CLAM DIGGERS ASSOCIATION OF OREGON

PowerHooker®
Patent Pending

June 20, 2019

Coos County Planning
250 N. Baxter
Coos County Courthouse
Coquille, OR 97423

Re: File # REM-19-01 (2nd more detailed Public comment)
Jordan Cove Energy Project

The Clam Diggers Association of Oregon (CDAO) members and Power Hooker Tackle L.L.C. are adamantly opposed to the Jordan Cove LNG project.

This LNG project will interfere with our public trust rights to recreate and fish on Coos Bay. Public trust rights were mandated by Oregon's law of the land use, see (exhibit 101) Oregon's Public Trust Doctrine in the 21st Century: Public Rights in Waters, Wildlife, and Beaches.

We do not want to give up our use of the bay because of the LNG ships 500' exclusion zone on all sides. This problem is compounded by the 240 transits per year during high tide and high slack tide that these large ships will make coming and going at Coos Bay.

When low tide occurs we harvest clams and bait shrimp. When high tide happens we harvest crabs and fish. We fish by the tide in Coos. High tide slack is when we catch our crab. Fish and crabs move in and out with tides. Simply put this is prime time to harvest our resources. Coos Bay is the most productive bay to harvest clams, crabs, fish and sand shrimp.

Besides gathering shellfish, fish, shrimp and crabs our members and recreational people also enjoy taking pictures and viewing wildlife on Coos Bay. These large ships and restrictions will interfere with this activity. Kayaking is very popular in Coos Bay and the ship restrictions will interfere with this recreation.

Coos Bay Estuary has abundant wildlife, see (exhibit 102) natural resources of Coos Bay Estuary. The construction of Jordan Cove LNG plant will have a negative impact on the bays wildlife and the public's right to enjoy viewing these resources. Our friends and members enjoy watching the Harbor Porpoises and Killer Whales that visit Coos Bay during high tides.

The construction of Jordan Cove LNG plant will require a large dredge and fill removal for the LNG ship dock. The mud flats that will be removed are home for sand and mud shrimp plus other necessary invertebrates that make a healthy eco system. These invertebrates feed our Chinook and Coho Salmon. They also feed Steelhead (Ocean going rainbow trout.) They feed the near shore rock fish, lingcod, California halibut and surf perch. All of these fish are harvested by sport and commercial fishermen. These shrimp also feed many different resident and migratory shore birds and other wildlife. Sport fisherman gather shrimp for bait at the location of the proposed fill and dredge area for Jordan Cove.

Historically sand and mud shrimp were numerous and their importance to our fisheries has been well studied as noted in (exhibit 103) Biological Report 82(11.93) from Fish and Wildlife Service, U.S. Department of Interior and U.S. Army Corps of Engineers. This report was released January 1989.

In June 24, 2009 an OSU scientists found a new invasive parasite that is killing off our mud shrimp. See (Exhibit 104) OSU report. This report states "The researchers estimate an overall parasite infestation rate as high as 45 percent and believe that 80 percent or more of the breeding -size adults may be infected.

Destroying shrimp beds for Jordan Cove LNG plant will have a negative impact on our fisheries food source. Our fisheries are already overly impacted from other human causes. Salmon, Steelhead, lingcod, halibut, sturgeon, rock fish and surf perch are a renewable resources that should be protected from projects that degrade the ecosystem. Our fisheries support commercial and sports fishermen along the coastal areas of Oregon and Washington State.

In May 2009 (ODFW) Oregon Department of Fish and Wildlife hired Dean Runyan Associates to study the benefits from sport fishing, clamming, crabbing, see (exhibit 105) Dean Runyan Executive Summary and (exhibit 106) Dean Runyan Fishing, Hunting, Wildlife Viewing and Shell fishing in Oregon. These two documents clearly show the economic value of recreation in our coastal economy. Oregon has many boat builders who also benefit from robust sport fisheries.
In 2016 and 2017 ODFW, (exhibit 107) Oregon Commercial and Recreational Fishing Industry Economic Activity Coast wide and in Proximity to Marine Reserves sites for years 2016 and 2017. This study also shows the benefit of healthy coastal fisheries which are a major component of Oregon's economy.

June LeTarte from the Oregon State Marine Board, (exhibit 108) email states that Oregon has 1,150 fishing guides and charter boat operators who make a living off our fisheries. She also said Oregon has 155,000 registered boat owners in Oregon. The State of Oregon receives much needed revenue from boating fishermen. These funds support marine deputies, boat launches and docks. Healthy fisheries help make this possible and Oregon collects $ 5,243,595.00 from fishermen and other boaters.

All fishing equipment has a 10% federal fishing excise tax that is paid to the Federal Government see (exhibit 109) IRS Publication 510. These taxes benefit everyone. They help fund much needed fisheries research and development.

Jordan Cove LNG project might have a 20 year life if they are lucky or if the big earthquake doesn't bring it down sooner. On January 26, 1700 the Coos Bay area was struck by a 9.0 earthquake that caused a tsunami that flooded Coos Bay see (exhibit 110) A brief History of the Coos, Lower Umpqua & Siuslaw Indians. This fact is another reason why the location of Jordan Cove LNG plant should not be built.

Conclusion:

Once again the Clam Diggers Association of Oregon (CDAO) and Power Hooker Tackle LLC state our objections to the development of the LNG facility at Jordan Cove for good reasons. Our objections are based on the unacceptable impacts on the ecological productivity to the natural occurring marine organisms and to the sustainability to the bay's oyster farms.

Our fisheries have declined because of the damage by industry and neglect of any meaningful restoration of coastal estuaries and our rivers and streams. What remaining salmon habitat should be protected and not removed for the Jordan Cove LNG project short life exporting natural gas that will end when the wells go dry or we get another 9.0 earthquake and tsunami.

In addition we strongly oppose the loss of recreational opportunity due the failure of the State and Federal Government to adequately compensate the users of the bay for loss of recreational opportunity.

Coos Bay is a public bay and is used for recreation, photography, wildlife viewing, fishing, crabbing, clam digging, harvesting bait shrimp, hunting, kayaking and boating.

This project has been rejected by FERC two times.

We ask that ~~FERC~~ Coos Planning reject Jordan Cove Project a third and final time.

Sincerely,

C. E

Power Hooker Tackle L.L.C. # 93921493
Chuck Erickson member & Director CDAO
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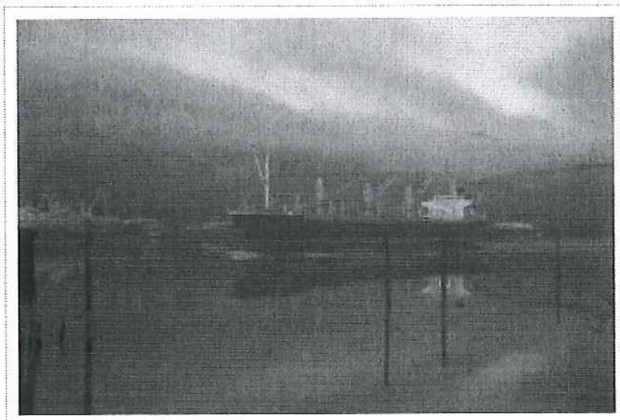
Exhibit 101, 102, 103, 104, 105, 106, 107, 108, 109 and 110
can be found by googling the description after the exhibit number.

Note: If needed I can print the exhibits that are over 2 inches thick.

Exhibit 101

Submitted June 25, 2019 From:
Clam Diggers Association
&
Power Hooker Tackle

Oregon's Public Trust Doctrine in the 21st Century: Public Rights in Waters, Wildlife, and Beaches



By

Michael C. Blumm & Erika A. Doot.

Oregon's public-trust doctrine has been misunderstood. The doctrine has not been judicially interpreted in over 30 years, but was the subject of a recent opinion of the Oregon Attorney General (AG). In 2005, the AG interpreted the scope of the doctrine to be limited to the beds of tidelands and navigable-for-title water and erected a separate "public use" doctrine protecting public rights in other waters, including recreational waters. But because Oregon courts have never limited public rights in the state's waters to those with publicly owned bedlands, the opinion should have recognized that the public-trust doctrine provides broad public recreational rights in all waters of the state.

Indeed, since early statehood, Oregon courts and the legislature have recognized that water is a publicly owned resource, a resource that present and future generations have the right to use. Since the 1860s, the Oregon Supreme Court has consistently ruled in favor of public rights in waterways, based on language in the Oregon Statehood Act declaring navigable waters to be public highways that would remain "forever free," not monopolized by private owners.

Moreover, in the early 20th century, the court explicitly ruled that the scope of public rights in publicly owned waters could and should evolve over time. The court explained that public rights in state waters include not only navigation, fishing, hunting, and recreation, but also sailing, rowing, bathing, skating, taking water for various purposes, cutting ice, and other public use that could not then be anticipated.
We maintain that the Oregon public-trust doctrine is grounded on public ownership of natural resources held in trust by the state in a sovereign capacity, not solely on ownership of the beds of navigable-for-title waters, as the AG suggested. Indeed, in earlier opinions, the AG consistently recognized public rights in resources managed in a sovereign capacity. Oregon has always claimed sovereign ownership of water and wildlife within the state, so the courts should recognize both as public-trust resources.
Although the state can authorize private rights in those resources, all private rights are subject to the state's sovereign ownership, which is properly characterized as a public easement that requires the state, as trustee, to maintain these resources for the public. Thus, trust resources simultaneously have public and private "owners." The AG was mistaken in thinking that the public-trust doctrine applied only to lands the public owned in fee and failed to appreciate the broad nature of the state's public-trust doctrine.

Just as in the Statehood Act's declaration of public ownership of waterways, courts should interpret the public-trust doctrine to be implicit in other statutory declarations of public ownership of natural resources. Thus, although its origins may lie in common law, the public-trust doctrine's future likely is in statutory interpretation because many statutes recognize public ownership of natural resources and impose trust obligations on the government. For example, in 2011, interpreting Oregon statutes, the Oregon Court of Appeals rejected assertions that game farm animals were not subject to wildlife statutes, reaffirmed that the state owns all wildlife within its borders in a sovereign capacity, and concluded that the state must manage these resources for the public benefit.

Similarly, ocean beaches are public-trust resources because the public possesses usufructuary rights in beaches that are necessary to enable use of the adjacent ocean waters. Over 40 years ago, the Oregon Supreme Court upheld public rights to use these resources under the doctrine of custom, but the courts should also acknowledge that ocean beaches have long been public highways, and therefore the subject of a public easement in these trust resources.

In 1869, in its first decision on public rights in the state's waterways, the Oregon Supreme Court explained that the public had rights in adjacent uplands to facilitate log drives. We maintain that similar public ancillary rights exist in other uplands where necessary to provide public access to, or preservation of, public-trust water and wildlife resources.

Oregon's public-trust doctrine is not of mere academic interest. The doctrine imposes duties on the state as sovereign owner of water, wildlife, and ancillary uplands to manage these resources for the common good.

Throughout the state's history, the courts have relied on public-trust principles to resolve disputes among competing natural resource users. In the late 19th century, the courts generally recognized superior public rights in waterways for commercial purposes such as logging and fishing. By 1920, the Oregon Supreme Court had recognized recreation as commerce protected under the public-navigation easement. n the 21st century, the doctrine is fully capable of evolving to meet contemporary pressing needs, such as climate change, as the court recognized nearly a century ago.

When called upon to resolve disputes between competing uses of natural resources, Oregon courts should rely on the public-trust doctrine to sustain these public resources for present and future generations. In an era of widespread skepticism of government management, this venerable doctrine seems to be an especially appropriate mechanism to ensure access to publicly owned resources as well as to provide citizens with an opportunity to gain review of government action and inaction threatening unsustainable development of natural resources that are central to the state's identity, culture, and economy.

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Michael Blumm is Jeffrey Bain Faculty Scholar & Professor of Law at Lewis & Clark Law School; Erika Doot graduated magna cum laude from Lewis & Clark Law School in May 2011. Their article, complete with citations, is available at http://ssrn.com/abstract=1925112.

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Natural Resources of Coos Bay Estuary

ESTUARY INVENTORY REPORT

Vol. 2, No. 6

OREGON
Fish & Wildlife

Prepared by

RESEARCH AND DEVELOPMENT SECTION
Oregon Department of Fish and Wildlife

for

Oregon Land Conservation and Development Commission

1979

FINAL REPORT

ESTUARY INVENTORY PROJECT
OREGON

PROJECT TITLE: Technical assistance to local planning staffs in fulfilling the requirements of the LCDC estuarine resources goal.

JOB TITLE: Natural resources of Coos Bay estuary

PROJECT PERIOD: February 1978 - June 1979

Prepared by: Cyndi Roye

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PREFACE

This report is one of a series prepared by the Oregon Department of Fish and Wildlife (ODFW) which summarizes the physical and biological data for selected Oregon estuaries. The reports are intended to assist coastal planners and resource managers in Oregon fulfilling the inventory and comprehensive plan requirements of the Land Conservation and Development Commission's Estuarine Resources Goal (LCDC 1977).

A focal point of these reports is a habitat classification system for Oregon estuaries. The organization and terminology of this system are explained in volume 1 of the report series entitled "Habitat Classification and Inventory Methods for the Management of Oregon Estuaries."

Each estuary report includes some general management and research recommendations. In many cases ODFW has emphasized particular estuarine habitats or features that should be protected in local comprehensive plans. Such protection could be achieved by appropriate management unit designations or by specific restrictions placed on activities within a given management unit. In some instances ODFW has identified those tideflats or vegetated habitats in the estuary that should be considered "major tracts", which must be included in a natural management unit as required by the Estuarine Resources Goal (LCDC 1977). However, the reports have not suggested specific boundaries for the management units in the estuary. Instead, they provide planners and resource managers with available physical and biological information which can be combined with social and economic data to make specific planning and management decisions.

INTRODUCTION

Coos Bay, the estuary of the Coos River, is the site of a unique set of dynamic interactions involving its tributaries, the basin through which they flow, and the ocean (Fig. 1). In historic times man has altered conditions of the estuary more rapidly than expected in nature. Future actions will continue to modify the bay, and only carefully made decisions will insure that Coos Bay continues its history as a biologically productive multiple-use estuary.

Coos Bay has been classified as a deep-draft development estuary by LCDC (1977). Under Statewide Planning Goal 16 (LCDC 1977) the local comprehensive plan will designate estuarine areas as distinct water use management units. In a deep-draft development estuary such management units must include natural, conservation, and development units.

This report is a summary of available information for Coos Bay. It addresses the bay as a system, identifying processes occurring throughout the bay, and as a set of subsystems, smaller geographic areas which are functionally or physiographically distinct. Recommendations are made concerning certain areas or processes. The report is intended to provide information useful to planners, biologists, and citizens during the designation of management units and use policies.

THE COOS BAY ESTUARINE SYSTEM

Physical Characteristics

Dimensions

Several authors have used different methods in estimating the surface area of Coos Bay (Table 1).

Table 1. Reported surface areas of Coos Bay (Percy et al. 1974).

Reference	Surface area (acres)	Measured at	Tidelands		Submerged	
			Acres	Percentage	Acres	Percentage
Johnson 1972	10,973	HW				
"	8,242	MSL				
"	5,810	LW				
Marriage 1958	9,543	area affected by by tidal action	4,569	48		
Oregon Division of State Lands (DSL) 1973	12,380	MHW	6,200	50	6,180	50

DSL (1973) estimates that 6,200 acres (50% of the surface area) is submersible land (between high water and mean low water) and 6,180 acres (50%) is submerged land (below MLW). Using these figures, Coos Bay, although larger, compares closely to Tillamook Bay in ratio of submersible to submerged land (Table 2).

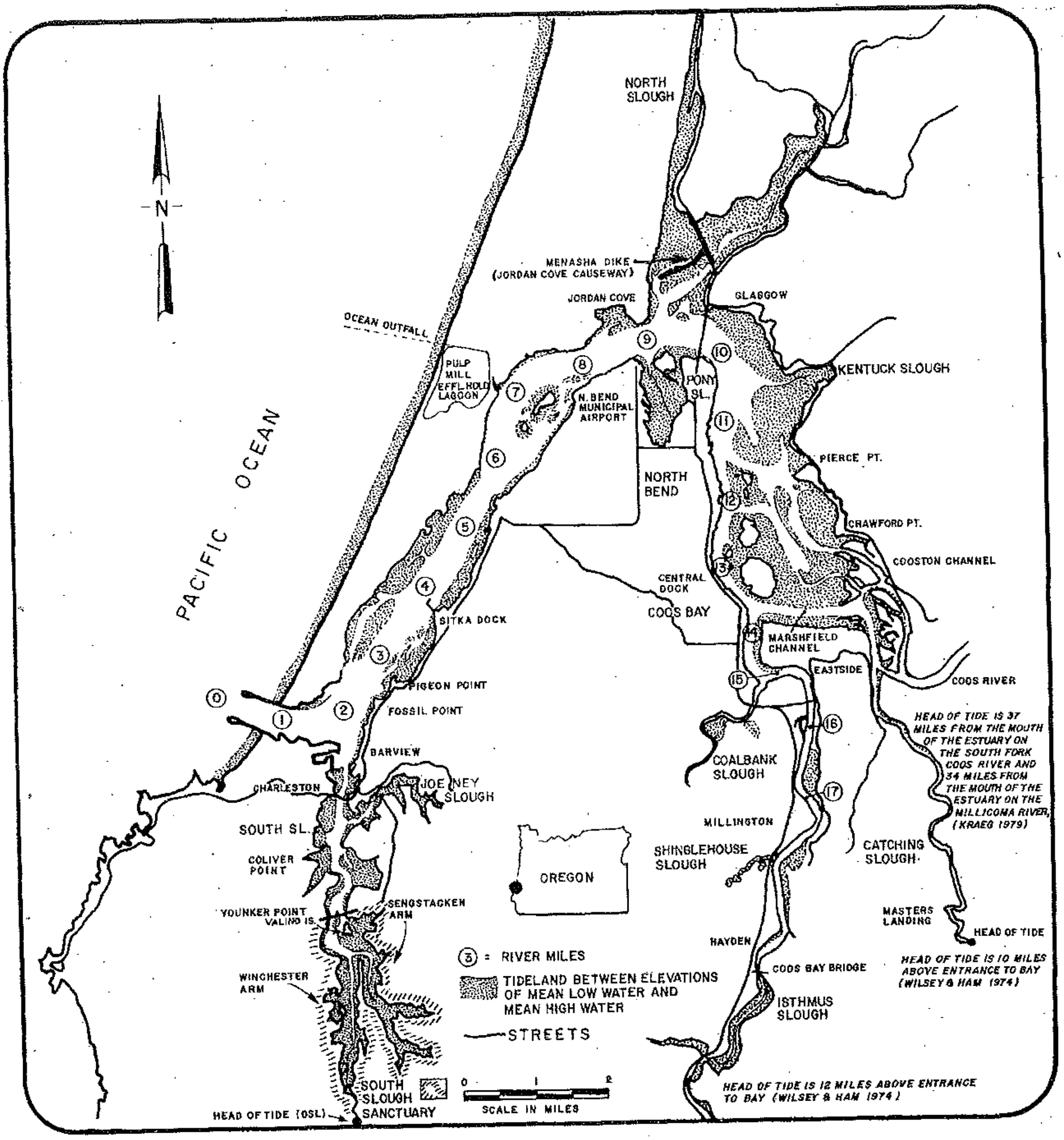

Fig. 1. Coos Bay estuary (base map from DSL 1973).

Table 2. Ratios of tideland (MHW to MLW) to submerged land (below MLW) (estimated from DSL 1973).

Sand Lake	3.0	Nehalem	0.87
Siletz	1.9	Alsea	0.84
Netarts	1.9	Coquille	0.64
Salmon River	1.6	Yaquina	0.53
Nestucca	1.4	Siuslaw	0.57
Necanicum	1.2	Columbia	0.35
Tillamook	1.0	Rogue	0.31
Coos Bay	1.0	Umpqua	0.25
		Chetco	0.13

Even the most extensive estimate of surface area (12,380 acres) covers only the area to mean high water. Much tidal marsh extends above this level and is therefore excluded in all available estimates. By including only the high marshes, at least 1,000 acres could be safely added to that estimate (Hoffnagle and Olson 1974).

Tributaries

About 30 tributaries enter Coos Bay from its 605 mi^2 drainage basin (Fig. 2) (Percy et al. 1974). The major tributary is the Coos River which is formed by the confluence of the Millicoma River and the South Fork Coos River. Head of tide extends up the South Fork Coos River approximately 32 miles from the mouth of the estuary and 34 miles from the mouth of the estuary up the Millicoma River (Kreag 1979). Other streams which contribute a much smaller amount of fresh water to the estuary enter through Catching, Isthmus, Pony, South, North, and Kentuck sloughs and Haynes Inlet. Gradients of the principal tributaries are slight for several miles allowing tidal effects to extend a considerable distance [Oregon State Water Resources Board (OSWRB) 1963]. Head of tide has been recorded for some of these slough systems, and in others the extent of salt water intrusion is limited by a tidegate, which acts as the effective head of tide under most conditions of flow. Information available on drainage areas of tributaries and location of heads of tide is summarized in Table 3.

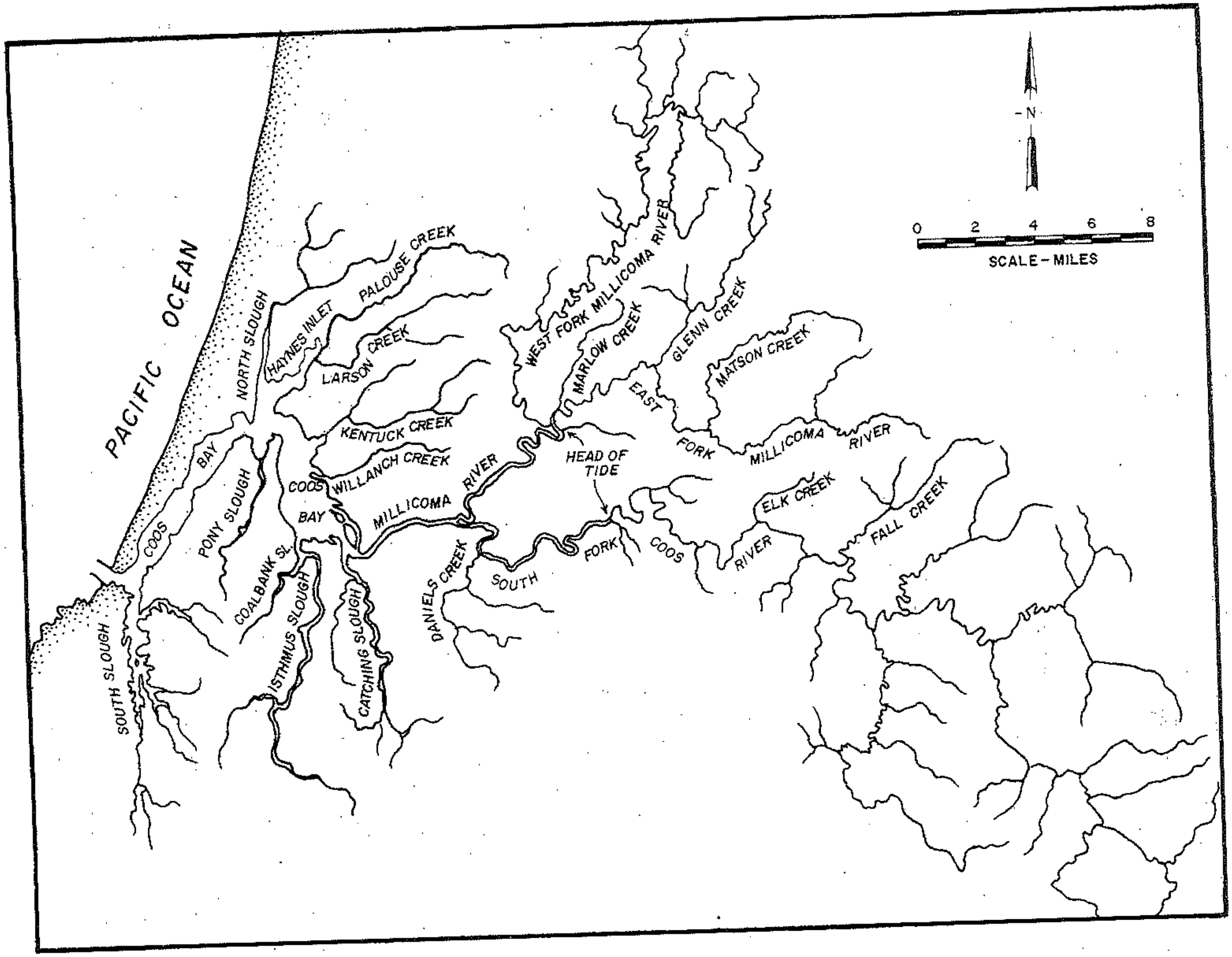

Fig. 2. Coos Bay drainage basin (USDI 1971).

Table 3. Drainage area and head of tide for Coos Bay tributaries.

Tributary	Drainage area (mi^2)	Head of tide (miles from entrance of tributary to main bay)
Coos River	415[a]	10 mi[c]
Catching Sl.		
Coalbank Sl.	6.2[a]	
Haynes Inlet	11[a]	12 mi[c]
Isthmus SL		
Kentuck	17[a]	
North	12.8[a]	
Willarch	7.8[a]	
South Sl.	26[b]	

[a] *OSWRB 1963*
[b] *Stevens, Thompson and Runyon, Inc. (STR) 1974*
[c] *Wilsey & Ham 1974*

Physiography

The physiography of Coos Bay is complex. From its mouth the narrow lower portion of the bay runs southwest to northeast to about river mile (RM) 9, measured from the mouth of the estuary. The main channel then swings to the south and the bay widens into an area of broad tidal flats. Sloughs branch off near the estuary mouth and at several locations in the upper bay. The Coos River enters the upper bay in its southeast corner about 17 mi from the mouth of the estuary. Johnson (1972) states the width at the mouth is 2,060 feet, and the average width of the bay at low tide is 1,200 feet.

Currently the U. S. Army Corps of Engineers (USACE) maintains a dredged ship channel from the entrance to RM 15 (Isthmus Slough). The channel is 45 ft deep and 700 ft wide at the entrance bar and decreases to 35 ft deep and 300 ft wide at RM 1. These dimensions continue to RM 9. From there the channel is 35 ft deep, 400 ft wide to RM 15. Two wide turning basins and an anchorage basin are located at North Bend, near the mouth of Coalbank Slough, and at RM 5.5 respectively. Shallower channels are also dredged by the USACE in the Coos River, the South Fork Coos River, the Millicoma River, and in South Slough connecting Charleston boat basin to the Coos Bay channel. Private concerns maintain a channel in Isthmus Slough to RM 17 (USACE 1976).

The physiography of the Coos estuary has been significantly altered by man. Prior to alterations, the channel across the bar at the entrance to Coos Bay was 10 ft deep and 200 ft wide (USACE 1975). The channel wound to the north with a depth of about 11 ft and width of 200 ft to the town of North Bend, then gradually decreased in width to 50 ft and in depth to 6 ft at Marshfield. Shoals were numerous.

Extensive filling and diking in the main bays, sloughs, and tributaries have changed the form and consequently the function of the estuary. Channel shifts and areas of accelerated erosion and deposition have been noted

(Dicken et al. 1961; Aagard et al. 1971). Other major alterations include the North and South jetties, the Charleston breakwater, and the Charleston small boat basin.

Bottom topography

Coos Bay shares several features with other drowned river valley estuaries. It has a "V"-shaped cross section, a relatively shallow and gently-sloping bottom, and a fairly uniform increase in depth toward the mouth (Baker 1978 [citing Schubel 1971]). NOS charts provide soundings in the navigable portions of the estuary (NOS 1978). Soundings of the bay following completion of the USACE Deep-Draft Navigation Project are available from the Portland District Engineer.

Bottom topography of South Slough can be determined from soundings made in 1977 (USACE 1977). Topography of most other shallow portions of the bay is less well known. Contours showing tidal levels such as MLLW and ELW are generally unavailable.

Water discharge

Fresh water inflow into the Coos estuary is measured only on the West Fork of the Millicoma River. Estimates of total fresh water flow at the mouth are made from extrapolations of these data. Estimated average annual discharge at the mouth of Coos Bay is 2.2 million acre-feet of fresh water (Percy et al. 1974). Using this figure as an average, a yearly maximum of 3,044,000 ac-ft and minimum of 1,560,000 ac-ft may be estimated from data presented in Percy et al. (1974) for the mouth.

Records from 1933-63 show that January is the wettest month at North Bend, averaging 9.9 in of precipitation, and July is the driest with an average 0.38 in (USACE 1975). According to USACE (1975) freshwater inflow may vary from 100,000 cubic feet per second (cfs) in winter to 100 cfs in summer. Arneson (1976) measured an even lower inflow of 35.3 cfs during September of 1973.

Runoff follows the pattern of precipitation. Soils provide a minimum of water retention, and snowfall is light so that a significant snow pack does not form (OSWRB 1963). Figure 3 suggests a one month lag in discharge response to precipitation.

Range of tide

The USACE (1978) states that mean tidal range is 6.7 ft above mean lower low water (MLLW) at the entrance to Coos Bay and 6.9 ft above MLLW at the city of Coos Bay. Predicted extreme range is 10.5 ft above MLLW. Extreme low water (ELW) is predicted to be -3.0 ft below MLLW.

Tidal range predictions are made by the National Oceanic and Atmospheric Administration (NOAA) and are based on data taken over 40 years ago (Arneson 1976). Arneson found that measured ranges at the entrance were slightly greater than predicted ranges for all seasons, although the error was usually

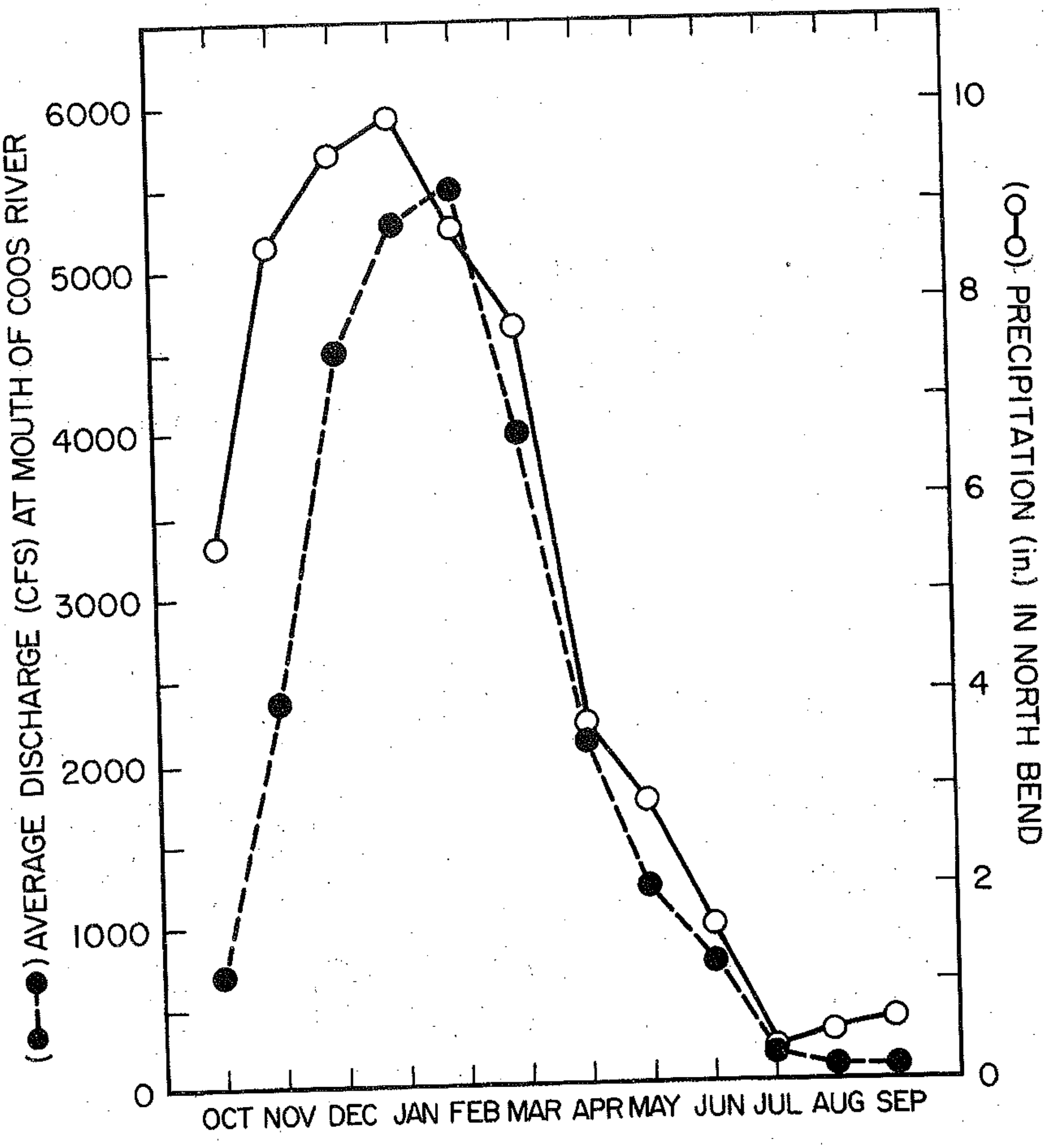

Fig. 3. Precipitation in North Bend (USACE 1975) and average monthly discharge of Coos River at the mouth (OSWRB 1963).

less than 15% . At the city of Coos Bay, Arneson (1976) consistently measured higher tidal ranges than those predicted by NOAA. He states that unusually high ranges may be attributed to river flow.

Arneson (1976) hypothesizes that tidal ranges greater than predicted mainly resulted from fill placed in the bay. Large fills have been placed on the tidelands of the upper bay, near the airport, and at Eastside since the predictions were made. Although the channel was deepened concurrently, the resulting cross-section may be more hydraulically efficient so that dampening of the tidal wave is less (Arneson 1976). The effect of further channel deepening has not been assessed.

Tidal prism

Johnson (1972) based his calculation of the tidal prism of Coos Bay (1.86×10^9 ft^3) on a mean tide range of 5.2 ft multiplied by a mean surface area between high and low water of 10,973 acres. The accuracy of these figures may be questionable. Compared to values for other Oregon estuaries shown in Table 4, Coos Bay is most similar to Tillamook Bay in volume of saltwater exchange.

Table 4. Coos Bay tidal prism compared with selected Oregon estuaries.[a]

Estuary	Tidal prism (ft^3)	Ratio of other estuaries to Coos Bay
Coos Bay	1.86×10^9*	1.0
Tillamook	2.49×10^9	1.3
Umpqua	1.18×10^9*	0.6
Yaquina	8.35×10^9*	0.45
Alsea	5×10^8*	0.3
Nehalem	4.28×10^8*	0.2
Siletz	3.5×10^8	0.2
Netarts	3.3×10^8	0.2
Siuslaw	2.76×10^8	0.2
Nestucca	1.8×10^8*	0.1
Coquille	1.32×10^8	0.07
Sand Lake	8.2×10^7	0.4

[a] *Values indicated by * are from Johnson (1972). All other estimates are calculated by Starr (1979) from DSL (1973).*

Time of tide

Both the high and low tides occur progressively later upbay from the mouth. Lag time at some locations seems to vary with seasonal changes in river flow (Arneson 1976). Arneson's study shows that lag times are variable and difficult to predict for different locations in the estuary.

Arneson (1976) compared his tidal measurements to predictions made by NOAA. For the mouth he discovered actual tides to be within 20 minutes of predications 80% of the time and to generally be earlier than predicted. At Coos Bay tides occurred considerably earlier than predicted. Only 25% of measured tides were within 20 minutes of NOAA predictions.

Arneson suggests the earlier tides at Coos Bay could be attributed to increases in mean channel depth that have occurred subsequent to the tidal predictions. Shallow wave theory predicts that the tidal wave should move faster at increased depth. Measurements have not been made since completion of channel deepening associated with the Deep-Draft Navigation Project. This further depth increase could allow the tidal wave to travel even faster.

Tidal circulation

The USACE (1975) states that the average tidal current at Coos Bay is 2.0 knots (3.4 ft per sec) and that flood currents of 3.5 knots (5.9 fps) have been reported. Arneson (1976) mentions that ebb currents as high as 5.0 knots (8.4 fps) have been measured, although maximum ebb measured during his study was 2.4 knots (4.0 fps).

Arneson (1976) studied the relationships of flow and velocity to maximum and minimum tidal heights to determine the character of the tidal wave. His data (Table 5) reveal that the wave is neither a true standing nor progressive wave. The tide resembles a cooscillating wave in which the tidal wave is reflected at the head of the estuary and the resulting tidal motion is the sum of the incident and reflected waves. However, studies of tidal ranges and lag times of high and low water as one progresses up the mouth show that the cooscillation theory does not strictly define Coos Bay. The complex geometry of the bay and the fact that one may consider tributaries both as sources and as inertial forces contributes to this complexity (Arneson 1976). The response of the tidal phenomena to further changes in estuarine geometry is difficult to predict.

Mixing

Burt and McAllister (1959) used a salinity gradient approach to describe mixing in Coos Bay. They classified the bay as well mixed for all months except November, when the estuary was partly mixed. They also specified a secondary classification of partly mixed for January, March, and June. Arneson (1976) applied the salinity gradient approach and the approach developed by Simmons (Dyer 1973), which uses a ratio of river flow to tidal prism, to data which he collected in 1973 and 1974. Results are shown in Fig. 4.

Both the flow ratio and salinity gradient methods classify the entire estuary as one mixing type. Arneson (1976) used salinity profiles to depict conditions along the main channel of the bay (Fig. 4). He finds a consistent change in mixing patterns occurring between RM 14 and 15 in Marshfield Channel, not far from the entrance of Coos River into the wide, shallow tidal flat area of the bay. It also appears that RM 8-9 is a zone of change. This may also be related to shape changes that occur there.

Table 5. Flow and velocity phase results (Arneson 1976).

Date	Tide	Phase lag following low or high water[a]						Range (m)
		Entrance (RM 1.06)		Coos River (RM 15)		Isthmus Slough (RM 14.22)		
		Flow	Velocity	Flow	Velocity	Flow	Velocity	
Sept. 12, 1973 (Summer)	Flood	78°	78°	148°	126°	156°	129°	1.79
	Ebb	87°	81°	100°	130°	--	--	-1.82
Dec. 18, 1973 (Fall)	Flood	--	--	--	--	--	--	1.33
	Ebb	81°	87°	--	--	90°	49°	-2.15
Mar. 22, 1974 (Winter)	Flood	--	--	113°	95°	128°	--	1.71
	Ebb	84°	78°	124°	156°	92°	112°	-1.89
June 11, 1974 (Spring)	Flood	114°	127°	168°	122°	--	--	1.71
	Ebb	88°	90°	168°	162°	88°	74°	-1.07

a *360° = 1 tidal cycle of 12.42 hours*

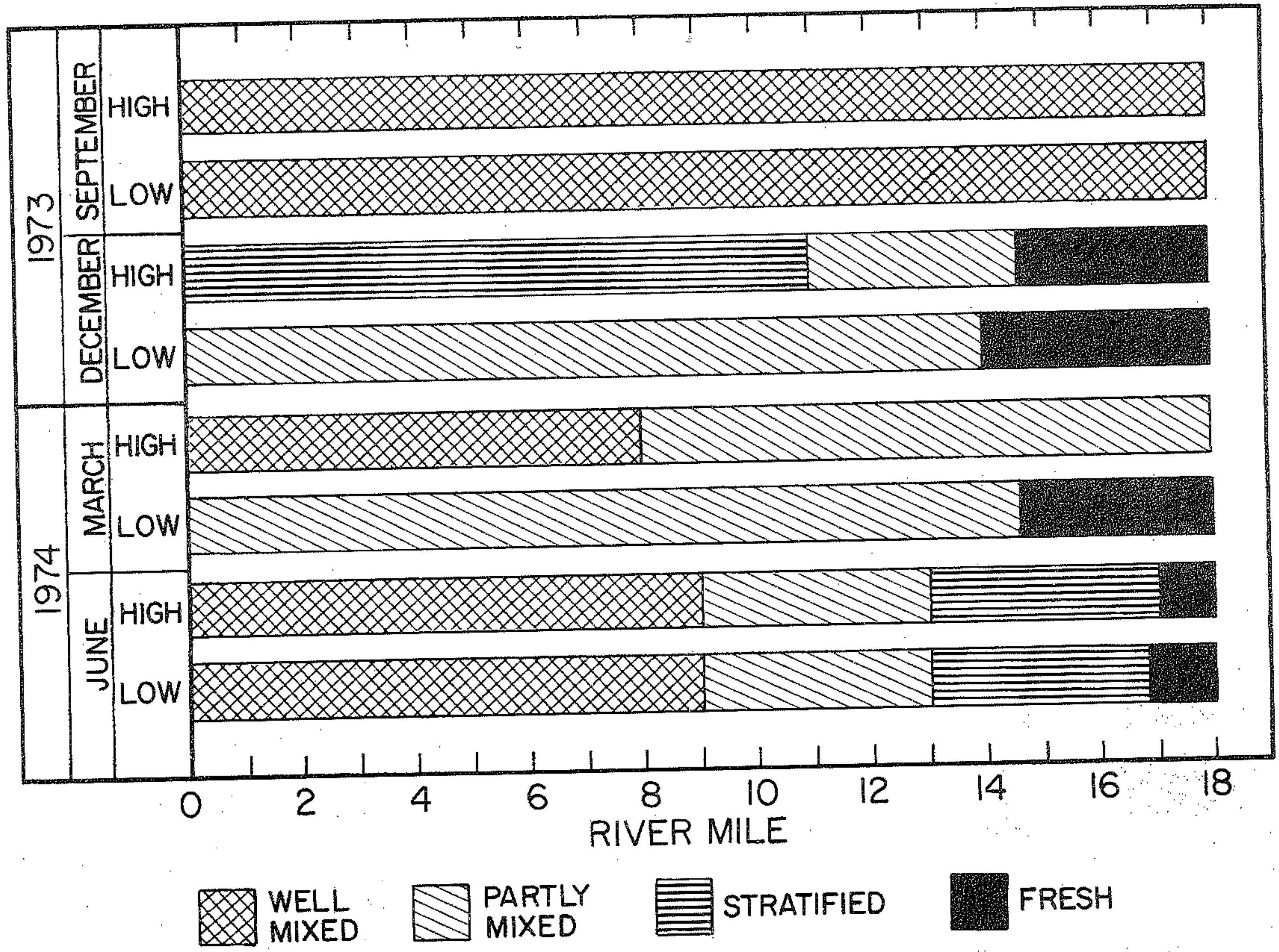

Fig. 4. Coos Bay mixing characteristics (Arneson 1976).

Flushing

Using the modified tidal prism method Arneson (1976) calculated flushing times for several points in the estuary (Table 6). His calculations for a point 27 miles from the mouth of the estuary ranged from 13.4 days at a time of high river flow and tidal range to 48.5 days at low flow and low tidal range. Although these estimates are based on only a few measurements, they demonstrate that flushing takes a number of days even under optimum flow.

Table 6. Calculated flushing rates using the modified tidal prism method (Arneson 1976).

Date	Tidal Range (ft)	Flow (cfs)	Flushing time (days) RM 7.6	RM 17.3	RM 27.0
Sept. 13, 1973	7.9	28	9.7	22.9	40.3
Dec. 19, 1973	5.9	3,814	6.2	11.8	13.4
Mar. 23, 1974	7.2	1,074	8.2	14.4	15.9
June 12, 1974	3.3	431	19.0	41.3	48.5

Temperature

The temperature of Coos Bay undergoes both seasonal and diurnal fluctuations. Fresh water inflow and tidal currents are the main factors affecting temperature distribution in the estuary (Arneson 1976). Coastal upwelling causes offshore surface temperatures to be coldest during summer (Bourke et al. 1971). River temperatures are coldest in winter and warmest during summer and fall (Arneson 1976). DEQ (1978) data show that temperatures in the estuary have reached extremes of 35.6°F and 73.4°F. Seasonal temperature fluctuations are greater upbay than near the mouth of the estuary, reflecting that fluctuations in tributary temperatures are more extreme than those of the ocean.

Arneson (1976) plotted temperature vs RM for the data he collected in 1973 and 1974 (Figs. 5 and 6). His data show large longitudinal variations in September and June when entering fresh water was warmest. June data also show vertical gradients because a greater amount of fresh water was entering at that time. High tide profiles each show a significant increase at RM 8, which Arneson attributes to solar heating of the shallow water over the large tideflats of the upper bay.

In December and March the ocean and entering fresh water were nearly the same temperature so profiles were almost identical. DEQ (1978) data show that fresh water temperatures may be much colder than ocean temperatures. Different profiles would be expected under those conditions.

In summer, low streamflows and poor circulation cause high temperatures in some areas of the bay (STR 1974). High temperatures physiologically stress aquatic life. STR (1974) list high temperature as a water quality problem in Coos River, Millicoma River, North Slough, Catching Slough, and Isthmus Slough.

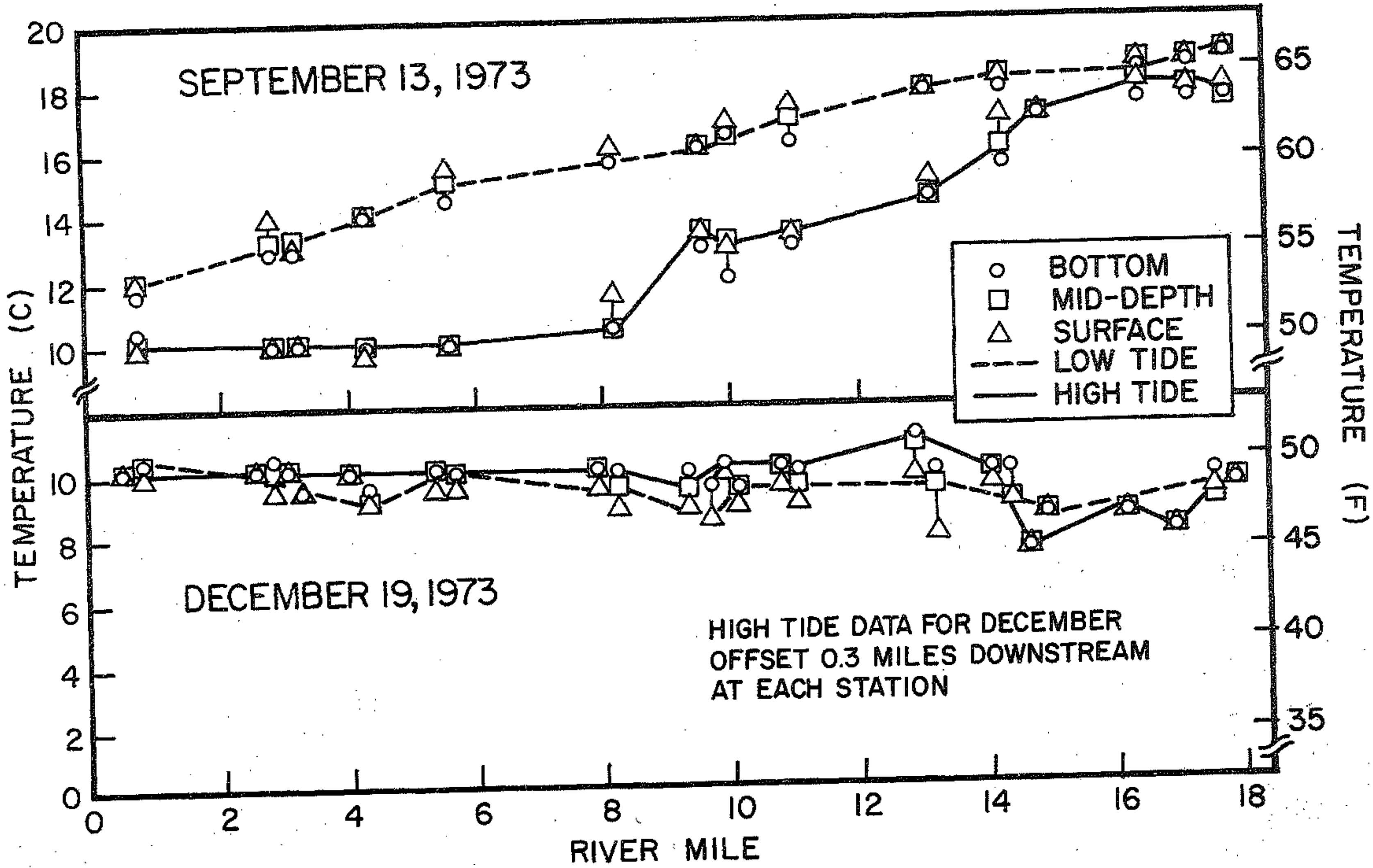

Fig. 5. Temperature vs. river mile, Coos Bay, September 13 and December 19, 1973 (Arneson 1976).

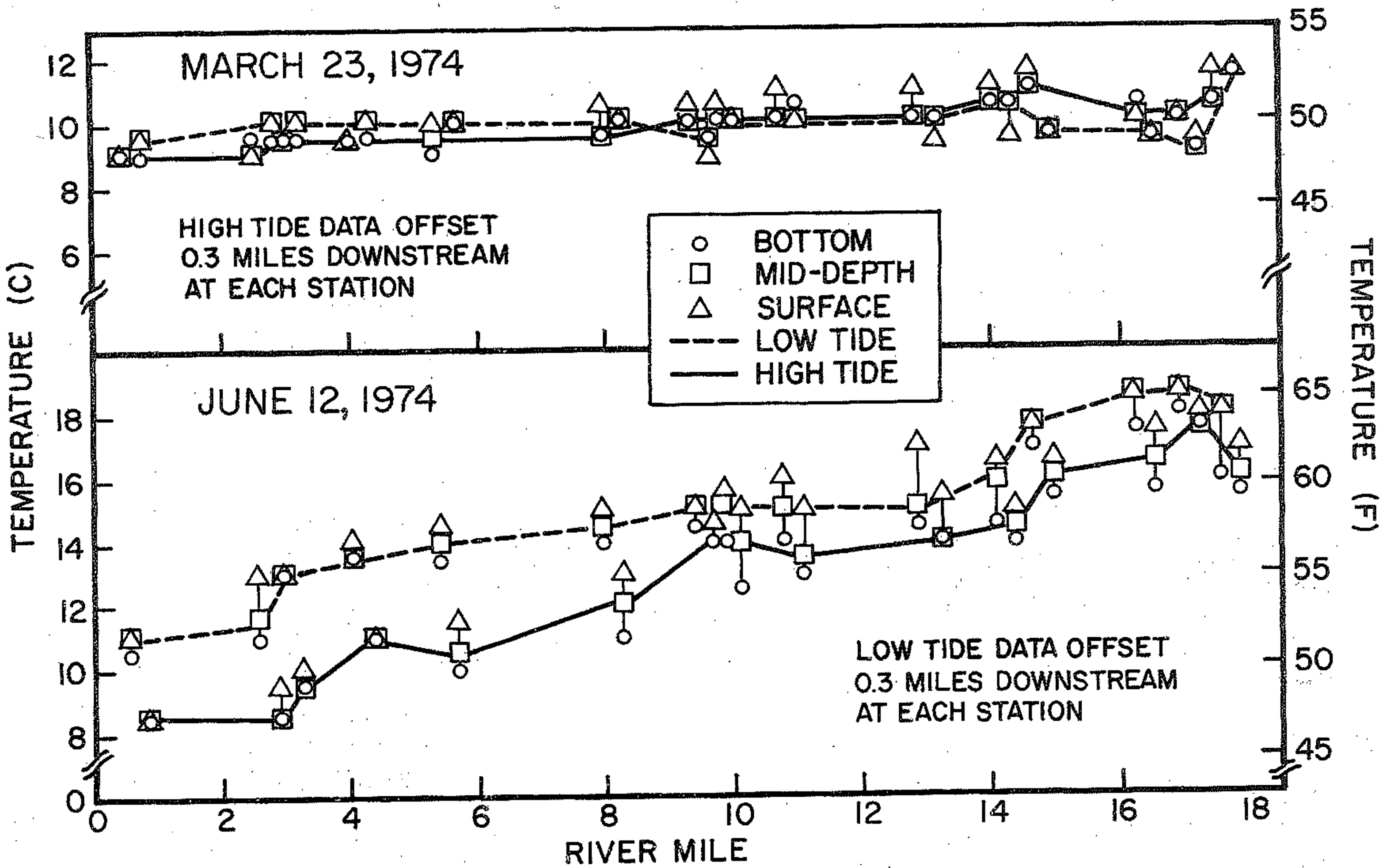

Fig. 6. Temperature vs. river mile, Coos Bay, March 23 and June 12, 1974 (Arneson 1976).

Dissolved oxygen

Dissolved oxygen (DO) is measured by DEQ as part of their regular water quality monitoring program. Others who have measured DO in conjunction with specific projects include Arneson (1976), STR (1974), and Slotta et al. (1973).

DEQ data show DO levels below the 6 mg/l standard occasionally at various locations in the bay (DEQ 1978). Measurements below standards were more frequent above RM 13 and in Isthmus Slough. STR (1974) data generally concur. Arneson (1976) sampled seasonally in 1973 and 1974. His limited data show that DO concentrations were slightly higher in December and March than in June and September. Lowest levels were recorded from Isthmus Slough. DO concentrations below the standard can kill resident fish and invertebrates and prevent migrants from utilizing the area.

Arneson (1976) mentions that DO depressions during fall have been attributed to low fresh water inflow and waste loading caused by offshore upwelling of low DO water and input of organic material, such as seafood industry waste water and bark from stored logs.

Arneson (1976) also noted supersaturation in the Coos River and in Catching Slough during June which he attributes to photosynthetic activity. Arneson attributed supersaturation observed near the mouth in December to reaeration aided by wave action.

Turbidity

Arneson (1976) found, with only a few exceptions, that low tide turbidity levels were higher than high tide levels. He interpreted this to mean that the primary cause of turbidity in Coos Bay is the sediment carried in by fresh water entering the bay. High tide turbidities increase from the mouth upstream during all seasons although this increase is very slight during times of low runoff.

USACE (1975) states the average turbidity in the bay ranges from 20 to 49 Jackson Turbidity Units. Slotta et al. (1973) found that below RM 12 dredging does not significantly increase turbidities. Above RM 12 post-dredging levels of 500 JTU have been recorded. North Slough and the area near Empire Mill are mentioned by the USACE (1975) as areas of high turbidity. Discharge of industrial waste water is listed as a probable cause of these high turbidities by STR (1974). USACE (1975) states that highest turbidity levels measured by STR in 1972 were 2,400 JTU during high tide at the site of log-dumping operations at the Empire Mill. The clearest waters were found at the entrance and near North Bend (USACE 1975).

DEQ standards specify that no more than a 10% cumulative increase in natural turbidities is allowed except for certain DEQ approved limited duration activities (OAR 340-41-325).

Coliform

DEQ has measured fecal coliform counts which exceed standards for commercial shellfish growing areas occasionally below RM 8.75 in the bay and frequently above this point. Counts exceeding general standards are frequent above RM 11.5. With a few exceptions, coliform counts in South Slough have been within shellfish area standards. STR (1974) has measured counts above the standard upbay of Jordon Point in the main bay, in North Slough, Isthmus Slough, and Catching Slough. The bay has been closed to commercial shellfish harvest above Sitka Dock by the State Health Division (Osis and Demory 1976).

Major causes of high coliform counts include improper disinfection of sewage plant effluents, inadequate subsurface disposal systems, and livestock (STR 1974).

Sediments

Coos Bay is an aggrading system--more sediment enters the bay than is removed by natural forces (USACE 1975). Prior to the channel deepening for the Deep-Draft Navigation Project, an annual average of 1.65 million yd^3 of material was removed from Coos Bay by the USACE (1976) to maintain navigation channels.

Sediments entering the bay include

1. materials, primarily silts, derived from erosion of the drainage basins of tributary streams;
2. marine sands carried into the bay by littoral drift;
3. dune sands which are blown into the bay even though the dunes have been partially stabilized by vegetation;
4. sands from wind erosion of the sandstone cliffs of the lower bay and South Slough.

The material from the entrance to RM 12 is predominantly fine sand. No shift to smaller grain size has been observed in that section following dredging. From RM 12 to RM 15 channel, sediments are primarily silts, clays, and organic fines, and the composition shifts to smaller grain sizes after dredging. Above RM 15 sediments are silty (USACE 1975).

Sedimentation is controlled by hydrology. Arneson (1976) has applied the concept of realms of deposition used by Kulm and Byrne (1976) for Yaquina Bay to the Coos. He hypothesizes a marine and a transition realm extends to RM 12 and a fluviatile realm exists above RM 12. Percy et al. (1974) estimate an average of 72,000 tons of sediment enters the bay from its drainage basin annually.

Known areas of sediment deposition in Coos Bay include the entrance to Charleston Channel, the area adjacent to disposal islands west of the North Bend Airport, Jordan Cove, east of the upper Coos Bay Channel, and at the mouths of Pony Slough, North Slough, and Haynes Inlet (USACE 1976).

In the lower portions of Coos Bay, material removed from the channel is deposited in in-bay disposal sites. During recent years the amount of material has been constant and shoaling has recurred at the same sites. USACE (1976) hypothesizes that a semi-closed sediment transport system has been operating from RM 2 to RM 12. Sediments originating upstream of RM 15 were thought to have been trapped between RM 12 and RM 15 where the channel was dredged by the Corps. Sediments from the ocean were thought to accumulate mainly below RM 2. Below RM 2 and RM 12 sediments were thought to result from redistribution of existing sediments in a cycle of removal of material from the channel, disposal of dredged material adjacent to the channel, and gradual infilling of the channel (USACE 1976). Effects of channel deepening on this sytem are unknown.

Most studies of the sediment chemistry of Coos Bay have been related to dredging and disposal of dredged material (STR 1972; Slotta et al. 1973; Arneson 1976). STR (1972) determined that sediments below RM 10 met standards for inwater disposal, whereas all materials above RM 10 failed to meet those standards. Above RM 10 volatile solids increased (Arneson 1976). USACE (1975) found the area above RM 12 in the estuary exceeded EPA standards for grease and oil, volatile solids, nitrogen, and phosphorus.

Biological Characteristics

The biology of Coos Bay has been the subject of numerous studies, including those by individual students and classes at Oregon Institute of Marine Biology (OIMB), by OSU students and faculty, and by ODFW personnel. Most of the studies are descriptive in nature. Quantitative studies of productivity and population dynamics are generally lacking.

Phytoplankton

The USACE (1975) has summarized work done by several authors on the summer phytoplankton of Coos Bay (Kilburn 1961; Ednoff 1970; Ide 1970; McGowan and Lyons 1973). Diatoms are the principal members of Coos Bay's planktonic flora. There appears to be a continuum of species from the ocean to the upper bay containing two species assemblages and a transition zone. The transition zone lies between RM 5 and 9 and is an area of high species diversity and productivity (McGowan and Lyons 1973). *Chaetoceros*, *Skeletonema*, and *Thalassiosira* predominate in the lower bay, while *Melosira* and *Skeletonema* are found in the upper bay.

OIMB is currently taking quantitative measurements of phytoplankton in South Slough. Preliminary results indicate definite seasonal and tidal changes in species composition.

Macroalgae

The algal flora of Coos Bay is not well described. Most of the existing information is derived from qualitative studies by Sanborn and Doty (1944) and OIMB (1970). The USACE (1975) states that attached algae are probably found throughout the bay on solid substrates and that very few marine algae are restricted to the bay environment and not found in other locations along the Pacific Coast.

The greatest variety of algal species is found near the mouth of the estuary where hard substrates providing significant attachment sites and moderate wave action support a flora similar to that of the protected outer coast (Sanborn and Doty 1944). Along the main channel there is a change from a strictly marine to a brackish water flora.

Small subtidal kelp (*Nereocystis leutkeana*) beds are located in the lower sections of the estuary, and free-floating, seasonally occurring mats of green algae sometimes cover large areas of the upper bay (Ednoff 1970).

Productivity studies of the algae of Coos Bay have not been done.

Seagrasses

Two seagrasses occur in Coos Bay--eelgrass (*Zostera marina*) and ditchgrass (*Ruppia* sp.) (USACE 1975). Approximately 1,400 acres of lower intertidal and shallow subtidal tideflats are covered by eelgrass meadows (Akins and Jefferson 1973). Large contiguous beds of eelgrass occur in the lower and upper bay, in North and South Sloughs, and in Haynes Inlet. George M. Baldwin and Associates et al. (1977) state that the eelgrass meadows of the upper bay are among the largest in the state. In the lower reaches of the estuary eelgrass often occurs in pure stands, whereas in upper, less saline, areas it is often accompanied by ditchgrass.

Tidal marsh

Tidal marsh generally occurs from lower high tide inland to the line of non-aquatic vegetation and includes both salt marsh and tidally influenced fresh marsh. The U.S. Department of the Interior (USDI 1971) states that marsh vegetation in Coos Bay developed where broad, low gradient flats of soft sediment were not too strongly stressed by waves or currents. Large present day marshes are located at the mouth of Coos River and in the slough systems--North Slough, Pony Slough, Kentuck Inlet, Isthmus Slough, and Coalbank Slough. Fringing marshes have developed along the shoreline of the main channel near Empire, around the spoil islands of the lower and upper bay, and along the undisturbed shorelines of South Slough.

Using a classification adapted from Jefferson (1975) and estimating an error of less than 10%, Hoffnagle and Olson (1974) calculated the marsh acreage of Coos Bay (Table 7). Akins and Jefferson (1973) have given a figure of 2,738 ac. of marsh for Coos Bay.

Table 7. Area of Coos Bay marshes (Hoffnagle and Olson 1974).

Marsh type	Area (acres)
Low silt marsh	71.6
Low sand marsh	289.1
Immature high marsh	1000.5
Mature high marsh	97.5
Sedge marsh	353.5
Bullrush and sedge marsh	149.8
Surge plain	285.0
Total undiked marsh	1951.9
Total diked marsh	2942.9

Prior to human alterations of the estuary and its drainage basin, vast marshes occupied the upper bay and slough systems. Hoffnagle ad Olson (1974) estimate that 90% of the salt marshes of this estuary have been diked or filled to accomodate expansion of industry or residential areas and for agriculture and for dredged material disposal sites. Eilers (1974) indicates that of the 14 estuaries examined, Coos Bay marshes have been the most severely disturbed by human activities.

Marsh species and types present in Coos Bay resemble those found in other Oregon estuaries to the north and in the Coquille to the south. Akins and Jefferson (1973) noted that south of the Coquille there is a distinct change in vegetation and marsh types.

Hoffnagle et al. (1976) studied six marsh sites in Coos Bay. The group estimated those marshes produced over 1,050,000 gm/acre/year of plant material and considered this figure to be an underestimate. Their data suggest higher marshes are more productive than lower marshes. Bullrush and sedge were found to be particulary productive species. Productivity alone may be insufficient evidence to judge the importance of a marsh. The palatability of marsh plants to consumer organisms and the importance of the plant to detritus production are examples of other considerations (Hoffnagle et al. 1976).

According to Hoffnagle and Olson (1974), "The salt marsh and bacterial and clinging forms associated with its detritus comprise a base of production for the Coos Bay Estuary, providing food and habitat for commerical fish, bivalves, crab, birds, and mammals, and life in Coos Bay in general." The marsh serves as a buffer between shorelands and estuarine waters, preventing or minimizing erosion, flooding, and pollution. Jefferson (1974) indicates that flooding poses a greater potential hazard to shorelands because vast areas of Coos Bay marshes have been diked. Areas constructed on filled marsh are the most susceptible to flooding.

Zooplankton

McGowan and Lyons (1973) directed a short sampling program during the summer of 1973. Their data show a decreasing number of zooplankton taxa along the axis of Coos Bay with increasing distance from the ocean. The lower bay appeared to have a species assemblage which included neritic zooplankters carried in by tidal action and resident species which maintained reproductive populations. Peak zooplankton numbers occurred near Empire in an area of high chorophyll values. Different species were found in the upper bay and in Coos River.

Quantitative information on Coos Bay zooplankton is sparse, and seasonal species distributions are unknown.

Invertebrates

A wide variety of ecological niches are available to invertebrates in the Coos Bay estuary. Differing substrates provide a range of attachment sites and sediments in which to burrow from the solid rock of Fossil Point to the silty, highly organic mud of Isthmus Slough. In addition to substrate variations, differing salinities, temperatures, dissolved oxygen, and other physical factors provide even more variation in conditions.

Subtidal invertebrate populations of the dredged ship channel have been studied by Parr (1974), Slotta et al. (1974), and Jefferts (1977). Jefferts (1977) found the channel infauna of the lower portions of the estuary to be more diverse than that of the upper bay channel. Species of the upper bay, such as the polychaete *Streblospio benedicti*, are generally widespread and opportunistic. Parr (1974) hypothesizes that the fauna of the upper channel are adapted to dredging and that the "weed" species occurring there require frequent disturbance to maintain their competitive advantage.

A qualitative overview of the intertidal macroinvertebrates in Coos Bay was conducted by OIMB in 1970. Many other workers have concentrated on certain taxa or on limited geographic areas of the bay. Distribution of *Corophium*, an important crustacean in the diet of salmonids and other fishes, is shown in Fig. 7. ODFW has surveyed intertidal clam and shrimp distribution in some areas and is completing surveys in other areas (Gaumer 1978) (Fig. 8-15). Hartmann and Reish (1950 described the annelid fauna of the bay with notes on distribution, and Queen (1930) studied the decapod crustaceans of the bay.

Commercially and recreationally harvested invertebrates include several species of clams, the Dungeness and red rock crabs, oysters, bay mussels, ghost shrimp, kelp worms, and mud shrimp.

Clams. Principal species of clams harvested in Coos Bay are gapers (*Tresus capax*), cockles (*Clinocardium nuttallii*), butter clams (*Saxidomus giganteus*), littlenecks (*Protothaca staminea*), softshell clams (*Mya arenaria*), and razor clams (*Siliqua patula*). Of these, all but the softshell clams are restricted in distribution to areas below the railroad bridge (RM 9). These clam species are all filter feeders. Salinity, substrate, and water circulation probably play significant roles in limiting distribution (USACE 1975).

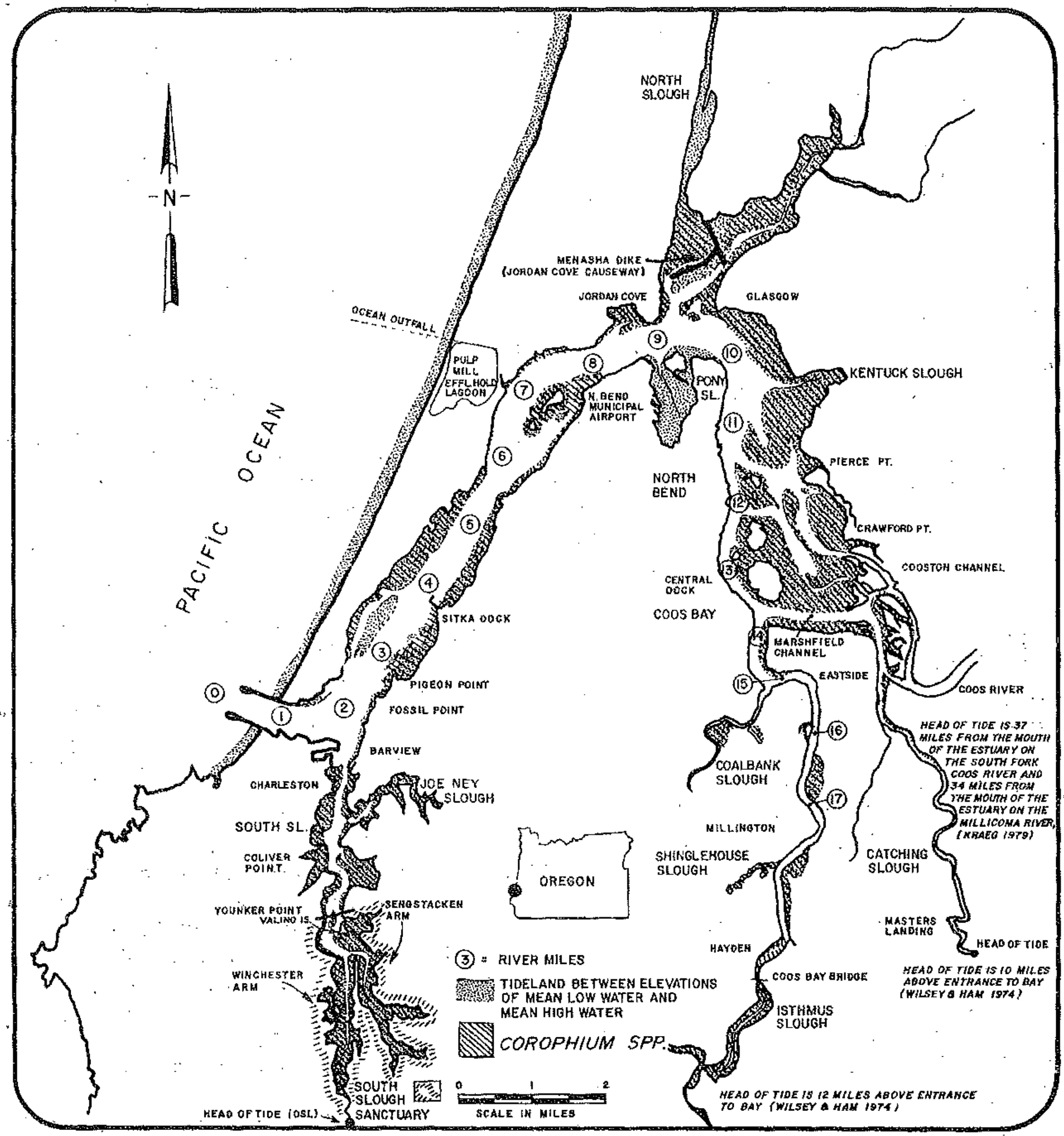

Fig. 7. *Corophium* distribution in Coos Bay (Coos Bay Planning Department 1979).

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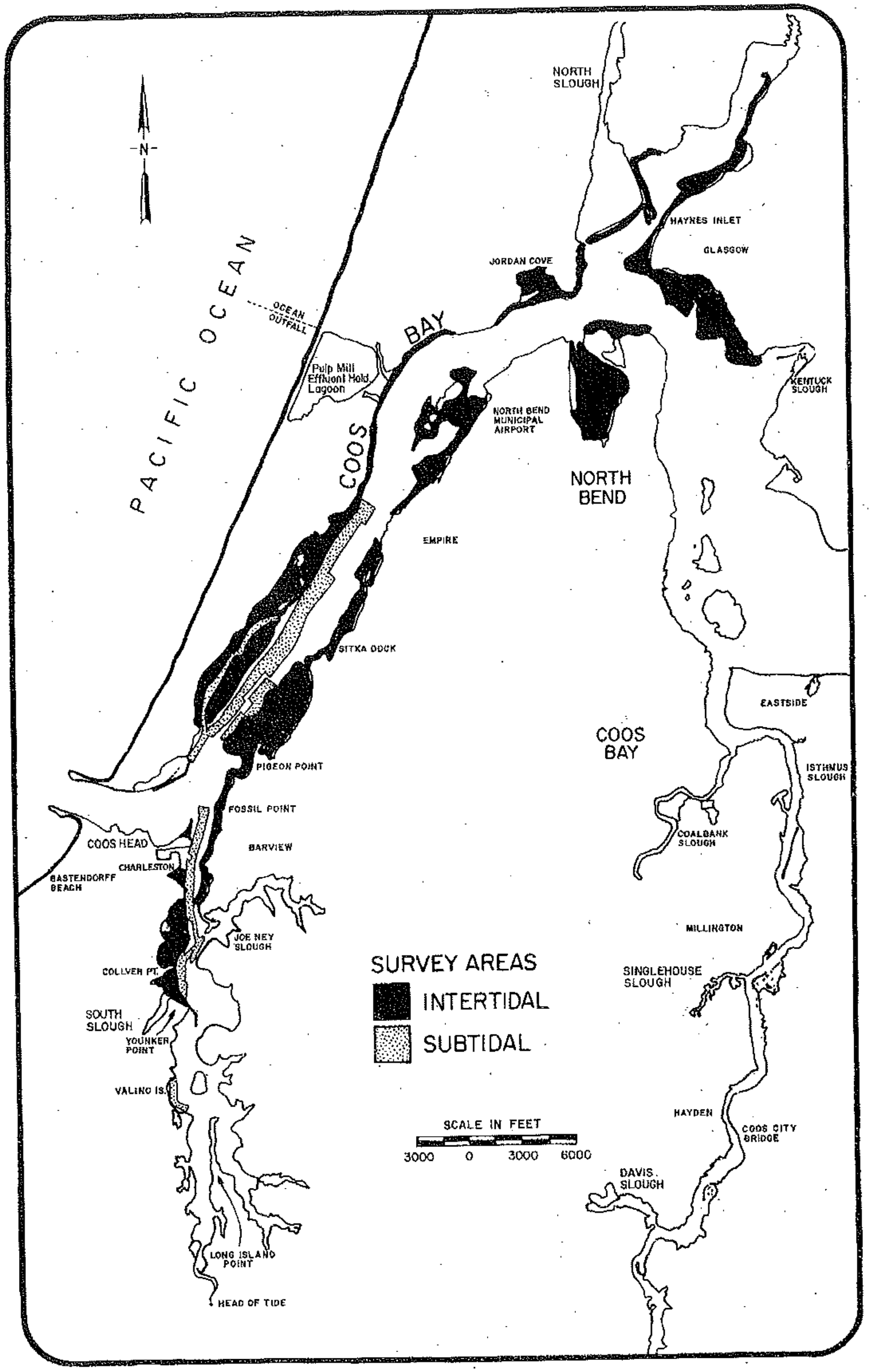


Fig. 8. Areas surveyed for clam and shrimp distribution (Gaumer 1978).

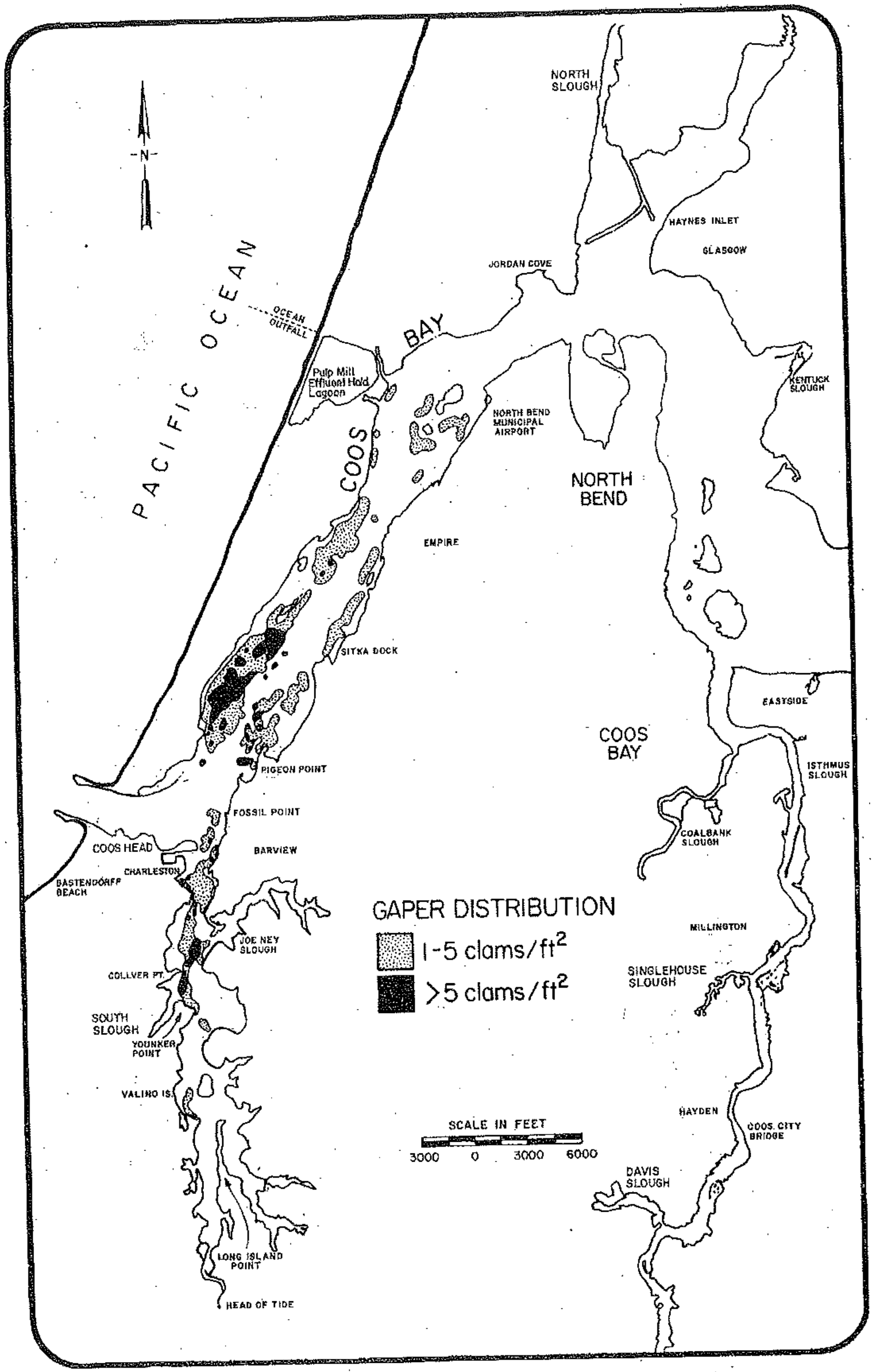


Fig. 9. Gaper distribution in Coos Bay (Gaumer 1978).

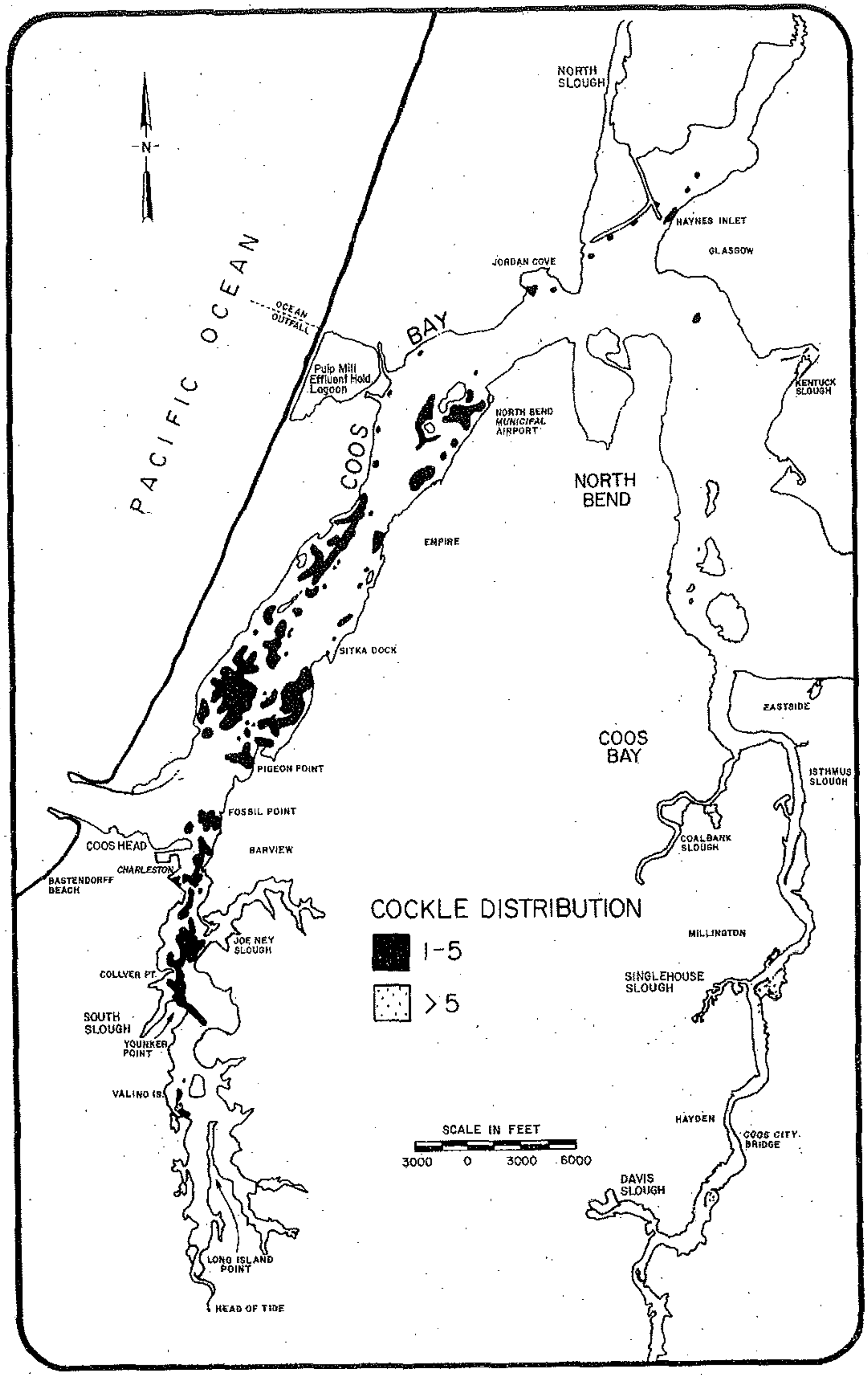


Fig. 10. Cockle distribution in Coos Bay (Gaumer 1978).

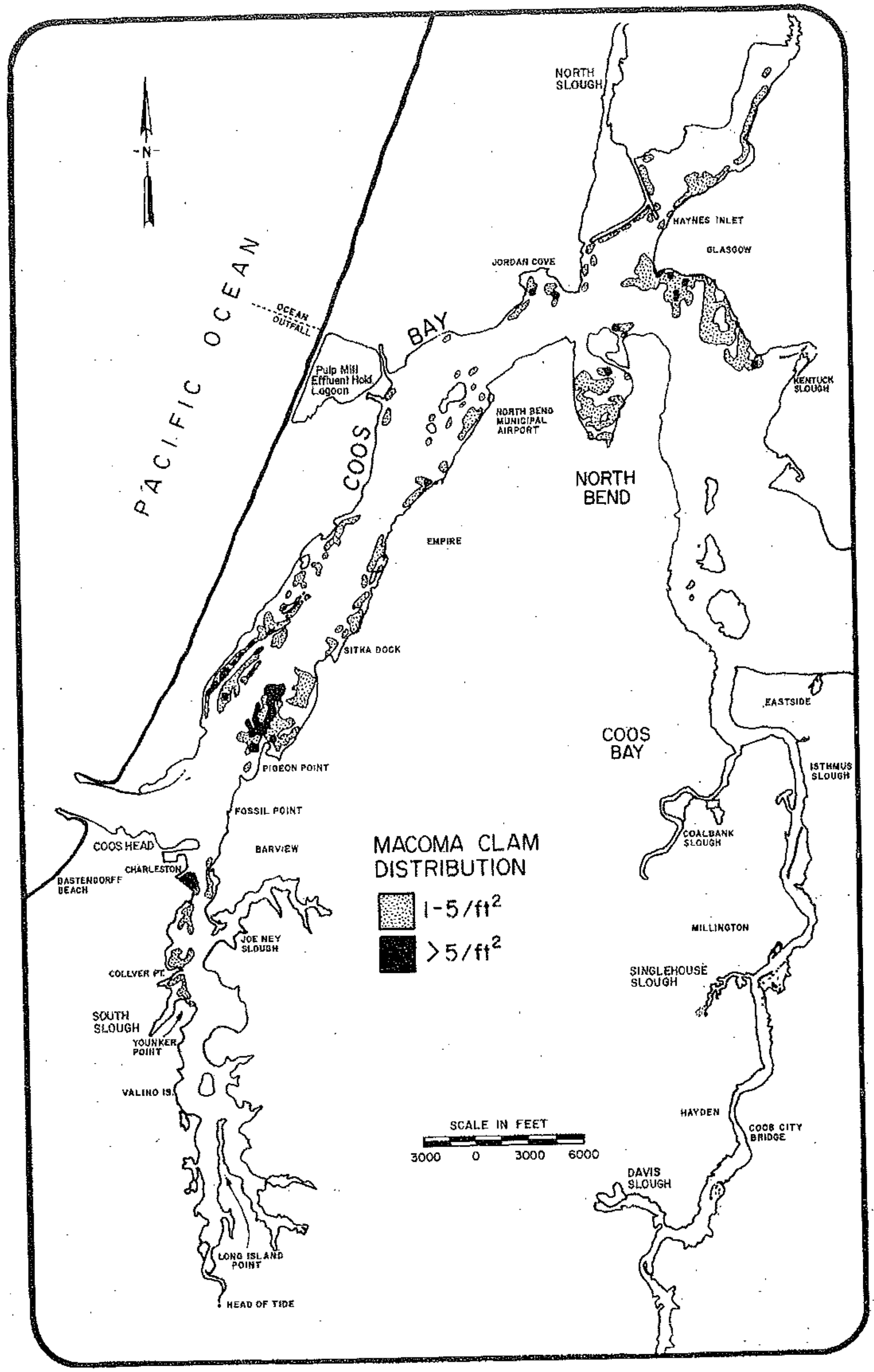


Fig. 11. *Macoma* (*Macoma irus, M. nasuta and M. balthica*) distribution in Coos Bay (Gaumer 1978).

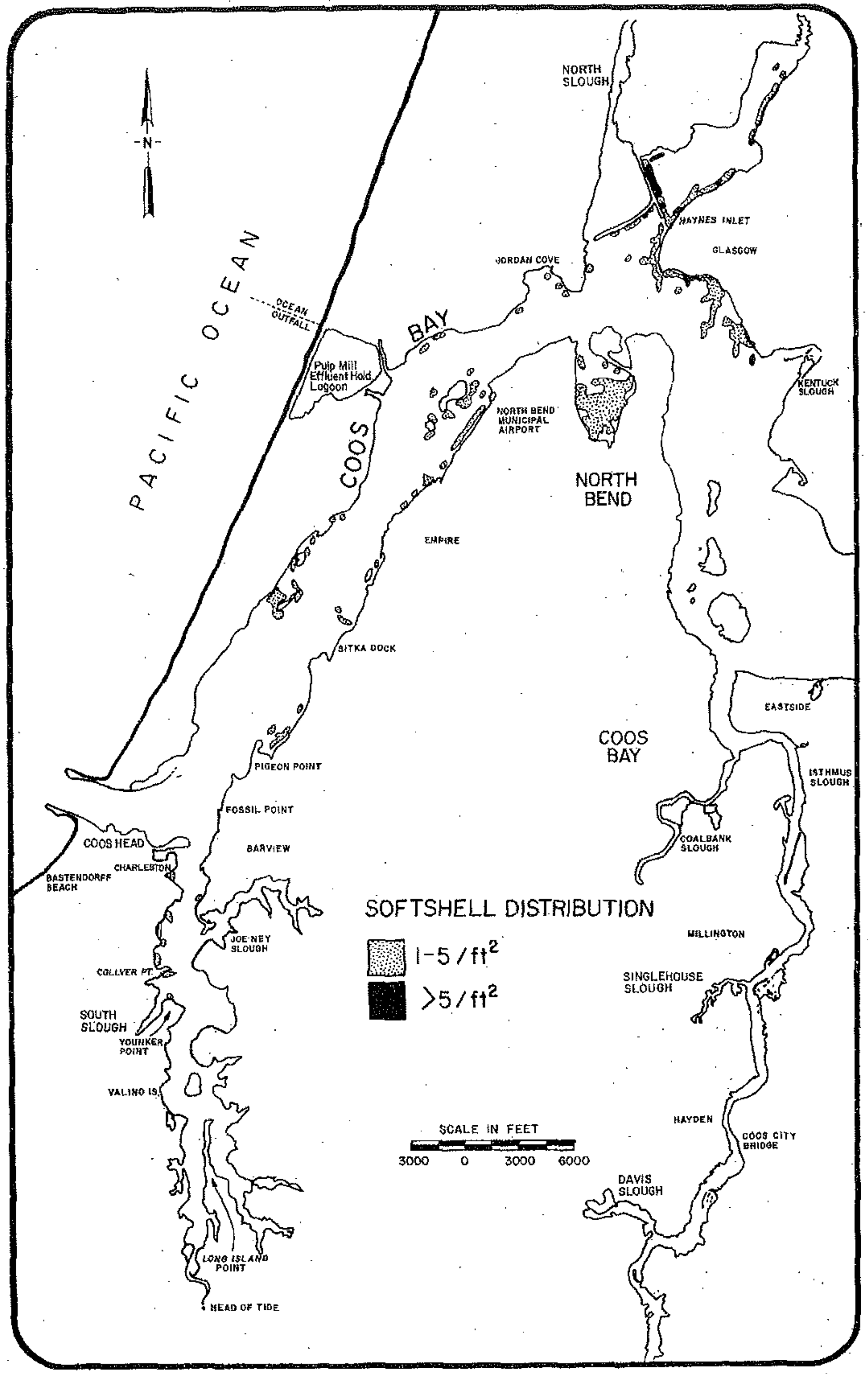


Fig. 12. Softshell distribution in Coos Bay (Gaumer 1978).

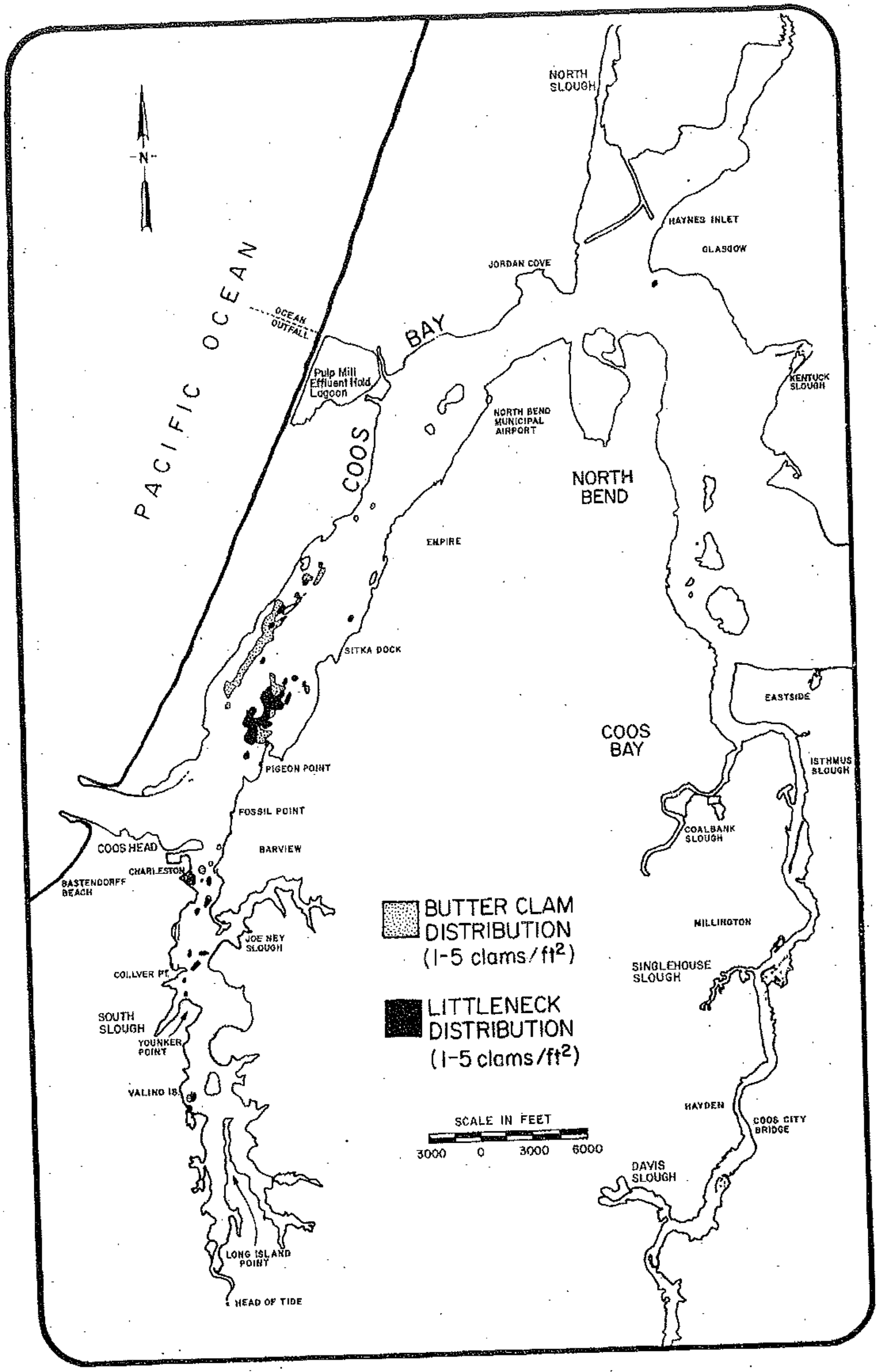


Fig. 13. Butter clam and littleneck distribution in Coos Bay (Gaumer 1978).

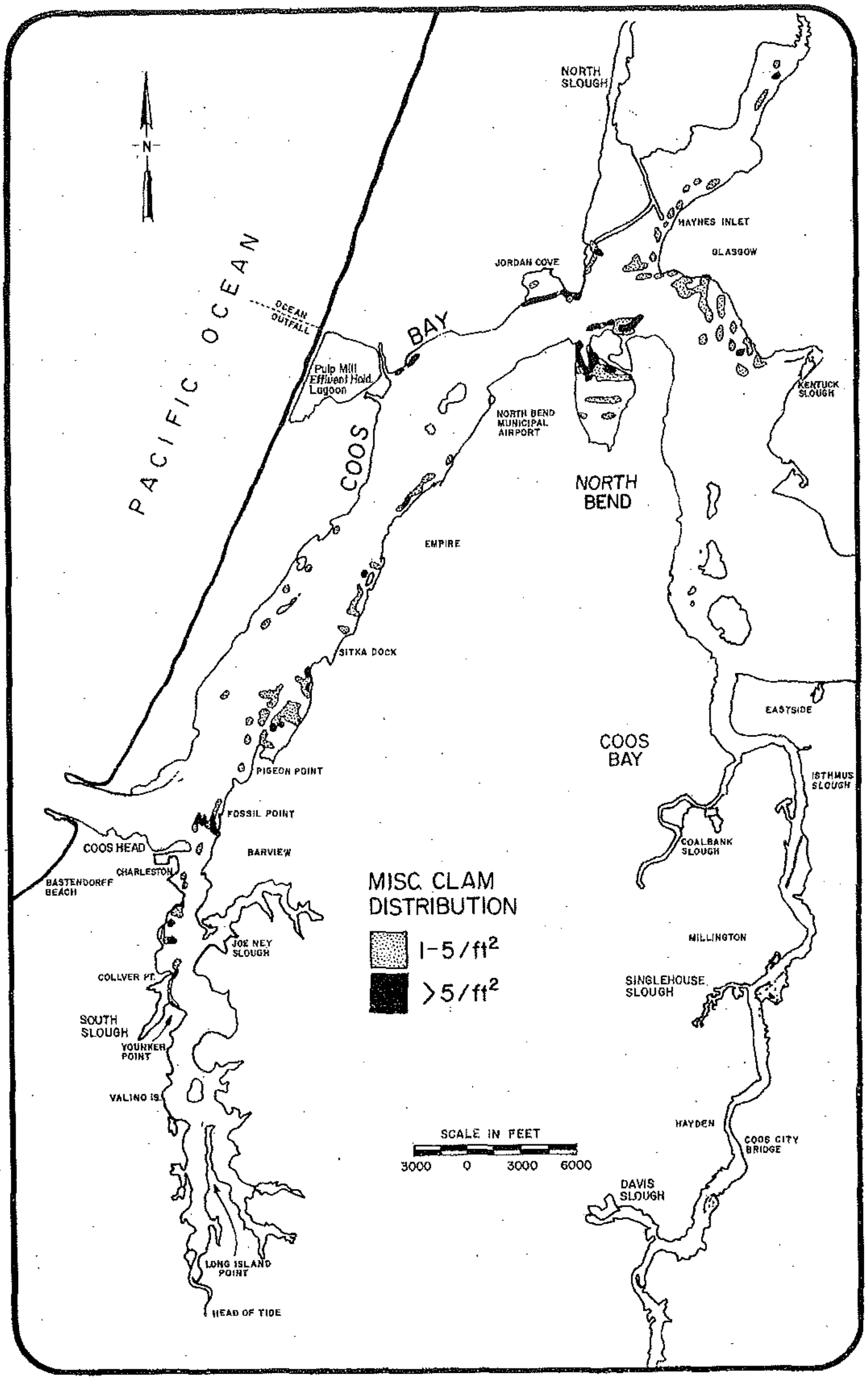


Fig. 14. Miscellaneous clam (California softshell, bodega, paddock, jackknife and rockclams) distribution in Coos Bay (Gaumer 1978).

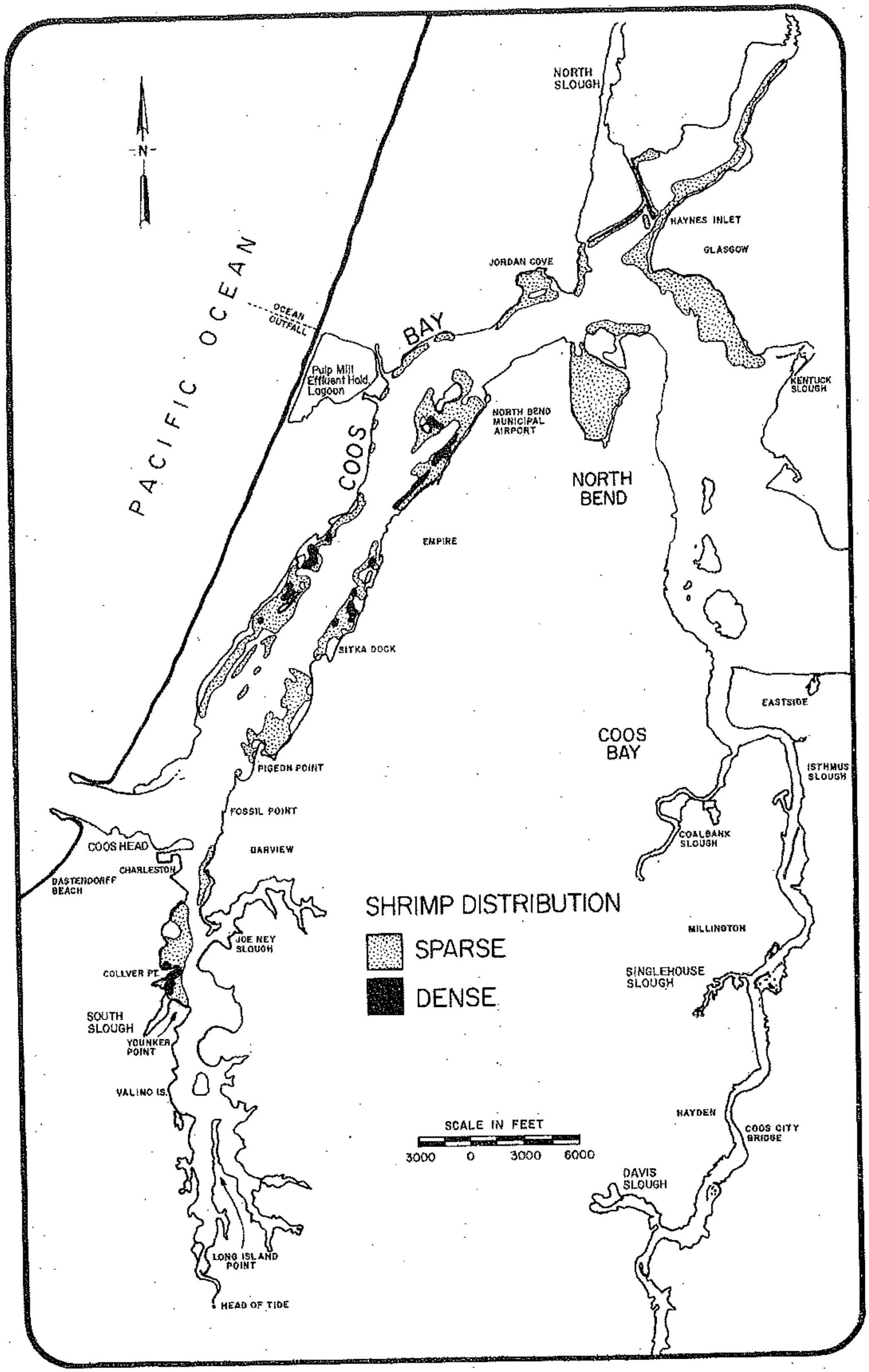


Fig. 15. Shrimp distribution in Coos Bay (Gaumer 1978).

Preliminary ODFW studies indicate that Coos Bay has extensive subtidal clam beds, including large beds of gapers and cockles (Gaumer and Lukus 1976). Principal beds are in the lower bay and lower South Slough. In 1976 one subtidal bed was investigated by ODFW to determine the feasibility of a commercial clam fishery (Gaumer and Halstead 1976). The 48-acre bed off Pigeon Point contained approximately 26.4 million clams, principally gapers and Irus clams (*Macoma inquinata*). Mean size of butter, cockle, littleneck and gaper clams was larger for each species than in a similar study in Yaquina Bay (Gaumer and Halstead 1976). A commercial harvest of 55,482 lb of gapers was taken from the Coos Bay site in 1975-76.

A 1971 estuarine resource use survey (Gaumer et al. 1973) showed that the greatest numbers of clams were taken from tideflats adjacent to North Spit and Pigeon Point and the flats just south of Charleston bridge. Menasha Dike, which separates North Slough from the main bay ranked second. Of the areas surveyed, the Menasha Dike above the railroad bridge was the principal site of softshell clam harvest. Some resource use information on major recreational clam species is contained in Table 8.

Table 8. Clam catch by tideflat users, 1971 (Gaumer et al 1973).

Clam species	Number taken	% of invertebrate tideflat catch	Primary digging area	Secondary digging area
Gaper	107,907	35.3	North Spit	Pigeon Point
Cockle	53,250	17.5	Charleston Flat	North Spit
Butter	53,288	17.4	Pigeon Point	North Spit
Softshell	45,101	14.8	Menasha Dike	North Bend
Native littleneck	15,482	5.1	Pigeon Point	Boat Basin

Razor clams maintain a fluctuating population on a wave-washed sand spit immediately north of the Charleston breakwater where they are taken recreationally (USACE 1978).

Crabs. Both Dungeness (*Cancer magister*) and red rock (*C. productus*) crabs are taken recreationally in Coos Bay. In 1971 crabs accounted for over 80% of the recreational boat fishing catch with Dungeness crabs alone accounting for 76.7% of the catch (Gaumer, Demory, and Osis 1973). Dungeness crabs are also fished commercially within Coos Bay. In-bay crab landings fluctuate, as do those of the ocean, but an average of 11,441 lb were landed from Coos Bay in 1971-74 (personal communication, Darrel Demory, ODFW, May 8, 1979). Of the 31,000 lb landed from Oregon bays in 1977, Demory (personal communication) estimates that 15,000-18,000 lb were from Coos Bay.

Both species of crabs are found subtidally throughout the bay (USACE 1975). Waldron (1958) states that Dungeness crabs have a preference for sandy or muddy bottoms, although they may be found on almost any bottom. Gaumer et al. (1973) found the lower bay to be the primary site of recreational crab fishing.

Fish Commission of Oregon studies (Waldron 1958) have shown that while crabs do move between bays and the ocean, and from bay to bay, 84% of the crabs tagged in bays were recovered within four miles of the tagging site.

The importance of the estuary as rearing ground for crabs is not understood (USACE 1975). Large numbers of crab larvae (megalops) are found in Coos Bay in late spring and early summer and are also found offshore at that time of year (Waldron 1958). Samll (0.8-2 in) Dungeness crabs are found abundantly in the upper reaches of the estuary. Hunter (1973) has shown that small Dungeness crabs seem to be more tolerant of low salinities than are large individuals.

Several other crab species inhabit the bay including the freshwater crab (*Rhithropanopeus harrissi*) of the upper bay and the shore crabs (*Pachygrapsus crassipes* and *Hemigrapsus nusus*) of rocky intertidal areas.

Oysters. While native oysters (*Ostrea lurida*) no longer inhabit Coos Bay, Pacific oysters (*Crassostrea gigas*) are grown commercially in the bay. All existing Coos Bay oyster leases are in South Slouth (Fig. 16). In 1976, 144.08 acres of oyster ground were leased in Coos Bay. About 40% (57 ac.) were actually in production at that time. Osis and Demory (1976) listed a potential ground acreage of 525 ac and indicated that siltation problems account for much of the land remaining unused. Excessive fresh water and heavy siltation sometimes cause oyster mortality in Coos Bay during winter.

The potential oyster culture area of Coos Bay extends upstream from the mouth to the lower reaches of Haynes and North Sloughs, but high bacterial counts have forced closure of commercial areas above Sitka Dock. Jambor and Rilette (1977) note the area open to oyster harvest is only about one-half of the useable oyster tideland.

According to Jambor and Rilette (1977), DEQ officials state that because high bacterial counts in Coos Bay are mainly caused by dairy and wild animal stocks, little improvement is expected. Purification of shellfish grown in polluted waters (depuration) may be one way to increase acreage in Coos Bay used for commercial oyster culture (ODFW 1976; Jambor and Rilette 1977). However, other factors such as existing clam beds and navigation rights may limit expansion of oyster culture.

Other invertebrates. Other invertebrates taken by recreationists in Coos Bay include ghost shrimp (*Callianassa californiensis*), and mud shrimp (*Upogebia pugettensis*), kelp worms (*Nereis* spp.) (Fig. 15) (Gaumer et al. 1973), and lug worms (*Abarenicola pacifica*) (personal communication, Reese Bender, ODFW, March 10, 1979). These organisms are frequently used as bait. The shrimp are primarily taken from tideflats of the lower bay while the worms are harvested in greatest abundance from Menasha Dike (Gaumer et al. 1973).

Fish

At least 66 species of fish are known to use the Coos Bay estuary (Cummings and Schwartz 1971). Fish distribution has been studied during summer months (Cummings and Schwartz 1971; Ednoff 1970) and seining efforts by ODFW in 1977 and 1978 have added further information regarding seasonal use of the bay (personal communication, Reese Bender and Bill Mullarkey, ODFW, April 4, 1979)

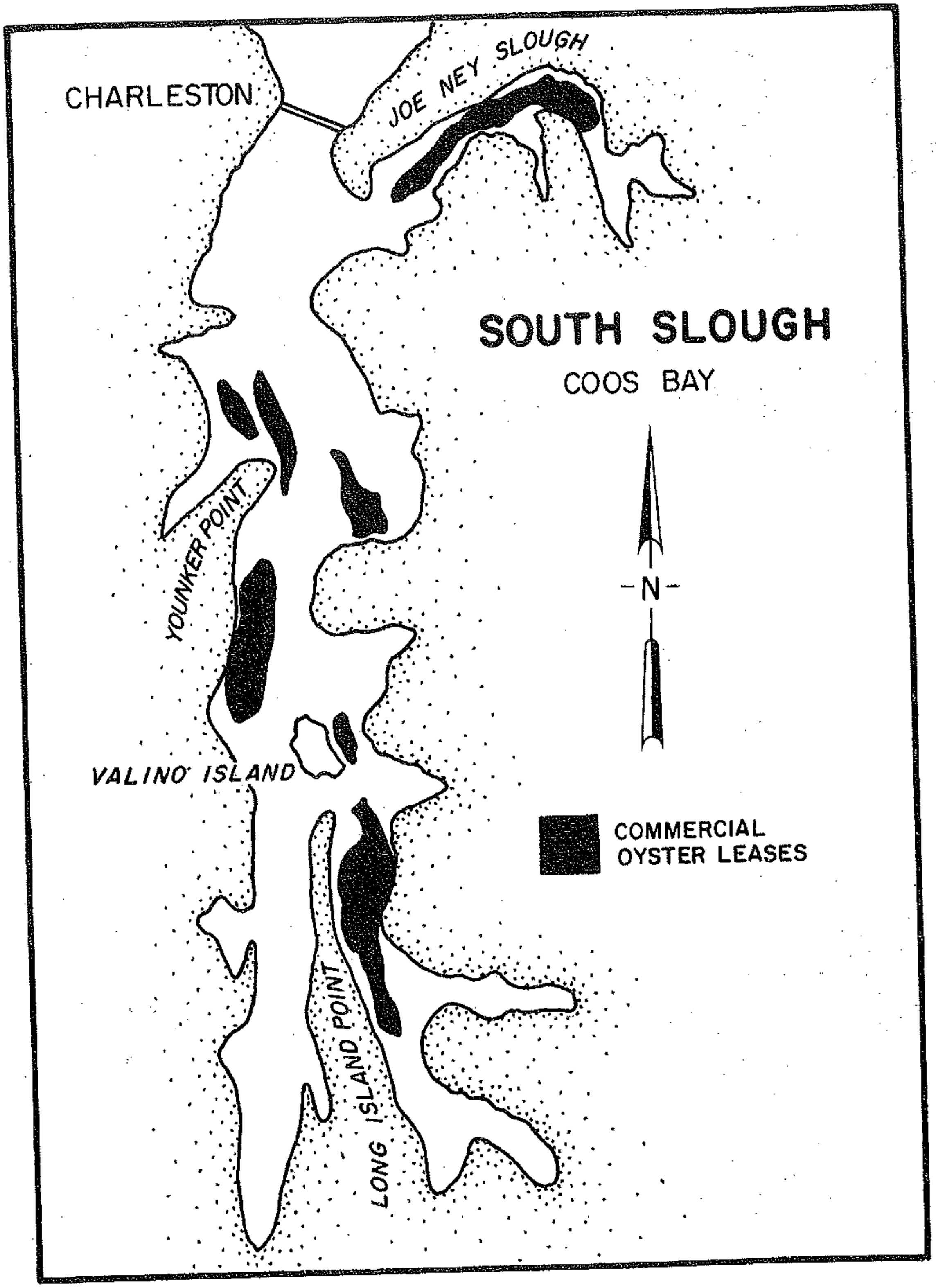


Fig. 16. Commercial oyster leases in Coos Bay (Jambor and Rilette 1977).

(Table 9), but documentation of the use of specific areas and habitats by fish species is lacking.

The greatest variety of species is found in the lower parts of the estuary (Cummings and Schwartz 1971), while the greatest numbers of fish, captured during the same sampling program, were taken near the mouth of the Joe Ney Slough and just west of Jordan Point (Hostick 1975). One might expect those species requiring high salinities to reach the upper most extent of their ranges in the bay during summer and those species requiring low salinities to extend further downbay during periods of high runoff.

The Coos system supports stocks of fall chinook salmon, coho salmon, steelhead, and searun cutthroat trout. Chum salmon are seen occasionally. Records show that a sizeable population of fall chinook salmon once inhabited the Coos system (Cleaver 1951). Gillnet catches declined from an average of 200,000 lb between 1923 and 1930 to 36,000 lb between 1930 and 1940. After the building of splash dams on the South Fork Coos River in 1941, the population declined substantially (personal communication, Al McGie, ODFW, January 17, 1979). Since removal of the dams in 1957, the population has recovered so that now approximately 5,000 chinook spawn in Coos River and its tributaries (personal communication, Bill Mullarkey, ODFW, April 14, 1979). Based on historic records, a spawning population of at least 12,000 chinook is possible when the recovery of spawning grounds and reaccumulation of spawning gravel is complete (personal communication, Mullarkey). Information on salmonids is summarized in Table 10.

In 1978 anglers caught 1,145 chinook and 24,000 coho salmon in the ocean sport fishery offshore from Coos Bay. In late summer chinook and coho are caught from the jetties. A boat fishery develops in late August in the upper bay and river and continues through the fall. In 1977, a year of drought, 604 salmon over 24 inches were caught in the Coos and Millicoma rivers, and Bender (pers. comm.) estimates another 600 jacks may have been caught. A cutthroat fishery of unknown catch also occurs in the river.

Three private hatcheries have obtained permits from ODFW for salmon release/ recapture operations (Table 11). ODFW has begun an evaluation of the private hatchery programs in Coos Bay to determine the periods and areas of residence and food habits of hatchery and wild salmonids.

Coos Bay also supports a large population of striped bass. Commercial fishing for bass has been closed in Coos Bay since 1975, but prior to the 60s, the striped bass fishery on the Coos was surpassed on the West Coast only by that of the Sacramento River in California (Hutchison 1962). Currently an active sport fishery occurs on a population of unknown size. Stripers are taken throughout the year at various places in the bay. Upriver migration of striped bass occurs in several runs from May until July. After spawning the fish move back into the bay to feed, seeking the deeper holes and channel. Although a few may go to the ocean, most of the fish probably stay in the bay all year (personal communication, Al McGie, ODFW, July 10, 1979). Young fish appear to stay upriver until the end of their first year of life.

Table 9. Distribution of fish species by subsystem (Cummings and Schwartz 1971; Hostick 1975, and Mullarkey and Bender 1979).

Species	Subsystem[a] Marine (RM 0-3)	Lower Bay (RM 3-9)	Upper Bay (RM 9-17)	Riverine (RM 17-30)	South Slough	North Slough	Haynes Inlet	Isthmus Slough	Catching Slough
Leopard shark *(Triakis semifasciata)*	X								
Longnose lacetfish *(Alepisaurus richardsoni)*	X								
White seabass *(Cynoscion nobilis)*	X								
Pomfret *(Brama rayi)*	X								
Redtail surfperch *(Amphistichus rhodoferus)*	X								
Wolf-eel *(Anarrhichthys ocellatus)*	X								
Copper rockfish *(Sebastodes caurinus)*	X								
Rock greenling *(Hexagrammos superciliosus)*	X								
Tidepool sculpin *(Oligottus maculosus)*	X	X							
Mosshead sculpin *(Clinocottus globiceps)*	X								
Fluffy sculpin *(Oligottus snyderi)*	X								
Tubenose poacher *(Pallasina barbata)*	X								
Longnose skate *(Raja rhina)*	X	X							
Whitebait smelt *(Allosmerus elongatus)*	X	X							

Table 9. Continued.

Species	Subsystem[a] Marine (RM 0-3)	Lower Bay (RM 3-9)	Upper Bay (RM 9-17)	Riverine (RM 17-30)	South Slough	North Slough	Haynes Inlet	Isthmus Slough	Catching Slough
Eulachon *(Thaleichthys pacificus)*	X	X							
Penpoint gunnel *(Apodichthys flaridus)*	X	X							
Pacific sandlance *(Ammodytes hexapteros)*	X	X							
Bocaccio *(Sebastodes paucispinis)*	X	X		X					
Cabezon *(Scorpaenichthys marmoratus)*	X	X		X					
Tubesnout *(Aulorhynchus flaudius)*	X	X		X					
Spiny dogfish *(Squalus acanthias)*	X	X	X						
White sturgeon *(Acipenser transmontanus)*	X	X	X						
Northern anchovy *(Engraulis mordax)*	X	X	X	XXF					
Longfin smelt *(Spirinchus dilatus)*	X	X	X						
Pacific tomcod *(Microgadus proximus)*	X	X	X						
Surf smelt *(Hypomesus pretiosus)*	X	X	X	F					
Striped seaperch *(Embiotoca lateralis)*	X	X	X	XX					
Walleye surfperch *(Hyperprosopon argenteum)*	X	X	X	XXF					
White seaperch *(Phanerodon furcatus)*	X	X	X	XX					

Table 9. Continued.

Species	Subsystem[a]								
	Marine (RM 0-3)	Lower Bay (RM 3-9)	Upper Bay (RM 9-17)	Riverine (RM 17-30)	South Slough	North Slough	Haynes Inlet	Isthmus Slough	Catching Slough
Pile Perch *(Rhacochilus vacca)*	X	X	X	XX					
High cockscomb *(Anoplarchus purpurescens)*	X	X	X						
Arrow goby *(Clevelandia ios)*	X	X	X						
Pacific pompano *(Palometa simillima)*	X	X	X						
Black rockfish *(Sebastodes melanops)*	X	X	X	XX					
Kelp greenline *(Hexagrammos decagrammus)*	X	X	X	XX					
Lingcod *(Ophiodon elongatus)*	X	X	X	XX					
Padded sculpin *(Artedius fenestralis)*	X	X	X						
Buffalo sculpin *(Enophys biason)*	X	X	X						
Sand sole *(Psettichthys melanostichus)*	X	X	X						
Pacific lamprey *(Lompetra tridentata)*	X	X	X	X					
Green sturgeon *(Acipenser medirostris)*	X	X	X	X					
American shad *(Alosa sapidissima)*	X	X	X	X	XF	X		X	XX
Pacific herring *(Clupea harengus pallasi)*	X	X	X	X	X			X	
Chum salmon *(Oncorhynchus keta)*	X	X	X	X					

Table 9. Continued.

Species	Subsystem[a] Marine (RM 0-3)	Lower Bay (RM 3-9)	Upper Bay (RM 9-17)	Riverine (RM 17-30)	South Slough	North Slough	Haynes Inlet	Isthmus Slough	Catching Slough
Coho salmon (*Oncorhynchus kisutch*)	X	X	X	X	F				
Chinook salmon (*Oncorhynchus tsawytcha*)	X	X	X	XF	XF				
Cutthroat trout (*Salmo clarki*)	X	X	X	XF					
Rainbow trout (*Salmo gairdneri*)	X	X	X	X					
Topsmelt (*Atherinops affinis*)	X	X	X	X	XX		X	XX	
Bay pipefish (*Syngnathus griseolineatus*)	X	X	X	X	X		X		
Striped bass (*Roccus saxatilis*)	X	X	X	X					
Shiner perch (*Cymatogaster aggregata*)	X	X	X	XE	XXE	X	X	XX	X
Silver surfperch (*Hyperprosopon ellipticum*)	X	X	X	XE	XXF			XX	
Snake prickleback (*Lumpenus sagitta*)	X	X	X	X	XX			X	
Saddleback gunnel (*Pholis ornata*)	X	X	X	X					
Pacific staghorn sculpin (*Leptoccotus armatus*)	X	X	X	XF	XXF	X	X	XX	XX
Speckled sanddab (*Citharichthys stigmaeus*)	X	X	X	X	XX				
English sole (*Parophrys retulus*)	X	X	X	X	XX				
Starry flounder (*Platichthys stellatus*)	X	X	X	XF	XF	X	X	X	XX

Table 9. Continued.

Species	Subsystem[a]								
	Marine (RM 0-3)	Lower Bay (RM 3-9)	Upper Bay (RM 9-17)	Riverine (RM 17-30)	South Slough	North Slough	Haynes Inlet	Isthmus Slough	Catching Slough
Bay goby *(Lepidogobius lepidus)*		X	X						
Threespine stickleback *(Gasterosteus aculeatys)*		X	X	XF			X	XX	XX
Prickly sculpin *(Cottus asper)*		X	X	X					
Redside shiner *(Richardsonius balteatus)*				X	F				
Speckled dace *(Rhinichthys osculus)*				X					
Largescale sucker *(Catostomus machrochelius)*				X					

[a] *Pony Slough not included in sources used.*
X= species present according to summer sampling by Cummings and Schwartz (1971).
F= species present in ODFW 1977 seine samples. Applies only to South Slough and Riverine because data from other areas was combined by authors.

Table 10. Salmonid use of Coos Bay (Thompson etal 1972; Bender and Mullarkey 1979).

Species	Estimated population	Time of spawning migration	Spawning peak	Juvenile use of estuary	State releases
Fall chinook salmon	5,000	Sept.-Jan.	Nov.	Feb.-Oct.	--
Coho salmon	8,300	Oct.-Feb.	Dec.	Mar.-Jun.	--
Chum salmon	incidental				
Steelhead	5,000	Nov.-Apr.	Jan.-Mar.	Mar.-Jun.	100,000
Cutthroat trout	3,500	Aug.-Jan.	unknwon	entire yr.	10,000

Table 11. Private hatchery permits for Coos Bay (Cummings 1977).

Hatchery	Total permit	Permits by species		
		Chinook	Coho	Chum
Weyerhaeuser	40,000,000	10,000,000	10,000,000	20,000,000
Anadromous	10,000,000	5,000,000	5,000,000	
Calvin Heckard				5,000,000

Shad are fished commercially in Coos Bay from April 20 to June 21. A five-year (1973-77) average of 19,310 lbs of shad was taken from Coos Bay. Sport fishermen take shad from the South Coos River and Millicoma River from mid April through June by trolling from boats.

Shad tagged in the Coos River have been recovered from the Umpqua and Coquille rivers, but evidence suggests each of these rivers supports its own population of shad (Mullen 1974). Mullen (1974) estimated from tagging studies a population of over 50,762 shad in the Coos River system. However, shad too small to be caught in the gillnets were not included in the estimate.

Shad enter the bay from the ocean in the spring months and start to appear in the commercial gill net fishery when it opens in April. Spawning usually occurs in May and June in upper tidal areas of the Coos and Millicoma rivers. Juvenile shad rear in the Coos and Millicoma rivers throughout the summer. Shad begin to appear in seine hauls in lower Coos Bay during August (pers. comm., Bender). Most of the juveniles enter the ocean in the fall.

In 1978 a conservative estimate of 145 tons of herring spawned in Coos Bay between 0.6 and 13.7 miles from the mouth (Miller and McRae 1978). Spawning occurs from January through April, and herring remain in the bay through summer (pers. comm., Bender). Three areas heavily used during the 1978 spawn were Fossil Point (eelgrass, algae, rocks), lower North Spit (eelgrass), and the Ford Dock near Jordan Cove (pilings) (Miller and McRae 1978). Jackson (1979) observed heavy spawns on lower North Spit, south of Clam Island in 1979. It is possible that timing of the herring spawn is influenced by freshwater runoff so that spawning occurs farther downbay during high runoff periods (Miller and McRae 1978).

Shiner perch, redtail surfperch, striped seaperch, black rockfish, and kelp greenling are among the other fish inhabiting the bay in large numbers which are taken by sport anglers (Gaumer et al. 1973).

Distribution maps for major species have been prepared by the Coos County Planning Department.

Mammals

Resident marine mammals in the estuary are limited to the harbor seal (*Phoca vitulina*) and the harbor porpoise (*Phocoena phocoena*) (personal communication, Mike Graybill, OIMB, March 15, 1979). Approximately 120 harbor seals haul out in the Pigen Point area of Coos Bay. They use the bay for feeding, primarily on bait fish such as herring and eulachon, and have been sighted in both the upper and lower bay. There is evidence that lower North Spit serves as a pupping area (pers. comm., Graybill). Harbor porpoises live in the lower estuary where they are seen frequently from RM 1 to 3.

Non-resident marine mammals occasionally sighted in the bay include California sea lions (*Zalophus californianus*), Stellar sea lions (*Eumetopias jubata*), and rarely California gray whales (*Eschrichtius gibbosu*) and killer whales (*Orciniis orca*).

River otters are common in the Coos and Millicoma rivers (pers. comm., Bender) and have been seen in the Crawford Point area (pers. comm., Graybill) and in South Slough (Magwire 1976a). The population size is unknown.

A variety of mammals are found in Coos Bay salt marshes. Raccoon, bobcat, muskrat, mink, weasel, fox, coyote, black-tailed deer (Magwire 1976a), and striped skunk (Pinto 1972) are found in the salt marshes, and beaver are found in areas of inflowing fresh water (Magwire 1976a). The marsh is only part of the range of animals, and their abundance depends primarily on how remote and undisturbed the community is (Magwire 1976a).

The major small mammals of the marshes are vagrant shrews and deer mice. The deer mouse is most abundant in the high marsh and tends to remain close to the terrestrial environment, while the shrew uses lower marshes and is often near logs or debris. Other species of mice, shrews, voles, and the black rat use the marshes in lesser numbers. These small mammals serve as primary and secondary consumers in the terrestrial food chain (Magwire 1976a).

Birds

Although a thorough study of the use of the estuary by bird populations has not been published, observations by individuals and groups provide information on seasonal use and abundance of bird species at Coos Bay. USACE (1975) abstracted a list of birds using the bay from information published by U.S. Department of the Interior (1971). Magwire (1976a) has summarized observations by Wampole (1959), Fawver and Wampole (1971), McGie (1976), and Richer (1976). Table 12 presents a compilation of this information. In addition, a census of birds of the greater Coos Bay area is made each December by the local chapter of the National Audubon Society.

Table 12. Bird use of Coos Bay estuary (key on p. 46).

Species	Subsystems: Marine & Lower Bay	Subsystems: Upper Bay	Subsystems: Riverine	Habitats: Channel	Habitats: Unconsolidated Shores & Flats	Habitats: Rocky Shores	Habitats: Tidal Marsh	Coos Head W	Coos Head S	Fossil Point to Pigeon Point W	Fossil Point to Pigeon Point S	Empire W	Empire S	Pony Slough W	Pony Slough S	Haynes Inlet W	Haynes Inlet S	Metcalf *Salicornia* Marsh W	Metcalf *Salicornia* Marsh S
Arctic loon (*Gavia arctica*)	FWSp			U				O	U	C	U	U						C	
Red-throated loon (*G. stellata*)	FWSP			U				O	O			O				O	O	O	
Red-necked grebe (*Podiceps grisegena*)	FWSp			U						O		C		O					
Brown pelican (*Pelecanus occidentalis*)	F			U				O	O										
Brandt's cormorant (*Phalacrocorax penicillatus*)	Res			C															
Pelagic cormorant (*P. pelagicus*)	Res			C				A	A	O	O	O				O	O		
Black brant (*Branta nigricans*)	Sp			A[1]	A[1]			O		A	A	R				A		U	
Harlequin duck (*Histrionicus histrionicus*)	FWSp			R		R		O	R					R		R			
Oldsquaw (*Clangula hyemalis*)	W			R				O	R										
Common scoter (*Oidemia nigra*)	W			U								R							
Surf scoter (*Melanitta perspicillata*)	FWSp			A				A	U	A	C	A	A	U	U			A	A
Red-breasted merganser (*Mergus serrator*)	FWSp			U				O	O	U		C	U	U		U			
Surfbird (*Aphriza virgata*)	FWSp					C		C	O										
Ruddy turnstone (*Arenaria interpres*)	M					U							R						

Table 12 continued.

	Subsystems				Habitats			Subsystems or Specific Areas											
Species	Marine & Lower Bay	Upper Bay	Riverine	Channel	Unconsolidated Shores & Flats	Rocky Shores	Tidal Marsh	Coos Head		Fossil Point to Pigeon Point		Empire		Pony Slough		Haynes Inlet		Metcalf *Salicornia* Marsh	
								W	S	W	S	W	S	W	S	W	S	W	S
Red phalarope (*Phalaropus fulicarius*)	M			R															
Northern phalarope (*Lobipes lobatus*)	M			C										R					
Glaucous-winged gull (*Larus glaucescens*)	FWSp			C								C				O			
Herring gull (*L. argentatus*)	FW			U				O				A	A	C					
California gull (*L. californicus*)	FW			U										R					
Mew gull (*L. canus*)	FWSp			C				C	U			C	O	C	O				
Heerman's gull (*L. heermanni*	SF			C				O	U								O		
Bonaparte's gull (*L. philadephia*)	M			C				C	U				O		O		O		
Blacklegged kittiwake (*Rissa tridactyla*)	FWSp			R				O	O										
Caspian tern (*Hydroprogne caspia*)	M			U					R						R				
Common Murre (*Uria aalge*)	Res			A				U	A			O	U		U				
Marbled Murrelet (*Brachyramphus marmoratum*)	Res			R						C		C		C		U		C	C
Horned grebe (*Podiceps auritus*)	FWSp	FWSp		C															
American wigeon (*Mareca americana*)	W	W		A	A		A							A		A			

Table 12 continued.

Species	Subsystems: Marine & Lower Bay	Subsystems: Upper Bay	Subsystems: Riverine	Habitats: Channel	Habitats: Unconsolidated Shores & Flats	Habitats: Rocky Shores	Habitats: Tidal Marsh	Coos Head W	Coos Head S	Fossil Point to Pigeon Point W	Fossil Point to Pigeon Point S	Empire W	Empire S	Pony Slough W	Pony Slough S	Haynes Inlet W	Haynes Inlet S	Metcalf *Salicornia* Marsh W	Metcalf *Salicornia* Marsh S
Black-bellied plover (*Squatarola squatarola*)	FWSp	FWSp			C		C	R						C	U			R	
Semi-palamated plover (*Charadrius semipalmatus*)	M	M			C							U		U	U				
Snowy plover (*C. alexandrinus*)	Res	Res			R														
Whimbrel (*Numenius phaeopus*)	F	F			U														
Spotted sandpiper (*Actitus macularia*)	F	F				U			O						U				
Dunlin (*Erolia alpina*)	WSp	WSp			A			O	O	C	O	C	C	A	A			O	O
Sanderling (*Crocethia alba*)	FWSp	FWSp			C							C	C	O					
Baird's sandpiper (*Erolia bairdii*)	F			F	R														
Western sandpiper (*Ereunetes mauri*)	FWSp	FWSp			A														
Least sandpiper (*Erolia minutilla*)	FWSp	FWSp			A														
Willet (*Catoptrophorus semipalmatus*)	M	M			U		U												
Western gull (*Larus occidentalis*)	Res	Res		A						C		C		U		C	U	C	C
Common tern (*Sterna hirundo*)	M	M		U					R						R				
Pigeon guillemot (*Cepphus columba*)	S	S		C				U	A		U		U		U				C

Table 12 continued.

Species	Subsystems: Marine & Lower Bay	Subsystems: Upper Bay	Subsystems: Riverine	Subsystems: Channel	Habitats: Unconsolidated Shores & Flats	Habitats: Rocky Shores	Habitats: Tidal Marsh	Coos Head W	Coos Head S	Fossil Point to Pigeon Point W	Fossil Point to Pigeon Point S	Empire W	Empire S	Pony Slough W	Pony Slough S	Haynes Inlet W	Haynes Inlet S	Metcalf *Salicornia* Marsh W	Metcalf *Salicornia* Marsh S
Common loon (*Gavia immer*)	FWSp	FWSp	FWSp	C				A	C	C	O	C	O	C	O	C	O	C	
Pied-billed grebe (*Podiceps dominicus*)	W	W	W	R				O	R					O		O	O	U	
Western grebe (*Aechmophorus occidentalis*)	FWSp	FWSp	FWSp	C															
Double-crested cormorant (*Phalacrocorax auritus*)	FWSp	FWSp	FWSp	C				C	U	A		U		C		O	O	U	
Common goldeneye (*Bucephala clangula*)	W	W	W	C			U	O				U		R		U		R	
Bufflehead (*B. albeola*)	W	W	W	C				O		C		U		C		C		C	
Marsh hawk (*Circus cyaneus*)	Res	Res	Res				U		O					O					
Bald eagle (*Haliaeetus leucocephalus*)	Res	Res	Res				R	R	R							R			
Red-tailed hawk (*Buteo jamaicensis*)	FWSp	FWSp	FWSp				U												
Great Blue heron (*Ardea herodias*)	Res	Res	Res		U		C	U	U	U	U	U		C	C	C	C	C	C
Green heron (*Butorides virescens*)	Res	Res	Res		U		U								O				
American coot (*Fulica americana*)	FWSp	FWSp	FWSp	A			A	U	O	C	C	C	C	A		A		O	
Killdeer (*Charadrius vociferus*)	Res	Res	Res		C			U	U	U		C	C	C	C	U			
Belted kingfisher (*Megaceryle alcyon*)	Res	Res	Res	C								U	U	C	C			C	C

Table 12 continued.

Species	Subsystems: Marine & Lower Bay	Subsystems: Upper Bay	Subsystems: Riverine	Habitats: Channel	Habitats: Unconsolidated Shores & Flats	Habitats: Rocky Shores	Habitats: Tidal Marsh	Coos Head W	Coos Head S	Fossil Point to Pigeon Point W	Fossil Point to Pigeon Point S	Empire W	Empire S	Pony Slough W	Pony Slough S	Haynes Inlet W	Haynes Inlet S	Metcalf *Salicornia* Marsh W	Metcalf *Salicornia* Marsh S
Whistling swan (*Olor columbianus*)		W					R							R					
Canada goose (*Branta canadensis*)		M					R	O											
Pintail (*Anas acuta*)		FW		A										A	C	A			
Gadwall (*A. strepera*)		FW					U							A					
Shoveler (*Spatula clypeata*)		FW		U	U									C					
Green-winged teal (*Anas carolinensis*)		FW		C	C									A	C	A	O		
Redhead (*Aythya americana*)		W		C										O					
Canvasback (*A. valisineria*)		W		C										A		C			
Blue-winged teal (*Anas discors*)		M		R															
Snowy egret (*Leucophoyx thula*)		W					R							R					
Virginia rail (*Rallus limicola*)		SpSF					U												
Long-billed curlew (*Numenius americanus*)		M			R		R							U					
Marbled godwit (*Limosa fedoa*)		FW			U									O					
Greater yellowlegs (*Totanus melanoleucus*)		FWSp			U									C	O				

Table 12 continued.

Species	Subsystems: Marine & Lower Bay	Subsystems: Upper Bay	Subsystems: Riverine	Habitats: Channel	Habitats: Unconsolidated Shores & Flats	Habitats: Rocky Shores	Habitats: Tidal Marsh	Coos Head W	Coos Head S	Fossil Point to Pigeon Point W	Fossil Point to Pigeon Point S	Empire W	Empire S	Pony Slough W	Pony Slough S	Haynes Inlet W	Haynes Inlet S	Metcalf *Salicornia* Marsh W	Metcalf *Salicornia* Marsh S
Lesser Yellowlegs (*Totanus flavipes*)		M(F)			R														
Short-billed dowitcher (*Limnodromus griseus*)		M			U									C	C		O		
Long-billed dowitcher (*L. scolopaceus*)		M(F)			R														
Pectoral Sandpiper (*Erolia melanotos*)		M(F)					R							R					
Knot (*Calidris canutus*)		M			U		U												
American bittern (*Botaurus lentiginosus*)		Res	Res				R												
Common egret (*Casmerodius albus*)		FWSp	FWSp				C							U					
Black-crowned night heron (*Nycticorax nycticorax*)		FWSp	FWSp		U														
Sora rail (*Porzana carolina*)		SpS	SpS				R												
Common snipe (*Capella gallinago*)		Res	Res		U		U							U					
Ring-billed gull (*Larus delawarensis*)		FWSp (Res)	FWSp (Res)		C							C	C	C	C	U	U		
Mallard (*Anas platrhynchos*)			FW	A	C		C							A	C	A			
Ring-necked duck (*Aythya collaris*)			W	R										R					
Common merganser (*Mergus merganser*)			Res	U												R			

Table 12 continued.

Species	Subsystems: Marine & Lower Bay	Upper Bay	Riverine	Channel	Habitats: Unconsolidated Shores & Flats	Rocky Shores	Tidal Marsh	Subsystems or Specific Areas: Coos Head		Fossil Point to Pigeon Point		Empire		Pony Slough		Haynes Inlet		Metcalf *Salicornia* Marsh	
								W	S	W	S	W	S	W	S	W	S	W	S

Key (Subsystems and Habitats):

Seasonal Use:

- F Fall
- W Winter
- Sp Spring
- S Summer
- M Migrant
- Res Resident
- (Res) Some residents

Abundance:

- A = Abundant $\geq$ 50/day/observer
- C = Common 10-49/day/observer
- U = Uncommon 0-9/day/observer
- R = Rare $\leq$ 5/day/observer (includes very rarely sighted species)

Key (Subsystems or Specific Areas):

Seasonal Use:

- W = Oct. - Mar.
- S = Apr. - Sept.

Abundance:

- A = Abundant $\geq$ 50/day/observer
- C = Common 1-50/day/observer
- U = Uncommon Not seen each day
- O = Occasional
- R = Rare Not seen every year

[1] *Eelgrass beds*

Table 12 continued.

Species noted by Magwire 1976 but not by USACE 1975	C H		F Pt, P Pt		Emp		P SI		H I		MM	
	W	S	W	S	W	S	W	S	W	S	W	S
Yellow-billed loon *(Garia adamsii)*		R										
Eared grebe *(Podiceps caspicus)*		O	C		O		O	O	C	O	C	
Emperor goose *(Anser albifrons)*											R	
White-fronted goose *(Philacte canagica)*							R					
European wigeon *(Mareca penelope)*							R					
Hooded merganser *(Lophodytes cucullatus)*									R			
Turkey vulture *(Cathartes aura)*	O	U						O				
Osprey *(Pandron haliaetus)*		O						O	O			
Black oystercatcher *(Haematopus bachmani)*	U	O										
Wandering tattler *(Heteroscelus incanun)*	U	O										
Rock sandpiper *(Erolia ptilocnemis)*		O										
Forster's tern *(Sterna forsteri)*		R										
Common crow *(Corvus brachyrhychos)*					C	C	C	C	C	C	C	C

Coos Bay is located in the Pacific Flyway for migratory waterfowl. USDI (1971) lists marshes, tideflats, and open water as prime bird habitats with some birds relying entirely on one habitat type and others using a variety of habitats.

Ducks, geese, loons, gulls, murres, and terns use the open water for resting but are commonly found near food sources in shallow water (USDI 1971). Thompson, Smith, and Lauman (1972) state mallard, pintail, wigeon, and coot are the most abundant waterfowl of the area. Surf and white-winged scoters are also found in large numbers. Waterfowl are abundant in November through March with peak populations occurring in December. USDI (1971) states that Coos Bay has 575,000 waterfowl-use days annually and 1,350 hunter-use days. The protected Pony Slough and Haynes Inlet areas receive particularly heavy use by waterfowl.

COOS ESTUARINE SUBSYSTEMS

The Coos Bay estuary can be divided into marine, bay, riverine and slough subsystems based on sediments, habitats, and geographic location (Fig. 17). Physical and biological characteristics of each subsystem are a result of the relative influence of ocean water, river water, and currents. Although the subsystems do not function independently, a separate discussion of each of the subsystems is used in considering management options.

Marine Subsystem

The marine subsystem is defined as the area between the mouth of the Coos Bay estuary and RM 2.5 (Fig. 17). The vigorous wave action it experiences helps to create and maintain the unique habitats found in this subsystem.

Alterations to the marine subsystem have been numerous. The natural channel across the Coos Bay bar averaged 10 ft in depth and 200 ft in width. The first alteration was a half-tide jetty just upbay from Fossil Pt. constructed in 1880 (USACE 1973). The North Jetty was constructed in the 1890s and reconstructed in the late 1920s, when the South Jetty was built (Lizarraga-Arciniega and Komer 1975). The entrance channel has recently been dredged to 45 ft deep and 700 ft wide at the outer bar and gradually decreases to 35 ft deep and 300 ft wide at RM 1. Previously, the depth was maintained at 40 ft over the entrance bar and 30 ft at RM 1 (USACE 1975).

The entrance channel is exposed to high waves generated by local coastal storms and swells from Pacific Ocean storms (USACE 1973). Waves up to 27 ft occur during major storms (USACE 1973). Mean tidal range at the bar is 6.7 ft with predicted extremes of 10.5 ft above MLLW and 3 ft below MLLW.

During 1973-74, high tide salinities at the mouth ranged from 30.5 ppt at the surface in December to 33.9 ppt at both surface and bottom in June (Arneson 1976). Even during periods of high runoff, high tide salinity at the mouth is similar to that of the ocean. Low tide extremes of 13.0 ppt at the surface in December and 3.33 ppt in September demonstrate the dilution effect of high runoff (Arneson 1976). Vertical salinity profiles from 1973-74 show the mouth was well mixed in June and September, stratified at high tide and partially

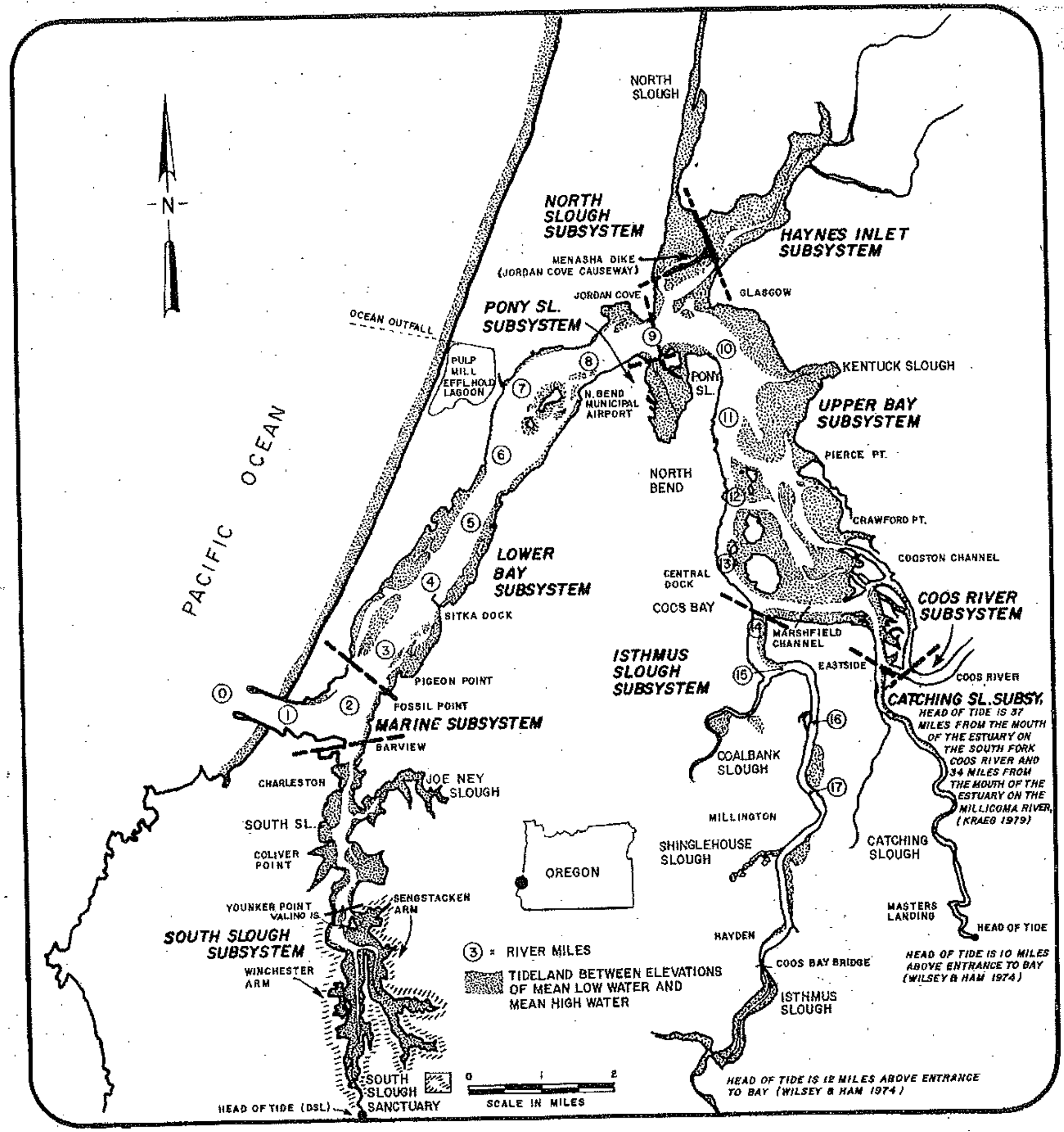


Fig. 17. Coos Bay estuarine subsystems.

mixed at low tide in December, and well mixed at high tide and partially mixed at low tide in March (Arneson 1976).

In general, the water quality of the marine subsystem is good. Temperature generally is similar at high tide to that of offshore waters and may be somewhat influenced by the temperature of the inflowing river waters at low tide (Arneson 1976). Low dissolved oxygen has occasionally been measured by DEQ near the mouth, and a DO depression was also observed by Arneson (1976) during his fall low tide measurements. Waste water from seafood processing which is discharged subtidally into the marine subsystems and upwelling of offshore waters low in dissolved oxygen may be contributing factors to low DO near the mouth (Arneson 1976).

Dredging records show that most of the materials removed from the entrance are clean sands, probably of marine origin (USACE 1975). Dredged material from this area is normally disposed at sea. Spoil from the Charleston area to about RM 10 is disposed in the estuary. The shorelines to the north and south of the entrance advanced following construction of the jetties, probably as an adjustment to a new equilibrium in an area that is experiencing no net north-south sand transport along the beaches (Lizarraga-Arciniega and Komar 1975).

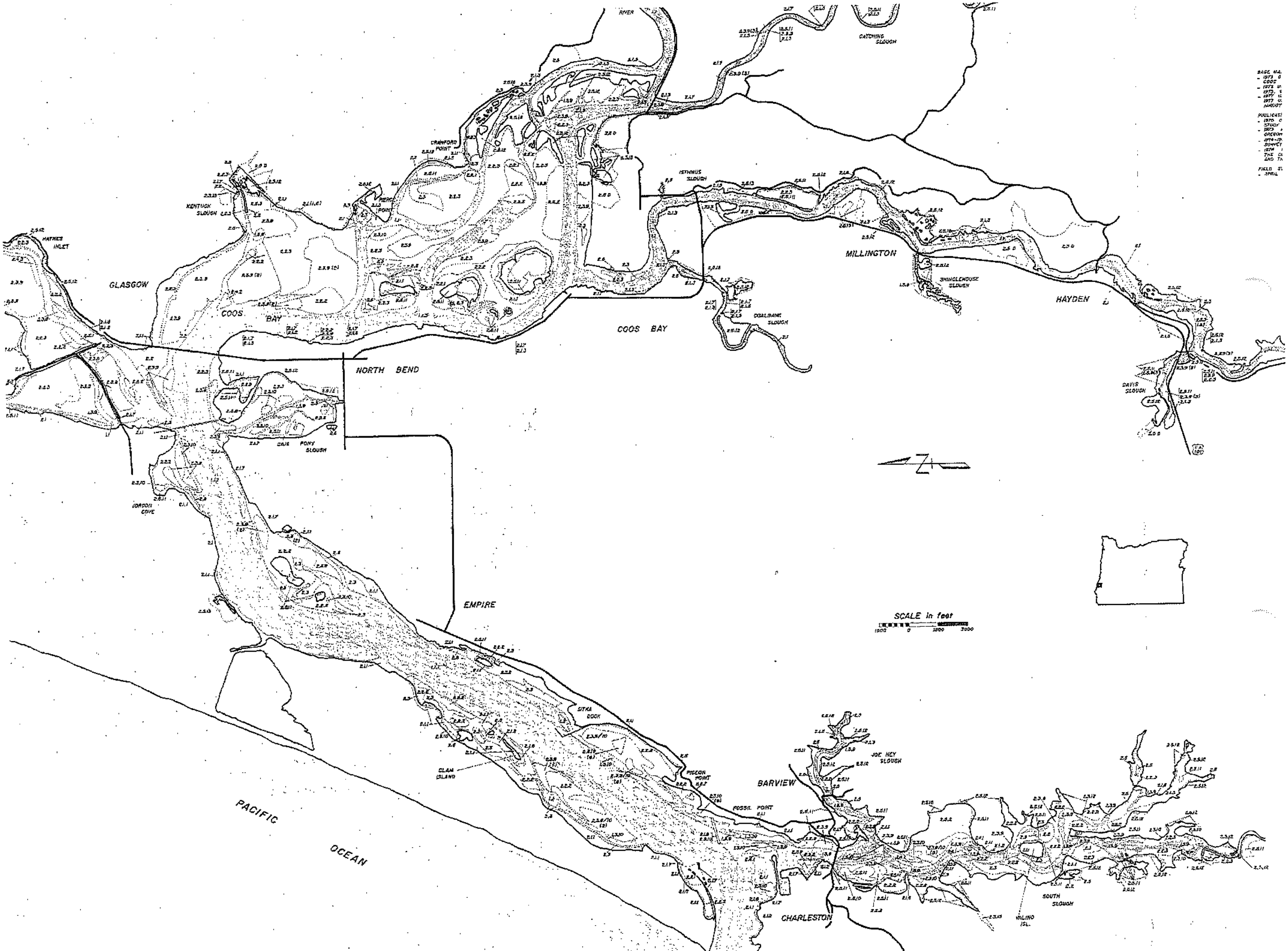
Habitats and species

The marine subsystem has an exceptional diversity of habitats, including sand, cobble, boulder, and bedrock shores; sand and sand-mud flats; algal beds on unconsolidated bottoms and on bedrock; eelgrass; and subtidal unconsolidated bottom (Fig. 18).

Habitats of the north shore of the marine subsystem include the artificial boulder shores of the jetty, a narrow cobble shore, sandy shores and flats, and a flat of sand-mud substrate (Fig. 18). Little is known of the biology of this area. Seining studies have shown large numbers of Pacific herring, surfsmelt, whitebait smelt, shiner perch, and silver surfperch in the area (Hostick 1975). Feeder coho salmon have been found using the sandy area just inside the jetty. This area is just below a very productive portion of the lower bay subsystem and the salmon may be feeding on material carried in the water column as it ebbs from the productive flats (personal communication, Bill Mullarkey, ODFW, May 15, 1979).

The south shore habitats of the marine subsystem include jetty boulders, bedrock shores below the cliffs of Coos Head, small sandy shores, the boulders of the Charleston breakwater, and a transient sand bar west of the Charleston channel (Fig. 18).

The area north of the Charleston breakwater is inhabited primarily by a few species of molluscs and annelids. The sand bar west of the Charleston channel contains the only in-bay population of razor clams on the southern Oregon coast. This clam bed is heavily used by recreational diggers (USACE 1978). USACE has proposed an extension of the Charleston breakwater near the sand spit to stabilize the Charleston channel. The Corps Environmental Impact Statement for this project (USACE 1978) states the clam population will survive the planned modification.



RIVER
CATCHING SLOUGH
CRAWFORD POINT
ISTHMUS SLOUGH
KENTUCK SLOUGH
PIERCE POINT
HAYNES INLET
GLASGOW
COOS BAY
MILLINGTON
SHINGLEHOUSE SLOUGH
HAYDEN
COALBANK SLOUGH
DAVIS SLOUGH
NORTH BEND
PONY SLOUGH
JORDON COVE
EMPIRE
SCALE in feet
1500 0 1500 3000
SITKA DOCK
CLAM ISLAND
PIGEON POINT
BARVIEW
JOE NEY SLOUGH
FOSSIL POINT
CHARLESTON
SOUTH SLOUGH
VALINO ISL.
PACIFIC OCEAN

The eastern shore of the marine subsystems has the largest naturally occurring rock habitat in the estuary. This high salinity, protected bedrock is unique to the Coos Bay marine subsystem and is rare in other Oregon estuaries. Over 40 species of plants and 100 species of animals inhabit this area in a community that resembles typical protected outer coast algal and invertebrate communities (Rosenkeetter et al. 1970). Green, brown, and red algae are well represented in the flora of Fossil Pt. (Sanborn and Doty 1944). Sponges, sea anemones, hydroids, and ribbon worms are found in this area (USACE 1975). Certain groups of annelids (sabellids, serpulids, syllids, and phyllodocids), grazing gastropods, carnivorous snails, and nudibranchs are also common.

Small kelp (*Nereocystis leutkeana*) beds occur in the tidal area just north of Coos Head, north of Charleston breakwater, and southward of Fossil Pt.

During the summer sampling, certain fishes were found only in the marine subsystem (Table 9) (Hostick 1975). These fish are commonly associated with open coastal waters. The apparent restriction of these species to the marine subsystem may be due to physiological tolerances or preference for rocky habitat. Almost all other species recorded in the estuary occur in the marine subsystem at some time during the year as residents or migrants (Cummings and Schwartz 1971).

A substantial percentage of the 1978 Pacific herring spawn in Coos Bay occurred on the rocks, algae, and eelgrass of the Fossil Pt. area (Miller and McRae 1978).

The South Jetty is a popular area for sport angling and offers the most varied species to shore fishermen (Gaumer et al. 1973). Redtail surfperch, striped seaperch, Pacific tomcod, starry flounder, and kelp greenling were the most frequently taken fish (Gaumer et al. 1973). A small fishery for chinook and coho salmon occurs from the jetties in late summer. Black rockfish, Pacific tomcod, coho salmon, and Dungeness crab are taken in large numbers in the marine subsystem by boat anglers.

Within Coos Bay, brown pelican, harlequin duck, oldsquaw, surfbird, and blacklegged kittiewake, yellow-billed loon, black oystercatcher, wandering tattler, rock sandpiper, and Forster's tern have been observed only in the marine subsystem (Table 12). Common murres and pigeon guillemots are most abundant in the bay at Coos Head (pers. comm., McGie). Bald eagle and osprey are occasionally sighted (pers. comm., McGie). Pelagic cormorant are abundant at Coos Head, and a nesting population of 12 to 15 pairs occurs on the cliffs there (Graybill 1978). Belted kingfisher and rough winged swallows also nest along the cliffs at Coos Head.

Recommendations

The marine subsystem of Coos Bay contains unique habitats not found in other sybsystems of the estuary and infrequently occurring in other Oregon estuaries. Fossil Pt. is the only naturally occurring rock in the bay exposed to vigorous wave action. Within the area are a biologically significant algal bed and subtidal kelp bed. It provides habitat for diverse invertebrates and fishes and an important spawning site for herring. It is also a valuable scenic and open-space resource. Only those low intensity uses which will not substantially alter these existing habitats and species should be permitted.

The cliffs of Coos Head, which provide nesting areas for pelagic cormorants, kingfishers, and swallows, and the tidal sand flat west of Charleston channel, whch has the only in-bay population of razor clams on the south coast, should be protected in order to maintain the diversity of habitats within Coos Bay and among Oregon estuaries.

Use policies of the marine subsystem should strive to protect water quality. It may be appropriate to restrict discharge of effluent at low tide during times of low river flow or high water temperature.

Lower Bay Subsystem

The lower bay subsystem extends along the main channel from RM 2.5 to the railroad bridge at RM 9 (Fig. 17). Although still under considerable oceanic influence, it is not as strongly affected by wave action as is the marine subsystem.

Salinity extremes recorded by DEQ in this subsystem were 34.0 ppt and 10.7 ppt at a station 1/4 mile north of Pigeon Point, compared to 34.2 ppt and 3.7 ppt at a station 1/4 mile west of the railroad bridge. During 1973-74 surface salinity from RM 2.9 to RM 8.3 at one time differed as little as 0.3 ppt at high tide during periods of low flow to as much as 14.4 ppt at high tide during periods of high flow (Arneson 1976). Surface salinity changed from 24.7 ppt to 11.5 ppt between high and low tides during high flow at RM 2.9 (Arneson 1976).

Salinity gradients indicated the lower bay was well mixed at times of low flow. During high flow the subsystem was stratified at high tide and partly mixed at low tide. During intermediate flows (March), it was partially mixed at low tide and well mixed at high tide.

Dissolved oxygen levels measured at DEQ monitoring stations in the lower bay have been above the minimum standards required for estuarine waters during the 70s (DEQ 1978). However, one sample taken near a log dump in Empire showed very low DO and high turbidity (STR 1974, USACE 1975).

Coliform counts exceeding standards for commercial shellfish harvest and even exceeding general health standards have frequently been measured at DEQ Station 6, 1/4 mile west of the railroad bridge (DEQ 1978). Counts exceeding standards at other DEQ stations in the lower bay are infrequent. Two sewage treatment plants discharge waste from the east side of the lower bay near Empire and near Pony Slough.

Pollutants discharged in the lower bay may not be rapidly flushed through the estuary. Flushing times ranged from 6.2 days in December to 19 days in June 7.6 miles from the mouth (Arneson 1976).

The sediments of the lower bay are predominantly marine sands (Arneson 1976) and probably include sands blown into the bay from the dunes.

Habitats and species

Subtidal habitats of the lower bay include the unconsolidated bottom of the dredged ship channel and adjacent area and aquatic beds in shallower areas (Fig. 18). The substrate is primarily sand (USACE 1975, Jefferts 1977). Shell and wood mixed with sand have also been reported at RM 7, 8, and 9 (Jefferts 1977).

The major alteration to the subtidal lower bay is channel dredging and associated in-bay spoil disposal. Disposal sites for the recently completed deep draft dredging project were adjacent to the channel at about RM 3, between RM 4 and 5, just below RM 6, and between RM 8 and 9.

Biological information on the subtidal lower bay is incomplete. Jefferts (1977) has examined infauna of the dredged ship channel, and ODFW has surveyed clam populations of some subtidal areas (Gaumer 1978).

Surveys west of the channel between RM 4 and 6 show scattered distributions of gaper and cockle clams and densities of 1-5 clams/ft^2 (Figs. 9 and 10) (Gaumer 1978). Butter clams were found in only a few locations in the survey area (Fig. 13) (Gaumer 1978). A 48 ac subtidal area off Pigeon Point was thoroughly surveyed to evaluate its potential for commercial clam harvest (Gaumer 1976). Population estimates for that bed were 5,648,700 gapers, 202,200 cockles, 843,000 littlenecks, and 809,200 butters (Gaumer and Halstead 1976). The bed produced a commercial gaper harvest of 11,931 lb in 1977 and 27,505 lb in 1978.

The infauna of the lower bay dredged channel has numerous species representing many groups of animals (Jefferts 1977). The fauna is more diverse and less likely to be composed of cosmopolitan species than the upper reaches of the dredged channel. Both numbers of species and numbers of individuals were found to decrease with depth in the sediment. Jefferts (1977) concluded that dredging has a relatively minor influence on the fauna of the lower reaches of the estuary, which primarily reflect the coarse sediment type rather than the effects of mechanical disturbance.

The intertidal habitats of the west side of the lower bay include large aquatic beds, sand-mud flats, sand shores, and small marshes (Fig. 18). Between RM 2.5 and 6, flats prevail. From RM 6 to RM 8 there is a narrow sand shore, and between RM 8 and 9 lies Jordan Cove with its flats, aquatic beds, and fringe of marsh.

The southwestern portions of the lower bay has been altered through the disposition of dredge spoils which form "Clam Island" and which have raised some of the shoreline above tidal level. The eelgrass beds are quite extensive and the flats are probably the most productive clamming areas in the bay. Gaper clams occur in densities of greater than 5/ft^2 over much of the area (Fig. 9) (Gaumer 1978). Cockles, butter clams, and native littlenecks are also widely distributed over the flats but occur in lesser density than the gapers (Figs. 10 and 13). Softshell clams are not found in the southernmost flat but occur from Clam Island northward (Fig. 12) (Gaumer 1978).

The southern flat was by far the most prolific site for recreational gaper harvest during a 1971 ODFW survey (Gaumer et al. 1973). Substantial numbers of cockles and butter clams were also taken there.

Above RM 6 the narrow sandy shore drops off quickly into the subtidal zone. Current through this portion of the bay is swift and scours the shores so that attached vegetation is absent. Five pile dikes were placed along this shore to retard erosion and prevent further curvature of the ship channel (USACE 1973). While this area appears barren in comparison to the flats to the south, it is an important feeding area for Englis sole, topsmelt, surfsmelt, herring, northern anchovy, and coho and chinook salmon (pers. comm., Mullarkey). Many of these fish feed on material in the water column from productive areas adjacent. Gut content analysis of salmon seined in sandy areas during August 1978 showed larval fishes were the main diet during the period sampled (pers. comm., Bender).

Jordan Cove lies between RM 8 and 9. Recreationally important clams are scarce, but ghost shrimp occur in moderate density over the entire area of flats and aquatic beds (Fig. 15). Softshell clams are sparsely distributed around the edges of the flats, and smaller species of clams are scattered across the cove (Gaumer 1978).

Just west of the railraod bridge at Jordan Point is a sandy area where ODFW repeatedly seines large numbers of fish (pers. comm., Bender and Mullarkey). The site was highest in numbers of individuals and second in numbers of species taken during seining efforts in 1970 (Hostick 1975).

Below Sitka Dock on the east side of the lower bay, there are broad algal and eelgrass beds on a sand-mud substrate with three large areas of cobble, where dredeged materials have been deposited. The cobbles form a habitat that is unique in the bay and may add niches for colonization by marine life. A high density of marine species, primarily rockfish, have been consistently found there in recent ODFW surveys (pers. comm., Bender).

Gaper clams are much less dense here than on the west side of the bay (Gaumer 1978), but the area provided recreational diggers with the second highest number of gapers taken in 1971 (Gaumer 1973). Butter clams are found among the cobbles of the spoil site (Gaumer 1978), and the Pigeon Point flat was by far the most productive butter clam area in 1971 (Gaumer 1973). Pigeon Point was also the prime site for the harvest of littleneck clams (Gaumer 1973). Ghost shrimp are also common in the area (Gaumer 1978).

The large eelgrass beds of the Pigeon Point area are of particular significance in providing food for migratory black brant. Harbor seals use one of the spoils disposal sites as a haul out area (pers. comm., Graybill). A historic seal haul out area is also located on the western shore of the lower bay just below the Ore-Aqua salmon ranching facility.

The tideflat habitats near Sitka Dock were significantly degraded by waste discharge from the Coos Head Pulp Mill which operated until 1971. Biological productivity has been increasing since closure of the mill (George M. Baldwin and Associates et al. 1977). A dense eelgrass meadow has become established southwest of the mill site, and gaper, tellen (*Tellina* sp.), cockle, *Macoma* spp., and softshell clams occur there (George M. Baldwin and Associates et al. 1977). Studies of the recovery of the flat have not been undertaken. The area is under private ownership and is not available to the public for recreation.

North of Sitka Dock, ghost shrimp, tellens, *Macoma* spp., and softshells inhabit the sand-mud flats and eelgrass beds. Flats there provided the greatest number of ghost shrimp to diggers of the areas surveyed in 1971 but were used much less heavily than the Pigeon Point flats (Gaumer 1973). Limited access and the clam distribution may influence the use pattern.

The narrow north shore of Empire, which is affected by storage of logs at the Cape Arago Lumber Company Mill, gradually widens into the broad complex of flats, aquatic beds, and small marshes southwest of North Bend Municipal Airport (Fig. 18). Qualitative studies show that the area is inhabited by softshell clams, tellens, *Macoma* spp., and polychaete worms (Figs. 12, 14, and 11). A quantitative study of the area has recently been completed and will be available through LCDC (Gonor 1979).

Several fish species are found in the lower bay nad marine subsystems (Table 9). Other species, such as English sole are most abundant in the lower bay, although they may be found further upbay. Sampling during the summer of 1970 showed that juvenile chinook salmon and lingcod were most common at lower bay sites (Hostick 1975; Cummings and Schwartz 1971).

Most of the fish species of Coos Bay use the flats of the lower bay at some time during the year (Cummings and Schwartz 1971). Habitat has considerable bearing on types of fish present. Vegetated areas appear to exhibit greater species diversity and are preferred by surfperch, pipefish, snake prickleback, gunnel species, and starry flounder (pers. comm., Mullarkey). Many of the species are found in greatest numbers over the sandy substrates (pers. comm., Mullarkey).

The aquatic beds adjacent to the North Spit, the Roseburg Lumber Co. dock, and the aquatic beds of Jordan Cove on the west side of the lower bay and the aquatic beds to the north and south of Sitka Dock are prime herring spawning areas (Jackson 1979; Miller and McRae 1978).

A salmon release-recapture facility (Oregon Aqua Foods) is located at about RM 5.5 on the west side of the bay. Another facility, Anadromous Inc., is located at Jordan Pt. at the extreme eastern border of the lower and upper bay subsystems (Fig. 17).

The lower bay was by far the most popular boat angling area in surveys conducted in 1971 (Gaumer et al. 1973). Dungeness crabs represented 80% of the catch. Black rockfish, red rock crab, perch species, and kelp greenling were also taken in large numbers (Gaumer et al. 1973).

Most of the bird species of Coos Bay may be found in the lower bay, and several species have their prime distributions in the lower bay and marine subsystems (Table 12). The more abundant of these birds include Brandt's cormorants, pelagic cormorants, black brant, surf scoters, northern phallaropes, western gulls, glaucous-winged gulls, mew gulls, Heerman's gulls, Bonaparte's gulls, and common murres. A variety of migrant and wintering shorebirds feed on the exposed intertidal mud flats.

Recommendations

The lower bay between RM 2.5 and RM 5 is an area of exceptional natural productivity and a prime aesthetic and recreational resource. The tideflats, eelgrass, and algal beds along the western shore of this region should be considered as major tracts, which require inclusion in a natural designation as described by the LCDC Estuarine Resources Goal (1977).

Although the sandy shore between RM 6 and 8 on the western side of the bay appears unproductive because it does not have attached vegetation, it is a valuable habitat for certain species of fish. Any development occurring there should preserve the sandy substrate and water quality of the area. Use of pilings may be appropriate in the area unless subsequent reduction in current velocity changes the quality of the substrate.

Sitka Dock at about RM 3.8 is located along the eastern shore of the productive lower bay. The adjacent area was formerly degraded by waste discharges, but some evidence suggests that the nearby tidal flats are recovering. Upland uses near the Sitka Dock area are primarily residential. The location of the dock within a prime natural and recreational resource area makes the area unsuitable for industrial development, but water-dependent recreational development would appear to be appropriate.

A public boat ramp, fish processing plant, oil company docks, and a mill are located on the eastern shore at Empire. These developments contribute to degradation of the habitats. Habitat restoration or further development for water-dependent uses, preferably constructed on pilings, are possibilities for this area.

The large flats southwest of the North Bend Airport and the Jordan Cove area should be considered major tracts and protected accordingly (LCDC 1977).

In-bay spoiling of material dredged from the channel between RM 3 and RM 10 should be discontinued. This activity reduces the tidal prism and further increases filling of the estuary, which is already accelerated from upstream activities. Habitat is irreversibly lost, even with mitigation. Suitable areas should be located for upland or offshore spoil disposal.

Upper Bay Subsystem

In the upper bay subsystem Coos Bay broadens into a complex of wide shallow tidal flats adjacent to the main dredged ship channel (Fig. 18). It extends from the railroad bridge at RM 9 to the southeastern corner of Bull Island at RM 17 (Fig. 17).

Massive alterations have occurred in the upper bay. The dredged ship channel runs along the west side of the bay, and industrial activity for the Port of Coos Bay is centered there. The channel between RM 9 and the mouth of Isthmus Slough is 35 ft deep and 400 ft wide. A turning basin 35 ft deep, 800 ft wide, and 1000 ft long is at RM 12. Filling of tidelands has occurred along the western shore, south of Marshfield Channel at Eastside, and on the major tideflats, where dredged materials form several spoil islands. Much of the filling has occurred to dispose dredged material and to provide sites for industrial development. The upper bay also receives industrial wastes and is a site of log storage and handling.

The upper bay receives freshwater inflow from Coos River, Catching, Isthmus, Kentuck, and North sloughs, and Haynes and Willanch inlets. Measurements at the mouth of Kentuck Slough indicate salinity extremes of 33.7 ppt and 3.0 ppt, while extremes measured at the mouth of Marshfield Channel were 33.7 ppt and 0.5 ppt (DEQ 1978). The organisms of the upper bay are exposed to low salinity during freshets, but the water is saline during low flows.

Extreme tidal currents of 4 ft/s have been measured at North Bend, and mean currents are about 1 ft/s (Aagard et al. 1971). Mean seaward velocity of river dishcarge passing a cross section between North Bend and Pierce Pt. is less than 0.1 ft/s at times of low runoff and 3-4 ft/s during peak runoff. Seaward ebbs of 6-8 ft/s during periods of high runoff have been predicted (Aagard 1971).

Wave development over the tideflats of the upper bay is limited by the short fetch and shallow water. Before recent channel deepening, phase changes indicated high dampening of the tidal wave in the upper bay as tidal energy was spent in turbulent mixing over the wide tideflats (Blanton 1964). Mixing in the main bay was probably sufficient so that stagnation causing anoxic conditions did not occur in the main bay (Aagard et al. 1971). The effect of recent channel deepening on tidal circulation has not been evaluated.

Sediments of the upper bay main channel are sandy from RM 9 to RM 10.5, shell from RM 10.5 to RM 12, and mud from RM 12 to RM 15 (USACE 1975). The main channel adjacent to Coos Bay is the area of most active deposition of river sediments (Aagard et al. 1971). Prior to channel deepening, RM 12-15 have been dredged every three years with an average of 450,000 yd^3 of sediment removed annually (USACE 1976). Sediments removed from the main channel above RM 12 do not pass EPA pollution standards for in-water disposal of materials. The sediments of the upper bay tidal flats are primarily silty with some areas of sand near the spoils islands. Wood debris overlies the sediments in many areas (Ednoff 1970).

During the past century the Coos River has changed its course through the upper bay (Aagard et al. 1971). Formerly the main flow of the river was east of Bull Island. At the northern end of Bull Island, it bifurcated into the East Channel and the main Marshfield Channel. At that time, Catching Slough had a large tidal prism and strong tidal flushing.

Splash damming, log transportation, and dredging have increased the size of the channel to the south of Bull Island (the Cutoff) so that it now carries the main flow of the river. As recently as 1970 the channel northwest of Bull Island has been deepening and eroding the tip of the island. From 1944 to 1970 the Cooston and East channels have been stable with minimal channel migration and sedimentation (Aagard et al. 1971). The tendency for channel migration does exist, and changes in hydrographic conditions, such as major dredging projects, may have unpredicted effects on shifting river channels.

Elutriate tests of core and water samples indicate that the main ship channel above RM 12 is polluted (USACE 1976). Coliform counts at DEQ stations in the upper bay during the 70s have frequently been higher than general standards for estuarine waters. In the main shipping channel, the frequency of violations increased from the station at the mouth of Kentuck Slough to the station at the mouth of Marshfield Channel (DEQ 1978). Dissolved oxygen less than the 6 ppm standard for estuarine waters was also measured with increasing frequency (DEQ 1978). STR (1974) attributed coliform problems to the presence of municipal sewage treatment plants and DO problems to municipal sewage treatment plants, industrial wastes, and log storage.

Habitats and species

Subtidal areas of the upper bay include the deep draft dredged ship channel; the shallowly dredged Marchfield, Cooston, and East channels; and the smaller channels draining the tidal flats (Fig. 18). Most of the information available on the upper bay subtidal concerns the dredged ship channel. The ship channel presents an altered environment for colonization by estuarine species. Maintenance dredging, propellor wash, and anchor drag frequently resuspend sediments so that little attached vegetation can grow (Parr 1974).

The benthic fauna of the dredged channel represents a community that has become adapted to the stresses of frequent sediment disruption (Parr 1974). Patches of substrate missed during dredging may be important to re-establishment of benthic organisms (Slotta et al. 1974).

Streblospio benedicti, an annelid, is the dominant organism in the upper bay subtidal area (Parr 1974; Jefferts 1977). Species most frequently encountered by Parr (1974) were

Annelids:

- *Streblospio benedicti*
- *Pseudopolydora kempi*
- *Polydora ligni*
- *Eteone lighti*
- *Capitella (capitata) ovincola*
- *Notomastus (Clistomastus) tenuis*
- *Glycinde armigera*

Pycnogonids:

- *Achelia nudiuscula*
- *Achelia chelata*

Bivalves:

- *Macoma inconspicua*
- *Clinocardium nuttallii*
- *Mya arenaria*
- *Modiolus* sp.

Amphipods:

- *Corophium salmonis*
- *Corophium spinicorne*
- *Anisogammarus ramellus*

These taxa are frequently reported in the literature to be associated with polluted environments (Parr 1974). Jefferts (1977) postulated that in the upper reaches of the estuary, the high water, organic content of the sediment, and the reduced grain size have a deleterious effect on faunal diversity and depth of distribution of organisms in the sediment.

Distribution of fish and of mobile invertebrates, such as crabs, in the dredged channel has not been adequately studied. Seining near the channel in 1970 revealed that shiner perch, silver surfperch, American shad, and English sole use the area in addition to a number of less freqeuntly captured species. More silver surfperch were captured per haul at this location than in other seining sites on the estuary.

Anglers catch pile perch, striped seaperch, and white seaperch from the Coos Bay waterfront (Gaumer et al. 1973). Thirty-eight species of fish have been recorded using the upper bay during the summer (Cummings and Schwartz 1971). Many of the fish probably feed over the tidal flats and congregate in the channels at low tide.

The intertidal area of the upper bay is composed of broad, shallow tidal flats, eelgrass beds, and tidal marshes (Fig. 18). George M. Baldwin and Associates et al. (1977) calculated that tidal flats composed predominantly of mud occupied about 4.5 mi^2. Sand occurs near the spoil islands, and wood debris is common on the southern portion of the flats. A huge eelgrass-tide-flat complex stretches from the Jordan Cove causeway south to the Marshfield Channel. The northern two-thirds of this area is an extensive eelgrass meadow, the largest in Coos Bay and one of the largest in Oregon (George M. Baldwin and Associates et al. 1977). Development has altered intertidal habitats along the shoreline of Coos Bay and North Bend. Studies of invertebrate distribution and abundance have not been conducted.

At least 10 species of annelids, 10 species of molluscs, and 13 species of crustaceans have been recorded from the muddy upper bay tidal flats (USACE 1975). The sea hare (*Aglaja diomeda*) has been recorded in the bay only from upper bay eelgrass beds, and the distribution of the freshwater crab is the upper bay and riverine areas.

The only clam taken recreationally which inhabits the upper bay in large numbers is the softshell, although small cockles have also been reported there. Lugworms and ghost shrimp are the other upper bay invertebrates sought by recreationists. McConnaughey et al. (1971) divided the tidal flats and eel-grass beds into four smaller subunits in their study. Biomass results of the most common species are summarized in Table 13. Animals were the most diverse and abundant within the dense eelgrass beds. Softshells and Dungeness crabs were found in much greater concentrations in the dense eelgrass, but certain invertebrates, such as the ghost shrimp and the false mya (*Cryptomya californica*) preferred sandier substrates and areas of less eelgrass.

Log storage over the flats and channels of th upper bay is common. Log storage areas have been mapped by the Coos County Planning Department. A DEQ study (Zegers 1978) of the impact of logs grounding on tideflats at low tide included sampling sites in the Cooston Channel of the upper bay. There was a large reduction in the number of total organisms (including annelids, arthropods, and molluscs) per unit area in grounding areas compared to adjacent control sites.

It is possible to cultivate oysters (*Crassotrea gigas*) in the upper bay, but commercial harvest there is prohibited because of poor water quality.

The upper bay tidal flats are an important feeding area for shad and striped bass (Cummings and Schwartz 1971). Adult shad may spend several weeks there, and bass can be found there most of the year. Juvenile salmonids also use the area for feeding. Among the most numerous fish found in the upper bay were shiner perch, silver surfperch, shad, topsmelt, starry flounder, and English sole (Hostick 1975).

Table 13. Average sample composition (g/m^2) of most common macrofaunal invertebrates in upper bay tidal flats and eelgrass beds (McConnaughey et al. 1971)

Organism	Subunit I	II	III	IV
Mya arenaria	3.02	0.97	17.28	39.20
Tellina salmonea	1.69	3.95	2.02	2.27
Macoma baltica	0.71	1.95	0.91	0.61
Others	0.77	0.07	4.51	0.65
Clam Total	6.19	6.94	24.72	42.73
Nereis brandti	1.25	2.89	1.60	5.42
Heteromastus f.	2.26	2.48	1.88	2.49
Eteone lighti	0.53	1.04	1.62	1.08
Others	0.87	0.66	1.04	1.91
Worm Total	4.91	7.07	6.14	10.90
Corophium s.	0.71	2.62	2.05	3.53
Anisogammarus c.	0.24	0.00	0.05	0.32
Haustorius sp.	0.01	0.01	0.03	0.01
Others	0.10	0.00	0.00	0.05
Amphipod Total	1.06	2.63	2.13	3.91
Cancer magister	0.00	0.00	0.00	1.55
Callianassa c.	0.34	0.00	1.56	0.00
Tectibranch (?)	0.07	0.16	0.01	0.49
Biomass Total	12.97	16.75	34.72	59.85
Number of Samples	38	16	9	11

I. Near spoil islands, sandy substrate, high elevation
II. Mud without eelgrass
III. Areas with sparse to medium density eelgrass
IV. Areas with dense eelgrass covering.

The upper bay has not been studied as a discrete unit with regard to bird use. Western grebes, pintails, canvasbacks, buffleheads, killdeer, snipe, sandpipers, sanderlings, dunlins, herring gulls, and Bonaparte's gulls were among the more abundant birds sighted in the area during the 1977 and 1978 Audubon Christmas Bird Counts. Graybill (1978) noted a particularly large population of sandpipers on the flats of the upper bay.

In general, the upper bay intertidal area is inhabited by fewer species than either the lower bay or marine subsystems. Jefferts (1977) states "The number of species present in a community is roughly inversely proportional to the degree of environmental uncertainty." The physiological stresses of salinity and temperature fluctuations in the upper bay as well as the presence of pollution and mechanical disturbance tend to produce a community that is physically controlled. Although fewer species are present in such a community, individuals may be numerous, occur in high biomass, and be important to the overall estuarine food chain. For example, *Corophium spinicorne*, the dominant upper bay amphipod, is abundant and is important in the diet of juvenile salmonids during their seaward migration (personal communication, Paul Reimers, ODFW, March 18, 1979).

Present marshes of the upper bay subsystem are located along the eastern side of the bay at the mouths of Kentuck Slough and Willanch Inlet, on the Coos River delta islands and adjacent shores, on the northeastern portion of the Eastside peninsula, and on the spoil islands east of the main ship channel (Fig. 18). Acreage of upper bay undiked marshes was estimated by Hoffnagle and Olson (1974):

Low sand marsh	46.3
Low silt marsh	3.8
Sedge march	22.1
Immature high marsh	416.4
Mature high marsh	44.8

Most of the marsh area of Kentuck and Willanch inlets has been lost through diking (Johannessen 1961, Hoffnagle and Olson 1974). Original diking along the upper portion of Kentuck Inlet was extended and a bridge and tidegate installed. Marsh rapidly invaded the tideflat below this diking (Johannessen 1961). The diked area is currently used for a golf course. In Willanch Inlet about 100 acres have been diked and are used for agriculture, leaving only about 6 acres as marsh (Hoffnagle and Olson 1974).

Extensive marshes currently exist in the Coos River delta and on the shore across the East Channel. Marshland there has increased since the 1800s (Johannessen 1961), probably because of increased siltation (Hoffnagle et al. 1976). The marshes are primarily immature high marsh with *Deschampsia caespitosa, Carex lyngbyei,* and *Triglochin maritima* the dominant plants (Hoffnagle et al. 1976).

The marsh along the shore east of the delta islands was studied by Hoffnagle et al. (1976). The site showed rapid increase in biomass from April to a maximum in June. This site was second in net primary productivity of six marshes studied in Coos Bay with a productivity of 1007.85 $g/m^2/yr$.

Invertebrates of the Bull Island study site included the sea anemone (*Nematostella* sp.), polychaetes, crustaceans, and molluscs. The number of species reported was intermediate between a site in lower South Slough and one in North Slough (Hall 1976). Fish taken from the site include shiner perch, Pacific staghorn sculpin, starry flounder, gunnel, bay pipefish, and coho salmon. The most common birds noted were the great blue heron, barn swallow, long-billed marsh wren, and song sparrow (Magwire 1976).

In the vicinity of Eastside, diking began before 1980 (Johannessen 1961). About half of the mature high marsh remaining in Coos Bay is in Eastside (Hoffnagle and Olson 1974). Low sand marshes have colonized the edges of these islands (Hoffnagle and Olson 1974).

Losses of marshland in the upper bay have been extensive. Large areas of Kentuck and Willanch inlets, at Graveyard Pt., on the Eastside peninsula, and near sea level in the cities of Coos Bay and North Bend have been diked or filled for agriculture, industry, and dredge spoil disposal.

Recommendations

The marshes of the Coos River delta islands constitute major tracts of salt marsh, which should be included in a natural management unit as required by the Estuarine Resources Goal (LCDC 1977).

The entire eastern side of the upper bay from Jordan Point to Bull Island and west to the shipping channel is a vast complex of flats, marshes, and eelgrass beds, providing valuable habitat and a rich source of organic material for the entire estuary. George M. Baldwin and Associates et al. (1977) note "the condition of this area is critical for the overall production of the Coos Bay Estuary. Because of its biological importance, the area as a whole should be considered environmentally sensitive." The area should be managed as a single ecological unit. It definitely encompasses major tracts of tideflat and seagrass as discussed in the LCDC Estuarine Resources Goal (1977) and should be managed accordingly.

The tidal flats of the upper bay are feeding grounds for fish, including the anadromous salmonids, striped bass, and American shad. Productivity of these flats should be maintained and increased through restoration of their surface area, including removal of stored logs which ground on the flats.

Habitats along the main channel adjacent to the cities of Coos Bay and North Bend have been altered. Water-dependent uses in these areas are appropriate. Unnecessary pilings should be removed and water quality should be considered in future development. The Cooston Channel is a main artery for the passage of fish between the river and ocean. It should remain unobstructed.

South Slough Subsystem

South Slough enters the main body of Coos Bay near Coos Head, less than 2 mi from the estuary mouth (Fig. 17). It may have once been a separate estuary with its own opening to the ocean. The slough has a drainage basin of 26 mi^2 (STR 1974). Because of its proximity to the ocean, South Slough receives more marine influence than the other slough subsystems. Its north-south orientation makes it particularly susceptible to strong north-northwest winds.

The slough bifurcates into the western Winchester arm and the eastern Sengstacken arm. Major tributaries include Joe Ney and Day creeks from the east; John B. and Talbot creeks, which flow into the Sengstacken arm; and Winchester Creek, which flows into the Winchester arm.

The upper reaches of South Slough (Fig. 17) have been set aside as a research sanctuary to preserve an unaltered site for studies to improve our ability to properly manage estuarine systems. The South Slough Sanctuary was the first of its kind in the nation.

Fresh water inflow into the slough has not been measured directly. Freshwater runoff from the South Slough drainage basin has been estimated from the precipitation and runoff measured in two nearby drainage basins (Harris et al. 1979). Monthly average values ranged from 6 cfs in August to 232 cfs in February. Monthly extremes of 1 cfs and 445 cfs were estimated. Further calculations yielded a representative tidal prism of 3.3×10^8 ft^3 and implied that mixing is thorough and flushing of fresh water is rapid (Harris et al. 1979). Salinity gradients for stations at the mouth of the slough and at Younker Pt. also show the lower slough is well mixed throughout the year (Arneson 1976).

A breakwater separates South Slough from the main body of Coos Bay. A project to extend the jetty to provide additional protection to boats moored in the Charleston boat marina is currently underway. A 10-ft deep, 50-ft wide channel is maintained between the main bay channel and the Charleston Bridge. The Charleston Small Boat Basin is also dredged to dimensions of 500 ft x 900 ft in lower South Slough (USACE 1978). Studies of bottom topography have been conducted by USACE (1978) and a mathematical model, verified by field measurements, of tidal elevations, current velocities, and circulation in South Slough under calm wind and wave conditions has been constructed (USACE 1978). Bathymetric charts are on file at the offices of the South Slough Estuarine Sanctuary. Although DEQ maintains 11 water quality stations in South Slough, most of them are in the lower portion of the slough. Stations have recently been established farther up the slough in conjunction with the South Slough Estuarine Sanctuary, so comparisons should soon be possible.

At the entrance to South Slough, DEQ (1978) has measured salinity extremes of 35.3 ppt and 14.6 ppt. Extremes 0.3 miles south of Collver Pt. were 33.3 ppt and 6.3 ppt. The data suggest that highly saline water extends far into the slough at periods of low flow and that water at the head is fresh at times of high flow.

Dissolved oxygen at the stations monitored by DEQ is generally above minimum standards for estuarine waters (DEQ 1978). Arneson's data (1976) show slight depressions in DO at Younker Pt. in March and at the Charleston Bridge in December relative to surrounding stations.

Several coliform measurements greater than 70 mpn have been taken by DEQ (1978) within the Charleston Small Boat Basin and at the Joe Ney Slough Bridge. Recent work by Plotnick (1979) suggests that improper disposal of sewage from boats may be a problem in the boat basin. Septic tank leakage from dwellings not yet hooked up to the Charleston sanitary district sewage disposal system are another source of coliform. Sampling for coliform in the upper reaches of the slough has only recently begun. Counts in the Sengstacken arm are within standards for shellfish harvest, while those in the Winchester arm often exceed those standards. Livestock waste may elevate coliform counts in the upper reaches of the slough (personal communication, Delane Munson, Manager of South Slough Sanctuary, February 15, 1979).

An examination of the sediment characteristics of volatile solids, Kjeldahl nitrogen, grease and oil, and total sulfides showed that, although the outer boat basin is more exposed to flushing action, it is more highly polluted than the inner basin (Slotta and Noble 1977).

South Slough is an area of sediment deposition. Sediment movement is generally seaward and deposition occurs where movement is obstructed, such as at Valino Island and in regions of large cross sectional area (Baker 1978).

Strong winds may be a factor in sediment resuspension in South Slough as wave bases disturb the bottom (Baker 1978).

Baker (1978) found that most of the sediments of South Slough are a mixture of medium to fine sand eroded from the terrace shorelands and coarse to medium silt from fluvial input. Silty sands are the dominant sediment type over tideflats and in the channels toward the head of the slough. The uppermost reaches are generally silt. Organic content of slough sediments ranged from 0.00 ppt in channel sands to 19.77 ppt in tideflat silts (Baker 1978).

Drainage from Joe Ney Sanitary Landfill was reported to have been increasing sedimentation in South Slough, but recent measures seem to have alleviated the problem (pers. comm., Munson). Logging activities have occurred in the drainage basin which may have obscured the effects of the landfill.

Habitats and Species

The habitats of South Slough show the most variation of any slough subsystem within Coos Bay (Fig. 18). The marine influence, the coarse sediments found in the lower portions of the slough, and the relatively undisturbed nature of the upper portion provide habitats for more species of invertebrates and fish than are found in the other slough subsystems.

South Slough has a irregular shoreline, which leads to a high shoreline to surface area ratio. The area has many diverse habitats. Below the Charleston Bridge are flats of mixed substrate, intertidal and subtidal eelgrass beds, riprapped shores, sandy shores, and only a small amount of marsh. Between the bridge and Valino Island are, in addition to most of the above habitats, a small amount of bedrock shore, sandy bars, and much larger marshes. Above Valino Island the substrate becomes more silty and marshes are more prominent. Eelgrass in the channels extends far up the slough.

Because of the proximity to the ocean and its varied habitats, the number of species inhabiting South Slough is high. Ednoff (1970) recorded more total species from the mud in South Slough than in any other portion of the bay. Polychaetes and molluscs were most diverse in South Slough, but crustaceans were most diverse in the lower bay.

A rich intertidal infauna was also found by Jefferts (1977), who recorded 26 polychaetes, 10 bivalves, 4 harpacticoid copepods, and 7 amphipods. Jefferts' uppermost South Slough station had the lowest diversity of any station sampled. This station was in a backwater with a high concentration of volatile solids, a high water content in the substrate, and was dominated by a few opportunistic species. In these respects, it resembled stations in the upper bay, although the faunal assemblage was different.

Most clambeds used by recreational diggers in South Slough are north of Valino Island. Gaper, butter, cockle, littleneck, and softshell clams are taken from the tide flats. Four South Slough sites provided a total of 22.6% of the marine animals taken by tideflat users in Coos Bay in a 1971 survey (Gaumer et al. 1973). While the clam bed just south of the Charleston Bridge provided the greatest number of clams of the South Slough flats surveyed, the flat just south of the existing boat basin (the Charleston Triangle) had the highest catch per unit effort (Gaumer 1973). Clam resources of this flat have been surveyed in greater detail (Gaumer 1978). Estimates of the populations of recreationally harvested clams occurring there are 1,333,000 gapers, 348,000 cockles, 289,000 native littlenecks, 119,000 butters, and 50,000 softshells. Estimate of the total clam population was 10,078,000 (Gaumer 1978).

Of major significance is the use of South Slough for commercial oyster culture. The only oyster leases in Coos Bay are on South Slough. Leases are scattered on Joe Ney Slough and South Slough proper, except for the Winchester arm (Fig. 16). Oysters can be grown in areas throughout the estuary, but health restrictions due to poor water quality prohibit commercial oyster leases in most of the estuary.

Many of the 995 acres of undiked tidal marsh in South Slough are fringing marshes at scattered points along the slough's edges, especially in inlets and coves (Hoffnagle and Olson 1974). The largest expanses of marsh are found at the heads of various inlets and on the flats just south of the Charleston Bridge and just south of Valino Island. Low sandy marsh and immature high marsh are the major marsh types of the slough (Hoffnagle and Olson 1974).

Several areas in South Slough are reverting to marsh following the breaching of dikes or as a result of tidegate failure. Regions at the head of the Winchester arm are inundated only during high water or very high tides as a result of tidal damming of streams. These areas are termed "surge plain marshes" by Hoffnagle and Olson (1974).

The only area of bullrushes in South Slough is along part of the north bank of Joe Ney Slough (Hoffnagle and Olson 1974). At the head of Joe Ney Slough is a large, tidegated freshwater marsh with dense stands of cattail (*Typha latifolia*) (Hoffnagle and Olson 1974). Studies of this marsh site as a potential mitigation site for alterations in other portions of the estuary have been conducted and results will be available from LCDC (Gonor et al. 1979).

Two South Slough marshes of differing character were studied in detail by Hoffnagle et al. (1976). The marsh site at the upper end of the slough was vegetated primarily by *Carex lyngbyie* and *Distichlus spicata*. Its net primary productivity was estimated at 764.81 $g/m^2/yr$. A low sandy marsh in the Henry Metcalf Estuarine Preserve just south of the Charleston bridge was the other study site (Hoffnagle et al. 1976). The marine influence experienced by this marsh is probably responsible for the diversity of species observed there. Bird observations near the Metcalf marsh are summarized in Table 12.

As in other portions of the bay, the habitats of South Slough have been altered by human use. The lower slough has been a site of rapid change accompanying a growing fishing industry. The construction of the Charleston Breakwater, dredging of the channel and of the small boat basin, and filling of adjacent tidelands have all occurred within the past 25 years. In the middle and upper slough, oyster culture has added a habitat to the intertidal area. Although there have been splash dams and dikes in the upper slough, recent developments have been few.

Recommendations

While generally one would choose to concentrate development in the lower South Slough, certain features of the area deserve special attention. Of 6,200 acres of submersible land in Coos Bay, 6% of the clams harvested were from the 11.5 ac area frequently referred to as the "Charleston Triangle". Because of the density of clam populations at this site and its recreational value, it should be protected. The flats south of Charleston Bridge on the west bank also receive heavy recreational use.

Generally, the diversity of organisms present in lower South Slough and the recreational capacity of the area suggest maintaining as much diversity of habitats and uses as possible. On the east side of the lower slough is the Barview State Wayside, an areas used by recreationists. The site should be maintained for these uses.

The values of South Slough marshes accrue primarily because of the long involuted shore and many fringing marshes. Development should be planned to leave the marshes undisturbed. Although individual marshes are small, the total marsh area makes a significant contribution to the primary productivity of the estuary. The low sandy marsh just south of the Charleston Bridge on the Metcalf Preserve is the closest marsh to the mouth of the bay and is a unique habitat as a marsh under marine influence.

South Slough is the only area within Coos Bay where legal commercial oyster harvest currently takes place. That use must be carefully protected. Oyster land and water quality should be protected for oyster growth. Proper sewage disposal and management of upland uses to minimize sedimentation are particularly important for oyster production.

There are several sites in South Slough appropriate for restoration, including formerly diked areas in the upper slough and in Joe Ney Slough. Habitat improvements should be considered on the east side of the channel from north of Peterson's Seafoods to the mouth of Joe Ney Slough, where discharge of sewage and industrial pollutants has occurred.

The use of Sough Slough Sanctuary an an unaltered site for research presupposes that it will remain undeveloped and its habitats and water quality will be protected. South Slough is very directly influenced by marine waters that enter through the mouth of the bay and slough and flow through the extensive development in the Charleston area. It is imperative that existing uses and new development north of the sanctuary not degrade the water quality of the sanctuary. Approval of new development north of the South Slough should be contingent upon evidence that the development will not adversely impact the water quality of the sanctuary.

Pony Slough Subsystem

Pony Slough branches south from the main bay between RM 8 and 9. Formerly a triangular embayment, its shape has been altered by filling. Presently a narrow mouth gradually opens into a wide tidal flat which is divided by a channel. The slough is about 1 mile long and the widest point is slightly more than 1/2 mile.

Hydrological studies of Pony Slough are limited. Freshwater discharge from Pony Creek is controlled at dams on Upper and Lower Pony reservoirs. Since 1975, USCS has monitored water discharge below the lower reservoir. Records for Water Year 1976 show a total freshwater discharge of 3,010 ac-ft. Flow ranged from a minimum of 0.08 cfs in May, June, July, and September and to a maximum of 26 cfs in December (USGS 1977). Summer mean flow was between 0.27 and 1.42 cfs, and the winter mean was between 4.33 and 13.6 cfs. Water discharge doesn't necessarily coincide with precipitation because of the controlling dams.

Information regarding salinity is limited to a single set of samples taken during August 1970. These measurements showed salinities in the main channel were 30.6 ppt at the mouth and 27.9 ppt at the Virginia Blvd. Bridge on an incoming tide and 23.4 ppt at the mouth and 5.5 ppt at the bridge on the outgoing tide (Horstmann et al. 1970). This demonstrates that considerable variation can occur over one tidal cycle. Interstitial salinities fluctuate less, and standing water on the marsh may become hypersaline because of evaporation (Horstmann et al. 1970).

The sediments of Pony Slough tidal flats are mostly mud and mixed sand-mud near the channels and marsh edges (Horstmann et al. 1970). A reducing layer at depths varying from 0.2 to 11.8 in was present over most of the slough area sampled.

Water quality of Pony Slough has not been examined. Domestic waste and waste water from an adjacent car wash enter the slough. In the spring of 1970, a large accidental discharge of raw sewage entered the slough from a nearby waste treatment plant (Horstmann et al. 1970). The effects of this discharge have not been studied.

Pony Slough has a long history of human alteration. Filling for the Southern Pacific Railroad began in 1917 in the northeastern section of the slough. During World War II, 240 ac. were filled for the North Bend Municipal Airport. In 1958 filling for Pony Village shoping center began, and in 1960 filling occurred north of Virginia Street in North Bend. The southeastern portion of the slough is bordered by residences, the southern side by commercial enterprises, and the North Bend Municipal Airport lies along the western border (Fig. 17). A public boat launch is located near the mouth on the western side. Several waste outfalls empty into the slough.

Habitats and Species

Habitats of Pony Slough include subtidal areas with unconsolidated bottoms and eelgrass and intertidal mud flats, sand-mud flats, eelgrass beds, algal beds and marshes (Fig. 18).

Benthic diatoms were ubiquitous on Pony Slough tideflats and are probably a major source of productivity (Horstmann et al. 1970). Mats of green algae (*Chaetomorpha cannabinna* and *Rhizoclonium* spp.) covered large areas of the tidal flats. Blue-green algae were noted on the eastern edges of the mud flats, and brown algae (*Fucus* sp.) was present on hard substrates and in the marshes.

Dense eelgrass is distributed along the intertidal area near the slough entrance and through part of the main channel. The various types of plant communities in Pony Slough show that the area remains an important producer of organic material for Coos Bay despite extensive alterations by filling. Fringes of high marsh also occur on the east and west margins of the slough and an expanse of low sand marsh occurs on the west side (Hoffnagle and Olson 1974). Most of the marsh vegetation lies between 5.5 and 7.5 ft above MLLW (MacDonald 1967).

The plant community of the low marsh at Pony Slough is composed primarily of *Salicornia virginica* and *Distichlis spicata* (Hoffnagle et al. 1976). *Deschampsia caespitosa* and *Spergularia marina* were also noted (Hoffnagle et al. 1976). These plants evidence a change in species composition since Johannessen studied the marsh 1961. He recorded *Scirpus validus* as a significant member of the flora and did not record any *Distichlis spicata* (Johannessen 1961).

The Pony Slough marsh increases in biomass from April to July (Hoffnagle et al. 1976). Net primary productivity was lower than that of North and South slough marshes probably because of the perennial *Saliconria virginica*, which has high biomass but a low rate of production. The marshes of Pony Slough were the lowest in elevation of the marshes studied by Hoffnagle et al. (1976). Dead standing shoots disappeared quickly probably because of the frequency of inundation. *Salicornia*, although lower in productivity, is an important detritus source, and its woody perennial form stabilizes soil (Hoffnagle et al. 1976).

The Pony Slough mud flat is populated primarily by burrowing mudflat organisms (Hoffnagle et al. 1970). *Corophium spinicorne*, an important amphipod in the diet of juvenile salmonids, is widely distributed over Pony Slough tideflats. Lugworms, ghost shrimp, and clams (*Mya arenaria, Cryptomya californica*) also occur, often in very high densities (Horstmann et al. 1970). Dungeness crabs are found in lower intertidal and subtidal areas. Tideflat users harvest softshell clams and ghost shrimp at Pony Point to the west of the entrance to Pony Slough, but this accounted for only a small percentage of tideflat use on Coos Bay (Gaumer et al. 1973).

Most sampling for fishes in Pony Slough has been by otter trawl because the soft muddy substrate makes beach seining difficult. However, ODFW has seined in the lower slough for the past three years. Eleven species occur in Pony Slough (Rousseau 1972). The slough is an important striped bass feeding area. Adult striped bass feed over much of the tideflats at high tide and move in and out of the slough with the tides. Pony Slough is a popular bass angling area from May through September.

Over 100 species of birds use Pony Slough. The slough harbors the largest concentrations of wintering birds in the estuary (Rousseau 1972). Peak numbers of 7,000-9,000 wigeon and other waterfowl and shorebirds have been noted (Rousseau 1972). Thornburgh (1979) conducted weekly surveys from June 1978 to June 1979 (Table 14).

The protection from southerly winter storms offered by the sheltered Pony Slough is probably a major reason for its heavy use by waterfowl. ODFW manages Pony Slough as a refuge, where hunting is prohibted.

Table 14. Peak counts of birds occurring in Pony Slough between June 1978 and March 1979 in numbers greater than 100 per observation period (Thornburgh 1979).

	Number	Time of observed peak
Dabbling Ducks		
American Wigeon	3,526	Nov.
Pintail	1,943	Jan.
Green-winged Teal	872	Dec.
Gadwall	330	Jan.
Shoveler	209	Jan.
Diving Ducks		
Canvasback	648	Dec.
Plovers		
Killdeer	204	Jan.
Semipalmated Plover	177	July
Black-bellied Plover	151	Mar.
Medium-sized Waders		
Dowitch	220	Sept.
Sandpipers		
Dunlin	2,808	Nov.
Western Sandpiper	1,577	Sept.

Recommendations

Pony Slough is a very important striped bass feeding area in Coos Bay. It is an area of high plant and animal productivity and a critical waterfowl and shorebird habitat, which harbors the largest concentrations of wintering birds in the estuary. The entire slough should be managed as a single unit. Most of Pony Slough is a major tract of intertidal land as described in the LCDC Estuarine Resources Goal (1977) and should be managed accordingly.

In its present condition Pony Slough provides valuable and scenic open space and natural resources to the urban North Bend area and could be used in satisfying state land use Planning Goal 5 (LCDC 1977).

North Slough Subsystem

North Slough extends approximately 3 mi north from the main body of Coos Bay at RM 9 (Jefferson 1975). The slough has a watershed of 8,190 ac (OSWRB 1963). Freshwater inflow from North Creek has not been measured. Although there is a tidegate at the slough's north end, near Highway 101, it may be too high in elevation to provide good flood drainage relief (OSWRB 1963). Upland plants are found adjacent to the channel before the slough crosses under Highway 101 (Hoffnagle and Olson 1974). The lands to the east of the highway are tidegated and diked but may be of sufficient elevation to be unaffected by salt water (Hoffnagle and Olson 1974).

The hydrography of North Slough has not been studied. The Jordan Cove Causeway separates the slough from full exposure to the main bay. The dike system undoubtedly reduces tidal circulation in the slough and may be accelerating sediment deposition. The Southern Pacific railroad bed parallels the western perimeter and acts as a dike, separating the slough from the dunes and forming a barrier between salt and fresh water marshy areas.

Sediments of North Slough are fine silts and broken shells (STR 1974). Sand from the dunes is also carried into the slough by the wind. These sands sometimes clog the channel at the tidegate (OSWRB 1963). Derelict logs occur on both sides of the slough and wood chips are found under the mud surface near the mouth (Baker et al. 1970).

Water quality samples are limited to a single set of samples taken in the summer of 1971 (STR 1974). Results showed high temperatures, high coliform counts, and excessive turbidity. Temperature problems were thought to occur because of low summer stream flows and incomplete mixing. Livestock and log storage were possible sources of turbidity, and livestock waste was thought to account for the high coliform counts. Log storage no longer takes place in North Slough. A municipal water treatment plant is located on North Slough, but wastes are not discharged into the slough from this plant.

The invertebrates of North Slough tidal flats include the molluscs *Mya arenaria, Crytpomya californica, Tellina salmonea, T. Buttoni, Macoma nasuta,* and *M. balthica* (Baker et al. 1970). Softshell clams and *T. salmonea* are widely distributed in the lower, broader regions of the slough. *C. californica, Macoma nasuta* and *T. Buttoni* are found near the causeway. *Macoma balthica* is found in the narrower portion of this area. The softshell clam is the only mollusc taken by recreational diggers in this area. The Jordan Cove Causeway yielded by far the most softshell clams to recreationists in Coos Bay of areas surveyed in 1971 (Gaumer et al. 1973).

Other invertebrates with wide distributions on North Slough flats include spionid worms, (*Eteone* spp.), ribbon worms (*Paranemertes* spp. and *Cerebratulus* spp.), lugworms, bamboo worms (*Heteromastes* spp.), amphipods (*Corophium* spp.), crangonid shrimp (*Crago* spp.) (USACE 1975), and Dungeness crab (Baker et al. 1970). Ghost shrimp are found only near the causeway, and shore crab (*Hemigrapsus oregonensis*) are associated with the riprap shores. Ghost shrimp and lugworms are collected from North Slough flats by recreationists.

American shad, shiner perch, staghorn sculpin, and starry flounder were found during 1970 sampling in the slough (Cummings and Schwartz 1971). Boat and shore angling for striped bass occurs in the slough May through September. There is an upstream fishery for coho salmon which spawn in North Creek (pers. comm., Bender and Mullarkey).

Large numbers of dunlin have been observed on North Slough tideflats, and North Slough has been identified as a great blue heron feeding area (McMahon 1974). North Slough is a major feeding and resting area for redheads and other ducks.

Of particular significance in North Slough are the marshes. Large, intact, diverse marshes occur there (Akins and Jefferson 1974). Jefferson (1975) described the marshes of North Slough as the "most complete and diverse mosaic of salt marsh plant communities in all stages of succession and with ecotones to freshwater, forest, and sand dunes."

Marsh acreage mapped by Hoffnagle and Olson (1974) included 7 ac. of immature high marsh, 138.5 ac. of sedge marsh, 18 ac. of bullrush-sedge marsh and 23 ac. of low sand marsh. Of six sites studied on Coos Bay, the site on North Slough, which was an almost pure stand of *Scirpus validus*, had the highest standing crop and net primary productivity (Hoffnagle et al. 1976). The plant *Cordelanthus maritima*, which is rare in Oregon, is found within the immature high marsh of North Slough (Hoffnagle and Olson 1974). *Cotula coronopifolia*, an introduced species which thrives in areas of wood and bark accumulation, is quite common (Hoffnagle et al. 1976).

Shiner perch and staghorn sculpin were found adjacent to North Slough marshes. Harpacticoid copepods, insect larvae, small bivalves and *Corophium* spp. were major items in their diet (Hoffnagle et al. 1976).

In addition to barn swallows, long-billed marsh wrens, and song sparrows, the uncommon Virginia rail has been sighted in North Slough marshes and nesting areas for this bird were observed there by Magwire (1976b).

Recommendations

The marshes of North Slough represent major tracts as described in the LCDC Estuarine Resources Goal (1977) and should be protected (Jefferson 1975). Because these diverse marshes have remained relatively unaltered, they could serve as valuable research natural areas for baseline studies of natural processes in undisturbed ecosystems. They are particularly well suited to studies of dune encroachment, impacts of drift logs, and recovery from log storage (Jefferson 1975).

North Slough includes suitable sites for habitat restoration. Removal of derelict logs would increase the surface area available for estuarine production.

Placement of culverts beneath the Jordan Cove Causeway would increase tidal circulation to North Slough and might reverse the accelerated sediment accretion.

Haynes Inlet Subsystem

Haynes Inlet extends about 2-1/2 mi northeast from its entrance into Coos Bay just east of North Slough (Fig. 17). It has a watershed of 7,120 ac (OSWRB 1963), which is drained by Larson and Palouse creeks.

Haynes Inlet was once broad at its mouth, gradually narrowing to a system of narrow, meandering channels at its head. Larson and Palouse creeks once contained large tidal marshes and had substantial tidal prisms. Currently the mouth has been greatly restricted by the Highway 101 causeway. Marshlands on both major creeks have been diked for agricultural use, and stream flows are controlled by tidegates, which reduce the total tital prism of the inlet.

Hydrological studies of freshwater inflow and tidal circulation have not been made. Data on the water quality of Haynes Inlet is lacking, and only minimal biological information is available.

Habitats of Haynes Inlet include subtidal channels with unconsolidated bottoms; intertidal flats of sand, mud, and sand-mud mixed; eelgrass beds; low marsh; high marsh; and sand shores (Fig. 18).

In a brief qualitative survey, invertebrates of the Haynes Inlet mudflats were similar to those recorded in North Slough included (Rischen and Danielson 1970). Additional species not recorded in North Slough included several species of amphipods and the nudibranch *Hermissenda crassicornis*. The California papershell, *Lyonsia californica*, has not been recorded elsewhere in Coos Bay. An oyster farm operated there before construction of the Highway 101 Causeway. The presence of shells suggest that cockles once inhabited the sea.

Fish seined in Haynes Inlet include threespined stickleback, shiner perch, topsmelt, bay pipefish, staghorn sculpin, and starry flounder, all species with wide distributions in Coos Bay (Hostick 1975) (Table 9). Bender (pers. comm.) noted that large numbers of anchovies occur near the mouth of the inlet in September and October. Boat angling for striped bass is popular in Haynes Inlet in May through September. Shiner perch, pile perch, and striped seaperch are also taken there by shore anglers. Larson and Palouse creeks are both productive coho and steelhead streams (pers. comm., Bender). Larson Creek is used to chart coho population trends in coastal streams. It has the highest number of spawning coho of the 3 creeks surveyed by ODFW in the Coos system. A sport fishery for coho develops in October and continues until the end of steelhead season (pers. comm., Bender).

Haynes Inlet is heavily used by waterfowl. The most abundant winter species include black brant, American wigeon, ruddy duck, American coot, pintail, greenwinged teal, and mallard (Magwire 1976b). Few species appear to use the area in summer, but great blue heron are common (Magwire 1976b) and use the inlet as a feeding area (McMahon 1974).

Several hundred acres of salt marsh have been diked for agricultural use in Haynes Inlet (Hoffnagle and Olson 1974). About 150 acres of marsh remain, including immature high marsh, sedge marsh, bullrush-sedge marsh, and one of the few areas of low silty marsh mapped in Coos Bay (Hoffnagle and Olson 1974).

The watershed of Haynes Inlet has a fairly high level of both agriculture and logging (Wilsey and Ham 1974). Other human uses of the slough and adjacent uplands include a small mill and log dump, residences, light commercial use near the mouth, and a boat launch and wayside (Wilsey and Ham 1974).

Recommendations

Haynes Inlet was classlified as an area of moderate marine biological value and high terrestrial biological value by Wilsey and Ham (1974). Of particular significance are the salt marshes of the upper end of the inlet, which are listed by Jefferson (1975) as an area that should be protected for primary production in Coos Bay.

The Highway 101 causeway has changed tidal circulation within Haynes Inlet and may be contributing to accelerated accretion. It may be advisable to increase ciruclation with the main bay through a system of culverts. Leaking tidegates, especially the one controlling the entrance to Larson Creek, have necessitated recent diking to protect agricultural land from salt water intrusion. Dike material should be obtained from upland sources rather than from the adjacent channel to protect water quality and bottom characteristics, which are important for anadromous fish using these streams.

Isthmus Slough Subsystem

Isthmus Slough is a very long, narrow body of water which enters the upper southwest corner of Coos Bay at about RM 13.8 (Fig. 17). Head of tide is about 12 mi up the slough (Wilsey and Ham 1974). The drainage area of Isthmus Slough is 32 mi^2 (Arneson 1976), and major tributaries include Coalbank Slough, Shinglehouse Slough, Davis Slough, and Noble Creek.

In Isthmus Slough the deep draft navigation channel extends to RM 15 at a depth of 35 ft and width of 400 ft. Near the mouth of Coalbank Slough a turning basin has recently been enlarged to 700 ft by 1,000 ft. Major shipping activities occur in this area of the bay. A shallower channel 22 ft deep and 150 ft wide extends from RM 15 to Millington at RM 17. It is privately maintained and used primarily for log transport (USACE 1976).

Freshwater flow has been calculated for Isthmus Slough using drainage basin area and precipitation averages (Arneson 1976). In 1973-74 minimum flow was estimated at 1.4 cfs in September 1973 and maximum flow at 304 cfs. Extreme salinities of 30.6 ppt and 4.7 ppt have been measured at the Eastside Bridge over the slough. Salinities at the Coos City Bridge measured 30.2 ppt and 0.3 ppt (DEQ 1978). Downstream from Eastside a minimum salinity of 0.2 ppt has been measured, which probably indicates the influence of fresh water from Coos River.

Salinity profiles show Isthmus Slough to be well mixed at essentially all times of the year (Arneson 1976). In December, when some portions of the estuary were stratified, Isthmus Slough was well mixed at high tide and essentially fresh water at low tide (Arneson 1976). The well mixed condition of the slough may be attributed to limited freshwater inflow (Arneson 1976), even though diking has greatly reduced the tidal prism in the slough (Aagard 1971). Water temperatures as low as 46.4°F have been recorded in Isthmus Slough, while maximum temperatures of 73.4°F have occurred at upstream stations (DEQ 1978).

Isthmus Slough receives heavy industrial use for shipping, waste disposal, and log handling and storage. These uses combined with minimal flushing (Arneson 1976) and low freshwater inflow cause dissolved oxygen to be lowest in

Isthmus Slough of the stations measured in Coos Bay (DEQ 1978). DEQ data show that DO improved from 1974 to 1978, but measurements less than the minimum standards for estuarine waters still occur(DEQ 1978). USACE (1976) reports Isthmus and Coalbank sloughs are moderately to heavily polluted according to EPA standards.

High coliform counts have been recorded in Isthmus Slough. Of the stations measured by DEQ, the most frequent and severe violations occurred in Coalbank Slough and downbay from Coalbank (DEQ 1978). At the upper stations coliform less frequently exceeded standards for general health but was often over the maximum for commercial shellfish harvesting areas.

Sediments of Isthmus Slough are river-born silts (Arneson 1976). Although winter freshets do aid flushing, the slow currents of the slough and general lack of fresh water inflow contribute to the deposition of fine material (Arneson 1978). Wood chips and bark also occur in the substrate of much of the slough. Anerobic sediments are found in most areas (Thompson 1971).

Habitats and Species

The habitats of Isthmus Slough are predominantly the unconsolidated bottom in the channel, muddy shores which are sometimes covered by eelgrass beds, and marshes (Fig. 18). Log rafts are often stored and ground along the tidal flats. Consequently, the exact location of aquatic beds and marshes is subject to change as vegetation is removed and reestablishes itself.

A survey of organisms of Isthmus Slough, primarily those of the tidal flats, was conducted by Thompson (1971). Algae noted in the slough include the green (*Enteromorpha tubulosa*), reds (*Gracilaria* spp., *Antithamnion* spp., *Platythamnion* spp., *Polysiphonia* spp., and *Gigartina* spp.), and the brown (*Fucus* spp.). *Ruppia* is found in increasing abundance in aquatic beds toward the southern end of the slough in less saline water.

Invertebrates primarily include crustacean arthropods and polychaete worms. Only six molluscs are recorded from Isthmus Slough. The softshell clam is the only species taken recreationally. Historical notes show softshells were once more abundant than at present (Thompson 1971).

The arthropods found in the slough are the shrimp *Crago franciscorum* and the crabs *Cancer magister, Rhithropanopeus harrisii,* and *Hemigrapsis oregonensis* (Thompson 1971). At least eight species of amphipods and isopods are also found. The amphipods were primarily in channels under algae, and in eelgrass beds. *Anisogammarus confervicolus* became less dense with increased temperature and decreased salinity. *Corophium* spp. were found farther into freshwater than *Anisogammarus*.

The most abundant polychaete worms were the nereids, *Nereis brandti* and *N. limnicola*. *Heteromastis filiformis* and *Capitella (Capitata) ovincola* were found in reducing layers, and ampharetids and spionids were found throughout the slough. Many of the annelids found have been termed pollution indicators.

At least 11 species of fish have been seined from Isthmus Slough (Table 9).

Adult coho salmon have been seined in Coalbank Slough, and a spawning run of coho occurs in tributaries of Isthmus Slough and in Davis Slough (pers. comm., Mullarkey and Bender).

Historically Isthmus Slough has been used by striped bass which tend to seek out deep holes and channels (pers. comm., Bender). Isthmus Slough was a prime striped bass fishing area until low DO and chemical wastes apparently prevented all use of the slough by striped bass. Conditions have improved somewhat and bass are again showing up. Several age classes of stripped bass have been found south of Davis Slough which have not recently been seen in other portions of Coos Bay (pers. comm., Mullarkey and Bender). It is possible this area is critical to the bass at certain stages of their life cycle (pers. comm., Bender). In February and March striped bass fishing is popular from the banks of Isthmus Slough.

Many of the marshes in Isthmus Slough have been eliminated by diking, filling, and log storage. In Coalbank Slough alone, marshes occupied 597 ac. in 1892, and now only 57.0 ac. remain (Hoffnagle and Olson 1974). The major marshes of Isthmus Slough occur along its banks and in Coalbank, Shinglehouse, and Davis sloughs. Marshes of Coalbank Slough include a 25 ac. marsh separated from the channel by a dike with culverts and a 35 ac. marsh partially bordered by an old dike. These marshes have characteristics of sedge marshes and immature high marshes, but *Carex lyngbyei* is the dominant species present (Hoffnagle and Olson 1974).

Along the main channel of Isthmus Slough south of the mouth of Coalbank Slough lies the estuary's largest expanse of low silty marsh, which is returning to its former state after being diked (Hoffnagle and Olson 1974). Sedge and immature high marshes occur along the main Isthmus Slough channel south of the silty marsh, and bullrush-sedge marsh occurs at the south end of Isthmus Slough (Hoffnagle and Olson 1974). Sedge marshes occur in Shinglehouse Slough, and Davis Slough has marshes of bullrush and sedge. Total undiked marsh acreage of Isthmus Slough and its tributaries is 431.8 ac., which contains 62.8 ac. of sedge marsh, 64.6 ac. of low silt marsh, 219.0 ac. of immature high marsh, and 85.4 ac. of bullrush and sedge marsh.

Recommendations

Hoffnagle and Olson (1974) estimated that 90% of the total acreage of Coos Bay marshes have been lost to filling or other causes since 1892. It is therefore critical that remaining marsh lands be protected from filling and diking in order to maintain habitat diversity in the estuary, as well as the flow of organic material to and from marsh communities. Significant tracts of salt marsh remain in Coalbank and Shinglehouse sloughs and should be preserved for primary production (Jefferson 1975).

Much of Isthmus Slough can be considered degraded habitat, and restoration measures should be undertaken to restore water quality and biological production. The acreage of tide flats impacted by grounding log rafts should be minimized. Log rafts should be removed from intertidal areas wherever feasible. The inventory of logs stored in the slough at any given time and the length of residence of stored logs should not exceed the minimum levels required to keep pace with mill production. All unused pilings, derelict logs, and wood debris should be removed. Breaching of several partially diked areas of Isthmus Slough should improve circulation, water quality, and the flow of materials between these areas and the other portion of the subsystem. The 35-ac. marsh in Coalbank Slough and the low silty marsh east of the channel just south of Eastside should also be considered for restoration through dike removal.

Increased circulation to the 25-ac. Coalbank Slough marsh should be considered to improve the exchange of organic materials with the remainder of the estuary.

Davis Slough and the section of Isthmus Slough above it should remain free of log storage or other uses which would further degrade water quality in the subsystem. Log storage has been gradually phased out in upper Isthmus and Davis sloughs, and during the same period water quality has improved significantly. This recovery and the poor circulation in these upper reaches suggest the area may be particularly important in maintaining the water quality of Isthmus Slough.

Catching Slough Subsystem

Catching Slough enters the main body of Coos Bay just west of the mouth of Coos River (Fig. 17). It is fed by several small streams and is about 10 mi long from its mouth to its head (Wilsey and Ham 1974).

In the late 1800s, Catching Slough was an area of vast tidal marshes and a large tidal prism. Strong tidal flushing was responsible for maintaining depths of 18 to 20 ft at the confluence of the Catching Slough channel and the Marshfield Channel. By the 1940s diking of Catching Slough for agricultural purposes had decreased tidal transport and velocity through Marshfield Channel (Aagard 1971).

Little is known of the physical or biological processes of Catching Slough. Freshwater inflow is unmeasured, but STR (1974) state that because of low summer flow, tidal circulation during summer in Catching Slough is a simple exchange of water from the main bay.

In a single series of summer water quality samples, high temperatures, probably resulting from low summer flows, were noted (STR 1974). Fecal coliform increased from the mouth toward the head of the slough (STR 1974) and could be expected to be greater at times of high runoff.

Habitats of Catch Slough include the subtidal channel, narrow muddy shores, eelgrass or ditchgrass beds, fringing tidal marshes, and rip-rapped shores (Fig. 18). Typically these habitats occur in narrow bands zoned from lowest to highest as listed. The tidal marshes are the only Catching Slough habitat that have been studied.

Tidal marshes of Catching Slough once totalled 1,600 ac., but through extensive alterations for agricultural use, only fringing marshes of bullrush and sedge totalling less than 50 ac. remain (Hoffnagle and Olson 1974).

Distribution of invertebrates in Catching Slough has not been studied. Large numbers of juvenile American shad have been seined from Catching Slough

(Hostick 1974). Coho salmon and steelhead spawn in the upper reaches of the slough (pers. comm., Mullarkey and Bender). Other fish seined from the slough include species with wide distributions in the upper bay and sloughs, such as shiner perch, staghorn sculpin, threespine stickleback, starry flounder, and bay pipefish (Cummings and Schwartz 1971). Water in the upper part of the slough apparently is sufficiently fresh to maintain significant numbers of largescale suckers. Recent gill netting surveys by ODFW have shown the area is also used by striped bass.

Recommendations

Materials needed for dike repair should be obtained from upland sources rather than by dredging in the slough. Dredging can convert productive intertidal areas into less productive subtidal habitats and degrade surrounding habitats. Consideration should be given to restoring a portion of the large amount of diked tidal land to estuarine production. Derelict pilings previously used for log storage should also be removed.

Catching Slough supports good runs of coho salmon in Catching, Selander, and Wilson creeks. Recent sampling suggests the slough may also be an important area for 5- and 6-year-old striped bass. Isthmus Slough is the only other area where concentrations of this age group of striped bass have been found, but Isthmus Slough may be unsuitable for the fish during the summer due to low DO. Water quality in Catching Slough should be maintained and improved for fish and other organisms dependent upon the area. Catch Slough has good potential for recreational fishing, and public use may be improved with increased access.

Coos Riverine Subsystems

There are several riverine subsystems in the Coos Bay estuary, including the Coos and the South Fork Coos rivers and Millicoma river, which enters the Coos River. Tidewater extends more than 11 mi upstream from the boundary of the upper bay subsystem (Fig. 17) on the South Fork Coos and 10.6 mi upstream on the Millicoma River (Wilsey and Ham 1974).

The riverine subsystems provide important fish habitats. Shad are entirely dependent on the area during the first 6-12 months of life and part of their second year. Coho and steelhead can be found in the spring enroute to their spawning grounds. The Coos system is a major freshwater rearing area for chinook, especially during their first year. Juvenile cutthroat also rear in the system, and adults return in late summer to spawn. The lower portions are also used by starry flounder and staghorn sculpin. Prickly sculpin and shiner perch occur in the upper portions. Other species found in the riverine subsystems include red-sided shiners and largescale suckers. Shiner perch and largescale suckers are important forage fish for striped bass (pers. comm., Bender).

This section of the estuary is a popular fishing area for shad (May-July), striped bass (year-round), cutthroat (August-October), coho and chinook (September-November), and steelhead (November-March). Commercial shad fishing takes place on the lower Millicoma, South Fork Coos, and throughout the Coos River.

Recommendations

Generally there is little specific information on other biological and physical characteristics of the riverine subsystems. The habitat map (Fig. 18) does not depict habitats far beyond the upper bay subsystem. However, the Coos riverine subsystems are similar to the tidewater areas of other coastal rivers, and many of the same general considerations should be made in developing management strategies.

The Coos Bay riverine subsystems should be managed as units to prevent the piecemeal destruction of shoreland habitats. Riprap, bulkheads, and docks can destroy riparian vegetation, which is important for fish and terrestrial animals. Docks can reduce the productivity of aquatic plants by shading. Riparian vegetation should be protected as suggested in the implementation of the LCDC Coastal Shorelands Goal (LCDC 1977). New homes and other structures should be placed a sufficient distance from the shore so that bank stabilization measures are not required. This will also help reduce flooding and erosion caused by encroachment into the floodway fringe. Non-structural solutions to erosion and flooding are also encouraged in the LCDC Coastal Shorelands Goal. Bank stabilization should only be allowed as part of an overall stream corridor management plan.

Dredging during July and August will have the least detrimental impact on the riverine fisheries. Spawning and larval development of shad and striped bass occur in the spring (April-June). After September, the tidewater sections are used extensively for sport fishing.

Pollutants discharged into the riverine sections of estuaries can be particularly detrimental to estuarine water quality since flushing times are extremely long much of the year, and all material from the upper estuary may affect the rest of the system downstream. Adequate waste treatment facilities are needed to prevent pollution of the riverine subsystem. Particular care must be excercised to prevent oxygen depletion and high water temperatures, which can stress fish, and to maintain minimum stream flows. Logging and other activities which cause erosion within the riverine subsystems and in the upper watershed should be carefully regulated to prevent rapid filling, which has occurred in many Oregon estuaries as a result of these activities.

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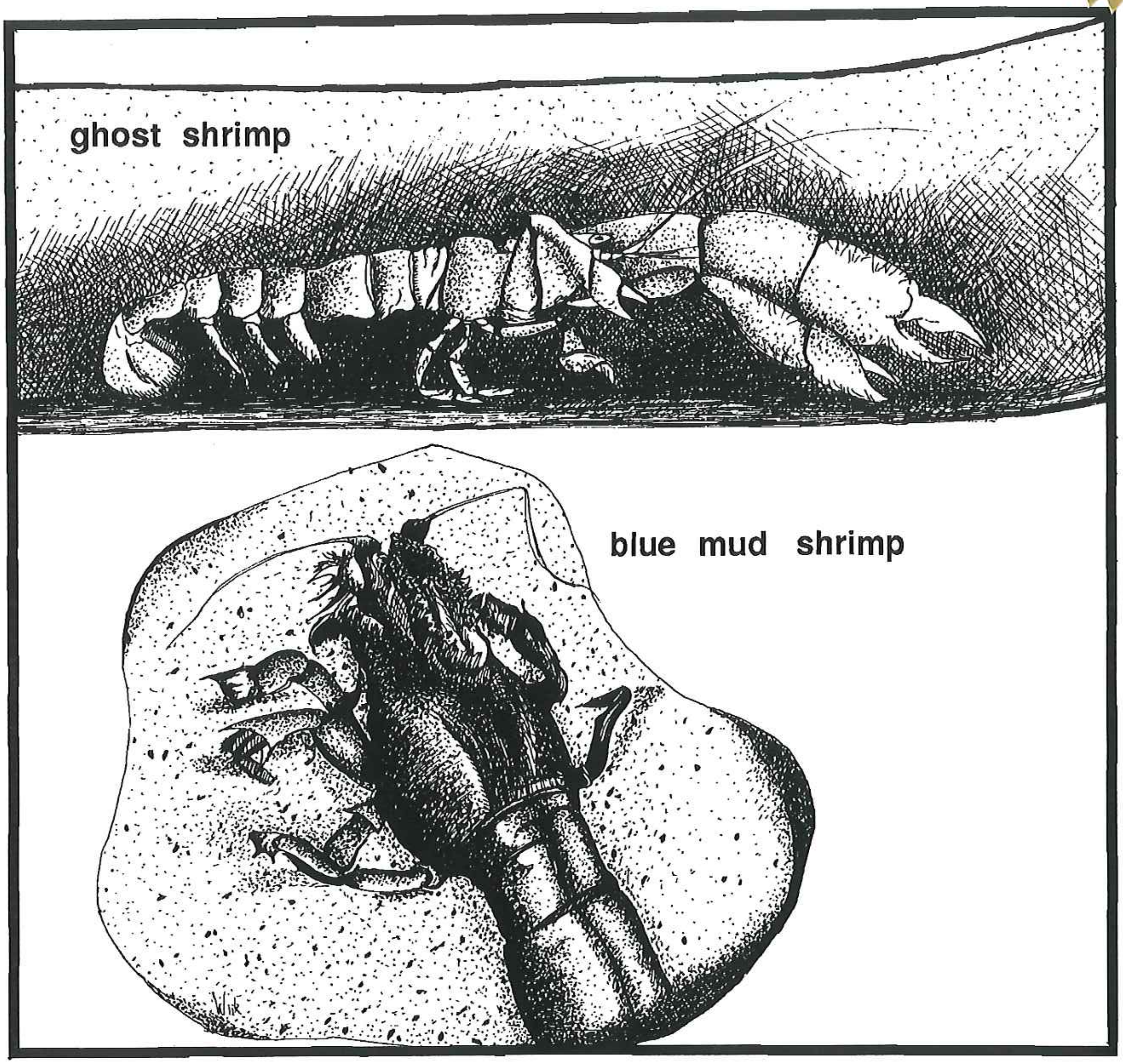
Biological Report 82(11.93)
January 1989

TR EL-82-4

Exhibit 103

Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (Pacific Northwest)

GHOST SHRIMP AND BLUE MUD SHRIMP



Submitted June 25, 2019 From:
Clam Diggers Association
&
Power Hooker Tackle

Fish and Wildlife Service
U.S. Department of the Interior

Coastal Ecology Group
Waterways Experiment Station
U.S. Army Corps of Engineers

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Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (Pacific Northwest)

GHOST SHRIMP AND BLUE MUD SHRIMP

by

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Vicksburg, MS 39180

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PREFACE

This species profile is one of a series on coastal aquatic organisms, principally fish, of sport, commercial, or ecological importance. The profiles are designed to provide coastal managers, engineers, and biologists with a brief comprehensive sketch of the biological characteristics and environmental requirements of the species and to describe how populations of the species may be expected to react to environmental changes caused by coastal development. Each profile has sections on taxonomy, life history, ecological role, environmental requirements, and economic importance, if applicable. A three-ring binder is used for this series so that new profiles can be added as they are prepared. This project is jointly planned and financed by the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service.

Suggestions or questions regarding this report should be directed to one of the following addresses.

Information Transfer Specialist
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or

U.S. Army Engineer Waterways Experiment Station
Attention: WESER-C
Post Office Box 631
Vicksburg, MS 39180

CONVERSION TABLE

Metric to U.S. Customary

Multiply	By	To Obtain
millimeters (mm)	0.03937	inches
centimeters (cm)	0.3937	inches
meters (m)	3.281	feet
meters (m)	0.5468	fathoms
kilometers (km)	0.6214	statute miles
kilometers (km)	0.5396	nautical miles
square meters (m^2)	10.76	square feet
square kilometers (km^2)	0.3861	square miles
hectares (ha)	2.471	acres
liters (l)	0.2642	gallons
cubic meters (m^3)	35.31	cubic feet
cubic meters (m^3)	0.0008110	acre-feet
milligrams (mg)	0.00003527	ounces
grams (g)	0.03527	ounces
kilograms (kg)	2.205	pounds
metric tons (t)	2205.0	pounds
metric tons (t)	1.102	short tons
kilocalories (kcal)	3.968	British thermal units
Celsius degrees (°C)	1.8(°C) + 32	Fahrenheit degrees

U.S. Customary to Metric

Multiply	By	To Obtain
inches	25.40	millimeters
inches	2.54	centimeters
feet (ft)	0.3048	meters
fathoms	1.829	meters
statute miles (mi)	1.609	kilometers
nautical miles (nmi)	1.852	kilometers
square feet (ft^2)	0.0929	square meters
square miles (mi^2)	2.590	square kilometers
acres	0.4047	hectares
gallons (gal)	3.785	liters
cubic feet (ft^3)	0.02831	cubic meters
acre-feet	1233.0	cubic meters
ounces (oz)	28350.0	milligrams
ounces (oz)	28.35	grams
pounds (lb)	0.4536	kilograms
pounds (lb)	0.00045	metric tons
short tons (ton)	0.9072	metric tons
British thermal units (Btu)	0.2520	kilocalories
Fahrenheit degrees (°F)	0.5556 (°F - 32)	Celsius degrees

CONTENTS

ACKNOWLEDGMENTS

We are grateful for the reviews and suggestions of David Buchanan of the Oregon Department of Fish and Wildlife and Jefferson Gonor of Oregon State University, and for the use of the illustrations by Paul and Lynn Rudy.

GHOST SHRIMP AND BLUE MUD SHRIMP

NOMENCLATURE/TAXONOMY/RANGE

Scientific name .... Callianassa californiensis Dana
Preferred common name ... Ghost shrimp (Figure 1)
Scientific name .... Upogebia pugettensis (Dana)
Preferred common name .... Blue mud shrimp (Figure 2)

Other common names ..... Crawfish, mud prawns, ghost shrimp (collectively), burrowing shrimp (Stevens 1928); red ghost shrimp (C. californiensis; Phillips 1984); orange mud shrimp (C. californiensis; MacGinitie 1935); mud shrimp (U. pugettensis; Hedgpeth 1970).
Class .... Crustacea
Order .... Decapoda
Family .... Callianassidae

Geographic range: The ghost shrimp is found in intertidal areas along the west coast of North America from Mutiny Bay, Alaska, to the mouth of the Tijuana River, San Diego County, California; MacGinitie (1934) and Ricketts and Calvin (1968) reported finding specimens as far south as El Estuario de Punto Banda, Baja California Norte, Mexico. The blue mud shrimp is found from southeastern Alaska to San Quentin Bay (Bahia de San Quentin) in Baja California Norte. The general distribution of the two species in the Pacific Northwest is identical (Figure 3).

MORPHOLOGY AND IDENTIFICATION AIDS

The head and thorax of the ghost and blue mud shrimps are united into a cephalothorax. Like that of other arthropods, this cephalothorax is covered by a carapace or exoskeleton of hard, chitinous material that is shed (molted) periodically to allow for growth. The gills are located in special chambers at the sides of the thorax under the carapace. The blue mud shrimp has a large rostrum (forward extension of the carapace) and cylindrical eye stalks; the ghost shrimp has no rostrum or a small one and flattened eye stalks. Both have external mouthparts (maxillipeds) and antennae. Hair-like structures cover much of the shrimps' bodies and serve such functions as receiving sensory stimuli, obtaining food, cleaning self, creating water currents, and cleaning and carrying eggs (MacGinitie 1934).

Both shrimps have five pairs of thoracic legs (periopoda). The first pair of legs may be slightly unequal and only somewhat pincerlike (subchelate), and the rest, simple as in the blue mud shrimp; or, the first pair may be very unequal and very pincerlike (chelate), the second pair also pincerlike, and the fifth pair somewhat pincerlike as in the ghost shrimp (Schmitt 1921). The asymmetry of the first pair of legs characteristic of the ghost shrimp is more pronounced in males, and the larger cheliped (pincer leg) may be on either the left or the right side (MacGinitie 1934).

Both shrimps have five pairs of leaflike abdominal appendages (pleopods) or swimmerets. They also have flattened tail appendages (uropods) adapted for swimming. The blue mud shrimp has a short, square telson

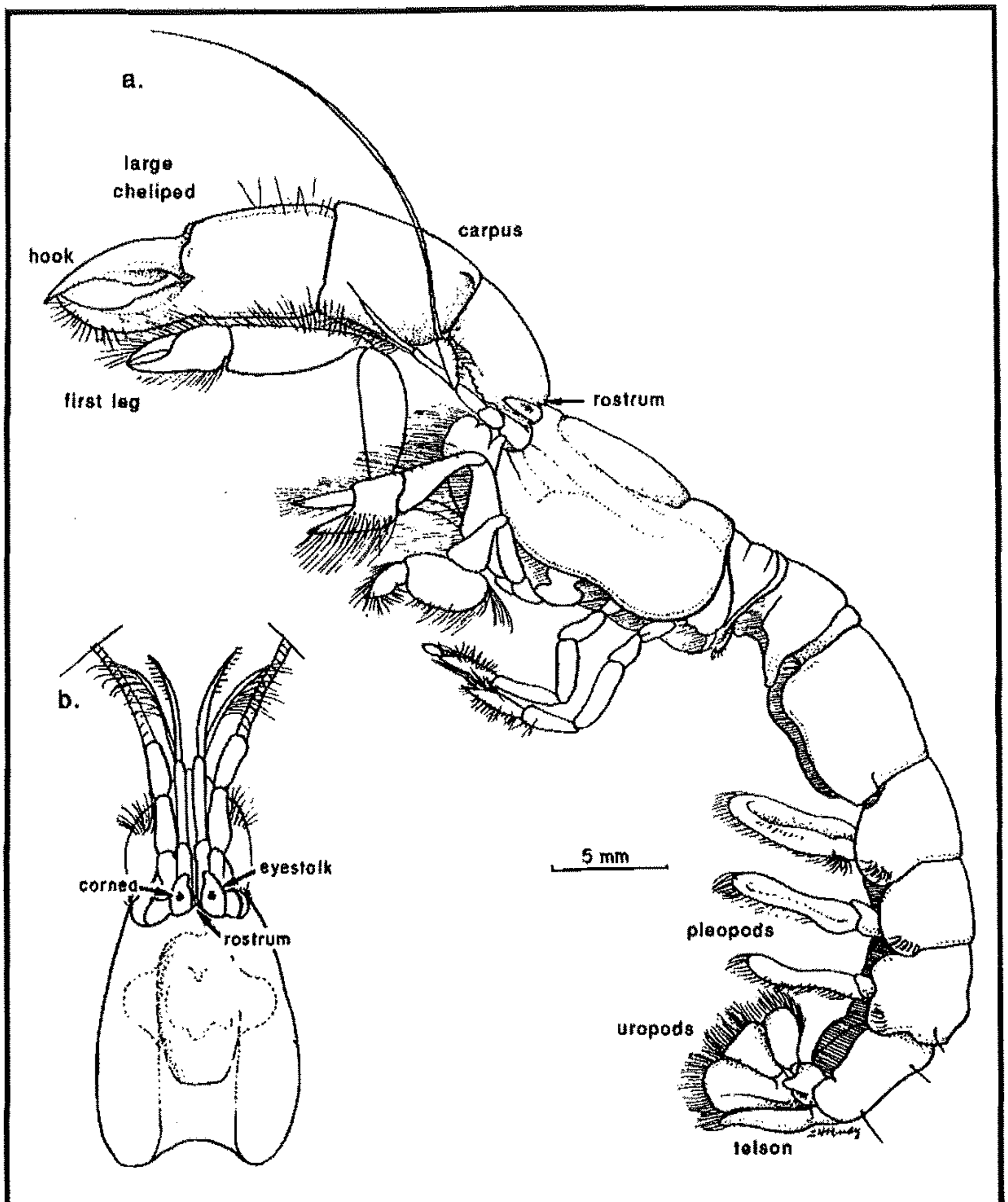

Figure 1. Ghost shrimp male (a) showing morphology of leg pairs (actual total length of specimen from rostrum to telson is 5 cm (2 inches)) and (b) enlargement of head area (dorsal view). Reproduced with permission from Rudy and Rudy 1983 (copyright Paul and Lynn Rudy).

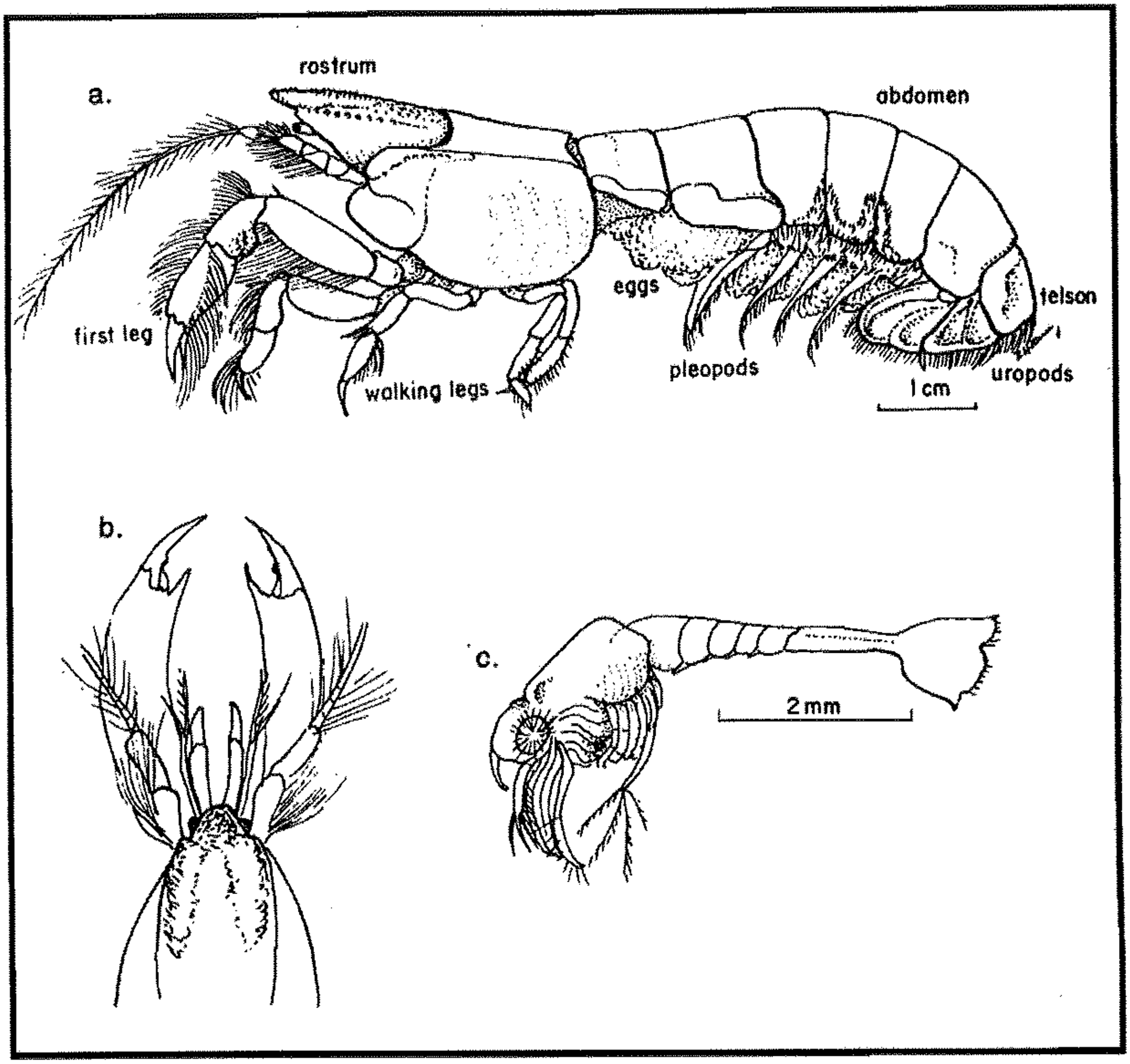

Figure 2. Ovigerous blue mud shrimp female (a) actual length from rostrum to telson (9 cm; 3.5 inches), (b) enlarged dorsal view of head, and (c) first-stage larval form (actual total length about 5 mm (0.2 inches)). Reproduced with permission from Rudy and Rudy 1983 (copyright Paul and Lynn Rudy).

(terminal segment); the ghost shrimp has a longer, more pointed one.

These two shrimps can be distinguished from each other on the basis of the differences in the first pair of legs and color. The blue mud shrimp is usually dirty blue-green and the ghost shrimp varies from white to pink, red, and orange. The carapace of the ghost shrimp is often transparent enough to allow observation of its internal organs (Johnson and Snook 1955), making it an interesting study specimen. There are other Callianassa species besides the ghost shrimp on the west coast; however, only one, C. gigas, is similar

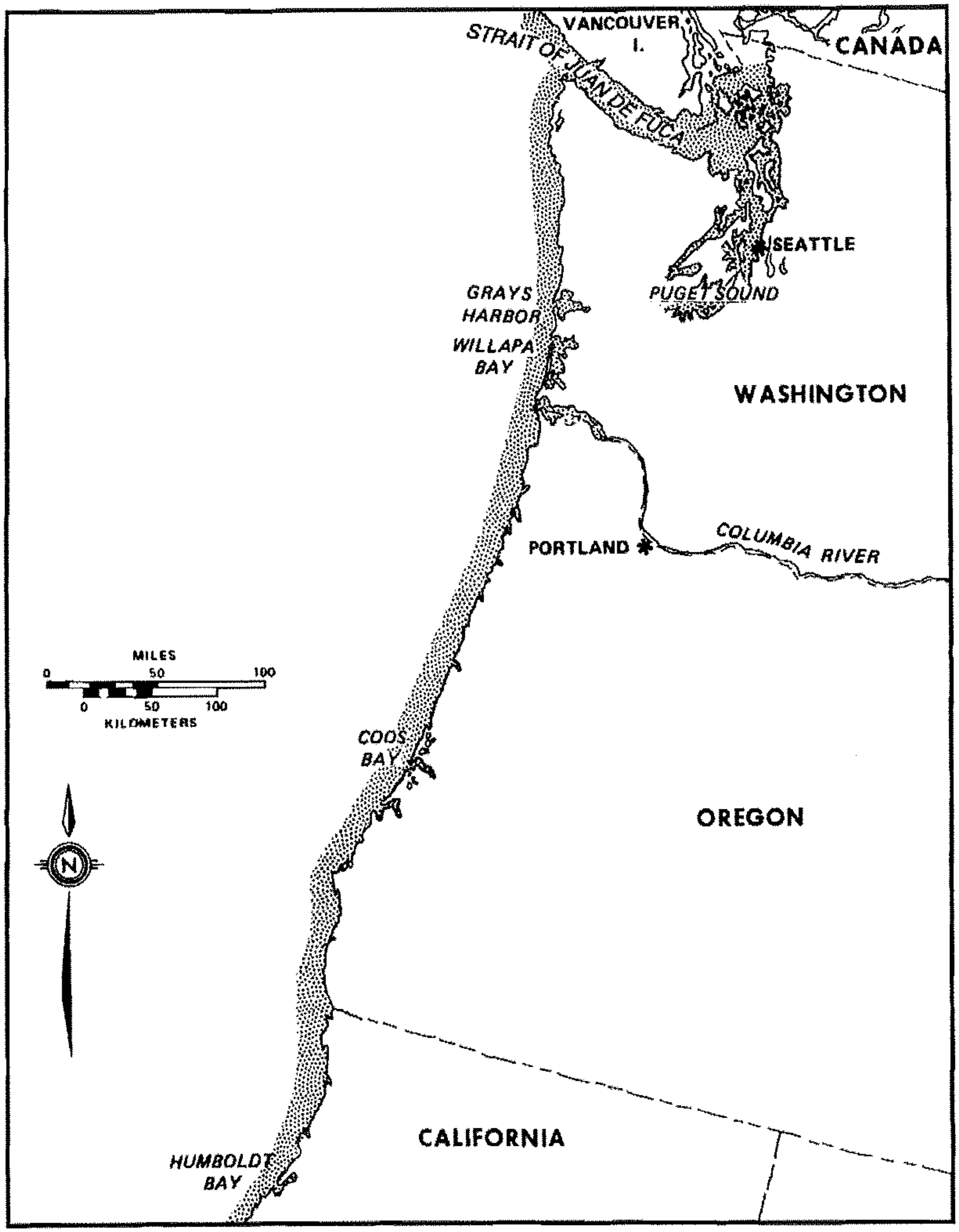

Figure 3. Map showing geographic distribution of ghost shrimp and blue mud shrimp in Pacific Northwest region in intertidal sand or mudflats of west coast bays and estuaries.

in distribution, habitat, and habits. *Callianassa gigas* is larger than the ghost shrimp (125-150 mm (5-6 inches) long). And although the females and juveniles of these two species are similar in appearance, the large cheliped of the *C. gigas* male is longer and narrower than that of the male ghost shrimp (Morris et al. 1980).

REASONS FOR INCLUSION IN THE SERIES

Although the ghost shrimp and blue mud shrimp are harvested as bait along the entire west coast of the United States, they are considered by some to be important pests of commercial oyster-growing operations in the Pacific Northwest (Ricketts and Calvin 1968; McCrow 1972; Buchanan et al. 1985). They are believed to destabilize the substrate, smother oysters with debris, and drain off water (through their burrows) from diked oyster beds.

Either species can alter the physical characteristics of the habitat it occupies and affect the composition of the intertidal infaunal community (Brenchley 1981; Posey 1986a). The ghost shrimp (Figure 1) is the more active burrower of the two and more severely affects substrate consistency (Bird 1982). Both the blue mud shrimp (Figure 2) and the ghost shrimp are associated with a variety of commensal and parasitic species (MacGinitie 1930, 1934, 1935; MacGinitie and MacGinitie 1968; Rickets and Calvin 1968; Kozloff 1973). The ghost shrimp is one of the most abundant residents of marine sloughs or bay mudflats on the west coast of North America (MacGinitie 1934).

LIFE HISTORY

Both the ghost shrimp and the blue mud shrimp live in burrows in the intertidal sand or mudflats of west coast bays and estuaries. Entrances to ghost shrimp burrows may be observed in the center of small conical hills of sand and small pebbles; those of the blue mud shrimp are less conspicuous, with much smaller, or absent, surrounding hills of sand (Kozloff 1973).

Members of the blue mud shrimp species nearly always live in male-and-female pairs; each pair inhabits a smooth-walled, permanent, branching burrow extending about 45 cm (18 inches) below the surface. The burrow generally has several entrances, each about 1 cm (0.4 inches) in diameter. The diameter of the tunnel beyond the opening is too narrow to allow the shrimp to turn around; consequently, specially enlarged chambers are required. The smooth walls appear to be cemented with a secretion produced by the shrimp. The blue mud shrimp forms a "mud basket," with its first two pairs of legs, which it uses as a scoop to transport mud and build its burrow, and as a strainer to collect food. The third and fifth pairs of legs are used for walking, and the fourth pair is braced against the burrow walls. The tail-fan can be used to block the burrow tunnel so effectively that the flow of water is stopped; this may possibly be a protective maneuver to ward off attacks from the rear (MacGinitie 1934). The species feeds on detritus and plankton strained from seawater, which it forces through the burrow by using its four pairs of swimmerets (pleopods) (MacGinitie 1930).

The ghost shrimp also inhabits burrows, but of a less permanent character since this species sifts most of its food directly from the substrate and tunnels almost constantly, reworking the sediment to a depth of about 75 cm (30 inches) in search of food. Burrow structures of ghost shrimp are less consistent in pattern than those of blue mud shrimp; the ghost shrimp digs tunnels branching in all directions, forming complex burrows with various numbers of openings (MacGinitie 1934). The second and third pairs of legs are used for digging and the fourth and fifth for cleaning its appendages, gills, and back, and for cleaning and manipulating its eggs (MacGinitie 1934). The third, fourth, and fifth pairs of legs are used in walking; the fourth pair is extended outward against the burrow wall for support. The swimmerets of the ghost shrimp constantly circulate water through the burrow, facilitating respiration. Its tail-fan, like the blue mud shrimp's, can be used (probably protectively) to block the burrow. The large cheliped of the male is a weapon used in disputes over territory and during the mating season (MacGinitie 1934).

Development of Eggs and Larvae

Female ghost shrimp are ovigerous (capable of producing fertile eggs) throughout the year, but the principal spawning season is in late June and early July (MacGinitie 1935). Intensive breeding probably begins in spring, but ovigerous females may still be plentiful as late as August. Spring warming appears to be the trigger for egg development. Three to four broods are produced at about 6-week intervals. The larvae develop as plankton in coastal waters through five zoeal stages, which are distinguishable from one another primarily on the basis of size (McCrow 1972). A total of 6-8 weeks is spent as nearshore oceanic plankton (through the five zoeal and one megalopal stage); zoeal larvae are usually released on ebb tides in June and July, and the first megalopae appear in early August. Recruitment to the estuary is probably facilitated by flood tides occurring in late summer and fall. Larval drifting during this planktonic phase very likely serves as a mechanism of genetic exchange among populations in different estuaries (Johnson and Gonor 1982).

Blue mud shrimp females are known to be ovigerous in January, February, and part of March (MacGinitie 1935), but larval development of this species has not been studied extensively.

Postlarval Development

Juvenile ghost shrimp are presumed to metamorphose rapidly to a state adapted for life on the bottom just before recruitment to the estuary (Johnson and Gonor 1982). Mortality due to predation is probably substantial during the short period (minutes to hours) between the moment the organism drops to the substrate and its successful burrowing beneath the surface (MacGinitie 1934). The lifespan of the ghost shrimp has been variously estimated at 3-5 years (Bird 1982), 10 years (MacGinitie 1935), and 15-16 years (Ricketts and Calvin 1968). The blue mud shrimp is also believed to be relatively long-lived (MacGinitie 1930).

Habitat

Both of these species are commonly found in intertidal areas of mixed sand and mud. The blue mud shrimp lives in muddier areas than does the ghost shrimp; observations with respect to tidal height preferences vary (Table 1). In Oregon estuaries, ghost shrimp were consistently found in tideflats closer to the ocean than were blue mud shrimp (Bird 1982). Both species are common residents of eelgrass beds in the Pacific Northwest (Phillips 1984).

GROWTH CHARACTERISTICS

Typically, length of adults is 5-10 cm (2-4 inches) in the ghost shrimp and 7.5-10 cm (3-4 inches) in the blue mud shrimp (MacGinitie and MacGinitie 1968). However, length may reach 11.5 cm (4.5 inches) in the ghost shrimp and 15 cm (6 inches) in the blue mud shrimp (Morris et al. 1980). MacGinitie (1930, 1935)

Table 1. Habitat preferences of ghost shrimp and blue mud shrimp reported at different locations.

Location	Ghost shrimp	Blue mud shrimp	Source
Pacific NW	Muddy sand	Muddier sand	Kozloff 1973
Yaquina Bay, OR	0 to 1 ft	0 to 1 ft	Thompson and Pritchard 1969
Oregon estuaries	Tideflats close to ocean	Tideflats further from ocean	Bird 1982
N. California	Sandier mid-tidal areas	Lower, muddier flats	Hedgpeth 1970
Tomales Bay & Elkhorn Slough, CA	Muddy sand	Softer mud	Smith and Carlton 1975
Monterey Bay, CA	Generally lower tidal areas; mixed sand and mud	Generally higher tidal areas; mud, sandy mud with clay	MacGinitie 1935

reported finding the largest blue mud shrimp in the muddiest, least rocky areas.

Ghost shrimp mature at 18-24 months and some reproductive females may be less than 3 cm (1.2 inches) long; blue mud shrimp take 3 or more years to mature and reproductive females exceed 6 cm (2.4 inches) in length. Estimated growth in length averages approximately 15-30 mm/yr (0.6-1.2 inches/yr) in ghost shrimp and 18-26 mm/yr (0.7-1.0 inches/yr) in blue mud shrimp (Bird 1982). Density within a ghost shrimp colony and the colony's location appear to influence both growth and size at sexual maturity; ghost shrimp in the less dense colonies closest to the ocean grow faster, and the females become sexually mature at larger sizes and produce more and larger eggs (Bird 1982).

Densities of ghost shrimp have been estimated at 700-1,400/m^2 (2.8-5.6 million/acre) in Yaquina Bay, Oregon (McCrow 1972); 420-770/m^2 (1.7-3.1 million/acre) in high-density areas of Sand Lake Estuary, Oregon; and less than 300/m^2 (1.2 million/acre) in other areas on the Oregon coast (Bird 1982). Blue mud shrimp densities in Oregon estuaries range from 330 to 660/m^2 (1.3-2.7 million/acre) (Bird 1982). Biomass of either species sometimes exceeds 2.0 kg/m^2 (18,000 lb/acre (wet weight)).

THE FISHERY

Ghost and blue mud shrimp are harvested by commercial bait fishermen and recreational fishermen in California, Oregon, and Washington. Peterson (1977) described a method used in southern California in which water is pumped into the substrate under pressure, forcing the animals out of their burrows; in the area he studied, harvest noticeably reduced the ghost shrimp population. In the Pacific Northwest, attempts have been made to control the shrimp on commercial Japanese oyster (Crassostrea gigas) grounds with the insecticide Sevin (carbaryl). This pesticide has been used to control ghost and mud shrimp in Washington since 1963 (Washington Department of Fisheries and Washington Department of Ecology 1985), and although it has been used on oyster grounds in Oregon, such use is currently unlawful there (L. Fredd, Oregon Department of Fish and Wildlife, Portland, OR; pers. comm.). During its use in Oregon, bait fishermen noted ghost shrimp mortalities in untreated areas soon after nearby oyster grounds were sprayed (Buchanan et al. 1985).

Washington oyster growers estimate that oyster production would drop 70%-80%, resulting in a $5 million annual loss in Pacific and Grays Harbor Counties, without ghost shrimp control (Washington Department of Fisheries and Washington Department of Ecology 1985). However, questions have been raised about the effects of Sevin on other organisms, including the commercially important Dungeness crab (Cancer magister), and on the estuarine ecosystem as a whole (Lindsay 1961; Stewart et al. 1967; Buchanan et al. 1985). Although the blue mud shrimp is believed to disturb the sediment far less extensively than the ghost shrimp (Bird 1982), both have been the objects of control programs.

ECOLOGICAL ROLE

Food and Feeding Habits

The ghost shrimp was once thought to feed exclusively by sifting organic detritus from the floor of its burrow through the hairs on the second and third pairs of legs, rejecting coarse material, and then ingesting the retained fine particles by the use of the maxillipeds (MacGinitie 1934). And although it is still thought to obtain most of its food in this manner, there is evidence that it also filters detritus and plankton from the water moving through its burrow as does the blue mud shrimp (Morris et al. 1980). Rejected material is deposited outside the burrow. Burrowing activity is heaviest in the upper 45-50 cm (18-20 inches), where the availability of food is greatest (MacGinitie 1934). The burrowing and feeding behavior of the ghost shrimp is vigorous enough to cause substantial alterations in surface sediment characteristics over time, decreasing organic content and shifting the particle size distribution upwards (Bird 1982). Sediment in dense ghost shrimp beds often has a soft, quicksand quality (Posey 1985). The burrowing activity of both the ghost and blue mud shrimp aerates the subsurface soil (MacGinitie 1930, 1934).

The blue mud shrimp is a suspension feeder, straining detrital particles and plankton from seawater kept moving through its burrow by the action of its swimmerets. To feed, the animal positions itself near a burrow entrance and increases the movement of the swimmerets to increase the current of seawater through the burrow. The third maxillipeds are used to periodically sweep the food particles collected into the animal's mouth. Particles that are too big are ejected (MacGinitie 1930).

Cooperation, Competition, and Predation

By aerating the subsurface sediment and digging burrows protected from most predators, ghost shrimp and blue mud shrimp provide an environment attractive to commensals. Commensal and parasitic species associated with these shrimp include a blind goby, three species of pea crabs, two species of clams, a copepod, a shrimp, polynoid worms, and isopods (see Table 2).

Species that might compete with these shrimp for either food or space

Table 2. Commensal (c) and parasitic (p) species reported in burrows of ghost shrimp and blue mud shrimp (compiled from MacGinitie and MacGinitie 1968; Ricketts and Calvin 1968; Kozloff 1973).

Species	Found with ghost shrimp	Found with blue mud shrimp
Goby		
Clevelandia ios (c)	In burrow	In burrow
Pea crabs		
Scleroplax granulata (c)	Abundant in burrow	Abundant in burrow
Pinnixa franciscana (c)	Abundant in burrow	---
P. schmitti (c)	In burrow (rare)	---
Clams		
Pseudopythina rugifera (c)	---	Underside of abdomen
Cryptomya californica (c)	Extends syphons into burrow	Extends syphons into burrow
Copepods		
Hemicyclops callianassae (c)	On gills	On gills
Clausidium vancouverense (c)	Underside carapace (common)	Under carapace
Shrimp		
Betaeus enseñadensis (c)	On gills	---
Polynoid worms		
Hesperonoe spp. (c)	In burrow	In burrow
Isopods		
(unidentified--p)	Under carapace	---
Phyllodurus abdominalis (p)	---	Underside of abdomen

are rare in ghost shrimp colonies because of the continual reworking of the sediment by this species. Infauna are both more varied and more abundant in blue mud shrimp colonies because this species less severely affects the sediment structure (Bird 1982).

Although ghost shrimp typically inhabit deep burrows, they are susceptible to predation by other animals because they sometimes venture outside their burrow entrances. Under test conditions, ghost shrimp spent over 25% of the time within 2 cm of the burrow entrance; the shrimp were also observed to move from one burrow to another and were often found with part of an appendage exposed above the surface (Posey 1985).

The seaward boundary of dense shrimp beds coincided with a fourfold seaward increase in the density of the major predator, the Pacific staghorn sculpin (*Leptocottus armatus*) in Coos Bay, Oregon (Posey 1986b). Caging experiments in Coos Bay indicated that predation by this fish, which was most intense in summer, probably restricts the seaward distribution of ghost shrimp (Posey 1986b).

Mud and ghost shrimps are sometimes killed by the leopard shark, *Triakis semifasciata*, and by the brown smooth-hound shark, *Mustelus henlei*. The leopard shark, whose range extends north to Oregon, apparently can shovel or burrow into the substrate to prey on benthic species (Russo 1975). Dungeness crabs are known to eat ghost shrimp, but the shrimp does not appear to be a major component of the crab's diet (Stevens et al. 1982; Posey 1985). Sea-run cutthroat trout (*Salmo clarki clarki*) also commonly eat ghost shrimp, but are not considered a major predator (Posey 1985). Posey also suggests that intertidally foraging birds may occasionally eat ghost shrimp.

ENVIRONMENTAL REQUIREMENTS

The optimal temperature range for ghost shrimp appears to be 10 to 13 °C, depending on depth below the surface. Egg-bearing females seem to prefer the cooler water at the greater depths; immature specimens are found higher up in the burrow. Water temperature in ghost shrimp habitat in Yaquina Bay, Oregon, varies seasonally from 9 to 15 °C (McCrow 1972). Activity of ghost shrimp decreased slightly with increasing maximum daily air temperature in an outdoor aquarium (Posey 1987).

Ghost shrimp tend to be most abundant at the seaward end of bays with substantial freshwater inflow (McCrow 1972) and tolerate salinities from about 25% to 125% the salinity of normal seawater (33 ppt). Blood salinity changes along with water salinity. In a laboratory test, salinities of 8-9 ppt were lethal to 75%-100% of ghost shrimp (Posey 1987). Activity of ghost shrimp decreased with decreasing salinity between 33 and 10 ppt (Posey 1987). The blue mud shrimp tolerates salinities as low as 10% that of seawater and regulates osmotically when salinity falls below 75% that of seawater (Morris et al. 1980).

Oxygen availability is no doubt a limiting factor for all intertidal species, including the ghost and blue mud shrimps (MacGinitie 1935). Thompson and Pritchard (1969) measured oxygen levels in burrows in Yaquina Bay, Oregon, and found that during ebb tide, oxygen levels were occasionally zero. They also found that under laboratory conditions, the ghost shrimp could survive anoxia (lack of oxygen) for 5.7 days and the blue mud shrimp could survive for 3.3 days, far longer than they would normally be subjected to anoxia in the environment.

Although the ghost shrimp has a lower normal metabolic rate and survives anoxia and hypoxia (low oxygen) better than does the blue mud shrimp, both appear to have respiratory adaptations that allow them to tolerate the low oxygen conditions under which they live. Laboratory experiments have shown that both species are able to lower their metabolic rates once oxygen levels become critically low. Additionally, studies of the ghost shrimp have demonstrated the following adaptations to hypoxia/anoxia: when oxygen levels become low, heart rate is lowered (Thompson and Pritchard 1969); a respiratory pigment, hemocyanin, liberates more bound oxygen to the tissues (Morris et al. 1980); and the shrimp is able to switch to an alternate, anaerobic metabolism (Pritchard and Eddy 1979; Morris et al. 1980).

Clifton et al. (1984) studied the effect of spilled oil on ghost shrimp colonies in Willapa Bay, Washington. They concluded that small amounts of oil carried in on the tides and temporarily stranded in intertidal areas are unlikely to have a serious long-term impact. However, stranded oil that is buried by a subsequent deposition of oil-free sediment creates a barrier to burrowing activity that can be expected to persist for years. They also concluded that the burrowing activity of the shrimp contributes to the introduction of oil into the sub-surface.

Although their effects on the environment are controversial in nature, the ghost and blue mud shrimp appear to be an integral part of the nearshore environments. And fortunately for the shrimp, their widespread distribution should allow them to sustain their populations despite the current attempts to eliminate them locally.

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16. Abstract (Limit: 200 words)

Species profiles are literature summaries of the taxonomy, morphology, range, life history, and environmental requirements of coastal aquatic species. The profiles are prepared to assist in environmental impact assessments. The ghost shrimp (Callianassa californiensis) and blue mud shrimp (Upogebia pugettensis) are common residents of intertidal mudflats of the Pacific Northwest, as well as of the entire west coast of the contiguous United States. These species are decapod crustaceans, but not true shrimp. They are harvested as bait by recreational and commercial oyster-growing operations. Ghost shrimp larvae develop in summer in nearshore coastal waters and settle to the substrate surface, where they rapidly metamorphose; the life cycle of the blue mud shrimp is presumed to be similar. Both species spend their lives in burrows in the mudflat, where the ghost shrimp is primarily a deposit feeder and the blue mud shrimp is a suspension feeder.

17. Document Analysis a. Descriptors

Fishery	Salinity	Sediments	Predators
Growth	Temperature	Life Cycles	Competitors
Estuaries	Oxygen	Shrimps	Commensals
Feeding habits	Depth	Oil spills	

b. Identifiers/Open-Ended Terms

Ghost Shrimp Callianassa californiensis Dana

Blue Mud Shrimp Upogebia pugettensis (Dana)

c. COSATI Field/Group

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New invasive parasite raises concern for West Coast estuaries

June 24, 2009

SOURCE:
John Chapman,
541-867-0235

NEWPORT, Ore. - Scientists have identified a prolific parasite that preys on mud shrimp - a native species of West Coast estuaries - and threatens to decimate mud shrimp populations, raising concern for the fragile, complex ecosystems of these coastal inlets.

This bopyrid isopod, known as Orthione griffenis (or Griffen's isopod) is a form of aquatic crustacean that enters the shrimp gill chamber under the carapace. It destroys the shrimp's ability to reproduce by sucking their blood or nutrients. Oregon State University's John Chapman, an invasive species expert, thinks the parasite is a non-native species, probably introduced to West Coast waters through ballast water released from ships.

"If we're right," Chapman said, "this may be the most significant ballast water introduction of a non-native species yet discovered on the West Coast."

The zebra mussel, the most well-known invasive aquatic species in the United States, has thus far been restricted to the East Coast and Great Lakes, where it has caused millions of dollars in damages to dams, ships and structures.

A professor of fisheries and wildlife at OSU, Chapman heads the Biological Invasions Program at the university's Hatfield Marine Science Center in Newport. He and his colleagues already have found the parasite in Yaquina Bay, Alsea Bay, Siletz Bay and Tillamook Bay in Oregon, as well as in Willapa Bay in Washington. There also are reports of the isopod as far south as Santa Barbara, Calif., and as far north as British Columbia, he added.

Chapman says the parasite's impact on mud shrimp populations is difficult to estimate. In 1999 and 2001, Ted DeWitt, an HMSC ecologist with the Environmental Protection Agency, conducted mud shrimp surveys in Yaquina Bay. This summer, Chapman and colleagues are working with Lincoln County natural resource crews on new surveys that will give them an idea of the early impact of the parasite on mud shrimp numbers, though the effect of limited reproduction may take time to complete.

"Nothing we know already provides reason to be optimistic," said Chapman, who added that all of the mud shrimp populations they've investigated this summer have been infested with the parasite.

The researchers estimate an overall parasite infestation rate as high as 45 percent and believe that 80 percent or more of the breeding-sized adults may be infested. Once infested, reproduction - almost without exception - is halted.

Humans use mud shrimp primarily as fishing bait, but they are valuable prey for birds, fish, and other animals in estuaries. The mud shrimp are a dominant species in many Oregon estuaries, comprising the greatest biomass in many intertidal mudflats. Mud shrimp feeding may filter as much as 80 percent of the water per day in some estuaries.

Chapman says removing a dominant species from any ecosystem can have large impacts.

"It's hard to guess what the removal of mud shrimp would mean to the estuary," Chapman said, "but because they are so abundant and filter so much of the water, we have to be concerned. Mud shrimp also are important in the sediment dynamics of estuaries and their loss could conceivably lead to greater erosion. There also are signs that where mud shrimp are disappearing, populations of sand shrimp increase. Both species cause problems for oyster growers, but sand shrimp may be worse."

Chapman and Brett Dumbauld, a U.S. Department of Agriculture ecologist working out of OSU's Hatfield Marine Science Center, recently examined 42 female mud shrimp from Yaquina Bay during the winter breeding season and found that only eight of them had eggs. The rest were infested with the parasite. Only one of the eight females that had eggs was infested - and she had just 15 eggs. Normally, females produce 1,800 to 11,000 eggs.

The message, Chapman said, is that infestation cuts off reproduction. He is working to find out why. "Mud shrimp don't begin to reproduce until their carapaces are about 20 millimeters long, and these parasites seem to have targeted them by that time," he said.

Chapman said this parasite is huge compared to previously discovered species. At eight-tenths of an inch, Griffen's isopod is the largest bopyrid isopod ever seen on the West Coast.

"Over the past 140 years, virtually every new parasitic isopod species discovered has been smaller than previously known species," he said. "In comparison, this recently discovered species is a monster. Because of its great abundance, large size and it occurrence also in Japan, we are sure this is an introduced species, and not an overlooked native species.

"If you had a water buffalo in your back yard," he said, wryly, "you would notice it."

The parasitic isopod primarily targets the mud shrimp, Upogebia pugettensis, but doesn't seem to affect sand shrimp. Though the two species appear to be similar, sand shrimp are burrowing animals that get their nutrients from the sand, while mud shrimp draw water down into their mud tubes and filter it through their feeding baskets.

Chapman said this parasite wasn't fully identified until this past winter. Since then, he and other scientists have been scrambling to learn more about it. They have been able to trace its appearance on the West Coast back about 20 years by combing through references in scientific literature, examining samples and/or photos of mud shrimp used in other studies, and working with biological museums. Its numbers, however, have been very small.

Something caused the population to "take off" over the last few years, Chapman said, and scientists aren't sure why. Unusual ocean conditions, characterized by changes in upwelling, may have played a role by maximizing their growth and reproduction at a time when other species have suffered. Or more of them may have been introduced to West Coast waters in recent years.

Chapman said the origins of the parasitic isopod may be in Asia. Japanese taxonomist Gyo Itani of the Center for Marine Environmental Studies at Ehime University found a Japanese bopryid isopod that is morphologically identical to Orthione griffenis.

How the parasite arrived at the West Coast is a matter of guesswork. More important, Chapman said, is trying to understand how prevalent it is and what impact it may have.

Dumbauld has been working with oyster growers in Willapa Bay for years studying the impact of mud shrimp on the industry. Some local populations of the shrimp there have almost completely disappeared, and the researchers suspect the parasite is to blame. The few remaining Willapa Bay mud shrimp are heavily infested.

Chapman said it doesn't appear that the isopod invasion will disappear soon. Water samples from the bay are full of the parasites at their early stages of life.

Female Orthione griffenis brood their young and may release as many as 60,000 epicarid offspring. These epicarids migrate out of the estuaries and into the ocean, where ey attach themselves to copepods and parasitize them before moulting into their final dispersal phase, known as "cryptoniscans." These cryptoniscans return to estuaries and apparently seek out mud shrimp as final hosts. Their abundance in the seawater covering mud shrimp communities is surprising, Chapman said.�

"We collected water samples from Yaquina Bay and thought finding them would be like the proverbial needle-in-the-haystack," Chapman said, "But on our first scoop of the net, we found a bunch of them. And then we found a bunch in the second scoop, and the third scoop, and so on. It didn't matter whether it was day or night, the bay is full of them."

Chapman said the parasites live at least two years and when they return to the estuaries, they "simply suck the life out of the mud shrimp. They may not kill them right away, but the shrimp lose their ability to reproduce, and they may just be lying there, living out the rest of their lives.

"They are zombies," he added, "And there aren't many healthy breeders left to keep the species going."

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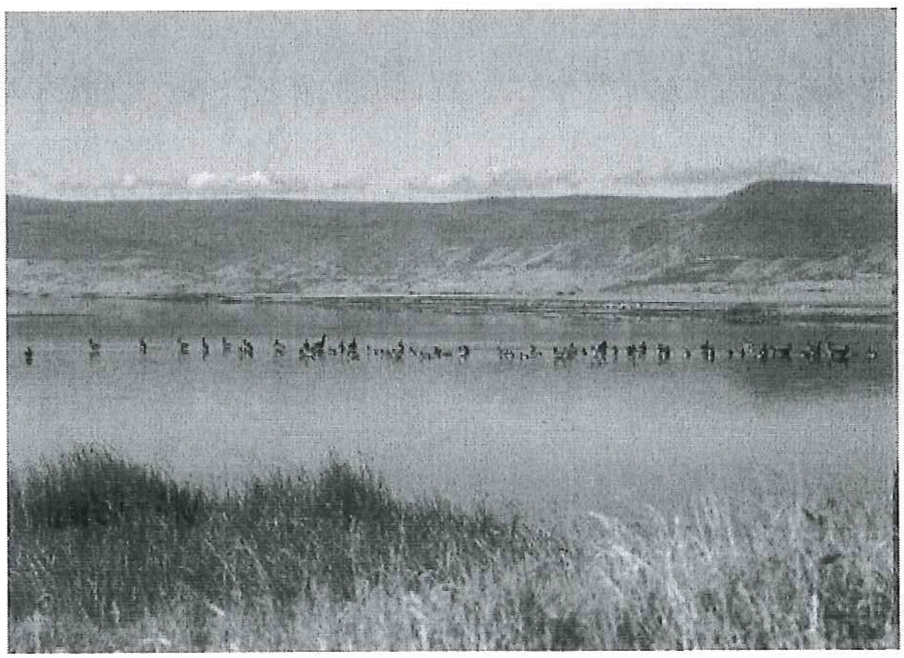
Exhibit 105

Fishing, Hunting, Wildlife Viewing, and Shellfishing in Oregon

2008 State and County Expenditure Estimates

Submitted June 25, 2019 From:
Clam Diggers Association
&
Power Hooker Tackle

May 2009



Summer Lake Wildlife Area
Photo Credit: Oregon Department of Fish and Wildlife

Prepared for the

Oregon Department of Fish and Wildlife
Travel Oregon

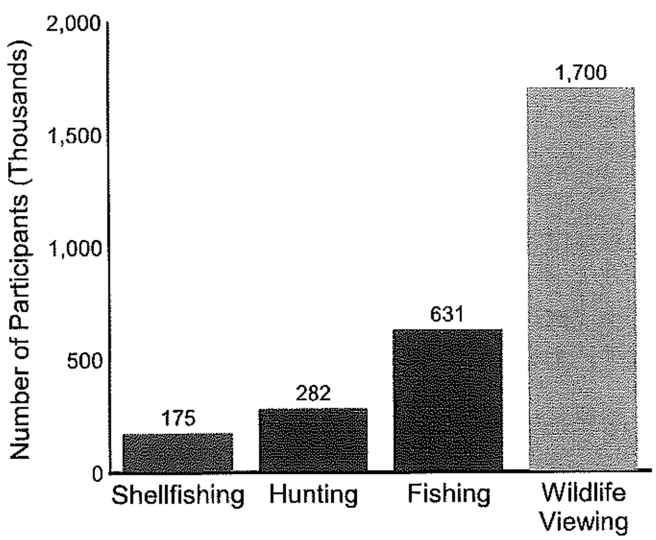
Executive Summary

This study, the result of a comprehensive effort by the Oregon Department of Fish and Wildlife (ODFW) and Travel Oregon, describes hunting, fishing, wildlife viewing, and shellfish harvest participation and related expenditures made throughout Oregon and the state's travel regions and counties.

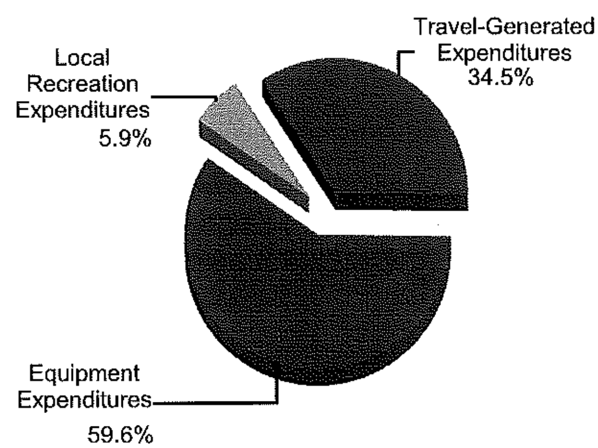
Participation and Expenditures in Oregon

In 2008, nearly 2.8 million Oregon residents and nonresidents participated in fishing, hunting, wildlife viewing, and shellfish harvesting in Oregon. Of the total number of participants, 631 thousand fished, 282 thousand hunted, 175 thousand harvested shellfish, and 1.7 million participated in outdoor recreation where wildlife viewing was a planned activity.

Total Participants by Activity, 2008



Fish and Wildlife Recreation Expenditures in Oregon, 2008
(Total: $2.5 billion)



In 2008, state residents and nonresidents made three distinct types of fish and wildlife recreation expenditures:

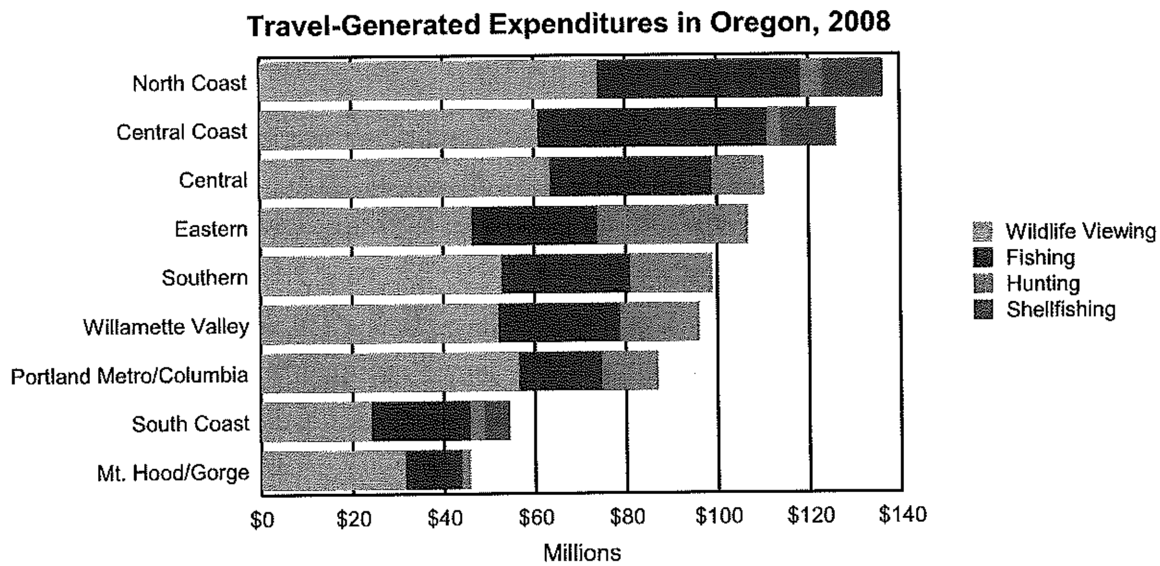
- Travel-Generated
- Local Recreation (less than 50 miles from home)
- Equipment Purchases (includes boats and recreation vehicles)

When all three categories are combined, fish and wildlife recreation resulted in expenditures of $2.5 billion in 2008. Oregon residents and nonresidents who traveled overnight and on day trips of 50 or more miles (one-way) from home made travel-generated expenditures of $862 million. Local recreation expenditures of $147 million were made by Oregon residents while participating in these activities less than 50 miles from home. State residents and nonresidents also spent an additional $1.5 billion on specialty equipment and other activity-related purchases from retail establishments and suppliers based in Oregon.

Fish and Wildlife Activities Benefit All Regions of Oregon

During 2008, travel-generated expenditures accounted for over $100 million in four of Oregon's travel regions (North Coast, Central Coast, Central, and Eastern). In all nine travel regions, travel-generated expenditures for wildlife viewing and fishing were particularly notable. While travel-generated expenditures for hunting occurred in each of the nine travel regions of the state, spending made in the Eastern, Southern, and Willamette Valley travel regions accounted for nearly two-thirds of the total.

Local recreation expenditures occurred most notably in travel regions with large urban-centered populations (Willamette Valley, Portland Metro/Columbia, and Southern), with fishing, hunting, and wildlife viewing representing the bulk of all local recreation expenditures made throughout the state.



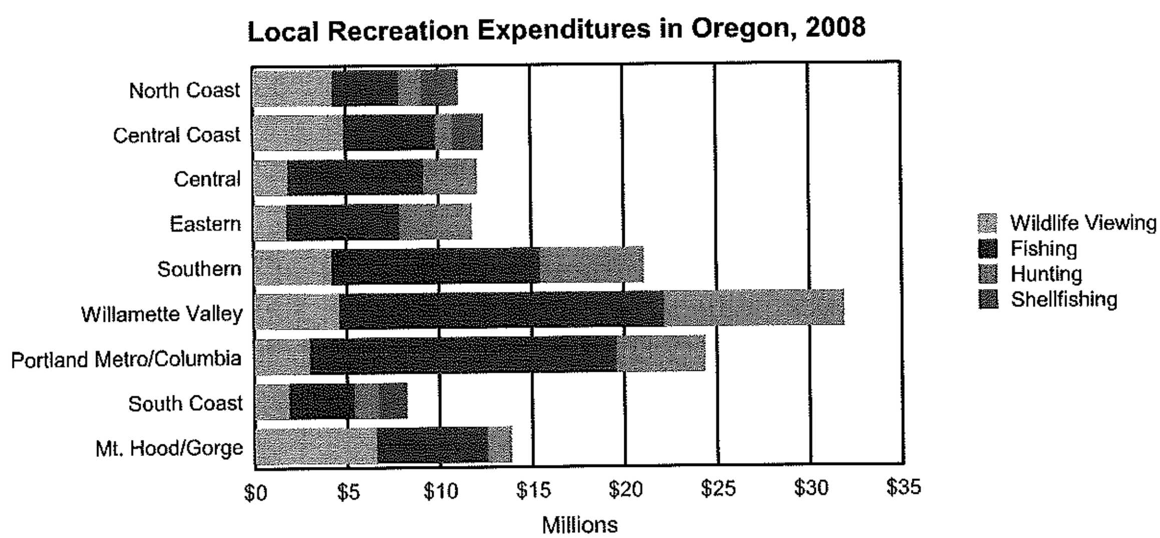


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Exhibit 106

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Fishing, Hunting, Wildlife Viewing, and Shellfishing in Oregon

2008 State and County Expenditure Estimates

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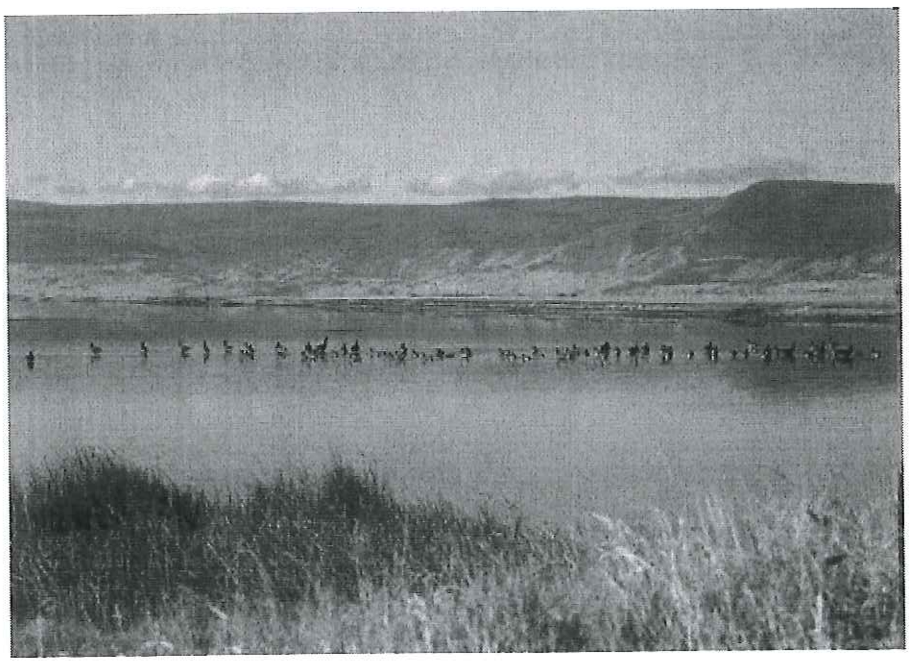

Summer Lake Wildlife Area
Photo Credit: Oregon Department of Fish and Wildlife

Prepared for the

Oregon Department of Fish and Wildlife
Travel Oregon

Fishing, Hunting, Wildlife Viewing, and Shellfishing in Oregon, 2008

May 2009

Prepared for

Oregon Department of Fish and Wildlife
Travel Oregon

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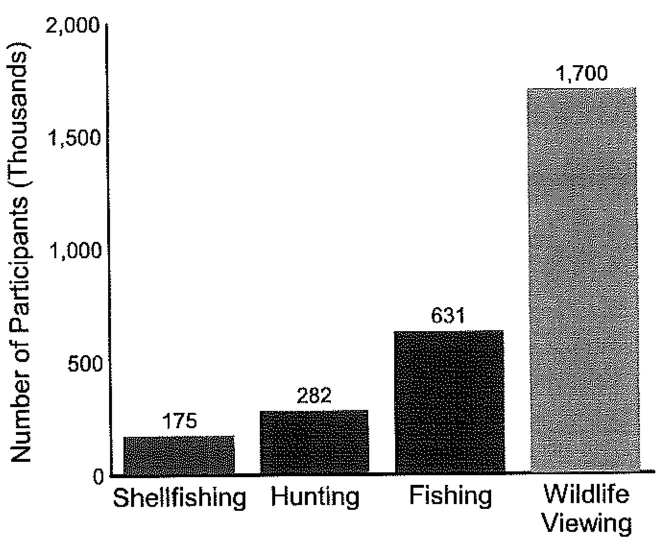

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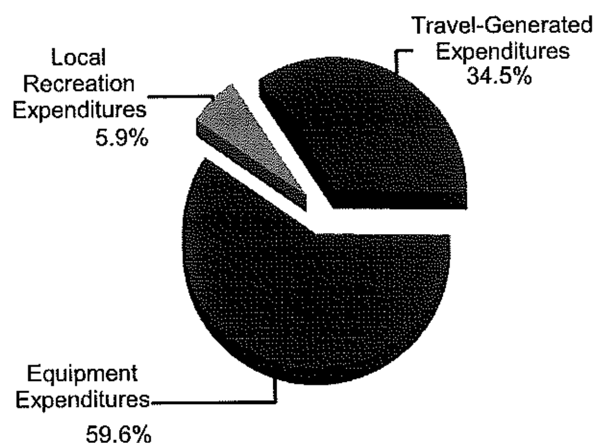

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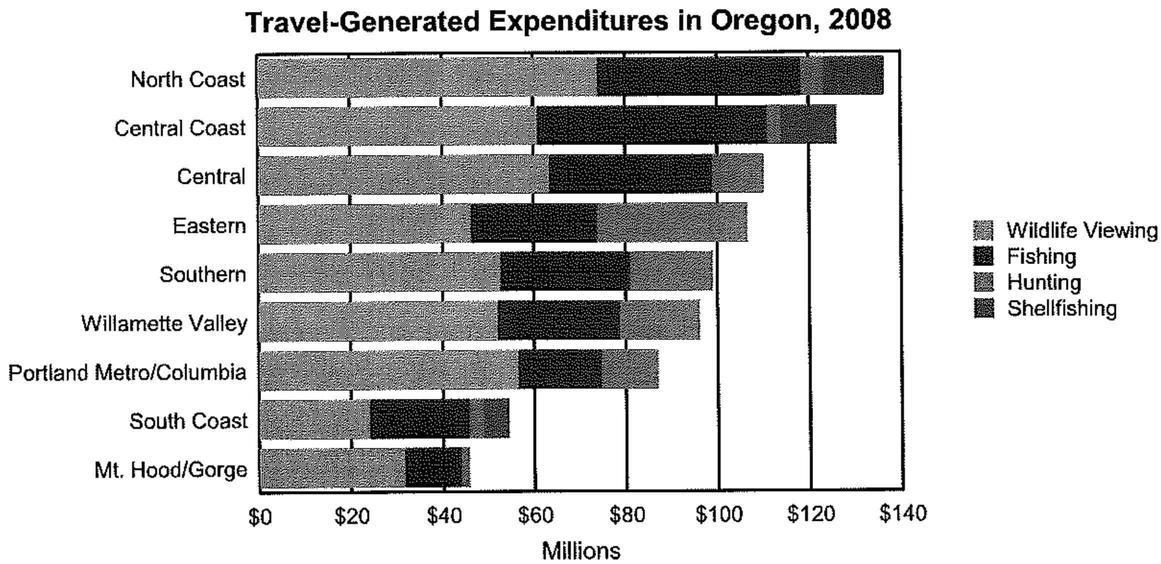

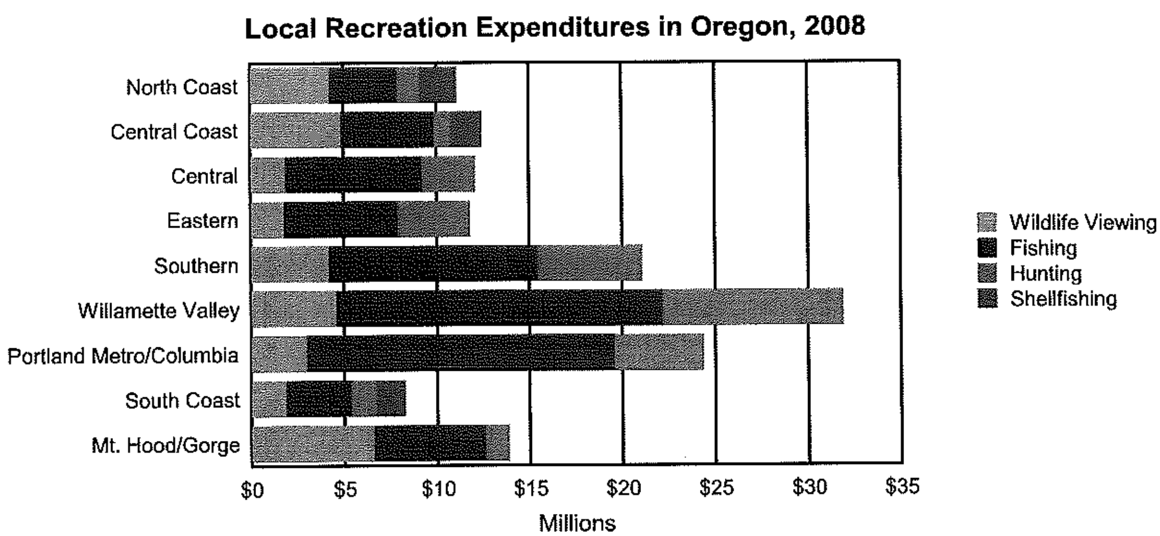

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Preface

This study, the result of a comprehensive effort by the Oregon Department of Fish and Wildlife (ODFW) and Travel Oregon, documents the economic significance of fishing, hunting, wildlife viewing and shellfish harvest in Oregon and its 36 counties in 2008. The report is intended to assist ODFW watershed and regional managers, state and local officials, as well as local chapters of sports groups or other organizations interested in fish and wildlife.

Dean Runyan Associates and The Pulse Group prepared this study for ODFW and Travel Oregon. Dean Runyan Associates has specialized in research and planning services for the travel, tourism, and recreation industry since 1984. Dean Runyan Associates also has extensive experience in project feasibility analysis, market evaluation, survey research, and travel and recreation planning. The Pulse Group is a market research and strategic planning firm specializing in large-scale study design and implementation.

In preparing this report, we have received essential guidance and assistance from numerous ODFW staff, whom we thankfully acknowledge. Stephen Williams, *Deputy Administrator Fish Division*, Larry Cooper, *Deputy Administrator Wildlife Division*, Dave Fox, *Marine Resource Program Assessment and Management Section Leader*, Tom Thornton, *Game Program Manager*, Dave Budeau, *Upland Game Bird Coordinator*, Christine Broniak, *Economist*, Christopher Carter, Ph.D., *Natural Resource Economist*, as well as many others who provided information and advice for this report.

In addition, we want to express our thanks for the cooperation of over 11,000 individuals who voluntarily provided detailed information about their hunting, fishing, wildlife viewing or shellfish harvest activity in Oregon.

Finally, special thanks are due to Roger Fuhrman, Administrator, Information and Education Division, ODFW, and Todd Davidson, CEO, Travel Oregon for their project support and assistance.

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I. Introduction

In Oregon, fishing, hunting, wildlife viewing, and shellfish harvesting generates economic activity for regions and counties throughout the state. Many locations within Oregon serve as appealing overnight and day destinations for both Oregon residents and out-of-state visitors (nonresidents) who participate in fishing, hunting, wildlife viewing, and shellfish harvesting activities while traveling away from home. In addition, many Oregon residents participate in these same fish and wildlife recreation activities close to home, supporting local businesses by spending dollars within their region and county of residence.

Based on results reported from detailed questionnaires and phone interviews, this study describes detailed expenditures made by Oregon residents and nonresidents for fishing, hunting, wildlife viewing and shellfish harvesting in Oregon during 2008. This study also estimates the retail expenditures for fish and wildlife activity-related equipment purchased in Oregon during 2008.

Detailed statewide information on trip characteristics and demographics for each recreation activity type is also included, providing details such as the purpose and length of the trips, the distance traveled, the type of fish or wildlife pursued or viewed, travel party size, as well as other associated trip-related characteristics (shown in Appendix A).

Objectives

This study represents a comprehensive effort by Oregon Department of Fish and Wildlife (ODFW) and Travel Oregon to document the economic significance of fishing, hunting, wildlife viewing, and shellfish harvest in Oregon. Other previous research, including the U.S. Department of the Interior, Fish and Wildlife Service 2006 National Survey of Fishing, Hunting and Wildlife-Associated Recreation, provide economic information at the statewide level. While this information is helpful, many of the decisions that directly affect fish and wildlife, habitat and recreation are made at the local level – by ODFW watershed or regional managers, by state and local officials, by local chapters of sports groups, or by other organizations interested in fish and wildlife.

The information contained in this help will help further the following objectives:

- Highlight the economic impact of decisions that may affect fishing, hunting or wildlife viewing opportunities. This information will help local decision makers more accurately evaluate the impact of changes in regulations, habitat, invasive species, land use, fish passage and other activities that could affect recreation and fish and wildlife.

- Provide additional information to help secure grants and other funding to improve fishing, hunting and wildlife viewing opportunities such as handicap access, boat launches, fishing piers, viewing blinds, and public access. The information may also be used for grants for habitat improvement projects and other efforts to improve fish and wildlife habitat.

- Increase understanding of who is involved in fishing, hunting, shellfish harvest, and wildlife viewing. This will help ODFW prioritize efforts to meet public demand for fishing, hunting, shellfish, and wildlife viewing activities.

- Increase understanding of where individuals fish, hunt, harvest shellfish, and view wildlife. This will help ODFW prioritize funding for restoration, enhancement, and development of fishing, hunting, shellfish, and wildlife viewing opportunities.

- Provide communities, industry, groups and others information on the economic value of fish and wildlife recreation and how they may benefit from these activities.

- Help ODFW more effectively target outreach efforts to contact hunters, anglers and wildlife viewers in their home communities and where they recreate.

Survey Method

Four separate surveys were conducted in 2008 in order to accurately assess the economic significance of fishing, hunting, wildlife viewing, and shellfish harvesting in Oregon. For fishing, hunting and shellfishing, survey participants were selected at random from license sales records – more than 50,000 questionnaires were mailed to ODFW resident and non-resident license holders (see Appendix D for self-administered questionnaires). For wildlife viewing, participants were identified through random digit dialing of Oregon telephone numbers. Those agreeing to participate were asked questions similar to those in the written questionnaires. Samples were stratified by certain portions of the state (groups of counties) and by collection period (quarterly). Overall, nearly 12,000 individuals provided information about their fishing, hunting, shellfishing, and wildlife viewing trips.

Survey Sample and Respondents

	Hunting	**Fishing**	**Shellfish**	**Wildlife**
Survey Method	Mail	Mail	Mail	Telephone
Collection Period	Annual	Bi-Annual	Annual	Quarterly
Number of Contacts	19,833	24,911	3,224	1,624
Completed Questionnaires	5,200	4,533	1,122	1,000
Response Rate	26%	18%	35%	62%

Note: Number of contacts does not include mailed questionnaires that were undeliverable.

In order to test for nonresponse bias, a telephone interview was conducted for a random sample of nonrespondents (those who did not return a questionnaire) for each of the segments contacted with mailed self-administered questionnaires. The responses of these groups were similar to those of the initial respondents. Through these telephone interviews, additional detail was gathered with regard to where to the allocation of expenditures -- before, during, or in the community closest to where the recreation activity occurred. The additional information was used to allocate expenditures at the county-level.

Generally, representative samples of 1,000 or more provide very reliable results. Confidence levels for respondent segments are shown in the table below. Appendix E describes the sampling design for the study and describes the approach taken to produce findings from the completed questionnaires.

Segment	**Sample Size**	**Confidence Level (%)**	
		90% Level (+/-)	**95% Level (+/-)**
Hunters	5,200	1.2	1.4
Fishers	4,533	1.3	1.5
Shellfishers	1,122	2.6	3.0
Oregon Households	1,000	2.6	3.1

Types of Expenditures Included

All of the expenditures associated with overnight and day trips where fishing, hunting, and shellfish harvest occurred in Oregon are included in the scope of this analysis. Expenditures made by both Oregon residents and nonresidents are included. For wildlife viewing, all of the expenditures associated with trips where wildlife viewing was a planned activity - *the primary reason* or *one of several reasons* for the trip – are included. Wildlife viewing expenditures made by nonresidents were estimated based on the data provided by survey participants and the U.S. Department of the Interior, Fish and Wildlife Service 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation.

The analysis distinguishes between *travel-generated expenditures* – defined as those expenditures associated with overnight trips and day trips 50 + miles (*one-way)* – and *local recreation expenditures*, associated with activities occurring in locations under 50 miles from the participant's home. In addition, expenditures made for equipment used while participating in the above activities, if the equipment was purchased from a retailer or supplier located in Oregon during 2008 – such as gear, clothing, campers, recreational vehicles, boats etc. – are reported as *equipment expenditures.* Expenditures made by Oregon residents associated with trips, recreation, or equipment purchases that occurred or were made in locations outside of Oregon are not included.

The specific categories of expenditures included in this analysis are as follows:

Expenditure Categories	Description
Travel-Generated	Travel-generated expenditures associated with *all* overnight trips and *all* day trips 50$^+$ miles (one-way) from a participant's home.
Local Recreation	Local Recreation expenditures associated with *all* day recreation less than 50 miles *(one-way)* from a participant's home.
Equipment purchases	Equipment expenditures made for specific activity-related equipment, as well as special clothing, tents, boats, campers, recreational vehicles and other, additional assorted purchases.

Report Contents

Following this introductory section, Section II provides a statewide review. Section III provides detailed expenditures by region (based on Travel Oregon regions). Section IV provides detailed expenditures for each of Oregon's 36 counties. Appendices A through C shows detailed trip characteristics, demographics, and number of trips by type of fish and wildlife. Copies of the survey questionnaires are shown in Appendix D. Appendix E describes the sampling design in more detail and highlights the steps taken to produce estimates from the completed questionnaires.

II. Oregon Statewide Summary

Participation and Expenditures in Oregon

In 2008, 2.8 million Oregon residents and nonresidents participated in fishing, hunting, wildlife viewing, and shellfish harvesting in Oregon. Of the total number of participants, 631 thousand fished, 282 thousand hunted, 175 thousand harvested shellfish, and 1.7 million participated in outdoor recreation where wildlife viewing was a planned activity, which includes observing, feeding, and photographing any kind of wildlife (not including visits to zoos or aquariums).

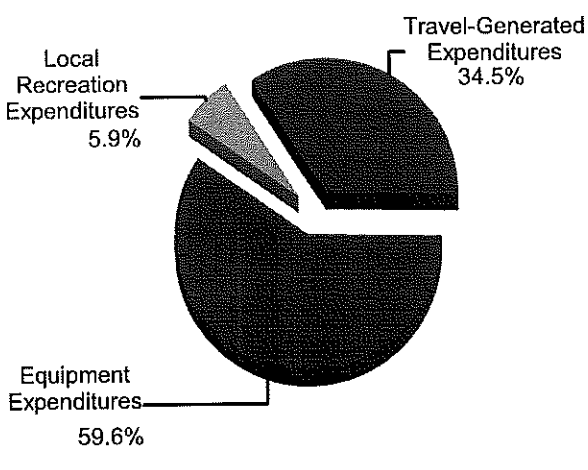
In 2008, state residents and nonresidents made three distinct types of wildlife recreation expenditures: travel-generated, local recreation, and equipment purchases. Oregon residents and nonresidents who traveled overnight and on day trips of 50+ miles (one-way) from home made *travel-generated expenditures* of $862 million. Local recreation expenditures of $147 million were made by Oregon residents while participating in these activities less than 50 miles from home. State residents and nonresidents also spent an additional $1.5 billion on equipment and activity-related purchases from retail establishments and suppliers based in Oregon.

Statewide Participants, Trips and Expenditures in Oregon, 2008

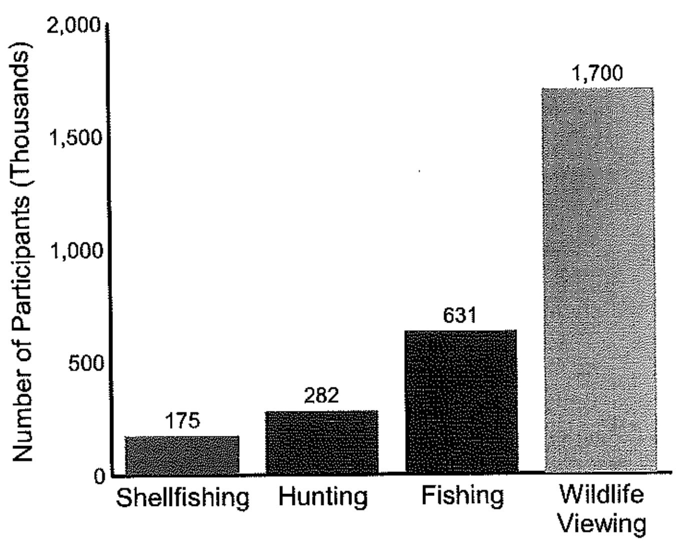
Total	***(in thousands)***
Participants in Oregon	2,788
Trips in Oregon	21,163
Travel-Generated Expenditures	$862,188
Local Recreation Expenditures	$146,908
Equipment Expenditures	$1,486,932

Notes: Resident and nonresident expenditures associated with all reported activities in Oregon. Travel-Generated expenditures associated with overnight and day trips 50+ miles (one-way).
Source: Dean Runyan Associates.

Fish and Wildlife Recreation Expenditures in Oregon, 2008
(Total: $2.5 billion)



Total Participants by Activity, 2008



Participants, Trips and Expenditures in Oregon by Activity, 2008

Fishing	***(in thousands)***	**Shellfishing**	***(in thousands)***
Anglers in Oregon	631	Shellfishers in Oregon	175
Angler Trips in Oregon	5,241	Shellfisher Trips in Oregon	471
Travel-Generated Expenditures	$264,605	Travel-Generated Expenditures	$31,039
Local Recreation Expenditures	$76,905	Local Recreation Expenditures	$5,256
Equipment Expenditures	$441,356	Equipment Expenditures	$135,688
Hunting		**Wildlife Viewing***	
Hunters in Oregon	282	Wildlife-Viewing Participants in Oregon	1,700
Hunter Trips in Oregon	1,754	Wildlife Viewing Trips in Oregon	13,697
Travel-Generated Expenditures	$104,458	Travel-Generated Expenditures	$462,087
Local Recreation Expenditures	$31,574	Local Recreation Expenditures	$33,173
Equipment Expenditures	$381,908	Equipment Expenditures	$527,980

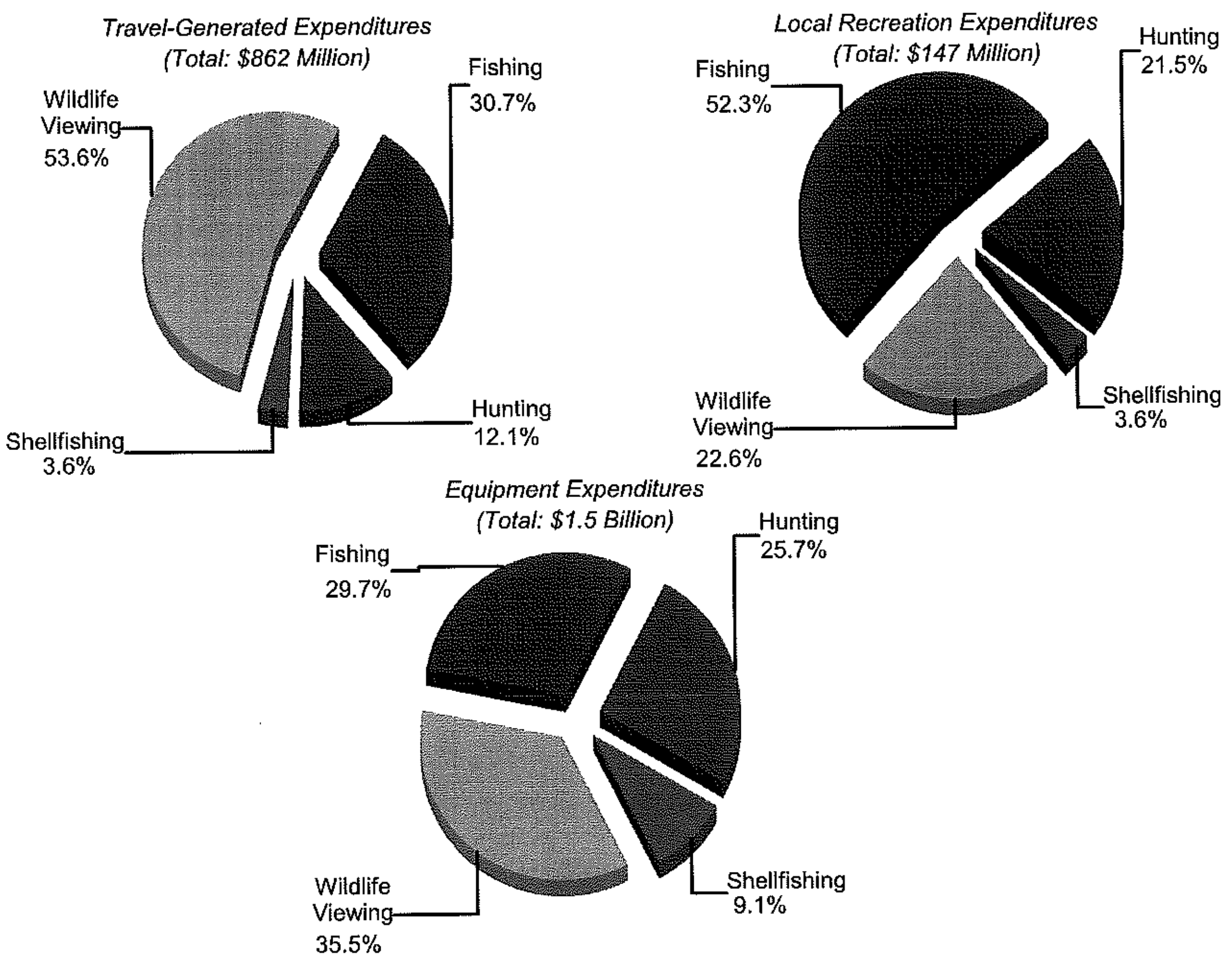
* Trips and Expenditures where wildlife viewing was a planned activity -- *the primary reason* or *one of several reasons* for the trip. Does not include expenditures associated with trip where incidental wildlife viewing occured.

Notes: Resident and nonresident expenditures associated with all reported activities in Oregon.

Travel-Generated expenditures associated with overnight and day trips 50+ miles (one-way).

Source: Dean Runyan Associates.

Expenditures in Oregon by Type and Activity, 2008



Note: Wildlife viewing expenditures on trips where wildlife viewing was a planned activity.
Source: Dean Runyan Associates.

Table 1. Expenditures for Fishing in Oregon, 2008

Freshwater Fishing	***(Thousands)***
*Travel-Generated Expenditures**	
Accommodations	$31,378
Food & Beverage Services	$31,059
Food Stores	$42,032
Ground Transportation	$43,876
Retail	$17,871
Outfitter/Guide/Charter Fees	$20,680
Other Recreation & Entertainment	$8,692
Total Travel Expenditures	$195,587
*Local Recreation Expenditures***	$74,293
Saltwater Fishing	***(Thousands)***
*Travel-Generated Expenditures**	
Accommodations	$12,217
Food & Beverage Services	$13,394
Food Stores	$9,842
Ground Transportation	$13,646
Retail	$6,981
Outfitter/Guide/Charter Fees	$8,074
Other Recreation & Entertainment	$4,864
Total Travel Expenditures	$69,018
*Local Recreation Expenditures***	$2,612
Total, All Fishing	***(Thousands)***
*Travel-Generated Expenditures**	
Accommodations	$43,595
Food & Beverage Services	$44,453
Food Stores	$51,873
Ground Transportation	$57,522
Retail	$24,852
Outfitter/Guide/Charter Fees	$28,754
Other Recreation & Entertainment	$13,556
Total Travel Expenditures	$264,605
*Local Recreation Expenditures***	$76,905

* Travel-generated expenditures associated with overnight and day trips 50+ miles (one-way).
** Recreation expenditures associated with local trips under 50 miles.

Note: Resident and nonresident expenditures associated with fishing in Oregon. Additionally, an estimated $5.3 million was made in airfares (round-trip) by those visitors who traveled to Oregon by air.
Source: Dean Runyan Associates.

Table 2. Expenditures for Shellfishing in Oregon, 2008

Shellfishing	***(Thousands)***
*Travel-Generated Expenditures**	
Accommodations	$6,848
Food & Beverage Services	$7,570
Food Stores	$6,496
Ground Transportation	$4,975
Retail	$2,996
Outfitter/Guide/Charter Fees	$580
Other Recreation & Entertainment	$1,574
Total Travel Expenditures	$31,039
*Local Recreation Expenditures***	$5,256

* Travel-generated expenditures associated with overnight and day trips 50+ miles (one-way).
** Recreation expenditures associated with local trips under 50 miles.

Note: Resident and nonresident expenditures associated with shellfishing in Oregon.
Source: Dean Runyan Associates.

Table 3. Expenditures for Hunting in Oregon, 2008

Hunting	***(Thousands)***
*Travel-Generated Expenditures**	
Accommodations	$10,664
Food & Beverage Services	$16,579
Food Stores	$33,381
Ground Transportation	$17,212
Retail	$21,199
Outfitter/Guide/Charter Fees	$2,435
Other Recreation & Entertainment	$2,989
Total Travel Expenditures	$104,458
*Local Recreation Expenditures***	$31,574

* Travel-generated expenditures associated with overnight and day trips 50+ miles (one-way).
** Recreation expenditures associated with local trips under 50 miles.

Note: Resident and nonresident expenditures associated with hunting in Oregon.
Source: Dean Runyan Associates.

Table 4. Expenditures for Wildlife Viewing in Oregon, 2008

Wildlife Viewing	*(Thousands)*
*Travel-Generated Expenditures**	
Accommodations	$129,033
Food & Beverage Services	$102,369
Food Stores	$88,780
Ground Transportation	$71,905
Retail	$44,542
Outfitter/Guide/Charter Fees	...
Other Recreation & Entertainment	$25,459
Total Travel Expenditures	$462,087
*Local Recreation Expenditures***	$33,173

* Travel-generated expenditures associated with overnight and day trips 50+ miles (one-way).
** Recreation expenditures associated with local trips under 50 miles.
... Sample size too small to report data reliably.

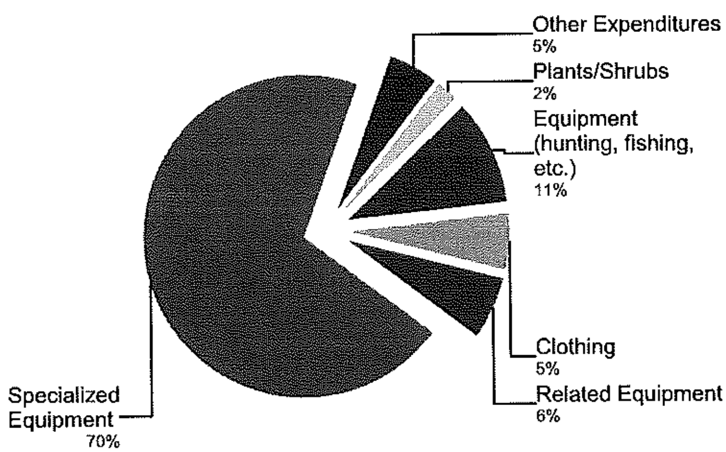
Note: Expenditures where wildlife viewing was a planned activity -- *the primary reason* or *one of several reasons* for the trip. Resident and nonresident expenditures associated with wildlife viewing in Oregon.
Source: Dean Runyan Associates.

Table 5. Equipment Expenditures in Oregon, 2008 ($Millions)

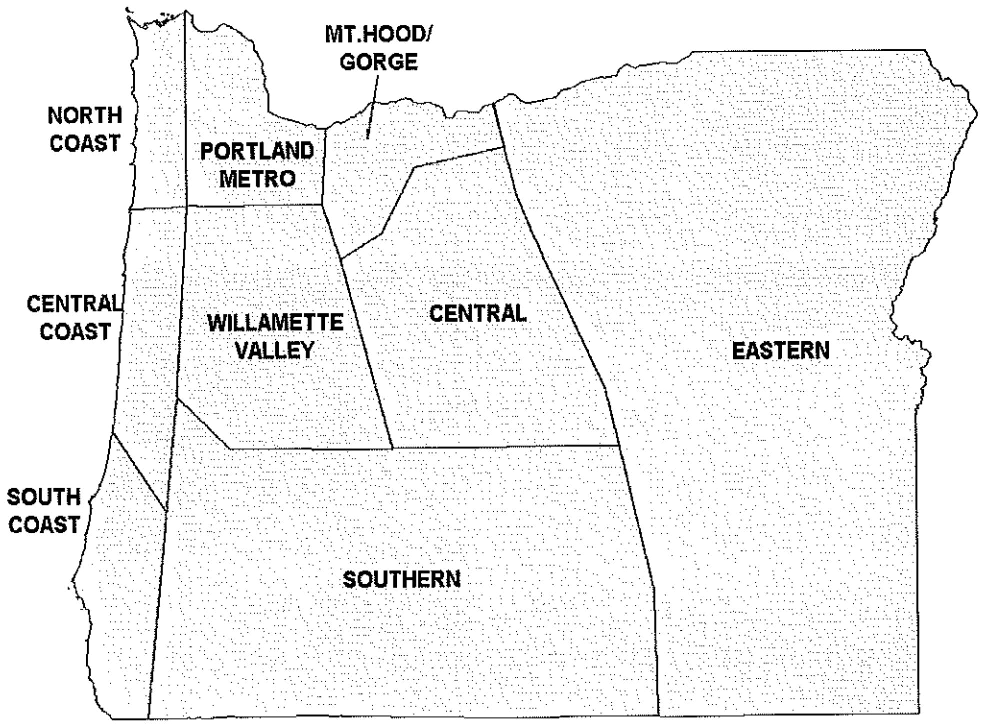
	Fishing	Hunting	Shellfishing	Wildlife Viewing	Combined Activities
Equipment (hunting, fishing, etc.)	$41.2	$73.7	$4.9	$37.6	$157.4
Clothing	$17.8	$26.7	$4.4	$31.6	$80.6
Related Equipment	$32.8	$22.7	$4.3	$36.8	$96.6
Specialized Equipment	$342.7	$234.3	$117.8	$349.4	$1,044.1
Other Expenditures	$6.8	$24.6	$4.3	$38.3	$74.0
Plants/Shrubs	$0.0	$0.0	$0.0	$34.2	$34.2
Total Equipment Expenditures	$441.4	$381.9	$135.7	$528.0	$1,486.9

Note: Special Equipment includes boats, campers, ATVs and other recreation vehicles.
For Hunting, Other Expenditures may include meat processing, and taxidermy.
Plants/Shrubs include plants and materials purchased for wildlife habitat areas.
Source: Dean Runyan Associates.

Equipment Expenditures in Oregon, 2008



III. Oregon Travel Regions



Counties by Oregon Travel Region

North Coast
- Clatsop
- Tillamook

Central Coast
- Douglas (West)
- Lincoln
- Lane (West)

South Coast
- Coos
- Curry

Willamette Valley
- Benton
- Clackamas (South)
- Lane (East)
- Linn
- Marion
- Polk
- Yamhill

Portland Metro
- Clackamas (West)
- Columbia
- Multnomah (West)
- Washington

Southern
- Douglas (East)
- Jackson
- Josephine
- Klamath
- Lake

Central
- Crook
- Deschutes
- Jefferson
- Wasco (South)

Mt.Hood/Gorge
- Clackamas (East)
- Multnomah (East)
- Hood River
- Wasco (North)

Eastern
- Baker
- Gilliam
- Grant
- Harney
- Malheur
- Morrow
- Sherman
- Umatilla
- Union
- Wallowa
- Wheeler

The tables in this section provide detailed estimates for the regions of Oregon for 2008.

Table 6. Travel-Generated Expenditures by Activity for Oregon Travel Regions, 2008 ($Million)

Region	Shell-fishing	Fishing	Hunting	Wildlife Viewing *	Combined Activities	All Oregon Travel**	Combined Activities (%)
Willamette Valley		$26.7	$17.3	$52.1	$96.1	$1,337.9	7.2%
North Coast	$13.3	$44.4	$4.7	$74.1	$136.5	$551.0	24.8%
Central Coast	$12.2	$50.1	$2.9	$61.0	$126.2	$624.5	20.2%
South Coast	$5.5	$21.7	$3.3	$24.1	$54.6	$283.0	19.3%
Portland Metro/Columbia		$18.1	$12.3	$56.6	$87.0	$3,567.3	2.4%
Southern		$28.3	$17.9	$52.8	$99.0	$831.3	11.9%
Central		$35.4	$11.4	$63.6	$110.4	$581.4	19.0%
Eastern		$27.6	$32.8	$46.3	$106.7	$361.1	29.5%
Mt. Hood/Gorge		$12.3	$1.8	$31.6	$45.7	$279.2	16.4%
State	**$41.0**	**$263.6**	**$103.3**	**$362.2**	**$862.2**	**$8,316.5**	**10.2%**

* Expenditures associated with overnight and day trips where wildlife viewing was *primary* or *one of several reasons* for the trip.

** All Oregon Travel expenditures based on Oregon Travel Impacts, 1991-2008p (statewide preliminary estimates).

Note: Travel-generated expenditures associated with overnight and day trips 50+ miles (one-way). Resident and nonresident expenditures associated with all reported activities in Oregon.
The estimates of travel-generated expenditures by county in this report will necessarily differ somewhat from estimates generated from different models, methodologies, and data sources, including Oregon Travel Impacts.

Source: Dean Runyan Associates.

Travel-Generated Expenditures in Oregon, 2008

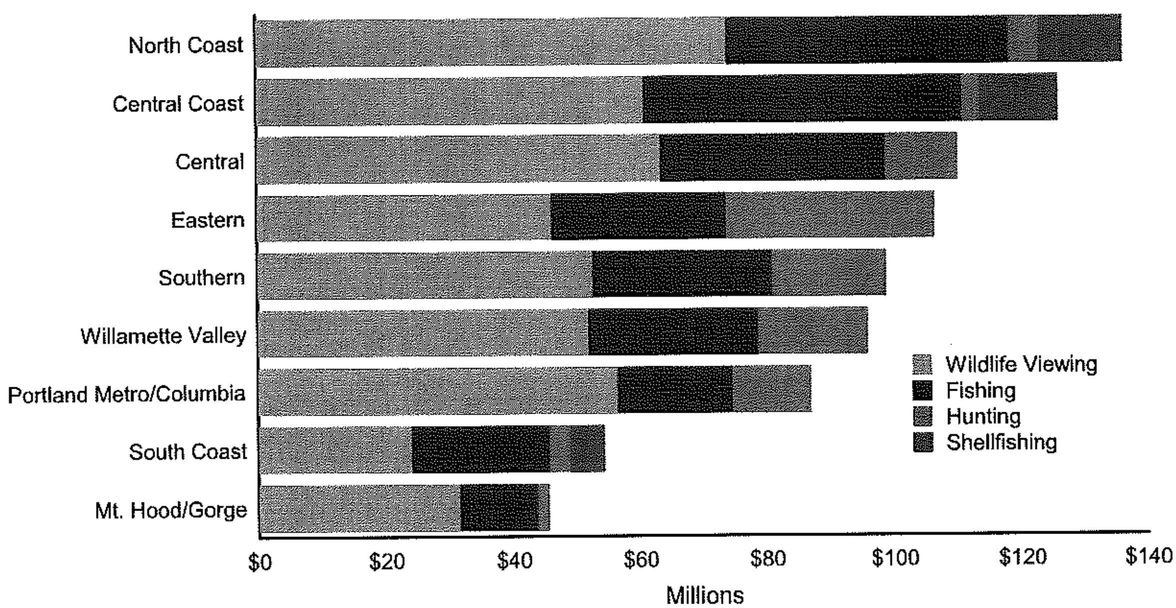


Table 7. Local Recreation Expenditures by Activity for Oregon Travel Regions, 2008 ($Million)

Region	Shell-fishing	Fishing	Hunting	Wildlife Viewing *	Combined Activites
Willamette Valley		I $4.7	I 5.4	I 3.7	I , $.5
North Coast	I 2.0	I , .7	I $.2	I 3.,	I $$.$
Central Coast	I $.4	I 6.0	I 0.5	I 3.5	I $2.6
South Coast	I $.7	I , .6	I $.,	I $.5	I 8.,
Portland Metro9Columbia		I $7.7	I 3.8	I , .0	I 23.3
Southern		I $$.,	I 6.7	I 3.2	I 2$.$
Central		I 4.,	I 2.5	I $.5	I $2.$
Eastern		I 7.$	I , .5	I $.8	I $$.8
Mt. Hood9Gorge		I 7.0	I $.,	I 7.7	I $, .5
State	**$5.3**	**$77.0**	**$31.6**	**$33.2**	**$147.1**

* E/ penditures associated with local trips where wildlife viewing was *primary* or *one of several reasons* for the trip.

Note: Any Nonresidents1who reported less than 60 miles1are included in Travel-Generated E/ penditures. Local Recreation e/ penditures associated with trips under 60 miles.

Source: Dean Runyan Associates.

Local Recreation Expenditures in Oregon, 2008

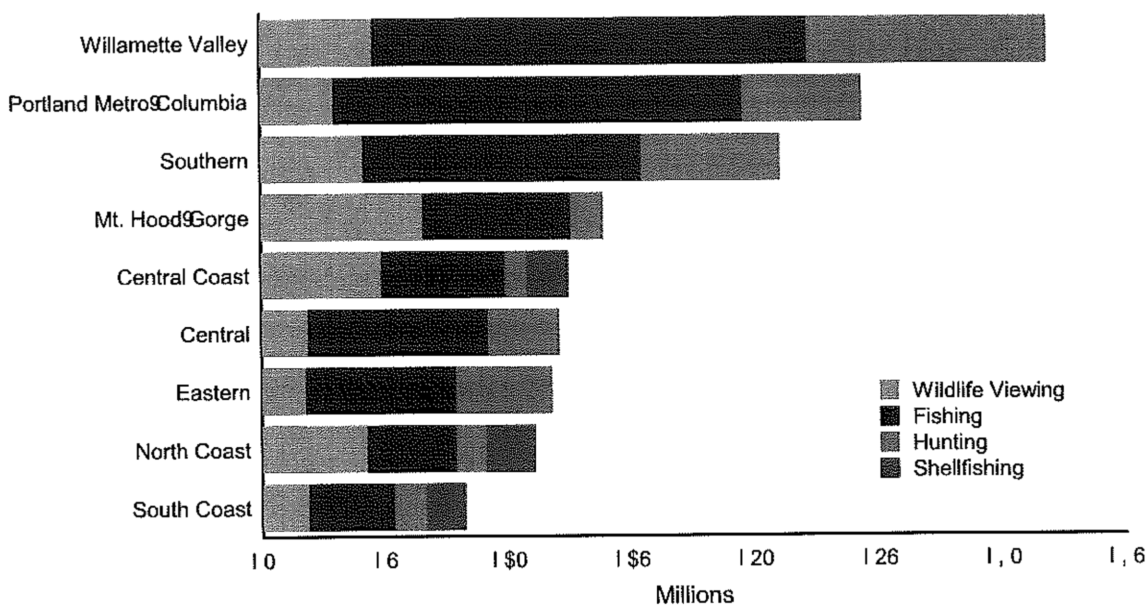


Table 8. Expenditures for <u>Freshwater Fishing</u> by Trip Type for Oregon Travel Regions, 2008

	Travel-Generated Expenditures* ($Million)			Local Recreation Expenditures** ($Million)
Region	Overnight	Day	Total	
Willamette Valley	$17.7	$12.3	$26.9	$19.6
North Coast	$4.1	$8.4	$18.0	$3.0
Central Coast	$12.0	$8.1	$20.1	$3.4
South Coast	$6.3	$2.9	$4.0	$2.6
Portland Metro/Columbia	$8.4	$4.2	$18.1	$16.6
Southern	$16.8	$11.5	$28.3	$11.3
Central	$25.8	$4.6	$35.7	$9.3
Eastern	$20.6	$9.0	$29.6	$6.1
Mt. Hood/Gorge	$6.4	$5.7	$12.3	$6.0
State	**$120.8**	**$74.8**	**$195.6**	**$74.3**

* Travel-generated expenditures associated with overnight and day trips 50+ miles (one-way).
** Local Recreation expenditures associated with trips under 50 miles.

Note: Resident and nonresident expenditures associated with freshwater fishing in Oregon.
Source: Dean Runyan Associates.

Table 9. Expenditures for <u>Saltwater Fishing</u> by Trip Type for Oregon Travel Regions, 2008

	Travel-Generated Expenditures* ($Million)			Local Recreation Expenditures** ($Million)
Region	Overnight	Day	Total	
North Coast	$18.3	$8.1	$26.7	$0.6
Central Coast	$14.4	$10.1	$30.0	$1.1
South Coast	$9.6	$5.0	$12.6	$0.4
State	**$45.8**	**$23.2**	**$69.0**	**$2.6**

* Travel-generated expenditures associated with overnight and day trips 50+ miles (one-way).
** Local Recreation expenditures associated with trips under 50 miles.

Note: Resident and nonresident expenditures associated with saltwater fishing in Oregon.
Source: Dean Runyan Associates.

Table 10. Expenditures for <u>Shellfishing</u> by Trip Type for Oregon Travel Regions, 2008

Region	Travel-Generated Expenditures* ($Million)			Local Recreation Expenditures** ($Million)
	Overnight	Day	Total	
North Coast	$10.1	$3.2	$13.3	$2.0
Central Coast	$4.3	$2.4	$12.2	$1.9
South Coast	$7.9	$0.8	$5.5	$1.6
State	**$24.1**	**$6.9**	**31.0**	**$5.3**

* Travel-generated expenditures associated with overnight and day trips 50+ miles (one-way).
** Local Recreation expenditures associated with trips under 50 miles.

Note: Resident and nonresident expenditures associated with shellfishing in Oregon.
Source: Dean Runyan Associates.

Table 11. Expenditures for <u>Hunting</u> by Trip Type for Oregon Travel Regions, 2008

Region	Travel-Generated Expenditures* ($Million)			Local Recreation Expenditures** ($Million)
	Overnight	Day	Total	
Willamette Valley	$11.4	$5.7	$19.3	$4.9
North Coast	$3.7	$1.3	$7.9	$1.2
Central Coast	$2.2	$0.9	$2.4	$0.4
South Coast	$2.7	$0.4	$3.3	$1.3
Portland Metro/Columbia	$8.5	$3.8	$12.3	$7.8
Southern	$13.5	$7.7	$19.4	$5.6
Central	$4.0	$2.7	$11.7	$2.4
Eastern	$24.0	$3.8	$32.8	$3.4
Mt. Hood/Gorge	$1.7	$0.7	$1.8	$1.3
State	**$81.3**	**$23.1**	**$104.4**	**$31.6**

* Travel-generated expenditures associated with overnight and day trips 50+ miles (one-way).
** Local Recreation expenditures associated with trips under 50 miles.

Note: Resident and nonresident expenditures associated with hunting in Oregon.
Source: Dean Runyan Associates.

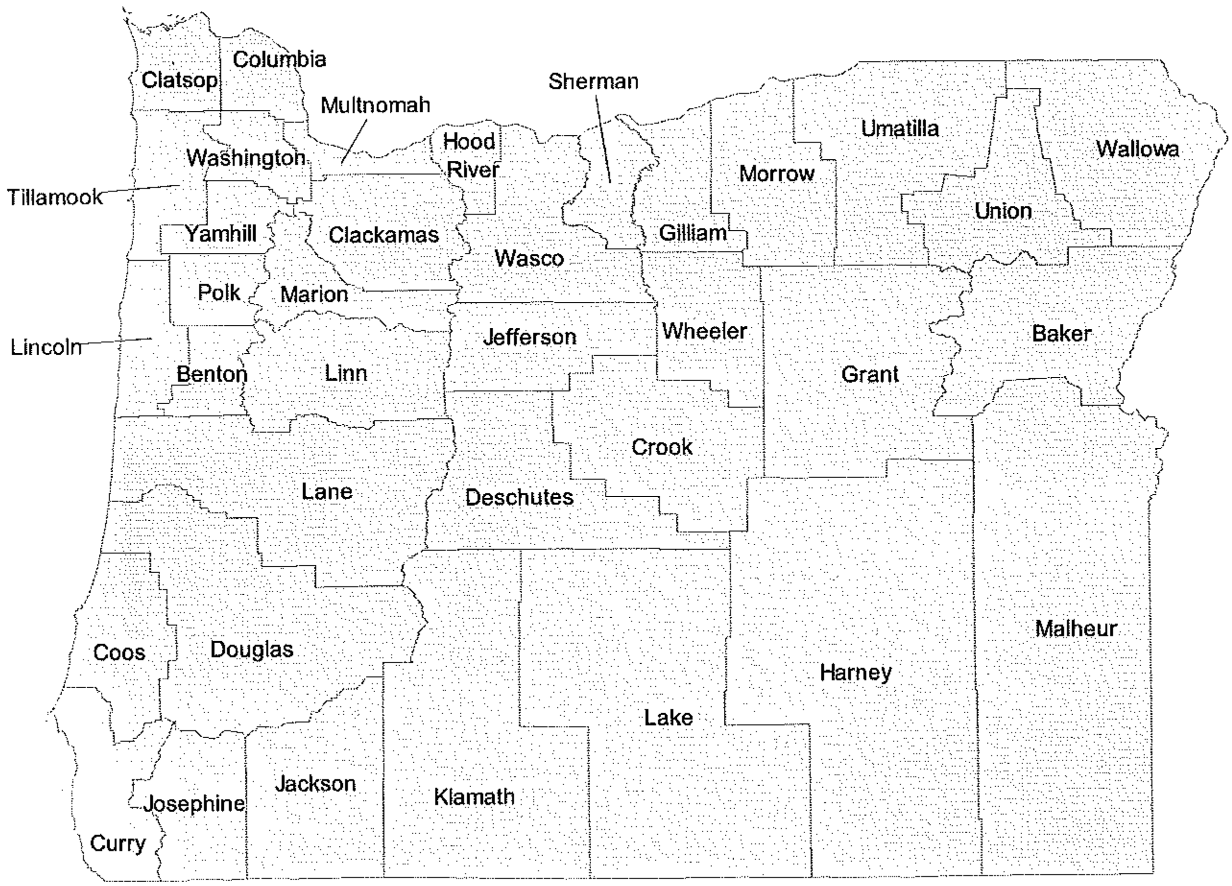
Table 12. Expenditures for Wildlife Viewing by Trip Type for Oregon Travel Regions, 2008

Region	Travel-Generated Expenditures* ($Million) Overnight	Day	Total	Local Recreation Expenditures** ($Million)
Willamette Valley	$40.7	$11.4	$52.1	$4.6
North Coast	$67.5	$6.6	$74.1	$4.3
Central Coast	$53.7	$7.3	$61.0	$4.9
South Coast	$20.8	$3.3	$24.1	$1.9
Portland Metro/Columbia	$44.2	$12.4	$56.6	$3.0
Southern	$44.2	$8.6	$52.8	$4.2
Central	$59.6	$4.0	$63.6	$1.9
Eastern	$42.8	$3.5	$46.3	$1.8
Mt. Hood/Gorge	$22.0	$9.6	$31.6	$6.6
State	**$395.5**	**$66.7**	**$462.2**	**$33.2**

* Travel-generated expenditures associated with overnight and day trips 50+ miles (one-way).
** Local Recreation expenditures associated with trips under 50 miles.

Note: Resident and nonresident expenditures associated with wildlife viewing in Oregon.
Source: Dean Runyan Associates.

IV. Oregon Counties



A description of the expenditure impact categories used in the detailed county tables follows:

Travel-Generated Expenditures by Activity includes the total travel spending made by Oregon residents and nonresidents in the county of destination, plus other specific trip-related purchases such as gasoline, food and beverages, and other retail purchases made before or while traveling to the destination. Expenditures for gasoline, food, and retail items made *before* the trip are allocated to the participant's home county. All other expenditures are allocated to the county in which the recreation activity occurred.

Local Recreation Expenditures by Activity includes the total recreation-related expenditures made by Oregon residents for day recreation activities less than 50 miles (one-way) from a participant's home.

The next five tables show detailed *Expenditures by Trip Type by County* for each of the five activities: freshwater fishing, saltwater fishing, shellfishing, hunting, and wildlife viewing. Trip types include overnight, day, and local recreation (less than 50 miles from participant's home).

Table 13. Travel-Generated Expenditures by Activity for Counties, 2008
($000s)

County	Shellfishing	Fishing	Hunting	Wildlife Viewing*	Combined Activities	All Oregon Travel**	Combined Activites (%)
Baker		$5,670	$4,524	$8,259	$18,452	$47,851	38.6%
Benton		$1,677	$953	$4,941	$7,572	$91,532	8.3%
Clackamas		$7,158	$4,421	$21,632	$33,211	$435,661	7.6%
Clatsop	$5,661	$9,693	$2,313	$55,481	$73,147	$389,494	18.8%
Columbia		$790	$1,177	$3,367	$5,333	$31,220	17.1%
Coos	$4,552	$12,253	$2,535	$14,111	$33,452	$183,020	18.3%
Crook		$3,010	$2,584	$6,769	$12,363	$29,663	41.7%
Curry	$1,020	$9,374	$728	$10,022	$21,145	$100,025	21.1%
Deschutes		$20,410	$6,663	$42,771	$69,844	$475,684	14.7%
Douglas	$2,616	$19,112	$6,233	$9,698	$37,658	$247,649	15.2%
Gilliam		...	...	...	$548	$3,812	14.4%
Grant		$3,279	$5,138	$3,147	$11,564	$9,107	***
Harney		$2,812	$4,564	$7,953	$15,329	$19,645	78.0%
Hood River		$4,117	$789	$13,005	$17,910	$67,622	26.5%
Jackson		$8,520	$5,096	$18,664	$32,280	$380,721	8.5%
Jefferson		$4,010	$730	$9,596	$14,336	$55,014	26.1%
Josephine		$3,432	$1,558	$6,695	$11,685	$121,530	9.6%
Klamath		$5,741	$3,179	$13,993	$22,913	$130,820	17.5%
Lake		$2,560	$2,490	$4,940	$9,991	$11,272	88.6%
Lane	$1,840	$17,642	$7,907	$27,570	$54,959	$580,771	9.5%
Lincoln	$7,660	$32,478	$1,607	$53,229	$94,974	$453,023	21.0%
Linn		$3,070	$2,776	$4,114	$9,959	$117,906	8.4%
Malheur		$3,996	$2,157	$1,345	$7,498	$47,102	15.9%
Marion		$8,601	$3,718	$16,360	$28,679	$357,095	8.0%
Morrow		$921	$2,652	$4,942	$8,514	$13,251	64.3%
Multnomah		$7,955	$3,387	$31,511	$42,853	$2,803,647	1.5%
Polk		$925	$957	$2,375	$4,256	$139,551	3.0%
Sherman		$2,032	$746	$1,193	$3,970	$10,582	37.5%
Tillamook	$7,689	$34,710	$2,477	$18,569	$63,446	$161,523	39.3%
Umatilla		$2,576	$3,543	$9,703	$15,821	$146,254	10.8%
Union		$1,729	$5,435	$4,318	$11,481	$33,194	34.6%
Wallowa		$2,821	$2,771	$5,172	$10,765	$26,778	40.2%
Wasco		$13,607	$2,099	$7,800	$23,506	$85,449	27.5%
Washington		$4,816	$3,727	$15,226	$23,769	$514,450	4.6%
Wheeler		$1,462	$1,168	...	$2,776	$3,539	78.4%
Yamhill		$1,341	$1,580	$3,308	$6,229	$91,252	6.8%
State	**$31,039**	**$264,605**	**$104,458**	**$462,087**	**$862,188**	**$8,416,710**	**10.2%**

* Expenditures associated with overnight and day trips where wildlife viewing was *primary* or *one of several reasons* for the trip.

** All Oregon Travel expenditures based on Oregon Travel Impacts, 1991-2008p (statewide preliminary estimates).

*** Percent FHW exceeds 100 due to dispersed camping related activity not included in Oregon Travel Impacts.

.... Sample size too small to report data reliably.

Note: Travel-generated expenditures associated with overnight and day trips 50+ miles (one-way). Resident and nonresident expenditures associated with all reported activities in Oregon. The estimates of travel-generated expenditures by county in this report will necessarily differ somewhat from estimates generated from different models, methodologies, and data sources, including Oregon Travel Impacts.

Source: Dean Runyan Associates.

Table 14. Local Recreation Expenditures by Activity for Counties, 2008 ($000s)

County	Shellfishing	Fishing	Hunting	Wildlife Viewing*	Combined Activities
Baker		$640	$491	$317	$1,448
Benton		$1,353	$1,075	...	$2,428
Clackamas		$8,704	$2,496	$621	$11,820
Clatsop	$1,016	$1,515	$666	$2,715	$5,912
Columbia		...	...	$134	$133
Coos	$1,081	$2,551	$905	$1,637	$6,175
Crook		$999	$683	$218	$1,900
Curry	$483	$935	$413	$309	$2,140
Deschutes		$5,321	$1,817	$1,520	$8,657
Douglas	$175	$3,577	$1,785	$835	$6,373
Gilliam		...	...	$106	$106
Grant		$377	$391	...	$768
Harney		$330	$262	...	$654
Hood River		$1,960	$282	$3,249	$5,492
Jackson		$4,512	$2,025	$1,906	$8,443
Jefferson		$822	$288	$170	$1,280
Josephine		$1,600	$745	$648	$2,993
Klamath		$2,134	$1,035	$938	$4,108
Lake		$339	$283	...	$660
Lane	$324	$7,689	$3,047	$2,714	$13,774
Lincoln	$1,185	$2,408	$482	$3,557	$7,631
Linn		$3,699	$1,392	$391	$5,482
Malheur		$1,062	$460	$167	$1,689
Marion		$3,586	$1,660	$1,408	$6,654
Morrow		$593	$185	...	$857
Multnomah		$8,215	$2,662	$3,835	$14,712
Polk		$507	$830	$883	$2,220
Sherman		$198	$223	...	$420
Tillamook	$992	$2,080	$541	$1,607	$5,221
Umatilla		$1,541	$990	$741	$3,271
Union		$700	$596	$170	$1,465
Wallowa		$567	$217	$115	$898
Wasco		$645	$278	$945	$1,868
Washington		$3,584	$1,489	$796	$5,868
Wheeler		$139	$103	...	$255
Yamhill		$2,025	$778	$330	$3,133
State	**$5,256.33**	**$76,905.23**	**$31,574**	**$33,172.99**	**$146,908.27**

* Expenditures associated with local trips where wildlife viewing was *primary* or *one of several reasons* for the trip.

.... Sample size too small to report data reliably.

Note: Any Nonresidents, who reported less than 50 miles, are included in Travel-Generated Expenditures. Local Recreation expenditures associated with trips under 50 miles.

Source: Dean Runyan Associates.

Table 15. Expenditures for Freshwater Fishing by Trip Type for Counties, 2008

County	Travel-Generated Expenditures* ($000s) Overnight	Day	Total	Local Recreation Expenditures** ($000s)
Baker	$4,773	$896	$5,670	$640
Benton	$395	$1,282	$1,677	$1,353
Clackamas	$3,997	$3,161	$7,158	$8,704
Clatsop	$2,080	$1,989	$4,069	$1,363
Columbia	$423	$367	$790	...
Coos	$2,714	$1,842	$4,555	$1,885
Crook	$2,300	$710	$3,010	$999
Curry	$3,545	$907	$4,452	$673
Deschutes	$15,854	$4,557	$20,410	$5,321
Douglas	$7,247	$5,187	$12,434	$3,258
Gilliam	...	...	...	...
Grant	$2,934	$346	$3,279	$377
Harney	$2,362	$450	$2,812	$330
Hood River	$1,238	$2,879	$4,117	$1,960
Jackson	$4,720	$3,801	$8,520	$4,512
Jefferson	$2,558	$1,452	$4,010	$822
Josephine	$1,926	$1,507	$3,432	$1,600
Klamath	$3,853	$1,889	$5,741	$2,134
Lake	$1,938	$623	$2,560	$339
Lane	$8,957	$6,331	$15,288	$7,415
Lincoln	$6,516	$4,992	$11,508	$1,932
Linn	$1,581	$1,489	$3,070	$3,699
Malheur	$2,811	$1,185	$3,996	$1,062
Marion	$4,923	$3,678	$8,601	$3,586
Morrow	$685	$236	$921	$593
Multnomah	$4,079	$3,876	$7,955	$8,215
Polk	$505	$420	$925	$507
Sherman	$1,785	$247	$2,032	$198
Tillamook	$7,026	$6,913	$13,939	$1,618
Umatilla	$1,054	$1,522	$2,576	$1,541
Union	$872	$857	$1,729	$700
Wallowa	$2,082	$740	$2,821	$567
Wasco	$9,056	$4,551	$13,607	$645
Washington	$2,207	$2,609	$4,816	$3,584
Wheeler	$948	$514	$1,462	$139
Yamhill	$573	$768	$1,341	$2,025
State	**$120,798**	**$74,789**	**$195,587**	**$74,293**

* Travel-generated expenditures associated with overnight and day trips 50+ miles (one-way).
** Local Recreation expenditures associated with trips under 50 miles.
.... Sample size too small to report data reliably.

Note: Resident and nonresident expenditures associated with freshwater fishing in Oregon.
Source: Dean Runyan Associates.

Table 16. Expenditures for Saltwater Fishing by Trip Type for Counties, 2008

County	Travel-Generated Expenditures* ($000s) Overnight	Day	Total	Local Recreation Expenditures** ($000s)
Clatsop	$3,991	$1,633	$5,624	$152
Coos	$3,587	$4,111	$7,698	$667
Curry	$4,019	$902	$4,921	$262
Douglas	$4,643	$2,036	$6,679	$319
Lane	$909	$1,445	$2,354	$274
Lincoln	$14,355	$6,615	$20,970	$476
Tillamook	$14,344	$6,428	$20,772	$463
State	**$45,848**	**$23,170**	**$69,018**	**$2,612**

* Travel-generated expenditures associated with overnight and day trips 50+ miles (one-way).
** Local Recreation expenditures associated with trips under 50 miles.

Note: Resident and nonresident expenditures associated with saltwater fishing in Oregon.
Source: Dean Runyan Associates.

Table 17. Expenditures for Shellfishing by Trip Type for Counties, 2008

County	Travel-Generated Expenditures* ($000s) Overnight	Day	Total	Local Recreation Expenditures** ($000s)
Clatsop	$3,999	$1,662	$5,661	$1,016
Coos	$3,770	$782	$4,552	$1,081
Curry	$972	$48	$1,020	$483
Douglas	$1,894	$721	$2,616	$175
Lane	$1,487	$353	$1,840	$324
Lincoln	$5,876	$1,784	$7,659	$1,185
Tillamook	$6,145	$1,545	$7,689	$992
State	**$24,143**	**$6,896**	**$31,039**	**$5,256**

* Travel-generated expenditures associated with overnight and day trips 50+ miles (one-way).
** Local Recreation expenditures associated with trips under 50 miles.

Note: Resident and nonresident expenditures associated with shellfishing in Oregon.
Source: Dean Runyan Associates.

Table 18. Expenditures for Hunting by Trip Type for Counties, 2008

County	Travel-Generated Expenditures* ($000s) Overnight	Day	Total	Local Recreation Expenditures** ($000s)
Baker	$4,010	$514	$4,524	$491
Benton	$612	$341	$953	$1,075
Clackamas	$3,112	$1,309	$4,421	$2,496
Clatsop	$1,661	$652	$2,313	$666
Columbia	$840	$337	$1,177	...
Coos	$1,834	$701	$2,535	$905
Crook	$2,060	$524	$2,584	$683
Curry	$519	$209	$728	$413
Deschutes	$5,495	$1,167	$6,663	$1,817
Douglas	$4,758	$1,475	$6,233	$1,785
Gilliam	...	...	...	...
Grant	$4,748	$390	$5,138	$391
Harney	$4,215	$349	$4,564	$262
Hood River	$632	$157	$789	$282
Jackson	$3,879	$1,217	$5,096	$2,025
Jefferson	$512	$217	$730	$288
Josephine	$1,032	$526	$1,558	$745
Klamath	$2,321	$858	$3,179	$1,035
Lake	$2,114	$377	$2,490	$283
Lane	$5,687	$2,220	$7,907	$3,047
Lincoln	$1,167	$441	$1,607	$482
Linn	$1,879	$897	$2,776	$1,392
Malheur	$1,704	$453	$2,157	$460
Marion	$2,473	$1,245	$3,718	$1,660
Morrow	$2,377	$275	$2,652	$185
Multnomah	$2,320	$1,067	$3,387	$2,662
Polk	$647	$310	$957	$830
Sherman	$448	$298	$746	$223
Tillamook	$1,789	$688	$2,477	$541
Umatilla	$2,851	$692	$3,543	$990
Union	$4,896	$539	$5,435	$596
Wallowa	$2,553	$217	$2,771	$217
Wasco	$1,459	$640	$2,099	$278
Washington	$2,516	$1,211	$3,727	$1,489
Wheeler	$1,101	...	$1,168	$103
Yamhill	$1,051	$529	$1,580	$778
State	**$81,326**	**$23,132**	**$104,458**	**$31,574**

* Travel-generated expenditures associated with overnight and day trips 50+ miles (one-way).
** Local Recreation expenditures associated with trips under 50 miles.
.... Sample size too small to report data reliably.

Note: Resident and nonresident expenditures associated with hunting in Oregon.
Source: Dean Runyan Associates.

Table 19. Expenditures for Wildlife Viewing by Trip Type for Counties, 2008

County	Travel-Generated Expenditures* ($000s) Overnight	Day	Total	Local Recreation Expenditures** ($000s)
Baker	$7,709	$550	$8,259	$317
Benton	$4,556	$385	$4,941	...
Clackamas	$19,013	$2,619	$21,632	$621
Clatsop	$51,349	$4,132	$55,481	$2,715
Columbia	$2,914	$453	$3,367	$134
Coos	$11,376	$2,735	$14,111	$1,637
Crook	$6,331	$439	$6,769	$218
Curry	$9,438	$585	$10,022	$309
Deschutes	$39,719	$3,052	$42,771	$1,520
Douglas	$7,909	$1,788	$9,698	$835
Gilliam	...	$163	$163	$106
Grant	$3,107	...	$3,147	...
Harney	$7,825	$128	$7,953	...
Hood River	$8,214	$4,791	$13,005	$3,249
Jackson	$14,803	$3,861	$18,664	$1,906
Jefferson	$9,247	$349	$9,596	$170
Josephine	$5,292	$1,403	$6,695	$648
Klamath	$12,269	$1,725	$13,993	$938
Lake	$4,842	...	$4,940	...
Lane	$21,961	$5,609	$27,570	$2,714
Lincoln	$47,820	$5,409	$53,229	$3,557
Linn	$3,010	$1,104	$4,114	$391
Malheur	$961	$384	$1,345	$167
Marion	$12,949	$3,412	$16,360	$1,408
Morrow	$4,774	$168	$4,942	...
Multnomah	$22,487	$9,025	$31,511	$3,835
Polk	$762	$1,613	$2,375	$883
Sherman	$1,183	...	$1,193	...
Tillamook	$16,104	$2,465	$18,569	$1,607
Umatilla	$8,264	$1,439	$9,703	$741
Union	$3,934	$384	$4,318	$170
Wallowa	$4,967	$205	$5,172	$115
Wasco	$6,305	$1,495	$7,800	$945
Washington	$11,535	$3,691	$15,226	$796
Wheeler	$117	...	$146	...
Yamhill	$2,389	$919	$3,308	$330
State	**$395,430**	**$66,657**	**$462,087**	**$33,173**

* Travel-generated expenditures associated with overnight and day trips 50+ miles (one-way).
** Local Recreation expenditures associated with trips under 50 miles.
.... Sample size too small to report data reliably.

Note: Resident and nonresident expenditures associated with wildlife viewing in Oregon.
Source: Dean Runyan Associates.

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APPENDIX A

Trip Characteristics by Activity

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Table A-1. Travel Characteristics of Oregon Freshwater Anglers: 2008

	Oregon Residents				Nonresidents		
	Travel Characteristics			Local	Travel Characteristics		
	Overnight	Day	Total	Recreation	Overnight	Day	Total
Purpose of Trip							
Primary Reason	63.7%	87.4%	74.9%	93.1%	72.5%	85.4%	78.2%
One Of Several Reasons	33.3%	11.3%	22.9%	5.9%	24.8%	8.6%	17.7%
Incidental Activity	2.9%	1.3%	2.1%	1.1%	2.7%	6.0%	4.1%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Type of Accommodation							
Hotel, Motel, Rented Cabin	72.3%	NA	72.3%	NA	51.4%	NA	51.4%
Campground/Camping	20.4%	NA	20.4%	NA	39.4%	NA	39.4%
Friends/Relatives	11.3%	NA	11.3%	NA	19.0%	NA	19.0%
Second Home	7.4%	NA	7.4%	NA	2.9%	NA	2.9%
Total *	111.4%		111.4%		112.7%		112.7%
Number of Nights							
1 Night	9.6%	NA	9.6%	NA	7.4%	NA	7.4%
2 Nights	28.8%	NA	28.8%	NA	16.9%	NA	16.9%
3-4 Nights	32.3%	NA	32.3%	NA	32.7%	NA	32.7%
5-6 Nights	13.1%	NA	13.1%	NA	23.0%	NA	23.0%
7-13 Nights	11.7%	NA	11.7%	NA	13.4%	NA	13.4%
14+ Nights	4.5%	NA	4.5%	NA	6.5%	NA	6.5%
Total	100.0%		100.0%		100.0%		100.0%
Miles Traveled							
less than 50	10.3%	NA	5.4%	100.0%	4.2%	20.5%	11.2%
50-99	28.7%	72.5%	49.5%	NA	11.3%	44.7%	25.6%
100-199	41.8%	22.8%	32.8%	NA	21.5%	16.9%	19.5%
200-299	12.1%	4.3%	8.4%	NA	12.9%	4.0%	9.1%
300+	7.1%	0.3%	3.9%	NA	50.1%	13.9%	34.5%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Average Party Size							
Number of Adults	2.6	2.2	2.4	2.0	2.6	2.0	2.3
with Oregon License	2.3	2.0	2.2	1.7	2.2	1.7	2.0
Number of Children	0.8	0.5	0.7	0.4	0.2	0.3	0.2
Travel Companions							
Just Myself	5.0%	6.7%	5.8%	12.8%	7.8%	5.5%	6.8%
Immediate Family Only	46.2%	38.0%	42.4%	36.1%	37.2%	30.3%	34.1%
Multiple Families	22.0%	20.3%	21.2%	14.8%	25.0%	27.0%	25.9%
Other Adult Friends	23.6%	29.6%	26.4%	30.2%	26.2%	32.2%	29.0%
Other	3.3%	5.5%	4.3%	6.0%	3.7%	4.9%	4.2%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Freshwater Species Fished							
Trout	66.6%	54.8%	61.0%	54.9%	46.9%	53.6%	49.9%
Salmon	21.2%	35.4%	27.9%	34.1%	24.4%	26.9%	25.5%
Steelhead	23.3%	34.3%	28.5%	35.9%	35.8%	29.5%	33.0%
Bass	22.6%	18.0%	20.4%	23.3%	17.9%	24.0%	20.6%
Sturgeon	7.1%	10.4%	8.6%	10.5%	6.2%	6.7%	6.4%
Other	13.6%	10.4%	12.1%	7.8%	14.9%	13.7%	14.3%
Total *	154.4%	163.3%	158.5%	166.5%	146.1%	154.4%	149.7%

* Detail may total more than 100% due to multiple response.
Note: Local Recreation represents local trips of less than 50 miles (one-way).
Source: Dean Runyan Associates.

Table A-2. Travel Characteristics of Oregon Saltwater Anglers: 2008

	Oregon Residents				Nonresidents		
	Travel Characteristics			Local	Travel Characteristics		
	Overnight	Day	Total	Recreation	Overnight	Day	Total
Purpose of Trip							
Primary Reason	80.5%	87.1%	83.4%	94.2%	69.8%	85.1%	75.2%
One Of Several Reasons	19.5%	12.9%	16.6%	5.8%	30.2%	10.6%	23.3%
Incidental Activity	0.0%	0.0%	0.0%	0.0%	0.0%	4.3%	1.5%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Type of Accommodation							
Hotel, Motel, Rented Cabin	36.2%	NA	36.2%	NA	39.2%	NA	39.2%
Campground/Camping	50.1%	NA	50.1%	NA	24.3%	NA	24.3%
Friends/Relatives	17.5%	NA	17.5%	NA	32.4%	NA	32.4%
Second Home	13.7%	NA	13.7%	NA	18.9%	NA	18.9%
Total *	117.5%		117.5%		114.8%		114.8%
Number of Nights							
1 Night	12.8%	NA	12.8%	NA	7.1%	NA	7.1%
2 Nights	31.9%	NA	31.9%	NA	21.2%	NA	21.2%
3-4 Nights	27.6%	NA	27.6%	NA	30.6%	NA	30.6%
5-6 Nights	6.0%	NA	6.0%	NA	9.4%	NA	9.4%
7-13 Nights	15.6%	NA	15.6%	NA	5.9%	NA	5.9%
14+ Nights	6.2%	NA	6.2%	NA	25.9%	NA	25.9%
Total	100.0%		100.0%		100.0%		100.0%
Miles Traveled							
less than 50	1.5%	NA	0.8%	100.0%	2.4%	18.4%	8.2%
50-99	43.9%	63.1%	52.7%	NA	25.9%	6.1%	18.7%
100-199	44.7%	34.9%	40.2%	NA	20.0%	20.4%	20.1%
200-299	7.0%	1.7%	4.6%	NA	22.4%	42.9%	29.9%
300+	3.0%	0.2%	1.7%	NA	29.4%	12.2%	23.1%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Average Party Size							
Number of Adults	2.8	2.6	2.7	2.1	2.6	1.3	1.3
with Oregon License	2.5	2.4	2.4	2.0	2.6	1.1	1.1
Number of Children	0.6	0.5	0.6	0.3	0.1	0.4	0.4
Travel Companions							
Just Myself	2.1%	0.8%	1.6%	6.3%	1.4%	2.0%	1.7%
Immediate Family Only	47.3%	38.9%	43.7%	22.5%	39.4%	22.4%	32.5%
Multiple Families	26.2%	17.5%	22.4%	16.2%	32.4%	28.6%	30.8%
Other Adult Friends	19.8%	38.0%	27.6%	51.5%	26.8%	46.9%	35.0%
Other	4.6%	4.8%	4.7%	3.5%	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Saltwater Species Fished							
Salmon	65.0%	63.8%	43.5%	62.6%	69.8%	67.5%	70.4%
Halibut	22.8%	35.2%	19.2%	22.2%	26.7%	57.5%	34.1%
Tuna	17.5%	21.9%	13.2%	17.4%	27.9%	55.0%	39.3%
Rock/Bottom	49.2%	55.1%	35.0%	69.5%	45.3%	75.0%	57.8%
Perch	12.8%	13.7%	8.9%	11.9%	4.7%	7.5%	5.2%
Other	18.7%	17.0%	12.1%	13.7%	9.3%	5.0%	7.4%
Total *	186.0%	206.7%	131.8%	197.3%	183.7%	267.5%	214.1%

* Detail may total more than 100% due to multiple response.
Note: Local Recreation represents local trips of less than 50 miles (one-way).
Source: Dean Runyan Associates.

Table A-3. Travel Characteristics of Oregon Shellfishers: 2008

	Oregon Residents				Nonresidents		
	Travel Characteristics			Local	Travel Characteristics		
	Overnight	Day	Total	Recreation	Overnight	Day	Total
Purpose of Trip							
Primary Reason	39.6%	74.3%	56.0%	89.5%	25.4%	40.8%	28.9%
One Of Several Reasons	54.5%	21.5%	38.9%	10.0%	60.2%	45.1%	56.8%
Incidental Activity	5.9%	4.3%	5.1%	0.6%	14.3%	14.1%	14.3%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Type of Accommodation							
Hotel, Motel, Rented Cabin	22.8%	NA	22.8%	NA	30.7%	NA	30.7%
Campground/Camping	50.4%	NA	50.4%	NA	58.2%	NA	58.2%
Friends/Relatives	15.2%	NA	15.2%	NA	19.3%	NA	19.3%
Second Home	20.3%	NA	20.3%	NA	9.4%	NA	9.4%
Total *	108.7%		108.7%		117.6%		117.6%
Number of Nights							
1 Night	13.5%	NA	13.5%	NA	1.7%	NA	1.7%
2 Nights	30.7%	NA	30.7%	NA	9.4%	NA	9.4%
3-4 Nights	24.5%	NA	24.5%	NA	17.1%	NA	17.1%
5-6 Nights	10.4%	NA	10.4%	NA	15.4%	NA	15.4%
7-13 Nights	9.8%	NA	9.8%	NA	25.2%	NA	25.2%
14+ Nights	11.2%	NA	11.2%	NA	31.2%	NA	31.2%
Total	100.0%		100.0%		100.0%		100.0%
Miles Traveled							
less than 50	3.4%	NA	1.8%	100.0%	0.4%	50.0%	12.3%
50-99	49.5%	69.9%	59.2%	NA	2.1%	9.2%	3.8%
100-199	35.6%	28.4%	32.2%	NA	16.7%	35.5%	21.2%
200-299	8.6%	1.2%	5.1%	NA	8.8%	0.0%	6.6%
300+	2.9%	0.5%	1.8%	NA	72.1%	5.3%	56.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Average Party Size							
Number of Adults	3.0	2.7	2.8	2.5	2.9	3.3	3.0
with Oregon License	2.7	2.5	2.6	2.5	2.4	2.9	2.5
Number of Children	0.7	0.5	0.6	0.5	0.6	0.3	0.5
Travel Companions							
Just Myself	1.9%	4.1%	3.0%	15.3%	4.3%	3.5%	4.2%
Immediate Family Only	39.6%	40.6%	40.1%	41.7%	59.7%	31.6%	54.2%
Multiple Families	22.0%	8.6%	15.6%	7.6%	20.3%	7.0%	17.7%
Other Adult Friends	33.4%	44.8%	38.8%	34.8%	15.6%	57.9%	24.0%
Other Travel Party	3.1%	1.8%	2.5%	0.7%	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Shellfish Harvested							
Crabs	79.8%	71.4%	75.9%	70.0%	91.8%	92.4%	91.9%
Razor Clams	26.9%	28.7%	27.8%	30.1%	13.5%	22.7%	15.5%
Bay Clams	25.5%	12.8%	19.6%	28.5%	27.0%	34.8%	28.7%
Mussels	5.4%	2.1%	3.9%	3.4%	0.4%	1.5%	0.6%
Rock Scallops	0.7%	1.1%	0.9%	0.0%	0.0%	0.0%	0.0%
Sand/Mud Shrimps	6.1%	6.2%	6.1%	10.6%	0.0%	0.0%	0.0%
Other	0.9%	2.8%	1.8%	2.4%	0.4%	7.6%	1.9%
Total *	145.3%	125.1%	135.9%	145.0%	133.1%	159.0%	138.7%

* Detail may total more than 100% due to multiple response.
Note: Local Recreation represents local trips of less than 50 miles (one-way).
Source: Dean Runyan Associates.

Table A-4. Travel Characteristics of Oregon Hunters: 2008

	Oregon Residents				Nonresidents		
	Travel Characteristics			Local	Travel Characteristics		
	Overnight	Day	Total	Recreation	Overnight	Day	Total
Purpose of Trip							
Primary Reason	91.5%	90.4%	91.1%	93.3%	93.6%	88.5%	91.6%
One Of Several Reasons	8.1%	9.1%	8.5%	6.1%	6.3%	9.3%	7.4%
Incidental Activity	0.4%	0.6%	0.5%	0.6%	0.1%	2.2%	0.9%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Type of Accommodation							
Hotel, Motel, Rented Cabin	13.3%	NA	13.3%	NA	30.1%	NA	30.1%
Campground/Camping	80.3%	NA	80.3%	NA	54.3%	NA	54.3%
Friends/Relatives	9.5%	NA	9.5%	NA	29.7%	NA	29.7%
Second Home	6.8%	NA	6.8%	NA	6.1%	NA	6.1%
Total *	109.9%		109.9%		120.2%		120.2%
Number of Nights							
1 Night	3.5%	NA	3.5%	NA	3.7%	NA	3.7%
2 Nights	13.9%	NA	13.9%	NA	13.6%	NA	13.6%
3-4 Nights	20.3%	NA	20.3%	NA	19.8%	NA	19.8%
5-6 Nights	20.3%	NA	20.3%	NA	19.7%	NA	19.7%
7-13 Nights	33.2%	NA	33.2%	NA	31.3%	NA	31.3%
14+ Nights	8.8%	NA	8.8%	NA	11.9%	NA	11.9%
Total	100.0%		100.0%		100.0%		100.0%
Miles Traveled							
less than 50	11.5%	NA	7.4%	100.0%	4.0%	17.6%	9.3%
50-99	22.4%	69.4%	39.0%	NA	9.0%	43.6%	22.4%
100-199	25.4%	24.3%	25.0%	NA	15.0%	20.0%	16.9%
200-299	20.5%	3.3%	14.4%	NA	14.0%	5.6%	10.7%
300+	20.1%	3.1%	14.1%	NA	58.1%	13.3%	40.7%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Average Party Size							
Number of Adults	2.8	2.2	2.5	2.0	2.5	2.3	2.4
with Oregon License	2.7	2.1	2.2	1.9	2.3	2.3	2.4
Number of Children	0.5	0.4	0.4	0.4	0.2	0.2	0.2
Travel Companions							
Just Myself	16.2%	6.5%	12.8%	3.2%	10.2%	2.2%	7.1%
Immediate Family Only	29.5%	41.7%	33.9%	36.1%	25.5%	24.3%	25.0%
Multiple Families	44.9%	38.1%	42.5%	38.1%	55.1%	58.3%	56.3%
Other Adult Friends	3.8%	2.4%	3.3%	2.2%	2.6%	3.2%	2.8%
Other Travel Party	5.6%	11.3%	7.6%	20.4%	6.6%	12.1%	8.7%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Game Hunted During Trip							
Deer	54.0%	54.2%	54.1%	68.0%	41.2%	20.8%	33.4%
Elk	58.3%	35.3%	50.3%	36.2%	39.3%	20.4%	32.1%
Wild Turkey	5.0%	5.8%	5.3%	5.9%	3.2%	2.2%	2.8%
Other Big Game	9.1%	10.2%	9.5%	9.1%	2.5%	1.5%	2.1%
Upland Game Birds	15.8%	23.7%	18.6%	18.2%	25.7%	48.0%	34.2%
Waterfowl	6.3%	11.0%	7.9%	18.3%	16.9%	22.2%	18.9%
Other	5.4%	7.9%	6.3%	4.2%	4.5%	6.0%	5.1%
Total *	153.9%	148.1%	151.8%	159.9%	133.3%	121.1%	128.7%

* Detail may total more than 100% due to multiple response.
Note: Local Recreation represents local trips of less than 50 miles (one-way).
Source: Dean Runyan Associates.

Table A-5. Travel Characteristics of Oregon Wildlife Viewers: 2008
(where wildlife viewing activity occurred)

	Oregon Residents			
	Travel Characteristics			Local
	Overnight	Day	Total	Recreation
Purpose of Trip				
Primary Reason	15.7%	20.5%	17.4%	22.5%
One Of Several Reasons	38.3%	38.6%	38.4%	47.9%
Incidental Activity	46.0%	40.9%	44.2%	29.6%
Total	100.0%	100.0%	100.0%	100.0%
Type of Accommodation				
Hotel, Motel, Rented Cabin	36.6%	NA	36.6%	NA
Campground/Camping	35.7%	NA	35.7%	NA
Friends/Relatives	13.7%	NA	13.7%	NA
Second Home	4.8%	NA	4.8%	NA
Other	15.2%	NA	15.2%	NA
Total *	106.0%		106.0%	
Number of Nights				
1 Night	24.3%	NA	24.3%	NA
2 Nights	37.3%	NA	37.3%	NA
3-4 Nights	21.3%	NA	21.3%	NA
5-6 Nights	8.2%	NA	8.2%	NA
7-13 Nights	5.9%	NA	5.9%	NA
14+ Nights	3.0%	NA	3.0%	NA
Total	100.0%		100.0%	
Miles Traveled				
less than 50	10.4%	NA	6.7%	100.0%
50-99	29.7%	76.2%	46.1%	NA
100-199	30.6%	17.8%	26.0%	NA
200-299	17.2%	2.8%	12.1%	NA
300+	12.2%	3.2%	9.0%	NA
Total	100.0%	100.0%	100.0%	100.0%
Average Party Size				
Number of Adults	2.8	2.6	2.7	2.4
Number of Children	1.2	0.5	0.9	0.8
Travel Companions				
Just Myself	7.4%	9.9%	8.3%	15.1%
Immediate Family Only	52.6%	58.3%	54.6%	56.8%
Multiple Families	15.7%	5.7%	12.1%	7.6%
Other Adult Friends	20.6%	25.6%	22.4%	18.2%
Other Travel Party	3.7%	0.6%	2.6%	2.3%
Total	100.0%	100.0%	100.0%	100.0%
Wildlife Viewed				
Birds	90.6%	88.4%	89.8%	85.4%
Land Animals	83.5%	76.9%	81.1%	71.4%
Marine Mammals	18.4%	17.1%	17.9%	10.5%
Marine Life/Tidepools	16.9%	14.4%	16.0%	9.0%
Fish	29.2%	23.3%	27.1%	27.2%
Amphibians/Reptiles	17.3%	8.7%	14.2%	11.9%
Other	4.4%	2.7%	3.8%	4.8%
Total *	260.3%	231.5%	250.0%	220.2%

* Detail may total more than 100% due to multiple response.
Note: Local Recreation represents local trips of less than 50 miles (one-way).
Source: Dean Runyan Associates.

Table A-6. Travel Characteristics of Oregon Wildlife Viewers : 2008

(where wildlife viewing was the primary reason of trip)

	Oregon Residents			
	Travel Characteristics			Local
	Overnight	Day	Total	Recreation
Purpose of Trip				
Primary Reason	100.0%	100.0%	100.0%	100.0%
One Of Several Reasons	0.0%	0.0%	0.0%	0.0%
Incidental Activity	0.0%	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%	100.0%
Type of Accommodation				
Hotel, Motel, Rented Cabin	16.4%	NA	16.4%	NA
Campground/Camping	48.0%	NA	48.0%	NA
Friends/Relatives	7.5%	NA	7.5%	NA
Second Home	0.0%	NA	0.0%	NA
Other	30.1%	NA	30.1%	NA
Total *	102.0%		102.0%	
Number of Nights				
1 Night	8.9%	NA	8.9%	NA
2 Nights	34.2%	NA	34.2%	NA
3-4 Nights	26.0%	NA	26.0%	NA
5-6 Nights	14.4%	NA	14.4%	NA
7-13 Nights	6.8%	NA	6.8%	NA
14+ Nights	9.6%	NA	9.6%	NA
Total	100.0%		100.0%	
Miles Traveled				
less than 50	10.6%	NA	6.5%	100.0%
50-99	36.2%	91.1%	57.6%	NA
100-199	23.4%	4.4%	16.0%	NA
200-299	16.3%	1.1%	10.4%	NA
300+	13.5%	3.3%	9.5%	NA
Total	100.0%	100.0%	100.0%	100.0%
Average Party Size				
Number of Adults	2.6	2.8	2.7	2.1
Number of Children	1.1	0.6	0.9	1.0
Travel Companions				
Just Myself	7.5%	16.8%	11.5%	31.3%
Immediate Family Only	45.9%	52.3%	48.6%	42.2%
Multiple Families	13.7%	9.3%	11.9%	7.8%
Other Adult Friends	24.7%	21.5%	23.3%	3.1%
Other Travel Party	8.2%	0.0%	4.7%	15.6%
Total	100.0%	100.0%	100.0%	100.0%
Wildlife Viewed				
Birds	82.9%	83.2%	83.0%	57.8%
Land Animals	80.8%	57.0%	70.8%	95.3%
Marine Mammals	12.3%	15.9%	13.8%	0.0%
Marine Life/Tidepools	9.6%	11.2%	10.3%	0.0%
Fish	29.5%	29.9%	29.6%	15.6%
Amphibians/Reptiles	19.2%	2.8%	12.3%	0.0%
Other	9.6%	5.6%	7.9%	0.0%
Total *	243.9%	205.6%	227.7%	168.7%

* Detail may total more than 100% due to multiple response.
Note: Local Recreation represents local trips of less than 50 miles (one-way).
Source: Dean Runyan Associates.

APPENDIX B

Demographics

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Table B-1. Demographic Characteristics and Preferred Communication: Residents versus Nonresidents

	Hunters		Shellfishers		Anglers		Wildlife Viewers*
	Res.	Nonres.	Res.	Nonres.	Res.	Nonres.	Res.
Household Income							
UNDER $25,000	8.3%	2.3%	10.7%	9.0%	13.4%	4.4%	16.2%
$25,000-$49,999	25.0%	11.3%	26.0%	16.0%	27.6%	15.8%	30.5%
$50,000-$74,999	28.2%	23.2%	29.1%	34.0%	25.5%	24.2%	21.9%
$75,000-$99,999	18.5%	19.5%	15.2%	23.0%	16.8%	20.5%	13.1%
$100,000 OR MORE	20.0%	43.6%	19.0%	18.0%	16.7%	35.1%	18.2%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
Education							
Some High School Or H.S. Diploma	32.3%	20.7%	28.5%	23.1%	29.6%	20.1%	23.1%
Some College Or 2-Year Degree	40.3%	33.9%	40.0%	43.3%	39.6%	31.2%	36.5%
Bachelors Degree	18.5%	27.7%	18.9%	20.2%	18.1%	24.9%	23.6%
Advanced Degree	8.9%	17.7%	12.6%	13.5%	12.6%	23.7%	16.8%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
Preferred Communication with ODFW							
Email	14.4%	18.0%	14.7%	16.7%	13.0%	17.7%	24.3%
ODFW Printed Brochures	22.9%	16.9%	19.8%	23.5%	21.9%	14.8%	6.2%
Information At License Vendors	14.3%	6.0%	14.2%	14.7%	15.6%	14.0%	3.4%
ODFW Website	20.8%	30.5%	23.9%	19.6%	24.3%	26.4%	64.2%
Direct Mail	25.2%	26.1%	24.0%	23.5%	21.6%	24.1%	0.6%
Other	2.4%	2.5%	3.4%	2.0%	3.7%	3.0%	1.2%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

* Oregon Residents who reported either planned or unplanned wildlife viewing activity in 2008.
Note: Detail may total more than 100% due to multiple response.

Source: Dean Runyan Associates.

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APPENDIX C

Number of Trips and Days of Participation by Activity

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Table C-1. Freshwater Fishing Trips in Oregon by Type of Fish (in Thousands), 2008

	Trout	Salmon	Steelhead	Bass	Sturgeon	Other	Total
Willamette Valley							
Overnight	47	4	5	4	0	7	67
Day (50+ miles)	101	20	31	9	0	11	173
Local (under 50 miles)	280	81	103	101	13	19	597
North Coast							
Overnight	15	28	13	6	5	4	72
Day (50+ miles)	34	81	71	8	10	12	216
Local (under 50 miles)	39	28	18	5	11	0	101
Central Coast							
Overnight	29	26	17	13	6	7	97
Day (50+ miles)	40	61	45	26	12	11	194
Local (under 50 miles)	38	35	33	13	5	6	132
South Coast							
Overnight	8	20	12	4	0	1	46
Day (50+ miles)	9	14	10	15	0	2	52
Local (under 50 miles)	20	23	28	16	0	0	87
Portland Metro/Columbia							
Overnight	2	5	4	2	5	0	18
Day (50+ miles)	15	26	20	7	14	1	83
Local (under 50 miles)	82	194	135	35	109	9	564
Southern							
Overnight	72	3	10	15	2	7	109
Day (50+ miles)	107	24	38	25	0	13	207
Local (under 50 miles)	125	67	109	63	5	14	382
Central							
Overnight	126	5	26	22	0	16	195
Day (50+ miles)	114	16	35	15	0	11	191
Local (under 50 miles)	161	9	21	33	0	25	248
Eastern							
Overnight	52	8	17	50	3	26	156
Day (50+ miles)	49	5	12	42	4	26	139
Local (under 50 miles)	55	23	47	56	7	21	209
Mt. Hood/Gorge							
Overnight	15	9	16	8	3	4	56
Day (50+ miles)	35	35	32	9	18	3	131
Local (under 50 miles)	43	55	46	21	24	14	204
Statewide Total							
Overnight	367	107	119	125	25	74	817
Day (50+ miles)	505	283	294	156	60	90	1,386
Local (under 50 miles)	842	516	540	343	173	109	2,523
Total Trips	1,713	906	953	624	258	272	4,726

.... Sample size too small to report data reliably.

Note: Trip estimates are for Oregon residents and nonresidents. Detail may not add to total due to rounding.

Source: Dean Runyan Associates.

Table C-2. Saltwater Fishing Trips in Oregon by Type of Fish (in Thousands), 2008

	Salmon	Other Marine/Saltwater	Total
North Coast			
Overnight	64	11	76
Day (50+ miles)	68	35	103
Local (under 50 miles)	4	3	7
Central Coast			
Overnight	49	33	82
Day (50+ miles)	89	40	128
Local (under 50 miles)	11	1	12
South Coast			
Overnight	13	19	31
Day (50+ miles)	26	38	64
Local (under 50 miles)	4	7	11
Statewide Total			
Overnight	126	63	189
Day (50+ miles)	182	113	295
Local (under 50 miles)	20	11	31
Total Trips	328	186	514

.... Sample size too small to report data reliably.
Note: Trip estimates are for Oregon residents and nonresidents. Detail may not add to total due to rounding.
Source: Dean Runyan Associates.

Table C-3. Shellishing Trips in Oregon by Type of Harvest (in Thousands), 2008

	Crabs	Razor Clams	Bay Clams	Mussels	Rock Scallops	Sand/Mud Shrimps	Other	Total
North Coast								
Overnight	30	19	10	1	1	1	1	63
Day (50+ miles)	26	28	7	1	0	7	4	72
Local (under 50 miles)	27	20	11	0	0	6	0	64
Central Coast								
Overnight	38	6	9	3	0	1	0	57
Day (50+ miles)	49	3	4	5	1	1	1	64
Local (under 50 miles)	34	6	7	3	0	3	0	54
South Coast								
Overnight	17	4	6	1	0	2	0	29
Day (50+ miles)	11	1	5	0	0	1	1	19
Local (under 50 miles)	28	6	12	2	0	2	0	50
Statewide Total								
Overnight	84	30	26	5	1	4	1	149
Day (50+ miles)	86	32	16	5	1	9	6	155
Local (under 50 miles)	89	32	30	5	0	11	0	167
Total Trips	259	93	72	15	2	24	7	471

.... Sample size too small to report data reliably.
Note: Trip estimates are for Oregon residents and nonresidents. Detail may not add to total due to rounding.
Source: Dean Runyan Associates.

Table C-4. Hunting Trips in Oregon by Type of Game (in Thousands), 2008

	Deer	Elk	Other Big Game	Game Birds	Waterfowl	Wild Turkey	Other	Total
Willamette Valley								
Overnight	7	8	2	1	0	0	1	18
Day (50+ miles)	39	14	5	8	10	6	3	85
Local (under 50 miles)	136	51	18	23	46	14	7	294
North Coast								
Overnight	4	10	0	2	2	0	0	18
Day (50+ miles)	22	17	3	3	2	1	0	50
Local (under 50 miles)	15	13	2	4	2	0	0	37
Central Coast								
Overnight	3	6	2	0	0	1	0	12
Day (50+ miles)	6	7	1	4	5	0	0	23
Local (under 50 miles)	9	10	3	2	2	0	1	27
South Coast								
Overnight	1	4	1	0	0	0	1	7
Day (50+ miles)	8	5	3	2	0	0	0	19
Local (under 50 miles)	17	8	5	4	2	2	1	40
Portland Metro/Columbia								
Overnight	1	1	0	0	0	0	0	3
Day (50+ miles)	12	13	0	0	2	0	0	28
Local (under 50 miles)	58	42	5	12	26	0	2	144
Southern								
Overnight	20	15	2	6	2	2	2	49
Day (50+ miles)	39	19	9	16	6	2	2	92
Local (under 50 miles)	78	32	11	24	15	6	4	170
Central								
Overnight	18	12	2	2	1	1	2	38
Day (50+ miles)	19	14	1	7	5	2	4	52
Local (under 50 miles)	36	24	1	7	9	4	6	87
Eastern								
Overnight	53	66	10	20	6	7	7	169
Day (50+ miles)	30	30	7	28	6	5	5	111
Local (under 50 miles)	37	26	5	23	13	10	5	119
Mt. Hood/Gorge								
Overnight	4	1	0	1	0	1	1	9
Day (50+ miles)	5	3	2	3	0	1	2	15
Local (under 50 miles)	19	10	5	3	0	1	3	41
Statewide Total								
Overnight	110	123	19	32	12	12	13	322
Day (50+ miles)	181	121	32	71	37	17	15	475
Local (under 50 miles)	404	216	55	101	115	39	28	958
Total Trips	695	460	107	204	164	68	57	1,754

.... Sample size too small to report data reliably.
Note: Trip estimates are for Oregon residents and nonresidents. Detail may not add to total due to rounding.
Source: Dean Runyan Associates.

Table C-5. Wildlife Viewing Trips in Oregon by Type of Wildlife Viewed (in Thousands), 2008

	Birds	Land Animals*	Marine Mammals	Tidepools	Fish	Reptiles	Other	Total
Willamette Valley								
Overnight	123	114	...	...	42	18	6	316
Day (50+ miles)	163	141	...	...	27	5	5	364
Local (under 50 miles)	738	495	...	...	149	112	19	1,615
North Coast								
Overnight	259	192	87	139	86	34	0	797
Day (50+ miles)	120	104	28	28	40	16	8	344
Local (under 50 miles)	49	46	17	17	16	3	4	153
Central Coast								
Overnight	194	162	117	81	64	11	4	632
Day (50+ miles)	139	82	67	67	29	5	0	388
Local (under 50 miles)	111	63	44	40	36	4	4	301
South Coast								
Overnight	76	65	34	10	28	14	10	237
Day (50+ miles)	50	45	30	10	20	0	0	155
Local (under 50 miles)	69	46	33	25	25	10	5	214
Portland Metro/Columbia								
Overnight	85	63	...	...	6	0	0	154
Day (50+ miles)	119	96	...	...	16	8	0	239
Local (under 50 miles)	1,085	757	...	...	303	101	50	2,347
Southern								
Overnight	176	159	...	...	56	30	13	450
Day (50+ miles)	132	151	...	...	25	19	0	334
Local (under 50 miles)	451	419	...	...	63	73	31	1,048
Central								
Overnight	274	252	...	...	86	54	16	687
Day (50+ miles)	55	59	...	...	25	8	0	152
Local (under 50 miles)	167	202	...	...	63	35	0	480
Eastern								
Overnight	183	210	...	...	39	31	16	494
Day (50+ miles)	68	62	...	...	8	3	0	141
Local (under 50 miles)	170	188	...	...	23	6	6	393
Mt. Hood/Gorge								
Overnight	89	84	...	...	42	28	0	262
Day (50+ miles)	217	166	...	...	77	26	13	524
Local (under 50 miles)	192	156	...	...	82	18	18	476
Statewide Total								
Overnight	1,459	1,302	278	259	448	219	64	4,029
Day (50+ miles)	1,063	906	159	129	267	90	26	2,641
Local (under 50 miles)	3,032	2,372	208	154	761	362	138	7,027
Total Trips	5,554	4,580	645	541	1,477	671	229	13,697

* Land Animals include deer, elk, bear, squirrels, chipmunks.
... Sample size too small to report data reliably.
Note: Trip estimates are for Oregon residents and nonresidents. Detail may not add to total due to rounding.
Source: Dean Runyan Associates.

Table C-6. Days of Participation in Oregon by Type of Activitiy (in Thousands), 2008

		Fishing				
	Shellfish	Saltwater	Freshwater	Hunting	Wildlife	Total
Willamette Valley						
Overnight			277	104	947	1,327
Day (50+ miles)			173	85	364	621
Local (under 50 miles)			597	294	1,615	2,506
North Coast						
Overnight	282	319	295	103	2,392	3,391
Day (50+ miles)	72	103	216	50	344	784
Local (under 50 miles)	64	7	101	37	153	361
Central Coast						
Overnight	257	343	398	68	1,896	2,962
Day (50+ miles)	64	128	194	23	388	799
Local (under 50 miles)	54	12	132	27	301	526
South Coast						
Overnight	132	132	189	40	712	1,205
Day (50+ miles)	19	64	52	19	155	308
Local (under 50 miles)	50	11	87	40	214	401
Portland Metro/Columbia						
Overnight			74	15	463	552
Day (50+ miles)			83	28	239	350
Local (under 50 miles)			564	144	2,347	3,055
Southern						
Overnight			447	286	1,350	2,083
Day (50+ miles)			207	92	334	634
Local (under 50 miles)			382	170	1,048	1,600
Central						
Overnight			801	218	2,060	3,079
Day (50+ miles)			191	52	152	395
Local (under 50 miles)			248	87	480	815
Eastern						
Overnight			641	981	1,481	3,103
Day (50+ miles)			139	111	141	391
Local (under 50 miles)			209	119	393	721
Mt. Hood/Gorge						
Overnight			230	51	787	1,067
Day (50+ miles)			131	15	524	670
Local (under 50 miles)			204	41	476	721
Statewide Total						
Overnight	672	794	3,351	1,865	12,088	17,304
Day (50+ miles)	155	295	1,386	475	2,641	4,502
Local (under 50 miles)	167	31	2,523	958	7,027	10,508
Total Days	994	1,119	7,260	3,298	21,756	32,313

Note: Days of participation are for Oregon residents and nonresidents. Detail may not add to total due to rounding.
Source: Dean Runyan Associates.

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APPENDIX D

Detailed Questionnaires

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Dear Angler License Holder:

The Oregon Department of Fish and Wildlife and the Oregon Tourism Commission are sponsoring an economic survey on the importance of wildlife related recreation to Oregon's economy. Information gathered from this survey will help increase the understanding of the economic impact anglers have on Oregon's economy. The results will also help ODFW, the Oregon Fish and Wildlife Commission and local governments to more accurately identify the potential economic impacts of changes in wildlife management activities and will help ensure continued hunting, fishing and wildlife viewing opportunities in Oregon.

As a 2008 Oregon angler license holder, we ask that you help us by providing information about your fishing experience(s) in Oregon. The answers you supply will be used for statistical purposes only and will be kept strictly confidential.

Your thoughtful responses to the survey questions are important and **even if you have not yet fished in 2008, please complete the applicable question(s) and return the survey in the prepaid envelope provided.** Deadline for returning the questionnaire is October 31, 2008.

Thank you in advance for taking the time to thoughtfully complete this survey.

Sincerely,

Roy Elicker

Roy Elicker
Director of ODFW

For the purposes of answering the following questions, "**Fishing Trip**" is defined as:

You left your house and during the time you were away, spent at least some time fishing before returning home; include both day and overnight trips.

1. Did you fish in Oregon during the six months from **April 2008** through **September 2008**?

☐ No (If your answer is no, please go to question #16)
☐ Yes

2. Did you take any <u>saltwater</u> fishing trips in Oregon between **April 2008 and September 2008**?

☐ No (If your answer is no, please go to question #3)
☐ Yes → Number of Overnight saltwater fishing trips ______# overnight trips-saltwater
Number of day trips —50 or more miles from residence ______# 50+mile day trips-saltwater
Number of local trips — less than 50 miles from residence ______# local trips-saltwater
Number of Total Saltwater Fishing Days ______# total saltwater fishing days
Number Days using a paid guide or outfitter -saltwater trips only ______# days using guide-saltwater trips

3. Did you take any <u>freshwater</u> **fishing trips** in Oregon **between April 2008 and September 2008?** ***(Please do not include any trips mentioned in Question #2)***

☐ No

☐ Yes ➔ Number of Overnight freshwater fishing trips ______# overnight trips-freshwater

Number of day trips —50 or more miles from residence ______# 50+mile day trips-freshwater

Number of local trips — less than 50 miles from residence ______# local trips-freshwater

Number of Total Freshwater Fishing Days ______# total freshwater fishing days

Number Days using a paid guide or outfitter -freshwater trips only ______# days using guide-freshwater trips

Please tell us about a **single specific overnight fishing trip** that is most typical of any overnight trips that you may have taken from April 2008 through September 2008.

☐ No Overnight Trips – (If your answer is no, please go to question #10a)

4a. How many nights did you stay overnight in Oregon on this particular trip? __________# number of nights

4b. Using the community list on the back page (pg. 4), please write the number of the community (or nearest community) where you stayed overnight (if you stayed in more than one place please indicate your PRIMARY location):

__________ # of community

4c. Approximately how many miles, (one way) from your residence did you travel on this overnight trip?
__________# miles one way

4d. What type of accommodations in Oregon did you use while on this particular trip? ***(Check √ all that apply)***

☐ Hotel, motel, lodge, bed and breakfast, rented home/cabin
☐ Home of friends/relatives
☐ Your own second home
☐ Campground/camping

5. For this overnight trip, was fishing: ***(Check √ the one that best applies)***

☐ Primary reason for trip ☐ One of several reasons for this trip ☐ An incidental activity while on this trip

6. Which of the following best describes the people that accompanied you on this trip: ***(Check √ the one that best applies)***

☐ My immediate family only ☐ Other adult friend(s) ☐ Multiple families ☐ Just myself
☐ Other (specify)______________________

7. How many people were in your travel group on this overnight fishing trip?
(Count yourself but do not include other families or fishing partners/buddies who paid their own expenses.)

______ # of **adults** (age 18 years or older) ➔ ______ # adults with fishing license
______ # of **children** (age 17 or younger)

8. Please indicate the species fished for during this overnight trip. ***(Check √ all that apply)***

Freshwater		Marine/Saltwater	
☐ Bass/Warm water	☐ Sturgeon	☐ Halibut	☐ Salmon
☐ Salmon	☐ Trout	☐ Perch	☐ Tuna
☐ Steelhead	☐ Other ________	☐ Rock/Bottom	☐ Other ________

9. Please estimate the dollar amount spent by the group you traveled with that shared expenses for an average day (total # of people in your answer to Q.7.) Please check √ "No Expenses" if you had no expenses for an item.

Single Specific Overnight Fishing Trip Expenses	No Expenses	Average Expenses per travel group
Accommodations (hotel, motel room rentals, campground fees)	☐	$ _______ per day
Restaurants/Bars/Lounges (food/drink in restaurants and nightclubs, bars)	☐	$ _______ per day
Groceries, snacks (groceries, liquor and snacks/food from a store)	☐	$ _______ per day
Fuel/Gas/Transportation/Parking (car rental, fuel/gas for auto/boat/truck)	☐	$ _______ per day
Other Retail (bait, lures, gifts, clothing, souvenirs, etc.)	☐	$ _______ per day
Other Recreation & Entertainment (access fees, boat rental, admission fees, golf, etc.)	☐	$ _______ per day
Airfare (please provide total roundtrip airfare paid)	☐	$ _______ total amount
Paid Guide, Charter or Outfitter Fees (total paid on this trip)	☐	$ _______ total amount

Please tell us about a **single specific day fishing trip** that is most typical of **any** day trips that you may have taken from April 2008 through September 2008.

☐ No Day Trips – (Please go to Question #16)

10a. Using the community list on the back page (page 4), please write the number of the community (or closest community) to where you made the ***most*** trip-related purchases (e.g., restaurants, food stores, gasoline, etc). _______ # of community

10b. Approximately how many miles, (one way) from your residence did you travel on this day trip? _______ # miles one way

11. For this day trip, was fishing: *(Check √ the one that best applies)*

☐ Primary reason for trip ☐ One of several reasons for this trip ☐ An incidental activity while on this trip

12. Which of the following best describes the people that accompanied you on this day trip: *(Check √ the one that best applies)*

☐ My immediate family only ☐ Other adult friend(s) ☐ Multiple families ☐ Just myself
☐ Other (specify) ______________________

13. How many people were in your travel group on this day trip?
(Count yourself but do not include other families or fishing partners/buddies who paid their own expenses.)

_______ # of adults (age 18 years or older) ➔ _______ # adults with fishing license
_______ # of children (age 17 or younger)

14. Please indicate the species fished for during this day trip. *(Check √ all that apply)*

Freshwater		Marine/Saltwater	
☐ Bass/Warm water	☐ Sturgeon	☐ Halibut	☐ Salmon
☐ Salmon	☐ Trout	☐ Perch	☐ Tuna
☐ Steelhead	☐ Other ___________	☐ Rock/Bottom Fish	☐ Other ___________

15. Please estimate the dollar amount spent by the group you traveled with that shared expenses for the day. (total # of people in your answer to Q. 13) Please check √ "No Expenses" if you had no expenses for an item.

Single Specific Day Fishing Trip Expenses	No Expenses	Average Expenses per travel group
Restaurants/Bars/Lounges (food/drink in restaurants and nightclubs, bars)	☐	$ ______ for the day
Groceries, snacks (groceries, liquor and snacks/food from a store)	☐	$ ______ for the day
Fuel/Gas/Transportation/Parking (car rental, fuel/gas for auto/boat/truck)	☐	$ ______ for the day
Other Retail (bait, lures, gifts, clothing, souvenirs, etc.)	☐	$ ______ for the day
Other Recreation & Entertainment (access fees, boat rental, admission fees, golf, etc.)	☐	$ ______ for the day
Paid Guide, Charter or Outfitter Fees	☐	$ ______ for the day

16. During the six months from April 2008 through September 2008, how much did your household spend in total in Oregon for the following items? *(Please estimate the dollar amount as closely as possible.)* Please check √ "No Expenses" if you had no expenses for an item.

Total Household Expenditures	No Expenses	Expenses per household
Fishing Equipment (rods, reels, poles, lines, tackle, lures, electronics, etc.)	☐	$ ______ total
Clothing (waders, boots, vests, raingear, hats, gloves, etc.)	☐	$ ______ total
Related Equipment (camping equipment, safety gear, etc.)	☐	$ ______ total
Specialized Equipment (boats, campers, ATV, etc.)	☐	$ ______ total
Other Retail (processing, taxidermy costs, etc.)	☐	$ ______ total

17. Which of the following includes your total family income (before taxes) in 2007? *(Check √ one answer only)*

☐ Under $25,000 ☐ $25,000-$49,999 ☐ $50,000-$74,999 ☐ $75,000-$99,999 ☐ $100,000 or more

18. Please check your highest education level. *(Check √ one answer only)*

☐ Some high school or high school diploma
☐ Some college or 2-year degree
☐ Bachelors degree
☐ Advanced degree

19. What is your preferred way of communication with ODFW for information on fishing? *(Check √ one answer only)*

☐ Email (please provide) ______________________
☐ ODFW printed brochures or publications
☐ Information at license vendors
☐ ODFW Website
☐ Direct Mail
☐ Other (specify) ______________

Community List ➔ Use For Questions #4b and #10a

North Coast
2 Cannon Beach
3 Manzanita/Nehalem
4 Seaside/Gearhart
5 Tillamook/Bay City
6 Pacific City

Central Coast
7 Florence/Dunes City
8 Lincoln City/Depoe Bay
9 Newport/Waldport
10 Reedsport

South Coast
11 Bandon
12 Brookings
13 Coos Bay/North Bend
14 Gold Beach/Port Orford

Willamette Valley/Cascades
16 Corvallis/Philomath
17 Dallas/Monmouth
18 Detroit
19 Eugene/Springfield/Cottage Grv.
20 McMinnville/Newberg
21 Molalla
22 Oakridge/Westfir
23 Salem/Keizer
24 Silverton/Mt. Angel
25 Sweet Home/Mill City

Portland Metro/Columbia
26 Beaverton/Hillsboro/Tigard
27 Forest Grove/Banks
28 Oregon City/Wilsonvillle
29 Portland/Gresham
30 St. Helens/Rainier/Scappoose
31 Sauvie Island

Southern
33 Grants Pass/Cave Junction
34 Klamath Falls
35 Lakeview/Paisley
36 Medford/Ashland
37 Roseburg/Canyonville

Central
38 Bend/Redmond
39 Madras/Metolius
40 Maupin
41 Prineville
42 Sisters

Mt. Hood/Gorge
43 Hood River/Cascade Locks
44 Sandy/Estacada/Welches
45 The Dalles
46 Troutdale

Eastern
48 Baker City
49 Boardman/Heppner
50 Burns/Hines
51 Enterprise/Joseph
52 Fossil/Mitchell
53 John Day/Prairie City
54 La Grande/Elgin
55 Ontario/Vale
56 Pendleton/Hermiston
57 Wasco/Moro/Grass Valley

OREGON Fish & Wildlife

TRAVEL OREGON

Dear Hunting License Holder:

The Oregon Department of Fish and Wildlife and the Oregon Tourism Commission are sponsoring an economic survey on the importance of wildlife related recreation to Oregon's economy. Information gathered from this survey will help increase the understanding of the economic impact hunters have on Oregon's economy. The results will also help ODFW, the Oregon Fish and Wildlife Commission and local governments to more accurately identify the potential economic impacts of changes in wildlife management activities and will help ensure continued hunting, fishing and wildlife viewing opportunities in Oregon.

As a 2007 and/or 2008 Oregon hunting license holder, we ask that you help us by providing information about your hunting experience(s) in Oregon. The answers you supply will be used for statistical purposes only and will be kept strictly confidential.

Your thoughtful responses to the survey questions are important and **even if you have not hunted in 2007 or 2008, please complete the applicable question(s) and return the survey in the prepaid envelope provided.** Deadline for returning the questionnaire is May 19, 2008.

Thank you in advance for taking the time to thoughtfully complete this survey.

Sincerely,

Roy Elicker

Roy Elicker
Director of ODFW

For the purposes of answering the following questions, "**Hunting Trip**" is defined as:

You left your house and during the time you were away, spent at least some time hunting before returning home; include both day and overnight trips.

1. Did you hunt in Oregon during the twelve months from **March 2007** through **February 2008**?

☐ No (If your answer is no, please go to question # 14)

☐ Yes ➔ Number of Overnight Trips ________ # overnight trips

Number of Day Trips —50 or more miles from residence ________ # 50+mile day trips

Number of Local Trips — less than 50 miles from residence ________ # local trips

Number of Total Hunting Days ________ # total days hunting

Number Days using a paid guide or outfitter ________ # days using guide

Please tell us about a **single specific overnight hunting trip** that is most typical of any overnight trips that you may have taken from March 2007 through February 2008.

☐ No Overnight Trips – (If your answer is no, please go to question # 8)

2a. How many nights did you stay overnight in Oregon on this particular trip? ________ # number of nights

2b. Using the community list on the back page (pg. 4), please write the number of the community (or nearest community) where you stayed overnight (if you stayed in more than one place please indicate your PRIMARY location):

________ # of community

2c. Approximately how many miles, (one way) from your residence did you travel on this overnight trip?
________ # miles one way

2d. What type of accommodations in Oregon did you use while on this particular trip? *(Check √ all that apply)*

☐ Hotel, motel, lodge, bed and breakfast, rented home/cabin ☐ Home of friends/relatives
☐ Your own second home ☐ Campground/camping

3. For this overnight trip, was hunting: *(Check √ the one that best applies)*

☐ Primary reason for trip ☐ One of several reasons for this trip ☐ An incidental activity while on this trip

4. Which of the following best describes the people that accompanied you on this trip: *(Check √ the one that best applies)*

☐ My immediate family only ☐ Other adult friend(s) ☐ Multiple families ☐ Just myself
☐ Other (specify) ________________

5. How many people were in your travel group on this overnight hunting trip?
(Count yourself but do not include other families or hunting partners/buddies who paid their own expenses.)

______ # of adults (age 18 years or older) ➔ ______ # adults with hunting license
______ # of children (age 17 or younger)

6. Please indicate the species hunted during this overnight trip. *(Check √ all that apply)*

☐ Deer ☐ Elk ☐ Other big game (specify) ________
☐ Waterfowl ☐ Upland game birds ☐ Wild turkey ☐ Other (specify) ________

7. Please estimate the dollar amount spent by the group you traveled with that shared expenses for an average day (total # of people in your answer to Q. 5.) Please check √ "No Expenses" if you had no expenses for an item.

Single Specific Overnight Hunting Trip Expenses	No Expenses	Average Expenses per travel group
Accommodations (hotel, motel room rentals, campground fees)	☐	$ ______ per day
Restaurants/Bars/Lounges (food/drink in restaurants and nightclubs, bars)	☐	$ ______ per day
Groceries, snacks (groceries, liquor, and snacks/food from a store)	☐	$ ______ per day
Fuel/Gas/Transportation/Parking (car rental, fuel/gas for auto/boat/truck)	☐	$ ______ per day
Other Retail (ammunition, game bags, gifts, clothing, souvenirs, etc.)	☐	$ ______ per day
Other Recreation & Entertainment (access fees, boat rental, admission fees, golf, etc.)	☐	$ ______ per day
Airfare (please provide total roundtrip airfare paid)	☐	$ ______ total amount
Paid Guide, Charter or Outfitter Fees (total paid on this trip)	☐	$ ______ total amount

Please tell us about a **single specific day hunting trip** that is most typical of **any** day trips that you may have taken from March 2007 through February 2008.

☐ No Day Trips – (Please go to Question # 14)

8a. Using the community list on the back page (page 4), please write the number of the community (or closest community) to where you made the ***most*** trip-related purchases (e.g., restaurants, food stores, gasoline, etc). ________ # of community

8b. Approximately how many miles, (one way) from your residence did you travel on this day trip? ________ # miles one way

9. For this day trip, was hunting: *(Check √ the one that best applies)*

☐ Primary reason for trip ☐ One of several reasons for this trip ☐ An incidental activity while on this trip

10. Which of the following best describes the people that accompanied you on this day trip: *(Check √ the one that best applies)*

☐ My immediate family only ☐ Other adult friend(s) ☐ Multiple families ☐ Just myself
☐ Other (specify) ________________________________

11. How many people were in your travel group on this day trip?
(Count yourself but do not include other families or hunting partners/buddies who paid their own expenses.)

______ # of adults (age 18 years or older) ➔ ______ # adults with hunting license
______ # of children (age 17 or younger)

12. Please indicate the species hunted during this day trip. *(Check √ all that apply)*

☐ Deer ☐ Elk ☐ Other big game (specify)________________
☐ Waterfowl ☐ Upland game birds ☐ Wild turkey ☐ Other (specify)__________

13. Please estimate the dollar amount spent by the group you traveled with that shared expenses for the day. (total # of people in your answer to Q. 11) Please check √ "No Expenses" if you had no expenses for an item.

Single Specific Day Hunting Trip Expenses	No Expenses	Average Expenses per travel group
Restaurants/Bars/Lounges (food/drink in restaurants and nightclubs, bars)	☐	$ ______ for the day
Groceries, snacks (groceries, liquor, and snacks/food from a store)	☐	$ ______ for the day
Fuel/Gas/Transportation/Parking (car rental, fuel/gas for auto/boat/truck)	☐	$ ______ for the day
Other Retail (ammunition, game bags, gifts, clothing, souvenirs, etc.)	☐	$ ______ for the day
Other Recreation & Entertainment (access fees, boat rental, admission fees, golf, etc.)	☐	$ ______ for the day
Paid Guide, Charter or Outfitter Fees	☐	$ ______ for the day

14. During the twelve months from March 2007 through February 2008, how much did your household spend in total in Oregon for the following items?
(Please estimate the dollar amount as closely as possible.) Please check √ "No Expenses" if you had no expenses for an item.

Total Household Expenditures	No Expenses	Expenses per household
Hunting Equipment (firearms, bows/arrows, telescopic sights, decoys, etc.)	☐	$ ________ total
Clothing (waders, boots, vests, raingear, hats, gloves, etc.)	☐	$ ________ total
Related Equipment (camping equipment, safety gear, etc.)	☐	$ ________ total
Specialized Equipment (boats, campers, ATV, etc.)	☐	$ ________ total
Other Retail (meat processing, taxidermy costs, etc.)	☐	$ ________ total

15. Which of the following includes your total family income (before taxes) in 2007? ***(Check √ one answer only)***

☐ Under $25,000 ☐ $25,000-$49,999 ☐ $50,000-$74,999 ☐ $75,000-$99,999 ☐ $100,000 or more

16. Please check your highest education level. ***(Check √ one answer only)***

☐ Some high school or high school diploma
☐ Some college or 2-year degree
☐ Bachelors degree
☐ Advanced degree

17. What is your preferred way of communication with ODFW for information on hunting? ***(Check √ one answer only)***

☐ Email (please provide) ______________________________
☐ ODFW printed brochures or publications
☐ Information at license vendors
☐ ODFW Website
☐ Direct Mail
☐ Other (specify)

Community List ➔ Use For Questions # 2b and # 8a

North Coast
2 Cannon Beach
3 Manzanita/Nehalem
4 Seaside/Gearhart
5 Tillamook/Bay City
6 Pacific City

Central Coast
7 Florence/Dunes City
8 Lincoln City/Depoe Bay
9 Newport/Waldport
10 Reedsport

South Coast
11 Bandon
12 Brookings
13 Coos Bay/North Bend
14 Gold Beach/Port Orford

Willamette Valley/Cascades
16 Corvallis/Philomath
17 Dallas/Monmounth
18 Detroit
19 Eugene/Springfield/Cottage Grv.
20 McMinnville/Newberg
21 Molalla
22 Oakridge/Westfir
23 Salem/Keizer
24 Silverton/Mt. Angel
25 Sweet Home/Mill City

Portland Metro/Columbia
26 Beaverton/Hillsboro/Tigard
27 Forest Grove/Banks
28 Oregon City/Wilsonvillle
29 Portland/Gresham
30 St. Helens/Rainier/Scappoose
31 Sauvie Island

Southern
33 Grants Pass/Cave Juncti
34 Klamath Falls
35 Lakeview/Paisley
36 Medford/Ashland
37 Roseburg/Canyonville

Central
38 Bend/Redmond
39 Madras/Metolius
40 Maupin
41 Prineville
42 Sisters

Mt. Hood/Gorge
43 Hood River/Cascade Locks
44 Sandy/Estacada/Welches
45 The Dalles
46 Troutdale

Eastern
48 Baker City
49 Boardman/Heppner
50 Burns/Hines
51 Enterprise/Joseph
52 Fossil/Mitchell
53 John Day/Prairie City
54 La Grande/Elgin
55 Ontario/Vale
56 Pendleton/Hermiston
57 Wasco/Moro/Grass Valley

If there is anything else that you would like to share with ODFW, please use the space below:

____
____
____

Dear Shellfish License Holder:

The Oregon Department of Fish and Wildlife and the Oregon Tourism Commission are sponsoring an economic survey on the importance of wildlife related recreation to Oregon's economy. Information gathered from this survey will help increase the understanding of the economic impact that crabbing, clamming and other shellfishing have on Oregon's economy. The results will also help ODFW, the Oregon Fish and Wildlife Commission and local governments to more accurately identify the potential economic impacts of changes in wildlife management activities and will help ensure continued hunting, fishing, shellfishing, and wildlife viewing opportunities in Oregon.

As a 2007 and/or 2008 Oregon shellfish license holder, we ask that you help us by providing information about your shellfishing experience(s) in Oregon. The answers you supply will be used for statistical purposes only and will be kept strictly confidential.

Your thoughtful responses to the survey questions are important and **even if you have not taken a crab, clam or other shellfish trip in 2007 or 2008, please complete the applicable question(s) and return the survey in the prepaid envelope provided.** Deadline for returning the questionnaire is October 20, 2008.

Thank you in advance for taking the time to thoughtfully complete this survey.

Sincerely,

Roy Elicker

Roy Elicker
Director of ODFW

For the purposes of answering the following questions, **"Crab, Clam or Other Shellfish Trip"** is defined as:
You left your house and during the time you were away, spent at least some time shellfishing before returning home; include both day and overnight trips.

1. Did you participate in crabbing, clamming or other shellfish harvesting in Oregon during the twelve months from **September 1, 2007 through September 1, 2008?**

☐ **No** **(If your answer is no, please go to question # 14)**

☐ **Yes** → Number of **Overnight Trips** ______ # overnight trips

Number of **Day Trips —50 or more miles from residence** ______ # 50+mile day trips

Number of **Local Trips — less than 50 miles from residence** ______ # local trips

Number of **Total Shellfish Days** ______ # total days shellfishing

Number Days using a paid guide or outfitter ______ # days using guide

Please tell us about a **single specific overnight crab, clam or other shellfish trip in Oregon** that is most typical of any overnight trips that you may have taken from September 1, 2007 through September 1, 2008.

☐ **No Overnight Trips – (If your answer is no, please go to question # 8)**

2a. How many nights did you stay **overnight** in Oregon on this particular trip? ____ # number of nights

2b. Using the community list on the back page **(page 4)**, please write the **number** of the community (or closest community) where you stayed overnight: (if you stayed in more than one place please indicate your PRIMARY location)

____ # of community

2c. Approximately how many miles, **(one way)** from your residence did you travel on this overnight trip?
____ # miles one way

2d. What type of accommodations in Oregon did you use while on this particular trip? (Check √ ***all that apply***)

☐ Hotel, motel, lodge, bed and breakfast, rented home/cabin ☐ Home of friends/relatives
☐ Your own second home ☐ Campground/camping

3. For this overnight trip, was shellfishing? (Check √ ***the one that best applies***)
☐ Primary reason for trip ☐ One of several reasons for this trip ☐ An incidental activity while on this trip

4. Which of the following best describes the people that accompanied you on this trip? (Check √ ***the one that best applies***)
☐ My immediate family only ☐ Other adult friend(s) ☐ Multiple families ☐ Just myself
☐ Other (specify)____________

5. How many people were in your travel group on this overnight shellfishing trip?
(Count yourself but do not include other families or partners/buddies who paid their own expenses.)
____ # of **adults** (age 18 years or older) → ____ # adults with shellfish license
____ # of **children** (age 17 or younger)

6. Please indicate the species harvested during this overnight trip: (Check √ ***all that apply***)
☐ Crabs ☐ Bay clams ☐ Razor clams ☐ Sand/mud shrimp
☐ Mussels ☐ Abalone ☐ Rock scallops ☐ Other (specify)____________

7. Please estimate the dollar amount spent by **the group you traveled with that shared expenses for an average day.** (total # of people in your answer to Q. 5) Please check √ **"No Expenses"** if you had no expenses for an item.

Single Specific Overnight Shellfishing Trip Expenses	No Expenses		Average Expenses per travel group
Accommodations (hotel, motel room rentals, campground fees)	☐	$	____ per day
Restaurants/Bars/Lounges (food/drink in restaurants and nightclubs, bars)	☐	$	____ per day
Groceries, snacks (groceries, liquor, and snacks/food from a store)	☐	$	____ per day
Fuel/Gas/Transportation/Parking (car rental, fuel/gas for auto/boat/truck)	☐	$	____ per day
Other Retail (bait, traps, gifts, clothing, souvenirs, dive shop, etc.)	☐	$	____ per day
Other Recreational & Entertainment (access fees, boat rental, admission fees, golf, etc.)	☐	$	____ per day
Airfare (please provide **total roundtrip airfare** paid)	☐	$	____ total amount
Paid Guide, Charter or Outfitter Fees (total paid on this trip)	☐	$	____ total amount

Please tell us about **a single specific crab, clam or other shellfish day trip** that is most typical of **any** day trips that you may have taken from September 1, 2007 through September 1, 2008.

☐ **No Day Trips – (Please go to Question # 14)**

8a. Using the community list on the back page **(page 4),** please write the **number** of the community (or closest community) to where you made the *most* trip-related purchases (e.g., restaurants, food stores, gasoline, etc.) ______ # of community

8b. Approximately how many miles, **(one way)** from your residence did you travel on this day trip? ______ # miles one way

9. For this day trip, was shellfishing? (Check √ ***the one that best applies***)

☐ Primary reason for trip ☐ One of several reasons for this trip ☐ An incidental activity while on this trip

10. Which of the following best describes the people that accompanied you on this day trip? (Check √ ***the one that best applies***)

☐ My immediate family only ☐ Other adult friend(s) ☐ Multiple families ☐ Just myself
☐ Other (specify)____________________

11. How many people were in your travel group on this day trip?
(Count yourself but do not include other families or partners/buddies who paid their own expenses.)

______ # of **adults** (age 18 years or older) ➔ ______ # adults with shellfish license
______ # of **children** (age 17 or younger)

12. Please indicate the species harvested during this day trip: (Check √ ***all that apply***)

☐ Crabs ☐ Bay clams ☐ Razor clams ☐ Sand/mud shrimp
☐ Mussels ☐ Abalone ☐ Rock scallops ☐ Other (specify) ______________

13. Please estimate the dollar amount spent by **the group you traveled with that shared expenses for the day.** (total # of people in your answer to Q. 11) Please check √ **"No Expenses"** if you had no expenses for an item.

Single Specific Day Shellfishing Trip Expenses	No Expenses	Average Expenses per travel group
Restaurants/Bars/Lounges (food/drink in restaurants and nightclubs, bars)	☐	$ _____ for the day
Groceries, snacks (groceries, liquor, and snacks/food from a store)	☐	$ _____ for the day
Fuel/Gas/Transportation/Parking (car rental, fuel/gas for auto/boat/truck)	☐	$ _____ for the day
Other Retail (traps, bait, gifts, clothing, souvenirs, dive shop, etc.)	☐	$ _____ for the day
Other Recreational & Entertainment (access fees, boat rental, admission fees, golf, etc.)	☐	$ _____ for the day
Paid Guide, Charter or Outfitter Fees	☐	$ _____ for the day

14. During the **twelve months from September 1, 2007 through September 1, 2008,** how much did **your household spend in total in Oregon** for the following items?
(Please estimate the dollar amount as closely as possible.) Please check √ **"No Expenses"** if you had no expenses for an item.

Total Household Expenditures	No Expenses	Expenses per household
Shellfish Equipment (traps, buoys, shovel, rakes, nets, clam bags, rings, etc.)	☐	$ ______ total
Clothing (waders, boots, vests, raingear, hats, gloves, etc.)	☐	$ ______ total
Related Equipment (camping equipment, safety gear, etc.)	☐	$ ______ total
Specialized Equipment (boats, campers, ATV, SCUBA, etc.)	☐	$ ______ total
Other Retail (meat processing, propane, etc.)	☐	$ ______ total

15. Which of the following includes your total family income (before taxes) in 2007? (Check √ ***one answer only***)

☐ Under $25,000 ☐ $25,000-$49,999 ☐ $50,000-$74,999 ☐ $75,000-$99,999 ☐ $100,000 or more

16. Please check your highest education level: (Check √ ***one answer only***)

☐ Some high school or high school diploma
☐ Some college or 2-year degree
☐ Bachelors degree
☐ Advanced degree

17. What is your preferred way of communication with ODFW for information on shellfishing? (Check √ ***one answer only***)

☐ Email (please provide)________________________
☐ ODFW printed brochures or publications
☐ Information at license vendors
☐ ODFW Website
☐ Direct Mail
☐ Other (specify) ______________

Community List ➔ Use For Questions # 2b and # 8a

North Coast
1 Astoria/Warrenton
2 Cannon Beach
3 Manzanita/Nehalem
4 Seaside/Gearhart
5 Tillamook/Netarts/Bay City
6 Pacific City

Central Coast
7 Florence/Dunes City
8 Lincoln City/Depoe Bay
9 Newport/Waldport/Yachats
10 Reedsport

South Coast
11 Bandon
12 Brookings
13 Coos Bay/North Bend
14 Gold Beach/Port Orford

Willamette Valley/Cascades
15 Albany/Lebanon
16 Corvallis/Philomath
17 Dallas/Monmouth
18 Detroit
19 Eugene/Springfield/Cottage Grv.
20 McMinnville/Newberg
21 Molalla
22 Oakridge/Westfir
23 Salem/Keizer
24 Silverton/Mt. Angel
25 Sweet Home/Mill City

Portland Metro/Columbia
26 Beaverton/Hillsboro/Tigard
27 Forest Grove/Banks
28 Oregon City/Wilsonville
29 Portland/Gresham
30 St. Helens/Rainer/Scappoose
31 Sauvie Island

Southern
32 Gold Hill/Rogue River
33 Grants Pass/Cave Junction
34 Klamath Falls
35 Lakeview/Paisley
36 Medford/Ashland
37 Roseburg/Canyonville

Central
38 Bend/Redmond
39 Madras/Metolius
40 Maupin
41 Prineville
42 Sisters

Mt. Hood/Gorge
43 Hood River/Cascade Locks
44 Sandy/Estacada/Welches
45 The Dalles
46 Troutdale

Eastern
47 Arlington/Condon
48 Baker City
49 Boardman/Heppner
50 Burns/Hines
51 Enterprise/Joseph
52 Fossil/Mitchell
53 John Day/Prairie City
54 La Grande/Elgin
55 Ontario/Vale
56 Pendleton/Hermiston
57 Wasco/Moro/Grass Valley

APPENDIX E

Sample Design

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Sample Design

Appendix E describes the sampling design for the study and describes the approach taken to produce findings from the completed questionnaires. For each recreation activity, the sample design and timing of the questionnaire mailings and telephone interviews (in the case of wildlife viewing participants) was designed to provide the seasonal data most appropriate to represent each recreation activity, which was then reported as findings for calendar year 2008.

Fishing

The sample of self-administered questionnaires for fishing was mailed in two waves in order to collect detailed data for a twelve-month period October, 2007 through September, 2008: First, in May, 2008 for activity that occurred from October, 2007 - March, 2008 (fall/winter season), and next in November, 2008 for activity that occurred from April - September, 2008 (spring/summer season). The sample was randomly selected from the ODFW fishing license database after adjusting in order to eliminate duplicate mailing addresses. A sample of 24,911 questionnaires was received (via mail) by Oregon residents and nonresidents from the ODFW fishing license database. The sample was stratified in order to obtain a reliable sample of *both* Oregon residents and nonresidents. Approximately 4,533 questionnaires were returned for a response rate of 18 percent.

Wildlife Viewing

The sample was selected through a random digit-dial telephone survey (to include non-listed and unpublished telephone numbers) of Oregon resident 18 years and older. The sample of telephone interview was conducted in four waves to coincide with each season with the first wave conducted in March, 2008 to capture wildlife viewing activity during the winter months of the year (Dec.-Feb.), the second wave conducted in June, 2008 to capture spring activity (Mar.-May), the third wave conducted in September, 2008 to capture summer activity (Jun.-Aug.), and the final wave conducted in December, 2008 to capture fall activity (Sep.-Nov.). A sample of 1,624 Oregon residents agreed to be interviewed and 1,000 interviews were completed for a response rate of 62%. In addition, the sample was stratified geographically in order to obtain a representative sample of residents throughout the state.

Hunting

The sample of self-administered questionnaires for hunting was mailed in one wave (in March, 2008) to collect detailed data for hunting activity that occurred during the twelve-month period from March 2007 through February 2008. The sample was randomly selected from the ODFW hunting license database after adjusting in order to eliminate duplicate mailing addresses. A sample of 19,833 questionnaires was received (via mail) by Oregon residents and nonresidents from the ODFW hunting license database. The sample was stratified in order to obtain a reliable sample of *both* Oregon residents and nonresidents. Approximately 5,200 questionnaires were returned for a response rate of 26 percent.

Shellfishing

The sample of self-administered questionnaires for shellfish harvesting was mailed in one wave (in September, 2008) to collect detailed data for shellfish harvest activity that occurred during the twelve-month period from September 2007 through August 2008. The sample was randomly selected from the ODFW shellfish license database after adjusting in order to eliminate duplicate mailing addresses. A sample of 3,224 questionnaires was received (via mail) by Oregon residents and nonresidents from the ODFW hunting license database. The sample was stratified in order to obtain a reliable sample of *both* Oregon residents and nonresidents. Approximately 1,000 questionnaires were returned for a response rate of 35 percent.

Geographic Allocation

Detailed findings for number of trips, days of participation, and expenditures are based on an allocation of the total number of trips taken during twelve-month period, as reported by the participants. Trip expenditure data was applied to locations throughout the state (regions and counties) based on the community (or nearest community) reported for as the primary location where participant spent the night overnight stay or in the case of day trip, the community where the most trip-related purchases were made.

Confidence levels

Generally, representative samples of 1,000 or more provide very reliable results. Confidence levels for respondent segments are shown in the table below.

Segment	Sample Size	Confidence Level (%) 90% Level (+/-)	95% Level (+/-)
Hunters	5,200	1.2	1.4
Fishers	4,533	1.3	1.5
Shellfishers	1,122	2.6	3.0
OR Households	1,000	2.6	3.1

Nonresponse Bias

The effect of nonresponse error was measured directly through the use of telephone interviews for each of the three recreation activities that were reported through use the self administered questionaires (fishing, hunting, and shellfishing). Telephone interviews were conducted for a random sample of nonrespondents (those who did not return a questionnaire) for each of the three segments. The sample of nonrespondents was 200 for fishing and hunting, and 100 for shellfish harvesting. Overall, responses for each of these groups were similar, in terms of trip characteristics and expenditures, to those reported by the initial respondents. Through these telephone interviews, additional detail was gathered with regard to where to the allocation of expenditures -- before, during, or in the community closest to where the recreation activity occurred. The additional information was used to allocate expenditures at the regional and county-level.

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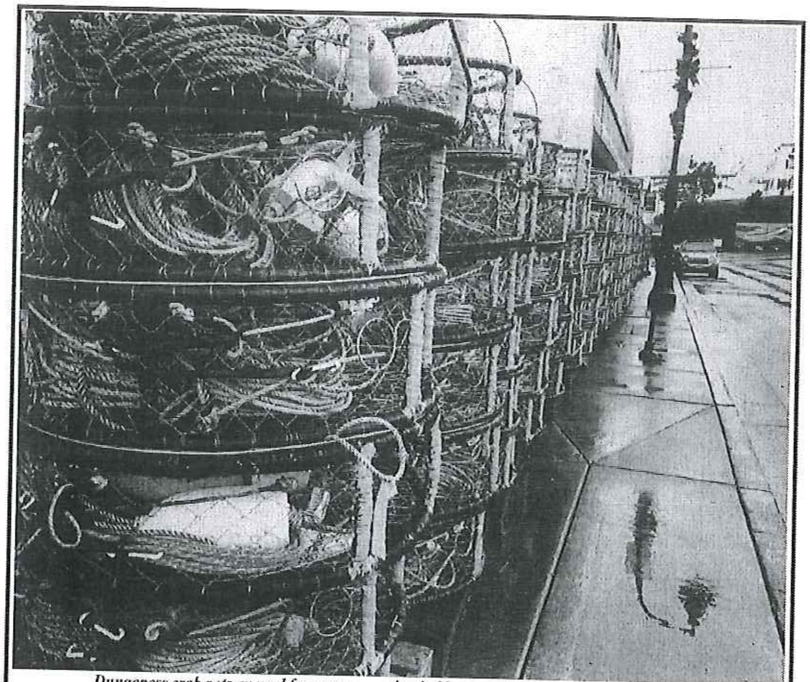
Submitted June 25, 2019 From:
Clam Diggers Association
&
Power Hooker Tackle

Exhibit 107

Oregon Commercial and Recreational Fishing Industry Economic Activity Coastwide and in Proximity to Marine Reserve Sites for Years 2016 and 2017



Dungeness crab pots queued for season opening in Newport, Oregon. Photo credit ODFW.

Oregon Department of Fish and Wildlife

Reproduction of Material

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Version 1.7

prepared by

The Research Group, LLC
Corvallis, Oregon

prepared for

Marine Reserve Program
Oregon Department of Fish and Wildlife

November 2018

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Preface

This report was sponsored by the Marine Reserve Program (MR Program), 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. 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 reports are referenced, full citations are included in a bibliography chapter.

The ODFW Marine Resource Program fish managers and staff need to be acknowledged for their help in generating the summary fisheries descriptions. Tommy Swearingen (MR human dimension project leader) and Troy Buell (fisheries management project leader) were especially helpful. 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. The federal agency people providing information and advice include Robin Ehlke (Pacific Fishery Management Council (PFMC) salmon fishery officer), John Devore (PFMC groundfish fishery officer), Brad Stenberg (Pacific States Marine Fisheries Commission (PSMFC) PacFIN representative), and Steve Williams (PSMFC RecFIN representative). Hans Radtke (natural resource consulting economist), Gil Sylvia (Marine Resource Economist and OSU Coastal Oregon Marine Experiment Station (COMES) Director), and Chris Carter (retired ODFW economist) provided valuable guidance and insight in the development of methods and review of draft material.

Table of Contents

List of Tables, Figures, and Maps

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Appendix

Glossary

Acronyms

ACS	U.S. Census Bureau, American Community Survey
BEA	U.S. Bureau of Economic Analysis
CCRMP	Coastal Chinook Research and Monitoring Program
COMES	Coastal Oregon Marine Experiment Station
CRCP	Columbia River Creel Program
CROOS	Collaborative Research on Oregon Ocean Salmon
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
ODFW	Oregon Department of Fish and Wildlife
ORBS	Ocean Recreational Boat Survey
PacFIN	Pacific Coast Fisheries Information Network
PSMFC	Pacific States Marine Fisheries Commission
RecFIN	Recreational Fisheries Information Network
SEB	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

PacFIN annual vessel summary data and RecFIN data from the PSMFC.
ORBS effort and catch from ODFW.
SSHSTRP recreational catch from ODFW.
Fisheries logbook program records from ODFW.
Creel surveys on Elk River and Salmon River performed annually for the CCRMP from ODFW.
CRCP surveys on lower Columbia River performed annually from ODFW and WDFW.
Area income from U.S. Bureau of Economic Analysis.
Demographic and well-being indicator data from ACS.

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.
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 measurement selected for this study is income and job equivalents. 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 business output (analogous but different than sales), value added, and 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. 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.

For years 2016 and 2017, 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.

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 2016 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 2016 are described.

Harvester and processor revenue Harvest revenue 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 ex-processor revenue is from the wholesale price fetched by processors for manufactured seafood products.

Home-port vessels Home-port vessels are where a majority of landings measured by ex-vessel revenue occurs. Oregon home-port vessels can deliver to other states (such as Astoria area vessels delivering to Ilwaco processors) and other state home-port vessels can deliver to Oregon processors.

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.

Job equivalents 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. Equivalent jobs at the statewide level include jobs within all coastal communities plus jobs in the rest of the state.

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 (September 2017) 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), and Holland et al. (2017).

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.
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. Trip counts in this study have been adjusted to account for multiple days when fishing occurred during a single trip.
Recreational fishing mode	The mode can be charter boat, private boat, 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. 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.

Spillover effect	Increased fish production from ecological functions occurring within MR sites that may result in increased recreational angler effort 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.

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

Note: Area economic data is used for showing commercial fisheries (distant water fisheries are included) representation in local economies in 2017. Demographic and well-being data is used to show an area's commercial (distant water fisheries are excluded) and recreational fisheries engagement in 2016. (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. A more complete discussion of fisheries importance would be to show historical trends for the measures.

Executive Summary

Background

This report was prepared for the Marine Reserve Program (MR Program), Oregon Department of Fish and Wildlife (ODFW). The MR Program is responsible for monitoring the effects from establishing five marine reserve areas (MR's) in the Oregon Territorial Sea (TS). 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.

The following three summary sections discuss trends and economic contributions for Oregon commercial, marine recreational, and nearshore fisheries. The economic contributions are expressed as generated household income which includes the multiplier effect. All prices, harvest revenue, and economic contributions are expressed in 2017 dollars, except where noted otherwise. Landing volume is expressed in round pound equivalents.

Commercial Fisheries

The Oregon commercial fishing industry economic contribution trends by major fisheries from 1973 through 2017 are shown on Figure ES.1. The fisheries generated an estimated $570 million income in 2017. The previous five-year (2012-2016) average annual income was $594 million with range of $467 million in 2015 to $696 million in 2013. About half of this amount is generated by distant water fisheries, such as the West Coast at-sea fishery and Alaska fisheries. Some of the revenue from those fisheries is returned to households in Oregon. The generated household income from all commercial fisheries sources in 2017 is equivalent to about 10 thousand jobs in the statewide economy.

There are ups and downs in specific fisheries and in fishing dependent communities, but the consistency in industry activity overall has allowed related businesses (provisioning, repair, gear manufacturing, etc.) to develop. Not included in the industry estimated economic contribution estimates are the associated enforcement, management, research, and education employment; boat building businesses; and, seafood retail operations.

The Oregon commercial fishing industry onshore landings in 2017 were 303.8 million pounds worth $148.6 million in harvest value. The harvest value was a slight increase over 2016 ($146.9 million), but was still below the previous five-year (2012-2016) average ($153.4 million). Figure ES.2 shows percent change in landing volumes and prices between years 2016 and 2017 for selected fisheries. Some notable trends were:

- Salmon and pink shrimp volumes were down in 2017, while Dungeness crab volume was almost 50 percent higher than the previous five-year average landings. The aggregate salmon price slightly increased in both the ocean troll and Columbia River gillnet fisheries in 2017.
- The trawl and pot gear sablefish (also called black cod) fishery comprises about half the harvest value of the overall groundfish fishery. Sablefish volume and the two-gear

harvested average price was steady in 2017 as compared to 2016. The sablefish price has not returned to the record level prices received in 2011.

- Pacific whiting volume was way up (over 50 percent greater) in 2017 as compared to the previous five-year average, while price remained about 30 percent below the average.
- There was a bump up in some groundfish management quota volumes due to several species recently being declared recovered from an overfished status. Consequently, the fishery category for all other groundfish species had a big volume jump in 2017 as compared to the previous five-year average. The other groundfish overall price slightly decreased in 2017 compared to the previous five-year average.
- Other fishery news for 2017 was the continued closure for the Pacific sardine directed fishery, a small herring fishery emerged at Yaquina Bay, and the market squid fishery that was big in 2016 did not return.

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.

Recreational Fisheries

Commercial wild harvesting activities share natural resources with a large ocean and inland recreational fisheries sector. Complex management by federal and state agencies ensure reasonable access by both sectors, yet conserve the resource to achieve sustainability.

There is scattered and disparate information available about the economic contributions from marine recreational finfish fisheries in Oregon's coastal areas. This report pulls together existing economic information and provides additional economic analysis results so that magnitudes and trends can be discerned. Still, the accounting is selective leaving out trips targeting freshwater resident fish. The notes on Figure ES.3 explain the included target fisheries. Economic contribution shares for the targeted recreational ocean and inland targeted fisheries in 2017 are shown on Figure ES.4.

Total trips for the selective fisheries increased in the late 2000's through 2015. Trips for years 2016 and 2017 are in a downward trend mostly due to decreased participation in the inland fall salmon and steelhead fisheries. Ocean trips for salmon have also been decreasing in recent years. Trips for ocean bottomfishing have grown ostensibly as replacement for decreased success rates and fishing opportunities for ocean salmon. There were about 1.2 million total trips in 2016 and 1.1 million in 2017. Economic contribution from trip spending generated $61.8 million income in 2016 and $54.7 million income in 2017 (Figures ES.4).

Recreational anglers make additional contributions to local economies in ways other than trip spending, such as purchasing fishing equipment and boats, and owning second homes. 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 prospective employees. The attraction will be an important business location decision variable, along with more straightforward considerations such as the markets and suppliers logistics, and labor costs.

Fishery managers are often presented with economic effects information from different user groups wanting more favorable access to fisheries. The report counsels there are different ways to measure economic effects and that misuse of information can occur. Economic information can be valuable to decision making when there is forethought in proper data collection, economic modeling, and tradeoff discussions.

Nearshore Fisheries

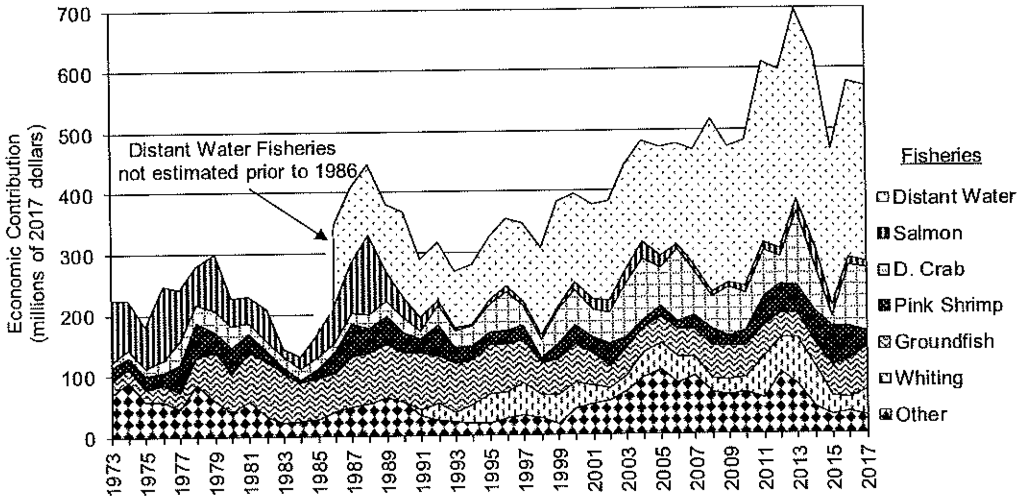
Economic activity descriptions are provided for nearshore fisheries, i.e. commercial and recreational fisheries that take place within the TS and adjacent bays. The descriptions are provided to assist in characterizing the potential economic impact from marine reserve management. The nearshore commercial and recreational fisheries economic contribution share was 19 percent of the estimated $640 million income in 2016 (Figure ES.5). The total income includes commercial onshore and distant water fisheries and selective recreational target fisheries that are located in ocean and bays.

A model was developed in another project to estimate the economic contributions from fisheries within alternative marine reserve boundary designs. The model informed decision making in the geographic shaping and fisheries management plan formulation process that ultimately led to the existing system of marine reserves. The model shows, based on average 2013-2015 harvesting, that the maximum potential economic impact (i.e. no fishing would occur elsewhere) from marine reserve management is 3.6 percent of all nearshore commercial and recreational fishing economic contributions which take place in the TS (Table ES.1). Since the marine reserve system is less than 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. 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. The 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.

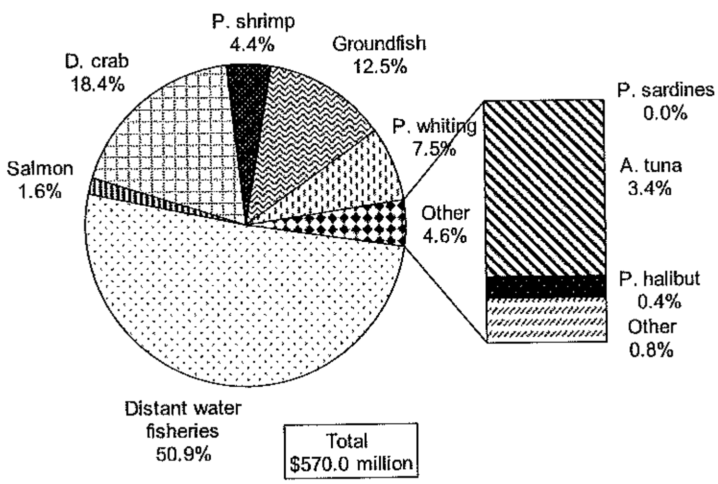
There are other MR Program human dimension investigative projects underway and planned that address the extent of effort shift and leaving fisheries. The problem will be to find the degree and outcome of any influence from marine reserve implementation within participation variability given that fishers are also responding to such factors as fish resource conditions, other regulations, market conditions, personal investment choices, and even weather.

Figure ES.1

Economic Contributions From Onshore Landings in 1973 to 2017
and Distant Water Fisheries in 1986 to 2017



Economic Contributions by Major Fishery in 2017



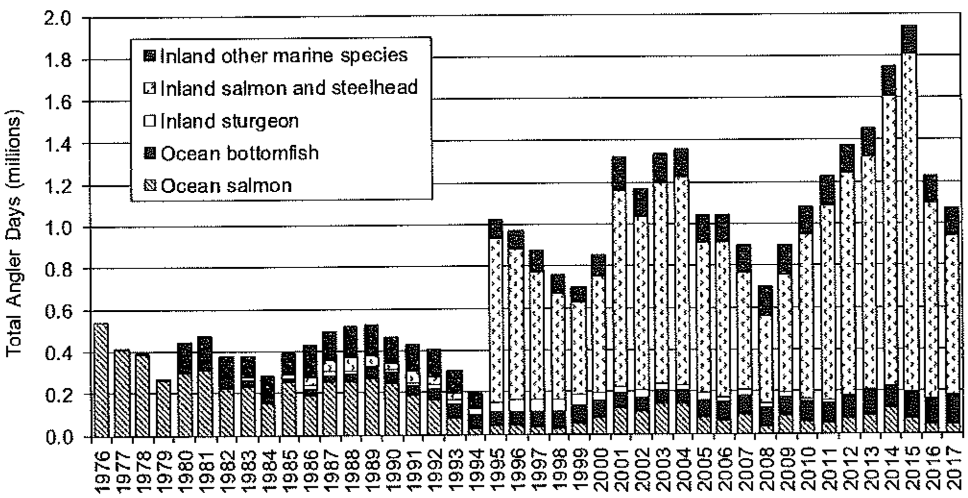
Notes: 1. Economic contributions are expressed as household income in millions of 2017 dollars. The contributions are for the state level economy.
2. The economic contribution estimates prior to 2016 come from the Oregon Fisheries Economic Assessment Model (FEAM). For 2016 and 2017 onshore, the input-output model for Pacific Coast fisheries (IO-PAC) is used for the calculations.

Figure ES.2
Oregon Selected Commercial Fisheries Volume and Price Annual Change for 2016 and 2017

Fishery	Price 2016-17	Volume 2016-17
Salmon	1%	-35%
Dungeness crab	-16%	44%
Pink shrimp	-24%	-35%
Sablefish	0%	0%
Pacific whiting	4%	78%
Groundfish, other	-17%	42%

Note: The Dungeness crab fishery is for the 2016-2017 season and all other fisheries are calendar year.

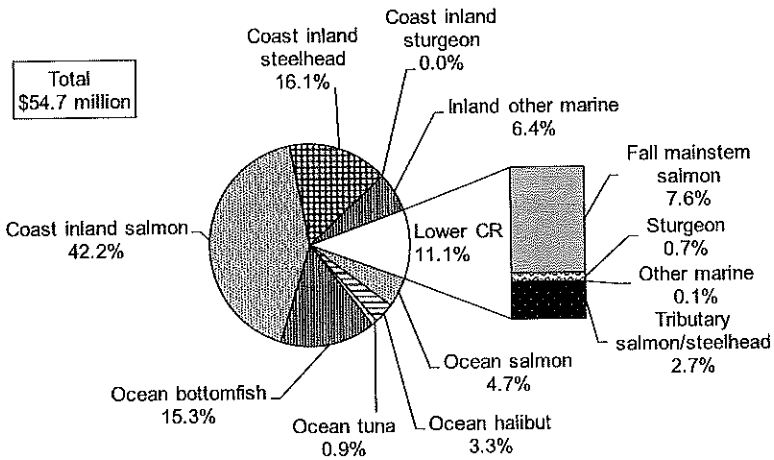
Figure ES.3
Recreational Angler Days for the Study Selected Fisheries in 1976 to 2017



Notes: 1. Angler days are included when the fishing trip occurs in the ocean, inland marine areas (estuaries), and when the trip purpose is for certain species in coastal area inland 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. The inland locations are approximated for being west of the Coast Range crest. Trips targeting resident freshwater fish are not included.

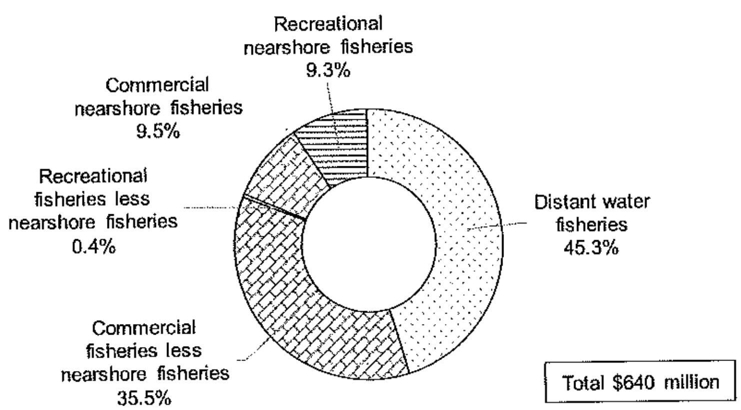
2. There are gaps in data for the included fisheries. Bottomfish angler days not available before 1980. Lower Columbia River fall salmon fishery trips are not included prior to 1982. Lower Columbia River estuary tributary and Coast estuaries are not included prior to 1995. Lower Columbia River sturgeon 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 2017. Coast inland 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.

Figure ES.4
Recreational Ocean and Inland Fisheries Economic Contribution Shares for 2017



Notes: ODFW SSHSTRP data is 2017 preliminary for salmon/steelhead and sturgeon, November 2018 extraction.

Figure ES.5
Oregon Fishing Industry Economic Contribution and Nearshore Fisheries Component in 2016



Notes: 1. Economic contribution measured by generated income in 2017 dollars at the statewide economy level.
2. Recreational fisheries exclude ocean and bay crabbing, which generated an estimated $6 million in 2017

Table ES.1
Marine Reserve Sites Annual Average Regional Economic Impacts From Assessed and Displaced Commercial and Recreational Fisheries for 2013-2015

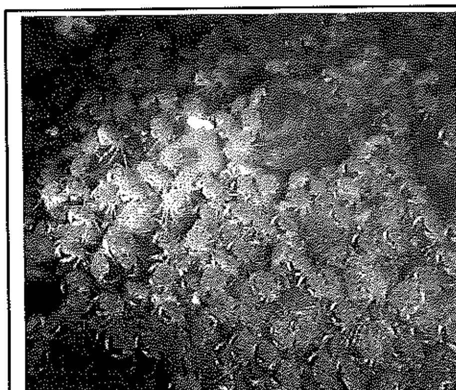
Harvest Area	Area Share of Territorial Sea	Assessed Fisheries Economic Impact Comm.	Rec.	Total	Displaced Fisheries Economic Impact Comm.	Rec.	Total
Marine Reserve Sites							
Cape Falcon	1.6%	661	77	737	341	62	403
Cascade Head	2.6%	877	472	1,349	256	145	401
Otter Rock	0.1%	32	24	56	30	24	53
Cape Perpetua	4.4%	1,480	228	1,708	332	103	434
Redfish Rocks	0.6%	224	78	302	99	71	169
Total	9.3%	3,273	878	4,152	1,057	404	1,461

Comparison Areas		Economic Impact Comm.	Rec.	Total	Assess. Share	Displ. Share
Territorial Sea	100.0%	34,212	6,701	40,914	10.1%	3.6%
Onshore landed commercial fisheries		224,575				
Ocean recreational fisheries			16,948			
Ocean commercial and recreational fisheries				241,523	1.7%	0.6%

Notes:
1. Economic impacts are expressed as household income in thousands of 2015 dollars.
2. 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.
3. 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.

I. Introduction

This report contains 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 2017, except distant water fisheries are current through 2016. 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. More complete related reports that have glossaries, methods descriptions, and additional analysis results are TRG (2015a) and TRG (2017) for commercial fisheries, TRG (2015b) for marine recreational fisheries, and TRG (February 2018) for nearshore fisheries.



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.

The economic activity descriptions include estimates for economic contributions which include the "multiplier effect." The economic contributions are measured by household income and equivalent full and part-time jobs. 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 (2015a) came from an economic impact model titled FEAM. For this report, a new model titled IO-PAC is used to provide the commercial fisheries economic contribution estimates in 2016 and 2017.[1] The economic contribution estimates for marine recreational fisheries continued to rely on economic relationships from the FEAM.

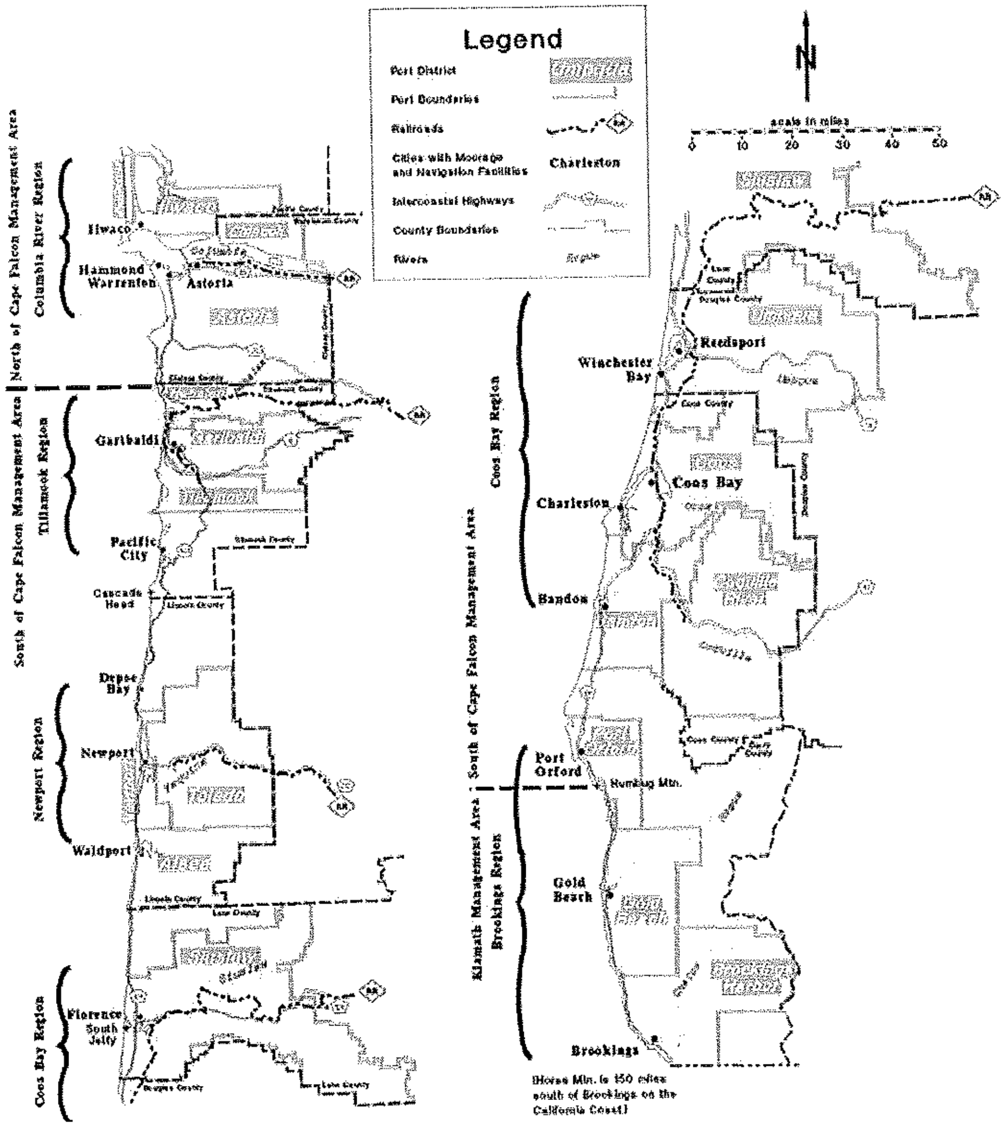
All fisheries values (such as ex-vessel revenue and angler trip expenditures) are expressed in 2017 dollars except where noted otherwise. The dollars have been adjusted using the GDP Implicit Price Deflater developed by the U.S. Bureau of Economic Analysis.

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.

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

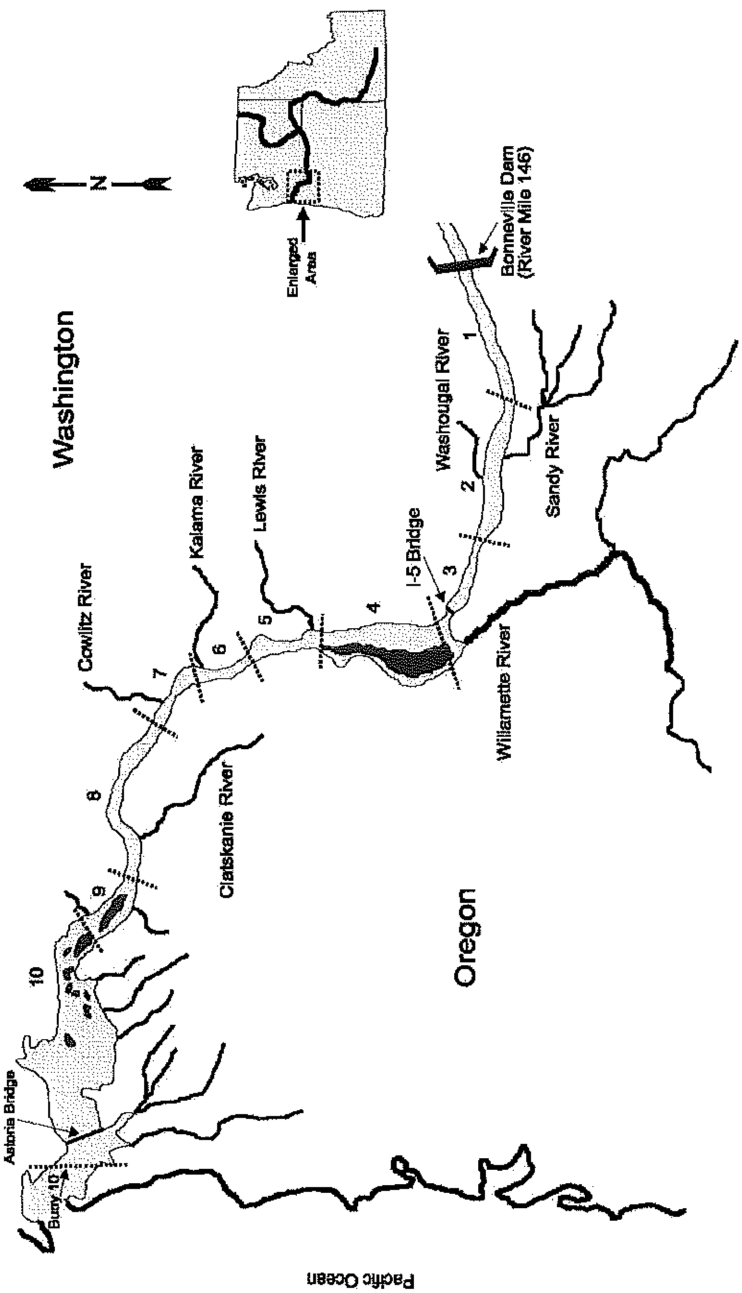
Commercial and recreational fisheries vicinity maps are shown as Maps I.1 through I.4. Map I.1 shows port group regions and salmon management areas. Maps I.2 and I.3 show watersheds included in compiling recreational trips in lower estuaries that target anadromous fish on the Columbia River and Oregon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

Map I.1
Salmon Fishery Management Areas and Port Group Regions



Source: The Research Group (June 2000).

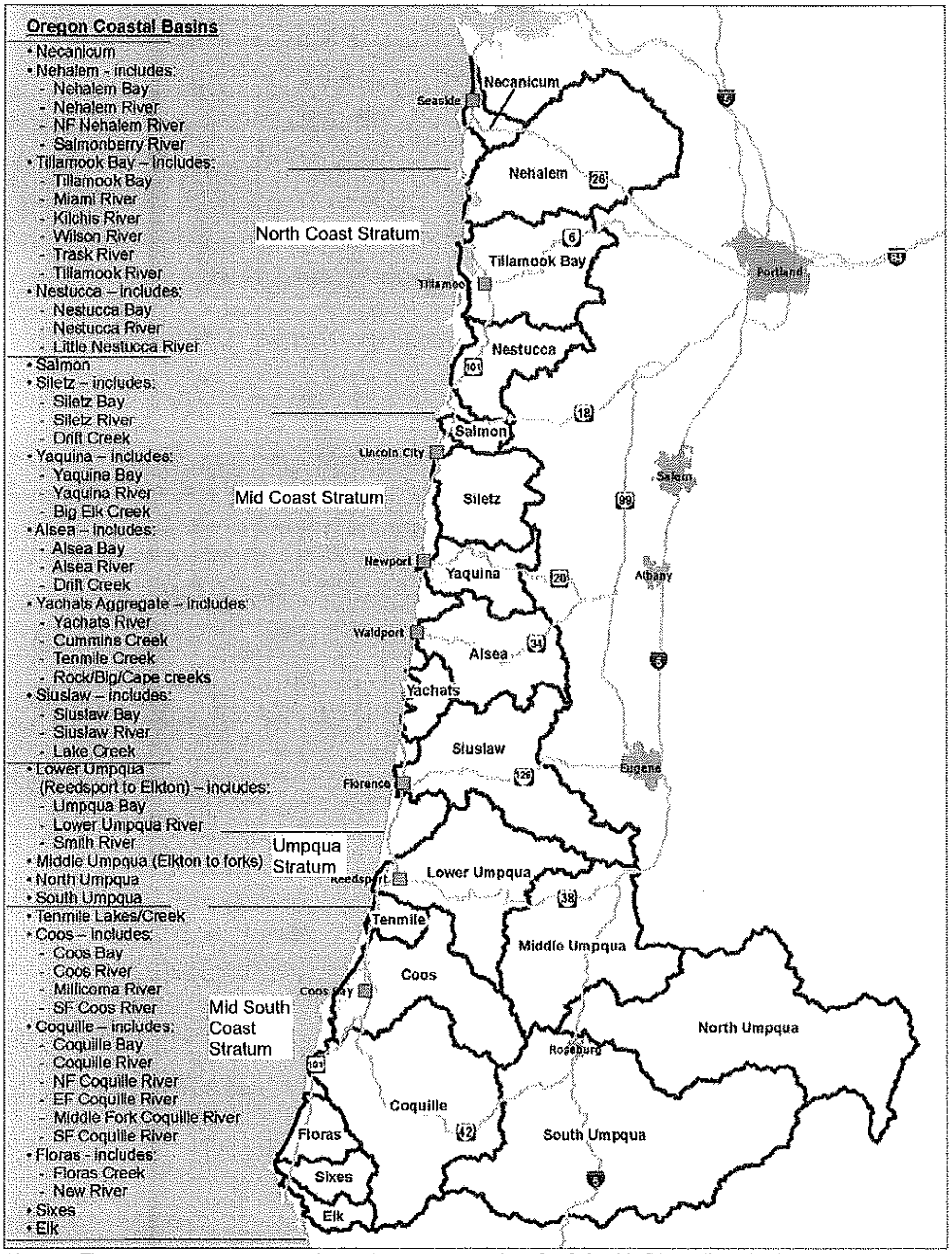
Map I.2
Recreational Sampling Sections on the Columbia River Below Bonneville Dam



Source: Watts (2009).

Map I.3

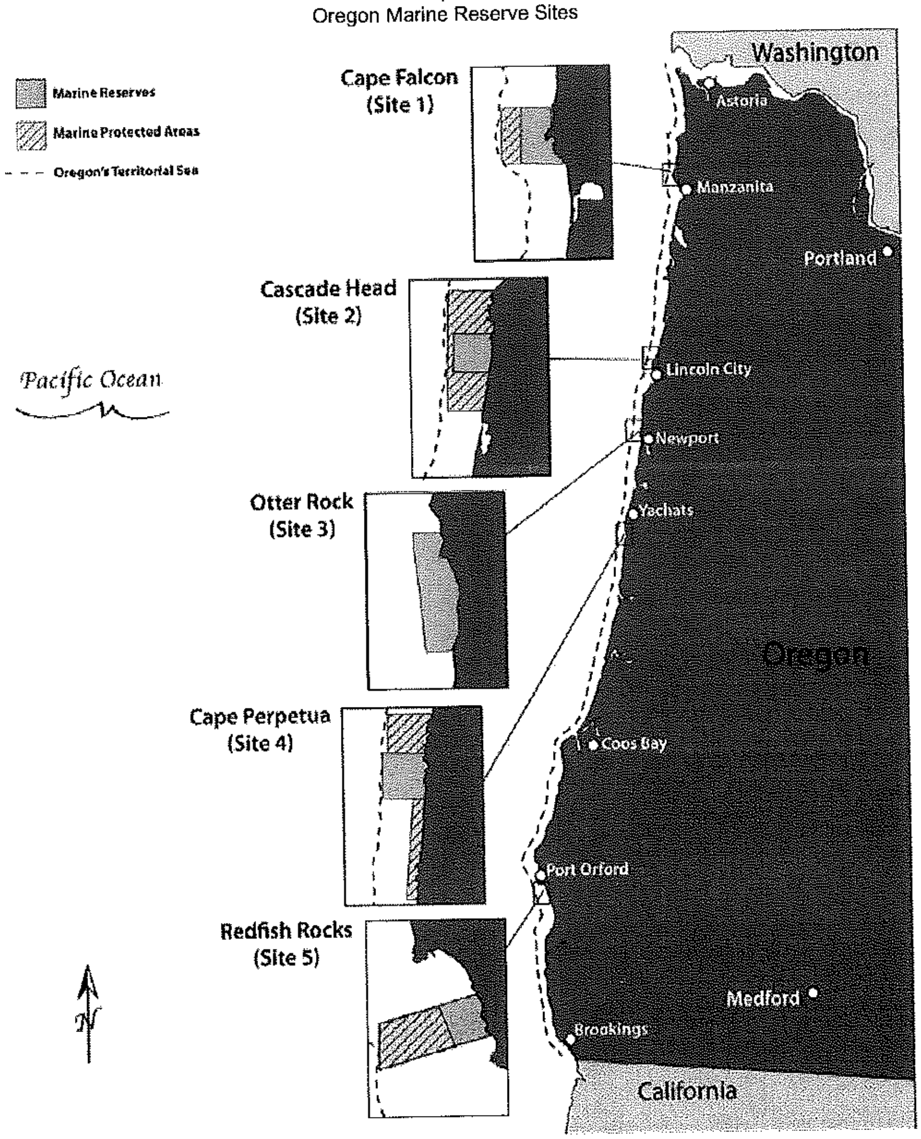
Coastal Basins Within the Oregon Coastal Multispecies Conservation and Management Plan Area



Notes: There are separate conservation and management plans for Columbia River tributaries in Clatsop County, and other coastal basins not shown on this map including the Rogue River. The conservation and management plans are required by the Oregon Native Fish Conservation Policy.

Source: ODFW (June 5, 2013).

Map I.4
Oregon Marine Reserve Sites



Notes: Marine reserve sites are defined by the Oregon Ocean Policy Advisory Committee to be areas within Oregon's state territorial waters that are to be protected from all extractive activities, including the removal or disturbance of living and non-living marine resources, except as necessary for monitoring or research to evaluate reserve condition, effectiveness, or impact of stressors. The Oregon Legislature House Bill 3013 enacted in 2009 assigned the ODFW as the lead agency for establishing and implementing marine reserve sites. Two sites were designated: Redfish Rocks at Port Orford and Otter Rock near Depoe Bay. Senate Bill 1510 was enacted in 2011 requiring ODFW to evaluate, establish, and enforce regulations on three new marine reserves: Cape Falcon, Cape Perpetua, and Cascade Head. Recreational and commercial fishing was constrained within Redfish Rocks and Otter Rocks in 2012, Cape Perpetua and Cascade Heads in 2014, and Cape Falcon in 2015.

Source: Oregon Marine Reserves Website.

II. Commercial Fisheries

The Oregon commercial fishing industry harvest value in 2017 ($148.6 million) had a slight increase over 2016 ($146.9 million), but was still below the previous five-year average ($153.4 million).[1] Different fisheries had ups and downs compared to previous years (Table II.1).

- The *ocean salmon fishery* harvest volume in 2017 (307 thousand pounds) was about one-half of 2016 (595 thousand pounds) landings. These two years volumes are compared to 1.5 million pounds for the 2012-2016 five-year average. The price for ocean Chinook fishery was $6.97 in 2017 and $7.29 in 2016. The price of *Columbia River gillnet Chinook fishery* was $4.55 in 2017 and $3.68 in 2016 and the price for *Columbia River gillnet coho fishery* was $2.03 in 2017 and $1.87 in 2016. Oregon wild capture salmon is a specialty product sensitive to price increases when supplies are low. Combining the salmon fisheries results in a harvest value of $5.6 million ($2.1 million for the ocean salmon fishery and $3.4 million for the Columbia River salmon fishery) in 2017. The ocean Chinook salmon fishery south of Cape Falcon (five miles south of Cannon Beach) is forecast to be continued poor in 2018 due to 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* (171 vessels participated in the ocean salmon fishery in 2017 and 77 vessels participated in both the ocean salmon fishery and the tuna fishery). Volume was way down in 2017 (4.7 million pounds) as compared to 2016 (7.3 million pounds) while prices increased in 2017 ($2.28) as compared to 2016 ($1.76). The harvest value of the fishery was $10.8 million in 2017 and $12.7 million in 2016.
- The *Dungeness crab fishery* (usually the highest harvest value fishery for Oregon) had a very good season at $63.1 million harvest value despite prices (average season price $3.08) being down 16 percent over 2016 ($3.67). The 2016-2017 season which normally would have opened on December 1, 2016 was delayed until December 18, 2016 south of Cape Blanco and January 1, 2017 north of Cape Falcon. Delays can be due to crab health and minimum meat recovery rates (minimum meat recovery yields are 23 percent north and 25 percent south of Cascade Head). Bad winter weather will also delay harvesting.
- The *pink shrimp fishery* had a one-third drop in harvest landings (23.1 million pounds in 2017 and 35.5 million pounds in 2016). The year 2017 harvest was the lowest since 2009. Sixty-three vessels participated in the pink shrimp fishery in 2017. Prices also dropped in 2017 (season and size average $0.55) as compared to a previous five-year average (season and size average $0.63). The fishery harvest value was $12.7 million in 2017. The drop in landings was due to a moderate year 2 and small year 3 size class. Large catches of the year 1 size class in 2017 may hold promise that the 2018 season will have improved harvests.

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1. Volume is expressed as round pounds. Weight for species delivered dressed is converted to a round weight. All values are expressed in 2017 dollars except where noted otherwise. Prices are averaged across fishery seasons and across delivery size and condition.

- The *groundfish fishery* (other than sablefish and whiting) quotas have increased over recent years. This increase was partially due to lifting restrictions on some species previously classified for being in overfished status. Landings in 2017 were 42.8 million pounds compared to 30.2 million pounds in 2016. Prices for nearshore groundfish landed live had been decreasing in recent years, but there was a bump-up to $3.00 per pound in 2017 compared to $2.91 in 2016. Aggregate prices for flatfish (soles, flounders, etc.) and groundfish (other than sablefish and whiting) in 2017 decreased from 2016. With the mix of increase volume and decreased prices, the harvest value at $20.2 million was up in 2017. The *sablefish fishery* (also called black cod) had steady prices ($2.79 in both 2017 and 2016 when averaged over trawl and fixed gear sub-fisheries) and generated $15.5 million harvest value in 2017.
- The large 2014 year class in the *Pacific whiting fishery* raised quotas in 2017. Onshore landings in 2017 (201.5 million pounds) were almost 80 percent higher than in 2016 (113.0 million pounds). More surimi was produced in 2017 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 2017 for a new product form frozen, whole, and boxed that is shipped to Africa markets. Prices in 2017 were $0.081 as compared to a five-year average $0.112. The harvest value was $16.4 million in 2017 as compared to $14.5 million for the previous five-year average.
- The seine gear *Pacific sardine fishery* was restricted to a research and incidental fishery in 2017 as resource abundances have disappeared from what they were a few years ago. The unusually high volume of northern anchovy landings (11.7 million pounds) and market squid (2.8 million pounds) in 2016 did not continue in 2017. Another coastal pelagic species with significant landings in the past was Pacific (chub) mackerel, but landings were absent in 2016 and 2017. There is a limited market as bait or human consumption for this species. It could be abundances did not make targeting viable or processors were reluctant to purchase harvests.
- The other notable Oregon fisheries in 2017 were *hagfish,* also called slime eel (1.6 million pounds, $1.6 million harvest value), *Pacific halibut* (269 thousand pounds, $1.4 million), *red sea urchin* (282 thousand pounds, $362 thousand), *gaper clam* (327 thousand pounds, $297 thousand), and *basket cockle* (285 thousand pounds, $261 thousand).[1]

The central coast port groups (Tillamook, Newport, and Coos Bay) have increased harvest value in 2017 as compared to 2016 (Table II.2). Astoria's share of coastwide landings dropped from 32 percent in 2016 to 30 percent in 2017. The Brookings port group (includes Port Orford) share also decreased from 13 percent in 2016 to eight percent in 2017. A new processor facility with a pink shrimp line owned by BC Fisheries, LLC opened at the Port of Brookings Harbor in the spring 2016. 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.

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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 oysters grown in estuaries are not included in the delivery database and must be treated separately for modeling economic contributions.

The harvest value represents revenue for 894 different vessels making 23,060 deliveries to Oregon ports in 2017 (Table II.3). This is a decrease in vessels and deliveries (1,051 and 27,365) in 2016. The average revenue for active vessels (harvest revenue more than $500) was $160,601 in 2017. The active vessel median revenue was $37,700 in 2017. 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 were 108 processing plants, restaurants, etc. that each purchased at least $10 thousand of Oregon landings. The top five parent processing companies purchased 77 percent of landings measured by harvest value in 2017.[2]

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 2014 was only six percent of all U.S. West Coast, Alaska, and BC landings (TRG 2017). Some Oregon fisheries have a higher harvest value proportion in this northern Pacific Ocean area, such as Dungeness crab at 19 percent and pink shrimp at 56 percent in 2014.

BC Fisheries located in Brookings, Oregon was established 2007. The business is a family owned seafood wholesaler, offloader and processor. Photo credit BC Fisheries, LLC.

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 $280 million household income in 2017 (Table II.4 and Figure ES.1). This compares to a 2016 economic contribution of $288 million.

Distant water fisheries are a significant component of the commercial fishing industry's total economic effects in Oregon. These fisheries include harvests adjacent to the three West Coast continental states and delivered by catcher-vessels to motherships or caught by catcher processors, harvests in Alaska waters, and harvests in the western Pacific. Detailed estimates are not yet available for 2017.[3] Distant water fisheries were 50 percent of the commercial fishing industry statewide economic contributions in 2016.

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. Another way of saying this is 21 percent of the vessels in 2015 had 83 percent of all harvest value.
2. The top five parent companies in 2017 are (alphabetical order): Bornstein Seafoods; California Shellfish Co.; Da Yang Seafoods Inc., Oceanic Logistics LLC; and Pacific Seafood Group.
3. The most recent year that distant water fisheries model results are available is 2016. The results show $290 million (2017 dollars) household income was contributed to the statewide economy.

The estimated household income generated by the Oregon commercial fishing industry (includes distant water fisheries) is $570 million in 2017.[1] Using a statewide ratio of household net earnings to full and part time jobs, the economic contribution is equivalent to about 10 thousand jobs. This job estimate is a slight decrease over 2016, and about a 10 percent decrease over the previous five-year average.

The Oregon commercial fishing industry representation along Oregon Coast economies varies. The industry in 2017 represented about one-half percent of statewide net earnings and nine percent of Oregon Coast net earnings. The commercial fishing industry share of local net earnings in 2017 ranged from over 17 percent in Lincoln County to two percent in Tillamook County (Table II.5).

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.

1. Shellfish aquaculture is not included in the economic contribution which has been estimated to be $10 million (2017 dollars) household income in 2003 (TRG 2006).

Table II.1
Oregon Harvest Volume and Value by Fishery for Five-Year Average, 2016, and 2017

	2012-2017	2012-2016 Five Year Average			2016			2017		
Fishery	Value	Volume	Value	Price	Volume	Value	Price	Volume	Value	Price
Salmon		3,371	12,456	3.69	1,844	8,467	4.59	1,196	5,556	4.64
Troll Chinook		1,454	7,960	5.47	595	4,335	7.29	304	2,118	6.97
Troll coho		24	36	1.46	0	0		3	8	2.64
Net Chinook		1,418	3,797	2.68	1,001	3,680	3.68	648	2,949	4.55
Net coho		443	626	1.41	216	404	1.87	223	454	2.03
Other species/gear		32	37	1.15	31	49	1.55	18	27	1.49
Dungeness crab		13,907	47,354	3.41	14,246	52,303	3.67	20,483	63,144	3.08
Pink shrimp		47,556	29,999	0.63	35,528	25,575	0.72	23,057	12,688	0.55
Albacore tuna		8,739	13,407	1.53	7,250	12,742	1.76	4,745	10,803	2.28
Groundfish (other than sablefish and whiting)		26,844	15,367	0.57	30,179	17,172	0.57	42,817	20,154	0.47
Trawl gear LE		26,166	13,849	0.53	29,464	15,796	0.54	42,029	18,382	0.44
Fixed gear LE		139	174	1.25	134	167	1.25	163	197	1.21
Fixed gear OA		492	1,326	2.69	488	1,197	2.45	612	1,562	2.55
Sablefish		4,487	11,506	2.56	5,538	15,430	2.79	5,557	15,519	2.79
Trawl gear LE		1,998	3,895	1.95	2,323	4,763	2.05	2,555	4,885	1.91
Fixed gear LE		2,303	7,073	3.07	2,859	9,551	3.34	2,705	9,692	3.58
Fixed gear OA		186	538	2.89	356	1,116	3.14	296	942	3.18
Pacific whiting		130,264	14,531	0.112	113,035	8,861	0.078	201,499	16,385	0.081
Pacific sardine		34,758	4,175	0.120	9	0	0.037	3	0	0.097
Pacific halibut		224	1,232	5.50	248	1,419	5.71	269	1,413	5.25
Other		8,280	3,367	0.41	17,572	4,916	0.28	4,196	2,947	0.70
Hagfish		1,906	1,633	0.86	1,499	1,325	0.88	1,635	1,573	0.96
Red sea urchin		484	292	0.60	252	156	0.62	282	362	1.29
Pacific (chub) mackerel		1,519	124	0.082	18	2	0.086	100	0	0.004
Total		278,430	153,393	0.55	225,448	146,886	0.65	303,822	148,609	0.49

Notes:
1. Volume and value are in thousands. The harvest value and prices are in 2017 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 2016 D. crab includes December 2015 to November 2016.
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 northern anchovy (11.7 million pounds) and market squid (2.8 million pounds) in 2016; and jack mackerel (668 thousand pounds, $8 thousand), shad (375 thousand pounds, $14 thousand), gaper clam (327 thousand pounds, $297 thousand), and basket cockle (285 thousand pounds, $261 thousand) in 2017.

Source: PacFIN fish ticket data, April 2013, March 2014, April 2015, November 2016, March 2017, and June 2018 extractions.

Table II.2
Oregon Onshore Harvested Volume and Ex-vessel Value by Port Groups for 2016 and 2017

	2016			2017		
Port Group	Volume	Value	Share	Volume	Value	Share
Astoria	105,247	47,823	32%	154,535	43,641	30%
Tillamook	1,392	3,478	2%	2,083	4,800	3%
Newport	84,994	49,333	33%	115,043	52,996	37%
Coos Bay	22,399	30,879	20%	20,395	30,619	21%
Brookings	12,885	19,874	13%	10,299	12,138	8%
Port Orford	1,604	4,643	3%	1,160	3,426	2%
Total	226,918	151,387	100%	302,355	144,193	100%

Notes: 1. Volume and ex-vessel value are in thousands. Values are in 2017 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.

Source: PacFIN fish ticket data and annual vessel summary, March 2017 and June 2018 extractions.

Table II.3
Oregon Vessel Counts and Deliveries by Fishery in 2013 to 2017

	2013			2014			2015			2016			2017		
	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	588	531	10,610	698	636	11,952	687	607	9,672	510	430	6,737	319	267	5,869
Troll Chinook	397	371	5,249	491	455	5,845	485	448	4,551	311	267	2,261	171	151	1,088
Troll coho	40	4	56	235	70	597	50	18	113	0	0	0	27	5	69
Net Chinook	167	158	4,917	178	169	5,368	170	154	4,584	177	157	4,002	123	110	4,184
Net coho	144	98	1,852	162	134	3,109	144	82	1,574	132	86	1,336	110	76	1,549
Dungeness crab	342	323	6,626	348	321	6,351	336	319	6,065	341	319	6,019	362	345	6,535
Pink shrimp	60	60	1,017	60	60	1,033	78	78	1,285	75	75	1,051	63	62	754
Albacore tuna	380	360	1,365	379	361	1,290	348	322	1,294	367	348	1,440	301	288	1,098
Groundfish (other than sablefish and whiting)	339	228	6,204	340	200	5,661	363	246	5,795	329	220	5,120	312	227	6,010
Trawl gear LE	60	60	1,497	60	59	1,410	56	56	1,134	55	55	1,192	56	55	1,687
Fixed gear LE	48	35	575	34	21	316	42	32	463	38	31	459	40	34	496
Fixed gear OA	183	132	3,827	168	119	3,553	213	150	3,891	194	132	3,295	198	137	3,702
Sablefish	143	119	1,268	130	110	1,010	140	126	1,512	157	143	1,555	169	156	1,732
Trawl gear LE	57	41	672	57	42	579	56	45	788	53	44	701	55	45	910
Fixed gear LE	45	45	424	42	42	303	43	43	480	40	40	487	40	40	415
Fixed gear OA	42	34	170	33	28	128	47	44	244	67	62	367	76	73	407
Pacific whiting	45	24	1,065	40	24	1,010	47	23	755	57	21	882	57	22	1,308
Pacific sardine	25	14	458	32	17	198	13	6	49	17	0	70	12	0	62
Pacific halibut	119	53	267	195	93	468	173	85	382	163	99	411	121	68	275
Other	242	120	6,570	128	49	5,173	112	42	5,304	119	46	7,333	171	65	4,696
All fisheries	1,139	1,094	32,322	1,199	1,152	30,703	1,129	1,068	27,058	1,051	991	27,365	894	859	23,060

Notes: 1. Vessel counts include vessels 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. These are typically vessels delivering in tribal fisheries. Total deliveries include those with no valid vessel identification number.

2. The columns titled ">$500" show the number of vessels that landed over $500 of ex-vessel revenue from the shown fishery in Oregon, and is an arbitrary threshold to filter for vessels that are actively participating in the shown fishery. The fisheries are counted separately, so the $500 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. For example, the Columbia River fisheries include tribal fisheries.

4. Dungeness crab is shown seasonally by December to November for each year, for example 2016 Dungeness crab includes December 2015 to November 2016.

5. "Other" includes (parentheses list 2017 vessels, active vessels, and deliveries): white sturgeon (82, 44, 388), hagfish (10, 8, 188), shad (28, 4, 675), ghost shrimp (1, 0, 1,140), red sea urchin (0, 0, 270), Pacific (chub) mackerel (22, 0, 226), northern anchovy (2, 0, 4), market squid (3, 0, 3), and others

Source: PacFIN fish ticket data, April 2013, January 2014, March 2014, April 2015, November 2016, March 2017, and June 2018 extractions.

Table II.4
Commercial Fishing Industry Economic Contribution Trends in 2012 to 2017

	2012	2013	2014	2015	2016	2012-2016 Average	2017
Oregon							
Ex-vessel value	136.4	188.1	162.5	117.7	151.4	151.2	144.2
Landed pounds	306.7	349.4	300.4	203.9	226.9	277.5	302.4
Onshore economic contributions	302.0	383.0	306.0	209.5	288.2	297.7	279.6
Distant water economic contributions	297.3	313.1	320.9	257.9	290.4	295.9	290.4
Total economic contributions	599.3	696.1	626.9	467.4	578.7	593.7	570.0
Equivalent jobs (not millions)	11,398	13,306	11,889	8,202	10,265	11,012.0	9,913

Notes:
1. Amounts are in millions, except for equivalent jobs. Values are in 2017 dollars.
2. Economic contribution is income accruing to households.
3. Prior to 2016, the economic contributions are calculated with the Fisheries Economic Assessment Model (FEAM). For 2016 and 2017 onshore, the input-output model for Pacific Coast fisheries (IO-PAC) is used.
4. Equivalent jobs at the statewide level include jobs within all coastal communities plus jobs in the rest of the state.
5. Distant water 2017 model year estimates are not available, so Year 2016 estimate is assumed the same.
4. Amounts are based on landings during calendar year, including Dungeness crab.

Sources:
1. Landing data is from PacFIN annual vessel summary data, April 2013, March 2014, April 2015, November 2016, March 2017, and June 2018 extractions.
2. Average earnings per job data is from BEA through 2017.

Table II.5
Representation of the Commercial Fishing Industry by Port Groups in Area Economies in 2017

	Statewide		Coastwide		Astoria		Tillamook		Newport		Coos Bay		Brookings	
	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent
All income	199,422.2	0.3%	8,418.3	4.3%	1,676.0	6.6%	1,112.4	1.0%	2,027.6	8.5%	2,670.7	2.1%	931.7	1.3%
Earned income	121,153.6	0.5%	4,066.5	8.9%	904.3	12.2%	536.4	2.1%	986.7	17.4%	1,269.0	4.3%	370.2	3.3%
Fishing income	570.0		360.6		110.4		11.4		171.6		55.1		12.1	
Onshore	279.6		210.2		80.6		5.8		63.9		49.3		10.5	
Distant water	290.4		150.4		29.8		5.6		107.6		5.8		1.6	
Equivalent jobs	9,913		8,182		2,401		253		3,924		1,179		311	

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.

3. Earnings per job are county annual average computed by dividing all industry earnings 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. Average earnings per job would not account for variations in the distribution of earnings among high-pay vs. low-pay jobs.

4. 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.

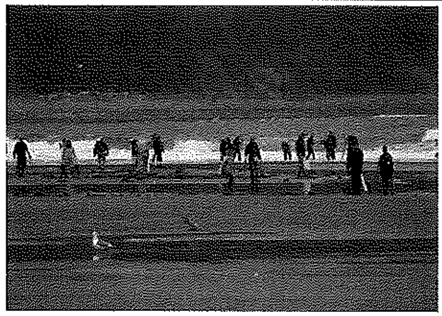
5. Onshore fishing income is based on landings during calendar year, including Dungeness crab.

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

III. Marine Recreational Fisheries

Commercial wild harvesting activities share natural resources with a large ocean and inland 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 inland 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 also excluded.[4] The

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 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. 2012 and 2014). Ainsworth et al. (2012) provided catch and effort estimates for a recent five year time period ending in 2011. The greatest statewide harvest occurred in 2011 when over one 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 bay crab fisheries were the greatest component of the statewide harvest, accounting for approximately 60

presented economic information includes findings from other researchers, as well as economic modeling results developed for this project.

The selected 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 inland), 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 inland 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. The appendix Table A.2 shows trip expenditures per day for the various fisheries and fishing mode.

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 multiplier effect estimates are calculated using relationships from an economic input-output model. 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 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).[2]

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percent of the annual total recreational harvest. 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. 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 (Ainsworth et al. 2014). Bay clams (including cockles, butter clams, gaper clams, and native littleneck clams) are targeted for recreational and commercial harvest in Oregon. Popular bays for clamming in 2012 were the Tillamook (11,018 digging trips), Netarts (13,653 trips), Yaquina (7,052 trips), and Coos Bay (9,729 trips).

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.
2. 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 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.[1] The reader is encouraged to review TRG (2015b) for discussions about the data limitations.

B. Description

The total economic contributions measured by income for the analyzed recreational fisheries in 2016 are estimated to be $61.8 million and in 2017 are estimated to be $54.7 million. There were an estimated 42.3 thousand ocean salmon fishing angler days generating $2.6 million economic contribution in 2017 (Table III.2 and Figure ES.4). Ocean non-salmon angler days were estimated to be 128.6 thousand which generated $10.7 million in economic contributions. Of this amount, $8.4 million was generated when bottomfish was the target species or trips were for diving. Halibut as a target species generated $1.8 million and tuna as a target species generated $0.5 million.

The inland recreational fisheries can be defined first by those fisheries in all non- Columbia River inland locations, and second by the lower Columbia River estuary and its tributaries. The total non-Columbia River coastal inland estuary and freshwater fisheries estimated angler days were 0.8 million and the economic contribution is estimated to be $35.3 million for the 2017 season. (Year 2017 non-Columbia River catch and effort estimates are preliminary.) Of this, salmon fisheries generated $23.0 million in coastal economies. This includes all spring, summer,

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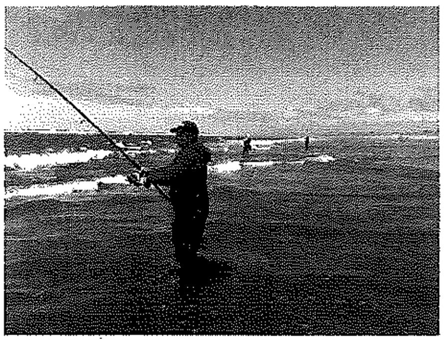
Oregon. The U.S. Fish and Wildlife Service (USFWS) National Survey in data year 2016 found total fishing nationwide spending was 53 percent for non-trip related items such as equipment, boats, and other non-durable items (USFWS 2017).

1. For descriptions about stock conditions and management approaches, 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 in-river 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 Oregon Department of Fish and Wildlife (ODFW) conservation and recovery plan website. Whiteside et al. (2017) discuses the efficacy of using RecFIN data for estimating effort in the bay marine fishery.

and fall Chinook, and hatchery origin coho, as well as native coho fishing allowed in some rivers. Trips for other coastal inland anadromous fish and other marine species generated $12.3 million in coastal economies in 2017. This includes $8.8 million for trips where the primary purpose is for steelhead, $16 thousand for sturgeon, and $3.5 million for other marine species trips.

The lower Columbia River estuary is estimated to have had 99.0 thousand angler days which generated $6.0 million in economic contributions in 2017. Of this, the Columbia River fall salmon fishery in 2017 generated $4.2 million in economic contributions. The 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. The lower Columbia River estuary sturgeon fishery is estimated to have generated $0.4 million in economic contributions in 2017. Other marine species trips in the lower Columbia River estuary were expected to have generated $36 thousand in economic contributions in 2017. Salmon and steelhead trips in tributaries to the lower Columbia River estuary are estimated to have generated $1.4 million in economic contributions in 2017.


Surf perch fishing. Photo credit Travel Oregon.

Of all recreational fisheries trips described above, trips to non-Columbia River coastal inland estuary and freshwater areas are estimated to generate 64.7 percent of the economic contributions in 2017 (Figure ES.4). Trips targeting salmon species generate an estimated 42.2 percent (largest share) of economic contribution in these locations. The Columbia River fisheries generate 11.1 percent and ocean fisheries generate 24.3 percent of the economic contribution in 2017. Ocean trips when bottomfish were the target species generated the most economic contribution in 2017, but trips when salmon alone or combination salmon and bottomfishing are target species can be the highest generator depending on management allowed fishing opportunities.

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 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
Ocean and Inland Recreational Fisheries Trips in 2010 to 2017

Target Fishery	2010	2011	2012	2013	2014	2015	2016	2017
Ocean								
Salmon	53.3	48.8	67.3	85.5	121.5	66.0	38.9	42.3
Halibut	13.8	16.5	18.0	19.4	14.2	17.6	21.6	21.8
Tuna	11.4	10.8	16.0	9.4	12.0	11.9	9.8	5.7
Bottomfish	71.3	69.2	70.3	85.0	75.6	100.6	91.9	101.1
Subtotal ocean	149.7	145.3	171.6	199.3	223.3	196.0	162.2	170.9
Coast estuary and inland								
Fall salmon	357.8	573.3	447.8	734.0	927.0	1,041.7	444.0	422.4
Spr./sum. Chinook	98.3	111.8	119.4	106.4	110.2	120.9	69.6	64.3
Inland steelhead	252.4	196.3	430.0	213.6	243.8	330.0	324.2	185.6
Other marine species	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
Subtotal Coast	843.7	1,017.0	1,132.2	1,187.7	1,414.2	1,626.0	970.7	805.6
Lower Columbia River								
Mainstem fall salmon/steelhead	31.0	31.8	41.6	42.9	74.3	74.1	64.0	61.9
Mainstem spr./sum. Chinook	25.5	8.8	10.1	9.2	8.5	27.2	16.8	16.4
Tributary fall salmon/steelhead	13.4	9.4	10.4	8.9	23.4	14.0	12.3	11.8
Other marine species	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	7.2
Subtotal Lower Columbia River	87.9	63.3	72.6	70.2	108.6	117.6	96.1	99.0
Total	1,081.3	1,225.6	1,376.5	1,457.2	1,746.2	1,939.6	1,229.0	1,075.5

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 inland and lower Columbia tributary salmon and steelhead fisheries data is preliminary for 2017. Lower Columbia River mainstem salmon, steelhead, and sturgeon fisheries trips are reported for the CRCP and are through 2017 (Watts 2018).
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 2018) for salmon ocean and Columbia River mainstem; ODFW, Oregon Ocean Salmon Fisheries, Annual Status Report, for bottomfish. Watts (2018) for lower Columbia River estuary salmon and sturgeon; ODFW (SSHSTRP) for lower Columbia River off-channel and coast; RecFIN for coastal inland other species; and MRFSS for lower Columbia River other species.

Table III.2
Ocean and Inland Recreational Fisheries Economic Contributions in 2016 and 2017

Economic Contributions in 2016

Target Fishery	Ocean	Coast Inland Salmon/ Steelhead	Coast Inland Marine Species	Lower Columbia River	Total	Fishery Share
Ocean salmon	$2.37				$2.37	3.8%
Inland fall salmon		$21.02		$0.30	$21.32	34.5%
Inland steelhead		$15.35		$0.30	$15.65	25.3%
Inland spr./sum. Chinook		$3.30		$0.96	$4.26	6.9%
Mainstem fall salmon				$4.32	$4.32	7.0%
Ocean halibut	$1.77				$1.77	2.9%
Ocean tuna	$0.80				$0.80	1.3%
Ocean bottomfish	$7.75				$7.75	12.5%
Other marine species			$3.49	$0.04	$3.53	5.7%
Sturgeon			$0.00	$0.07	$0.07	0.1%
Total	$12.68	$39.67	$3.49	$5.99	$61.83	100.0%
Shares	20.5%	64.2%	5.6%	9.7%	100.0%	

Economic Contributions in 2017

Target Fishery	Ocean	Coast Inland Salmon/ Steelhead	Coast Inland Marine Species	Lower Columbia River	Total	Fishery Share
Ocean salmon	$2.59				$2.59	4.7%
Inland fall salmon		$20.00		$0.45	$20.45	37.4%
Inland steelhead		$8.79		$0.13	$8.92	16.3%
Inland spr./sum. Chinook		$3.04		$0.87	$3.92	7.2%
Mainstem fall salmon				$4.18	$4.18	7.6%
Ocean halibut	$1.82				$1.82	3.3%
Ocean tuna	$0.47				$0.47	0.9%
Ocean bottomfish	$8.39				$8.39	15.3%
Other marine species			$3.49	$0.04	$3.53	6.5%
Sturgeon			$0.02	$0.38	$0.39	0.7%
Total	$13.27	$31.83	$3.51	$6.04	$54.65	100.0%
Shares	24.3%	58.2%	6.4%	11.1%	100.0%	

Notes: 1. Economic contributions are expressed as income in millions of 2017 dollars and are at the coastwide economic level.
2. Fall Columbia River mainstem salmon is sometimes referred to as the Buoy 10 salmon fishery.
3. Other marine species is sometimes referred to as bottomfishing when it takes place in the ocean.

Source: Study.

Table III.3
Recreational Fisheries Economic Contribution at Port Groups in 2017

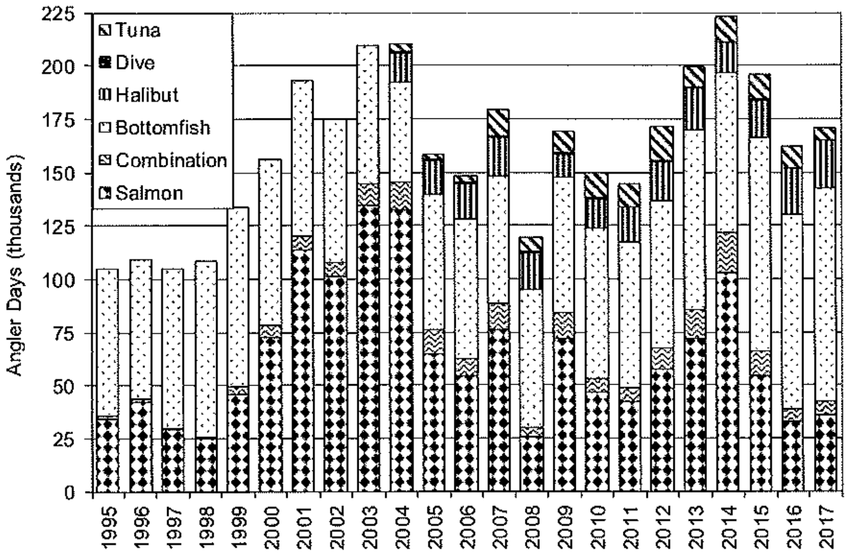
Port Area	Ocean	Coast Inland	Lower CR	Total
Astoria	605	13	6,040	6,657
Tillamook	2,307	12,827	0	15,134
Newport	5,896	9,201	0	15,096
Coos Bay	2,619	7,576	0	10,195
Brookings	1,916	5,721	0	7,637
Port Orford	69	737	0	806
Coastwide	13,343	35,338	6,040	54,720

Notes: 1. Economic contributions are expressed as income in thousands of 2017 dollars. They are at the coastwide economic level for trip expenditures.

2. Year 2017 inland trips information is preliminary. Port Orford ocean economic contribution is estimated using the most recent angler trips available from sampling year of 2012.

3. Coast inland 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
Ocean Recreational Salmon and Non-Salmon Fishing Effort in 1995 to 2017



Notes: Halibut, dive, and tuna are included in bottomfish prior to 2004.
Source: ODFW (ORBS).

IV. Nearshore Fisheries

A. Overview

An economic activity description is provided for nearshore fisheries, i.e. commercial and recreational fisheries that take place within the TS and adjacent bays. The description is provided to assist in characterizing the potential economic impact from marine reserve management.

Nearshore fisheries are usually defined by *place* of harvest. ODFW (2016) specifies the nearshore area to be the Oregon Territorial Sea (TS) and 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. The 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 does have 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 following nearshore fisheries descriptions rely on the species identifications made in TRG (February 2018) to compile the commercial and recreational fishing activity.[1]

Nearshore commercial and recreational fisheries activity is substantial (Figure ES.5). Total commercial fishing onshore landed value was $151.4 million in 2016. There were 162.2 thousand ocean recreational trips in 2016 of which 34 percent are estimated to be via charter boat services. The nearshore fisheries proportion of commercial and recreational community economic contribution in 2016 was $120 million. This represents 19 percent of Oregon total commercial and recreational fishing industry (includes distant water fisheries) economic contribution which was $640 million in 2016 (Figure ES.5).[2]

The most important (highest harvest revenue generating) nearshore fisheries are Dungeness crab, salmon troll, and nearshore groundfish. While the three fisheries fishing grounds may be within the nearshore area for some fishers for some of the season, fishing activity for the fisheries will include ocean areas westward of the TS.[3] Table IV.1 shows landed value for the nearshore

1. A summary explanation of which species are included in nearshore groundfish is contained in the glossary.
2. Recreational ocean and bay crabbing is not included in the compilation which generated an estimated $6 million income in 2017. (Trips are from Ainsworth et al. (2012) and economic contributions based on per trip spending from Dean Runyan Associates (2009) and Gentner et al. (2001).)
3. 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

fisheries and other major fishery categories at port groups in 2016.[1] The coastwide total for the nearshore fisheries was $61.5 million in 2016 and the coastwide total of all fisheries was $148.5 million.

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, or simply
- Personal investment choice made by the permit owner unrelated to fishing.

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. The churn of vessels leaving and entering all fisheries at port groups is shown on Table IV.2. (Appendix B shows itemization by year for the exit and entry vessel counts.) The table itemizes the 2007-2016 average annual intra-state status (make landings at another port group or do not show any in-state activity) for those that exit and those that enter. A little less than half that do exit/enter come-from or go-to 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.

B. Fleet Characteristics

This section dwells on nearshore fisheries participant characteristics to emphasize that vessels and processors/buyers are not a homogenous group. 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. The descriptors are for a single year 2016. The descriptors are participant counts and landing value, which is sometimes synonymously referred to as vessel revenue and processor purchases.

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

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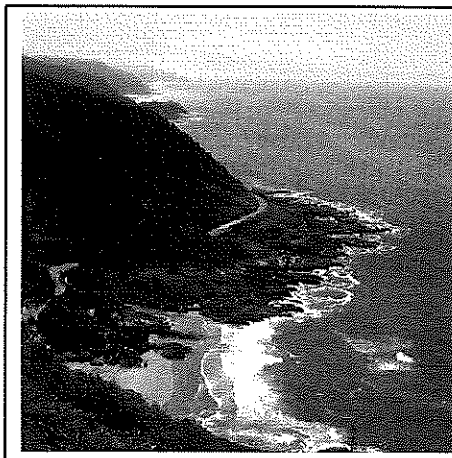
year average ending in the 2013-2014 season logbook information (ODFW personal communication May 2015).

1. The table's Dungeness crab and salmon troll fisheries are not apportioned to harvesting taking place within the TS.

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.

Table IV.3 presents nearshore fishery vessel counts and revenue distribution in 2016. There were 253 vessels that delivered nearshore groundfish species. Concerning permit types, 79 percent of all vessels are open access with the balance either LE trawl (19 percent) or LE fixed gear (two percent). The 79 percent open access vessels are 38 percent with an Oregon Nearshore Fisheries Permit and 41 percent without. The top 88 nearshore groundfish revenue producing vessels (35 percent) delivered 90 percent of the $1.5 million nearshore groundfish landings. The top 75 vessels (30 percent) delivered 90 percent of the $51.0 million "all fisheries" landings. The top 10 vessels delivering nearshore groundfish have average landings $41,823 for the fishery, and their total is 28.1 percent of all vessels nearshore groundfish landings. The top 10 vessels delivering nearshore groundfish average landings in all fisheries is $1.4 million, and their total is 28.3 percent of all nearshore groundfish vessels' Oregon onshore revenue.


Cape Perpetua Marine Reserve. Photo credit ODFW.

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 high nearshore groundfish representative average landings ($6,636 and $6,225 respectively), but are least dependent on the fishery (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 $10,442, which is 32 percent dependency, and open access vessels without a permit representative average is $1,272, which is two percent dependency. Open access vessels land rockfish species and lingcod caught with hook and line gear.

Typical and representative revenue averages by major fishery category for vessels participating in the nearshore groundfish fishery at port groups and coastwide in 2016 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 (92 percent). Newport has the most diversified permit type shares with open access being 69 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. Appendix 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 ($63,958 versus $12,266). There were seven 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).

C. Fisheries Engagement

A brief set of 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.[1] When supplemental ocean use choices data are available, primary factors for adaptive responses can be identified and predictive models developed.[2] 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).[3]

1. 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.
2. 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.
3. The authors acknowledge 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. Norman et al. (2007) used social and cultural descriptors along with fishery data 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. 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) at port groups in 2016 are shown on Figure IV.1. The commercial fisheries are itemized for an aggregate of the nearshore fisheries and the residual for all other onshore fisheries. Commercial fisheries generated $201.1 million income coastwide in 2016. (Distant water fisheries effects are not included.) Recreational fisheries generated $60.7 million income in 2016.

Fisheries engagement can be decomposed into regional economy reliance, fisheries dependency, and social vulnerability.[2] Figure IV.2 shows port group rankings for these dimensions in 2016. While the Astoria port group had the highest reliance on commercial onshore fisheries in 2016, as previously mentioned the Tillamook port group was the most dependent on commercial nearshore fisheries. (If distant water fisheries were included in Figure IV.2, then the Newport port group would have had the highest reliance on commercial fisheries.) Brookings and Port Orford port groups are of higher social vulnerability with greater commercial fisheries reliance and dependence on nearshore fisheries.

Demographic and well-being indicators at port groups in 2016 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, unemployment), wealth (income sources, poverty), and education. The Oregon Coast levels and contrasts with the State are:

- Newport port group has the largest population (60,917) and Port Orford the smallest (3,158).

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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.

- The Coos Bay port group is the most racially diverse at 11.2 percent.
- All port groups (coastwide median age 49.5) are older than the State (median age 39.1) and household size is smaller (State 2.52 and coastwide 2.30).
- The ACS tourism industry category (arts, entertainment, recreation, accommodation, and food service) is higher coastwide (15.6 percent of all civilian employment age 16 and over) than the State (10.0 percent). The Newport port group has the highest employment in this category at 21.1 percent.
- Costs (rent or 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 33.8 percent.
- There is a dramatic difference in household mean income at the Coast ($55,544) compared to the State ($72,013). Port Orford has the lowest income ($47,245) and the highest number of households receiving social security payments (57.5 percent).
- The share of self-employed individuals such as crew and skipper jobs on fishing boats is higher on the Coast (10.4 percent) than in the State (7.6 percent).
- Port Orford is distinguished by having the highest share of residing individuals living under the poverty level (29.5 percent). The State individuals poverty level is 15.7 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. (Section IV.B discusses the heterogeneity in nearshore fisheries participant portfolios.) 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. The TRG (February 2018) follow-on project generalized the model to apply to a new base period and any nearshore areas.

Based on average 2013 to 2015 conditions, the TRG (February 2018) project estimated that the maximum potential economic impact (i.e. no replacement from fishing elsewhere) from marine reserve management is 3.6 percent of all nearshore commercial and recreational fishing economic contribution that takes place in the TS (Table ES.1). Since the marine reserve system is less than 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. 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

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.

from possible increased stock abundances that might raise catch per effort in the new fishing area.

There are other MR Program human dimension investigative projects underway and planned that address the extent of effort shift and leaving fisheries.[1] The projects 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 landing value variability between 2008 and 2017 has a range of 72 percent for Dungeness crab, 223 percent for salmon troll, and 30 percent for nearshore groundfish (TRG November 2018). In regards to fishing tenure, Figure IV.3 shows nearshore groundfish vessel annual exit and entry before and after marine reserve management plan implementation.[2] 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.

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1. A more thorough description of human dimensions research and monitoring plans can be found at the Oregon Marine Reserves portal.
2. 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 2016

	Port Group						
Fishery	Astoria	Tillamook	Newport	Coos Bay	Port Orford	Brookings	Coastwide
Nearshore Fisheries							
Ocean salmon	192,065	142,976	2,828,968	887,985	149,879	52,032	4,253,905
D. crab	15,161,951	2,411,481	15,600,124	11,788,031	2,872,524	7,900,763	55,734,874
Nearshore groundfish	281,554	195,605	97,387	97,152	533,037	289,503	1,494,238
Subtotal	15,635,570	2,750,062	18,526,479	12,773,168	3,555,440	8,242,298	61,483,017
Other Fisheries							
Col. R. salmon	4,053,970	0	0	0	0	0	4,053,970
Other groundfish	13,965,928	13,365	9,713,738	3,780,887	718,336	2,301,401	30,493,655
P. shrimp	3,756,197	0	8,620,048	8,520,680	0	4,196,328	25,093,253
Tuna	3,704,528	161,212	4,752,673	3,715,771	7,859	160,049	12,502,092
Whiting	3,938,583	0	4,755,090	0	7	2	8,693,682
Sardine	89	0	168	60	0	0	317
Other	1,867,366	487,933	2,035,195	1,507,268	273,630	44,280	6,215,672
Total	46,922,231	3,412,572	48,403,391	30,297,834	4,555,272	14,944,358	148,535,658

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, March 2017 extraction.

Table IV.2
Vessel Average Annual Exit/Entry for All Fisheries at Port Groups in 2006 to 2016

2007-2016 average annual share of vessels exiting the port group:

Port Group	Share Previous Year Amount	Share Previous Year Variability	Landed at Other Oregon Port	Did Not Land at Other Oregon Port
Astoria	27.1%	41.1%	30.8%	69.2%
Tillamook	34.6%	86.4%	44.0%	56.0%
Newport	34.0%	25.2%	45.8%	54.2%
Coos Bay	31.7%	90.0%	46.9%	53.1%
Port Orford	18.4%	72.1%	37.4%	62.6%
Brookings	29.3%	89.6%	50.4%	49.6%

2007-2016 average annual share of vessels entering the port group:

Port Group	Share Current Year Amount	Share Current Year Variability	Entered From Other Oregon Port	Did Not Land at Other Oregon Port
Astoria	26.0%	42.3%	31.2%	68.8%
Tillamook	32.6%	33.4%	47.5%	52.5%
Newport	34.0%	30.2%	44.6%	55.4%
Coos Bay	33.3%	60.8%	44.8%	55.2%
Port Orford	17.4%	79.8%	36.6%	63.4%
Brookings	29.8%	110.8%	49.0%	51.0%

Notes: 1. Variability is range divided by mean expressed as a percent.
2. Vessel counts itemized for whether they landed in the port group the previous year.
3. An exiting vessel landed at the port group the previous year but not the current year. The vessel may have landed at another Oregon port group in the current year. An entering vessel landed at the port group in the current year but not the previous year. The vessel may have landed at another Oregon port group in the previous year.

Source: PacFIN annual vessel summary, April 2009, March 2010, July 2011, April 2013, March 2014, April 2015, November 2016, and March 2017 extractions.

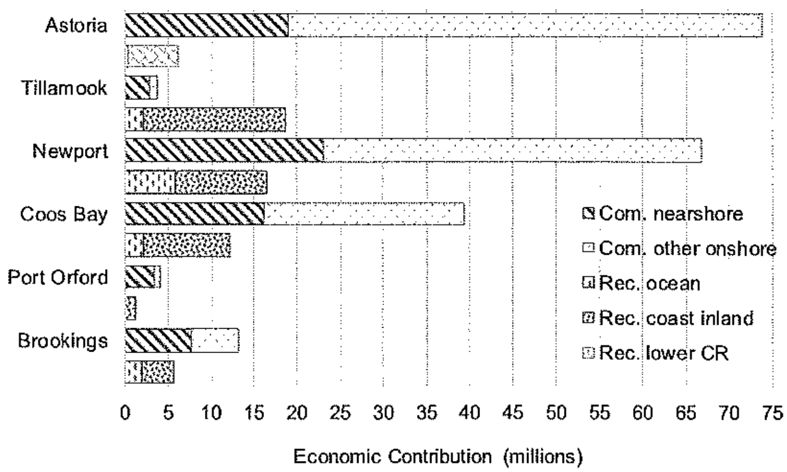
Table IV.3
Nearshore Groundfish Fisheries Vessel Revenue Distribution in 2016

	Nearshore Groundfish Fisheries		All Fisheries	
	Count	Share	Count	Share
Volume (thousands pounds)	1,215.3		133,537.0	
Ex-vessel value (thousands $)	1,489.4		50,966.1	
Vessels (w or w/o permit)	253	100%	253	100%
Vessels >$500	160	63%	236	93%
Vessels 50% value	25	10%	22	9%
Vessels 90% value	88	35%	75	30%
Top 10 vessels	10	4%	10	4%
Average species revenue	41,823		1,444,828	
Fishery share of Oregon revenue		28.1%		28.3%
OA vessels	199	79%	199	
Permit	96	38%	96	
No permit	103	41%	103	
LE trawl permit vessels	48	19%	48	
LE fixed gear permit vessels	6	2%	6	

Notes:
1. Vessel counts include vessels making any deliveries in the nearshore groundfish fisheries to Oregon ports. Vessel revenue includes Oregon onshore landings only.
2. Excludes landings with no vessel identification. This results in less than five thousand dollars of nearshore groundfish being excluded from the tabulations.
3. Distant water fisheries revenue is not included.
4. OA vessels with a permit include those with an ODFW rockfish permit type in 2016. The permit for nearshore groundfish is a state issued limited entry Oregon nearshore fishery permit with and without a nearshore endorsement permit for harvesting other rockfish. Federal and state regulations allow nearshore groundfish to be harvested without a permit as a trip limited incidental fishery. State regulations apply inside three nautical miles and are accompanied with depth restrictions.

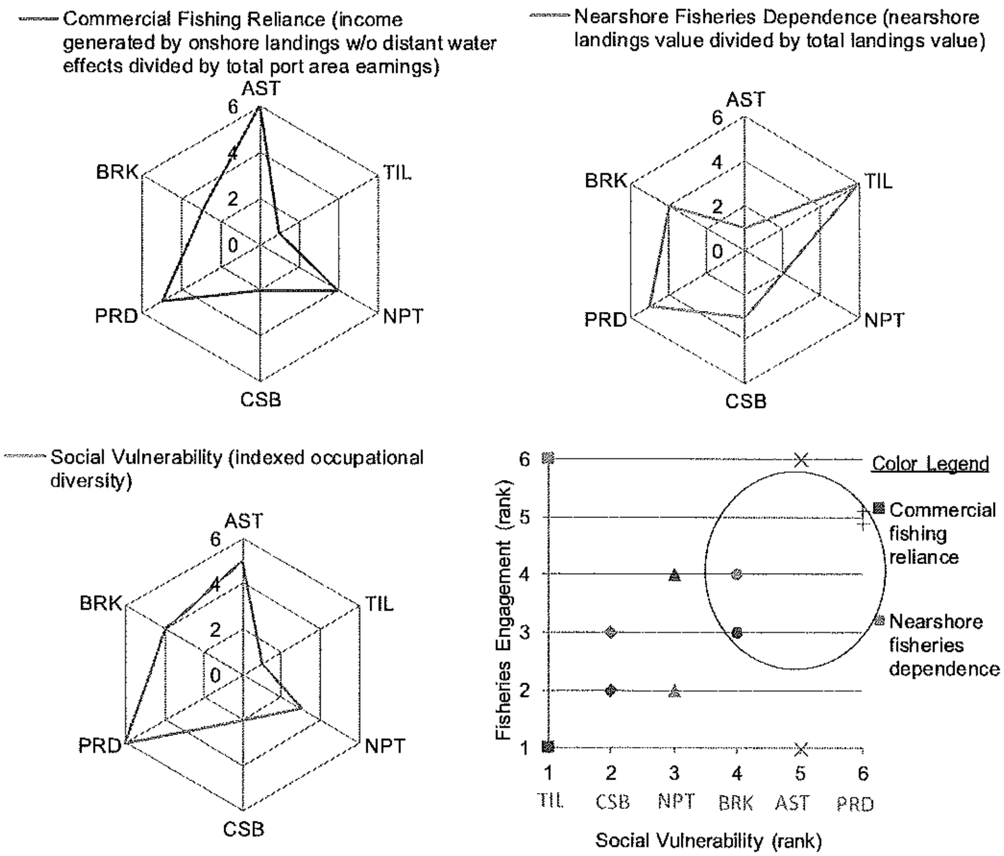
Source: PacFIN annual vessel summary and fish ticket data, March 2017 extraction.

Figure IV.1
Commercial and Recreational Fisheries Engagement at Port Groups in 2016



Notes:
1. Economic contribution (measured by income that includes the multiplier effect) is generated household income at the coastwide economy level in 2016 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, 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. Port Orford recreational ocean economic contribution is estimated using the most recent angler trips available from sampling year of 2012.
4. Angler days are included when the fishing trip occurs in the ocean, inland marine areas (estuaries), and when the trip purpose is for certain species in coastal area inland locations. The ocean fisheries include trip purpose being for salmon, bottomfish, halibut, tuna, or dive (but not crab). The only trips included at inland locations are when the catch was Chinook or coho salmon, steelhead, sturgeon, or other marine species. The inland 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 and recreational crabbing/clamming are not included.
6. Lower Columbia River mainstem spring/summer Chinook fishery includes trips in off-channel areas.

Figure IV.2
Oregon Rankings of Port Group Area Commercial Fishing Industry Reliance, Commercial Nearshore Fisheries Dependency, and Social Vulnerability in 2016

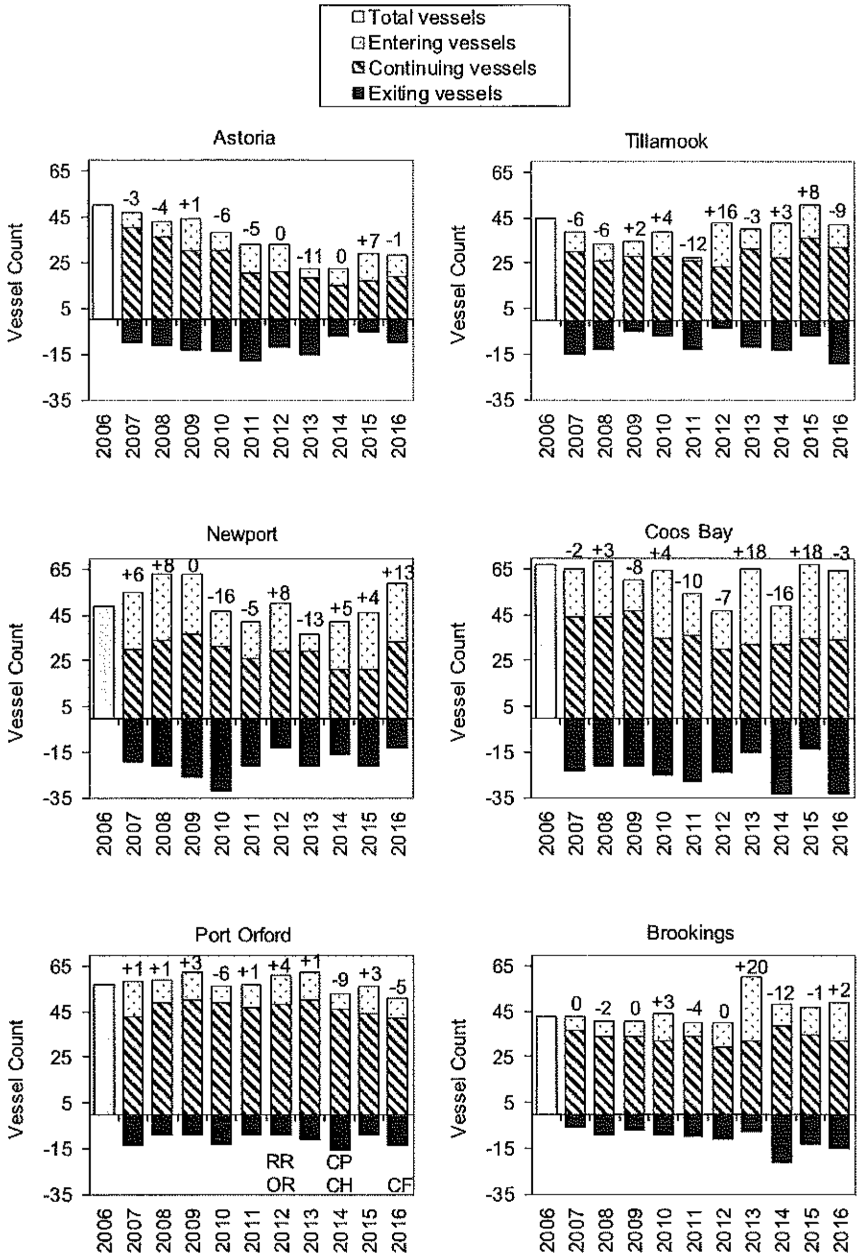


Notes: 1. Nearshore fisheries are defined for this figure to be Dungeness crab, salmon troll, and nearshore groundfish. The nearshore fisheries portion of the commercial salmon troll fishery is assumed 35 percent and the nearshore portion of the Dungeness crab fishery is assumed to be 54 percent of the total amounts shown (TRG February 2018).

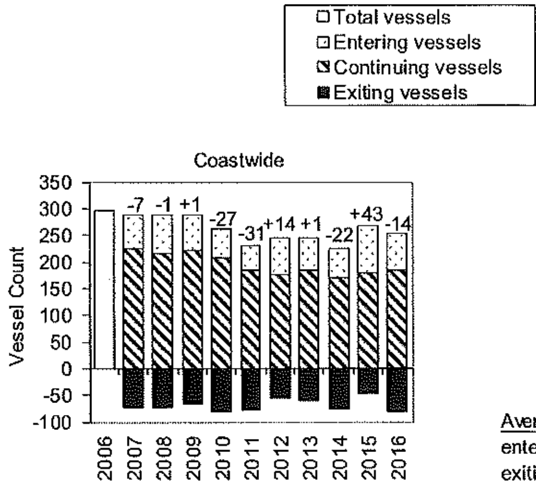
2. Reliance rankings are based on economic contribution (measured by income that includes the multiplier effect) from commercial fisheries (without distant water fisheries effects) divided by port group area household earnings. Port Orford area earnings are from northern Curry County zip codes.
3. Dependency rankings are from the ratio of commercial nearshore fisheries landed value divided by total onshore fisheries landed value.
4. Social vulnerability rankings are based on Shannon Index of occupational diversity.
5. The ranking 6 represents the highest commercial fishing reliance, highest commercial nearshore fisheries dependency, and highest social vulnerability.
6. Port groups within red ellipse would be of higher social vulnerability with greater commercial fisheries reliance and dependence on nearshore fisheries.

Sources: TRG (2017) and ACS 2012-2016 estimates.

Figure IV.3
Vessel Exit/Entry Trends for Nearshore Groundfish Fishery
Vessels at Port Groups and Coastwide in 2006 to 2016



re IV.3 (cont.)



Average	2007-2011	2012-2016
entering	61	69
exiting	-74	-64

Notes: 1. Appendix B, Table B.1 notes and sources apply.
2. Annotated numbers are net change in number of vessels participating each year.

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Appendix A

Recreational Fisheries
Trips by Target Species

Table A.1
Historical and Assigned Success Rates for Inland and Ocean Recreational Fisheries

			Inland Success Rates				
			Chinook			Winter/ Summer	
Waterway	Source	Dates	Fall	Spring/ Summer	Coho	Steelhead	Sturgeon
ESTUARY AND INLAND							
Lower Columbia River							
Sturgeon fishery							
	Devore et al. (1999)	1996-1998 average	--	--	--	--	7.32
Columbia River fall mainstem salmon fishery							
	Watts (CRCP)	2002	3.91	--	13.51	--	--
		2003	6.13	--	1.64	--	--
		2004	3.73	--	4.49	--	--
		2005	4.95	--	7.00	--	--
		2006	19.01	--	9.17	--	--
		2007	8.32	--	4.21	--	--
		2008	3.40	--	4.22	--	--
		2009	11.58	--	1.49	--	--
		2010	6.80	--	5.95	--	--
		2011	4.43	--	5.95	--	--
		2012	3.20	--	8.23	--	--
		2013	2.75	--	8.86	--	--
		2014	3.89	--	1.75	--	--
		2015	2.90	--	2.90	--	--
		2016	4.58	--	10.40	--	--
		2017	2.87	--	5.17	--	--
		2002-2016 average	4.27	--	3.48	--	--
Columbia River mainstem Section 10							
	Watts (CRCP)	2002	--	7.65	--	17.54	2.26
		2003	--	6.66	--	16.43	2.53
		2004	--	4.32	--	19.92	2.77
		2005	--	7.95	--	28.92	3.44
		2006	--	6.76	--	17.41	2.85
		2007	--	7.99	--	13.29	2.60
		2008	--	10.57	--	12.92	3.56
		2009	--	6.29	--	12.20	3.90
		2010	--	5.93	--	21.96	5.82
		2011	--	10.69	--	8.00	4.31
		2012	--	6.34	--	10.03	4.45
		2013	--	7.84	--	17.81	3.79
		2014	--	7.82	--	10.81	--
		2015	--	3.69	--	53.47	--
		2016	--	6.65	--	24.31	--
		2017	--	4.72	--	423.51	--
		2002-2016 average	--	6.35	--	16.43	3.17
Coast							
Nehalem River							
	ODFW AFS 65	1963-64 season	--	--	--	5.33	--
		1964-65 season	--	--	--	8.43	--
		1968-69 season	--	--	--	2.18	--
	Creel Surveys	2010	10.03	--	--	--	--
		2012	44.95	--	--	--	--

Table A.1 (cont.)

Waterway	Source	Dates	Inland Success Rates: Chinook Fall	Chinook Spring/Summer	Coho	Winter/Summer Steelhead	Sturgeon
Tillamook Bay							
	Creel Surveys	1996	6.81	--	--	--	--
Wilson River							
	ODFW AFS 65	1964-65 season	--	--	--	7.88	--
		1965-66 season	--	--	--	16.91	--
Salmon River							
	Creel Surveys	1986-1989 average	8.80	--	--	--	--
		2002	6.91	--	42.04	--	--
		2003	6.70	--	104.29	--	--
		2005	5.28	--	--	--	--
		2006	7.07	--	--	--	--
		2007	12.61	--	--	--	--
		2008	21.75	--	--	--	--
		2009	14.49	--	--	--	--
		2010	5.89	--	--	--	--
		2011	5.20	--	--	--	--
		2012	6.18	--	--	--	--
		2013	2.65	--	--	--	--
		2014	2.91	--	--	--	--
		2015	2.45	--	--	--	--
		2016	3.04	--	--	--	--
Siletz Estuary							
	Creel Surveys	2010	14.43	--	34.55	--	--
		2011	--	--	21.14	--	--
		2012	29.86	--	52.48	--	--
Yaquina Estuary							
	Creel Surveys	2009	--	--	6.44	--	--
		2011	--	--	18.07	--	--
		2012	--	--	32.96	--	--
Alsea River							
	ODFW AFS 65	1964-65 season	--	--	--	22.79	--
		1965-66 season	--	--	--	32.25	--
Alsea Estuary							
	Creel Surveys	2011	--	--	12.05	--	--
		2012	--	--	6.12	--	--
Siuslaw River							
	ODFW AFS 65	1967-68 season	--	--	--	7.88	--
Siuslaw Estuary							
	Creel Surveys	2011	--	--	10.81	--	--
		2012	--	--	16.29	--	--
Umpqua River							
	Creel Surveys	1977-1988 average	--	11.25	--	--	--

Table A.1 (cont.)

Waterway	Source	Dates	Inland Success Rates: Chinook Fall	Chinook Spring/ Summer	Coho	Winter/ Summer Steelhead	Sturgeon
Elk River							
	Creel Surveys	1972-1974 average	3.53	--	--	--	--
		1992-1998 average	4.01	--	--	--	--
		2007	4.47	--	--	--	--
		2008	3.20	--	--	--	--
		2009	3.71	--	--	--	--
		2010	2.54	--	--	--	--
		2011	2.19	--	--	--	--
		2012	4.21	--	--	--	--
		2013	2.30	--	--	--	--
		2014	3.54	--	--	--	--
		2015	2.60	--	--	--	--
		2016	3.29	--	--	--	--
Rogue River							
	Creel Surveys	1986	4.55	5.68	--	--	--
Chetco River							
	Creel Surveys	2011	--	--	--	3.67	--
Assigned non-Columbia River inland 2017			6.00	7.50	15.00	4.00	7.32
NON-RETAINED CATCH RATES			23%	27%	41%	62% winter 57% summer	

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Pacific Ocean (north or south of Cape Falcon)		Ocean Pacific Halibut Success Rates: Charter N CF	Charter S CF	Private N CF	Private S CF
ODFW ORBS	2011	1.66	1.15	1.36	1.94
	2012	2.58	1.18	1.80	1.80
	2013	4.79	1.20	1.62	1.79
	2014	1.49	1.09	2.28	1.86
	2015	2.31	1.27	1.29	2.07
	2016	--	1.61	1.28	2.20

Pacific Ocean (north or south of Cape Falcon)		Ocean Salmon Success Rates: Chinook Only N CF	Chinook Only S CF	Chinook or Coho N CF	Chinook or Coho S CF	Season N CF	Season S CF
PFMC annual	2011	3.56	11.55	0.94	1.86	0.96	2.53
	2012	1.18	3.42	1.53	1.78	1.43	1.98
	2013	2.18	2.41	1.12	1.89	1.03	2.04
	2014	4.72	6.19	0.62	0.93	0.64	1.10
	2015	2.70	6.03	0.74	1.88	0.74	2.20
	2016	--	7.82	1.17	3.27	1.17	3.92

Table A.1 (cont.)

Notes: 1. Success rates are expressed as number of days per fish retained. Non-retained catch rates were derived using Question 19a and 20a preference survey results as described in OSU (2013).

2. Non-retained catch rates apply to sum of wild and hatchery retained catch. Fisheries are inclusive of the central coast from Necanicum River in the north through the Elk River in the south.

3. The "assigned" 2017 success rate is a conservative estimate used to convert SSHSTRP catch data to angler days. The assigned success rates are used in the economic modeling for all coast and Columbia River off-channel lower estuary salmon and sturgeon recreational fisheries, except Chinook and coho caught in Youngs Bay use the Columbia River mainstem success rates.

4. Fall Chinook and coho fisheries are concurrent on some rivers and streams.

5. Columbia River fall mainstem salmon fishery includes Oregon side only, and Columbia River mainstem Section 10 includes both Oregon and Washington side.

6. Sturgeon has a catch and release regulation in some months, and trips for those months are included in success rates to account for the fishing pressure during the catch and release season. Sturgeon trips in lower Columbia River are from Watts (CRCP) data.

7. Ocean salmon 'Chinook only' includes June and October for North of Cape Falcon, and June, August, and October for South of Cape Falcon. Ocean salmon 'Chinook or coho' includes July through September for North of Cape Falcon, and July and September for South of Cape Falcon. In some years coho fisheries allowed in other months. Ocean salmon 'season" includes all months and both fisheries.

8. North of Cape Falcon (N CF) region includes Astoria area. South of Cape Falcon (S CF) region includes the south of Humbug Mt. to Oregon-California border management area.

Sources: Watts (2018); creel surveys performed by ODFW (CCRMP); ODFW (1977); Devore et al. (1999); PFMC (February 2018); ODFW (ORBS).

Table A.2
Economic Contributions Per Angler Day for Study Recreational Fisheries in 2017

Fishery	Fishing Mode			
Inland Marine and Freshwater Fisheries	Guided	Private Boat	Private Bank	
All areas and species	$181.18	$45.55	$22.07	
	Coast Inland	Lower Columbia River		
Salmon and steelhead (incl. coast and lower Col. R. off-channel)	$47.35	$48.72		
Salmon (incl. lower Col. R. mainstem)		$67.51		
Sturgeon	$46.05	$52.06		
Other marine	$26.25	$22.33		
Ocean Non-Salmon Fisheries	Charter	Private	Shore	Trip Weighted Average
Bottomfish	$151.23	$66.34	$41.66	$82.95
Halibut and tuna	$302.47	$66.34	$41.66	$83.57
Ocean Salmon Fisheries				
All salmon species	$133.69	$35.84		$61.30

Notes:
1. Economic contributions are expressed as income in 2017 dollars and are at the coastwide economic level.
2. Coastwide economic contributions for ocean salmon fisheries and the lower Columbia River mainstem fall salmon fishery are from PFMC (February 2018). The ocean non-salmon fishery uses economic contributions per angler day derived from expenditures in Gentner and Steinback (2008). Coastwide economic contributions per angler day for inland marine and freshwater fisheries are from TRG (1991).
3. The ocean non-salmon trip weighted average economic contributions per day are based on 2017 trips provided by ODFW (ORBS).
4. Tuna and halibut ocean bottomfishing economic contributions per day adjusted for additional spending due to charter services fishery higher costs.
5. Lower Columbia River mainstem spr./sum. salmon fishery economic contributions per angler day are assumed to be the same as the fall mainstem salmon fishery.
6. Ratio of coastwide to state economic level uses household expenditure coefficients from 2011 IMPLAN data year, except lower Columbia River mainstem salmon uses PFMC (February 2018).

Source: Study; TRG (1991); PSMFC RecFIN database; ODFW (ORBS); PFMC (February 2018); Gentner and Steinback (2008).

Table A.3
Recreational Fisheries Trips by Target Species for Ocean and Inland Locations at Port Groups in 2017

Ocean Angler Trips (Charter and Private) by Trip Purpose in 2017

Trips	Salmon	Combination	Bottomfish	Halibut/Tuna	Dive	Total
Astoria	7,908	599	747	260	0	9,514
Garibaldi	5,299	1,134	12,775	2,296	18	21,522
Pacific City	1,168	1,091	5,130	1,096	51	8,536
Depoe Bay	1,372	952	20,235	1,989	26	24,574
Newport	5,519	2,355	25,278	14,710	58	47,920
Florence	991	21	0	370	0	1,382
Winchester Bay	10,007	29	39	760	0	10,835
Coos Bay/Charleston	1,233	494	13,819	3,571	118	19,235
Bandon	95	30	3,418	1,026	0	4,569
Port Orford	-	-	-	-	-	-
Gold Beach	0	0	2,628	59	0	2,687
Brookings	2,006	6	16,582	1,312	185	20,091
Coastwide	35,598	6,711	100,651	27,449	456	170,865
Proportion that is Charter						
Astoria	8%	1%	3%	20%	n/a	8%
Garibaldi	0%	2%	58%	20%	100%	37%
Pacific City	7%	13%	29%	3%	0%	21%
Depoe Bay	36%	25%	83%	41%	0%	74%
Newport	10%	10%	61%	16%	0%	39%
Florence	0%	0%	n/a	0%	n/a	0%
Winchester Bay	0%	0%	0%	0%	n/a	0%
Coos Bay/Charleston	0%	0%	26%	6%	0%	20%
Bandon	0%	0%	53%	19%	n/a	44%
Port Orford	-	-	-	-	-	-
Gold Beach	n/a	n/a	24%	59%	n/a	25%
Brookings	1%	0%	22%	1%	0%	18%
Coastwide	5%	9%	51%	15%	4%	34%

Notes:
1. A trip is one angler day.
2. Recreational crabbing is not included.
3. Combination trips target salmon and bottomfish.
4. 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. There was no ORBS sampling at Port Orford in 2017.

Source: ODFW (ORBS).

Table A.3 (cont.)

Inland Salmon, Steelhead, Sturgeon, and Other Marine Species Trips in 2017

County	Community	Fall Chinook/ Coho	Spr./Sum. Chinook	Steelhead	Sturgeon	Other Marine Species	Total
Clatsop	Astoria area (excl.CR	126	53	92	0	0	271
Tillamook	Tillamook area	108,778	32,645	93,173	271	65,033	299,899
Lincoln	Newport area	98,378	5,443	34,327	66	30,409	168,623
Lane	Florence	34,644	1,332	3,279	0	0	39,254
Douglas	Reedsport	52,268	12,620	5,020	0	13,602	83,510
Coos	Coos Bay area	37,817	651	36,170	0	14,297	88,935
Curry	Port Orford	11,568	0	3,991	0	0	15,559
	Gold Beach	72,666	11,535	3,348	0	0	87,549
	Brookings	6,198	0	6,208	0	9,596	22,002
Subtotal		422,443	64,278	185,607	337	132,938	805,603
Coastwide		493,550	80,706	188,235	7,551	134,596	904,639

Notes:
1. 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 and recreational crabbing/clamming are not included. Coastwide total includes lower Columbia River estuary.
2. Trips are from Salmon-Steelhead, Halibut, and Sturgeon Tag Return Program (SSHSTRP) catch times success rates in angler days per fish, and expanded for non-retention rates.
3. Lower Columbia River mainstem spring/summer Chinook fishery includes trips in off-channel areas.
4. 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.
5. Coast inland and lower Columbia tributary salmon and steelhead fisheries data is preliminary. Lower Columbia River mainstem salmon, steelhead, and sturgeon fisheries trips are reported by Watts (CRCP) and are for 2017.

Source: ODFW (SSHSTRP).

Appendix B

Vessel Exit/Entry Trends at Port Groups and Coastwide

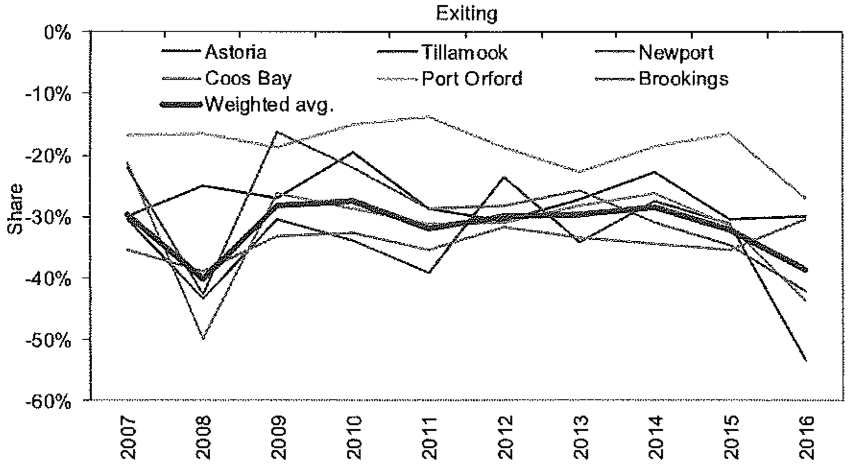
Table B.1
Vessel Exit/Entry Trends for Nearshore Groundfish Fishery
Vessels at Port Groups and Coastwide in 2006 to 2016

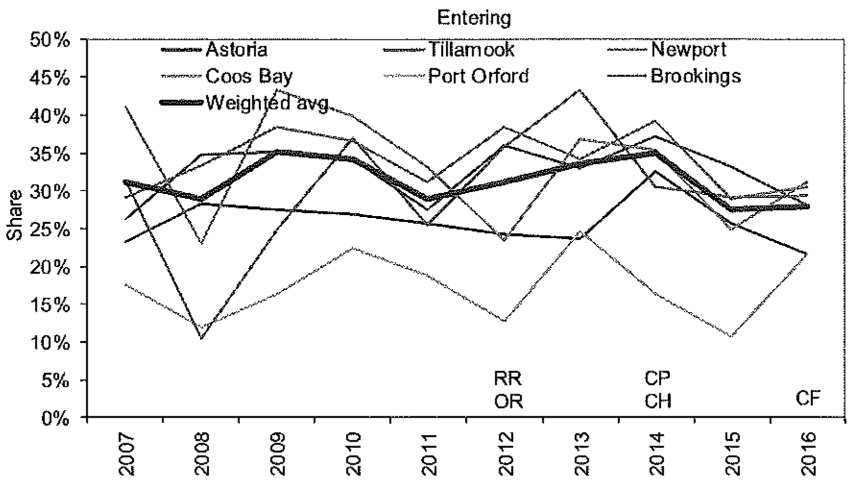
	Astoria	Tillamook	Newport	Coos Bay	Port Orford	Brookings	Coastwide	Mean Variability
Total vessels								
2006	50	45	49	67	57	43	296	46%
2007	47	39	55	65	58	43	289	51%
2008	43	33	63	68	59	41	288	68%
2009	44	35	63	60	62	41	289	55%
2010	38	39	47	64	56	44	262	54%
2011	33	27	42	54	57	40	231	71%
2012	33	43	50	47	61	40	245	61%
2013	22	40	37	65	62	60	246	90%
2014	22	43	42	49	53	48	224	72%
2015	29	51	46	67	56	47	267	77%
2016	28	42	59	64	51	49	253	74%
Proportion entering								
2007	14.9%	23.1%	45.5%	32.3%	25.9%	14.0%	22.5%	122%
2008	16.3%	21.2%	46.0%	35.3%	16.9%	17.1%	25.0%	117%
2009	31.8%	20.0%	41.3%	21.7%	19.4%	17.1%	23.2%	96%
2010	21.1%	28.2%	34.0%	45.3%	12.5%	27.3%	21.0%	117%
2011	39.4%	3.7%	38.1%	33.3%	17.5%	15.0%	19.9%	146%
2012	36.4%	46.5%	42.0%	36.2%	21.3%	27.5%	28.6%	72%
2013	18.2%	22.5%	21.6%	50.8%	19.4%	46.7%	24.8%	109%
2014	31.8%	37.2%	50.0%	34.7%	13.2%	18.8%	24.1%	119%
2015	41.4%	29.4%	54.3%	47.8%	21.4%	25.5%	33.7%	90%
2016	32.1%	23.8%	44.1%	46.9%	17.6%	34.7%	26.9%	88%
Proportion continuing								
2007	85.1%	76.9%	54.5%	67.7%	74.1%	86.0%	77.5%	43%
2008	83.7%	78.8%	54.0%	64.7%	83.1%	82.9%	75.0%	40%
2009	68.2%	80.0%	58.7%	78.3%	80.6%	82.9%	76.8%	32%
2010	78.9%	71.8%	66.0%	54.7%	87.5%	72.7%	79.0%	46%
2011	60.6%	96.3%	61.9%	66.7%	82.5%	85.0%	80.1%	47%
2012	63.6%	53.5%	58.0%	63.8%	78.7%	72.5%	71.4%	39%
2013	81.8%	77.5%	78.4%	49.2%	80.6%	53.3%	75.2%	46%
2014	68.2%	62.8%	50.0%	65.3%	86.8%	81.3%	75.9%	53%
2015	58.6%	70.6%	45.7%	52.2%	78.6%	74.5%	66.3%	52%
2016	67.9%	76.2%	55.9%	53.1%	82.4%	65.3%	73.1%	44%
Proportion exiting								
2007	-20.0%	-33.3%	-38.8%	-34.3%	-24.6%	-14.0%	-24.3%	-90%
2008	-23.4%	-33.3%	-38.2%	-32.3%	-15.5%	-20.9%	-25.3%	-83%
2009	-30.2%	-15.2%	-41.3%	-30.9%	-15.3%	-17.1%	-22.9%	-105%
2010	-31.8%	-20.0%	-50.8%	-41.7%	-21.0%	-22.0%	-28.4%	-99%
2011	-47.4%	-33.3%	-44.7%	-43.8%	-16.1%	-22.7%	-29.4%	-90%
2012	-36.4%	-14.8%	-31.0%	-44.4%	-15.8%	-27.5%	-24.2%	-105%
2013	-45.5%	-27.9%	-42.0%	-31.9%	-18.0%	-20.0%	-24.5%	-89%
2014	-31.8%	-32.5%	-43.2%	-50.8%	-25.8%	-35.0%	-30.9%	-68%
2015	-22.7%	-16.3%	-50.0%	-28.6%	-17.0%	-27.1%	-21.0%	-125%
2016	-34.5%	-37.3%	-28.3%	-49.3%	-25.0%	-31.9%	-30.7%	-71%

Notes: 1. Vessel counts itemized for whether they landed nearshore groundfish in the port group the previous year.
2. The included nearshore groundfish landings are from vessels that have an Oregon Nearshore Fishery Permit with or without a Nearshore Endorsement Permit, as well as incidental fishery landings from vessels that do not have an Oregon Nearshore Fishery Permit.

Source: PacFIN annual vessel summary, April 2013, March 2014, April 2015, November 2016, and March 2017 extractions.

Figure B.1
Vessel Exit/Entry Trends for All Fisheries at Port Groups and Coastwide in 2006 to 2016





Notes:
1. Vessel counts itemized for whether they landed in the port group the previous year.
2. Management restrictions were first applied: January 1, 2012 for Redfish Rocks (RR) and Otter Rock (OR), January 1, 2014 for Cape Perpetua (CP) and Cascade Head (CH), and January 1, 2016 for Cape Falcon (CF).
3. Annual port group lines include vessels exiting to or entering from other Oregon port groups, non-Oregon ports, and non-fishing status.
4. Weighted averages are averages of port groups weighted by the number of vessels that exited or entered a port group.

Source: PacFIN annual vessel summary, April 2009, March 2010, July 2011, April 2013, March 2014, April 2015, November 2016, and March 2017 extractions.

Appendix C

Commercial Vessel and Landings Trend Information

Appendix C
Commercial Vessel and Landings Trend Information

Contents

Table C.1
Onshore Landed Volume by Major Fishery in 1981 to 2017

Year	Salmon	D. Crab	P. Shrimp	A. Tuna	Groundfish	P. Whiting	P. Sardine	P. Halibut	Other	Total
1981	7,009	6,981	25,904	7,693	81,835	360	--	150	17,614	147,546
1982	8,572	7,020	18,429	1,855	90,084	3	–	234	2,581	128,779
1983	2,669	5,332	6,532	3,397	77,369	143	–	579	3,952	99,972
1984	3,595	4,999	4,844	1,594	61,309	746	–	1,055	5,702	83,844
1985	6,570	7,358	14,840	1,518	61,920	1,950	–	813	4,276	99,245
1986	13,792	4,658	33,884	2,461	54,883	927	--	1,314	1,599	113,517
1987	15,094	5,991	44,589	2,288	67,176	403	–	916	1,925	138,383
1988	17,789	9,417	41,846	3,967	70,495	543	–	582	3,486	148,126
1989	11,724	11,676	49,129	1,080	81,047	196	--	916	9,640	165,408
1990	5,412	9,510	31,883	2,079	73,305	5,058	–	622	11,033	138,903
1991	5,344	4,924	21,711	1,259	80,847	29,109	–	544	6,136	149,875
1992	2,364	11,908	48,033	3,896	75,215	107,939	9	712	6,744	256,820
1993	1,848	10,456	26,923	4,754	81,303	78,970	1	663	5,377	210,294
1994	1,285	10,638	16,386	4,698	64,265	143,563	0	540	4,226	245,602
1995	2,862	11,954	12,106	5,034	55,066	147,355	–	543	3,655	238,574
1996	2,842	19,302	15,727	8,948	57,002	155,590	0	310	2,731	262,452
1997	2,245	7,777	19,560	9,168	52,703	162,782	0	377	6,267	260,877
1998	1,978	7,410	6,096	10,603	41,806	157,895	2	237	4,375	230,402
1999	1,560	12,347	20,451	4,553	44,119	160,965	1,710	350	3,339	249,394
2000	3,142	11,180	25,462	8,757	39,311	151,461	21,005	331	2,774	263,423
2001	5,266	9,690	28,482	8,959	31,645	117,673	28,176	253	3,527	233,671
2002	6,119	12,444	41,584	4,362	21,102	71,220	50,069	529	2,684	210,112
2003	6,722	23,930	20,546	9,165	25,934	80,648	55,683	342	2,662	225,632
2004	5,936	27,273	12,207	10,754	25,590	130,238	79,610	345	2,264	294,217
2005	4,688	17,730	15,784	8,087	27,231	135,503	99,450	357	3,609	312,439
2006	1,814	33,316	12,195	8,536	27,395	135,186	78,634	251	3,216	300,543
2007	1,384	17,026	20,125	10,468	30,881	94,360	92,911	244	3,598	270,997
2008	1,923	13,888	25,520	8,864	37,922	61,466	50,593	243	4,345	204,765
2009	2,312	21,854	22,153	10,072	41,400	62,988	47,357	234	2,442	210,811
2010	2,774	15,868	31,463	10,700	36,855	69,530	45,971	186	3,270	216,618
2011	2,422	17,260	48,314	9,682	28,936	151,464	24,302	217	3,222	285,821
2012	1,927	8,666	49,144	9,886	28,475	107,652	93,957	197	6,811	306,716
2013	3,513	26,073	47,629	10,205	31,111	167,499	57,956	205	5,198	349,390
2014	6,414	11,915	51,960	8,777	28,375	168,226	17,171	206	7,319	300,362
2015	3,159	2,287	53,516	7,577	32,976	94,907	4,699	263	4,502	203,885
2016	1,844	15,716	35,528	7,250	35,716	113,035	9	248	17,572	226,918
2017	1,196	19,016	23,057	4,745	48,374	201,499	3	269	4,196	302,355
Avg12-16	3,371	12,931	47,556	8,739	31,331	130,264	34,758	224	8,280	277,454

Notes: 1. Landings are reported in thousands of round pounds. Landing data is preliminary for 2017.
2. Salmon includes landings of steelhead, which have come exclusively from the tribal fisheries since 1975.
3. D. crab includes only Dungeness crab; p. shrimp includes only pink shrimp; and a. tuna includes only albacore tuna.
4. Pacific whiting (also known as hake) did not emerge as a major fishery species until after 1990. Groundfish in 2017 includes (thousands of round pounds) flatfish (19,082), sablefish (5,557), thornyheads (2,197), rockfish other than thornyheads (18,589), cods other than sablefish (1,150), and other (1,800).
5. Biological studies have found the northern population of the Pacific sardine has a three decade or so abundance cycle, and did not emerge as a major fishery species until 2000 in the latest cycle.
6. 'Other' in 2017 includes landings (thousands of round pounds) of hagfish (1,635), jack mackerel (668), shad (375), gaper clam (327), and other species (1,191). Shellfish volume excludes aquaculture harvests

Source: PacFIN annual vessel summary, March 2008, April 2009, March 2010, July 2011, April 2013, March 2014 April 2015, November 2016, March 2017, and June 2018 extractions.

Table C.2
Onshore Landed Value by Major Fishery in 1981 to 2017

	Price	Salmon		Dungeness Crab		Pink Shrimp		Albacore Tuna		Groundfish		Pacific Whiting		Pacific Sardine		Pacific Halibut		Other		Total	
Year	Index	Real	Nominal	Real	Nominal	Real	Nominal	Real	Nominal	Real	Nominal	Real	Nominal	Real	Nominal	Real	Nominal	Real	Nominal	Real	Nominal
1981	42.9	25,770	11,047	15,651	6,709	30,406	13,034	15,528	6,657	33,814	14,496	59	25	–	–	373	160	12,165	5,215	133,766	57,344
1982	45.5	27,144	12,356	16,549	7,533	20,363	9,269	2,703	1,230	44,078	20,064	0	0	–	–	585	266	2,159	983	113,581	51,702
1983	47.3	6,428	3,040	16,723	7,910	9,848	4,658	3,983	1,884	38,794	18,349	50	24	–	–	1,333	631	3,227	1,526	80,387	38,023
1984	49.0	10,444	5,118	15,806	7,746	4,393	2,153	1,811	888	30,570	14,981	120	59	–	–	1,658	813	4,640	2,274	69,442	34,031
1985	50.6	17,913	9,056	21,072	10,654	10,357	5,236	1,621	819	33,480	16,927	343	173	–	–	1,579	798	3,804	1,923	90,168	45,587
1986	51.6	29,432	15,181	12,770	6,587	35,150	18,131	2,569	1,325	33,642	17,353	117	60	–	–	3,643	1,879	2,626	1,355	119,948	61,871
1987	52.8	51,078	26,994	15,802	8,351	57,282	30,273	3,178	1,680	46,081	24,353	65	34	–	–	2,693	1,423	3,003	1,587	179,182	94,696
1988	54.7	71,315	39,020	20,617	11,280	31,344	17,150	6,083	3,328	43,924	24,033	75	41	–	–	1,603	877	3,442	1,883	178,402	97,612
1989	56.9	25,024	14,228	23,854	13,564	31,490	17,905	1,559	887	44,356	25,221	26	15	–	–	2,289	1,301	7,151	4,066	135,750	77,187
1990	59.0	16,227	9,573	24,669	14,554	26,492	15,629	2,989	1,764	39,235	23,147	372	220	–	–	1,888	1,114	9,677	5,709	121,550	71,710
1991	61.0	9,557	5,828	12,236	7,462	19,803	12,076	1,606	979	47,251	28,814	2,247	1,370	–	–	1,675	1,022	7,431	4,531	101,805	62,083
1992	62.4	5,911	3,687	21,463	13,388	27,555	17,187	6,363	3,969	42,879	26,745	8,142	5,078	–	–	1,327	828	5,170	3,225	118,810	74,106
1993	63.9	3,798	2,425	18,633	11,898	13,956	8,912	6,081	3,883	43,285	27,638	3,585	2,289	–	–	1,350	862	4,623	2,952	95,312	60,859
1994	65.2	2,238	1,459	22,177	14,462	14,761	9,626	5,750	3,750	44,116	28,769	6,591	4,298	–	–	1,556	1,015	3,500	2,282	100,688	65,662
1995	66.6	5,367	3,574	30,104	20,044	12,915	8,599	6,083	4,050	46,519	30,974	10,514	7,000	–	–	1,413	941	3,432	2,285	116,347	77,467
1996	67.8	4,850	3,288	38,613	26,180	13,808	9,362	10,958	7,430	44,653	30,275	6,116	4,147	–	–	1,038	704	1,827	1,239	121,862	82,623
1997	69.0	4,019	2,772	21,219	14,636	11,469	7,910	10,644	7,342	40,576	27,987	9,892	6,823	–	–	1,008	695	2,040	1,407	100,866	69,573
1998	69.7	3,714	2,590	17,952	12,519	4,573	3,189	9,379	6,540	27,950	19,491	5,387	3,756	1	1	464	323	2,287	1,595	71,707	50,005
1999	70.7	2,887	2,042	32,667	23,107	13,530	9,571	5,349	3,784	31,373	22,192	8,366	5,917	121	86	979	692	1,484	1,050	96,756	68,441
2000	72.3	5,570	4,029	32,779	23,709	14,091	10,192	10,353	7,489	33,696	24,373	8,407	6,081	1,588	1,149	965	698	2,781	2,012	110,231	79,732
2001	74.0	7,906	5,847	26,092	19,296	10,223	7,560	10,220	7,559	27,591	20,405	5,587	4,132	2,189	1,619	652	482	2,996	2,216	93,456	69,116
2002	75.1	9,234	6,933	27,650	20,761	15,120	11,353	3,931	2,952	18,925	14,210	4,288	3,219	3,755	2,819	1,350	1,013	2,516	1,889	86,769	65,149
2003	76.5	11,593	8,869	48,520	37,117	6,603	5,051	8,064	6,169	23,102	17,673	4,761	3,642	3,845	2,941	1,125	860	1,521	1,163	109,134	83,487
2004	78.5	16,545	12,995	54,686	42,954	6,035	4,740	11,642	9,145	20,805	16,342	5,908	4,641	6,200	4,870	1,114	875	1,487	1,168	124,422	97,730
2005	81.0	12,889	10,438	32,842	26,597	8,522	6,901	10,886	8,816	22,814	18,475	8,776	7,107	7,654	6,199	1,106	896	1,899	1,538	107,386	86,965
2006	83.5	5,920	4,940	64,474	53,807	5,385	4,494	9,667	8,067	23,885	19,933	9,555	7,974	4,485	3,743	918	766	1,445	1,206	125,734	104,931
2007	85.7	5,439	4,662	44,576	38,202	10,927	9,365	11,048	9,468	23,918	20,497	7,585	6,501	5,310	4,551	991	849	1,603	1,374	111,397	95,468
2008	87.3	4,855	4,240	33,392	29,164	15,960	13,939	12,195	10,651	30,850	26,943	7,820	6,830	6,487	5,665	1,036	905	2,304	2,012	114,899	100,349
2009	88.0	4,026	3,544	48,177	42,404	7,741	6,813	11,565	10,179	31,965	28,135	4,226	3,720	6,011	5,291	762	670	1,845	1,624	116,318	102,380
2010	89.0	8,645	7,698	36,775	32,746	12,333	10,982	13,951	12,422	28,782	25,629	6,080	5,414	5,898	5,252	832	740	2,370	2,111	115,666	102,996
2011	90.9	7,412	6,737	49,163	44,690	27,070	24,607	20,644	18,766	31,286	28,439	18,171	16,518	3,511	3,192	1,255	1,141	2,635	2,395	161,147	146,485
2012	92.7	7,474	6,925	31,423	29,114	26,643	24,685	16,273	15,077	25,725	23,834	15,769	14,611	9,689	8,977	1,041	965	2,356	2,183	136,394	126,370
2013	94.3	13,169	12,418	75,518	71,209	25,614	24,153	17,052	16,079	23,673	22,322	21,639	20,405	6,681	6,299	1,042	982	3,742	3,529	188,131	177,396
2014	96.1	20,948	20,124	49,953	47,988	30,526	29,326	11,475	11,023	22,703	21,810	19,022	18,274	3,666	3,522	1,196	1,149	3,030	2,911	162,519	156,127
2015	97.1	12,224	11,864	12,273	11,912	41,638	40,413	9,491	9,212	29,661	28,788	7,363	7,146	837	813	1,461	1,418	2,791	2,709	117,738	114,274
2016	98.1	8,467	8,308	56,805	55,735	25,575	25,093	12,742	12,502	32,602	31,988	8,861	8,694	0	0	1,419	1,392	4,916	4,823	151,387	148,536
2017	100.0	5,556	5,556	58,728	58,728	12,688	12,688	10,803	10,803	35,673	35,673	16,385	16,385	0	0	1,413	1,413	2,947	2,947	144,193	144,193
Avg12-16		12,456		45,194		29,999		13,407		26,873		14,531		4,175		1,232		3,367		151,234	

Notes:
1. Nominal value is the revenue received by fishermen/harvesters in the landing year. Real value is in thousands of 2017 dollars adjusted using the GDP implicit price deflator developed by U.S. Bureau of Economic Analysis.
2. Groundfish in 2017 includes landings (real ex-vessel value in thousands) of sablefish ($15,519), flatfish ($10,446), thornyheads ($1,121), rockfish other than thornyheads ($6,339), cods other than sablefish ($1,662), and other ($585). 'Other' in 2017 includes (real ex-vessel value in thousands) hagfish ($1,573), red sea urchin ($362), gaper clam ($297), basket cockle ($261), ghost shrimp ($113), white sturgeon ($83), butter clam ($79), and other species ($178). Shellfish value excludes private lands harvest.
3. Notes and sources from volume table concerning species composition also apply to this table.

Table C.3
Fisheries Annual Ex-Vessel Prices by Selected Species and Species Groups in 1971 to 2017

Species	1971	1973	1975	1977	1979	1981	1983	1985	1987	1989	1991	1993	1995	1997	1999	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	201
roll Chinook (ocean)	2.81	4.42	3.79	7.07	7.22	5.21	3.52	4.28	4.29	3.41	3.53	2.97	2.21	2.01	2.39	1.89	1.79	2.25	3.83	3.42	5.70	5.74	5.79	4.95	5.36	5.70	5.37	5.42	5.16	5.50	7.29	6.97
roll coho (ocean)	1.72	3.38	2.81	4.34	6.34	3.38	1.76	2.59	2.84	1.63	1.41	1.54	-	-	1.26	0.93	0.87	0.97	1.37	2.01	3.03	1.93	2.69	2.02	2.18	1.92	2.07	2.36	1.81	1.67	-	2.64
let Chinook (below Bonneville Dam)															2.00	1.92	1.68	1.10	2.25	2.07	3.01	3.88	3.22	2.31	3.11	2.71	2.84	2.73	1.94	2.78	3.75	4.31
Spring															4.01	3.96	4.38	3.67	4.80	4.30	5.11	6.48	7.21	5.46	5.55	5.41	6.38	6.74	5.59	5.87	7.31	7.58
Fall															1.58	0.88	0.71	0.86	1.70	1.87	2.45	3.00	2.87	2.20	2.30	2.34	2.30	2.50	1.80	2.27	3.08	3.05
let Chinook (above Bonneville Dam)															0.76	0.55	0.39	0.34	0.95	0.74	1.84	2.37	2.27	1.51	2.13	2.44	2.47	2.22	1.89	2.33	2.96	3.44
Spring															-	1.74	1.58	1.43	2.15	2.09	2.81	4.35	5.13	3.48	4.32	3.86	5.18	4.91	4.94	4.13	5.51	5.55
Fall															0.81	0.33	0.24	0.25	0.97	0.71	1.70	2.40	1.88	1.22	1.40	2.08	1.98	2.04	1.54	1.99	2.51	3.13
let coho (below Bonneville Dam)															1.18	0.38	0.45	0.70	1.16	1.31	1.57	1.89	1.48	1.35	1.53	1.77	1.75	1.95	1.21	1.59	1.88	2.04
let steelhead (above Bonneville Dam)															0.59	0.21	0.13	0.10	0.27	0.35	0.60	0.76	0.80	0.70	0.95	1.24	1.31	1.14	1.15	1.37	1.43	2.16
ungeness crab	1.35	2.46	2.89	1.77	2.07	2.24	3.14	2.86	2.64	2.04	2.49	1.79	2.52	2.74	2.65	2.69	2.22	2.03	2.01	1.85	1.94	2.62	2.41	2.21	2.33	2.85	3.64	2.90	4.20	5.39	3.62	3.10
ink shrimp	0.58	0.95	0.49	0.74	1.07	1.17	1.51	0.70	1.28	0.64	0.91	0.52	1.07	0.59	0.66	0.36	0.36	0.32	0.49	0.54	0.44	0.55	0.63	0.35	0.39	0.56	0.54	0.54	0.59	0.78	0.72	0.55
lbacore tuna	1.31	1.53	1.15	0.84	1.47	2.02	1.17	1.07	1.39	1.44	1.28	1.28	1.21	1.16	1.17	1.14	0.90	0.88	1.08	1.35	1.13	1.06	1.38	1.15	1.30	2.13	1.65	1.67	1.30	1.25	1.76	2.28
roundfish species group	0.39	0.51	0.51	0.68	0.75	0.41	0.50	0.54	0.69	0.55	0.58	0.55	0.87	0.79	0.73	0.87	0.90	0.89	0.82	0.84	0.89	0.80	0.84	0.79	0.80	1.12	0.94	0.79	0.83	0.94	0.96	0.77
learshore live fishery						-	-	-	-	-	-	-	-	2.07	3.82	4.18	4.23	3.84	3.52	3.45	3.33	3.31	3.15	2.95	3.16	3.19	3.39	3.20	3.00	2.87	2.91	3.00
ablefish (black cod)						0.48	0.47	0.59	0.84	0.78	0.99	0.87	2.01	2.34	1.67	1.90	1.96	2.04	1.64	1.83	2.01	2.07	2.41	2.52	2.69	3.76	2.63	2.10	2.55	2.64	2.79	2.82
Trawl gear						0.34	0.37	0.44	0.64	0.65	0.71	0.67	1.85	1.85	1.39	1.64	1.54	1.68	1.34	1.44	1.63	1.77	2.13	2.17	2.18	2.64	1.88	1.72	2.06	2.04	2.06	1.98
Fixed gear						0.66	0.62	0.76	1.02	1.03	1.46	1.20	2.23	3.14	2.02	2.27	2.41	2.52	2.04	2.28	2.55	2.61	2.98	3.06	3.46	4.59	3.16	2.47	3.01	3.09	3.32	3.54
Vidow rockfish						-	-	0.50	0.61	0.45	0.44	0.43	0.50	0.44	0.54	0.55	0.55	0.57	0.60	0.53	0.56	0.57	0.51	0.49	0.52	0.49	0.47	0.50	0.46	0.43	0.44	0.30
ellowtail rockfish						-	-	0.50	0.61	0.47	0.50	0.49	0.56	0.53	0.56	0.62	0.61	0.62	0.66	0.62	0.63	0.60	0.70	0.53	0.56	0.57	0.57	0.55	0.53	0.50	0.47	0.35
hornyhead, longspine						-	-	-	-	-	-	-	1.46	1.08	1.04	1.19	1.13	0.84	0.65	0.71	0.82	0.61	0.55	0.36	0.38	0.47	0.49	0.46	0.43	0.41	0.44	0.44
hornyhead, shortspine						-	-	-	-	-	-	-	1.68	1.22	1.28	1.35	1.33	1.04	0.85	0.87	0.93	0.74	0.77	0.62	0.61	0.66	0.72	0.68	0.70	0.67	0.66	0.65
hornyhead, mixed						-	-	0.49	0.62	0.65	0.75	0.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acific Ocean perch						0.37	0.45	0.48	0.60	0.45	0.48	0.45	0.48	0.41	0.50	0.56	0.59	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.53	0.54	0.55	0.50	0.44
ingcod						0.52	0.53	0.52	0.72	0.59	0.54	0.58	0.64	0.68	1.07	1.57	1.53	1.44	1.32	1.24	1.21	1.30	1.44	1.44	1.46	1.19	1.13	1.17	1.27	1.69	1.53	1.35
rrowtooth flounder						0.21	0.21	0.20	0.28	0.17	0.19	0.16	0.17	0.15	0.14	0.16	0.17	0.16	0.15	0.13	0.13	0.12	0.12	0.11	0.11	0.11	0.13	0.12	0.10	0.10	0.10	0.10
lover sole						0.51	0.48	0.50	0.59	0.49	0.50	0.46	0.53	0.46	0.48	0.50	0.49	0.49	0.48	0.46	0.46	0.44	0.43	0.38	0.35	0.46	0.47	0.49	0.49	0.48	0.46	0.44
nglish sole						0.68	0.68	0.66	0.77	0.65	0.54	0.50	0.56	0.48	0.48	0.48	0.47	0.45	0.44	0.40	0.38	0.37	0.36	0.33	0.34	0.35	0.37	0.33	0.33	0.32	0.33	0.32
etrale sole						1.23	1.47	1.45	1.56	1.47	1.35	1.25	1.47	1.35	1.36	1.33	1.21	1.32	1.29	1.13	1.20	1.12	1.11	1.00	1.26	1.59	1.63	1.33	1.15	1.25	1.23	1.18
od, Pacific						0.50	0.52	0.50	0.62	0.46	0.49	0.52	0.59	0.58	0.64	0.79	0.77	0.78	0.61	0.57	0.59	0.62	0.62	0.52	0.56	0.63	0.65	0.60	0.56	0.62	0.61	0.60
Vhiting, Pacific						0.163	0.137	0.176	0.161	0.132	0.077	0.048	0.073	0.064	0.057	0.047	0.060	0.059	0.045	0.065	0.078	0.093	0.141	0.079	0.107	0.128	0.154	0.135	0.118	0.083	0.089	0.08
ardines						-	-	-	-	-	-	-	-	-	0.071	0.078	0.075	0.069	0.078	0.077	0.060	0.059	0.132	0.131	0.132	0.150	0.106	0.117	0.216	0.179	-	-
lalibut, Pacific						2.48	2.30	1.94	2.94	2.50	3.08	2.04	2.61	2.68	2.82	2.58	2.55	3.30	3.24	3.09	3.67	4.06	4.28	3.26	4.53	5.93	5.35	5.11	5.92	5.57	5.72	5.22
turgeon, white						2.43	2.40	2.89	3.16	3.39	3.23	2.14	2.64	1.56	1.91	2.36	2.12	2.25	2.24	2.17	2.41	2.46	2.44	2.22	2.35	2.81	2.90	3.40	3.69	3.34	4.13	3.44
ea urchin, red						-	-	-	0.54	0.61	1.24	1.37	1.21	0.79	0.81	0.86	0.57	0.55	0.47	0.37	0.46	0.43	0.43	0.52	0.60	0.59	0.62	0.60	0.59	0.60	0.62	1.29

lotes: 1. Annual prices are in 2017 dollars. Adjustment used GDP implicit price deflator developed by U.S. Bureau of Economic Analysis.
2. Prices are for onshore landings. There will be differences for the same species, such as Pacific whiting, when delivered offshore. Landings after 1980, other than inriver Chinook and coho, exclude harvests from research, discards, bait, personal use, seized, overages, live for aquariums, and unspecified disposition.
3. Prices are for round pound equivalents, except for troll Chinook and troll coho prior to 1981 which are based on dressed weight.
4. Prices where landings are less than $500 annually are shown with a dash.
5. Inriver salmon prices include Oregon and Washington side landings. Inriver steelhead includes only Oregon side in 2017.
6. The nearshore live groundfish fishery includes seven indicator species that are typically landed live in Oregon. These include cabezon, lingcod, black and blue rockfish, greenling, and other unspecified rockfish (not uniquely identified on a fish ticket).

ource: Oregon Department of Fish and Wildlife for years prior to 1981. PacFIN March 2008, April 2009, March 2010, July 2011, April 2013, March 2014, April 2015, November 2016, March 2017, and June 2018 extractions for 1981 to 2017. PFMC "Review of Ocean Salmon Fisheries," annual in February, for inriver Chinook and coho.

Table C.4

Vessel Counts and Revenue Shares by Revenue Categories in 1981 to 2016

	<$500				$500 to $4,999				$5,000 to $49,999				>=$50,000				Total	
	Vessel	Average	Share %		Vessel	Average	Share %		Vessel	Average	Share %		Vessel	Average	Share %		Vessel	Average
Years	Count	Revenue	Count	Revenue	Count	Revenue	Count	Revenue	Count	Revenue	Count	Revenue	Count	Revenue	Count	Revenue	Count	Revenue
1981	1,239	351	33.2%	0.3%	1,339	4,666	35.8%	4.7%	867	37,897	23.2%	25.0%	292	315,432	7.8%	70.0%	3,737	35,227
1982	1,041	310	30.4%	0.3%	1,308	4,423	38.2%	5.1%	820	34,936	24.0%	25.4%	251	310,494	7.3%	69.2%	3,420	32,950
1983	1,643	276	50.4%	0.6%	995	3,540	30.5%	4.5%	403	36,451	12.4%	18.6%	217	277,810	6.7%	76.4%	3,258	24,232
1984	350	345	23.2%	0.2%	526	4,189	34.9%	3.6%	460	34,347	30.5%	25.6%	171	255,037	11.3%	70.6%	1,507	40,966
1985	1,060	232	43.1%	0.3%	626	3,861	25.5%	2.9%	554	34,003	22.5%	22.3%	219	286,998	8.9%	74.5%	2,459	34,304
1986	827	246	30.9%	0.2%	840	4,027	31.4%	3.0%	757	33,672	28.3%	22.6%	251	333,720	9.4%	74.2%	2,675	42,183
1987	492	302	18.8%	0.1%	721	4,217	27.6%	1.8%	1,052	35,178	40.3%	21.8%	346	375,451	13.3%	76.4%	2,611	65,148
1988	276	385	10.5%	0.1%	620	4,178	23.7%	1.6%	1,299	35,323	49.6%	27.7%	424	275,756	16.2%	70.6%	2,619	63,193
1989	436	353	17.7%	0.1%	856	3,769	34.8%	2.6%	894	26,775	36.3%	19.1%	277	352,772	11.2%	78.2%	2,463	50,765
1990	443	301	21.1%	0.1%	720	3,567	34.3%	2.3%	641	27,456	30.6%	15.5%	293	317,053	14.0%	82.1%	2,097	53,981
1991	350	330	18.3%	0.1%	772	3,351	40.4%	2.6%	540	26,129	28.2%	14.1%	251	332,311	13.1%	83.2%	1,913	52,390
1992	293	266	20.0%	0.1%	434	3,107	29.6%	1.2%	422	29,532	28.7%	10.7%	319	321,451	21.7%	88.1%	1,468	79,313
1993	347	235	25.2%	0.1%	383	3,014	27.8%	1.2%	352	27,290	25.5%	10.2%	296	280,668	21.5%	88.5%	1,378	68,156
1994	316	247	26.1%	0.1%	327	3,190	27.0%	1.0%	285	28,750	23.5%	8.1%	283	323,730	23.4%	90.8%	1,211	83,345
1995	282	227	24.0%	0.1%	253	3,143	21.5%	0.7%	311	29,490	26.4%	7.8%	330	326,027	28.1%	91.5%	1,176	100,017
1996	184	270	15.8%	0.0%	266	3,034	22.8%	0.7%	360	28,059	30.9%	8.4%	356	308,847	30.5%	90.9%	1,166	103,694
1997	138	255	12.8%	0.0%	263	3,072	24.3%	0.8%	352	27,289	32.5%	9.4%	329	278,032	30.4%	89.7%	1,082	94,197
1998	124	251	12.7%	0.0%	251	3,214	25.7%	1.1%	332	27,931	34.1%	13.1%	268	226,909	27.5%	85.7%	975	72,741
1999	98	251	10.3%	0.0%	229	3,207	24.1%	0.8%	329	26,464	34.6%	9.1%	295	293,294	31.0%	90.1%	951	100,933
2000	88	279	8.2%	0.0%	218	3,108	20.4%	0.6%	413	26,630	38.7%	10.1%	349	277,660	32.7%	89.2%	1,068	101,689
2001	94	289	8.4%	0.0%	239	3,000	21.2%	0.8%	460	27,156	40.9%	13.3%	332	243,072	29.5%	85.9%	1,125	83,498
2002	81	269	8.0%	0.0%	208	2,997	20.6%	0.7%	426	25,834	42.2%	12.9%	295	249,512	29.2%	86.3%	1,010	84,413
2003	72	271	6.9%	0.0%	205	2,952	19.7%	0.6%	424	25,406	40.8%	10.2%	337	279,646	32.5%	89.2%	1,038	101,770
2004	81	280	7.5%	0.0%	175	2,903	16.2%	0.4%	448	25,399	41.6%	9.5%	373	290,367	34.6%	90.1%	1,077	111,622
2005	69	286	6.3%	0.0%	193	2,782	17.7%	0.5%	476	24,702	43.6%	11.3%	354	258,602	32.4%	88.1%	1,092	95,110
2006	66	233	6.9%	0.0%	189	2,777	19.6%	0.4%	352	22,858	36.6%	6.5%	355	325,857	36.9%	93.1%	962	129,174
2007	56	231	5.8%	0.0%	214	2,681	22.1%	0.5%	357	22,855	36.9%	7.8%	341	280,872	35.2%	91.6%	968	107,979
2008	48	259	5.4%	0.0%	177	2,579	20.0%	0.4%	328	24,887	37.0%	7.4%	333	305,061	37.6%	92.2%	886	124,399
2009	93	265	9.6%	0.0%	202	2,284	20.8%	0.4%	319	23,198	32.9%	6.8%	357	284,000	36.8%	92.8%	971	112,538
2010	77	259	7.9%	0.0%	166	2,439	17.0%	0.4%	369	23,589	37.8%	8.2%	363	265,940	37.2%	91.4%	975	108,375
2011	87	258	8.9%	0.0%	150	2,276	15.3%	0.2%	343	23,253	35.0%	5.3%	400	357,713	40.8%	94.5%	980	154,515
2012	49	214	5.2%	0.0%	169	2,638	17.8%	0.3%	349	21,343	36.7%	5.5%	384	332,496	40.4%	94.2%	951	142,569
2013	43	186	4.5%	0.0%	147	2,430	15.4%	0.2%	320	22,291	33.6%	3.9%	443	398,808	46.5%	95.9%	953	193,253
2014	42	279	4.3%	0.0%	149	2,334	15.3%	0.2%	345	22,158	35.5%	5.0%	435	335,827	44.8%	94.8%	971	158,691
2015	54	234	5.8%	0.0%	159	2,272	17.0%	0.3%	386	21,794	41.3%	7.4%	336	310,202	35.9%	92.2%	935	120,871
2016	55	238	6.3%	0.0%	142	2,350	16.2%	0.2%	284	20,989	32.4%	4.1%	395	351,050	45.1%	95.6%	876	165,493

Notes: 1. Revenue is in 2016 dollars.

2. Includes only vessels with home-port group in Oregon. Home-port group is defined as the port group where a vessel made the most landings by value.

3. Revenue excludes deliveries to offshore processors and revenues returned from distant water fisheries.

4. Excludes vessel identification codes "NONE" and "ZZ..." which are usually used to identify vessels within tribal commercial fisheries.

Source: PacFIN March 2008, April 2009, March 2010, July 2011, April 2013, March 2014, April 2015, Nov. 2016, and March 2017 annual vessel summary extractions.

Table C.5
Port Group Share of Onshore Landings and Home-Port Vessels in 2012 to 2016

		2012			2013			2014			2015			2016		
	Local/	Onshore Landings		Home-Port	Onshore Landings		Home-Port	Onshore Landings		Home-Port	Onshore Landings		Home-Port	Onshore Landings		Home-Port
Port Group/Communities	Regional	Volume	Value	Vessels	Volume	Value	Vessels	Volume	Value	Vessels	Volume	Value	Vessels	Volume	Value	Vessels
Astoria		58%	33%	31%	48%	31%	30%	44%	31%	30%	49%	38%	31%	46%	32%	30%
Astoria and Warrenton	R															
Tillamook		0%	2%	11%	1%	2%	10%	0%	2%	10%	1%	2%	11%	1%	2%	9%
Garibaldi	L															
Pacific City	L															
Newport		27%	30%	23%	37%	31%	22%	42%	34%	22%	33%	29%	22%	37%	33%	26%
Depoe Bay	L															
Newport	R															
Coos Bay		11%	23%	20%	10%	21%	21%	10%	24%	23%	12%	21%	21%	10%	20%	21%
Florence	L															
Winchester Bay	L															
Charleston	R															
Bandon	L															
Brookings		3%	12%	15%	5%	14%	17%	3%	9%	14%	5%	10%	15%	6%	13%	15%
Port Orford	L															
Gold Beach	L															
Brookings	R															
Total		306.7 million pounds	$133.9 million ex-vessel	951 vessels	349.4 million pounds	$184.9 million ex-vessel	953 vessels	300.4 million pounds	$159.9 million ex-vessel	971 vessels	203.9 million pounds	$115.8 million ex-vessel	935 vessels	226.9 million pounds	$148.5 million ex-vessel	876 vessels

Notes: 1. Declaration of local or regional considers presence of vessel repair businesses, fishing equipment suppliers, ice services, cold storage, delivery services from buyers and processors, moorage and landing facilities, etc.
2. Value is in millions of 2016 dollars adjusted using the GDP implicit price deflator developed by U.S. Bureau of Economic Analysis.

Source: PacFIN annual vessel summary April 2013, March 2014, April 2015, November 2016, and March 2017 extractions.

Table C.6
Landings and Participant Counts by Port in 2017

Activity	Astoria and Warrenton	Garibaldi	Pacific City	Depoe Bay	Newport	Florence	Reedsport/ Winchester Bay	Coos Bay and Charleston	Bandon	Port Orford	Gold Beach	Brookings Harbor	Statewide
Volume (millions pounds)	153.6	2.0	0.1	0.04	115.0	0.01	0.8	19.5	0.03	1.2	0.2	9.0	302.4
Value (millions ex-vessel)	$40.1	$4.6	$0.2	$0.1	$52.8	$0.0	$3.0	$27.5	$0.1	$3.4	$0.3	$8.4	$144.2
Deliveries													
Count	2,207	1,125	331	68	3,928	3	289	2,505	75	2,300	516	1,244	18,111
Unique vessels	172	93	24	9	297	c	32	229	9	61	24	110	894
Processor/buyer/restaurant counts													
Statewide purchase volume													
>$500 thousand	11	4	c	c	15	c	5	11	c	4	c	6	25
>$10 thousand	23	17	8	6	40	c	10	33	8	15	6	11	79
Purchases at port													
>$500 thousand	6	3	0	0	10	0	c	7	0	c	0	4	
>$10 thousand	18	11	4	c	35	c	6	21	4	9	3	10	

Notes: 1. Shown ports landings do not sum to Oregon total because of minor landings at unspecified ports. Vessel and processor counts do not sum to Oregon total because vessels may deliver to more than one port, and processors may make purchases at more than one port.
2. Deliveries exclude vessels with identification of "NONE" or "ZZ..."
3. Processor counts exclude occurrences when vessels make direct sales to the public.
4. Processing does not necessarily occur at the port where the landings are shown to be purchased. In some cases, the purchases are hauled by truck to another location for processing, cold storage, and distribution.
5. Counts with a "c" are not shown to avoid revealing confidential information.

Source: PacFIN annual vessel summary and fish ticket data, June 2018 extractions.

Appendix D

Revenue Portfolios for Vessels Participating in the Nearshore Groundfish Fishery

Table D.1
Typical and Representative Revenue Portfolio for Vessels Participating in the Nearshore Groundfish Fishery by Groundfish Permit Category in 2016

	Vessel Category							
	OA Vessels, Permit		OA Vessels, No Permit		LE Trawl Permit Vessels		LE Fixed Gear Permit Vessels	
Fishery	Amount	Count	Amount	Count	Amount	Count	Amount	Count
Average Landed Value Per Vessel, Typical								
Nearshore Fisheries								
Salmon troll	$5,434	20	$11,206	55	$0	13	c	c
D. crab	$81,613	21	$98,435	42	$185,313	24	$157,089	6
Nearshore groundfish	$10,442	96	$1,272	103	$6,636	48	$6,225	6
Other Fisheries								
Col. R. salmon	$0	0	$0	0	$0	0	$0	0
Other groundfish	$3,377	75	$5,166	74	$416,051	48	$78,434	6
P. shrimp	$0	0	c	c	$379,831	19	$0	0
Tuna	$4,657	6	$19,293	44	c	c	c	c
Whiting	c	c	$0	0	$145,776	46	c	c
Sardine	$0	0	$34	3	$11	8	$0	0
Other	$3,634	16	$26,191	52	$218	31	$20,530	5
Total per vessel	$32,962	96	$73,341	103	$805,617	48	$262,991	6
Standard deviation	$63,424		$95,028		$416,793		$135,656	
Number of vessels	96		103		48		6	
	Amount	Share	Amount	Share	Amount	Share	Amount	Share
Average Landed Value Per Vessel, Representative								
Nearshore Fisheries								
Salmon troll	$1,132	3%	$5,984	8%	$0	0%	$3,534	1%
D. crab	$17,853	54%	$40,139	55%	$92,657	12%	$157,089	60%
Nearshore groundfish	$10,442	32%	$1,272	2%	$6,636	1%	$6,225	2%
Other Fisheries								
Col. R. salmon	$0	0%	$0	0%	$0	0%	$0	0%
Other groundfish	$2,638	8%	$3,712	5%	$416,051	52%	$78,434	30%
P. shrimp	$0	0%	$770	1%	$150,350	19%	$0	0%
Tuna	$291	1%	$8,241	11%	$79	0%	$601	0%
Whiting	$0	0%	$0	0%	$139,702	17%	$0	0%
Sardine	$0	0%	$1	0%	$2	0%	$0	0%
Other	$606	2%	$13,223	18%	$140	0%	$17,108	7%
Total per vessel	$32,962	100%	$73,341	100%	$805,617	100%	$262,991	100%
Standard deviation	$63,424		$95,028		$416,793		$135,656	
Number of vessels	96		103		48		6	
Average vessel length (ft)	24.6		36.2		71.4		32.2	

Table D.1 (cont.)

Fishery	Vessel Category: Coastwide Amount	Count
Average Landed Value Per Vessel, Typical		
Nearshore Fisheries		
Salmon troll	$8,291	90
D. crab	$120,841	93
Nearshore groundfish	$5,887	253
Other Fisheries		
Col. R. salmon	$0	0
Other groundfish	$103,826	203
P. shrimp	$364,805	20
Tuna	$16,683	53
Whiting	$139,702	48
Sardine	$17	11
Other	$14,706	104
Total per vessel	$201,447	253
Standard deviation	$354,108	
Number of vessels	253	

	Amount	Share
Average Landed Value Per Vessel, Representative		
Nearshore Fisheries		
Salmon troll	$2,949	1%
D. crab	$44,420	22%
Nearshore groundfish	$5,887	3%
Other Fisheries		
Col. R. salmon	$0	0%
Other groundfish	$83,307	41%
P. shrimp	$28,838	14%
Tuna	$3,495	2%
Whiting	$26,505	13%
Sardine	$1	0%
Other	$6,045	3%
Total per vessel	$201,447	100%
Standard deviation	$354,108	
Number of vessels	253	
Average vessel length (ft)	38.4	

Notes: 1. Amounts shown as "c" are hidden for confidentiality reasons.

Table D.2
Typical and Representative Revenue Portfolio for Vessels Participating in the Nearshore Groundfish Fishery at Port Groups and Coastwide in 2016

Fishery	Astoria	Tillamook	Newport	Coos Bay	Port Orford	Brookings	Coastwide
Average Landed Value Per Vessel, Typical							
Nearshore Fisheries							
Salmon troll	$240	$1,909	$10,604	$7,669	$7,923	$4,909	$8,291
D. crab	$126,707	$60,805	$179,875	$53,672	$134,008	$103,345	$120,841
Nearshore groundfish	$10,056	$4,574	$1,647	$1,511	$10,452	$5,894	$5,887
Other Fisheries							
Col. R. salmon	$0	$0	$0	$0	$0	$0	$0
Other groundfish	$393,599	$356	$106,411	$37,802	$14,930	$63,266	$103,826
P. shrimp	$128,390	$0	$527,857	$317,883	$0	$246,239	$364,805
Tuna	$5,006	$4,561	$18,726	$12,093	$1,965	c	$16,683
Whiting	$103,239	$0	$326,039	$0	c	$0	$139,702
Sardine	$30	$0	$11	$0	$0	$0	$17
Other	$6,709	$1,037	$21,141	$20,571	$7,496	c	$14,706
Total per vessel	$550,498	$16,235	$275,866	$107,989	$78,368	$97,936	$201,447
Vessel Counts							
Nearshore Fisheries							
Salmon troll	8	15	30	19	13	6	90
D. crab	11	7	20	26	19	10	93
Nearshore groundfish	28	42	59	64	51	49	253
Other Fisheries							
Col. R. salmon	0	0	0	0	0	0	0
Other groundfish	28	24	46	52	46	35	203
P. shrimp	3	0	4	8	0	5	20
Tuna	3	5	16	19	4	c	53
Whiting	21	0	13	9	c	5	48
Sardine	3	0	9	0	0	0	11
Other	22	4	34	26	16	c	104
Number of vessels	28	42	59	64	51	49	253
Average Landed Value Per Vessel, Representative							
Nearshore Fisheries							
Salmon troll	$69	$682	$5,392	$2,277	$2,020	$601	$2,949
D. crab	$49,778	$10,134	$60,974	$21,804	$49,924	$21,091	$44,420
Nearshore groundfish	$10,056	$4,574	$1,647	$1,511	$10,452	$5,894	$5,887
Other Fisheries							
Col. R. salmon	$0	$0	$0	$0	$0	$0	$0
Other groundfish	$393,599	$204	$82,964	$30,714	$13,466	$45,190	$83,307
P. shrimp	$13,756	$0	$35,787	$39,735	$0	$25,126	$28,838
Tuna	$536	$543	$5,078	$3,590	$154	$28	$3,495
Whiting	$77,430	$0	$71,839	$0	$0	$0	$26,505
Sardine	$3	$0	$2	$0	$0	$0	$1
Other	$5,272	$99	$12,183	$8,357	$2,352	$6	$6,045
Total per vessel	$550,498	$16,235	$275,866	$107,989	$78,368	$97,936	$201,447
Standard deviation	$392,289	$46,670	$429,799	$205,973	$108,005	$260,276	$354,108

Table D.2 (cont.)

Fishery	Astoria	Tillamook	Newport	Coos Bay	Port Orford	Brookings	Coastwide
Number of vessels	28	42	59	64	51	49	253
Open access	21%	100%	69%	81%	92%	80%	79%
Permit	0%	45%	12%	22%	80%	65%	38%
No permit	21%	55%	58%	59%	12%	14%	41%
LE trawl	79%	0%	29%	19%	0%	18%	19%
LE fixed	0%	0%	2%	0%	8%	2%	2%
Shares of Landed Value Per Vessel, Representative							
Nearshore Fisheries							
Salmon troll	0.0%	4.2%	2.0%	2.1%	2.6%	0.6%	1.5%
D. crab	9.0%	62.4%	22.1%	20.2%	63.7%	21.5%	22.1%
Nearshore groundfish	1.8%	28.2%	0.6%	1.4%	13.3%	6.0%	2.9%
Other Fisheries							
Col. R. salmon	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other groundfish	71.5%	1.3%	30.1%	28.4%	17.2%	46.1%	41.4%
P. shrimp	2.5%	0.0%	13.0%	36.8%	0.0%	25.7%	14.3%
Tuna	0.1%	3.3%	1.8%	3.3%	0.2%	0.0%	1.7%
Whiting	14.1%	0.0%	26.0%	0.0%	0.0%	0.0%	13.2%
Sardine	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other	1.0%	0.6%	4.4%	7.7%	3.0%	0.0%	3.0%
Total per vessel	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Notes: 1. Vessel revenues are average over all vessels in 2016 making at least one delivery of nearshore groundfish at the port group or coastwide.
2. Excludes landings with no vessel identification. This results in less than five thousand dollars of nearshore groundfish being excluded from the tabulations.
3. Distant water fisheries revenue is not included.
4. Amounts shown as "c" are hidden for confidentiality reasons.

Source: PacFIN annual vessel summary and fish ticket data, March 2017 extraction.

Table D.3
Typical and Representative Purchase Portfolios for Processors and Buyers by Major Fisheries Coastwide in 2016

Fishery	Total Purchases	Purchaser Count	Typical Average	Representative Average Amount	Representative Average Share
	Nearshore Groundfish Purchasers				
Nearshore Fisheries					
Salmon troll	$2,233,275	16	$139,580	$101,513	2%
D. crab	$35,901,048	17	$2,111,826	$1,631,866	35%
Nearshore groundfish	$1,407,065	22	$63,958	$63,958	1%
Other Fisheries					
Col. R. salmon	$1,594,018	8	$199,252	$72,455	2%
Other groundfish	$28,637,070	22	$1,301,685	$1,301,685	28%
P. shrimp	$20,848,775	5	$4,169,755	$947,672	20%
Tuna	$6,685,386	16	$417,837	$303,881	7%
Whiting	$3,499,250	4	$874,813	$159,057	3%
Sardine	$155	c	c	$7	0%
Other	$1,479,448	17	$87,026	$67,248	1%
Total	$102,285,091	22	$4,649,322	$4,649,322	100%
	Purchasers Specializing in Nearshore Groundfish (Purchases >50%)				
Nearshore groundfish	$225,733	7	$32,248	$32,248	
Total	$253,915	7	$36,274	$36,274	
	All Oregon Purchasers				
Nearshore Fisheries					
Salmon troll	$4,230,075	51	$82,943	$35,251	3%
D. crab	$55,687,613	60	$928,127	$464,063	38%
Nearshore groundfish	$1,471,936	40	$36,798	$12,266	1%
Other Fisheries					
Col. R. salmon	$4,046,208	73	$55,428	$33,718	3%
Other groundfish	$30,493,812	115	$265,164	$254,115	21%
P. shrimp	$25,093,253	10	$2,509,325	$209,110	17%
Tuna	$12,408,545	66	$188,008	$103,405	8%
Whiting	$8,693,682	7	$1,241,955	$72,447	6%
Sardine	$257	3	$86	$2	0%
Other	$6,158,142	71	$86,734	$51,318	4%
Total	$148,283,123	120	$1,235,693	$1,235,693	100%

Notes: 1. "Nearshore groundfish purchasers" are filtered for those that purchased over $10 thousand of Oregon onshore nearshore groundfish. "All Oregon purchasers" are filtered for those that purchased over $10 thousand of Oregon onshore any fishery. There were 77 processors/ buyers whose purchases were less than $10 thousand in 2016. The sum of purchases for these processors/buyers is $252,535.

2. Amounts shown as "c" are hidden for confidentiality reasons.

Source: PacFIN annual vessel summary and fish ticket data, March 2017 extraction.

Appendix E

Demographic and Well-Being Indicators at Port Groups

Appendix E
Demographic and Well-Being Indicators at Port Groups in 2016

Contents

Notes: 1. Astoria port group is Clatsop County, Tillamook is Tillamook County, Newport is Lincoln County and zip code 97439 (Florence), Coos Bay is Coos County and zip code 97467 (Reedsport), Port Orford is zip codes 97465, 97476, and 97450, and Brookings is Curry County other than Port Orford.
2. The year used in table titles corresponds to the ending year in estimates sourced to the American Community Survey (ACS) 2012-2016 data.

Table E.1
Population and Housing Characteristics in 2016

	Oregon	Coastwide	Astoria	Tillamook	Newport	Coos Bay	Port Orford	Brookings
Population	3,982,267	214,386	37,660	25,552	60,917	67,893	3,158	19,206
By age								
Under 18	21.6%	17.8%	19.7%	19.2%	16.1%	18.6%	10.6%	16.1%
Age 18 to 64	62.4%	57.0%	61.1%	57.8%	55.7%	56.9%	57.9%	52.3%
65 and over	15.9%	25.2%	19.2%	22.9%	28.2%	24.5%	31.5%	31.6%
Median age (years)	39.1	49.5	43.7	48.1	52.8	48.4	57.1	54.8
By race								
White	85.1%	89.9%	90.6%	91.4%	89.5%	88.8%	98.5%	90.5%
Other	14.9%	10.1%	9.4%	8.6%	10.5%	11.2%	1.5%	9.5%
Housing units	1,706,290	125,631	21,869	18,520	39,506	33,115	1,901	10,720
Households	1,545,745	91,756	15,876	10,154	27,374	27,956	1,470	8,926
Average household size	2.52	2.30	2.32	2.44	2.20	2.39	2.12	2.13

Notes: 1. Median age for port groups with multiple geographic areas is estimated to be the average of the areas weighted by population.
Source: ACS 2012-2016 estimates.

Table E.2
Civilian Employment at Port Groups by Occupation in 2016

	Oregon	Coastwide	Astoria	Tillamook	Newport	Coos Bay	Port Orford	Brookings
Civilian employed population 16 years+	1,832,620	82,845	16,840	9,859	23,489	25,031	871	6,755
Management, business, science, and arts occupations	37.5%	28.4%	30.5%	26.9%	26.3%	28.2%	28.5%	33.1%
Service occupations	18.6%	24.0%	22.6%	20.4%	28.0%	22.6%	20.0%	24.4%
Sales and office occupations	23.2%	23.3%	24.7%	18.7%	24.3%	23.1%	20.6%	24.1%
Natural resources, construction, and maintenance occupations	8.8%	11.5%	9.6%	15.2%	10.0%	12.4%	17.8%	12.2%
Production, transportation, and material moving occupations	11.9%	12.8%	12.5%	18.7%	11.3%	13.8%	13.2%	6.2%

Notes: 1. Includes civilian employed population 16 years and over.
2. City of Port Orford is included in the three Port Orford zip codes, and the three zip codes are assumed to be entirely in Curry County.

Source: ACS 2012-2016 estimates.

Table E.3
Civilian Employment at Port Groups by Industry in 2016

	Oregon	Coastwide	Astoria	Tillamook	Newport	Coos Bay	Port Orford	Brookings
Civilian employed population 16 years+	1,832,620	82,845	16,840	9,859	23,489	25,031	871	6,755
Ag., forestry, fishing and hunting, mining:	3.3%	5.4%	3.2%	9.0%	4.4%	5.6%	18.5%	6.1%
Agriculture, forestry, fishing and hunting	3.2%	5.2%	2.9%	9.0%	4.1%	5.5%	18.5%	6.1%
Mining, quarrying, and oil and gas extrac	0.1%	0.2%	0.3%	0.0%	0.3%	0.1%	0.0%	0.0%
Construction	5.7%	6.5%	6.7%	6.9%	6.1%	7.1%	4.4%	5.2%
Manufacturing	11.4%	7.6%	8.1%	11.4%	5.3%	8.6%	0.0%	5.4%
Wholesale trade	2.9%	1.3%	1.8%	1.4%	1.3%	1.1%	2.5%	0.5%
Retail trade	12.0%	13.4%	14.5%	10.7%	14.1%	13.2%	13.0%	12.3%
Transp. and warehousing, and utilities:	4.2%	4.4%	4.1%	5.9%	4.2%	4.1%	8.0%	4.1%
Transportation and warehousing	3.4%	3.3%	3.4%	3.3%	3.0%	3.8%	4.0%	2.5%
Utilities	0.8%	1.1%	0.7%	2.5%	1.2%	0.4%	4.0%	1.6%
Information	1.9%	1.7%	2.2%	0.9%	1.7%	1.7%	0.0%	1.6%
Fin. and ins.; real est., rental and leasing:	5.7%	4.8%	6.1%	5.3%	4.9%	3.5%	5.7%	4.7%
Finance and insurance	3.7%	2.1%	2.6%	1.7%	2.1%	1.8%	1.1%	3.2%
Real estate and rental and leasing	2.0%	2.6%	3.5%	3.7%	2.8%	1.7%	4.6%	1.5%
Prof., sci., mgmt.; admin., waste mgmt.:	10.7%	7.8%	7.5%	6.8%	9.6%	7.7%	3.0%	3.9%
Professional, sci., and tech. services	6.7%	3.9%	4.4%	3.6%	4.4%	3.5%	1.4%	3.0%
Mgmt. of companies and enterprises	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Admin., support, waste mgmt. services	4.0%	3.8%	3.2%	3.2%	5.2%	4.2%	1.6%	0.8%
Ed. svcs., health care and social assist.:	23.0%	21.5%	21.8%	20.2%	18.4%	24.0%	17.5%	24.9%
Educational services	8.6%	6.7%	7.3%	6.9%	5.2%	7.4%	7.1%	7.9%
Health care and social assistance	14.4%	14.8%	14.5%	13.3%	13.2%	16.6%	10.3%	17.0%
Arts, entertain., rec.; accom., food service	10.0%	15.6%	16.4%	12.2%	21.1%	12.4%	20.0%	10.4%
Arts, entertainment, and recreation	2.1%	4.1%	3.2%	3.5%	5.1%	4.6%	9.4%	1.7%
Accommodation and food services	7.8%	11.5%	13.2%	8.8%	16.0%	7.9%	10.6%	8.7%
Other services, except public administratic	4.8%	4.3%	3.1%	3.7%	4.3%	4.4%	4.8%	8.0%
Public administration	4.5%	5.9%	4.4%	5.5%	4.6%	6.5%	2.6%	12.9%

Source: ACS 2012-2016 estimates.

Table E.4
Housing Costs at Port Groups in 2016 and Vacancy at Port Groups in 2010

	Oregon	Coastwide	Astoria	Tillamook	Newport	Coos Bay	Port Orford	Brookings
Housing costs (2016 $)								
Median gross rent	941	800	872	811	818	715	635	869
Median mortgage payments	1,563	1,303	1,446	1,276	1,302	1,193	1,145	1,462

Notes: 1. Median mortgage payments are selected monthly owner costs for housing units with a mortgage.
2. Median gross rent for port groups with multiple geographic areas is estimated to be the average of the areas weighted by number of occupied units paying rent. Median mortgage payments is estimated to be the average of the areas weighted by number of housing units with a mortgage.
Source: ACS 2012-2016 estimates.

	Oregon	Coastwide	Astoria	Tillamook	Newport	Coos Bay	Port Orford	Brookings
Housing units								
Vacancy rate	9.3%	24.9%	26.9%	41.0%	30.2%	11.5%	19.4%	17.1%
Second homes (% housing units)	3.3%	17.3%	19.9%	33.8%	22.1%	4.1%	10.5%	8.7%

Notes: Second homes are defined to be for seasonal, recreational, or occasional use.
Source: Census 2010.

Table E.5
Household Income at Port Groups in 2016

	Oregon	Coastwide	Astoria	Tillamook	Newport	Coos Bay	Port Orford	Brookings
Households	1,545,745	91,756	15,876	10,154	27,374	27,956	1,470	8,926
Portion of households								
With earnings	75.5%	62.9%	71.3%	64.1%	60.4%	63.0%	55.1%	55.7%
With Social Security	32.8%	48.3%	39.5%	47.2%	50.9%	48.8%	57.5%	54.3%
With retirement income	19.6%	26.5%	24.3%	25.7%	26.8%	27.9%	25.6%	26.5%
With food stamps/SNAP benefits	18.8%	21.4%	19.0%	18.3%	22.0%	24.7%	34.1%	15.3%
Mean earnings households	71,949	54,368	59,955	53,231	51,334	54,714	46,202	53,326
Mean household income	72,013	55,544	62,295	57,343	53,802	54,238	47,245	52,286
Median household income	53,270	41,166	47,492	43,777	40,099	38,603	33,845	39,454
Per capita income	28,822	24,805	27,071	23,688	24,760	23,976	23,260	25,179

Notes: 1. Median household income for port groups with multiple geographic areas is estimated to be the average of the areas weighted by number of households.
Source: ACS 2012-2016 estimates.

Table E.6
Well-Being Indicators at Port Groups in 2016

	Oregon	Coastwide	Astoria	Tillamook	Newport	Coos Bay	Port Orford	Brookings
Individuals below poverty level	15.7%	16.9%	14.0%	15.4%	18.2%	18.3%	29.5%	12.8%
Unemployment rate (16 and over)	8.1%	8.8%	6.9%	7.4%	7.4%	11.0%	18.6%	9.9%
Self-employed (16 and over)	7.6%	10.4%	8.3%	9.3%	12.1%	9.9%	20.9%	12.1%
Education (percent of persons age 25+)								
High school or above	90.0%	89.9%	91.9%	89.8%	89.9%	88.8%	86.8%	90.2%
Bachelor's degree or above	31.4%	21.3%	24.1%	20.9%	22.7%	18.0%	24.8%	23.4%
Percent of population that is female householder	19.3%	21.2%	21.4%	19.4%	22.9%	19.5%	24.9%	23.0%
Percent of owner occupied housing units with owner's monthly cost over 30% of income	27.4%	28.7%	27.7%	28.1%	29.9%	28.3%	26.6%	29.0%
Percent of renter occupied housing units with renter's monthly cost over 30% of income	49.7%	49.5%	48.8%	49.2%	47.6%	49.4%	53.2%	57.4%

Source: ACS 2012-2016 estimates.

Submitted June 25, 2019 From:
Clam Diggers Association
&
Power Hooker Tackle

Exhibit 108

Find messages, documents, photos or people C Home

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home list
James Leuenb... 127
jeff files
Jeff Howard
Jeff Miller 6
Jennifer Davis
Jim part 2
Judge pahl

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RE: Question Yahoo/Inbox

LETARTE June * OSMB <June.LETARTE@oregon.gov> Jun 20 at 8:09 AM
To: 'chuck erickson'

Chuck,

1. There are approximately 155,000 boats with current boat registrations.

2. There are approximately 1,150 registered fishing guides in Oregon.

3. $5,243,595 state boater funds and $429,867 federal boater funds for a total of **$5,673,462** are anticipated to be expended during the 2017-19 biennium for construction and maintenance grants.

June LeTarte

June LeTarte
Executive Assistant - Office of the Director
Administrative Rules Coordinator
Oregon State Marine Board
435 Commercial Street NE #400
Salem OR 97301
Office: (503) 378-2617
Fax: (503) 378-4597
june.letarte@oregon.gov

BOAT OREGON — OREGON STATE MARINE BOARD

P Keeping it Green; conserve paper and print only what you need.

From: chuck erickson [mailto:cerickson97838@yahoo.com]
Sent: Wednesday, June 19, 2019 3:04 PM
To: LETARTE June * OSMB
Subject: Question

Hi June,

Chuck Erickson here and I am hoping you can help me with some information for a public comment I am working on about the Jordan Cove LNG at Coos Bay.

1. How many licensed boat does Oregon have?

Submitted June 25, 2019 From:
Clam Diggers Association
&
Power Hooker Tackle

Exhibit 109

Publication 510

Sport Fishing Equipment

Sport Fishing Equipment (p30)

A tax of 10% of the sale price is imposed on many articles of sport fishing equipment sold by the manufacturer. This includes any parts or accessories sold on or in connection with the sale of those articles.

Pay this tax with Form 720. No tax deposits are required.

Sport fishing equipment includes all the following items.

1. Fishing rods and poles (and component parts), fishing reels, fly fishing lines, and other fishing lines not over 130 pounds test, fishing spears, spear guns, and spear tips.
2. Items of terminal tackle, including leaders, artificial lures, artificial baits, artificial flies, fishing hooks, bobbers, sinkers, snaps, drayles, and swivels (but not including natural bait or any item of terminal tackle designed for use and ordinarily used on fishing lines not described in (1)).
3. The following items of fishing supplies and accessories: fish stringers, creels, bags, baskets, and other containers designed to hold fish, portable bait containers, fishing vests, landing nets, gaff hooks, fishing hook disgorgers, and dressing for fishing lines and artificial flies.
4. Fishing tip-ups and tilts.
5. Fishing rod belts, fishing rodholders, fishing harnesses, fish fighting chairs, fishing outriggers, and fishing downriggers.

See Revenue Ruling 88-52 in Cumulative Bulletin 1988-1 for a more complete description of the items of taxable equipment.

Fishing rods and fishing poles. (p30)

The tax on fishing rods and fishing poles (and component parts) is 10% of the sales price not to exceed $10 per article. The tax is paid by the manufacturer, producer, or importer.

Fishing tackle boxes. (p30)

The tax on fishing tackle boxes is 3% of the sales price. The tax is paid by the manufacturer, producer, or importer.

Electric outboard boat motors. (p30)

A tax of 3% of the sale price is imposed on the sale by the manufacturer of electric outboard motors. This includes any parts or accessories sold on or in connection with the sale of those articles.

Certain equipment resale. (p30)

The tax on the sale of sport fishing equipment is imposed a second time under the following circumstances. If the manufacturer sells a taxable article to any person, the manufacturer is liable for the tax. If the purchaser or any other person then sells it to a person who is related (discussed next) to the manufacturer, that related person is liable for a second tax on any subsequent sale of the article. The second tax, however, isn't imposed if the constructive sale price rules under section 4216(b) apply to the sale by the manufacturer.

If the second tax is imposed, a credit for tax previously paid by the manufacturer is available provided the related person can document the tax paid. The documentation requirement is generally satisfied only through submission of copies of actual records of the person that previously paid the tax.

Related person. (p31)

For the tax on sport fishing equipment, a person is a related person of the manufacturer if that person and the manufacturer have a relationship described in section 465(b)(3)(C).

Exhibit 110

Submitted June 25, 2019 From:
Clam Diggers Association
&
Power Hooker Tackle

History

A Brief History of the Coos, Lower Umpqua & Siuslaw Indians

The Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians are made up of 3 tribes (4 Bands): 2 bands of Coos Tribes: Hanis Coos (Coos Proper), Miluk Coos; Lower Umpqua Tribe; and Siuslaw Tribe. Although both Coos bands lived in close proximity to one another on the Coos River tributaries, they spoke different dialects of the Coos language and had their own unique history and cultural differences. A days walk north from the Coos River, you found yourself in the Lower Umpqua territory with a much different spoken language that both the Lower Umpqua and Siuslaw bands shared; the Siuslaw language. The diversity of languages and cultures you can find along the West Coast attests to the longevity these bands sustained for hundreds of generations in the lands they call home.

The tribes trace their ancestry back to the aboriginal inhabitants of the South-Central coast of Oregon. Their historic homelands extended from the richly forested slopes of the Coastal Range in the East to the rocky shoreline of the Pacific Ocean in the West, a vast region of some 1.6 million acres. They lived peacefully in an area characterized by moderate temperatures and abundant natural resources, including fish, shellfish, wildlife, and a rich variety of edible plants. This was their land; the Coos cosmology states that:

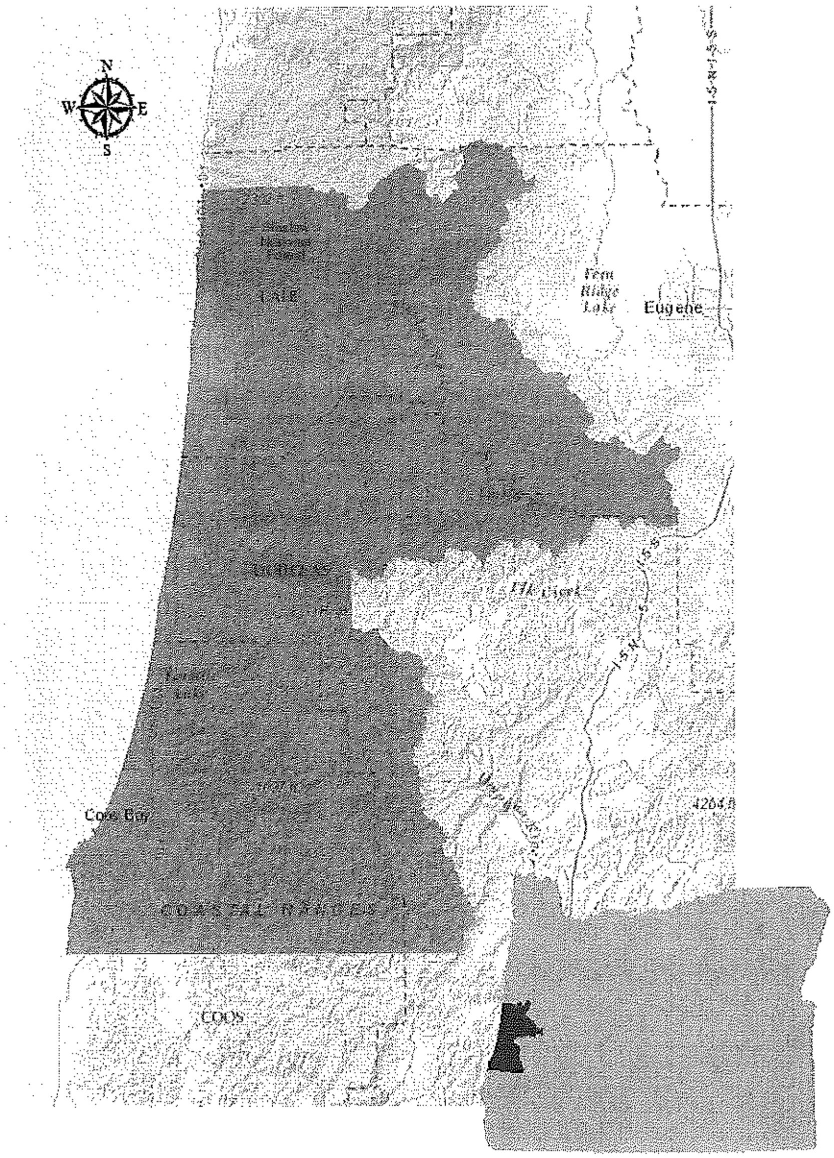
Two young men from the Sky World looked down below, and saw only water. Blue clay they laid down for land, and tule mats and baskets they laid down to stop the waves from running over the land. Eagle feathers they planted, and they became trees. As they were thinking, it was happening. All kinds of vegetation grew; animals came. The world became beautiful. The world became as it is now.

The people lived in villages of cedar plank houses on the margins of the extensive estuaries of the Siuslaw, Umpqua, and Coos rivers. This is an area of rugged cliffs and open beaches, bordered by shifting sand dunes and steep, heavily vegetated mountainsides. Their villages tended to be autonomous to each other. Most people within a village were related to each other by blood or marriage. People often visited other villages for social occasions, and to trade. During the summers, they would move to hunting camps in the surrounding mountains. They also navigated the rivers, and mountain ridge trails, to trade with other villages or journey to the Willamette and Camas Valleys for certain prized foods.

The Tribes had a distinct social stratification based on wealth measured in quantities of dentalium shells, woodpecker scalps, abalone shells, grey pine seeds, and clam shell disk money. The chief of the village was the wealthiest man. He was obligated to his people to use his wealth to benefit the people, and people in turn brought him food and gifts. The men of the village hunted and fished, made projectile points, canoes, traps and house planks. The women picked berries, dug for roots and clams, helped fish, wove baskets, processed hides, dried meat, sewed clothing and cooked the food. Those who were too elderly or ill to help in gathering or processing of food, were given food by everyone else in the village. Food was always shared, and no one went hungry.

The Coos tribe lived on the southwest Oregon Pacific Coast. The Hanis speaking Coos lived in Now day North Bend, while the Miluk speaking Coos lived on the South Slough. Several Oregon landmarks are named after the tribe, the Coos Bay, the city of Coos Bay, and Coos County. Most of them were hunters, fishermen, and gatherers. For entertainment, they held foot races, canoe races, dice (bone or stick) games, target practice, and also nauhina'nowas (shinny). The Lower Umpqua people lived within the lower reaches of the Umpqua River watershed. They spoke the Kuitsch dialect of the Siuslawan language. The Siuslaw people lived within the Siuslaw River watershed which is named after them. They spoke the Siuslawan language. All three tribes lived in cedar longhouses. Men hunted and fished; while Women collected berries, roots and nuts. In addition, their rich diet consisted of seafood, game, sea bird eggs and other delicacies. Deer and elk skins were fashioned into garments and blankets. Baskets were woven using a variety of materials, from conifers to grasses. Nearly everything was treated as having a spirit, and spirits could exert a positive influence on people's lives. Young people set out on vision quests, a rite of passage, to locate their spirit power. To become a shaman, one had to possess five powers.

CTCLUSI Aboriginal Ancient Boundary



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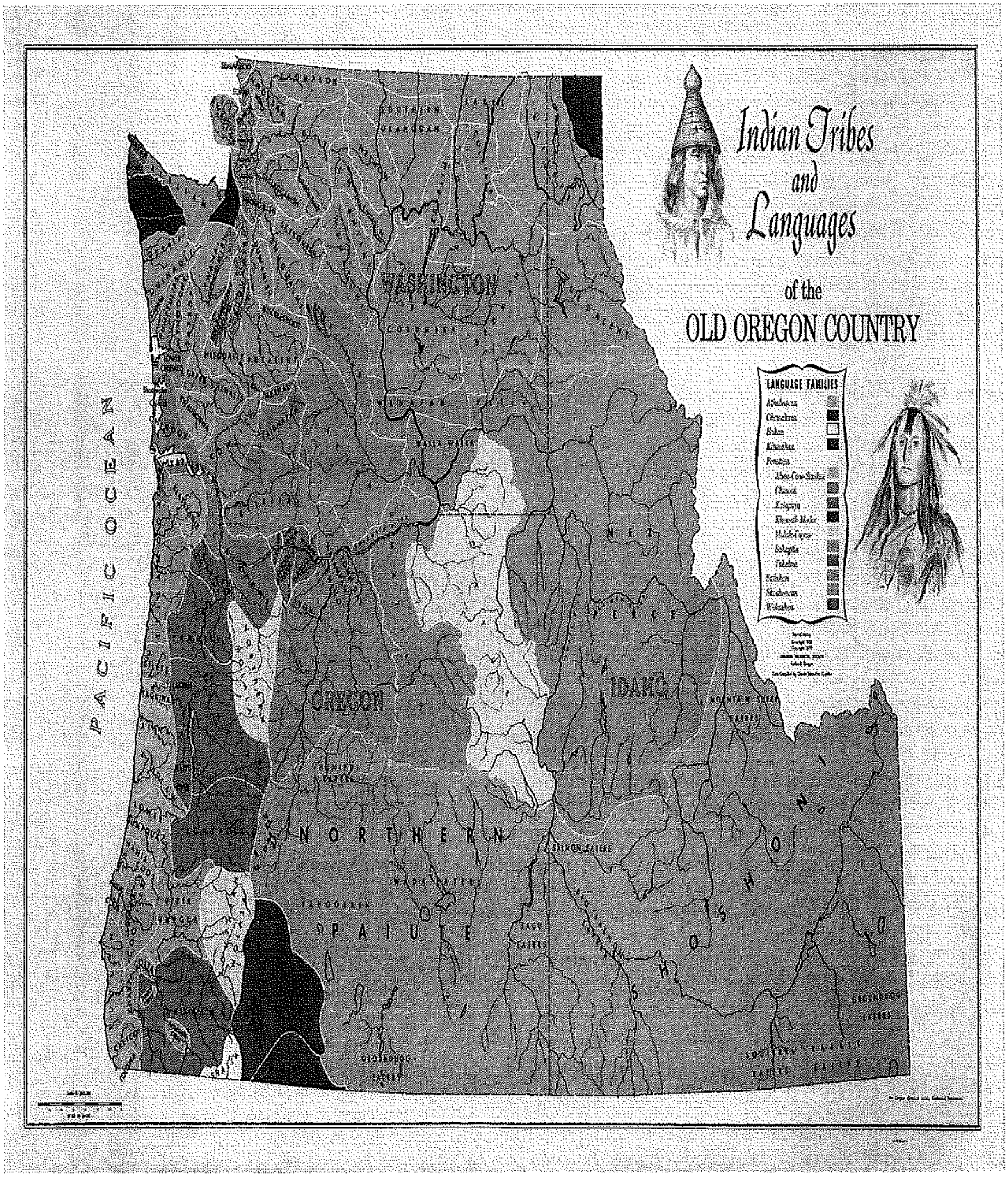

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Some Significant Dates to the Coos, Lower Umpqua & Siuslaw Indians

On January 26th, 1700 a 9.0 Earthquake caused a tsunami that flooded the coastal communities. In 1791 American Captain James Baker entered the Umpqua Indians' lands and traded with the Lower Umpqua for about twelve days.

February 8th 1806 was the first time the Coos were mentioned by Euro-Americans. William Clark, wintering at

Fort Clatsop near the Columbia with Meriwether Lewis and the Corp of Discovery, reported the existence of the "Cook-koo-oose nation". His journal entry says: "I saw Several prisoners from this nation with the Clatsops and Kilamox, they are much fairer than the common Indians of this quarter, and do not flatten their heads."
Trappers working for Hudson Bay Company made first contact with the coastal tribes in 1820. The first American fur trapper, Jedediah Smith and his men, followed in 1828.

In 1824 Smallpox had entirely wiped out the Hanis Coos Indian village at Tenmile Lakes. In 1836 A measles outbreak struck Indian villages on the Coos Bay reducing the population from 2,000 to 800. Such European diseases as smallpox arrived with the white man's penetration into the area and sickened the tribes.

In 1846, Great Britain transferred sovereignty of the Oregon Territory to the United States. The Oregon Organic Act, which established the U.S. Oregon Territory, confirmed and guaranteed the Indians right and title to their lands and property, and stated: "That nothing in this Act contained shall be construed to impair the rights of persons or property now pertaining to the Indians in said territory so long as such rights shall remain unextinguished by the treaty between the United States and said Indians."

The Coos, Lower Umpqua and Siuslaw Indians maintained peaceful relations with settlers as they began to stream in from the East. In 1855, four years before Oregon attained Statehood, a treaty was drafted by the federal government to allow for the peaceful acquisition and settlement of the Confederated Tribes ancestral lands. The treaty provided for compensation to the Tribes in terms of food, clothing, employment, education and health benefits. The three Tribes agreed to the Treaty of 1855, and patiently waited for Congress to ratify it.

However, they waited in vain. The federal government chose to ignore the treaty, and it was never ratified by the United States Senate. Within a year of the Indians' signing of the treaty, and the beginning of the 1856 Rogue River War between the whites and Indians to the south, the Coos Indians were rounded up and forcefully marched to a military fort, Fort Umpqua, where they were held prisoner along with the Lower Umpqua to prevent their involvement in the war raging in the south.

In 1860, they were marched 60 miles up the coast to the Alsea subagency in Yachats, a reservation on the Yachats River. This long trek was their "Trail of Tears", and within a short time at the reservation, many died of hunger, exposure, mistreatment, and sheer exhaustion. Once there, they were imprisoned for 17 years and forced to give up their traditional culture for farming, on a coastal plain ill-suited to agriculture. Fifty percent of the Tribal members died during this period due to the deplorable conditions including starvation, mistreatment, and disease.

Along with loss of their homelands to white settlement, federal promises of just treatment were persistently broken over the ensuing 100 years. In 1876, the Yachats area was opened for pioneer settlement, and the Tribal members were released to return to their homelands that had been changed forever, or travel north to the Siletz Reservation. Indeed, they found that their homes no longer existed and they became wanderers, settling wherever they could fit in amongst the new pioneer homesteads.

Those Tribal members who stayed in the area found menial jobs or worked in the fields as harvesters. They kept their Tribal identity alive by meeting monthly and observing special celebrations through the year. In 1916, the Tribes established a formal, elected tribal government that they have maintained ever since. Then, in 1941, the Bureau of Indian Affairs (BIA) took a small privately donated parcel (6.12 acres) into trust for the Confederated Tribes in the city of Coos Bay. On this small "reservation", the BIA also erected a Tribal Hall that included an assembly hall, kitchen, offices and medical clinic. It is still in use today and is on the Register of Historic Places.

In the late 1940's, the U.S. government started action to withdraw recognition of some Indian tribes. The Coos, Lower Umpqua and Siuslaw Indians voted to strongly oppose termination. However, without their knowledge or consent, they were included in the Western Oregon Termination Act of 1954. To quote: " The blatant lack of participation in the process is most evident among the Indians of Southwest Oregon. The Coos, Lower Umpqua and Siuslaw never passed a resolution in favor of termination, and were adamantly opposed to it. In 1948, the Coos, Lower Umpquas sent forty-eight delegates to the Siletz Reservation to express their disapproval of termination; but were not allowed to make their case, as they had been locked out of the meeting and were told the termination bill did not affect them".

Even though the U.S. government officially terminated them, the Confederated Tribes never sold their small reservation and Tribal Hall, and, instead, maintained it. During the Termination Years (1954 to 1984), the Confederated Tribes attempted to provide services to its members with the few resources that they had. They also continued to fight for restoration, and recognition as a sovereign nation.

Then, on October 17, 1984, as a result of a long moral, legal and legislative battle, President Ronald Reagan restored the Tribes to federal recognition by signing Public Law 98-481. The Tribes' sovereignty was once again recognized and funding was restored for education, housing and health programs. In 1987, the Tribe approved a constitution and began to lay the groundwork for a self-sufficiency plan.

Since this historic event, there has been a period of rapid growth, along with some political and administrative pains as a result. This internal turmoil has created impediments to progress in achieving self-sufficiency and cultural restoration. In spite of these obstacles, the Tribes have been continually building on the basic framework established by Restoration Act.

During the past several years, the Tribal Planning Department, Tribal Council and Tribal members have conducted and participated in studies to develop demographic data and determine socioeconomic needs of the tribal membership. Through formal survey, input has also been obtained from tribal members concerning priorities and needs relating to restoration of a tribal forest land base. Using information obtained from these studies and surveys, goals have been established for service delivery programs, forest land restoration, and other Tribal government functions to meet the needs of tribal members. These activities represent a major effort to plan for the future of the Tribes and establish the foundation for development of a Reservation Plan and Forest Land Restoration proposal.

Today we strive to perpetuate our unique identity as Indians and as members of the Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians, and to promote and protect that identity. It is our goal to preserve and promote our cultural, religious and historical beliefs while continuing to learn and grow as a part of the community we live in. We also work to promote the social and economic welfare of our members both inside and outside of our five-county service area here in Oregon. Our five-county service area is made up of Coos, Curry, Lincoln, Douglas and Lane counties.

(historyphotos)