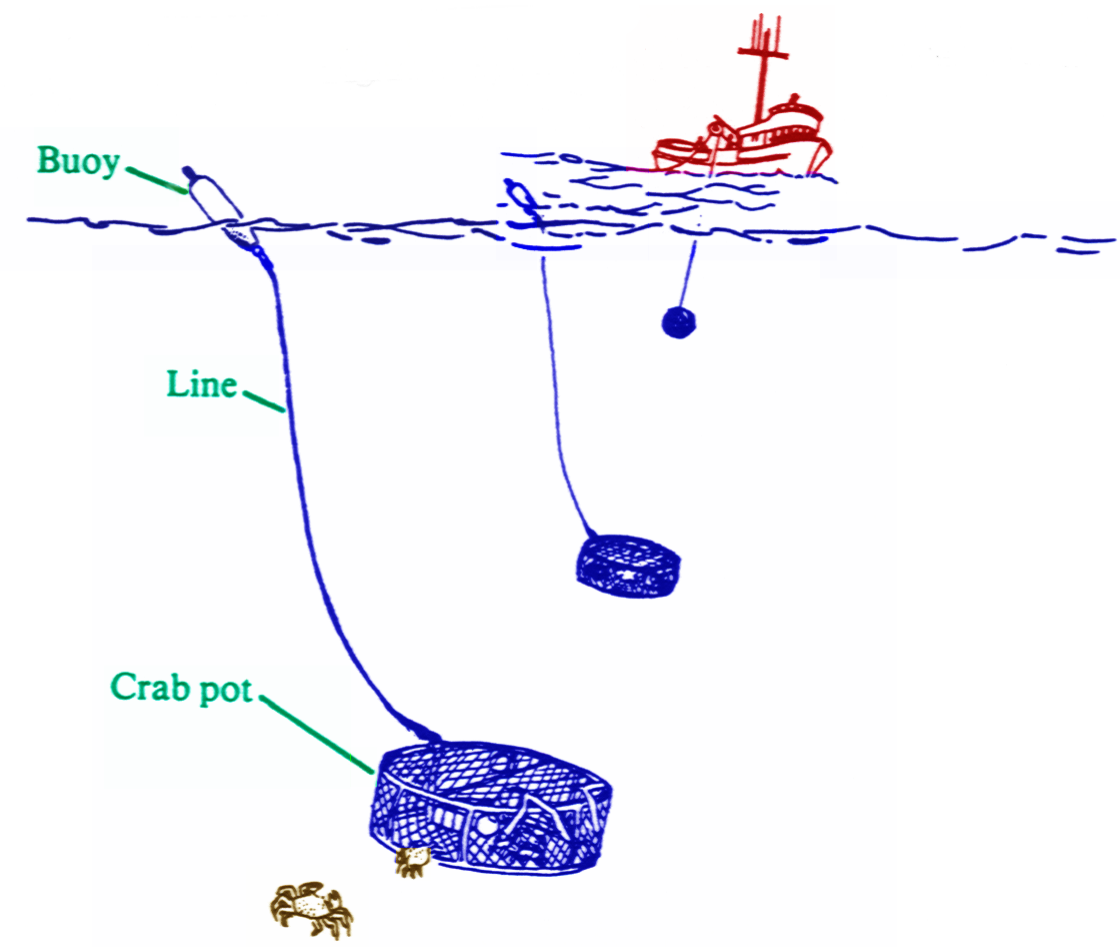
DESCRIPTION OF THE U.S. WEST COAST COMMERCIAL FISHING FLEET AND SEAFOOD PROCESSORS



Pacific States Marine Fisheries Commission

February 2000

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prepared by

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together the many overlapping data sets used in the analysis. While these individuals and other contributors provided information and comments, the authors take sole responsibility for describing project results.

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
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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. However, the vessel's homeport may not necessarily be 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 California onshore fisheries	PSMFC PacFIN Program	Vessel specific landing information
Alaska onshore fisheries	CFEC and anecdotal	Summary landings by species and gear, and vessel specific lists
U.S. West Coast and Alaska offshore fisheries	PSMFC AKFIN Program and NMFS Blend File	Vessel specific landing information
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.

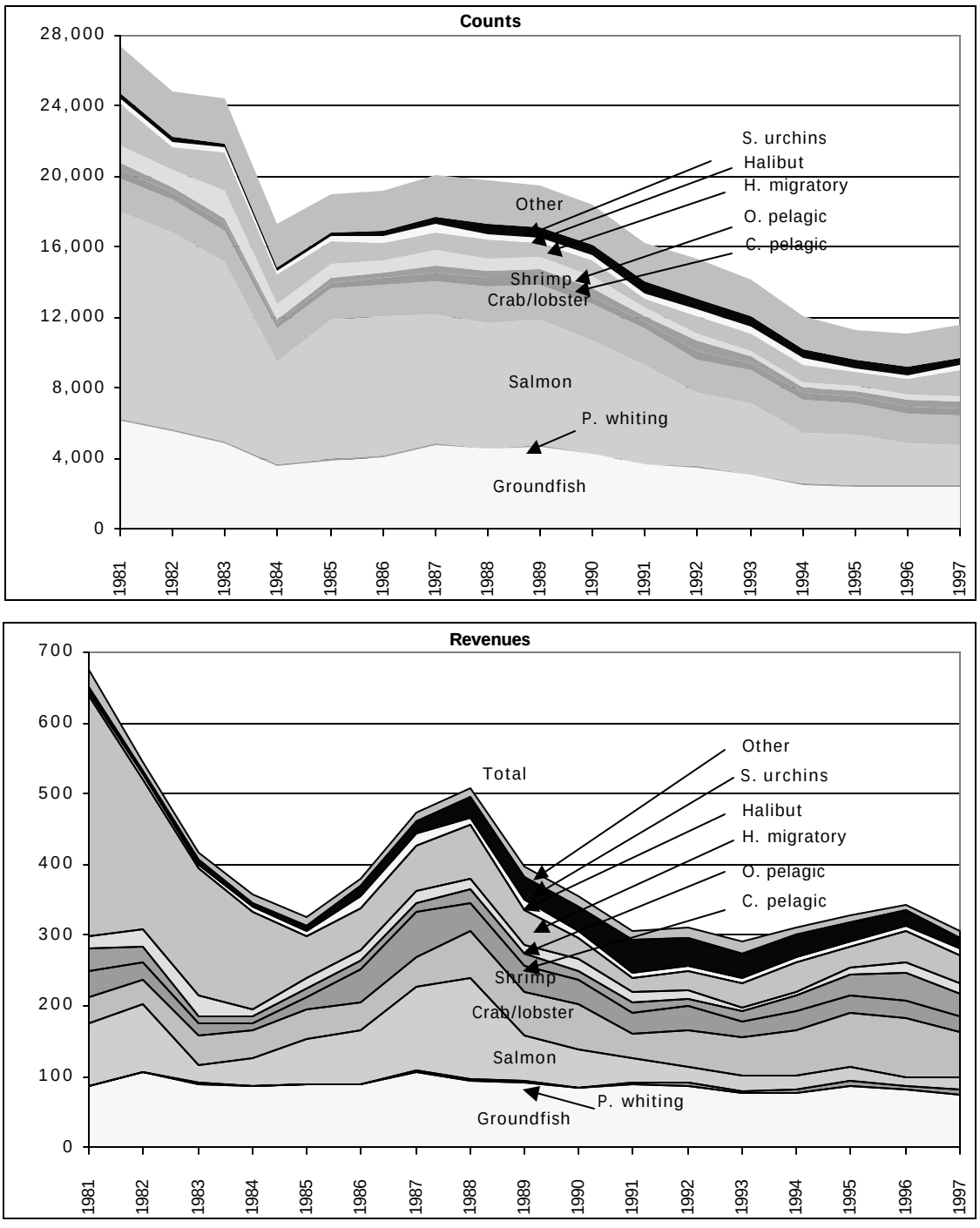
During the 1970's and 1980's, increasing salmon supplies and prices also attracted new American immigrants to the salmon fisheries in lower Alaska. This component consists of a large number of "Russian Old Believers" from all over the world who settled near Woodburn, Oregon. Many of them now fish in 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.

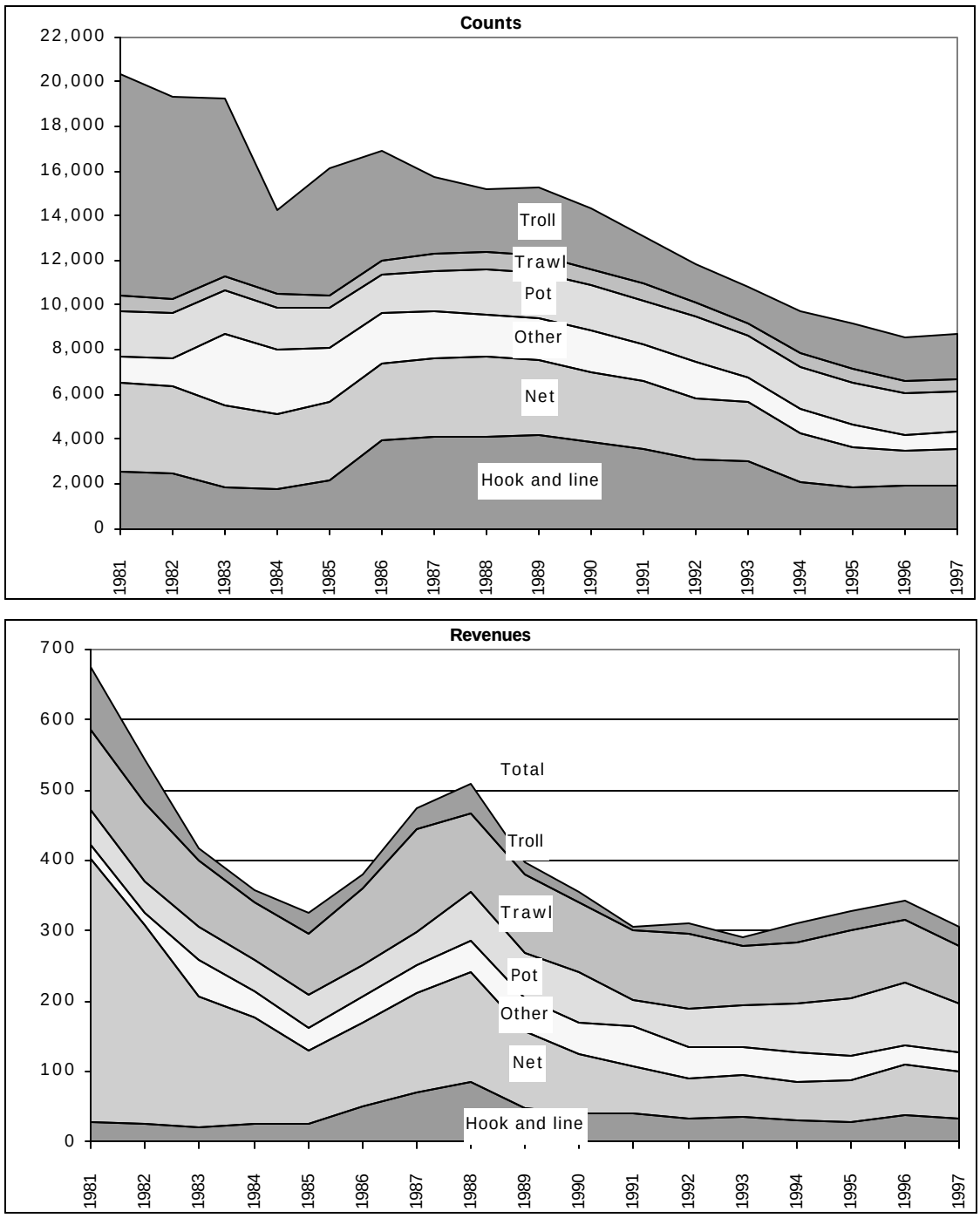
Figure E1
Vessel Counts and Revenues by Species Group for
Vessels Landing at U.S. West Coast Ports in 1981-1997



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.

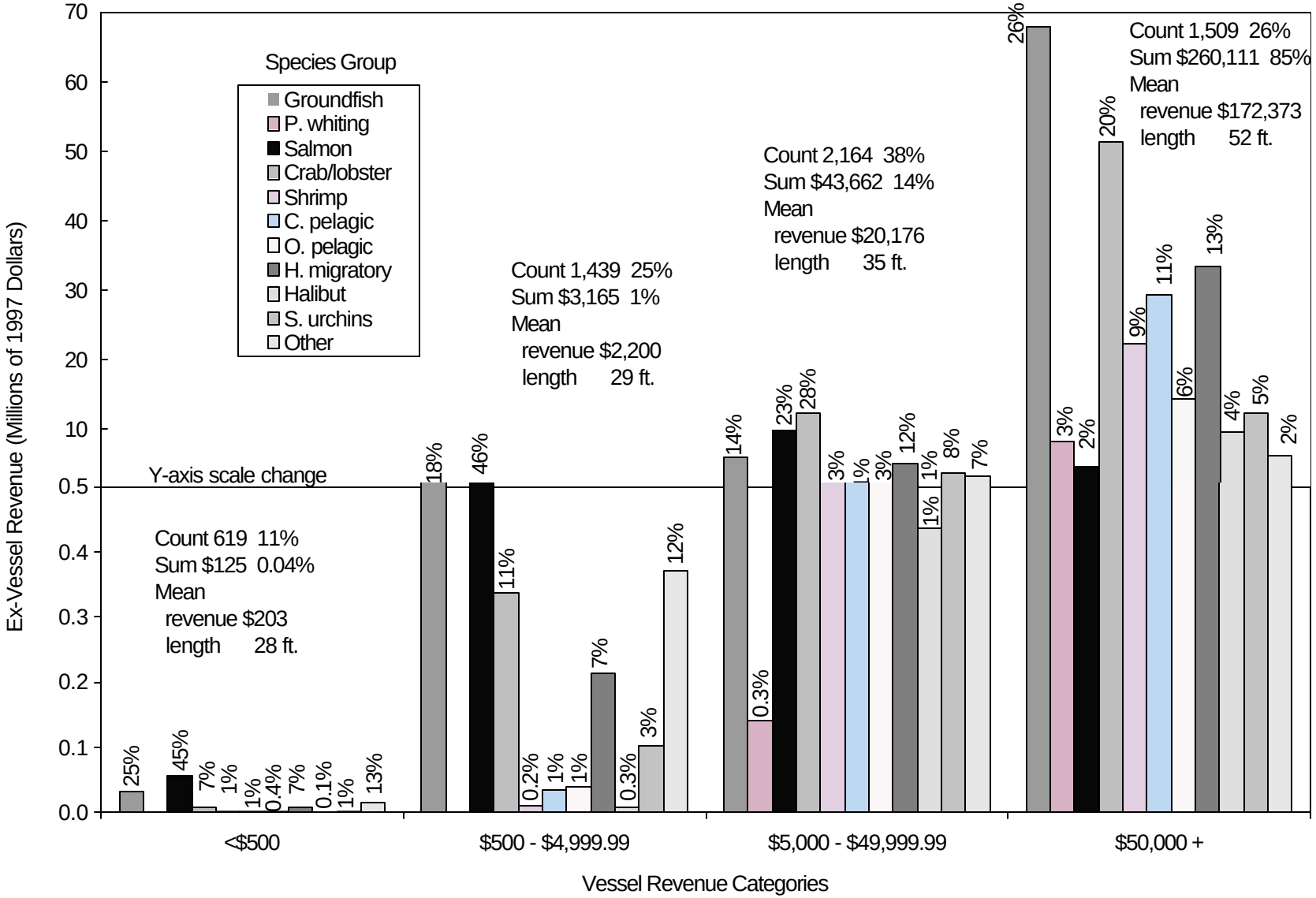
Vessel Classifications

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 Vessel Volume Categories

Vessel count: (5,705 + 26 with length 0)		5,731
Per vessel mean landings (revenue)		$53,579
Per vessel std. dev. landings (revenue)		$117,389
Vessel mean length (excluding 0 length)		37 ft.
Vessel std. dev. length (excluding 0 length)		23 ft.
Multi-gear profile (vessels):	1 gear	65%
	2 gears	24%
	3 gears	9%
	4+ gears	2%

		Hook and line	Net	Other	Pot	Trawl	Troll	All gears	Percent
1	Groundfish	6.48%	0.12%	0.00%	0.94%	16.59%	0.15%	$74,564	24%
2	Pacific whiting	0.00%	0.00%			2.72%		$8,356	3%
3	Salmon	0.01%	2.00%		0.00%	0.00%	3.21%	$16,038	5%
4	Crab/lobster	0.00%	0.01%	0.00%	20.83%	0.00%	0.00%	$63,995	21%
5	Shrimp		0.26%	0.06%	0.63%	6.72%		$23,525	8%
6	Coastal pelagic	0.04%	9.67%	0.00%	0.00%	0.01%	0.00%	$29,849	10%
7	Other pelagic	0.00%	4.40%	0.71%		0.03%	0.00%	$15,785	5%
8	Highly migratory	1.02%	4.22%	0.28%	0.00%	1.33%	5.82%	$38,910	13%
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

Vessel count: (616 + 3 with length 0)		619
Per vessel mean landings (revenue)		$203
Per vessel std. dev. landings (revenue)		$139
Vessel mean length (excluding 0 length)		28 ft.
Vessel std. dev. length (excluding 0 length)		17 ft.
Multi-gear profile (vessels):	1 gear	95%
	2 gears	4%
	3 gears	0%
	4+ gears	

		Hook and line	Net	Other	Pot	Trawl	Troll	All gears	Percent
1	Groundfish	23.58%		0.01%	1.32%	0.27%	0.31%	$32	25%
2	Pacific whiting							$0	0%
3	Salmon	0.43%	23.95%				20.46%	$56	45%
4	Crab/lobster				6.62%			$8	7%
5	Shrimp		0.35%	0.18%	0.18%	0.28%		$1	1%
6	Coastal pelagic	0.04%	0.48%			0.04%		$1	1%
7	Other pelagic	0.01%	0.43%					$1	0%
8	Highly migratory	3.14%	0.12%	0.11%		0.51%	3.23%	$9	7%
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

Vessel count: (1,431 + 8 with length 0)		1,439
Per vessel mean landings (revenue)		$2,200
Per vessel std. dev. landings (revenue)		$1,283
Vessel mean length (excluding 0 length)		29 ft.
Vessel std. dev. length (excluding 0 length)		16 ft.
Multi-gear profile (vessels):	1 gear	82%
	2 gears	15%
	3 gears	3%
	4+ gears	0%

		Hook and line	Net	Other	Pot	Trawl	Troll	All gears	Percent
1	Groundfish	16.00%	0.19%	0.02%	1.23%	0.63%	0.32%	$582	18%
2	Pacific whiting							$0	0%
3	Salmon	0.29%	25.68%				20.52%	$1,471	46%
4	Crab/lobster	0.00%		0.04%	10.57%	0.00%		$336	11%
5	Shrimp		0.07%	0.03%	0.20%			$10	0%
6	Coastal pelagic	0.25%	0.82%	0.00%			0.00%	$34	1%
7	Other pelagic	0.01%	1.20%				0.01%	$39	1%
8	Highly migratory	0.98%		0.20%		0.44%	5.09%	$213	7%
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%
	Percent	22%	35%	3%	12%	2%	26%	100%	

Table E2 (continued)

$5,000 - $49,999.99

Vessel count: (2,153 + 11 with length 0)		2,164
Per vessel mean landings (revenue)		$20,176
Per vessel std. dev. landings (revenue)		$12,766
Vessel mean length (excluding 0 length)		35 ft.
Vessel std. dev. length (excluding 0 length)		16 ft.
Multi-gear profile (vessels):	1 gear	59%
	2 gears	29%
	3 gears	11%
	4+ gears	2%

	Hook and line	Net	Other	Pot	Trawl	Troll	All gears	Percent
1 **Groundfish**	11.06%	0.32%	0.01%	0.95%	0.89%	0.40%	$5,953	14%
2 **Pacific whiting**	0.00%	0.00%			0.32%		$141	0%
3 **Salmon**	0.04%	8.39%		0.00%	0.00%	14.10%	$9,838	23%
4 **Crab/lobster**	0.00%	0.01%	0.01%	28.10%	0.01%		$12,280	28%
5 **Shrimp**		0.05%	0.22%	1.02%	1.37%		$1,159	3%
6 **Coastal pelagic**	0.24%	0.98%	0.00%	0.00%	0.01%	0.00%	$538	1%
7 **Other pelagic**	0.00%	2.75%	0.08%		0.07%	0.00%	$1,268	3%
8 **Highly migratory**	0.49%	0.15%	0.61%		1.30%	9.27%	$5,154	12%
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%	

$50,000 +

Vessel count: (1,505 + 4 with length 0)		1,509
Per vessel mean landings (revenue)		$172,373
Per vessel std. dev. landings (revenue)		$180,871
Vessel mean length (excluding 0 length)		52 ft.
Vessel std. dev. length (excluding 0 length)		31 ft.
Multi-gear profile (vessels):	1 gear	46%
	2 gears	33%
	3 gears	16%
	4+ gears	5%

	Hook and line	Net	Other	Pot	Trawl	Troll	All gears	Percent
1 **Groundfish**	5.59%	0.09%	0.00%	0.93%	19.43%	0.11%	$67,997	26%
2 **Pacific whiting**	0.00%				3.16%		$8,214	3%
3 **Salmon**	0.00%	0.63%		0.00%	0.00%	1.16%	$4,672	2%
4 **Crab/lobster**	0.00%	0.00%	0.00%	19.74%	0.00%	0.00%	$51,371	20%
5 **Shrimp**		0.29%	0.03%	0.57%	7.70%		$22,355	9%
6 **Coastal pelagic**	0.00%	11.24%	0.00%	0.00%	0.01%	0.00%	$29,276	11%
7 **Other pelagic**	0.00%	4.72%	0.82%		0.03%	0.00%	$14,477	6%
8 **Highly migratory**	1.11%	4.96%	0.22%	0.00%	1.35%	5.25%	$33,534	13%
9 **Halibut**	3.71%				0.00%	0.00%	$9,669	4%
10 **Sea urchins**		0.06%	4.69%				$12,351	5%
11 **Other**	0.06%	0.39%	1.16%	0.19%	0.58%	0.00%	$6,194	2%
All species	$27,245	$58,248	$18,001	$55,752	$83,903	$16,961	$260,111	100%
Percent	10%	22%	7%	21%	32%	7%	100%	

Notes: 1. Revenue in thousands of 1997 dollars.

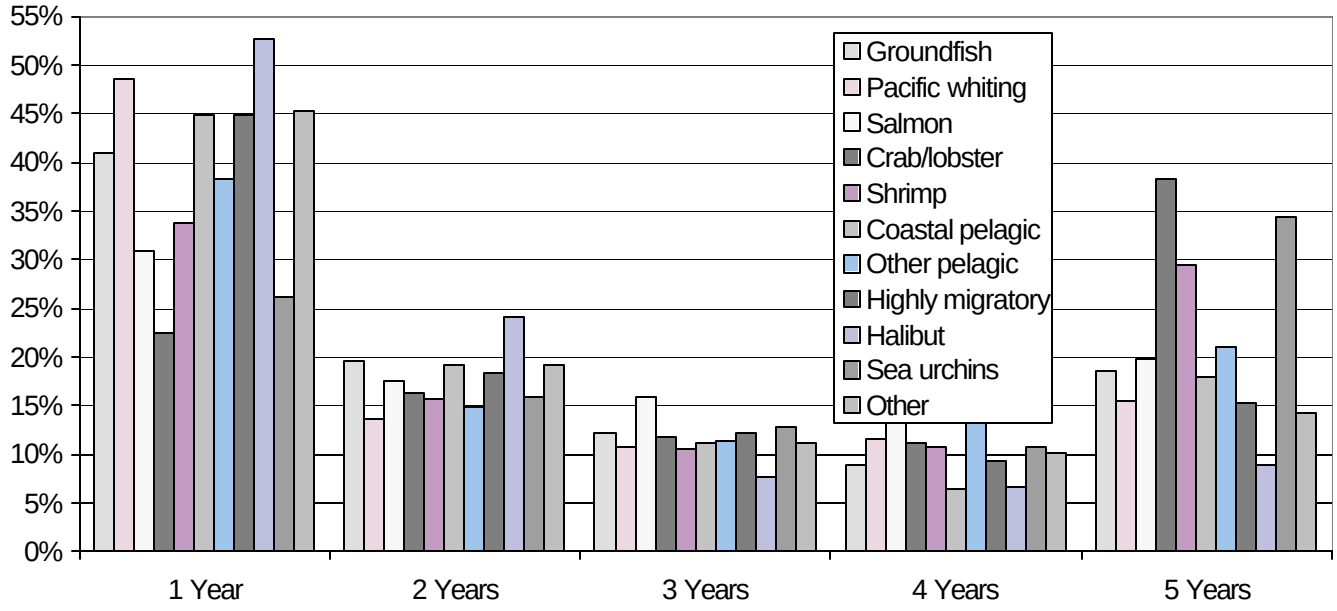
2. Excludes vessel identification codes "NONE" and "ZZ..."

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.

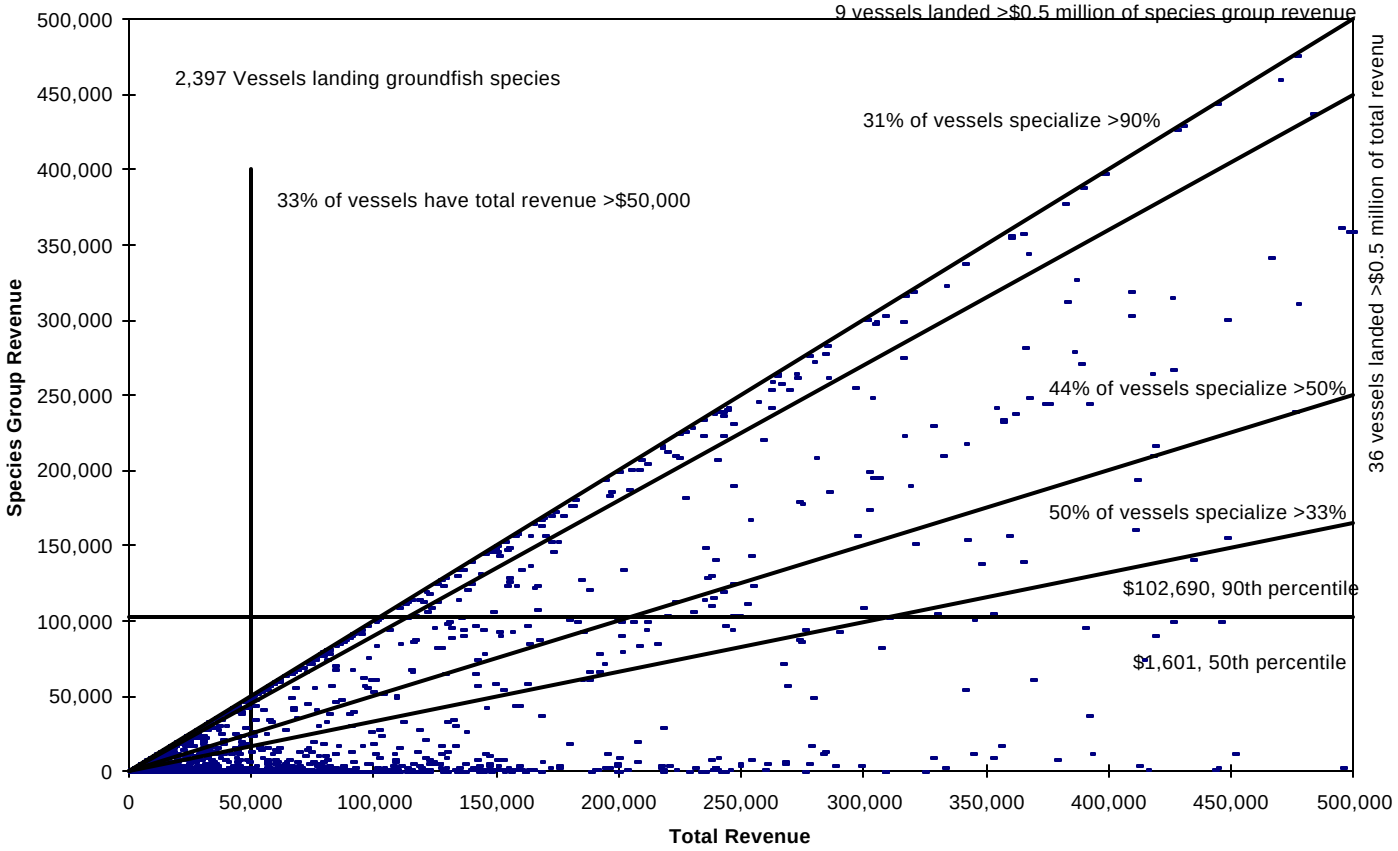
Table E3
Vessel Counts and Revenues by Species and Gear Groups for Specialization Categories in 1997

Species	>90% Vessel Count	>90% Average Species Revenue	>90% Average Total Revenue	>50% and <=90% Vessel Count	>50% and <=90% Average Species Revenue	>50% and <=90% Average Total Revenue	>33% and <=50% Vessel Count	>33% and <=50% Average Species Revenue	>33% and <=50% Average Total Revenue	>=0% and <=33% Vessel Count	>=0% and <=33% Average Species Revenue	>=0% and <=33% Average Total Revenue	Total Vessel Count	Total Average Species Revenue	Total Average Total Revenue
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	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
Net	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

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 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: 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

	Vessel Category	Total Category Revenue	Percent	Vessel Count	Percent	Average 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. West Coast Onshore																						U.S. West			
Vessel Category	Ground-fish		Pacific Whiting		Salmon		Crab/ Lobster		Shrimp		Coastal Pelagic		Other Pelagic		Highly Migratory		Halibut		Sea Urchins		Other		Total Onshore		Alaska Onshore		Alaska Offshore		Coast Offshore	Other Offshore		Tota
1 Mothership/Catcher	866	6%													94	1%	287	2%			0	0%	1,248	9%	1,105	8%	11,233	83%		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%	146	0%	513	1%	1,051	3%	56	0%	0	0%	8,038	22%	28,391	78%				175	0%	36,604
	1%				9%		6%		0%		0%		1%		1%		10%		0%		0%		3%		68%					2%		10%
3 Pacific Whiting Onshore	3,154	16%	7,204	37%	3	0%	751	4%	109	1%	3	0%	31	0%	1	0%	0	0%			2	0%	11,259	58%	3,377	17%	90	0%	4,755	24%			19,481
and Offshore Trawler	4%		86%		0%		1%		0%		0%		0%		0%		0%				0%		4%		8%		1%		100%				5%
4 Large Groundfish	44,649	80%	826	1%	26	0%	3,050	5%	4,961	9%	25	0%	163	0%	507	1%	112	0%			1,400	3%	55,718	100%	105	0%				100	0%	55,924
Trawler	60%		10%		0%		5%		21%		0%		1%		1%		1%				14%		18%		0%					1%		15%
5 Small Groundfish	2,016	54%	1	0%	10	0%	237	6%	46	1%	10	0%	4	0%	159	4%			1	0%	1,227	33%	3,710	100%								3,710
Trawler	3%		0%		0%		0%		0%		0%		0%		0%				0%		13%		1%									1%
6 Sablefish Fixed Gear	12,503	68%	0	0%	217	1%	3,006	16%	71	0%	2	0%	12	0%	417	2%	1,098	6%	93	1%	12	0%	17,431	95%	854	5%				25	0%	18,311
	17%		0%		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%	2	0%	2	0%	1	0%	302	2%	6,564	43%	32	0%	288	2%	12,658	82%	2,652	17%				125	1%	15,435
Fixed Gear	6%		0%		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%	15,075	29%	3,409	7%	45	0%			124	0%	49,432	95%	2,849	5%				25	0%	52,306
	0%				5%		0%		1%		99%		96%		9%		0%				1%		16%		7%					0%		14%
9 Migratory Netter	66	0%			251	2%	37	0%	155	1%	19	0%	1	0%	14,706	93%			19	0%	267	2%	15,521	98%						350	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%	2	0%	15,093	61%	7	0%	220	1%	42	0%	18,969	77%	53	0%				5,725	23%	24,747
	0%				6%		4%		1%		0%		0%		39%		0%		1%		0%		6%		0%					80%		7%
11 Shrimper	741	3%			41	0%	3,916	18%	16,577	75%	10	0%	19	0%	537	2%	62	0%	6	0%	147	1%	22,057	100%	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%	100	0%	1,751	4%	253	1%	75	0%	74	0%	44,076	97%	1,217	3%				200	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%			0	0%	14	0%	342	6%	39	1%			30	0%	6,020	99%	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	0%					0	0%			12	0%	139	5%	2,528	96%	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	0%	0	0%	0	0%			342	30%	737	65%	1,125	99%	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%	198	3%	7	0%	1	0%	81	1%			28	0%	527	8%	6,908	100%								6,908
	0%				0%		9%		1%		0%		0%		0%				0%		5%		2%									2%
17 Diver Vessel	214	1%			15	0%	43	0%	1	0%	0	0%	5	0%	60	0%	0	0%	15,132	80%	3,507	18%	18,977	100%	12	0%						18,989
	0%				0%		0%		0%		0%		0%		0%		0%		94%		36%		6%		0%							5%
18 Other > $15 Thousand	762	17%	306	7%	326	7%	693	16%	114	3%	15	0%	9	0%	33	1%	564	13%			228	5%	3,051	70%	861	20%				450	10%	4,362
	1%		4%		2%		1%		0%		0%		0%		0%		6%				2%		1%		2%					6%		1%
19 Other <= $15 Thousand	2,004	24%	18	0%	1,792	22%	1,873	22%	169	2%	179	2%	205	2%	904	11%	29	0%	107	1%	1,055	13%	8,336	100%								8,336
	3%		0%		11%		3%		1%		1%		1%		2%		0%		1%		11%		3%									2%
Total revenue	74,564	20%	8,356	2%	16,038	4%	63,995	17%	23,525	6%	29,849	8%	15,785	4%	38,910	10%	10,112	3%	16,124	4%	9,806	3%	307,063	83%	41,693	11%	11,323	3%	4,755	1%	7,200	2%	372,034
	100%		100%		100%		100%		100%		100%		100%		100%		100%		100%		100%		100%		100%		100%		100%		100%		100%
Vessel count	2,399		91		2,319		1,590		384		398		377		1,402		350		385		1,848		5,731		377		14		15	148		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."

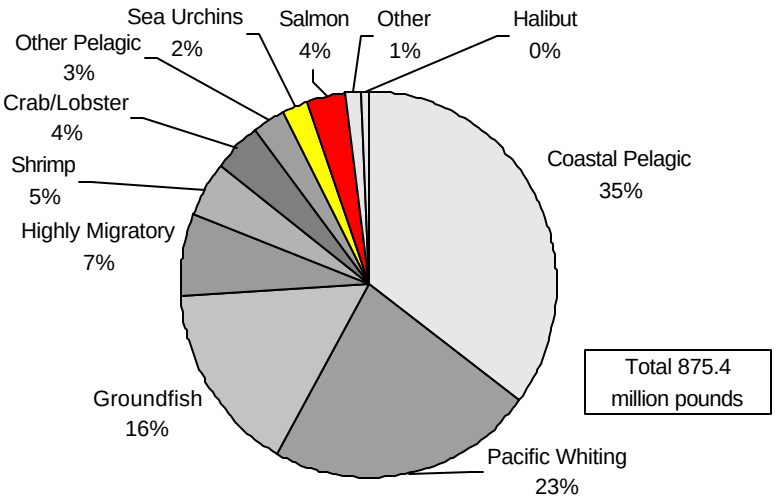
3. Vessel counts across species group categories are not unique but the column "total" is for unique vessels.

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

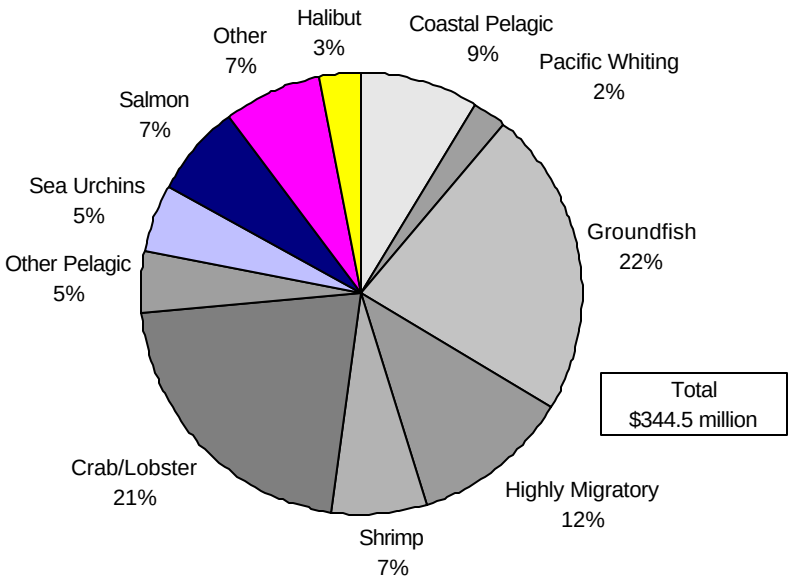
Source: PacFIN March 1999 extraction.

Figure E6
Total Landed Volume and Value by Species in 1997

Volume



Value



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

Table E7
Volume and Value of Fish Landings by State in 1997

	Landed Volume		Ex-Vessel Value	
Area	Volume	%	Value	%
Washington	122.0	14%	$103.6	30%
Oregon	260.9	30%	$69.6	20%
California	492.5	56%	$171.3	50%
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.

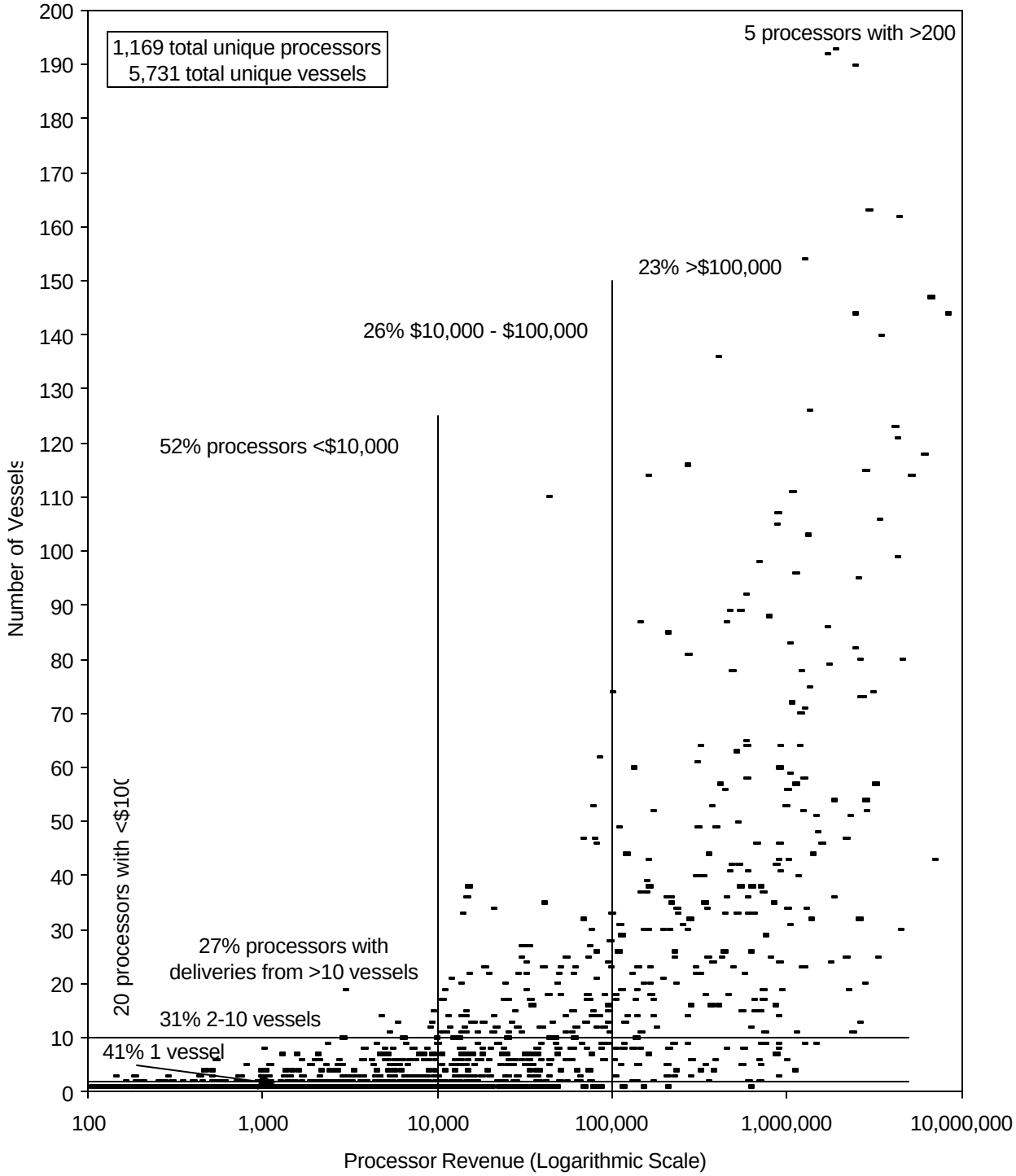
flow throughout the year. Some of these primary processing firms also include distributing and wholesaling as their function.

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).

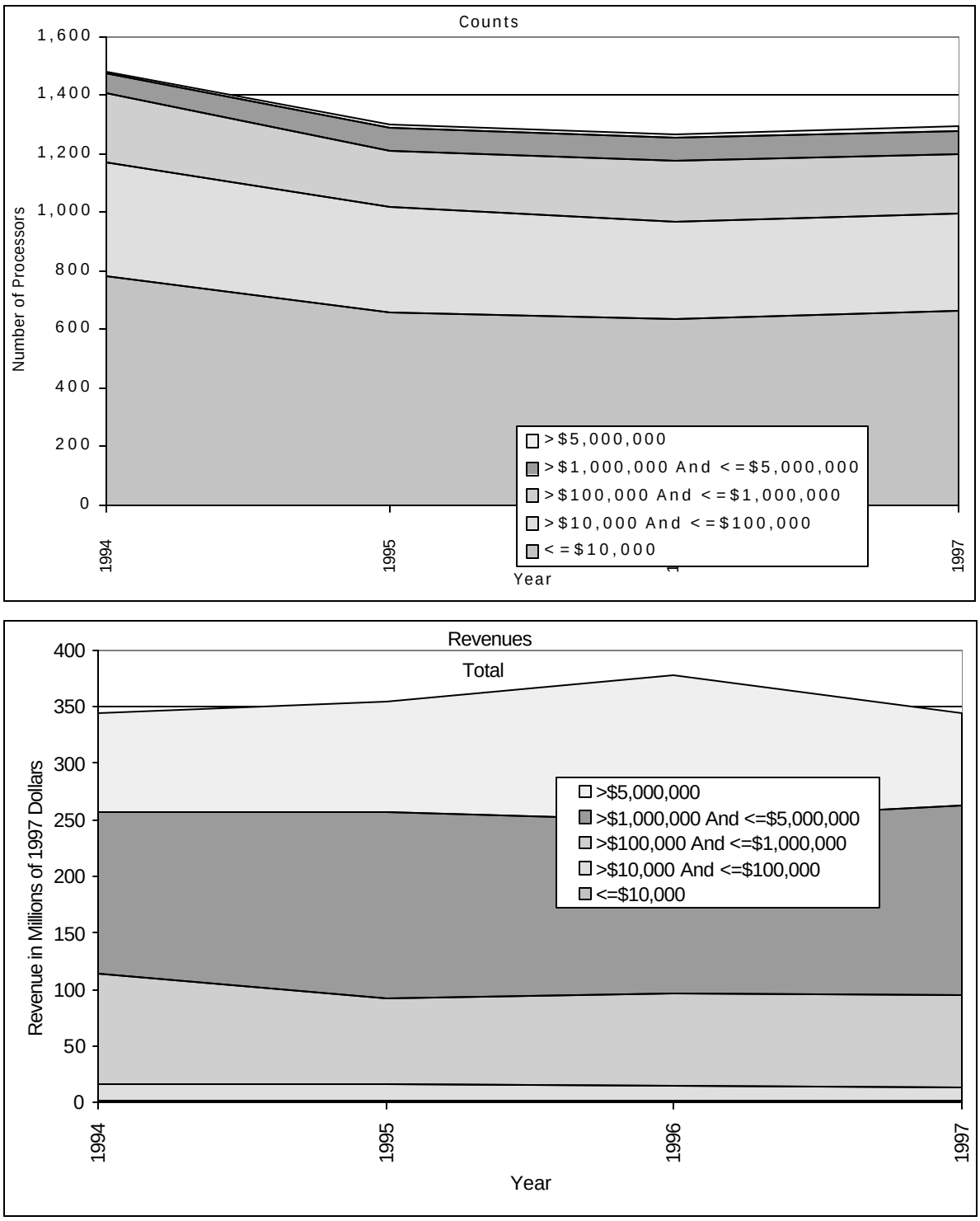
Figure E7
Scattergram Showing Processors' Revenue Compared to
Number of Vessels Delivering to the Processor in 1997



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.

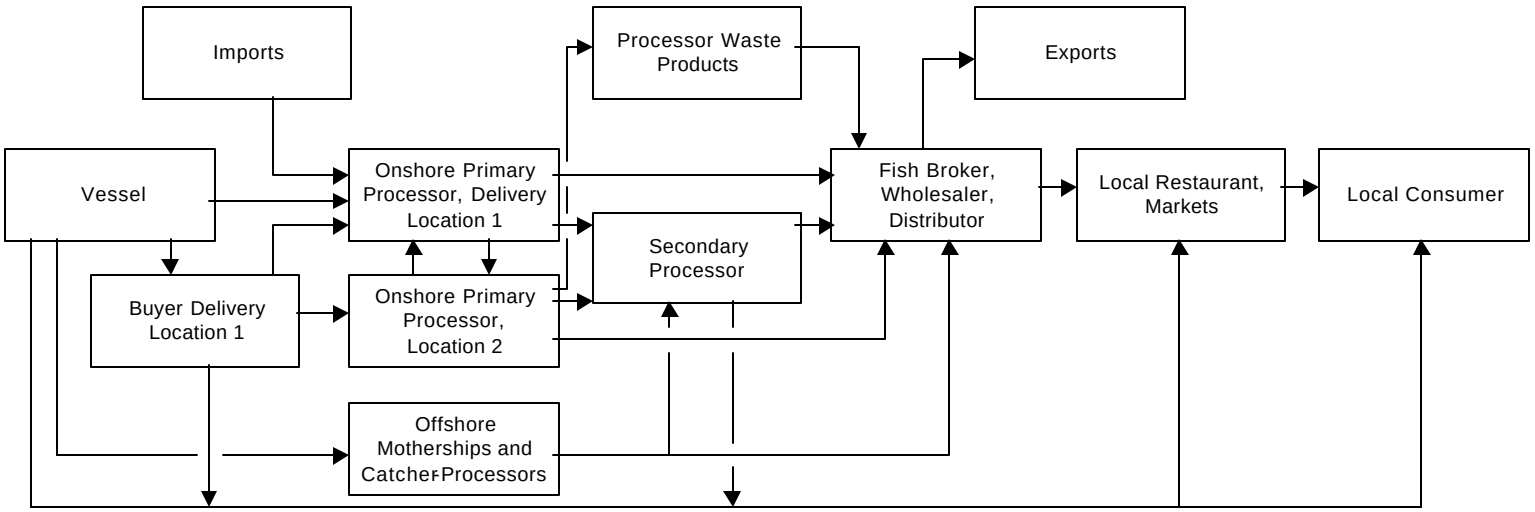
Source: PacFIN March 1999 extraction.

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 ex-processor 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

Species	Count Total	Processor Counts Within Revenue Categories <=$10K	<=$100K	<=$1,000K	<=$5,000K	>$5,000K	Counts Within Revenue Specialization Categories >90%	>50%	>33%
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%			

Species	Sum of Revenue (thousands)	Revenue Distribution (thousands) 90th Percentile	50th 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

Volume Category	Ground-fish		Pacific Whiting		Salmon		Crab/ Lobster		Shrimp		Coastal Pelagic		Other Pelagic		Highly Migratory		Halibut		Sea Urchins		Other		Total Onshore	
<=$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%	
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 ex-processor 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.[1]

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.[2] 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.

1. For a more complete description of seafood processing on the West Coast, see Radtke and Davis (1997).
2. 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

	Count	Percent of Volume	Percent of Value	Average Annual Ex-Vessel Value	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.

A. INTRODUCTION

1. Project Purpose

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. For example:

- In Washington, Oregon, and northern California, the ocean salmon fishery was the mainstay species of a small, day boat, fishing fleet during the 1970's and 1980's. Thousands of commercial fishing vessels moored at coastal communities would fish for salmon using troller gear during the summer months. Abundances of coho salmon and other stocks have declined to such a level that some species are now managed for zero harvests.

- Hundreds of seiners shared in the harvest of pink and sockeye salmon stocks in northern Puget Sound, Juan de Fuca Strait, Georgia Strait, and Johnstone Strait with Canadian vessels. The collapse of Fraser River salmon stocks and restricted allocations from international agreements have substantially reduced this fleet.

- Tuna vessels home ported at southern California ports delivered millions of pounds of albacore, skipjack, and yellowfin tuna to processors in the Long Beach area. Harvesting and processing tuna and other highly migratory species is now being done in Hawaii and southern Pacific countries.

- Groundfish fisheries developed in the early 1980's, and then spurred by the Pacific whiting joint venture fishery, saw heavy investments in equipment and technology. A limited entry program started in 1987 to assist in limiting vessel numbers was delayed until 1992 because of the failure to correctly publish the management program rules in the Federal Register. This brought swift entry of many vessels into this fishery attempting to preserve options for participation. Because many vessels failed to qualify for new limited entry rules, approximately 10 percent of groundfish harvest quotas were set aside for open access. Rockfish and some flatfish species have been declared overfished, which reduces trip and aggregate catch levels. The numbers of vessels without limited entry permits are sharing a decreasing amount of the quotas. Permits can be sold and combined into a permit for a larger vessel, causing the count of vessels harvesting limited entry groundfish quotas to decrease.

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. Based on participation, a vessel classification scheme was developed using 1997 landing information.

This project is also to review the fish processing segment of the commercial fishing industry. Background information is provided about raw product purchases, finished products, and seafood markets. The profile includes classifications of processors and buyers by amount of raw product purchased and degree of dependence on particular fisheries. The profiles are developed for main port groupings within states and in aggregate for the U.S. West Coast. The period of analysis to show trends and changes was 1994 to 1997 and, where applicable, more historical references dates are used. The processor classification scheme used 1997 purchase information.

Benefits from the study could be to serve as a basis for determining cost and earnings surveys, designing observer programs, making capacity investigations, showing management measure effectiveness, analyzing bycatch and discard, and the like. Specifically, developing models to determine fleet capacity for prosecuting fisheries under certain management measures affecting common vessel types could rely on study findings. In addition to understanding harvester and processor characteristics, investment planning, facility design, marketing efforts, and other operational decision making could benefit from study results.

Many other fleet and seafood processing studies have classification methods, most of which are ad hoc and depend on the study purpose. The North Pacific Fishery Management Council (NPFMC) developed a vessel classification scheme in 1996 based on performance and vessel size criteria (Brannan 1997). Its purpose was to understand fleet capacity and assumed there was upward mobility in fleet response to fishery status. If a vessel demonstrated it could harvest a certain species with a certain gear, or a processor could output a certain product form, then the principal species landed or processed over time did not matter. Once the capital expense was made for a certain gear (say midwater trawl) or a product final form (say picked shrimp), then those capital expenses are sunk and capacity exists. No expiration from when the vessel or processor entered a certain classification was used. Certain vessel gear and species combinations and processor final products were ranked from highest to lowest in terms of capital costs in order to classify a vessel.

A widely distributed study about port facilities by Kramer, Chin, and Mayo (1982) used six broad gear based categories to show potential for harvesting along the U.S. West Coast and Alaska to determine port facility needs. These categories were the U.S. West Coast groundfish trawl fleet, Alaska groundfish trawl fleet, U.S. West Coast shrimp trawl fleet, Alaska shrimp trawl fleet, Alaska king and tanner crab fleet, halibut longline fleet, and Alaska floating processor fleet. The importance placed on only these gear categories and geographical references in 1982 rather than the characteristics of the multi-fishery and mobile fleet of today show how vessel classifications schemes can quickly become dated.

More recently, the Federal Fisheries Investment Task Force (1999) reviewed capacity definition and measurement in order to understand "excess harvesting capacity." Besides a thorough explanation of factors and behavior that explains capacity, the case studies of financial and regulatory programs to reduce capacity were offered. Each of the case study explanations gave glimpses of vessel categories impacted by management programs.

A study by Färe and Grosskopf (1998) classified vessels using an economic based approach to determine fleet capacity. Economic capacity was defined to be the largest feasible output when

input prices and cost (or a budget) can be determined. Therefore maximum output will be determined when the maximum level of inputs do not cost more than the fixed budget. This definition overcomes indeterminacy problems with applying cost curves to fisheries when fixed budgets are unknown. While theoretically appealing, its application is problematic. Data regularly available about fleets do not include cost factors.

The economic approach was discussed in a different context by the National Marine Fisheries Service (NMFS) (1999) when addressing the Sustainable Fisheries Act of 1996 for development of a national fisheries information system. Data would be collected to allow end-users to develop relationships to predict vessel capacities and capacity utilization. Data models would cover harvester catch and effort, biological variables, sociocultural information, processor product and inventories, and cost-earnings information. Obviously if available, data from such a comprehensive registration system would be very effective in establishing a comprehensive vessel classification system.

2. Project Limitations

The project draws upon existing information sources about landings and permits. Past relevant studies are also referenced when applicable. The data and its analysis may prove useful for fishery managers and others interested in the U.S. West Coast commercial fishing industry, however, the project's purpose was not to explain responses by the harvesting sector to fisheries management decisions, species abundances, seafood market conditions, or other factors that affect the earnings potential of vessels. Also, some species stock status is described but is not explained in terms of how fishing pressure might be altered to take advantage of or avoid stocks. Finally, comprehensive detailed landing information is only available since 1981. This period is inadequate from a biological perspective to show how the fishing fleet may change due to stock recoveries from management decisions, or due to cyclical variations in stock abundances. No prescriptions or recommendations are offered to influence the trends witnessed during the analysis period, to develop fisheries, or help in fisheries' recoveries.

The report content includes some description of data sources and limitations, as well as data analysis results. There were many assumptions that had to be made to determine vessel and processors revenue characteristics, and it is important to consider how these assumptions propagate through the analysis. Trends are described in terms of aggregate landing history where it might have been just as revealing to show a longitudinal perspective of fleet and processor groups. A review of fishery entry and exit over a recent five year period was completed to better understand how cross-sectional data would be applicable for describing fleet characteristics. Study resources prevented a more thorough longitudinal analysis of categories. That is, while vessel counts participating in U.S. West Coast commercial fisheries have declined considerably in the last two decades, have the characteristics of particular categories in remaining vessels changed? The vessel and processor groupings were determined using species and gear combinations and geographic source of revenue. Other criteria, such as cost functions, vessel and processor size characteristics, ownership considerations, past fishery participation factors, etc. may also have been revealing for determining groups, but data availability precluded this criterion’s use in the classification methodology.

3. Sources of Information

a. Vessels

A description of the U.S. West Coast commercial fishing fleet and processors in terms of revenue received from landings must consider more than just deliveries made to U.S. West Coast ports. Vessels with homeports in U.S. West Coast states may travel to other waters in the Pacific Ocean for fishing opportunities and make landings at those locations. 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 1).

Table 1
Data Sources

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

The U.S. West Coast onshore landing information is from fish ticket programs administered by states. A fish ticket is issued by a purchaser to a vessel selling its catch to a processor or buyer. The fish ticket information for the U.S. West Coast is compiled by the states and copies of data sets are sent to the Pacific States Marine Fisheries Commission (PSMFC), Pacific Fisheries Information Network (PacFIN) Program. The PacFIN Program constructs a database using common units of measurement. Vessel and processor specific landing information is available to qualified researchers executing confidentiality agreements. Project analysis results from this information source are summarized in this report to remove visibility of any one vessel or processor's revenues.

Alaska onshore landings are compiled by the Alaska Commercial Fishing Entry Commission (CFEC). Downloads of this database are not available to other than fishery managers, however the CFEC staff did provide summary revenue information by gear and species groupings for vessels with owners who have addresses in the U.S. West Coast states. Vessel specific information is available from CFEC vessel permit and registration files, including the owners address. The average revenues by gear and species were imputed to U.S. West Coast states

vessels based on whether the vessel had permits for the respective Alaska fisheries. There are instances where Alaska fishery permits are held by owners from U.S. West Coast states but leased to vessels owned by others, i.e. the U.S. West Coast states owners received lease revenues but not revenues from landings. In these instances, this report's analysis imputed revenues just as if the owner received the lease revenues from landings. This will accurately reflect earnings returned to U.S. West Coast states, but cause an overcount of vessels that actually fished in Alaska.

Offshore landings in Alaska and the U.S. West Coast are compiled in the NMFS Alaska Fisheries Information Network (AKFIN) Program and Blend File. These information sources show deliveries made to motherships and harvests done by catcher-processors in Alaska and the U.S. West Coast. The NMFS provided summary revenue information for vessels with owners from U.S. West Coast states. The same procedures used for imputing Alaska onshore revenues were used for offshore revenues. Other information sources included anecdotal information from vessel associations and others about vessels participating in other distant water fisheries. For example, such information included estimated revenues and vessel lists for the tuna fisheries in the southern Pacific Ocean. The other information sources also included information about vessels with owners from U.S. West Coast states, but with corporate addresses in other states.

A separate analysis was done for vessels holding federal permits for the groundfish limited entry program administered by NMFS. Many states along the U.S. West Coast also require permits in order to fish and land certain species. For example, a vessel moratorium permit system for salmon has existed in U.S. West Coast states since 1980.

There are data limitations with landing information being associated with a vessel, and determining vessel attribute information, such as length and tonnage. Vessels are required to be registered and hold valid permits for most of the fisheries in which the U.S. West Coast fleet participates. However, the vessel registration number is not always the same in the various fisheries jurisdictions and the U.S. Coast Guard requires only vessels over five tons displacement to be documented. Moreover, a vessel can be re-documented with the same or new name. Vessels harvesting in treaty fisheries are not required to be identified. For these reasons, tracking individual vessels for mobility between fisheries was not exact.

Treaty fishery landings were particularly vexing for tracking vessel revenues. While fish tickets must be issued for landings within treaty fishery allocations, it is not required that individual vessels be identified. The PacFIN Program uses a routine to assign a sequential code to non-identified vessels. It is "ZZ" followed by a number. There are also some fish tickets that erroneously omit vessel plate number and are also assigned a ZZ code. There are other landings not associated with a vessel, such as imports across state boundaries and illegal catches. In these cases, a vessel identification code of "NONE" is assigned. Table 2 shows the occurrence of the vessel identification codes and the revenues associated with each.

Vessel attribute information is supplied by states to the PacFIN Program. Certain vessel attribute information, such as length, is included for state licensing. PacFIN routines can retrieve vessel attributes from both the state supplied information and from USCG documentation information.

Table 2
Data Limitations for Analyzing the Onshore Landings by the U.S. West Coast Fishing Fleet and for Analyzing Processor or Buyer Purchases in 1997

1. Vessel Identifier Limitations by Participation Group and Vessel Attributes

Derived Vessel Identifier	Participation Group	State Length	USCG Tonnage	Sum of Revenue	Count of Vessels
All	All	All	All	344,520,888	8,860
"NONE"	All	All	All	957,658	5
"ZZ..."	All	All	All	36,500,345	2,651
"ZZ..." or "NONE"	I	All	All	33,425,119	2,502
All	All	0	All	40,042,292	2,729
All	All	All	0	79,150,516	5,121
All	All	0	0	39,762,015	2,703

2. Vessel Identifier Limitations by Species Group Revenue Distribution

	Vessels showing identifier of "ZZ..." or "NONE"	Vessels showing 0 length and including all vessel identifiers	Vessels showing 0 tonnage and including all vessel identifiers	Total
Groundfish	3,392,476	3,508,151	12,234,962	77,956,094
Pacific Whiting			236,832	8,355,607
Salmon	7,815,620	7,946,034	10,792,432	23,853,668
Crab/Lobster	9,342,745	9,360,676	18,335,228	73,337,658
Shrimp	527,693	556,412	1,860,459	24,052,991
Coastal Pelagic	130	160	187,246	29,848,863
Other Pelagic	2,707	2,707	2,311,571	15,787,463
Highly Migratory	762,384	768,874	1,682,257	39,671,887
Halibut	567,144	569,882	868,991	10,679,358
Sea Urchins	597,645	594,456	10,779,123	16,721,706
Other	14,449,459	16,734,940	19,861,415	24,255,593

3. Record Count for Landings Showing 0 Revenues

Total number of records:	73,001	
Records showing 0 revenue, but some pounds:	566	(number of pounds is 3,918,649)
Records showing some revenue, but 0 pounds:	0	
Records showing 0 revenue and 0 pounds:	0	

4. Processor or buyer identification code data limitations

		Count	Revenue	
Washington				
	Other unique	243	67,944,948	(from non-ZZ and non-NONE vessels)
		185	35,682,122	(from ZZ and NONE vessels)
	0000000	0	0	
	9999999	0	0	
	XXXXXXX	0	0	
	Subtotal	339	103,627,070	

Table 2 (continued)

4. Processor or buyer identification code data limitations (cont.)

		Count	Revenue	
Oregon				
	Other unique	163	68,620,271	(from non-ZZ and non-NONE vessels)
		43	947,687	(from ZZ and NONE vessels)
	0000000	0	0	
	9999999	0	0	
	XXXXXXX	0	0	
	Subtotal	180	69,567,958	
California				
	Other unique	760	170,459,071	(from non-ZZ and non-NONE vessels)
		84	828,134	(from ZZ and NONE vessels)
	0000000	1	430	
	9999999	1	2,273	
	XXXXXXX	1	35,952	
	Subtotal	771	171,325,860	
Total		1,290	344,520,888	

5. Vessel identification code data limitations

	Count	Revenue
Processors with only deliveries from "ZZ.." or "NONE" vessels		
Washington	96	10,122,140
Oregon	17	104,948
California	8	15,169

Notes:
1. Participation group can either be "I" for tribal fisheries or "C" for commercial fisheries.
2. Vessels assigned a "ZZ.." code are generally fish tickets issued for tribal fisheries and are not unique vessels. Landings not associated with a vessel, such as illegal catches, are assigned a "NONE" code.
3. Oregon supplies a vessel length from state registration information. Vessels assigned a "ZZ.." or "NONE" code will not have length or tonnage information. Sometimes other vessels with a valid registration number have 0 length assigned and some unique vessels have different assigned lengths.
4. PacFIN can also retrieve vessel information, such as length and tonnage, from the U.S. Coast Guard vessel documentation information. Vessels under five tons are not required to be documented.
5. Excludes one processor where $0 revenue was reported.

Source: PacFIN March 1999 extraction.

Since it is not necessary to document vessels less than five tons, the USCG data is only relevant for larger vessels.

Various analysis tables in this report refer to an extraction of data from PacFIN. This is not important information for the reader, but is useful for future comparative analysis purposes. PacFIN downloads vary somewhat as information from states is constantly being benchmarked using adjustments in methodologies and error reduction routines (NMFS 1997).

The PacFIN data was downloaded as annual vessel summary information. This removed visibility of trip specific information, such as vessel trip number, trip duration, trip catch, seasonal occurrences of trips, etc.

There is some limitation in trend data used for describing the history of landings by the U.S. West Coast fishing fleet. Trend information since 1981 was available for onshore landings in Washington, Oregon, and California, however the only data for distant water fisheries was cross-sectional for 1996. Where necessary to include information about distant water fisheries at a vessel specific level, it was assumed that vessel activity in 1997 was the same as in 1996. The federal limited entry program has only been in existence since 1994, so only the years 1994 through 1997 were available for comparison.

b. Processors

Processor information was also developed mostly using landing information from the PacFIN. Personal communication with owners and processor associations was also used to sort out how licensed processor and buyer names are related to parent companies.

There are data limitations with landing information being associated with a processor or buyer. The limitations are due to the limited information included on a fish ticket and the complexity of the types of businesses that issue fish tickets. States submit the fish ticket data sets to PacFIN with processor identification codes along with a separate file that translates the codes to names and other registration information about a processor or buyer. Sometimes the codes do not have an entry in the translation file whereby a PacFIN Program routine assigns a "XXXXXXX" or "9999900" or "0000000" to the non-identified processor or buyer. Analysis that includes associating processor or buyer purchases with individual vessels also has problems. Table 1 shows the occurrence of problem vessel and processor or buyer identification codes and the revenues associated with each in 1997.

Ownership of processing plants changes frequently, therefore analysis based on ownership information collected at a point in time may not be applicable over a longer period of time. The results presented in this project should be considered an approximation for the period of the descriptive analysis. Further, exact name matches will tend to miss matches between licenses held by the same firm when the firm's name differs between the license records due to typographical errors or data entry choices (e.g. entering "&" or "and"). It is also likely that not all instances of cross ownership were detected between firms with different names. For these reasons, the actual number of processors/buyers is likely to be lower and the concentration of processing/buying activities greater than represented in this analysis.

4. Definition of the Fishing Fleet and Processors

a. Vessels

There are many vessels listed in the sources of information used in this project that have ties to Washington, Oregon, and California, as defined by owners and crews with residency in these states. However, the vessel's homeport may not necessarily be in these states and the vessel may

not make deliveries to these states' ports. It was decided that the U.S. West Coast fleet would be defined by only those vessels that make at least one onshore landing in Washington, Oregon, or California. 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 offshore or distant water fisheries.

The project defined vessel counts are shown in Table 3. Years 1996 and 1997 are the most recent years for complete information. Since U.S. West Coast onshore landings represented a very high proportion of all landings, this information is adequate to show fleet summary capability for harvesting. Other fisheries landing information is also described in aggregate and where appropriate to show revenue contributions from distant water fisheries.

Table 3
Vessel Counts for U.S. West Coast Fishing Fleet in 1996 and 1997

Fishery	Washington		Oregon		California		Total	
	1996	1997	1996	1997	1996	1997	1996	1997
U.S. West Coast								
Onshore	1,781	1,806	1,331	1,257	3,282	3,145	5,891	5,731
Offshore	4	1	9	13	1	4	13	15
Alaska								
Onshore	264	304	61	64	71	69	349	377
Offshore	5	7	4	6	0	2	9	14
Other Pacific Ocean waters	NA	74	NA	55	NA	79	NA	148

Notes:
1. NA - not available.
2. Excludes vessel identifiers "ZZ.." and "NONE."
3. Vessel counts among states are not unique vessels. The "total" counts are unique.
4. The inclusion criteria for vessel counts 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 March 1999 extraction, AKFIN 1998 extraction, and Wayne Heikkila, Western Fishing Boat Owners Association.

b. Processors

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.

5. Definition of Species and Gear Groups

The PacFIN system contained 203 different species codes and 32 different gear codes through 1997. To reduce the number of codes to a reasonable number for analysis purposes, mapping to groups was done. The mapping was mostly influenced by existing management regimes that combine species dependent upon similar habitat and are harvested using common gears. Some analysis required more detailed subgrouping within major groupings. The appendix contains the mapping scheme using the notation Summary Level 1 for major groups and Summary Level 2 for subgroups. Single variable (such as species) analysis was revealing about fleet and processor characteristics, but it was necessary to use multi-variable (such as species, gears, and vessel attributes) analysis to explain unique groupings of vessels and processor businesses. Hypothesis testing for grouping was sometimes performed using a priori knowledge about the fishing industry, however blind statistical procedures, including discriminate and cluster analysis was also applied.

6. Statistical Classifications

A statistical analysis was used early in the study to assist in determining relevancy of available data to find vessel and processor classifications. The example of statistically classifying vessels is used to describe the procedures and results. Discriminant analysis was used to find the predictive variables for a vessel classification grouping variable. Since it might have been of interest to allow blind statistical procedures to find salient vessel groups, all combinations of revenues by species and gear summary levels were used. This results in 66 combinations (11 species and six gear groups). In addition, distant water fisheries revenue, vessel length, and permit status were used as variables. Additional variable transformations, such as ratios (total revenues divided by vessel length, for example), were used in the variable selection process. Residual analysis and statistical scoring was used to determine the most beneficial independent variables to predict groupings. This resulted in the following list:

- Greatest revenue from any summary level species and gear combination
- Total onshore revenue
- Revenue from Alaska fisheries
- Revenue from other offshore source
- Total revenue
- Vessel length
- Federal groundfish limited entry permit status

Cluster analysis was employed to find an arbitrary number of groupings based on the selected predictive variables. The K-means algorithm developed by Hartigan (1975) was used for the partitioning. The algorithm was repeated many times with varied configurations to find an optimum solution for a particular number of clusters. The goodness-of-fit criteria was used to compare the various cluster configurations.

$$WSS_K = \left(\frac{NP}{NP - m} \right) \sum_{k=1}^{K} \sum_{i=1}^{P} \sum_{j=1}^{n_k} (1 - \delta_{ijk})(z_{ij} - c_{ik})^2$$

where WSS_K is the within-cluster sum of squares and c_{ik} is the average (center) value of the i^{th} variable in the k^{th} cluster.

The percent of variation is defined as

$$PV_K = 100\frac{WSS_K}{WSS_1}$$

Some of the variables were discrete (species and gear combination identifier and permit status), but most were continuous (revenues and length). A random sample of 1,000 vessels was chosen from the universe of 5,112 vessels defined as the U.S. West Coast fleet for the statistical analysis. (This excludes vessels landing less than or equal to $500 onshore revenue and all vessels identified as "ZZ..." and "NONE.") A range of five to 15 clusters was designated, but the best goodness-of-fit test resulted in 10 clusters. The following table shows the descriptive statistics for the 10 clusters.

		Mean Revenue			Species/		
Cluster	Percent	Specialization	Onshore	Distant Water	Gear Frequency	Mean Length	Permit Status
1	3%	92,013	102,849	199,250	halibut/hook	60	no
2	13%	89,033	113,788	9,515	groundfish/hook	50	yes
3	25%	49,636	60,113	2,409	crab,lobster/pot	40	no
4	<1%	131,493	133,088	125,000	highly migratory/troll	92	no
5	6%	51,723	62,596	3,321	crab,lobster/pot / highly migratory/troll	67	no
6	21%	15,639	17,861	11,108	salmon/net	47	no
7	29%	15,118	20,068	1,487	salmon/troll	40	no
8	2%	391,047	497,546	36,564	coastal pelagic/net	68	mixed
9	<1%	1,197,829	436,450	0	coastal pelagic/net	101	no
10	<1%	127,576	237,101	197,205	halibut/hook	63	yes

Notes: 1. Species/gear frequency and permit status is defined to be the highest count within the cluster.
2. Percent is the share of sample vessels within the cluster partition.

Source: Study.

The statistical procedures were most useful as a tool to investigate relevant variables and threshold ranges for the variables. The statistical results were not particularly useful for revealing a classification scheme that would comprehensively describe the U.S. West Coast fleet. Later sections in the report describe how a combination of a priori knowledge about fishery management, vessel fisheries participation, and statistical procedures was used to determine classifications.

B. ONSHORE LANDING TRENDS

In recent history, the U.S. West Coast fishing fleet shifted from salmon and tuna toward groundfish and shrimp (Table 4). In the late 1980's, groundfish landings stabilized and shrimp landings increased. Both landings and prices (except for shrimp) were such that 1987 and 1988 were banner years. Because of declining prices and declining species abundances, the value of landings in most U.S. West Coast ports has declined dramatically in the late 1990's.

With the development of the groundfish fishery and the heydays in the southern California tuna fishery, historical landings in terms of volume increased to 1.1 billion pounds in 1981 (Table 4). These landings decreased during the low years of "El Niño" in 1983 and 1984 then increased again when Pacific whiting was brought onshore to be processed into "surimi." Because of the influence of Pacific whiting prices, total landings have changed generally from high value-low volume to low value-high volume species.

The count of vessels making landings generally pattern landing volume (Table 5). While the number of vessels overall has declined, the decreased numbers making landings for the species groups salmon and groundfish are most pronounced.

The value of landings (in inflation adjusted, real terms) peaked in the years 1979-1981 when high levels of landings in tuna, groundfish, crab, and salmon combined with strong prices for almost all species (Tables 6 and 7). In 1997 real terms, the ex-vessel value of all landed fish declined to less than $350 million in 1984 through 1986 and then increased to over $500 million in 1988. The value has declined overall to around $300 million in 1997. There have been higher years of landing values in 1992 and again in 1996 due to increased prices and higher landings of certain species other than salmon.

Table 4
U.S. West Coast Onshore Landed Volume in 1981-1997

Year	Ground-fish	Pacific Whiting	Salmon	Crab/ Lobster	Shrimp	Coastal Pelagic	Other Pelagic	Highly Migratory	Halibut	Sea Urchins	Other	Total
1981	256,304	11,263	41,661	23,133	40,799	284,091	32,369	334,490	2,751	26,670	27,702	1,081,233
1982	292,017	15,594	42,264	19,610	28,585	211,120	71,731	252,948	2,755	19,541	12,193	968,360
1983	246,812	17,405	17,463	18,990	13,777	75,120	79,639	251,001	2,826	17,760	12,549	753,343
1984	241,775	14,778	18,491	17,286	10,678	85,986	54,683	185,054	4,228	15,168	12,619	660,745
1985	226,495	29,059	41,331	20,550	28,388	82,801	67,821	74,514	4,109	20,282	11,632	606,980
1986	209,291	16,863	43,750	20,141	58,997	110,371	75,873	76,365	6,607	35,275	12,129	665,662
1987	219,728	38,054	49,259	22,549	68,240	125,264	74,890	79,074	5,798	49,611	9,794	742,260
1988	209,199	29,248	51,539	40,998	71,549	165,550	75,492	79,337	5,085	62,686	11,783	802,468
1989	223,979	22,488	40,243	39,553	79,306	167,563	83,450	61,754	5,623	60,087	14,090	798,135
1990	213,728	20,717	26,318	34,398	56,433	148,600	48,110	35,021	4,058	53,777	15,212	656,371
1991	212,054	50,793	30,023	17,323	44,538	182,083	19,589	23,701	2,988	53,157	12,930	649,179
1992	212,779	127,970	14,647	37,488	80,586	116,354	18,499	30,421	3,214	39,903	13,503	695,365
1993	200,027	93,517	21,412	42,053	52,138	163,751	12,079	38,210	4,791	32,538	9,013	669,531
1994	162,827	162,350	15,929	42,962	35,259	180,397	8,680	45,884	3,430	27,666	6,123	691,505
1995	149,864	168,294	20,625	41,338	28,369	271,211	11,567	41,376	3,005	24,997	5,731	766,376
1996	153,283	196,392	13,430	56,926	33,428	281,914	14,138	62,872	3,097	21,545	5,467	842,492
1997	140,110	197,379	17,897	31,304	42,373	310,775	22,952	56,655	4,112	18,931	5,808	848,297

Notes:
1. Thousands of round pounds.
2. Excludes landings from vessels with identifier codes "ZZ.." and "NONE."
3. Volume excludes deliveries to offshore processors or revenues from distant water fisheries.
4. Groundfish includes landings of cods, rockfish (snapper), sablefish, soles, and flounders. Other includes landings of sturgeon, shad, smelt, clams, scallops, squid, crayfish and other shellfish species. See Appendix A for detailed species and gear mapping schemes.

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

Table 5
Counts of Vessels Landing at U.S. West Coast Ports in 1981-1997

Year	Ground-fish	Pacific Whiting	Salmon	Crab/ Lobster	Shrimp	Coastal Pelagic	Other Pelagic	Highly Migratory	Halibut	Sea Urchins	Other	Total
1981	6,156	49	11,799	1,855	470	452	1,000	2,357	306	277	2,615	15,438
1982	5,590	42	11,193	1,841	412	319	914	1,378	280	240	2,625	14,662
1983	4,890	97	10,088	1,826	390	352	1,488	2,262	250	243	2,551	13,696
1984	3,555	96	5,879	1,812	288	253	891	1,610	264	201	2,455	9,696
1985	3,894	93	7,835	1,798	300	305	793	1,313	293	212	2,121	11,264
1986	4,086	119	7,902	1,755	392	267	721	979	422	293	2,240	11,180
1987	4,790	110	7,265	1,890	442	403	888	1,045	454	444	2,298	10,934
1988	4,517	85	7,119	2,051	441	402	729	1,024	338	602	2,477	10,689
1989	4,660	68	7,132	1,992	415	425	731	781	305	562	2,430	10,847
1990	4,259	52	6,388	2,008	414	480	767	813	313	606	2,311	10,188
1991	3,634	72	5,635	1,991	456	286	466	517	319	636	2,233	9,498
1992	3,498	53	4,119	1,966	455	548	472	990	336	627	2,262	8,310
1993	3,032	49	4,092	1,809	442	371	332	965	412	569	2,037	7,804
1994	2,533	61	2,871	1,823	395	361	268	1,025	346	519	1,841	6,667
1995	2,404	71	2,877	1,772	375	339	263	782	212	486	1,705	6,370
1996	2,403	77	2,401	1,684	361	369	279	925	259	425	1,872	5,912
1997	2,399	91	2,322	1,584	388	400	380	1,406	350	385	1,847	5,733

Notes:
1. Excludes vessels with identifier code "ZZ..." or "NONE" and counts of vessels that participate exclusively in distant water fisheries or treaty fisheries.
2. Vessel counts across species groups are not unique vessels because vessels land within more than one species group. The column titled "total" is unique vessels.

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

Table 6
U.S. West Coast Landed Revenue in 1981-1997

Year	Price Index	Ground-fish	Pacific Whiting	Salmon	Crab/ Lobster	Shrimp	Coastal Pelagic	Other Pelagic	Highly Migratory	Halibut	Sea Urchins	Other	Total
1981	58.7	86,093	584	88,593	37,637	36,320	32,811	17,004	338,444	5,486	8,618	23,193	674,783
1982	62.4	105,685	829	95,461	35,112	24,815	21,190	25,109	213,332	5,591	5,644	11,722	544,491
1983	65.1	89,862	950	24,784	43,089	16,284	9,727	29,870	179,808	5,669	5,821	10,138	416,001
1984	67.5	86,317	1,010	39,897	39,519	8,124	10,893	9,363	139,020	5,821	5,417	11,967	357,347
1985	69.8	88,653	1,889	62,729	42,781	15,490	12,692	15,200	59,780	7,309	6,956	11,878	325,356
1986	71.7	88,977	1,191	76,489	39,555	45,273	13,081	14,644	59,956	16,268	13,879	10,632	379,945
1987	73.9	106,156	2,522	117,500	42,783	63,924	12,807	15,808	66,509	14,746	19,285	11,097	473,137
1988	76.6	94,731	2,376	143,096	65,825	40,116	18,675	15,317	75,975	10,808	29,550	11,420	507,888
1989	79.8	91,456	1,718	65,935	59,817	37,756	16,254	12,527	51,180	12,843	33,371	13,955	396,813
1990	83.2	83,651	1,438	52,224	65,570	34,986	12,184	15,672	30,122	10,970	34,466	13,279	354,563
1991	86.6	88,924	3,065	34,935	33,348	30,474	15,230	12,542	19,626	7,752	47,333	13,088	306,316
1992	88.9	86,005	6,859	20,034	52,465	34,083	9,853	11,911	29,189	5,160	39,545	15,004	310,109
1993	91.3	76,551	3,146	22,060	54,678	21,948	15,356	3,529	34,151	8,642	34,943	15,211	290,215
1994	93.5	76,175	5,251	20,057	65,370	25,563	23,283	4,052	41,005	8,205	31,155	11,136	311,251
1995	95.8	86,306	8,301	20,152	76,018	24,473	29,299	10,653	28,848	7,523	26,356	10,127	328,056
1996	98.0	81,648	5,539	11,859	84,134	24,766	37,809	15,579	44,742	8,582	20,431	8,447	343,536
1997	100.0	74,459	8,356	16,030	63,841	23,497	30,025	15,827	38,807	10,111	16,016	9,724	306,690

Notes:
1. Revenue is ex-vessel value in thousands of 1997 dollars adjusted using the GDP Implicit Price Deflator.
2. Excludes landings from vessels with identifier codes "ZZ.." and "NONE."
3. Volume excludes deliveries to offshore processors or revenues from distant water fisheries.
4. Groundfish includes landings of cods, rockfish (snapper), sablefish, soles, and flounders. Other includes landings of sturgeon, shad, smelt, clams, scallops, squid, crayfish and other shellfish species. See Appendix A for detailed species and gear mapping schemes.

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

Table 7
Real Prices of Species Groups From Onshore Landings in 1981-1997

Year	Ground-fish	Pacific Whiting	Salmon	Crab/ Lobster	Shrimp	Coastal Pelagic	Other Pelagic	Highly Migratory	Halibut	Sea Urchins	Other
1981	0.34	0.052	2.13	1.63	0.89	0.12	0.53	1.01	1.99	0.32	0.84
1982	0.36	0.053	2.26	1.79	0.87	0.10	0.35	0.84	2.03	0.29	0.96
1983	0.36	0.055	1.42	2.27	1.18	0.13	0.38	0.72	2.01	0.33	0.81
1984	0.36	0.068	2.16	2.29	0.76	0.13	0.17	0.75	1.38	0.36	0.95
1985	0.39	0.065	1.52	2.08	0.55	0.15	0.22	0.80	1.78	0.34	1.02
1986	0.43	0.071	1.75	1.96	0.77	0.12	0.19	0.79	2.46	0.39	0.88
1987	0.48	0.066	2.39	1.90	0.94	0.10	0.21	0.84	2.54	0.39	1.13
1988	0.45	0.081	2.78	1.61	0.56	0.11	0.20	0.96	2.13	0.47	0.97
1989	0.41	0.076	1.64	1.51	0.48	0.10	0.15	0.83	2.28	0.56	0.99
1990	0.39	0.069	1.98	1.91	0.62	0.08	0.33	0.86	2.70	0.64	0.87
1991	0.42	0.060	1.16	1.93	0.68	0.08	0.64	0.83	2.59	0.89	1.01
1992	0.40	0.054	1.37	1.40	0.42	0.08	0.64	0.96	1.61	0.99	1.11
1993	0.38	0.034	1.03	1.30	0.42	0.09	0.29	0.89	1.80	1.07	1.69
1994	0.47	0.032	1.26	1.52	0.73	0.13	0.47	0.89	2.39	1.13	1.82
1995	0.58	0.049	0.98	1.84	0.86	0.11	0.92	0.70	2.50	1.05	1.77
1996	0.53	0.028	0.88	1.48	0.74	0.13	1.10	0.71	2.77	0.95	1.55
1997	0.53	0.042	0.90	2.04	0.55	0.10	0.69	0.68	2.46	0.85	1.67

Notes: Prices in 1997 dollars adjusted using the GDP Implicit Price Deflator.
Source: Annual vessel summary information extracted from PacFIN in September 1998.

C. VESSEL FISHERY PARTICIPATION

1. 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.

2. Fisheries Description

The aggregate number of vessels landing at U.S. West Coast ports has decreased almost 63 percent since 1981 (Table 5). Figure 1 and Figure 2 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.

The following section discusses historical fishery participation on a fisheries basis and reviews the gear types and vessel size used to catch the various species groups. Counts and per vessel revenues by length categories are shown in Table 8. Where the number of vessels in a fishery is mentioned, only vessels landing at least $500 for each fishery group was used as a filter to show vessels that target within fisheries rather than vessels that might land bycatch within a species group. Later sections in this report discuss more about how vessels specialize in fisheries. The exercise of attempting to find specialization patterns proved interesting, but the outcome simply revealed the multi-fisheries participation nature of the small proportion of the fishing fleet that makes a large proportion of the landings.

Table 8
Vessel Length Distribution and Average Revenue by Fisheries in 1997

Distant Waters	Vessel Length Frequency	Average Length	Count	%	Average Revenue (Thousands) Species	% Species	Total	% Fishery
	<30	27	9	2%	$123	87%	$140	2%
	<50	40	162	43%	$88	60%	$145	25%
	<75	57	176	47%	$125	51%	$246	38%
	75+	87	31	8%	$661	72%	$917	35%
	Total	51	378	100%	$153	60%	$255	100%

Salmon Troller	Vessel Length Frequency	Average Length	Count	%	Average Revenue (Thousands) Species	% Species	Total	% Fishery
	<30	24	309	30%	$5	65%	$8	16%
	<50	38	658	65%	$12	37%	$31	78%
	<75	53	50	5%	$12	21%	$59	6%
	75+	360	1	0%	$16	52%	$31	0%
	Total	35	1,018	100%	$10	38%	$26	100%

Salmon Netter	Vessel Length Frequency	Average Length	Count	%	Average Revenue (Thousands) Species	% Species	Total	% Fishery
	<30	25	407	49%	$3	41%	$8	23%
	<50	35	282	34%	$6	17%	$36	29%
	<75	55	139	17%	$21	22%	$96	48%
	75+		0	0%				
	Total	34	828	100%	$7	22%	$32	100%

Crabber (Dungeness crab, lobster)	Vessel Length Frequency	Average Length	Count	%	Average Revenue (Thousands) Species	% Species	Total	% Fishery
	<30	24	393	27%	$21	74%	$28	13%
	<50	38	795	54%	$40	57%	$70	50%
	<75	57	244	17%	$88	43%	$207	34%
	75+	115	29	2%	$83	21%	$404	4%
	Total	39	1,461	100%	$44	50%	$88	100%

Shrimper (pink shrimp, prawns)	Vessel Length Frequency	Average Length	Count	%	Average Revenue (Thousands) Species	% Species	Total	% Fishery
	<30	20	40	11%	$31	69%	$45	5%
	<50	39	96	27%	$33	35%	$92	13%
	<75	62	178	51%	$80	34%	$233	61%
	75+	94	37	11%	$132	37%	$361	21%
	Total	54	351	100%	$67	36%	$186	100%

Migratory (tuna, swordfish)	Vessel Length Frequency	Average Length	Count	%	Average Revenue (Thousands) Species	% Species	Total	% Fishery
	<30	23	106	10%	$6	25%	$23	2%
	<50	40	560	51%	$14	24%	$58	20%
	<75	58	357	32%	$43	29%	$147	39%
	75+	101	85	8%	$180	56%	$318	39%
	Total	49	1,108	100%	$35	34%	$103	100%

Table 8 (continued)

Groundfish Trawl		Vessel						
	Length	Average			Average Revenue (Thousands)			
	Frequency	Length	Count	%	Species	% Species	Total	% Fishery
	<30	13	2	1%	$57	100%	$57	0%
	<50	43	68	17%	$28	37%	$76	4%
	<75	62	241	61%	$138	59%	$236	66%
	75+	84	86	22%	$180	39%	$466	30%
	Total	63	397	100%	$128	50%	$258	100%

Groundfish Fixed Gear (Sablefish)		Vessel						
	Length	Average			Average Revenue (Thousands)			
	Frequency	Length	Count	%	Species	% Species	Total	% Fishery
	<30	24	57	13%	$16	48%	$34	6%
	<50	39	266	62%	$30	44%	$67	51%
	<75	57	102	24%	$61	24%	$254	40%
	75+	124	6	1%	$60	7%	$859	2%
	Total	43	431	100%	$36	30%	$118	100%

Pacific Whiting		Vessel						
	Length	Average			Average Revenue (Thousands)			
	Frequency	Length	Count	%	Species	% Species	Total	% Fishery
	<30	17	1	1%	$1	11%	$12	0%
	<50	48	2	3%	$5	8%	$59	0%
	<75	65	23	33%	$60	17%	$361	17%
	75+	86	43	62%	$162	33%	$495	83%
	Total	77	69	100%	$121	28%	$430	100%

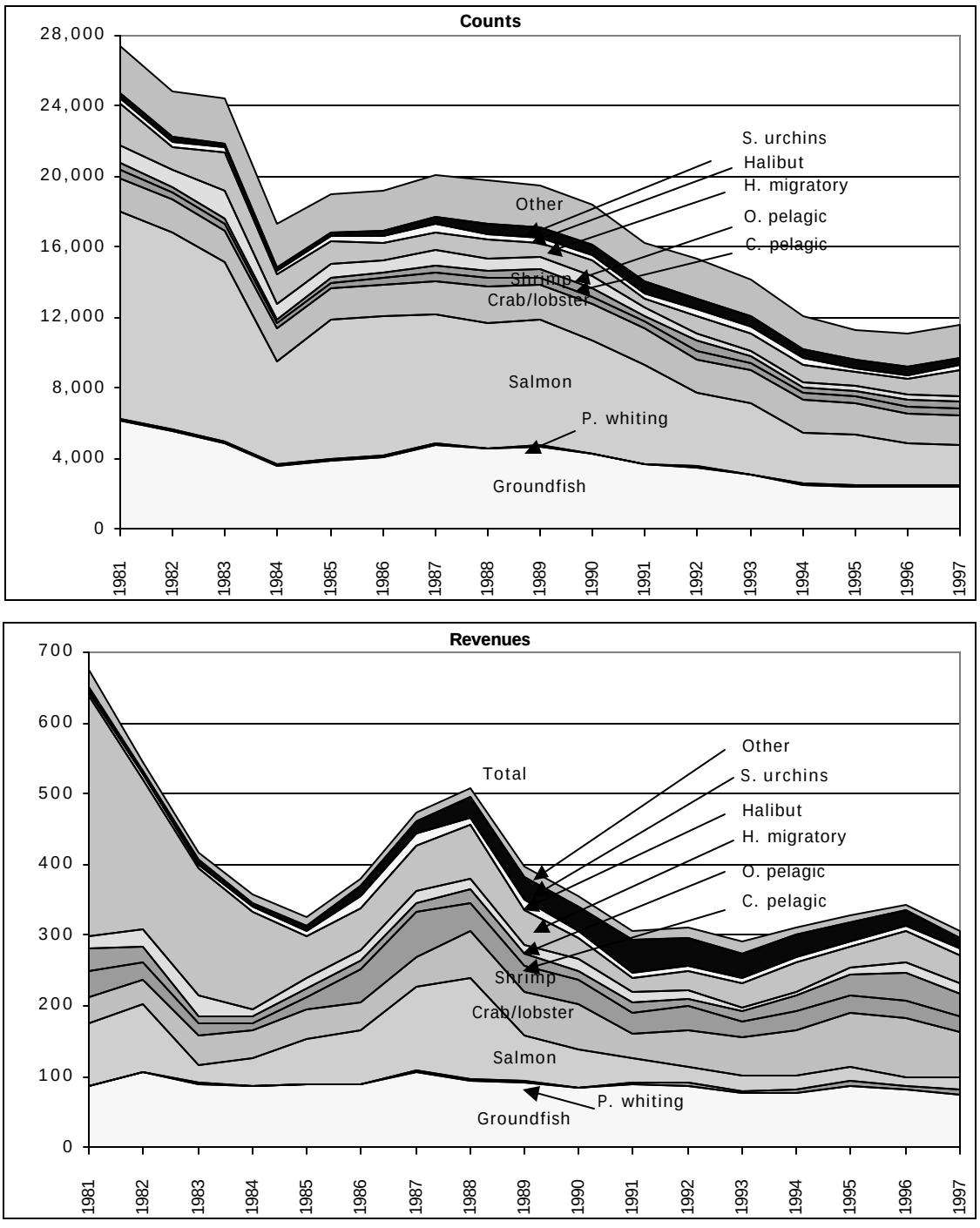
Pelagics (wet fish fishery, including market squid, anchovy, Pacific mackerel, Pacific sardine, jack mackerel)		Vessel						
	Length	Average			Average Revenue (Thousands)			
	Frequency	Length	Count	%	Species	% Species	Total	% Fishery
	<30	20	28	15%	$6	26%	$23	1%
	<50	41	53	29%	$51	58%	$88	9%
	<75	59	85	47%	$232	67%	$344	66%
	75+	80	15	8%	$482	64%	$756	24%
	Total	50	181	100%	$165	65%	$254	100%

Diver Boats (abalone, sea urchins, geoduck, sea cucumbers)		Vessel						
	Length	Average			Average Revenue (Thousands)			
	Frequency	Length	Count	%	Species	% Species	Total	% Fishery
	<30	24	261	62%	$39	95%	$41	56%
	<50	35	154	36%	$49	79%	$62	42%
	<75	53	6	1%	$37	68%	$55	1%
	75+	294	2	0%	$20	52%	$39	0%
	Total	30	423	100%	$43	87%	$49	100%

Notes:
1. Vessels filtered for identifier codes "ZZ" and "NONE," unassigned length, and landings less than or equal to $500 within a fishery.
2. Vessel counts are not unique across fisheries.
3. Percent of fishery based only on filtered vessels.
4. Vessel analysis based only on the shown species groups within a fishery. Total average revenue includes all commercially harvested species.

Source: Annual vessel survey information extracted from PacFIN in March 1999.

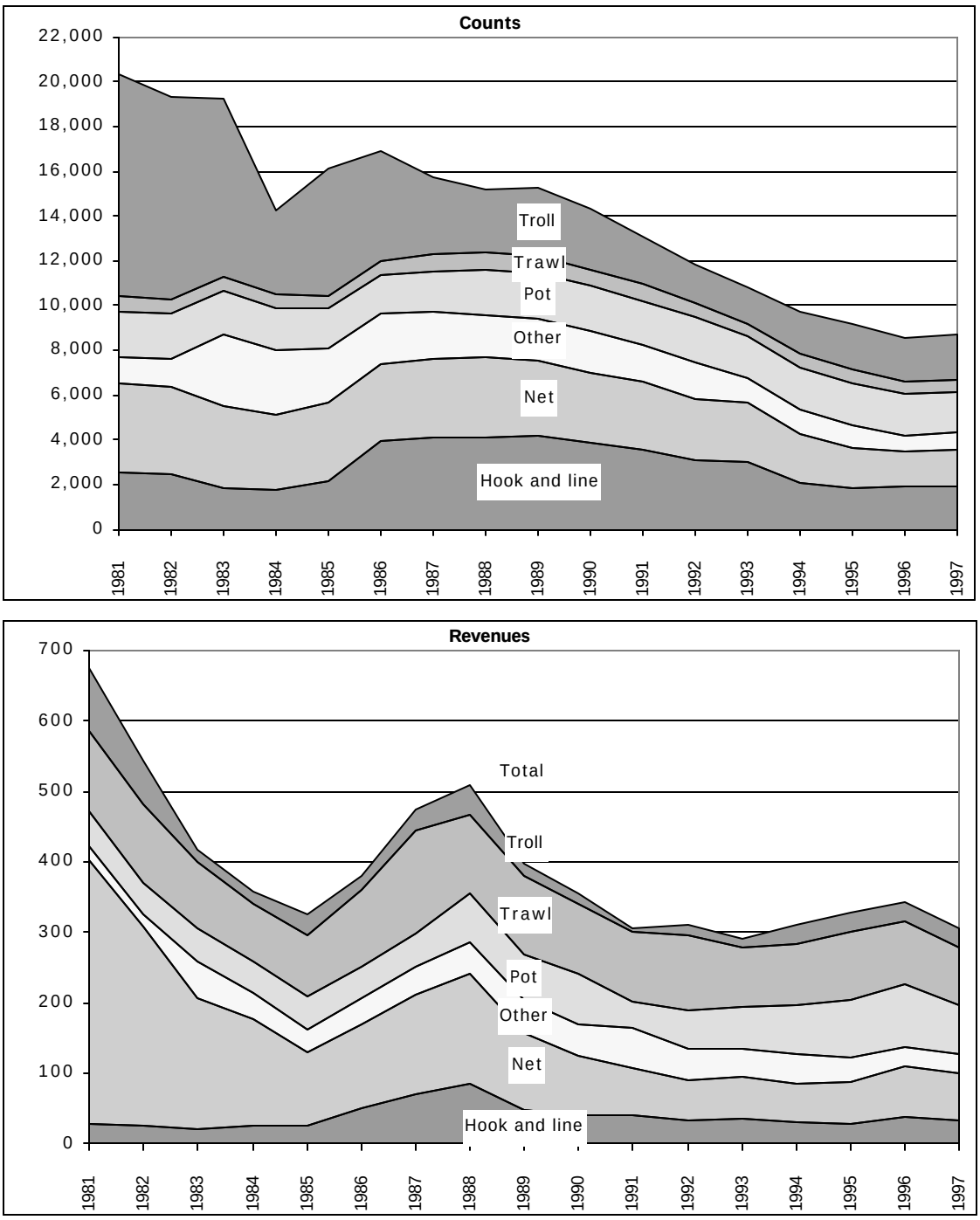
Figure 1
Vessel Counts and Revenues by Species Group for
Vessels Landing at U.S. West Coast Ports in 1981-1997



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 2
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.

a. 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.

b. U.S. West Coast Fisheries

i. Salmon Fishery

The first commercial use of fishery resources for the new settlers was the packing of salmon. In the mid 1800's, packing and canning operations created a large industry for many coastal

communities. By 1940, salmon were becoming less abundant from the Sacramento River to the Puget Sound rivers. Fishing pressures and habitat destruction caused the salmon runs to become less abundant and the U.S. West Coast states salmon canning industry declined dramatically as the demand for fresh fish decreased the markets for canned products. The El Niño years of the early 1980's caused another reduction in harvest. These harvests rebounded in 1988, but decreased dramatically in 1991 as both inland deterioration of habitat and unfavorable ocean conditions took their toll. International treaties, Indian tribe treaties, and allocation agreements limit the expansion that the fishery may take. Of special concern are the decreased runs of some natural stocks in the Columbia, Sacramento, and Klamath Rivers. Decreases in the other natural runs on the U.S. West Coast are of special concern to managers and the salmon industry.

Northern California and Pacific Northwest watersheds produces two main species of salmon (chinook and coho) that are harvested along the coast by two main gear methods (troll and gillnet). In the Puget Sound, Washington area, other methods such as purse seiners and set nets are also used to harvest sockeye and pink salmon in the summer and chum and coho in the fall. Trollers tow a number of lures or baited hooks through the water at depths of up to 80 fathoms (Figure 3). Vessels vary in size from 18-foot day boats to 60-foot trip boats (Figure 4). Table 8 shows most gillnet equipped vessels are less than 30 feet and most trollers are less than 50 feet. There were 2,322 vessels that landed salmon in 1997 (Table 5). Vessels that use troll gear are about 55 percent of this count, and salmon provides about one third of their revenue. Non-treaty gillnet gear vessels comprise 45 percent of the count and less than 25 percent of their total revenue is from salmon landings.

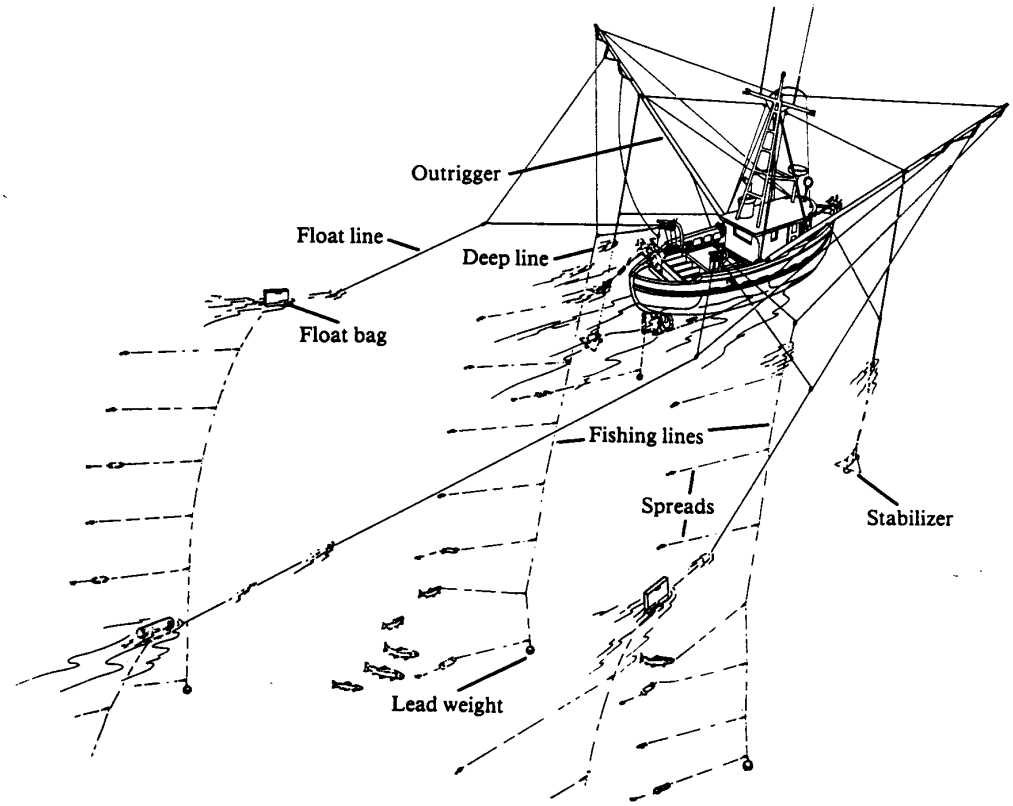
Gill nets are used on the Columbia River. This fishing technique includes Indian treaty fisheries above Bonneville Dam and non-treaty fisheries in-river below Bonneville Dam. Salmon swim into the net and are caught by the gills; when the net is lifted, the fisherman picks out salmon as they come aboard (Figure 5). There has been no mainstem Columbia River non-treaty fishery in recent years. The gillnet fishery below Bonneville Dam has been confined to fishing in Youngs Bay and other off-channel areas for hatchery derived stocks that have been acclimated and released from net pens.

Coho abundance is closely related to favorable ocean conditions. In good upwelling years, abundance increases dramatically; in bad years, the abundance plummets. The sockeye harvest by Washington nets are mostly Fraser River, Canada produced fish. In the past these have been fairly abundant. However, there is a great amount of controversy between the U.S. and Canada about the allocation of the Fraser River sockeye and pink salmon runs. Chinook harvests have been relatively good in recent years, however fishery managers are generally projecting downturns of these harvests for the next few years. Additionally, the growth of aquaculture is increasing the availability of salmon in the marketplace and decreasing the price of salmon paid to fishermen. Because of price pressures from aquaculture grown salmon, there is no indication that troll or net caught salmon prices will increase to former levels in the future.

ii. Dungeness Crab Fishery

Dungeness crab landings historically have been quite volatile. Two very low periods occurred in the early 1970's and again in the early and mid-1980's. Crab landings off the U.S. West Coast

Figure 3
Salmon Troll Gear Set



Source: Oregon State University Extension Sea Grant.

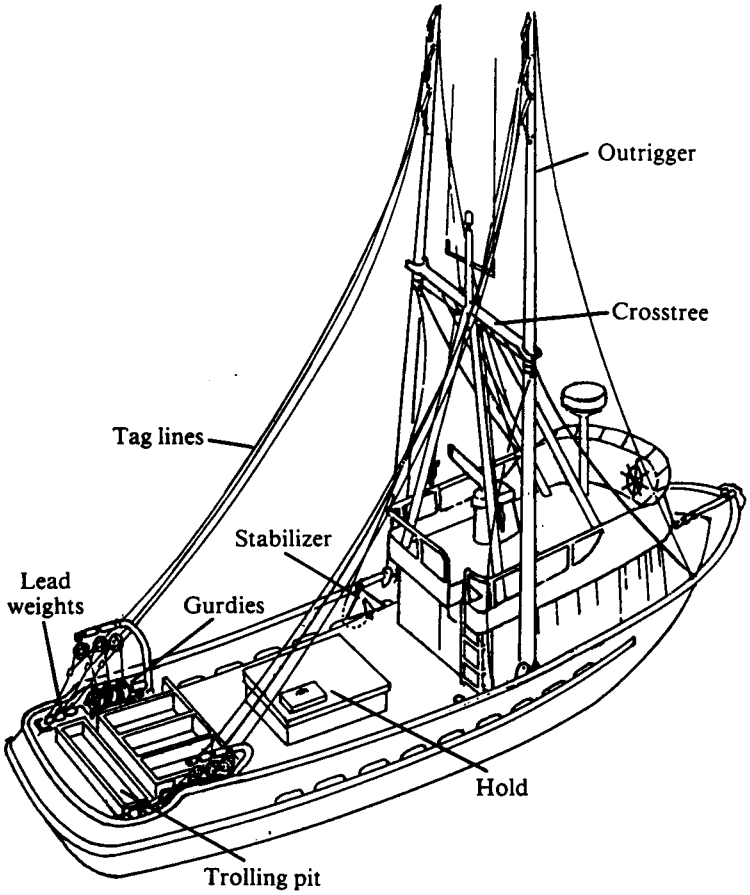
seem to show an eight to 11 year abundance cycle. The reasons for this cyclical abundance are unknown; although several theories have been advanced. The abundance cycle could be caused or modified by several other factors, including oceanographic conditions and interspecies relationships.

Crab harvests usually start in the early part of December, although the Puget Sound fishery starts as early as October. The fishery is characterized by extremely high effort in the first part of the season, followed by a rapid decrease in effort. During some years, 75 percent of the total catch is landed in the first month of the season. The larger crab boats are very mobile, moving from the Puget Sound area to northern California, to Oregon and Washington and then on to Alaska.

Dungeness crab is harvested by vessels of various types and sizes, from small troller/crabbers to large trawler/crabbers. There were 1,584 vessels that landed crab in 1997 (Table 5). Over half of these vessels were in the 30 foot to 50 foot length category (Table 8). For this length category, crab comprises over half of their total revenue.

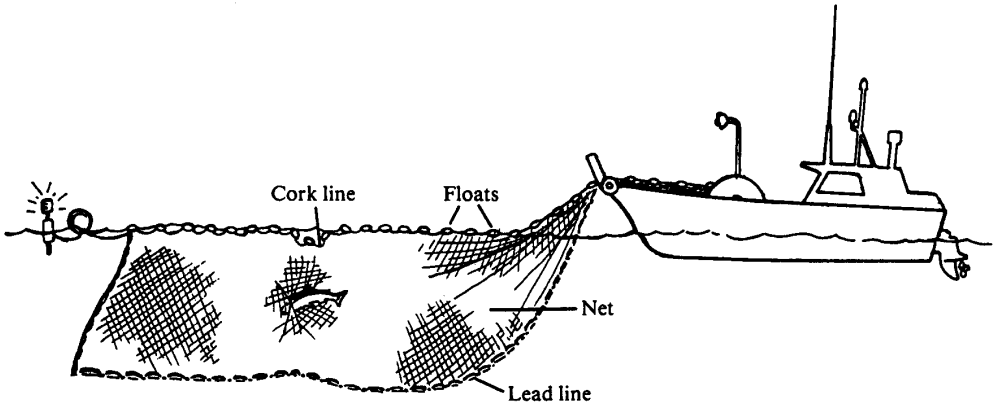
Crab pots are circular, 36 to 48 inches across, and have a line and buoy to mark their position on the ocean bottom (Figures 6 and 7). Placed in the ocean during the December to August season, they are checked every one to seven days, depending on weather and fishing conditions. Only

Figure 4
Salmon Troller



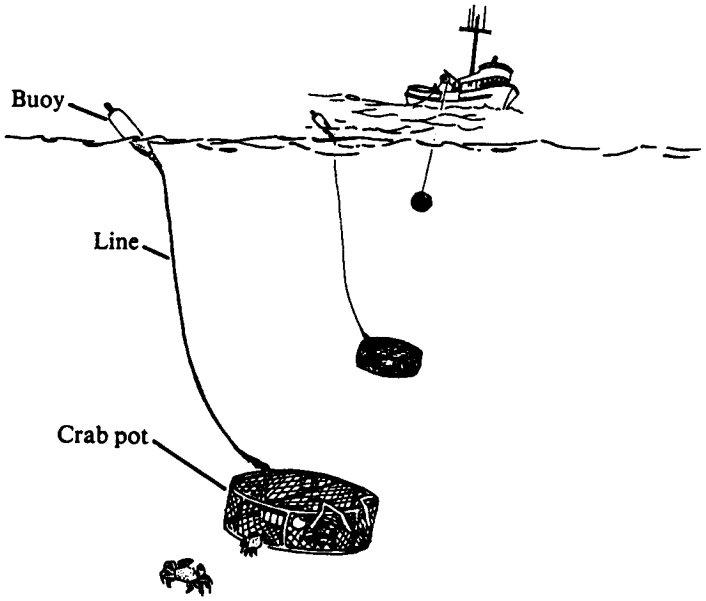
Source: Oregon State University Extension Sea Grant.

Figure 5
Bow Reel and Roller - Floating Gill Net



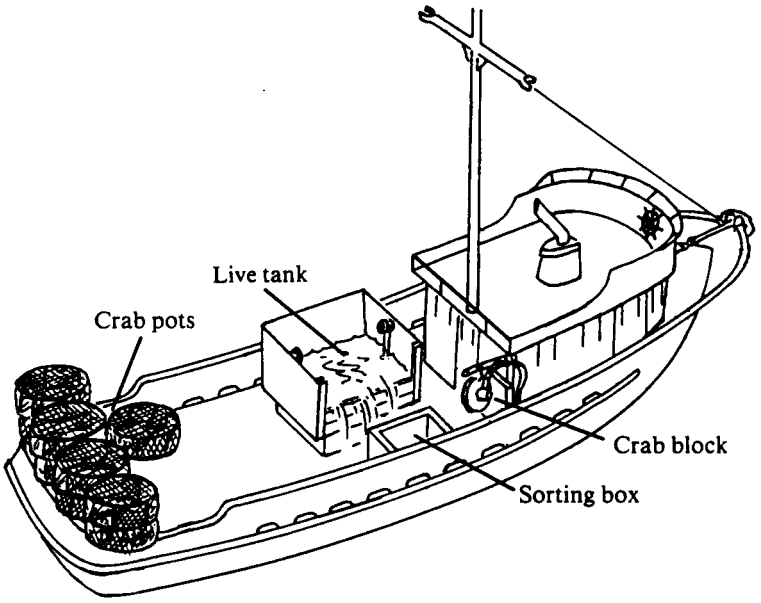
Source: Oregon State University Extension Sea Grant.

Figure 6
Crab Pot Sets



Source: Oregon State University Extension Sea Grant.

Figure 7
Crabber



Source: Oregon State University Extension Sea Grant.

male Dungeness crabs at least six and one quarter inches across the shell may be harvested; the rest are returned live to the sea.

The crab fishery is a source of revenue, during the off-season, for many other vessels from trollers to trawlers. The decline of the Alaska crab fishery has most likely had a positive effect on Dungeness crab prices. The price of crab is very sensitive to harvest levels and season. Years of low abundance mean higher prices and beginning season prices can be higher than in the later season. Ex-vessel crab prices averaged over $2.00 (1997 dollars) per pound in 1983 through 1985 and have averaged 30 percent less than these highs since then. Most likely the increase in crab substitutes made from groundfish (surimi) are effecting the price of crab. Dungeness crab, however, is a distinctive product that can effectively be marketed; there are special markets being developed for both crab sections and live crabs.

iii. Pink Shrimp Fishery

The introduction of technological improvements in processing made pink shrimp (cocktail shrimp) more economical to process, which increased the ability of processors to handle more product. Automatic peeling machines were introduced in 1957. Previously, the shrimp were entirely peeled by hand, an expensive operation that often made the fishery uneconomical given the existing market prices and labor availability. The shrimp harvest peaked in 1978, collapsed in the early 1980's, and rebounded in 1989. Because of prices that averaged over $0.92 (1997 dollars) per pound, the harvest produced a revenue record in 1987. These revenues are an important source of capital for some boats in the trawl industry.

The pink shrimp is short-lived (three or four years). Because of their short lifespan, the relative success or failure of any year class can have a considerable effect on the size of the exploitable stock, resulting in sizable fluctuations in abundance. The pink shrimp is a major food item for a number of other species. The strength of a pink shrimp year class loss also appears to be related to upwelling. During years of poor upwelling - El Niño years - surface water temperatures during the summer will be higher than during years of strong upwelling, and these differences may be high enough to have a negative effect on larval survival and feeding conditions for young shrimp. The Pacific Northwest states produce a substantial amount of shrimp. The Norwegian shrimp industry and eastern Canada are other high producer of the cold water variety that is in direct competition with this shrimp. In recent years, when the Norwegians produced a record of 200 million pounds, the worldwide as well as the domestic price declined. In 1993, the average price for pink shrimp from U.S. West Coast states declined to $0.36 (1997 dollars) per pound. Subsequently, when the Norwegian shrimp industry collapsed, the Pacific Northwest shrimp industry received $0.74 (1997 dollars) per pound in 1995. The price again declined to $0.40 (1997 dollars) per pound in 1997.

The success of the shrimp fishery is one of the major factors determining participation in other fisheries; if production in the shrimp fishery is down the fishermen turn to other alternative fisheries such as groundfish. Much of the groundfish as well as shrimp are taken by trawling, the use of nets to harvest the resource. Shrimpers tow one or two small meshed (one and one half inch) nets just above the ocean floor for the small, pink cocktail shrimp found off the Pacific Northwest coast. Chains attached to the nets drag along the muddy bottom, stirring shrimp up

and into the net (Figures 8 and 9). Most vessels landing shrimp are in the 50 to 75 foot range (Table 8). The species accounts for 34 percent of total revenue for this size class. There was a total of 388 vessels landing shrimp in 1997 (Table 5).

Prawns (sometimes are also called shrimp) are captured by pots as well as trawl nets. Some of these prawns, such as the spotted shrimp, may demand as much as seven dollars per pound live. The trawl fishery has expanded rapidly into this fishery in California. There are, however, some concerns being raised about "bycatch" of other species in this fishery.

The shrimp market in the United States is not only supplied by products from capture fisheries (domestic and foreign) but also aquaculture (primarily foreign). The major producers of cultured shrimp are Mexico, Ecuador, and China. Even though the cold water pink shrimp is not the same product as warm water cultured shrimp, there are cross product effects in price between these two products.

iv. Tuna Fishery

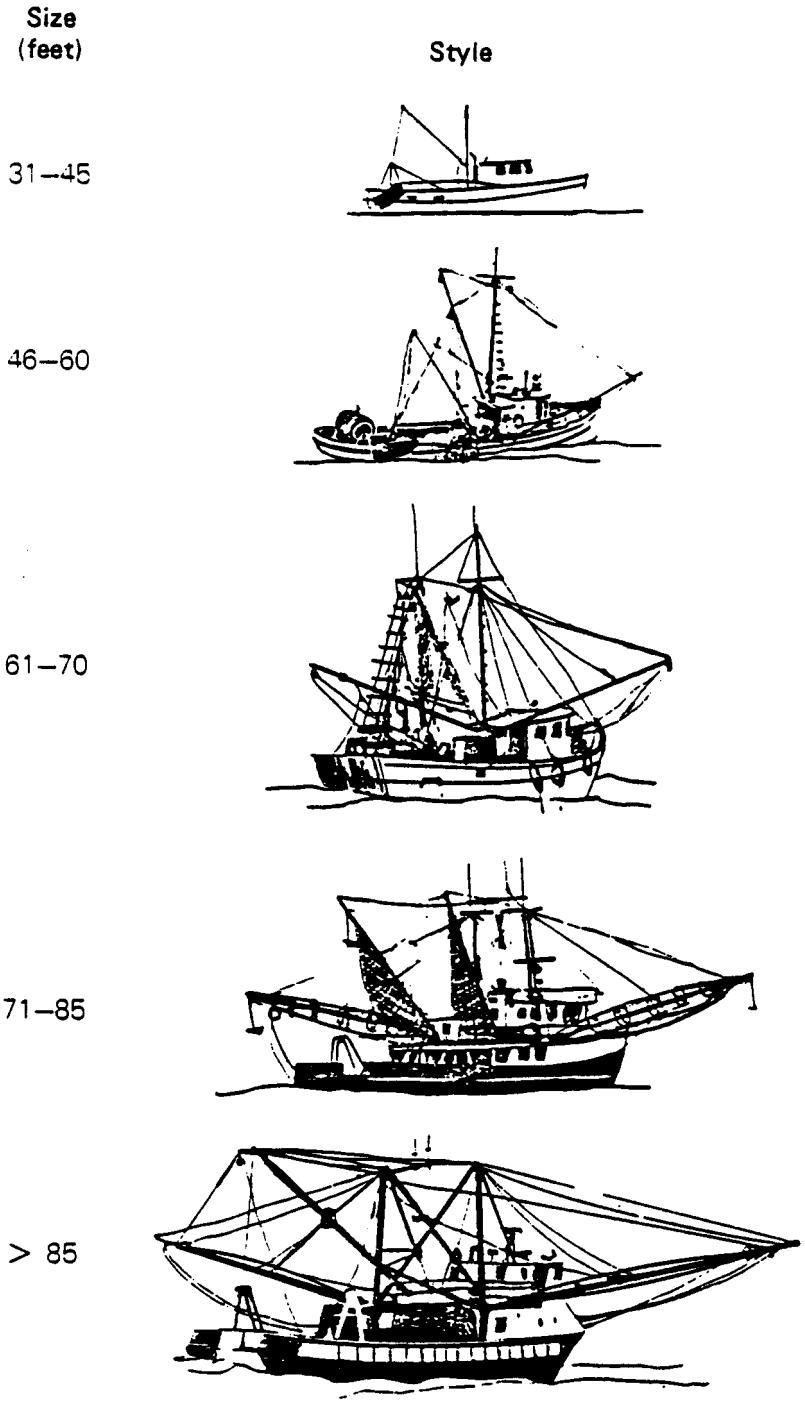
The commercial tuna fishery can be divided into two major categories. Albacore tuna are harvested by hook and line boats along the U.S. West Coast. Skipjack and yellowfin are harvested mostly by purse seiners operating out of southern California ports. Both of these fisheries expanded in the 1960's and 1970's when processing facilities in Astoria, Oregon and in Long Beach, California canned large amounts of tuna annually. As domestic processing costs increased and environmental concerns emerged, many of these processing plants and dependent harvesters moved offshore to places such as Guam and Thailand. Presently, the tuna fishery, although smaller, remains an important part of the U.S. West Coast fishing industry.

Albacore tuna vessels range far offshore; some venture to the mid-Pacific Ocean. They tow as many as 13 lines (Figure 10). Many vessels fish for salmon during the early part of the season, switch to tuna, and then turn to crab during the winter. There were a total of 1,406 vessels that landed tuna or other highly migratory species in 1997 (Table 5). The number of vessels participating in the tuna fishery since 1981 has varied widely. Most vessels that harvest tuna are in the 50 foot range (Table 8). For the larger tuna vessels, species revenue accounts for more than half of total revenue.

Historically, tuna has been one of the U.S. West Coast major fisheries. The tuna is a wide-ranging fish and therefore susceptible to interception in many parts of the Pacific Ocean. Most tuna canneries have left the U.S. and the fishery has declined steadily. Some of the albacore currently harvested by trollers is destined for the fresh/frozen markets on the west coast of the United States, while the bulk of the catch is shipped to southern California or overseas to be canned.

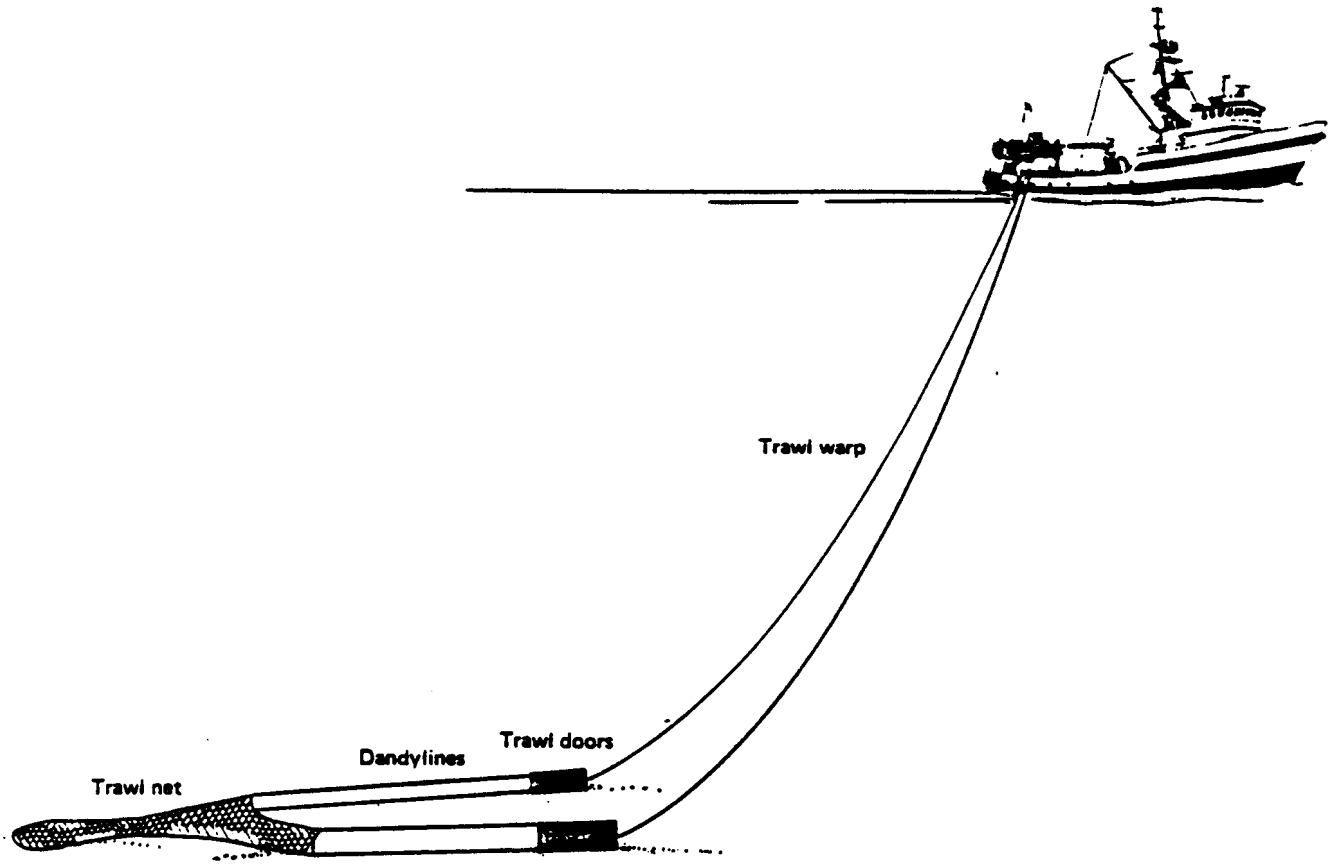
There are no seasonal restrictions in the albacore tuna fishery. Rather, the beginning and end of the season fished depends on water temperature. The fish generally show up in the south during July and move north. The fishery generally ends with the onset of southerly winds and cooling water temperatures in late September or early October.

Figure 8
U.S. West Coast Shrimp Trawlers



Source: Kramer, Chin & Mayo, Inc. (1982).

Figure 9
Shrimp Trawls in Operation



Source: Kramer, Chin & Mayo, Inc. (1982).

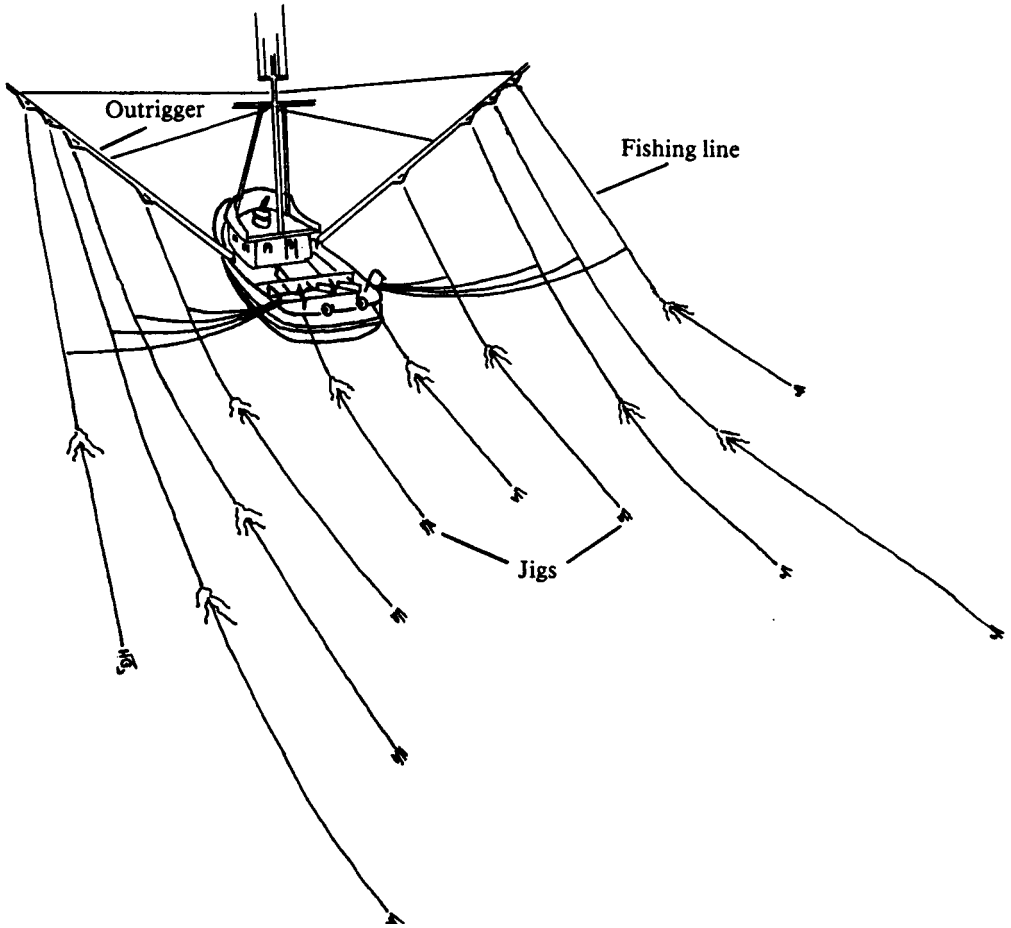
The warming of the ocean, which has been part of the salmon problem, has been a positive factor for tuna harvests. Concern for highly migratory species such as tunas (as well as swordfish and some sharks) has resulted in an international process that may lead to management for allocations at the international level through fishery management plans recognized by treaties.

v. Groundfish Fishery

This category includes a number of species such as cod, rockfish, sole, flounder, Pacific whiting and halibut. There were 2,399 vessels that landed groundfish and 91 vessels that landed Pacific whiting in 1997 (Table 5). (These counts are not unique, since one vessel could have landed within each of these species groups.)

Most of the groundfish are harvested by trawlers using midwater or bottom trawl nets. The bottom trawlers are often referred to as draggers. Trawlers drag funnel-shaped nets through the water (Figures 8 and 9). The nets are wider at the mouth and taper back to a narrow "cod" end that collects the catch. Trawls can be over 100 feet across the opening and 150 feet long. In 1997, about 20 percent of the total count of vessels are trawlers (Table 9). Most of the trawl

Figure 10
Albacore Gear Set



Source: Oregon State University Extension Sea Grant.

vessels are in the 50 to 75 foot length category and groundfish species comprise about half of total revenue (Table 8).

There are several species generally referred to as groundfish that are harvested by long-lines, pots, gillnets in southern California, and by other hook and line gear. Halibut and blackcod are harvested by long-lines, which stretch along the ocean bottom as long as three miles. Anchored at each end, marked with buoys, and containing up to 800 hooks, the line is soaked six to 12 hours before hauling (Figure 11). Blackcod (also called sablefish) has a high oil content and is favored in the Asian market. About half are harvested by trawlers and the remainder by fixed gear (pots, longlines, or hook and line). Vessels that harvest blackcod by fixed gear are generally less than 50 feet long (Table 9). Their total revenue is about one third from sablefish.

In recent years, a market for hook and line caught live fish is developing. Although this fishery is considered a "value added" market, there are concerns that the fishery is targeting on small fish and thereby decreasing future harvests from the fecundity of mature adults.

Table 9
Representative Earnings (Thousands) From Distant Water Fisheries
for Vessels With Owner Addresses From U.S. West Coast States in 1996

Fishery	Information Source	Per Vessel Earnings
Alaska Onshore	CFEC	
Other		$17
Troll		$14
Longline		$93
Trawl		$247
Pot		$395
Net (Other than Trawl)		$48
Total		$98
Alaska Offshore	AKFIN	
Catcher Processors		$1,887
Catcher Vessels		$81
Motherships		$7,958
Total		$1,309
Other Waters	Anecdotal	
Large vessels (>55 feet)		$125
Small vessels (#55 feet)		$25
U.S. West Coast Offshore	NMFS Blend	
Total		$311

Notes: 1. Representative earnings are shown in thousands of 1996 dollars.
2. Representative earnings are the average per vessel ex-vessel value for a fishery. Some vessels land within more than one fishery.

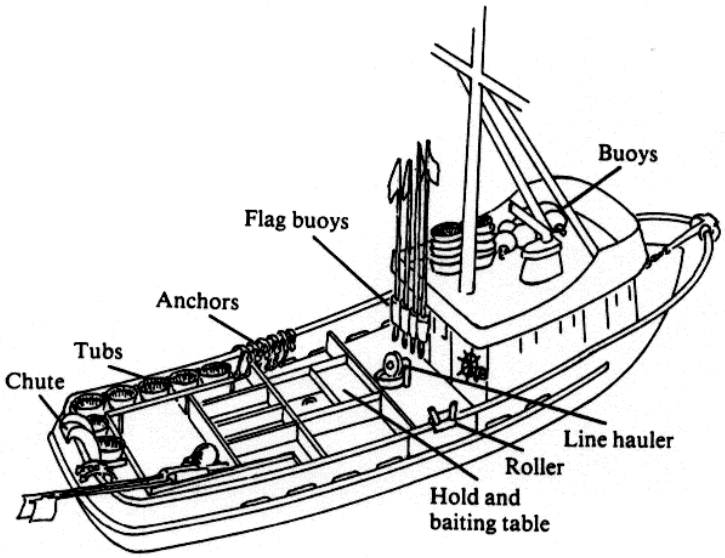
Source: Study.

The volume of groundfish harvested increased steadily to 290 million pounds in 1982, then declined to about 150 million pounds in the late 1990's. Most of the species are now harvested at or near the maximum sustainable yield (MSY) rates. In order to dampen catch rates, time closures, trip limits and other methods have been initiated by the fishery managers. One signal of concern is the consideration of a vessel buy back program for trawlers in the groundfish fishery.

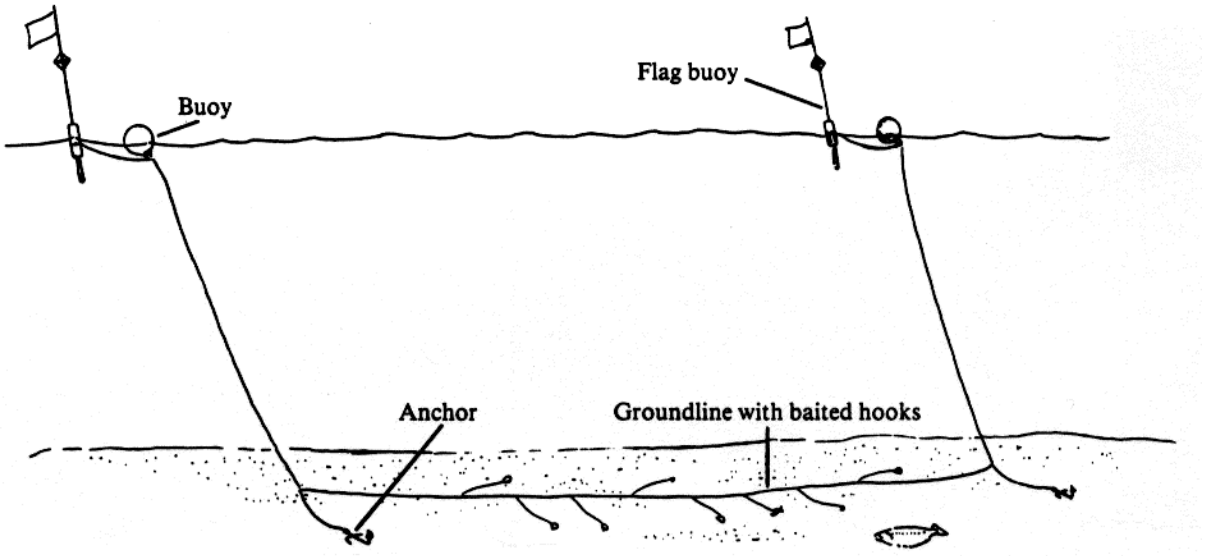
No increases in any domestic groundfish harvests are anticipated except perhaps for a couple of species: shortbelly rockfish and grenadier. Any increase in revenues to vessels or processors will therefore be in terms of adding value. This might be accomplished by directing harvests at specific markets, such as the whole rockfish market.

About 57 percent of the total maximum sustainable yield of groundfish available off of the Washington, Oregon, and northern California coasts is Pacific whiting. In a regional perspective, it is therefore an important fishery, even though the current market prices for whiting are significantly lower than prices of other commercially harvested groundfish. At

Figure 11
Longliner (Using Tub Gear)



Longline Gear Set



Source: Oregon State University Extension Sea Grant.

current domestic prices for whiting (about $0.04 per pound in 1997 dollars), the 200,000 metric ton MSY of whiting would have an ex-vessel value of nearly 21 million dollars.

The Pacific whiting fishery has evolved from a foreign fishery to a domestic fishery within about 15 years. Much of the expansion of the domestic fishery has been dependent on the Alaska pollock resource. This fishery has invited massive investment in harvesting and processing capacity. The fishing industry of the U.S. West Coast has taken part in this investment. Many of the same vessels that were involved in the Alaska pollock fishery were also taking part in the Pacific whiting fishery. These vessels are generally over 75 feet and Pacific whiting comprises most of their total revenue.

As both of these resources are being fully utilized by the domestic harvesting and processing fleet, the potential exists for resources use that will disrupt coastal communities that have become dependent upon the income generated by the revenues and therefore expenditures of the pollock and whiting fleet. The potential exists for economic disruption of fisheries that depend on whiting as well as other fish resources. On the U.S. West Coast, groundfish and shrimp are prime examples. For example, the $300,000 to $400,000 that each vessel in the whiting fishery depends on could result in about a $20 million reduction in revenues for other boats if these trawlers decide to fish for groundfish or shrimp. The consequence of a fleet larger than is necessary to harvest a finite amount of resources is that members of the fleet and dependent communities are going to face financial hardships.

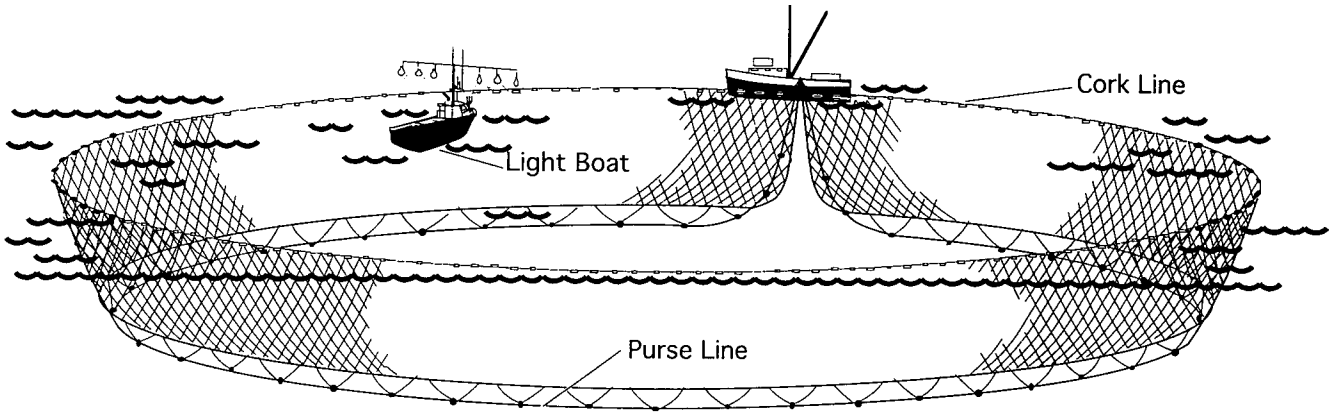
Since federal limited entry permits have been required for groundfish landings, more of the smaller vessels especially in California have entered the “open access” portion of the groundfish fishery. Decreases in allowable harvests are anticipated for many species of the rockfish species. Both the limited entry portion of groundfish quotas (about 90 percent) and the open access portion (about 10 percent) will face decreased quota amounts. There are some quota species, such as shortbelly and rosefish (splitnose) rockfish that fetch lesser prices which may have future markets. However, monthly vessel trip quotas that encourage discards in favor of higher priced species may prevent market development.

The development in the lingcod resource is of special concern to the fishing industry. The fight for the declining resource, an estimated 10 percent of virgin biomass, could pit the recreation industry against the commercial industry, while groups within the fishing industry vie for the right to catch a portion of the allowable harvest.

vi. Pelagic Fisheries

Coastal pelagic fisheries (CPS) include species such as anchovy, Pacific mackerel, Pacific sardine, jack mackerel, and market squid. Vessels using roundhaul gear (purse seines and lampara nets) are responsible for 99 percent of total landings and revenues in any given year (Figure 12). The southern California round haul fleet is known locally as the "wetfish fleet." The wetfish fleet is based primarily in Los Angeles Harbor, with smaller segments in the Monterey and Ventura areas. It harvests Pacific bonito, market squid, bluefin tuna and other tunas, as well as CPS. There were a total of 400 vessels landing pelagic species in 1997, however the active fleet specializing in these species consists of about 40 active purse seiners

Figure 12
Purse Seiner



Source: Starr et al. (1998).

(Table 5). The length is an average of 50 feet and pelagic species comprise two thirds of the total revenue (Table 8). Approximately one third of the wetfish fleet are steel-hulled boats built during the last 20 years. The rest are wooden-hulled, built in the heyday of the Pacific sardine fleet, from 1930 to 1949.

Anchovy is used for reduction to fish meal and oil, live and dead bait, and human consumption. Reduction landings, which generally receive much lower ex-vessel prices than non-reduction landings, have been exceedingly low since 1983 due to competition with other sources of protein meal. Reduction was the main use for anchovy prior to 1983. Anchovy is more recently a critical source of live bait for recreational fishing.

Commercially harvested Pacific mackerel is processed into canned products for pet food and human consumption, and a small but increasing amount is sold to fresh fish markets that cater to California's growing Asian population. Jack mackerel, when available in southern California, is processed in the same canned product.

Pacific sardine is canned for human consumption and sold as live and dead bait. With sardine biomass increasing after years of low biomass levels, markets are being developed.

Market squid are generally frozen or canned and exported for human consumption. Smaller amounts are sold domestically in fresh fish markets and used for live and dead bait. In the last several years, the demand for squid has increased greatly, which has raised concerns about protecting the resource. Very little is known about the biology of squid.

vii. Other Fisheries

There are several other species that have generated some revenues. In 1981, two New England scallopers on their way to Alaska located good beds off Coos Bay. In 1981 landings totaled over 16 million pounds. After 1991, these landings dropped to a low yearly average. The abalone

fishery in California seems to have experienced the same fate, although local overfishing in this case was fueled by high prices and liberal management practices.

The sea urchin fishery has been developed along the U.S. West Coast from San Diego to Washington. Because of anticipated increased pressures, a revised limited entry program for this fishery has been adopted for most areas. Sea urchins are harvested by divers. The eggs are packaged for the Japanese sushi and gift markets. Sea urchin landings have decreased from almost 62.7 million pounds in 1988 to record lows (less than 19 million pounds) in 1997. The price has also decreased to low levels as a result of the Japanese economic downturn. Low kelp production due to El Niño warm water, has resulted in poor quality uni. The resulting low prices has decreased overall production along the U.S. West Coast.

The Pacific lobster vessel that harvests the spiny lobster in southern California is a small craft that utilizes up to 160 pots to deliver live products directly to the market. There were 80 to 100 vessels that specialize in this fishery.

Aquaculture and mariculture in the rivers and estuaries of the U.S. West Coast also produce seafood products. Oysters, clams, and other species commercially grown by farming are generally not included in commercial fishery statistics because the products are usually not harvested by commercial fishing boats. However, these species are very dependent on the same abundant water resources as are other fishery products. One significant trend is the increase in oyster production in estuaries that have resulted from increased water quality from pollution abatement programs. Two other bay commercial fisheries that are important on a local basis are the limited entry roe herring fishery in Yaquina Bay, and the Alsea Bay commercial crab fishery.

D. VESSEL CHARACTERISTICS

1. Vessel Physical Attributes

The types of vessels that are most responsible for the overall decrease in vessel counts are those that fish with one gear type (Figure 13). The number of vessels that only fish with one gear group have decreased from 71 percent in 1989 to 64 percent in 1997 (Figure 14). During the same period, those that fished with three or more gear groups rose from nine percent to 12 percent.

Average vessel length has not changed dramatically. Figure 15 shows vessel length trends after 1981. Vessel length does not necessarily explain a vessel landing potential. Figure 16 is a scattergram showing vessel length versus vessel revenues in 1997. The linear relationship between length and revenues has a low "R^2" statistic, showing the poor relationship between these two variables. A similar causal relationship was found using vessel gross weight.

2. Vessel Revenue Categories

a. Distant Water Fisheries Revenues

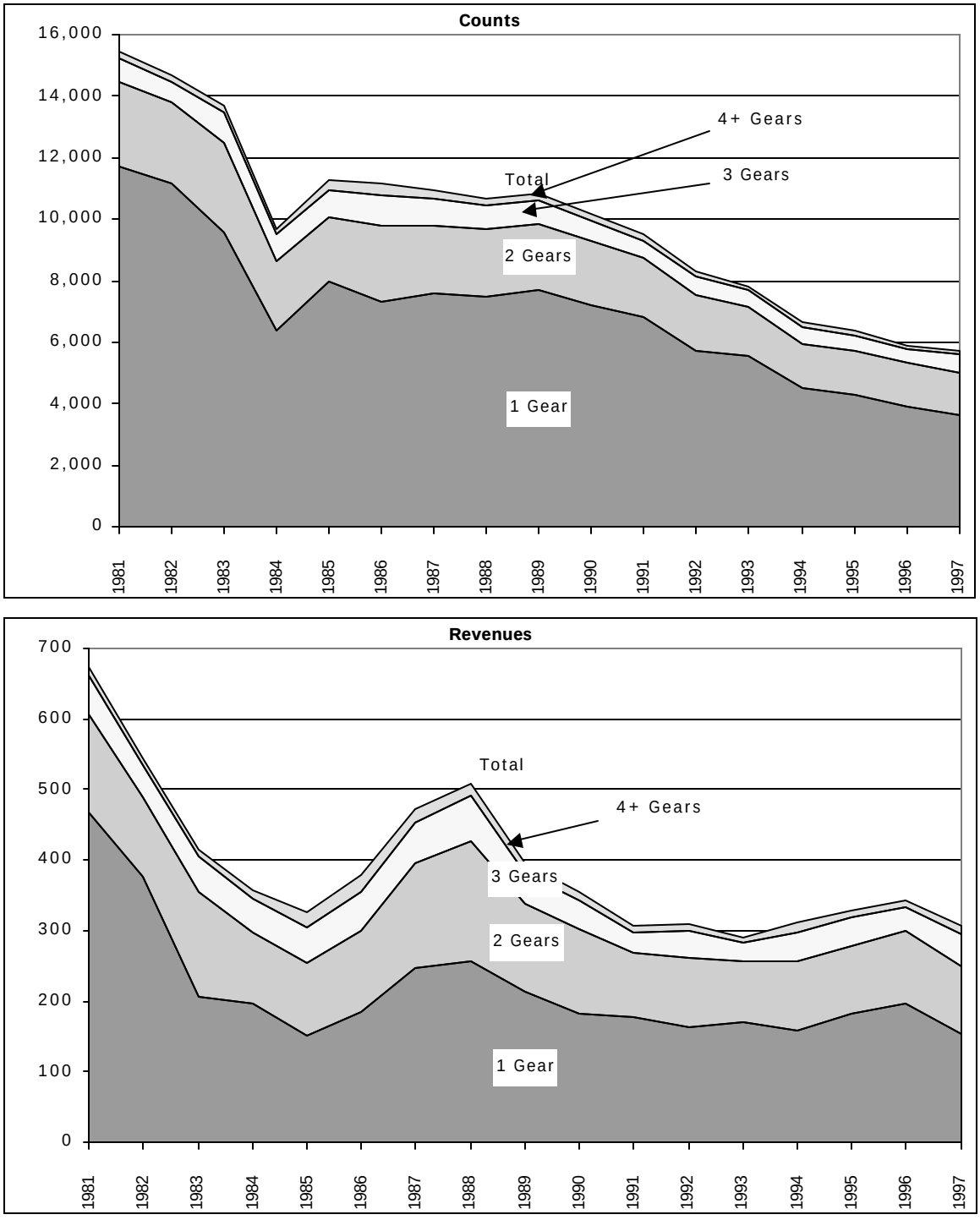
In recent years, there have been over 500 vessels with ownership ties to U.S. West Coast states that made landings in other U.S. West Coast states, Alaska, or other Pacific Ocean locations. Of these, 11 delivered to Alaska motherships or acted as catcher-processors, 15 delivered to motherships and acted as catcher-processors off the U.S. West Coast, and 148 delivered elsewhere in Hawaii and other western Pacific Ocean nations. Table 9 summarizes average per vessel representative revenues. 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.

b. U.S. West Coast Onshore Revenues

Revenues are not evenly distributed among vessels (Table 10 and Figure 17). 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 (Figure 18). Prior to those years, landings were spread somewhat more evenly among vessel revenue categories.

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. Table 11 and Figure 19 show vessel experience in single fisheries over the last five years prior to 1997. 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 Table 11 and Figure 19 will exit and enter fisheries

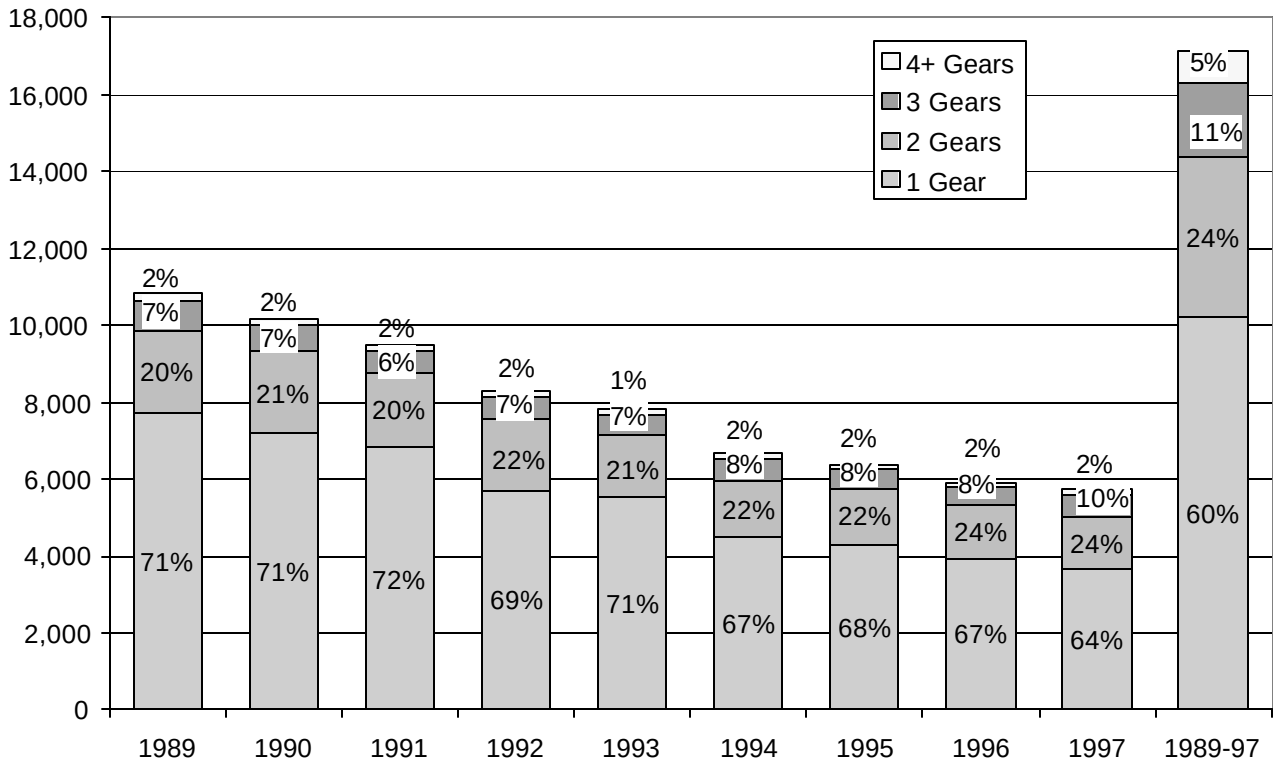
Figure 13
Vessel Counts and Revenues by Number of Gear Groups for
Vessels Landing at U.S. West Coast Ports in 1981-1997



Notes: 1. Vessel counts are for unique vessels. Vessels with identifier codes "ZZ.." or "NONE" are excluded.
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 14
Vessel Counts by Number of Gear Groups for Vessel Landings at U.S. West Coast Ports in 1989-1997



Notes: 1. Excludes vessels with identifier codes "ZZ…" or "NONE."
2. Gears are summarized into six categories, then analyzed for the number of gear categories. See Appendix A for detailed species and gear mapping schemes.
3. The number of gear groups used by vessels represented in the 1989-1997 period is the maximum number of gear groups used by a vessel in any one year.

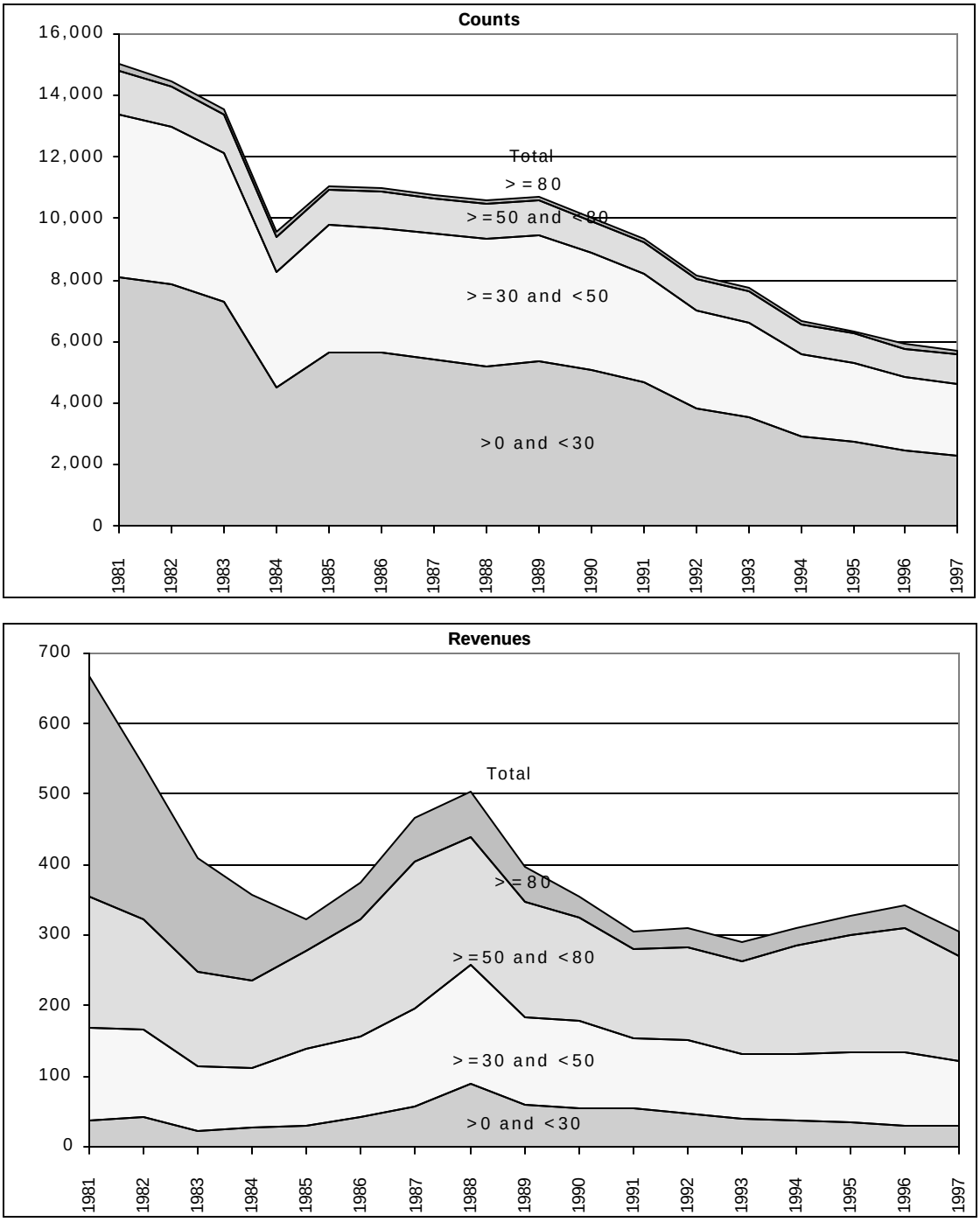
Source: Annual vessel summary information extracted from PacFIN in September 1998.

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.

3. Vessel Permits

Many fisheries are regulated by vessel entry as well as managed for conservation purposes. The federal government has administered a limited entry program for groundfish since 1994 (50 CFR Part 660, Subpart G). Permits are capped at vessel numbers that existed prior to 1994 and permits are transferable. Permits are issued based on the fishing history of a qualifying vessel. There are separate caps on groundfish trawl and sablefish fixed gear vessels. A small harvest guideline is still allocated to non-permitted vessels, in what is called the open-access fishery. There are separate trip limits and harvest guidelines for each fishery, and the sablefish fixed gear fishery has vessel cumulative limits. Vessels without permits may participate in the open access fishery with any gear except groundfish trawl, subject to any open access trip limits and harvest guidelines in effect. There are other exempted trawl gears, such as shrimp trawls, that can

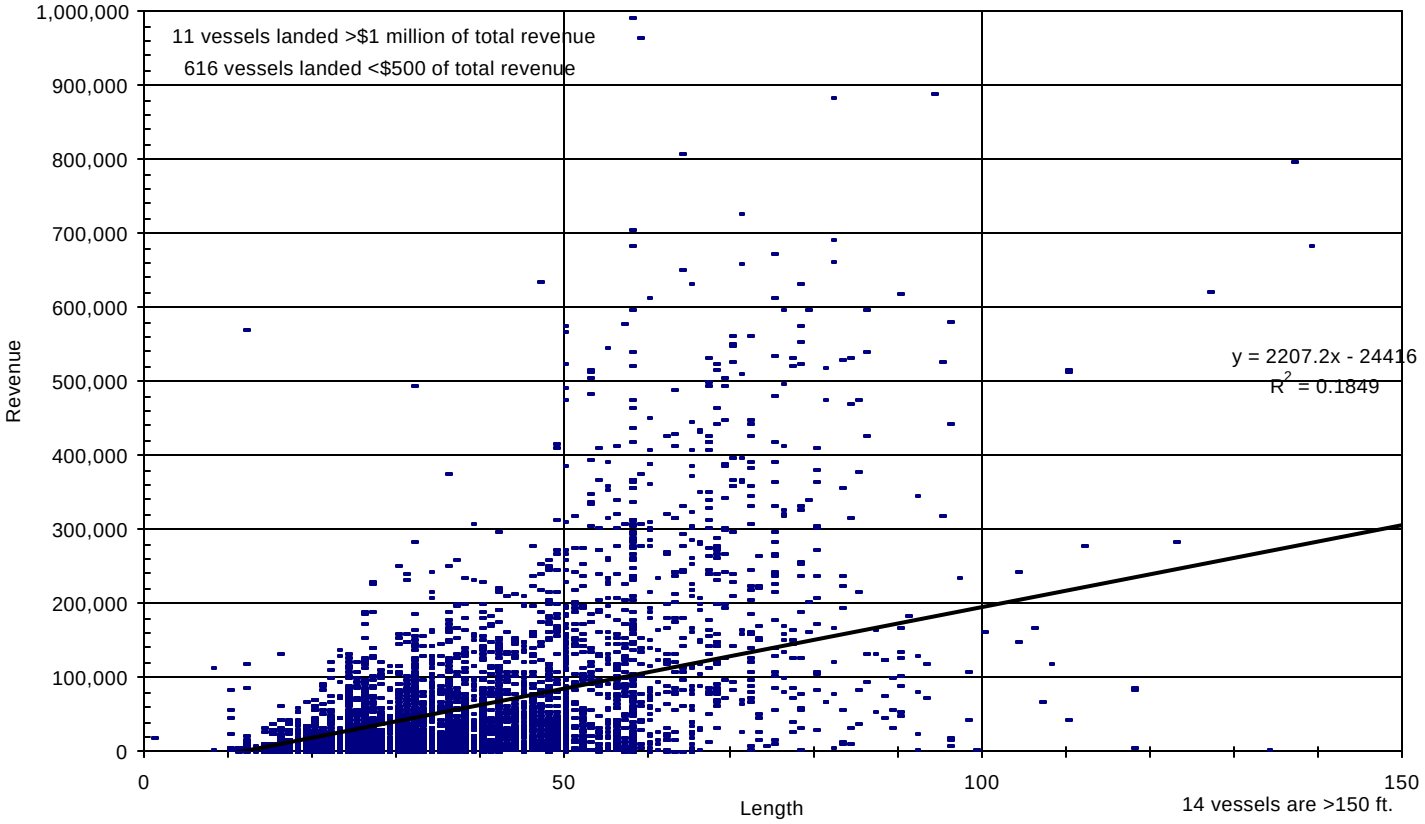
Figure 15
Vessel Counts and Revenue by Length Categories for
Vessels Landing at U.S. West Coast Ports in 1981-1997



Notes: 1. Excludes vessels reported with length 0.
2. Vessel counts are for unique vessels. Counts and revenues exclude vessels with identifier codes "ZZ…" or "NONE."
3. Total revenue does not include deliveries to offshore processors or revenues from distant water fisheries.
4. Revenue in millions of 1997 dollars adjusted for inflation using the GDP Implicit Price Deflator.

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

Figure 16
Scattergram Showing Revenue for U.S. West Coast States Vessels by Length in 1997 for All Species



Notes: 1. Excludes vessel identifiers "NONE" and "ZZ..."
2. Excludes vessels with 0 length and vessels with revenues less than $500.
3. Each dot represents a unique vessel.

Source: PacFIN March 1999 extraction.

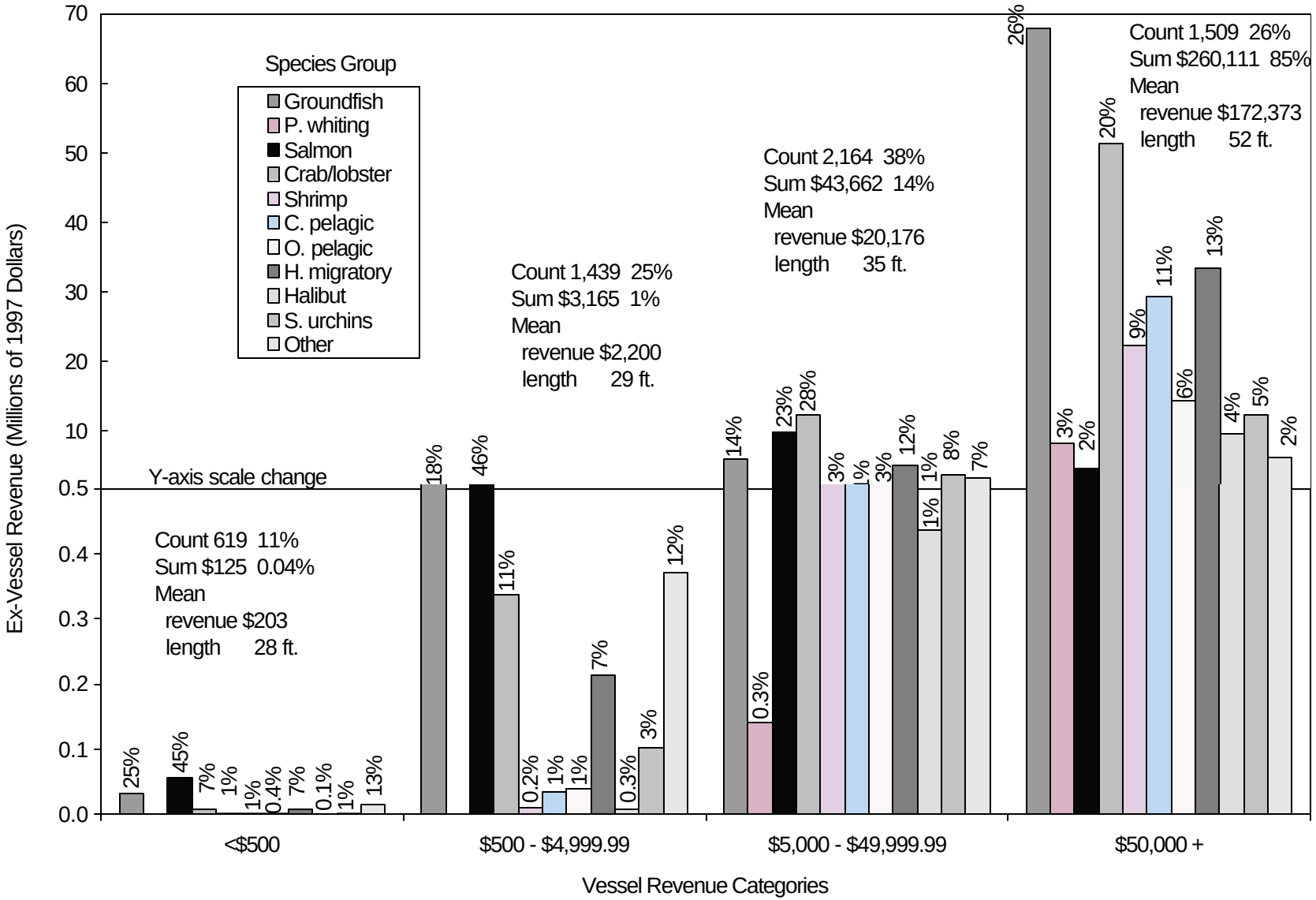
Table 10
Vessel Revenue Frequency Distribution in 1997

Category	Vessel Counts		Average Vessel Length	Revenue Category	Average Per Vessel Revenue
<$500	619	11%	28'	0.04%	$203
$500 - $4,999.99	1,439	25%	29'	1%	$2,200
$5,000 - $49,999.99	2,164	38%	35'	14%	$20,176
$50,000+	1,509	26%	52'	85%	$172,373
Total	5,731	100%	37'	100%	$53,579

Notes: 1. Revenue excludes offshore and distant water fisheries sources.
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.

Source: PacFIN March 1999 extraction.

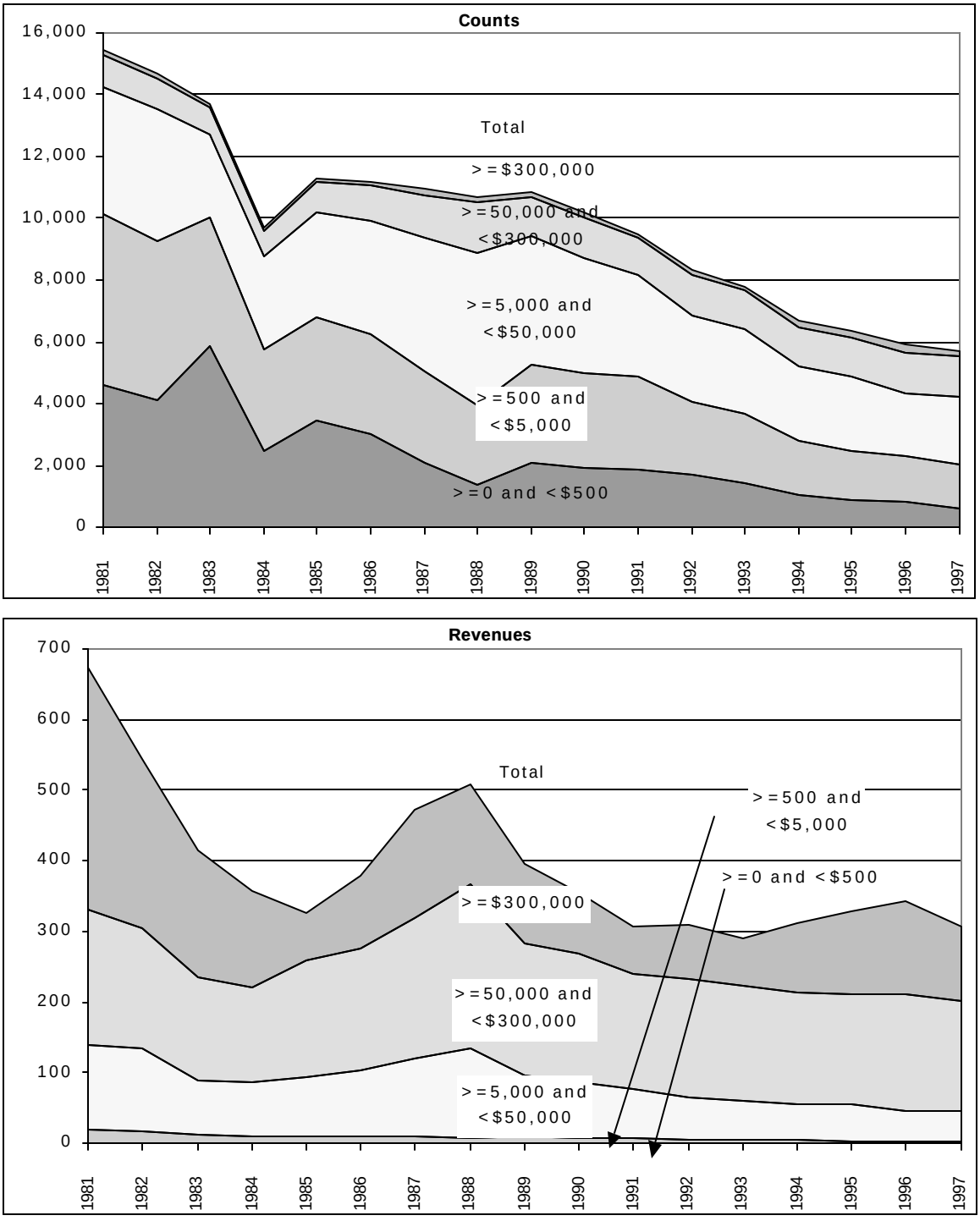
Figure 17
Revenue by Species Group for Revenue Categories in 1997



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.

Figure 18
Vessel Counts and Revenues by Revenue Categories for
Vessels Landing at U.S. West Coast Ports in 1981-1997



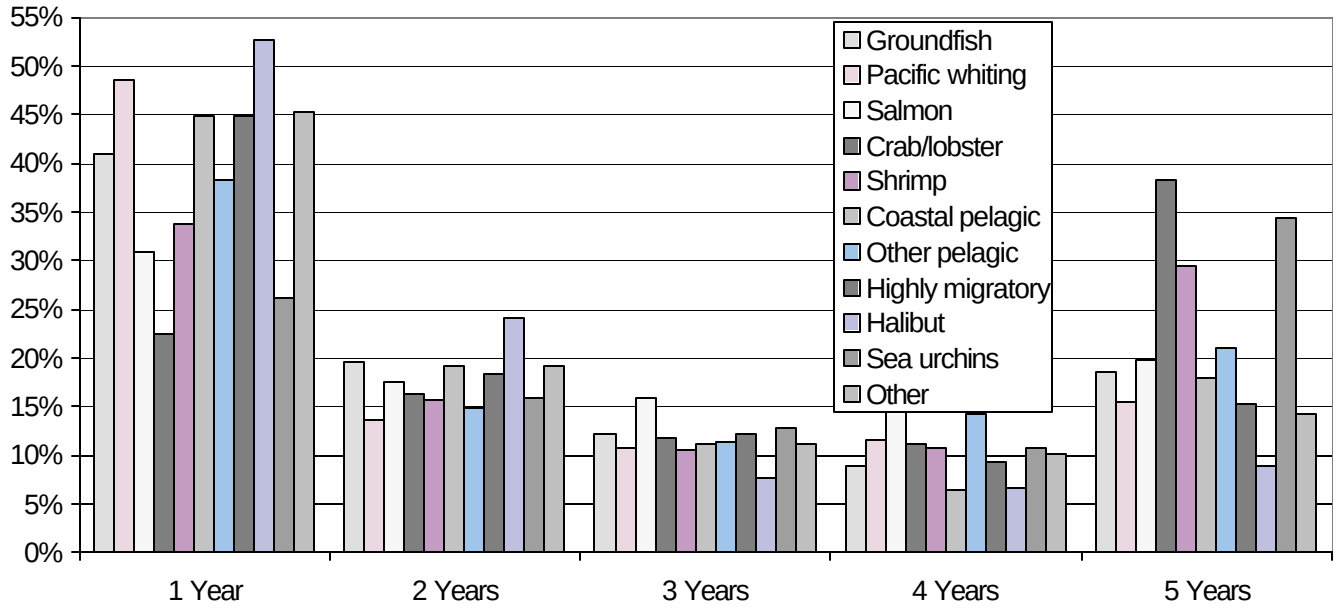
Notes: 1. Vessel counts are for unique vessels. Counts and revenues exclude vessels with identifier code "ZZ.." or "NONE."
2. Total revenue does not include deliveries to offshore processors or revenues from distant water fisheries.
3. Revenue in millions adjusted for inflation using the GDP Implicit Price Deflator, 1997=100.

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

Table 11
Vessel Participation by Fishery During Period 1993-1997

	Period Participation											
	1 Year		2 Years		3 Years		4 Years		5 Years		Total	
Fishery	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent
1 Groundfish	1,272	41%	611	20%	379	12%	274	9%	575	18%	3,111	100%
2 Pacific whiting	50	49%	14	14%	11	11%	12	12%	16	16%	103	100%
3 Salmon	1,212	31%	688	18%	622	16%	615	16%	772	20%	3,909	100%
4 Crab/lobster	537	23%	389	16%	280	12%	264	11%	915	38%	2,385	100%
5 Shrimp	206	34%	96	16%	64	10%	66	11%	180	29%	612	100%
6 Coastal pelagic	152	45%	65	19%	38	11%	22	7%	61	18%	338	100%
7 Other pelagic	162	38%	63	15%	48	11%	60	14%	89	21%	422	100%
8 Highly migratory	784	45%	320	18%	212	12%	161	9%	268	15%	1,745	100%
9 Halibut	321	53%	147	24%	47	8%	40	7%	54	9%	609	100%
10 Sea urchins	191	26%	116	16%	94	13%	78	11%	252	34%	731	100%
11 Other	828	45%	353	19%	206	11%	184	10%	261	14%	1,832	100%
Total	2,343	26%	1,359	15%	1,099	12%	1,080	12%	2,963	34%	8,844	100%

Figure 19
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.

harvest in the open access fishery. States also have limited entry programs for several fisheries, such as ocean troll salmon, pink shrimp, Columbia River gillnet salmon, ocean Dungeness crab, ocean scallop, sea urchin, abalone, etc.

The implementation of the entry permit programs began substantial changes to fisheries, especially the groundfish fishery. The federal groundfish limited entry program allows permits to be combined in order to promote fishing capacity reduction, allow increased trip limits, encourage prolonged fisheries, reduce bycatch, and have more efficient vessel operations. This has resulted in a reduction in the number of vessels making landings in U.S. West Coast states without permits and an increase in revenues for vessels with permits since the federal groundfish entry program has been in existence. Table 12 shows the revenue frequency distribution and average per vessel revenues for 1994-1997. The number of vessels in the smaller revenue categories has fallen during this period, while the vessels in higher revenue categories have gained about the same. The proportion of total revenues from landings by vessels with federal limited entry permits during the program's existence is shown in Figure 20. In 1997, vessels with federal groundfish permits represented eight percent of the U.S. West Coast fleet, but captured 32 percent of all vessel revenue.

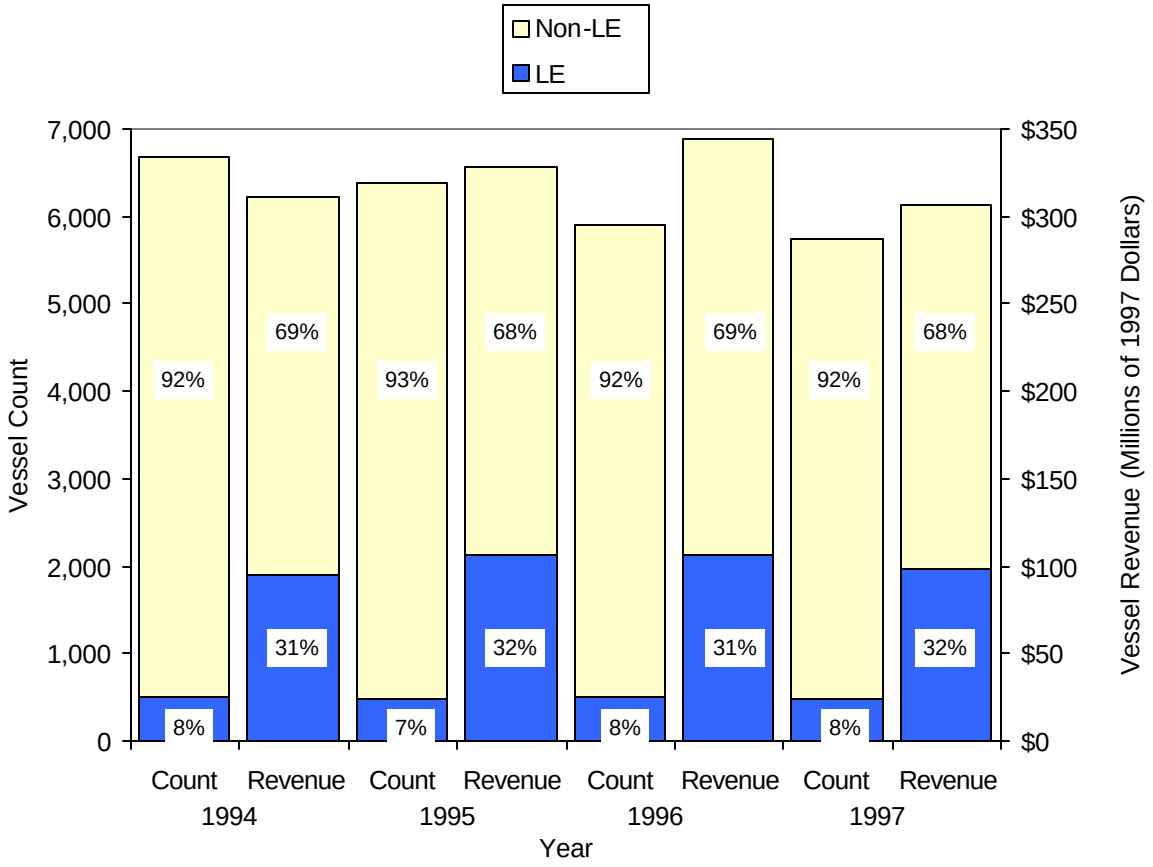
Table 12
Revenue Frequency Distribution by Federal Groundfish Limited Entry Program 1994-1997

	1994		1995		1996		1997	
LE								
Average revenue	$187,643		$222,773		$212,416		$203,549	
	Count	%	Count	%	Count	%	Count	%
<$500	3	1%	0	0%	1	0%	4	1%
<$5,000	8	2%	6	1%	4	1%	8	2%
<$50,000	111	22%	75	16%	73	15%	63	13%
<$300,000	281	55%	263	55%	289	58%	292	60%
$300,000+	106	21%	133	28%	132	26%	116	24%
Total	509	100%	477	100%	499	100%	483	100%
Non-LE								
Average revenue	$35,047		$37,652		$44,097		$39,777	
	Count	%	Count	%	Count	%	Count	%
<$500	1,028	17%	914	16%	829	15%	615	12%
<$5,000	1,766	29%	1,555	26%	1,432	27%	1,431	27%
<$50,000	2,306	37%	2,354	40%	1,983	37%	2,101	40%
<$300,000	975	16%	981	17%	1,024	19%	1,014	19%
$300,000+	85	1%	90	2%	124	2%	87	2%
Total	6,160	100%	5,894	100%	5,392	100%	5,248	100%

Notes: 1. Revenue category is upper bound of vessel total revenue.
2. Average revenue in 1997 dollars adjusted using the GDP Implicit Price Deflator.
3. Revenue excludes offshore and distant water fisheries sources.
4. Excludes vessel identification codes "NONE" and "ZZ..."

Source: PacFIN extraction March 1999.

Figure 20
Vessel Count and Total Revenue by Federal Groundfish Limited Entry Program Permit Status 1994-1997

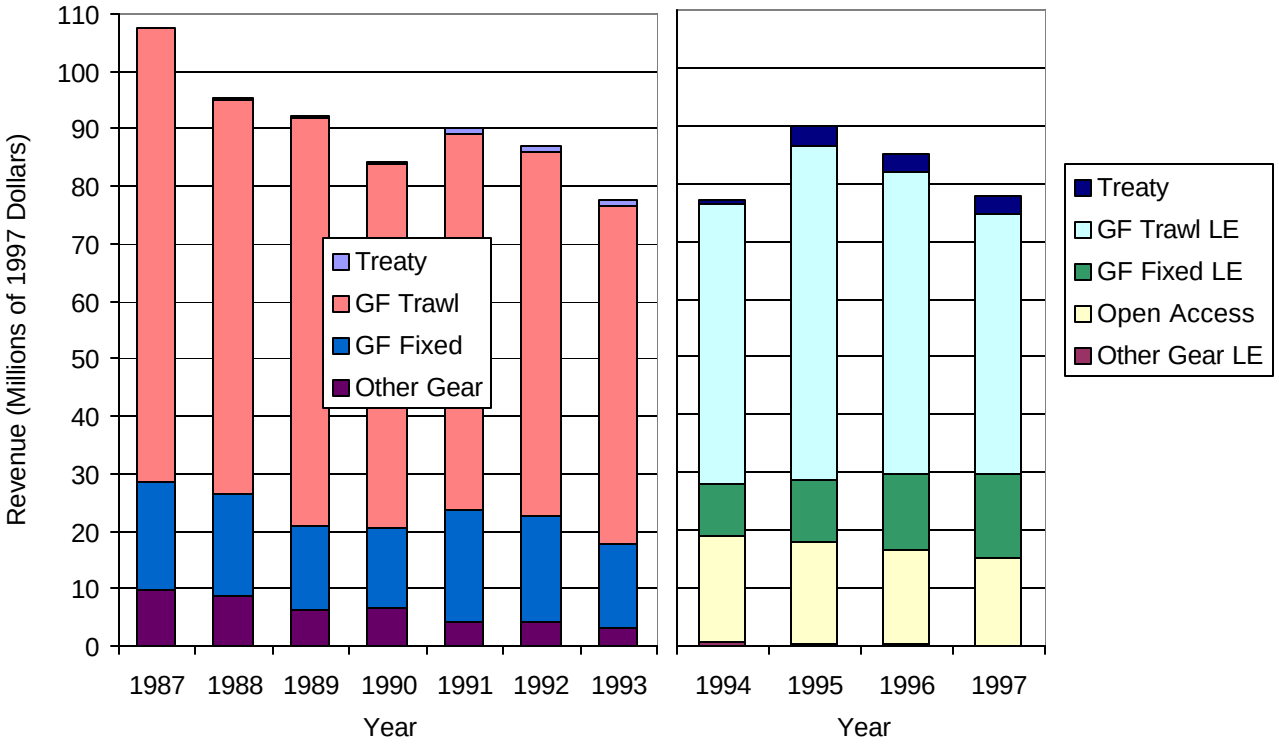


Note: 1. Revenue is ex-vessel value in millions of 1997 dollars adjusted using the GDP Implicit Price Deflator.
2. Revenue is from all species landed by vessels with or without a federal groundfish limited entry permit. Revenue excludes offshore and distant water fisheries sources.

Source: PacFIN March 1999 extraction.

Landings of groundfish quotas among user groups since 1987 are shown in Figure 21. Groundfish quota allocations by gear groups started in 1987. Groundfish quota allocations for the federal limited entry program started in 1994. Groundfish quota allocations for treaty fisheries started in 1990. The figure shows a decreasing trend in overall revenues from this fishery and a higher share of revenues received by the limited entry, fixed gear user group after 1994. The increasing share is due to higher prices received for sablefish, which is the dominant species harvested by the fixed gear user group.

Figure 21
Groundfish Revenue by User Group Allocations 1987-1997



Note:
1. Revenue is ex-vessel value in millions of 1997 dollars adjusted using the GDP Implicit Price Deflator.
2. Revenue excludes offshore and distant water fisheries sources.
3. Revenue inclusive of vessels with identification codes "NONE" and "ZZ..."
4. "Other Gear LE" is groundfish landed under LE permits using other gear types, such as shrimp trawl, prawn traps, drift gill net, etc.
5. Groundfish quota allocations by gear groups started in 1987. Groundfish quota allocations for the federal limited entry program started in 1994. Groundfish quota allocations for treaty fisheries started in 1990.

Source: PacFIN March 1999 and September 1998 extractions.

E. 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 13 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. Figure 22 shows vessel counts by species and gear combinations, respectively. Figure 23 is an example of the overlap between vessels that fish with pot, net, and trawl gear. The size of the circles is proportional to the number of vessels using those gear types. The appendix contains tables showing higher dimensional combinations of gear and species combinations.

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. Tables 14 and 15 show the count of U.S. West Coast vessels that fall within categories for 33 percent, 50 percent, and 90 percent specialization levels. Figure 24 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 classifications in Table 16 is 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 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.

Table 13
Vessel Counts and Characteristics by Species and Gear Groups for Revenue Categories in 1997

All Vessel Volume Categories

Vessel count: (5,705 + 26 with length 0)		5,731
Per vessel mean landings (revenue)		$53,579
Per vessel std. dev. landings (revenue)		$117,389
Vessel mean length (excluding 0 length)		37 ft.
Vessel std. dev. length (excluding 0 length)		23 ft.
Multi-gear profile (vessels):	1 gear	65%
	2 gears	24%
	3 gears	9%
	4+ gears	2%

		Hook and line	Net	Other	Pot	Trawl	Troll	All gears	Percent
1	Groundfish	6.48%	0.12%	0.00%	0.94%	16.59%	0.15%	$74,564	24%
2	Pacific whiting	0.00%	0.00%			2.72%		$8,356	3%
3	Salmon	0.01%	2.00%		0.00%	0.00%	3.21%	$16,038	5%
4	Crab/lobster	0.00%	0.01%	0.00%	20.83%	0.00%	0.00%	$63,995	21%
5	Shrimp		0.26%	0.06%	0.63%	6.72%		$23,525	8%
6	Coastal pelagic	0.04%	9.67%	0.00%	0.00%	0.01%	0.00%	$29,849	10%
7	Other pelagic	0.00%	4.40%	0.71%		0.03%	0.00%	$15,785	5%
8	Highly migratory	1.02%	4.22%	0.28%	0.00%	1.33%	5.82%	$38,910	13%
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

Vessel count: (616 + 3 with length 0)		619
Per vessel mean landings (revenue)		$203
Per vessel std. dev. landings (revenue)		$139
Vessel mean length (excluding 0 length)		28 ft.
Vessel std. dev. length (excluding 0 length)		17 ft.
Multi-gear profile (vessels):	1 gear	95%
	2 gears	4%
	3 gears	0%
	4+ gears	

		Hook and line	Net	Other	Pot	Trawl	Troll	All gears	Percent
1	Groundfish	23.58%		0.01%	1.32%	0.27%	0.31%	$32	25%
2	Pacific whiting							$0	0%
3	Salmon	0.43%	23.95%				20.46%	$56	45%
4	Crab/lobster				6.62%			$8	7%
5	Shrimp		0.35%	0.18%	0.18%	0.28%		$1	1%
6	Coastal pelagic	0.04%	0.48%			0.04%		$1	1%
7	Other pelagic	0.01%	0.43%					$1	0%
8	Highly migratory	3.14%	0.12%	0.11%		0.51%	3.23%	$9	7%
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

Vessel count: (1,431 + 8 with length 0)		1,439
Per vessel mean landings (revenue)		$2,200
Per vessel std. dev. landings (revenue)		$1,283
Vessel mean length (excluding 0 length)		29 ft.
Vessel std. dev. length (excluding 0 length)		16 ft.
Multi-gear profile (vessels):	1 gear	82%
	2 gears	15%
	3 gears	3%
	4+ gears	0%

		Hook and line	Net	Other	Pot	Trawl	Troll	All gears	Percent
1	Groundfish	16.00%	0.19%	0.02%	1.23%	0.63%	0.32%	$582	18%
2	Pacific whiting							$0	0%
3	Salmon	0.29%	25.68%				20.52%	$1,471	46%
4	Crab/lobster	0.00%		0.04%	10.57%	0.00%		$336	11%
5	Shrimp		0.07%	0.03%	0.20%			$10	0%
6	Coastal pelagic	0.25%	0.82%	0.00%			0.00%	$34	1%
7	Other pelagic	0.01%	1.20%				0.01%	$39	1%
8	Highly migratory	0.98%		0.20%		0.44%	5.09%	$213	7%
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%
	Percent	22%	35%	3%	12%	2%	26%	100%	

Table 13 (continued)

$5,000 - $49,999.99

Vessel count: (2,153 + 11 with length 0)		2,164
Per vessel mean landings (revenue)		$20,176
Per vessel std. dev. landings (revenue)		$12,766
Vessel mean length (excluding 0 length)		35 ft.
Vessel std. dev. length (excluding 0 length)		16 ft.
Multi-gear profile (vessels):	1 gear	59%
	2 gears	29%
	3 gears	11%
	4+ gears	2%

	Hook and line	Net	Other	Pot	Trawl	Troll	All gears	Percent
1 **Groundfish**	11.06%	0.32%	0.01%	0.95%	0.89%	0.40%	$5,953	14%
2 **Pacific whiting**	0.00%	0.00%			0.32%		$141	0%
3 **Salmon**	0.04%	8.39%		0.00%	0.00%	14.10%	$9,838	23%
4 **Crab/lobster**	0.00%	0.01%	0.01%	28.10%	0.01%		$12,280	28%
5 **Shrimp**		0.05%	0.22%	1.02%	1.37%		$1,159	3%
6 **Coastal pelagic**	0.24%	0.98%	0.00%	0.00%	0.01%	0.00%	$538	1%
7 **Other pelagic**	0.00%	2.75%	0.08%		0.07%	0.00%	$1,268	3%
8 **Highly migratory**	0.49%	0.15%	0.61%		1.30%	9.27%	$5,154	12%
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%	

$50,000 +

Vessel count: (1,505 + 4 with length 0)		1,509
Per vessel mean landings (revenue)		$172,373
Per vessel std. dev. landings (revenue)		$180,871
Vessel mean length (excluding 0 length)		52 ft.
Vessel std. dev. length (excluding 0 length)		31 ft.
Multi-gear profile (vessels):	1 gear	46%
	2 gears	33%
	3 gears	16%
	4+ gears	5%

	Hook and line	Net	Other	Pot	Trawl	Troll	All gears	Percent
1 **Groundfish**	5.59%	0.09%	0.00%	0.93%	19.43%	0.11%	$67,997	26%
2 **Pacific whiting**	0.00%				3.16%		$8,214	3%
3 **Salmon**	0.00%	0.63%		0.00%	0.00%	1.16%	$4,672	2%
4 **Crab/lobster**	0.00%	0.00%	0.00%	19.74%	0.00%	0.00%	$51,371	20%
5 **Shrimp**		0.29%	0.03%	0.57%	7.70%		$22,355	9%
6 **Coastal pelagic**	0.00%	11.24%	0.00%	0.00%	0.01%	0.00%	$29,276	11%
7 **Other pelagic**	0.00%	4.72%	0.82%		0.03%	0.00%	$14,477	6%
8 **Highly migratory**	1.11%	4.96%	0.22%	0.00%	1.35%	5.25%	$33,534	13%
9 **Halibut**	3.71%				0.00%	0.00%	$9,669	4%
10 **Sea urchins**		0.06%	4.69%				$12,351	5%
11 **Other**	0.06%	0.39%	1.16%	0.19%	0.58%	0.00%	$6,194	2%
All species	$27,245	$58,248	$18,001	$55,752	$83,903	$16,961	$260,111	100%
Percent	10%	22%	7%	21%	32%	7%	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.

Table 14
Vessel Counts and Revenues by Species and Gear Groups for Specialization Categories in 1997

	>90%			>50% and <=90%			>33% and <=50%			>=0% and <=33%			Total		
Species	Vessel Count	Average Species Revenue	Average Total Revenue	Vessel Count	Average Species Revenue	Average Total Revenue	Vessel Count	Average Species Revenue	Average Total Revenue	Vessel Count	Average Species Revenue	Average Total Revenue	Vessel Count	Average Species Revenue	Average Total Revenue
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	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
Net	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

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.

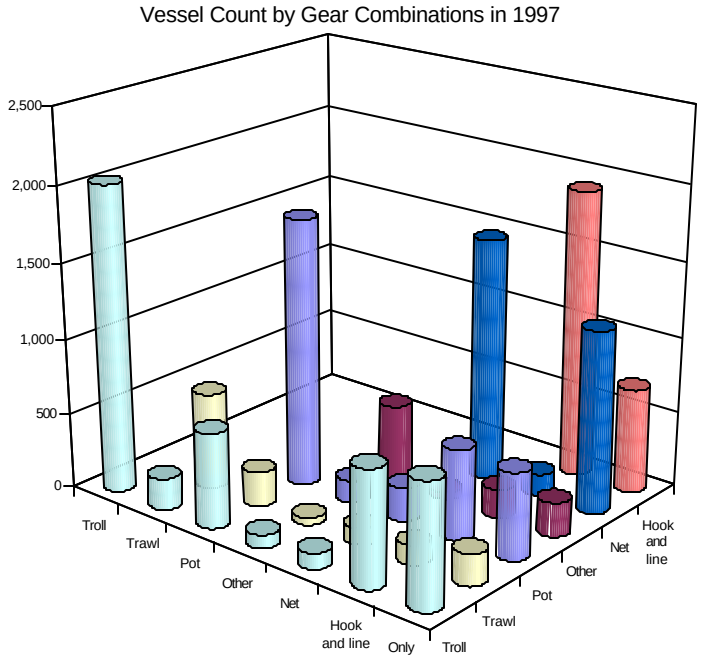
Table 15
Count of Vessels Within Species and Gear Revenue Groups and Specialization Categories in 1997

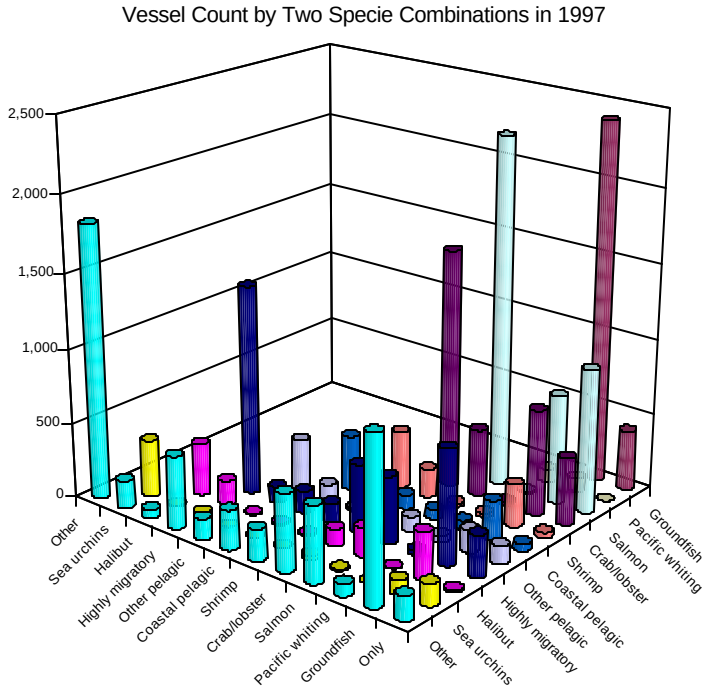
	Sum of Revenue (thousands)	Vessel Count	Count of Vessels Within Revenue Categories				Count of Vessels Within Revenue Specialization Categories			Revenue Distribution	
			<$500	$500-$5K	$5K-$50K	≥$50,000	≥90%	≥50%	≥33%	90th Percentile	50th Percentile
Species											
Groundfish	74,564	2,399	9%	21%	38%	33%	31%	44%	50%	102,625	1,600
Pacific whiting	8,356	91	0%	0%	13%	87%	15%	31%	38%	292,078	8,217
Salmon	16,038	2,319	13%	34%	41%	12%	55%	70%	76%	19,954	2,846
Crab/lobster	63,995	1,590	2%	11%	45%	42%	44%	68%	79%	104,033	22,931
Shrimp	23,525	384	2%	2%	25%	71%	22%	42%	51%	157,054	25,585
Coastal pelagic	29,849	398	2%	10%	31%	57%	17%	29%	33%	309,137	205
Other pelagic	15,785	377	2%	6%	31%	62%	41%	50%	53%	119,568	10,997
Highly migratory	38,910	1,402	3%	12%	42%	43%	26%	35%	41%	68,057	3,471
Halibut	10,112	350	1%	8%	45%	46%	9%	21%	25%	104,357	1,125
Sea urchins	16,124	385	2%	11%	51%	36%	63%	83%	89%	112,791	25,264
Other	9,806	1,848	6%	24%	38%	33%	12%	24%	30%	10,587	387
Gear											
Hook and line	34,046	1,908	12%	25%	39%	24%	44%	56%	62%	55,407	1,865
Net	66,829	1,609	11%	32%	37%	20%	79%	83%	86%	74,568	4,494
Other	22,186	516	2%	11%	47%	40%	61%	69%	72%	110,115	16,639
Pot	69,560	1,777	3%	12%	45%	40%	46%	67%	77%	103,969	19,805
Trawl	86,201	642	2%	4%	24%	70%	51%	74%	80%	362,196	78,190
Troll	28,240	2,032	8%	22%	42%	28%	48%	61%	66%	38,674	4,679

Notes: 1. Excludes vessel identification codes reported as "NONE" or "ZZ..."
2. Total revenue does not include deliveries to offshore processors or revenues from distant water fisheries.

Source: PacFIN March 1999 extraction.

Figure 22
Vessel Count by Gear and Specie Combinations in 1997

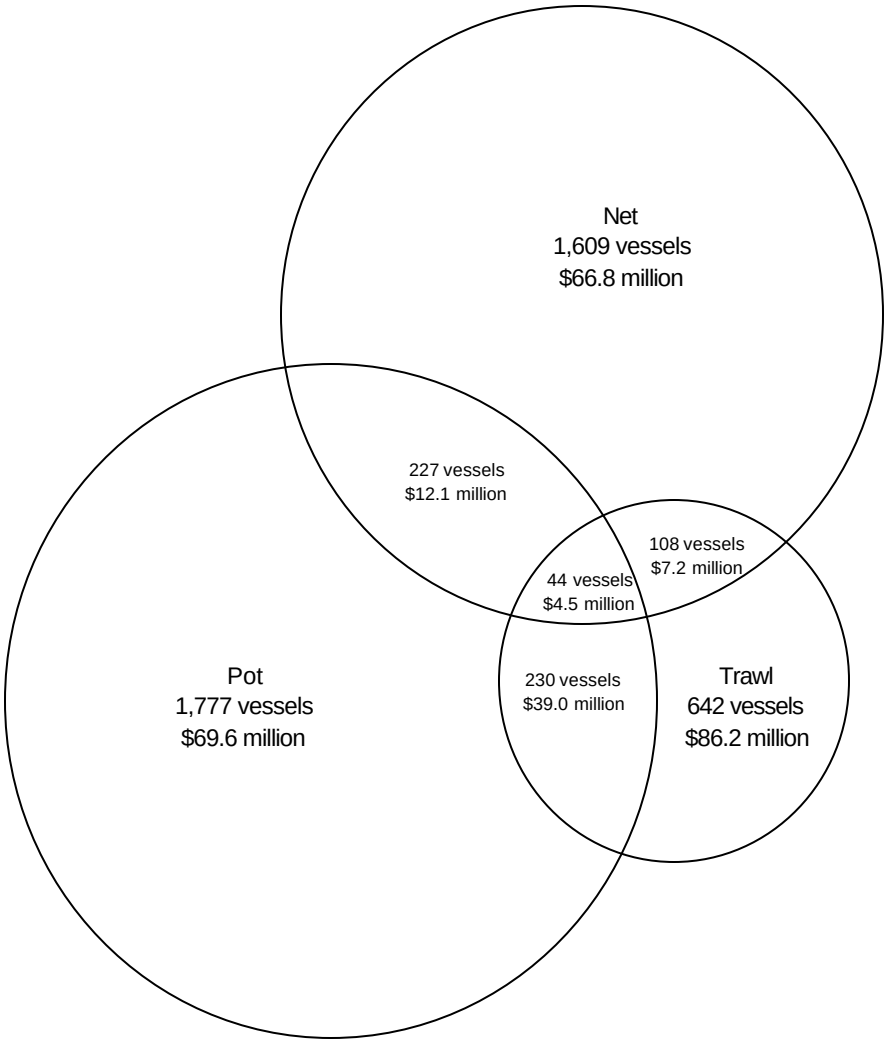




Notes: 1. Excludes vessel identification codes reported as "NONE" or "ZZ..."
2. Counts of vessels for a species or gear combination are the number of vessels with any landings of both species groups or with both gear groups. For example, if the combination is "salmon" and "shrimp," the count is the number of vessels whose landings include both salmon and shrimp. If the combination is "troll" and "only," the count is the number of vessels that used troll gear and no other. The combination of "net" and "net" shows the number of vessels using net gear, regardless of any other gears used.

Source: PacFIN March 1999 extraction.

Figure 23
Distribution of Counts and Revenue for Gear (Trawl, Net, and Pot) Combinations in 1997

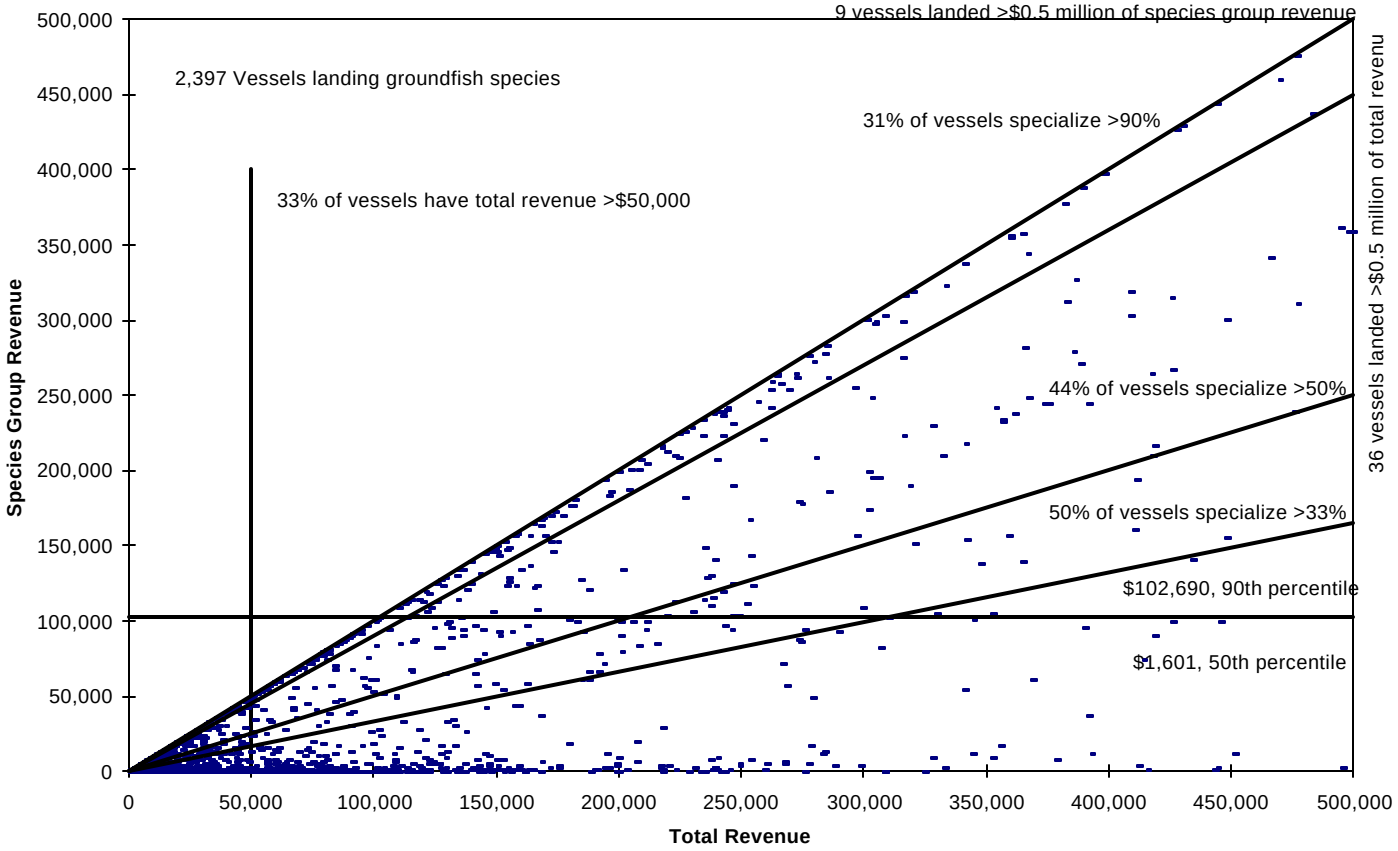


Notes: 1. Excludes vessel identification codes reported as "NONE" or "ZZ..."
2. Size of circle and overlap is proportionally correct to number of vessels using the gear combinations for all species.
3. Revenue excludes offshore and distant water fisheries sources.

Source: Study.

- 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

Figure 24
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.

keeping experienced crew members retained by participating in fisheries of lower return to owners.

- 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

Table 16
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: Study.

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 by 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 17). 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

Table 17
Total Counts and Revenues by Vessel Classifications in 1997

	Vessel Category	Total Category Revenue	Percent	Vessel Count	Percent	Average 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.

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.

The complexity of the revenue distribution among species and gear groups and for other sources of revenue is shown in Table 18 and summarized for revenue source (onshore, offshore, or distant water fisheries) on Figure 25. 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 17). 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.

Table 18
Sources of Revenue by Vessel Classifications in 1997

	U.S. West Coast Onshore																						U.S. West			
Vessel Category	Ground-fish		Pacific Whiting		Salmon		Crab/ Lobster		Shrimp		Coastal Pelagic		Other Pelagic		Highly Migratory		Halibut		Sea Urchins		Other		Total Onshore		Alaska Onshore		Alaska Offshore		Coast Offshore		Other Offshore		Total
1 Mothership/Catcher	866	6%													94	1%	287	2%			0	0%	1,248	9%	1,105	8%	11,233	83%			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%	146	0%	513	1%	1,051	3%	56	0%	0	0%	8,038	22%	28,391	78%					175	0%	36,604
	1%				9%		6%		0%		0%		1%		1%		10%		0%		0%		3%		68%						2%		10%
3 Pacific Whiting Onshore	3,154	16%	7,204	37%	3	0%	751	4%	109	1%	3	0%	31	0%	1	0%	0	0%			2	0%	11,259	58%	3,377	17%	90	0%	4,755	24%			19,481
and Offshore Trawler	4%		86%		0%		1%		0%		0%		0%		0%		0%				0%		4%		8%		1%		100%				5%
4 Large Groundfish	44,649	80%	826	1%	26	0%	3,050	5%	4,961	9%	25	0%	163	0%	507	1%	112	0%			1,400	3%	55,718	100%	105	0%					100	0%	55,924
Trawler	60%		10%		0%		5%		21%		0%		1%		1%		1%				14%		18%		0%						1%		15%
5 Small Groundfish	2,016	54%	1	0%	10	0%	237	6%	46	1%	10	0%	4	0%	159	4%			1	0%	1,227	33%	3,710	100%									3,710
Trawler	3%		0%		0%		0%		0%		0%		0%		0%				0%		13%		1%										1%
6 Sablefish Fixed Gear	12,503	68%	0	0%	217	1%	3,006	16%	71	0%	2	0%	12	0%	417	2%	1,098	6%	93	1%	12	0%	17,431	95%	854	5%					25	0%	18,311
	17%		0%		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%	2	0%	2	0%	1	0%	302	2%	6,564	43%	32	0%	288	2%	12,658	82%	2,652	17%					125	1%	15,435
Fixed Gear	6%		0%		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%	15,075	29%	3,409	7%	45	0%			124	0%	49,432	95%	2,849	5%					25	0%	52,306
	0%				5%		0%		1%		99%		96%		9%		0%				1%		16%		7%						0%		14%
9 Migratory Netter	66	0%			251	2%	37	0%	155	1%	19	0%	1	0%	14,706	93%			19	0%	267	2%	15,521	98%							350	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%	2	0%	15,093	61%	7	0%	220	1%	42	0%	18,969	77%	53	0%					5,725	23%	24,747
	0%				6%		4%		1%		0%		0%		39%		0%		1%		0%		6%		0%						80%		7%
11 Shrimper	741	3%			41	0%	3,916	18%	16,577	75%	10	0%	19	0%	537	2%	62	0%	6	0%	147	1%	22,057	100%	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%	100	0%	1,751	4%	253	1%	75	0%	74	0%	44,076	97%	1,217	3%					200	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%			0	0%	14	0%	342	6%	39	1%			30	0%	6,020	99%	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	0%					0	0%			12	0%	139	5%	2,528	96%	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	0%	0	0%	0	0%			342	30%	737	65%	1,125	99%	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%	198	3%	7	0%	1	0%	81	1%			28	0%	527	8%	6,908	100%									6,908
	0%				0%		9%		1%		0%		0%		0%				0%		5%		2%										2%
17 Diver Vessel	214	1%			15	0%	43	0%	1	0%	0	0%	5	0%	60	0%	0	0%	15,132	80%	3,507	18%	18,977	100%	12	0%							18,989
	0%				0%		0%		0%		0%		0%		0%		0%		94%		36%		6%		0%								5%
18 Other > $15 Thousand	762	17%	306	7%	326	7%	693	16%	114	3%	15	0%	9	0%	33	1%	564	13%			228	5%	3,051	70%	861	20%					450	10%	4,362
	1%		4%		2%		1%		0%		0%		0%		0%		6%				2%		1%		2%						6%		1%
19 Other <= $15 Thousand	2,004	24%	18	0%	1,792	22%	1,873	22%	169	2%	179	2%	205	2%	904	11%	29	0%	107	1%	1,055	13%	8,336	100%									8,336
	3%		0%		11%		3%		1%		1%		1%		2%		0%		1%		11%		3%										2%
Total revenue	74,564	20%	8,356	2%	16,038	4%	63,995	17%	23,525	6%	29,849	8%	15,785	4%	38,910	10%	10,112	3%	16,124	4%	9,806	3%	307,063	83%	41,693	11%	11,323	3%	4,755	1%	7,200	2%	372,034
	100%		100%		100%		100%		100%		100%		100%		100%		100%		100%		100%		100%		100%		100%		100%		100%		100%
Vessel count	2,399		91		2,319		1,590		384		398		377		1,402		350		385		1,848		5,731		377		14		15		148		5,731

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

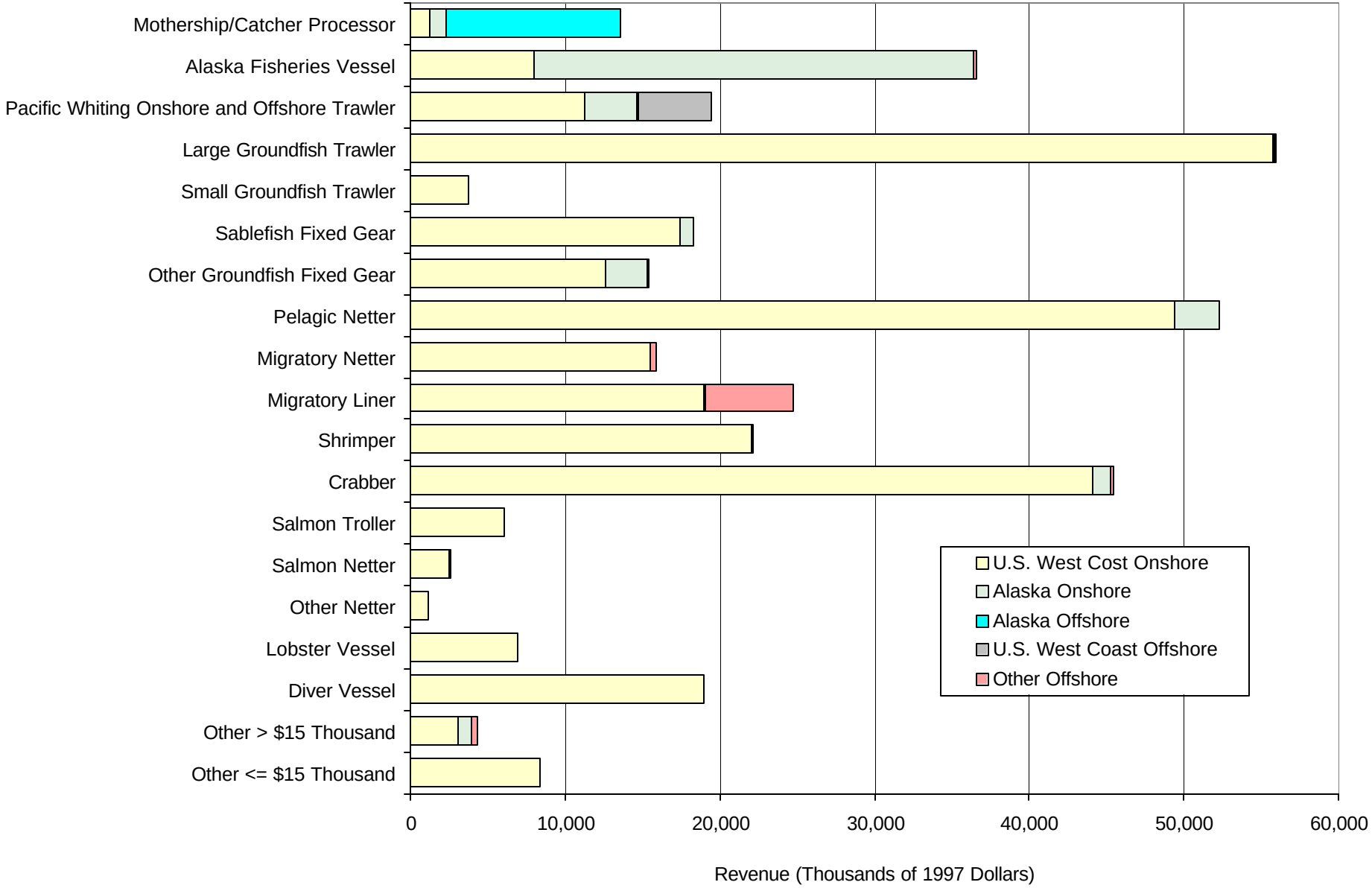
2. U.S. West Coast onshore revenues exclude landings from vessels with identifier code "ZZ..." or "NONE."

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 25
Sources of Revenue by Vessel Classifications in 1997



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."
Source: PacFIN March 1999 extraction.

Assigning vessels to a certain classification is rule order dependent, i.e. vessel classes are from a hierarchical structure. Table 19 shows that the hierarchical does not significantly change if vessels were not removed from the pool for being previously classified in another category.

Table 19
Vessels That Meet a Category's Rule Criteria, But Were Assigned to a Previous Category

	Vessel Count																			Hierarchical Structure			Independent of Hierarchical Structure		
Category	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Count	Revenue	Average	Count	Revenue	Average
1	6																			6	13,611	2,268	6	13,611	2,268
2	6	224																		224	36,604	163	230	50,215	218
3			29																	29	19,481	672	29	19,481	672
4			8	195																195	55,924	287	203	59,698	294
5		1	8	195	78															78	3,710	48	282	63,434	225
6					1	167														167	18,311	110	168	18,332	109
7		4			2	23	159													159	15,435	97	188	19,501	104
8		3		1				247												247	52,306	212	251	52,951	211
9				2	2			5	77											77	15,871	206	86	20,761	241
10		1			1	3	4		15	266										266	24,747	93	290	27,515	95
11				13	1			1	2	3	140									140	22,112	158	160	27,815	174
12		13		12	4	32	9	6		31	32	601								601	45,493	76	740	66,701	90
13		5				2	10	2	1	34	1	47	364							364	6,064	17	466	10,506	23
14		11					1		2			7		170						170	2,634	15	191	4,084	21
15				3	21							1		2	37					37	1,137	31	64	2,568	40
16					2						3	10				108				108	6,908	64	123	8,162	66
17		1				1	2			4		1		1	16	3	285			285	18,989	67	314	20,569	66
18	6	224	29	195	78	167	159	247	77	266	140	601	149	48	37	108	230	35		35	4,362	125	2,796	360,307	129
19													215	122			55		2,543	2,543	8,336	3	2,935	11,726	4

Notes:
1. Total revenue and average revenue are in thousands of 1997 dollars.
2. U.S. West Coast onshore revenues exclude landings from vessels with identifier code "ZZ..." or "NONE."
3. Row vessel counts are unique, but column vessel counts are only unique under the hierarchical methodology.
4. Revenue includes U.S. West Coast onshore landings and revenue from offshore and distant water fisheries.

Source: Study.

F. PROCESSOR AND BUYER CHARACTERISTICS

1. Purchase Volume and Purchaser Counts

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 26). About one half of the volume and value is landed in California (Table 20). 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 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 (Table 21). 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 (Table 22 and Figure 27). The aggregate number of processors and buyers has not changed significantly in recent years (Figure 28).

2. Multi-Fisheries Dependency

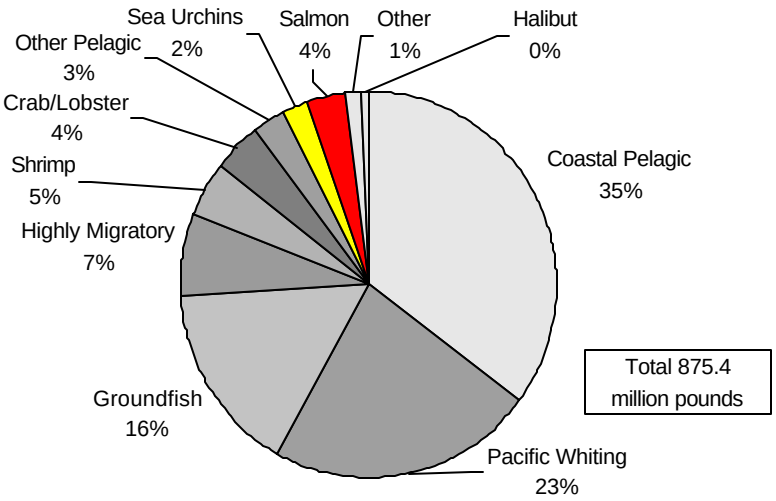
The major processing firms in the U.S. West Coast are multi-species, multi-market oriented. Most of the firms' plants are located in areas where, by natural conditions or by management decisions, the availability of products changes over the year. Out of competitive necessity, they therefore process 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 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.

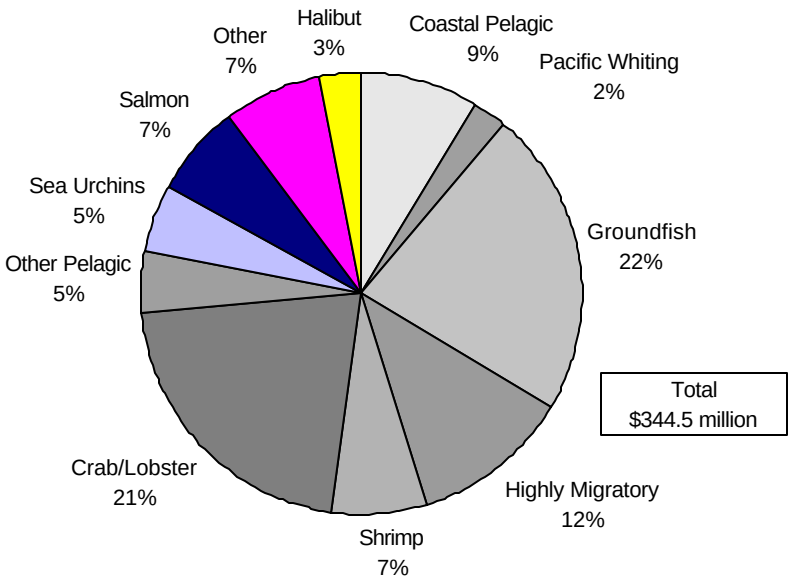
The processing and distribution of seafood is complex (Figure 29). Some products flow directly to the consumer, while others are processed, brokered, distributed, and retailed by separate entities. Value may be added to the product at any stage. This may involve selling a product whole, or retaining only a portion of the landed product for sale. Value may be added also by

Figure 26
Total Landed Volume and Value by Species in 1997

Volume



Value



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

Table 20
Volume and Value of Fish Landings by State in 1997

	Landed Volume		Ex-Vessel Value	
Area	Volume	%	Value	%
Washington	122.0	14%	$103.6	30%
Oregon	260.9	30%	$69.6	20%
California	492.5	56%	$171.3	50%
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.

Table 21
Processors or Buyers Counts and Revenues by Revenue Categories in 1997

	Counts		Sum of Revenues	
Revenue Categories	Number	%	Amount (millions)	%
<=$10K	666	52%	1.8	1%
<=$100K	330	26%	11.0	3%
<=$1,000K	204	16%	81.3	24%
<=$5,000K	80	6%	167.9	49%
>$5,000K	11	1%	82.5	24%
Total	1,291	100%	344.5	100%

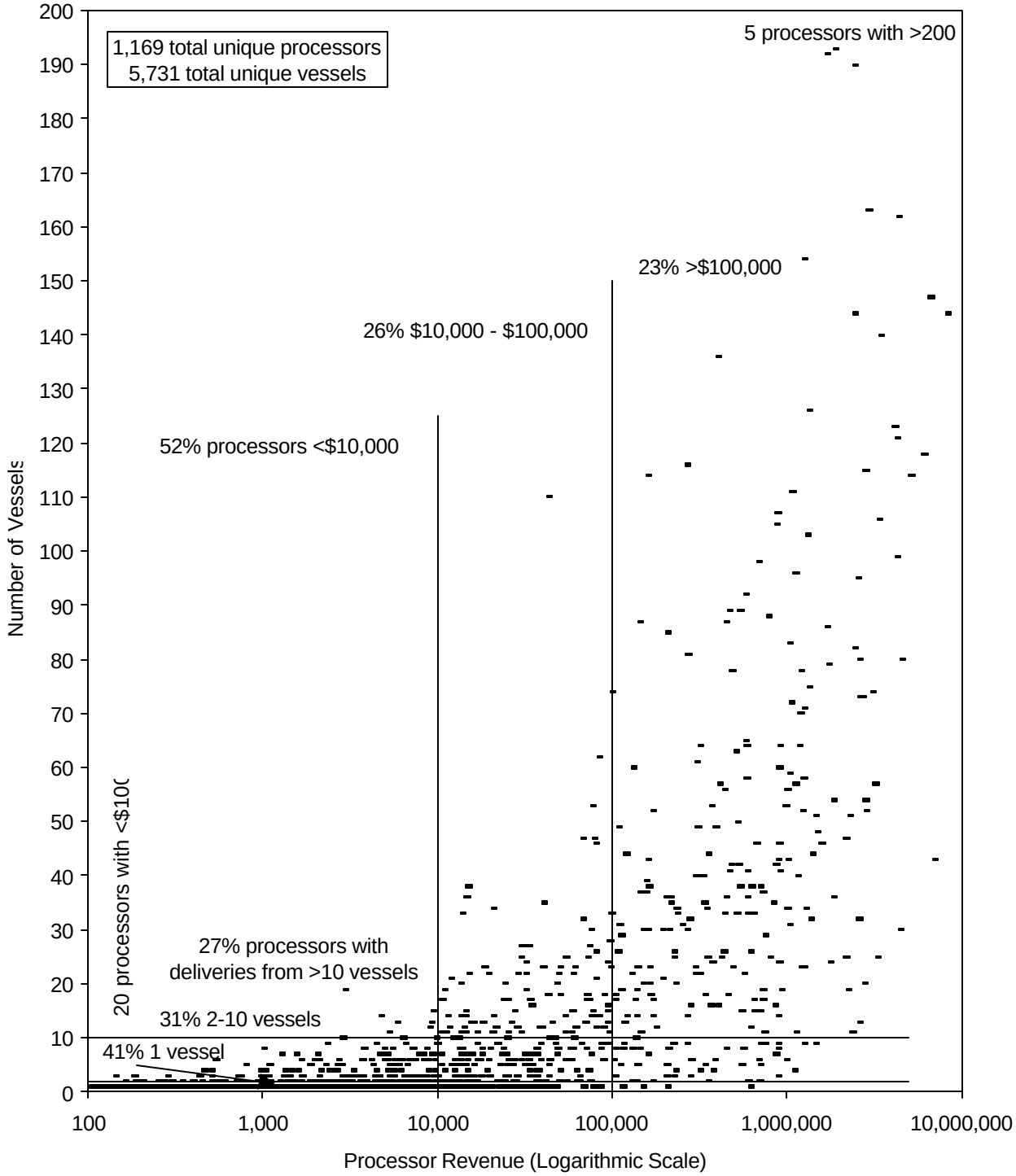
Source: PacFIN March 1999 extraction.

Table 22
Processors and Buyers by Revenue Categories and by Number of Vessels Delivering in 1997

	Processor Revenue					
Vessels	<=$10,000	>$10,000 And <=$100,000	>$100,000 And <=$1,000,000	>$1,000,000 And <=$5,000,000	>$5,000,000	All
1	408	70	4	0	0	482
2-5	144	72	21	1	0	238
6-10	46	58	24	2	0	130
>10	7	99	135	69	9	319
All	605	299	184	72	9	1,169
1	35%	6%	0%	0%	0%	41%
2-5	12%	6%	2%	0%	0%	20%
6-10	4%	5%	2%	0%	0%	11%
>10	1%	8%	12%	6%	1%	27%
All	52%	26%	16%	6%	1%	100%

Notes: 1. Excludes vessel identification codes reported as "NONE" or "ZZ…"
2. Excludes one processor where 0 revenue is reported.
Source: PacFIN March 1999 extraction.

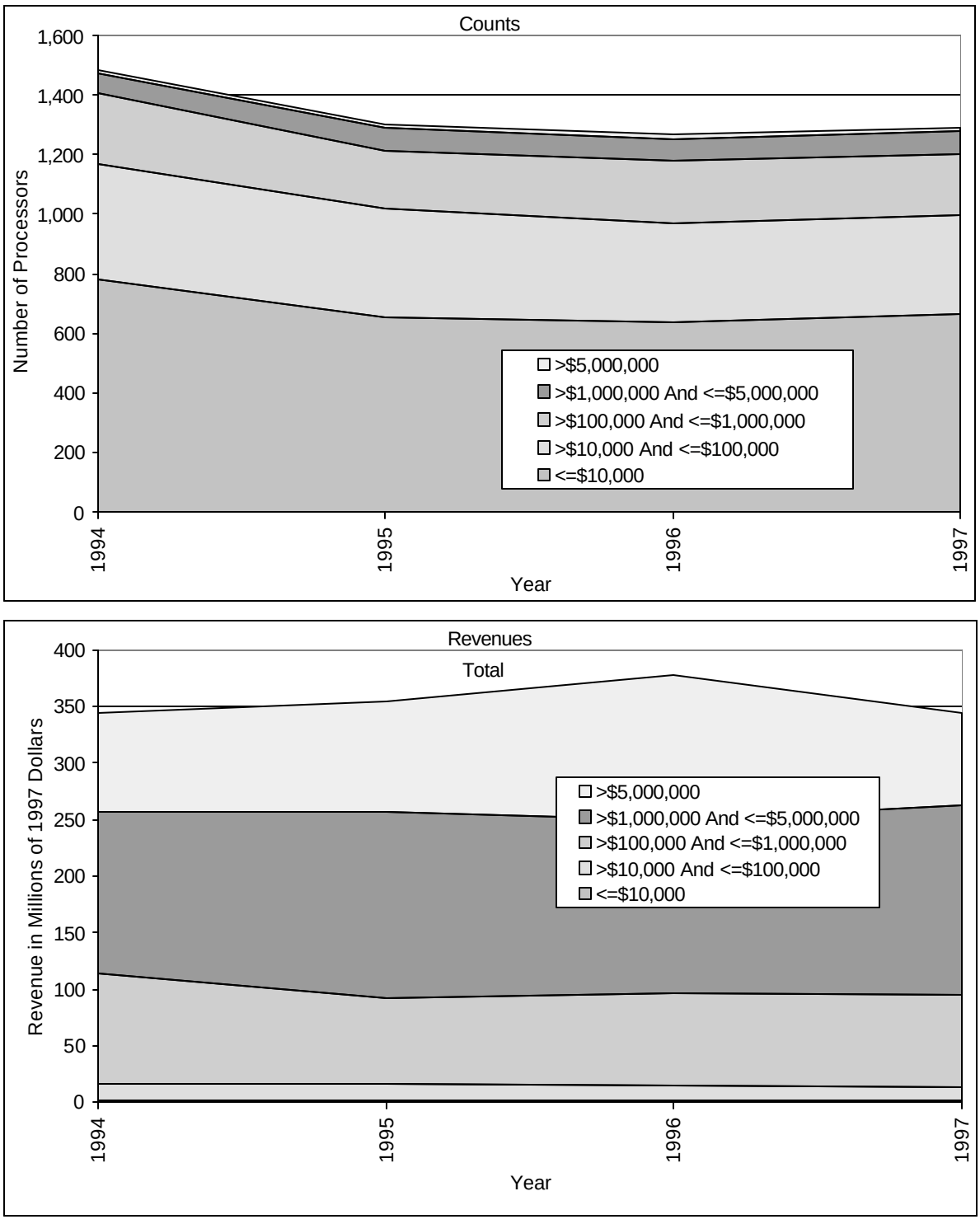
Figure 27
Scattergram Showing Processors' Revenue Compared to
Number of Vessels Delivering to the Processor in 1997



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.

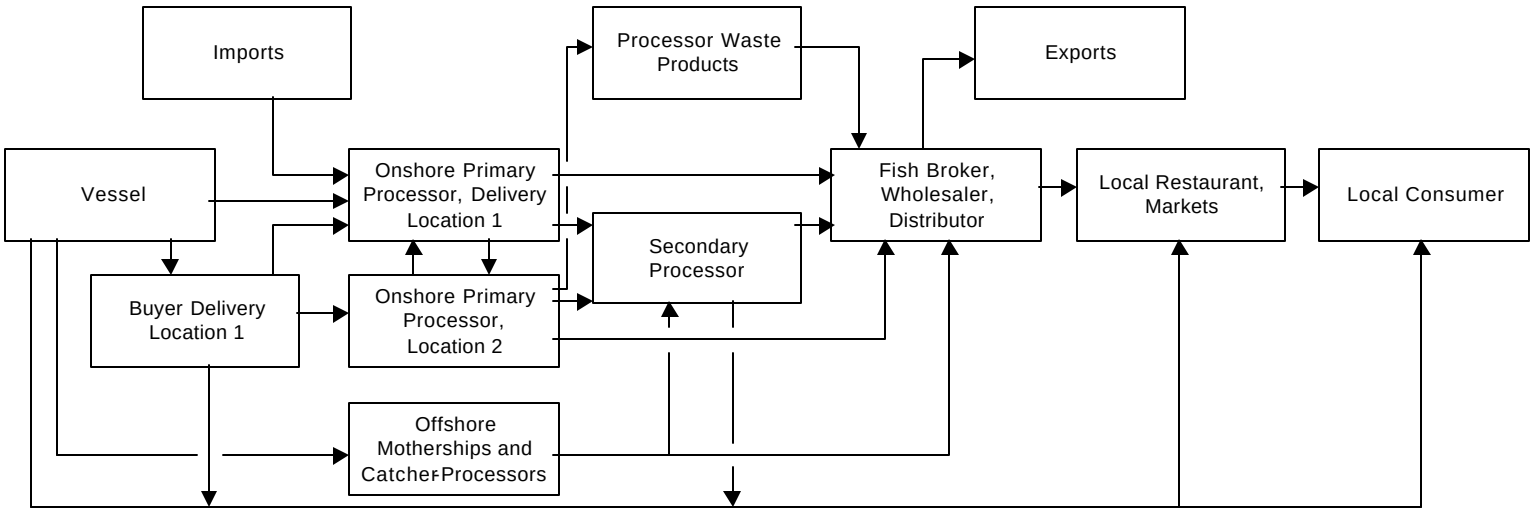
Source: PacFIN March 1999 extraction.

Figure 28
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 29
Seafood Product Distribution Chain



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 23). 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). The trend in multi-fisheries dependency is increasing. Figure 30 shows a narrowing band of processor and buyer counts that depend on a widening band of multi-fisheries revenues.

3. 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 24. The ex-vessel values by purchased species for these categories are shown in the other columns on Table 24.

Table 23
Counts and Revenue Distribution of Processors or Buyers Purchasing Within Species Groups in 1997

Species	Count Total	Processor Counts Within Revenue Categories <=$10K	<=$100K	<=$1,000K	<=$5,000K	>$5,000K	Counts Within Revenue Specialization Categories >90%	>50%	>33%
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%			

Species	Sum of Revenue (thousands)	Revenue Distribution (thousands) 90th Percentile	50th 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 24
Sources of Revenue by Processor Volume in 1997

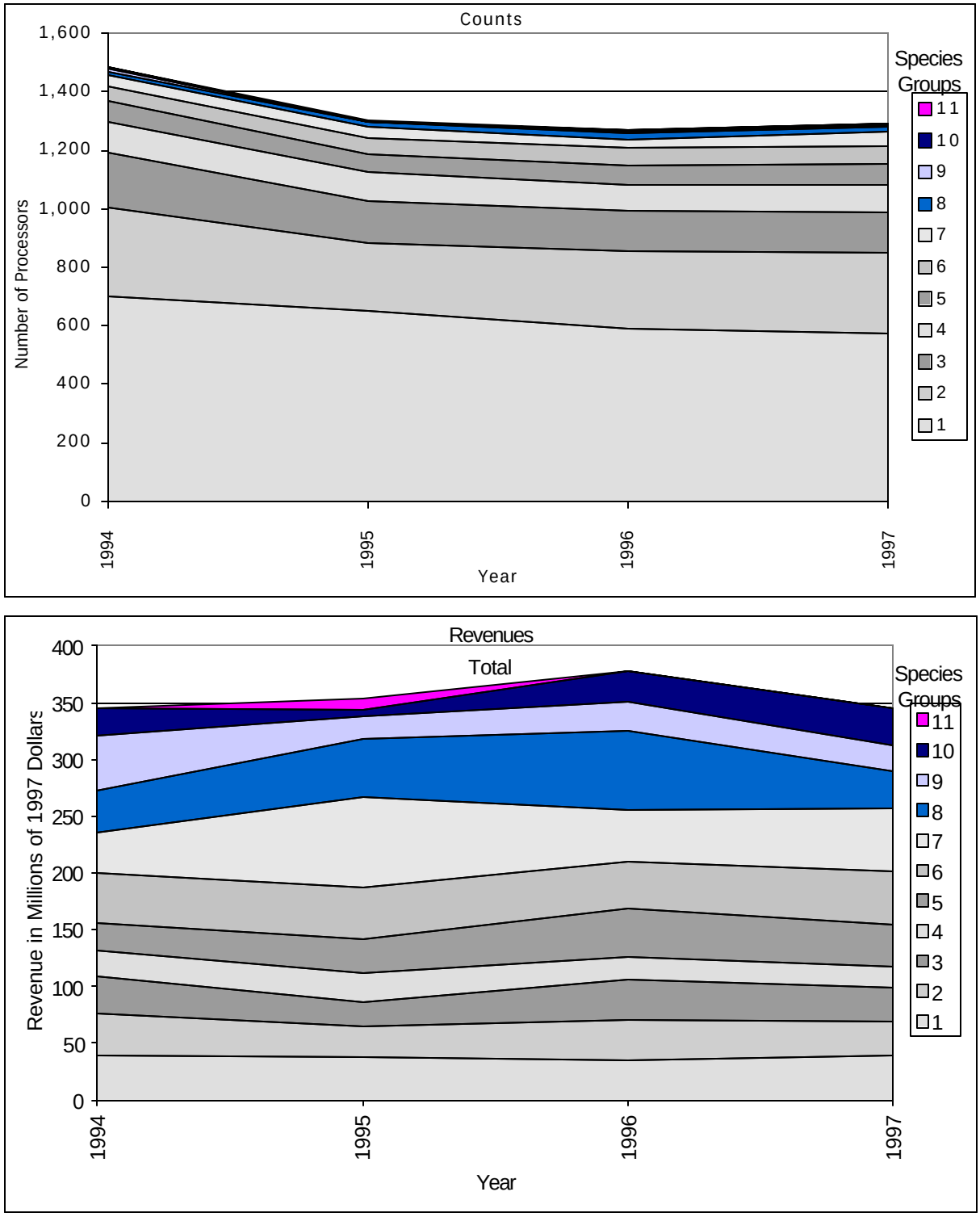
U.S. West Coast Onshore

Volume Category	Ground-fish		Pacific Whiting		Salmon		Crab/ Lobster		Shrimp		Coastal Pelagic		Other Pelagic		Highly Migratory		Halibut		Sea Urchins		Other		Total Onshore	
<=$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%	
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.

Figure 30
Processor Counts and Revenues by Number of Species Groups 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.

4. 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 (Table 25). 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 ex-processor value from processing the U.S. West Coast landings in 1996 was about double the ex-vessel value of the landings. Using the same relationship between ex-vessel price and ex-processor price in 1996, the 1997 ex-processor sales, including non-edible products, such as fish meal, are estimated to be $689.0 million.

Table 25a
Estimated Value of Finished Pounds Sold by Primary Processors in Washington by Species Groups in 1996

	Species/Gear Group Name	Ex-Vessel Price	Product Analysis Form	Yield	Use	Marginal Processor Costs/Sales Price Per Finished Pound Raw	Labor	Tax/Fee	Other	Contrib.	Sales Price	Finished Pounds (thousands)	Ex-processor Sales (thousands)
1	Groundfish	$0.59	Mixed3			1.32	0.26	0.03	0.10	0.40	2.11	14,330	30,227
2	Pacific whiting	$0.03	Surimi	16%	80%	0.19	0.12	0.00	0.30	0.30	0.91	4,404	4,017
		$0.03	H&G	61%	20%	0.05	0.29	0.00	0.10	0.40	0.84	4,198	3,528
3	Salmon	$0.60	Gutted	80%	100%	0.73	0.25	0.04	0.1	0.4	1.51	11,821	17,843
4	Crab/lobster	$1.39	Mixed1	46%	100%	3.03	0.61	0.07	0.10	0.40	4.20	12,656	53,202
5	Shrimp	$0.69	Mixed5	26%	100%	2.38	0.24	0.05	0.31	0.40	3.39	1,989	6,736
6	Coastal pelagic	$0.34	Mixed6	99%	100%	0.34	0.06	0.01	0.10	0.12	0.63	204	129
7	Other pelagic	$0.39	Mixed6	99%	100%	0.38	0.13	0.01	0.10	0.40	1.02	1,072	1,093
8	Highly migratory	$0.84	Mixed2	85%	100%	0.98	0.20	0.02	0.10	0.40	1.71	9,284	15,834
9	Halibut	$2.77	Fillet	72%	100%	3.85	0.15	0.09	0.10	0.40	4.59	2,125	9,755
10	Sea urchins	$1.04	Eggs	7%	100%	14.81	1.50	0.33	0.85	0.40	17.89	63	1,132
11	Other	$2.08	Mixed4			2.32	0.16	0.05	0.10	0.40	3.03	5,837	17,693
	Fish meal			10%		-	0.04		0.10	0.11	0.25	712	178
	TOTAL	$0.72				1.53	0.29	0.04	0.12	0.39	2.37	64,498	157,840

Notes: 1. Mixed1. Crab tends to start out "whole" during the year-end holidays and then move to "picked" meat later in the season. Over the last few years, "sections" have also become a product form. As a result, we have used 20%, 20%, and 60%, respectively, in terms of final product recovery of landed weight. In the past, we used 75% for meat and 25% whole formula or a mix of about 35%. We have now shifted the yield to 46%, reflecting the change to sections and whole. Lobster is mostly sold whole.

Mixed2. Albacore tuna assumes 75% "whole frozen" with a yield of 100% and 25% "fillet" with a yield of 43%, or about 85% mixed yield. Swordfish is sold as fillets, 75% yield; other tunas are assumed to be frozen or canned at 60% yield; sharks are filleted with 60% yield.

Mixed3. Groundfish generally is processed as a fillet; however, several species, such as sablefish and thornyheads are marketed fresh, whole.

Mixed4. Other species have many end products, including frozen and fresh whole, fillets, and eggs for the species sea urchin.

Mixed5. Pink shrimp is sold cooked. Other shrimp (prawns are usually sold whole).

Mixed5. Squid, mackerel, sardines, and herring are packed frozen to be shipped out. This assumes a 97% yield.

2. The two primary products using Pacific whiting are headed and gutted and surimi. Surimi processing requires expensive equipment and established marketing channels. There are a few central ports with processors that produce surimi. Pacific whiting landings at ports without this processing capability are hauled to the processors that have the equipment or the product is processed locally for headed and gutted.
3. Sales price is estimated using cost calculation from the FEAM model or using published sales price information for the product form sold in the market area.
4. Processor costs/sales price are per finished pound.

Source: Study.

Table 25b
Estimated Value of Finished Pounds Sold by Primary Processors in Oregon by Species Groups in 1996

	Species/Gear Group Name	Ex-Vessel Price	Product Analysis Form	Yield	Use	Processor Costs/Sales Price Per Finished Pound Raw	Labor	Tax/Fee	Other	Contrib.	Sales Price	Finished Pounds (thousands)	Ex-processor Sales (thousands)
1	Groundfish	$0.66	Mixed3			1.59	0.28	0.017	0.10	0.40	2.38	18,799	44,795
2	Pacific whiting	$0.03	Surimi	16%	80%	0.17	0.12	0.002	0.30	0.30	0.89	19,915	17,691
		$0.03	H&G	61%	20%	0.04	0.09	0.000	0.10	0.17	0.40	18,982	7,671
3	Salmon	$1.13	Gutted	80%	100%	1.35	0.17	0.088	0.10	0.40	2.10	2,424	5,103
4	Crab/lobster	$1.35	Mixed1	46%	100%	2.93	0.61	0.032	0.10	0.40	4.07	8,886	36,144
5	Shrimp	$0.60	Mixed5	26%	100%	2.27	0.25	0.025	0.35	0.40	3.29	4,167	13,726
6	Coastal pelagic	$0.08	Mixed6	99%	100%	0.06	0.15	0.001	0.10	0.30	0.61	779	477
7	Other pelagic	$0.85	Mixed6	99%	100%	0.45	0.14	0.005	0.10	0.39	1.08	315	340
8	Highly migratory	$0.83	Mixed2	85%	100%	0.97	0.20	0.011	0.10	0.34	1.62	7,608	12,357
9	Halibut	$2.28	Fillet	72%	100%	3.16	0.15	0.034	0.10	0.40	3.85	223	860
10	Sea urchins	$0.53	Eggs	7%	100%	7.57	1.50	0.083	0.85	0.40	10.40	57	597
11	Other	$0.38	Mixed4			0.54	0.21	0.006	0.10	0.40	1.26	1,390	1,750
	Fish meal			10%		-	0.04	0.000	0.10	0.11	0.25	2,051	513
	TOTAL	$0.39				0.98	0.22	0.013	0.16	0.32	1.69	66,616	134,352

Notes: 1. Mixed1. Crab tends to start out "whole" during the year-end holidays and then move to "picked" meat later in the season. Over the last few years, "sections" have also become a product form. As a result, we have used 20%, 20%, and 60%, respectively, in terms of final product recovery of landed weight. In the past, we used 75% for meat and 25% whole formula or a mix of about 35%. We have now shifted the yield to 46%, reflecting the change to sections and whole. Lobster is mostly sold whole.

Mixed2. Albacore tuna assumes 75% "whole frozen" with a yield of 100% and 25% "fillet" with a yield of 43%, or about 85% mixed yield. Swordfish is sold as fillets, 75% yield; other tunas are assumed to be frozen or canned at 60% yield; sharks are filleted with 60% yield.

Mixed3. Groundfish generally is processed as a fillet; however, several species, such as sablefish and thornyheads are marketed fresh, whole.

Mixed4. Other species have many end products, including frozen and fresh whole, fillets, and eggs for the species sea urchin.

Mixed5. Pink shrimp is sold cooked. Other shrimp (prawns are usually sold whole).

Mixed5. Squid, mackerel, sardines, and herring are packed frozen to be shipped out. This assumes a 97% yield.

2. The two primary products using Pacific whiting are headed and gutted and surimi. Surimi processing requires expensive equipment and established marketing channels. There are a few central ports with processors that produce surimi. Pacific whiting landings at ports without this processing capability are hauled to the processors that have the equipment or the product is processed locally for headed and gutted.
3. Sales price is estimated using cost calculation from the FEAM model or using published sales price information for the product form sold in the market area.
4. Processor costs/sales price are per finished pound.

Source: Study.

Table 25c
Estimated Value of Finished Pounds Sold by Primary Processors in California by Species Groups in 1996

	Species/Gear Group Name	Ex-Vessel Price	Product Analysis Form	Yield	Use	Marginal Processor Costs/Sales Price Per Finished Pound Raw	Labor	Tax/Fee	Other	Contrib.	Sales Price	Finished Pounds (thousands)	Ex-processor Sales (thousands)
1	Groundfish	$0.66	Mixed3			1.71	0.28	0.00	0.10	0.40	2.49	18,775	46,825
2	Pacific whiting		Surimi	16%	0%	-	0.12	0.000	0.30	0.30	0.72	0	0
		$0.04	H&G	61%	100%	0.06	0.09	0.00	0.10	0.15	0.40	3,901	1,565
3	Salmon	$1.22	Gutted	80%	100%	1.40	0.15	0.10	0.10	0.40	2.15	4,097	8,806
4	Crab/lobster	$1.64	Mixed1	60%	100%	3.01	0.51	0.04	0.10	0.40	4.06	7,565	30,742
5	Shrimp	$0.86	Mixed5	26%	100%	2.20	0.24	0.03	0.23	0.40	3.09	4,716	14,576
6	Coastal pelagic	$0.13	Mixed6	99%	100%	0.13	0.11	0.00	0.10	0.08	0.42	291,410	128,447
7	Other pelagic	$1.20	Mixed6	99%	100%	1.16	0.13	0.01	0.10	0.04	1.45	13,027	18,860
8	Highly migratory	$0.62	Mixed2	75%	100%	0.95	0.21	0.00	0.10	0.38	1.64	29,920	49,103
9	Halibut	$2.32	Fillet	72%	100%	3.22	0.15	0.04	0.10	0.40	3.91	6	23
10	Sea urchins	$0.94	Eggs	7%	100%	13.49	1.50	0.15	0.85	0.40	16.39	1,404	23,012
11	Other	$0.91	Mixed4			1.10	0.19	0.07	0.10	0.40	1.86	7,024	13,054
	Fish meal			10%		-	0.04		0.10	0.11	0.25	615	154
	TOTAL	$0.42				0.47	0.15	0.00	0.10	0.14	0.86	378,558	333,602

Notes: 1. Mixed1. Crab tends to start out "whole" during the year-end holidays and then move to "picked" meat later in the season. Over the last few years, "sections" have also become a product form. As a result, we have used 20%, 20%, and 60%, respectively, in terms of final product recovery of landed weight. In the past, we used 75% for meat and 25% whole formula or a mix of about 35%. We have now shifted the yield to 46%, reflecting the change to sections and whole. Lobster is mostly sold whole.

Mixed2. Albacore tuna assumes 75% "whole frozen" with a yield of 100% and 25% "fillet" with a yield of 43%, or about 85% mixed yield. Swordfish is sold as fillets, 75% yield; other tunas are assumed to be frozen or canned at 60% yield; sharks are filleted with 60% yield.

Mixed3. Groundfish generally is processed as a fillet; however, several species, such as sablefish and thornyheads are marketed fresh, whole.

Mixed4. Other species have many end products, including frozen and fresh whole, fillets, and eggs for the species sea urchin.

Mixed5. Pink shrimp is sold cooked. Other shrimp (prawns are usually sold whole).

Mixed5. Squid, mackerel, sardines, and herring are packed frozen to be shipped out. This assumes a 97% yield.

2. The two primary products using Pacific whiting are headed and gutted and surimi. Surimi processing requires expensive equipment and established marketing channels. There are a few central ports with processors that produce surimi. Pacific whiting landings at ports without this processing capability are hauled to the processors that have the equipment or the product is processed locally for headed and gutted.
3. Sales price is estimated using cost calculation from the FEAM model or using published sales price information for the product form sold in the market area.
4. Processor costs/sales price are per finished pound.

Source: Study.

G. MAJOR PROCESSING COMPANIES AND FACILITIES

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 state (Table 26). One processing group has processing plants in the states of California, Oregon, Washington, and Alaska.[1]

Licensed processor names found in the fish ticket database were associated with parent companies (referred to as processing groups) and, using these new processor groupings, aggregated landing information was compared and contrasted. The major processing companies often own several processing plants along the U.S. West Coast under different names, usually the names of former companies. Figures 31 through 33 show the geographical location of the major processing companies for Washington, Oregon, and California. Plants that purchased more than $100,000 of fish annually are shown in Table 27. There are some other significant buyers/processors in local areas that are part of the fishing industry. Many of these small companies are especially important in adding value via canning, smoking, etc. to local fish harvests.

Table 26
Processing Groups with Multiple State Plants

(3) Pacific Choice Seafood (A)(W)(O)(C)
(1) California Shellfish Co. (O)(C)
(6) Eureka Fish (O)(C)
(8) Crystal Ocean/Sea Products (W)(O)(C)
(29) Sea-K Fish Co. (W)(C)
(2) Ocean Beauty (A)(W)(O)
(4) Depoe Bay Fish Co. - Tyson (A)(O)
(5) Bornstein Seafoods (W)(O)
(24) East Point Seafood Co. (A)(W)
(26) Icicle Seafoods Company (A)(W)
(31) Dory Seafoods, Inc. (A)(W)
(11) Jessie's Ilwaco Fish Co. (W)(O)
(36) Bell Buoy Crab Co. (W)(O)
(98) Kingfisher Trading Co. (W)(O)(C)
(30) Trident (A)(O)
(39) Delmar Seafoods (O)(C)
(9) Fishhawk Fisheries (A)(O)
(7) Spencer (O)(C)

Notes: 1. The numbers preceding the parent company identify the major processing group associated with the processing facility. Parent companies primarily located in Oregon are numbered 1 to 10, in Washington 11 to 38, and California 39 to 123.
2. (A) Alaska
(W) Washington
(O) Oregon
(C) California

Source: Study.

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

Figure 31
Major Processing Groups in Washington by Geographic Area

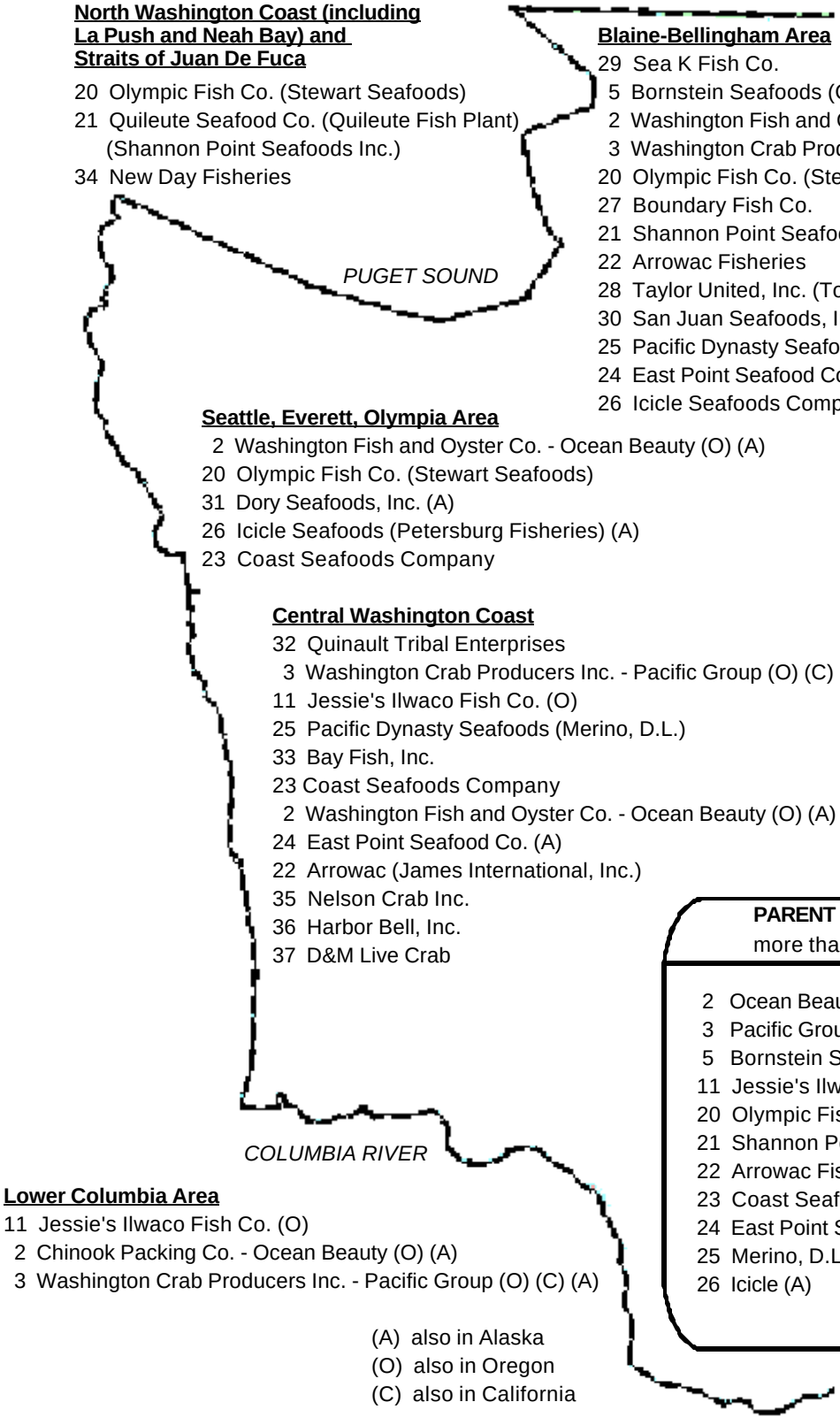
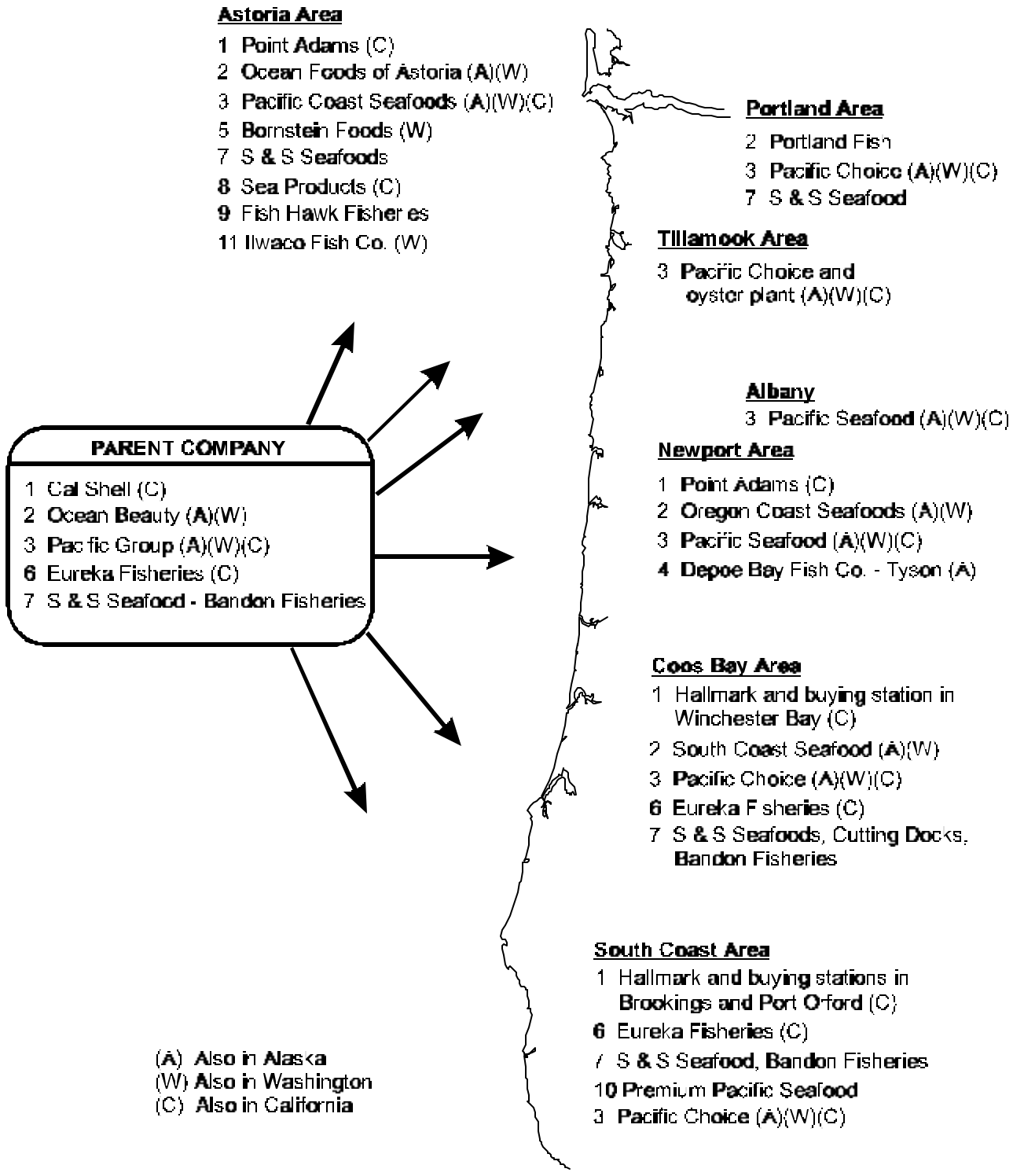


Figure 32
Major Processing Groups in Oregon by Geographic Area



Notes:
1. Landing processor or buyer name and identification code is from fish dealer license information. Parent company assignment is from personal communication or other investigation of cross ownership.
2. The numbers preceding the parent company identify the major processing group associated with the processing facility. Parent companies primarily located in Oregon are 1 to 10, Washington 11 to 38, and California 39 to 123. The number 0 identifies small, independent, local processing plants.
3. For landing processors or buyers, only named processors or buyers receiving landings greater than $100,000 in any port group area are shown. Facility locations are indicated for these processors or buyers if named processor or buyers received greater than $10,000 at these locations.

Source: Study.

Figure 33
Major Processing Groups in California by Geographic Area

Figure 33
Major Processing Groups in California by Geographic Area (cont.)

EUREKA AREA

Crescent City
- (40) Castle Rock
- (8) Sea Products Co. (O)
- (6) Eureka Fish (O)
- (3) Pacific Choice Seafood (O)(W)(A)
- (39) Del Mar Seafood
- (1) California Shellfish Co. (O)
- (42) Alioto Fish
- (41) Caito Fisheries
- (43) Apto Inc.

Fort Bragg
- (41) Caito Fisheries
- (3) Pacific Choice Seafood (O)(W)(A)
- (6) Eureka Fish (O)
- (51) Natural Sales
- (52) Manuson Enterprises
- (53) Y and L Associates
- (43) Apto Inc.
- (44) Sonoma Coast Seafood
- (1) California Shellfish Co. (O)

Eureka
- (3) Pacific Choice Seafood (O)(W)(A)
- (6) Eureka Fish (O)
- (54) Pacific American Seafoods
- (41) Caito Fisheries
- (55) Corrolho Fisheries
- (43) Apto Inc.
- (56) West Coast Crab Co.
- (1) California Shellfish Co. (O)

SAN FRANCISCO AREA

Bodega Bay
- (6) Eureka Fish (O)
- (3) Pacific Choice Seafood (O)(W)(A)
- (8) Sea Products Co. (O)
- (44) Sonoma Coast Seafoods
- (52) Manuson Enterprises
- (58) Lucas Warf
- (59) Nunos
- (1) California Shellfish Co. (O)
- (50) Standard Fish Co.

San Francisco
- (49) H&N Fish Co.
- (60) Engle
- (61) Three Captains Sea Products
- (42) Alioto Fish
- (62) San Francisco Bay Brands
- (29) Sea-K Fish Co. (W)
- (63) Omega B. Seafoods
- (64) Morgan Fish
- (41) Caito Fisheries
- (1) California Shellfish Co. (O)
- (3) Pacific Choice Seafood (O)(W)(A)
- (6) Eureka Fish (O)
- (50) Standard Fish Co.

MONTEREY AREA

Morro Bay
- (65) Central Coast Seafood
- (66) Olde Ponte Fish Co.
- (67) Fish Market
- (39) Del Mar Seafood
- (68) Cannery, The
- (6) Eureka Fish (O)
- (3) Pacific Choice Seafood (O)(W)(A)
- (69) Ming Dynasty Fish Co.
- (70) Quality Seafood

Monterey
- (45) Monterey Fish Co.
- (39) Del Mar Seafood
- (71) Royal Seafoods
- (8) Sea Products Co. (O)
- (49) H&N Fish Co.
- (72) Alioto Wholesale Fish Co.
- (48) Cappaccio Inc.
- (73) Lusamerica Fish Co.
- (43) Apto Inc.
- (50) Standard Fish Co.

SANTA BARBARA AREA

Santa Barbara
- (45) Monterey Fish Co.
- (39) Del Mar Seafood
- (8) Sea Products Co. (O)
- (46) State Fish Co.
- (48) Cappaccio Inc.
- (79) Tradewind Inc.
- (47) California Uni Inc.
- (75) S.M. Uni Inc.

Figure 33 (continued)

LOS ANGELES/SAN DIEGO AREA

Los Angeles
- (46) State Fish Co.
- (76) Tomich Bros.
- (77) Quality Pak Specialty Foods
- (78) Ocean Fish Co.
- (79) Pan Pacific
- (80) Star Kist Foods
- (81) Pacific Seafoods
- (82) Tri-marine International
- (83) Maruhide Marine Products

San Diego
- (84) Catalina Offshore
- (85) Chesapeake Fish Co.
- (47) California Uni Inc.
- (86) Ghio Seafood Products
- (87) Dong Duang Inc.
- (88) Ocean Storm
- (89) San Diego Seafood

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) (Tables 28 and 29). 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 (Table 10). These processors average about $10.6 million in landed value and about $22 million in ex-processor value annually.[1] 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.

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.

1. 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 27a
Location and Parent Company of Major Seafood Processing Groups as of 1997, Washington

Processor or Buyer Name	Identification Code		Parent Company	Out-of-State	Facility Location (Port Group Area) Coastal WA North	Coastal WA South and Central	Northern Puget Sound	Southern Puget Sound	Unidentified Washington
ALASKA ICE SEAFOODS INC	5485	0	ALASKA ICE SEAFOODS INC					X	
ARROWAC FISHERIES INC	0432	22	ARROWAC FISHERIES INC			X	X		
ASTORIA SEA PRODUCTS LLC	5462	8	Crystal Ocean/Sea Products	(O)(C)		X			
BAIN SEAFOOD	4255	0	BAIN SEAFOOD		X				
BAY FISH LLC	0051	8	Crystal Ocean/Sea Products	(O)(C)		X			
BELL BUOY CRAB CO INC	0063	36	BELL BUOY CRAB CO INC	(O)		X			
BESECKER DANA F	1697	14	BESECKER DANA F			X	X		
BLAINE CRAB INC	5562	0	BLAINE CRAB INC				X		
BLUE HERON FISH INC	3911	13	BLUE HERON FISH INC			X			
BLUE HERON SFD INC	5435	13	BLUE HERON FISH INC				X		
BORNSTEIN SEAFOODS INC	0090	5	Bornstein Seafoods	(O)		X	X		
BOUNDARY FISH CO INC	0094	27	BOUNDARY FISH CO INC				X		
BRANT ISLAND SEAFOODS	5447	0	BRANT ISLAND SEAFOODS				X		
BROCK ROGER D	3714	0	BROCK ROGER D				X		
BUY RITE SEAFOODS	3573	0	BUY RITE SEAFOODS					X	
CAPILANO PACIFIC INC	5332	0	CAPILANO PACIFIC INC				X		
CHAD'S SEAFOOD	5427	0	CHAD'S SEAFOOD					X	
CRAB FRESH INC	3595	0	CRAB FRESH INC			X			
CRYSTAL BAY CO INC	5115	0	CRYSTAL BAY CO INC					X	
CRYSTAL OCEAN SEAFOOD INC	5266	8	Crystal Ocean/Sea Products	(O)(C)			X		
D & M LIVE CRAB	3907	37	D & M LIVE CRAB			X			
DAKOTA FISHERIES INC	1923	0	DAKOTA FISHERIES INC				X		
DORY SEAFOODS INC	2082	31	DORY SEAFOODS INC	(A)				X	
DUNGENESS DEVELOPMENT ASSOC INC	5593	0	DUNGENESS DEVELOPMENT ASSOC II			X			
DUNGENESS OYSTER HOUSE	5126	0	DUNGENESS OYSTER HOUSE		X				
DYNAMIC DIVING	5484	19	DYNAMIC DIVING					X	X
EAST OCEAN SEAFOODS INC	5055	0	EAST OCEAN SEAFOODS INC					X	
ELLIOTT BAY SEAFOODS	5060	17	ELLIOTT BAY SEAFOODS				X	X	
EVERGREEN FISHERIES INC	3650	23	EVERGREEN FISHERIES INC		X		X	X	
EXOTIC ALASKAN SEAFOODS	5461	16	EXOTIC ALASKAN SEAFOODS				X	X	
FAR EAST SEAFOOD COMPANY	3526	0	FAR EAST SEAFOOD COMPANY					X	
FINKBONNER SHELLFISH	4337	0	FINKBONNER SHELLFISH				X	X	
GITSUM SEAFOODS INC	5588	0	GITSUM SEAFOODS INC		X				
GRAND HALE MARINE PRODUCTS CO	5481	12	GRAND HALE MARINE PRODUCTS CO		X		X	X	
GREAT AMERICAN SEAFOOD INC	3317	0	GREAT AMERICAN SEAFOOD INC					X	
GREEN VALLEY MEATS INC	3606	0	GREEN VALLEY MEATS INC					X	
HIGH TIDE SEAFOODS	0765	0	HIGH TIDE SEAFOODS		X				
ICICLE SEAFOODS INC	0716	26	ICICLE SEAFOODS INC	(A)			X		
INLET FISH PRODUCERS INC	5575	15	INLET FISH PRODUCERS INC				X	X	
JESSIE'S ILWACO FISH CO INC	0414	11	JESSIE'S ILWACO FISH CO INC	(O)		X			
JOHNSON TRACY	4198	0	JOHNSON TRACY					X	
KANAWAY SEAFOODS INC	3814	0	KANAWAY SEAFOODS INC				X		
KELL-NOR FISHERIES	5424	0	KELL-NOR FISHERIES					X	
KING FISH TRADING CO	1113	98	KINGFISHER TRADING CO INC	(O)(C)		X			
KLAHHANE FISH CO	3991	0	KLAHHANE FISH CO		X				

Table 27a (continued)

Processor or Buyer Name	Identification Code		Parent Company	Out-of-State	Facility Location (Port Group Area) Coastal WA North	Coastal WA South and Central	Northern Puget Sound	Southern Puget Sound	Unidentified Washington
KUCHIN STEVE L	5037	0	KUCHIN STEVE L				X		
LEO'S LIVE SEAFOOD	5051	0	LEO'S LIVE SEAFOOD				X		
LIVE SEAFOOD INC	3765	0	LIVE SEAFOOD INC			X			
LONE TREE POINT SEAFOODS INC	5624	0	LONE TREE POINT SEAFOODS INC				X		
LONGSHORE TWANA	4152	0	LONGSHORE TWANA					X	
LUMMI SHELLFISH	4362	0	LUMMI SHELLFISH				X		
MAN MING SEAFOODS LTD	5056	18	MAN MING SEAFOODS LTD				X	X	
MARY TREVATHAN SHELLFISH CO	4210	0	MARY TREVATHAN SHELLFISH CO					X	
MERINO'S SEAFOODS INC	3611	25	MERINO'S SEAFOODS INC			X			
MISCELLANEOUS DEALERS	0999	0	MISCELLANEOUS DEALERS			X			
MOE GREG	5214	0	MOE GREG				X		
NATIVE AMERICAN SHELLFISH CO	4403	0	NATIVE AMERICAN SHELLFISH CO				X		
NELSON BRADLEY D	5454	0	NELSON BRADLEY D					X	
NELSON CRAB INC	0635	35	NELSON CRAB INC			X			
NEW DAY FISHERIES INC	1533	34	NEW DAY FISHERIES INC		X				
NEW WEST FISHERIES INC	5143	0	NEW WEST FISHERIES INC				X		
NORTH PACIFIC PROCESSORS INC	5595	0	NORTH PACIFIC PROCESSORS INC					X	
NORTHERN LIGHTS SEAFOODS INC	5561	0	NORTHERN LIGHTS SEAFOODS INC					X	
NORTHWEST NATIVE SEAFOODS INC	4190	0	NORTHWEST NATIVE SEAFOODS INC		X				
OCEAN BEAUTY SEAFOODS INC	0840	2	Ocean Beauty	(A)(O)		X			
OCEAN BEAUTY SEAFOODS INC	0165	2	Ocean Beauty	(A)(O)			X	X	
OLYMPIA DIVING SERVICES	5352	0	OLYMPIA DIVING SERVICES					X	
OLYMPIC FISH CO	1556	20	OLYMPIC FISH CO		X		X	X	
ORIENT SEAFOOD	1542	0	ORIENT SEAFOOD		X		X		
PACIFIC SALMON CO INC	0696	0	PACIFIC SALMON CO INC					X	
POST PT SEAFOOD INC	3447	0	POST PT SEAFOOD INC				X		
PUGET SOUND HERRING SALES INC	0747	0	PUGET SOUND HERRING SALES INC					X	
QUALITY ALASKAN SEAFOODS	5566	0	QUALITY ALASKAN SEAFOODS					X	
QUINAULT TRIBAL ENTERPRISES	0749	32	QUINAULT TRIBAL ENTERPRISES		X				X
SAN JUAN SEAFOODS INC	0822	30	Trident Inc.	(A)(O)			X		
SEA K FISH CO INC	0797	29	SEA K FISH CO INC	(C)			X		
SEA WORLD FISHERIES LTD	3792	0	SEA WORLD FISHERIES LTD		X			X	
SEABED HARVESTING INC	1221	0	SEABED HARVESTING INC					X	
SHANNON POINT SEAFOOD	3491	21	Quileute Seafoods Inc.		X		X		
SQUAXIN ISLAND TRIBE	0873	0	SQUAXIN ISLAND TRIBE					X	
SUNRISE MARINE	3612	0	SUNRISE MARINE					X	
SUNRISE SEAFOODS INC	5152	0	SUNRISE SEAFOODS INC			X			
TAYLOR SHELLFISH INC	3204	28	Taylor United Inc.				X	X	
TOEBBE'S CLAM FARM INC	2003	0	TOEBBE'S CLAM FARM INC					X	
TRIDENT SEAFOODS CORPORATION	1301	30	Trident Inc.	(A)(O)			X		
UFER GARY W	5618	0	UFER GARY W					X	
WASHINGTON CRAB PRODUCERS INC	0921	3	Pacific Group	(A)(O)(C)		X			
WESTPORT SEAFOOD EXCHANGE	0185	0	WESTPORT SEAFOOD EXCHANGE			X			

Notes: 1. Landing processor or buyer name and identification code is from fish dealer license information. Parent company assignment is from personal communication or other investigation of cross ownership.

2. The numbers preceding the parent company identify the major processing group associated with the processing facility. Parent companies primarily located in Oregon are 1 to 10, Washington 11 to 38, and California 39 to 123. The number 0 identifies small, independent, local processing plants.

3. For landing processors or buyers, only named processors or buyers receiving landings greater than $100,000 in any port group area are shown. Facility locations are indicated for these processors or buyers if named processor or buyers received greater than $10,000 at these locations.

Source: PacFIN March 1999 extraction.

Table 27b
Location and Parent Company of Major Seafood Processing Groups as of 1997, Oregon

Processor or Buyer Name	Identification Code		Parent Company	Out-of-State	Facility Location (Port Group Area)						
					Astoria	Tillamook	Newport	Coos Bay	Brookings	Portland	Albany
BANDON BAY FISHERIES BANDON	0638	3	Pacific Group	(A)(W)(C)				X	X		
BELL BUOY CRAB CO SEASIDE	0557	36	BELL BUOY CRAB CO INC	(W)	X						
BORNSTEIN SEAFOODS OF OREGON AS	0646	5	Bornstein Seafoods	(W)	X						
CHETCO SEAFOOD CO HARBOR	0588	0	Chetco Seafood Co.						X		
COASTAL AQUATIC SEAFOOD INC PORT	0621	0	Coastal Aquatic Seafood Inc.						X		
CRYSTAL OCEAN SEAFOOD INC ASTOI	0668	8	Crystal Ocean/Sea Products	(W)(C)	X						
CUTTING DOCK INC CHARLESTOI	0602	3	Pacific Group	(A)(W)(C)				X			
DBA SPORTSMEN'S CANNERY & SMOKEHOUSE	0116	0	dba Sportsmen's Cannery & Smokehous					X			
DELMAR SEAFOODS CHARLESTC	0267	39	DEL MAR SEAFOODS INC	(C)				X			
DEPOE BAY FISH CO INC NEWPORT	0016	4	Depoe Bay - Tyson	(A)			X				
EUREKA FISHERIES INC - COOS BAY COOS	0152	6	Eureka Fisheries	(C)				X			
EUREKA FISHERIES INC - BROOKINGS HAR	0153	6	Eureka Fisheries	(C)					X		
FERGUS - MC - BARENDSE CO ASTORI	0611	0	Fergus - McBarendse Co.		X						
FISHHAWK FISHERIES ASTORIA	0385	9	Fishhawk Fisheries	(A)	X						
HALLMARK FISHERIES - CHARLESTON CH	1505	1	California Shellfish Co.	(C)			X	X	X		
INTERNATIONAL C FOOD MARKETING FLO	0522	0	International C Food Marketing					X			
LIGHTHSE DELI/FISH CO, JAMES IVERSON DBA	0523	0	Lighthse Deli/Fish Co., James Iverson d				X	X			
NETARTS SEAFOOD COMPANY TILLA	0281	0	Netarts Seafood Company				X				
OCEAN BEAUTY - ASTORIA ASTORIA	0059	2	Ocean Beauty	(A)(W)	X						
OCEAN BEAUTY - CHARLESTON CHAR	0084	2	Ocean Beauty	(A)(W)				X			
OCEAN BEAUTY SEAFOODS INC NWF NE	0544	2	Ocean Beauty	(A)(W)			X				
OCEAN BEAUTY SEAFOODS INC/NEWPORT	0060	2	Ocean Beauty	(A)(W)			X				
OREGON GOURMET CRAB GARIBA	0640	0	Oregon Gourmet Crab			X					
PACIFIC CHOICE SEAFOODS CO INC CHA	0272	3	Pacific Group	(A)(W)(C)			X	X			
PACIFIC COAST SEAFOODS COMPANY W	0081	3	Pacific Group	(A)(W)(C)	X	X					
PACIFIC SHRIMP COMPANY NEWPOR	0654	3	Pacific Group	(A)(W)(C)			X				
POINT ADAMS PACKING CO - HAMMOND H	0242	1	California Shellfish Co.	(C)	X						
PREMIUM PACIFIC SEAFOOD INC PORT	0336	10	Premium Pacific Seafood Inc.						X		
SEA PRODUCTS CO ASTORIA	0601	8	Crystal Ocean/Sea Products	(W)(C)	X						
SMITH'S PACIFIC SHRIMP GARIBALDI	0058	0	Smith's Pacific Shrimp		X	X					
TARABOCHIA, BRIAN ASTORIA	0672	0	Tarabochia, Brian		X						
TYSON SEAFOOD GROUP NEWPOR	0531	4	Depoe Bay - Tyson	(A)			X				
Non-Landing Processors											
Portland Fish		2	Ocean Beauty Seafood							X	
Pacific Choice Seafoods Co. Inc.		3	The Pacific Group	A, W, C						X	
Inland Quick Freeze		3	The Pacific Group	A, W, C							X

Notes: 1. Landing processor or buyer name and identification code is from fish dealer license information. Parent company assignment is from personal communication or other investigation of cross ownership.

2. The numbers preceding the parent company identify the major processing group associated with the processing facility. Parent companies primarily located in Oregon are 1 to 10, Washington 11 to 38, and California 39 to 123. The number 0 identifies small, independent, local processing plants.

3. For landing processors or buyers, only named processors or buyers receiving landings greater than $100,000 in any port group area are shown. Facility locations are indicated for these processors or buyers if named processor or buyers received greater than $10,000 at these locations.

Source: PacFIN March 1999 extraction.

Table 27c
Location and Parent Company of Major Seafood Processing Groups as of 1997, California

Processor or Buyer Name	Identification Code		Parent Company	Out-of-State	Facility Location (Port Group Area)								
					Bodega Bay	Crescent City	Eureka	Fort Bragg	Los Angeles	Monterey	Morro Bay	San Diego	San Francisco
ALIOTO FISH CO INC SAN FR/	0455100	42	ALIOTO FISH CO INC			X							X
ALIOTO FISH CO INC CRESCE	0455102	42	ALIOTO FISH CO INC			X							
ALIOTTI MONTEREY	6028100	72	ALIOTTI WHOLESALE FISH CO							X			
ALIOTTI WHOLESALE FISH CO MC	0575800	72	ALIOTTI WHOLESALE FISH CO							X			
ALIOTTI WHOLESALE FISH CO MC	0575801	72	ALIOTTI WHOLESALE FISH CO							X			
ANDRIAS SEAFOOD VENTU	0684401	108	ANDRIAS SEAFOOD							X	X		
ANGEL DELIGHTS SEAFOOD CO F	0445000	96	ANGEL DELIGHTS SEAFOOD CO		X				X		X		X
APTCO INC SAN FRANCI	0904400	43	APTCO INC		X		X	X		X			X
AVICENA NETWORK TEMPL	7150400	122	AVICENA NETWORK						X				
B J ENTERPRIZES NIPOMO	6045000	102	B J ENTERPRIZES		X						X		
BAEK TORRANCE	7020400	0	BAEK						X			X	
BAY FRESH SEAFOODS MOS	6032500	0	BAY FRESH SEAFOODS		X					X	X		
BAYSHORES FISH CO MORR	6037500	105	BAYSHORES FISH CO							X	X		
MAIDHOF ALBION	5116500	0	BILL'S LIVE FISH CO					X					
BUGATTO ENT INC BODEGA	0433301	1	California Shellfish Co.	(O)	X								X
CAITO FISHERIES INC FORT E	0283200	41	CAITO FISHERIES INC			X	X	X					X
CAITO FISHERIES INC FORT E	0283201	41	CAITO FISHERIES INC		X	X	X	X					
CAITO FISHERIES INC CRESC	0283202	41	CAITO FISHERIES INC			X		X					X
CAITO FISHERIES INC EUREK/	0283203	41	CAITO FISHERIES INC				X						X
CAITO FISHERIES INC SAN FR	0283204	41	CAITO FISHERIES INC		X				X	X	X		X
CALIFORNIA UNI INC LONG B	0726103	47	CALIFORNIA UNI INC						X			X	
CANNERY (THE) MORRO B	0646501	68	CANNERY (THE)								X		X
CAPILANO PACIFIC INC BELLI	4096100	0	CAPILANO PACIFIC INC										X
CAPPUCCIO INC MONTERE	0573600	48	CAPPUCCIO INC							X			
CAPTAIN KIDDS FISH MARKET RE	0773001	106	CAPTAIN KIDDS FISH MARKET						X		X	X	
CARVALHO FISHERIES MCKIN	2017500	55	CARVALHO FISHERIES			X	X	X					
CASTLE ROCK SEAFOODS INC C	0289301	40	CASTLE ROCK SEAFOODS INC			X							
CATALINA OFFSHORE PRODUCTS INC	0840700	84	CATALINA OFFSHORE PRODUCTS INC						X			X	
CENTRAL COAST SEAFOOD INC /	0686600	65	CENTRAL COAST SEAFOOD INC							X	X		X
CENTRAL COAST SEAFOOD INC /	0686603	65	CENTRAL COAST SEAFOOD INC		X						X		
CHESAPEAKE FISH CO INC SAN	0890500	85	CHESAPEAKE FISH CO INC									X	
CRAB SHACK EUREKA	2026800	0	CRAB SHACK				X	X					
DA GREEN INC LOS ANGE	3127601	113	DA GREEN INC						X			X	
DAMATOS COMMERCIAL FISHING	7124200	123	DAMATOS COMMERCIAL FISHING						X			X	
DEL MAR SEAFOODS INC SALI	6008800	39	DEL MAR SEAFOODS INC	(O)	X	X				X	X		X
DONG DUONG SEAFOOD CO BI	7091100	87	DONG DUONG SEAFOOD CO						X			X	
EAST OCEAN CO INC SOUTH	0701300	118	EAST OCEAN CO INC						X			X	
EUREKA FISHERIES INC FIELD	0248300	6	Eureka Fisheries	(O)	X	X	X	X					
EUREKA FISHERIES INC FIELD	0248301	6	Eureka Fisheries	(O)	X	X	X	X					
EUREKA FISHERIES INC FORT	0248305	6	Eureka Fisheries	(O)	X	X	X	X					X
EUREKA FISHERIES INC CRES	0248306	6	Eureka Fisheries	(O)		X	X	X					

Table 27c (continued)

Processor or Buyer Name	Identification Code		Parent Company	Out-of-State	Facility Location (Port Group Area)								
					Bodega Bay	Crescent City	Eureka	Fort Bragg	Los Angeles	Monterey	Morro Bay	San Diego	San Francisco
EUREKA FISHERIES INC TRINI	0248308	6	Eureka Fisheries	(O)			X	X					
EUREKA ICE & COLD STORAGE E	0248302	6	Eureka Fisheries	(O)			X	X					
EXCEL SEAFOOD CO INC EL M	7138700	0	EXCEL SEAFOOD CO INC										
FENG'S INVESTMENT GROUP, INC	7095100	121	FENG'S INVESTMENT GROUP, INC						X			X	
FISH MARKET AT MOSS LANDING M	6013401	0	FISH MARKET AT MOSS LANDING							X			
THE FISH MARKET SAN DIEGO SA	8022800	0	FISH MARKET RESTAURANT THE									X	
FISH MARKET/6 HARBOR WAY SA	7096801	110	FISH MARKET/6 HARBOR WAY		X				X				
FITZ HALF MOON BAY	4078501	0	FITZ										X
FLAGSHIP FISHERIES LTD RICH	4102800	0	FLAGSHIP FISHERIES LTD										X
FS & W LIVE FISH AVILA BEA	6048200	94	FS & W LIVE FISH		X			X	X	X	X		
GHIO SEAFOOD PRODUCTS SA	0890401	86	GHIO SEAFOOD PRODUCTS									X	
VIDULICH SAN FRANCIS	4102900	0	GOLDEN NORTH FISHERIES INC										X
GREAT HORSE IMPORT & EXPORT INC	7082700	119	GREAT HORSE IMPORT & EXPORT INC						X			X	
H & N FISH CO SAN FRANC	0446500	49	H & N FISH COMPANY							X	X		X
H & N FISH CO HALF MOON	0446501	49	H & N FISH COMPANY				X						X
H & N FISH COMPANY SANTA	0446502	49	H & N FISH COMPANY							X			X
H & N FISH COMPANY SAN FR	0446503	49	H & N FISH COMPANY					X		X	X	X	X
HAINES GOLETA	7134400	0	HAINES										
HALLMARK FISHERIES CHARI	0425000	1	California Shellfish Co.	(O)	X	X							
HASHIMOTO SEA BRIDGE INC VE	7102901	115	HASHIMOTO SEA BRIDGE INC						X				
HI-SEAS FISH INC VENTURA	7111900	0	HI-SEAS FISH INC										
HOLLY SEAFOOD CO INC LOS	0783400	0	HOLLY SEAFOOD CO INC						X				
J & D SEAFOODS SAN PED	7076200	120	J & D SEAFOODS						X	X	X	X	
J AND K TRADING SAN FRA	4056000	0	J AND K TRADING										X
J&J OLD PORTS FISHERIES AVIL	0727702	0	J&J OLD PORTS FISHERIES							X	X		
JATALY SEAFOOD INC VENTU	7115500	114	JATALY SEAFOOD INC										
JATALY SEAFOOD INC VENTU	7115501	114	JATALY SEAFOOD INC						X				
KANAWAY SEAFOODS INC BEL	3134600	0	KANAWAY SEAFOODS INC										X
KAPJIN USA GARDENA	7089300	116	KAPJIN USA						X				
KINGFISHER TRADING CO INC SA	7093800	98	KINGFISHER TRADING CO INC	(W)(O)					X	X	X	X	X
LAINE SHRIMP HARVESTERS, INC A	4008300	0	LAINE SHRIMP HARVESTERS, INC										X
LOS ANGELES FISH & OYSTER INC	0781800	0	LOS ANGELES FISH & OYSTER INC						X				
LUCAS WHARF INC BODEGA	0449100	58	LUCAS WHARF INC		X			X					X
MADRUGA SAN DIEGO	8008000	0	MADRUGA									X	
MALNATI FORT BRAGG	4077800	0	MALNATI										X
MARUHIDE MARINE PRODUCTS INC	0775901	83	MARUHIDE MARINE PRODUCTS INC						X		X	X	
MARUJU SEAFOOD INC GARD	7138400	112	MARUJU SEAFOOD INC						X				
MARUSAN ENT INC FORT BI	0236500	52	MARUSAN ENT INC			X	X	X					
EUREKA FISHERIES INC BODE	0248311	1	California Shellfish Co.	(O)	X	X	X						X
MICHELLE INTERNATIONAL SEAFOOD	7062001	0	MICHELLE INTERNATIONAL SEAFOOD									X	
MING DYNASTY FISH CO GOLE	7087300	69	MING DYNASTY FISH CO					X	X		X		X
MONTEREY FISH COMPANY INC S	0501900	45	MONTEREY FISH COMPANY INC							X			
MONTEREY FISH COMPANY INC M	0501901	45	MONTEREY FISH COMPANY INC							X			
MOORES SEAFOOD INC CAM	7110101	100	MOORES SEAFOOD INC						X	X	X		X

Table 27c (continued)

Processor or Buyer Name	Identification Code		Parent Company	Out-of-State	Facility Location (Port Group Area)								
					Bodega Bay	Crescent City	Eureka	Fort Bragg	Los Angeles	Monterey	Morro Bay	San Diego	San Francisc
MORGAN FISH SAN FRAN	0455600	64	MORGAN FISH										X
MORNING STAR FISHERIES EL (	0405300	0	MORNING STAR FISHERIES										X
MRS KELLEY'S INC SAN DIE(	0898700	0	MRS KELLEY'S INC									X	
NEW WEST FISHERIES INC BEL	0419700	0	NEW WEST FISHERIES INC										X
NEWPORT DORY FLEET CO-OP (	7083400	0	NEWPORT DORY FLEET CO-OP						X				
NOR CAL SEAFOOD INC OAKL	4070800	93	NOR CAL SEAFOOD		X	X	X	X		X	X		X
NOR CAL SEAFOODS EUREK	0248304	93	NOR CAL SEAFOOD				X	X					
NORQUEST SEAFOOD INC SEA	4089000	0	NORQUEST SEAFOOD INC										X
NORTH COAST FISHERIES INCORPOR.	3123800	95	NORTH COAST FISHERIES INCORPOR.		X					X	X		X
NOVALEK INC HAYWARD	4038700	0	NOVALEK INC										X
OCEAN DRAGON SEAFOOD CORP	7130100	0	OCEAN DRAGON SEAFOOD CORP						X			X	
OCEAN FISH CO SAN PEDF	0781900	78	OCEAN FISH CO						X				
OCEAN HARVESTORS CO CO\	7125401	99	OCEAN HARVESTORS CO								X		X
OCEAN QUEEN 87 INC LOS AI	0793600	111	OCEAN QUEEN '87 INC						X				
OCEAN STAR SEAFOODS INC BE	0439300	0	OCEAN STAR SEAFOODS INC										X
OCEAN WEST SEAFOOD SAN	0729500	101	OCEAN WEST SEAFOOD						X	X	X	X	X
PACIFIC CHOICE SEAFOOD CO CI	0243602	3	Pacific Group	(A)(W)(O)		X	X	X					
PACIFIC CHOICE SEAFOOD COMPANY	0243600	3	Pacific Group	(A)(W)(O)	X	X	X	X					X
PACIFIC CHOICE SEAFOOD COMPANY	0243601	3	Pacific Group	(A)(W)(O)	X		X	X					X
PACIFIC MARINE PRODUCTS CORP	0687100	109	PACIFIC MARINE PRODUCTS CORP						X				
PACIFIC OCEAN PRODUCT WIL	7080200	0	PACIFIC OCEAN PRODUCT						X				
PACIFIC SEAFOOD SAN FR/	4077700	54	PACIFIC SEAFOOD				X			X			X
PACIFIC SEAFOODS CO LONG	0725700	81	PACIFIC SEAFOODS CO						X	X			
PAISANO FISHERIES BODEG	4097500	0	PAISANO FISHERIES		X								X
PAN PACIFIC SEAFOODS INC SE/	4056900	79	PAN PACIFIC SEAFOODS INC										X
PEMBERTON FISH EL GRAN	0462600	0	PEMBERTON FISH										X
PETERSEN MAYWOOD	7026900	0	PETERSEN						X			X	
PIERPONT SEAFOOD VENTU	7058100	0	PIERPONT SEAFOOD										
PILLAR POINT SEAFOOD EL GF	4077900	0	PILLAR POINT SEAFOOD										X
PILLAR POINT SEAFOOD HALF	4077901	0	PILLAR POINT SEAFOOD										X
POINT ST JOSEPH FISH CO INC PC	5104800	0	POINT ST JOSEPH FISH CO INC		X								
PRINCETON SEAFOOD CO EL (	0460600	0	PRINCETON SEAFOOD CO										X
QUALITY SEAFOOD CO SAN F	4109700	70	QUALITY SEAFOOD CO				X						
QUALY PAK SPECIALTY FOODS INC	0768800	77	QUALY PAK SPECIALTY FOODS INC						X				
REICHLE BRIDGETON	7120100	0	REICHLE										
ROYAL SEAFOODS INC MONT	0581700	71	ROYAL SEAFOODS INC							X			
S M UNI INC LOS ANGELE	0755000	75	S M UNI INC						X				
S M UNI INC LOS ANGELE	0755001	75	S M UNI INC					X	X				
SALINAS TALLOW CO INC SALI	0501800	0	SALINAS TALLOW CO INC							X			
SAN DIEGO SEAFOOD NATIO	0825900	89	SAN DIEGO SEAFOOD									X	
SAN FRANCISCO BAY BRAND INC	0484300	62	SAN FRANCISCO BAY BRAND INC									X	X
SAN FRANCISCO FRESH CRAB CO	4038600	0	SAN FRANCISCO FRESH CRAB CO			X	X						
SAN PEDRO FISH MARKET & RESTAUF	0799000	103	SAN PEDRO FISH MARKET & RESTAUF						X		X	X	X

Table 27c (continued)

Processor or Buyer Name	Identification Code		Parent Company	Out-of-State	Facility Location (Port Group Area)								
					Bodega Bay	Crescent City	Eureka	Fort Bragg	Los Angeles	Monterey	Morro Bay	San Diego	San Francisc
SANTA BARBARA CRAB COMPANY	7147201	0	SANTA BARBARA CRAB COMPANY										
SEA HARVEST MONTERE	0520700	0	SEA HARVEST							X			
SEA K FISH CO INC SAUSALI	0449300	29	SEA K FISH CO INC	(W)	X								X
SEA PRODUCTS CO/CONSOLIDATED F	0500400	8	Crystal Ocean/Sea Products	(W)(O)	X	X				X	X		X
SEA PRODUCTS CO MOSS I	0500401	8	Crystal Ocean/Sea Products	(W)(O)		X				X			
SEA PRODUCTS CO CRESC	0500402	8	Crystal Ocean/Sea Products	(W)(O)		X		X					
SEA PRODUCTS COMPANY OX	0500407	8	Crystal Ocean/Sea Products	(W)(O)		X				X			
SEACO MARINE PRODUCTS INC M	7118500	0	SEACO MARINE PRODUCTS INC						X		X		
SEAFOOD PRODUCERS CO-OP I	6045600	97	SEAFOOD PRODUCERS CORP		X					X			X
SF BAY FISHERMEN'S ASSOCIATION	0403300	0	SF BAY FISHERMEN'S ASSOCIATION										X
SONOMA OFFSHORE PRODUCTS INC	5103800	44	SONOMA OFFSHORE PRODUCTS INC		X			X					X
SOUTHERN CAL SEAFOOD INC S	7119900	0	SOUTHERN CAL SEAFOOD INC										
SPENCER PORTLAND	3143400	7	Spencer	(O)	X	X				X			
STAGNARO BROS SEAFOOD INC	0564101	0	STAGNARO BROS SEAFOOD INC							X			
STANDARD SEAFOOD INC SAN	0782100	50	STANDARD SEAFOOD INC						X				
STAR KIST FOODS INC TERMI	0817600	80	STAR KIST FOODS INC						X				
STATE FISH CO, INC SAN PEI	0785700	46	STATE FISH CO, INC						X				
SUN COAST CALAMARI INC OXN	7120101	0	SUN COAST CALAMARI INC										
T & L TRADING INC MONTEBI	7104900	91	T & L TRADING INC		X	X			X	X	X	X	X
TAN-FAT HUNTINGTON	0786100	0	TAN-FAT										
THE SANTA BARBARA CRAB STATION	7143800	0	THE SANTA BARBARA CRAB STATION								X		
THREE CAPTAINS SEA PRODUCTS	0460900	61	THREE CAPTAINS SEA PRODUCTS		X	X				X			X
TOMICH BROS FISH CO, INC SAN	0780300	76	TOMICH BROS FISH CO, INC						X				
TRADEWIND SEAFOOD INC OX	0647901	79	PAN PACIFIC SEAFOODS INC						X				
TRI MARINE CANNING LLC SAN	7136500	82	TRI MARINE CANNING LLC						X				
TSANG OXNARD	7128000	0	TSANG						X				
UNIFIED SEAFOOD CORP INC LO	0740300	117	UNIFIED SEAFOOD CORP INC						X			X	
V.W.S. SEAFOOD TRADING INC SA	7077000	92	V.W.S. SEAFOOD TRADING INC			X	X	X	X		X		
VALLEJO MARKET INC SAN F	3108500	0	VALLEJO MARKET INC		X					X			X
VENTURA PACKER INC VENT	7135800	0	VENTURA PACKER INC										
WEST COAST CRAB CRESC	0425002	1	California Shellfish Co.	(O)		X	X	X					
WO WONG INT TRADING CO AR	7139100	0	WO WONG INT TRADING CO						X		X		
WOODBINE ALASKA FISH COMPANY	3128000	0	WOODBINE ALASKA FISH COMPANY										X
Y & L ASSOCIATES INC SACRA	3063300	53	Y & L ASSOCIATES INC					X					X
YALE FISH COMPANY LOS AI	7105200	0	YALE FISH COMPANY						X				

Notes: 1. Landing processor or buyer name and identification code is from fish dealer license information. Parent company assignment is from personal communication or other investigation of cross ownership.

2. The numbers preceding the parent company identify the major processing group associated with the processing facility. Parent companies primarily located in Oregon are 1 to 10, Washington 11 to 38, and California 39 to 123. The number 0 identifies small, independent, local processing plants.

3. For landing processors or buyers, only named processors or buyers receiving landings greater than $100,000 in any port group area are shown. Facility locations are indicated for these processors or buyers if named processor or buyers received greater than $10,000 at these locations.

Source: PacFIN March 1999 extraction.

Table 28
Group Ownership and Estimated Sales of Larger Processing Groups in Washington, Oregon, California

Large
Estimated Group Annual Sales > $10 Million

5	BORNSTEIN SEAFOODS
41	CAITO FISHERIES INC
1	CALIFORNIA SHELLFISH CO.
8	CRYSTAL OCEAN/SEA PRODUCTS
39	DEL MAR SEAFOODS INC
4	DEPOE BAY - TYSON
6	EUREKA FISHERIES
25	MERINO'S SEAFOODS INC
45	MONTEREY FISH COMPANY INC
2	OCEAN BEAUTY
20	OLYMPIC FISH CO
3	PACIFIC GROUP
29	SEA K FISH CO INC
46	STATE FISH CO, INC
82	TRI MARINE CANNING LLC

Medium
$5 Million < Estimated Group Annual Sales <= $10 Million

22	ARROWAC FISHERIES INC
55	CARVALHO FISHERIES
65	CENTRAL COAST SEAFOOD INC
31	DORY SEAFOODS INC
0	FERGUS - MCBARENDSE CO.
49	H & N FISH COMPANY
11	JESSIE'S ILWACO FISH CO INC
52	MARUSAN ENT INC
0	NEW WEST FISHERIES INC
77	QUALY PAK SPECIALTY FOODS INC
32	QUINAULT TRIBAL ENTERPRISES
30	SAN JUAN SEAFOODS INC (TRIDENT)
0	SEA WORLD FISHERIES LTD
0	SQUAXIN ISLAND TRIBE
0	SUNRISE SEAFOODS INC
76	TOMICH BROS FISH CO, INC

Small
$1 Million < Estimated Group Annual Sales <= $5 Million

0	ALASKA ICE SEAFOODS INC
42	ALIOTO FISH CO INC
72	ALIOTTI WHOLESALE FISH CO
43	APTCO INC
0	BAY FRESH SEAFOODS
105	BAYSHORES FISH CO
36	BELL BUOY CRAB CO INC
14	BESECKER DANA F
0	BLAINE CRAB INC
13	BLUE HERON FISH INC
27	BOUNDARY FISH CO INC
0	BROCK ROGER D
0	BUY RITE SEAFOODS
47	CALIFORNIA UNI INC
0	CAPILANO PACIFIC INC
48	CAPPUCCIO INC
40	CASTLE ROCK SEAFOODS INC
84	CATALINA OFFSHORE PRODUCTS INC
0	CHAD'S SEAFOOD
85	CHESAPEAKE FISH CO INC
0	COASTAL AQUATIC SEAFOOD INC.
37	D & M LIVE CRAB
113	DA GREEN INC
0	DAKOTA FISHERIES INC
87	DONG DUONG SEAFOOD CO
0	EAST OCEAN SEAFOODS INC
83	MARUHIDE MARINE PRODUCTS INC
112	MARUJU SEAFOOD INC
69	MING DYNASTY FISH CO
0	MISCELLANEOUS DEALERS
0	MOE GREG
100	MOORES SEAFOOD INC
64	MORGAN FISH
0	MORNING STAR FISHERIES
34	NEW DAY FISHERIES INC
93	NOR CAL SEAFOOD
95	NORTH COAST FISHERIES INCORPORATED
0	NORTHERN LIGHTS SEAFOODS INC
78	OCEAN FISH CO
99	OCEAN HARVESTORS CO
111	OCEAN QUEEN '87 INC
0	OCEAN STAR SEAFOODS INC
101	OCEAN WEST SEAFOOD
109	PACIFIC MARINE PRODUCTS CORP
81	PACIFIC SEAFOODS CO
0	PAISANO FISHERIES
79	PAN PACIFIC SEAFOODS INC
0	PEMBERTON FISH
0	PILLAR POINT SEAFOOD
10	PREMIUM PACIFIC SEAFOOD INC.
0	REICHLE
71	ROYAL SEAFOODS INC

Table 28 (continued)

Small (continued)

17	ELLIOTT BAY SEAFOODS
23	EVERGREEN FISHERIES INC
121	FENG'S INVESTMENT GROUP, INC
0	FINKBONNER SHELLFISH
110	FISH MARKET/6 HARBOR WAY
9	FISHHAWK FISHERIES
0	FLAGSHIP FISHERIES LTD
86	GHIO SEAFOOD PRODUCTS
0	GOLDEN NORTH FISHERIES INC
0	GREAT AMERICAN SEAFOOD INC
0	GREEN VALLEY MEATS INC
115	HASHIMOTO SEA BRIDGE INC
0	HIGH TIDE SEAFOODS
0	HI-SEAS FISH INC
15	INLET FISH PRODUCERS INC
0	INTERNATIONAL C FOOD MARKETING
120	J & D SEAFOODS
0	J AND K TRADING
114	JATALY SEAFOOD INC
0	KELL-NOR FISHERIES
98	KINGFISHER TRADING CO INC
0	LOS ANGELES FISH & OYSTER INC
75	S M UNI INC
89	SAN DIEGO SEAFOOD
62	SAN FRANCISCO BAY BRAND INC
0	SAN FRANCISCO FRESH CRAB CO
0	SEABED HARVESTING INC
97	SEAFOOD PRODUCERS CORP
0	SF BAY FISHERMEN'S ASSOCIATION
21	SHANNON POINT SEAFOOD
0	SMITH'S PACIFIC SHRIMP
44	SONOMA OFFSHORE PRODUCTS INC
0	SOUTHERN CAL SEAFOOD INC
7	SPENCER
80	STAR KIST FOODS INC
0	SUN COAST CALAMARI INC
0	SUNRISE MARINE
91	T & L TRADING INC
61	THREE CAPTAINS SEA PRODUCTS
117	UNIFIED SEAFOOD CORP INC
0	VENTURA PACKER INC
0	WESTPORT SEAFOOD EXCHANGE
0	WOODBINE ALASKA FISH COMPANY
53	Y & L ASSOCIATES INC

Very Small
$100,000 < Estimated Group Annual Sales <= $1 Million

108	ANDRIAS SEAFOOD
96	ANGEL DELIGHTS SEAFOOD CO
122	AVICENA NETWORK
102	B J ENTERPRIZES
0	BAEK
0	BAIN SEAFOOD
0	BILL'S LIVE FISH CO
0	BRANT ISLAND SEAFOODS
68	CANNERY (THE)
106	CAPTAIN KIDDS FISH MARKET
0	CHETCO SEAFOOD CO.
0	CRAB FRESH INC
0	CRAB SHACK
0	CRYSTAL BAY CO INC
123	DAMATOS COMMERCIAL FISHING
0	DBA SPORTSMEN'S CANNERY & SMOKEHOUSE
0	DUNGENESS DEVELOPMENT ASSOC INC
0	DUNGENESS OYSTER HOUSE
19	DYNAMIC DIVING
118	EAST OCEAN CO INC
0	EXCEL SEAFOOD CO INC
16	EXOTIC ALASKAN SEAFOODS
0	FAR EAST SEAFOOD COMPANY
0	MADRUGA
0	MALNATI
18	MAN MING SEAFOODS LTD
0	MARY TREVATHAN SHELLFISH CO
0	MICHELLE INTERNATIONAL SEAFOOD DIST
0	MRS KELLEY'S INC
0	NATIVE AMERICAN SHELLFISH CO
0	NELSON BRADLEY D
35	NELSON CRAB INC
0	NETARTS SEAFOOD COMPANY
0	NEWPORT DORY FLEET CO-OP
0	NORQUEST SEAFOOD INC
0	NORTH PACIFIC PROCESSORS INC
0	NORTHWEST NATIVE SEAFOODS INC
0	NOVALEK INC
0	OCEAN DRAGON SEAFOOD CORP
0	OLYMPIA DIVING SERVICES
0	OREGON GOURMET CRAB
0	ORIENT SEAFOOD
0	PACIFIC OCEAN PRODUCT
0	PACIFIC SALMON CO INC
54	PACIFIC SEAFOOD
0	PETERSEN
0	PIERPONT SEAFOOD
0	POINT ST JOSEPH FISH CO INC

Table 28 (continued)

Very Small (continued)

0	FISH MARKET AT MOSS LANDING	0	POST PT SEAFOOD INC
0	FISH MARKET RESTAURANT THE	0	PRINCETON SEAFOOD CO
0	FITZ	0	PUGET SOUND HERRING SALES INC
94	FS & W LIVE FISH	0	QUALITY ALASKAN SEAFOODS
0	GITSUM SEAFOODS INC	70	QUALITY SEAFOOD CO
12	GRAND HALE MARINE PRODUCTS CO	0	SALINAS TALLOW CO INC
119	GREAT HORSE IMPORT & EXPORT INC	103	SAN PEDRO FISH MARKET & RESTAURANT
0	HAINES	0	SANTA BARBARA CRAB COMPANY
0	HOLLY SEAFOOD CO INC	0	SEA HARVEST
26	ICICLE SEAFOODS INC	0	SEACO MARINE PRODUCTS INC
0	J&J OLD PORTS FISHERIES	0	STAGNARO BROS SEAFOOD INC
0	JOHNSON TRACY	50	STANDARD SEAFOOD INC
0	KANAWAY SEAFOODS INC	0	TAN-FAT
116	KAPJIN USA	0	TARABOCHIA, BRIAN
0	KLAHHANE FISH CO	28	TAYLOR SHELLFISH INC
0	KUCHIN STEVE L	0	THE SANTA BARBARA CRAB STATION
0	LAINE SHRIMP HARVESTERS, INC	0	TOEBBE'S CLAM FARM INC
0	LEO'S LIVE SEAFOOD	0	TSANG
0	LIGHTHSE DELI/FISH CO., JAMES IVERSON DBA	0	UFER GARY W
0	LIVE SEAFOOD INC	92	V.W.S. SEAFOOD TRADING INC
0	LONE TREE POINT SEAFOODS INC	0	VALLEJO MARKET INC
0	LONGSHORE TWANA	0	WO WONG INT TRADING CO
58	LUCAS WHARF INC	0	YALE FISH COMPANY
0	LUMMI SHELLFISH		

Note: The numbers preceding the parent company identify the major processing group associated with the processing facility. Parent companies primarily located in Oregon are 1 to 10, Washington 11 to 38, and California 39 to 123. The number 0 identifies small, independent, local processing plants.

Source: Study.

Table 29
Ranking of U.S. West Coast Processor Groups in 1997

	Count	Percent of Volume	Percent of Value	Average Annual Ex-Vessel Value	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.

H. CHALLENGES FACING THE SEAFOOD PROCESSING INDUSTRY

There are five major issues in the 1990's that have or are changing the fish processing industry along 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

This section of the report provides a short overview discussion of each of these events.

1. Collapse of the Salmon Industry

The U.S. West Coast states salmon landings, because of a host of reasons, declined from an average of 45 million pounds in the late 1980's to about 13 million pounds in 1996. 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.

2. Expansion of the Pacific Whiting Industry

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 processed a total of 197 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 U.S. West Coast economies.

3. Consolidation of Seafood Processing Industry

The consolidation of processing groups that are located along the U.S. West Coast has followed an earlier expansion in the processing industry, based on exploitation of available resources. As some major processing groups expand, many other existing processing groups have either closed, sold out, or reduced their operations.

4. Reductions in Groundfish Resources and Efforts to Improve Utilization

The new Magnuson-Stevens Fishery Conservation and Management Act of 1996 requires the Pacific Fishery Management Council (PFMC) to use the most recent stock assessments from the NMFS 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. For example, full utilization of these resources may result in an increase of up to $39 million of personal income to Oregon's 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.

5. Infrastructure Issues

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. Seafood processing requires significant water usage and generates large amounts of byproducts. Table 30 shows typical water usage by species for a medium sized plant. Shrimp requires the greatest amount of water (25-40 gallons per one pound shrimp reported by Nielsen 1983), while groundfish water demand varies widely, depending on the product being produced. Fillets require much higher water usage than processing for headed-gutted products.

Table 30
Water Use in Seafood Processing (Gallons per Day)

Bottom fish	6,100	-	420,000
Dungeness	38,000	-	74,000
Fish meal	38,000	-	93,000
Salmon	50,000	-	52,000
Shrimp	90,000	-	161,000
Surimi	50,000		

Source: Carawan et al. 1979; CH2M 1993; Nielsen et al. 1983.

According to CH2M Hill (1993), surimi requires around two gallons of water for every pound of surimi. Surimi is high in water use because of the repetitive washings the mince must undergo. Surimi processing for the offshore allocation (about half of total harvest) takes place on factory ships where desalinated water is used.

Wastewater discharges by onshore processing plants are generally done to the waterway where they are located. This is allowed in U.S. West Coast states as long as adequate mixing occurs in the waterway. Wastewater discharged to municipal sewer systems is very costly to plants because they are charged on strength and volume. Some processors in U.S. West Coast states use pretreatment methods prior to discharge to municipal systems to recover useful byproducts and meet local regulations for wastewater acceptance.

Brown (1995) found in a survey that seafood processors have learned to be efficient with their solid byproducts. Very few hauled any byproducts to the land fill. The two most popular methods of disposal were recovery either in fish meal production or agricultural use (direct field application and composting).

Most of the shells from shrimp, crab and urchins are composted, which encompasses both the careful biological breakdown through a process of oxygenating and heating or simply applying

the byproducts to a field to decompose without the benefit of aeration (Hilderbrand 1995). The cost of disposal of shrimp, crab, and urchin shells varies between processors; some farmers and reducing plants will pick up the byproducts, while other processors need to deliver their materials to a receiving facility. Shell disposal is generally a barter arrangement where the processor is able to dispose of the material and farmers are able to fertilize their fields at minimal cost to either party.

There are valid concerns for 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.

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APPENDIX A

Species and Gear Mapping to Groups

Project: Fleet Description
Date: September 16, 1999
Extraction: March 1999 PacFIN
Subject: Species Mapping

SPID	Common Name	Summary1		Summary2
ARRA	AURORA ROCKFISH	1	Groundfish	Cod/rockfish
BANK	BANK ROCKFISH	1	Groundfish	Cod/rockfish
BCC1	NOMINAL BOCACCIO	1	Groundfish	Cod/rockfish
BGL1	NOMINAL BLACKGILL ROCKFISH	1	Groundfish	Cod/rockfish
BLK1	NOMINAL BLACK ROCKFISH	1	Groundfish	Cod/rockfish
BLUR	BLUE ROCKFISH	1	Groundfish	Cod/rockfish
BRNZ	BRONZESPOTTED ROCKFISH	1	Groundfish	Cod/rockfish
BRWN	BROWN ROCKFISH	1	Groundfish	Cod/rockfish
BYEL	BLACK-AND-YELLOW ROCKFISH	1	Groundfish	Cod/rockfish
CBZN	CABEZON	1	Groundfish	Cod/rockfish
CHNA	CHINA ROCKFISH	1	Groundfish	Cod/rockfish
CLP1	NOMINAL CHILIPEPPER	1	Groundfish	Cod/rockfish
CNR1	NOMINAL CANARY ROCKFISH	1	Groundfish	Cod/rockfish
COPP	COPPER ROCKFISH	1	Groundfish	Cod/rockfish
CWCD	COWCOD ROCKFISH	1	Groundfish	Cod/rockfish
DBRK	DARKBLOTCHED ROCKFISH	1	Groundfish	Cod/rockfish
FLAG	FLAG ROCKFISH	1	Groundfish	Cod/rockfish
GPHR	GOPHER ROCKFISH	1	Groundfish	Cod/rockfish
GRAS	GRASS ROCKFISH	1	Groundfish	Cod/rockfish
GRDR	UNSP. GRENADIERS	1	Groundfish	Cod/rockfish
GSPT	GREENSPOTTED ROCKFISH	1	Groundfish	Cod/rockfish
GSRK	GREENSTRIPED ROCKFISH	1	Groundfish	Cod/rockfish
KLPG	KELP GREENLING	1	Groundfish	Cod/rockfish
KLPR	KELP ROCKFISH	1	Groundfish	Cod/rockfish
LCOD	LINGCOD	1	Groundfish	Cod/rockfish
LSP1	NOMINAL LONGSPINE THORNYHEAD	1	Groundfish	Cod/rockfish
OGRN	OTHER GROUNDFISH	1	Groundfish	Cod/rockfish
OLVE	OLIVE ROCKFISH	1	Groundfish	Cod/rockfish
ORCK	OTHER ROCKFISH	1	Groundfish	Cod/rockfish
PCOD	PACIFIC COD	1	Groundfish	Cod/rockfish
PLCK	WALLEYE POLLOCK	1	Groundfish	Cod/rockfish
PNKR	PINK ROCKFISH	1	Groundfish	Cod/rockfish
POP	PACIFIC OCEAN PERCH	1	Groundfish	Cod/rockfish
POP1	NOMINAL POP #1	1	Groundfish	Cod/rockfish
POP2	NOMINAL POP #2	1	Groundfish	Cod/rockfish
PRRK	PINKROSE ROCKFISH	1	Groundfish	Cod/rockfish
QLBK	QUILLBACK ROCKFISH	1	Groundfish	Cod/rockfish
RATF	RATFISH	1	Groundfish	Cod/rockfish
RCK1	BOCACCIO+CHILIPEPPER RCKFSH	1	Groundfish	Cod/rockfish
RCK2	UNSP. BOLINA RCKFSH	1	Groundfish	Cod/rockfish
RCK3	UNSP. DPWTR REDS RCKFSH	1	Groundfish	Cod/rockfish
RCK4	UNSP. REDS RCKFSH	1	Groundfish	Cod/rockfish
RCK5	UNSP. SMALL REDS RCKFSH	1	Groundfish	Cod/rockfish
RCK6	UNSP. ROSEFISH RCKFSH	1	Groundfish	Cod/rockfish
RCK7	UNSP. GOPHER RCKFSH	1	Groundfish	Cod/rockfish
RCK8	CANARY+VERMILION RCKFSH	1	Groundfish	Cod/rockfish
RCK9	BLACK+BLUE ROCKFISH	1	Groundfish	Cod/rockfish
RDBD	REDBANDED ROCKFISH	1	Groundfish	Cod/rockfish
ROSY	ROSY ROCKFISH	1	Groundfish	Cod/rockfish
RSTN	ROSETHORN ROCKFISH	1	Groundfish	Cod/rockfish
SBLY	SHORTBELLY ROCKFISH	1	Groundfish	Cod/rockfish
SNS1	NOMINAL SPLITNOSE ROCKFISH	1	Groundfish	Cod/rockfish
SPKL	SPECKLED ROCKFISH	1	Groundfish	Cod/rockfish
SQRS	SQUARESPOT ROCKFISH	1	Groundfish	Cod/rockfish
SSP1	NOMINAL SHORTSPINE THORNYHEAD	1	Groundfish	Cod/rockfish
STAR	STARRY ROCKFISH	1	Groundfish	Cod/rockfish
SWSP	SWORDSPINE ROCKFISH	1	Groundfish	Cod/rockfish
THDS	THORNYHEADS (MIXED)	1	Groundfish	Cod/rockfish
TREE	TREEFISH	1	Groundfish	Cod/rockfish
UPOP	UNSP. POP GROUP	1	Groundfish	Cod/rockfish
URCK	UNSP. ROCKFISH	1	Groundfish	Cod/rockfish

SPID	Common Name	Summary1		Summary2
VRML	VERMILION ROCKFISH	1	Groundfish	Cod/rockfish
WDW1	NOMINAL WIDOW ROCKFISH	1	Groundfish	Cod/rockfish
YEYE	YELLOWEYE ROCKFISH	1	Groundfish	Cod/rockfish
YTR1	NOMINAL YELLOWTAIL RCKFSH	1	Groundfish	Cod/rockfish
SABL	SABLEFISH	1	Groundfish	Sablefish
DSRK	SPINY DOGFISH	1	Groundfish	Sharks (PFMC)
LSRK	LEOPARD SHARK	1	Groundfish	Sharks (PFMC)
SSRK	SOUPFIN SHARK	1	Groundfish	Sharks (PFMC)
BSKT	BIG SKATE	1	Groundfish	Skates
CSKT	CALIFORNIA SKATE	1	Groundfish	Skates
OSKT	OTHER SKATES	1	Groundfish	Skates
USKT	UNSPECIFIED SKATE	1	Groundfish	Skates
ARTH	ARROWTOOTH FLOUNDER	1	Groundfish	Sole/flounder
BSOL	BUTTER SOLE	1	Groundfish	Sole/flounder
CSOL	CURLFIN SOLE	1	Groundfish	Sole/flounder
DOVR	DOVER SOLE	1	Groundfish	Sole/flounder
EGLS	ENGLISH SOLE	1	Groundfish	Sole/flounder
FSOL	FLATHEAD SOLE	1	Groundfish	Sole/flounder
OFLT	OTHER FLATFISH	1	Groundfish	Sole/flounder
PTRL	PETRALE SOLE	1	Groundfish	Sole/flounder
REX	REX SOLE	1	Groundfish	Sole/flounder
RSOL	ROCK SOLE	1	Groundfish	Sole/flounder
SDAB	SANDDABS	1	Groundfish	Sole/flounder
SSOL	SAND SOLE	1	Groundfish	Sole/flounder
STRY	STARRY FLOUNDER	1	Groundfish	Sole/flounder
UFLT	UNSP. FLATFISH	1	Groundfish	Sole/flounder
PWHT	PACIFIC WHITING	2	Pacific whiting	Pacific whiting
CHNK	CHINOOK SALMON	3	Salmon	Chinook
CHUM	CHUM SALMON	3	Salmon	Chum
COHO	COHO SALMON	3	Salmon	Coho
PINK	PINK SALMON	3	Salmon	Pink
SOCK	SOCKEYE SALMON	3	Salmon	Sockeye
STLH	STEELHEAD	3	Salmon	Steelhead
USMN	UNSP. SALMON	3	Salmon	Unspecified
LOBS	CALIF. SPINY LOBSTER	4	Crab/lobster	California spiny lobster
DCRB	DUNGENESS CRAB	4	Crab/lobster	Dungeness crab
BTCR	BAIRDI TANNER CRAB	4	Crab/lobster	Other crab
OCRB	OTHER CRAB	4	Crab/lobster	Other crab
RCRB	ROCK CRAB	4	Crab/lobster	Other crab
UCRB	UNSPECIFIED CRAB	4	Crab/lobster	Other crab
UKCR	UNSP. KING CRAB	4	Crab/lobster	Other crab
UTCR	UNSP. TANNER CRAB	4	Crab/lobster	Other crab
BSRM	UNSP. BAIT SHRIMP	5	Shrimp	Other shrimp
GSRM	GHOST SHRIMP	5	Shrimp	Other shrimp
MSRM	MUD SHRIMP	5	Shrimp	Other shrimp
OSRM	OTHER SHRIMP	5	Shrimp	Other shrimp
USRM	UNSP. OCEAN SHRIMP	5	Shrimp	Other shrimp
PSHP	PINK SHRIMP	5	Shrimp	Pink shrimp
RPRW	RIDGEBACK PRAWN	5	Shrimp	Prawns
SPRW	SPOTTED PRAWN	5	Shrimp	Prawns
NANC	NORTHERN ANCHOVY	6	Coastal pelagic	Anchovy
OANC	OTHER ANCHOVY	6	Coastal pelagic	Anchovy
CMCK	CHUB MACKEREL	6	Coastal pelagic	Mackerel
JMCK	JACK MACKEREL	6	Coastal pelagic	Mackerel
MSQD	MARKET SQUID	6	Coastal pelagic	Market squid
SQID	UNSPECIFIED SQUID	6	Coastal pelagic	Other squid
	CA	6	Coastal pelagic	Other squid
	OR	6	Coastal pelagic	Market squid
	WA	6	Coastal pelagic	Market squid
PSDN	PACIFIC SARDINE	6	Coastal pelagic	Pacific Sardine
UMCK	UNSPECIFIED MACKEREL	7	Other pelagic	Other mackerel
PBNT	PACIFIC BONITO	7	Other pelagic	Other pelagic
PHRG	PACIFIC HERRING	7	Other pelagic	Other pelagic
RHRG	ROUND HERRING	7	Other pelagic	Other pelagic
ALBC	ALBACORE	8	Highly migratory	Albacore tuna
BSRK	BLUE SHARK	8	Highly migratory	Other sharks

SPID	Common Name	Summary1		Summary2
MAKO	SHORTFIN MAKO	8	Highly migratory	Other sharks
TSRK	THRESHER SHARK	8	Highly migratory	Other sharks
SWRD	SWORDFISH	8	Highly migratory	Swordfish
BSJK	BLACK SKIPJACK	8	Highly migratory	Tunas not albacore
BTNA	BLUEFIN TUNA	8	Highly migratory	Tunas not albacore
OTNA	OTHER TUNA	8	Highly migratory	Tunas not albacore
STNA	SKIPJACK TUNA	8	Highly migratory	Tunas not albacore
UTNA	UNSPECIFIED TUNA	8	Highly migratory	Tunas not albacore
YTNA	YELLOWFIN TUNA	8	Highly migratory	Tunas not albacore
PHLB	PACIFIC HALIBUT	9	Halibut	Halibut (PFMC)
OURC	OTHER SEA URCHINS	10	Sea urchins	Sea urchins
RURC	RED SEA URCHIN	10	Sea urchins	Sea urchins
OCRK	OTHER CROAKER	11	Other	Croakers
WCRK	WHITE CROAKER	11	Other	Croakers
OCTP	GIANT PACIFIC OCTOPUS	11	Other	Giant Pacific octopus
BCLM	BUTTER CLAM	11	Other	Mollusks
CKLE	BASKET COCKLE	11	Other	Mollusks
CMSL	CALIFORNIA MUSSEL	11	Other	Mollusks
GABL	GREEN ABALONE	11	Other	Mollusks
GCLM	GAPER CLAM	11	Other	Mollusks
GDUK	GEODUCK	11	Other	Mollusks
HCLM	HORSE CLAMS	11	Other	Mollusks
JCLM	CALIFORNIA JACKKNIFE CLAM	11	Other	Mollusks
LCLM	NATIVE LITTLENECK	11	Other	Mollusks
LSTR	OLYMPIA OYSTER	11	Other	Mollusks
MACL	MUD CLAMS	11	Other	Mollusks
MCLM	MANILA CLAM	11	Other	Mollusks
OABL	OTHER ABALONE	11	Other	Mollusks
OMSK	OTHER MOLLUSKS	11	Other	Mollusks
OSCL	OTHER SCALLOP	11	Other	Mollusks
PABL	PINK ABALONE	11	Other	Mollusks
PRCL	PURPLE CLAM	11	Other	Mollusks
PSTR	PACIFIC OYSTER	11	Other	Mollusks
RABL	RED ABALONE	11	Other	Mollusks
RCLM	RAZOR CLAM	11	Other	Mollusks
RZCL	ROSY RAZOR CLAM	11	Other	Mollusks
SCLM	SOFT-SHELLED CLAM	11	Other	Mollusks
UABL	UNSPECIFIED ABALONE	11	Other	Mollusks
UCLM	UNSPECIFIED CLAM	11	Other	Mollusks
UMSK	UNSPECIFIED MOLLUSKS	11	Other	Mollusks
USCL	UNSPECIFIED SCALLOP	11	Other	Mollusks
USTR	UNSPECIFIED OYSTER	11	Other	Mollusks
WABL	WHITE ABALONE	11	Other	Mollusks
CHLB	CALIFORNIA HALIBUT	11	Other	Other
EELS	UNSPECIFIED EELS	11	Other	Other
EULC	EULACHON	11	Other	Other
MISC	MISC. FISH/ANIMALS	11	Other	Other
MSC2	MISCELLANEOUS FISH	11	Other	Other
SCLP	UNSPECIFIED SCULPIN	11	Other	Other
UHAG	UNSPECIFIED HAGFISH	11	Other	Other
UHLB	UNSPECIFIED HALIBUT	11	Other	Other
UECH	UNSPECIFIED ECHINODERM	11	Other	Other echinoderms
USCU	UNSP. SEA CUCUMBERS	11	Other	Other echinoderms
OSRK	OTHER SHARK	11	Other	Other sharks
USRK	UNSP. SHARK	11	Other	Other sharks
CUDA	PACIFIC BARRACUDA	11	Other	Pacific barracuda
GBAS	GIANT SEA BASS	11	Other	Sea bass
OBAS	OTHER BASS	11	Other	Sea bass
WBAS	WHITE SEABASS	11	Other	Sea bass
YLTL	YELLOWTAIL	11	Other	Sea bass
GSTG	GREEN STURGEON	11	Other	Sturgeon
USTG	UNSP. STURGEON	11	Other	Sturgeon
WSTG	WHITE STURGEON	11	Other	Sturgeon
SHAD	UNSPECIFIED SHAD	11	Other	Unspecified shad
SMLT	UNSPECIFIED SMELT	11	Other	Unspecified smelt

Project: Fleet Description
Date: September 16, 1999
Extraction: March 1999 PacFIN
Subject: Gear Mapping

GRID	Description	Summary1	Summary2	Salmon
LGL	LONGLINE OR SETLINE	Hook and line	Longline or setline	Other
STL	SETLINE	Hook and line	Longline or setline	Other
JIG	JIG	Hook and line	Other hook and line	Other
OHL	OTHER HOOK AND LINE GEAR	Hook and line	Other hook and line	Other
POL	POLE (COMMERCIAL)	Hook and line	Other hook and line	Other
VHL	VERTICAL HOOK AND LINE GEAR	Hook and line	Other hook and line	Other
GLN	GILL NET	Net	Gillnet	Net
DPN	DIP NET	Net	Other net	Net
ONT	OTHER NET GEAR	Net	Other net	Net
STN	SET NET	Net	Other net	Net
SEN	SEINE	Net	Seine	Net
DVG	DIVING GEAR	Other	Diving	Other
OTH	OTHER KNOWN GEAR	Other	Other known gear	Other
ODG	OTHER DREDGE GEAR	Other	Other trawl	Other
USP	UNKNOWN OR UNSPECIFIED GEAR	Other	Unknown or unspecified gear	Other
CLP	CRAB AND LOBSTER POT	Pot	Crab pot	Other
CPT	CRAB POT	Pot	Crab pot	Other
FPT	FISH POT	Pot	Fish pot	Other
OPT	OTHER POT GEAR	Pot	Other pot	Other
PRW	PRAWN TRAP	Pot	Other pot	Other
GFT	GROUNDFISH (OTTER) TRAWL	Trawl	Groundfish trawl	Other
MDT	MIDWATER TRAWL	Trawl	Groundfish trawl	Other
PRT	PAIR TRAWL	Trawl	Groundfish trawl	Other
RLT	ROLLER TRAWL	Trawl	Groundfish trawl	Other
BMT	BEAM TRAWL	Trawl	Other trawl	Other
OTW	OTHER TRAWL GEAR	Trawl	Other trawl	Other
RVT	RIVER TRAWL	Trawl	Other trawl	Other
DGN	DRIFT GILL NET	Trawl	Pelagic trawl	Other
DST	SHRIMP TRAWL, DOUBLE RIGGED	Trawl	Shrimp trawl	Other
SHT	SHRIMP TRAWL, SINGLE OR DOUBLE RIG	Trawl	Shrimp trawl	Other
SST	SHRIMP TRAWL, SINGLE RIGGED	Trawl	Shrimp trawl	Other
TRL	TROLL	Troll	Troll	Troll

APPENDIX B

Vessel Counts and Revenue Distribution by Gear and Species Group Combinations

Project: Fleet Description
Extraction: March 1999 PacFIN
Subject: Count of vessels and sum of revenue for multiple gears in 1997

All Gears

Count of Vessels

Gear	Only	Hook and line	Net	Other	Pot	Trawl	Troll
Hook and line	696	1,908	143	189	597	129	769
Net	1,212		1,609	46	227	108	104
Other	227			516	149	49	90
Pot	573				1,777	230	633
Trawl	210					642	210
Troll	819						2,031

Sum of Revenue

Gear	Only	Hook and line	Net	Other	Pot	Trawl	Troll
Hook and line	16,437,388	34,045,952	6,017,719	7,007,505	29,125,421	10,044,985	19,273,463
Net	55,459,063		66,829,120	2,963,363	12,144,753	7,167,879	5,029,639
Other	13,409,001			22,186,339	7,827,379	4,585,924	2,930,288
Pot	22,726,156				69,560,071	39,000,808	36,195,438
Trawl	36,698,275					86,200,953	28,971,159
Troll	11,835,985						28,240,450

Hook and line

Count of Vessels

Gear	Only	Hook and line	Net	Other	Pot	Trawl	Troll
Hook and line	696	1,908	143	189	597	129	769
Net	48		143	19	51	40	48
Other	57			189	93	20	69
Pot	198				597	53	312
Trawl	29					129	57
Troll	387						769

Sum of Revenue

Gear	Only	Hook and line	Net	Other	Pot	Trawl	Troll
Hook and line	16,437,388	34,045,952	6,017,719	7,007,505	29,125,421	10,044,985	19,273,463
Net	2,831,024		6,017,719	645,661	3,277,467	2,426,069	2,424,065
Other	3,018,267			7,007,505	4,963,019	850,457	2,628,055
Pot	9,588,409				29,125,421	6,076,293	19,460,501
Trawl	4,261,463					10,044,985	4,482,408
Troll	9,093,663						19,273,463

Net

Count of Vessels

Gear	Only	Hook and line	Net	Other	Pot	Trawl	Troll
Hook and line	48	143	143	19	51	40	48
Net	1,212		1,609	46	227	108	104
Other	16			46	16	17	11
Pot	132				227	44	45
Trawl	22					108	36
Troll	22						104

Sum of Revenue

Gear	Only	Hook and line	Net	Other	Pot	Trawl	Troll
Hook and line	2,831,024	6,017,719	6,017,719	645,661	3,277,467	2,426,069	2,424,065
Net	55,459,063		66,829,120	2,963,363	12,144,753	7,167,879	5,029,639
Other	2,097,855			2,963,363	901,689	887,741	295,891
Pot	6,405,801				12,144,753	4,497,596	3,025,606
Trawl	1,320,107					7,167,879	3,471,611
Troll	1,674,723						5,029,639

Other

Count of Vessels

Gear	Only	Hook and line	Net	Other	Pot	Trawl	Troll
Hook and line	57	189	19	189	93	20	69
Net	16		46	46	16	17	11
Other	227			516	149	49	90
Pot	39				149	26	47
Trawl	9					49	12
Troll	10						90

Sum of Revenue

Gear	Only	Hook and line	Net	Other	Pot	Trawl	Troll
Hook and line	3,018,267	7,007,505	645,661	7,007,505	4,963,019	850,457	2,628,055
Net	2,097,855		2,963,363	2,963,363	901,689	887,741	295,891
Other	13,409,001			22,186,339	7,827,379	4,585,924	2,930,288
Pot	2,463,706				7,827,379	3,020,806	2,888,704
Trawl	1,771,308					4,585,924	1,193,225
Troll	525,284						2,930,288

Pot

Count of Vessels

Gear	Only	Hook and line	Net	Other	Pot	Trawl	Troll
Hook and line	198	597	51	93	597	53	312
Net	132		227	16	227	44	45
Other	39			149	149	26	47
Pot	573				1,777	230	633
Trawl	85					230	93
Troll	240						633

Sum of Revenue

Gear	Only	Hook and line	Net	Other	Pot	Trawl	Troll
Hook and line	9,588,409	29,125,421	3,277,467	4,963,019	29,125,421	6,076,293	19,460,501
Net	6,405,801		12,144,753	901,689	12,144,753	4,497,596	3,025,606
Other	2,463,706			7,827,379	7,827,379	3,020,806	2,888,704
Pot	22,726,156				69,560,071	39,000,808	36,195,438
Trawl	19,488,566					39,000,808	15,889,464
Troll	16,605,468						36,195,438

Trawl

Count of Vessels

Gear	Only	Hook and line	Net	Other	Pot	Trawl	Troll
Hook and line	29	129	40	20	53	129	57
Net	22		108	17	44	108	36
Other	9			49	26	49	12
Pot	85				230	230	93
Trawl	210					642	210
Troll	76						210

Sum of Revenue

Gear	Only	Hook and line	Net	Other	Pot	Trawl	Troll
Hook and line	4,261,463	10,044,985	2,426,069	850,457	6,076,293	10,044,985	4,482,408
Net	1,320,107		7,167,879	887,741	4,497,596	7,167,879	3,471,611
Other	1,771,308			4,585,924	3,020,806	4,585,924	1,193,225
Pot	19,488,566				39,000,808	39,000,808	15,889,464
Trawl	36,698,275					86,200,953	28,971,159
Troll	14,607,344						28,971,159

Troll

Count of Vessels

Gear	Only	Hook and line	Net	Other	Pot	Trawl	Troll
Hook and line	387	769	48	69	312	57	769
Net	22		104	11	45	36	104
Other	10			90	47	12	90
Pot	240				633	93	633
Trawl	76					210	210
Troll	819						2,031

Sum of Revenue

Gear	Only	Hook and line	Net	Other	Pot	Trawl	Troll
Hook and line	9,093,663	19,273,463	2,424,065	2,628,055	19,460,501	4,482,408	19,273,463
Net	1,674,723		5,029,639	295,891	3,025,606	3,471,611	5,029,639
Other	525,284			2,930,288	2,888,704	1,193,225	2,930,288
Pot	16,605,468				36,195,438	15,889,464	36,195,438
Trawl	14,607,344					28,971,159	28,971,159
Troll	11,835,985						28,240,450

Notes: 1. Excludes vessel ID's "NONE" and "ZZ..."

Project: Fleet Description
Extraction: March 1999 PacFIN
Subject: Row and column percents for count of vessels and sum of revenue for multiple gears

row %
column %

All Gears

Count of Vessels

Gear	Hook and line	Net	Other	Pot	Trawl	Troll	Total
Hook and line	100% 100%	7% 9%	10% 37%	31% 34%	7% 20%	40% 38%	1,908
Net		100% 100%	3% 9%	14% 13%	7% 17%	6% 5%	1,609
Other			100% 100%	29% 8%	9% 8%	17% 4%	516
Pot				100% 100%	13% 36%	36% 31%	1,777
Trawl					100% 100%	33% 10%	642
Troll						100% 100%	2,031
Multi-gear							
One gear	696	1,212	227	573	210	819	3,737
Two gears	719	240	131	694	221	735	1,370
Three gears	394	103	100	412	147	383	513
Four + gears	99	54	58	98	64	95	111

Sum of Revenue

Gear	Hook and line	Net	Other	Pot	Trawl	Troll	Total
Hook and line	100% 100%	18% 9%	21% 32%	86% 42%	30% 12%	57% 68%	34,045,952
Net		100% 100%	4% 13%	18% 17%	11% 8%	8% 18%	66,829,120
Other			100% 100%	35% 11%	21% 5%	13% 10%	22,186,339
Pot				100% 100%	56% 45%	52% 128%	69,560,071
Trawl					100% 100%	34% 103%	86,200,953
Troll						100% 100%	28,240,450
Multi-gear							
One gear	16,437,388	55,459,063	13,409,001	22,726,156	36,698,275	11,835,985	156,565,868
Two gears	10,352,419	7,309,379	5,413,997	28,186,435	33,796,787	10,693,971	95,752,988
Three gears	6,312,985	2,668,751	2,562,477	14,939,494	13,112,873	4,426,870	44,023,450
Four + gears	943,160	1,391,927	800,864	3,707,986	2,593,018	1,283,624	10,720,579

Hook and line

Count of Vessels

Gear	Hook and line	Net	Other	Pot	Trawl	Troll	Total
Hook and line	100% / 100%	7% / 9%	10% / 37%	31% / 34%	7% / 20%	40% / 38%	1,908
Net		7% / 9%	13% / 10%	36% / 9%	28% / 31%	34% / 6%	143
Other			10% / 37%	49% / 16%	11% / 16%	37% / 9%	189
Pot				31% / 34%	9% / 41%	52% / 41%	597
Trawl					7% / 20%	44% / 7%	129
Troll						40% / 38%	769
Multi-gear							
One gear	696						696
Two gears	719	48	57	198	29	387	719
Three gears	394	51	80	312	48	297	394
Four + gears	99	44	52	87	52	85	99

Sum of Revenue

Gear	Hook and line	Net	Other	Pot	Trawl	Troll	Total
Hook and line	100% / 100%	18% / 9%	21% / 32%	86% / 42%	30% / 12%	57% / 68%	34,045,952
Net		18% / 9%	11% / 9%	54% / 11%	40% / 24%	40% / 13%	6,017,719
Other			21% / 32%	71% / 17%	12% / 8%	38% / 14%	7,007,505
Pot				86% / 42%	21% / 60%	67% / 101%	29,125,421
Trawl					30% / 12%	45% / 23%	10,044,985
Troll						57% / 68%	19,273,463
Multi-gear							
One gear	16,437,388						16,437,388
Two gears	10,352,419	2,831,024	3,018,267	9,588,409	4,261,463	9,093,663	10,352,419
Three gears	6,312,985	1,548,734	2,777,883	15,464,114	3,178,278	8,313,595	6,312,985
Four + gears	943,160	1,637,961	1,211,355	4,072,898	2,605,244	1,866,205	943,160

Net

Count of Vessels

Gear	Hook and line	Net	Other	Pot	Trawl	Troll	Total
Hook and line	7% 9%	7% 9%	10% 37%	31% 34%	7% 20%	40% 38%	143
Net		100% 100%	3% 9%	14% 13%	7% 17%	6% 5%	1,609
Other			3% 9%	35% 7%	37% 16%	24% 11%	46
Pot				14% 13%	19% 41%	20% 43%	227
Trawl					7% 17%	33% 35%	108
Troll						6% 5%	104
Multi-gear							
One gear		1,212					1,212
Two gears	48	240	16	132	22	22	240
Three gears	51	103	11	54	50	40	103
Four + gears	44	54	19	41	36	42	54

Sum of Revenue

Gear	Hook and line	Net	Other	Pot	Trawl	Troll	Total
Hook and line	18% 9%	18% 9%	21% 32%	86% 42%	30% 12%	57% 68%	6,017,719
Net		100% 100%	4% 13%	18% 17%	11% 8%	8% 18%	66,829,120
Other			4% 13%	30% 7%	30% 12%	10% 6%	2,963,363
Pot				18% 17%	37% 63%	25% 60%	12,144,753
Trawl					11% 8%	48% 69%	7,167,879
Troll						8% 18%	5,029,639
Multi-gear							
One gear		55,459,063					55,459,063
Two gears	2,831,024	7,309,379	2,097,855	6,405,801	1,320,107	1,674,723	7,309,379
Three gears	1,548,734	2,668,751	410,226	3,324,673	3,738,174	2,043,496	2,668,751
Four + gears	1,637,961	1,391,927	455,282	2,414,279	2,109,598	1,311,420	1,391,927

Other

Count of Vessels

Gear	Hook and line	Net	Other	Pot	Trawl	Troll	Total
Hook and line	10% / 37%	13% / 10%	10% / 37%	49% / 16%	11% / 16%	37% / 9%	189
Net		3% / 9%	3% / 9%	35% / 7%	37% / 16%	24% / 11%	46
Other			100% / 100%	29% / 8%	9% / 8%	17% / 4%	516
Pot				29% / 8%	17% / 53%	32% / 52%	149
Trawl					9% / 8%	24% / 13%	49
Troll						17% / 4%	90
Multi-gear							
One gear			227				227
Two gears	57	16	131	39	9	10	131
Three gears	80	11	100	56	18	35	100
Four + gears	52	19	58	54	22	45	58

Sum of Revenue

Gear	Hook and line	Net	Other	Pot	Trawl	Troll	Total
Hook and line	21% / 32%	11% / 9%	21% / 32%	71% / 17%	12% / 8%	38% / 14%	7,007,505
Net		4% / 13%	4% / 13%	30% / 7%	30% / 12%	10% / 6%	2,963,363
Other			100% / 100%	35% / 11%	21% / 5%	13% / 10%	22,186,339
Pot				35% / 11%	39% / 66%	37% / 99%	7,827,379
Trawl					21% / 5%	26% / 41%	4,585,924
Troll						13% / 10%	2,930,288
Multi-gear							
One gear			13,409,001				13,409,001
Two gears	3,018,267	2,097,855	5,413,997	2,463,706	1,771,308	525,284	5,413,997
Three gears	2,777,883	410,226	2,562,477	2,934,714	1,868,047	1,223,971	2,562,477
Four + gears	1,211,355	455,282	800,864	2,428,959	946,569	1,181,033	800,864

Pot

Count of Vessels

Gear	Hook and line	Net	Other	Pot	Trawl	Troll	Total
Hook and line	31% / 34%	36% / 9%	49% / 16%	31% / 34%	9% / 41%	52% / 41%	597
Net		14% / 13%	35% / 7%	14% / 13%	19% / 41%	20% / 43%	227
Other			29% / 8%	29% / 8%	17% / 53%	32% / 52%	149
Pot				100% / 100%	13% / 36%	36% / 31%	1,777
Trawl					13% / 36%	40% / 15%	230
Troll						36% / 31%	633
Multi-gear							
One gear				573			573
Two gears	198	132	39	694	85	240	694
Three gears	312	54	56	412	93	309	412
Four + gears	87	41	54	98	52	84	98

Sum of Revenue

Gear	Hook and line	Net	Other	Pot	Trawl	Troll	Total
Hook and line	86% / 42%	54% / 11%	71% / 17%	86% / 42%	21% / 60%	67% / 101%	29,125,421
Net		18% / 17%	30% / 7%	18% / 17%	37% / 63%	25% / 60%	12,144,753
Other			35% / 11%	35% / 11%	39% / 66%	37% / 99%	7,827,379
Pot				100% / 100%	56% / 45%	52% / 128%	69,560,071
Trawl					56% / 45%	41% / 44%	39,000,808
Troll						52% / 128%	36,195,438
Multi-gear							
One gear				22,726,156			22,726,156
Two gears	9,588,409	6,405,801	2,463,706	28,186,435	19,488,566	16,605,468	28,186,435
Three gears	15,464,114	3,324,673	2,934,714	14,939,494	14,853,853	15,188,538	14,939,494
Four + gears	4,072,898	2,414,279	2,428,959	3,707,986	4,658,389	4,401,432	3,707,986

Trawl

Count of Vessels

Gear	Hook and line	Net	Other	Pot	Trawl	Troll	Total
Hook and line	7% / 20%	28% / 31%	11% / 16%	9% / 41%	7% / 20%	44% / 7%	129
Net		7% / 17%	37% / 16%	19% / 41%	7% / 17%	33% / 35%	108
Other			9% / 8%	17% / 53%	9% / 8%	24% / 13%	49
Pot				13% / 36%	13% / 36%	40% / 15%	230
Trawl					100% / 100%	33% / 10%	642
Troll						33% / 10%	210
Multi-gear							
One gear					210		210
Two gears	29	22	9	85	221	76	221
Three gears	48	50	18	93	147	85	147
Four + gears	52	36	22	52	64	49	64

Sum of Revenue

Gear	Hook and line	Net	Other	Pot	Trawl	Troll	Total
Hook and line	30% / 12%	40% / 24%	12% / 8%	21% / 60%	30% / 12%	45% / 23%	10,044,985
Net		11% / 8%	30% / 12%	37% / 63%	11% / 8%	48% / 69%	7,167,879
Other			21% / 5%	39% / 66%	21% / 5%	26% / 41%	4,585,924
Pot				56% / 45%	56% / 45%	41% / 44%	39,000,808
Trawl					100% / 100%	34% / 103%	86,200,953
Troll						34% / 103%	28,971,159
Multi-gear							
One gear					36,698,275		36,698,275
Two gears	4,261,463	1,320,107	1,771,308	19,488,566	33,796,787	14,607,344	33,796,787
Three gears	3,178,278	3,738,174	1,868,047	14,853,853	13,112,873	11,178,604	13,112,873
Four + gears	2,605,244	2,109,598	946,569	4,658,389	2,593,018	3,185,211	2,593,018

Troll

Count of Vessels

Gear	Hook and line	Net	Other	Pot	Trawl	Troll	Total
Hook and line	40% 38%	40% 38%	37% 9%	52% 41%	44% 7%	40% 38%	769
Net		6% 5%	24% 11%	20% 43%	33% 35%	6% 5%	104
Other			17% 4%	32% 52%	24% 13%	17% 4%	90
Pot				36% 31%	40% 15%	36% 31%	633
Trawl					33% 10%	33% 10%	210
Troll						100% 100%	2,031
Multi-gear							
One gear						819	819
Two gears	387	22	10	240	76	735	735
Three gears	297	40	35	309	85	383	383
Four + gears	85	42	45	84	49	95	95

Sum of Revenue

Gear	Hook and line	Net	Other	Pot	Trawl	Troll	Total
Hook and line	57% 68%	57% 68%	38% 14%	67% 101%	45% 23%	57% 68%	19,273,463
Net		8% 18%	10% 6%	25% 60%	48% 69%	8% 18%	5,029,639
Other			13% 10%	37% 99%	26% 41%	13% 10%	2,930,288
Pot				52% 128%	41% 44%	52% 128%	36,195,438
Trawl					34% 103%	34% 103%	28,971,159
Troll						100% 100%	28,240,450
Multi-gear							
One gear						11,835,985	11,835,985
Two gears	9,093,663	1,674,723	525,284	16,605,468	14,607,344	10,693,971	10,693,971
Three gears	8,313,595	2,043,496	1,223,971	15,188,538	11,178,604	4,426,870	4,426,870
Four + gears	1,866,205	1,311,420	1,181,033	4,401,432	3,185,211	1,283,624	1,283,624

Notes: 1. Excludes vessel ID's "NONE" and "ZZ..."

Project: Fleet Description
Extraction: March 1999 PacFIN
Subject: Count of vessels and sum of revenue for multiple species in 1997

Count of Vessels

	Species	Only	1	2	3	4	5	6	7	8	9	10	11
1	Groundfish	403	2,397	90	727	705	291	262	153	762	314	94	1,092
2	Pacific whiting	1		87	11	22	26	61	44	30	4	0	84
3	Salmon	961			2,319	446	24	66	98	447	195	12	511
4	Crab/lobster	452				1,590	192	95	75	459	115	28	516
5	Shrimp	37					383	68	18	131	8	5	215
6	Coastal pelagic	49						365	110	147	11	1	266
7	Other pelagic	122							352	106	7	2	139
8	Highly migratory	279								1,396	163	29	486
9	Halibut	13									350	9	62
10	Sea urchins	147										385	187
11	Other	162											1,828

Sum of Revenue

	Species	Only	1	2	3	4	5	6	7	8	9	10	11
1	Groundfish	5,933,569	74,563,618	24,881,502	11,364,245	48,469,229	44,999,406	24,145,858	9,113,523	31,928,851	17,742,403	5,379,688	58,080,236
2	Pacific whiting	16,757		8,355,607	950,516	4,106,621	3,633,723	8,191,244	7,992,937	2,976,453	782,657	0	8,278,778
3	Salmon	5,109,162			16,038,048	17,571,935	839,282	3,205,994	6,058,372	9,096,498	2,560,510	463,537	4,049,734
4	Crab/lobster	17,324,456				63,994,913	22,040,899	5,007,624	4,028,143	28,492,738	8,010,429	1,224,831	22,478,323
5	Shrimp	1,259,270					23,525,298	4,171,814	1,098,299	9,871,502	512,696	133,697	14,168,949
6	Coastal pelagic	11,357,886						29,848,733	13,158,247	17,196,842	489,511	87,816	7,322,167
7	Other pelagic	8,044,473							15,784,756	4,949,015	46,925	49,204	2,146,079
8	Highly migratory	16,345,049								38,909,503	2,930,449	1,730,554	17,308,032
9	Halibut	1,200,258									10,112,214	209,445	473,088
10	Sea urchins	5,804,237										16,124,061	9,673,810
11	Other	2,924,819											9,806,134

Notes: 1. Excludes vessel ID's "NONE" and "ZZ..."

Project: Fleet Description
Extraction: March 1999 PacFIN
Subject: Count of vessels and sum of revenue for multiple species in 1997

Count of Vessels

	Species	1	2	3	4	5	6	7	8	9	10	11	Total
1	Groundfish	100% / 100%	4% / 103%	30% / 31%	29% / 44%	12% / 76%	11% / 72%	6% / 43%	32% / 55%	13% / 90%	4% / 24%	46% / 60%	2,397
2	Pacific whiting		100% / 100%	13% / 0%	25% / 1%	30% / 7%	70% / 17%	51% / 13%	34% / 2%	5% / 1%	0% / 0%	97% / 5%	87
3	Salmon			100% / 100%	19% / 28%	1% / 6%	3% / 18%	4% / 28%	19% / 32%	8% / 56%	1% / 3%	22% / 28%	2,319
4	Crab/lobster				100% / 100%	12% / 50%	6% / 26%	5% / 21%	29% / 33%	7% / 33%	2% / 7%	32% / 28%	1,590
5	Shrimp					100% / 100%	18% / 19%	5% / 5%	34% / 9%	2% / 2%	1% / 1%	56% / 12%	383
6	Coastal pelagic						100% / 100%	30% / 31%	40% / 11%	3% / 3%	0% / 0%	73% / 15%	365
7	Other pelagic							100% / 100%	30% / 8%	2% / 2%	1% / 1%	39% / 8%	352
8	Highly migratory								100% / 100%	12% / 47%	2% / 8%	35% / 27%	1,396
9	Halibut									100% / 100%	3% / 2%	18% / 3%	350
10	Sea urchins										100% / 100%	49% / 10%	385
11	Other											100% / 100%	1,828

Sum of Revenue

	Species	1	2	3	4	5	6	7	8	9	10	11	Total
1	Groundfish	100% / 100%	33% / 298%	15% / 71%	65% / 76%	60% / 191%	32% / 81%	12% / 58%	43% / 82%	24% / 175%	7% / 33%	78% / 592%	74,563,618
2	Pacific whiting		100% / 100%	11% / 6%	49% / 6%	43% / 15%	98% / 27%	96% / 51%	36% / 8%	9% / 8%	0% / 0%	99% / 84%	8,355,607
3	Salmon			100% / 100%	110% / 27%	5% / 4%	20% / 11%	38% / 38%	57% / 23%	16% / 25%	3% / 3%	25% / 41%	16,038,048
4	Crab/lobster				100% / 100%	34% / 94%	8% / 17%	6% / 26%	45% / 73%	13% / 79%	2% / 8%	35% / 229%	63,994,913
5	Shrimp					100% / 100%	18% / 14%	5% / 7%	42% / 25%	2% / 5%	1% / 1%	60% / 144%	23,525,298
6	Coastal pelagic						100% / 100%	44% / 83%	58% / 44%	2% / 5%	0% / 1%	25% / 75%	29,848,733
7	Other pelagic							100% / 100%	31% / 13%	0% / 0%	0% / 0%	14% / 22%	15,784,756
8	Highly migratory								100% / 100%	8% / 29%	4% / 11%	44% / 177%	38,909,503
9	Halibut									100% / 100%	2% / 1%	5% / 5%	10,112,214
10	Sea urchins										100% / 100%	60% / 99%	16,124,061
11	Other											100% / 100%	9,806,134

Notes: 1. Excludes vessel ID's "NONE" and "ZZ..."