

**Final**

**Washington Commercial Fisheries Economic Value in 2006**

*prepared by*

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*in association with*

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*prepared for*

Washington Department of Fish and Wildlife

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## Preface

The Research Group (TRG) is providing this report to TCW Economics in partial fulfillment of a work scope contracted by the Washington Department of Fish and Wildlife (WDFW). The WDFW requested consulting services to provide an estimate of non-Indian commercial fishing and recreational economic valuations. The WDFW was responding to a request by Governor Gregoire in a July 11, 2008 letter to the Washington Fish and Wildlife Commission seeking information about the economic benefits from fisheries. The WDFW set forth the following study objectives to obtain the economic information:

- Identify affected non-treaty fisheries and their beneficiaries
- Establish the conceptual foundation (net economic values and economic impacts) for assigning value to the beneficiaries
- Characterize sport fishing activity in terms of catch and effort by species groups for the 2006 base year
- Establish statewide economic values (net economic values) and impacts (jobs, earnings) associated with sport fisheries for the 2006 base year
- Characterize non-treaty commercial fishing activity in terms of harvest by species groups and by port
- Establish statewide economic values (net economic values) and impacts (jobs, earnings) associated with non-treaty commercial fisheries for 2006 base year

TRG had the responsibilities for developing the economic value estimates for the commercial fisheries while TCW Economics provided estimates for the recreational fisheries. The principals that worked as staff or advisors for TRG were Hans D. Radtke, Shannon W. Davis, and Edward C. Waters. The principals are grateful to Kari Olsen at TRG for her tireless efforts to generate the database queries and modeling results for the estimating procedures. TRG appreciates the opportunity to work with Thomas Wegge and Roger Trott at TCW Economics on this project.

The commercial fisheries' study objectives are to provide economic value estimates for a small segment of Washington's overall commercial fishing industry. The term of reference for the segment is Washington commercial fisheries. The overall fishing industry includes businesses supplying goods and services to a huge demand created by harvests in other West Coast and Alaska fisheries. The fishing industry also includes a complex seafood processing and distribution network that serves world markets. The study report narrative devotes explanations and cites other investigations in an attempt to show the representation for the Washington commercial fisheries within the overall fishing industry.

Fish landing data and licensing information used in the commercial fisheries economic analysis were from the Pacific Coast Fisheries Information Network (PacFIN). PacFIN is a database program sponsored by the Pacific States Marine Fishery Commission (PSMFC). West Coast states, British Columbia, and Alaska fish ticket information is regularly uploaded to a central database. The database assists fish management and enforcement for federally managed fisheries. It also assists in fish resource research and investigations. (Additional information is available at: <http://www.psmfc.org>.) The data was compared to information supplied by WDFW

in Year 2006. There were insignificant differences in volume and prices, except for the species geoduck. The geoduck volume was very close between the two data sources, but the price was considerably different. It was decided to correct the PacFIN supplied data for this species to be commensurate with the State's information. This resulted in the PacFIN summation over all landings to be \$65.5 million harvest value, while the WDFW summation was \$65.1 million harvest value in Year 2006. TRG thanks Brad Stenberg from the Pacific States Marine Fisheries Commission (PSMFC) and Lee Hoines at WDFW for their close cooperation in developing the data products.

The commercial fishing economic analysis was completed for one cross sectional data year to be consistent with the availability of recreational economic value information. The U.S. Fish and Wildlife Service (USFWS) completed their five year National Survey of Fishing, Hunting, and Wildlife-Associated Recreation in Year 2006. This recreation survey results provides a wealth of information about fishing activity, such as trip and equipment spending, angler demographics, fishing area (saltwater, freshwater), etc. Southwick Associates used the USFWS survey results to calculate fishing regional economic impact (REI) for each state in a study sponsored by the American Sportfishing Association. There is more timely longitudinal (i.e. not periodic) information available about the commercial fishing industry, and trend characteristic information was developed to supplement the economic analysis snapshot information.

This report was reviewed in draft form to provide candid and critical comments. This feedback helped make the findings of this report as sound as possible and ensures the report meets standards for objectivity, evidence, and responsiveness to the study charges. Although reviewers provided many useful comments and suggestions, they were not asked to endorse study findings and recommendations. This independent examination task was done in accordance with accustomed procedures and review comments were carefully considered.

The authors' interpretations and conclusions should prove valuable for this study's purpose. However, no absolute assurances can be given that the described results will be realized. Government legislation and policies, market circumstances, and other situations will affect the basis of assumptions in unpredictable ways and will lead to unanticipated changes. The information should not be used for investment or operational decision making. The authors do not assume any liability for the information and shall not be responsible for any direct, indirect, special, incidental, or consequential damages in connection with the use of the information.

Authorization is granted for the study report's contents to be quoted either orally or in written form without prior consent of the authors. Customary reference to authorship, however, is requested.

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## Glossary

BCA	benefit-cost analysis
C&S	ceremonial and subsistence
EEZ	Exclusive Economic Zone
FEAM	Fisheries Economic Assessment Model
FPE	full-time and part-time employment
IMPLAN	IMpact Analysis for PLANning
NEV	net economic value
PacFIN	Pacific Coast Fisheries Information Network
PFMC	Pacific Fishery Management Council
PSMFC	Pacific States Marine Fisheries Commission
REI	regional economic impact
TRG	The Research Group
WDFW	Washington Department of Fish and Wildlife
WTP	willingness-to-pay

## I. FISHERIES

### A. Background

Washington's commercial fisheries are unique and diverse. They have historically played a role in the development of Puget Sound's waterfront and other coastal and inland areas. Fishing vessels, seafood processors, and support businesses that participate in Washington fisheries are also involved in Alaska and other distant water fisheries. Harvests landed and processed in other West Coast locations are transported to Washington for distribution to world markets.

The working waterfronts serving both Washington and distant water fisheries are integrated with restaurants, retail stores, and offices. The waterfronts attract visitors wanting to experience and see lively commerce activities in a backdrop of expansive harbor views. Many Washington waterfronts are experiencing gentrification.<sup>1</sup> This sometimes causes conflicts where fishing industry interests feel threatened that their way of life may be lost in favor of higher private sector returns gained from different shoreline land uses (Hall-Arber et al. 2001). But the mix of waterfront uses can help educate and safeguard fishing heritage which helps preserve the industry. This economic study is about the economic values of fishing, but it is acknowledged that a broader economic study would include the associated uses of waterfronts that are dependent on historical and existing fishing activity.

The spending by the harvesting and processing businesses in Washington represents an important share of Washington's economy. Past studies of Washington's fishing industry have found:

- Spending in the central Puget Sound economy from vessels using Port of Seattle facilities was \$672.0 million and the economic impact was \$846.0 million personal income in 2003 (Martin and Associates 2005).
- Spending arising from Alaska fisheries was \$1.62 billion in Washington and Oregon in 2004 (TRG 2007). The Oregon share was about five percent according to TRG (2007).
- Spending in the Washington economy as a result of all tribal and non-Indian onshore landings in Washington was \$297.4 million and the economic impact was \$312.2 million in personal income in 2004 (TRG 2006).

These numbers do not include other spending for education, research, management, enforcement, etc. that is connected to the fishing industry activity. In sum, the spending is an important statistic to consider in government policy directed towards sustaining commercial fisheries and enhancing economic development.

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1. Gentrification in this application is the displacement of traditional fishing infrastructure with non-fishing related business and activities.

## B. Washington Commercial Fisheries

### 1. Washington Commercial Fisheries' Definition

While the harvesting and processing industry in Washington is involved with fisheries taking place in Alaska and other locations, a policy question would be: what is the position of Washington's commercial fisheries in the overall fishing industry? The answer would be in the sense of both a natural resource perspective and management responsibility perspective. Protection of marine and terrestrial habitat needed by fish resources is an important government responsibility. State government participation in the management of commercial fisheries transcends those fisheries that are resident or migrate through Washington State boundaries. Many of the commercially caught species are federally managed, but the State has representation on management boards such as the Pacific Fishery Management Council, North Pacific Fishery Management Council, Pacific Salmon Commission, International Pacific Halibut Commission, and others.

It becomes a definitional matter to sort out the fishing industry activity that might be categorized as Washington's commercial fisheries. The definition can be explained through a description of fisheries that are excluded. Five prominent fisheries and their 2006 harvest value excluded in a definition of Washington commercial fisheries are described as follows.<sup>1</sup>

- 1) Tribal fisheries guaranteed by U.S. treaty, federal trust responsibilities, and reaffirmed through case law are a growing share of harvests. Through implementation of the Belloni and Boldt court decisions, commercial tribal fisheries have harvest allocation set aside whenever and wherever tribe usual and accustomed fishing took place.<sup>2</sup> Fisheries include shellfish, ocean finfish, salmon harvested in the ocean and rivers, and others.<sup>3</sup> These tribal fisheries have their own management complexity and economic and cultural value involvement that deserve separate attention.<sup>4</sup> Harvests in tribal commercial fisheries pass through the same markets as non-tribal commercial catch. The estimated

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1. Home-port is defined as the port and state associated with a vessel's plurality of shoreside landings measured by ex-vessel value. In the case of vessels that do not have shoreside landings, but participate in West Coast offshore or Alaska fisheries, the home-port is the declared hailing port or corporate headquarters on the vessel documentation record.
  2. Columbia River fisheries are managed under a continuing jurisdiction of the U.S. District Court for the District of Oregon in the Case of United States v. Oregon (1969 Belloni Decision). The court affirmed that the treaties reserved to the tribes 50 percent of the harvestable surplus of fish destined to pass through their usual and accustomed fishing areas. A parallel case is U.S. v. Washington (1974 Boldt Decision) interpreting the same treaty language for tribes in the Puget Sound area. The courts have established a large body of case law setting forth the fundamental principles of treaty rights and the permissible limits of conservation regulation in treaty fisheries. Interpretations have included declaring tribal shellfishing rights on tidelands sold to private parties (1994 Rafeedie Decision). Tribes and Washington State signed the Centennial Accord in 1989. The Accord formally recognized the sovereign government-to-government relationship that exists with treaty tribes. The New Millennium Accord, signed in 1999, pledges all the governments to implement the Centennial Accord's terms.
  3. Tribes are co-managers of natural resources in Washington. As sovereign governments, each tribe regulates and coordinates their own program for fishery harvest management, enhancement, habitat protection, and enforcement.
  4. Two studies that discuss the economic dimensions of tribal fisheries are in Tiller Research and Chase Economics (1998) and TRG (2003).

commercial harvest value from tribal fisheries in 2006 was \$48.9 million. This does not include an economic value placed on personal use harvests. Personal use harvests are for the purposes of ceremonial and subsistence (C&S) use. There may be economic analysis methods to assign a substitution value for subsistence catch, but placing a value on ceremonial catch would be tantamount to placing a value on cultural and spiritual beliefs. C&S harvests are not sold. Commercial harvests are not undertaken until C&S harvests are fulfilled.

- 2) Private sector aquaculture is a large and thriving fishing industry segment with worldwide markets in trout, salmon, and shellfish. Shellfish alone had a harvest value in 2003 of \$76.2 million (PACAQUA 2004).<sup>1</sup> There are several trade organizations representing private aquaculture that have information available to characterize this industry segment.<sup>2</sup>
- 3) West Coast offshore Pacific whiting fishery prosecuted by catcher vessels delivering to motherships, and catcher-processor vessels.<sup>3</sup> Many of the catcher-vessels and all of the motherships and catcher-processors home-port in Puget Sound localities. The offshore catch areas for this fishery extends from the U.S.–Canada border to north of San Francisco. The estimated harvest value by the 11 catcher vessels that hail from Washington ports (out of the 24 total catcher vessels that participated in the fishery) was \$2.9 million in 2006. The estimated harvest value by the nine catcher-processors that hail from Washington ports is \$8.8 million. There were six motherships in this fishery and all are owned by businesses with corporate headquarters in the Puget Sound area. There is a separate tribal allocation in the Pacific whiting fishery that has been delivered each year to a mothership rather than made an onshore landing. Year 2006 was unique in that most of the tribal allocation was delivered onshore. The Pacific whiting non-tribal allocation to be landed onshore also has a separate annually determined quota. This separate allocation has the same catch area as the offshore allocation.

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1. Revenue received by harvesters from first sale of catch (sometimes called dockside value) is not necessarily a good indicator of the economic value of the fishery. The first sale amount does not include any consideration of production costs required to generate the harvester's sale amount, where the spending occurred for those costs, or the net income realized by vessel investors. It also does not reflect the added value generated from processing and distributing the harvests (sometimes called wholesale value) which has its own set of production costs and spending considerations. The economic analysis attempts to sort out the spending and economic effects caused by the spending in regional economies.
  2. Examples are the Pacific Coast Shellfish Growers Association <http://www.pcsqa.org> and the Washington Fish Growers Association <http://www.wfga.net>.
  3. The West Coast Pacific whiting fishery is a federally managed fishery. Depending on stock abundance estimates, there are U.S. and Canada allocation quotas of certain size. The U.S. allocations are further specified for tribal, offshore, and onshore harvest quotas. The offshore allocations are split between the mothership and catcher-processor sectors. After the set aside for the tribal fishery, the shoreside, mothership, and catcher-processor sectors are 42, 24, and 34 percent, respectively. The tribal fishery has only been prosecuted in recent years by the Makah tribe. There are expectations that the Quileute Tribe will participate in the whiting fishery beginning in 2009 and the Quinault Tribe will enter the whiting fishery in 2010. This will require larger tribal set asides in the future.

A portion of the Pacific whiting landed onshore is included as a Washington commercial fishery. The landings made at Washington ports are mostly filtered to be from catch areas north of the Oregon Coast for inclusion as a Washington commercial fishery.

- 4) Oregon Coast catch area harvests that are southerly of the Washington–Oregon land boundary extension but delivered to Washington ports are excluded from the definition of Washington commercial fisheries. Fisheries include albacore tuna (\$11.4 million), Dungeness crab (\$2.5 million), sablefish (\$1.2 million) and Pacific whiting (\$1.0 million), pink shrimp (\$0.5 million), and others. Harvests in catch areas north of the boundary but delivered to Oregon and other West Coast ports are also excluded.
- 5) Alaska and other West Coast waters' catch are excluded in the Washington commercial fishery accounting. These waters are outside the Exclusive Economic Zone (EEZ) and/or the fisheries' management jurisdiction is not covered by the Pacific Fishery Management Council (PFMC).<sup>1</sup> An example fishery is Pacific halibut whose catch is from Alaska. The Washington landings' harvest value was \$6.2 million in 2006. This represented 73 percent of all Pacific halibut delivered in Washington in 2006.

The estimated harvest value share of these included and excluded fisheries used in the definition of Washington commercial fisheries is shown in Figure 1 and the 17 year trends are shown on Figure 2. After accounting for the excluded fisheries, the total harvest value was \$65.5 million for the defined Washington commercial fisheries in 2006. The Washington commercial fisheries harvest value has decreased about one-third over the 17 year period and represents slightly more than one-quarter of the total harvest value in 2006. These fisheries' harvests have been quite variable over the years due to the landing volume and price for the largest segment which is Dungeness crab at 45 percent in 2006. The volume landed for this species was at its highest in 2003. (There was banner landings in January 2003 for the 2002-2003 season and in December 2003 for the 2003-2004 season that contributed to the high volume. Crab meat pick-out standards in December 2004 delayed the start of the next year's season.) Year 2006 was the highest year on record for volume and value of aquaculture. Despite price increases, the dip in aquaculture volume in 2007 returned aquaculture harvest value to the averages seen in the early 2000's. Year 2006 was an off-year for pink salmon and an on-year for chum salmon harvests in Puget Sound. There were decreased landings in both ocean and Puget Sound salmon Chinook and coho fisheries that contributed to the overall decrease in harvest value in 2007.

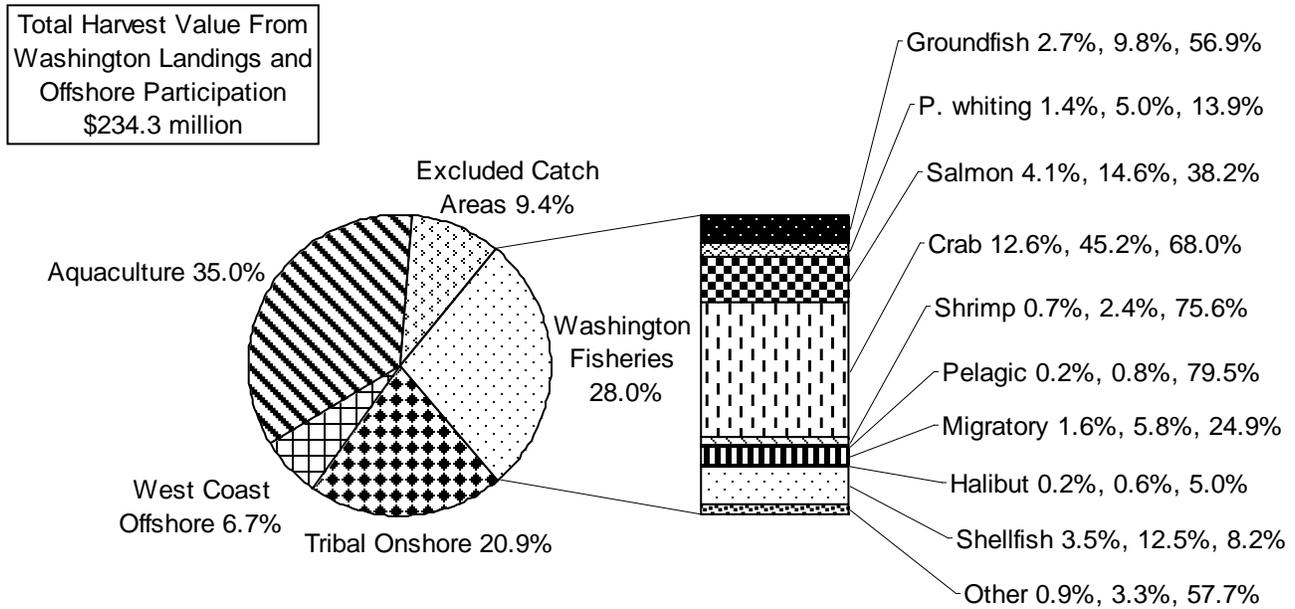
## 2. Washington Commercial Fisheries' Economic Activity

The economic activity generated from the defined Washington commercial fisheries comes from vessels, processors, and fishing industry support businesses. Another section in this report explains the economic analysis methods used to determine the total economic contribution from the economic activity. This section of the report describes how the fisheries are associated with vessel and processor business classifications that are used in the economic analysis.

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1. The EEZ was established by the United Nations Convention on the Law of the Sea. It provides for special marine exploration and use rights over a sea zone that extends 200 nautical miles seaward of coasts.

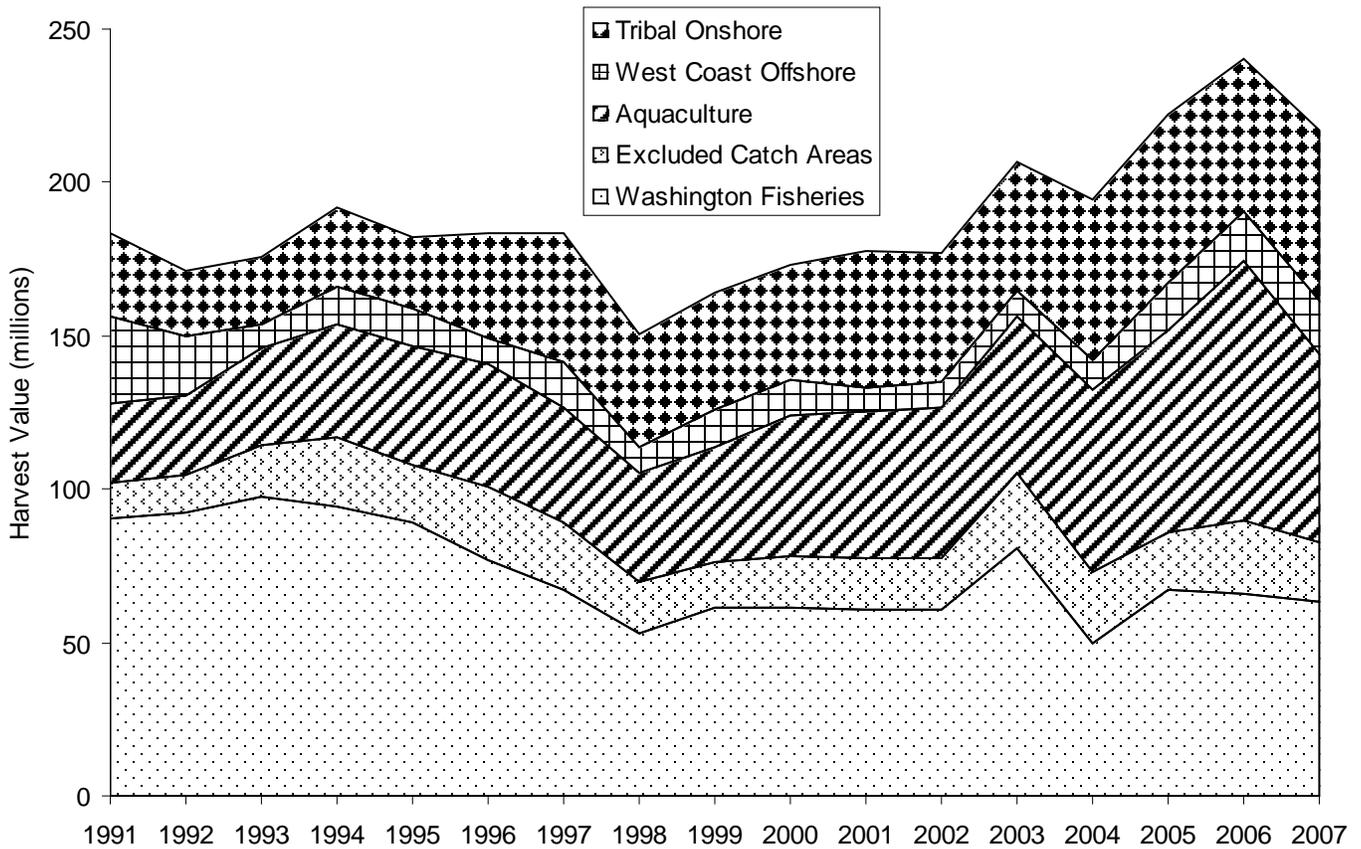
Figure 1  
Harvest Value Shares of Washington's West Coast Fishing Participation in 2006



- Notes:
1. The harvest value does not include revenue from landings made in Alaska, other distant water fisheries' ports, or other West Coast states by Washington's home-port vessels.
  2. The shares (XX%, XX%, XX%) on the vertical bar are percent of total harvest value, percent of Washington commercial fisheries harvest value, and Washington commercial fisheries percent of species group harvest value, respectively.
  3. Tribal harvest value is from the commercial fisheries' allocations for treaty and trust set asides landed onshore. The West Coast offshore includes an approximately \$0.6 million tribal harvest in 2006. The harvest values do not include an estimate for C&S harvests.
  4. Excluded catch areas are fishing grounds in two defined regions. The first region is outside the West Coast EEZ. Landings in Washington are sometimes from non-EEZ fishing grounds located close to Alaska or from the high seas outside of the jurisdiction of the PFMC. The second region is southerly of an extension of the Washington-Oregon land border. Any species in the Oregon Coast catch area is excluded from the definition of Washington commercial fisheries. The harvest value from catch in waters off the Washington Coast or in Puget Sound landed in Oregon or elsewhere are not included in the accounting of Washington commercial fisheries.
  5. Aquaculture is from the raising and harvesting of shellfish, salmon, trout, and other species. Catch of wild shellfish is included in the definition of Washington commercial fisheries.
  6. West Coast offshore catch is often referred to as the offshore Pacific whiting fishery. It is caught by catcher-processors and catcher-vessels that deliver to motherships. The harvest value is the estimated catch from these two vessel types that home-port in Washington. The estimated value uses a proxy price of similar species onshore deliveries price less 15 percent.
  7. The harvest value for "other" Washington fisheries includes \$729 thousand for sea cucumbers, \$471 thousand for other shrimp, \$228 thousand for other sea urchins, \$184 thousand for white sturgeon, \$150 thousand for hagfish, and other species.

Source: PacFIN annual vessel summary, fish ticket data, and offshore data, November 2008 extraction.

Figure 2  
Harvest Value Trends of Washington's West Coast Fishing Participation in 1991 to 2007



- Notes: 1. Harvest values are adjusted to 2007 dollars using the GDP implicit price deflator developed by the U.S. Bureau of Economic Analysis.  
2. Figure 1 notes apply for explaining the displayed fishing segments.

Source: PacFIN annual vessel summary, fish ticket data, and offshore data, November 2008 extraction.

The defined Washington commercial fisheries in 2006 include many marine ocean and Puget Sound species and many different anadromous species. Species can be grouped for convenience from a fish resource perspective based on common habitat and biological traits. However, there is a diverse set of vessel classes that harvest across these marine and anadromous species and a diverse set of seafood products made from the harvests. It is necessary to know the vessel and processor classes because that determines the spending that occurs in Washington's economy.

This study relies on a vessel and processor classification scheme developed for the Pacific States Marine Fisheries Commission (PSMFC). (Appendix A explains the rules used in the classification scheme.) The vessel classes harvesting the different species groups in 2006 are shown in Table 1.<sup>1</sup> The definition of processor classes relies on the detailed ownership

1. The vessel classification scheme is described in TRG (2006). The scheme used all domestic and distant water fisheries to determine which class a Washington home-ported vessel might be placed.

Table 1  
Harvest Value and Vessel Counts by Vessel Categories for Washington Commercial Fisheries in 2006

Vessel Classes	Vessels	Harvest Value (\$000's)									Total
		Ground- fish	Pacific Whiting	Salmon	Crab	Shrimp	Coastal Pelagic	Highly Migratory	Halibut	Other	
1 Mothership/Catcher Processor	4	271		25					25	68	389
2 Alaska Fisheries Vessel	127	1,852	2,974	2,961	3,226	21	111	109	122	108	11,485
3 Pacific Whiting Onshore and Offshore Trawler	4	311	162	0	0	13	0		0	2	488
4 Large Groundfish Trawler	15	1,207	139	0	215	174	0	78	1	2	1,815
5 Small Groundfish Trawler	3	225								1	226
6 Sablefish Fixed Gear	19	1,834		65	242			23	141	16	2,321
7 Other Groundfish Fixed Gear	C	56									56
8 Pelagic Netter	13			213	86		377			4	680
9 Migratory Netter	5	87			120			86	8		302
10 Migratory Liner	50	22		88	533	26		1,827	3		2,499
11 Shrimper	26	0		13	845	1,721		60		0	2,639
12 Crabber	263	387		637	23,733	210		1,016	25	38	26,046
13 Salmon Troller	34	83		562	21			39	91	1	796
14 Salmon Netter	182	5		4,066	58	8				124	4,262
15 Other Netter	16									922	922
17 Diver Vessel	C									100	100
18 Other > \$15 Thousand	23	2		247	45			472		40	805
19 Other <= \$15 Thousand	214	82		232	438	21	29	66	1	34	904
20 Unidentified				445	45			16	4	8,271	8,782
Total	1,003	6,424	3,274	9,554	29,607	2,195	517	3,792	422	9,732	65,517

- Notes: 1. Vessel counts shown as "C" are hidden for confidentiality reasons.
2. Vessel class names are descriptive of the fisheries in which they participate sometime during the year. However, they may also switch gears and participate in other fisheries. The numbering system for vessel categories pertains to a hierarchical category assignment scheme that is explained in Appendix A.
3. Unidentified vessel class includes landings where a unique vessel identifier in PacFIN was not available. Some of these landings are from tribal vessels participating in non-tribal fisheries, and some are landings where no vessel was used. Harvest value from the "other" species group for unidentified vessels is predominantly geoduck (\$7,958 thousand), with \$202 thousand of razor clams, \$56 thousand of white sturgeon, \$47 thousand of Pacific oyster, and smaller amounts of other species.

Source: PacFIN annual vessel summary, November 2008 and March 2007 extractions, with adjustments to geoduck price.

investigations conducted by TRG (2006). The purchasing patterns from all of Washington onshore fisheries in the different species groups in 2004 are shown in Table 2.<sup>1</sup>

The vessel and processor businesses counts are revealing of the complexity of the fishing industry. There were 1,003 vessels that had landings in the Washington commercial fisheries in 2006 (Table 1). This compares to the 1,151 vessels that had landings in the onshore, non-Indian commercial fisheries in 2004 (Appendix A). Some of these vessels would also have made landings in the fisheries excluded from the Washington commercial fisheries definition. The Washington commercial fisheries were 60 percent of the vessels total West Coast revenue. (The distant water fisheries and aquaculture revenue is not included in the vessels total revenue.) The greatest number of vessels (263) were in the "crabber" class that harvested \$23.7 million of crab.

There were 24 processors that purchased 72 percent of all landings made in Washington in 2004 (Table 2). (The processor businesses are aligned with parent company owners so that multiple plants owned by a single owner are counted as one.) The trends for processing business have been for owner concentration and plant centralization. The processor count in Table 2 shows there are still many different owners involved in Washington commercial fisheries. Some smaller firms are involved with a single species or species group, but the majority is diversified and are also involved in Alaska and foreign fisheries as well.

### C. Washington Port Information

Nineteen communities along the Washington Coast, Strait of Juan de Fuca, or in Puget Sound are the mainstay harbors for the fishing fleet (Table 3). The harbors are geographically combined to four port groups to simplify descriptions. The communities have evolved around harbors and fishing grounds with different characteristics. Each has a presence of key facilities and services that make it unique. Some serve a locally based fleet and others are regional fisheries centers (NMFS 2007). The comparative size of the harbors can be described by how much volume and value of fish is delivered there. The Coastal South and Central Port Group has the largest share of Washington commercial fisheries (48.3 percent). The largest share of landings when offshore and aquaculture is included is in the unidentified port group (43.7 percent). The offshore fleet processes harvests into finished products at-sea which is then introduced into distribution channels for domestic and foreign markets. These harvests would be associated with the Southern Puget Sound port group because that is where the vessels get repairs and provisioning services, and hire crew. The port with the highest number of finfish deliveries is Bellingham (11,588), and highest number of mollusk deliveries is Shelton (5,757).

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1. Processor is a loosely used term that is associated with the harvest's first-purchase business. It could be that the purchase is made by a buyer that resells the purchase to another business for eventual manufacturing of a seafood product. Counts of businesses could be overestimated because one processor can purchase seafood under multiple licenses. Purchases can be made by the public directly from vessels, so in this case, the vessel itself is counted as a processor. It is recommended that TRG (2006) be used for a reader that has more interest in the characterization and trends for processor businesses.

Table 2  
Onshore Purchases by Processor Size Categories and by Species Groups in 2004

Processor Category	Owner-ship/Count	Purchase Share	Major Company	Processing Buyer/		Species Group Purchases										
				General	Specialized	Total	Groundfish	Whiting	Salmon	Crab/lobst	Shrimp	Pelagic	H. Migratory	Halibut	S.urchin	Other
<b>Washington Statewide</b>																
>\$5M	6	38%	6	6	0	43,430,376	6,867,551	2,442,456	3,230,460	9,916,669	1,812,651	1,120,802	14,552,678	3,289,412	0	197,697
\$1M-\$5M	18	34%	0	2	16	38,431,047	5,345,785	17,653	3,519,512	6,746,436	599,592	194,538	938,526	3,321,680	6,298	17,741,027
\$500K-\$1M	23	15%			✓	16,637,671	311,608	0	5,219,209	7,918,298	326,515	67	115,751	546,069	0	2,200,154
\$100K-\$500K	47	10%			✓	11,019,156	64,662	2	4,157,897	3,174,651	208,635	112,482	27,702	180,353	374,900	2,717,872
\$50K-\$100K	29	2%			✓	2,126,716	2,755	0	646,899	710,727	246,826	79,525	54,769	56,381	0	328,834
\$10K-\$50K	92	2%			✓	2,161,233	2,564	0	770,126	461,454	443,306	96,784	175,119	18,712	5,829	187,339
<\$10K	152	0%			✓	462,471	9,542	0	219,396	121,132	20,354	4,623	27,020	22,214	0	38,190
Subtotal	367	100%				114,268,670	12,604,467	2,460,111	17,763,499	29,049,367	3,657,879	1,608,821	15,891,565	7,434,821	387,027	23,411,113

- Notes:
1. A "major" company is defined to be a purchaser of at least \$5 million in any state's landings. A processing plant is defined to be "general" if it has the capacity (such as fillet lines and refrigeration equipment) as well as the recent history for processing multiple species on a year-around basis. This definition's purpose is to identify plants that maintain a large, local commitment to labor. These definitions exclude companies and plants that specialize in offering product forms or packaging services for such species as salmon, tuna, and sardines on a seasonal or part-time basis. There are general processing plants not identified in this list, because they are not located at ports where vessel deliveries are made. For example, general processing plants are or recently have been located in Woodland, Washington; Portland, Oregon; Salem, Oregon; Sacramento, California; and Watsonville, California. There are also several large custom cutting and cold storage businesses which are primary seafood processors, however they do not make vessel purchases so are not represented in this table.
  2. Landing data was used to verify the thresholds for the table's processor categories and interviews with processing company representatives were used to determine plant capacity.
  3. Ownership unique identifier tags were assigned if a processor purchased more than \$1 million.
  4. Parents are assigned to subsidiaries groups by interpretations and evidence of various legal arrangements that include ownership ties, lease contracts, and purchasing arrangements.
  5. Several processing companies in Washington also manufacture products from oysters and other shellfish, however processor purchases of aquaculture are excluded.

Source: TRG (2006).

**Table 3**  
**Port and Port Group Landings, Vessel Counts, and Processor Counts in 2006**

Port Groups	Community Local/ Regional	Onshore Commercial, Tribal Fisheries, Aqua- culture, and Offshore			Washington Commercial Fisheries			Unique Vessels	Processors		Deliveries		
		Value			Value				>\$1 million	>\$10,000	Total	Mollusks	Finfish
		Volume (000)	Amount (\$000)	Percent	Volume (000)	Amount (\$000)	Percent						
<u>Coastal Washington North</u>		9,843	14,267	6.1%	3,659	5,094	7.8%	162	3	27	11,204	1,800	9,404
La Push	L	1,726	2,996		723	1,309					2,602		2,602
Neah Bay	R	5,562	6,608		1,555	1,704					3,499	1	3,498
Port Angeles	L	215	419		54	91					335	47	288
Port Townsend	R	1,711	2,804		944	901					3,423	1,050	2,373
Sequim	L	629	1,439		384	1,090					1,345	702	643
<u>Coastal Washington South and Central</u>		185,973	52,822	22.5%	82,869	31,625	48.3%	531	9	65	14,490	1,441	13,049
Grays Harbor	L	277	450		274	446					644	418	226
Ilwaco/Chinook	R	40,514	19,116		14,426	6,739					3,076		3,076
Westport	R	140,955	26,647		64,811	19,056					4,065	100	3,965
Willapa Bay	L	2,780	4,236		2,764	4,217					3,739	891	2,848
<u>Northern Puget Sound</u>		28,186	39,428	16.8%	15,601	18,087	27.6%	463	9	72	27,896	5,578	22,318
Anacortes	L	2,912	5,497		1,913	3,664					4,151		4,151
Bellingham Bay	R	17,621	24,766		9,655	9,950					16,888	5,300	11,588
Blaine	L	4,162	6,006		2,890	3,567					3,437	276	3,161
Friday Harbor	L	164	200		124	135					214		214
La Conner	L	3,105	2,687		961	666					2,445	2	2,443
<u>Southern Puget Sound</u>		16,652	25,004	10.7%	7,183	10,671	16.3%	214	7	69	22,066	9,655	12,411
Everett	L	2,214	1,960		1,306	1,121					1,844	81	1,763
Olympia	L	1,700	3,352		545	1,003					2,205	956	1,249
Seattle	R	6,839	9,321		3,958	5,895					5,976	1,550	4,426
Shelton	L	3,088	4,800		98	91					8,631	5,757	2,874
Tacoma	L	2,069	3,012		1,145	2,367					2,223	781	1,442
Unidentified onshore, offshore, and aquaculture		344,074	102,752	43.9%	25	40	0.1%	47					
Offshore		309,429	15,598	6.7%			0.0%	33	6	0			
Aquaculture		31,706	82,095	35.0%			0.0%	0					
<b>Total</b>		<b>584,727</b>	<b>234,275</b>	<b>100.0%</b>	<b>109,337</b>	<b>65,517</b>	<b>100.0%</b>						

- Notes:
1. Local or regional designation from NMFS (2007).
  2. Unique vessels are the different vessels that home-port in Washington then deliver within the shown port group. These vessels are not additive across port groups because they may deliver to more than one. Catcher-vessels and catcher-processors participating in the offshore fishery are included. Vessels with no unique identifier, such as for tribal fisheries, are excluded.
  3. Deliveries are approximated by counting fish tickets. This may over estimate deliveries if more than one ticket is issued per trip. It is a rare occurrence, but possible, if a vessel sells catch to more than one processor. Counts are divided between fish tickets issued for mollusks and finfish to distinguish mollusk diver vessel and non-vessel deliveries from finfish vessel deliveries.
  4. Port group statistics may be larger than the sum of the ports because some landings and vessel counts are not identified with a port.
  5. Processor counts are not additive across port groups because the same processing business may purchase in different harbors. Motherships are included in the count of processors with greater than \$1 million of purchases.
  6. The geoduck Washington commercial fisheries value is corrected for the State price.
  7. Columbia River gillnet and tribal fishery landings are accounted in the coastal south and central port group.

Source: PacFIN annual vessel summary, fish ticket data, and offshore data, November 2008 extraction.

## II. ECONOMIC ANALYSIS

### A. Methods

Economic analysis is provided to show measurements of regional economic impacts (REI) and net economic value (NEV) arising from Washington commercial fisheries. The REI are the result of the fishing industry business spending within a defined region. The spending is payments to labor and for other costs associated with prosecuting fisheries, processing a product and readying it for distribution, and the capital costs for vessels and processing plants. The defined region for this study is the State of Washington. A model called the Fishery Economic Assessment Model (FEAM) is used to calculate the REI.<sup>1</sup> The FEAM uses economic input-output relationships to multiply the fishing industry spending through all businesses and households that are touched by the direct (first round spending by the fishing industry), indirect (spending by suppliers to the fishing industry), and induced (re-spending by households that have received money through wages or proprietor income) effects from the fishing industry.<sup>2</sup> Because the FEAM results are payments to labor for all sectors of the economy, a calculation for full-time and part-time employment (FPE) jobs can be developed using the region's average wage and proprietorship income.<sup>3</sup>

The measures of business profitability (business net income) are itemized for a suite of vessel and processor types in the FEAM. The profitability and other variable and fixed costs from the business types can be used to estimate NEV. NEV can be both a business level and a social welfare quantity. The social welfare quantity (hereafter called social NEV) is a gauge of the amount of wealth generated to the nation from the fishing industry activity. The total dimension of social NEV includes consumer seafood value and the revenue created from the fishing and processing activity minus opportunity cost of the resources employed (i.e., what if something else were done with those resources instead of the activity?). For example in a social NEV calculation, expenditures for crew would not count as an economic opportunity cost if the labor would otherwise have been unemployed. Or if the labor would have been employed, but at a lower wage, then the difference between the wages in the fishery and the wage in the next best alternative employment would not be counted (i.e., only the next best available wage is counted as a cost). For a business level NEV, all labor costs are included in the accounting.

The consumer seafood value is the difference in what a consumer would pay for seafood less what is actually paid for the seafood provided from the activity. It is a measure of the net willingness-to-pay (WTP) and is sometimes called consumer surplus and as such is a conceptual value that can only be found through consumer surveys. Accurate surveys are prohibitively expensive so past studies are usually relied upon to estimate these values. However, using past

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1. The FEAM generates measures of REI measured by personal income and measures of commercial harvesting and primary processing business profitability. The FEAM was developed by William Jensen and Hans D. Radtke for Alaska and U.S. West Coast during the 1980's. Both models have been updated many times and the West Coast FEAM is currently used by the PFMC for preparation of fishery management plans. An economic theory description of the FEAM can be found in Seung and Waters (2005).
  2. The I/O model used in the FEAM is the IMPact Analysis for PLANning (IMPLAN) model offered by the Minnesota IMPLAN Group Inc., St. Paul, Minnesota.
  3. While an average earnings across all sectors is used for the calculation, the result probably under represents jobs, because of the elevated nature of part-time employment in the fishing industry.

study results is controversial. It can be argued that survey results pertain only to the specific time and methods of the survey. Where there are insufficient resources to carry out such a survey, economic analysis must rely on the other studies or make assumptions that the change in consumer surplus is inconsequential.

The difference between fishing industry revenues and actual or opportunity costs is sometimes called producer surplus. The estimation of opportunity costs in the producer surplus equation is also difficult because it is not a direct measurement. It requires thoughtful reveal or preference surveys of industry participants to determine if there might be foregone revenue or better use of capital.

Economists will sometimes leave out consumer surplus and some opportunity cost estimation when social NEV is used in a benefit-cost analysis (BCA). BCA calculates the difference between the activity as it exists under status quo and as it may exist in the changed condition. Generally the changed condition, such as changed fishery management practices that will decrease or increase the amount of fish that can be harvested, will not affect consumer surplus or some opportunity costs. For example, it could be that enforcement costs would not change under either alternative. So these quantities will cancel each other out in the benefit-cost accounting and the result will be only a change in producer surplus.

The FEAM is a useful model because it provides factors for the REI and NEV producer surplus measures per harvest pound. These factors are specific to vessel and processor stratifications. For example, a vessel stratification includes the many species caught using certain gear types by a vessel that is predominantly engaged as a crabber vessel, and a processor stratification includes seafood product types (such as fresh and picked crab) produced from those harvests. The FEAM is a matrix that marries the many vessel and processor stratifications that are found in the Washington fishing industry. The matrix is static. Changes that might occur from different market conditions, such as the price paid to harvesters or prices received by processors for certain products, are not reflected in the matrix. In this study, the incremental factors are being applied to only a small portion of the commercial fishing industry in the State.

It is important to note that the REI measure for the small portion of the fishing industry activity being assessed should be considered an economic contribution within the overall effects from the fishing industry. It is an annualized estimate for conditions as they occurred in the year 2006. If the activity were for some reason taken away, it may be there would be adjustments that would ameliorate the loss one way or another and show a different impact. For these reasons, the REI estimates shown here have fairly qualified use as a comparison to the fishing industry in other points in time. It also has limited applicability for comparisons to other economic activities, such as the REI derived from recreational fishing within the State.

Fish resource allocations between commercial and recreational user groups are controversial. Both groups can be competing to catch the same fish at the same time in the same location. Fisheries management decision makers will hear testimony from both groups that their activity will generate higher economic impacts. It is cautioned that the economic measures provided in this study must be carefully viewed for their applicability. Economic measures should be essential criteria for management deliberations, but they can be misused if their context and

applicability is not considered. This caution is thoroughly treated by INR (2005) in the case of the lower Columbia River spring Chinook fishery. That treatment includes literature references for other Pacific Northwest fisheries where there are commercial and recreational allocation tensions.

The FEAM version being used to develop the REI and NEV is described in Davis (2003). This FEAM version was populated using the particular year 2006 harvests that are included in this study. Those particular harvests represent about one-quarter of the ex-vessel revenues generated by the vessels in Washington's fishing fleet that make West Coast offshore and onshore deliveries. The spending that occurs in the Washington economy from these particular harvests is about five to six percent of the total fishing industry spending when Alaska and other distant water fisheries and private aquaculture are included. Washington's total fishing industry economic contributions from West Coast fisheries in 2004 is described in TRG (2006). The distant water fisheries effects are discussed in NRC (1986 and 1999) and more recently TRG (2007).

A summary list of assumptions used to generate the commercial REI and NEV estimates are as follows. The assumptions are both general and specific in how the estimates were developed and how they should be interpreted.

1. Only harvesting and primary processing effects are assessed. Processed products can enter seafood distribution channels that can generate additional economic effects in Washington's economy. Management, enforcement, and research activity is not included in the economic effects measurements.
2. The economic effects are a contribution measure that may have substitutes if the included fisheries are taken away. Harvesters might be able to pursue other West Coast or distant water fisheries and processors may have access to other catches. The substitutes may have different industry input-output and export-import relationships, and therefore, the effect on the economy of the substituted activities may be different.
3. The economic effects are static and not necessarily linear. That is, if the included fisheries are more or less than shown, the proportional difference in REI and NEV may be different. The model does not include industry behavior dimensions, such as would undoubtedly occur if there was a shift in prices received for seafood products or prices paid to harvesters.
4. The total value of seafood products associated with the included fisheries is based solely on what the seafood actually sells for. In other words, the difference in what a consumer would be willing to pay and actually pays is assumed to be zero.
5. Those that work in commercial harvesting and processing businesses are motivated by the enjoyment of their careers and do not compare their participation with other employment prospects. Moreover, the harvesting and processing businesses do not necessarily have other profit making opportunities. Therefore, the opportunity costs from participating in the harvesting and processing of the included fisheries is assumed to be zero.
6. The economic effects from the movement of fish resources between commercial and recreational user groups cannot be assessed with the modeled estimates. Showing

economic benefits from changes in allocations would require close examination of spending on a per unit basis and in aggregate before any conclusions could be reached.

7. The calculation of NEV included a portion of fixed costs and labor costs were not discounted. If other assumptions were made about alternative uses of capital and/or there were alternative employment opportunities, NEV might be significantly different than the estimates shown.
8. Only commercial REI and NEV "use" benefits are calculated. There may be other non-use and non-market benefits associated with commercial fisheries that would be additive to the use benefits. For example, there may be tourists who are drawn to working waterfronts, and their spending may generate economic contributions and add to economic wealth. There may be (positive or negative) passive use values associated with commercial harvests that should be taken into account in the NEV calculation. Passive use values are associated with people wanting the fish resource to exist but who may not actually use the resource.

While the above list of assumptions was intended to be inclusive, there may also be others that have significant bearing on the results expressed below.

## B. Results

The modeled NEV and REI estimates are shown for the included commercial fisheries in Table 4.<sup>1</sup> The total personal income contributions are \$148 million which represents 3,530 jobs in Washington's economy in 2006. This is a small part of the total net earnings in Washington's economy (0.1 percent), but can be important at the community level on the Washington Coast and in Puget Sound. Of the fisheries shown, the Dungeness crab fishery contributed the highest share (39 percent) and the West Coast harvested halibut fishery the smallest (0.5 percent). There is a large amount of halibut caught in distant water fisheries but landed for processing in Washington that is not reflected in the included halibut fishery. The non-tribal salmon and shellfish fisheries each contributed about 14 percent. The onshore landed Pacific whiting fishery was also a significant portion of the total (12 percent), but this represents only a fraction of the total Pacific whiting fishery that includes offshore harvests by catcher-processors and by catcher vessels delivering to motherships, and by tribal catcher vessels delivering on shore and to motherships.

The NEV generated by the included commercial fisheries is \$38 million. This is a measure of the benefit side of the social wealth generated in 2006.<sup>2</sup> While NEV is positive in the aggregate,

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1. The economic value measurements are prorated benefits. That means they are a calculated fraction of the direct and total economic effects associated with the included business activity. This creates an "exclusionary" effect that has uncertain implications for a description of economic contributions and benefits. By way of an example to show the effect, the included Washington commercial fisheries are only a share of harvester's total annual revenues. Washington fishermen must rely on a number of different fisheries. The harvester may not be able to sustain the business activity if all of the revenues did not occur. More comprehensive and complex economic modeling would be needed to account for the exclusionary effect.
  2. There may be other social benefits, such as the payments to labor if it would otherwise be unemployed. There are also social costs such as for enforcement, monitoring, management, public hatchery production, etc. that are not included in the calculation.

Table 4  
Economic Effects From Washington Commercial Fisheries in 2006  
(thousands)

Fishery	Revenue		REI					NEV
	Ex-vessel	Ex-processor	Harvester	Processor	Subtotal	Share	Jobs	
1 Groundfish	6,425	8,858	8,874	3,029	11,903	8%	0.283	3,103
2 P. whiting	3,274	12,296	4,857	12,271	17,128	12%	0.408	4,978
3 Salmon	9,554	16,624	12,370	8,935	21,305	14%	0.507	7,091
4 Crab	29,607	41,612	41,721	15,377	57,098	39%	1.359	11,596
5 Shrimp	1,592	2,953	2,252	1,509	3,761	3%	0.090	881
6 Pelagic	509	3,577	735	3,946	4,681	3%	0.111	1,914
7 Migratory	3,792	6,772	4,351	3,762	8,112	5%	0.193	2,142
8 Halibut	422	497	587	89	676	0.5%	0.016	201
9 Shellfish	8,209	5,183	10,082	9,132	19,214	13%	0.457	5,038
10 Other	2,134	2,838	2,901	1,492	4,393	3%	0.105	1,138
Total	65,517	101,210	88,729	59,543	148,272	100%	3.530	38,082

- Notes:
1. Washington commercial fisheries are landings made at Washington ports except for those in the following fisheries: tribal commercial and C&S fisheries, aquaculture, West Coast offshore fisheries, fishing grounds southerly of an extension of the Washington-Oregon land border, harvests returned from Alaska, and other distant water fisheries.
  2. Ex-vessel revenue are what harvesters receive when selling their retained catch. Ex-processor revenue is the wholesale value of seafood products.
  3. Regional economic impact (REI) is measured as total personal income. It includes the "multiplier" effects. It is a measurement for the state level economy.
  4. Jobs are full-time and part-time employment using BEA estimates for wage and salary, and proprietorship earnings in 2006 for the State.
  5. Net economic value (NEV) is the prorated profitability of vessels and processors active in the included fisheries. It does not include an accounting of social costs to sustain the fisheries. It is a measurement at the fishing industry level.

Source: TRG.

it masks what is happening at a fishery level or business level. For example, it could be that some local fisheries in the harvesting sector are operating at economic losses which are offset when highliner harvester and processing businesses are included. There may be tax advantages for staying in the fishing industry even though profits are negative. Policy making about management and public support for the industry need to use NEV measures itemized by fisheries and participant group in order to evaluate conditions and effects. In some cases, participation is an elective lifestyle and consequentially public policy decisions should not be based wholly on economic effects.

The offered NEV measures are one estimate of only the benefits that are realized from fish resources. Policy makers would necessarily use a BCA where the costs of a given policy are subtracted from the changes in NEV benefits. An example is the use of salmon hatcheries to sustain salmon fisheries. In this case, the cost to administer and operate a hatchery program would be subtracted to the incremental NEV from the harvested fish that originated from the hatchery. BCA is an assessment of efficiency, and for policy making, it is often accompanied by

discussions about REI distributional effects (e.g., jobs created in one area and diminished in another), other social and cultural impacts, and impacts to government (i.e., effects on public services like enforcement and monitoring). Ultimately, policy making about use of fisheries resources is a political determination after weighing societal values about tradeoffs and impacts.

## Bibliography

- Davis, S. West Coast Groundfish Fishery Economic Assessment Model: Final Report for Cooperative Agreement No. NEPA-0402. Portland, PFMC. September 28, 2003.
- Hall-Arber, M., Dyer, C., Poggie, J., McNally, J., and Gagne, R. New England's Fishing Communities. Final report for Northeast MARFIN grant #NA87FF0547. 2001.
- Institute for Natural Resources. Review Of Economic Literature And Recommendations For Improving Economic Data And Analysis For Managing Columbia River Spring Chinook. Prepared for the Oregon Department of Fish and Wildlife. December 2005.
- Martin and Associates. The 2003 Economic Impacts of the Port of Seattle. January 2005.
- National Marine Fisheries Service (NMFS). Community Profiles for West Coast and North Pacific Fisheries. NOAA Technical Memorandum NFMS-NWFSC-85. November 2007.
- Natural Resource Consultants, Inc. Commercial Fishing and the State of Washington: A Contemporary Economic Overview of Local and Distant Water Commercial Fisheries. 1986.
- Natural Resource Consultants, Inc. Status of Washington Based Commercial Fisheries and the Fleets Future Utilization of Fisherman's Terminal. Prepared for Port of Seattle, Fisherman's Terminal Market Research Project. June 1999.
- Pacific Aquaculture Caucus (PACAQUA). State of Aquaculture on the West Coast: 2004 Annual Report. Proceedings from the Fisheries-Aquaculture Ideas Start Here Conference. 2004.
- The Research Group (TRG). Draft: Estimating Economic Impacts of Alaska Fisheries Using a Computable General Equilibrium Model. Prepared for the NMFS Alaska Fisheries Science Center. November 2007.
- The Research Group (TRG). Oregon's Commercial Fishing Industry, Year 2005 and 2006 Review and Year 2007 Outlook. Oregon Department of Fish and Wildlife and Oregon Coastal Zone Management Association. June 2007.
- The Research Group (TRG). Review of the West Coast Commercial Fishing Industry in 2004. Prepared for Pacific States Marine Fisheries Commission. September 2006.
- The Research Group (TRG). Tribal Salmon Fisheries Marketing Opportunities. Northwest Indian Fisheries Commission. June 2003.
- The Research Group (TRG). Description of the U.S. West Coast Commercial Fishing Fleet and Seafood Processors. Pacific States Marine Fisheries Commission. February 2000.

Seung, C.K. and E.C. Waters. A Review of Regional Economic Models for Alaska Fisheries. Alaska Fisheries Science Center Processed Report 2005-01. National Marine Fisheries Service, U.S. Department of Commerce. 2005.

Tiller Research and Chase Economics. Economic Contribution of Indian to the Economy of Washington State. Prepared for the Economic Study Planning Group for the Tribal Economic Vitality Initiative. 1998.

William Jensen Consulting. Notes on Using the "FEAM" Economic Impact Model: The Practitioner's Approach. Prepared for Steve Freese, National Marine Fisheries Service. May 1998.

## APPENDIX A

### Vessel Classification Rules<sup>1</sup>

There are many vessels listed in the sources of information used in this project that have ties to Washington, Oregon, and California. The vessel's homeport may not necessarily be in these states and the vessel may not make deliveries to these states' ports. Also there are fishing permit owners, and crew, skippers, and processor workers with residency in these states that don't own vessels. Vessel accounting information in this report when possible distinguishes whether a vessel is a U.S. West Coast fishery participant or a participant solely in offshore or distant water fisheries. It was decided that the U.S. West Coast fleet would be defined by those vessels that make at least one onshore landing in Washington, Oregon, or California. Otherwise, vessel, permit, or worker derived revenue is put into another classification. The project defined U.S. West Coast fleet vessel counts are shown in Table A.1.

For purposes of describing the U.S. West Coast fishing fleet, it is problematic to lump vessels into classes that might be descriptive of common vessel traits. Most of the more active fishing vessels harvest in more than one species group and use more than one gear type. A vessel on December 1 may be equipped and fishing for something quite different than on June 1. Some vessels participate in only single fisheries and others will move into other fisheries only when prices and abundances appear lucrative. Insight on unique vessel types and fishing capability can be shown by analyzing a vessel's landings using species and gear combinations. Vessel expenditures, physical attributes, and homeport locations can also be variables that are important in classifying vessels.

Categorization of fishing vessels into groups that have similar fishing strategies and revenue/cost streams is dependent on available data and knowledge of the fishing industry. The vessel classifications in Table A.2 is a combination of statistical analysis of available data and information available in published data or from informal surveys. The classification scheme was the result of two previous projects. The first project (William Jensen Consulting 1998) provided a starting point for classification procedures used in the second project (TRG 2000).

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1. The vessel classification scheme is more fully described in TRG (2006).

Table A.1  
Vessel Counts for U.S. West Coast Fishing Fleet in 2004

<u>Fishery</u>	<u>Washington</u>	<u>Oregon</u>	<u>California</u>	<u>Total</u>
U.S. West Coast				
Onshore	1,151	1,306	2,082	4,111
Offshore	--	--	--	25
Motherships	--	--	--	4
Catcher-processors	--	--	--	6
Catcher vessels	--	--	--	15
Alaska	2,133	362	233	2,728
U.S. West Coast landings	194	30	9	233
Other	1,939	332	224	2,495
Other Pacific Ocean waters	74	55	79	148

- Notes:
1. NA - not available.
  2. Excludes vessel identifiers "ZZ.." and "NONE."
  3. U.S. West Coast vessel counts among states are not unique vessels. The "total" counts for states are unique.
  4. The inclusion criteria for Alaska registered vessel counts with landings at U.S. West Coast states is whether at least one landing was made at a U.S. West Coast port. This excludes vessels that may have a homeport in a U.S. West Coast state, but participate exclusively in offshore or distant water fisheries.

Source: PacFIN annual vessel summary March 2005 extraction and offshore November 2005 extraction, CFEC August 2005 extraction and AKFIN May 2006 extraction, and Wayne Heikkila, Western Fishing Boat Owners Association.

Table A.2  
Vessel Classification Rules

Order	Vessel Category	Rule Description
1	Mothership/Catcher Processor	Identified by vessel documentation
2	Alaska Fisheries Vessel	Alaska revenue is greater than 50% of that vessel's total revenue
3	Pacific Whiting Onshore and Offshore Trawler	Pacific whiting PacFIN revenue plus U.S. West Coast offshore revenue is greater than 33% of that vessel's total revenue, and total revenue is greater than \$100,000
4	Large Groundfish Trawler	groundfish (including sablefish, halibut, and California halibut) revenue from other than fixed gear is greater than 33% of that vessel's total revenue, and total revenue is greater than \$100,000
5	Small Groundfish Trawler	groundfish (including sablefish, halibut, and California halibut) revenue from other than fixed gear is greater than 33% of that vessel's total revenue, and total revenue is greater than \$15,000
6	Sablefish Fixed Gear	sablefish revenue from fixed gear is greater than 33% of that vessel's total revenue, and total revenue is greater than \$15,000
7	Other Groundfish Fixed Gear	groundfish (including halibut and California halibut), other than sablefish, revenue from fixed gear is greater than 33% of that vessel's total revenue, and total revenue is greater than \$15,000
8	Pelagic Netter	pelagic species revenue is greater than 33% of that vessel's total revenue, and total revenue is greater than \$15,000
9	Migratory Netter	highly migratory species revenue from gear other than troll or line gear is greater than 33% of that vessel's total revenue, and total revenue is greater than \$15,000
10	Migratory Liner	highly migratory species revenue from troll or line gear is greater than 33% of that vessel's total revenue, and total revenue is greater than \$15,000
11	Shrimper	shrimp revenue is greater than 33% of that vessel's total revenue, and total revenue is greater than \$15,000
12	Crabber	crab revenue is greater than 33% of that vessel's total revenue, and total revenue is greater than \$15,000
13	Salmon Troller	salmon revenue from troll gear is greater than 33% of that vessel's total revenue, and total revenue is greater than \$5,000
14	Salmon Netter	salmon revenue from gill or purse seine gear is greater than 33% of that vessel's total revenue, and total revenue is greater than \$5,000
15	Other Netter	other species revenue from net gear is greater than 33% of that vessel's total revenue, and total revenue is greater than \$15,000
16	Lobster Vessel	lobster revenue is greater than 33% of that vessel's total revenue, and total revenue is greater than \$15,000
17	Diver Vessel	revenue from sea urchins, geoduck, or other species by diver gear is greater than 33% of that vessel's total revenue, and total revenue is greater than \$5,000
18	Other > \$15 Thousand	all other vessels not above who have total revenue greater than \$15,000
19	Other <= \$15 Thousand	all other vessels not above who have total revenue less than or equal to \$15,000

Source: TRG (2006).

APPENDIX B  
Mapping of PacFIN Species and Port Codes to Groups for Washington in 2006

Summary1	Table 1	Table 4	FEAM_grp	SPID	Common Name	All Onshore Landings		Commercial Fisheries	
						Pounds	Revenue	Filtered Landings	Revenue
1 Groundfish	Groundfish	Groundfish	11 Cod/Rockfish	BLK1	NOM. BLACK ROCKFISH	262	203	183	91
1 Groundfish	Groundfish	Groundfish	11 Cod/Rockfish	CNR1	NOM. CANARY ROCKFISH	9,103	4,117	2,199	994
1 Groundfish	Groundfish	Groundfish	11 Cod/Rockfish	DBR1	NOM. DARKBLOTCHED ROCKFISH	4,228	2,031	3,726	1,824
1 Groundfish	Groundfish	Groundfish	11 Cod/Rockfish	LCOD	LINGCOD	175,751	126,758	66,565	42,862
1 Groundfish	Groundfish	Groundfish	11 Cod/Rockfish	LSP1	NOM. LONGSPINE THORNYHEAD	2,180	1,293	2,180	1,292
1 Groundfish	Groundfish	Groundfish	11 Cod/Rockfish	NUSF	NOR. UNSP. SHELF ROCKFISH	30,552	13,170	14,697	6,330
1 Groundfish	Groundfish	Groundfish	11 Cod/Rockfish	NUSP	NOR. UNSP. SLOPE ROCKFISH	195,117	87,377	121,606	54,903
1 Groundfish	Groundfish	Groundfish	11 Cod/Rockfish	NUSR	NOR. UNSP. NEAR-SHORE ROCKFISH	1,463	685	726	339
1 Groundfish	Groundfish	Groundfish	11 Cod/Rockfish	PCOD	PACIFIC COD	543,735	286,620	436,034	228,468
1 Groundfish	Groundfish	Groundfish	11 Cod/Rockfish	RATF	SPOTTED RATFISH	3	10	2	7
1 Groundfish	Groundfish	Groundfish	11 Cod/Rockfish	SSP1	NOM. SHORTSPINE THORNYHEAD	106,360	77,035	58,161	44,411
1 Groundfish	Groundfish	Groundfish	11 Cod/Rockfish	UPOP	UNSP. POP GROUP	34,350	17,042	25,797	13,033
1 Groundfish	Groundfish	Groundfish	11 Cod/Rockfish	URCK	UNSP. ROCKFISH	10	13	10	13
1 Groundfish	Groundfish	Groundfish	11 Cod/Rockfish	WDW1	NOM. WIDOW ROCKFISH	98,985	40,796	55,810	21,554
1 Groundfish	Groundfish	Groundfish	11 Cod/Rockfish	YEY1	NOM. YELLOWEYE ROCKFISH	7,754	8,080	1,000	938
1 Groundfish	Groundfish	Groundfish	11 Cod/Rockfish	YTR1	NOM. YELLOWTAIL ROCKFISH	620,563	269,062	200,487	74,255
1 Groundfish	Groundfish	Groundfish	13 Black Cod	SABL	SABLEFISH	4,272,793	8,336,304	2,119,567	4,313,409
1 Groundfish	Groundfish	Groundfish	21 Sole/Flounder	ARTH	ARROWTOOTH FLOUNDER	1,213,564	132,311	774,541	92,140
1 Groundfish	Groundfish	Groundfish	21 Sole/Flounder	BSOL	BUTTER SOLE	609	201	585	193
1 Groundfish	Groundfish	Groundfish	21 Sole/Flounder	DOVR	DOVER SOLE	1,550,042	578,658	1,057,380	398,507
1 Groundfish	Groundfish	Groundfish	21 Sole/Flounder	EGLS	ENGLISH SOLE	623,745	204,766	531,078	174,070
1 Groundfish	Groundfish	Groundfish	21 Sole/Flounder	PTRL	PETRALE SOLE	647,210	661,014	588,989	599,571
1 Groundfish	Groundfish	Groundfish	21 Sole/Flounder	REX	REX SOLE	79,058	28,212	33,576	12,272
1 Groundfish	Groundfish	Groundfish	21 Sole/Flounder	RSOL	ROCK SOLE	11,200	3,673	8,671	2,906
1 Groundfish	Groundfish	Groundfish	21 Sole/Flounder	SSOL	SAND SOLE	20,417	10,287	20,377	10,266
1 Groundfish	Groundfish	Groundfish	21 Sole/Flounder	STRY	STARRY FLOUNDER	94,232	27,446	94,126	27,410
1 Groundfish	Groundfish	Groundfish	21 Sole/Flounder	UDAB	UNSP. SANDDABS	48,400	15,570	30,896	9,416
1 Groundfish	Groundfish	Groundfish	21 Sole/Flounder	UFLT	UNSP. FLATFISH	76,510	23,388	10,262	3,288
1 Groundfish	Groundfish	Groundfish	37 Sharks/Skates	DSRK	SPINY DOGFISH	1,259,622	266,115	1,079,207	234,465
1 Groundfish	Groundfish	Groundfish	37 Sharks/Skates	SSRK	SOUPFIN SHARK	1,961	490	1,757	440
1 Groundfish	Groundfish	Groundfish	37 Sharks/Skates	USKT	UNSP. SKATE	472,166	66,644	386,115	54,191
1 Groundfish	Groundfish	Other	28 Other	PLCK	WALLEYE POLLOCK	2,342	512	432	72
2 Pacific whiting	Pacific whiting	P. whiting	26 Whiting (Onshore)	PWHT	PACIFIC WHITING	133,195,303	8,018,872	51,066,719	3,274,185
3 Salmon	Salmon	Salmon	1.4 Coho	COHO	COHO SALMON	3,407,626	4,174,003	515,107	709,924
3 Salmon	Salmon	Salmon	2.5 Chinook	CHNK	CHINOOK SALMON	4,116,934	7,726,978	972,345	2,581,067
3 Salmon	Salmon	Salmon	3.7 Pink	PINK	PINK SALMON	2,004	1,593	26	10
3 Salmon	Salmon	Salmon	6.01 Chum	CHUM	CHUM SALMON	14,765,696	7,610,876	8,273,244	4,763,951
3 Salmon	Salmon	Salmon	8.01 Steelhead	STLH	STEELHEAD	364,600	478,720	0	0
3 Salmon	Salmon	Salmon	9.01 Sockeye	SOCK	SOCKEYE SALMON	4,203,010	4,995,556	1,251,656	1,499,455
4 Crab/lobster	Crab/lobster	Crab	10 Dungeness Crab	DCRB	DUNGENESS CRAB	24,662,071	43,543,751	17,106,237	29,607,125
4 Crab/lobster	Crab/lobster	Other	36 Other Crab	RCRB	ROCK CRAB	4	6	0	0
5 Shrimp	Shrimp	Other	33 Other Shrimp	BSRM	UNSP. BAIT SHRIMP	168,783	192,020	109,123	132,361
5 Shrimp	Shrimp	Other	33 Other Shrimp	OSRM	OTHER SHRIMP	313,401	1,361,350	158,984	470,671
5 Shrimp	Shrimp	Shrimp	20 Pink Shrimp	PSHP	PINK SHRIMP	6,477,017	2,105,128	4,986,709	1,591,941
6 Pelagic	Pelagic	Other	12 Squid	JMQD	UNSP. SQUID	924	231	570	143
6 Pelagic	Pelagic	Other	35 Mackerel	SJCK	JACK MACKEREL	3,861	301	3,559	278
6 Pelagic	Pelagic	Other	35 Mackerel	UMCK	UNSP. MACKEREL	90,934	13,502	51,446	7,621
6 Pelagic	Pelagic	Pelagic	22 Herring	PHRG	PACIFIC HERRING	468,446	154,105	468,442	154,104
6 Pelagic	Pelagic	Pelagic	31 Sardine	PSDN	PACIFIC SARDINE	9,618,782	448,048	7,354,425	316,878
6 Pelagic	Pelagic	Pelagic	38 Anchovy	NANC	NORTHERN ANCHOVY	355,206	37,593	355,206	37,593
8 Highly migratory	Highly migratory	Groundfish	37 Sharks/Skates	BSRK	BLUE SHARK	309	227	132	97
8 Highly migratory	Highly migratory	Groundfish	37 Sharks/Skates	TSRK	COMMON THRESHER SHARK	250	214	250	214
8 Highly migratory	Highly migratory	Migratory	14 Albacore Tuna	ALBC	ALBACORE	19,195,583	15,226,204	4,802,931	3,791,827
9 Halibut	Halibut	Halibut	24 Halibut	PHLB	PACIFIC HALIBUT	2,507,538	8,494,568	135,864	422,208
10 Sea urchins	Other	Other	19 Sea Urchin	OURC	OTHER SEA URCHINS	205,442	227,920	205,442	227,920
10 Sea urchins	Other	Other	19 Sea Urchin	RURC	RED SEA URCHIN	190,664	154,860	142,556	117,724
11 Other	Other	Groundfish	37 Sharks/Skates	OSRK	OTHER SHARK	84	51	0	0
11 Other	Other	Groundfish	37 Sharks/Skates	USRK	UNSP. SHARK	898	566	822	518
11 Other	Other	Other	28 Other	EULC	EULACHON	5,866	9,591	5,866	9,592
11 Other	Other	Other	28 Other	MISC	MISC. FISH/ANIMALS	3,733	4,372	3,417	4,291
11 Other	Other	Other	28 Other	MSC2	MISCELLANEOUS FISH	8,035	7,120	8,035	7,120
11 Other	Other	Other	28 Other	OCTP	UNSP. OCTOPUS	4,839	2,459	3,944	1,995
11 Other	Other	Other	28 Other	SCLP	UNSP. SCULPIN	16	7	0	0
11 Other	Other	Other	28 Other	UHAG	UNSPECIFIED HAGFISH	293,947	150,193	293,947	150,193
11 Other	Other	Other	39 Sturgeon	GSTG	GREEN STURGEON	6,120	4,730	179	116
11 Other	Other	Other	39 Sturgeon	WSTG	WHITE STURGEON	172,373	353,244	92,024	183,508
11 Other	Other	Other	40 Smelt	SMLT	UNSP. SMELT	108,704	55,318	108,704	55,319
11 Other	Other	Other	43 Shad	SHAD	UNSPECIFIED SHAD	84,040	48,854	60,457	35,156
11 Other	Other	Other	48 Sea Cucumber	USCU	UNSP. SEA CUCUMBERS	641,042	1,108,186	453,641	729,456
11 Other	Other	Shellfish	23 Clams and Mussels	BCLM	BUTTER CLAM	32,131	12,790	0	0
11 Other	Other	Shellfish	23 Clams and Mussels	BMSL	BLUE OR BAY MUSSEL	3,871,742	6,564,176	0	0
11 Other	Other	Shellfish	23 Clams and Mussels	CKLE	BASKET COCKLE	1,136	239	0	0
11 Other	Other	Shellfish	23 Clams and Mussels	GDUK	GEODUCK	6,854,091	24,343,269	2,472,598	7,957,798
11 Other	Other	Shellfish	23 Clams and Mussels	HCLM	HORSE CLAMS	5,495	3,289	5	11
11 Other	Other	Shellfish	23 Clams and Mussels	LCLM	NATIVE LITTLENECK	94,834	98,458	0	0
11 Other	Other	Shellfish	23 Clams and Mussels	MACL	MUD CLAMS	13	3	0	0
11 Other	Other	Shellfish	23 Clams and Mussels	MCLM	MANILA CLAM	13,285,308	30,818,615	1,025	2,255
11 Other	Other	Shellfish	23 Clams and Mussels	RCLM	RAZOR CLAM	134,661	201,527	134,661	201,529
11 Other	Other	Shellfish	23 Clams and Mussels	SCLM	SOFT-SHELLED CLAM	864,460	331,347	0	0
11 Other	Other	Shellfish	47 Oyster	ESTR	EASTERN OYSTER	33,111	159,562	0	0
11 Other	Other	Shellfish	47 Oyster	EURO	EUROPEAN OYSTER	13,533	251,491	0	0
11 Other	Other	Shellfish	47 Oyster	KSTR	KUMAMOTO OYSTER	106,497	1,826,015	0	0
11 Other	Other	Shellfish	47 Oyster	LSTR	OLYMPIA OYSTER	19,943	985,336	0	0
11 Other	Other	Shellfish	47 Oyster	PSTR	PACIFIC OYSTER	12,132,483	35,079,494	9,636	47,057
Total						275,297,810	218,676,633	109,336,676	65,517,141

Notes: 1. Filters are non-EEZ, aquaculture, Oregon Coast catch area, offshore, tribal.  
2. Geoduck revenue of \$6,691,304 for filtered landings was adjusted using the State fish ticket price.  
Source: PacFIN fish ticket data and annual vessel summary, November 2008 extraction.

APPENDIX B (cont.)

Port Group	Port	PCID	All Onshore Landings		Commercial Fisheries Filtered Landings	
			Pounds	Revenue	Pounds	Revenue
Coastal Washington North	LA PUSH	LAP	1,725,566	2,996,092	722,638	1,309,059
Coastal Washington North	NEAH BAY	NEA	5,562,342	6,608,180	1,555,306	1,703,575
Coastal Washington North	PORT ANGELES	PAG	215,180	419,493	53,543	90,861
Coastal Washington North	PORT TOWNSEND	TNS	1,710,765	2,804,091	943,710	950,439
Coastal Washington North	SEQUIM	SEQ	628,673	1,439,434	383,501	415,763
Coastal Washington South and Central	GRAYS HARBOR	GRH	276,533	450,457	273,608	445,896
Coastal Washington South and Central	ILWACO/CHINOOK	LWC	40,514,070	19,115,732	14,425,612	6,739,017
Coastal Washington South and Central	OTHER COLUMBIA RIVER PORTS	OCR	1,447,019	2,373,483	594,833	1,167,516
Coastal Washington South and Central	WESTPORT	WPT	140,955,144	26,646,791	64,811,431	19,055,626
Coastal Washington South and Central	WILLAPA BAY	WLB	2,780,338	4,235,838	2,763,973	4,217,253
Northern Puget Sound	ANACORTES	ANA	2,911,903	5,496,826	1,912,695	3,664,232
Northern Puget Sound	BELLINGHAM BAY	BLL	17,621,163	24,765,514	9,654,720	9,950,162
Northern Puget Sound	BLAINE	BLN	4,161,776	6,006,478	2,889,535	3,579,467
Northern Puget Sound	FRIDAY HARBOR	FRI	164,040	199,728	124,028	135,372
Northern Puget Sound	LA CONNER	LAC	3,105,125	2,686,584	961,408	666,116
Northern Puget Sound	OTHER NORTH PUGET SOUND PORTS	ONP	221,676	273,053	58,407	104,847
Southern Puget Sound	EVERETT	EVR	2,213,558	1,960,298	1,306,348	1,038,795
Southern Puget Sound	OLYMPIA	OLY	1,699,869	3,352,313	545,069	1,308,668
Southern Puget Sound	OTHER SOUTH PUGET SOUND PORTS	OSP	742,433	2,558,359	131,082	193,747
Southern Puget Sound	SEATTLE	SEA	6,838,976	9,321,248	3,957,592	5,226,302
Southern Puget Sound	SHELTON	SHL	3,087,848	4,800,300	97,930	91,140
Southern Puget Sound	TACOMA	TAC	2,068,817	3,011,829	1,144,660	2,157,236
Unidentified Washington	OTHER OR UNKNOWN WASHINGTON PORTS	OWA	5,965	4,599	0	0
Unidentified Washington	OTHER WASHINGTON COASTAL PORTS	OWC	2,932,375	5,055,397	25,047	39,558
Total			243,591,154	136,582,117	109,336,676	64,250,647

- Notes:
1. Filters are non-EEZ, aquaculture, Oregon Coast catch area, offshore, tribal.
  2. The geoduck value is not corrected for the State price.
  3. Aquaculture is excluded from all onshore landings.

Source: PacFIN annual vessel summary, November 2008 extraction.