- to 2017 season.

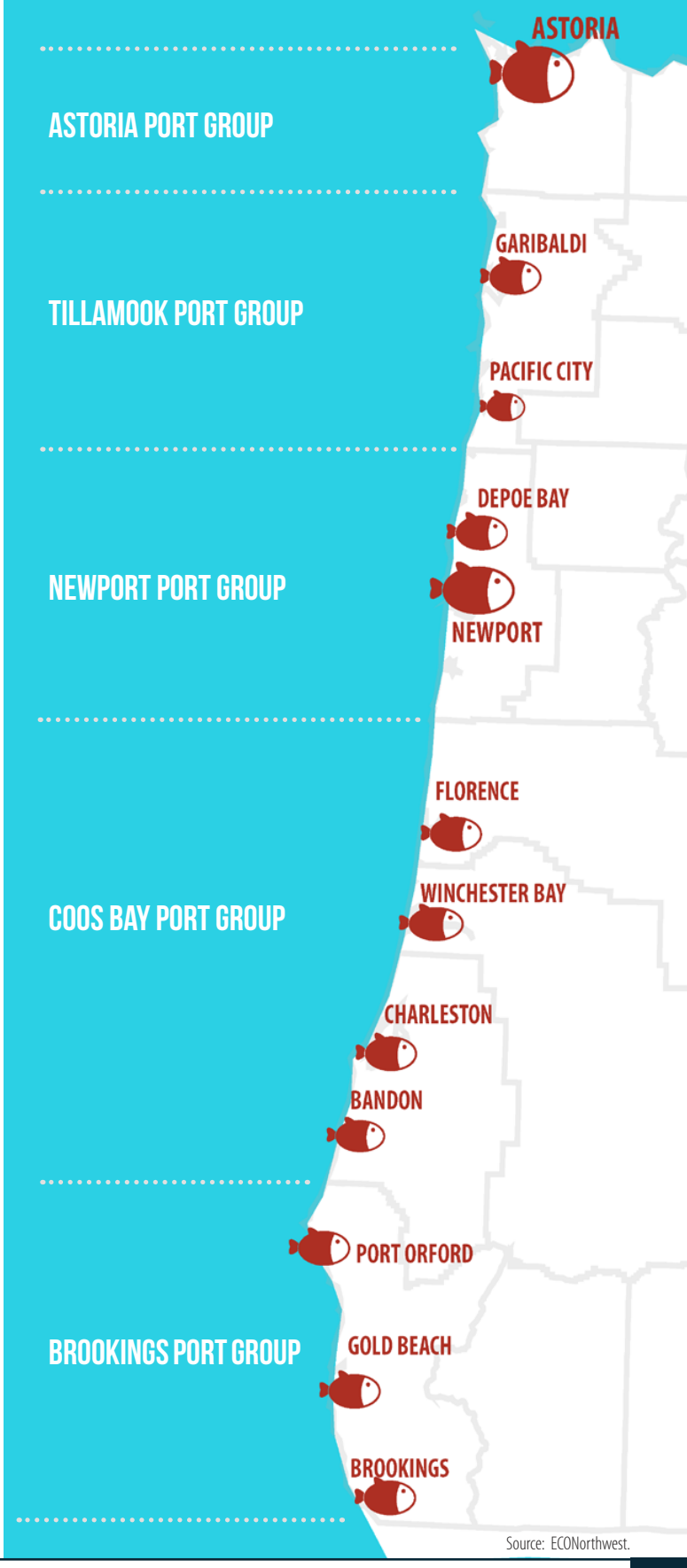
ONSHORE PORT GROUPS

Commercial landings occur. These at multiple ports in Oregon. For consistency with other reports and as inputs to the economic contributions model, individual ports are aggregated into port groups from north to south: Astoria, Tillamook, Newport, Coos Bay, and Brookings. The Astoria port group contains only the combined Astoria/Warrenton port — the other port groups have at least two ports. Exhibit 6 depicts the location of the port groups and corresponding individual ports and harbors.

In terms of pounds landed statewide, the two largest port groups in 2017 were Astoria (51 percent) and Newport (38 percent) (Exhibit 7). There were 17,343 vessel landings at onshore ports in 2017 by over 1,000 vessels. The average number of landings per vessel is dependent on the type of fishery, gear, and vessel size.

EXHIBIT 6.
OREGON PORT GROUPS AND PORTS

*FISH SIZE CORRESPONDS TO THE POPULATION SIZE OF THE CITY



Source: ECONorthwest.

OVERVIEW OREGON'S OCEAN FISHING INDUSTRY

ONSHORE SPECIES AND GEAR TYPES

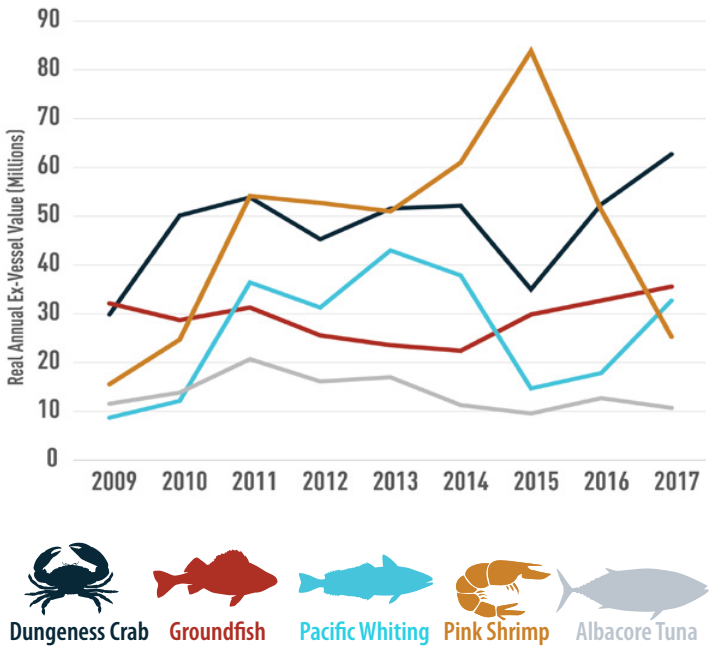
In terms of landed volume, Oregon's onshore commercial fishing industry is dominated by Pacific whiting which accounted for 66 percent of the total landed pounds in 2017. However, Pacific whiting contributed only 11 percent to total annual revenue in 2017 (Exhibit 8). Dungeness crab contributed the most to revenue in 2017, accounting for 42 percent of the total although the species contributed only 7 percent of total landed pounds. In addition to Pacific whiting and Dungeness crab, other key commodities landed at onshore Oregon ports include Pacific halibut, Chinook salmon, albacore tuna, groundfish, and pink shrimp.

Many vessels participated in more than one fishery. For example, a commercial fishing vessel may catch albacore tuna during the summer and Dungeness crab during the winter. The majority of vessels in the onshore fishing fleet have small revenues, 74 percent of vessels had revenue less than $100,000 in 2017 and another 19 percent of vessels had revenues less than $500,000 per year.

Gross revenues from harvest of the primary commercial fishery species in Oregon have fluctuated in recent years. Dungeness

EXHIBIT 9.

Onshore Real Annual Ex-Vessel Values by Species (2017$)



Source: ECONorthwest using data from PacFIN
Note: Real annual ex-vessel value for Dungeness crab represents the 2016 to 2017 season.

EXHIBIT 8. Commercial Onshore Landings – Key Species (2017)

SPECIES	INDIVIDUAL LANDINGS	PRICE PER POUND	LANDED POUNDS (MILLIONS OF LBS)	REVENUE ($MILLIONS)
Pacific Halibut	165	$6.03	0.23	$1.41
Salmon	1,353	$4.90	1.13	$5.56
Dungeness Crab	6,006	$3.08	20.38	$62.75
Albacore Tuna	548	$2.28	4.74	$10.80
Groundfish	8,099	$0.74	48.22	$35.67
Other	927	$0.80	4.19	$2.95
Pink Shrimp	100	$0.55	23.06	$12.69
Pacific Whiting	145	$0.08	201.50	$16.38
TOTAL	17,343	N/A	303.46	$148.2

Source: ECONorthwest using data from PacFIN
Note: Other includes Pacific Sardines, and 96 other species including other crab, other shrimp, shark species, eels, mackerel, and other species. Dungeness crab represents the 2016 to 2017 season.

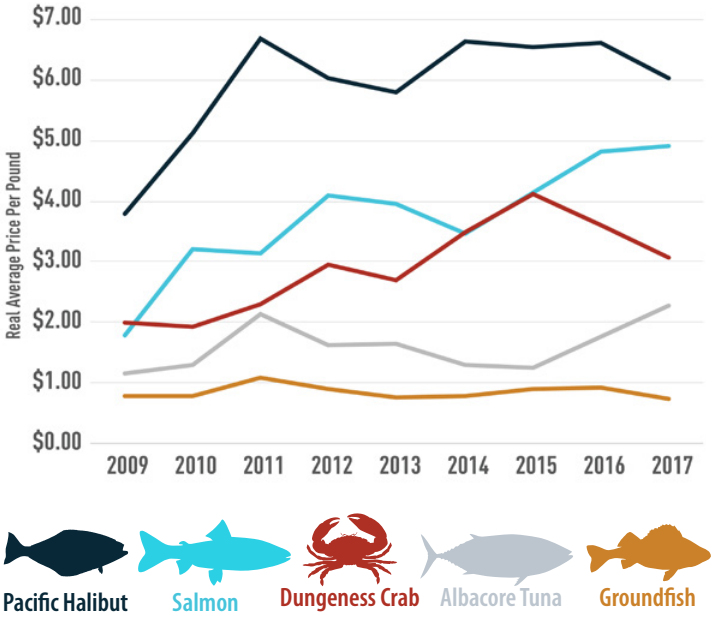
crab experienced low catch levels during the 2014-2015 season, which led to a significant drop in revenues compared with prior years — however, revenue has been on an upward trend since then. Another notable change is the decline in revenue for pink shrimp in 2016 and 2017, attributable to lower catches in these years. Exhibit 9 depicts the revenue trends for key species since 2009.

The onshore prices for key commodities, calculated as the real annual ex-vessel value divided by landings (pounds), have been rising in recent years for Pacific halibut, salmon, Dungeness crab, and albacore tuna. However, there have been recent fluctuations in prices, especially during 2015 when the low supply of Dungeness crab led to higher average prices per pound (Exhibit 10).

AT-SEA AND DISTANT WATERS FISHERIES:

At-sea and distant water fisheries refer to activity by Oregon vessels that deliver their harvest to locations outside of the state. The at-sea fishery consists of Oregon vessels that deliver landings of Pacific whiting to at-sea motherships. In 2017, seven at-sea vessels registered in Oregon landed 68.4 million pounds of Pacific whiting using trawl gear, for a gross revenue value of $5.4 million.

EXHIBIT 10.
Real Average Annual Price per Pound for Select Species (2017$)



Source: ECONorthwest using data from PacFIN
Note: Real annual average prices for Dungeness crab have been adjusted to reflect the annual season.

EXHIBIT 11. Key Figures for At-Sea and Distant-Water Fisheries (2017)

FISHERY AND SPECIES	NUMBER OF PERMITS	LANDED WEIGHT (MILLIONS)	REVENUE (MILLIONS)
AT-SEA			
Pacific Whiting	7	68.4 lbs.	$5.44
DISTANT WATER			
Dungeness Crab	12	4.2 lbs.	$18.52
Pacific Halibut	46	0.7 lbs.	$3.49
Other	17	1 lbs.	$0.29
Groundfish	76	484.1 lbs.	$72.46
Salmon	208	22.1 lbs.	$22.78
TOTAL	366	580.4 lbs.	$122.98

Source: ECONorthwest using data from CFEC and AKFIN.

OVERVIEW OREGON'S OCEAN FISHING INDUSTRY

The distant water fishery refer to landings delivered to non-Oregon ports (Alaska) by vessels with permit holder residency in Oregon. In 2017, 359 Oregon fishermen[5] fished the distant water fishery and landed more than 512 million pounds valued at $117.5 million.

Exhibit 11 summarizes the characteristics of the at-sea and distant water fisheries in 2017. Although the at-sea and distant water fisheries make their landings outside of Oregon (and are thus not assessed for landing fees by Oregon), the fishing vessels (not necessarily the motherships) are often owned and crewed by Oregon residents, whose income contributes to state and local taxes and purchases in the state, thus benefiting Oregon's overall economy.

PROCESSORS

Although some commercial harvest is sold directly to live markets and consumers, most of the commercial harvest in Oregon is sold to processors, who then sell the processed product to wholesalers, retailers, restaurants, and consumers. Oregon's processors are located throughout the state, with 26 located on the coast and another 8 at inland locations. In 2018,[6] 34 processors employed 1,245 people (Exhibit 12). Beginning around 2010, consolidation in the processing industry resulted in an increased market share for the largest processors. In 2015 competition among processors increased as five new seafood processors opened in the state, followed by two more each year from 2016 to 2018.[7] The majority of harvest is sold to large processors, which collectively command approximately 64 percent of the $148 million onshore Oregon market (Exhibit 14).

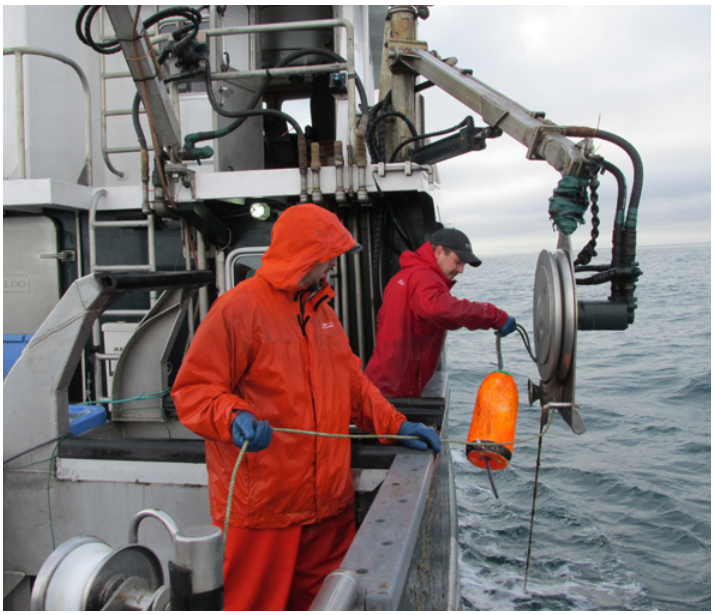


EXHIBIT 12.
Processors by Location (2018)

LOCATION	EMPLOYING ESTABLISHMENTS	EMPLOYMENT
Southern Oregon Coast	7	326
Central Oregon Coast	9	418
Northern Oregon Coast	10	449
Inland Processors	8	52
Total	34	1,245

Source: ECONorthwest using data from Oregon Employment Department
Note: Southern Oregon Coast includes Coos, Curry, coastal Douglas, and coastal Lane counties. Central Oregon coast includes Lincoln and Tillamook counties. North Oregon Coast includes Clatsop County.

EXHIBIT 13.
Processor Revenue by Size of Processor (2017)

PROCESSOR SIZE	INDIVIDUAL PROCESSOR REVENUE	PERCENT OF MARKET
Large	>$10M	64%
Mid-Large	$1M to $10M	29%
Mid-Small	$100,000 to $1M	6%
Small	<$100,000	1%
Total		100%

Source: ECONorthwest using data from PacFIN

[5] The Alaska CFEC data defines fishermen as the count of permit holders who made at least one landing during the harvest year. Due to permit transfers, more than one person can fish the same permit.
[6] There were 32 active processors in Oregon for 2017. We do not have detailed processor information for 2017, so for this table, we report 2018 data.
[7] Knoder, E. (2017). In Cod (And Crab!) We Trust – Oregon's Seafood Processing Industry. June 3. Retrieved from https://www.qualityinfo.org/-/in-cod-and-crab-we-trust-oregon-s-seafood-processing-industry

DEFINING ECONOMIC CONTRIBUTIONS

ECONorthwest worked with ODFW and NOAA to obtain the necessary data to perform an economic contributions analysis. Data sources include commercial fish ticket (landings and revenue) from Oregon harvesters obtained from the Pacific Fisheries Information Network (PacFIN) and the Alaska Commercial Fisheries Entry Commission.

To evaluate the economic contributions of Oregon's marine commercial fisheries, ECONorthwest used an input-output model which enables users to follow expenditures from an industry as they flow through a region's economy. Given the unique structure of commercial fisheries, this study relies on the Input-Output model for the Pacific Coast Fisheries (IO-PAC) developed by NOAA.[8] The IO-PAC modifies the existing supply-chain and consumption relationships in IMPLAN to improve modeling capabilities for fish harvesters and processors.

For this analysis, ECONorthwest modeled the total economic contributions of Oregon's commercial fisheries to the state in 2017, along with the community-level contributions within each port group. Economic contributions analyses employ specific terminology to identify different types of economic effects that can be modeled using input-output tools.

- **DIRECT EFFECTS** are the initial economic activity that occur within the commercial marine fisheries industry in Oregon, which generates subsequent demand for goods and services in the regional economy. For this study, direct effects are represented by the ex-vessel value generated by Oregon's commercial fishing community.

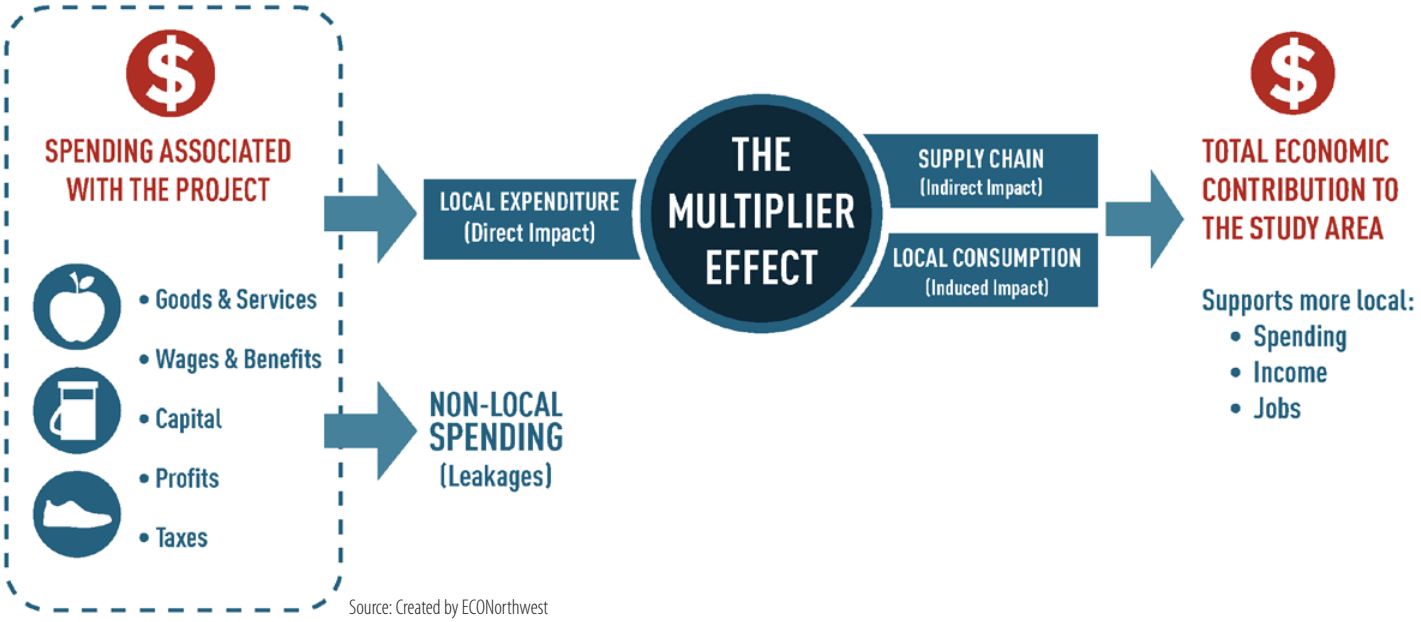
- **SECONDARY EFFECTS** represent the subsequent rounds of economic activity arising from the direct effect, such as the additional purchase of goods and services from businesses (indirect) and household spending (induced). These affected businesses and their employees, in turn, purchase intermediate goods and services from other businesses in the region, generating subsequent rounds of activity (the "multiplier effect").

Output represents the total value of goods and services produced. This is the largest, most encompassing measure of economic activity and includes personal income.

Personal Income consists of total payroll costs (including bonuses and benefits) paid to workers, as well as self-employment income earned by individuals. This includes all income directly and indirectly supported by commercial fishing activity.

Jobs represent the number of people working full- or part-time jobs in terms of full-year equivalents (FYE). This includes all jobs directly and indirectly supported by commercial fishing activity.

EXHIBIT 14. COMPONENTS OF AN ECONOMIC CONTRIBUTION ANALYSIS



Source: Created by ECONorthwest

[8] Leonard, J., and P. Watson. (2011). Description of the input-output model for Pacific Coast fisheries. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-111, 64 p.

ECONOMIC CONTRIBUTIONS

ECONOMIC CONTRIBUTIONS TO OREGON

Oregon's commercial fishing industry, including the onshore, at-sea, and distant water fisheries, generated $271.2 million in ex-vessel value (i.e. gross revenue) during 2017, resulting in an estimated $108.7 million in labor income being paid out to an average of 1,364 employees. The majority of revenues (54 percent) earned by the Oregon commercial fishing industry were generated by catching fish in Oregon waters, then returning the harvest to onshore processors in the state.

At-sea catch of Pacific whiting and distant water fisheries are an important source of revenue for Oregon harvesters. In 2017, this accounted for 46 percent of total commercial fishing revenues for Oregon harvesters. Although these harvests occurred outside of Oregon, the income generated from these commercial fishing activities still supports economic activity in Oregon through wages paid to employees,[9] proprietor income, or payments to other industries that support the operation of Oregon's fishing vessels.

EXHIBIT 15.
Total Economic Contributions to Oregon (2017)

IMPACT TYPE	JOBS	LABOR INCOME ($M)	OUTPUT ($M)
On-Shore	1,364	$62.5	$148.2
At-Sea	-	$2.7	$5.4
Distant Water	-	$43.5	$117.5
Total Direct	**1,364**	**$108.7**	**$271.2**
Total Secondary	**5,483**	**$247.4**	**$426.7**
Total Contribution	**6,848**	**$356.2**	**$697.9**

Source: ECONorthwest calculations using data from NOAA, NMFS, and AK CFEC

In 2017 Oregon's commercial fishing industry supported $697.9 million in state economic output. This figure is up from $692 million (around 1 percent), in economic output compared to 2016. This change is primarily due to the decline in total onshore and distant water revenues during 2016 and 2017.

The economic effect of Oregon's commercial fishing industry extends beyond coastal communities by supporting economic activity in seafood processing and other support industries. Seafood processing and canning businesses are the largest industry affected by commercial fishery activities in Oregon,

as they typically purchase harvest directly from fishermen. In order to operate the vessels to generate sales, commercial harvesters spend money on fuel, vessel maintenance, insurance, and provisions for crew, which all have downstream effects in Oregon's economy. Exhibit 16 displays some of the primary industries affected by commercial fishing in 2017.

EXHIBIT 16.
Statewide Economic Contributions for Top Industries (2017)

SEAFOOD	
Output ($M)	$250.6
Jobs	1,443

WHOLESALE	
Output ($M)	$27.3
Jobs	125

RETAIL	
Output ($M)	$26.6
Jobs	402

FINANCE & INSURANCE	
Output ($M)	$37.5
Jobs	146

Source: ECONorthwest calculations using data from NOAA, NMFS, and AK CFEC.

FISCAL IMPACTS TO OREGON

In addition to supporting jobs and economic output in Oregon, the commercial fishing industry supports state revenues through permit fees, landing fees, and income taxes. Oregon collects revenues for licenses and permits sold to commercial fishers and processors. Landing fees are paid by wholesale fish dealers and bait dealers and are calculated as a percentage of the value of the fish bought from commercial harvesters. According to ODFW's budget report, the commercial fish fund, which includes licenses, permits, and landing fees collected on commercial fisheries (marine and non-marine), generated $9.9 million in agency revenues during 2017.[10] These revenues are spent on research, enforcement, and fisheries management programs.

[9] Direct jobs for at-sea and distant water fisheries are not listed in Exhibit 1,5, as we assume that some share of Oregon harvesters operate within multiplier fisheries and are therefore not additive.

[10] Oregon Department of Fish and Wildlife. (2018). Preparing for the 2019-21 Biennium. May. Retrieved from https://www.dfw.state.or.us/agency/budget/docs/19-21_ARB/19-21%20Budget%20briefing%20paper_Town%20Hall%20Version%20-%20for%20web%20post.pdf

EXHIBIT 17.
Statewide Economic Contributions by Species (2017)

NON-WHITING GROUNDFISH	
DIRECT EFFECT	
Jobs	429
Labor Income ($M)	$37.7
Output ($M)	$105.2
SECONDARY EFFECT	
Jobs	2,253
Labor Income ($M)	$78.8
Output ($M)	$114.7
TOTAL EFFECT	
Jobs	2,682
Labor Income ($M)	$116.5
Output ($M)	$220.0

DUNGENESS CRAB	
DIRECT EFFECT	
Jobs	514
Labor Income ($M)	$41.7
Output ($M)	$81.5
SECONDARY EFFECT	
Jobs	1,098
Labor Income ($M)	$71.4
Output ($M)	$130.9
TOTAL EFFECT	
Jobs	1,612
Labor Income ($M)	$113.1
Output ($M)	$212.3

PACIFIC WHITING	
DIRECT EFFECT	
Jobs	30
Labor Income ($M)	$5.8
Output ($M)	$21.8
SECONDARY EFFECT	
Jobs	676
Labor Income ($M)	$46.3
Output ($M)	$97.7
TOTAL EFFECT	
Jobs	706
Labor Income ($M)	$52.1
Output ($M)	$119.5

PINK SHRIMP	
DIRECT EFFECT	
Jobs	90
Labor Income ($M)	$1.8
Output ($M)	$12.7
SECONDARY EFFECT	
Jobs	725
Labor Income ($M)	$19.6
Output ($M)	$36.3
TOTAL EFFECT	
Jobs	815
Labor Income ($M)	$21.3
Output ($M)	$49.0

PACIFIC SALMON	
DIRECT EFFECT	
Jobs	126
Labor Income ($M)	$11.4
Output ($M)	$28.3
SECONDARY EFFECT	
Jobs	352
Labor Income ($M)	$13.3
Output ($M)	$14.9
TOTAL EFFECT	
Jobs	478
Labor Income ($M)	$24.7
Output ($M)	$43.2

ALL OTHERS	
DIRECT EFFECT	
Jobs	174
Labor Income ($M)	$10.3
Output ($M)	$21.9
SECONDARY EFFECT	
Jobs	381
Labor Income ($M)	$18.2
Output ($M)	$32.0
TOTAL EFFECT	
Jobs	555
Labor Income ($M)	$28.5
Output ($M)	$53.9

Source: ECONorthwest calculations using IMPLAN 2017 and data from NOAA, NMFS, and AK CFEC

TOTAL CONTRIBUTIONS BY SPECIES

Exhibit 17 displays the total contributions of onshore, at-sea, and distant water harvest by species. During 2017:

Non-whiting groundfish generated the largest amount of gross revenue for Oregon harvesters. Approximately 35 percent of gross revenues (direct output) were generated by Oregon commercial fishermen harvesting in Alaskan waters.

Dungeness Crab Dungeness crab continued to be a critical revenue source for Oregon's onshore commercial harvests. The 20.38 million lbs. of crab harvested in Oregon waters during the 2016-2017 season supported 1,612 jobs, $116.5 million in labor income and $212.3 million in economic output.

Pacific Whiting was the largest species by volume. The revenue per pound is considerably less than crab and groundfish, but the markup for (onshore and at-sea) processors is high, as it is processed into product forms such as frozen blocks, fillets, and surimi and is an important export commodity for Oregon's seafood industry.

REGIONAL ECONOMIC CONTRIBUTIONS

The economic contributions of Oregon's fishing industry are concentrated along the coast, with 70 percent of the economic activity occurring in the Astoria and Newport port groups. The revenue that supports this economic activity is generated by the species listed in Exhibit 17. Across all of the port groups, Dungeness crab and groundfish generate the majority of commercial fishing revenues. Exhibit 18 displays the total economic output supported across each port group for 2017.

The at-sea and distant water fisheries also serve as an important revenue source for Oregon's marine commercial fishing industry because they provide income to Oregonians (i.e. the captains and crew members). However, information is not available to distribute those revenues to onshore port groups because the hometown of the fishermen is unknown. Instead, we display the total economic output supported by at-sea and distant water fishing as its own port group in Exhibit 18.

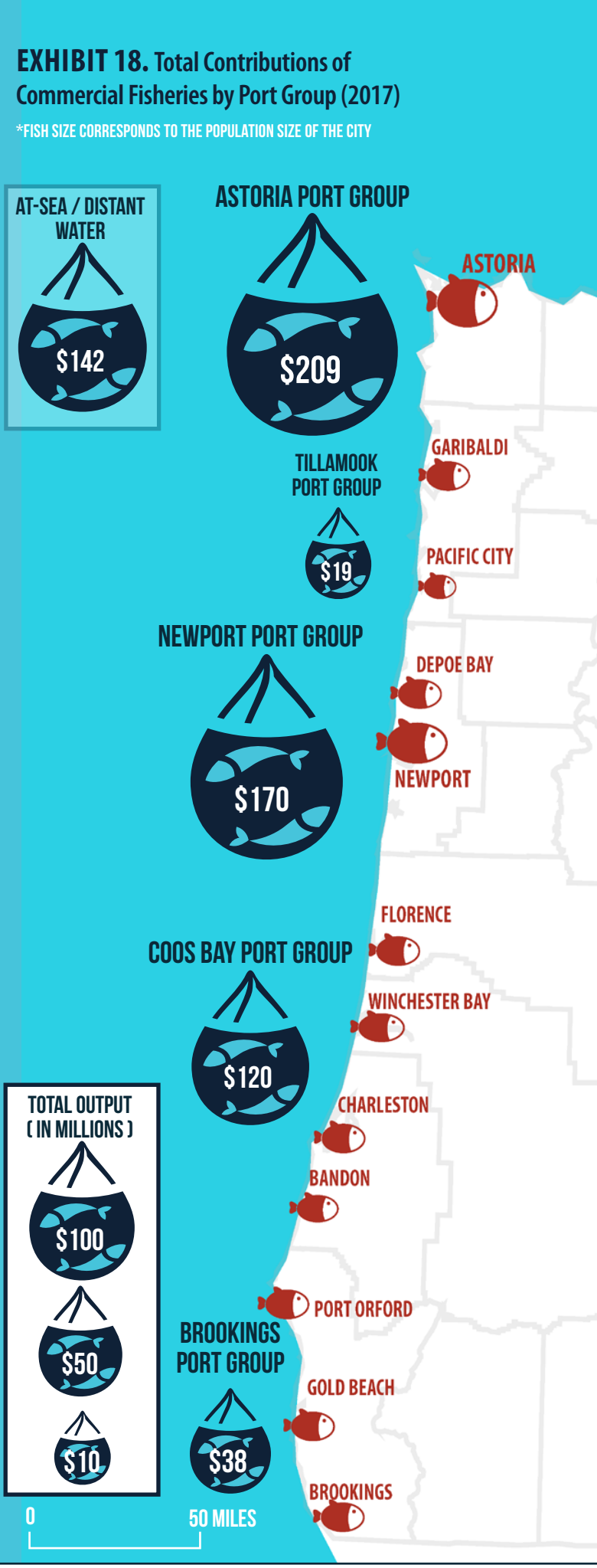
The economic contributions displayed in Exhibit 18 tell only part of the story. As mentioned previously, Oregon's commercial fisheries support economic activity beyond the state's coastal communities. Exhibit 19 displays the contributions of each port group to Oregon's coastal economy and other regions of the state. Approximately $20.1 million in total economic output and 1,510 jobs are supported elsewhere in the state's economy. This economic activity in the rest of Oregon is primarily in the wholesale and retail industries.

OTHER ECONOMIC CONTRIBUTIONS

Oregon's marine commercial fishing industry provides value beyond the economic activity associated with harvesting and processing. In addition to the economic contributions calculated by the input-output model, Oregon's marine resources provide value in the form of exports, supporting sustainable marine species populations, as well as quality of life on the Oregon coast. Although the economic value of sustainable fisheries and quality of life are not derived from a market, they are important components and contribute to the value that marine commercial fisheries create in Oregon. This value is demonstrated in various ways, including by through taxes, property values, tourism, and other mechanisms.

EXHIBIT 18. Total Contributions of Commercial Fisheries by Port Group (2017)

*FISH SIZE CORRESPONDS TO THE POPULATION SIZE OF THE CITY



Source (right): ECONorthwest calculations using data from NOAA, NMFS, and AK CFEC
Note: Economic output from at-sea and distant water fisheries are not assigned to individual port groups but are included in the statewide total.

EXHIBIT 19. Regional Contributions of Onshore Commercial Fisheries by Port Group (2017)

PORT GROUP	TOTAL EMPLOYMENT			TOTAL OUTPUT ($M)		
	COASTAL	REST OF OREGON	STATEWIDE	COASTAL	REST OF OREGON	STATEWIDE
ASTORIA	1,440	475	1,915	$201.6	$7.6	$209.1
BROOKINGS	373	40	412	$36.6	$1.4	$38.0
COOS BAY	945	332	1,277	$116.0	$4.4	$120.4
NEWPORT	1,302	540	1,842	$163.3	$6.1	$169.5
TILLAMOOK	257	123	379	$18.0	$0.7	$18.7
AT-SEA / DISTANT	-	-	1,022	-	-	$142.3
TOTAL	**4,316**	**1,510**	**6,847**	**$535.5**	**$20.1**	**$697.9**

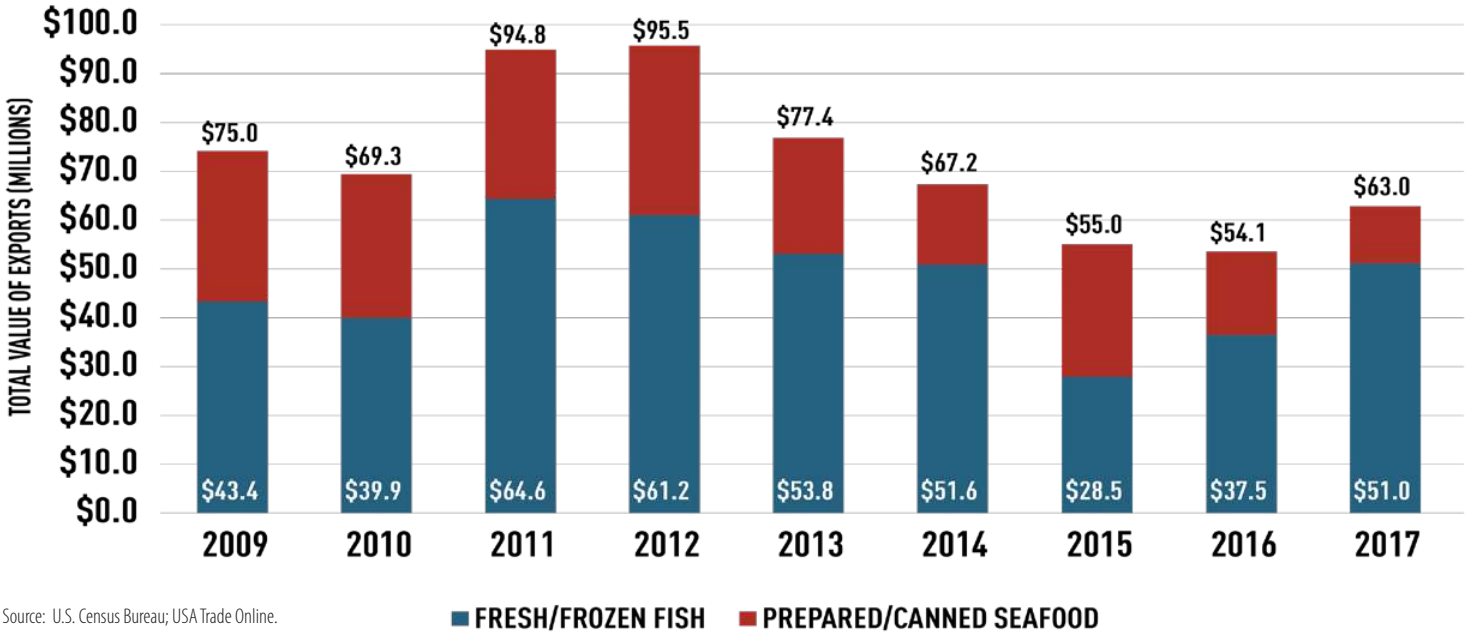
Source: ECONorthwest calculations using data from NOAA, NMFS, and AK CFEC.

Exports

Seafood is one of the world's largest traded food commodities. Oregon's commercial fisheries are part of a broader global seafood market, which helps support jobs within the state. Although not directly calculated for this study, the jobs and wages associated with exports are important to the stability and growth of Oregon's commercial fishing industry.

Oregon's seafood exports include minimally processed fresh and frozen fish, as well as canned or prepared seafood. Accessing broad commodity markets helps ensure access to a diverse customer base across both mature and rapidly growing marketplaces, which supports growth and stability in the commercial fishing industry.

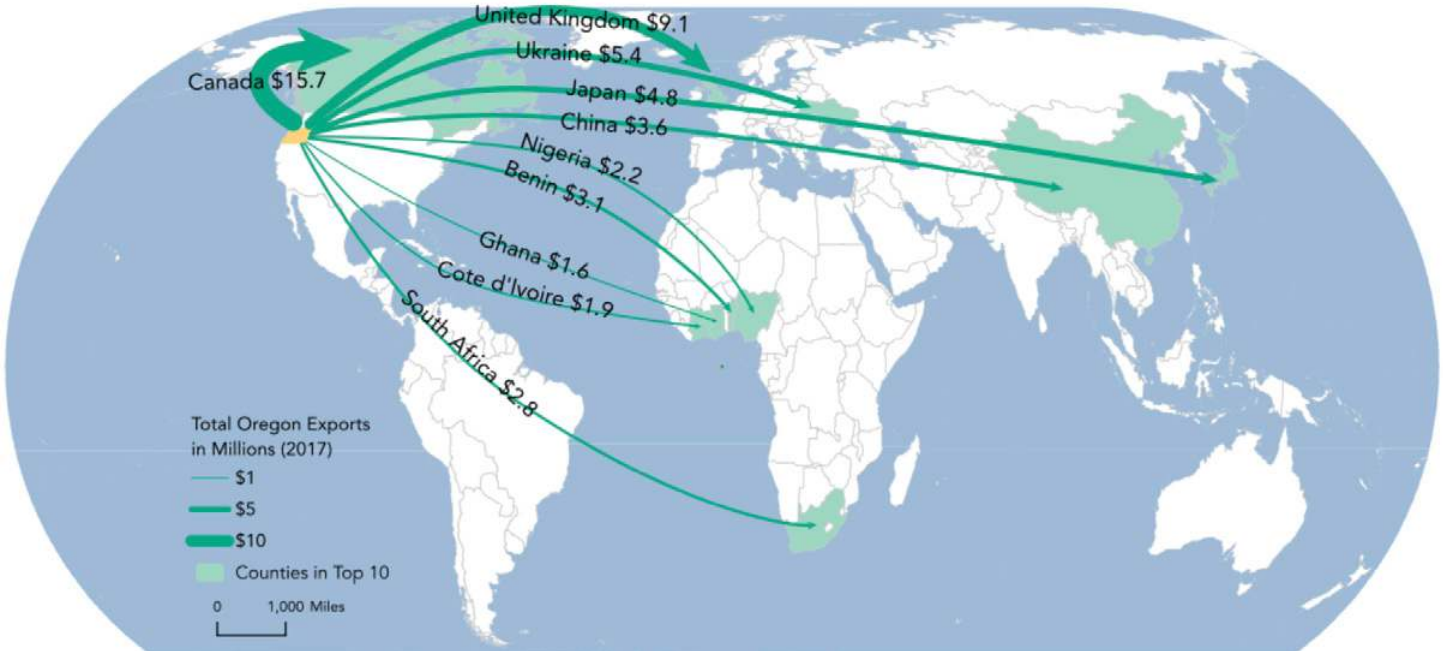
EXHIBIT 20. Total Value of Oregon's Seafood Exports, in millions (2017$)



Source: U.S. Census Bureau; USA Trade Online.

ECONOMIC CONTRIBUTIONS

EXHIBIT 21. Oregon's Top 10 Countries for Seafood Exports (2017)



Source: U.S. Census Bureau; USA Trade Online.

Foreign exports can help maintain or grow Oregon's commercial fisheries. However, agricultural products, such as seafood, can be volatile due to changes in exchange rates which affect the relative cost of U.S. seafood exports in other countries. Additionally, the market for many species is global and consumers may be sensitive to small changes in price given the availability of substitutes in the market.[11]

The data in Exhibit 20 are based on the primary activity of the establishment, however, the U.S. Census uses a system that aligns NAICS and commodity categories.[12] Oregon's seafood exports experienced a decline between 2012 and 2015, but that trend began to reverse in 2016. During 2017, Oregon exported $62.9 million worth of seafood products to foreign markets, up from $53.1 million in 2016. Most of the growth in exports in

EXHIBIT 22. Oregon Seafood Exports, farmed and commercial, 2017 (in millions)

Source: U.S. Census Bureau; USA Trade Online

[11] Chidmi, B., Hanson, T., & Nguyen, G. (2012). Substitutions between fish and seafood products at the US national retail level. Marine Resource Economics, 27(4), 359-370.

[12] National Oceanic and Atmospheric Administration, Northwest Fisheries Science Center. (2019). Outlook of adult returns for coho and Chinook Salmon. Retrieved from https://www.nwfsc.noaa.gov/research/divisions/fe/estuarine/oeip/g-forecast.cfm.

2017 and recent prior years came from the increased sales of frozen fish products, with much of the growth in 2017 coming from China and Ukraine, which showed strong growth and increased domestic demand for agricultural products.[13]

Approximately 80 percent of Oregon's seafood exports are sent to go to 10 countries, which span the globe. Exhibit 21 displays the top countries for Oregon's seafood exports during 2017. That year, Canada accounted for 25 percent of Oregon's seafood exports, primarily frozen fish. Conversely, the United Kingdom imports primarily canned, or other prepared seafood products from Oregon. Oregon also supplies seafood to Western Africa where fish remains an affordable source of protein and local markets are increasingly dependent on imports due to the depletion of local fish stocks largely because of illegal fishing by foreign firms.[14]

Exhibit 22 displays Oregon's seafood exports by the type of species. As demonstrated by this figure, marine exports are subset of exports and contribute to a broader export market that also includes farmed fish and shellfish. In 2017, Pacific whiting, salmon, and Dungeness crab account for slightly more than 60 percent of Oregon's seafood exports. Pacific whiting accounts for a larger share of seafood commodity exports than in recent years, driven by demand growth in Ukraine. In 2015 and 2016, Pacific whiting accounted for 5 percent and 6 percent of total export values, respectively.

SUSTAINABILITY

Economic contributions are inherently short-run analyses, representing only a snapshot of economic activity over the course of a year. Like other natural systems, fisheries require ongoing monitoring and investment to ensure adequate stock for harvest in future years and to meet ecosystem needs. Oregon has made innovative strides in ensuring sustainable fisheries, while also supporting investment in commercial fisheries as an important contributor to their economies.

Minimizing Bycatch

ODFW has worked to reduce the bycatch of numerous species. In 2007, Oregon's pink shrimp fishery was the first shrimp fishery worldwide to receive the certification for sustainability from Marine Stewardship Council. The certification was awarded for the state's and fishing industry's dedication to exclude at-risk species using bycatch reduction devices. In 2010, eulachon smelt was listed as endangered by the federal Endangered Species Act. Through collaborative research, pink shrimp fishermen and state scientists and managers developed significant bycatch-reducing techniques and changed the pink shrimp fishery regulations to include light-emitting diode (LED) lights placed on the net. These lights have proven to help eulachon and other fish species avoid the trawl nets while still allowing the catch of pink shrimp. The changes protect multiple species while also reducing the processing costs associated with sorting excessive bycatch out of the shrimp harvest onboard shrimp vessels and at processors.[15]

Supporting Education and Tourism

ODFW also supports tourism activities in the state through hatcheries, which draw 1.4 million people per year.[16] A booming recreational fishery industry stimulates the economy of fishing related businesses, such as sporting goods, gas stations, hotels, and restaurants.

Building Resilience into the system

Warming temperatures and increased prevalence of biotoxins have resulted in closures and delays, especially within the valuable Dungeness crab fishery. ODFW is actively working with NGO's and other state agencies to improve the ability of fisheries to adapt to a changing climate and mitigate the effects of specific threats through improved regulatory frameworks and increased management of ecosystem services.

QUALITY OF LIFE

For coastal residents, ocean fisheries provide a sense of identity and pride that allow the fishing tradition to be passed down through generations. Marine fisheries also provide community support for coastal regions of Oregon through organizations like the Fishermen's Wives Association in Newport and membership in ports and trade associations.

Having access to fresh Oregon seafood also increases the quality of life for Oregonians who expect high quality and fresh seafood to be available locally. Tourism to coastal areas is partially fueled by a desire to consume fresh seafood. For example, the Newport Seafood and Wine festival sees an average of 25,000 visitors per year in a town with a population of less than 11,000.[17]

[13] https://www.export.gov/article?id=Ukraine-Market-Overview

[14] Belhabib, Dyhia. 2017. "West Africa: Illegal fishing, the black hole in the seas". Samudra Report. pp. 20-25.

[15] Hannah, R.W. (2016). Modeling the effect of changing fishing effort and bycatch reduction technology on risk to eulachon (Thaleichthys pacificus) from bycatch mortality in the ocean shrimp (Pandalus jordani) trawl fishery. Oregon Department of Fish and Wildlife. February. Retrieved from https://www.dfw.state.or.us/mrp/shellfish/commercial/shrimp/docs/ODFW-INFO-2016-02-Modeling%20the%20effect%20of%20changing%20fishing%20effort%20and%20bycatch%20reduction.pdf

[16] Oregon Department of Fish and Wildlife. August 8, 2008 Agency Minutes. (2008). Retrieved from https://www.dfw.state.or.us/agency/commission/minutes/12/08_aug/Exhibit%20B_Attachment%206_ODFW%20Bid%20Forms.pdf

[17] https://www.kptv.com/news/on-the-go-with-joe-for-newport-seafood-wine-festival/article_9a9978c9-231c-55c8-b9e0-c0f5f0763605.html

APPENDIX

ECONOMIC IMPACT METHODOLOGY

The economic contributions calculated for commercial fisheries used the multipliers from the Input-Output Model for Pacific Coast Fisheries (IO-PAC) model, provided by Jerry Leonard Northwest Fisheries Science Center, National Oceanic and Atmospheric Association (NOAA). The IO-PAC Model is used by NOAA to calculate economic contributions from commercial marine fisheries for the Pacific Coast of the United States. This technical appendix will discuss the methodology used for input-output models generally, followed by the specific assumptions and construction of the IO-PAC Model.

Input-Output Modeling Framework

Economists have developed several approaches to measure the contributions of industries to the communities in which they operate. The most common method estimates the contribution associated with the company's spending on payroll, goods and services, and capital projects.

This expenditure approach is typically conducted within an input-output modeling framework. Input-output models are mathematical representations of the economy that show how different parts (or sectors) are linked to one another. The strengths of the input-output modeling framework include:

- A double-entry accounting framework that results in a model structure that is well ordered, symmetric, and where, by definition, inputs must be equal to outputs;
- A reasonably comprehensive picture of the economic activities within a region, with mathematical equations that describe the flow of commodities between producing and consuming sectors, the flow of income between businesses and institutions, and the trade in commodities between regions;
- Model construction using secondary source data that are gathered and vetted by government agencies; and
- The ability to cost-effectively create input-output or economic impact models for any region.

The IMPLAN modeling system was developed and has been distributed by the Minnesota IMPLAN Group, Inc. in 1993. IMPLAN is widely used and well respected. In general terms, the IMPLAN model works by tracing how spending associated with an industry circulates through an economy or study area.

Changes in one sector or multiple economic sectors trigger changes in demand and supply throughout the economy. Initial changes in the model propagate through the economy via supply- and demand-chain linkages, altering the equilibrium quantities of inputs and outputs and associated jobs, income, and value-added. These multiplier effects continue until the initial change in final demand leaks out of the economy in the form of savings, taxes, and imports.

Classifying Economic Contributions

Depending on the activity being analyzed, economic contributions (or impacts) can be classified by phases, types, and measures. Economic impact analysis employs specific terminology to identify the different types of economic impacts. The four terms of interest are as follows.

1. **Direct Impacts** are those associated with the payroll and employment. They also include the direct output (i.e. gross revenue) of the activities associated with the organization, which is estimated using an expenditure approach that sums labor and non-labor operating expenses.
2. **Indirect Impacts** are the goods and services purchased for operations (e.g. fuel purchases and boat repair). This spending generates the first round of indirect impacts. Suppliers will also purchase additional goods and services;

this spending leads to additional rounds of indirect impacts. Because they represent interactions among businesses, these indirect effects are often referred to as supply-chain impacts.

3. **Induced Impacts** are the purchases of goods and services from household incomes. The direct and indirect increases in employment and income enhance the overall purchasing power in the economy, thereby inducing further consumption- and investment-driven stimulus. Employees at the organization, for example, will use their income to purchase groceries or take their children to the doctor. These induced effects are often referred to as consumption-driven impacts.

4. **Secondary Impacts** are the sum of indirect and induced impacts or, simply, the economic effects on sectors outside of direct work on the project.

IMPLAN is used to develop the multipliers for the Input-Output Model for Pacific Coast Fisheries (IO-PAC) model, discussed further in the proceeding section.

Overview of IO-PAC Model

NOAA's Northwest Fisheries Science Center (NWFSC) created an input-output model that can estimate the gross economic contributions from the fishing industry by port. This model is known as the Input-Output Model for Pacific Coast Fisheries (IO-PAC).[18] The IO-PAC model measures the effect from changes in fish harvest to harvesting vessels, seafood wholesalers, and processors, and how they change regional economic output, income, or employment.

The following summary of the IO-PAC Model is modified from the methodology detailed in Leonard and Watson (2011). Economic contributions are estimated by IO-PAC based on port group and fish species and gear combinations. There are 32 unique species and gear combinations in the model. The production functions which define the spending patterns for each of these species and gear combinations are from survey responses to a NWFSC cost earnings survey, and include the categories of: fuel and oil; food and provisions; ice; bait; repairs, maintenance, and improvements; insurance; leased permits; purchased permits; interest; crew expense; captain expense.

To calculate the economic multipliers, IO-PAC uses the IMPLAN software (economic industry data as of 2015) and modifies the sectors based on the NWFSC cost earning survey responses. From IMPLAN, regional purchase coefficients (RPCs) are available to determine what portion of local demand for a commodity is met by local production.

To apply the IO-PAC model to Oregon, fish ticket data (records of individual landings) from Pacific Fisheries Information Network (PacFIN) maintained by the Pacific States Marine Fisheries Commission is required. PacFIN data include fish ticket and vessel registration information that are supplied by ODFW. For this purpose, the PacFIN fish ticket data are aggregated into vessel classifications to match the IO-PAC multipliers.

Comparison of IO-PAC to FEAM

Prior biennial reports for ODFW used the Fisheries Economic Assessment Model (FEAM) originally developed by Hans Radtke and William Jensen for the West Coast Fisheries Development Foundation. FEAM is also based on an underlying IMPLAN input-output model.

The following comparison of the IO-PAC model and the FEAM is adapted from Seung and Waters (2006).[19] FEAM is similar to the IO-PAC model in many ways but deviates in a few key aspects. Both FEAM and IO-PAC use fish ticket data and ex-vessel value as the primary model inputs, but the IO-PAC requires additional information, including employment, exports, and values by type of expenditure — all of which are obtained through survey data collected by the NWFSC. For FEAM, regional economic contributions are calculated by applying income multipliers from an IMPLAN model to harvester and processor incomes and expenditures.

The multiplier for each FEAM expenditure category is calculated as the weighted average of the underlying IMPLAN multipliers for the mapped expenditure categories. The IO-PAC model differs because the default IMPLAN multipliers are modified to reflect information from the survey data on the sectors of expenditures. Unlike the IO-PAC model, FEAM is not able to capture relationships where fisheries supply intermediate inputs to non-fishery sectors (such as fuel and other inputs required for fish harvesting), which may cause it to underestimate indirect and induced impacts.

[18] Leonard, J., and P. Watson. (2011). Description of the input-output model for Pacific Coast fisheries. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-NWFSC-111, 64 p.
[19] Seung, C. K., & Waters, E. C. (2006). A review of regional economic models for fisheries management in the US. Marine Resource Economics, 21(1), 101-124.

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