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Profile of the Groundfish Fishery

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The groundfish fishery off California, Oregon, and Washington is a highly diverse fishery. Several different commercial vessel and gear types harvest a large number of species in all sections of the coast. Recreational hook-and-line fishing is important as well, especially in central and southern California. Figure 1 illustrates the International North Pacific Fishery Commission (INPFC) areas for which commercial fishing data and management regulations are reported.

Species classified as "groundfish" include flatfishes (e.g., Dover, English, petrale, rock, and rex sole), roundfishes (e.g., sablefish, Pacific cod, ling cod, and Pacific whiting), a large number of the *Sebastes* species (yellowtail, canary, widow, boccacio, chilipepper, and shortbelly rockfish), and thornyheads (*Sebastolobus*). The Pacific Coast Groundfish Fishery Management Plan also includes certain sharks, skates, ratfish, rattails, jack mackerel, and other fish that are of minor importance to the fishery.

Commercial groundfish fishing is divided into three distinct segments: shoreside domestic landings, "joint venture" harvest, and foreign catch. The quantity and exvessel value of shoreside landings (Table 1) grew from about 60 thousand metric tons (mt) and $20 million in 1976, to 120 thousand mt and $60 million in 1982. As the rockfish harvest declined, however, the totals fell to about 90 thousand mt and $49 million in 1984, although the exvessel value recovered to $57 million in 1985. As shown in Table 2, most of the commercial stocks of groundfish have been harvested at or near the maximum sustainable levels estimated by the Groundfish Management Team. Unless the domestic fishery expands its harvest of less utilized fish stocks (such as shortbelly rockfish and Pacific whiting), the total harvest is unlikely to grow by more than a few thousand tons.

Since 1978, "joint venture" agreements between domestic trawl fishermen and foreign floating processors have become an important factor in the harvest of Pacific whiting. This provides a major source of income for many of the new, midwater trawl vessels. Annual harvests in joint venture fishing grew to 79 thousand mt in 1984, but fell back to 31 thousand mt in 1985. Since this is still far below the estimated sustainable yield of 175,000 mt, expansion of both joint venture and shoreside landings is possible.

Foreign harvests declined substantially after 1976. With the expulsion of Soviet and Polish trawlers after Soviet invasion of Afghanistan, foreign harvest stopped entirely. In 1985 Polish vessels were again permitted to harvest Pacific whiting. Foreign harvest of underutilized species can continue under Governing International Fishery Agreements negotiated with the State Department until the U.S. fishing industry demonstrates a capacity and intent to take the entire available biological yield.

Tables 3a and 3b show the breakdown of harvests of the most important species groups in 1985 by geographic areas and gear types. Rockfish seem to concentrate mainly in the Columbia area and the Monterey area, while sablefish catch is more evenly distributed along the coast. The Columbia area is most important and the Conception area is least significant for all main species groups. The huge volumes of Pacific whiting caught in Vancouver and Columbia areas are due to the joint venture fishery. From Table 3b it is clear that trawl fishing dominates to an overwhelming degree the commercial harvest of groundfish. Fixed gear (pots and traps, gill nets, and hook-and-line) took a substantial portion of the sablefish in 1985 and a moderate amount of rockfish and other groundfish. The division of catch among the gear types will exhibit some variation over the years, but trawl gear always dominates.

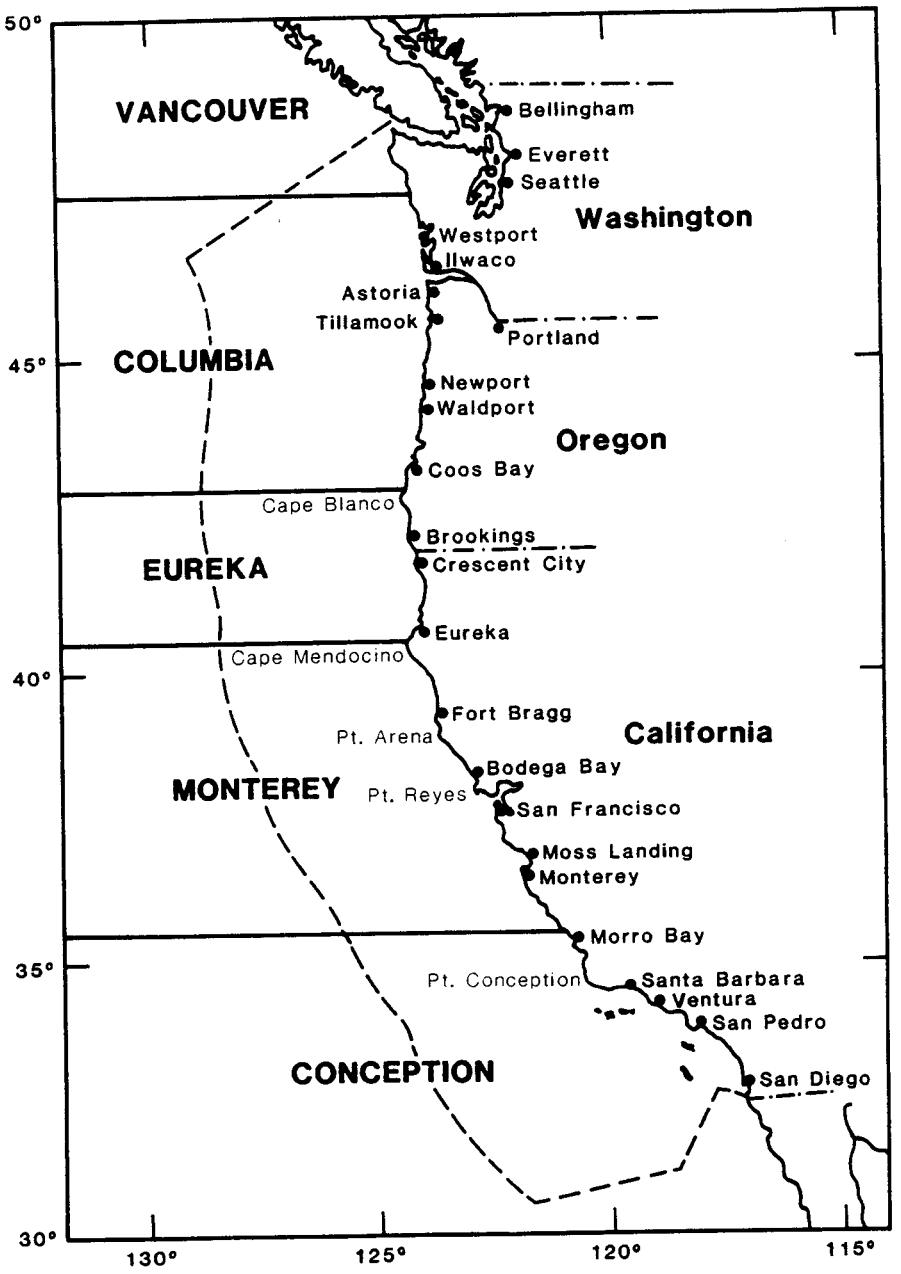

Figure 1—Pacific coast region with INPFC statistical areas, major fishing ports, and exclusive economic zones.

Table 1—Pacific coast groundfish harvest quantity and exvessel values. n.d. = no data.

	Domestic harvests					
	Shoreside		Joint venture		Foreign[1]	
Year	1,000 mt	$mil.	1,000 mt	$mil.	1,000 mt	$mil.
1976	57.0	19.4	—	—	255.0	n.d.
1977	59.8	20.7	—	—	118.0	n.d.
1978	71.6	34.5	0.9	0.1	98.0	13.3
1979	90.0	47.9	8.8	1.2	117.0	15.9
1980	87.9	37.1	26.8	3.3	44.6	5.5
1981	103.9	46.8	43.8	6.3	70.9	10.2
1982	119.0	60.0	67.7	10.4	7.3	1.1
1983	97.7	52.2	72.1	10.2	—	—
1984	89.6	49.1	79.0	11.8	14.8	2.2
1985	89.8	57.0	31.6	3.8	50.2	6.1

[1]Foreign fishery value calculated on assumption that price is equal to joint venture average price per metric ton.

Sources: Pacific Fishery Management Council (1982, 1986).

Table 2—Pacific coast groundfish harvests, estimated maximum sustainable yields (MSY), and allowable biological catch (ABC). n.d. = no data; * = MSY estimated to be at least as large as ABC.

	Annual harvest				
Species	1976	1982	1985	MSY	ABC 1986
Arrowtooth flounder	n.d.	n.d.	2,568	—	—
Dover sole	13,179	20,916	20,525	24,398	27,900
English sole	4,488	2,771	1,871	4,500	1,500
Petrale sole	2,816	2,619	1,826	3,200	3,200
Other flatfish	4,690	11,691	3,455	*	7,700
Boccacio	n.d.	n.d.	1,250	6,100	6,100
Canary rockfish	n.d.	4,296	2,046	3,500	3,500
Chilipepper	n.d.	n.d.	1,001	2,300	2,300
Yellowtail rockfish	n.d.	8,715	3,058	3,416	4,855
Pacific Ocean perch	2,336	893	1,375	5,300	1,550
Shortbelly rockfish	—	3	12	44,200	10,000
Widow rockfish	—	25,445	9,026	9,200	9,300
Remaining rockfish	n.d.	n.d.	15,225	*	13,700
Thornyheads	n.d.	n.d.	4,067	4,400	4,400
Ling cod	2,542	3,809	3,809	7,000	7,000
Pacific cod	2,165	910	377	*	3,100
Pacific whiting					
Shoreside	trace	1,023	3,895		
"Joint Venture"	0	67,465	31,512	175,500	300,000
Foreign catch	231,000	7,089	50,563		
Sablefish	7,028	18,592	14,580	7,200	10,000
Other roundfish	5,187	4,918	5,723	*	14,700
Totals	295,482	193,550	170,146	339,414	430,805

Sources: 1976 harvests from Pac. Fish. Manage. Counc. (1982), Table 8. 1982 and 1985 harvests from PACFIN Rep. 001.
MSY estimates and ABCs from Pac. Fish. Manage. Counc. (1985).

Table 3a—1985 Pacific coast commercial domestic harvests (mt) by INPFC area and species group.

Species group	Vancouver	Columbia	Eureka	Monterey	Conception	Total
Rockfish	3,406	14,684	6,024	9,751	2,892	36,800
Sablefish	5,745	5,307	2,480	3,214	269	14,016
Pacific whiting	14	885	2,996	—	—	3,895
Other roundfish	2,253	2,340	(	6,902	)	11,495
Flatfish	4,306	9,262	7,203	7,619	1,847	30,237
Others	123	45	97	113	101	479
Total	14,819	30,424	(	51,679	)	96,922

Source: PACFIN Rep. 001. Includes joint venture catch.

Table 3b—1985 Pacific coast commercial groundfish harvests (mt) by gear type and species group.

Species group	Groundfish trawls	Pots and traps	Shrimp trawl	Gill nets	Hook-and line	Other
Rockfish	29,692	56	372	2,996	1,764	1,915
Sablefish	7,194	3,574	34	231	2,665	343
Pacific whiting	3,886	—	7	1	—	1
Other roundfish	14,300	4	—	416	208	418
Flatfish	30,016	1	54	54	57	57
Others	289	—	1	116	39	34
Total	85,377	3,635	468	3,814	4,733	2,768

Source: PACFIN Rep. 009.

Coinciding with the growth in groundfish harvest was an expansion in commercial fishing fleet size (see Table 4). The greatest increase in fishing capacity is due to additional trawl fishing vessels. The number of active Pacific coast trawlers grew from about 270 in 1976 to 444 in 1982. Recent financial difficulties (which coincided with decreased rockfish harvests and some lower groundfish exvessel prices) have caused the trawl fleet to shrink by about 87 vessels. During the same period of nine years, the number of vessels fishing with fish pots or traps grew from 36 to 207 and then fell back to 34. This pattern of growth and decline was widely attributed to the changing Japanese demand for sablefish, the major target species for fish pots.

Longline (or setline) fishing vessels target mainly on sablefish and rockfish, although they take significant amounts of ling cod as well. Some Pacific halibut is taken by longline off the Pacific coast, but in comparison with the Gulf of Alaska fishery this is a relatively insignificant fishery. The number of hook-and-line fishing vessels has remained in the neighborhood of 200 in recent years.

Set net fishing (including gill nets and trammel nets) for groundfish species has expanded in two areas. In central and southern California (i.e., the Monterey and Conception statistical areas) there were nearly 900 licensed gill net fishermen in 1984. Gill net harvest grew from about 1,460 mt in 1981 to 3,814 mt in 1985. California groundfish set gill and trammel nets catch mainly rockfish, ling cod, California halibut, and croakers. The number of commercial set net fishermen is limited by a State license limitation program. The second area of gill net expansion is the Washington coast, where the success of one experimental gill net fisherman in 1980 has led to the entry of a dozen additional commercial set net operators. Operating at depths ranging down to 200 fathoms in canyons, the

Table 4—Groundfish fleet size, 1976-84.

Year	No. vessels with specified gear		
	Otter trawl[1]	Pot/trap[2]	Longline[2]
1976	269	36	N/A
1977	286	60	N/A
1978	351	119	N/A
1979	472	207	299
1980	458	116	205
1981	408	66	191
1982	444	82	208
1983	436	61	184
1984	398	34	[3]96
1985	357	32	[3]129

Source: Korson and Silverthorne (1985).

[1]Vessel numbers before 1981 include double-counting of vessels fishing in more than one state.

[2]Vessels landing fish with these gear types in two or more states are counted more than once.

[3]These numbers represent only Oregon and Washington with double-counting eliminated. California data not available at time of publication.

Table 5—Catch and revenue share distributions among 401 active groundfish trawl vessels, 1983 and 1984.

Top % of vessels	% of groundfish catch		% of revenue	
	1983	1984	1983	1984
10	35.6	32.9	32.6	30.4
20	57.0	53.7	53.3	50.8
30	71.6	69.1	67.6	65.7
40	82.0	80.8	78.5	77.4
50	89.1	88.5	86.4	85.8
60	93.9	93.8	92.1	92.0
70	96.9	97.0	95.9	95.9
80	98.9	98.9	98.5	98.4
90	99.8	99.8	99.7	99.7

Source: Annual summary records for vessels using bottom, groundfish, or midwater trawl gear. Includes domestic landings and exvessel revenue from all species landed by trawl vessels.

Table 6—Technical changes affecting fishing power and safety characteristics of Pacific coast trawlers.

Technical innovation	% adopting		
	Before 1980	1980-84	Total
Midwater trawling	3.7	18.1	21.7
Chromoscope	1.2	43.4	44.6
Sonar	21.7	19.3	41.0
Track plotter	13.3	48.1	61.4
Radio facsimile	3.6	7.2	10.8
Survival suit	48.2	32.5	80.7
EPIRB	8.4	16.9	25.3
Personal computer	4.8	6.0	10.8

Source: Dewees (1985).

set nets catch primarily sablefish, "slope" rockfish, arrowtooth flounder, and spiny dogfish.

Pacific coast groundfish fishermen often take nongroundfish species as well. In 1981, for example, 152 of the 340 coastwide shrimp trawlers switched to groundfish trawl gear for at least part of the year. Due to poor shrimp yields in 1982 through 1984, nearly all of the pink shrimp trawlers converted to groundfish trawling. This is one source of new entrants to the groundfish trawl fleet. Ability to shift among target fisheries is also exhibited by smaller inshore trawlers of the Crescent City area which fish for Dungeness crab in the winter and trawl for sole and rockfish during the fall and spring.

Groundfish vessels display a significant amount of geographic mobility as well. It is not uncommon for midwater trawl vessels to fish in joint venture operations off the West coast or in Alaska during the spring and summer, but to fish rockfish for shoreside processors during the winter. Nearshore, flatfish trawlers are known to make seasonal shifts between ports as distant as Crescent City and Morro Bay, California. Similarly, large groundfish processors are not reluctant to purchase raw fish from geographically dispersed sources. A Eureka area processor, for example, may buy fish in Coos Bay and San Francisco when it is convenient to do so.

Both economic reasoning (see Huppert 1979) and statements by industry members suggest that the degree of flexibility reflected in the geographic, gear, and species switching in the commercial fleet is an important aspect of business strategy. When market prices and species availability exhibit unanticipated fluctuations, commercial operators with experience and expertise in several different fisheries have an advantage. They can respond by shifting among fishing activities which will reduce their business risk by "diversification," in much the same way that investors diversify among stocks, bonds, and other assets. Many trawl fishermen consider it essential that management regulations allow them to move between joint venture fisheries (either Pacific coast or Alaska) and shoreside domestic fishing, between bottom trawling and midwater trawling, and between shrimp and bottom trawling. This multipurpose capability must be recognized in designing a limited access system.

Another fleet characteristic important to the operation of a limited entry system, the concentration of harvests among a small proportion of vessels, is displayed in Table 5. To construct this table we ranked domestic trawl vessels in order of annual tonnage landed and exvessel value of shoreside landings in 1981 and 1982 (not including joint venture catch). The top 10% of the fleet caught 43% of total fleet landings in 1981 and 44% in 1982. Ninety percent of the total catch was taken by only 50% of the nominal trawl fleet. Exvessel value of landings is not quite so concentrated in the upper end of the fleet, indicating that higher volume of landings is associated with lower value per ton landed. We expect that concentration of volume and value of landings would be about the same in recent years.

The technical capabilities of commercial fishing vessels are being steadily improved. Dewees (1985) has recently studied the rate of adoption of technological innovations by the trawl fleet. Table 6 summarizes some of Dewees' findings based upon interviews with 83 trawl vessel operators during 1984. Of the eight technical innovations examined, the four that seem to contribute most directly to fishing power are midwater trawling, chromoscope, sonar, and track plotter. The radio facsimile, survival suit, emergency position indicator radio beacon (EPIRB), and personal computer are

Table 7—Length distribution (ft) of trawl vessels in 1984, and disposition of 100 vessels missing from the active fleet in 1984.

	<30	30-39	40-49	50-59	60-69	70-79	80-89	>90
1984 fleet	2	20	100	108	105	44	11	8
Known losses	1	5	25	27	26	11	3	2
Sunk	0	1	8	12	10	6	1	2
Alaska and other	0	0	0	3	5	3	3	4
Repossessed	0	1	4	1	5	5	2	1
Inactive	0	1	2	4	1	0	0	0
Other	0	0	2	4	4	0	1	0

Note: A total of 201 trawlers that landed groundfish on the Pacific coast during 1981-83 did not land fish during 1984. Of these we have information on the disposition of 103. For three of these we do not know the vessel length, and they are not reported in the table.

more closely related to safety and convenience. While the specific contribution of any of these innovations to fish harvest capability or safety would be difficult to quantify, the fact that new equipment is rapidly adopted by a significant portion of the fishing fleet indicates that fishing capacity is changing and expanding in many dimensions. This suggests that it would be a mistake to rely heavily upon the number and size of vessels as a simple measure of fleet capacity.

Due to both the changing technology and the wide variation in landings among vessels, one cannot assume the fleet's harvest will be proportional to number of active vessels. Consequently, a license limitation program coupled with attrition or voluntary "buy-back" of licenses may have surprisingly little effect on fleet capacity. Even if "high-liners" are targeted in the fleet reduction, it is possible for licensed vessels that were previously low producers to become high-liners.

During 1983 and 1984 the trawl fleet was beset by falling rockfish quotas, falling sablefish and Dover sole prices, and a backlog of high interest-rate loans. One result was an unusual number of losses from the fleet due to bankruptcy, bank repossessions, sinkings, and transfers to other fisheries. Of the 599 trawlers known to have made commercial sales of groundfish during 1981-84, a total of 201 were no longer in the Pacific coast fishery in 1985. We were unable to ascertain the fate of all 201 vessels, but information on 100 vessels has been summarized in Table 7. This shows that losses from the fleet occurred among almost all sizes of vessels and that there was no disproportionate loss from large or small size categories. Forty-five percent of the known losses were due to sinkings or burnings, 21% percent were repossessed and inactive, 20% of the vessels were fishing in Alaska, 8% were fishing in other fisheries, and 6% were still afloat but not fishing.

The financial hardships reflected in these losses from the trawl fleet had a variety of causes, and have elicited a variety of suggested solutions, including a return to use of mesh size restrictions rather than species quotas; elimination of trips limits on rockfish; greater involvement of industry representatives in management decisions; grouping of species quotas to reflect catch groupings; leaving regulations unchanged for longer periods of time; prohibition of discards; prohibition of gill nets; better stock assessments by biologists; creation of a separate California regional fishery management council; reduced dependence of management on fishery data (i.e., fish tickets and logbook records); and placement of a moratorium on trawl vessel licenses. All of these suggestions (and many others not listed here) have been delivered in person or in writing to the Pacific Fishery Management Council and its subgroups. Many deserve serious attention by the management agencies. However, financial and management problems prompting the trawl license moratorium proposal and some of the other more controversial proposals seem to have declined since 1984. This may provide a needed respite for careful and thorough consideration of a range of new management alternatives, including license limitation systems and individual fishermen quotas.

CONCLUSIONS

Based on this short review of the groundfish fishery, several important implications for discussion of limited access are evident. First, both the total levels of harvest and the trawl fleet size seem to have peaked in 1982. Future growth of the fishery will depend upon increased exploitation of less valued stocks such as Pacific whiting and shortbelly rockfish. There seems to be more than sufficient fishing capacity for the traditional species. Second, geographical and biological diversity of the fishery resources results in a wide variety of fishing operations. Although trawl vessels dominate the catch, the pot, longline, and set net fleets harvest substantial amounts of fish as well. Third, flexibility in fishing patterns by the predominant trawl fleet suggests that a harvest rights system requiring fishermen to specialize in predetermined areas, species, or gear might be too restrictive for economical fishing operations. Finally, the concentration of harvests in a small portion of the fleet, and the pace of change in fishing technology, indicates that simple controls on fleet size cannot be expected to wield much control over fishing capacity or harvest levels.