

# DESCRIPTION OF THE U.S. WEST COAST COMMERCIAL FISHING FLEET AND SEAFOOD PROCESSORS

prepared by

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The authors' interpretations and conclusions should prove valuable for the project's purposes, but no absolute assurances can be given that the described results will be realized. Government legislation and policies, market circumstances, and other situations can affect the basis of assumptions in unpredictable ways and lead to unanticipated changes. The methodologies used to determine estimates were adopted with the understanding that technically sound and defensible approaches would be used. Where judgment was necessary, conservative interpretation was employed. Because this philosophy was strictly adhered to in all aspects of the report, the authors represent that the descriptions presented herein are reasonable.

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

Hans D. Radtke Shannon W. Davis

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### EXECUTIVE SUMMARY

The fishing fleet making landings at ports in the states of Washington, Oregon, and California has changed dramatically in recent years due to changes in fish resource levels, fishery management plan amendments, and market forces. Vessels have had to switch to other than their primary fisheries, and many times several different fisheries, to sustain revenue levels. Many vessel owners have simply elected to quit commercial fishing. This project is to describe the trends and characteristics of the U.S. West Coast fishing fleet and processors to show how numbers, revenues, and participation in fisheries has changed. A special analysis was completed to find descriptive vessel and processor categories. The classification scheme used 1997 landing data to determine the vessel and processor categories.

#### Information Sources

There is no single source of information for all of the fisheries in which the U.S. West Coast fleet may participate. Four different sources, including anecdotal information, were used to track revenues for this project (Table E1).

#### Definition of the U.S. West Coast Fishing Fleet and Processors

There are many vessels listed in the sources of information used in this project that have ties to U.S. West Coast states, as defined by owners and crews with residency in U.S. West Coast states and the vessel may not make deliveries to U.S. West Coast ports. It was decided that the U.S. West Coast fleet would be defined by only those vessels that make at least one landing in U.S. West Coast states. If they did make one landing, then all revenues received by that vessel would be included in the analysis. This definition may undercount vessels in some ports that have a high proportion of vessels that participate solely in distant water fisheries.

The U.S. West Coast fishing industry is also made up of businesses and industries that process and distribute finfish and shellfish products and the businesses and industries that furnish supplies and services to them. While some smaller fishing, processing, and marketing firms may deal with a single species or species group, the majority of the U.S. West Coast seafood production comes from firms involved in a variety of species and products. This industry is diverse and complex, and many of the businesses along the U.S. West Coast are also involved in Alaska and foreign fisheries as well. A seafood processor was included in the analysis if at least one purchase from a harvester was made at a U.S. West Coast port. There are other businesses that produce secondary seafood products (such as breaded products) and use raw products from non-U.S. West Coast landings that are not included in project investigations.

#### Table E1 Data Sources

Fishery	Data Source	Status
Washington, Oregon, and	PSMFC PacFIN Program	Vessel specific landing information
California onshore fisheries		
Alaska onshore fisheries	CFEC and anecdotal	Summary landings by species and
		gear, and vessel specific lists
U.S. West Coast and Alaska	PSMFC AKFIN Program	Vessel specific landing information
offshore fisheries	and NMFS Blend File	
Other Pacific Ocean waters	Anecdotal	Expert estimate

Notes: 1. CFEC - Alaska Commercial Fisheries Entry Commission PSMFC - Pacific States Marine Fisheries Commission NMFS - National Marine Fisheries Service AKFIN - Alaska Fisheries Information Network PacFIN - Pacific Fisheries Information Network USCG - U.S. Coast Guard

Source: Study.

#### Annual Fishing Cycle

There is a seasonal pattern to U.S. West Coast fisheries. However, not every active vessel participates in all fisheries in this cycle. Below is a description of the cycle and following sections discuss the counts and characteristics of vessels that do participate in the different fisheries.

Different species are available at different times of the year, and general fishing, processing, and marketing patterns have developed over time. It is more appropriate to view the fishing year as a pattern of activities rather than in terms of individual species seasons. Individual species, when viewed in isolation, may not appear important, but these often affect the harvesting, processing, and marketing of other species and the fishing industry as a whole. Fishing vessels as well as crew members move from one fishery to another, depending on seasons and alternatives available. Offshore and Alaska fisheries are important for the total fish harvesting/processing industries in coastal communities. During the year, some crew members and fishing vessels will travel to Alaska to fish for salmon, halibut, sablefish, shellfish, and groundfish. The Pacific whiting fishery has been an integral part of the annual fishing cycle, and revenues generated in that fishery were an important part of the total revenues of a large segment of the trawl fleet and support industries.

The U.S. West Coast annual fishing cycle begins with the Dungeness crab fishery, which typically has its highest landings from December into March. The Puget Sound Dungeness crab fishery begins in October. The larger vessels involved in this fishery may move south to the Crescent City, California fishing grounds in early December for two weeks and the north to Alaska. Groundfish fishing, often greatly restricted at year's end, begins to pick up early in the year, especially the trawl fishery for widow rockfish ("brownies") and other species. Widow rockfish is taken to a large extent with midwater (pelagic) trawls, the same gear used in the whiting fishery. Only vessels with more powerful engines and winches can operate this gear. As

crabbing declines and weather along the northern coast improves, fishing activity for on-bottom groundfish species increases. Pink shrimp fishing generally begins in April and continues in earnest through July, dropping off somewhat in August and September. The pelagic fishery depends on timing of the runs. Purse seiners may be harvesting squid, sardines, and mackerel off California in April. Many other California fisheries will peak in the winter months when weather and harvest conditions are favorable. The whiting fishery begins in April and traditionally continues into or through the summer; the off-shore factory trawler harvests peak in late spring while the shoreside harvest continues during the summer. This sequence may be changing as the offshore whiting fishery develops its "co-op" concept. In this strategy, the available resource is divided among participating boats, therefore reducing the need to harvest the resource as quickly as possible. Groundfish trawl landings accelerate in April and May, especially in years of poor shrimp fishing. Small hook and line boats provide a steady flow of product throughout the year. The larger nontrawl (longline and pot) sablefish (black cod) fishery begins in May; sablefish is an important species for both trawl and nontrawl gears during spring and summer. Trawl landings continue through the summer, but the nontrawl black cod season has ended earlier each of the past several years due to quota attainment. Salmon trolling starts in May and peaks in June and July. In the Puget Sound, Washington areas, net boats harvest much of the Fraser River origin sockeye and pink salmon in July and August as well as some chinook and coho salmon in the fall. The salmon gill net season peaks later in the fall. Small diving boats harvest species such as sea urchins and sea cucumbers through most of the year. Larger seine boats as well as "bait boats" will harvest a variety of tuna species. Some of these landings will be made in California. Other landings will be delivered to islands such as Guam for canning. Near-shore ocean water temperatures dictate the size of the fleet that shifts to albacore tuna fishing. If warmer temperatures are closer, then a growing number of vessels displaced by closed access fisheries and declining fish resources start fishing in June and July and continue to the first major storms in October when the fish migrate farther offshore. A few vessels from U.S. West Coast ports spend the winter in the south Pacific fishing for tuna. Local processors buy tuna, although there is an increasing trend toward direct sales and loined sales. Most albacore tuna is frozen and shipped to southern California and/or Guam to be canned, although a small "home canning" industry is developing in some U.S. West Coast ports. In September many of the fisheries directed at specific species begin to taper off. The nontrawl sablefish fishery is over (except for limited incidental catches), shrimp catches decline, and most salmon fishing is completed. Much of the groundfish harvest remains steady; however, the harvest of widow rockfish generally increased after the whiting fishery closes. October, November, and December are usually the slowest months in the fish harvesting and processing industries. Although there are exceptions, such as swordfish fishing which peaks later in the year, one key factor in the groundfish fishery is the status of quotas for species managed by trip limits (such as widow rockfish, yellowtail rockfish, and sablefish). Earlier landing rates determine how much remains to be harvested during this period, and trip limits are often more restrictive late in the year to prevent premature closures.

#### **Distant Water Fisheries**

The U.S. West Coast based fishing fleet also lands fish in other parts of the Pacific Ocean. These landings are an integral part of the U.S. West Coast fishing industry. There are several distinct components of this distant water fishery. Perhaps the oldest component is the gillnet salmon fishery in Bristol Bay and Cooks Inlet in Alaska waters. The Alaskan vessels are stored in Alaskan ports, usually under a contract with a processor. Some of these gillnetters also participate in the Grays Harbor, Washington gillnet fishery as well as the Columbia River gillnet fishery. The second component is the longline and pot fleet that fishes for crab and groundfish. This segment had its start from the old "halibut schooners" that sent salted and iced fish to eastern U.S. markets. Many of these vessels also do some fishing off the Pacific Northwest Coast and tend to homeport their vessels in Astoria, Oregon and Bellingham, Washington. The Magnuson Act of 1976 created an opportunity for midwater trawlers (the third component) to fish for pollock in Alaska and Pacific whiting off the Pacific Northwest. The earlier ventures included foreign "motherships" that received their catch in the open ocean. Many of these vessels are now bringing their catch onshore in Alaska or U.S. West Coast states. The major homeports for these trawlers is Newport, Oregon or at marinas in Puget Sound, Washington.

During the 1970's and 1980's, increasing salmon supplies and prices also attracted new American immigrants to the salmon fisheries in lower Alaska. This component consists of a large number of "Russian Old Believers" from all over the world who settled near Woodburn, Oregon. Many of them now fish in Alaska waters with purse seines for salmon and long line for halibut in Alaska based combination vessels. The last component is the tuna boats that fish in waters off the Pacific Northwest and the western Pacific. Some of their albacore catch is landed in iced or frozen form in U.S. West Coast coastal communities. However, sometimes they will offload at sea for deliveries to American Samoa or Hawaii in the southern Pacific Ocean. The large purse seiners may deliver their catch of skipjacks and yellowfin tuna to island canners or bring a portion to southern California ports.

In recent years, there have been over 500 vessels with ownership ties to U.S. West Coast states that made landings in other U.S. West Coast states, Alaska, or other Pacific locations. Of these, the number that also made deliveries in U.S. West Coast states in 1996 is 64 at U.S. West Coast ports; 11 delivered to Alaska motherships or acted as catcher-processors, 15 delivered to motherships and acted as catcher-processors off the U.S. West Coast, and 148 delivered elsewhere in Hawaii and other western Pacific Ocean nations. Distant water fisheries provide a significant source of revenue for some vessels and definitions were needed to categorize the vessels that deliver in U.S. West Coast states, but whose revenue is mostly from elsewhere. If a vessel's distant water fisheries revenues were greater than 50 percent of its total revenues, then it is treated in a special category for vessel classification purposes.

### Fishing Fleet Trends and Characteristics

The aggregate number of vessels landing at U.S. West Coast ports has decreased almost 63 percent since 1981. Figure E1 and Figure E2 show how participation has decreased by species and gear types, respectively. The number of salmon troll vessels declined dramatically since 1981 and there is a large drop in the count of vessels delivering in the El Niño year of 1984. The large drop in revenue derived from net gear during the 1980's is from both salmon and tuna fisheries using gillnets, set nets, and purse seines.

Figure E1 Vessel Counts and Revenues by Species Group for Vessels Landing at U.S. West Coast Ports in 1981-1997



Notes: 1. Vessel total counts are not for unique vessels because vessels land within more than one species group. Counts and revenues exclude vessels with identifier codes "ZZ..." or "NONE."

- 2. Total revenue does not include deliveries to offshore processors or revenues from distant water fisheries.
- 3. Revenue in millions adjusted for inflation using the GDP Implicit Price Deflator, 1997=100.

Source: Annual vessel summary information extracted from PacFIN in September 1998.

Figure E2 Vessel Counts and Revenues by Gear Groups for Vessels Landing at U.S. West Coast Ports in 1981-1997



Notes: 1. Vessel total counts are not for unique vessels because vessels use more than one gear group. Counts and revenues exclude vessels with identifier codes "ZZ..." or "NONE."

2. Total revenue does not include deliveries to offshore processors or revenues from distant water fisheries.

3. Revenue in millions adjusted for inflation using the GDP Implicit Price Deflator, 1997=100.

Source: Annual vessel summary information extracted from PacFIN in September 1998.

Revenues are not evenly distributed among vessels (Figure E3). In 1997, 74 percent of the vessels landed 15 percent of the total ex-vessel value. The average per vessel revenues for the other 26 percent that land 85 percent of the value is \$172,373, while the average for the rest of the fleet is \$11,134. This characteristic is not unique to 1997; the distribution has been about the same following the El Niño years of 1983-1984. Prior to those years, landings were spread somewhat more evenly among vessel revenue categories.

The multi-species fisheries participation by the U.S. West Coast fleet for higher volume vessels is also shown in Table E2. The percentage of vessels fishing with one gear group is 82 percent for vessels landing between \$500 and \$5,000 total revenue and 46 percent for vessels landing greater than \$50,000. Predictably, the higher volume vessels land a much greater share by trawl gear (32 percent) than the low volume vessels (two percent).

Vessel participation among fisheries has been discussed in previous sections, especially for vessels in the higher total revenue categories. However, vessel participation within a single fishery will vary over the years. Vessels fishing shrimp (29 percent), crab/lobster (38 percent), and sea urchins (34 percent) tend to stay in the fisheries each year. Vessels participating in the other fisheries shown on Figure E4 will exit and enter fisheries at a higher rate. Reductions in open access fisheries through limited entry and area licensing management schemes will undoubtedly reduce the mobility rate even further in the future.

## Vessel Classifications

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. As previously described, 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.

Table E2 shows the revenue distribution by species and gear groups in 1997. The analytical problem is to determine thresholds and limits on species and gear combinations that generate unique vessel types. Several analytical approaches were used to find unique vessel categories, based on a vessel's specialization in species and gear revenue groupings and total revenue volume. Table E3 shows the count of U.S. West Coast vessels that fall within categories for 33 percent, 50 percent, and 90 percent specialization levels. Figure E5 is an example scattergram to show where vessels landing groundfish are clustered according to the three revenue specialization.

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

Figure E3 Revenue by Species Group for Revenue Categories in 1997



Notes: 1. Sum of revenue in thousands of 1997 dollars.

- 2. Excludes vessels identified as "NONE" or "ZZ..."
- 3. Length mean excludes 0 length vessels. Where a vessel has more than one reported length, the smallest non-zero assignment is used.
- 4. Revenue excludes offshore and distant water fisheries sources.
- Source: PacFIN March 1999 extraction and Study.

# Table E2 Vessel Counts and Characteristics by Species and Gear Groups for Revenue Categories in 1997

All Ve	ssel Volume Categories				Hook and line	Net	Other	Pot	Trawl	Troll	All gears	Percent
	Vessel count: (5,705 + 26 with le	ngth 0)	5,731	1 Groundfish	6.48%	0.12%	0.00%	0.94%	16.59%	0.15%	\$74,564	24%
	Per vessel mean landings (reven	ue)	\$53,579	2 Pacific whiting	0.00%	0.00%			2.72%		\$8,356	3%
	Per vessel std. dev. landings (rev	enue)	\$117,389	3 Salmon	0.01%	2.00%		0.00%	0.00%	3.21%	\$16,038	5%
	Vessel mean length (excluding 0	length)	37 ft.	4 Crab/lobster	0.00%	0.01%	0.00%	20.83%	0.00%	0.00%	\$63,995	21%
	Vessel std. dev. length (excluding	0 length)	23 ft.	5 Shrimp		0.26%	0.06%	0.63%	6.72%		\$23,525	8%
	Multi-gear profile (vessels):	1 gear	65%	6 Coastal pelagic	0.04%	9.67%	0.00%	0.00%	0.01%	0.00%	\$29,849	10%
		2 gears	24%	7 Other pelagic	0.00%	4.40%	0.71%		0.03%	0.00%	\$15,785	5%
		3 gears	9%	8 Highly migratory	1.02%	4.22%	0.28%	0.00%	1.33%	5.82%	\$38,910	13%
		4+ gears	2%	9 Halibut	3.28%				0.00%	0.02%	\$10,112	3%
				10 Sea urchins		0.22%	5.04%				\$16,124	5%
				11 Other	0.26%	0.87%	1.14%	0.25%	0.66%	0.00%	\$9,806	3%
				All species	\$34,046	\$66,829	\$22,186	\$69,560	\$86,201	\$28,240	\$307,063	100%
				Percent	11%	22%	7%	23%	28%	9%	100%	
<\$500					Hook and line	Net	Other	Pot	Trawl	Troll	All gears	Percent
	Vessel count: (616 + 3 with lengt	h 0)	619	1 Groundfish	23.58%		0.01%	1.32%	0.27%	0.31%	\$32	25%
	Per vessel mean landings (reven	ue)	\$203	2 Pacific whiting							\$0	0%
	Per vessel std. dev. landings (rev	enue)	\$139	3 Salmon	0.43%	23.95%				20.46%	\$56	45%
	Vessel mean length (excluding 0	length)	28 ft.	4 Crab/lobster				6.62%			\$8	7%
	Vessel std. dev. length (excluding	0 length)	17 ft.	5 Shrimp		0.35%	0.18%	0.18%	0.28%		\$1	1%
	Multi-gear profile (vessels):	1 gear	95%	6 Coastal pelagic	0.04%	0.48%			0.04%		\$1	1%
		2 gears	4%	7 Other pelagic	0.01%	0.43%					\$1	0%
		3 gears	0%	8 Highly migratory	3.14%	0.12%	0.11%		0.51%	3.23%	\$9	7%
		4+ gears		9 Halibut	0.11%					0.03%	\$0	0%
				10 Sea urchins		0.12%	1.18%				\$2	1%
				11 Other	7.66%	3.08%	0.24%	1.07%	0.46%		\$16	13%
				All species	\$44	\$36	\$2	\$12	\$2	\$30	\$125	100%
				Percent	35%	29%	2%	9%	2%	24%	100%	
\$500 -	\$4,999.99				Hook and line	Net	Other	Pot	Trawl	Troll	All gears	Percent
	Vessel count: (1,431 + 8 with leng	gth 0)	1,439	1 Groundfish	16.00%	0.19%	0.02%	1.23%	0.63%	0.32%	\$582	18%
	Per vessel mean landings (reven	ue)	\$2,200	2 Pacific whiting							\$0	0%
	Per vessel std. dev. landings (rev	enue)	\$1,283	3 Salmon	0.29%	25.68%				20.52%	\$1,471	46%
	Vessel mean length (excluding 0	length)	29 ft.	4 Crab/lobster	0.00%		0.04%	10.57%	0.00%		\$336	11%
	Vessel std. dev. length (excluding	0 length)	16 ft.	5 Shrimp		0.07%	0.03%	0.20%			\$10	0%
	Multi-gear profile (vessels):	1 gear	82%	6 Coastal pelagic	0.25%	0.82%	0.00%			0.00%	\$34	1%
		2 gears	15%	7 Other pelagic	0.01%	1.20%				0.01%	\$39	1%
		3 gears	3%	8 Highly migratory	0.98%		0.20%		0.44%	5.09%	\$213	7%
		4+ gears	0%	9 Halibut	0.15%					0.10%	\$8	0%
				10 Sea urchins		0.75%	2.45%				\$101	3%
				11 Other	4.77%	5.96%	0.27%	0.17%	0.52%	0.07%	\$372	12%
				All species	\$711	\$1,097	\$95	\$385	\$51	\$827	\$3,165	100%

100%

26%

Percent

22%

35%

3%

12%

2%

#### Table E2 (continued)

\$5,000	- \$49,999.99				Hook and line	Net	Other	Pot	Trawl	Troll	All gears	Percent
	Vessel count: (2,153 + 11 with le	ngth 0)	2,164	1 Groundfish	11.06%	0.32%	0.01%	0.95%	0.89%	0.40%	\$5,953	14%
	Per vessel mean landings (revenu	le)	\$20,176	2 Pacific whiting	0.00%	0.00%			0.32%		\$141	0%
	Per vessel std. dev. landings (rev	enue)	\$12,766	3 Salmon	0.04%	8.39%		0.00%	0.00%	14.10%	\$9,838	23%
	Vessel mean length (excluding 0	length)	35 ft.	4 Crab/lobster	0.00%	0.01%	0.01%	28.10%	0.01%		\$12,280	28%
	Vessel std. dev. length (excluding	0 length)	16 ft.	5 Shrimp		0.05%	0.22%	1.02%	1.37%		\$1,159	3%
	Multi-gear profile (vessels):	1 gear	59%	6 Coastal pelagic	0.24%	0.98%	0.00%	0.00%	0.01%	0.00%	\$538	1%
		2 gears	29%	7 Other pelagic	0.00%	2.75%	0.08%		0.07%	0.00%	\$1,268	3%
		3 gears	11%	8 Highly migratory	0.49%	0.15%	0.61%		1.30%	9.27%	\$5,154	12%
		4+ gears	2%	9 Halibut	0.92%					0.08%	\$435	1%
				10 Sea urchins		1.08%	7.32%				\$3,670	8%
				11 Other	1.10%	3.34%	1.12%	0.64%	1.17%	0.02%	\$3,224	7%
				All species	\$6,046	\$7,448	\$4,088	\$13,411	\$2,245	\$10,422	\$43,662	100%
				Percent	14%	17%	9%	31%	5%	24%	100%	
\$50,00	0 +				Hook and line	Net	Other	Pot	Trawl	Troll	All gears	Percent
	Vessel count: (1,505 + 4 with leng	gth 0)	1,509	1 Groundfish	5.59%	0.09%	0.00%	0.93%	19.43%	0.11%	\$67,997	26%
	Per vessel meen landings (revenue)					0.0070						
	Per vessei mean landings (revenu	le)	\$172,373	2 Pacific whiting	0.00%	0.007			3.16%		\$8,214	3%
	Per vessel std. dev. landings (reven	ue) enue)	\$172,373 \$180,871	2 Pacific whiting 3 Salmon	0.00% 0.00%	0.63%		0.00%	3.16% 0.00%	1.16%	\$8,214 \$4,672	3% 2%
	Per vessel mean landings (revenue) Per vessel std. dev. landings (rev Vessel mean length (excluding 0	ue) enue) length)	\$172,373 \$180,871 52 ft.	2 Pacific whiting 3 Salmon 4 Crab/lobster	0.00% 0.00% 0.00%	0.63%	0.00%	0.00% 19.74%	3.16% 0.00% 0.00%	1.16% 0.00%	\$8,214 \$4,672 \$51,371	3% 2% 20%
	Per vessel mean landings (revent Per vessel std. dev. landings (revent Vessel mean length (excluding 0 Vessel std. dev. length (excluding	ue) enue) length) 0 length)	\$172,373 \$180,871 52 ft. 31 ft.	2 Pacific whiting 3 Salmon 4 Crab/lobster 5 Shrimp	0.00% 0.00% 0.00%	0.63% 0.00% 0.29%	0.00%	0.00% 19.74% 0.57%	3.16% 0.00% 0.00% 7.70%	1.16% 0.00%	\$8,214 \$4,672 \$51,371 \$22,355	3% 2% 20% 9%
	Per vessel mean landings (revent Per vessel std. dev. landings (revent Vessel mean length (excluding 0 Vessel std. dev. length (excluding Multi-gear profile (vessels):	ue) enue) length) 0 length) 1 gear	\$172,373 \$180,871 52 ft. 31 ft. 46%	2 Pacific whiting 3 Salmon 4 Crab/lobster 5 Shrimp 6 Coastal pelagic	0.00% 0.00% 0.00%	0.63% 0.00% 0.29% 11.24%	0.00% 0.03% 0.00%	0.00% 19.74% 0.57% 0.00%	3.16% 0.00% 0.00% 7.70% 0.01%	1.16% 0.00% 0.00%	\$8,214 \$4,672 \$51,371 \$22,355 \$29,276	3% 2% 20% 9% 11%
	Per vessel mean landings (revent Per vessel std. dev. landings (rev Vessel mean length (excluding 0 Vessel std. dev. length (excluding Multi-gear profile (vessels):	ue) enue) length) 0 length) 1 gear 2 gears	\$172,373 \$180,871 52 ft. 31 ft. 46% 33%	2 Pacific whiting 3 Salmon 4 Crab/lobster 5 Shrimp 6 Coastal pelagic 7 Other pelagic	0.00% 0.00% 0.00% 0.00%	0.63% 0.00% 0.29% 11.24% 4.72%	0.00% 0.03% 0.00% 0.82%	0.00% 19.74% 0.57% 0.00%	3.16% 0.00% 0.00% 7.70% 0.01% 0.03%	1.16% 0.00% 0.00% 0.00%	\$8,214 \$4,672 \$51,371 \$22,355 \$29,276 \$14,477	3% 2% 20% 9% 11% 6%
	Per vessel mean landings (revent Per vessel std. dev. landings (rev Vessel mean length (excluding 0 Vessel std. dev. length (excluding Multi-gear profile (vessels):	ue) enue) length) 0 length) 1 gear 2 gears 3 gears	\$172,373 \$180,871 52 ft. 31 ft. 46% 33% 16%	2 Pacific whiting 3 Salmon 4 Crab/lobster 5 Shrimp 6 Coastal pelagic 7 Other pelagic 8 Highly migratory	0.00% 0.00% 0.00% 0.00% 0.00% 1.11%	0.63% 0.00% 0.29% 11.24% 4.72% 4.96%	0.00% 0.03% 0.00% 0.82% 0.22%	0.00% 19.74% 0.57% 0.00%	3.16% 0.00% 0.00% 7.70% 0.01% 0.03% 1.35%	1.16% 0.00% 0.00% 0.00% 5.25%	\$8,214 \$4,672 \$51,371 \$22,355 \$29,276 \$14,477 \$33,534	3% 2% 20% 9% 11% 6% 13%
	Per vessel mean landings (revenue Per vessel std. dev. landings (revenue Vessel mean length (excluding 0 Vessel std. dev. length (excluding Multi-gear profile (vessels):	ue) enue) length) 0 length) 1 gear 2 gears 3 gears 4+ gears	\$172,373 \$180,871 52 ft. 31 ft. 46% 33% 16% 5%	<ol> <li>Pacific whiting</li> <li>Salmon</li> <li>Crab/lobster</li> <li>Shrimp</li> <li>Coastal pelagic</li> <li>Other pelagic</li> <li>Highly migratory</li> <li>Halibut</li> </ol>	0.00% 0.00% 0.00% 0.00% 1.11% 3.71%	0.63% 0.00% 0.29% 11.24% 4.72% 4.96%	0.00% 0.03% 0.00% 0.82% 0.22%	0.00% 19.74% 0.57% 0.00%	3.16% 0.00% 7.70% 0.01% 0.03% 1.35% 0.00%	1.16% 0.00% 0.00% 0.00% 5.25% 0.00%	\$8,214 \$4,672 \$51,371 \$22,355 \$29,276 \$14,477 \$33,534 \$9,669	3% 2% 20% 9% 11% 6% 13% 4%
	Per vessel mean landings (revenue Per vessel std. dev. landings (revenue Vessel mean length (excluding 0 Vessel std. dev. length (excluding Multi-gear profile (vessels):	ue) enue) length) 0 length) 1 gear 2 gears 3 gears 4+ gears	\$172,373 \$180,871 52 ft. 31 ft. 46% 33% 16% 5%	<ol> <li>Pacific whiting</li> <li>Salmon</li> <li>Crab/lobster</li> <li>Shrimp</li> <li>Coastal pelagic</li> <li>Other pelagic</li> <li>Highly migratory</li> <li>Halibut</li> <li>Sea urchins</li> </ol>	0.00% 0.00% 0.00% 0.00% 1.11% 3.71%	0.63% 0.00% 0.29% 11.24% 4.72% 4.96%	0.00% 0.03% 0.00% 0.82% 0.22% 4.69%	0.00% 19.74% 0.57% 0.00%	3.16% 0.00% 7.70% 0.01% 0.03% 1.35% 0.00%	1.16% 0.00% 0.00% 5.25% 0.00%	\$8,214 \$4,672 \$51,371 \$22,355 \$29,276 \$14,477 \$33,534 \$9,669 \$12,351	3% 2% 20% 9% 11% 6% 13% 4% 5%
	Per vessel mean landings (revenu Per vessel std. dev. landings (revenu Vessel mean length (excluding 0 Vessel std. dev. length (excluding Multi-gear profile (vessels):	ue) enue) length) 0 length) 1 gear 2 gears 3 gears 4+ gears	\$172,373 \$180,871 52 ft. 31 ft. 46% 33% 16% 5%	<ul> <li>2 Pacific whiting</li> <li>3 Salmon</li> <li>4 Crab/lobster</li> <li>5 Shrimp</li> <li>6 Coastal pelagic</li> <li>7 Other pelagic</li> <li>8 Highly migratory</li> <li>9 Halibut</li> <li>10 Sea urchins</li> <li>11 Other</li> </ul>	0.00% 0.00% 0.00% 0.00% 1.11% 3.71% 0.06%	0.63% 0.00% 0.29% 11.24% 4.72% 4.96% 0.06% 0.39%	0.00% 0.03% 0.00% 0.82% 0.22% 4.69% 1.16%	0.00% 19.74% 0.57% 0.00% 0.00%	3.16% 0.00% 7.70% 0.01% 0.03% 1.35% 0.00%	1.16% 0.00% 0.00% 5.25% 0.00%	\$8,214 \$4,672 \$51,371 \$22,355 \$29,276 \$14,477 \$33,534 \$9,669 \$12,351 \$6,194	3% 2% 20% 9% 11% 6% 13% 4% 5% 2%
	Per vessel mean landings (revenu Per vessel std. dev. landings (revenu Vessel mean length (excluding 0 Vessel std. dev. length (excluding Multi-gear profile (vessels):	ue) enue) length) 0 length) 1 gear 2 gears 3 gears 4+ gears	\$172,373 \$180,871 52 ft. 31 ft. 46% 33% 16% 5%	<ul> <li>2 Pacific whiting</li> <li>3 Salmon</li> <li>4 Crab/lobster</li> <li>5 Shrimp</li> <li>6 Coastal pelagic</li> <li>7 Other pelagic</li> <li>8 Highly migratory</li> <li>9 Halibut</li> <li>10 Sea urchins</li> <li>11 Other All species</li> </ul>	0.00% 0.00% 0.00% 0.00% 1.11% 3.71% 0.06% \$27,245	0.63% 0.00% 0.29% 11.24% 4.72% 4.96% 0.06% 0.39% \$58,248	0.00% 0.03% 0.82% 0.22% 4.69% 1.16% \$18,001	0.00% 19.74% 0.57% 0.00% 0.00% 0.19% \$55,752	3.16% 0.00% 7.70% 0.01% 0.03% 1.35% 0.00% 0.58% \$83,903	1.16% 0.00% 0.00% 5.25% 0.00% 0.00% \$16,961	\$8,214 \$4,672 \$51,371 \$22,355 \$29,276 \$14,477 \$33,534 \$9,669 \$12,351 \$6,194 \$260,111	3% 2% 20% 9% 11% 6% 13% 4% 5% 2% 100%

Notes: 1. Revenue in thousands of 1997 dollars.

2. Excludes vessel identification codes "NONE" and "ZZ..."

3. Length mean excludes 0 length vessels. Where a vessel has more than one assigned length, the smallest non-zero assignment is used.

4. Revenue excludes offshore and distant water fisheries sources.

Source: PacFIN March 1999 extraction.

Figure E4 Vessel Participation by Fishery During Period 1993-1997



- Notes: 1. Includes U.S. West Coast vessels, excludes vessels with identifier "NONE" or "ZZ...", includes only vessels with species revenue >\$500.
  - 2. Vessels are tracked over years by their plate numbers. If a vessel is re-documented and continues participation in the same fishery, then its previous experience is omitted. Only vessels that make deliveries in each year are included in the analysis.
  - 3. Revenue excludes offshore and distant water fisheries sources.

Source: PacFIN September 1998 extraction.

classifications in Table E4 are a combination of statistical analysis of available data and information available in published data or from informal surveys.

The results from a previous project by the authors (William Jensen Consulting 1998) provided a starting point for classification procedures. In 1983 the West Coast Fisheries Development Foundation (through S-K funding) developed the Fisheries Economic Assessment Model (FEAM). The purpose was to develop a model to estimate contributions of the fishing industry to regional economies. The only information available was the "fish tickets" or landings. Economic information on vessel revenue and spending flows as well as primary processing products and costs was needed to estimate economic contribution of fish landings. While some cost information was available from literature, most of the information was gathered by informal surveys of individual fishery, processors, and associations.

From these informal surveys several general observations emerged. These were:

• Vessel size and gear combinations are factors for skipper and owner decision making about when and where to go fishing. Other more important factors are the availability of resources and the management measures that allow access to fisheries.

		>90%		>50	)% and <=	90%	>30	3% and <=	50%	(	)% and <=	33%	Total			
		Average	Average		Average Averaç											
	Vessel	Species	Total	Vessel	Species	Total										
<u>Species</u>	<u>Count</u>	<u>Revenue</u>	<u>Revenue</u>	<u>Count</u>	<u>Revenue</u>	<u>Revenue</u>										
1 Groundfish	739	52.539	53.416	316	77.290	114.475	147	41.756	99.226	1.197	4.324	62.151	2.399	31.081	68.624	
2 Pacific whiting	14	179,516	186,179	14	251,011	360,655	7	199,023	492,574	56	16,698	299,587	<sup>′</sup> 91	91,820	306,380	
3 Salmon	1,269	6,122	6,187	356	9,652	14,329	148	12,037	29,466	546	5,590	57,983	2,319	6,916	21,117	
4 Crab/lobster	695	44,185	44,875	389	52,119	75,587	171	40,924	99,415	335	17,951	112,169	1,590	40,248	72,433	
5 Shrimp	84	99,688	101,670	79	107,835	168,047	32	79,573	193,642	189	21,620	198,499	384	61,264	170,648	
6 Coastal pelagic	69	226,061	229,227	46	289,872	397,892	15	44,338	103,795	268	938	160,388	398	74,997	197,640	
7 Other pelagic	155	71,360	71,904	33	81,573	110,987	10	79,677	195,716	179	6,901	200,847	377	41,869	139,832	
8 Highly migratory	360	71,933	72,457	126	29,006	43,568	92	39,964	97,554	824	6,896	98,632	1,402	27,753	86,892	
9 Halibut	32	90,916	92,136	41	128,884	188,905	13	61,276	149,588	264	4,250	68,323	350	28,892	87,644	
10 Sea urchins	242	52,234	52,945	76	37,405	51,443	23	18,275	44,539	44	5,006	35,488	385	41,881	50,151	
11 Other	229	17,080	17,284	217	12,091	17,585	107	11,057	27,376	1,295	1,612	97,972	1,848	5,306	74,446	
Total	3,888	41,205	41,776	1,693	53,514	77,926	NA	NA	NA	NA	NA	NA	5,731	53,579	53,579	
Gear																
Hook and line	845	25,395	25,565	220	35,880	50,302	112	20,585	48,738	731	3,266	56,654	1,908	17,844	41,688	
Vet	1,264	48,547	48,649	69	45,401	61,152	46	25,696	62,355	230	5,007	62,795	1,609	41,535	51,599	
Other	313	63,810	64,235	44	38,997	53,552	12	19,567	47,878	147	1,789	77,496	516	42,997	66,721	
Pot	821	46,804	47,483	368	50,560	72,060	173	38,108	92,705	415	14,302	101,947	1,777	39,145	69,695	
Trawl	330	187,817	189,388	148	139,395	191,439	38	65,709	157,179	126	8,683	84,720	642	134,269	167,412	
Troll	976	14,890	14,993	257	22,729	34,156	116	27,532	66,451	683	6,842	96,500	2,032	13,898	47,751	
Total	4,549	47,864	48,212	1,106	52,279	73,482	NA	NA	NA	NA	NA	NA	5,731	53,579	53,579	

 Table E3

 Vessel Counts and Revenues by Species and Gear Groups for Specialization Categories in 1997

Notes: 1. Excludes vessel identification codes reported as "NONE" or "ZZ..."

2. Tables show unique vessels for >50% specialization but vessels are repeated in other species for <=50% specialization.

3. Total revenue does not include deliveries to offshore processors or revenues from distant water fisheries.

Source: PacFIN March 1999 extraction.

Figure E5 Scattergram Showing U.S. West Coast Vessel Species Group Revenue as Compared to Total Revenue in 1997 for Groundfish



Notes: 1. Vessels with total revenue greater than \$0.5 million and/or species revenue greater than \$0.5 million not shown.

- 2. Excludes vessel identification codes reported as "NONE" or "ZZ..."
- 3. Revenue excludes offshore and distant water fisheries sources.

Source: PacFIN March 1999 extraction.

- Even though there are very broad vessel groups that can be defined by total revenue, most fishermen are opportunists who will move from fishery to fishery within limits of perceived payback.
- Some specialization may develop for species using certain gear types. For example, the Seattle purse seiners will fish Puget Sound salmon, but may also go to California for the pelagic fisheries and then move to Alaska for the herring, salmon fisheries. The timing of fisheries influences many decisions of capital as well as human investments.
- Crew wages (including skipper) tend to average about 39 percent. This may change for the "derby" fisheries and also for the small boat owner/operated boats that require very little capital investment. Deciding which fisheries to pursue may include criteria for keeping experienced crew members retained by participating in fisheries of lower return to owners.

#### Table E4 Vessel Classification Rules

Order	Vessel Category	Rule Description
1	Mothership/Catcher	Identified by vessel documentation
	Processor	
2	Alaska Fisheries Vessel	Alaska revenue is greater than 50% of that vessel's total revenue
3	Pacific Whiting Onshore	Pacific whiting PacFIN revenue plus U.S. West Coast offshore revenue
	and Offshore Trawler	is greater than 33% of that vessel's total revenue, and total revenue is
		greater than \$100,000
4	Large Groundfish	groundfish (including sablefish, halibut, and California halibut) revenue
	Trawler	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	groundfish (including halibut and California halibut), other than sablefish,
	Gear	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 vessels total revenue, and total revenue is
10	MigrotonyLipor	highly migratory appaign revenue from troll or line goer in greater than
10		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
	Chimpon	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: Study.

• Other decisions to define the vessels' classification depend on data availability. For example, distant water fisheries revenue is included because of the substantial amount of revenues that are returned from Alaska and U.S. West Coast offshore fisheries.

A goal of this project was to provide a classification scheme that could be used with available data. While cost and earnings background information was useful in the initial classification procedures, final rules are dependent only upon revenues revealed through the PacFIN, AKFIN, and other fish purchasing based systems.

The classification also included comments from the economic advisory group to this project. For most fisheries, the consensus was to use \$15,000 as the dividing point for available fishing operation. The vessel categories that included revenues less than \$15,000 were for salmon trollers and diver vessels. Otherwise most trollers as well as diving vessels would have been included in the "other" category. There also developed a need to separate larger groundfish trawlers from small ground trawlers. These small trawlers were mostly California based halibut trawlers. Therefore, since analysis of the data showed two groupings, it was decided to have large trawlers put into categories of \$100,000 or more.

The 33 percent specialization rule developed from analysis of the data. Without the 33 percent rule, too many boats would be classified as other. This is especially true for some groups such as shrimpers and sablefish fixed gear. For some groups the total amount of licenses permitted is close to those counted in this vessel classification; e.g. trawlers. This is not the case for other categories such as salmon trollers. In Oregon alone, about 1,100 boats have salmon troll permits. From Washington to California only 367 boats land enough salmon (over \$5,000) to be classified to be salmon trollers.

Several scenarios for number of classes, rule series order, and rule criteria were tested to best explain classification fit. It was necessary to itemize the revenue distribution within a species group for three specific species: sablefish, Pacific whiting, and lobster, and certain species harvested with dive gear. These species are either significant sources of revenue for some vessels and/or are managed separately from other complexes.

There is a separate harvest guideline for sablefish caught by trawl gear and fixed gear (pot and hook and line gear groups). Vessels that fish with fixed gear have different physical characteristics and participate in other fisheries differently than vessels that harvest sablefish with trawl gear. They are treated in a special category for further analysis.

Crab and lobster vessels use similar gear types, but the species are managed differently and harvests are geographically separated. California spiny lobster comprises about 15 percent of the crab/lobster species group. Landings are mostly at central and southern California ports while landings for Dungeness crab are in northern California, Oregon, and Washington.

Pacific whiting is also a case of groundfish that is harvested by vessels with special characteristics. These vessels can have expensive handling and processing equipment onboard

that is not used on other trawlers. A portion of the vessels that land Pacific whiting deliver only to floating processors. The unique characteristics of vessels that harvest Pacific whiting require that they be treated in special analysis categories.

What is identified as "diving vessels" harvest species such as abalone, sea urchins, geoducks, etc. Some of these species were previously discussed as either a single-species group or lumped with the "other" species group.

The rules "explained" vessel classifications for about 55 percent of the fleet and 97 percent of the revenue in 1997 (Table E5). Despite the scenario testing to make classes more general, two catch-all classifications were needed for vessels that didn't meet other rule criteria. The catch-all classifications were for vessels with total revenue greater than \$15,000, representing one percent of the fleet, and vessels less than or equal to \$15,000, representing 44 percent of the fleet. These vessels have either very low revenues or such a distributed revenue profile that it was not possible to treat them with any degree of specialization.

Assigning vessels to a certain classification is rule order dependent, i.e. vessel classes are from a hierarchical structure. The hierarchy does not significantly change if vessels were not removed from the pool for being previously classified in another category.

The complexity of the revenue distribution among species and gear groups and for other sources of revenue is shown in Table E6. For vessels classified as groundfish trawlers (large and small), these vessels harvest 63 percent of all groundfish landings off U.S. West Coast ports in 1997. Groundfish revenues make up 80 percent of total revenues for large trawlers and 54 percent of revenues for the small trawlers. In addition, they land 21 percent of the shrimp and five percent of the Dungeness crab. While there are only 273 vessels in this category out of 5,731 making landings in U.S. West Coast states, they produce the highest revenue (16 percent) of all other vessel categories (Table E5). The second highest category is a pelagic netter (14 percent), followed by a crabber (12 percent). Alaska fisheries vessels land 10 percent of all revenue, followed by migratory netters and liners (nine percent), and shrimpers (six percent). Vessels specializing in salmon troll or gillnet gear are second from last when omitting the catch-all categories.

# Processor Characteristics

U.S. West Coast fish purchases by processors, dealers, and individual consumers buying directly from vessels totaled 875.4 million pounds with an ex-vessel value of \$344.5 million in 1997 (Figure E6). About one half of the volume and value is landed in California (Table E7). Data sources only show where the purchase occurs; not all landings are processed at their geographical location of deliveries. Purchased fish are transported to processors in other locations and there is cross hauling of species between processor facilities.

There were 1,291 unique names of processors or buyers in 1997. These companies include operators of processing plants, buyers that may do little more than hold the fish prior to their shipment to a primary or secondary processor, and consumers buying directly from vessels. Forty-one percent of processors and buyers are simply the owners of vessels who also own

Table E5
Total Counts and Revenues by Vessel Classifications in 1997

		Total Category		Vessel		Average
	Vessel Category	Revenue	Percent	<u>Count</u>	Percent	Revenue
1	Mothership/Catcher Processor	13,611	4%	6	0%	2,268
2	Alaska Fisheries Vessel	36,604	10%	224	4%	163
3	Pacific Whiting Onshore and					
	Offshore Trawler	19,481	5%	29	1%	672
4	Large Groundfish Trawler	55,924	15%	195	3%	287
5	Small Groundfish Trawler	3,710	1%	78	1%	48
6	Sablefish Fixed Gear	18,311	5%	167	3%	110
7	Other Groundfish Fixed Gear	15,435	4%	159	3%	97
8	Pelagic Netter	52,306	14%	247	4%	212
9	Migratory Netter	15,871	4%	77	1%	206
10	Migratory Liner	24,747	7%	266	5%	93
11	Shrimper	22,112	6%	140	2%	158
12	Crabber	45,493	12%	601	10%	76
13	Salmon Troller	6,064	2%	364	6%	17
14	Salmon Netter	2,634	1%	170	3%	15
15	Other Netter	1,137	0%	37	1%	31
16	Lobster Vessel	6,908	2%	108	2%	64
17	Diver Vessel	18,989	5%	285	5%	67
18	Other > \$15 Thousand	4,362	1%	35	1%	125
19	Other <= \$15 Thousand	8,336	2%	2,543	44%	3
	Total	372,034	100%	5,731	100%	65

Notes: 1. Revenue is ex-vessel value in thousands of 1997 dollars.

2. U.S. West Coast onshore revenues exclude landings from vessels with identifier code "ZZ..." or "NONE."

3. Revenue includes U.S. West Coast onshore landings and revenue from offshore and distant water fisheries.

Source: PacFIN March 1999 extraction.

licenses allowing them to sell harvested fish directly to the public or retail markets. A relatively small number of processors and buyers handle most of the deliveries in the U.S. West Coast. An annotated scattergram of revenue versus number of delivering vessels shows that 27 percent of the processors or buyers have deliveries from greater than 10 vessels (Figure E7). The aggregate number of processors and buyers has not changed significantly in recent years (Figure E8).

#### Volume and Multi-fisheries Dependency of Processors and Buyers

The major processing firms in the U.S. West Coast are multi-species, multi-market oriented. Most of the firms' plants are located in areas where, by natural conditions or by management decisions, the availability of products changes over the year. Out of competitive necessity, they therefore process most species harvested. There is an increasing trend in multi-fisheries dependency for the higher volume processors. Most species groups' landings have seasonal peaks but, because of fishery management regulations, groundfish is now landed on a more even

# Table E6 Sources of Revenue by Vessel Classifications in 1997

									U.S. Wes	st Coa	ast Ons	hore													U.S. W	est		
-	Ground-	Pad	cific			Crab/			Coastal		Other		Highly				Sea				Total	_	Alaska	Alaska	Coas	t C	Other	
Vessel Category	fish	Wh	iting	Salmo	n	Lobster	Shrin	np	Pelagic		Pelagi	с	Migratory	,	Halibut		Urchins	6	Other		Onshore		Onshore	Offshore	Offsho	re Of	fshore	Tota
1 Mothership/Catcher	866 6	%											94 1	1%	287	2%			0	0%	1,248	9%	1,105 8%	11,233 839	6		25 0%	13,611
Processor	1%												0%		3%				0%		0%		3%	99%			0%	4%
2 Alaska Fisheries Vessel	622 2	%		1,405	4%	4,103 11	% 89	0%	52 0	0%	146	0%	513 1	1%	1,051	3%	56	0%	0	0%	8,038 22	2% 2	28,391 78%			1	75 0%	36,604
	1%			9%		6%	0%		0%		1%		1%		10%		0%		0%		3%		68%				2%	10%
3 Pacific Whiting Onshore	3,154 16	% 7,20	4 37%	3	0%	751 4	109	1%	3 0	0%	31	0%	1 0	0%	0	0%			2 (	0%	11,259 58	8%	3,377 17%	90 09	6 4,755	24%		19,481
and Offshore Trawler	4%	869	%	0%		1%	0%		0%		0%		0%		0%				0%		4%		8%	1%	100%			5%
4 Large Groundfish	44,649 80	% 82	6 1%	26	0%	3,050 5	5% 4,961	9%	25 0	)%	163	0%	507 1	1%	112	0%			1,400	3%	55,718 100	)%	105 0%			1	00 0%	55,924
Trawler	60%	109	%	0%		5%	21%		0%		1%		1%		1%				14%		18%		0%				1%	15%
5 Small Groundfish	2,016 54	%	1 0%	10	0%	237 6	5% 46	1%	10 0	0%	4	0%	159 4	1%			1	0%	1,227 3	3%	3,710 100	0%						3,710
Trawler	3%	09	%	0%		0%	0%		0%		0%		0%				0%		13%		1%							1%
6 Sablefish Fixed Gear	12,503 68	%	0 0%	217	1%	3,006 16	5% 71	0%	20	)%	12	0%	417 2	2%	1,098	6%	93	1%	12	0%	17,431 95	5%	854 5%				25 0%	18,311
	17%	09	%	1%		5%	0%		0%		0%		1%		11%		1%		0%		6%		2%				0%	5%
7 Other Groundfish	4,636 30	%	0 0%	224	1%	606 4	1% 2	0%	20	0%	1	0%	302 2	2%	6,564 4	13%	32	0%	288	2%	12,658 82	2%	2,652 17%			1	25 1%	15,435
Fixed Gear	6%	09	%	1%		1%	0%		0%		0%		1%		65%		0%		3%		4%		6%				2%	4%
8 Pelagic Netter	85 0	%		824	2%	309 1	122	0%	29,438 56	5% 1	15,075	29%	3,409 7	7%	45	0%			124	0%	49,432 95	5%	2,849 5%				25 0%	52,306
	0%			5%		0%	1%		99%		96%		9%		0%				1%		16%		7%				0%	14%
9 Migratory Netter	66 <sup>0</sup>	%		251	2%	37 (	0% 155	1%	19 0	0%	1	0%	14,706 93	8%			19	0%	267	2%	15,521 98	8%				3	50 2%	15,871
	0%			2%		0%	1%		0%		0%		38%				0%		3%		5%						5%	4%
10 Migratory Liner	101 0	%		939	4%	2,285	9% 268	1%	12 0	0%	2	0%	15,093 61	%	7	0%	220	1%	42	0%	18,969 77	%	53 0%			5,7	25 23%	24,747
	0%			6%		4%	1%		0%		0%		39%		0%		1%		0%		6%		0%			8	0%	7%
11 Shrimper	741 3	%		41	0%	3,916 18	3% 16,577	75%	5 10 C	)%	19	0%	537 2	2%	62	0%	6	0%	147	1%	22,057 100	0%	55 0%					22,112
	1%			0%		6%	70%		0%		0%		1%		1%		0%		2%		7%		0%					6%
12 Crabber	1,793 4	%		2,490	5%	36,831 81	638	1%	, 72 0	0%	100	0%	1,751 4	1%	253	1%	75	0%	74	0%	44,076 97	%	1,217 3%			2	00 0%	45,493
	2%			16%		58%	3%		0%		1%		4%		2%		0%		1%		14%		3%				3%	12%
13 Salmon Troller	219 4	%		5,146	85%	230 4	1%		0 0	0%	14	0%	342 6	5%	39	1%			30	0%	6,020 99	9%	44 1%					6,064
	0%			32%		0%			0%		0%		1%		0%				0%		2%		0%					2%
14 Salmon Netter	47 2	%		2,278	87%	50 2	2% 2	0%	)				0 0	)%			12	0%	139	5%	2,528 96	5%	105 4%					2,634
	0%			14%		0%	0%						0%				0%		1%		1%		0%					1%
15 Other Netter	0 0	%		33	3%	9 1	% 3	0%	, 1 C	0%	0	0%	0 0	0%			342 :	30%	737 6	5%	1,125 99	9%	12 1%					1,137
	0%			0%		0%	0%		0%		0%		0%				2%		8%		0%		0%					0%
16 Lobster Vessel	84 1	%		17	0%	5,967 86	5% 198	3%	, 7 C	)%	1	0%	81 1	1%			28	0%	527	8%	6,908 100	0%						6,908
	0%			0%		9%	1%		0%		0%		0%				0%		5%		2%							2%
17 Diver Vessel	214 1	%		15	0%	43 0	0% 1	0%	0 0	0%	5	0%	60 0	0%	0	0%	15,132 8	30%	3,507 1	8%	18,977 100	0%	12 0%					18,989
	0%			0%		0%	0%		0%		0%		0%		0%		94%		36%		6%		0%					5%
18 Other > \$15 Thousand	762 17	% 30	6 7%	326	7%	693 16	5% 114	3%	15 0	0%	9	0%	33 1	1%	564 1	13%			228	5%	3,051 70	)%	861 20%			4	50 10%	4,362
	1%	49	%	2%		1%	0%		0%		0%		0%		6%				2%		1%		2%				6%	1%
19 Other <= \$15 Thousand	2,004 24	% 1	8 0%	1,792	22%	1,873 22	2% 169	2%	179 2	2%	205	2%	904 11	%	29	0%	107	1%	1,055 1	3%	8,336 100	)%						8,336
	3%	09	%	11%		3%	1%		1%		1%		2%		0%		1%		11%		3%							2%
Total revenue	74,564 20	% 8,35	6 2%	16,038	4%	63,995 17	7% 23,525	6%	29,849 8	3% 1	15,785	4%	38,910 10	)% 1	10,112	3%	16,124	4%	9,806	3% 3	807,063 83	3% 4	41,693 11%	11,323 39	6 4,755	1% 7,2	00 2%	372,034
	100%	100	%	100%		100%	100%		100%		100%		100%		100%		100%		100%		100%		100%	100%	100%	10	0%	100%
Vessel count	2,399	9	1	2,319		1,590	384		398		377		1,402		350		385		1,848		5,731		377	14	15	1	48	5,731

Notes: 1. Revenue is ex-vessel value in thousands of 1997 dollars. Percents are column \ row total revenue shares.

2. U.S. West Coast onshore revenues exclude landings from vessels with identifier code "ZZ..." or "NONE."

3. Vessel counts across species group categories are not unique but the column "total" is for unique vessels.

4. Revenue includes U.S. West Coast onshore landings and revenue from offshore and distant water fisheries.

Source: PacFIN March 1999 extraction.

Figure E6 Total Landed Volume and Value by Species in 1997



Note: Volume and value landings are inclusive of "NONE" and "ZZ..." landings. Source: PacFIN March 1999 extraction.

# Table E7Volume and Value of Fish Landings by State in 1997

	Landed Vo	olume	Ex-Ves	sel Value
<u>Area</u>	Volume	<u>%</u>	Value	<u>%</u>
Washington	122.0	14%	\$103.6	30%
Oregon	260.9	30%	\$69.6	20%
California	<u>492.5</u>	<u>56%</u>	<u>\$171.3</u>	<u>50%</u>
Total	875.4	100%	\$344.5	100%

Notes: Volume is in millions of pounds and value is ex-vessel value in millions of 1997 dollars. Source: PacFIN March 1999 extraction.

flow throughout the year. Some of these primary processing firms also include distributing and wholesaling as their function.

Processing of fish products includes a variety of functions. For some products, processing involves icing fish and selling the product directly to consumers or shipping the iced or frozen product to be canned. In the case of albacore tuna, more of the product is frozen and shipped offshore to be canned. Other products, such as Dungeness crab and pink shrimp, are cooked and picked for local sale or shipment to final markets. Groundfish are generally filleted. The primary product for fillets is about 30 percent of the total weight. The processing of the residue (carcasses) is therefore an important component in the total value of the product.

The processing and distribution of seafood is complex (Figure E9). Some products flow directly to the consumer, while others are processed, brokered, distributed, and retailed by separate entities. Value may be added to the product at any stage. This may involve selling a product whole, or retaining only a portion of the landed product for sale. Value may be added also by small, local processors that prepare (smoke, can, etc.) specialty items. The preparation and sale of the secondary product then becomes a key consideration in total value of the product.

The higher volume processors and buyers especially depend upon year-around deliveries from many fisheries (Table E8). Many of licensed processor and buyers received salmon, Dungeness crab, pelagics, migratory, and groundfish (other than Pacific whiting) in 1997. However, only the larger volume firms took deliveries of pink shrimp (266 firms of which 42 percent had revenues greater than \$1 million) and Pacific whiting (30 firms of which 90 percent had revenue greater than \$1 million). The species group causing the greatest specialization was sea urchins (55 percent of processors or buyers had 90 percent specialization within this species group and 62 percent had greater than 50 percent specialization). Predictably, salmon (not considering the other species category) had the lowest average ex-vessel value of deliveries (\$49 thousand mean and \$3 thousand median) and Pacific whiting had the highest (\$279 thousand mean and \$20 thousand median).



Figure E7 Scattergram Showing Processors' Revenue Compared to Number of Vessels Delivering to the Processor in 1997

Processor Revenue (Logarithmic Scale)

Note: Excludes deliveries by vessel identification codes reported as "NONE" or "ZZ..." This results in 121 processors not being shown because all deliveries were from "NONE" or "ZZ.." vessels. Source: PacFIN March 1999 extraction.

Figure E8 Processor or Buyer Counts and Revenues by Revenue Categories in 1994-1997



Notes: 1. Revenue adjusted for inflation using the GDP Implicit Price Deflator, 1997=100. Source: Annual vessel summary information extracted from PacFIN in March 1999.

Figure E9 Seafood Product Distribution Chain



## Processor Classifications

Finding categories of processors is analogous to determining a vessel classification scheme. Processors making the higher volume purchases are a generalized category for using many species and manufacturing many product forms. The rules adopted for a classification scheme adopted the threshold purchase levels as shown in the first column on Table E9. The ex-vessel values by purchased species for these categories are shown in the other columns on Table E9.

### Processed Product Value

The value of primary seafood products produced in the U.S. West Coast can be calculated using sales price of product forms and the landed species group finished product poundage. Radtke and Davis (1998b) used an analysis of final product form to estimate ex-processor pricing. The ex-processor price was determined using financial information about five components of product cost or published sales price for product forms.

- Raw product purchase = Average price ÷ Product form yield
- Labor = Cost for labor associated with product form processing
- Tax/fee = Costs for ad valorem and poundage taxes and fees paid on deliveries of raw product by the processor. For Oregon, taxes are 0.0109 of ex-vessel value for all fish except salmon. Salmon taxes are 0.0315 of value, plus \$0.05 per round pound for salmon habitat restoration programs.
- Other = Fixed plant costs, etc.
- Contribution = Profit, etc.

Using previous project results by the authors (Radtke and Davis 1998b), the estimated exprocessor value from processing the U.S. West Coast landings in 1996 was about double the ex-

 Table E8

 Counts and Revenue Distribution of Processors or Buyers Purchasing Within Species Groups in 1997

							Counts	Within R	evenue
	Count	Proce	ssor Count	Specialization Categorie					
<u>Species</u>	Total	<u>&lt;=\$10K</u>	<u>&lt;=\$100K</u>	<u>&lt;=\$1,000K</u>	<u>&lt;=\$5,000K</u>	<u>&gt;\$5,000K</u>	<u>&gt;90%</u>	<u>&gt;50%</u>	<u>&gt;33%</u>
Groundfish	528	37%	29%	21%	12%	2%	18%	35%	44%
Pacific whiting	30	3%	7%	27%	43%	20%	13%	17%	20%
Salmon	483	48%	25%	16%	9%	2%	34%	50%	57%
Crab/lobster	485	29%	32%	26%	11%	2%	29%	49%	60%
Shrimp	266	30%	28%	24%	15%	3%	27%	37%	44%
Coastal pelagic	163	20%	25%	30%	21%	5%	14%	23%	26%
Other pelagic	124	10%	25%	36%	23%	5%	18%	21%	23%
Highly migratory	375	37%	28%	19%	13%	3%	25%	34%	40%
Halibut	89	17%	26%	28%	20%	9%	7%	18%	21%
Sea urchins	85	25%	29%	33%	12%	1%	55%	62%	66%
Other	593	35%	29%	23%	11%	2%	19%	29%	35%
Total	1,290	52%	26%	16%	6%	1%			

	Sum of	Revenue D	Revenue Distribution (thousands						
<b>o</b> .	Revenue	900	50th						
Species	(thousands)	Percentile	Percentile	Mean					
Groundfish	\$77,956	\$270	\$2	\$148					
Pacific whiting	8,356	786	20	279					
Salmon	23,854	85	3	49					
Crab/lobster	73,338	464	11	151					
Shrimp	24,053	330	6	90					
Coastal pelagic	29,849	479	1	183					
Other pelagic	15,787	186	0	127					
Highly migratory	39,672	118	4	106					
Halibut	10,679	250	4	120					
Sea urchins	16,722	868	11	197					
Other	24,256	61	2	41					
Total	\$344,521	\$674	\$9	\$267					

Notes: 1. Table shows counts of unique processors or buyers for >50% specialization, but counts are repeated in species groups for <=50% specialization.

2. One processor is identified as making a purchase, but the value is zero. This processor is excluded from this table.

Source: PacFIN March 1999 extraction.

Table E9
Sources of Revenue by Processor Volume in 1997

	U.S. West Coast Onshore																						
	Ground-	Pacifi	С			Crab/				Coasta	al	Other		Highl	/			Sea				Tota	
Volume Category	fish	Whitir	ng	Salmo	n	Lobste	ər	Shrim	р	Pelagi	ic	Pelagi	с	Migrate	ory	Halibu	ıt	Urchin	IS	Othe	r	Onsho	bre
<=\$10K	203 11%	0	0%	413	23%	272	15%	200	11%	56	3%	7	0%	318	17%	17	1%	45	2%	304	17%	1,837	100%
	0%	0%		2%		0%		1%		0%		0%		1%		0%		0%		1%		1%	
<=\$100K	1,659 15%	25	0%	1,630	15%	2,747	25%	1,039	9%	265	2%	274	2%	862	8%	124	1%	554	5%	1,841	17%	11,021	100%
	2%	0%		7%		4%		4%		1%		2%		2%		1%		3%		8%		3%	
<=\$1,000K	11,374 14%	1,257	2%	8,327	10%	23,165	28%	5,033	6%	4,408	5%	3,553	4%	4,984	6%	2,964	4%	9,075	11%	7,176	9%	81,319	100%
	15%	15%		35%		32%		21%		15%		23%		13%		28%		54%		30%		24%	
<=\$5,000K	40,111 24%	3,881	2%	10,219	6%	29,474	18%	12,885	8%	16,062	10%	11,744	7%	15,016	9%	6,829	4%	6,962	4%	14,701	9%	167,886	100%
	51%	46%		43%		40%		54%		54%		74%		38%		64%		42%		61%		49%	
>\$5,000K	24,608 30%	3,192	4%	3,264	4%	17,679	21%	4,895	6%	9,056	11%	209	0%	18,491	22%	744	1%	86	0%	234	0%	82,459	100%
	32%	38%		14%		24%		20%		30%		1%		47%		7%		1%		1%		24%	1
Total revenue	77,956 23%	8,356	2%	23,854	7%	73,338	21%	24,053	7%	29,849	9%	15,787	5%	39,672	12%	10,679	3%	16,722	5%	24,256	7%	344,521	100%
	100%	100%		100%		100%		100%		100%		100%		100%		100%		100%		100%		100%	
Processor count	528	30		483		485		266		161		120		373		89		85		589		1,290	

Notes: 1. Revenue is ex-vessel value in thousands of 1997 dollars. Percents are column \ row total revenue shares.

2. Processor counts across species group categories are not unique but the column total is for unique vessels.

3. Excludes one processor where \$0 revenue was reported.

Source: PacFIN March 1999 extraction.

vessel value of the landings. Using the same relationship between ex-vessel price and exprocessor price in 1996, the 1997 ex-processor sales, including non-edible products, such as fish meal, are estimated to be \$689.0 million.

### Major Processor Companies and Facilities in the U.S. West Coast

There are numerous processing and fish buyers licenses in all three states. About 80 of these may be identified as individual or business groups. Several groups (about 50) have business operations in more than one area. Thirteen processing groups have plants in more than one U.S. West Coast state. One processing group has processing plants in the states of California, Oregon, Washington, and Alaska.<sup>1</sup>

The major processor groups can be categorized by ex-processor sales in four classifications: largest (greater than \$10 million), medium (\$5 million to \$10 million), small (\$1 million to \$5 million), or very small (less than \$1 million) (Table E10). The largest classification is composed of 15 companies (parent groups) and processed 65 percent of the fish by volume and 46 percent of the total fish by value in 1997. These processors average about \$10.6 million in landed value and about \$22 million in ex-processor value annually.<sup>2</sup> The medium sized processor category process 12 percent of the landed volume and 16 percent of the landed value. This group averages about \$3.4 million in purchases per year. The large and medium processors purchase 77 percent of the landed volume and 62 percent of the landed value along the U.S. West Coast. The other smaller processors purchase an additional 22 percent of the total volume. The rest are either individual vessels that also act as dealers and other very small buyers found along the U.S. West Coast.

# Seafood Markets

While many processing plants are located in many locations along the U.S. West Coast, only some of these processing plants serve to hold inventories and distribute products in the U.S. and to the rest of the world. U.S. West Coast seafood production and distribution is primarily to serve the closest major regional markets. The San Francisco and Los Angeles market areas dominate the absorption of seafood products. Strong markets for some groundfish have also developed in Japan. This includes products from sablefish, Pacific whiting, and relatively modest amounts of salmon and shrimp. Most of the Pacific whiting processing capability being developed by U.S. West Coast firms is for surimi production. Surimi markets are mostly in Japan and Korea. Some domestic and European markets for Pacific whiting headed and gutted, fillet and other product forms are also developing. A study of groundfish markets by Oregon State University (Shriver 1996) concluded that Pacific whiting surimi markets and sablefish markets were mostly destined for the Asian markets, while other groundfish and Pacific whiting (headed and gutted) markets were mostly in the U.S. These markets for groundfish were evenly divided between the U.S. northwest, California, and the rest of the U.S.

<sup>1.</sup> For a more complete description of seafood processing on the West Coast, see Radtke and Davis (1997).

<sup>2.</sup> These estimates are based on fish ticket information, so it does not necessarily include purchases from small buyers that take delivery from harvesters and sell their products to the larger processors.

#### Table E10 Ranking of U.S. West Coast Processor Groups in 1997

	<u>Count</u>	Percent of <u>Volume</u>	Percent of <u>Value</u>	Average Annual <u>Ex-Vessel Value</u>	Annual Estimated Ex-Processor Sales
Largest	15	64.8%	46.0%	\$10.6 million	> \$10 million
Medium	16	11.9%	15.6%	\$3.4 million	\$5 million to \$10 million
Small	96	18.9%	27.5%	\$990,400	\$1 million to \$5 million
Very small	97	2.9%	6.7%	\$238,400	\$100,000 to \$1 million
All others	1,067	1.5%	4.2%	NA	NA
Total	1,291	-			

Source: PacFIN November 1998 extraction and anecdotal information.

The Oregon seafood processing sector ownership is most concentrated of the states. The three largest seafood processing groups in Oregon purchase 79 percent of seafood landed (64 percent by value) in Oregon. In Washington, the four largest processing groups purchase 38 percent (24 percent by value) in Washington. California is similarly diversified, with the four largest processing groups purchasing 29 percent of seafood landed (21 percent by value). Part of the reason may be that, in Washington and California, most of the marine products are landed close to the metropolitan centers of Seattle, San Francisco, and Los Angeles.

# Challenges Facing the Seafood Processing Industry

There are five major issues in the 1990's that have changed and are changing the fish processing industry in the U.S. West Coast. These are:

- Collapse of the salmon industry
- Expansion of the Pacific whiting industry
- Consolidation of seafood processing industry
- Reductions in groundfish resources and efforts to improve utilization
- Infrastructure problems

The U.S. West Coast salmon landings, because of a host of reasons, declined from an average of 14 million pounds in the late 1980's to about 1.2 million pounds in 1994. Coho, except for some special seasons, has been eliminated as a commercial species. At the same time, largely because of the expansion of the farmed salmon industry, real prices for troll caught chinook salmon have dropped to an average of \$1.60 per landed pound. This compares to inflation adjusted prices in the 1970's and 1980's of \$4.00 to \$5.00 per pound.

There has been a major expansion of the onshore whiting processing industry since 1992. At the present time, five surimi plants have the capacity to process up to 20 million pounds per week. In 1997, the whiting industry in the U.S. West Coast processed a total of 162 million pounds of whiting. With greater utilization and added value development, this industry has the potential to generate up to \$100 million annually to the national economy.

The consolidation of processing groups that are located in the U.S. West Coast has followed an earlier expansion in the processing industry, based on exploitation of available resources. One company has led in the consolidation. The Pacific Group expansion has been based on its regional distribution network. This company has utilized local resources to fill regional markets, while at the same time developing export markets.

The new Magnuson-Stevens Fishery Conservation and Management Act requires the Pacific Fishery Management Council to use the most recent stock assessments from the National Marine Fisheries Service and cautionary principles to determine harvest guidelines. The new stock assessments and conservative management measures indicate immediate and substantial groundfish harvest reductions are needed in order to prevent further stock declines in many of the rockfish species. The results are fewer available resources, smaller trip limits, and increasing bycatch and discards. As discards increase, there is a growing interest in utilization of the unintended bycatch and resulting discards. Full utilization of these resources may result in an increase of up to \$39 million of personal income to the U.S. West Coast economy (Radtke and Davis 1998). The challenge for the U.S. West Coast seafood processing industry is to develop markets for products that may be developed from these resources.

Part of the challenge of full utilization will also be to develop the infrastructure (utilities, docks and unloading facilities, cold storage, navigation channels, and product shipping ground and air transportation routes) required for processing. The greatest concern is whether water and byproduct use will overwhelm existing infrastructure. Increased demands for potable water from growth and fixed supply sources will probably increase water costs as an overall share of production costs in the future. Seafood processors would benefit from water conservation measures, as well as improved controls for waste utilization and disposal methods. With industry participation, seafood processing wastes can be put to further use by existing plants. Creative options for waste disposal exist, but additional research and product development needs to make sure these options are cost effective. Further study of the composition of seafood wastes may show that they are a benefit rather than a hindrance for improved utilization of marine resources.