



## Economic Analysis to Support Marine Spatial Planning in Washington

### Executive Summary

*Prepared for:*

WASHINGTON COASTAL MARINE ADVISORY COUNCIL

*Prepared by:*



*In association with:*

TCW ECONOMICS  
NORTHERN ECONOMICS, INC.

June 30, 2015

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### *Prepared by:*

Michael L. Taylor, Ph.D., Cascade Economics LLC (team lead)

Janet R. Baker, M.F., Cascade Economics LLC

Edward C. Waters, Ph.D., Cascade Economics LLC

Thomas C. Wegge, M.S., TCW Economics

Katharine (Trina) Wellman, Ph.D., Northern Economics, Inc.

With assistance from Gold Leaf Creative Solutions

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## Acronyms

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DNR	Washington Department of Natural Resources
I-O	input-output
MSP	Washington Marine Spatial Planning
QIN	Quinault Indian Nation
RCW	Revised Code of Washington
SR	State Route

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## Executive Summary

The Washington Marine Spatial Planning (MSP) effort is, by state law, a “public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives” (Revised Code of Washington [RCW] 43.372). Other aspects of the overall planning process are addressing both ecological and social objectives; this report is intended to fulfill the economic objectives of the ecosystem assessment. The Washington MSP study area is shown in Figure ES-1.

The economic analysis developed the tools and data to characterize baseline conditions for ocean uses and their important relationships to coastal communities on the Washington coast, and can be used to evaluate the economic consequences of proposed new proposed uses or planning options in the future. Indeed, as an overriding mission, the economic analysis was intended to “foster and encourage sustainable uses that provide economic opportunity without significant adverse environmental impacts” (RCW 43.372.040).

In general, the components of an economic analysis will reflect identified needs of the study, required precision of output, industry sectors or affected groups, geographic locations being examined, data availability and delivery, timeline, and budget availability. Because so many elements must be balanced, a scoping process was built into the design of the study. Based on the completed scoping process, the consultants developed analyses within the following subject areas:

- ◆ Economic Profile of the Washington Coast
- ◆ Economic Profile of Tribal Communities
- ◆ Washington Coast Commercial Fisheries
- ◆ Recreational Fishing
- ◆ Shellfish Aquaculture
- ◆ Recreation and Tourism
- ◆ Ecosystem Services
- ◆ Social Assessment
- ◆ Risk and Industry Vulnerability Assessment
- ◆ Qualitative Analysis of New Uses

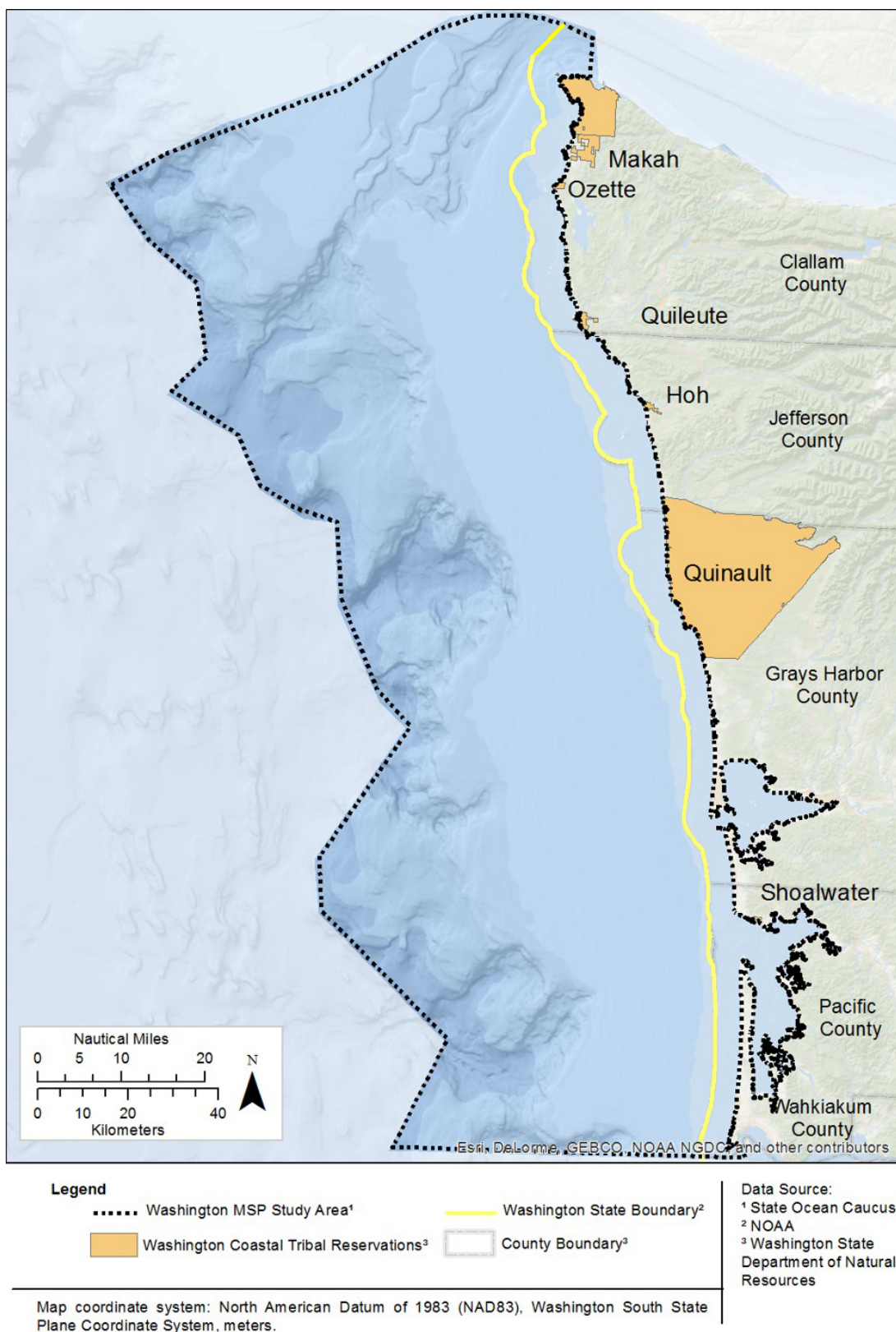


Figure ES-1 Washington Marine Spatial Plan Study Area

## ES.1 ECONOMIC IMPACT MODELING APPROACHES AND MEASURES

### ES.1.1 IMPLAN Models

To estimate the economic contributions of the marine sectors, the economic models used rely on the IMPLAN input-output (I-O) modeling system. Two separate regional economic models were constructed:

- ♦ Coastwide Model: includes Clallam, Jefferson, Grays Harbor, Pacific, and Wahkiahkum Counties
- ♦ Statewide Model: includes the entire state of Washington

The first model provides estimates of the economic contribution of identified sectors to the coastal-region economy. It can also be used to estimate the economic impact of proposed uses. The second model provides estimates of contributions coastal sectors to the economy of Washington State as a whole.

#### WHY MODEL THE COAST AS A COLLECTION OF COUNTIES AND NOT AS FIVE INDIVIDUAL ONES?

Because the populations and economies of the five individual coastal counties are so small, it makes sense to explicitly capture the economic linkages between adjacent counties rather than to artificially isolate each county's economy from the others. Furthermore, the small populations of the individual counties means that sales leakage rates for individual counties are high and the resulting economic multipliers are quite small.

### ES.1.2 Estimating Industry Economic Contributions and Economic Impacts

This study includes estimates of economic contributions of the key marine resource-related sectors. Models of the economic relationships between industries, households, and local governments constructed using IMPLAN were cross checked and calibrated using available published data and information gleaned from interviews with key informants. Economic models were tailored specifically to analyze each sector's economic contribution and can be used to evaluate the potential impacts of new alternative use scenarios. Certain new uses may entail a projected increase in activity in one sector while simultaneously contributing to a reduction in activity in other sectors.

Once the necessary regional economic data were assembled for each Washington coast marine resource sector, the corresponding annual expenditure patterns estimated for each sector were applied to the two regional economic models to derive the economic contribution of each marine sector to the five-county Coastal Region and to the State of Washington.

It should also be noted that, while the estimates of economic contribution or impact produced in this analysis are generally reliable enough for descriptive purposes, they are not designed to be used as decision variables to compare trade-offs between alternatives or industry sectors.

## ES.2 ECONOMIC PROFILE OF THE WASHINGTON COAST

The economic base of the five counties in the MSP study area are centered on natural resource industries—commercial fishing, aquaculture, and recreation and tourism—but are individually diverse. Pacific and Grays Harbor Counties function as integrated economic units, with most of their populations

residing in coastal areas. In contrast, the Pacific coastal areas of Clallam and Jefferson Counties are geographically isolated from the larger population and economic centers of their respective counties.

### **ES.2.1 Clallam County**

Clallam County on the northern Olympic Peninsula reflects diversity of both climate and economy. More than half the county is in public ownership, including the Olympic National Park, Olympic National Forest, and state forest lands. Two coastal Indian reservations, Makah and Quileute, are in Clallam County. The population center of Port Angeles is on the Strait of Juan de Fuca and outside of the MSP study area.

Between 2000 and 2010, Clallam County's population increased 11.3 percent, a faster rate than the other four counties in the study area. In 2014, the estimated population was 72,500. In terms of employment, a greater share of jobs are in accommodation and food service sector and in the government sector than in the state as a whole. In 2013, the average annual wage for jobs in Clallam County was \$35,340, less than the statewide average of \$53,029, but comparable to other counties in the MSP study area.

### **ES.2.2 Jefferson County**

Although Jefferson County stretches from the Pacific Ocean, across Olympic National Park, to Hood Canal, nearly its entire population is located on the east side of the county. The Hoh Indian Reservation, which is located on the mouth of the Hoh River, is the exception. Roughly two-thirds of the county is in public ownership. About 30,200 persons live in the county. Jobs are significantly more concentrated in accommodations and food sector and the government sector than in the state as a whole. The average wage rate is \$34,497, well below the state average; but per capita personal income, which includes earned income, investment income, and government payments (e.g., Social Security, Veterans Benefits), was \$44,946 for Jefferson County, not far below the state average of \$46,045.



*(cc) John Fowler, 2010*

*Ruby Beach*

### **ES.2.3 Grays Harbor County**

Grays Harbor County covers a land area of slightly more than 1,900 square miles (1.22 million acres), the largest of the five MSP counties. The county has diverse topography, with the Olympic Mountains on the northern border, the Pacific coastline on the west, and steep foothills in much of the rest of the area, except for six river valleys. At the mouth of the Chehalis River, the Grays Harbor Estuary covers 58,000 acres and extends inland about 25 miles. Shoalwater Bay Reservation and most of the Quinault Reservation is in Grays Harbor County, except for a small portion in Jefferson County. The Quinault Reservation covers slightly more than 10 percent of the total county land area.

Grays Harbor County population grew 8.3 percent from 2000 to 2010. In 2014, Gray Harbor County had an estimated population of 73,300 people. Jobs in the county are more concentrated than in the state as a



whole in agriculture, forestry, and fishing; manufacturing; accommodations and food service; and the government sectors. Average annual wage was \$35,884, which is significantly lower than the state average

#### **ES.2.4 Pacific County**

Bordered by the Pacific Ocean to the west and the Columbia River on the south, Pacific County is 596,902 acres or about 933 square miles in size. Pacific County includes the Long Beach Peninsula, which wraps around Willapa Bay, a highly productive shellfish farming area. The eastern part of the county is predominantly timberlands. In contrast to other MSP study area counties, less than 1 percent of Pacific County is under federal ownership, although State Forest Lands managed by the Washington Department of Natural Resources (DNR) account for 23,340 acres, about 4 percent of the total county acreage.

Between 2000 and 2010, the population of Pacific County declined by 0.3 percent, the only one of the five MSP counties to see a decline during that period. In 2014, Pacific County had an estimated population of 21,100. The county has a considerably higher proportion of jobs in the agriculture, forestry, and fishing sector than the state as a whole, reflecting a predominant reliance on fishing and aquaculture for employment. Average annual wage for jobs in Pacific County was \$32,734.

#### **ES.2.5 Wahkiakum County**

Although no part of the county touches the Pacific Ocean, Wahkiakum County is included in the MSP Study Area due to its economic dependence on the coast. The county is small in size relative to the other counties, encompassing only 263 square miles. There are no federal lands but State Forest Lands account for about 8 percent of the total acres. The town of Cathlamet is the county seat and only incorporated community. The population in 2014 is 4,010.

Wahkiakum County has a very high concentration of jobs in agriculture, forestry, and fishing sector, more than five times that of the state overall. Average annual wage for jobs was \$33,690.

### **ES.3 COMMERCIAL SHIPPING**

#### **ES.3.1 Port of Grays Harbor**

The Port of Grays Harbor is the only deepwater port on the west coast of Washington and is 2 days closer to Asia than Puget Sound ports. This locational advantage, along with other advantages, has enabled the port to expand beyond traditional commodity shipments. The economic contribution of the Port of Grays Harbor was not modeled explicitly in this economic analysis, but impacts of proposed new uses on shipping would be reflected in the coastwide model. Instead, this report provides a summary of two other detailed analyses of commercial shipping and of the Port of Grays Harbor itself.



(cc) Richard Wilson, PhD, 2009  
*Bay Center*

A recent analysis estimated that approximately 1,524 total jobs are associated with marine cargo activities of the Port of Grays Harbor (see Table ES-1). This is associated with \$36.2 million in direct personal income, and \$130.7 million in total personal income for employees. Of a total revenue of \$143.5 million, the largest share of annual revenue is associated with grain exports (\$69.2 million), followed by automobiles (at \$32.5 million).

**Table ES-1** Economic Impacts Generated by the Port of Grays Harbor Marine Cargo Activities

Category	
<b>Jobs (number)</b>	
Direct	574
Indirect	645
Induced	305
<b>Total Jobs</b>	<b>1,524</b>
<b>Personal Income (\$1,000)</b>	
Direct	\$36,239
Indirect	\$79,654
Induced	\$14,860
<b>Total Income</b>	<b>\$130,754</b>
Business Revenue (\$1,000)	\$143,488
Local Purchases (\$1,000)	\$31,513
State and Local Taxes (\$1,000)	\$12,291

### ES.3.2 Port of Port Angeles

The Port of Port Angeles is comprised of several components:

- ♦ Airports – William R Fairchild International Airport and Sekiu General Aviation Airport,
- ♦ Marinas – Port Angeles Boat Haven, John Wayne Marina, the Boat Yard, and the Boat Ramp,
- ♦ Marine Terminal – cargo operations, topside repair operations, and boat building and repair,
- ♦ Log Yard, and
- ♦ Rental Properties, including the Port’s industrial parks

A recent study by BST Associates estimated some 924 direct jobs and \$42.9 million in personal income is associated with the marine terminal. The marinas generate an additional 421 jobs and \$22.6 million in personal income. The two airports generate 86 jobs and \$4.4 million in income, and the log yard an additional 88 jobs and \$7.3 million in personal income.

## ES.4 ECONOMIC PROFILES OF WASHINGTON COAST TRIBES

Five Indian reservations are included within the MSP study area: Makah, Quileute, Hoh, Quinault, and Shoalwater Bay.<sup>1</sup> There is considerable economic interaction among the tribes, tribal members, and the non-Indian communities on Washington's coast. Commerce and employment are often co-mingled, as tribal members work and shop off-reservation, non-Indians are employed by the tribes, and many tourists and local residents alike visit tribally owned businesses. Many natural resources off-reservation are co-managed by federal, state, and tribal entities through treaties between the United States and the respective tribes, executive orders, and federal court rulings. Yet important distinctions can be made about tribal communities that merit developing a profile separate from the non-tribal communities of the coast.

### ES.4.1 Makah

The Makah Reservation is in the northwest corner of the Olympic Peninsula, and covers approximately 44 square miles (30,142 acres). The reservation is physically isolated from the rest of Washington and even from other parts of Clallam County. The reservation has been accessible by road only since 1931. Neah Bay is the main community on the reservation and is located on the Strait of Juan de Fuca. There are 1,414 individuals living on the reservation.

The reservation is very dependent on two primary sectors: tourism and fishing. There are currently four tourism-related tribal enterprises that employ 55 persons during peak season, but many are laid off during the winter. Other visitor attractions and services include the Makah Cultural and Research Center and charter boat fishing trips.

About 70 commercial fishing vessels (including three charter boats) operate out of Neah Bay. These vessels are owned by individual tribal members. It is reported by the tribe that about 515 jobs were associated with these vessels owned and operated by Makah tribal members.

### ES.4.2 Quileute

The Quileute Reservation encompasses 2,161 acres inclusive of La Push, the community center of the reservation. La Push itself is a fishing village known for its dramatic scenery with cliffs, sea stacks and beaches. The reservation is bounded by the Quillayute River, the Pacific Ocean, and Olympic National Park. Much of the reservation is surrounded by wilderness areas managed by the National Park Service. Offshore, beyond reservation waters, lies the National Olympic Marine Sanctuary.

There are 460 individuals living on the reservation. The primary sources of employment are provided by government services (Tribal and Federal), commercial ocean fisheries, subsistence river fisheries, and the tribe's resort and tourist facilities; annual surveys show that many families derive some proportion of their

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<sup>1</sup> The Chehalis Indian Reservation is located partially in Grays Harbor County, but is not within the MSP study area, and is not profiled in this report.

income from fishing. In addition, a non-tribal fish processing facility in La Push provides seasonal employment.

The Quileute tribal members currently operate six commercial fishing vessels, each with a captain and 2–3 crew members. The tribal also owns and operates a 95-slip marina, leased to both commercial and recreational vessel owners. This provides a means for several charter boat companies to operate out of La Push.

#### **ES.4.3 Hoh**

The Hoh Reservation is located on the Olympic Peninsula in Jefferson County, about 25 miles south of Forks and 80 miles north of Aberdeen. Until recently, the size of the reservation was about one square mile, but with recent land purchases and land transfers, the reservation encompasses more than 900 acres. The reservation land is bounded on the south by the Olympic Natural Park and on the north by the Hoh River. East of the reservation are private and state lands. The west side includes about 1 mile of ocean frontage at the mouth of the Hoh River.

There are 116 individuals living on the reservation. Most of the employment of tribal members is associated with commercial fishing or tribal, federal, or state government. The tribe invests considerably in the management of over 400 square miles of its U&A lands within the Hoh River watershed.

#### **ES.4.4 Quinault**

The 208,150 acre, mostly forested Quinault Reservation is in the southwestern corner of the Olympic Peninsula with the Pacific Ocean as its western boundary, Queets village to the north, Lake Quinault on the east side and Moclips on the south end. Most of the reservation is at low elevation, except for the northeast part which rises to almost 2,800 feet above sea level. Several major rivers cross the reservation – the Queets, Raft, and Quinault Rivers.

The reservation is home to 1,408 persons. Most of the population (840) lives within the community of Taholah. The Quinault identifies three primary industry “clusters” as central to the economy of the Quinault Indian Nation (QIN): Forestry, Fisheries, and Hospitality and Tourism. They operate business enterprises within each of these industry areas. The Quinault Beach Resort and Casino employs about 350 persons, and is the largest of the QIN businesses.

Fisheries remain an important part of the Quinault economy. In addition to about 13 ocean vessels, 22 crab boats, and over 150 fishers and crew working in the treaty fishery, the QIN was recently awarded a \$1.5 million dollar grant from the U.S. Economic Development Administration to upgrade the fish processing plant in Queets.

#### **ES.4.5 Shoalwater Bay**

The Shoalwater Bay Reservation is located in Pacific County on the north shore of Willapa Bay. The reservation is slightly more than 1 mile square with 440 acres of uplands and 700 acres of salt marsh and tidal flats. Within the tidal portion of the reservation are small bays and intertidal marsh communities.



The upland portion of the reservation is mostly a steep ridge, leaving only a narrow piece of developable land along the shoreline. State Route (SR) 105 runs along this narrow strip.

The tribe has more than 300 enrolled members, but only 82 live on the reservation. Employment is primarily in government or associated with hospitality and tourism. The Shoalwater Tribe owns several businesses grouped under the tribal corporation name, Willapa Bay Enterprises, with the centerpiece being the Shoalwater Bay Casino.

## **ES.5 COMMERCIAL FISHING**

### **ES.5.1 Non-tribal Fisheries**

Fishing is an important and historical component of the Washington coast economy. Commercial fisheries landings and seafood processing operations supply markets in the United States, Canada, and countries overseas and provide income and employment in the region. Important commercial fisheries operating on the Washington Coast include those for groundfish (including lingcod, rockfish, flatfish, sablefish or “black cod”, and Pacific whiting or “hake”), Dungeness crab, Pacific sardines, pink shrimp, albacore tuna, Pacific salmon species (including mostly Chinook, coho and chum salmon), and other fisheries for species such as Pacific halibut, and shellfish such as razor clams. Commercial net fisheries for salmon are also conducted in inside waters, in the Columbia River and tributaries of Willapa Bay and Grays Harbor. Large-scale fisheries for Pacific whiting are conducted in offshore waters by catcher-processors and “mothership” floating processors and associated catcher vessels.

Data from the Washington Department of Fish and Wildlife, summarized in Table ES-2, indicate that the Washington Coast non-tribal commercial fisheries landings generated approximately \$93 million in total ex-vessel revenue in 2014. The largest portion was landed in Grays Harbor County ports (\$60 million), followed by Pacific County (\$29 million). These landings contributed jobs and income to local communities and also provided economic opportunities for suppliers and support businesses located in coastal ports and elsewhere.

In terms of ex-vessel revenue, coastwide landings of crab (\$37 million), highly migratory species (albacore) (\$20 million), and pink shrimp (\$16 million) were the largest species management groups. Crab made up the largest portion of landings revenue in Grays Harbor County (\$22 million) and Pacific County (\$14 million); in Clallam County, shrimp was the largest component, followed closely by salmon (both about \$0.9 million). In Wahkiakum County ports, salmon was by far the largest portion of ex-vessel revenue (\$1 million).

**Table ES-2** Landings, Ex-vessel Revenues, and Participation by County for Washington Coast Non-tribal Commercial Fisheries in 2014

County	Management Group	Round Weight (1,000 lbs)	Ex-vessel Revenue (\$1,000)	Number of Dealers	Number of Vessels	
					All Identified Vessels	Vessels > \$1,000
Clallam	Crab	13	72			
	Groundfish	202	544			
	Highly Migratory	46	59			
	Salmon	219	853			
	Shrimp	1,077	865			
	Other	463	583			
<b>Clallam Totals</b>		<b>2,020</b>	<b>2,975</b>	<b>20</b>	<b>88</b>	<b>79</b>
Grays Harbor	Coastal Pelagic	12,370	2,137			
	Crab	4,941	22,481			
	Groundfish	38,615	4,433			
	Highly Migratory	12,070	13,835			
	Salmon	268	988			
	Shrimp	28,133	14,796			
	Shellfish	29	79			
	Other	929	993			
<b>Grays Harbor Totals</b>		<b>97,355</b>	<b>59,742</b>	<b>45</b>	<b>354</b>	<b>349</b>
Pacific	Coastal Pelagic	5,296	1,071			
	Crab	3,661	14,014			
	Groundfish	12,365	4,347			
	Highly Migratory	5,068	6,322			
	Salmon	1,304	2,347			
	Shrimp	1,333	738			
	Shellfish	128	253			
	Other	51	193			
<b>Pacific Totals</b>		<b>29,206</b>	<b>29,285</b>	<b>30</b>	<b>364</b>	<b>342</b>
Wahkiakum	Salmon	778	965			
	Other	1	1			
<b>Wahkiakum Totals:</b>		<b>779</b>	<b>966</b>	<b>7</b>	<b>80</b>	<b>72</b>
WA Coast Totals:	Coastal Pelagic	17,666	3,208			
	Crab	8,615	36,567			
	Groundfish	51,182	9,324			
	Highly Migratory	17,184	20,216			
	Salmon	2,568	5,152			
	Shrimp	30,543	16,398			
	Shellfish	157	332			
	Other	1,444	1,769			
<b>Grand Total</b>		<b>129,360</b>	<b>92,967</b>	<b>98</b>	<b>700</b>	<b>672</b>

## ES.5.2 Tribal Fisheries

Ocean and river fisheries are central to the social, cultural, and spiritual livelihoods and traditions of each of the five Washington coast tribes. To an extent that varies by Tribe, fisheries are also a foundational component of the tribal economy and of subsistence for tribal members. The Makah, Quileute, Hoh, and Quinault Tribes each signed treaties with the United States (the Shoalwater Bay did not) that secured each respective tribe's rights to hunt and gather resources at their "usual and accustomed fishing grounds and stations," also called U&As. Through a series of court cases, the United States formally recognized that the four treaty tribes have treaty rights to fish for salmon, groundfish, and shellfish in the Pacific Ocean. Thus, in total, for the above-mentioned four coastal treaty tribes, this includes a significant percent of Pacific Coast fish and shellfish.

Vessel-level harvest data are generally not recorded with federal or state public agencies for tribal fisheries because tribal vessels need not be registered with state or federal authorities. The economics consultants contacted the tribes directly to obtain fisheries data. Responses from individual tribes varied, so the report contains a mix of information available to the consultants.

### ***Makah***

Fish harvested by commercial vessels include five species of salmon, groundfish (including Pacific whiting), and shellfish (Dungeness crab and pink shrimp). The annual value of fish landed at Neah Bay from 2007 to 2011 ranged from \$5.4 million to \$8.2 million (in inflation-adjusted 2014 dollars), with more than half coming from groundfish. The total does not include the tribe's harvest of Pacific whiting, of which nearly all is delivered to an off-shore processor.



© Frank Kovalchek, 2013

*Marina at Neah Bay*

### ***Quileute***

Crab, salmon (coho and Chinook), blackcod, and Pacific halibut comprise the majority of the catch by commercial fishers. Other species caught include tuna and other highly migratory species, sea cucumber, and other groundfish. Data from 2005 to 2014 show that total inflation-adjusted revenue ranged from \$1.1 million to \$3.6 million per year. Dungeness crab, followed by Chinook salmon, provide the largest share of catch by volume and value.

### ***Hoh***

Although the tribe does not have a port or marina on the reservation, a high proportion of tribal members participate in, and are dependent upon, the treaty commercial fishery through other ports along the Washington coast. No public information is available about the Hoh Tribe's treaty commercial harvest or ex-vessel revenues.

### ***Quinault***

Quinault commercial fishers harvest several tribal treaty fisheries in river and marine waters. These fisheries include gillnet (Chinook, coho and chum salmon, steelhead, and white sturgeon) on the Chehalis

and Humptulips River sides of Grays Harbor; ocean troll (Chinook and coho salmon); marine (halibut, sablefish, lingcod, rockfish, and sardines); and Dungeness crab. Razor clams are also harvested from Pacific Coast beaches. A recent report released by the Quinault indicated that, for the period of 2004 through 2013, annual average ex-vessel revenues (in 2014 inflation-adjusted dollars) from treaty commercial fisheries totaled \$9.2 million. Of that amount, \$6.8 million is from Dungeness crab, and another \$1.1 million from marine fisheries (halibut, sablefish, lingcod, rockfish, and sardines), with the balance from salmon and razor clams.

### ES.5.3 Economic Contributions of Commercial Fishing

The total economic contribution of commercial fisheries to the Washington coast region includes the effects of fish landings and processing in the region's ports, fish harvested off the Washington coast that are landed elsewhere (e.g., in Oregon or processed at-sea), and income earned by Washington coast residents involved in other regions' fisheries. The economic contribution includes the effects of all measurable economic linkages associated with direct expenditures by the commercial fishing and primary seafood processing industries, plus all indirect effects (jobs and income generated by businesses supplying



(cc) Kat+Sam, 2009

*Commercial fishing vessel*

inputs to the commercial fishing and seafood processing industries) and induced effects (jobs and income generated when employees and owners of directly affected and indirectly affected businesses spend their disposable income). The combined direct, indirect, and induced effects are termed “total effects,” and the process whereby direct expenditures are translated into total effects is known as the “economic multiplier.”

As shown in Table ES-3, the total economic contribution to the five-county Washington coast region from non-tribal commercial fishing and processing activities, based on 2014 landings, was estimated to be approximately \$77.2 million in income and 1,820 jobs. Nearly two-thirds of the total was attributable to activity in Grays Harbor County, with most of the remainder (31 percent) attributable to Pacific County. Approximately 3 percent and 1 percent, respectively, of the total economic contributions were attributable to harvesting and processing activities in Clallam County and Wahkiakum County. An estimated 46 percent of total income and two-thirds of the total jobs contributed in the region are attributed to effects of harvesting sector activities.

**Table ES-3** Direct Effects and Total Contributions to the Five-county Coastal Region Economy from 2014 Washington Coast Non-tribal Commercial Fishing and Seafood Processing by County of the Activity

Activity	Coastwide	Clallam County	Grays Harbor County	Pacific County	Wahkiakum County
<i>Direct Expenditure Effects</i>					
<b>Harvesting</b>					
Income (\$ mil.)	30.8	1.0	18.6	10.7	0.5
Employment (jobs)	1,120	50	610	410	50
<b>Processing</b>					
Income (\$ mil.)	36.5	1.0	25.2	10.0	0.3
Employment (jobs)	470	10	330	130	5
<b>Combined</b>					
Income (\$ mil.)	67.3	2.0	43.8	20.7	0.8
Employment (jobs)	1,600	60	940	550	55
<i>Total Economic Contributions</i>					
<b>Harvesting</b>					
Income (\$ mil.)	35.6	1.2	21.5	12.3	0.5
Employment (jobs)	1,230	60	670	450	50
<b>Processing</b>					
Income (\$ mil.)	41.6	1.1	28.8	11.4	0.4
Employment (jobs)	600	20	410	160	10
<b>Combined</b>					
Income (\$ mil.)	77.2	2.3	50.3	23.7	0.9
Employment (jobs)	1,820	70	1,080	610	60

As shown in Table ES-4, the total economic contribution to the State of Washington from non-tribal commercial fishing and processing activities in the five-county coastal region in 2014 was estimated to be approximately \$117 million in income and 2,830 jobs. These estimates incorporate additional direct and indirect spending effects resulting from economic linkages between the Washington coast economy and businesses elsewhere in Washington State outside the five-county coastal region. The combined contribution of Washington coast harvesting and processing activities to the entire State of Washington economy is more than 50 percent larger, in terms of both income and employment effects, than the total economic contribution of those activities to the coastal region alone. Much of the difference is attributable to the effects of direct expenditures by vessels operating in Washington coast fisheries that are based in Puget Sound ports, with the remainder attributable to the additional indirect and induced effects captured in the larger state economy.

**Table ES-4** Direct Effects and Total Contributions to the State of Washington Economy from Washington Coast Non-tribal Commercial Fishing and Seafood Processing by County of the Activity

Activity	Coastwide	Clallam County	Grays Harbor County	Pacific County	Wahkiakum County
<i>Direct Expenditure Effects</i>					
<b>Harvesting</b>					
Income (\$ mil.)	50.4	1.6	30.8	17.5	0.6
Employment (jobs)	1,770	90	990	640	50
<b>Processing</b>					
Income (\$ mil.)	38.4	1.0	26.5	10.5	0.4
Employment (jobs)	505	10	350	140	5
<b>Combined</b>					
Income (\$ mil.)	88.8	2.6	57.3	27.9	0.9
Employment (jobs)	2,275	100	1,340	780	55
<i>Total Economic Contributions</i>					
<b>Harvesting</b>					
Income (\$ mil.)	65.6	2.1	40.2	22.6	0.7
Employment (jobs)	2,060	100	1,170	740	50
<b>Processing</b>					
Income (\$ mil.)	51.4	1.3	35.6	14.0	0.5
Employment (jobs)	770	20	530	210	10
<b>Combined</b>					
Income (\$ mil.)	117.0	3.4	75.8	36.6	1.2
Employment (jobs)	2,830	120	1,700	950	60

## ES.6 SHELLFISH AQUACULTURE

The aquaculture industry on the Pacific Coast of Washington is concentrated primarily within Willapa Bay (Pacific County) and Grays Harbor (Grays Harbor County). The communities of South Bend, Nahcotta, and Bay Center (all on Willapa Bay) serve as the primary centers of the industry's activities, and all but one of the shellfish farms operating within this region are family-owned businesses. They range in size from small operations that farm relatively small parcels of aquatic lands to vertically integrated industrial complexes engaged in production, processing, distribution, and marketing with thousands of acres of productive land. The membership list for the Willapa Grays Harbor Oyster Growers Association in 2014 indicated 28 growers in Pacific and 7 growers in Grays Harbor counties. All of the reported shellfish farms are operated on privately owned tidelands or on tidelands that are owned by the state and leased through DNR to shellfish growers.

A survey, "Shellfish Aquaculture Processing and Distribution," was designed and implemented in January 2015. This survey was intended specifically to capture information about the processing and distribution

activities of shellfish growers in Pacific and Grays Harbor Counties. The intention was to ensure that this aspect of the industry is captured in the economic impact analysis. The survey included questions about the following:

- ◆ Location of the processing facility;
- ◆ Types of products produced (as a percentage of total sales);
- ◆ Amount and dollar value of sales of oysters and clams sold, by product type;
- ◆ Origin of the shellfish processed;
- ◆ Destination of processed shellfish sold; and
- ◆ Expenditures related to shellfish processing, sales, and distribution by category, by percentage of expenditure, and by location. To determine the location of expenditures, respondents were asked to allocate expenditures to (1) the Washington coast, (2) other Washington, (3) Oregon, (4) elsewhere in the United States, and (5) outside the United States. It is important to note that the survey described Washington's coast as five coastal counties: Clallam, Jefferson, Grays Harbor, Pacific, and Wahkiakum Counties.



(cc) Richard Wilson, PhD, 2006

*Preparing to process oysters*

Respondents reported total sales of nearly \$56 million. Figure ES-2 summarizes total sales by product type. The shucked meat market represents the majority of product being sold, representing nearly 80 percent of total sales for survey respondents. These oysters are packed and sold in bulk to major wholesalers, retailers, and restaurants. The whole oyster market, or shell market, generated the second most revenue among respondents, with 10 percent of total sales. The shell market is a higher margin product and can have both domestic and foreign markets. Depending on the size of the oyster, export markets exist locally, nationally, and internationally. Respondents reported 6 percent of sales attributable to whole clams. They also included revenues from various other types of products, including smoked and custom processing products.



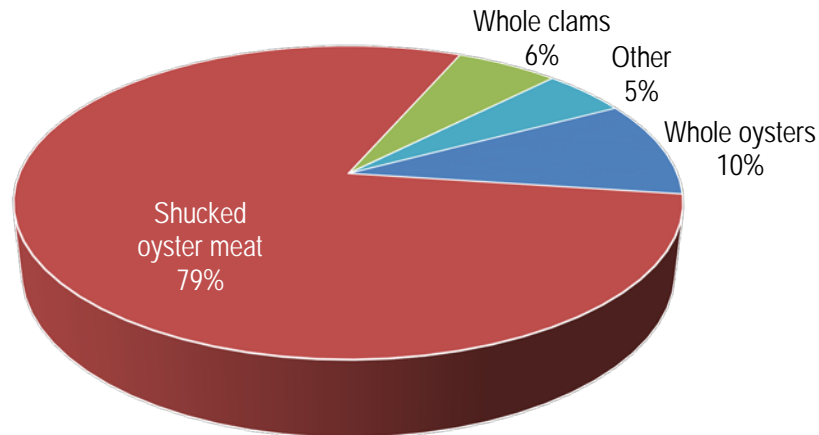


Figure ES-2 Surveyed Shellfish Aquaculture Sales

### ES.6.1 Economic Contributions of Shellfish Aquaculture

For this analysis, commercial harvesting and processing of shellfish includes the effects of direct expenditures by the shellfish industry, along with all indirect effects (jobs and income generated by businesses supplying inputs to the shellfish industry) and induced effects (jobs and income generated when employees and owners of directly affected and indirectly affected businesses spend their disposable income). The combined direct, indirect, and induced effects represent the total economic contribution.

As shown in Table ES-5, the aquaculture sector in Pacific and Grays Harbor Counties is estimated to directly provide 572 jobs in shellfish growing and processing. An additional 275 jobs are generated in the coastal region through indirect and induced activity. The employment multiplier is 1.48 (i.e., one additional job is created for every approximately two jobs directly employed by the aquaculture sector). Similarly the labor income multiplier for the coastal region is 1.36. Total direct labor income in the coastal region from the aquaculture industry is estimated to be more than \$36.7 million, with an additional \$13.3 million generated through indirect and induced activity. The total estimated employment and labor income contributed by shellfish aquaculture and processing to the Washington coast regional economy were 847 jobs and \$50 million, respectively.

Table ES-5 Estimated Economic Contribution of the Shellfish Aquaculture Sector to the Washington Coast Region

Total Effects Components	Employment	Labor Income (\$ million)
Direct	572	36.7
Indirect	159	8.1
Induced	116	5.2
Total Effects	847	50.0
Multiplier (Total effect/Direct effect)	1.48	1.36



Table ES-6 shows the estimated statewide economic contribution of the aquaculture industry. As shown, both the employment and labor income effects are larger than shown for the Washington coast in Table ES-5. This is expected, as the statewide impacts include additional direct and indirect expenditures made to businesses outside the coastal counties. The additional economic contributions to the state are represented by the difference between corresponding values in Table ES-5 and Table ES-6. The tables indicate that an additional 383 total jobs and \$23.2 million in total labor income were generated in Washington state outside the coastal region by the aquaculture sector's activities.

**Table ES-6** Estimated Economic Contribution of the Shellfish Aquaculture Sector to Washington State

Total Effects Components	Employment	Labor Income (\$ million)
Direct	655	43.3
Indirect	265	14.5
Induced	311	15.4
Total Effects	1,230	73.2
Multiplier (Total effect / Direct effect)	1.88	1.69

## ES.7 RECREATIONAL FISHING

The major recreational fisheries along the Washington coast include fishing for salmon, groundfish, Pacific halibut, and certain highly migratory species, especially Pacific albacore. In addition, the harvesting of razor clams along the southern Washington coast is a very popular recreational activity.

The two main ports for charter boat operations are Westport and Ilwaco along the southern Washington coast. Among clients of charter boat operators in the Westport area, 85 to 95 percent are estimated to be from Washington State. Albacore brought in the highest percentage of anglers outside of the Pacific



(cc) Erin Kohlenberg, 2011

*Dawn charter leaving Ilwaco*

Northwest (14 percent). Anglers out of Westport took 31,882 charter boat trips in 2013, with 51 percent of trips targeting salmon, 38 percent targeting bottomfish, 7 percent targeting halibut and 4 percent targeting other species. Charter operations in Ilwaco, farther south on the Washington coast, attracted more anglers from Oregon, with 45 percent of anglers estimated to be coming from that state, primarily from the Portland area. The remainder of Ilwaco anglers came from inland Washington counties (45 percent), elsewhere on the Washington coast (5 percent), and elsewhere in the United States (5 percent). Between 2004 and 2013, charter boat anglers out of Ilwaco took on average an estimated 10,171 trips annually, with 82 percent targeting salmon, 7 percent targeting bottomfish, 6 percent targeting albacore, and 4 percent targeting halibut.

The marinas and port areas where anglers fishing from private boats launch are identified in Table 6-8. As shown, about 30 percent of private boat anglers (on average over the 2004-2013 period) launched from

the Makah Marina in Neah Bay, 27 percent from the Port of Ilwaco, and 20 percent from Westport Marina in Grays Harbor. All of these ports cater to anglers working out of transient boats to rent slips during the fishing season. The smaller ports of La Push and Chinook have a limited number of slips for private boats. No data are currently available that identify the county of residence of private boat anglers in ocean waters of the Washington coast.

### ES.7.1 Sport Catch

Table ES-7 displays a Washington Department of Fish and Wildlife profile of sport catch along the Washington coast for the most recently available sport fishing season (2011/12), as representative of recent activity. About half of the salmon catch in marine waters off the Washington coast occurred in Marine Catch Area 2 (Westport area), about 25 percent in Marine Catch Area 1 (Ilwaco area), and about 12 percent in Marine Catch Area 4a (Neah Bay area). Marine Catch Area 3 (La Push area) and coastal streams both recorded about 6,000 salmon being caught during the 2011/12 season.



(cc) NOAA Corps, 2006

China rockfish

Most bottomfish caught were black rockfish caught near Westport in Area 2, comprising about a third of all bottomfish caught. Area 2 also had the most yellowtail rockfish and lingcod, comprising about 8 percent each of the total bottomfish catch on the Washington coast. Neah Bay had the largest variety of rockfish caught, with significantly more rare rockfish, including China rockfish, Quillback rockfish, and Copper rockfish. The catch of Pacific halibut is divided only into north and south coast; the 2011/12 catch on the north coast accounted for about 24 percent more than along the south coast.

**Table ES-7** Profile of Sport Catch along the Washington Coast during the 2011/12 Sport Fishing Season, by Catch Area

Species Group	Marine Catch Area						
	Area 1: Ilwaco	Area 2: Westport	Area 3: La Push	Area 4a: Neah Bay	Area 4b: Neah Strait	Total Marine Waters	Total Coastal Streams
Salmon <sup>1</sup>	26,948	43,710	5,558	13,024		89,240	5,996
Steelhead <sup>2</sup>	316	68	49	15		448	18,676
Sturgeon <sup>3</sup>	N/A						262
Pacific Halibut	3,025		5,014	8,039		N/A	
Bottomfish <sup>4</sup>	29,336	154,636	42,035	46,628	21,196	293,831	N/A
Razor Clams	1,060,066	1,373,230	2,952	N/A		2,436,248	N/A

**Notes:**

Numbers represent the number of fish caught or clams dug.

<sup>1</sup> Salmon totals include all species, including coho and Chinook.

<sup>2</sup> Steelhead totals include only fish caught in coastal streams.

<sup>3</sup> Bottomfish include all rockfish species and other bottomfish.

<sup>4</sup> Steelhead totals include winter and summer steelhead

Razor clam digging rates were similar throughout the southern Washington coast catch areas, with about 12 clams dug per trip in the fall and almost 14 in the spring. During the 2011/12 season, total harvest of razor clams was split between Catch Areas 1 and 2. Area 4, comprising only Kalaloch Beach in the La Push area, accounted for the remaining harvest.

### ES.7.2 Economic Contributions of Recreational Fishing

Total trip-related expenditures made by Washington State residents associated with sportfishing activities in the coastal study area are estimated at about \$32.1 million in 2014. Of this total, about \$2.7 million was estimated to be made in the coastal study area and about \$29.4 million was made elsewhere in the state. Trip-related expenditures associated sportfishing activities in the coastal study area made by out-of-state visitors are estimated at about \$5.7 million in 2014. In addition to the spending within the coastal study area by out-of-state visitors, these visitors also spent an estimated \$3.1 million related to sportfishing activities elsewhere in Washington.

## ES.8 RECREATION AND TOURISM

Historically, recreation and tourism have always been a part of the economy of Washington coast counties, but its contribution has been small relative to other well-established sectors, such as fishing, forestry, and manufacturing. While structural shifts continue to take place leading to declines in both forestry and manufacturing, the recreation and tourism sector remains steady or growing and is increasing in prominence.

The Northern Washington Coast is dominated by high rocky cliffs, with islands and sea stacks scattered offshore. The Makah, Quileute, and Hoh Indian Tribes have reservation lands along portions of this



*National Park Service 2015*

*Hiker at Second Beach,  
Olympic National Park*

coastline. This area of the coast has relatively few access points. The Olympic Coast National Marine Sanctuary makes up most of the northern half of the study area, and the Olympic National Park occupies significant portions of the Clallam and Jefferson County coastlines. According to the National Park Service, Olympic National Park, receives an estimated 3 million visitors annually including 759,000 to 783,000 visitors each year from 2011 through 2013 for the three coastal park districts located in the region (Mora, Kalaloch, and Ozette).

The geography along the Southern Washington Coast region southern coastline, extending along the coastline of Grays Harbor County into Pacific County, is dominated by long sandy beaches created by sand carried northward from the mouth of the Columbia River. In addition to coastal beach activities, peninsulas such as Point Brown and Damon Point provide access to the protected, calmer waters of Grays Harbor, where water sports such as kayaking, windsurfing, and paddle-boarding are popular. The coastline of Grays Harbor County is more heavily developed than the northern coast, with a greater number of urbanized areas and a greater concentration of marine industry and infrastructure.

Developed areas in the Southern Washington Coast region include the cities of Hoquiam and Aberdeen and the Port of Grays Harbor; the coastal towns of Pacific Beach, Ocean Shores, and Westport; and several smaller communities. The Quinault Indian Reservation takes in much of the coastline of the northern half of Grays Harbor County, and public access to the shoreline is greatly limited for much of the area within the reservation, particularly between Queets and Taholah. South of the reservation, access is provided by SR 109 between Taholah and Hoquiam/Aberdeen and by SR 105 between Aberdeen and Grayland.

The Willapa Bay/Long Beach Peninsula region includes Willapa Bay and the coastline of Pacific County. Similar to the coastline of Grays Harbor County, the Pacific County coastline features long sandy beaches, with access generally available from state highways and local roads. Additionally, the Long Beach Peninsula offers access to the protected, calmer waters of Willapa Bay, where water sports such as kayaking, windsurfing, and paddle-boarding are popular. Willapa Bay also supports an economically important oyster industry. Developed areas in this region include the communities of Tokeland, Raymond, South Bend, Chinook, Ilwaco, Seaview, Ocean Park, Nahcotta, and several smaller communities. Additionally, the Shoalwater Bay Reservation is located on the north shore of Willapa Bay.

Willapa Bay National Wildlife Refuge is located adjacent to Willapa Bay, with units in several locations, including the northern tip of the Long Beach Peninsula on Long Island and along areas of Shoalwater Bay. The refuge encompasses diverse ecosystems, including salt marsh, muddy tidelands, forest, freshwater wetlands, streams, grasslands, coastal dunes, and beaches. This diversity supports a variety of recreational activities, including wildlife viewing, hiking, hunting, boating from boat launches at the refuge, photography, fishing, and shellfish harvesting.

### **ES.8.1 Economic Contribution of Coastal Recreation and Tourism**

Total trip-related expenditure made by Washington State residents associated with recreation activities in the coastal study area were estimated to be about \$481 million in 2014. Of this total, an estimated \$331 million was made by Washington residents in the coastal study area, and about \$150 million was made elsewhere in the state.

Trip-related expenditures made by out-of-state visitors associated with outdoor recreation and tourism activities in the coastal study area were estimated to be about \$160 million in 2014. In addition to spending within the coastal study area, out-of-state visitors also spent an estimated \$29.8 million elsewhere in Washington related to their recreation trips to the coastal area.

### **ES.9 ECOSYSTEM SERVICES**

The relationship between the natural landscape and resource use, as well as a more complete understanding of the role of the ecosystem in the economic environment of the region is considered. The concepts of “ecosystem services valuation” are introduced and discussed on a qualitative basis to the types and forms of ecosystem services that are associated with the



© Janet Baker, 2015

*La Push harbor*

Washington coastal area, with examples drawn from seven studies pertinent to the Washington coast. Three studies address topics germane to applying ecosystem services in a trade-off analysis of alternative uses. One study identifies ecosystem services associated with shellfish production. Finally, three studies involve applications of “natural capital accounting” to determine a total economic value of ecosystem services generated within Washington coast counties.

## ES.10 SOCIAL IMPACT ASSESSMENT



(cc) Mickey Thurman, 2015  
*Sunset at Grays Harbor*

It is important to include an assessment of the social dimension in any review of the costs and benefits of potential new uses of the coastal zone. Coastal environments are fundamental to the sociocultural well-being of people and contribute to people’s sense of place, well-being, relationships, and community resilience. The economics consultants reviewed several projects that focus on the social and cultural dimension of MSP and, more generally, ecosystem-based management on the Washington coast. The consultants also designed and implemented an on-line key informant survey to assess the social impacts of new potential uses; the survey asked participants to describe

their impressions of the impact of new uses for a set of indicators of human well-being:

- ◆ Nature-based recreation
- ◆ Safe, locally harvestable foods
- ◆ Shellfish bed closures
- ◆ Natural resource industry output
- ◆ Participation in cultural practices
- ◆ Opportunity to influence decisions
- ◆ Trust in the government
- ◆ Sense of place:
  - Positive connections
  - Sense of stewardship
  - Pride of place
- ◆ Inspiration
- ◆ Safety from navigational hazards
- ◆ Access to coastal environment
- ◆ Economic development goals
- ◆ Marine water quality

- ♦ Beach closures

Respondents indicated that both gas hydrates and marine sand and gravel mining would have a high social impact and that marine product extraction would have a medium social impact. Tidal energy appears to have the lowest perceived social impact of the potential new uses presented in this survey.

## **ES.11 RISK AND VULNERABILITIES OF MARINE-DEPENDENT SECTORS**

The Washington coast economy and the base sectors upon which it relies – commercial fishing, shellfish aquaculture, recreation and tourism, recreational fishing, shipping – and the support businesses that supply or serve them, are vulnerable to factors affecting the marine environment, or to other factors beyond their control. There is a balance among resource-dependent businesses, suppliers, and buyers, and reductions in any one below a certain minimum threshold have the potential to risk the viability of an entire industry. In addition, there is a high degree of co-dependence among the different sectors; for example, coastal tourism and commercial fishing can, and often have, a synergistic relationship, benefiting both sectors. Similarly, a significant loss or downsizing of one sector can have negative consequences on the other. Contemporary issues are discussed that affect the viability of individual sectors, how they factor into the resilience of the industry in the face of potential impacts from new uses, and whether or not the impacts rise to the level of significance.

### **ES.11.1 Commercial Fishing**

Factors affecting commercial fishing are dominated by economic and environmental considerations. They include:

- ♦ Community dependence on commercial fishing
- ♦ Increasing costs without comparable increase in revenues
- ♦ Need to diversify
- ♦ Groundfish trawl rationalization, consolidation, and reduction of participating vessels
- ♦ Dungeness crab regulation changes
- ♦ Long-term reduction in commercial salmon gillnet quotas, and other impacts on salmon
- ♦ Reductions in Pacific halibut quotas and changes in incidental bycatch allowances
- ♦ Ocean acidification and warming

### **ES.11.2 Recreational Fishing**

The popularity and economic value of marine recreational fishing is substantially influenced by resource conditions and the resulting quality of the fishing experience. Resource conditions affect catch, which in turn affects the fishing experience for most anglers. Issues of particular concern include:

- ♦ Potential closures due to allowable catch quotas of rebuilding stocks
- ♦ Long-term declines in salmon stocks



- ♦ Reductions in halibut quota and changes in incidental bycatch allowance
- ♦ High levels of domoic acid in razor clams, causing early closures

### **ES.11.3 Shellfish Aquaculture**

Shellfish growers face a number of environmental issues that affect their current and long-term viability, including:

- ♦ Invasive and native noxious and nuisance species, including burrowing shrimp, Japanese eelgrass, and oyster drills, and ability to find suitable control measures
- ♦ Ocean acidification and potential risks of significant changes in the species composition and vulnerability of ocean ecosystems
- ♦ Sea level rise that could lead to an increase in water coverage and a reduction in harvest time, and availability of tidelands for shellfish farming
- ♦ Water quality changes, including increased temperatures, increased algae blooms, and development and industrialization in Grays Harbor, all of which can negatively affect shellfish production

### **ES.11.4 Recreational and Tourism**

Certain environmental and growth related issues could affect recreation and tourism on the coast. Issues of particular concern include:

- ♦ Use restrictions or period closures of beaches due to protection of species listed under the Endangered Species Act
- ♦ Erosion along the southern coast, resulting in adverse effects on activities and access
- ♦ High levels of domoic acid in razor clams, causing early closures
- ♦ Growth-related factors that can negatively affect recreation quality from crowding, access costs, and traffic and congestion

### **ES.11.5 Shipping**

Two key economic issues have been raised associated with commercial shipping:

- ♦ Uncertainties in markets
- ♦ Competition with other ports

## **ES.12 QUALITATIVE ANALYSIS OF THE IMPACTS OF PROPOSED NEW USES**

The MSP process has identified six potential new uses that may generate specific proposals in the future.

- ♦ Marine Product Extraction
- ♦ Offshore Aquaculture

- ♦ Dredge Disposal
- ♦ Mining of Gas Hydrates
- ♦ Mining of Marine Sand and Gravel
- ♦ Marine Renewable Energy:
  - Offshore Wind Energy
  - Wave Energy
  - Tidal Energy

The new uses are broad in scope and, with a few exceptions, are not specific in location. In addition, the current information on proposed uses does not provide details on scope or scale of potential projects. As such, it is not possible to identify, much less quantify, the impacts of proposed new uses on existing uses of coastal resources. However, the nature of the proposed uses, including general information that is known about their resource requirements and potential externalities or other effects, allows for general qualitative assessments (i.e., positive, negative, or neutral) associated with elements of current uses.

A table is presented for each existing use, with elements of importance to the use. Along the top row are the six proposed new uses. The last column contains explanatory notes. The intersecting squares of elements and uses contain a symbol representing “positive,” “negative,” or “neutral.” The symbol shows the *potential* effect of the new use on the element associated with the existing use. If the symbol indicates a “negative effect,” this means that under certain circumstances, or depending upon the precise location of the new use or its ancillary components, the new use *may* have a negative impact on the existing use. This should be interpreted as an indicator that any specific proposal for a new use may be required to evaluate and determine the impacts on the existing use as a part of their proposal.



**Table ES-8** Summary of Potential Impacts of New Uses on Commercial Fishing

Potential Impacts	Marine Product Extraction	Offshore Aquaculture	New Dredge Disposal Locations	Mining of Gas Hydrates	Mining of Sand and Gravel	Marine Renewable Energy	Notes
Impacts on commercial harvesters' income from increased competition with commercial fishery products	—	↓	—	—	—	—	Adverse effects on commercial harvesters from pressure on ex-vessel prices
Impacts on processors' income and consumer surplus from increased competition with commercial fishery products	—	↑	—	—	—	—	Possible positive effects on processors and consumers from increased seafood supplies
Impacts on fishing vessel navigation or safety	—	↓	↓	↓	↓	↓	Consultation/coordination needed to locate activities so as to minimize potential for conflict with commercial fisheries
Impacts on fish habitat	—	↓	—	↕	↓	↕	Offshore aquaculture and mining risk disruption or fouling of habitat; gas hydrate mining rigs and marine renewable energy platforms may enhance habitat for certain species
Impacts on marine food chain	↓	—	—	↓	—	—	Without careful planning, marine product extraction and mining of gas hydrates may risk depleting or fouling marine food chains
Impacts on the extent or quality of available fishing grounds	—	↓	↓	↓	↓	↓	Consultation/coordination needed to locate activities so as to minimize potential for conflict with commercial fisheries
Impacts from introduced species	—	↓	—	—	—	—	Planning needed to mitigate possible adverse effects on salmon from exposure to farmed fish

**Notes:** — = neutral impact; ↓ = negative impact; ↑ = positive impact; ↕ = positive and negative impacts.

Table ES-9 Summary of Potential Impacts of New Uses on Aquaculture

Potential Impacts	Marine Product Extraction	Offshore Aquaculture	New Dredge Disposal Locations	Mining of Gas Hydrates	Mining of Sand and Gravel	Marine Renewable Energy	Notes
Competition with existing shellfish products	—	↓	—	—	—	—	For marine product extraction and offshore aquaculture, competition will only be a concern if the off-shore products are viewed as substitutes to existing products. Off-shore aquaculture could be operated by existing shoreside grower processors. Aquaculture industry could benefit from a stronger support and processing infrastructure
Changes in turbidity, tidal flow and circulation that affect shellfish growth rates and production	—	—	—	↓	—	↓	There is limited evidence that commercial-scale Marine Renewable Energy projects sited in or near estuaries will influence tidal flow and other physical factors. Further consultation will be needed to understand these potential impacts. No scientific support for the supposition of impacts from sand and gravel mining in the estuaries.
Increased vessel traffic that affects safety in the estuaries	—	—	—	—	—	—	It is unlikely that there will be effects on aquaculture harvest and production. Consultation / coordination with aquaculture industry needed to minimize conflicts.
Restrictions on state lands for commercial aquaculture that affect shellfish production	—	—	—	—	—	—	No methane hydrates mining will occur in state waters. No sand mining will occur in tidal areas.
Placement of shoreside energy transmission and mining facilities that affect aquaculture harvest and processing activities	—	—	—	—	—	—	Rehandling areas/pipelines on aquaculture beds highly unlikely but Consultation / coordination with aquaculture industry needed to minimize conflicts.

Notes: — = neutral impact; ↓ = negative impact; ↑ = positive impact; ⇕ = positive and negative impacts.

Table ES-10 Summary of Potential Impacts of New Uses on Recreational Fishing

Potential Impacts	Marine Product Extraction	Offshore Aquaculture	New Dredge Disposal Locations	Mining of Gas Hydrates	Mining of Sand and Gravel	Marine Renewable Energy	Notes
Impacts on fishing vessel navigation, gear, or safety	↓	↓	↓	↓	↓	↓	Consultation/coordination needed to locate activities so as to minimize potential for conflict with recreational fisheries
Impacts on habitat important to marine recreational fishing	↓	↓	—	↕	↓	↑	Offshore aquaculture and mining risk disruption or fouling of habitat; gas hydrate mining and marine renewable energy platforms may enhance habitat for certain species
Impacts on extent or quality of available fishing grounds	—	↓	↓	—	↕	↓	Consultation/coordination needed to locate activities so as to minimize potential for conflict with recreational fisheries
Impacts from introduced species	—	↓	—	—	—	—	Planning needed to mitigate possible adverse effects on salmon from exposure to farmed fish

Notes: — = neutral impact; ↓ = negative impact; ↑ = positive impact; ↕ = positive and negative impacts.

Table ES-11 Summary of Potential Impacts of New Uses on Recreation and Tourism

Potential Impacts	Marine Product Extraction	Offshore Aquaculture	New Dredge Disposal Locations	Mining of Gas Hydrates	Mining of Sand and Gravel	Marine Renewable Energy	Notes
Access to Locations for Recreation and Tourism Activities	—	—	—	—	↑	—	Recreation sites near sand and gravel mining could be closed temporarily, but access would be much improved in the longer term.
Disruption or Displacement of Recreation Activities	—	↓	↓	↓	↓	↓	Disruption of cruise, sightseeing, or pleasure boaters from increased vessel traffic or access limits by offshore facilities.
Quality of Experience at Nearby Recreation Sites	—	↓	↕	↓	↑	↕	Vessel traffic and congestion, noise, visual impairment, and disturbed habitat areas important to wildlife viewers are the primary concerns. Habitat near marine renewable energy sites could enhance some activities.
Rate or Quantity of Tourist Participation	—	↓	—	↓	↑	↕	Offshore facilities can create unwanted views, vessel traffic conflicts with boater tourists. Marine renewable energy could be an attraction or distraction for tourists. Beach conditions would improve with sand and gravel mining.

Notes: — = neutral impact; ↓ = negative impact; ↑ = positive impact; ↕ = positive and negative impacts.

Table ES-12 Summary of Potential Impacts of New Uses on Commercial Shipping

Potential Impacts	Marine Product Extraction	Offshore Aquaculture	New Dredge Disposal Locations	Mining of Gas Hydrates	Mining of Sand and Gravel	Marine Renewable Energy	Notes
Additional project related vessel traffic could interfere with commercial vessel traffic	—	—	—	—	—	—	While conflicts between project-related vessels and commercial shipping vessels is possible it would be limited to near shore transits. The increase in project-related vessels is assumed to be small but coordination of vessels may be needed to minimize conflicts
Potential navigation conflicts or safety issues caused by project equipment	—	↓	—	↓	↓	↓	Level of conflict will depend on specific locations of projects and equipment used.
Increased access to ports	—	—	↑	—	—	—	Any negative navigation and safety issues for commercial shipping would be short term. Longer term positives

**Notes:** — = neutral impact; ↓ = negative impact; ↑ = positive impact; ⇕ = positive and negative impacts.

## IMAGES

Header Image: (cc) John Murphy 2011. Washington Coast. [www.flickr.com/photos/kingair42/5652097073](http://www.flickr.com/photos/kingair42/5652097073)

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