Northwest and Alaska Fisheries Center

National Marine Fisheries Service

U.S. DEPARTMENT OF COMMERCE

NWAFC PROCESSED REPORT 86-03

The 1985 Experimental Set-Net Fishery for Sablefish Off the Washington Coast

February 1986

NOTICE

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by

James R. Barrowman

National Marine Fisheries Service
Northwest Regional Office
7600 Sand Point Way NE.
Bin C15700
Seattle, Washington 98115

ABSTRACT

An experimental set-net fishery, targetting primarily on sablefish (Anoplopoma fimbria) has been conducted off the Washington coast since 1982. The fishery was developed to gather information on the use of set nets and their effect on resources and other modes of fishing. The primary question--whether to legalize set nets off the Washington, Oregon, and northern California coasts--was still unanswered after the 1984 experimental fishery. The fishery was thus continued in 1985, with the objectives being (1) to gather information from areas and depths not previously fished, and (2) to assess the effects of an intensified set-net fishery in a limited area. Twelve vessels participated in the 1985 fishery.

The 1985 season lasted from May to October. As in past years, effort was concentrated off the northern Washington coast in the Nitinat Canyon. The season-long landings contained 281.9 metric tons (t) of sablefish, 240.7 t of lingcod (Ophiodon elongatus), and 181.5 t of rockfish (Sebastes spp.). Despite a three-fold increase in effort, the sablefish catch was down 25% from 1984 with the resource showing signs of being overfished. The set-net take of lingcod increased 76% from 1984; the rockfish take more than doubled.

Slightly more than half the effort (51.3%) was in waters 180 fathoms (f) or deeper--waters not previously fished. These waters yielded 59.3% (167.1 t) of the sablefish, and the shallower waters (90-180 f) yielded 40.7% (114.8 t). Catch rates were generally higher in the deep area but fluctuated greatly with time in both areas.

Most of the lingcod (99.1%) and rockfish (90.1%) were taken in the shallow area, particularly between 90 and 140 f. The sharp decrease in the catch rates of lingcod and rockfish with depth implies that the incidental take of these species in a set-net fishery for sablefish could be controlled by a minimum depth regulation.

As in previous years, the frequency and consequences of gear conflict and loss were minimal. Gear conflict and loss did not increase proportionally with fishing effort in 1985.

The incidental catch of prohibited species was low. No salmon (Oncorhynchus spp.) were observed, and the take of halibut (Hippoglossus stenolepis) was only 4.6 t. The incidence of halibut decreased sharply with depth. One Stellar's sea lion (Eumetopias jubatus) perished in a set net.

There is a continuing lack of sustained fishing efforts with set nets outside Nitinat Canyon.

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INTRODUCTION

Federal regulations prohibiting the use of set nets (anchored gill nets) off the Washington-Oregon-California coast (WOC) north of Pt. Reyes (38° N. lat.) have been in effect since 1982, when the Pacific Fishery Management Council (PFMC) implemented the Pacific Coast Groundfish Fishery Management Plan (FMP). The decision to prohibit set nets was based on concerns regarding (1) the potential for set nets to take unacceptably large numbers of salmon (Oncorhynchus spp.) and halibut (Hippoglossus stenolepis), (2) the potential for set nets to "ghost fish" i.e., continue fishing indefinitely if lost or unattended, (3) the potential conflict between fixed and mobile gear fished in the same area, and (4) the possibility that the major target species of set nets were already fully utilized by other gear types. Prior to the enactment of the FMP, existing WOC regulations prohibited the use of set nets north of Pt. Reyes in the states' juristictional zone, which extended 3 miles offshore (Pacific Fishery Management Council 1982; Federal Register 1985).

While the FMP was being formulated, one vessel owner testified that he was already fishing set nets off the coast of Washington in waters outside 3 miles. The vessel, allegedly operating on a year-round basis, targetted on sablefish (Anoplopoma fimbria). In 1982, after the implementation of the FMP, the vessel owner applied for and was issued an experimental fishing permit (EFP) by the Regional Director of the National Marine Fisheries Service (NMFS), which allowed him to continue

fishing. The EFP had been granted so that data could be gathered with which to evaluate the use of set nets north of 38° N. lat. To monitor the fishing activity, NMFS placed an observer aboard the vessel during the final trip of the season (Norris 1984; Klein 1985a; Federal Register 1985).

In 1983 the experimental fishery continued, with two vessels receiving EFP's. Sixty-five percent of the vessel trips were with NMFS observers aboard to monitor the fishery and collect detailed information on the use of set nets (Klein 1984). The experimental fishery expanded further in 1984, involving three permitted vessels. Observers covered roughly 44% of the trips (Klein 1985a). The early studies suggested that:

1. Set nets effectively targetted on sablefish in the Nitinat Canyon Area during summer.

2. The incidence of salmon and halibut in set nets was very low in the times, depths, and areas observed.

3. Set nets fished in areas shallower than 90 fathoms (f) yielded smaller quantities of sablefish than those fished deeper and demonstrated the potential of taking large by-catches of lingcod (Ophiodon elongatus) and rockfish (Sebastes spp.).

4. Catch rates for sablefish were high only off the northern Washington coast at depths greater than 90 f.

5. Gear conflicts were minimal.

At the recommendation of the PFMC, the experimental set-net fishery was further expanded in 1985 when 12 vessels fished with EFP's. [Although NMFS approved the issuance of EFPs to all

applicants in 1985 (involving 17 vessels), only 15 were actually issued and only 12 were actually used.]

The purpose of this report is to describe the 1985 fishery--essentially incorporating the 1985 data into the analyses of the earlier data. Management implications are also discussed.

THE 1985 EXPERIMENTAL SET-NET FISHERY

Types of Permits

Two types of EFP were issued in 1985. Both had many terms and conditions that were similar to the 1984 permits, but each type differed from the 1984 permits with respect to the areas that could be fished. The areas to be fished were carefully delineated by NMFS so that information could be gathered (1) on the effects of an intensified set-net fishery within a limited area, and (2) from areas and depths that had not previously been fished.

Northern permits, which restricted fishing to the U.S. Fishery Conservation Zone (FCZ) north of 48° N. lat. at depths greater than 90 f, were issued to eight vessels (of which seven fished). Southern permits, which restricted fishing to the FCZ south of 48° N. lat. at depths greater than 90 f, went to seven vessels (of which five fished). The holders of southern permits also were allowed to fish north of 48° N. lat. provided that sets be at depths 180 f or greater.

The northern permit holders and the southern permit holders were each allocated the following quotas:

	Short Tons	Metric tons
Sablefish	750	680.25
Lingcod	400	362.80
Rockfish	200	181.40
Total	1,350	1,224.45

The 1985 EFP's became effective May 1, and were to continue to December 31, but were ultimately terminated December 13 when the coastwide optimum yield (OY) for sablefish had been reached.

Permit Requirements

Permit holders were required to make a minimum of two overnight sets each month. This provision was intended to ensure that all vessels would make a minimal effort each month so that needed information could be obtained throughout the season. This condition was lifted in September, however, in response to the reduced summer catch rates and the onset of inclement weather. It was felt that while vessel operators should still be encouraged to use their EFP's, they should not be compelled to take risks merely to satisfy the two-set-per-month requirement.

Nets were to consist of two mesh sizes--commercial and test. This provided a range of meshes over which set-net efficiencies could be compared. The commercial mesh had to be at least 5 7/8 inches (measured from the inside of one knot to the inside of the opposite knot, stretched when wet). The test mesh could be no larger than 5 1/4 inches and was to be incorporated into a shackle positioned at the end of a string of commercial gear. At

least one shackle of test mesh had to be in the water during every set. Finally, test gear had to be alternated between the deep and shallow ends of the string. It was also stipulated that no more than 1,600 f of net could be fished at one time.

Untreated (biodegradable) cotton twine, no thicker than No. 36 thread, was required for connecting the webbing to the corkline. This was to minimize the impacts of continued fishing in the event that a net was lost. Also, vessels were expected to remain with the gear at all times during a set, and all sets had to be removed from the grounds prior to the end of any trip. Set-net logs were also given to the operators. These had to be completed and submitted to NMFS within 5 days of trip's end.

The 1985 EFP terms and conditions are given in Appendix 1.

Fleet Composition

The 12 vessels that participated in the 1985 fishery ranged from 12.8 to 23.8 meters (m) long, and from 12.7 to 140.7 gross metric tons. All were operated by experienced fishermen, many having been longline or trawl fishermen in the past. Three vessels were operated by fishermen who had participated in the experimental fishery the previous year. Three other skippers had experience fishing set nets in deep water elsewhere (primarily in Alaska and in the North Atlantic). Still another had trapped sablefish off the WOC for several years. During periods of peak effort, the vessels operated out of Neah Bay, La Push, Port Angeles, and Ilwaco, Washington.

A complete listing of the vessels is in Appendix 2.

Variations in Gear and Operational Strategy

There were two major changes in the overall composition of the fishing gear and in the fishing strategies employed in 1985.

The first involved the consistent effort and ability, by both types of permit holders, to fish at depths exceeding 180 f. Fifty-seven percent of the 1985 sets were in waters exceeding 180 f. In 1982-84, on the other hand, there were no sets which lay entirely beyond 180 f. The deepest set observed in 1985 was at 445 f, while sets in waters deeper than 300 f were commonplace.

In general, the vessels which focussed their efforts in waters deeper than 180 f were those whose operators had invested the most money when constructing their nets--often more than $900 per 100 f. Vessels which restricted their efforts to the shallower depths were those whose owners had usually invested less than $600 per 100 f of net. The higher costs came in the form of stronger leadlines, stronger corklines, and higher quality floats which could withstand the greater pressures associated with greater depths.

The second major change involved the types of gear used to retrieve the nets from the deeper waters. Whereas each of the three vessels returning from the 1984 fishery retrieved over the side using a Crossley hauler[1/], only one of the new participants elected to retrieve in this manner. Seven of the new participants (including all five southern permit holders) equipped their vessels with either a gill-net drum or purse-seine

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1/ Reference to trade names does not imply endorsement by NMFS.

drum, with which they retrieved their nets directly over the stern. One new participant pulled his nets onto the foredeck using an Icelandic-style gill-net hauler (similar to a capstan) paired with a secondary hauler.

Duties of the Observers

Four observers were hired by NMFS to obtain detailed information on the uses and impacts of set nets in 1985. It was the NMFS objective that at least 25% of all sets be monitored by observers.

Observers were to:

1. Determine species composition of the catches,
2. Estimate the weight of the catch,
3. Obtain length information on sablefish, by mesh size,
4. Gather data on incidentally caught salmon, halibut, and marine mammals,
5. Verify the time and location of the sets,
6. Document gear conflicts, and
7. Record the degree of compliance with the conditions and requirements of the EFP's.

Regionally, the top priority for observers was to sample vessels fishing south of 48° N. lat, where there was definite need for additional data.

SAMPLING METHODS AND ESTIMATING PROCEDURES

Sampling

The sampling methods used in 1985 are essentially those described by Klein (1984; 1985a). Whenever possible, the observer determined the weight of the catch in the set, by mesh size and species. If the catch of a particular species was small, this was done directly--by weighing the entire catch. If the catch was large, the entire catch was counted, average weights were determined from a subsample, and the weight of the entire catch was estimated accordingly. There were times however when the observer had to forego determining the weight of the catch in order to measure a sample of fish or establish the relationship between round and dressed weights. Whenever weights were determined for every set on a particular trip, the observers were able to derive trip-long estimates for each species.

The catch weights estimated at sea included landed and non-landed components. The non-landed component was made up of specimens that were intentionally discarded, specimens that had been seen falling out of the net during retrieval, and specimens that had been consumed or given away by the crew. Discards included species that were generally of little market value, or (in the case of sablefish, lingcod, and rockfish) specimens that had been damaged by sandfleas, dogfish, or hagfish.

The estimated trip-long catch weights for sablefish, lingcod, and rockfish were later compared to the actual landed

weights reported to the Washington Department of Fisheries (WDF) on fish tickets. This provided a means of evaluating the accuracy of the observer estimates and, in turn, the adequacy of the shipboard sampling procedures. It was essential to determine the accuracy of the observer estimates because, for species other than sablefish, lingcod, and rockfish (as a group), the observer estimates were the only basis for determining the catches by boats not having observers.

Estimating Procedures

Seasonal catch weights for each vessel were determined using techniques similar to those described by Klein (1985a). Catch weights were by species, area, and depth.

For sablefish and lingcod, catch was calculated by summing the landed weights (as reported on the WDF fish tickets) by depth and area. Any dressed weights were converted to round weights before being summed into the total. Conversion rates were specific to a particular vessel or (if the conversion rate had not been determined for the particular vessel) to other vessels fishing in the most comparable time-area-depth combination. The average product recovery and conversion rates for the season were as follows:

	Product recovery rate	Conversion rate
Japanese-cut (J-cut) sablefish (similar to eastern-dressed)	0.635	1.57
Western-dressed sablefish	0.690	1.45
Western-dressed lingcod	0.693	1.44

An additional step was required to estimate the catch weights of the individual rockfish species. The weight of the rockfish species combined was estimated (as described for sablefish and lingcod above) by summing the WDF ticket weights by depth and area. This was then multiplied by the proportion that a particular species made up in the observers' samples of rockfish in the appropriate area and depth. Specifically

$$CATCH(i,j,k,) = RL(i,j) * RC(i,j,k,),$$

where,

RL(i,j,k) = rockfish landings in depth zone i and area j, and

RC(i,j,k) = proportion of species k in observed catch in depth zone i and area j.

Estimating the catch weights of flatfish and other species required a different approach because so few ever showed up in the WDF fish ticket records. Catch weights of these species were estimated instead, by utilizing information about the relative abundance of the individual species in the observers' samples in conjunction with the appropriate WDF information about the landed weights of the sablefish-lingcod-rockfish complex. Computations were by the formula

$$CATCH(i,j,k) = TL(i,j) * OGC(i,j)/1.0 - OGC(i,j) * OC(i,j,k),$$

where,

TL(i,j) = total landings of sablefish, lingcod, and rockfish, in depth zone i and area j,

OGC(i,j) = proportion of flatfish and other species in total catch in depth zone i and area j, and

OC(i,j,k) = proportion of species k in observed catch of flatfish and other species in depth zone i and area j.

The deep section of the Astoria Canyon Area was the only area for which the catch weights were calculated differently. There were only two sets in the Astoria Canyon Area, and all fish were weighed and counted by an observer. These data were summed and used directly.

The WDF fish ticket information had one limitation that required special treatment. Although the WDF information accurately reflects total landings of sablefish, lingcod, and rockfish, it is not sensitive to area or depth when more than one area or depth are fished on a single trip. Shipboard data recorded by the vessel operators provided the basis for overcoming this limitation. Each captain kept records of estimated catch of sablefish, lingcod, and rockfish, by navigational position and depth of each set. From this is was possible to determine the proportion of the catch of each species taken in a particular area or depth. This information was then applied to the trip totals recorded by WDF in the formula

$$CATCH(i,j,k) = TL(k) * EC(i,j,k)/TEC(k),$$

where,

TL(k) = total landings species group k,

EC(i,j,k) = estimated catch of species group k in depth zone i and area j, and

TEC(k) = Total estimated catch of species group k.

This computation was unnecessary for most trips as the vessels generally tended to stay within a single area. Because the skippers of the few vessels who regularly switched areas were meticulous, the catch weights of sablefish, lingcod, and rockfish computed by area and depth using the above procedure, are reasonable.

Catch rates, or catch per unit of effort (CPUE), were used to compute the catch weights of halibut. The CPUE of halibut, recorded by area and depth, is expressed as kilograms caught per 100 f of net fished (kg/100 f net). By multiplying CPUE (determined by the observers) by the number of 100 f units of net fished per area and depth, catch weights of halibut for the entire fleet were derived.

Because of the thorough treatment given to halibut by the observers, CPUE based on observer data was assumed to be more accurate than the CPUE based on seasonal catch weights. For other species, however, CPUE was determined by dividing the computed seasonal catch weight by the corresponding amount of 100 f units of gear fished.

Validity of the Estimating Procedure

Observers estimated the catch for 33 (24.3%) of the trips. By comparing the catches estimated by the observers to the actual trip landings, sample errors were computed using the procedures described by Klein (1984).

For sablefish, 30 of the 33 observer-generated estimates were within 10% of the landed totals. Of the three estimates that varied by more than 10%, two were within 12% and one exceeded the landed weight by 15%. Inquiry revealed that an unusually high percentage of sablefish taken in the latter set were discarded because of damage by sand fleas. The observer's estimate of the catch, when adjusted for the discards, came to within 10% of the actual landed catch.

For lingcod, only one estimate varied by more than 10%, and that varied by 12%.

Variance between the estimated and landed weights was largest for rockfish, with 11 of the 33 comparisons varying by more than 10%. Six of the 11 were within 13% of each other. The two highest differences (observer estimates exceeded landed weights by 37 and 24%) were from small landings of 34 and 129 kg, respectively, and probably reflect a difference brought about by crewmen using or giving away specimens rather than sample bias.

Overall, observer estimates exceeded the landed weights by 2.33% for sablefish, 0.10% for lingcod, and 0.05% for rockfish. The results indicate that the catches, as estimated from observer data, generally are accurate.

Data Grouping

When appropriate for comparative and analytical purposes, data were grouped by geographical area--two areas each in the International North Pacific Fisheries Commission (INPFC) Vancouver and Columbia statistical areas. The four geographical areas are:

INPFC Vancouver Area (North of 47°30' N. lat.)

1. Nitinat Canyon Area
2. Juan de Fuca Canyon Area

INPFC Columbia Area (South of 47°30' N. lat.)

1. Grays Canyon Area
2. Astoria Canyon Area and southward

The areas are depicted in Figure 1.

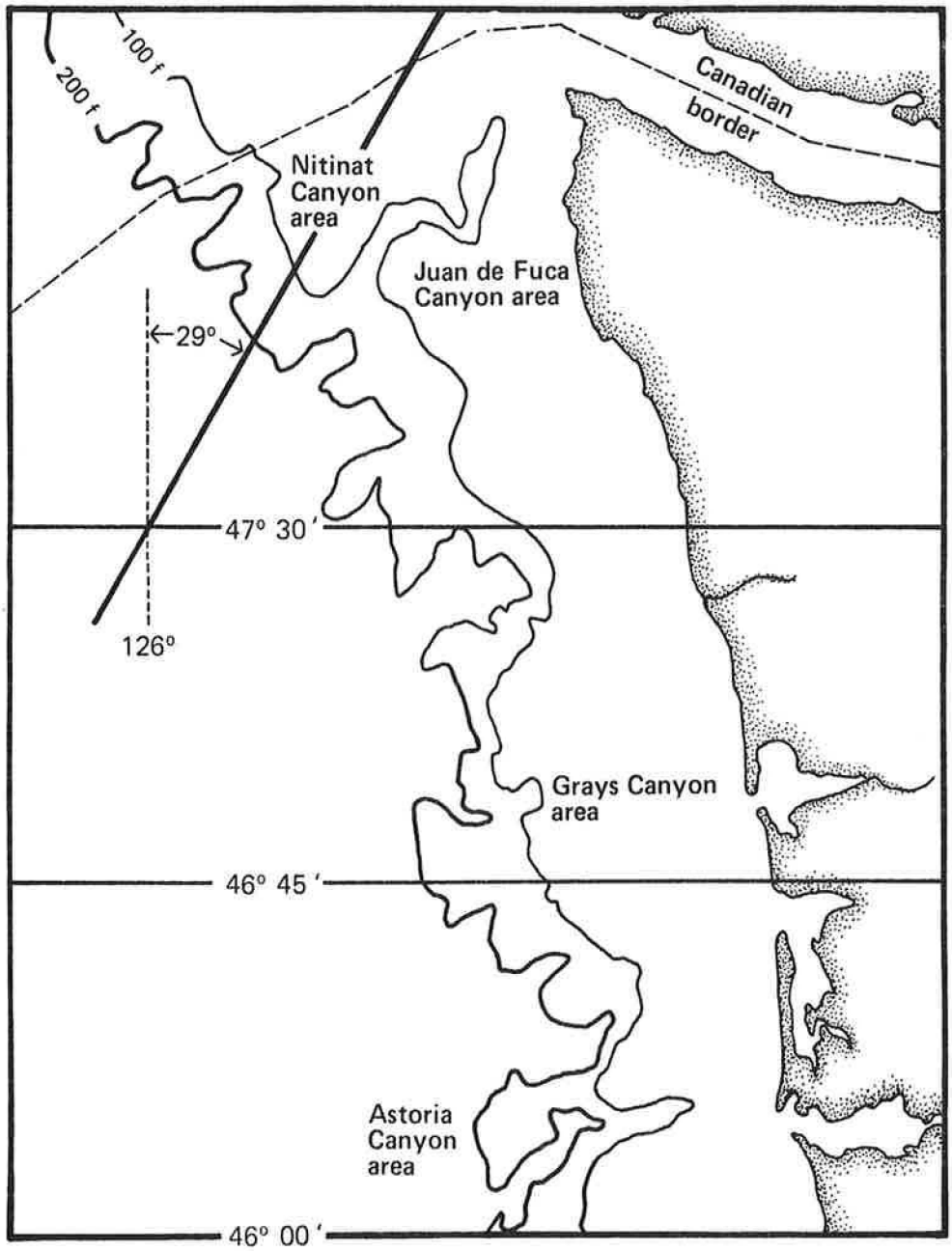

Figure 1.--Boundaries between the four designated fishing areas.

Data were further grouped within area by shallow and deep sets. Shallow sets were those between 90 and 180 f; deep sets were those lying entirely at or beyond 180 f.

As mentioned earlier, prior to 1985 there were no sets lying entirely at or beyond 180 f. All of the 1982-84 sets were in the shallow category, except six in 1983 and 18 (experimental sets) in 1984 were in depths less than 90 f. Grouping the 1985 data into shallow and deep categories permits comparison of the 1985 catches from shallow areas with data from similar depths in 1982-84.

SUMMARY OF THE 1985 CATCHES

The 1985 experimental set-net fishery yielded 281.9 metric tons (t) of sablefish, 240.7 t of lingcod, and 181.5 t of rockfish. In addition, 156.3 t of flatfish and other species were also caught, only 4% of which were landed. Despite the addition of nine vessels to the fishing fleet, and an approximate three-fold increase in effort, the 1985 catch of sablefish was down 94.8 t (23.3%) from 1984 (see below):

	1984 Catch (t)	%	1985 Catch (t)	%	Difference (t)
Sablefish	376.7	48	281.9	33	-94.8
Lingcod	137.1	17	240.7	28	+103.6
Rockfish	58.6	7	181.5	21	+122.9
Other	221.1	28	156.3	18	-64.8
Total	793.5		860.4		

The increased relative abundance of lingcod and rockfish, while partly the result of the decreased sablefish catch, also reflects the high degree to which these species remained available throughout the summer. Lingcod constituted only 17% of the total catch in 1984; 28% in 1985. The relative abundance of rockfish increased even more dramatically--up from 7% in 1984 to 21% in 1985.

Three species made up 83% of the rockfish catch. Bocaccio (Sebastes paucispinis), silvergray rockfish (Sebastes brevispinis), and canary rockfish (Sebastes pinniger) constituted 40.2, 24.1, and 18.9% of the rockfish catch, respectively. Arrowtooth flounder (Atheresthes stomias) and spiny dogfish (Squalus acanthias) were the predominant non-target species, making up 77.0 and 16.3% of the non-target catch. A listing of the species observed in the 1985 experimental fishery is given in Table 1.

Landings by Area

The 1985 landings, arranged by area and depth, are presented in Table 2. Overall, 98.8% were from north of 47°30' N. lat.; most from the Nitinat Canyon (where 93.3% of the effort was concentrated). The Nitinat contributed 95.9% of the sablefish, 99.7% of the lingcod, and 98.1% of the rockfish. Juan de Fuca Canyon, the second most heavily fished region (3.3% of the effort) yielded 1.9% of the sablefish and less than 1% each of the lingcod and rockfish.

Vessels fishing with southern permits tended to work the deep section of the Nitinat Canyon (a sanctioned alternative)

Table 1.--Species observed during the 1985 experimental set-net season.

Common name	Scientific name
Sablefish	*Anoplopoma fimbria*
Lingcod	*Ophiodon elongatus*
Rockfish	
Silvergray	*Sebastes brevispinis*
Canary	*S. pinniger*
Bocaccio	*S. paucispinis*
Pacific ocean perch	*S. alutus*
Redbanded	*S. babcocki*
Darkblotched	*S. crameri*
Shortraker	*S. borealis*
Rougheye	*S. aleutianus*
Yellowtail	*S. flavidus*
Widow	*S. entomelas*
Sharpchin	*S. zacentrus*
Yelloweye	*S. ruberrimus*
Splitnose	*S. diploproa*
Rosethorn	*S. helvomaculatus*
Redstripe	*S. proriger*
Yellowmouth	*S. reedi*
Greenstriped	*S. elongatus*
Black	*S. melanops*
Shortspine thornyhead	*Sebastolobus alascanus*
Flatfish	
Arrowtooth flounder	*Atheresthes stomias*
Dover sole	*Microstomus pacificus*
Rex sole	*Glyptocephalus zachirus*
Petrale sole	*Eopsetta jordani*
English sole	*Parophrys vetulus*
Other Species	
Pacific hake	*Merluccius productus*
Pacific cod	*Gadus macrocephalus*
Spiny dogfish	*Squalus acanthias*
Spotted ratfish	*Hydrolagus colliei*
Skate (unidentified)	*Raja spp.*
Pacific halibut	*Hippoglossus stenolepis*
Soupfin shark	*Galeorhinus zyopterus*
Pacific herring	*Clupea harengus pallasi*
Rattail (unidentified)	*Coryphaenoides spp.*
Pacific hagfish	*Eptatretus stouti*
Ribbon barracudina	*Notolepis rissoli*

Table 2.--The 1985 experimental set-net fishery: (A) fishing effort (100 f of net fished) and (B) catch (t) of sablefish, lingcod, and rockfish (as determined by Washington Department of Fisheries fish tickets), by area and depth.

		Sablefish		Lingcod		Rockfish	
Area and depth	Effort	Catch	% Total catch	Catch	% Total catch	Catch	% Total catch
All areas	3,731.24	281.90	100.00	240.69	100.00	181.52	100.00
Shallow	1,817.98	114.79	40.72	238.51	99.10	163.53	90.09
Deep	1,913.26	167.10	59.28	2.18	.90	17.99	9.91
Vancouver (INPFC)	3,604.14	275.69	97.80	240.60	99.96	179.47	98.87
Shallow	1,748.88	113.35	40.21	238.45	99.07	162.09	89.30
Deep	1,855.26	162.34	57.59	2.15	.89	17.38	9.59
Nitinat Canyon	3,479.76	270.38	95.92	239.85	99.65	178.14	98.14
Shallow	1,700.50	112.37	39.86	237.70	98.76	161.32	88.87
Deep	1,779.26	158.01	56.05	2.15	.89	16.82	9.26
Juan de Fuca Canyon	124.38	5.31	1.88	.74	.31	1.33	.74
Shallow	48.38	.98	.35	.74	.31	.77	.43
Deep	76.00	4.33	1.54	.00	.00	.56	.31
Columbia (INPFC)	127.10	6.21	2.20	.09	.04	2.05	1.13
Shallow	69.10	1.44	.51	.07	.03	1.44	.79
Deep	58.00	4.77	1.69	.02	.01	.61	.34
Grays Canyon	69.10	5.73	2.03	.05	.02	1.10	.61
Shallow	19.10	1.01	.36	.02	.01	.59	.33
Deep	50.00	4.72	1.67	.03	.01	.51	.28
Astoria Canyon	58.00	.48	.17	.04	.02	.94	.52
Shallow	50.00	.43	.15	.04	.02	.84	.46
Deep	8.00	.05	.02	.00	.00	.10	.05

rather than try unproven areas to the south. As a result, only 3.4% of the effort expended by the southern permit holders was south of 47°30' N. lat. (1.9% in the Grays Canyon Area and 1.5% in the Astoria Canyon Area and southward). In terms of seasonal landings, the waters south of 47°30' contributed 2.2% of the sablefish (nearly all from the Grays Canyon Area) and less than 1% each of the other species or species groups.

Additional information about fishing effort (and related observer coverage) is given in Appendix 3.

Catch Rates by Time and Depth

Nitinat Canyon

Catch rates for sablefish and lingcod fluctuated widely by time and depth in Nitinat Canyon (recall that catch rates are expressed as kg/100 f net). The catch rate for sablefish, for example, peaked at 154.2 kg/100 f net in the deep area in June, but was only 6.4 in the shallow area (Table 3). The catch rate for lingcod meanwhile, peaked at 324.9 in the shallow area, but was only 4.7 in the deep area.

Overall, the catch rate of sablefish in the shallow area of Nitinat Canyon was much lower than in previous years (66.1 in 1985 compared to 354.0 and 330.2 in 1983 and 1984, respectively). In 1985 the monthly catch rate for sablefish in the shallow area of Nitinat Canyon exceeded 50.0 only once, reaching 142.4 in September. This was largely attributable to a sudden surge on September 10-11, when the catch rate peaked at 667.0.

With respect to the within-season trend in catch rate for sablefish in 1985, quite the opposite occurred in the deep area

Table 3.--Catch and catch rate of sablefish, lingcod, and rockfish in the Nitinat Canyon in 1985, by depth category and month.

Species (group)	Month	Shallow area Sets	Shallow area 100 f net fished	Shallow area Catch (kg)	Shallow area kg/100 f net	Deep area Sets	Deep area 100 f net fished	Deep area Catch (kg)	Deep area kg/100 f net
Sablefish	May	32	103.95	381.6	3.67	12	35.50	269.1	7.58
Lingcod				25,464.1	244.96			0	0.00
Rockfish				9,842.8	94.69			219.3	6.18
Total				35,688.5	343.32			488.4	13.76
Sablefish	June	36	134.35	857.9	6.39	93	225.32	34,749.8	154.22
Lingcod				43,643.8	324.85			1,049.2	4.66
Rockfish				9,391.2	69.90			2,720.0	12.07
Total				53,892.9	401.14			38,519.0	170.95
Sablefish	July	87	328.61	15,248.9	46.40	212	715.98	69,430.8	96.97
Lingcod				54,057.6	164.50			577.6	0.81
Rockfish				25,065.4	76.28			6,894.0	9.63
Total				94,371.9	287.19			76,902.4	107.41
Sablefish	August	109	503.13	17,155.6	34.10	195	739.76	51,448.7	69.55
Lingcod				51,890.2	103.13			497.8	0.67
Rockfish				41,557.6	82.60			6,822.5	9.22
Total				110,603.4	219.83			58,769.0	79.44
Sablefish	September	114	529.04	75,308.4	142.35	7	31.50	1,650.0	52.38
Lingcod				44.367.8	83.86			22.0	0.70
Rockfish				64,506.8	121.93			136.5	4.33
Total				184,183.0	348.15			1,808.5	57.41
Sablefish	October	24	101.42	3,415.2	33.67	7	31.20	462.9	14.84
Lingcod				18,279.5	180.24			0	0
Rockfish				10,953.1	108.00			24.2	0.78
Total				32,647.8	321.91			487.1	15.61
				SUMMARY					
Sablefish	Season	402	1,700.50	112,367.6	66.08	526	1,779.26	158,011.3	88.81
Lingcod				237,703.0	139.78			2,146.6	1.21
Rockfish				161,316.9	94.86			16,816.5	9.45
Total				511,387.5	300.73			176,974.4	99.47
Sablefish	Season	928	3,479.76	270,378.9	77.70				
Lingcod	[Shallow			239,849.6	68.93				
Rockfish	+ Deep]			178,133.4	51.19				
Total				688,361.9	197.82				

of Nitinat Canyon. There, the catch rate peaked early (385.0 on June 10) and declined sharply thereafter. On a monthly basis the catch rate dropped steadily, from a high of 154.2 in June to 14.8 in October (Fig. 2).

The overall trend in the catch rate for lingcod in the shallow area has followed a similar pattern over the past 3 seasons. The catch rate is high early in the season, peaking in late June and then declining rapidly in July and August before picking up again in the autumn. In 1985 the catch rate for lingcod moved from a monthly high of 324.9 in June (peaking at 636.0 on June 25) to 164.5 in July, 103.1 in August, 83.9 in September, and back up to 180.2 in October. The 1985 trend departed from the trends of 1983 and 1984 only in that the catch rate bottomed out in September rather than August.

Less than 1% of the lingcod taken from the Nitinat Canyon in 1985 came from the deep area. The catch rate was less than 1.0 every month except June, when it reached 4.7.

The catch rate of rockfish in the shallow area of Nitinat Canyon remained relatively stable during the 1985 season, fluctuating only between 69.9 and 95.0 May through August before peaking at 121.9 in September.

Less than 10% of the rockfish taken in Nitinat Canyon in 1985 came from the deep area. The season-long catch rate was 9.5, with a high of 12.1 in June.

Overall, 74.3% of the 1985 Nitinat Canyon catch of the targetted sablefish-lingcod-rockfish complex came from the shallow area. Seasonal trends in the catch rate for the three

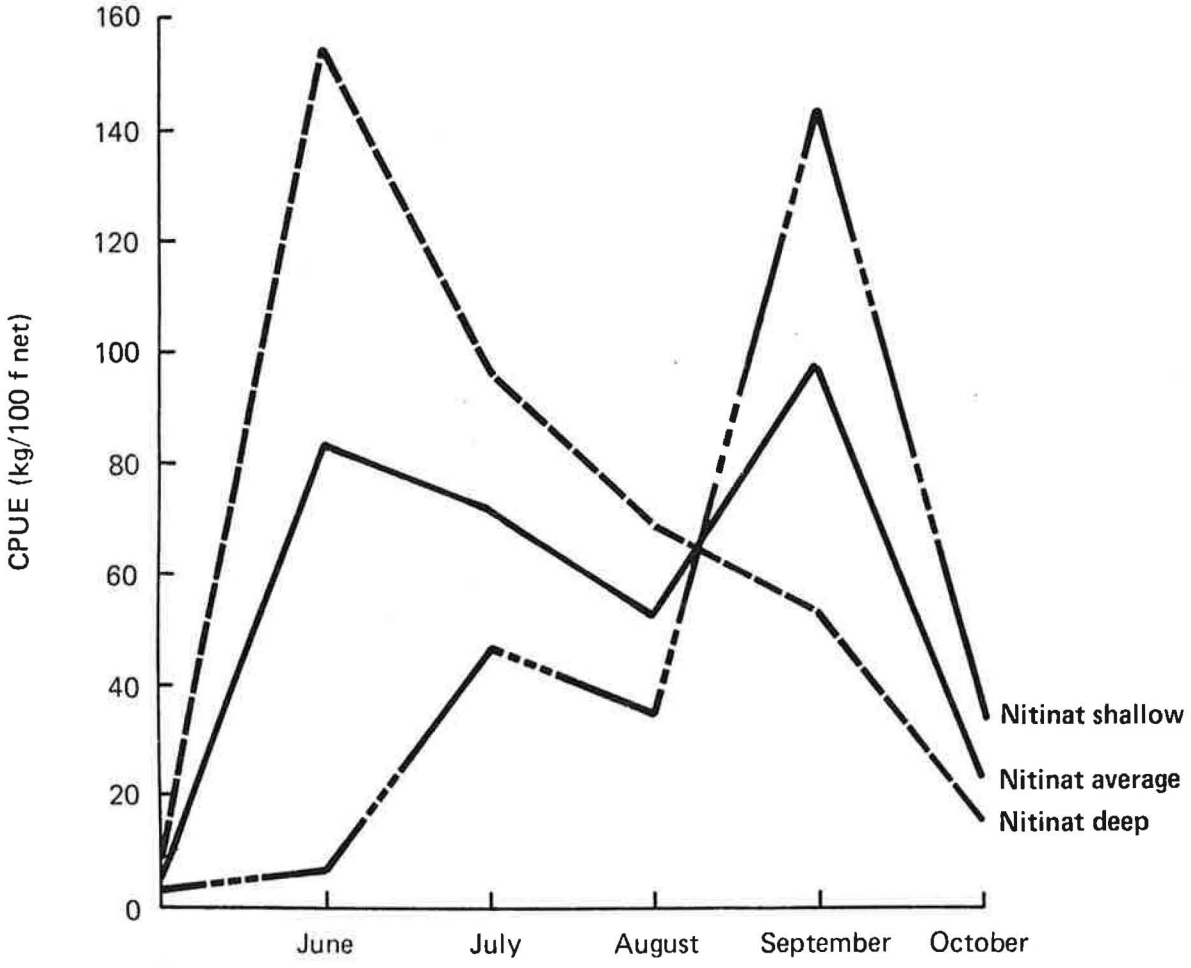

Figure 2.--Catch rates of sablefish in the experimental set-net fishery in Nitinat Canyon in 1985, by month and depth (data from Table 3).

components are shown in Figure 3. It is noteworthy that when the catch rate for lingcod reached a seasonal low in September, the catch rate for sablefish and rockfish increased. This has management implications which will be discussed in the section that compares the data from the deep and shallow areas.

Juan de Fuca Canyon

Catch rates in Juan de Fuca Canyon (Table 4) tended to be much lower than those in Nitinat Canyon. There are large gaps in the Juan de Fuca data, however, stemming from the small amount of fishing effort expended there. There were no sets in the shallow area in July or September, for example, and three or fewer in May, August, and October. Overall, the catch rate in the shallow area was 20.2, 15.4, and 16.0 for sablefish, lingcod, and rockfish, respectively.

Nor was there fishing in the deep area in August or September. Of the 4 months when there was fishing in the deep area, the highest catch rate (117.7) was in June--the same as in the Nitinat Canyon. No lingcod and only small amounts of rockfish were caught in the deep area of Juan de Fuca Canyon.

The Southern (Columbia) Area

Because of the limited amount of data available for each the Grays Canyon and Astoria Canyon areas, catch statistics have been pooled for the entire fishing area south of 47°30' N. lat. (Table 5). Months and the depth categories have been retained. This approach, despite its limitations, provides some basis for north-south comparisons. There are entries for the shallow area, May through August, and for the deep area, June through August.

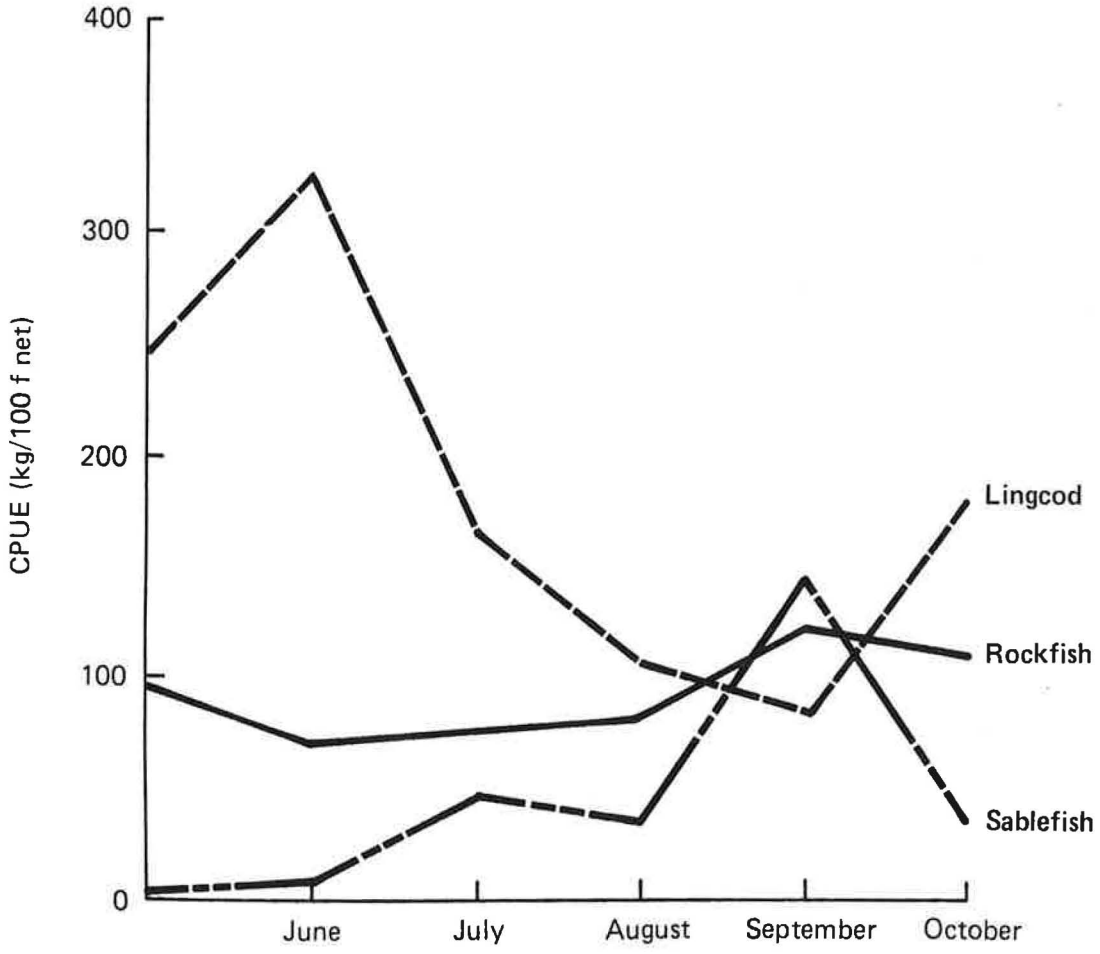

Figure 3.--Catch rates for sablefish, lingcod, and rockfish in the experimental set-net fishery in the shallow area of Nitinat Canyon in 1985, by month (data from Table 3).

Table 4.--Catch and catch rate of sablefish, lingcod, and rockfish in the Juan de Fuca Canyon in 1985, by depth category and month.

Species (group)	Month	Shallow area				Deep area			
		Sets	100 f net fished	Catch (kg)	kg/100 f net	Sets	100 f net fished	Catch (kg)	kg/100 f net
Sablefish	May	2	5.35	340.3	63.61	3	6.00	52.5	8.75
Lingcod				336.2	62.84			0.0	0.00
Rockfish				100.1	18.71			2.4	0.40
Total				776.6	143.29			54.9	9.15
Sablefish	June	9	27.08	261.8	9.67	7	16.50	1,924.7	116.65
Lingcod				367.1	13.56			0.0	0.00
Rockfish				612.6	22.62			148.6	9.01
Total				1,241.5	45.85			2,073.3	125.65
Sablefish	July	0	0.00	0.0	--	11	35.50	1,362.7	38.39
Lingcod				0.0	--			0.0	0.00
Rockfish				0.0	--			290.3	8.18
Total				0.0	--			1,653.0	46.56
Sablefish	August	3	11.85	309.3	26.10	0	0.00	0.0	--
Lingcod				5.6	0.47			0.0	--
Rockfish				56.8	4.79			0.0	--
Total				371.7	31.37			0.0	--
Sablefish	September	0	0.00	0.0	--	0	0.00	0.0	--
Lingcod				0.0	--			0.0	--
Rockfish				0.0	--			0.0	--
Total				0.0	--			0.0	--
Sablefish	October	2	4.10	67.4	16.44	9	18.00	987.9	54.88
Lingcod				35.8	8.73			0.0	0.00
Rockfish				4.9	1.20			121.7	6.76
Total				108.1	26.37			1,109.6	61.64
				SUMMARY					
Sablefish	Season	16	48.38	978.8	20.23	30	76.00	4,327.8	56.94
Lingcod				744.7	15.39			0.0	0.00
Rockfish				774.4	16.01			563.0	7.41
Total				2,497.9	51.63			4,890.8	64.35
Sablefish	Season	46	124.38	5,306.6	42.66				
Lingcod	[Shallow			744.7	5.99				
Rockfish	+ Deep]			1,337.4	10.75				
Total				7,388.7	59.40				

Table 5.--Catch and CPUE of sablefish, lingcod, and rockfish in the INPFC Columbia Area in 1985, by depth category and month.

Species (group)	Month	Shallow area Sets	100 f net fished	Catch (kg)	kg/100 f net	Deep area Sets	100 f net fished	Catch (kg)	kg/100 f net
Sablefish	May	6	23.00	160.0	6.96	0	0.00	0.0	--
Lingcod				25.4	1.10			0.0	--
Rockfish				433.6	18.85			0.0	--
Total				619.0	26.91			0.0	--
Sablefish	June	8	25.00	1,065.2	42.61	12	24.00	3,982.4	165.93
Lingcod				18.6	0.74			24.5	1.02
Rockfish				446.6	17.86			306.7	12.78
Total				1,530.4	61.22			4,313.6	179.73
Sablefish	July	3	11.00	75.3	6.85	10	22.00	705.0	32.05
Lingcod				0.0	0.00			0.0	0.00
Rockfish				64.4	5.85			134.6	6.12
Total				139.7	12.70			839.6	38.16
Sablefish	August	3	10.10	139.2	13.78	3	12.00	73.9	6.16
Lingcod				21.3	2.11			0.0	0.00
Rockfish				490.9	48.60			133.1	11.09
Total				651.4	64.50			207.0	17.25
				SUMMARY					
Sablefish	Season	20	69.10	1,439.7	20.84	25	58.00	4,761.3	82.09
Lingcod				65.3	0.95			24.5	0.42
Rockfish				1,435.5	20.77			574.4	9.90
Total				2,940.5	42.55			5,360.2	92.42
Sablefish	Season	45	127.10	6,201.0	48.79				
Lingcod	[Shallow			89.8	0.71				
Rockfish	+ Deep]			2,009.9	15.81				
Total				8,300.7	65.31				

There was no fishing in the deep area in May, nor in either area in September or October.

The catch rate in the shallow area of the southern region was low throughout the season, with the monthly rates for sablefish and rockfish each averaging 20.8 kg/100 f net; neither exceeding 50 in any month. The catch rate for lingcod was even lower, averaging less than 1.0.

In the deep area, the monthly catch rate for sablefish was highest in June (165.9); averaging 82.1 overall. The season-long catch rates for lingcod and rockfish in the deep area of the southern region were 0.4 and 9.9, in order.

Discard Rates of Sablefish, Lingcod, and Rockfish

Sample data showed that the discard rates for the major target species were low--1.4% for sablefish, 0.3% for lingcod, and 1.0% for rockfish. Most of the loss of sablefish and lingcod was due to predation by sandfleas. Most of the loss of rockfish was attributable to unwanted species such as greenstriped rockfish (Sebastes elongatus) and rosethorn rockfish (Sebastes helvomaculatus), and to specimens of submarket size.

Variability in the Catch Among Vessels

In season-long terms, three of the six vessels which landed the greatest quantities of sablefish were returning participants from the 1984 fishery. Prior to September, however, when all but one of the new participants dropped out of the fishery, only one of the top six was a returning vessel. It was only then that returnees took up the slack. In fact, the vessel that caught the

most sablefish in 1985 (21.6% of the total landings), took 77.7% of its catch in September.

The initial success of new participants relates to their concentrated efforts in the deep area.

The lingcod and rockfish catches were unevenly distributed among the vessels. Some operators avoided these species; four targetted on them--taking 98.0% of the lingcod and 93.1% of the rockfish. A single vessel, in fact, took 61.4% of the lingcod and 45.7% of the rockfish.

Incidental Catch of Salmon, Halibut, and Sea Lions

As in previous years, the incidental catch of salmon and halibut remained low in 1985. There were no salmon taken in 311 (observer-covered) sets in 1985, one salmon in 125 sets in 1984, and 4 salmon in 117 sets in 1983.

Although one fisherman anecdotally suggested that salmon had indeed been taken aboard a certain vessel, the comment was never verified and certainly not reported by the vessel operator. Some observer-monitored sets were in waters where salmon were active--giving rise to the possibility that some salmon might be taken incidentally, but none were.

Of the five salmon taken in 1983 and 1984, three were chinook (Oncorhynchus tshawytscha) and two were coho (Oncorhynchus kisutch). All were taken in overnight sets at less than 130 f. Three were taken in Nitinat Canyon; two in Grays Canyon.

The incidence and estimated total catch of Pacific halibut are given in Table 6. Despite the increased fishing effort in 1985, the incidental catch of halibut (estimated 4,493 kg) was

Table 6.--Calculation of the number and weight of Pacific halibut taken in the 1985 experimental set-net fishery, by area and depth.

Area and depth	Observer data						Seasonal data		
	A	B	C	D	E	F	G	H	I
					CPUE				
	Number	Weight (kg)	Average weight (kg)	Effort (100 f net)	Number (A/D)	Weight (kg) (B/D)	Effort (100 f net)	Number (ExG)	Weight (kg) (FxG)
Nitinat Canyon									
Shallow	287	1931.1	6.73	761.6	0.38	2.54	1,700.50	646.2	4,319.27
Deep	6	69.1	11.52	510.7	0.01	0.14	1,779.26	17.8	249.10
Juan de Fuca Canyon									
Shallow	0	0.0	0.00	21.2	0.00	0.00	48.38	0.0	0.00
Deep	0	0.0	0.00	44.0	0.00	0.00	76.00	0.0	0.00
Grays Canyon									
Shallow	1	24.7	24.70	19.1	0.05	1.29	19.10	1.0	24.64
Deep	0	0.0	0.00	4.0	0.00	0.00	50.00	0.0	0.00
Astoria Canyon									
Shallow	0	0.0	0.0	23.0	0.00	0.00	50.00	0.0	0.00
Deep	0	0.0	0.0	8.0	0.00	0.00	8.00	0.0	0.00
Sums	294	2,024.9		1,391.6			3,731.24	665.0	4,593.01

down slightly from 1984 (estimated 4,768 kg). The catch rate for halibut averaged 1.46 in 1985; 3.51 in 1984. The lower catch rate largely can be attributed to the utilization of the deep area by the 1985 fishery. Of the 294 halibut observed in 1985, only 7 were from the deep area--where 51% of the effort was expended.

A single dead Stellar's sea lion (Eumetopias jubatus) was retrieved from a set in the southern region. Observations on marine mammals are summarized in Appendix 4.

DEEP AREA VS SHALLOW AREA

The 1985 experimental set-net fishery successfully provided data from depths which had not previously been fished. More than half (51.3%) of the effort was expended at depths 180 f or more. Comparisons of data from sets in the deep area (180 f or more), with data from sets in the shallow area (less than 180 f) revealed major differences in species composition and catch rate. Highlights of the analysis (each of which will be developed more thoroughly as the section progresses) were:

1. The availability of sablefish varied greatly by time and depth. Overall, the catch rate was higher in the deep area.

2. Nearly all lingcod came from the shallow area; most from 140 f or less.

3. More than 90% of the rockfish came from the shallow area. Again, most were from 140 f or less.

4. The shallow-area rockfish catch was dominated by Bocaccio, silvergray rockfish, and canary rockfish (92.3% collectively).

5. The deep-area rockfish catch featured shortraker rockfish (Sebastes borealis) and rougheye rockfish (Sebastes aleutianus), which collectively made up 81.8% of the total.

6. Halibut were taken infrequently in both depth zones, but 18 times less frequently in the deep area than in the shallow area.

Relative Abundance of the Major Components

The relative abundance of sablefish, lingcod, and rockfish, as noted below, varied greatly with depth.

Catch Composition of the Major Groups

	Shallow Area	Deep Area
Sablefish	22.2%	89.2
Lingcod	46.2	1.2
Rockfish	31.6	9.6

The difference in the relative abundance of lingcod is most striking. Lingcod were the most abundant component in the shallow area (46.2%) but contributed little (1.2%) in the deep area. The relative contribution of sablefish and rockfish varied with depth as well, but not nearly as markedly as lingcod.

Unlike the deep area, where sablefish were totally dominant (89.2%), no one component dominated the shallow area. Moreover, the catch composition in the shallow area fluctuated widely with time. Consider, for example, the catch composition in the shallow section of the heavily fished Nitinat Canyon Area:

Catch Composition of the Major Groups
(Nitinat Canyon, Shallow Area)

	May	June	July	Aug.	Sept.	Oct.
Sablefish	1.1%	1.6	16.2	15.5	40.9	10.5
Lingcod	71.4	81.0	57.3	46.9	24.1	56.0
Rockfish	27.6	17.4	26.6	37.6	35.0	33.5

The composition of the catch in June and September exemplify the variation referred to. Whereas lingcod totally dominated the June landings, it was the least abundant component in September when the composition was more evenly balanced between the major groups. Yet lingcod was again the dominant component in October, demonstrating how rapidly the catch composition can change in the shallow area. It is important to note that the changes in catch composition in the shallow area of the Nitinat Canyon region do not appear to be related to altered fishing strategies. The large catches of lingcod in June came from the same depths and locations where there were large catches of sablefish in September.

Overall, the composition of the major components, by depth, was as follows (effort, it should be noted, was about even; 48.7% in the shallow area and 51.3% in the deep area):

	Sablefish		Lingcod		Rockfish	
	Catch (t)	%	Catch (t)	%	Catch (t)	%
Shallow	114.8	40.7	238.5	99.1	163.5	90.1
Deep	167.1	59.3	2.2	0.9	18.0	9.9
Total	281.9		240.7		181.5	

Roughly 60% of the sablefish were taken in the deep area--a figure which was higher (82%) before there were large catches of sablefish in the shallow section of the Nitinat Canyon Area in September. Lingcod and rockfish, on the other hand, were more abundant in the shallow area (99.1 and 90.1%, respectively). Lingcod and rockfish were particularly abundant in waters 140 f or less.

Species Composition Within the Rockfish Complex

The species composition of the rockfish catch varied widely with depth. In the shallow area, bocaccio, silvergray rockfish, and canary rockfish made up 92.3% of the rockfish catch (Table 7). Bocaccio was most common, making up 44.6% of the shallow-area rockfish catch.

On the other hand, only traces of bocaccio and no silvergray rockfish or canary rockfish appeared in the deep-area rockfish catch. Shortraker rockfish and rougheye rockfish constituted 81.8% of the rockfish catch in the deep area, with shortraker being the more abundant (48.8%).

It is important to note that the large catch of rockfish in the 1985 experimental set-net fishery (181.5 t) had little impact on the species of rockfish that are judged to be stressed and therefore closely managed. The fishery took only 4.8 t of Pacific ocean perch (Sebastes alutus), commonly known as POP, 2.4 t of yellowtail rockfish (Sebastes flavidus), and 1.9 t of widow rockfish (Sebastes entomelas). Of these catches, the shallow area yielded 83% of the POP, 100% of the yellowtail rockfish, and 99% of the widow rockfish.

Table 7.--Estimated species composition of rockfish taken in the 1985 experimental set-net fishery, based on observer data.

Species	Shallow area		Deep area		Total	
	Catch (t)	%	Catch (t)	%	Catch (t)	%
Bocaccio	72.99	44.6	0.05	0.3	73.04	40.2
Silvergray	47.30	26.7	--	--	43.70	24.1
Canary	34.36	21.0	--	--	34.36	18.9
Shortraker	0.39	0.2	8.79	48.8	9.19	5.1
Rougheye	0.45	0.3	5.93	33.0	6.38	3.5
Pacific ocean perch	3.98	2.4	0.82	4.6	4.80	2.6
Yellowtail	2.44	1.5	--	--	2.44	1.3
Redbanded	2.07	1.3	0.28	1.5	2.35	1.3
Widow	1.88	1.1	0.02	0.1	1.90	1.0
Other Spp.	1.27	0.8	2.10	11.7	3.37	1.9
Total	163.53		17.99		181.51	

Statistics pertaining to the rockfish aspect of the fishery (catch, catch rates, and average weights by species, area, and depth) are given in Appendix 5.

Implications for Management

The profound differences between the catches from the shallow and deep areas give rise to several management considerations. There is concern, for example, that there could be large catches of lingcod and rockfish in set-net fisheries said to be targetting on sablefish. In this regard, data from the present study shows that an increase in the minimum depth at which set-netters are allowed to fish, could virtually eliminate the taking of lingcod and greatly reduce the taking of rockfish. The degree to which such a move would affect the sablefish catch is more difficult to determine. Although it has been shown that it is possible to harvest sablefish with set nets at depths greater than previously thought, the ability to do so profitably over the course of a season remains unmeasured. At this stage of inquiry we know only that profitable set-net operations were conducted in the deep area of Nitinat Canyon in June and July, 1985. These operations yielded landings in which the composition of the major components was sablefish (90.3%), lingcod (1.4%), and rockfish (8.3%). By August, however, catch rates in the deep area had decreased to the point where all vessels either dropped out of the fishery or moved to shallow waters to supplement their catches with lingcod and rockfish. This raises a question as to the degree that setnetters could afford having the take of lingcod and rockfish controlled. In 1985 only four vessels

fished on through September, and all supplemented most of their catches with lingcod and rockfish.

Another concern was raised in September when there appeared to be a strong movement of sablefish into the shallow area of Nitinat Canyon. It was then that the four vessels still fishing landed a substantial portion (26.7%) of the overall sablefish catch. How much of this September catch would have been precluded by a minimum depth regulation designed to control the harvesting of lingcod and rockfish is not precisely known. Of the seven sets in the deep area in September, however, all were fairly unproductive.

The question can be similarly posed for the 1983 and 1984 set-net fisheries, when large catches of sablefish were taken in the shallow area during the summer. Whether these large catches would have been precluded by minimum depth regulation to control the harvesting of lingcod and rockfish is unknown. We do know that in 1985 the catch rates were often inversely proportional (high in the shallow area when they were low in the deep area and low in the shallow area when they were high in deep area). If this observation had held true in the summers of 1983 and 1984, it might follow that the high catch rates of sablefish in the shallow area signalled low, questionably profitable catch rates in the deep area.

Nonetheless, the potential for reducing the incidental take of lingcod and rockfish by setting minimum depth restrictions is great. In the Nitinat Canyon in 1985, for example, the elimination of fishing in the shallow area in

May-August and October would have reduced the catch of lingcod 80.6% and rockfish 54.6%. The catch of sablefish, meanwhile, would have been reduced only 8.6%.

Further, the elimination of all shallow-area fishing would have reduced the catch of lingcod 99% and rockfish 91%, while only reducing the sablefish catch 42%. It is questionable though, whether the 1985 fishery could have remained profitable with these reductions. More information is needed about the seasonable availability of sablefish in the deep area. The time of peak availability of sablefish in the shallow area appears to vary considerably from year to year. This likely occurs in the deep area as well.

ASSESSMENT OF INCREASED FISHING PRESSURE BY SET NETS

A primary objective in issuing the 1985 EFP's was to gain some insight as to the effects of increased fishing pressure in the Nitinat Canyon Area, where the number of vessels went from 3 to 10. The following topics will be developed here:

1. Certain indicators (catch rate, total catch, and average weight) suggest that sablefish in the Nitinat Canyon Area may have recently been overfished.

2. Set nets are so effective that it may be necessary to limit the number of vessels in a given area.

3. Although the number of gear conflicts between user groups increased, the increase was not as great as the increase in fishing effort.

Indicators of Stock Condition

Catch Rate

The within-season changes in catch rates for each of the three major components of the 1985 fishery have already been detailed in an earlier section. However, with an eye to assessing the effect of increased fishing pressure in a select area, it is instructive to examine catch rate on a year-to-year basis. This can be done for the shallow area of Nitinat Canyon (Table 8).

It is readily apparent from Table 8 that the catch rate for sablefish in the shallow area of Nitinat Canyon plunged precipitously--from 354.1 and 330.24 kg/100 f net in 1983 and 1984, respectively, to 66.08 in 1985. It is unlikely that inexperience by the new elements of the fishing fleet could have been much of a factor in this decline, being that 85% of the effort was by returnees from the 1984 fishery.

Catch

The catch of sablefish in the shallow area of Nitinat Canyon in 1985 (112.37 t) was less than one-third that of 1984 (368.63 t). This decrease came about despite a 34% increase in effort. The full significance of the decline is masked, however, by the existence in 1985 of the massive amount of effort expended in the deep area of Nitinat Canyon (where there was no fishing in earlier years). If, as stated by Klein (1985a), sablefish move from deeper to shallower waters during the critical summer months of the fishery, the heavy fishing in the deep area in 1985 probably would have reduced the fish available in the shallow

Table 8.--Comparison of the 1983-85 catch statistics for the set-net fishery in the shallow (90-180 f) Nitinat Canyon area[a].

Year and species (group)	Effort (100 f net)	Catch (t)	Average weight (kg)	Species composition (%)	Catch rate kg/100 f net)
1983					
Sablefish	324.00	114.70	4.68	47.9	354.01
Lingcod		55.48	5.49	23.2	171.23
Rockfish		25.59	2.94	10.7	78.98
Other species		43.50	2.10	18.2	134.26
1984					
Sablefish	1,116.26	368.63	4.36	48.2	330.24
Lingcod		129.25	5.93	16.9	115.79
Rockfish		51.09	2.43	6.7	45.77
Other species		215.19	2.36	28.2	192.78
1985					
Sablefish	1,700.50	112.37	3.97	18.1	66.08
Lingcod		237.70	5.92	38.3	139.78
Rockfish		161.32	2.81	26.0	94.86
Other species		109.09	2.37	17.6	64.15

[a]1983 effort and catch statistics pertain only to sets sampled by observers; the 1984 and 1985 effort and catch statistics are from seasonal totals determined from fishing logs and Washington Department of Fisheries landings, respectively.

area. Nonetheless, when the Nitinat Area is considered as a whole (both the shallow and deep areas), the 1985 sablefish catch is still down 25% from 1984 (270.38 t vs 368.63 t). Again, this was in the face of a three-fold increase in effort. The season-long catch rate for sablefish in the deep and shallow areas combined was only 77.7 kg/100 f.

Average Weight

As can readily be seen from the following text table (and in Figure 4), the average weight of sablefish in the shallow area of Nitinat Canyon decreased steadily as the 1985 fishing season progressed; less so in the deep area.

Average Weight (kg)

	Shallow Area	Deep Area
June	4.89	4.28
July	4.65	3.63
August	4.03	4.04
September	3.89	-
October	3.79	3.92

It is of interest that the average weight dipped to a momentary season low in the deep fishing area in July--the month when the largest catches were made there (44% of the season's deep-area landings).

The average weight of sablefish has also declined on a year-to-year basis in the shallow area of Nitinat Canyon (Table 8). From a high of 4.68 kg in 1983, average weight dropped to 4.36 in 1984 and 3.97 in 1985.

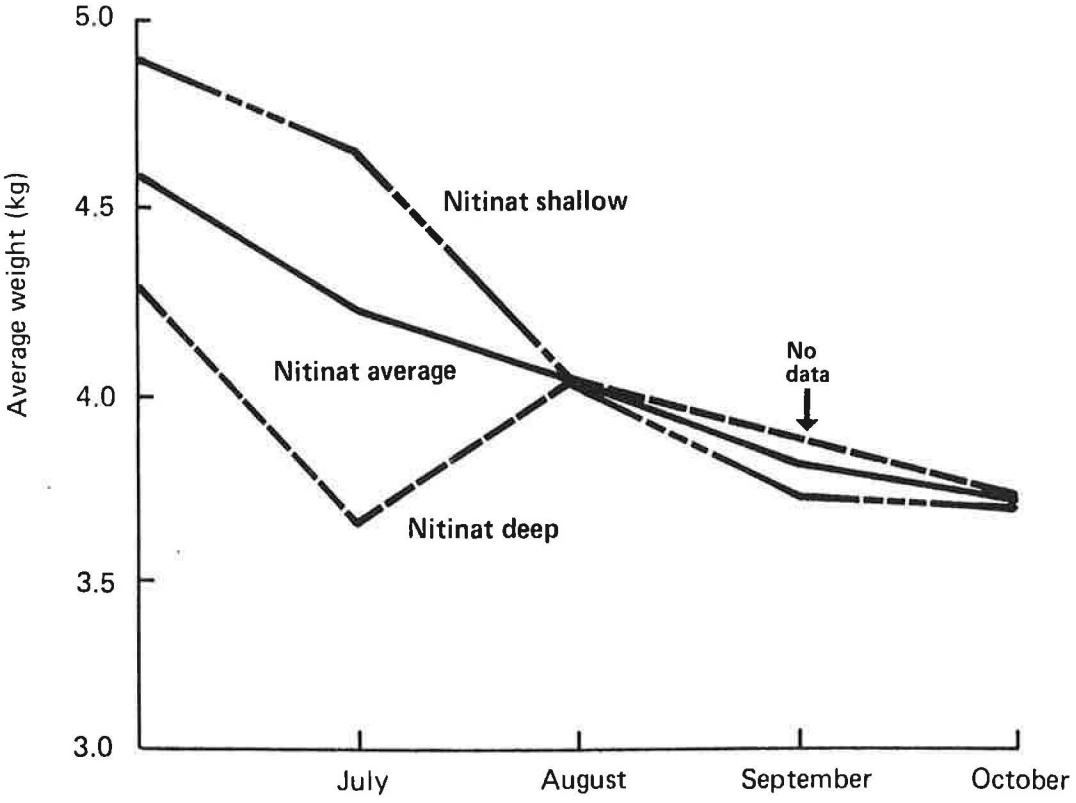

Figure 4.--Average weight of sablefish taken in the experimental set-net fishery in Nitinat Canyon in 1985, by month and depth.

Impacts of Other User Groups

The trend of the declining average weight of sablefish in the set-net fishery in the shallow area of Nitinat Canyon 1983-85, is consistent with information (on set nets and other gear types) from other sources Note, for example that in Table 9 and Figure 5 (which give size information for the Washington landings 1980-85) that for all gear types combined, fish larger than 7 lbs have declined from 57% in 1980 to 26% in 1985. At the same time, fish smaller than 5 lbs have increased from 29 to 61%.

The decrease in size was most noticeable for sablefish landed by longline--from 83% large fish in 1980 to 63% in 1984 and only 22% in 1985 (Fig. 6a). In absolute terms, the catch of large sablefish by longline decreased slightly in 1985 while the catch of small sablefish increased eight-fold. Although complete information is lacking as the present report is being prepared, it is known that effort by the longline fleet increased in 1985. It is clear that this increased effort is reaping larger harvests of small rather than large fish. Had it not been for the increased harvest of small fish, catch rates would have declined sharply. Small sablefish also made up a large proportion of the trawl and trap catches in 1985 (77 and 66%, respectively).

Francis (1985) using data from pot index surveys, still another source of data, reported that the relative abundance of medium (5-7 lb) and large sablefish has decreased off Washington and Oregon since 1980.

Because of the minimum mesh size requirement, small-grade sablefish are almost always less abundant in the set-net landings

Table 9.--Washington sablefish landings (t round weight) by gear type and size category, 1980-85. These are graded landings only (some were not graded).

Year	Size	Trawl		Trap		Longline		Set net		Total	
		t	%	t	%	t	%	t	%	t	%
1980	(S)mall	203	52	121	35	54	10	--	9	--	29
	(M)edium	49	12	99	28	37	7	--	0	--	14
	(L)arge	137	35	130	37	446	83	--	91	--	57
	Total	389	100	350	100	538	100	--	100	--	100
1981	(S)	415	74	367	30	48	10	--	3	--	36
	(M)	14	3	286	23	52	11	--	1	--	15
	(L)	133	24	589	47	356	78	--	96	--	48
	Total	562	100	1,241	100	456	100	--	100	--	100
1982	(S)	1,318	83	662	41	104	25	--	19	--	56
	(M)	156	10	356	22	85	20	--	6	--	16
	(L)	121	8	599	37	225	54	--	75	--	28
	Total	1,594	100	1,616	100	413	100	--	100	--	100
1983	(S)	987	84	532	36	58	16	48	29	1,625	51
	(M)	93	8	422	29	76	21	2	1	594	19
	(L)	99	8	518	35	221	62	116	70	954	30
	Total	1,179	100	1,472	100	355	100	166	100	3,172	100
1984	(S)	1,579	73	362	38	141	19	6	7	2,088	53
	(M)	35	2	325	34	131	18	26	29	517	13
	(L)	541	25	275	29	456	63	57	64	1,329	34
	Total	2,154	100	962	100	729	100	89	100	3,935	100
1985	(S)	577	77	536	66	1,179	61	15	5	2,307	61
	(M)	48	6	100	12	324	17	29	10	502	13
	(L)	120	16	177	22	428	22	250	85	976	26
	Total	746	100	814	100	1,931	100	294	100	3,785	100

Sources: 1980-84 (Klein 1985a), 1985 landings are from Washington Department of Fisheries fish ticket records.

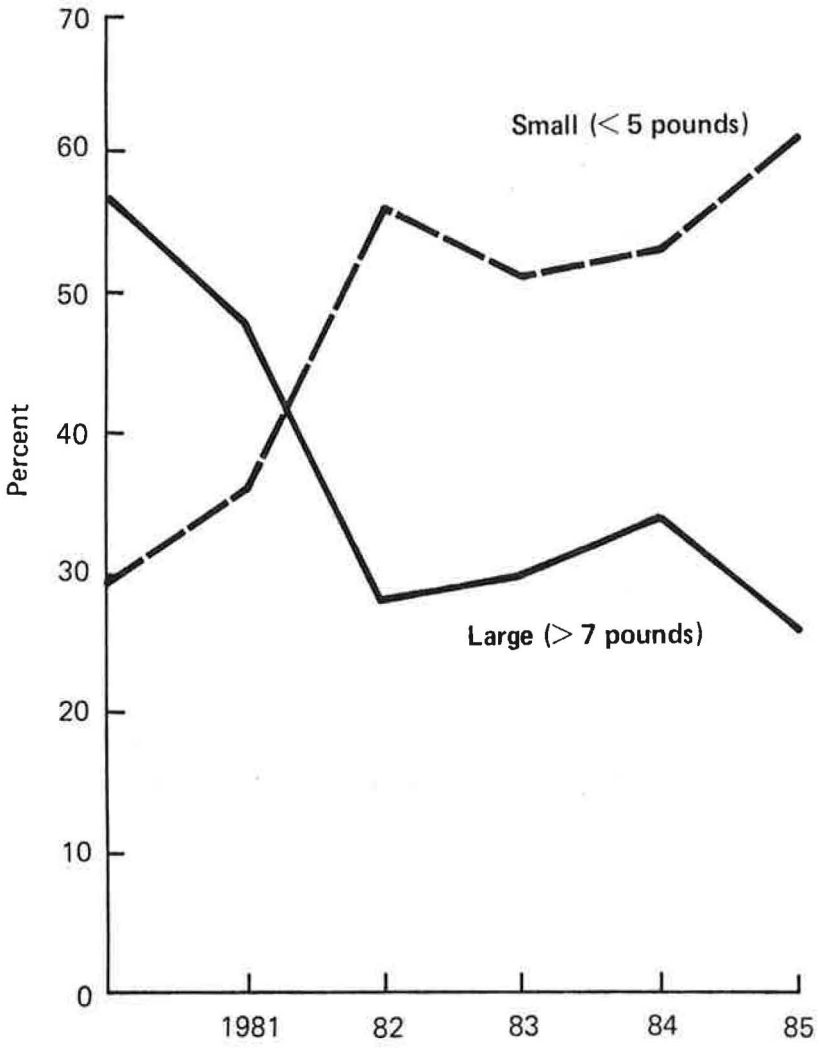

Figure 5.--The relative abundance of small-grade and large-grade sablefish taken off the Washington coast by combined gear types, 1980-85 (data from Table 9).

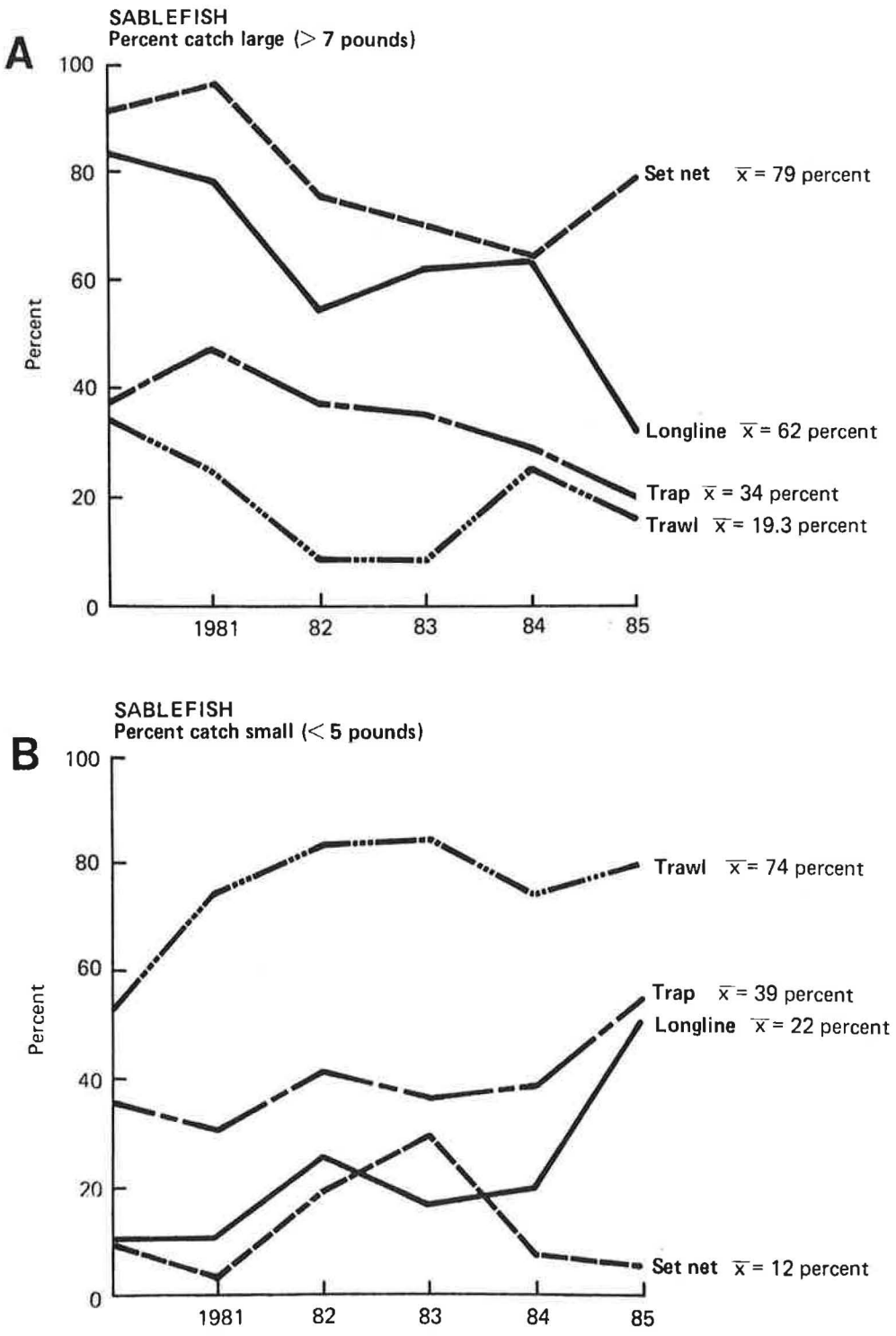

Figure 6.--The relative abundance of sablefish taken off the Washington coast, by gear type, 1980-85 (data from Table 9). 6A: Large-grade sablefish. 6B: Small-grade sablefish.

than in the landings by other types of gear. In 1985 small-grade fish made up only 5% of the set-net catch; down 2% from 1984 (Fig. 6b). Large-grade sablefish, on the other hand, increased from 64 to 85%. The other gears took an average of only 22% large-grade sablefish in 1985.

Set Nets Relative to the Overall Fishery for Sablefish

The increasing relative abundance of small-grade fish in the all-gear landings should be arrested, lest the trend lead to reduced landings in the near future. Francis (1985) asserted that if the catch of small-grade sablefish could be eliminated, the Allowable Biological Catch (ABC) could be increased by as much as 50%. Klein (1985b) determined that an increase in size at initial harvest to 60 cm (or 5.05 lbs) would not alter the yield, but would, rather, increase ex-vessel revenues by one-third. The current trend, lamentably, is in the opposite direction, with the fishery taking increasing proportions of smaller fish.

Manipulation of the minimum mesh size of set nets, or any other regulations designed to control the capture of small-grade sablefish, would drive the relative proportion of the larger categories in the all-gear catch upward thus taking some of the existing pressure off younger age groups and allow a greater entry into the spawning biomass (assuming that OY is set at an attainable level). Appendix 6 contains additional information on the matter of using mesh size as a means of altering size composition of the catch.

Vessel Limits

Fishing pressure by the setnetters was most heavily concentrated in the deep area of Nitinat Canyon in 1985. Catch rates were high early in the season, but then dropped steadily. As pointed out in earlier discussion, the lowest average weight accompanied the greatest harvest (in June). Although not definitive, the aforementioned features at least suggest that fishing levels were at or beyond the optimum level in the deep area of Nitinat Canyon in 1985. Further inquiry might be directed at comparing the size composition of longliners operating near to the intense set-net fishery with that of distant longliners.

Finally, should the experimental fishery continue, there should be a renewed effort to distribute the vessels more evenly over the range of the population.

Gear Conflicts

One of the major concerns about increasing use of set nets is the potential for conflict and mishap that might result in lost gear that would function as ghost-fishing gear. (Ghost fishing is the phenomenon wherein unattended gear continues to fish.) And while the heavy saturation of fishing effort (number of vessels) in Nitinat Canyon was expected to bring about increased conflict and loss, the actual increase was actually less than the increase in effort itself. Further, the problems that did occur tended to be brought about by lack of setnetting experience rather than by the increased number of vessels.

Early in the 1985 season there were numerous minor incidents among the setnetters themselves--tangled buoy lines, gear malfunctions, anchors being caught in one's own nets, vessels running over floating buoy lines, etc. There was no effort to estimate the exact number of these events, but their occurrence did diminish as the season progressed and the new participants perfected their operating procedures. Experienced setnetters caused few problems.

In addition to the internal (between setnetter) encounters, there were six conflicts between setnetters and other types of gear--three with trawlers, two with longliners, and one with a trap vessel. All of the gear is believed to have been recovered in each instance. There was one additional report of a set net possibly being lost to a trawler, but this is unsubstantiated.

The six (or seven) conflicts mentioned above represent a slight increase over the 5 incidents recorded during the combined 1983-84 seasons--insignificant by any standards, particularly in view of the several-fold increase in the number of vessels. However, a factor which may have reduced the rate of gear conflict in 1985 was the large amount of effort deployed at depths greater than those previously fished. Most effort by the various types of mobile gear, bottom trawlers in particular, is concentrated inshore from the area where setnetters are allowed to fish. It follows that the chance of gear conflict would be greatest in the shallow area. It should also be noted that most shallow sets were in a portion of Nitinat Canyon normally avoided by trawlers because of rough terrain.

Because further increases in effort by setnetters might (to avoid overcrowding) be outside that narrow area of Nitinat Canyon and in areas more likely to be worked by trawlers, chances of gear conflict might increase accordingly. Overall, the number of conflicts between setnetters and other types of gear has been minimal over the 3-year life of the experimental fishery.

Lost Nets

In past years, no nets were permanently lost (except when one of the vessels sank in 1984). In 1985, one net was permanently lost and a second net and part of a third were temporarily lost. Twice, large sections of leadline and web were left on the bottom. In another instance, two shackles of net were washed overboard in rough seas. Only one of these events was believed to be related to a gear conflict.

While the danger of net loss stemming from a gear conflict does not appear to be serious, the danger of net loss stemming from user carelessness and inexperience may be greater. Consider, for example that there was but a single loss of gear (albeit a temporary loss) at the hands of an experienced setnetter in 1985, and this was attributable to a malfunction. Any expansion of the experimental fishery should give some weight to experience in the selection process--especially experience with fixed gear.

The requirement that EFP vessels remain on the grounds when fishing also may have helped limit net loss. Some operators fishing south of Nitinat Canyon voiced the desire to return to port after setting, and then return to the grounds the following day to pick up the nets. This was not permitted. For an example

of what might have happened had the request been granted, consider the problems that developed on the three occasions when vessels necessarily returned to port without retrieving their nets--twice because of gear malfunction and once because of rough seas. The temporarily abandoned nets, when they were finally retrieved (a few days to a month later), contained fish of unsalable quality.

It seems likely, therefore, that if setnetters were not required to stay on the grounds while the gear was fishing, that the rate of net loss would increase. Requiring the operators to stay on the grounds while the gear is fishing, encourages them to set only when they expect that the weather will be suitable for them to stay on the grounds and retrieve the nets.

It is difficult to assess time required for biodegradable net to deteriorate to the point where a lost net is rendered inoperable. The 1985 season, however, provided some pertinent information. It was obvious, for example, that the strength of the biodegradable twine deteriorates rapidly. New nets which were fished but not properly maintained (rehung on a regular basis with the twine being repaired or replaced), deteriorated to the unfishable state after a few short months. One newly constructed net, fished only once and then relinquished by an operator who dropped out of the fishery, was used again 6 weeks later by a second operator. The net, although still appearing to be like new, came apart when the twine disintegrated. The entire net had to be rehung with new twine before it could be fished again. This suggests that the use of biodegradable twine greatly reduces the impact of ghost fishing by lost nets.

A more complete summary of the gear conflicts and net losses is given in Appendix 7.

THE SOUTHERN AREA

The 1985 set-net season did not provide the hoped-for information from the Southern Area. There were only 45 sets south of 47°30' N. lat. (the INPFC Columbia Area); 12 off Oregon. Most sets were early in the season, more to test the gear and fulfill the permit requirements than to actually catch fish. To date, therefore, there continues to have been no serious and sustained effort to fish set nets south of 47°30' N. lat.

Such as they were, however, the catch rates of lingcod and rockfish in the Southern Area may be deceptively low. The permitholders operating there made an obvious effort to avoid these species--they would move rather than set whenever signals on their fishfinders would indicate the presence of large quantities. Lingcod and rockfish appeared to be readily available in the Southern Area. Catches would have been higher had fishermen opted to fish for them.

Holders of the southern permits did not fish in September, thus it cannot be determined whether there was a late season surge in the abundance of sablefish in the southern shallow area, such as there had been in the shallow area of Nitinat Canyon.

It may be of some interest to note that the highest catch rates for sablefish in the southern deep area was in June, the same as in the deep area of Nitinat Canyon. The reliability of the southern data is questionable, however, because they were

derived from just 12 samples. Clearly, more information is needed.

EX-VESSEL PRICE OF SABLEFISH BY GEAR TYPE

This section examines the ex-vessel price of sablefish commanded by the various types of fishing gear, paying particular attention to set nets. A discussion of the factors that influence the overall price is also included. Finally, domestic and export market trends will be discussed, but only in the scope of Washington State being that all set-net deliveries were there in 1985.

Increased demand by the Japanese sablefish market created export opportunities for Washington fish distributors in 1985. As a result, most of the 1985 catch was dressed Japanese style (J-cut) whereas most of the 1984 catch was western dressed for domestic sale. The changing market not only affected the manner in which the fish were dressed, but for some types of gear at least, the percentage of the catch that was dressed. This, in turn, stemmed from the higher price offered for the Japanese-bound product.

Traditionally, longliners have been the only vessels fishing in waters off Washington that have delivered most of their sablefish dressed. In 1984, for example, longliners delivered 81% dressed; trap fishermen, trawlers, and setnetters less than 6% each (Klein 1985a). Longliners and trawlers maintained about the same proportion of dressed deliveries in 1985 (79 and 6%, respectively) but the setnetters increased their proportion to 49% and the trap fishermen to 38%. The latter groups were

motivated by the higher prices, and they (setnetters) also had more time available for dressing fish inasmuch as the catches of sablefish were smaller.

The average ex-vessel prices received for sablefish in Washington State in 1985 are given below by grade (size) and gear type. Dressed landings were converted to round weights before the averages were computed. (Data are from WDF fish ticket records.)

Grade	Longline	Set Net	Trap	Trawl
Large (>7 lb)	$0.68	0.59	0.72	0.35
Medium (5-7 lb)	0.60	0.50	0.42	0.26
Small (<5 lb)	0.54	0.53	0.49	0.25
Weighted Average	0.58	0.58	0.53	0.25

While the ex-vessel price for the large and medium categories averaged almost $0.10 higher for longliners than setnetters, both groups averaged $0.58 overall. This overall similarity came about because 85% of the set-net catch was graded into the higher priced large category and 61% of the longline catch was graded into the lower priced small category.

Note that medium-sized sablefish delivered by setnetters brought a lower price than small-sized fish. This is because an unusually high proportion of the medium fish were downgraded and sold at a lower price. Fish are normally downgraded because they are of poor quality--usually the result of poor handling or

heavy sandflea damage. Why the medium-sized sablefish were disproportionately downgraded is unknown.

The overall average price commanded by trap-caught sablefish ($0.53) was slightly lower than the price brought by longline and set-net fish (each $0.58), but much higher than the price earned by sablefish taken in trawls ($0.25).

The manner in which the fish are dressed and the location where they are sold appear to affect price more than gear type. Buyers on the coast, for example, offer one price for similarly dressed longline and set-net fish. The same product would draw $0.10 to $0.25 more in Seattle. Because a substantial proportion of longline sablefish were sold in the Seattle area and most set-net fish on the coast, the higher average price reported for longline fish (particularly the large and medium categories) is an artifact of delivery location. Further, the costs associated with delivering in the Seattle area are not taken into account.

In 1985, the highest prices were offered by a Seattle firm that dealt only with longliners. Their prices for J-cut sablefish are shown in column "A" in the following table:

Price per pound of J-cut sablefish

Size	"A" Longline caught/ Seattle exporter	"B" Set net caught/ Seattle (fresh)	"C" All gears/ Coast
>7 lb	$1.35	1.25	1.16
5-7	1.25	1.15	0.91
4-5	1.15	1.10	0.81
3-4	1.10	1.05	0.81
2-3	1.10	1.10	0.81
<2	0.85	0.95	0.81

A few vessels delivered frozen J-cut sablefish to the Seattle exporter (in contrast to the conventional ice-stored fish), receiving as much as $1.50 or even $1.70 per pound for the large fish.

The prices in column "B" were received by a setnetter who trucked his fish to Seattle to take advantage of the higher prices offered on the local fresh fish market. Typical prices offered on the coast are in column "C".

Some coastal buyers preferred to move fish to fresh markets rather than sell to Japan--particularly when small quantities of fish were involved. Western-dressed sablefish sold to these local markets brought the buyers the best returns although the markets were of limited capacity and easily became saturated. Excess fish would be shipped to other domestic markets, usually to be smoked. Longline, trawl, and set-net fish were often mixed in these transactions, as the market value was determined by size and not gear type.

Other coastal buyers, who dealt with both longliners and setnetters, preferred set-net fish when they were available--mainly because the fish were larger. One buyer alleged that, because he could not tell a longline fish from a set-net fish, he mixed the larger set-net fish in with the longline fish when selling to Japan. This allowed him to meet the demand for the larger, J-cut fish. The year before [according to Korson (1985)] Japanese buyers had been unable to find sufficient quantities of the larger, J-cut fish on the West Coast.

Complicating these economic analyses was a flexible brokerage system of marketing that was employed by some buyers. These dealers would buy the catch from the fishermen at a guaranteed minimum price, which was recorded on the WDF fish ticket. The price ultimately paid to the fishermen might be much higher than the price shown on the fish ticket--depending on the quality of the fish and the going rate at the time of sale. This practice tended to hold the recorded averages below the real averages.

CONCLUSIONS

From the the material presented in the preceding sections, and the accompanying discussion, the following conclusions emerge from the 1985 experimental set-net fishery:

1. Decreases in the size and catch rate of sablefish off the Washington coast (particularly in Nitinat Canyon), indicate that the resource has recently been overfished. Changes in harvesting procedures (like the deployment of set nets with a minimum mesh size) would reduce the take of small fish and pave the way for increasing the spawning biomass.

2. The efficiency with which set nets harvest sablefish is high. This may limit the number of set-net vessels that can be allowed in a prescribed area. Were the set-net fishery to expand in the future, it should be in less heavily exploited areas in order to reduce the risk of overfishing.

3. The incidental catch of lingcod and rockfish can be controlled by the implementation of a minimum depth restriction.

A minimum depth must be chosen, however, that does not foreclose access to the bulk of the sablefish resource. More information on the distribution of sablefish by depth through the season would be useful.

4. The frequency and consequences of gear conflicts between setnetters and other user groups have been minimal over the course of the experimental fishery. Gear conflict did not increase in 1985 in proportion to the increase in vessels. Because inexperience with the set-net operation contributes to gear conflict, this could be made a criterion for granting future admission to the fishery.

5. The incidence of salmon and halibut in set nets has remained low throughout the experimental set-net fishery--at least in the times,areas and depths fished. The incidence of halibut decreases sharply with depth.

6. As yet there have been no sustained efforts to fish with set nets south of 47°30' N. lat. More information is needed from this area.

ACKNOWLEDGEMENTS

Special thanks are expressed to Joe Scordino, Bob Ayers, and Harvey Hutchings of the Northwest Regional Office of the National Marine Fisheries Service, all of whom were helpful and supportive throughout the study. Scordino, particularly, provided advice, criticism, and encouragement on a regular basis.

Thanks go as well to Al Millikan and Mel Stanley of the Washington Department of Fisheries for their prompt and accurate

response to requests for information, and to Gary Stauffer and Steve Klein of the Northwest and Alaska Fisheries Center for their extensive contributions to the broad, 3-year study.

Nor can I overlook the cooperation of the many vessel owners, skippers, and crewmen. Further, observers Skip Gish, Jeff Gould, and Rex Long deserve recognition for their long hours of toil and their diligence in collecting data.

Dick Major of the Northwest and Alaska Fisheries Center made a significant contribution to this paper. His editorial review and assistance in preparing the paper for printing went far beyond normal expectations.

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APPENDIX 1

Terms and conditions of the EFP's.

Pacific Coast Groundfish Fishery
Experimental Fishing Permit
Terms and Conditions

South of 48° N. Latitude

(a) Permit Holder.

(b) Permitted Vessel.

(c) Scope. This permit authorizes, for limited experimental purposes, the direct and incidental harvest of groundfish with set nets north of 38°00' N. latitude, an activity which would otherwise be prohibited by 50 CFR 663.26(c). All other provisions of 50 CFR Part 663, including prohibited species provisions and size, catch, and landing limits specified by or pursuant to 50 CFR Part 663, apply to fishing conducted under this permit.

(d) Season.

1. Fishing under this permit is authorized from May 1 to December 31, 1985 or until the coastwide sablefish OY (quota) or the quota for this area is taken.

2. Every permittee is required to make at least one trip, consisting of at least two overnight sets, each calendar month that fishing is permitted.

(e) Area.

1. The permittee may fish all areas in the FCZ from 38° N. latitude north to 48° N. latitude and north of 48° N. latitude in waters deeper than 180 fathoms. No sets may be made in water shallower than 90 fathoms.

2. Contingent upon prior written approval from NMFS, the permittee may also fish in waters shallower than 180 fathoms north of 48° N. latitude. The permittee must request (in writing) permission to do so for consideration by NMFS. NMFS will consider the activities of other permittees and the availability of observers in deciding whether such approval is warranted.

(f) Catch Quota. The catch for all permitted vessels south of 48° N. latitude will be limited to 1,350 tons of groundfish, made up of 750 tons of sablefish, 400 tons of ling cod and 200 tons of the various rockfish species. When the quota for any one of these three species or group is taken, fishing with set nets in this area must cease for all permitted vessels.

(g) Set Net Restrictions.

1. Length. No more than 1600 fathoms (9600 feet) of net may be fished simultaneously.

2. Marking. Set nets must be marked at the surface at each terminal end with a pole and flag, light, radar reflector, and a buoy displaying clear identification of the permit holder. Each commercial set net also must be marked with a unique number (the net number) that distinguishes it from the other commercial set nets fished under this permit.

3. Test shackle. Permit holders must have one shackle of test webbing in one of the nets fished during each set. The test webbing shall be of the same material and specifications as the commercial webbing except for the mesh size.

4. Net specifications.

   (i) Mesh size. Mesh size is measured from the inside of one knot to the inside of the opposing knot, stretched, when wet.
      a. Commercial shackles - minimum mesh size is $5\ ^{7}/_{8}$ inches
      b. Test Shackle - maximum mesh size is $5\ ^{1}/_{4}$ inches.

   (ii) Height. Each shackle must measure no more than 25 meshes from the cork line to the leadline, or equivalent maximum height if larger mesh is used.

   (iii) Shackles. All shackles shall be the same length including the test shackle.

   (iv) Biodegradable twine. Untreated cotton twine no thicker than No. 36 thread must connect the webbing to the cork line, to minimize fishing if the net is lost.

   (v) Hanging coefficient. All set nets fished during a single trip must have the same hanging coefficient (length of cork line to length of stretched webbing), mesh size, length (within 10 fathoms), height and rigging.

   (vi) Buoy lines. Buoy lines must be at least 1/2-inch diameter line.

5. Recovery Gear. A grappling hook or other method to recover set nets must be available and operable on board the permitted vessel.

6. Tending Gear. The fishing vessel must remain with the gear at all times during a set. All set nets must be removed from the fishing grounds prior to the end of each fishing trip conducted under this permit. If conditions are such that retrieval of a set net would create an imminent risk to life or property, retrieval must be completed as soon a practicable after the risk has ended.

7. Test shackle fishing. The test shackle must be fished simultaneously with and next to the commercial shackles on each set unless conditions beyond the permit holder's control preclude such use.

   (i) The test shackle must be attached to one end of the string of commercial shackles.

   (ii) The location of the test shackle must be alternated with the location of commercial shackles so that the test shackle is fished 50% of the time at the shallower end of the net each month.

(h) Reporting Requirements. The "Fixed Gear Trip Log - Set Net" and "Set Net Description Log" are attached hereto and incorporated herein. These logs are not subject to the requirements of 44 U.S.C. 3507. The permit holder shall accurately record the information required in each log within 24 hours of each event required to be recorded. In the "Fixed Gear Trip Log - Set Net," enter data for the test net's shackles separately; write "T" (for the test shackle) in the net number column and "C" (for the commercial shackle) on the following line. The following additional information shall be recorded in the "Comments" section of this log or on an attached page as necessary:

1. Report of fish on board when entering fishery. Record (if applicable) before each set made under this permit, the species and amounts (in round weight) of fish on board not taken under this permit and not previously recorded in this log. Any fish on board not so recorded will be presumed to have been taken and retained in violation of this permit.

2. Report of birds or marine mammals. Record the species, number, and disposition of any birds or marine mammals taken in the course of fishing conducted under this permit. NOTE: Taking of marine mammals in the course of commercial fishing operations is prohibited except as conducted under a Certificate-of-Inclusion issued by NMFS, Northwest Regional Office and compliance with Federal regulations at 50 CFR 216.24.

3. Other reports. The date, time, and location of the following:

   (i) Gear conflicts with a domestic or foreign vessel (Gear conflict means any incident at sea involving one or more vessels, in which one vessel or the gear of a fishing vessel comes in contact with any other vessel or the gear of another fishing vessel, and which results in the loss of, or damage to, a fishing vessel, fishing gear, or catch.)

   (ii) Last sighting of any fishing gear in use under this permit that has been irretrievably lost, with a description of efforts to retrieve.

4. Submission. Pages of the logbook may be removed at any time by an authorized officer or observer. Pages not so removed must be submitted to the Director (Northwest Region, National Marine Fisheries Service, 7600 Sand Point Way N.E. BIN C15700, Seattle, Washington 98115) in person or by mail within 5 days of the end of each fishing trip.

5. Public Release of Information. The fishing activities carried out under this permit which are otherwise prohibited, are primarily for the purpose of collecting information upon which to base an assessment of the acceptability of this type of fishing gear. The permit holder agrees to the public release of any and all information submitted by the permit holder and information collected by the observers. Such data will be aggregated so as to conceal the identity of the permit holder whenever possible if in so doing the data does not lose its value for purposes of the assessment.

(i) Observer.

1. For the purposes of collecting scientific data and carrying out his other management and compliance responsibilities, the Regional Director may assign an observer to the permitted vessel or arrange for sampling when the vessel returns to port. The permit holder shall:

(i) Notify Joe Scordino, Fisheries Management Division, Northwest Regional Office, National Marine Fisheries Service, 7600 Sand Point Way N.E., Seattle, Washington 98115, phone 206-526-6140, a minimum of 48 hours in advance of the permitted vessel's departure on a fishing trip conducted under this permit, to allow for assignment and placement of an observer aboard the permitted vessel;

(ii) Provide, at no cost to the observer or the United States, board and living accommodations for the observer aboard the vessel which are equivalent to those provided to the officers of the permitted vessel;

(iii) Cause the permitted vessel to proceed to such places and at such times as may be directed by the Regional Director, Northwest Region, National Marine Fisheries Service, for the purpose of embarking and debarking the observer;

(iv) Allow the observer access to and use of the permitted vessel's navigation equipment and personnel as necessary to determine the vessel's position;

(v) Allow the observer to use the permitted vessel's communications equipment and personnel as necessary for the transmission and receipt of messages;

(vi) Provide all other reasonable assistance necessary to accomplish the observer's duties.

(vii) Notify Joe Scordino, Fisheries Management Division, NMFS, telephone 206-526-6140, immediately upon the vessel's return to port, advising where and when unloading will take place.

2. The permit holder shall provide safe working conditions and accommodations for the observer. The permit holder, his agents and employees, including the master and crew of the permitted vessel, shall not harass, assault, oppose, impede, intimidate, or interfere with the observer.

(j) Inspection. The permit holder must notify Wayne Lewis, Special Agent in Charge, Northwest Region, National Marine Fisheries Service, 7600 Sand Point Way N.E., Seattle, Washington 98115, phone 206-526-6133, at least 72 hours in advance of the permitted vessel's departure on its first fishing trip under this permit, to allow for inspection of the set nets and vessel by an authorized NMFS agent.

(k) Sanctions. Violation of the terms and conditions of this permit, a notice issued under subpart B of 50 CFR 663, any other applicable provision of 50 CFR Part 663, the Magnuson Act (MFCMA), or any other regulations promulgated thereunder, shall be grounds for revocation, suspension, or modification of this permit as well as civil or criminal penalties under the MFCMA.

Appendix 1.--Continued.

The terms and conditions for northern permits were identical to those for southern permits (described on the preceding pages) except for condition "e". Condition "e" read as follows for the northern permits:

(e) Area

1. The area to be fished under this permit lies north of 48° N. latitude and south of the Canadian border. Sets may not be made in waters shallower than 90 fathoms.

2. Contingent upon prior written approval of NMFS, the permittee may also fish south of 48° N. latitude. The permittee must request (in writing) permission to change area for consideration by NMFS. NMFS will take into consideration the activities of other permittees and the availability of observers in deciding whether such approval is warranted.

APPENDIX 2

Fleet compositon and vessel specifications.

Appendix table 2.1--Specifications of the vessels that participated in the 1985 experimental set-net fishery.

Vessel name	Length (meters)	Gross metric tons
Northern Permits		
Avenger	14.3	38.0
Contender	16.5	27.2
Cypress	19.8	39.9
Deborah Ann	14.3	29.9
Scandia/Julia Breeze[1/]	14.5/16.2	30.8/52.6
Sea Angel	14.3	22.7
Zarana	16.5	45.4
Southern Permits		
Aleutian Dream	17.7	70.7
Collier Bros.	23.8	140.6
Crystal Marie	14.3	39.0
Patty J./Pioneer[1/]	15.1/15.8	41.7/40.8
Tresea Dee	12.8	12.7

[1/] The Julia Breeze replaced the Scandia in mid-season; the Pioneer replaced the Patty J. in midseason.

APPENDIX 3

Fishing effort and observer coverage

Season

The NMFS objective to monitor at least 25% of the sets was achieved. Of 1,019 sets, 311 (30.5%) were monitored (Appendix Table 3.1). Observers monitored 225 of 763 sets by vessels with northern permits (29.5%); 86 of 256 sets by vessels with southern permits (33.6%). Holders of northern permits averaged 109 sets for the season; holders of southern permits 51.

Within season (areas and depths combined)

The distribution of the sets over time indicates that effort by vessels with northern permits increased sharply--from 41 sets in May to 244 and 249 in July and August, respectively, before dropping sharply to 32 in October. Effort by vessels with southern permits peaked earlier--increasing from 14 in May to 89 in June--then decreasing thereafter.

Observer coverage varied by month, ranging from 12.7% in May (when there were only 55 sets) to 51.2% in September (when there were 121 sets). The desired percentage coverage was achieved during the months of heaviest fishing--79 of 323 sets in July (24.5%) and 86 of 313 sets in August (27.5%). Coverage varied more widely over time, when considered by permit type, but was usually near the 25% goal during the months of heaviest fishing. On a vessel trip basis, observers sampled 35.3% of all trips; 35.2% of the trips by vessels with northern permits, and 35.6% of the trips by vessels with southern permits.

Appendix table 3.1.--Observer coverage of the 1985 experimental set-net fishery, by permit group and month.

Permit group/ month	Trips started	Trips observed	Vessel days	Avg. days per trip	Sets	Sets observed	% sets observed
Northern permits	91	32	266	2.92	763	225	29.5
May	9	1	20	2.22	41	7	17.1
June	14	4	32	2.29	76	31	40.8
July	24	8	86	3.58	244	52	21.3
Aug	21	7	72	3.43	249	56	22.3
Sept	17	9	44	2.59	121	62	51.2
Oct	6	3	12	2.00	32	17	53.1
Southern permits	45	16	106	2.36	256	86	33.6
May	8	-	15	1.88	14	-	0.0
June	15	5	35	2.33	89	26	29.2
July	12	6	32	2.67	79	27	34.2
Aug	7	4	20	2.86	64	30	46.9
Sept	-	-	-	-	-	-	-
Oct	3	1	4	1.33	10	3	30.0
All permits	136	48	372	2.74	1019	311	30.5
May	17	1	35	2.06	55	7	12.7
June	29	9	67	2.31	165	57	34.5
July	36	14	118	3.28	323	79	24.5
Aug	28	11	92	3.28	313	86	27.5
Sept	17	9	44	2.56	121	62	51.2
Oct	9	4	16	1.78	42	20	47.6

By area and depth

The Nitinat Canyon was by far the most heavily fished area, with 91.1% of the sets having been made there. Northern permitholders deployed 98.0% of their effort in Nitinat Canyon; southern permitholders 70.3% (Appendix Table 3.2). Of 928 sets in the Nitinat Canyon, 526 (56.7%) were in the deep area.

Of the remaining areas, Juan de Fuca Canyon received 4.5% of the fishing effort, Grays Canyon 2.9%, and Astoria Canyon and areas south 1.5%.

Observer coverage varied by depth within the critical Nitinat Canyon area, with 37.3% of the sets in the shallow area being covered, 23.6% in the deep area. Moreover, coverage varied by permit type within the Nitinat deep area, with 20.2% of the sets by northern permitholders being monitored and 30% of the sets by southern permitholders.

Appendix table 3.2.--Observer coverage of the 1985 experimental set-net fishery, by permit group, area, and depth.

Permit group/ area/depth	Sets	Sets observed	% sets observed	% effort in permit area
All permits	1,019	311	30.5	
Shallow	438	168	38.4	43.0
Deep	581	143	24.6	57.0
North of 47°30'N lat.	974	296	30.4	95.6
Shallow	418	156	37.3	41.0
Deep	556	140	25.2	54.6
Nitinat Canyon	928	274	29.5	91.1
Shallow	402	150	37.3	39.5
Deep	526	124	23.6	51.6
Juan de Fuca Canyon	46	22	47.8	4.5
Shallow	16	6	37.5	1.6
Deep	30	16	53.3	2.9
South of 47°30'N lat.	45	15	33.3	4.4
Shallow	20	12	60.0	2.0
Deep	25	3	12.0	2.5
Grays Canyon	30	7	23.3	2.9
Shallow	7	6	85.7	0.7
Deep	23	1	4.3	2.3
Astoria Canyon and south	15	8	53.3	1.5
Shallow	13	6	46.2	1.3
Deep	2	2	100.0	0.2
Northern permits	763	225	29.5	
Shallow	414	155	37.4	54.3
Deep	349	70	20.1	45.7
Nitinat Canyon	748	220	29.4	98.0
Shallow	402	150	37.3	52.7
Deep	346	70	20.2	45.3
Juan de Fuca Canyon	15	5	33.3	2.0
Shallow	12	5	41.7	1.6
Deep	3	0	0.0	0.4
Southern permits	256	86	33.6	
Shallow	24	13	54.2	9.4
Deep	232	73	31.5	90.6
Nitinat Canyon (deep only)	180	54	30.0	70.3
Juan de Fuca Canyon	31	17	54.8	12.1
Shallow	4	1	25.0	1.6
Deep	27	16	59.3	10.5
Grays Canyon	30	7	23.3	11.7
Shallow	7	6	85.7	2.7
Deep	23	1	4.3	9.0
Astoria Canyon and south	15	8	53.3	5.9
Shallow	13	6	46.2	5.1
Deep	2	2	100.0	0.8

APPENDIX 4

Marine mammal observations

Several species of marine mammals were observed near the set nets: Pacific white-side dolphins (Lagenorhynchus obliquidens), Dall's porpoises (Phocoenoides dalli), gray whales (Eschrichtius robustus), killer whales (Orcinus orca), California sea lions (Zalophus californianus), and Stellar's sea lions (Eumetopias jubatus).

Pacific white-sided dolphins were observed swimming near vessels on several occasions as gear was being retrieved. This activity was without incident. On three occasions, California sea lions were seen swimming around nets that were being retrieved, and eating fish (that presumably were from the net). Again, there were no incidents stemming from these encounters.

One large Stellar's sea lion became entangled and died during a set in the Grays Canyon Area. The set extended over bottom depths 94-130 f. The dead sea lion was discovered when the net was retrieved. This is the only incident recorded during the 3-year duration of the set-net fishery.

APPENDIX 5

Catch statistics from the 1985 experimental set-net fishery, by area, depth, and species

Appendix table 5.1.--Estimated catch in the 1985 experimental set-net fishery in the Nitinat Canyon Area, by depth and species.

	Shallow				Deep			
Species	Catch (kg)	Avg. weight (kg)	% of total catch	Catch rate (kg/100f net)	Catch (kg)	Avg. weight (kg)	% of total catch	Catch rate (kg/100f net)
Sablefish	112,367.6	3.97	18.11	66.08	158,011.3	4.00	70.89	88.81
Lingcod	237,703.0	5.92	38.31	139.78	2,146.6	5.63	0.96	1.21
Rockfish	161,317.0	-	26.00	94.87	16,816.7	-	7.55	9.45
Silvergray	43,001.6	2.49	6.93	25.29	-	-	-	-
Canary	33,806.6	2.20	5.45	19.88	-	-	-	-
Bocaccio	72,825.2	4.51	11.74	42.83	49.2	4.67	0.02	0.03
P.O.P.	3,925.9	1.29	0.63	2.31	773.2	1.00	0.35	0.43
Redbanded	1,862.5	1.62	0.30	1.10	269.7	1.54	0.12	0.15
Darkblotched	63.4	0.67	0.01	0.04	83.6	1.59	0.04	0.05
Shortraker	253.8	3.90	0.04	0.15	8,639.5	3.36	3.88	4.86
Rougheye	425.1	2.03	0.07	0.25	5,538.8	1.90	2.49	3.11
Yellowtail	2,331.7	1.84	0.38	1.37	-	-	-	-
Widow	1,870.4	1.73	0.30	1.10	24.6	1.75	0.01	0.01
Sharpchin	71.1	0.69	0.01	0.04	-	-	-	-
Yelloweye	219.8	2.28	0.04	0.13	960.8	2.14	0.43	0.54
Splitnose	163.6	0.97	0.03	0.10	158.4	0.88	0.07	0.09
Rosethorn	1.2	0.17	Tr	Tr	4.9	0.47	Tr	Tr
Redstripe	73.3	0.71	0.01	0.04	20.4	0.97	0.01	0.01
Yellowmouth	22.9	2.38	Tr	0.01	-	-	-	-
Greenstriped	278.1	0.26	0.04	0.16	-	-	-	-
Black	4.6	1.90	Tr	Tr	-	-	-	-
Shortspine thornyhead	116.2	0.98	0.02	0.07	293.6	1.27	0.13	0.17
Flatfish	75,116.9	-	12.11	44.17	44,919.4	-	20.15	25.24
Arrowtooth flounder	74,863.4	2.56	12.07	44.02	44,581.4	2.44	20.00	25.06
Dover sole	155.9	0.76	0.03	0.09	269.8	0.78	0.12	0.15
Rex sole	8.3	0.78	Tr	Tr	6.5	0.53	Tr	Tr
Petrale sole	79.6	1.10	0.01	0.05	61.1	1.69	0.03	0.03
English sole	9.7	0.33	Tr	0.01	-	-	-	-
Other species	33,972.9	-	5.48	19.98	992.8	-	0.45	0.55
Pacific hake	888.7	1.45	0.14	0.52	35.7	1.10	0.02	0.02
Pacific cod	571.2	2.54	0.09	0.34	-	-	-	-
Spiny dogfish	24,920.0	2.14	4.02	14.66	321.7	2.20	0.14	0.18
Ratfish	2,164.3	0.69	0.35	1.27	15.0	1.23	0.01	0.01
Skate (unident.)	858.2	7.12	0.14	0.50	326.2	5.03	0.15	0.18
Pacific halibut	4,319.3	6.73	0.70	2.54	249.1	11.52	0.11	0.14
Soupfin shark	247.3	18.46	0.04	0.15	-	-	-	-
Herring	3.0	0.14	Tr	Tr	-	-	-	-
Rattail	-	-	-	-	39.8	1.40	0.02	0.02
Hagfish	-	-	-	-	5.3	0.26	Tr	Tr
Total targetted species (sablefish, lingcod, rockfish)	511,387.6	-	82.42	300.73	176,974.6	-	79.40	99.47
Total non-targetted (flatfish & other species)	109,089.8	-	17.58	64.15	45,912.2	-	20.60	25.80
Total all species	620,477.4	-	-	364.88	222,886.8	-	-	125.27

Appendix table 5.2.--Estimated catch in the 1985 experimental set-net fishery in the Juan de Fuca Canyon Area, by depth and species.

	Shallow				Deep			
Species	Catch (kg)	Avg. weight (kg)	% of total catch	Catch rate (kg/100f net)	Catch (kg)	Avg. weight (kg)	% of total catch	Catch rate (kg/100f net)
Sablefish	978.8	3.81	30.52	20.23	4,327.8	3.29	85.04	56.94
Lingcod	744.7	5.63	23.22	15.39	-	-	-	-
Rockfish	774.6	-	24.15	16.00	562.9	-	11.07	7.41
Silvergray	399.0	2.36	12.44	8.25	-	-	-	-
Canary	60.4	2.29	1.88	1.25	-	-	-	-
Bocaccio	122.4	3.48	3.82	2.53	-	-	-	-
P.O.P.	22.4	1.46	0.70	0.46	9.6	0.90	0.19	0.13
Redbanded	134.9	2.05	4.21	2.79	8.5	0.80	0.17	0.11
Darkblotched	14.1	1.28	0.44	0.29	18.1	1.70	0.36	0.24
Shortraker	-	-	-	-	109.8	3.43	2.16	1.44
Rougheye	-	-	-	-	265.5	1.66	5.22	3.49
Yelloweye	-	-	-	-	81.0	1.90	1.59	1.07
Splitnose	5.5	0.83	0.17	0.11	-	-	-	-
Rosethorn	0.7	0.30	0.02	0.01	-	-	-	-
Shortspine thornyhead	15.2	1.38	0.47	0.31	70.4	1.32	1.38	0.93
Flatfish	441.6	-	13.76	9.13	93.8	-	1.84	1.23
Arrowtooth flounder	432.1	1.90	13.47	8.93	86.7	2.25	1.70	1.14
Dover sole	5.2	0.63	0.16	0.11	7.1	1.10	0.14	0.09
Rex sole	4.3	0.08	0.13	0.09	-	-	-	-
Other species	267.3	-	8.34	5.53	104.6	-	2.06	1.38
Pacific hake	11.4	1.05	0.36	0.24	3.2	1.00	0.06	0.04
Pacific cod	50.7	2.67	1.58	1.05	-	-	-	-
Spiny dogfish	135.3	2.17	4.22	2.80	99.5	1.35	1.96	1.31
Ratfish	69.9	1.01	2.18	1.44	-	-	-	-
Ribbon barracudina	-	-	-	-	1.9	0.60	0.04	0.03
Total targetted species (sablefish, lingcod, rockfish)	2,497.9	-	77.89	51.62	4,890.7	-	96.11	64.35
Total non-targetted (flatfish & other species	708.9	-	22.10	14.66	198.4	-	3.90	2.61
Total all species	3,207.0	-	-	66.28	5,089.1	-	-	66.96

Appendix table 5.3.--Estimated catch in the 1985 experimental set-net fishery in the Grays Canyon Area, by depth and species.

	Shallow				Deep			
Species	Catch (kg)	Avg. weight (kg)	% of total catch	Catch rate (kg/100f net)	Catch (kg)	Avg. weight (kg)	% of total catch	Catch rate (kg/100f net)
Sablefish	1,010.8	3.75	59.05	52.92	4,718.7	4.05	79.06	94.37
Lingcod	21.3	4.48	1.24	1.12	24.5	5.63	0.41	0.49
Rockfish	592.8	-	34.63	31.34	512.0	-	8.58	10.24
Silvergray	28.7	2.10	1.68	1.50	-	-	-	-
Canary	248.5	1.89	14.52	13.01	-	-	-	-
Bocaccio	17.3	2.73	1.01	0.91	-	-	-	-
P.O.P.	18.8	1.28	1.10	0.98	-	-	-	-
Redbanded	19.4	2.30	1.13	1.02	-	-	-	-
Darkblotched	106.8	1.45	6.24	5.59	280.8	1.65	4.70	5.62
Shortraker	25.1	11.90	1.47	1.31	37.0	5.00	0.62	0.74
Rougheye	5.3	1.67	0.31	0.28	71.9	1.94	1.20	1.44
Yellowtail	83.7	1.66	4.89	4.38	-	-	-	-
Widow	6.2	1.48	0.36	0.32	-	-	-	-
Sharpchin	10.3	0.75	0.60	0.54	-	-	-	-
Yelloweye	15.9	1.37	0.93	0.83	97.1	1.64	1.63	1.94
Shortspine thornyhead	6.8	1.30	0.40	0.36	25.2	1.70	0.42	0.50
Flatfish	52.9	-	3.09	2.77				
Arrowtooth flounder	52.9	2.12	3.09	2.77	201.6	1.30	3.38	4.03
Other species	33.9	-	1.98	1.77	-	-	-	-
Pacific hake	3.8	1.00	0.22	0.20	-	-	-	-
Pacific cod	5.4	2.80	0.31	0.28	-	-	-	-
Pacific halibut	24.7	24.70	1.44	1.29	-	-	-	-
Total targetted species (sablefish, lingcod, rockfish)	1,624.9	-	94.93	85.07	5,255.2	-	96.31	105.10
Total non-targetted (flatfish & other species)	86.8	-	5.07	4.54	201.6	-	3.69	4.03
Total all species	1,711.7	-	-	89.61	5,456.8	-	-	109.14

Appendix table 5.4.--Estimated catch in the 1985 experimental set-net fishery in the Astoria Canyon and south, by depth and species.

	Shallow				Deep			
Species	Catch (kg)	Avg. weight (kg)	% of total catch	Catch rate (kg/100f net)	Catch (kg)	Avg. weight (kg)	% of total catch	Catch rate (kg/100f net)
Sablefish	428.9	3.62	29.39	8.58	46.8	2.60	31.18	5.85
Lingcod	44.0	4.68	3.02	0.88		-	-	-
Rockfish	842.5	-	57.73	16.86	96.4	-	64.24	12.05
Silvergray	269.0	2.05	18.43	5.38	-	-	-	-
Canary	247.8	1.99	16.98	4.96	-	-	-	-
Bocaccio	27.2	3.28	1.86	0.54	-	-	-	-
P.O.P.	14.3	0.69	0.98	0.29	37.1	0.90	24.72	4.64
Redbanded	58.0	2.15	3.97	1.16	-	-	-	-
Darkblotched	52.8	1.27	3.62	1.06	1.8	1.80	1.20	0.23
Shortraker	120.3	7.24	8.24	2.41	-	-	-	-
Rougheye	18.9	1.52	1.30	0.38	54.0	1.93	35.98	6.75
Yellowtail	22.2	1.78	1.52	0.44	-	-	-	-
Widow	3.3	1.60	0.23	0.07	-	-	-	-
Sharpchin	3.7	0.60	0.25	0.07	-	-	-	-
Splitnose	0.6	0.10	0.04	0.01	1.3	0.65	0.87	0.16
Yellowmouth	-	-	-	-	2.2	2.20	1.47	0.28
Shortspine thornyhead	4.4	2.10	0.30	0.09	-	-	-	-
Flatfish	118.2	-	8.10	2.37	2.9	-	1.93	0.36
Arrowtooth flounder	117.3	2.02	8.04	2.35	-	-	-	-
Dover sole	0.9	0.20	0.06	0.02	2.9	0.97	1.93	0.36
Other species	25.7	-	1.76	0.52	4.0	-	2.66	0.50
Pacific hake	5.4	0.80	0.37	0.11	4.0	1.00	2.66	0.50
Ratfish	6.9	1.03	0.47	0.14	-	-	-	-
Skate (unident.)	13.4	6.00	0.92	0.27	-	-	-	-
Total targetted species (sablefish, lingcod, rockfish)	1,315.4	-	90.14	26.31	143.2	-	95.40	17.90
Total non-targetted (flatfish & other species)	143.9	-	9.86	2.88	6.9	-	4.60	0.86
Total all species	1,459.3	-	-	29.19	150.1	-	-	18.76

APPENDIX 6

The effect of mesh size on average length and sex composition

Sablefish

Average length and sex composition data for sablefish taken in the Nitinat Canyon Area in 1985 is given in Appendix Table 6.1. Average length increased with mesh size, but not to the degree one might have expected. The lack of a tighter relationship between mesh size and average length is not totally surprising, on the other hand, when the shortcomings of the sampling plan are taken into account. Whereas an ideal sampling plan would have called for samples from each mesh size-time-area-depth cell, the collections here were much more spotty. Not only were the various mesh sizes deployed unevenly, but the time available for observers to collect length data also varied. The trends reported here, therefore, should be considered as first order observations. Refinement is clearly needed.

In terms of sex ratio, females dominated the samples regardless of mesh size. The percentage of females ranged from 52.9% (5-inch mesh, shallow area) to 77.9% (5 7/8-inch mesh, deep area).

Klein (1985b) determined that a minimum mesh size of 5 1/4-inch would increase the sablefish size at recruitment to at least 60 cm (5.05 lb) for set nets and traps. This would allow the fish to enter the higher-priced medium category, thus increasing ex-vessel revenues while at the same time increasing the spawning biomass. During the 1985 set-net season, 93.4% of

Appendix table 6.1.--Average length (cm) and sex composition of sablefish taken by set-nets in the Nitinat Canyon in 1985, by depth and mesh size.

Depth	Mesh size	No. measured	$\bar{x}$ length (cm)	No. Sexed	% Female	% Male
Shallow	6"	1,262	71.88	442	63.3	36.7
Deep	6"	948	72.07	340	60.3	39.7
Shallow	5 7/8"	472	71.90	430	70.7	29.3
Deep	5 7/8"	2,262	73.36	122	77.9	22.1
Shallow	5 1/2"	293	70.78	293	66.9	33.1
Deep	5 1/2"	0	-	-	-	-
Shallow	5 1/4"	386	68.08	214	61.2	38.8
Deep	5 1/4"	280	66.55	15	66.7	33.3
Shallow	5 1/8"	0	-	0	-	-
Deep	5 1/8"	31	68.26	0	-	-
Shallow	5"	0	-	0	-	-
Deep	5"	351	66.96	172	52.9	47.1

the sablefish taken in the 5 1/4-inch mesh were greater than 60 cm; 61.6% were female.

Lingcod

Females made up a large percentage of all lingcod samples. One sample of 304, taken with 6-inch mesh, contained 296 (97.4%) females. Females were only slightly less prevalent in samples from the smaller mesh sizes. In a sample of 134, taken with 5 1/4-inch mesh, 116 (86.6%) were females.

APPENDIX 7

Summary of observed and reported gear conflict and loss

Gear Conflicts

Trawler vs set net--(1) A trawler passing in the vicinity of a setnetter ran over the buoy line of a set being cast--the buoy line becoming tangled in the propeller. The buoy line had to be cut and retied. All gear was recovered without further incident. (2) A bottom trawler fishing in the vicinity of a setnetter clipped one end of the set net with the trawl gear. No damage was reported by the trawler. The set-net captain reported that the contact started a tear at one end of the net. Stress placed on the net during retrieval ultimately caused the tear to continue through the entire 200 f. All gear appeared to be recovered, but with the net parted in two. (3) A bottom trawler ran gear through one end of a set. The trawl operator mentioned that he was confused by the placement of a nearby longline buoy and inadvertently went through the gear instead of around it. The trawler pulled one buoy and 62 f of net onto the vessel before separating the net. The set-net vessel retrieved the rest of the gear from the other end. There appeared to be no gear left on bottom. (4) One 200 f net was lost in what was suspected to have been a gear conflict with a trawler. A more complete description of the incident is given below under "permanent losses during operation".

Longline vs set net--(1) A string of longline hooks was retrieved in a set net. The string was badly entangled in one of the shackles and had apparently been cut free. (2) A set was made over a longline string. When the longliner retrieved his gear, one end of the set net was pulled on board. The damage to the longline appeared to be minimal. About 30 f of mesh in the set net was badly ripped in the process. All gear was retrieved by the setnetter once it was untangled from the longline.

Trap vs set net--(1) A setnetter found his buoy markers tangled with those from a trap vessel. The lines were untangled and the gear retrieved without further incident.

Set net vs set net--(1) One set was made over the end of another. The bottom net was retrieved first. Part of the top net, which had become tangled in the anchor, was brought to the surface. Some mesh was cut to free the anchor. The damage to each net appeared to be minor. (2) The anchor on one set tangled the buoy line of another. Both nets were retrieved undamaged.

Lost nets and lost mesh

Pemanent losses during operation--(1) One 200 f net was lost. The gear was deployed by an inexperienced operator, a crewmember, who was manning the vessel while the permitholder was on land. After the set, the operator moved the vessel about 2 miles to make two additional sets. When he returned, only the buoy lines and floats could be found. The end of one buoy line had chafe marks. The other buoy line appeared to have been cut with a knife. While it is suspected that the net may have been pulled in by a trawler, the facts of the incident have not been

substantiated. No attempt was made to drag for the net as the inexperienced operator had failed to record the position of the set. (2) Approximately 80 f of mesh and leadline were lost when a net got hung up on the bottom. The vessel was using a lighter leadline than the other vessels, which did not have this same difficulty. The ghost fishing potential was greatly diminished as there were no floats attached to the lost webbing. (3) Approximately 30 f of mesh and leadline were lost when a net got hung up on the bottom. The circumstances are identical to those described above, with the same vessel involved.

Permanent losses while in transit--(1) At least two 30 f shackles of net were washed overboard during rough seas. Crewmembers had initially estimated that four to five shackles had been lost. A recount by the captain lowered the estimate to two. An investigation on the way in which the nets had been tied indicated that they had probably sunk to the bottom in a solid bundle.

Temporary losses--(1) One 450 f net was lost in lower Nitinat Canyon. The set was released during rough weather into 250 f of water. The next day the net could not be found. The observer on board speculated that rough seas may have caused the net to settle at a depth greater than the length of the buoy lines. One month after the loss, the captain reported the net was recovered. He had snagged the net by dragging the bottom with a hook. The net was in good shape with both poles and buoys intact. An estimated 1,200-1,500 fish were in the net, only 60 were kept. Hooks in the net caused the captain to speculate that

it had been dragged under by a longliner. (2) Approximately 200 f of a 340 f net was lost during a gear malfunction. The net was being retrieved with two shackles already aboard, when the third shackle pulled out of the hauler. During the incident the third shackle became entangled in the propeller and had to be cut. When this was done a knot, which secured the unretrieved portion of the net to the vessel, slipped. This portion of the net was lost.

The vessel dragged on numerous occasions, attempting to snag the net. Nineteen days after the loss, the net finally was recovered. Most of the fish were badly decomposed. The captain theorized that the net had landed in a pile and was fishing very ineffectively. Only one lingcod and one sablefish were salvaged.

Nets temporarily abandoned--(1) One vessel attempted to retrieve a net during rough seas. The net was made up of 15 shackles (each 30 f). After one shackle was aboard, the vessel began having trouble with the hydraulic system. The captain decided to drop the remaining 14 shackles (420 f) back to the bottom. The vessel returned to port.

Four days later, the vessel returned to the grounds and retrieved the set. The net contained 217 kg of rockfish and 154 kg of sablefish. All the rockfish were discarded and the few sablefish that were salvaged were of such marginal quality that they were not sold either. (2) One 250 f net was left on the grounds when a vessel returned to port to fix a broken drum drive. The set was retrieved 4 days later--courtesy of another vessel. The net contained 680 kg of sablefish, 54 kg of lingcod, and 168 kg of rockfish. The fish were all sold, but

most were downgraded for reasons of quality. (3) One vessel experienced mechanical difficulties and was unable to retrieve a 200 f set. The vessel returned to port after arranging for another vessel to pick up the net later.