Oregon Commercial and Recreational Fishing Industry Economic Activity Coastwide and in Proximity to Marine Reserve Sites for Years 2018 and 2019

Technical Report

F/V Excalibur loaded trawl net. Newport, Oregon. Photo credit NOAA Fisheries.

Oregon Department of Fish and Wildlife

Suggested Citation

The Research Group, LLC. Oregon Commercial and Recreational Fishing Industry Economic Activity Coastwide and in Proximity to Marine Reserve Sites for Years 2018 and 2019, Technical Report. Prepared for Oregon Department of Fish and Wildlife, Marine Reserve Program and Marine Resource Program. June 2021.

Oregon Commercial and Recreational Fishing Industry Economic Activity Coastwide and in Proximity to Marine Reserve Sites for Years 2018 and 2019

Technical Report

prepared by

The Research Group, LLC
Corvallis, Oregon

prepared for

Oregon Department of Fish and Wildlife
Marine Reserve Program and Marine Resource Program

June 2021

(this page intentionally left blank)

Preface

This report was sponsored by the Marine Reserve Program (MR Program) and Marine Resources Program (MRP), Oregon Department of Fish and Wildlife (ODFW). The report was prepared by The Research Group, LLC, Corvallis, Oregon. Shannon Davis was the lead author who was greatly assisted by Kari Olsen. Hans Radtke (natural resource consulting economist), Gil Sylvia (marine resource economist and retired OSU Coastal Oregon Marine Experiment Station Director), and Chris Carter (retired ODFW economist) provided valuable guidance and insight in the development of methods and review of draft material.

The author and not the sponsors is solely responsible for analysis methods, interpretations, and conclusions. The author has completed other MR effect analysis projects for ODFW. This report advances material from those projects in a paraphrasing and non-attributed writing style for readability reasons. When other reports are referenced, full citations are included in a bibliography chapter.

The ODFW MRP fish managers and staff need to be acknowledged for their help in generating the summary fisheries descriptions. Tommy Swearingen (MR Program human dimension project leader) and Troy Buell (MRP fisheries management project leader) were especially helpful. Justin Ainsworth (technical and data services section manager) expertly coordinated the project for MRP. Data was provided by Eric Schindler (Ocean Recreational Boat Survey), Shari Beals (Salmon-Steelhead, Halibut, and Sturgeon Tag Return Program), Jimmy Watts (Columbia River Creel Program), and Brian Riggers and Shelly Miller (both from the Coastal Chinook Research and Monitoring Program). ODFW coastal district fish biologists also assisted. Chris Tortorelli from ODFW and Savannah Grove from ADFG provided respective state vessel and crewmember license data. Pacific Fishery Management Council (PFMC) people providing information and advice include Robin Ehlke (salmon fishery officer), John Devore (groundfish fishery officer), and Jim Seger (economist). Brad Stenberg (Pacific States Marine Fisheries Commission PacFIN representative) provided fish ticket data. Alex Manderson (Oregon Department of Agriculture, Food Safety Program) provided Oregon aquaculture information. Jerry Leonard (economist, Pacific Northwest Fisheries Science Center) transferred economy response factors. Rob Flemming and John Davidson (both from Fisheries and Oceans, Canada - Pacific Region) provided British Columbia landing information.

This report should prove helpful to understand and better deal with the challenges facing the fishing industry. Contents characterize the social and economic importance of the different fishing industry sectors. There is some information about marine related and connected business activity that benefits from having sustainable fisheries and share access to ocean and inriver locations. When it becomes necessary, results can be used by stakeholders and management agencies to shape and prioritize conservation and allocation decisions. Communities and others will be able to better plan for infrastructure necessary to gain access to the resources. Finally, contents will help design regulatory and promotional material for users and the public.

Table of Contents

List of Tables and Figures

Table of Contents (cont.)

Glossary

Acronyms

ACS	U.S. Census Bureau, American Community Survey
ADFG	Alaska Department of Fish and Game
BEA	U.S. Bureau of Economic Analysis
CCRMP	Coastal Chinook Research and Monitoring Program
CFEC	Alaska Commercial Fisheries Entry Commission
CFF	Commercial Fish Fund
CRCP	Columbia River Creel Program
CROOS	Collaborative Research on Oregon Ocean Salmon
CSF	community supported fisheries
DFO	Department of Fisheries and Oceans, Canada
EIA	U.S. Energy Information Administration
FEAM	Fisheries Economic Assessment Model
GDP	Gross Domestic Product
IO-PAC	input-output model for Pacific Coast fisheries
MR's	Oregon marine reserve system sites
MRFSS	Marine Recreational Fisheries Statistics Survey
NPFMC	North Pacific Fishery Management Council
NWFSC	Northwest Fisheries Science Center
ODA	Oregon Department of Agriculture
ODFW	Oregon Department of Fish and Wildlife
ORBS	Ocean Recreational Boat Survey
OSU	Oregon State University
PacFIN	Pacific Coast Fisheries Information Network
Port Group	AST - Astoria, TIL - Tillamook, NPT - Newport, CSB - Coos Bay, PRD - Port Orford, BRK - Brookings
PFMC	Pacific Fishery Management Council
PSMFC	Pacific States Marine Fisheries Commission
RecFIN	Recreational Fisheries Information Network
SEBS	Shore and Estuary Boat Survey
SSHSTRP	Salmon-Steelhead, Halibut, and Sturgeon Tag Return Program
TRG	The Research Group, LLC
TS	Oregon Territorial Sea
WDFW	Washington Department of Fish and Wildlife

Data Provenances

1) PacFIN annual vessel summary data, APEX reports, West Coast offshore data, and RecFIN data from the PSMFC.
2) ORBS effort and catch from ODFW.
3) SSHSTRP recreational catch from ODFW.
4) Fisheries logbook program records from ODFW.

5) Creel surveys on Elk River and Salmon River performed annually for the CCRMP from ODFW.
6) CRCP surveys on lower Columbia River performed annually from ODFW and WDFW.
7) Area income from BEA.
8) Demographic and well-being indicator data from ACS.
9) Alaska earnings by permit residency from CFEC
10) Alaska crewmember licenses, salmon and other fisheries landings from ADFG.
11) British Columbia landings from DFO.
12) Groundfish landings from NPFMC.
13) Fuel prices from U.S. Energy Information Administration.
14) Columbia River salmon landings from PFMC.
15) Aquaculture production in Oregon estuaries from ODA.
16) IO-PAC economy response coefficients from NWFSC.

Terms

Angler day	Sometimes the word "trip" is used in this report's narrative, but the unit of measurement for effort is an angler day. Trip expenditures for overnight lodging is factored into the average angler day spending. The hours actually spent fishing in a calendar day are not a consideration. The amount of money spent for the fishing experience is not appreciably different whether fishing was for a few or many hours. Literature use of the word trip is usually associated with a fishing experience duration that may be more or less than a calendar day. Trip counts in this study have been adjusted to account for multiple days when fishing occurred during a single trip.
Catch recreational	The term catch used in this study is retained fish. Catch is expanded to include non-retained fish counts using angler preference survey factors in order to calculate total effort using success rates. Success rates are angler days per retained and non-retained catch. Catch per unit effort is the multiplicative inverse of success rates.
Distant water fisheries	The distant water fisheries are the West Coast offshore fishery, Alaska fisheries, western Pacific highly migratory species fishery, fisheries in Washington and California, and elsewhere. Revenue generated from vessel deliveries in Oregon is referenced in this report as "onshore." Revenue returned to Oregon in the form of wages and salaries or profits and revenue derived from expenditures made in Oregon for repairs, provisioning, or moorage is referenced in this report as "distant water" fisheries revenue. For example, the revenue generated from the at-sea deliveries for the Pacific whiting fishery is categorized as distant water fishery revenue. Another example is Oregon residents own harvesting permits in Alaska, but keep vessels year around at Alaska ports. Sometimes owners will lease permits for others to harvest the permit quota shares. Distant water fisheries income can be centered at coastal communities where businesses sell goods and services to participants and the business labor has residency in those communities.

Some income for distant water fisheries is directly returned to Oregon via crewmember and permit/vessel owner participant earnings. Participants may live on the Oregon Coast or elsewhere in Oregon.

Dollar adjustments

Where dollar values are noted to be real, the adjustment index was the GDP implicit price deflator developed by the U.S. Bureau of Economic Analysis.

Economic contribution

Economic contributions include effects of harvesting and primary processing. The estimates include direct, indirect, and induced impacts, therefore include "multiplier effects." New fishing vessel construction, fishery management, and fishery research and education are not included.

An economic contribution metric relates to a short-term perspective for how an industry is represented in the local economy. If there is a change in the economy's industry activity, there may very well be adjustments in the longer term that may cause increased economic contributions. For example, a tourism business start-up may replace a fishing industry business closure.

Economic contributions and economic impacts are sometimes used interchangeably in literature. Other authors will differentiate the two terms - the latter being reserved for defining a short term disruption in economic activity. An example would be the lost commercial fishing economic activity due to implementing marine reserves if there was no replacement activity.

The economic contribution measurements selected for this study are income, jobs, and output. It could just as well have been other metrics that would describe the same economic direct and secondary effects, but in a different dimension. Other example metrics are taxes generated.

Economic modeling

Prior to 2016, the model used to calculate economic contributions was the Fisheries Economic Assessment Model (FEAM). The FEAM was originally developed by Hans Radtke and William Jensen for the West Coast Fisheries Development Foundation in 1988. The estimates include direct, indirect, and induced impacts, therefore include "multiplier effects." The FEAM relies on response coefficients from IMPLAN to estimate household income generated from harvester and processor activities. The FEAM has been useful because much of the commercial fishing industry information is not described in published employment data. Participants are mostly contractors that are not covered in employment insurance programs and do not show up in employment by industry data. They are included in BEA data in the general self-employed category. The Research Group, LLC updated the FEAM periodically using new fleet and processor structural information, changed industry cost-earnings profiles, and new data IMPLAN models. The FEAM methods are described in Seung and Waters (2006). Application of the FEAM adjusts fisheries' multipliers to the current year's harvest prices.

IMPLAN is a product of IMPLAN Group LLC, 16740 Birkdale Commons Parkway, Suite 212, Huntersville, NC 28078.

Starting in 2016, the economic model used to calculate economic contributions is the input-output model for Pacific Coast fisheries (IO-PAC), which is maintained by the NMFS Northwest Fisheries Science Center. The model was designed to estimate the changes in economic contributions and economic impacts resulting from policy, environmental, or other changes that affect fishery harvest. IO-PAC was built by customizing IMPLAN software. The development and design of IO-PAC is documented in detail in Leonard and Watson (2011). Discussions about the similarities and differences between FEAM and IO-PAC are found in SSC (2009). The PFMC now uses the IO-PAC instead of the FEAM for analyzing management alternatives.

Basic economic impact analysis attempts to sort out the driving economic activities in regional economies (Scott 1984). Local industries with markets outside of the region bring new money into the region and are called basic industries. Industries with markets within the region are called secondary or support industries. Thus, when there is an increase in spending in basic industries, there is a resultant increase in secondary industries. Trade leakage occurs when spending and respending for labor, supplies, and services occurs outside the region. The relationship between an activity's total impact on the region's economy that includes the effect from the secondary industries, and the basic industry, is known as the "multiplier effect." In the vernacular of input-output modeling terminology, the total impact on an economy included the direct, indirect, and induced effects of the activity. Economic contribution results are reported at the coastwide and statewide economy level. The statewide income and output measured economic contribution will be higher because of reduced trade leakage. See glossary description of jobs for an explanation why statewide equivalent jobs may be lower than coastwide. One-off capital purchases and construction type projects are precluded in the economic contribution modeling.

Fisheries engagement

While this report's purpose is to describe commercial and recreational fisheries economic activity, a broader context for how the activity is embedded in the social fabric of communities is offered. The brief context is provided using secondary demographic and well-being indicators (source is ACS) and three indexes of fisheries engagement. The demographic and well-being indicators at port groups in 2018 are generally: population (age, ethnicity), households (numbers, size), housing (costs, vacancy, second-home, tenure), labor force (employment in occupations and industries, unemployment), wealth (income sources, poverty), and education. Fisheries engagement is measured by the economic contribution generated (measured by income including multiplier effect) from commercial and recreational fishing activity. The fisheries engagement indexes are regional economy reliance (measured by economic contribution divided by area total earnings),

	fisheries dependency (measured by the ratio of nearshore fisheries commercial landings divided by total landings), and social vulnerability (measured by the Shannon Index of occupational diversity). Index port group rankings for Year 2018 are described.
Harvester and processor revenue	Harvest value and price (sometimes called ex-vessel revenue) is the amount paid to fishers at the time of fish delivery to processors or when sold directly to the public. The term is analogous with farm-gate value which is revenue received by growers for agricultural products. The term ex-processor revenue is from the wholesale price fetched by processors for manufactured seafood products.
Homeport vessels	Homeport vessels are where a majority of landings measured by ex-vessel revenue occurs. Oregon homeport vessels can deliver to other states (such as Astoria area vessels delivering to Ilwaco processors) and other state homeport vessels can deliver to Oregon processors.
Output	Industry output is a technical term that is not analogous to sales. It is a measure of annual production with only the margins of some sectors included. For manufacturers, the value would be sales plus/minus change in inventory. For service sectors production would be sales. For retail, wholesale, and transportation, output is margins. Margins represent the value in delivering commodities from producers' establishments to purchasers. The output measurement tends to convey an inflated notion of economic activity by including non-local cash flows and is subject to double counting. The term does not provide meaningful insight on what might be a change to the size of the economy. For understanding change and using measures to compare alternative actions or policies, the more appropriate terms are income and jobs.
Income	Income accrues to households in the form of net earnings (sometimes called earned income) from wages, salaries, proprietorship income, etc. For example, it can include the contract payments based on share of catch value that is paid to a commercial fishing vessel crewman/skipper and the net income after operating and fixed expenses for the vessel owner. Total household income would include other sources such as transfer payments (e.g. social security, unemployment insurance, etc.) and investments (e.g. rental income, dividends, interest, etc.). There can be small differences between total income in area that is from households and the area's total personal income because of how BEA calculates the income.
Inriver	Coastal rivers' inriver trips are in lower rivers or bays. Columbia River inriver trips are in the estuary, tributaries to the estuary, and the mainstem Section 10. The popular "Buoy 10" fishery is included in Columbia River trips. The only trips included at inriver locations are when the catch was

Chinook or coho salmon, steelhead, sturgeon, or other marine species. Trips when trout and other resident species are not included.

Jobs

Statewide and regional average annual earnings per job are computed by dividing the economies all industry earned income estimates by total full-time and part-time jobs estimates. Average earnings per job within industries involving more part-time work is lower than industries involving more full-time work, although there could be little difference in the underlying wage of full-time workers. Since average earnings per job are just a simple average, it does not account for variations in the distribution of earnings among high-pay vs. low pay jobs. Jobs at the statewide level include jobs within all coastal communities plus jobs in the rest of the state. Since average earnings statewide are much higher than coastwide, the reported statewide jobs may be lower than coastwide despite income being higher.

The Oregon Employment Department annually estimates direct employment for the harvest and processor sectors. The estimating methods survey data and harvest deliveries are necessary since harvest sector captain and crew positions are exempt from unemployment insurance coverage programs. Moreover, processor worker positions are sometimes provided by temporary labor service firms which do not report employment in a seafood industry category.

Value added

Input-output modeling value added equals output (sales or receipts and other operating income plus inventory change) minus intermediate inputs (consumption of goods and services purchased from other industries or imported). Value added will be from direct, indirect, and induced business activity. It is a measure of the contribution to GDP made by an individual producer or industry. A value added calculation for this study was made only for the processor sector direct impacts. The calculation for indirect and induced impact value added was not made.

Multiplier effect

Basic economic impact analysis attempts to sort out the driving economic activities in regional economies (Scott 1984). Local industries with markets outside of the region bring new money into the region and are called basic industries. Industries with markets within the region are called secondary or support industries. Thus, when there is an increase in spending in basic industries, there is a resultant increase in secondary industries. Trade leakage occurs when spending and respending for labor, supplies, and services occurs outside the region. The relationship between an activity's total impact on the region's economy that includes the effect from the secondary industries, and the basic industry, is known as the multiplier effect. In the vernacular of input-output modeling terminology, the total impact on an economy included the direct, indirect, and induced effects of the activity.

Marine reserve system	Ocean areas within the Territorial Sea set aside for research and management effectiveness monitoring. Oregon's five legislatively recognized areas have unique management specifications for non-take zones (referred to as marine reserve area) and selective take zones (referred to as marine protected area).
Nearshore area	The part of the continental shelf closest to shoreline and includes an intertidal zone. The intertidal zone extreme is the high tide splash zone and includes lower bay saline dominated estuarine waters. Some nearshore fisheries have management specifications using depth restrictions. Management depth closures can vary during the year.
Nearshore species	The fisheries chosen to represent nearshore fisheries are Dungeness crab, salmon troll, and nearshore groundfish. Nearshore groundfish species include selections of rockfish, roundfish, and flatfish. An estimate of the nearshore harvested portion of lingcod is included. The landings for lingcod were determined using species and gear filter queries to include open access landings with longline, other hook and line, or pot gear; and limited entry landings with longline, other hook and line, or selective FF trawl (small footrope) if it was on the same fish ticket with black or blue rockfish or certain other nearshore species. The criteria used to select species that are nearshore groundfish is discussed in TRG and GMC (2012). The selection is inclusive of State managed nearshore species for which an Oregon Nearshore Fishery Permit is needed. There are other federal managed species in the selection that are typically caught in nearshore areas. Some report tables only show nearshore species harvests for vessels that have an Oregon Nearshore Fishery Permit. Other tables' content is for all selected nearshore species determined without filtering on vessels associated with permits.
LE and OA groundfish permits	Limited entry and open access refer to federal permit types that allow nearshore groundfish to be harvested either as a directed fishery or incidental in other fisheries. The LE permit types have gear restrictions for being trawl (bottom net, mid-water net, etc.) or fixed gear (longline, pot, etc.). Only a prior qualified vessel can be used to hold a LE permit. Open access is a misnomer in that a permit still needs to be acquired and associated with a vessel. An Oregon Nearshore Fishery Permit is required to harvest certain groundfish species up to maximum bimonthly limits set by ODFW. There can be small harvests per trip made without the permit. The permit is limited entry. ODFW (June 2020) has a detailed description about permit requirements and discusses landing histories and fishery management. There are agency and many scholarly reports about the federal limited entry groundfish permits including NOAA Fisheries (2017), Lian et al. (2009), Pfeiffer and Gratz (2016), Holland et al. (2017), and Holland (2020).
Oregon Territorial Sea	The ocean that is three nautical miles seaward of shoreline. The seaward extent can be approximated to be the 30 fathom depth contour along the Oregon Coast (ODFW 2016).

Shannon index	The Shannon index is a measure of the occupational diversity within a community. Occupation data is compiled at the ACS 17 categories level. Less occupational diversity would mean higher vulnerability for accommodating worker adaption change. With little occupational diversity, community members may be forced to look for work elsewhere when there are job losses within their particular occupation. The index was originally proposed by Claude Shannon to quantify entropy (Shannon 1948). It is more commonly used to describe diversity in physical systems, such as species in a given marine environment.
Commercial fishing trips	Trips are approximated using fish tickets. A fish ticket represents the landing of fish or shellfish product from one fishing trip. Ticket counts may not reflect fishing trips, because multiple tickets can be issued for a single trip when a vessel delivers to more than one dealer after returning to port, and vessels issue tickets when a sale is made directly to the public. Trip undercounts could occur in the occasion when tendering services are used because more than one vessel's harvest could be combined onto a single fish ticket. Delivery counts are not additive across fisheries because a fish ticket may include more than one species.
Recreational fishing trips	Sometimes the word "trip" is used in this report's narrative, but the unit of measurement for effort is an angler day. The hours actually spent fishing in a calendar day are not a consideration. The amount of money spent for the fishing experience is not appreciably different whether fishing was for a few or many hours. Literature use of the word trip is usually associated with a fishing experience duration that may be more or less than a calendar day. The data source for ocean trips is ORBS which is a sampling program for boat trips. An angler day is the result of counting the anglers on the boat trip and expanding the sampled trips to represent all ocean fishing trips. The data source for inriver trips is translating catch using representative success rates. Success rates are from literature supplemented from ODFW annual creel surveys.
Recreational fishing mode	The mode can be charter boat, private boat, shore/bank fishing, or diving. A charter boat is owned by a private business which provides for-hire services on daily and fishing season schedules. The services are usually recreational fishing, but can for non-angling trips such as whale watching or just touring. The boat may make more than one trip per day depending on the distance to fishing grounds. Private boats do not provide for-hire services, although it is not uncommon that friends and relatives on the trip contribute to cost reimbursement. Shore/bank fishing distinguishes an angling trip when the fishing opportunity will not rely on a boat. It can occur on piers and water shorelines. Dive trips can originate from a boat or shore. There are very few ocean bank or dive fishing trips in Oregon and they are not included in the analysis.

Recreational target fishery	Trips are categorized by which species groups comprise retained catch. If there is a plurality of groups in the catch, then assumptions are made which group defines the target category. For example, trips resulting in a catch of both salmon and bottomfish are in the salmon category. The data source for ocean trips identifies trips when crabbing occurred. However, most of the those trips are made in combination with other target fisheries. It is assumed the finfish catch in the other fisheries defines the target category.
Spillover effect	Increased fish production from ecological functions occurring within MR sites that may result in increased recreational angler and commercial catch outside of a MR site.
Typical and representative averages	Typical are averages for only the actual number of vessels that had landings in a particular fishery. Representative are averages for all vessels regardless of whether they had landings in a particular fishery.
Port Group	The following table lists the major ports, acronyms, Census Bureau geographic areas (cities, counties, and zip code areas), and river/streams that are mapped to port groups. Area economic data is used for showing commercial fisheries (distant water fisheries are included) representation in local economies in 2019. Demographic and well-being data is used to show an area's commercial (distant water fisheries are excluded) and recreational fisheries engagement in 2018. (The time disparity is due to data availability.) Both measures have their unique purpose in showing the importance of fisheries in an area and how different Oregon Coast areas contrast.

Discussions of fisheries importance include showing historical trends and variability for the measures.

Port Group	Area Economic Data	Cities and Source of Demographic/Well-being Data	Major Rivers and Streams
Astoria (AST)	Clatsop County	Astoria, Hammond/Warrenton, Gearhart, Seaside, and Cannon Beach. Clatsop County used for Census Bureau data.	Columbia, Klaskanine, Lewis and Clark, Youngs, and Necanicum rivers; Big Creek, Gnat Creek, and Bear Creek
Tillamook (TIL)	Tillamook County	Tillamook, Garibaldi, Netarts, and Pacific City. Tillamook County used for Census Bureau data.	Tillamook, Kilchis, Miami, Nehalem, Nestucca, Trask, and Wilson rivers
Newport (NPT)	Lincoln County	Newport and Depoe Bay. Lincoln County plus zip code 97439 used for Census Bureau data.	Yaquina, Siletz, Alsea, and Salmon rivers; Big Elk Creek, Drift Creek
Coos Bay (CSB)	Coos County	Coos Bay, Florence, Winchester Bay, and Charleston. Coos County plus zip code 97467 used for Census Bureau data.	Siuslaw, Umpqua, Smith, Coos, Slough
Port Orford (PRD)		Port Orford. Zip codes 97465, 97476, and 97450 used for Census Bureau data.	Elk and Sixes rivers
Brookings (BRK)	Curry County	Brookings and Gold Beach. Curry County less Port Orford zip codes used for Census Bureau data.	Chetco and Rogue rivers

(this page intentionally left blank)

I. Introduction

This report was prepared for the Oregon Department of Fish and Wildlife (ODFW), Marine Reserve Program (MR Program) and Marine Resource Program (MRP). The MR Program is responsible for monitoring the effects from establishing five marine reserve areas (MR's) in the Oregon Territorial Sea (TS). The MRP provides management and research services for ocean and estuary fish, wildlife, and habitat resources. The information in this report updates information about overall trends in the Oregon fishing industry, and more specifically, describes the nearshore fisheries that would most likely be affected by MR management.

This report contents are economic activity descriptions for Oregon commercial fisheries (Chapter II) and marine recreational fisheries (Chapter III). The descriptions are for recent year trends that are current through 2019. The commercial and recreational nearshore fisheries receive a more detailed description (Chapter IV) in order to provide updated information about possible effects caused by managing the Oregon Marine Reserve (MR) system. The nearshore fisheries chapter contains an estimate of the maximum potential economic impact due to Oregon marine reserve system management. There is a nearshore fisheries fleet description section within the chapter that describes the heterogeneity of participating vessel and processor sectors. The chapter also contains some comments about whether fleet response to marine reserve management is subsumed by other participation decision factors. Finally, the nearshore fisheries description is supplemented with information about the social fabric in communities where the fisheries occur.

Dungeness crab juveniles in a photo taken near Port Orford, Oregon. Photo credit Aaron Galloway, Assistant Professor, University of Oregon, Oregon Institute of Marine Biology.

This report is an update to TRG (November 2018) that was done for the previous biennium years 2016-2017. More complete related reports that have glossaries, methods descriptions, and additional analysis results are TRG (September 2015a and September 2015b) for commercial and marine recreational fisheries, and TRG (February 2018) for nearshore fisheries.

The economic activity descriptions include estimates for economic contributions which include the "multiplier effect." The economic contributions are measured by household income, equivalent full and part-time jobs, and output. Jobs are spread across all sectors of the economy. For commercial fisheries, the economic activity is from harvesting and primary processing sectors. For recreational fisheries, the economic activity is from angler trip expenditures. In years prior to 2016, commercial fisheries economic contribution estimates in such publications as TRG (September 2015a) came from an economic impact model titled FEAM. For this report,

a new model titled IO-PAC is used to provide the commercial and recreational fisheries economic contribution estimates starting in 2016.[1]

Commercial fisheries activity information is from logbook programs and fish ticket programs. The fish ticket data was received in downloads from PacFIN. Landing volume is expressed in round pound equivalents. This is an adjusted weight to account for some fish being partially processed (such as headed and gutted) prior to making a delivery (selling to a processor or selling directly to the public). There was an unresolved data issue whereby sablefish caught with fixed gear volume is landed pounds rather than being adjusted for a small amount of catch being partially processed. All fisheries values (such as ex-vessel revenue and angler trip expenditures) are expressed in 2019 dollars except where noted otherwise. The dollars have been adjusted using the GDP Implicit Price Deflater developed by the U.S. Bureau of Economic Analysis.

Two levels of economic contribution are estimated. The first is for Oregon coastal economies and the second is for the whole Oregon economy. Since the State-level economy is much larger and actually includes the seven coastal counties, the economy will capture a much greater portion of total expenditures.

Commercial and recreational fisheries vicinity maps are shown in Appendix B. Map B.1 shows port group regions and salmon management areas. Maps B.2 and B.3 show watersheds included in compiling recreational trips in lower estuaries that target anadromous fish on the Columbia River and Oregon Coast. The location of the MR sites are shown on Map B.4. Map B.5 shows the TS boundary and 30 fm isobath.

1. See this report's glossary entry "economic modeling" for a description of the FEAM and IO-PAC models.

II. Commercial Fisheries

A. Onshore and Distant Water Fisheries Economic Activity

The Oregon commercial fishing industry onshore harvest value was $160.7 million in 2019 which was a decrease from $175.0 million in 2018 (Table II.1). However, the harvest value was slightly above the previous five-year average of $160.1 million.[1] Different fisheries had ups and downs compared to previous years.

- The *ocean salmon fishery* harvest volume in 2019 (412 thousand pounds) was a continuation for five years of depressed landings. The aggregate annual price for the ocean Chinook fishery was $5.74 in 2019 which was 23 percent less than received in 2018. The *non-treaty plus treaty Columbia River gillnet Chinook fisheries* landings in 2019 were 496 thousand pounds. The *non-treaty and treaty Columbia River gillnet coho fisheries* landings in 2019 were 132 thousand pounds. The non-treaty Chinook price in 2019 was $4.07 which was a price drop from $6.03 received in 2018. The non-treaty coho price decreased to $1.74 in 2019 from $1.96 in 2018. The treaty Chinook and coho prices similarly fell. Oregon wild capture salmon is a specialty product and can be sensitive to price increases when supplies are low. Early ocean and Columbia River spring Chinook prices can be much higher than when higher volume fall Chinook supplies hit the market. Combining the salmon fisheries results in a harvest value of $4.3 million ($2.3 million for the ocean salmon fishery and $2.0 million for the Columbia River salmon fishery) in 2019. The ocean Chinook salmon fishery south of Cape Falcon (five miles south of Cannon Beach) is constrained by continued contributing stocks weakness: moderate returns to Oregon coastal rivers, record low returns to the Klamath River, and low returns of the ESA listed Sacramento River winter-run.
- Many ocean salmon fishery vessels also participate in the troll gear *albacore tuna fishery* (218 vessels participated in the ocean salmon fishery in 2019, 329 vessels had deliveries of tuna, and 122 vessels participated in both the ocean salmon fishery and the tuna fishery). Tuna volume was up slightly in 2019 (6.6 million pounds) as compared to 2018 (5.8 million pounds), but prices decreased in 2019 ($1.65) as compared to 2018 ($1.70). The harvest value of the fishery was $10.8 million in 2019 and $9.9 million in 2018.
- The *Dungeness crab fishery* (usually the highest vessel revenue generating fishery for Oregon) had a very good season at $67.0 million harvest value. The average 2019 price ($3.58) was up over 2018 ($3.26). The 2018-2019 season which normally would have opened on December 1, 2018 was delayed until January 4, 2019 north of Cape Argo; south of Cape Argo did not open until February 1, 2019. Delays can be due to crab health and minimum meat recovery rates. (Minimum meat recovery yields were 23 percent north and 25 percent south of Cascade Head in 2019). Bad winter weather will also delay harvesting.
- The *pink shrimp fishery* harvest landings were down in 2019 (26.9 million pounds) as compared to 2018 (35.9 million pounds). Only year 2017 harvest was lower in the last 10

1. Volume is expressed as round pounds. Weight for species delivered dressed is converted to a round weight equivalent. Prices are averaged across fishery seasons and across delivery size and condition.

years. Seventy-eight vessels participated in the pink shrimp fishery in 2019. Prices (season and size average) were steady in 2019 ($0.74) as compared to 2018 ($0.76). The fishery harvest value was $19.9 million in 2019 and $27.4 million in 2018. The steady price per pound in 2019 was helped by harvests having average age composition: 70 percent age one, 27 percent age two, and 3 percent age three.

- The *groundfish fishery* (other than sablefish and whiting) quotas have been trending upward in recent years. This was partially due to lifting restrictions on some species previously classified for being in overfished status. However, landings in 2019 slightly decreased to 42.6 million pounds compared to 45.5 million pounds in 2018. Prices for nearshore groundfish landed live decreased a little in 2019 ($3.12 per pound) compared to 2018 ($3.27). Aggregate prices for flatfish (soles, flounders, etc.) and rockfish landed dead also slightly decreased in 2019 from 2018. With the mix of volume and decreased prices, the harvest value was lower in 2019 ($18.7 million) than in 2018 ($20.1 million).
- The trawl and fixed gear sectors allocated *sablefish* (also called black cod) fisheries comprise about half the harvest value of the overall non-whiting groundfish fishery. Sablefish volume was up slightly in 2019 (6.2 million pounds) as compared to 2018 (5.7 million pounds), while the two-gear harvested average price was about 20 percent less ($1.76 versus $2.16) over this one-year period. The sablefish price has not returned to the record level prices received in 2011. Sablefish harvest size in six categories sets the ex-vessel price with fish up to 4 pounds fetching higher prices. Most sablefish harvests are exported to Japan, however there is some resurgence in domestic food service markets. A current management issue is considering placing limits on the proportion of the LE trawl sector allocation that can be harvested using gear switching.
  Using fixed gear to target sablefish can be profitable, but has the effect of lowering harvests in the other groundfish mixed stock fishery (Krigbaum et al. 2021). The other groundfish fishery can be constrained if quota pounds are not available to cover the sablefish bycatch.[1]
- The strong 2010 and 2014 year classes in the *Pacific whiting fishery* raised quotas in the late 2010 years. Onshore landings in 2019 (222.2 million pounds) were more than double the landings in Oregon than in 2015 (94.9 million pounds). More surimi was produced in 2019 as compared to several years ago which means processors cannot afford to pay harvesters as much as when headed and gutted is the product form. There was continued demand in 2019 for a new product form frozen, whole, and boxed that is shipped to Africa markets. Prices were steady in 2019 ($0.098) as compared to 2018 ($0.090). The harvest value was $21.7 million in 2019 as compared to $16.7 million in 2018.
- There was an unusually high volume of *market squid* in 2019 (5.2 million pounds) and 2018 (7.0 million pounds). The delivery price was $0.55 per pound in 2019 which was an increase of $0.10 received in 2018. Market squid is harvested using purse seine gear with lights (sometimes on a separate light boat) to attract the fish. There were 23 vessels delivering market squid in 2019 of which 8 were unique for delivering to Newport port group, 4 were unique to Coos Bay port group, and 11 delivered to both port groups.

1. Sablefish gear switching trends and management is summarized in PFMC (April 2021). Limiting gear switching is a current PFMC controversial management topic and there are many background and analysis documents available that describe the issue.

Market squid was the majority of revenues for 18 of the 23 vessels which means they were probably commuters from Puget Sound, southern California, or Alaska areas. (Oregon does not have other fisheries prosecuted with purse gear, although several Oregon based vessels are investing in the gear specifically to take advantage of the market squid fisheries opportunity.) The mean and median annual harvest value per vessel was $125.3 thousand and $54.0 thousand respectively. Harvests are largely trucked to southern California to be processed into bait. The processed bait is used in the Oregon Dungeness crab fishery.

- The *Pacific sardine fishery* was restricted to a research and incidental fishery in 2019 as resource abundances have disappeared from what they were a few years ago. Other coastal pelagic species have had significant landings in the past. However, other than jack mackerel in 2019 (1.0 million pounds), no other species were significant. It could be abundances did not make targeting viable or processors were reluctant to purchase harvests.
- The other notable Oregon fisheries in 2019 were *hagfish,* also called slime eel (1.6 million pounds, $1.7 million harvest value), *Pacific halibut* (252 thousand pounds, $1.2 million), *red sea urchin* (181 thousand pounds, $570 thousand), *gaper clam* (318 thousand pounds, $275 thousand), and *basket cockle* (334 thousand pounds, $416 thousand).[1]

Table II.2 shows harvest value by port groups in 2018 and 2019. Only the Astoria port group increased harvest value in 2019 (29 percent) as compared to 2018 (25 percent). There was a slight increase of harvest share at Newport to 37 percent. Newport is the highest harvest value landings port group in Oregon and 14th in the nation in 2019 (Table C.9). Coos Bay and Brookings (includes Port Orford) shares decreased in 2019 from 2018.

The commercial fishing vessel fleet can be described in terms of total unique vessels making deliveries, whether the deliveries are being done by active vessels, and the number of homeport vessels making deliveries. An arbitrary choice of $500 harvest revenue is used to define active and inactive. The active and inactive category is an attempt to sort out whether there was a serious choice based on economic criteria to participate in a directed fishery and make landings at an Oregon port. A homeport vessel is the port group where a plurality of Oregon harvest value is delivered. Another category would be a vessel licensed and having attached fishery permits, but does not make deliveries for a variety of reasons such as breakdowns. The category might also be out-of-state registrants who simply want the flexibility to make landings at Oregon ports.

Table II.2 shows the 2019 harvest value represents revenue for 941 different vessels making 23,128 deliveries to Oregon ports. The 2019 counts are about the same as vessels and deliveries (949 and 24,528) in 2018.[2] Of those unique vessels making deliveries, 884 were active vessels.

1. Commercially harvested shellfish (such as razor clams, gaper clams, and basket cockle) is included in onshore delivery data, therefore included in economic contribution estimates. Aquaculture products such as Pacific oysters grown in estuaries are not included in the fish ticket database and must be treated separately for modeling economic contributions.
2. The 2018 and 2019 counts are down from 3,737 homeport vessels (2,498 active) making landings in 1981.

There were 1,570 vessels and 1,237 crew licensed in 2019 (Table C.10). The port with the highest ratio for "staying-at-homeport" is Port Orford. Coos Bay has a lower ratio being a regional fisheries center that vessels with other homeports will make deliveries. Astoria and Newport would also be considered regional fisheries centers. Some vessels participating solely in distant water fisheries use the regional fisheries centers for moorage, provisioning, and repairs, but do not show up in homeport vessel statistics because most of their landings are not in Oregon.

There were 23.1 thousand deliveries from ocean catch areas including unidentifiable vessels in 2019 to Oregon ports (Table II.3). The overall number of deliveries has been fairly steady over the last five years, however the new market squid fishery deliveries did jump in the last couple of years. The deliveries in the last five years are about half of the 1980's averages.

The average revenue for active vessels (harvest revenue more than $500) was $179,572 in 2019 (Figure II.1). The active vessel median revenue was $38,897 in 2019. The significant differences between the average and the median indicate that the industry is comprised of mostly lower revenue producing vessels and lesser numbers of high revenue producing vessels.[1] There have been increasing and decreasing years for average revenue which is partially explained by participation in salmon fisheries. For example in 2014, there was increased salmon abundance, more vessels returned to the fishery, and the revenue average decreased.

There were 110 processing plants, restaurants, etc. that each purchased at least $10 thousand of Oregon landings in 2019. There were 21 first buyers that purchased more than $1 million (Table C.4). The top five parent processing companies purchased 75 percent of landings measured by harvest value in 2019.[2] The new processor facility at the Port of Brookings Harbor with a pink shrimp line constructed by BC Fisheries, LLC was recently being operated by Pacific Seafood Group. Landings at ports do not always correspond with processing occurring at those ports. Buyers will transport the landings to central processing facilities that can be in Oregon or other states.

Oregon onshore landings from harvests in the Pacific Ocean and Columbia River catch areas are processed into seafood products that are sold locally or are shipped to high volume processing and distribution centers. The seafood products enter niche or commodity markets, both domestic and global. Those commodity markets include product substitutes that influence the price paid to processors and distributors that buy from Oregon harvesters. For example, many of the species landed in Oregon also are landed in greater numbers in Alaska and British Columbia (BC). For a comparison, Oregon's harvest value in 2019 was only six percent of all U.S. West Coast, Alaska, and BC landings. Some Oregon fisheries have high harvest value proportion in this northern Pacific Ocean area, such as Dungeness crab at 23 percent and pink shrimp at 62 percent in 2019 (Appendix Table C.11).

---

1. Another statistic showing revenue heterogeneity is 79 percent of vessels had less than $100 thousand harvest value in 2015 and their landings were 17 percent of all harvest value. Conversely, this is 21 percent of the vessels in 2015 had 83 percent of all harvest value. Other heterogeneity measures could be vessel physical size and the number of fisheries in which a vessel participates.
2. The top five parent companies in 2019 are (alphabetical order): Bornstein Seafoods, California Shellfish Co., Da Yang Seafoods Inc., Oceanic Logistics LLC, and Pacific Seafood Group.

The Oregon commercial fishing industry is an important contributor to the State's economy. The industry's onshore fisheries (not including distant water fisheries) generated $325 million income in 2019 which is down from $346 million in 2018 (Table II.5 and Figure II.3). The economic contribution share for processing onshore harvests, hauled-in fish, and manufacturing fishmeal is 35 percent. The economic value added from processing is estimated to be $139 million (Table C.5).

Distant water fisheries are a significant component of the commercial fishing industry's total economic effects in Oregon. Distant water fisheries were about two-fifths of the total commercial fishing industry statewide economic contributions in 2019. This is a decrease from about half in the previous five-year (2014-2018) average (Table II.5). Most of the distant water fisheries contributions are from participation in Alaska fisheries. Real harvest value trends for the West Coast offshore fishery and Alaska fisheries compared to Oregon fisheries are shown on Figure II.2. The West Coast at-sea fishery has been up and down since 2002. The Alaska fisheries overall have generally had steady value in recent years.

Oregon resident participation (crew member and vessel permit license counts) in Alaska fisheries for 2011, 2017, and 2019 are shown on Appendix Table C.10. Vessel license counts were down over this period. Crewmember licenses decreased about one-quarter (from 1,348 to 993) during this period. CFEC data shows fisheries permit holders residency in Oregon decreased from 438 in 2011 to 377 in 2019 and earnings decreased from $149.3 million to $92.4 million during the period (nominal dollars). It is not clear the influencing factors for the decreasing effects from distant water fisheries. It could be with rising fuel costs to commute and tax incentives to use Alaska business address registration, that ownership residence may not reflect where Alaska earnings are spent. More investigative studies are needed to determine if there are indicator data anomalies or underlying causes for the apparent decrease.

The estimated total income generated by the Oregon commercial fishing industry (includes distant water fisheries) is $558 million to the statewide economy in 2019 which is equivalent to about 9,200 jobs (Table II.6).[1] This 2019 job estimate is about the same as the 2018 estimate and a decrease over the previous five-year average 10 thousand job estimate (Table II.5). Output is estimated to be $1.2 billion.

The Oregon commercial fishing industry representation along Oregon Coast economies varies (Table II.4). The industry in 2019 represented about half a percent of statewide net earnings and 8 percent of Oregon Coast net earnings. The commercial fishing industry share of earnings in 2019 ranged from 14 percent in Lincoln County to 2 percent in Tillamook County. Tillamook County had the highest recreational fishing share of earnings at 4 percent in 2019.

1. Shellfish aquaculture is not included in the economic contribution estimates. Oregon coast aquaculture is principally Pacific oysters. The estimated farm-gate value was about $8 million in 2019 (ODA 2021). The growing and processing would generate about $9 million income to the State's economy. This farm-gate value estimate may undercount actual grower sales; value may be closer to the $15-20 million range. Oregon aquaculture production reported by USDA (December 2019) for 2017 was $19.9 million (nominal) for mollusks.

Another economic measurement that can be used to characterize the commercial and recreational fishing industry is the generation of government fees and taxes. At the local government level, the fishing industry pays fees for moorage, rental of upland property, landing poundage fees, etc. There are many vessel, crew member, limited entry fishery permit, processor, and other fees. The industry's general and personal tangible assets would add to the local property assessed value. Industry participants and businesses pay State personal and corporate income taxes and fees. There are a host of State level harvest landing and license fees and marine fuel taxes. The fees and taxes offset State and local government costs for services provided to the industry. Government not only provides physical infrastructure (maintained navigation channels and jetties, wharves, moorages, upland storage and work areas, launch facilities, etc.), but also provides other services such as fish hatchery programs. Local governments and port districts serve as advocates for the industry so as to ensure its continued viability.

The commercial fishing industry annually pays about $121 million in state and local taxes each year based on the assumption that there is a causal and integral relationship to income generated from the industry. (State and local taxes includes personal and corporate income taxes, property taxes, fuel taxes, selective sales taxes, etc.) The harvest and processing sectors are assessed ad valorem fees and license/permit fees at the state level. The ad valorem fees are for contributions to the Commercial Fish Fund (CFF) and for support of commodity commissions.[1] The revenue is deposited in a State CFF account to help reimburse the ODFW costs for management, enforcement, and research. A significant portion of the CFF receipts are used to fund the ODFW MRP. The expected CFF revenue receipts represent less than half of the MRP budget. The balance of the MRP funds come from federal sources, State general funds, and other funds. The other funds include sport angling and shellfish license fees and lottery dollars. The CFF also is used in the other ODFW programs, such as propagation. There are more ODFW commercial fishing oriented programs and services costs other than reflected in MRP expenditures. Associating the projected CFF revenue with the MRP expenditures is to illustrate the importance of the revenue source for providing management and research that benefit both commercial and recreational fisheries.

Commercial and recreational fishing businesses can receive direct payments for fishery failures. The most recent approved disaster declaration was the 2016-2017 Oregon and California Klamath River Fall Chinook fishery failure. The disaster declaration was approved by the Secretary of Commerce on September 24, 2018 (NOAA Fisheries May 2021a). Distribution to Oregon businesses (vessel owners and charter businesses) will be about $2.1 million. Other Oregon fisheries disasters have been requested for approval, but are not yet approved nor

1. CFF ad valorem rates range from 1.09 percent for albacore tuna to 5.00 percent for black/blue and other nearshore rockfish (ORS 508.505). The ad valorem fee for many finfish and shellfish (Dungeness crab, Pacific sardines, other groundfish) is 2.25 percent. The ad valorem fee on salmon landings was 3.15 percent. A special restoration and enhancement fee is another $0.05 per round pound. Revenue for the respective commodity commissions is raised using landing value assessments (ad valorem rates) on deliveries of specific species harvested with specific gear (ORS 576.325): Salmon Commission (1.5 percent ex-vessel value troll caught salmon assessed to harvester), Trawl Commission (0.5 percent ex-vessel value of groundfish, whiting, and shrimp caught with trawl gear assessed to harvester), albacore Commission (1.00 percent ex-vessel value of albacore tuna whose payment is split evenly by harvesters and processors), and Dungeness Crab Commission (one percent ex-vessel value assessed to harvester). Commodity commissions can use funds from other sources to carry out their responsibilities.

appropriations secured. Vessels and processors can receive direct payments from the USDA Seafood Trade Relief Program if there is evidence of loss from retaliatory tariffs. Related to direct payments is mitigation for lost fishing opportunities due to adverse impacts from other ocean and freshwater activities. There are already examples of mitigation in Oregon from the placement of undersea cables. The Bandon Submarine Cable Council and the Oregon's Fisherman Cable Committee oversee distributions of funds for communication, research, and damaged gear settlements. Another example of mitigation is the annual payment by the Bonneville Power Administration for fish and wildlife restoration programs (including foregone hydropower sales). The 2019 fiscal year expenditure was $788.1 million (NPCC May 2020). The issue for compensatory direct payments to industry or indirect fishery benefit payments for mitigating lost fishing opportunity may become more important as alternative uses for ocean space increase, such as for energy generation sites and restricted energy transmission and navigation corridors. Questions will have to be addressed on impact assessment methods and how long term costs are included in mitigation. There may be lost or gained society values from potentially affected resources and ecosystem services. Whether perceived benefits are lesser or greater will influence permitting and political support for the impact activities (NRC 2001).

Economic contribution due to the commercial fishing industry may also be generated from many activities other than just harvesting and seafood processing – for example, visitors attracted to food service and retail markets selling local harvests, and tourists drawn to working waterfronts. There are boat building and gear manufacturing businesses at some ports. Management, enforcement/safety, research, education, and training are related economic contributors. The commercial fishing industry is one component in a larger context maritime industry that would include these additional economic contribution activities.

While individual fisheries harvest value and economic contributions are important indicators for showing commercial fishing industry trends, the health of the industry has a social context for the well-being of harvesters, processor workers, affected communities, and ultimately the public. Studies show Oregonians not only care about natural resource conservation, but have empathy and appreciate the life style of the participants. Those involved in the industry know its vagaries: part-time employment, changes in abundances, dangerous weather conditions, volatile prices, and seeming unending surprises in management and regulations. Families and businesses must be dynamic and flexible to survive and prosper. Their resilience and innovation is celebrated by those that enjoy Oregon seafood.

B. Fishing Industry Challenges

The commercial fishing industry is a thriving and important economic sector for many communities along the Oregon Coast, but there are certain segments of the industry that are experiencing severe disruption. The long-term viability of all segments may need new thinking about the challenges posed changing environmental conditions, agile market competitors, increased regulation, changes in consumer tastes, and new technologies. This section discusses market trends and general structural issues that are challenging the industry.

General worldwide economic conditions can bring down demand for seafood products (and ultimately influence harvest level prices) because consumers view seafood as a discretionary purchase. Improving general economic conditions and certain situations of fish supply constraints helped increase Oregon fisheries prices in 2019 albeit some of the increases faded during 2019 (for example sablefish and albacore tuna). The expanded markets for Pacific whiting fillets were not as great as expected, and gains in the eastern European market for H&G products have diminished. The strong U.S. dollar currency exchange in 2019 reduces demand for U.S. harvests and lowers prices when there are international fisheries that have product substitutions. China imposed retaliatory tariffs on U.S. fishery exports which lowered foreign demand and continued the downward pressure on prices.

A point of optimism may come from demand for some specialty products from Oregon fisheries. Using the market demand for the specialty products along with traceability technology address consumer concerns for food safety and awareness about fish resource conservation (Petersen and Green 2006). The traceability technology allows seafood product to be marketed according to where, when and how they were caught. The authenticity of claims or certifications, such as wild fish harvested only from sustainable stocks, is backed-up with proper and easily accessed documentation about the product's supply chain.

Other issues that the commercial fishing industry is facing are:

- Pressure to set aside areas for: (1) no-take marine protection areas for conducting research and/or preserving their intrinsic values, and (2) other conflicting spatial uses of the ocean, such as wave/wind energy generation, telecommunication seabed cables, and whale migration routes.

- Allocations among user groups (commercial, recreational, and tribal fishermen) and communities to meet legal requirements and social objectives.

- Judicial decisions on habitat protection and incidental take issues brought to the forefront by conservation organizations, including protection of sea birds and mammals either impacted by fishing techniques or dependent on protein from the same fish species now being fished; compacts and international treaties, including treaties with Canada for allocation of Pacific whiting, salmon, and tunas; and, multi-national interests in highly migratory fish stocks in the western and central Pacific Ocean.

- Better understanding in the science of ecosystem interactions and improved stock assessments that may cause fishery management agencies to reduce exploitation rates, control fishing gear, reduce trip limits, or additional restrictions including time/area closures through new initiatives to develop an ecosystem fishery management plan. Stock building programs calculated using variables with large uncertainties; rebuilding programs will take many years for slow growing rockfish species to return to maximum sustainable harvest levels because of life cycle characteristics of these fish.

- Restrictions on harvests for species in a healthy stock status condition due to fishing techniques that have unavoidable mortalities on species in a depleted stock status where species occupy the same space at the same time. There is a need to develop innovative

methods to share real time information among vessels to avoid hotspots where the depleted species are congregating.

- For the most part, there are not major populations of underutilized species which harvesters can exploit, but new fisheries may develop around some minor opportunities for developing niche markets.

- Increasing costs for prosecuting fisheries, such as for fuel, safety equipment, insurance, moorage, etc. New, more selective management tools requiring different gear, area/time closures related to ocean depth, and more intrusive harvest verification techniques (log books, observers, satellite signal location registry programs, electronic monitoring, etc.) will add to operation costs.

- Implementation of the 2006 Magnuson-Stevens Act reauthorization. Reauthorization will undoubtedly include new definitions and processes for avoiding species overfishing; contain new procedures for stakeholder involvement; require new regulations for climate-ready fisheries; advance fisheries science and data; and, give new attention to ecosystems planning. The laudable goals will place new demands on fishing industry interests to watchdog implementation for making sure new regulations are balanced and efficient.

- Expanded use of ITQ programs with transferable quotas for vessels, processors, and cooperatives. Additional fisheries being managed using property rights approaches, such as now is being used in the trawl groundfish fishery. The management approach has the potential for greater individual economic profits and greater community benefits. However, poorly crafted rights may result in unintended consequences, including over-consolidation, unbalanced bargaining power favoring one sector over another, or asymmetrical redistribution of vessels and processors among coastal communities.

- The proliferation of certification programs for seafood product quality and capture fisheries sustainability has burdened harvesting associations and processors. The certification concept has merit, but there is considerable expense in trying to meet certifying conditions and science and management requirements. There may also be confusion on the part of consumers given duplicate and conflicting certification systems.

- Consumer concerns about quality (freshness, inclusions of toxics, etc.) will affect seafood product demands. Considerations about health and wholesomeness of natural coldwater fish could be a marketing advantage to Oregon's industry.

- Climate variability, as tracked by the Pacific Decadal Oscillation, El Niño/Southern Oscillation, and Oceanic Niño Index indexes, has effects on fish habitat that harm some species and boost populations of other species.

- Vessels in Oregon depend on public agencies to provide adequate moorage, upland facilities, and safe passage from harbors to the ocean. Decreased federal funding of the Corps of Engineers operation and maintenance budgets will mean smaller ports not meeting waterborne commerce volume standards will not be dredged. Public ports have

increasing demands for devoting scarce revenue sources for other than commercial fishing industry uses.

- Federal budgets for fishery management and science are challenged, and attendant federal support of state agency programs are being more closely scrutinized for cost savings. Some federal programs have opportunities for cost-recovery assessments on industry, but states can be locked into statutory limits on industry assessments.

The Oregon commercial fishing industry is mature, having beginnings in the late 1800's utilizing the amazing salmon returns to the Columbia River. In consideration of this report's landing trends and in light of the above mentioned current issues, it is a prudent assessment that commercial harvesting and processing of marine resources will not be a major growth industry in Oregon. Goals for the industry should include extracting more value from the fishery resources that are available through better resource management, utilization, and marketing. Raising value has obstacles. There will be continuing price pressures on seafood products from substitute aquaculture products. The fall-out from lower values will be disruptive to a fleet where profitability already suffers due to, among other influences, excess capacity.

Modernization of vessels for improved gear selectivity, better handling capabilities, modernization of processing plants will improve seafood products. Assistance through commodity commissions and other entities for developing marketing strategies should help the industry raise value at all levels of seafood production.

Vessels can receive revenue from participating in cooperative research projects and exempted fishing permits. Pursuing such private-government collaborative programs can be of immediate and long term benefit to the industry.

The fishing industry receives support from marketing, academic, and inter-industry trade associations. Under the auspices of the Oregon Department of Agriculture, there are four seafood commodity commissions (trawl, Dungeness crab, albacore tuna, and salmon). Oregon State University administers several programs supporting the industry, including Sea Grant Extension Service, Astoria Seafood Laboratory, Coastal Oregon Marine Experiment Station, Food Innovation Center Agricultural Experiment Station, and the interests from several academic departments. The Oregon Department of Agriculture, Oregon Sea Grant, and Oregon State University Extension Service in cooperation with Oregon's commodity commissions have launched the #EatOregonSeafood initiative to encourage purchase and preparation of local harvests. Oregon and Washington groundfish fishery participants have formed a non-profit trade association called Positively Groundfish. Its members are fishermen, fish processors, environmental advocates, certifiers, academic researchers and state agencies. There are several community supported fisheries (CSF) organizations available to Oregon residents. CSF's deliver catch directly from fishermen to households using central pickup locations. Local governments and coastal port districts provide public services and advocate causes. There have been enormous efforts from government and many watershed protection groups to restore anadromous fish freshwater habitat and passage. There have been commitments to research and improvements in hatchery operations to lower impacts from artificial propagation on wild stocks. Oregon State University (OSU) has furthered their leadership in education and research responsibilities related ocean resources and seafood. They recently created the OSU Marine

Studies Initiative and are designing an OSU Center for Seafood Systems and Innovation (Sylvia and Storms 2019). OSU is already home since 1982 to the Cooperative Institute for Marine Resource Studies to be named Cooperative Institute for Marine Ecosystems and Resource Studies. It is one of 16 National Oceanic and Atmospheric Administration (NOAA) Cooperative Institutes located in the United States. These programs build on a history of nationally ranked marine and agricultural programs and its rich heritage of research, outreach, education, and service.

Industry trade associations like the Western Fishboat Owners Association, Fishing Vessel Owners Association, Fishermen's Marketing Association, West Coast Seafood Processor's Association, Newport Fisherman's Wives Association, Coos Bay Trawlers Association, Midwater Trawlers Cooperative, and other associations and cooperatives are all working on behalf of the industry. Research agencies (like those located at the Hatfield Marine Science Center in Newport and the Oregon Institute of Marine Biology located at Charleston) provide support for better management, science, and development of seafood products. These marketing, management, and research efforts are needed to assist the industry compete in constantly changing harvest management regimes and changing seafood markets.

C. Fishing Industry Outlook

Commercial and recreational fishing participants have always been subject to catch and access variability due to changing environmental conditions. Increasing biophysical effects from climate change are predicted to exacerbate the variability.[1] Businesses within the fishing industry need to be resilient to downturns and take advantage of favorable stock sizes. Fisheries diversification is key to commercial fisheries businesses success.[2] Recreational fisherman need stability in fishing opportunity that may require allocation transferability when abundances are low. Management also needs to have the adaptive capacity to nimbly fit conservation and development measures to different conditions (Melnychuk et al. 2014). Vigilance on how stocks are responding to conditions is required for long term fisheries species conservation (NOAA Fisheries 2019). Flexible management processes and techniques need to be built into fishery management plans to deliver desired social, ecological, and economic outcomes.

Challenges facing the fishing industry include shifting stocks due to climate change. Change includes extreme weather and ecological surprises the nature, location, and effect are difficult to predict (Filbee-Dexter et al. 2017). There will be other conflicting spatial uses of the ocean, such as wave/wind energy generation, telecommunication seabed cables, and whale migration routes. Also facing the industry are foreign agile market competitors, increased regulation, changes in

1. The Nature Conservancy (TNC) assisted the PFMC in carrying out a Climate and Communities Initiative by providing two documents and partially funding a workshop. A TNC January 2020 document was provided to inform the scenario planning workshop. Workshop results are in TNC March 2020. TNC counseled over the next 20 years climate change will create numerous biophysical changes that will impact fishing communities. The period will also be a time of significant socio-economic and political change, partly driven by climate issues, but also driven by other factors.
2. While economic theory shows strong justification for diversification strategies, planning and implementation requires practical tools to aid in discovering the best diversification choices (Burgess 2015, Holland et al. August 2017, and Anderson et al. 2017).

consumer tastes, new technologies, and changing societal values toward natural resources protection. Fewer vessels are participating in commercial fisheries and those that do participate require higher annual revenues to be a viable business. The trend in processor ownership consolidation and centralization of operations continues. Some landings are hauled out-of-state, precluding the need for local labor and support businesses. These are efficiency moves by industry, but can hurt small fishing communities.

Goals for the industry would be to extract more value from the fishery resources that are available. Raising resource value has obstacles. There will be continuing price pressures on seafood products from substitute aquaculture products. Consumer concerns about quality (freshness, inclusions of toxics, etc.) will affect seafood product demands. Considerations about health and wholesomeness of natural coldwater fish could be a marketing advantage to Oregon's industry. Modernization of vessels for better handling capabilities and initial onboard processing, and modernization of processing plants will improve seafood products. Community based programs to own and lease access rights to fisheries and programs to direct market local catch to consumers are examples of cooperative and collaborative initiatives to promote the industry. Assistance through industry trade associations, Oregon Department of Agriculture commodity commissions, Oregon State University Sea Grant and Extension Service, and other entities for developing marketing strategies that will gain market power for Oregon seafood products should help the industry raise value at all levels of seafood production.

Table II.1
Harvest Volume and Value by Fishery for Five-Year Average, 2018, and 2019

	2014-2019	2014-2018 Five Year Average			2018			2019		
Fishery	Value	Volume	Value	Price	Volume	Value	Price	Volume	Value	Price
Salmon		2,719	10,964	4.03	980	5,663	5.78	1,060	4,339	4.09
Troll Chinook		1,113	6,592	5.92	331	2,461	7.44	404	2,320	5.74
Troll coho		24	36	1.52	1	2	3.23	8	19	2.30
Net Chinook		1,118	3,652	3.27	533	2,962	5.56	496	1,739	3.50
Net coho		430	634	1.47	81	162	2.00	132	224	1.70
Other species/gear		34	51	1.50	35	76	2.18	20	36	1.81
Dungeness crab		16,118	57,213	3.55	23,134	75,351	3.26	18,719	66,965	3.58
Pink shrimp		39,987	28,487	0.71	35,873	27,395	0.76	26,852	19,940	0.74
Albacore tuna		6,832	11,255	1.65	5,812	9,899	1.70	6,567	10,846	1.65
Groundfish (other than sablefish and whiting)		34,305	18,202	0.53	45,486	20,070	0.44	42,589	18,740	0.44
Trawl gear LE		33,603	16,530	0.49	44,649	18,120	0.41	41,786	16,816	0.40
Fixed gear LE		128	168	1.32	149	208	1.40	146	208	1.42
Fixed gear OA		553	1,482	2.68	623	1,707	2.74	650	1,702	2.62
Sablefish		5,016	13,380	2.67	5,681	12,143	2.14	6,176	10,607	1.72
Trawl gear LE		2,236	4,273	1.91	2,541	3,292	1.30	2,638	2,423	0.92
Fixed gear LE		2,534	8,361	3.30	2,875	8,204	2.85	3,321	7,744	2.33
Fixed gear OA		245	744	3.04	256	633	2.47	216	440	2.03
Pacific whiting		152,644	14,104	0.092	185,554	16,732	0.090	222,202	21,719	0.098
Pacific sardine		4,380	939	0.214	20	3	0.157	28	4	0.135
Pacific halibut		243	1,394	5.73	231	1,253	5.43	252	1,249	4.95
Other		8,807	4,158	0.47	10,446	6,531	0.63	10,065	6,266	0.62
Market squid		1,965	864	0.44	7,046	3,129	0.44	5,248	2,886	0.55
Hagfish		1,656	1,558	0.94	1,466	1,497	1.02	1,588	1,654	1.04
Red sea urchin		363	365	1.01	333	699	2.10	181	570	3.16
Pacific (chub) mackerel		591	74	0.125	155	2	0.013	202	11	0.053
Total		271,052	160,096	0.59	313,217	175,041	0.56	334,510	160,675	0.48

Notes:
1. Volume and value are in thousands. The harvest value and prices are in 2019 dollars.
2. Prices are annual and sometimes are averaged across harvests made using different gear types. Prices are expressed in round weight equivalents. Average prices for salmon are across seasons and sizes.
3. Acronyms: LE - limited entry, OA - open access.
4. D. crab is shown seasonally by December to November for each year, for example 2019 D. crab includes December 2018 to November 2019.
5. Starting in 2011 a small amount of sablefish in the LE trawl individual transferable quota (ITQ) program is harvested with fixed gear.
6. "Other" includes gaper clam (414 thousand pounds) and other species in 2018; and jack mackerel (1,008 thousand pounds, $31 thousand), basket cockle (334 thousand pounds, $416 thousand), and other species in 2019.

Source: PacFIN fish ticket data, April 2015, November 2016, March 2017, June 2018, July 2019, and September 2020 extractions.

Table II.2
Commercial Fishing Characteristics by Port Groups in 2018 and 2019

	Port Group						
	Astoria	Tillamook	Newport	Coos Bay	Port Orford	Brookings	Total
2018							
Volume	141,034	2,174	124,950	30,045	1,562	13,456	313,219
Value	43,783	5,285	63,558	40,793	4,710	16,911	175,040
Share	25%	3%	36%	23%	3%	10%	100%
Vessel counts							
Unique landing	288	117	324	286	67	155	949
Homeport	256	89	246	188	59	111	949
Ratio homeport to unique	89%	76%	76%	66%	88%	72%	100%
Active landing	268	94	312	265	61	146	884
Active homeport	239	73	238	176	54	103	883
Deliveries	7,886	3,056	4,816	3,394	2,695	2,681	24,528
2019							
Volume	178,229	2,045	123,372	20,961	1,594	8,625	334,826
Value	46,829	4,756	59,308	33,928	4,909	11,903	161,634
Share	29%	3%	37%	21%	3%	7%	100%
Vessel counts							
Unique landing	304	105	331	258	67	140	941
Homeport	246	87	264	186	56	102	941
Ratio homeport to unique	81%	83%	80%	72%	84%	73%	100%
Active landing	273	91	318	248	63	133	884
Active homeport	220	76	256	179	53	99	883
Deliveries	7,383	3,124	4,788	2,825	2,713	2,295	23,128

Notes:
1. Volume and ex-vessel value are in thousands. Values are in 2019 dollars.
2. See the glossary for which individual ports are included in the different port groups.
3. Onshore landings includes the Oregon side landings in the Columbia River non-Indian and tribal salmon fishery. All Columbia River landings are included in the Astoria port group.
4. Amounts are for landings during calendar year, including Dungeness crab.
5. Vessel counts exclude landings with vessel identification of "NONE" or "ZZ..." An active vessel is any identifiable vessel that landed over $500 in Oregon in a year.
6. A vessel's homeport is the port group where a plurality of Oregon harvest value is delivered.
7. Homeport vessel counts can be distorted by out-of-state vessels making landings at Oregon ports and Oregon based vessels making landings at out-of-state ports. An example of the former are vessels from Puget Sound, southern California, and Alaska participating in the Oregon market squid fishery. An example of the latter are vessels that deliver their whiting catch to processors in Westport, Washington.

Source: PacFIN fish ticket data and annual vessel summary, July 2019 and September 2020 extractions.

Table II.3
Vessel Counts and Deliveries by Fishery in 2015 to 2019

	2015			2016			2017			2018			2019		
	Vessel Counts		Deliveries	Vessel Counts		Deliveries	Vessel Counts		Deliveries	Vessel Counts		Deliveries	Vessel Counts		Deliveries
Fishery	Total	>$500	Total	Total	>$500	Total	Total	>$500	Total	Total	>$500	Total	Total	>$500	Total
Salmon	687	607	9,672	510	430	6,737	319	267	5,869	383	309	6,393	379	288	5,310
Ocean troll	487	450	4,564	311	267	2,261	171	151	1,094	230	194	1,496	218	189	1,401
CR net Chinook	170	154	4,584	177	157	4,002	123	110	4,184	129	110	4,273	118	91	3,036
CR net coho	144	82	1,574	132	86	1,336	110	76	1,549	104	54	1,229	116	65	1,301
Dungeness crab	336	319	6,065	341	319	6,019	362	345	6,535	357	335	6,129	356	336	5,829
Pink shrimp	78	78	1,285	75	75	1,051	63	62	754	70	70	994	78	78	970
Albacore tuna	348	322	1,294	367	348	1,440	301	288	1,098	276	266	983	329	314	1,297
Groundfish (other than sablefish and whiting)	363	246	5,795	329	220	5,120	312	227	6,010	340	228	5,736	334	237	5,887
Trawl gear LE	56	56	1,134	55	55	1,192	56	55	1,687	59	58	1,572	61	61	1,640
Fixed gear LE	42	32	463	38	31	459	40	34	496	43	29	463	35	32	419
Fixed gear OA	213	150	3,891	194	132	3,295	198	137	3,702	212	138	3,565	201	141	3,652
Sablefish	140	126	1,512	157	143	1,555	169	156	1,732	162	148	1,566	154	140	1,579
Trawl gear LE	56	45	788	53	44	701	55	45	910	58	47	874	59	50	958
Fixed gear LE	43	43	480	40	40	487	40	40	415	42	42	382	37	37	361
Fixed gear OA	47	44	244	67	62	367	76	73	407	66	63	309	59	55	259
Pacific whiting	47	23	755	57	21	882	57	22	1,308	61	21	1,188	63	22	1,349
Pacific sardine	13	6	49	17	0	70	12	0	62	17	0	103	29	0	134
Pacific halibut	173	85	382	163	99	411	121	68	275	101	59	237	156	98	411
Market squid	0	0	0	17	14	91	3	0	3	13	10	115	32	26	205
Other	112	42	5,304	115	33	7,267	171	65	4,696	191	60	5,790	219	79	5,683
All fisheries	1,129	1,068	27,058	1,051	991	27,365	894	859	23,060	949	884	24,528	941	884	23,128

Notes:
1. "Vessel counts" include those that landed at Oregon ports and had a valid vessel identification number. Vessels or non-vessels (such as from a dock) with identification of "NONE" or "ZZ..." are excluded. "Delivery counts" include those with no valid vessel identification number. These are typically vessels delivering in tribal fisheries.
2. The columns titled ">$500" show the number of vessels that landed over $500 of ex-vessel revenue from the shown fishery in Oregon. The revenue is an arbitrary threshold to filter for vessels that are actively participating in the shown fishery. The fisheries are counted separately, so the filter is applied to each. For the "all fisheries" row, the $500 threshold may be landed at any combination of fisheries.
3. Vessel counts and deliveries across fisheries will not sum to the "all fisheries" row because vessels can participate in more than one fishery, deliveries can include more than one fishery, and/or there are other important fisheries not itemized.
4. Dungeness crab is shown seasonally by December to November for each year, for example 2019 Dungeness crab includes December 2018 to November 2019.
5. "Other" includes (parentheses list 2019 vessels, active vessels, and deliveries): razor clam (0, 0, 1,309), basket cockle (0, 0, 927), ghost shrimp (c, c, 840), jack mackerel (33, 9, 769), unsp. squid (29, 0, 746), shad (36, 0, 566), white sturgeon (84, 52, 497), red sea urchin (0, 0, 256), hagfish (14, 11, 174), Pacific (chub) mackerel (26, 4, 150), and others. Counts with a "c" are not shown to avoid revealing confidential information.
6. Ocean troll is Chinook with tiny amounts of coho from harvest areas north of Cape Falcon.

Source: PacFIN fish ticket data, April 2015, November 2016, March 2017, June 2018, July 2019, and September 2020 extractions.

Table II.4
Representation of the Commercial and Recreational Fishing Industry by Port Groups in Statewide and Coastwide Economies in 2019

	Statewide		Coastwide		Astoria		Tillamook		Newport		Coos Bay		Brookings	
	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent
All income	224,346.4	0.3%	9,465.7	5.0%	1,893.8	8.0%	1,240.4	2.7%	2,295.0	7.8%	2,994.0	2.7%	1,042.5	2.9%
Earned income	134,693.4	0.5%	4,526.3	10.5%	1,023.5	14.9%	593.4	5.7%	1,098.2	16.4%	1,405.5	5.7%	405.6	7.4%
Fishing income	692.9		476.0		152.0		33.6		180.1		80.2		30.1	
Commercial	557.6	0.4%	382.1	8.4%	137.0	13.4%	10.6	1.8%	155.4	14.2%	60.5	4.3%	18.6	4.6%
Onshore	325.2		264.3		99.1		6.6		86.6		54.4		17.6	
Distant water	232.4		117.8		37.9		3.9		68.8		6.1		1.0	
Jobs	9,151		7,939		2,749		224		3,305		1,213		449	
Recreational	135.4	0.1%	93.9	2.1%	15.1	1.5%	23.0	3.9%	24.7	2.2%	19.7	1.4%	11.5	2.8%
Ocean recreational fishing	24.0		16.6		1.2		2.5		8.7		2.7		1.4	
Inriver non-resident fish fishing	111.3		77.4		13.9		20.5		15.9		17.0		10.0	
Jobs	2,222		1,987		302		488		525		395		276	

Notes:
1. Income is in millions. Earned income is the sum of wages and salaries, and proprietors' income. All income includes earnings, transfer payments (such as Social Security payments, etc.), and investment income (such as private pensions, etc.).
2. Earned income and all income estimates are adjusted for place of residence. Fishing income is for place of work. Fishing income comparison may overstate the calculated share since some of the income may accrue to places outside of the comparison location. Earned and all income is from households within Clatsop County for Astoria port group; Tillamook County for Tillamook port group; Lincoln County for Newport port group; Coos County for Coos Bay port group; and Curry County for Brookings port group. Fishing income is from commercial deliveries to and recreational trips at: Clatsop County for Astoria port group; Tillamook County for Tillamook port group; Lane (recreational only) and Lincoln County for Newport port group; Lane (commercial only), Douglas, and Coos County for Coos Bay port group; and Curry County for Brookings port group. Coastwide jobs are based on the average of the earnings per job for each of the five port groups.
3. Onshore fishing income is based on landings during calendar year. Sometimes annual reporting for the ocean Dungeness crab fishery is for season totals. The ocean season is December 1 through August 14 and the bay season is after Labor Day exclusive of weekends, holidays, or if the adjacent ocean is closed.
4. The recreational inriver category includes ocean and bay crabbing and clamming.

Source: Income and earnings data is from U.S. Department of Commerce, Bureau of Economic Analysis.

Table II.5
Commercial Fishing Industry Trends in Statewide Economy in 2014 to 2019

	2014	2015	2016	2017	2018	2014-2018 Average	2019
Oregon							
Ex-vessel value	169.2	122.7	157.8	150.3	175.0	155.0	161.6
Landed pounds	300.4	203.9	226.9	302.4	313.2	269.3	334.8
Onshore economic contributions	318.9	218.3	300.4	291.5	346.4	295.1	325.2
Distant water economic contributions	332.6	267.0	322.2	261.0	244.3	285.4	232.4
Total economic contributions	651.5	485.3	622.6	552.5	590.7	580.5	557.6
Jobs (not millions)	11,669	8,433	10,636	9,314	9,789	9,968	9,151

Notes: 1. Amounts are in millions, except for jobs. Values are in 2019 dollars.
2. Economic contributions are expressed as income.
3. Conditional methods notes from Table II.4 apply.

Sources: 1. Landing data is from PacFIN annual vessel summary data, April 2015, November 2016, March 2017, June 2018, July 2019, and September 2020 extractions.
2. Average earnings per job data is from BEA through 2019.

Table II.6
Commercial and Recreational Fishing and Nearshore Fisheries
Coastwide and Statewide Economic Contributions in 2019

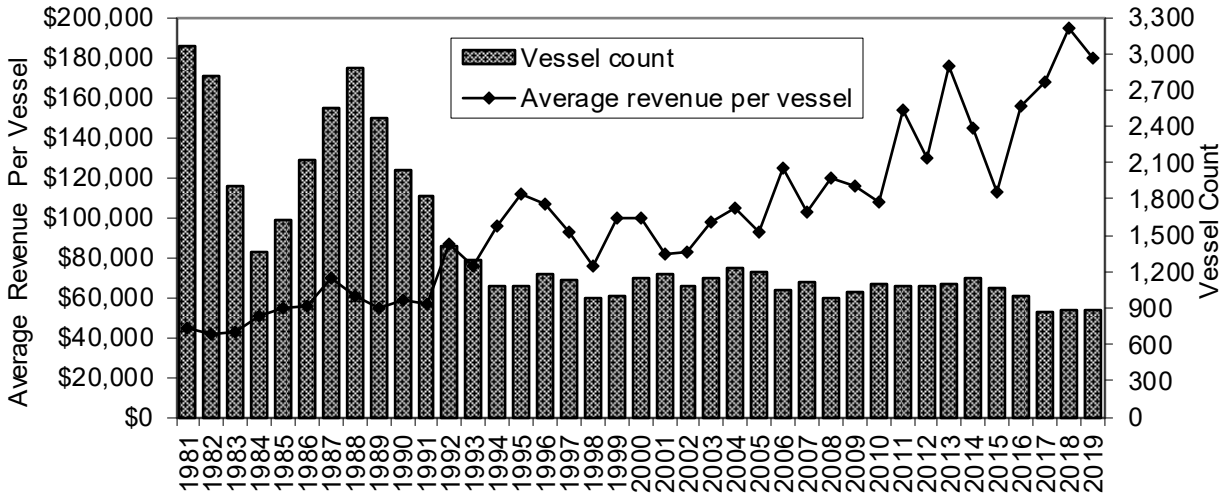
	Onshore				Distant Water			Total		
	Ex-vessel	Income	Jobs	Output	Income	Jobs	Output	Income	Jobs	Output
Commercial										
Coastwide		264.3	5,485	559.7	117.8	2,455	251.5	382.1	7,939	811.2
Statewide	161.6	325.2	5,337	680.6	232.4	3,814	486.3	557.6	9,151	1,166.9

	Ocean				Coastal Inriver				Total			
	Spending	Income	Jobs	Output	Spending	Income	Jobs	Output	Spending	Income	Jobs	Output
Recreational finfish												
Coastwide		16.6	351	44.8		65.6	1,394	177.8		82.1	1,746	222.6
Statewide	49.5	24.0	394	57.8	197.5	95.9	1,574	230.7	247.0	119.9	1,968	288.4
Recreational ocean and bay crabbing and clamming												
Coastwide										11.8	241	29.3
Statewide									20.5	15.4	253	37.1
Total recreational												
Coastwide										93.9	1,987	251.9
Statewide									267.5	135.4	2,222	325.5
Total commercial and recreational												
Coastwide										476.0	9,926	1,063.1
Statewide										692.9	11,373	1,492.5

	Ex-vessel/ Spending	Total		
		Income	Jobs	Output
Nearshore fisheries (coastwide economic level)				
Commercial		62.5	1,299	132.7
Recreational finfish		80.2	1,704	217.3
Recreational ocean and bay crabbing and clamming		11.8	241	29.3
Commercial and recreational		154.5	3,244	379.3
Nearshore fisheries (statewide economic level)				
Commercial	74.9	77.7	1,275	162.5
Recreational finfish	236.7	114.9	1,887	276.4
Recreational ocean and bay crabbing and clamming	20.5	15.4	253	37.1
Commercial and recreational		208.0	3,414	476.0

Notes:
1. Ex-vessel value, trip spending, income, and output are in millions of 2019 dollars.
2. Trip spending is regardless of where (trip origin, enroute, or destination) purchases occurred nor is spending differentiated for residents and non-residents.
3. The output calculation for distant water fisheries assumes the same spending patterns as onshore fisheries.
4. While income and output absolute values may increase at the statewide economy level due to reduced trade leakage, the calculation for the number of equivalent jobs may decrease. This is because average earnings per job are much higher in the statewide economy level.
5. Coastwide is the sum of the port groups at the coastwide economic level.
6. Commercial fishing excludes aquaculture production.
7. Recreational coastal inriver includes lower Columbia River.
8. Nearshore fisheries are a subset of overall commercial and recreational coastwide and statewide.

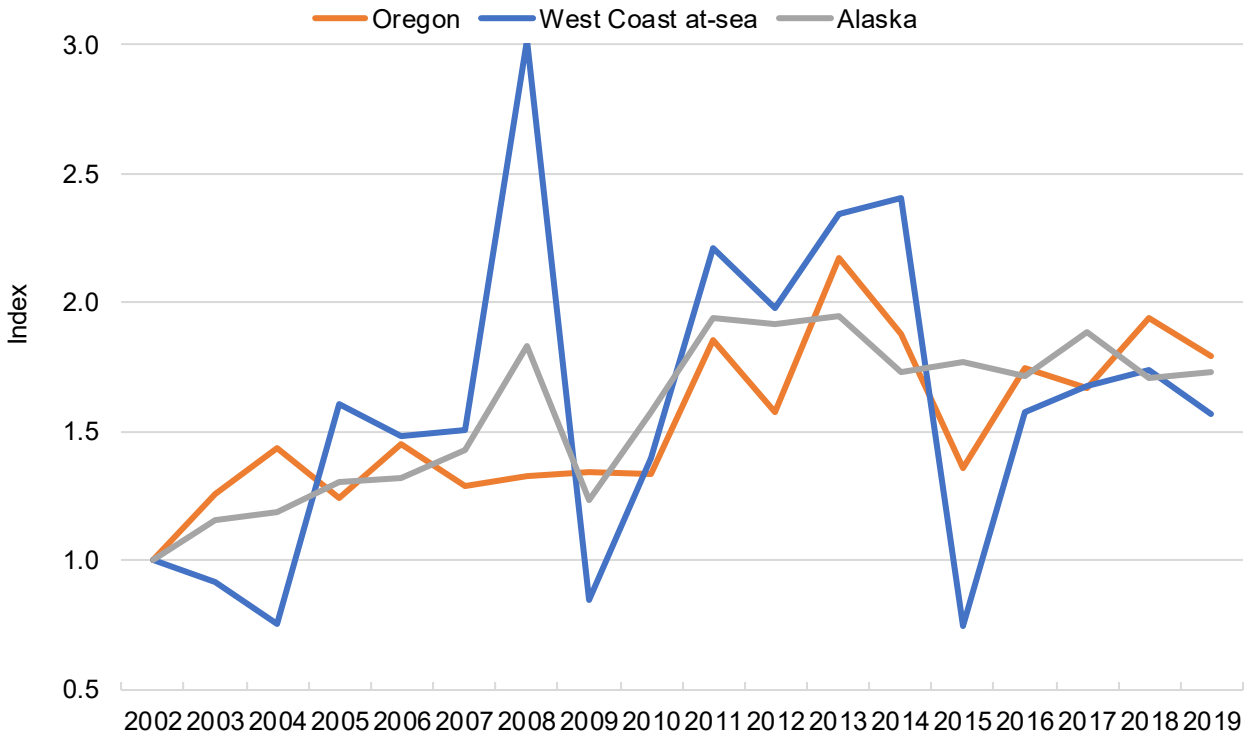
Figure II.1
Vessel Counts and Annual Average Revenue Per Vessel in 1981 to 2019



Notes:
1. Revenues adjusted to 2019 dollars using the GDP implicit price deflator developed by the U.S. Bureau of Economic Analysis.
2. Excludes vessels with identifier codes "NONE" or "ZZ…," which are generally attributable to deliveries made in tribal fisheries.
3. Includes only vessels with at least $500 of ex-vessel revenue at Oregon ports in a year.
4. Average revenue per vessel is for onshore landings; distant water fisheries revenue is not included.

Source: ODFW fish ticket data, March 2008, April 2009, March 2010, July 2011, April 2013, March 2014, April 2015, November 2016, March 2017, June 2018, July 2019, and September 2020 extractions.

Figure II.2
Oregon, West Coast At-Sea, and Alaska Onshore and Offshore Ex-vessel Value Trends in 2002 to 2019

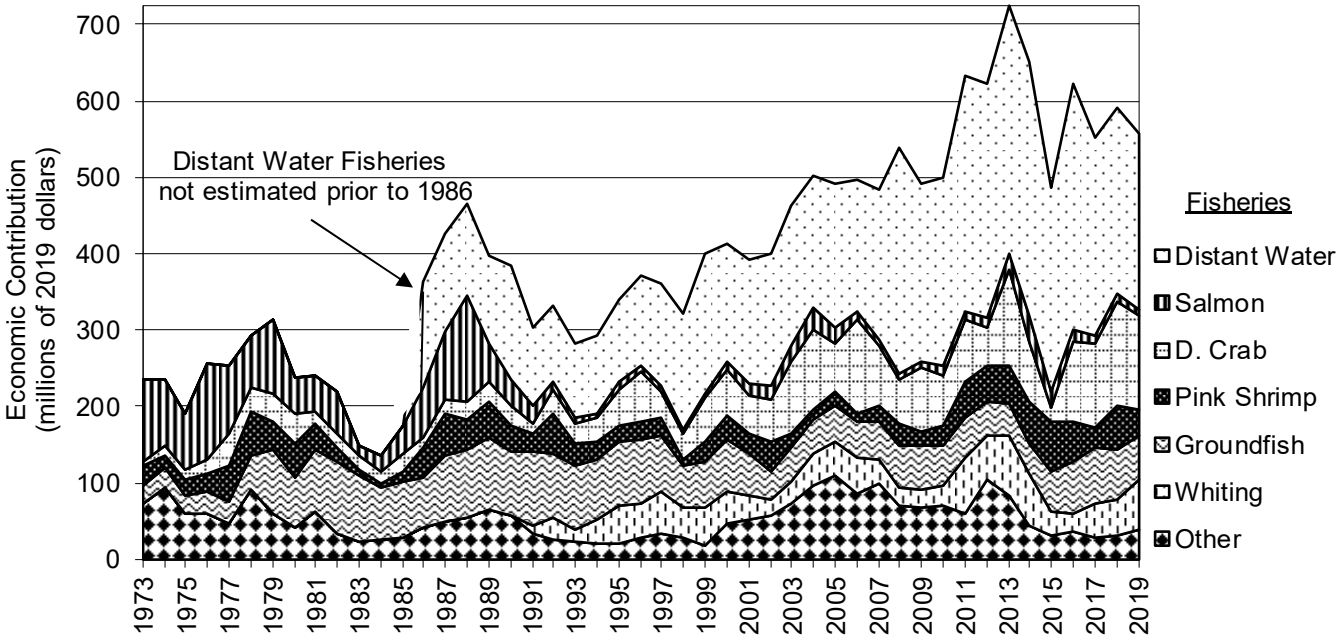


Notes: 1. Ex-vessel value is $161.6 million for Oregon, $8.9 million for West Coast at-sea, and $1,909.5 million for Alaska onshore and offshore in 2019.
2. West Coast at-sea includes catcher vessels harvests delivered to motherships and excludes catcher-processor harvests. In 2016, Oregon homeport vessels were 47% of the vessels delivering Pacific whiting to at-sea motherships. (Of the 17 catcher vessels delivering in 2016 and based on U.S. West Coast onshore landings, eight homeport in Oregon and nine homeport in Washington or homeport could not be determined because they did not have U.S. West Coast onshore landings.)
3. West Coast at-sea ex-vessel value estimated using West Coast onshore prices less 15%.

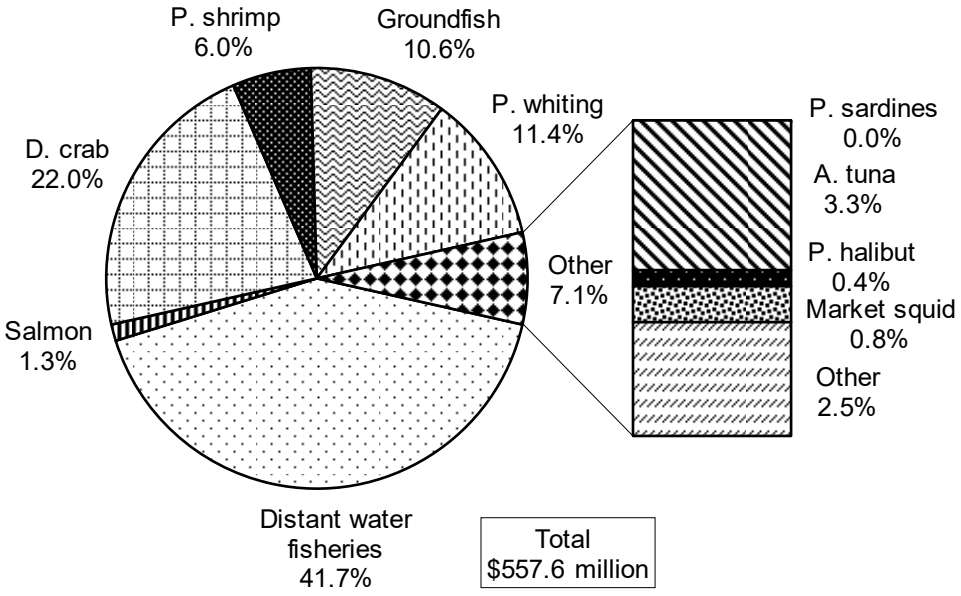
Sources: West Coast from PacFIN annual vessel summary, March 2008, April 2009, March 2010, July 2011, April 2013, March 2014, April 2015, November 2016, March 2017, June 2018, July 2019, and September 2020 extractions; and PSMFC APEX (2020) reports "ALL001" downloaded September 18, 2020 and "IFQ001" downloaded November 11, 2020. Alaska from Alaska CFEC (2020).

Figure II.3

Economic Contributions From Onshore Landings in 1973 to 2019
and Distant Water Fisheries in 1986 to 2019



Economic Contributions by Major Fishery in 2019



Notes: 1. Economic contributions are expressed as statewide income in millions of 2019 dollars.

(this page intentionally left blank)

III. Marine Recreational Fisheries

Commercial wild harvesting activities share natural resources with a large ocean and inriver recreational fisheries sector. Complex management by federal and state agencies ensure reasonable access by both sectors yet conserve the resource to achieve sustainability. This chapter discusses the economic activity of Oregon marine recreational fisheries.

The chapter title is somewhat of a misnomer regarding discussions being comprehensive for all Oregon Coast recreational fisheries. The study area and included fisheries are selective. Inclusion of these data is driven by data availability and the need to assess trends within this study. The following discussions always detail the selected fisheries and locations so that the reader can sort out what is included in the accounting for Oregon Coast recreational fishing trips. Sufficient itemizations are provided to distinguish results that might be found in other studies.

Razor clam digging on Clatsop County beaches. Photo credit ODFW.

A. Methods

Economic contribution estimates are provided for recreational finfish fisheries in Oregon's coastal area (westward of the Coast Range Crest).[1] The included fisheries are all saltwater fishing in the Pacific Ocean and inriver estuaries, and freshwater fishing for some anadromous fish species. Fisheries are excluded when an angling trip's purpose is for freshwater resident species and other than the identified salmon, steelhead, and sturgeon anadromous species.[2,3] Trips for shellfish harvesting (such as for crab, clams, and mussels) are treated in a separate economic analysis.[4] The presented economic information includes findings from other researchers, as well as economic modeling results developed for this project.

---

1. The study area can be approximated by five whole coastal counties (Clatsop, Tillamook, Lincoln, Coos, and Curry) plus the western portions of Lane and Douglas counties. Fishing trips in the Columbia River up to Puget Island (referred to as management area Section 10) that originate on the Oregon side are included.
2. Salmon and steelhead species are categorized in this study depending on their adult freshwater return timing. This is done for convenience with the acknowledgement that the species have finer biological groupings more aligned with life histories that have adapted them to localized conditions of climate and habitat. Salmon in this study have two categories: spring/summer and fall. Steelhead are lumped into one category despite life histories that show distinction in winter and summer runs. Steelhead were included with trouts in the Salmo genus until the 1990's, when they were reclassified in the Oncorhynchus genus with salmon. Oncorhynchus means "hooked snout," a physical characteristic of adult salmon when they are ready to spawn.
3. There are other anadromous fish species that are sought by anglers, such as striped bass and cutthroat trout. Trips for these species are only included in the other marine species (non-salmon) fisheries category if they occur in the lower estuaries. For example, fishing trips for the popular "half-pounders" on the Rogue River east of the Highway 101 bridge would not be included.
4. Recreational shellfish (principally Dungeness crab, but also other crabs, clams, mussels, etc.) harvesting is a popular fishing activity on the Oregon Coast. Ainsworth et al. (July 2012) provided catch and effort estimates for a five year time period ending in 2011. The greatest statewide harvest occurred in 2011 when over one

The recreational finfish fisheries in the study area have two major segments: when salmon is the targeted species; and, when all other non-salmon species are the primary purpose for making the fishing trip.[1] These two recreational fishery segments are further defined by where fishing occurs (ocean or inriver), mode (boat or bank), and whether guide services were used. Trip expenses and consequently the local economic contributions generated are quite different for these sub-segments. Ocean boat salmon fishing has much higher spending per trip, but there are more trips for the inriver location. The primary ocean non-salmon fishery is often times referred to as the bottomfish fishery. Species targeted in this fishery are mostly bottom dwelling rockfish. There are also many charter and private boat trips for halibut and albacore tuna. Each of these non-salmon targeted species is itemized in the trip accounting for this study.

A trip made for recreation purposes may be for multiple reasons, such as fishing and visiting a museum. It could be the spending and consequently the economic contribution estimates in this study overlap with other studies of non-fishing recreational activities. TRG (November 2018c) Table A.2 shows trip expenditures per day in 2017 for the various fisheries and fishing mode. Trip spending in this study for finfish is based on ratios between economic contribution and spending in a two step process. First, economic contribution is calculated using per trip IO-PAC coefficients. Second, ratios from NOAA Fisheries sponsored marine angler economic contribution studies are used to calculate spending. Recreational shellfish spending had the advantage of a recent participant economic survey. Again, ratios from the NOAA Fisheries sponsored studies were used to determine shellfish economic contributions. Trip spending is regardless of where (trip origin, enroute, or destination) purchases occurred. Readers are referred to the NOAA Fisheries sponsored studies for more information about the dissection of where spending occurs and differences between resident and non-resident spending. Citations for the studies accompany the economic contribution results descriptions below.

No differentiation is made between anglers that are resident and nonresidents. This is important to point out because non-resident spending in regional economies generates new income through their trip expenditures. Local resident fishing trip spending may or may not have been spent anyway in the regional economy, so the economic contribution estimates cannot be considered calculations of basic industry economic contribution.

The economic contribution estimates do include the multiplier effect from respending in the local economy. The calculations start with estimates of angler spending for a fishing trip's variable cost. This means the economic contributions do not include effects from capital purchase items

---

million pounds of Dungeness crab were harvested by recreational crabbers. The greatest number of crabbing trips were in 2009, when an estimated 130,000 trips occurred. The study did not sort out when crabbing trips are combined with finfish angling. The crabbing trip estimates were conservative because only five of nine major bays were sampled, only boat-based crabbing effort was counted, and the time period when sampling occurred was restricted to summer and fall months. Ainsworth et al. (December 2014) described clamming fisheries. The largest clam fisheries are for razor clams and for a group of clams collectively known as bay clams found, as the name implies, within the state's many bays and estuaries. Bay clams (including cockles, butter clams, gaper clams, and native littleneck clams) are targeted for recreational and commercial harvest in Oregon.

1. There is cross over between these two fisheries' segments. When non-salmon species are caught when salmon is the primary target species, the trip is counted as a salmon trip.

like boats. There are other studies that do include fishing capital costs which might be of interest to readers of this report: Gentner and Steinback (2008) and USFWS (2017).[1]

Oregon Coast recreational fishing trips have had increasing and decreasing trends over the last 20 years especially when salmon is the targeted species (Table III.1 and Figure III.1). There is not always a direct one-to-one relationship between abundance and response of angler's trip making. It would be expected that trips would decline (increase) with decreasing (increasing) abundance, but the rate of change would not be the same, i.e. the relationship is inelastic (Andrews and Wilen 1988; Allen et al. 2013; Larson and Lew 2013). The reason has to do with the intricacies of angler motivations, such as perceived success rate, fishing trip costs, and other factors that influence angler behavior. Schramm and Gerard (2004) discuss these factors on a nationwide basis. Some anglers choose to make a fishing trip just to have an outdoor experience and others are more motivated by catch aspects (numbers and size of fish). If recreational fishers elect not to fish, they may instead spend the same trip expenditures in non-fishing activities in the local economy.

There were many data sources and economic modeling considerations used in making the economic contribution estimates.[2] The reader is encouraged to review TRG (2015b) for other discussions about data limitations. Ocean and estuary data compiled in the RecFIN database is discussed in PSMFC (2020).

For descriptions about stock conditions and management approaches used to allocate for recreational fisheries, the reader is directed to salmon, groundfish, halibut, and highly migratory species fishery management plans developed by the Pacific Fishery Management Council (PFMC) as a start in better understanding fishery conditions. Freshwater anadromous fish returning to the Columbia River have overwhelming libraries of past and ongoing study publications. Current inriver management regimes are described in Columbia River Compact joint state staff reports and action notices. A wealth of information about anadromous fish returning to Oregon Coast streams can be found at the ODFW conservation and recovery plan website.

1. There are modeling issues associated with determining the economic effects from capital purchases in a regional economic study such as the Oregon Coast. One issue is where the spending for capital items has occurred. Was the spending in the angler's resident economy, en route to the fishing location, or at the fishing location? Another is how much of the capital item is actually associated with fishing. A pickup truck used to pull a boat may be used for other transportation purposes too. Estimates of the economic effects from equipment and other capital items vary widely in studies. For example, Gentner and Steinback (2008) found that in 2006 63.6 percent of total economic contributions were from durable goods used for saltwater fishing in Oregon. The U.S. Fish and Wildlife Service (USFWS) National Survey in data year 2016 found total fishing nationwide spending was 53 percent for non-trip related items such as equipment, boats, and other non-durable items (USFWS 2017).
2. Coast estuary other marine species trips most complete recent year available from RecFIN is for year 2002. The ODFW has undertaken a partial Shore and Estuary Boat Survey (SEBS) program for data from July 2003 through April 2005 and conducted other research in 2016 on best survey methods to acquire effort and catch data. Whiteside et al. (2017) discuses the efficacy of using RecFIN data for estimating effort in the bay marine fishery.

B. Description

There were an estimated 94.2 thousand ocean salmon fishing angler days (includes combination with bottomfishing trips) with $17.0 million trip spending generating $5.7 million income economic contribution at the coastwide economy level in 2019 (Table III.1, Figure III.2, and Table A.3).[1] Ocean non-salmon (tuna, halibut, and bottomfish) angler days were estimated to be 128.3 thousand with $32.5 million spending generating $10.8 million income. Ocean trips when bottomfish were the target species generated the most economic contribution in 2019, but in past years when salmon alone or combination salmon and bottomfishing are target species can be the highest generator depending on management allowed fishing opportunities. Total ocean finfish fishing spending of $49.5 million generated $17 million income at the coastwide economy level in 2019 which was equivalent to about 350 jobs. Output is estimated to be $45 million.

The coastal lower river recreational fisheries (non-Columbia River) had an estimated 646 thousand angler days in the 2019 season. The lower Columbia River's estuary and tributaries and mainstem up to and inclusive of management area Section 10 are estimated to have had 82.4 thousand angler days. The lower Columbia River fall salmon fishery includes trips in the mainstem that catch Chinook and coho salmon, and steelhead. This includes the popular August 1 opening Buoy 10 fishery. Spending from all the lower river finfish fisheries was an estimated $197.5 million. The total economic contributions from all the lower river fisheries generated $66 million income at the coastwide economy level in 2019 which is equivalent to about 1,400 jobs. Output is estimated to be $178 million.

Surf perch fishing. Photo credit Travel Oregon.

Total trip spending for the analyzed finfish recreational fisheries was $247.0 million, generating $82 million income at the coastwide economy level in 2019 (Table III.2 and Figure III.1). The estimate at the statewide economy level is $120 million income in 2019 (Table II.6). The income translated to equivalent jobs at the statewide economy level is about 2,000. Output is estimated to be $288 million.

Accounting for recreational shellfish fisheries (defined to be ocean and bay crabbing and shore and bay clamming) activity is difficult because there is no serial data collection for all trips. Moreover, the activities will occur in combination with other finfish and shellfish fisheries so double counting is a concern. Ocean crabbing trips are reported in the ODFW Ocean Recreational Boat Survey (ORBS) results. Ocean and bay crabbing and clamming are from other ODFW pressure studies that have single year counts. It is assumed the various years apply

1. Economic contributions are from per trip IO-PAC coefficients. Conversion of economic contributions to spending based on ratios from Lovell et al. (2020).

to 2019.[1] Ocean crabbing trips not in combination with trips where finfish are targeted had 6.4 thousand angler days in 2019. (Ocean crabbing angler days total estimate when not controlling for ocean combination trips is 91.1 thousand.) It was assumed bay crabbing angler days are 70.1 thousand in 2019. Bay clamming angler days are 48.5 thousand and razor clamming at ocean beaches (Clatsop County beaches are 95 percent of the effort) is 92.0 thousand all assumed for 2019. Total crabbing (not combination trips) and clamming angler days are 217.0 thousand and the resulting spending is $20.5 million. The spending generates an estimated $15 million income to the statewide economy in 2019 which is equivalent to about 250 jobs. The estimated output is $37 million. These shellfish fisheries estimate would be in addition to the above mentioned marine recreational finfish economic contributions.

Economic contribution summation from both finfish and shellfish trip spending generated $135 million income to the statewide economy in 2019 which was equivalent to about 2,200 jobs. The estimated output is $326 million (Table II.6).

C. Discussion

Fishery managers are often presented with regional economic contribution comparisons when trying to determine equitable assignment of fishing opportunities between commercial and recreation user groups while still ensuring fish resource conservation. As mentioned in the economic analysis methods section of this chapter, there are other economic valuation measurements which may be more appropriate for comparisons. For example, Southwick Associates (2006) uses a variety of measurement units to compare commercial and recreational fisheries on a nationwide basis. Gislason (2006) presents an interesting case study for allocating herring, salmon, and halibut between the sectors in western Canada and references several of the same measurements used by Southwick Associates (2006). Pendleton and Rooke (2006) attempted to sort out recreational resource use and non-use value measurements for California recreational fisheries and discussed allocation policy implications. Additional cautions on the use of regional economic impact assessments are in Propst and Gavrilis (1987). Hanna et al. (2006) discusses the application of economics to fishery allocation issues and they caution against misinterpretation and misuse of economic analysis. Plummer et al. (2012) cited many economic studies that discuss economic efficiency and fairness/equity concepts related to making user group allocation decisions. The report is noteworthy in the compilation of many user group allocation practices used by U.S. ocean fishery management councils.

Reducing economic measurements to a per fish value whether using regional economic contribution estimates or other economic valuation can be a misuse of economic analysis. Commercial fisheries economic contributions are a result of the total operations that transcend different fish resources found off the Oregon Coast and even include distant water fisheries in Alaska. Profit from harvest and processing revenue and operation expenditure variables change significantly from year to year. Recreational fisheries are equally complicated. Spending comes from a commitment to make the trip and not from the number of fish caught. Also, angling is

1. Trips are from Link (August 2000), Ainsworth et al. (July 2012), Ainsworth et al. (December 2014), and Ainsworth (May 2016). Economic contributions based on per trip spending are from Dean Runyan Associates (2009). Conversion of spending to economic contribution is based on ratios from Gentner et al. (2001).

one form of outdoor recreation that is tied to the more general tourism industry. The attraction of just the opportunity to fish have been one motivation to make a trip amongst other planned general tourism activities (OPRD 2013). Moreover, vibrant and year around fisheries access is an indicator of healthy natural resources and can be considered an economic development asset. Living in such an environment is attractive to entrepreneurs and employees. The attraction is an important decision variable with more straightforward business location considerations such as market and suppliers logistics, and labor costs.

Fish resource management and policy alternatives have to be weighed for their potential complex outcomes on conservation and society. Well-intended decisions can lead to unexpected effects when outcome evaluations are not provided or are specious. Economic information along with other social and environmental impact interpretations can assist the decision making process in a tractable manner. For example, policy makers might be interested when the sum of two or more user groups' net economic value is optimal when determining fisheries access allocations. If such information is to be included in decision making, a research plan that determines data collection needs and desired analyses should first be designed. Otherwise, incompatible measurements may be promulgated by interest groups to favor allocation or conservation in their direction. The intent herein is to provide sufficiently qualified descriptions in this report such that improper use of presented statistics will not occur.

Table III.1
Marine Recreational Finfish Fisheries Trip Trends in 2010 to 2019

Target Fishery	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Ocean										
Salmon and combination	53.3	48.8	67.3	85.5	121.5	66.0	38.9	42.3	63.8	94.2
Halibut	13.8	16.5	18.0	19.4	14.2	17.6	21.6	21.8	20.0	16.0
Tuna	11.4	10.8	16.0	9.4	12.0	11.9	9.8	5.7	5.9	15.3
Bottomfish	71.3	69.2	70.3	85.0	75.6	100.6	91.9	101.6	101.2	97.0
Subtotal ocean	149.7	145.3	171.6	199.3	223.3	196.0	162.2	171.3	190.9	222.5
Coast lower river										
Fall salmon	357.8	573.3	447.8	734.0	927.0	1,041.7	444.0	438.1	264.3	264.3
Spr./sum. Chinook	98.3	111.8	119.4	106.4	110.2	120.9	69.6	66.8	41.3	41.3
Lower river steelhead	252.4	196.3	430.0	213.6	243.8	330.0	324.2	182.4	206.8	206.8
Other marine species	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9	132.9
Sturgeon	2.3	2.6	2.1	0.8	0.2	0.4	0.0	0.3	0.5	0.5
Subtotal Coast	843.7	1,017.0	1,132.2	1,187.7	1,414.2	1,626.0	970.7	820.5	645.9	645.9
Lower Columbia River										
Mainstem fall salmon/steelhead	31.0	31.8	41.6	42.9	74.3	74.1	64.0	61.9	44.1	54.5
Mainstem spr./sum. Chinook	25.5	8.8	10.1	9.2	8.5	27.2	16.8	15.7	9.4	6.0
Tributary fall salmon/steelhead	13.4	9.4	10.4	8.9	23.4	14.0	12.3	10.9	9.9	9.9
Other marine species	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Sturgeon	16.4	11.7	8.9	7.5	0.8	0.5	1.3	7.3	8.7	10.4
Subtotal Lower Columbia River	87.9	63.3	72.6	70.2	108.6	117.6	96.1	97.5	73.7	82.4
Total	1,081.3	1,225.6	1,376.5	1,457.2	1,746.2	1,939.6	1,229.0	1,089.3	910.5	950.8

Notes:
1. Trips are in thousands.
2. Lower Columbia River mainstem spring/summer Chinook fishery includes trips in off-channel areas.
3. Coast estuary other marine species trips most complete recent year available from RecFIN is for year 2002. The counts include trips when anadromous fish are the target species. The anadromous fish trips in 2002 based on SSHSTRP data for "bay" waterway segments are subtracted from the RecFIN derived trip data in order to avoid double counting. It is assumed that other marine species trip counts after the subtraction do not change from 2002 in subsequent years. Lower Columbia River estuary other marine trips only available from MRFSS data ending in Year 1999. The 1997 to 1999 three-year average was assumed the trip count for subsequent years.
4. Coast lower river and lower Columbia River tributary salmon and steelhead fisheries data reported by SSHSTRP is only available up to 2018. It is assumed trip counts do not change for 2019. Lower Columbia River mainstem salmon, steelhead, and sturgeon fisheries trips are reported by Watts (CRCP) and are through 2019.
5. The counts include trips when anadromous fish are the target species. The anadromous fish trips in 2002 based on SSHSTRP data for "bay" waterway segments are subtracted from the RecFIN derived trip data in order to avoid double counting. It is assumed that other marine species trip counts after the subtraction do not change from 2002 in subsequent years. Lower Columbia River other marine species trips are only shown for 1993 to 1999, with 2000 to present estimated by 1997-1999 average.

Sources: PFMC (February 2020) for salmon ocean and Columbia River mainstem; ODFW, Oregon Ocean Salmon Fisheries, Annual Status Report, for bottomfish. Watts (2020) for lower Columbia River estuary salmon and sturgeon; ODFW (SSHSTRP) for lower Columbia River off-channel and coast; RecFIN for coastal inriver other species; and MRFSS for lower Columbia River other species.

Table III.2
Marine Recreational Finfish Fisheries Economic Contributions in 2018 and 2019

Economic Contributions in 2018

Target Fishery	Location: Ocean	Coast Lower River: Salmon/ Steelhead	Coast Lower River: Marine Species	Lower Columbia River	Total	Fishery Share
Total	$14.9	$46.2	$12.1	$6.8	$80.0	100.0%
Shares	18.6%	57.8%	15.1%	8.5%	100.0%	

Economic Contributions in 2019

Target Fishery	Location: Ocean	Coast Lower River: Salmon/ Steelhead	Coast Lower River: Marine Species	Lower Columbia River	Total	Fishery Share
Total	$16.6	$46.2	$12.1	$7.3	$82.1	100.0%
Shares	20.2%	56.3%	14.7%	8.9%	100.0%	

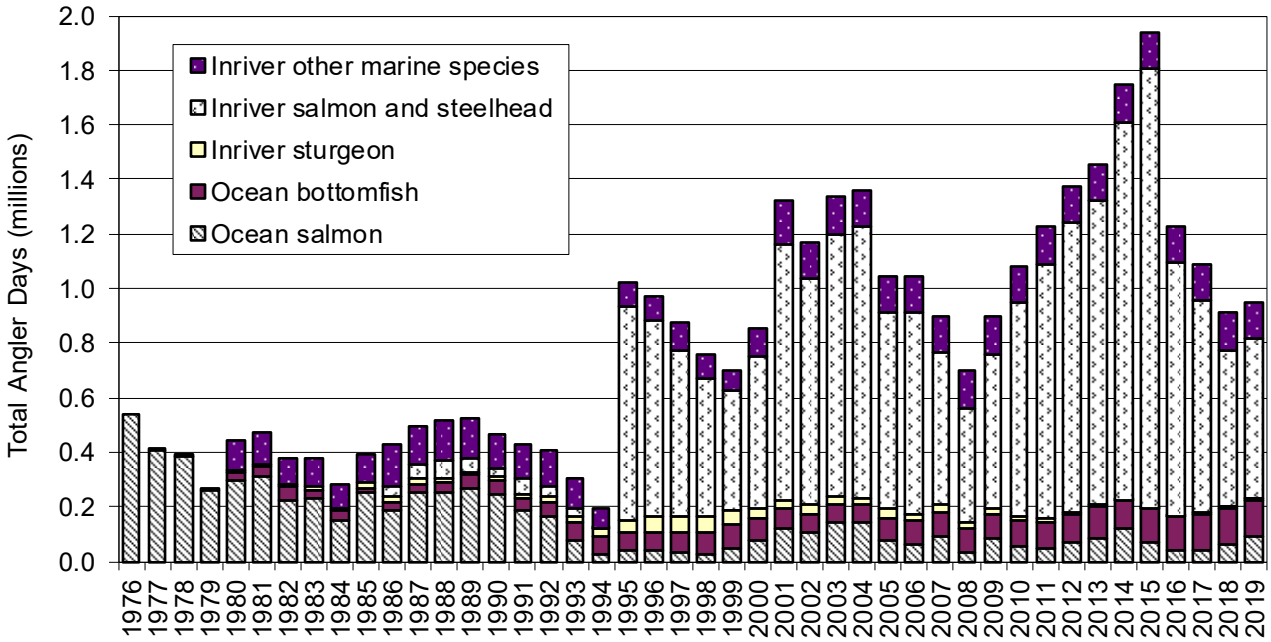
Notes: 1. Economic contributions are expressed as coastwide income in millions of 2019 dollars.
2. Other marine species is sometimes referred to as bottomfishing when it takes place in the ocean.

Table III.3
Marine Recreational Finfish Fisheries Economic Contribution at Port Groups in 2019

Port Area	Ocean	Coast Inriver	Lower CR	Total
Astoria	1,191	13	7,275	8,479
Tillamook	2,462	18,682	-	21,144
Newport	8,734	14,123	-	22,857
Coos Bay	2,738	15,472	-	18,210
Port Orford	n/a	868	-	868
Brookings	1,440	9,137	-	10,577
Coastwide	16,564	58,296	7,275	82,135

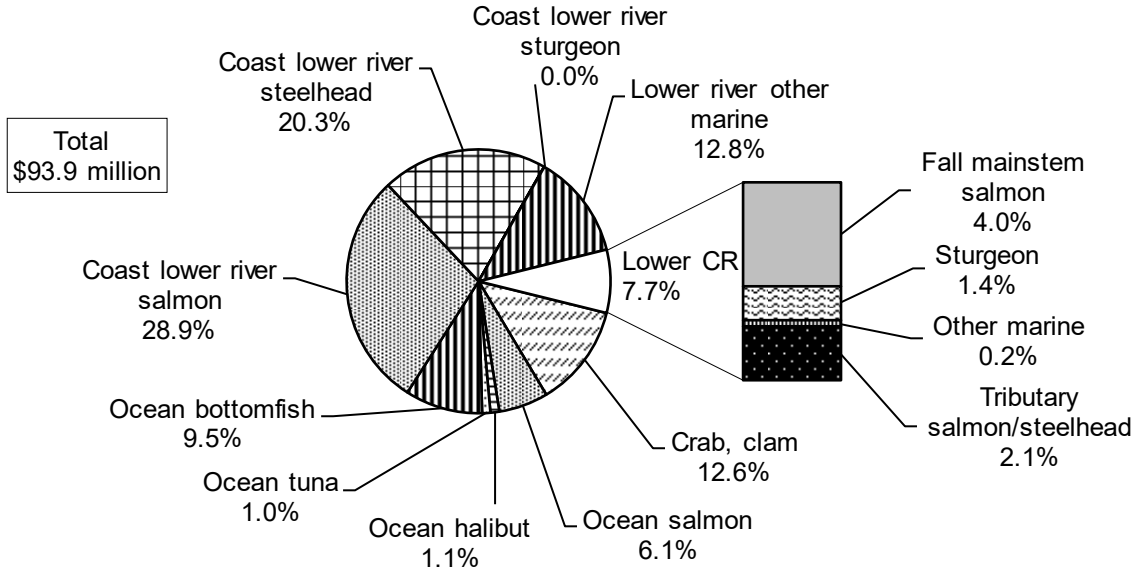
Notes: 1. Economic contributions are expressed as coastwide income in thousands of 2019 dollars.
2. Year 2019 inriver trips information is preliminary. Florence ocean economic contribution is estimated using the most recent angler trips available from sampling year of 2018. The last year data was available for Port Orford was 2012, and the trips were 24 for salmon, eight combination, 439 bottomfish, 133 halibut, no tuna, and 74 dive. Coast inriver and lower Columbia tributary salmon and steelhead fisheries is based on 2018 catch.
3. Coast inriver locations are marine and freshwater waterways approximated for being west of the Coast Range crest, other than Columbia River. Lower Columbia River includes mainstem Section 10, Oregon side only. Lower Columbia River mainstem spring/summer Chinook fishery includes trips in off-channel areas.

Figure III.1
Recreational Angler Days for the Study Selected Finfish Fisheries in 1976 to 2019



Notes:
1. Angler days are included when the fishing trip occurs in the ocean, inriver marine areas (estuaries), and when the trip purpose is for certain species in coastal area inriver locations. The ocean fisheries are separated by trip purpose being for salmon and bottomfish. If the trip purpose is for a combination of salmon and bottomfish, then it is classified as a salmon trip. The bottomfish fishery includes halibut and tuna trips for display purposes.
2. There are gaps in data for the included fisheries. Bottomfish angler days not available before 1980. Lower Columbia River fall salmon fishery trips are not included prior to 1982. Lower Columbia River estuary tributary and Coast estuaries are not included prior to 1995. Lower Columbia River sturgeon is not available prior to 1977. Lower Columbia River mainstem salmon and steelhead trips are in the Columbia River Section 10 zone and include the popular fall Buoy 10 fishery for 1982 to 2019. Coast inriver other marine species trips are only available for 1980 to 1989 and 1993 to 2002, with 1990 to 1992 estimated by 1989 and 1993, and 2003 to present estimated by 2002. Coast estuary other marine species trips most complete recent year available from RecFIN is for year 2002. Trips are for finfish. Trips when targeting crabs and clams in the ocean and bays are not included.
3. Year 2019 inriver trip estimates use 2018 ODFW SSHSTRP data for salmon/steelhead and sturgeon (September 2020 extraction).

Figure III.2
Recreational Marine Fisheries Coastwide Economic Contribution Shares for 2019



Notes: 1. Economic contributions are expressed as coastwide income in millions of 2019 dollars.

IV. Nearshore Fisheries

A. Overview

An economic activity description is provided for nearshore fisheries, i.e. commercial and recreational fisheries that take place within 30 fm depth using the definition from ODFW (2016). Commercial groundfish fisheries management constrained the fisheries to be shoreward of this depth through Year 2019. Map B.5 shows the isobath is approximately coincident with the Oregon Territorial Sea (TS) demarcation and correspondence was assumed for this study. The potential economic impact from marine reserve management is also described in this chapter. The impact is characterized by comparing it to the economic contribution from all fisheries within the assumed TS.

Nearshore fisheries are usually defined by *place* of harvest. ODFW (2016) includes bays in the definition. Bays are the portions of estuaries where species depend on saltwater. The ODFW definition is expanded for this report by assuming bay recreational fisheries include anadromous fish harvests in coastal rivers and streams freshwater segments. Subareas for the place definition used in this report are port groupings where nearshore fisheries landings are made and recreational trips originate. This report's glossary lists the major ports, census data areas, and river/streams associated with port groups.

In order to show commercial and recreational fishing activity that occurs in nearshore waters, a vexing problem is that harvest data has poor or non-existent information about harvest location. Some, but not all, fisheries have logbook information that has harvest location. TRG (February 2018) used surficial geologic habitat (SGH) data and species habitat association information combined with landing data to pinpoint nearshore harvest location. Certain groundfish species will generally occupy shallow water or structure only found within the TS. Other species will occupy and be harvested both within the TS and beyond, such as Dungeness crab and salmon. The nearshore fisheries descriptions rely on the species identifications made in TRG (February 2018) to compile the commercial and recreational fishing activity.[1]

The most important (highest harvest revenue generating) nearshore commercial fisheries are Dungeness crab, salmon troll, and nearshore groundfish. The Dungeness crab and salmon troll fisheries fishing grounds may be within the nearshore area for some fishers for only some of the seasons.[2] Table IV.1 shows landed value for the nearshore fisheries and other major fishery categories at port groups in 2019.[3] The coastwide total harvest value for nearshore fisheries was $74.9 million in 2019 which was 46 percent of the coastwide total of all commercial fisheries.

1. A summary explanation of which species are included in nearshore groundfish is contained in the glossary.
2. The nearshore fisheries proportion of the commercial salmon troll fishery was estimated in the TRG (February 2018) project to be 35 percent from CROOS project results (personal communication Pete Lawson, NMFS April 2015) and the nearshore proportion of the Dungeness crab fishery was estimated to be 54 percent from six year average ending in the 2013-2014 season logbook information (ODFW personal communication May 2015).
3. The table's Dungeness crab and salmon troll fisheries are not apportioned to harvesting taking place within the TS.

Nearshore commercial and recreational fisheries activity is substantial (Table II.6 and Figure IV.1). The nearshore fisheries commercial and recreational economic contribution was $208 million income to the statewide economy in 2019 which is equivalent to about 3,400 jobs. The estimated output is $476 million. This represents 30 percent of Oregon total commercial and recreational fishing industry (includes distant water fisheries) economic contribution.

B. Fleet Characteristics

This section dwells on nearshore fisheries participant characteristics to emphasize that vessels and processors/buyers are not a homogenous group.[1] The descriptors are for all vessels that have harvested and processors/buyers that have purchased nearshore groundfish species. This includes vessels that target nearshore groundfish species as well as those with catch that is incidental to other directed fisheries. Descriptions are for processors/buyers that specialize in the nearshore groundfish fishery and others that have included the fishery in a suite of other fisheries.

Cape Perpetua Marine Reserve. Photo credit ODFW.

Fishery participant diversity can be cast in many different dimensions, albeit the more the better to understand richness. For this report, just three dimensions are used to demonstrate fleet heterogeneity: permit types that allow for harvesting nearshore groundfish, average nearshore fisheries revenue, and the location where nearshore groundfish landings occur. Monitoring diversity temporally should include other dimensions, such as revenue inequality, to better illustrate how changed environmental conditions and fishery management have affected the fishery participants.

Nearshore fishery vessel counts and revenue distribution in 2017 was explained in TRG (November 2018c) Table IV.3 and can be discerned for 2019 from Appendix Table D.1.[2] There were 263 vessels that delivered nearshore groundfish species in 2019. Concerning permit types, 75 percent of all vessels are open access with the balance either LE trawl (21 percent) or LE fixed gear (four percent). The 75 percent open access vessels are 38 percent with an Oregon Nearshore Fisheries Permit and 37 percent without. The top 83 nearshore groundfish revenue producing vessels (32 percent) delivered 90 percent of the $1.8 million nearshore groundfish

1. The descriptors are participant counts and harvest value, which is sometimes synonymously referred to as vessel revenue and processor purchases.
2. Vessels participating in the market squid fishery are not included in Appendix Table D.1. Those vessels to-date tend to have a single business strategy. They mostly commute from out-of-state homeports in Puget Sound, southern California, and Alaska and only participate in the one fishery. A few local vessels are investing in purse seine gear and will be participating in the fishery.

landings. Open access average total revenue was $60.9 thousand and average vessel length was 29.8 feet in 2019.

Typical and representative average revenue profiles can be used to further explain fleet diversity. (This report's glossary explains the two average types.) Using groundfish permit criteria for four categories provides some illumination of fleet diversity; more research on finding common factors for subcategories would be needed to provide a more complete portrayal of fleet diversity. A more detailed categorization scheme would ferret out vessels with similar business strategies and who are the principal nearshore groundfish harvesters.

Appendix Table D.1 shows how some participants are much more dependent on the nearshore groundfish fishery than others. Vessels with LE trawl and LE fixed gear permit types have significant nearshore groundfish representative average landings ($1,540, $7,522 respectively) in 2019, but are least dependent on the fishery (less than one percent and two percent respectively). Most of these permitted vessels landings are flatfish species and lingcod. Open access vessels with a permit representative average is $14,197, which is 36 percent dependency, and open access vessels without a permit representative average is $2,060, which is two percent dependency.

Typical and representative revenue averages by major fishery category for vessels participating in the nearshore groundfish fishery at port groups and coastwide in 2019 are shown on Appendix Table D.2. The table shows that vessels have a portfolio of fisheries to rely upon for operations. The port group with the highest share of vessels making landings using an open access permit type is Tillamook (100 percent) closely followed by Port Orford (91 percent). Astoria has the lowest share (25 percent).

Descriptions of the processing/buyer sector that purchases nearshore groundfish can be informative about other coastal businesses that are dependent on the fishery. The additional sector descriptions are helpful to show the wider picture of community sensitivity to the nearshore groundfish fishery's status. Table D.3 shows a comparison of processors/buyers that purchase more than $10 thousand of nearshore groundfish, processors/buyers that specialize in the nearshore groundfish fishery, and for comparison purposes, processors/buyers with more than $10 thousand in any fishery. Purchases are itemized by major fisheries categories. Processors/buyers that do make the large purchases of nearshore groundfish have representative average purchases five times higher than all processors making purchases over $10,000 in any fisheries ($76,157 versus $16,013). There were 5 processors/buyers that specialize in the nearshore groundfish fishery (nearshore groundfish fishery purchases greater than 50 percent). There are processor/buyer businesses whose only purchases are live nearshore groundfish landings whose markets are Asian country exports or domestic restaurants with Asian oriented menus (TRG 2017). Selling live fish and shellfish is popular among ethnic markets, traditionally centered in urban areas catering to persons of East Asian (Chinese, Korean, and Japanese) descent. The East Asian customers perceive value in consuming fish and seafood as fresh as possible, which requires products are purchased live (Meyers et al. 2007; Thapa et al. 2015).

Not all vessels with permits in any of the three nearshore fisheries will participate in any given year. Some of the many reasons are (Holland et al. 2004; Pelletier and Mahévas 2005; Saul and Die 2016):

- Fish resource levels that will affect assumed CPUE,
- Changed distance to fishing grounds caused by modified management specifications,
- Other altered cost factors affecting perceived net revenue,
- Vessel physical problems,
- Crew labor complications,
- Unresolved processor purchasing issues,
- Personal investment choice made by the permit owner unrelated to fishing.

TRG (2018c) found the average annual year-over-year rate of permittee new or re-entrance in the three nearshore fisheries is 14.8 percent for Dungeness crab, 33.3 percent for salmon troll, and 25.0 percent for nearshore groundfish during 2006 to 2016 period.[1] The average annual intra-state status was a little less than half delivered previously at another Oregon port. The rest do not participate in Oregon fisheries. The Newport port group had the highest average churn (combined exit and entry rate during the 2006 to 2016 period) and the Port Orford port group was the lowest at about half of Newport's rate.

C. Fisheries Engagement

A brief set of community fishery engagement indicators is described in this section for the purpose of rounding out an Oregon nearshore fisheries description. The indicators discussion is supplemented with social/economic descriptors that show coastal area vulnerability to changes in fisheries. Fisheries engagement indicators along with social/economic descriptors can be used in trend analysis to monitor and assess social vulnerability status and risk positions. They provide a basis for retrospective and prospective investigations to determine impacts arising from changing ocean conditions, new ocean uses, and natural resource management.[2] When supplemental ocean use choices data are available, primary factors for adaptive responses can be identified and predictive models developed.[3] New management and mitigation program alternatives can be evaluated for implementation impacts and tradeoffs. Discussions can have benefits for providing conservation awareness and making natural resource planning more responsive to those most affected (Jacob et al. 2012; Poe et al. 2014).[4]

---

1. The ten year exit/entrance analysis period was chosen to represent a pre and post design with non-equivalent control groups (i.e. ports purportedly not affected by MR locations) related to MR implementation timing.
2. Example new ocean uses are renewable energy development. Example changed ocean conditions could be related to climate changes such as ocean acidification and hypoxia events, storm severity, etc. Example ocean resource management modifications could be the establishment of marine reserves that require implementation of no-take areas.
3. Reimer et al. (2017) caution that accurate assessment of the impacts of fishery management intervention requires sufficient fisheries structural descriptions so as to avoid misleading predictions for even the most short-run of management changes.
4. A more in-depth ecological and fisheries engagement indicator compilation could be used (Samhouri et al. 2013).

There are other related research efforts to derive U.S. West Coast indicators. The Social Well-being Indicators for Marine Management (SWIMM) project was undertaken to improve human dimensions understandings for ecosystem-based management (Breslow et al. 2017). The multi-agency team developed a suite of human well-being indicators for use in NOAA's Integrated Ecosystem Assessment of the California Current. Lindberg (2019, Lindberg et al. 2019, 2020) developed indicators of individual subjective well-being and resilience for examination of related phenomena between communities and among individuals. Norman et al. (2007) used social and cultural descriptors along with fishery data to develop indicators for communities along the U.S. West Coast and Alaska. Jepson and Colburn (2013) expanded on the descriptors for assessing engagement in the U.S. Southeast and Northeast Regions. Based on these efforts, NOAA Fisheries explains and maintains a current suite of indicators for coastal areas and the Great Lakes region.[1]

There have been several recent climate change effect studies that have included compilations of human dimension descriptors. Two studies using the Oregon Coast situation and employing resident surveys are Hoelting and Burkardt (2017) and Fischer (2018). Lynn et al. (2011) has an exhaustive literature search up to the date of the publication on climate change effects to Oregon Coast type environments. Dalton et al. (2013) relates climate change effects on the physical environment in the Pacific Northwest to communities.

Commercial/recreational fisheries engagement (measured by economic contribution) in 2019 is shown at port groups on Figure IV.2 and coastwide in Table II.6. The commercial fisheries are itemized for an aggregate of the nearshore fisheries and the residual for all other onshore fisheries. Commercial fisheries generated $264.3 million income coastwide in 2019. (Distant water fisheries effects are not included.) Recreational fisheries generated $93.9 million income in 2019. The nearshore proportion of commercial fisheries was 22 percent and the nearshore proportion of recreational fisheries was 98 percent.

Fisheries engagement can be decomposed into regional economy reliance, fisheries dependency, and social vulnerability.[2] Figure IV.3 shows port group rankings for these dimensions in 2018. The Astoria port group had the highest reliance on commercial onshore fisheries in 2018 and Port Orford was the most dependent on commercial nearshore fisheries. (If distant water fisheries were included in Figure IV.3, then the Newport port group would have had the highest reliance on commercial fisheries.) Port Orford and Astoria are also of higher social vulnerability with greater commercial fisheries reliance.

Demographic and well-being indicators at port groups in 2018 is provided in Appendix E. The indicators show the social fabric backdrop of communities where fishing families live and work. The indicators are related to population (age, ethnicity), households (numbers, size), housing (costs, vacancy, second-home, tenure), labor force (employment in occupations and industries,

1. The NOAA Fisheries website accessed July 2018 is: https://www.fisheries.noaa.gov/topic/socioeconomics#socio-cultural-dimensions.
2. Social vulnerability to fisheries downturns is based on Shannon index of occupational diversity.

unemployment), wealth (income sources, poverty), and education. The Oregon Coast levels and contrasts with the State are:

- Newport port group has the largest population (62,294) and Port Orford the smallest (2,703).
- The Coos Bay port group is the most racially diverse at 11.5 percent.
- All port groups (coastwide median age 49.9) are older than the State (median age 39.2) and household size is smaller (State 2.51 and coastwide 2.26).
- The ACS tourism industry category (arts, entertainment, recreation, accommodation, and food service) is higher coastwide (15.9 percent of all civilian employment age 16 and over) than the State (9.9 percent). Port Orford has the highest employment in this category at 21.8 percent.
- Housing costs (mortgage payments) are about 16 percent less than the State.
- The percentage of housing units that are second homes is five times higher on the Coast than in the State. The Tillamook port group is the highest at 37.4 percent.
- There is a dramatic difference in household mean income at the Coast ($61,365) compared to the State ($80,040). Port Orford has the lowest income ($53,886). Brookings had the highest number of households receiving social security payments (58.1 percent).
- The share of self-employed individuals such as crew and skipper jobs on fishing boats is higher on the Coast (10.1 percent) than in the State (7.3 percent).
- Port Orford is distinguished by having the highest share of individuals living under the poverty level (25.1 percent). The State individuals poverty level is 14.1 percent.

The demographic and well-being indicators are important for giving a higher-level picture of the social environment. Indicators help communicate and identify goals and objectives for natural resource management and enable decision makers to measure and monitor changes and outcomes towards meeting management goals (Poe et al. 2015). Social indicators can show disparity in impacts from marine conditions changes that are specific to communities and tribal interests (Tuler et al. 2008; Singleton 2009). However, there are two issues that will confound using the indicators to assess disparity.

First, areawide indicators and indexes may not show how individual commercial fisheries participants and families are affected. For example, fisheries reliance does not have to be high in regions where there is substantial engagement in commercial fisheries. A region can have a mature economy with other industries present so that the proportion participating in fisheries is low. Yet for those that do participate, there is a family financial dependency and social identity that is important. Usually the business participation is in a plurality of fisheries and even other businesses such as selling directly to the public. While diversification can provide a long term and sustainable lifestyle where short term revenue downturns in one staple fishery can be replaced with another revenue source, there can be cumulative impacts when one revenue opportunity is restricted long term. It takes away the viability of the business operation and

eventually there will be permanent exiting from the fishing industry. In general, the replacement business for small operations will be larger operations. Communities with a strong commercial fishing industry comprised of small operators will be left with a diluted industry presence as the larger operations are usually centralized at regional fisheries centers. In such cases, communities will have an eroded cultural identity.

The second issue in assessing disparity is that indicators and indexes do not necessarily provide an understanding of the quality of life experienced by living on the Oregon Coast. People are drawn to the region because they cherish the natural environment living conditions (Swedeen et al. 2008). In effect, the conditions provide a "second paycheck" which complements the "first paycheck" derived from their employment and pension programs (ECO Northwest 1999). Fishing families in particular are independent minded and appreciate the importance of healthy natural environment in pursuit of livelihood opportunities. These families may be resistant to giving up their second paycheck, and therefore, would be vulnerable to abundance downturns and species range fluctuations such as being caused by climate changes (Griffis and Howard 2013; Chavez et al. 2017). Planned effort shift investigations should prove helpful in better understanding the perceptions and attitudes towards changing fishing conditions and assist in developing social models to illuminate impacts and allow for development of education and mitigation programs (Swearingen 2018). Study results will help determine effects from fishing abandonment, from changing locations for same fisheries, and from switching to other fisheries.

D. Marine Reserve Fisheries

Commercial and recreational fisheries at sites that were within the Oregon system of marine reserves were investigated for the TRG and GMC (2012) project. The project purpose was to develop a model that could be used to estimate the economic contributions from fisheries within alternative marine reserve boundary designs. The model was used to inform decision making in the geographic shaping and fisheries management plan development process that ultimately led to the existing system of marine reserves. A follow-on project generalized the model to apply to a new base period and any nearshore area (TRG February 2018). A current project is underway to review whether there might be new MR applicable fisheries and to update the model to a more current base period (3-year average 2017-2019).[1]

The estimated maximum potential economic impact (i.e. no replacement from fishing elsewhere) from marine reserve management is 3.8 percent of all nearshore commercial and recreational fishing economic contribution that takes place in the TS (Table IV.2). Since the marine reserve system is about 10 percent of the TS, it would seem likely that the 90 percent commercial harvesting and recreation angling area opportunities would provide satisfactory substitute fishing grounds for most species. (Salmon and crabbing are only restricted in the MR portion which is

1. The economic analysis to show estimated maximum potential economic impact from marine reserve management does use the spatial model's new base period. However, there are no new nearshore fisheries added as applicable in the model. The market squid fishery was considered, but it is a developing fishery and it was determined to be too speculative whether or not it should be a marine reserve management displaced fishery. The consideration is ongoing and a future decision may be to include it as an applicable fishery. The fishery is included as another coastal pelagic commercial fishery that takes place in the nearshore.

about 3 percent of the TS.) However, some individual fishermen may have experience with the bottom features and water conditions at these sites and decide not to fish elsewhere given management closures.[1] If fishing does occur at new sites, fishing costs may rise from increased transit distances and changed catch per effort. If recreational fishers do not fish in new areas, they may instead spend the same trip expenditures in non-fishing activities in the local economy. Not included in the displaced fisheries estimates are potential biological spillover effects resulting from possible increased stock abundances that might raise catch per effort in the new fishing area.

One project addressing the extent of effort shift and fisheries abandonment was Hudson, et. al. (October 2018) with review by TRG (2018b). Other publications on commercial and charter fishers experience and attitudes related to marine reserve implementations are Marino (2017) and Marino (2020). There are other MR Program human dimension investigative projects underway and planned.[2] New project investigations in combination with analyzing existing information series (such as logbook and fish ticket data) will help determine and relate any perturbations in fishing activity to the establishment of marine reserves. The analysis will be necessary to discern any statistical discontinuity in effort (such as measured by harvest value and vessel counts) due to marine reserves implementation. For example, the 10-year harvest value relative variability between 2010 and 2019 is 124 percent for Dungeness crab, 179 percent for salmon, 40 percent for the nearshore live fishery, and 45 percent for all groundfish other than Pacific whiting (Table C.2).[3] In regards to fishing tenure, TRG (2018c) Figure IV.3 shows nearshore groundfish vessel annual exit and entry before and after marine reserve management plan implementation.[4] The exit/entry rate is around one-third in any given year in the nearshore groundfish fishery. There were net increases at some port groups near marine reserves during the year that marine reserve management restrictions were implemented. Port Orford vessel participation increased by four vessels the implementation year for Redfish Rocks. The problem will be to find the degree and outcome of any influence from marine reserve implementation within harvest and participation variability given that fishers are also responding to such factors as fish resource conditions, other regulations, market conditions, personal investment choices, and even weather.

1. Fishers in aggregate tend to continue fishing despite conditions that may affect landing success. This may reflect participant ambivalence towards entering and exiting the fishery based solely on lost revenue opportunities. This would be consistent with habit being a meaningful social/psychological factor in fishery choice models (Van Putten et al. 2012). This observation could be extended to mean fishers reaction to management restrictions on fishing grounds in one area are simply compensated at same effort levels when there are opportunities elsewhere. Compensation from other fisheries may also occur if the fisher has the capacity and permits to pursue other fishery opportunities.
2. A more thorough description of human dimensions research and monitoring plans can be found at the Oregon Marine Reserves portal. The most recent human dimensions research plan via internet: https://oregonmarinereserves.com/content/uploads/2017/08/Human-Dimensions-Monitoring-Plan-2017.pdf
3. The summary variance statistic relative variability is range divided by mean expressed as a percent.
4. Marine reserves management restrictions started on January 1, 2012 for Redfish Rocks (RR) and Otter Rocks (OR); started on January 1, 2014 for Cascade Head (CH) and Cape Perpetua (CP); and started on January 1, 2016 for Cape Falcon (CF).

Table IV.1
Landed Value for Nearshore and Other Fisheries by Port Groups in 2019

Fishery	Port Group						
	Astoria	Tillamook	Newport	Coos Bay	Port Orford	Brookings	Coastwide
Nearshore Fisheries							
Ocean salmon	29,914	121,848	1,458,683	454,167	151,354	123,883	2,339,849
D. crab	11,285,389	2,962,576	24,971,377	19,192,899	2,890,985	6,619,961	67,923,187
Nearshore groundfish	74,540	201,033	192,514	121,832	890,604	311,088	1,791,610
Market squid	0	0	1,137,501	1,746,429	0	1,893	2,885,823
Subtotal	11,389,843	3,285,457	27,760,075	21,515,327	3,932,943	7,056,825	74,940,469
Other Fisheries							
Col. R. salmon	1,999,159	0	0	0	0	0	1,999,159
Other groundfish	12,492,494	31,146	9,712,303	3,225,182	557,735	1,536,287	27,555,148
P. shrimp	6,186,680	0	6,951,110	4,092,282	0	2,710,296	19,940,368
Tuna	1,084,800	653,748	4,938,588	3,895,998	120,796	152,518	10,846,448
Whiting	13,179,589	1	8,539,712	0	3	0	21,719,305
Sardine	0	0	0	3,760	0	0	3,760
Other	496,736	785,208	1,406,017	1,195,812	297,696	447,466	4,628,935
Total	46,829,301	4,755,560	59,307,805	33,928,361	4,909,173	11,903,392	161,633,592

Notes: 1. Columbia River salmon fishery includes both non-Indian and tribal fisheries.
2. The nearshore fisheries portion of the commercial salmon troll fishery is assumed 35 percent and the nearshore portion of the Dungeness crab fishery is assumed to be 54 percent of the total amounts shown (TRG February 2018).
3. See glossary for explanation of individual ports included in port groups and species included in the nearshore groundfish category.

Source: PacFIN fish ticket data, September 2020 extraction.

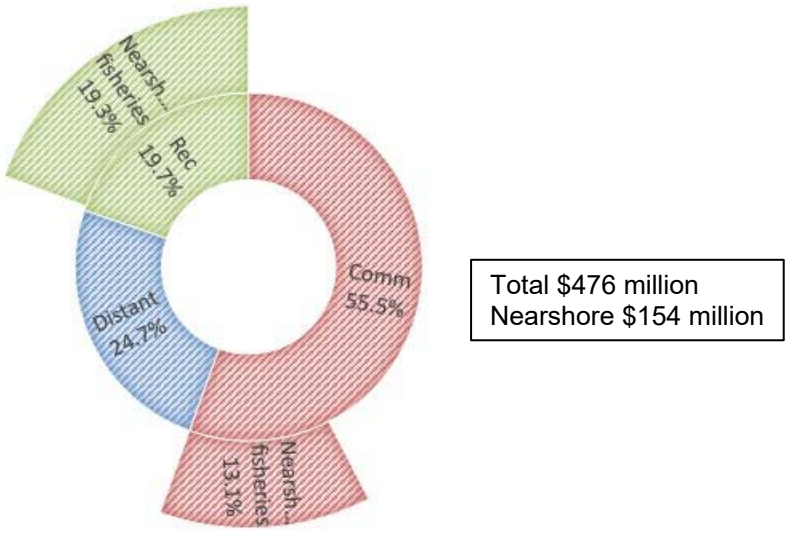
Table IV.2
Marine Reserve Sites Annual Average Regional Economic Impacts From
Assessed and Displaced Commercial and Recreational Fisheries for 2017-2019

Harvest Area	Area Share of Territorial Sea	Assessed Fisheries REI			Displaced Fisheries REI		
		Comm.	Rec.	Total	Comm.	Rec.	Total
Marine Reserve Sites							
Cape Falcon	1.6%	1,144	79	1,223	760	64	824
Cascade Head	2.6%	1,802	486	2,288	550	149	698
Otter Rock	0.1%	62	24	87	62	24	86
Cape Perpetua	4.4%	3,101	234	3,335	728	105	833
Redfish Rocks	0.6%	255	52	307	121	49	170
Total	9.3%	6,365	874	7,239	2,220	392	2,612

Comparison Areas		REI			Assess. Share	Displ. Share
		Comm.	Rec.	Total		
Territorial Sea	100.0%	63,179	5,976	69,155	10.5%	3.8%
Onshore landed commercial fisheries		252,518				
Ocean recreational fisheries			14,972			
Ocean commercial and recreational fisheries				267,490	2.7%	1.0%

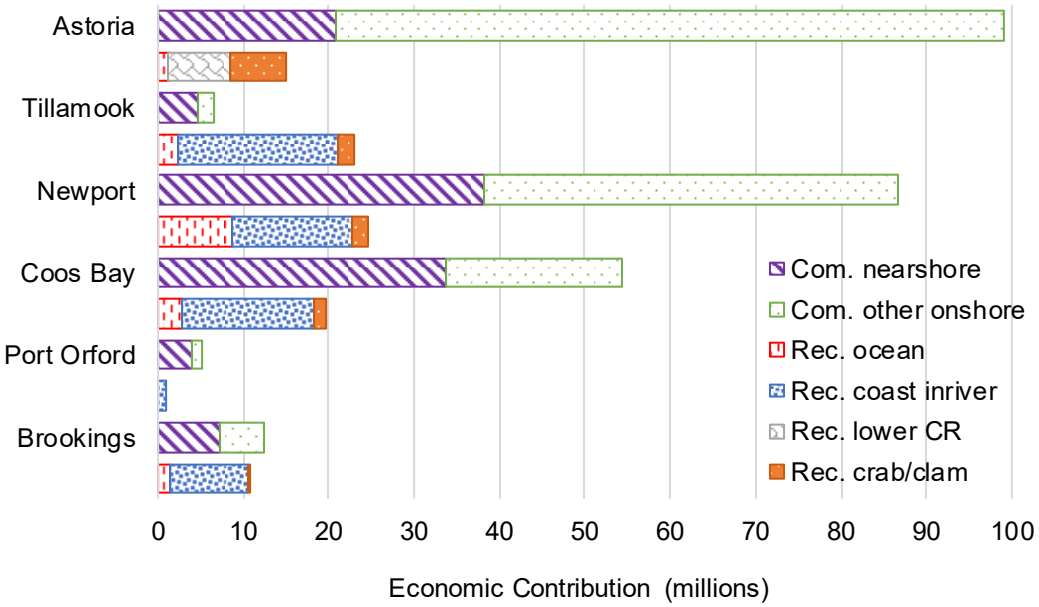
Notes:
1. Economic impacts are expressed as coastwide income in thousands of 2019 dollars.
2. REI is regional economic impact.
3. Assessed fisheries are all of those that took place in the marine reserve and marine protected area portions. Displaced fisheries are those that are closed due to marine reserve management. Closed fisheries are all fisheries in the marine reserve portion, and only certain fisheries in the marine protected area portion. For example, salmon and Dungeness crab fishing is allowed within the marine protected area portion. Exceptions are the commercial market squid fishery and ocean and bay crabbing and clamming.
4. The economic impacts for displaced fisheries should be considered the maximum potential effects from marine reserve management. Fishermen may elect to use other locations for same fisheries or participate in other fisheries as substitutes for the marine reserve management closures.

Figure IV.1
Oregon Fishing Industry Economic Contribution and Nearshore Fisheries Component in 2019



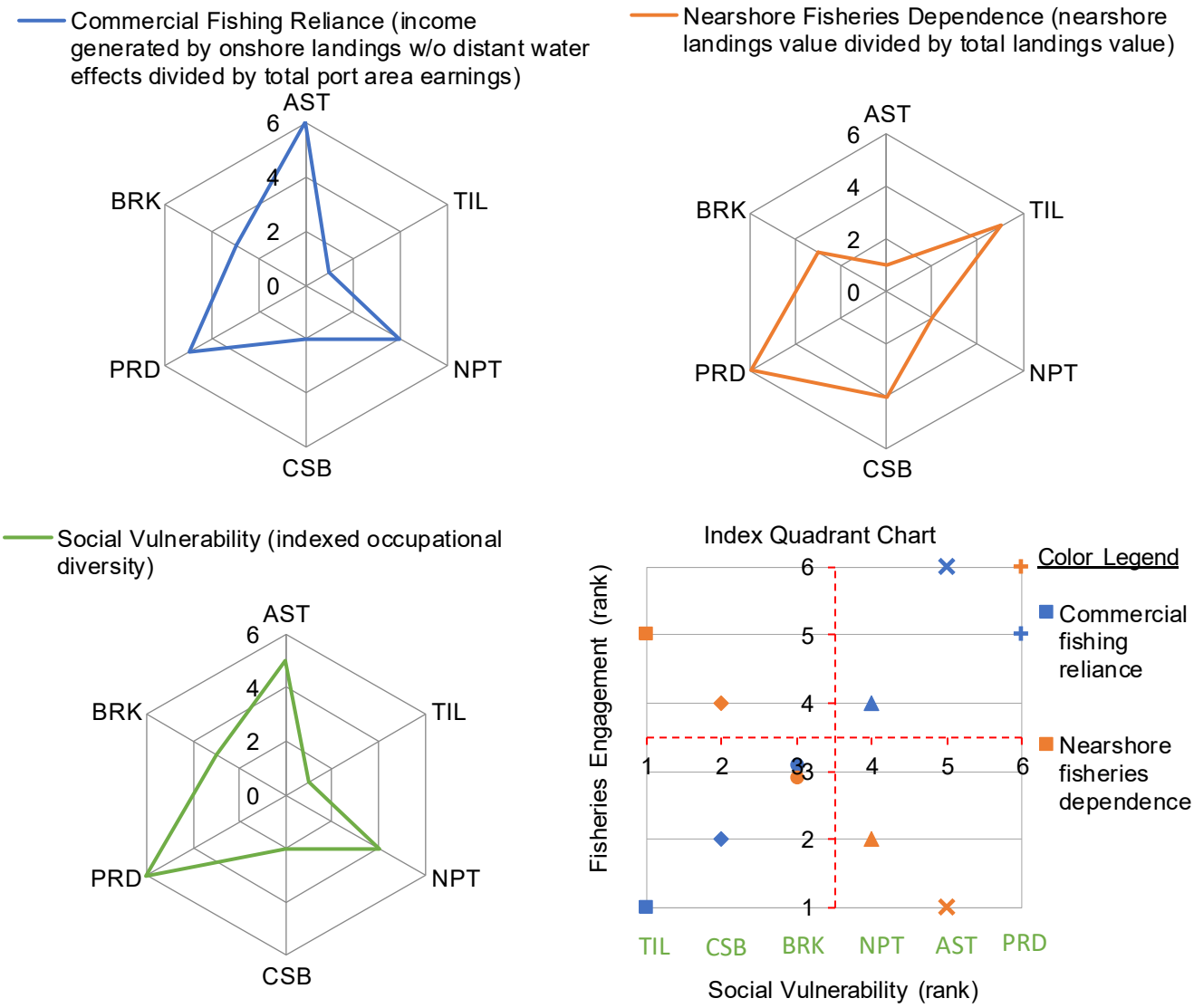
Notes: 1. Economic contributions are expressed as coastwide income in millions of 2019 dollars.

Figure IV.2
Commercial and Recreational Fisheries Engagement at Port Groups in 2019



Notes:
1. Economic contribution is expressed as coastwide income in 2019 dollars. Total economic contribution is without distant water fisheries effects. Recreational is calculated using trip expenditures. No differentiation is made between trips made by anglers that are resident and nonresidents. Expenditures for capital items (purchase of vehicles, boats, rods, and other durable goods) are not included in the calculation.
2. Commercial nearshore fisheries are defined for this figure to be Dungeness crab, salmon troll, market squid, and nearshore groundfish. The nearshore fisheries portion of the commercial salmon troll fishery is assumed 35 percent and the nearshore portion of the Dungeness crab fishery is assumed to be 54 percent of the total amounts shown (TRG February 2018).
3. Recreational inriver trip data is for various years and it is assumed that all data is applicable to 2019. Florence ocean economic contribution is estimated using the most recent angler trips available from sampling year of 2018. The last year data was available for Port Orford was 2012, and the trips were 24 for salmon, eight combination, 439 bottomfish, 133 halibut, no tuna, and 74 dive. Coast inriver and lower Columbia tributary salmon and steelhead fisheries is based on 2018 catch.
4. Angler days are included when the fishing trip occurs in the ocean, inriver marine areas (estuaries), and when the trip purpose is for certain species in coastal area inriver locations. The ocean fisheries include trip purpose being for salmon, bottomfish, halibut, tuna, or dive (but not crab only trips). The only trips included at inriver locations are when the catch was Chinook or coho salmon, steelhead, sturgeon, or other marine species. The inriver locations are waterways approximated for being west of the Coast Range crest.
5. Estimates for associated waterway recreational fishing exclude trips made for the purpose of catching resident fish. There are many coastal lakes and other streams near the communities where this occurs, but there were not consistent data sources to develop economic contribution estimates. Trips when the primary purpose is from recreational angling for cutthroat trout are not included.
6. Lower Columbia River mainstem spring/summer Chinook fishery includes trips in off-channel areas.
7. Recreational crab/clam includes ocean crabbing trips not in combination with finfish trips, bay crabbing trips, and shore and bay clamming trips.

Figure IV.3
Oregon Rankings of Port Group Area Commercial Fishing Industry Reliance,
Commercial Nearshore Fisheries Dependency, and Social Vulnerability in 2018



Notes:
1. Port group acronyms are explained in the report's glossary section.
2. Nearshore fisheries are defined for this figure to be Dungeness crab, salmon troll, nearshore groundfish, and market squid. The nearshore fisheries portion of the commercial salmon troll fishery is assumed 35 percent and the nearshore portion of the Dungeness crab fishery is assumed to be 54 percent of the total amounts shown (TRG February 2018).
3. Reliance rankings are based on economic contribution (measured by income that includes the multiplier effect) from commercial fisheries (without distant water fisheries effects) divided by port group area household earnings. Port Orford area earnings are from northern Curry County zip codes.
4. Dependency rankings are from the ratio of commercial nearshore fisheries landed value divided by total onshore fisheries landed value.
5. Social vulnerability rankings are based on Shannon Index of occupational diversity.
6. The ranking 6 represents the highest commercial fishing reliance, highest commercial nearshore fisheries dependency, and highest social vulnerability.
7. Port groups within upper right quadrant would be of higher social vulnerability with greater commercial fisheries reliance and dependence on nearshore fisheries.

Sources: ACS 2014-2018 estimates.

(this page intentionally left blank)

V. Bibliography

Ainsworth, Justin. "Recreational and Commercial Clam Fisheries in Oregon." Presentation Oregon Shellfish Task Force. May 2016.

Ainsworth, Justin C., Anthony F. D'Andrea, Mitch Vance, Scott D. Groth, Elizabeth A. Perotti. Status of Oregon Bay Clam Fisheries, Stock Assessment, and Research. Oregon Department of Fish and Wildlife Information Reports Number 2014-09. December 2014.

Ainsworth, J. C., M. Vance, M. Hunter, and E. Schindler. The Oregon Recreational Dungeness Crab Fishery, 2007-2011. Oregon Department of Fish and Wildlife. July 2012.

Allen, M.S., R.N.M. Ahrens, M.J. Hansen, R. Arlinghaus. "Dynamic Angling Effort Influences the Value of Minimum-Length Limits to Prevent Recruitment Overfishing." *Fisheries Management and Ecology,* 20: 247–257. 2013.

Anderson, S.C., E. Ward, A. Shelton, M. Adkison, A. Beaudreau, R. Brenner, A. Haynie, J. Shriver, J. Watson, and B. Williams. "Benefits and Risks of Diversification for Individual Fishers." *PNAS,* vol. 114, 10797–10802. 2017.

Andrews, E.J. and J.E. Wilen. "Angler Response to Success in the California Salmon Sport Fishery: Evidence and Management Implications." *Marine Resource Economics.* 5(1988): 125-138. 1988.

Breslow, Sara Jo, M. Allen, D. Holstein, B. Sojka, R. Barnea, X. Basurto, C. Carothers, S. Charnley, S. Coulthard, N. Dolšak, J. Donatuto, C. García-Quijano, C. Hicks, A. Levine, M. Mascia, K. Norman, M. Poe, T. Satterfield, K. St. Martin, and P. Levin. "Evaluating Indicators of Human Well-being for Ecosystem-based Management." *Ecosystem Health and Sustainability,* 3:12. 2017.

Burgess, M.G. "Consequences of Fleet Diversification in Managed and Unmanaged Fisheries." *Can. J. Fish. Aquat. Sci.* 72, 54–70. 2015.

Chavez, F.P., Costello, C., Aseltine-Neilson, D., Doremus, H., Field, J. C., Gaines, S. D., Hall-Arber, M., Mantua, N. J., McCovey, B., Pomeroy, C., Sievanen, L., Sydeman, W., and Wheeler, S. A. (California Ocean Protection Council Science Advisory Team Working Group). Readying California Fisheries for Climate Change. California Ocean Science Trust, Oakland, California, USA. 2017.

Dalton, M.M., P.W. Mote, and A.K. Snover. Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities. Island Press. 230 p. 2013.

Dean Runyan Associates. Fishing, Hunting, Wildlife Viewing, and Shellfishing in Oregon, 2008. Oregon Department of Fish and Wildlife and Travel Oregon. May 2009.

Devore, James, Brad James, and Ray Beamesderfer. Lower Columbia River White Sturgeon Current Stock Status and Management Implications (Draft). WDFW and ODFW. April 1999.

ECO Northwest. The Sky Did Not Fall: The Pacific Northwest's Response to Logging Reductions. Prepared for Earthlife Canada Foundation and Sierra Club of British Columbia. April 1999.

Filbee-Dexter, K., J. Pittman, H. Haig, S. Alexander, C. Symons, and M. Burke. "Ecological Surprise: Concept, Synthesis, and Social Dimensions." *Ecosphere* 8(12). 2017.

Fischer, Alexandra Paige. "Pathways of Adaptation to External Stressors in Coastal Natural-Resource-Dependent Communities: Implications for Climate Change" in World Development Volume 108, Pages 235-248. August 2018.

Gentner, Brad, Michael Price, and Scott Steinback. Marine Angler Expenditures in the Pacific Coast Region, 2000. National Marine Fisheries Service, NOAA Technical Memorandum NMFS-F/SPO-49. October 2001.

Gentner, Brad and Scott Steinback. The Economic Contribution of Marine Angler Expenditures in the United States, 2006. U.S. Dept. of Commerce, NOAA Technical Memorandum NMFS-F/SPO-94. Via Internet: http://www.st.nmfs.noaa.gov/st5/publication/AnglerExpenditureReport/AnglerExpendituresReport_ALL.pdf. December 2008.

Gislason, Gordon, GSGislason & Associates Ltd. "Commercial vs. Recreational Fisheries Allocation in Canada: Pacific Herring, Salmon and Halibut." Paper Presented to Sharing the Fish 06 Conference, Fremantle, Western Australia. February 26 - March 2 2006.

Griffis, R. and J. Howard (Eds). Oceans and Marine Resources in a Changing Climate: A Technical Input to the 2013 National Climate Assessment. Washington, D.C.: Island Press. 2013.

Hanna, Susan; Gilbert Sylvia, Michael Harte, Gail Achterman. Review of Economic Literature and Recommendations for Improving Economic Data and Analysis for Managing Columbia River Spring Chinook. A Report to Oregon Department of Fish and Wildlife in fulfillment of ODFW Agreement No. 005-4132S-Wild. Institute for Natural Resources, Oregon State University. April 2006.

Hoelting, K. and N. Burkardt. Human Dimensions of Climate Change in Coastal Oregon. Prepared for US Dept. of the Interior, Bureau of Ocean Energy Management (OCS Study BOEM 2017-052). 2017.

Holland, D.S. An Analysis of the Pacific Groundfish Trawl Individual Fishing Quota (IFQ) Quota Pound (QP) Market Through 2019. Via Internet: https://doi.org/10.25923/sxdw-kb49. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-157. 2020.

Holland, D.S., J.N. Sanchirico, R.E. Curtis, and R.L. Hicks. "An Introduction to Spatial Modeling in Fisheries Economics." *Marine Resource Economics,* 19(1): 1-6. 2004.

Holland, Daniel S., Cameron Speir, Juan Agar, Scott Crosson, Geret DePiper, Stephen Kasperski, Andrew W. Kitts, and Larry Perruso. "Impact of Catch Shares on Diversification of Fishers' Income and Risk." *PNAS,* vol. 114, 9302–9307, no. 35. August 2017.

Hudson, Bryn; Elise Granek; Max Nielsen-Pincus; and, Thomas Swearingen. Assessing Effort Shifts and Familial Successional Planning in Oregon's Nearshore Fisheries. Masters of Science Thesis, Portland State University. October 2018.

Jacob, S., P. Weeks, B.G. Blount, and M. Jepson. "Development and Evaluation of Social Indicators of Vulnerability and Resiliency for Fishing Communities in the Gulf of Mexico." *Marine Policy* 26:16-22. 2012.

Jepson, Michael and Lisa L. Colburn. "Development of Social Indicators of Fishing Community Vulnerability and Resilience in the U.S. Southeast and Northeast Regions." U.S. Dept. of Commerce. NOAA Technical Memorandum NMFS-F/SPO-129, 64 p. 2013.

Joint Technical Committee of the Pacific Hake/Whiting Agreement Between the Governments of the United States and Canada. Status of the Pacific Hake (Whiting) Stock in U.S. and Canadian Waters in 2018. March 2018.

Krigbaum, Melissa and Anderson, Christopher. "Increasing Value Through Gear Flexibility: A Case Study of U.S. West Coast Sablefish." *Canadian Journal of Fisheries and Aquatic Sciences* (accepted manuscript). 2021.

Larson, D.M. and D.K. Lew. How Do Harvest Rates Affect Angler Trip Patterns? *Marine Resource Economics,* 28(2):155-173. January 2013.

Lawson, Pete, NMFS. Personal communication. April 2015.

Legislative Revenue Office. 2019 Oregon Public Finance: Basic Facts. Research Report #1-19. Via Internet: https://www.oregonlegislature.gov/lro/Documents/final%202.pdf. January 18, 2019.

Leonard, J. and P. Watson. Description of the Input-Output Model for Pacific Coast Fisheries. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-NWFSC-111. 2011.

Lian, Carl, Rajesh Singh, and Quinn Weninger. "Fleet Restructuring, Rent Generation, and the Design of Individual Fishing Quota Programs: Empirical Evidence From the Pacific Coast Groundfish Fishery." *Marine Resource Economics* 24(4):329-359. Via Internet: http://www.bioone.org/doi/abs/10.5950/0738-1360-24.4.329. December 2009.

Lindberg, K. and Swearingen T. "A Reflective Thrive-Oriented Community Resilience Scale." *Am J Community Psychol,* 0: 1–12. 2020.

Lindberg, K., Swearingen, T., and White, E.M. "Parallel Subjective Well-Being and Choice Experiment Evaluation of Ecosystem Services: Marine and Forest Reserves in Coastal Oregon, USA." *Soc Indic Res,* https://doi.org/10.1007/s11205-019-02239-0. 2019.

Lindberg, K. and K. Williams. Oregon Coastal Community Well-Being Assessment. Conducted for and in cooperation with the Oregon Department of Fish and Wildlife. Oregon State University – Cascades. 2019.

Link, Terry. History and Status of Oregon's Pacific Razor Clam Resource. ODFW Information Report No. 2000-06. August 2000.

Lovell, Sabrina, James Hilger, Emily Rollins, Noelle A. Olsen, and Scott Steinback. The Economic Contribution of Marine Angler Expenditures on Fishing Trips in the United States, 2017. U.S. Dep. Commerce, NOAA Tech. Memo. NMFS-F/SPO-201. 2020.

Lynn, Kathy, Katharine MacKendrick, and Ellen Donoghue. Social Vulnerability and Climate Change: Synthesis of Literature. General Technical Report, PNW-GTR-838. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 70 p. 2011.

Marino, Elizabeth. Qualitative Evaluation of Impacts of Marine Reserves on Commercial and Charter Fishers: Understanding the Big Picture. Prepared by Oregon State University – Cascades. 2020.

Marino, Elizabeth. Cape Falcon Marine Reserve: A Pilot Study of Impacts, Outcomes and Effort Shift of Commercial and Charter Fishers. Prepared by Oregon State University—Cascades. 2017.

Melnychuk, M.C., Banobi, J.A. and Hilborn, R. "The Adaptive Capacity of Fishery Management Systems for Confronting Climate Change Impacts on Marine Populations." *Rev Fish Biol Fisheries* 24, 561–575. 2014.

Myers, Joseph, Ramu Govindasamy, John W. Ewart, Bin Liu, Yumin You, Venkata S. Puduri, and Linda J. O'Dierno. Consumer Analysis of and Business Network Development for Ethnic Live Seafood Markets of in the Northeast Region. 2007.

National Research Council (NRC). Marine Protected Areas: Tools for Sustaining Ocean Ecosystems. National Academy Press, Washington D.C. 2001.

NOAA Fisheries. "Fishery Disaster Determinations." https://www.fisheries.noaa.gov/national/funding-and-financial-services/fishery-disaster-determinations#74.-oregon-and-california-klamath-river-fall-chinook-salmon-fishery,-2016-and-2017. Accessed May 2021(a).

NOAA Fisheries. "Annual Commercial Landing Statistics." https://www.fisheries.noaa.gov/national/sustainable-fisheries/commercial-fisheries-landings. Accessed May 2021(b).

NOAA Fisheries. "On the Next Generation Stock Assessment Improvement Plan." Presentation by Cisco Werner, NOAA Fisheries Director of Scientific Programs and Chief Science Advisor to the Gulf States Marine Fisheries Commission. March 2019.

NOAA Fisheries. West Coast Groundfish Trawl Catch Share Program, Five-year Review - Draft. Via Internet: http://www.pcouncil.org/wp-content/uploads/2017/10/F2_Att3__E-Only_5Year_Review_August_Draft_for_public_review_NOV2017BB.pdf. August 2017.

The Nature Conservancy (TNC). Developing Future Scenarios for Climate Change in the California Current Ecosystem Workshop Report. Prepared for the Pacific Fishery Management Council. March 2020.

The Nature Conservancy (TNC). Driving Forces: Future of West Coast Fishing. Prepared for the Pacific Fishery Management Council. January 2020.

Norman, K., J. Sepez, H. Lazrus, N. Milne, C. Package, S. Russell, K. Grant, R. Peterson, J. Primo, M. Styles, B. Tilt, and I. Vaccaro. Community Profiles for West Coastal and North Pacific Fisheries – Washington, Oregon and California, and Other U.S. States. NMFS-NWFSC-85. 2007.

Northwest Power and Conservation Council (NPCC). 2019 Columbia River Basin Fish and Wildlife Program Costs Report. 19th Annual Report to the Northwest Governors. Via Internet: https://www.nwcouncil.org/sites/default/files/2020-2.pdf. May 2020.

Oregon Department of Agriculture (ODA). Personal communication with Alex Manderson. April 2021.

Oregon Department of Fish and Wildlife (ODFW). The Oregon Commercial Nearshore Fishery Data Update: 2019. Marine Resources Program. June 2020.

Oregon Department of Fish and Wildlife (ODFW). 31st Annual Pink Shrimp Review. Marine Resources Program. 2020.

Oregon Department of Fish and Wildlife (ODFW). Albacore Tuna Fishery Newsletter. Marine Resources Program. 2019.

Oregon Department of Fish and Wildlife (ODFW). 11th Annual Dungeness Crab Fishery Newsletter. Marine Resources Program. November 2019.

Oregon Department of Fish and Wildlife (ODFW). "Oregon Nearshore Strategy" in Oregon Conservation Strategy. 2016.

Oregon Department of Fish and Wildlife (ODFW). Personal communication. May 2015.

Oregon Department of Fish and Wildlife (ODFW). Coastal Multi-Species Conservation and Management Plan. Stakeholder Review Draft. Via Internet: http://www.dfw.state.or.us/fish/CRP/coastal_multispecies.asp. June 5, 2013

Oregon Department of Fish and Wildlife (ODFW). Federal Aid Completion Reports, Fisheries, 1977, AFS 65 Nehalem River Winter Steelhead Study. Final Report. Via Internet: http://ir.library.oregonstate.edu/xmlui/handle/1957/38092?show=full. 1977.

Oregon Parks and Recreation Department (OPRD). 2013-2017 Statewide Comprehensive Outdoor Recreation Plan (SCORP), Ensuring Oregon's Outdoor Legacy. 2013.

Oregon State University (OSU), Survey Research Center. Oregon Department of Fish and Wildlife 2013 Surveys: Angling in Oregon: A Survey Designed to Understand Anglers' Opinions About Fishing in Oregon; and Wild Fish Conservation and Management Survey: A Survey Designed for Oregon Residents. Prepared for Oregon Department of Fish and Wildlife. Via Internet: http://www.dfw.state.or.us/fish/CRP/docs/coastal_multispecies/CMP_Draft_6-17-13_Appendix_VI_Opinion_Survey.pdf. April 2013.

Pacific Fishery Management Council (PFMC). "Agenda Item F.4, Sablefish Gear Switching Situation Summary." Via internet: https://www.pcouncil.org/documents/2021/03/f-4-situation-summary-sablefish-gear-switching-identify-the-gear-switching-level-to-use-in-developing-alternatives.pdf. April 2021.

Pacific Fishery Management Council (PFMC). Review of 2017 Ocean Salmon Fisheries. February 2018.

Pacific Fishery Management Council (PFMC). Preseason Report I: Stock Abundance Analysis and Environmental Assessment Part 1 for 2018 Ocean Salmon Fishery Regulations. March 2018.

Pacific Fishery Management Council (PFMC). Status of the Pacific Coast Groundfish Fishery. September 2018.

Pacific Fishery Management Council (PFMC). Status of the Pacific Coast Coastal Pelagic Species Fishery and Recommended Acceptable Biological Catches (information through June 2017). December 2017.

Pacific State Marine Fisheries Commission (PSMFC). Recreational Fisheries Information Network (RecFIN), Marine Recreational Information Program (MRIP), Regional Implementation Planning Priorities 2019–2021. January 2020.

Pelletier, Dominique, and Stéphanie Mahévas. "Spatially Explicit Fisheries Simulation Models for Policy Evaluation." *Fish and Fisheries* 6 (4): 307–49. 2005.

Pendleton, Linwood H. and Jaime Rooke. Understanding the Potential Economic Impact of Marine Recreational Fishing: California. Environmental Science and Engineering Program, University of California, Los Angeles. March 1, 2006.

Petersen, Arni and David Green. Seafood Traceability: A Practical Guide for the U.S. Industry. UNC-SG-06-04. North Carolina State University Seafood Laboratory at the Center for Marine Sciences and Technology. 2006.

Pfeiffer, Lisa and Trevor Gratz. "The Effect of Rights-based Fisheries Management on Risk Taking and Fishing Safety." *PNAS,* 113 (10) 2615-2620. Via Internet: http://www.pnas.org/content/113/10/2615/tab-article-info. March 8, 2016.

Plummer, M., W. Morrison, and E. Steiner. Allocation of Fishery Harvests Under the Magnuson-Stevens Fishery Conservation and Management Act: Principles and Practice. U.S. Dept. of Commerce, NOAA Tech. Memo., NMFS-NWFSC-115, 84 p. 2012.

Poe, M.R., K.C. Norman, and P.S. Levin. "Cultural Dimensions of Socioecological Systems: Key Connections and Guiding Principles for Conservation in Coastal Environments." *Conservation Letters* 7:166-175. 2014.

Poe, Melissa R., Melissa Watkinson, Bridget Trosin, and Kevin Decker. Social Indicators for Washington Coast Integrated Ecosystem Assessment. Report to Washington Department of Natural Resources in fulfillment of Interagency Agreement No. IAA 14-204. Washington Sea Grant WSG-TR 15-07. 159pp. 2015.

Propst, Dennis B. and Dimitris G. Gavrilis. "Role of Economic Impact Assessment Procedures in Recreational Fisheries Management." *Transactions of the American Fisheries Society,* 116: 450-460. May 1987.

Reimer, Matthew, Joshua Abbott, and James Wilen. "Fisheries Production: Management Institutions, Spatial Choice, and the Quest for Policy Invariance." *Marine Resource Economics* 32(2): 143-168. April 2017.

The Research Group, LLC (TRG). Interactive Model User Guide for the Broadscale Spatial Analysis of Oregon Nearshore Fisheries. Prepared for Marine Resources Program, Oregon Department of Fish and Wildlife. February 2018.

The Research Group, LLC (TRG). Oregon Nearshore Fisheries Effort Shift Survey Commercial Fisheries Representativeness Report. Prepared for Marine Resources Program, Oregon Department of Fish and Wildlife. November 2018b.

The Research Group, LLC (TRG). Oregon Commercial and Recreational Fishing Industry Economic Activity Coastwide and in Proximity to Marine Reserve Sites for Years 2016 and 2017. Prepared for Marine Reserve Program, Oregon Department of Fish and Wildlife. November 2018c.

The Research Group, LLC (TRG). Oregon Commercial Fishing Industry Year 2016 Economic Activity Summary. Prepared for Oregon Department of Fish and Wildlife. April 2017.

The Research Group, LLC (TRG). Oregon's Commercial Fishing Industry, Year 2013 and 2014 Review. Prepared for Oregon Department of Fish and Wildlife, and Oregon Coastal Zone Management Association. September 2015a.

The Research Group, LLC (TRG). Oregon Marine Recreational Fisheries Economic Contributions in 2013 and 2014. Prepared for Oregon Department of Fish and Wildlife and Oregon Coastal Zone Management Association. September 2015b.

The Research Group (TRG). Economic Impacts From Ocean and Lower Estuary Salmon Commercial and Recreational Fisheries in 2000. Oregon Coastal Zone Management Association. June 2000.

The Research Group, LLC and Golden Marine Consulting (TRG and GMC). Using Spatial Analysis of Fisheries and Habitat Data to Evaluate Economic Effects of Oregon Marine Reserve Sites. Prepared for Marine Resources Program, Oregon Department of Fish and Wildlife. June 2012.

Robertson, D.R. and Gerald R. Allen. Shorefishes of the Tropical Eastern Pacific: Online Information System. Version 2.0 Smithsonian Tropical Research Institute, Balboa, Panamá. 2015.

Samhouri, J.F., A. Haupt, P. Levin, J. Link, and R. Shuford. "Lessons Learned From Developing Integrated Ecosystem Assessments to Inform Marine Ecosystem Based Management in the USA." *ICES Journal of Marine Science* 71(5): 1205–1215. 2013.

Saul, Steven and David Die. "Modeling the Decision-Making Behavior of Fishers in the Reef Fish Fishery on the West Coast of Florida." *Human Dimensions of Wildlife,* 21:6, 567-586. 2016.

Schramm, H.L. Jr., P.D. Gerard. "Temporal changes in fishing motivation among fishing club anglers in the United States." *Fisheries Management and Ecology* 11 (5), 313-321. doi:10.1111/j.1365-2400.2004.00384.x. 2004.

Scientific and Statistical Committee (SSC). Comments to the Pacific Fishery Management Council. Minutes from the PFMC SSC Meeting. November 2009.

Scott, M. "A Fishery's Guide to Understanding Secondary Economic Impacts of Northwest Salmon and Steelhead." Paper presented at Making Economic Information More Useful for Salmon and Steelhead Decision, a workshop sponsored by National Marine Fisheries Service, July 24-26, Seattle, Washington. NOAA Technical Memorandum NMFS F/NWR-8, National Marine Fisheries Service. Portland, Oregon. 1984.

Seung, Chang K. and Edward C. Waters. A Review of Regional Economic Models for Fisheries Management in the U.S. Marine Resource Economics. Volume 21, pp. 101–124. 2006.

Shannon, C.E. "A Mathematical Theory of Communication." *The Bell System Technical Journal,* 27, pgs. 379–423 and 623–656. 1948.

Singleton, S. "Native People and Planning for Marine Protected Areas: How "Stakeholder" Processes Fail to Address Conflicts in Complex, Real-World Environments." *Coastal Management* 37(5): 421-440. 2009.

Southwick Associates. The Relative Economic Contributions of U.S. Recreational and Commercial Fisheries. Prepared for the Theodore Roosevelt Conservation Partnership. April 2006.

Swearingen, Tommy, ODFW. Personal communication. November 2018.

Swedeen, P., D. Batker, H. Radtke, R. Boumans, C. Willer. An Ecological Economics Approach to Understanding Oregon's Coastal Economy and Environment. Audubon Society of Portland. Portland, OR. 2008.

Sylvia, G. and A. Storms. The Food from the Sea Workshop Report. Marine Studies Initiative. Oregon State University. Corvallis, OR. 2019.

Thapa, Ganesh, Madan Dey, and Carole Engle. "Consumer Preferences for Live Seafood in the Northeastern Region of USA: Results From Asian Ethnic Fish Market Survey." *Aquaculture Economics & Management,* 19:2, 210-225. 2015.

Tuler, S., J. Agyeman, P.P. da Silva, K.R. LoRusso, and R. Kay. "Assessing Vulnerabilities: Integrating Information About Driving Forces That Affect Risks and Resilience in Fishing Communities." *Human Ecology Review* 15(2): 171-184. U.S. Census. 2008.

U.S. Department of Agriculture, National Agricultural Statistics Service (USDA). 2018 Census of Aquaculture. Volume 3, Special Studies Part 2. AC-17-SS-2. December 2019.

U.S. Fish and Wildlife Service (USFWS). 2016 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation National Overview. August 2017.

Van Putten, Ingrid, Soile Kulmala, Olivier Thébaud, Natalie Dowling, Katell Hamon, Trevor Hutton, and Sean Pascoe. "Theories and Behavioural Drivers Underlying Fleet Dynamics Models." *Fish and Fisheries* Volume 13, Issue 2. June 2012.

Watts, James W. Lower Columbia River recreational catch and effort estimates. Personal communication. November 2018.

Watts, James W. The 2008 Lower Columbia River and Buoy 10 Recreational Fisheries. Oregon Department of Fish and Wildlife. December 2009.

Whiteside, Cassandra, Justin Ainsworth, and Jason Edwards. Shore and Estuary Boat Recreational Fishing Effort Surveys, Comparing the Effectiveness of Phone and Mail Surveys. ODFW. June 2017.