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Recent Changes in Halibut CPUE: Studies on Area Differences in Setline Catchability

by

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and

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Contents

Abstract 4

Introduction 5

1982 Experiment 7
- Sampling Design 7
- Comparison of Catches 7
- Effect of Trawl Disturbance and Dogfish 12

1983 Experiment 14
- Sampling Design .....
- Comparison of Catches 15
- Methodology for Calculating Relative Setline Catchability 17
- Estimates of Relative Setline Catchability 20

Commercial Fishery Data 21

Discussion and Conclusions 22

Acknowledgments 24

Literature Cited 25

Appendix 26

ABSTRACT

Catch-per-unit-effort in the Pacific halibut fishery increased sharply during the late 1970's and early 1980's off Alaska, but remained stable at a low level off British Columbia. One explanation for the divergence in CPUE is a change in the relative effectiveness (catchability) of setlines for halibut among areas. Experiments involving comparative fishing with trawls and setlines indicated that high dogfish concentrations reduced the CPUE of setlines in British Columbia. Prior trawling on fishing grounds may also reduce CPUE, although the experimental results were questionable because of small sample size. Estimates of setline catchability were substantially higher in Alaska than in British Columbia, but depend on the assumption that trawl catchability is constant between areas. Data from the commercial fishery support the findings that catchability is higher in Alaska, and suggest that the major difference between areas may be due to an increase in setline catchability in Alaska rather than a decline in British Columbia. The relationship between catch and setline effort is complex and further investigations are required before CPUE and effort data can be standardized among areas.

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INTRODUCTION

Pacific halibut (*Hippoglossus stenolepis*) are fished commercially with setline gear, and data from fishermen's logbooks provide estimates of catch-per-unit-effort (CPUE). These estimates are important to the International Pacific Halibut Commission (IPHC) for assessing halibut stocks and managing the fishery.

After declining during the 1960's and 1970's, CPUE increased sharply from 1978 through 1983 in the Alaska fishery but remained at a low level off British Columbia. Until recently, CPUE values and trends have been similar in southeast Alaska and British Columbia and, although CPUE in central Alaska has tended to be higher than in British Columbia, the magnitude of the present difference is without historical precedent (Figure 1). The CPUE data suggest that halibut stocks are increasing off Alaska, but not off British Columbia, if the assumption that CPUE is proportional to fish density is valid.

Many factors affect CPUE, and one alternative explanation for the area divergence in CPUE is a change in the relative catchability or effectiveness of setlines for halibut among areas. Populations of dogfish (*Squalus acanthias*) in British Columbia have increased substantially since the 1940's and 1950's (Wood et al. 1979), and may compete with halibut for the baited hooks. Skud (1978) examined data on the number of halibut and other species caught on setline gear and concluded that halibut are a "dominant predator," i.e., more successful than other species in competing for available bait. Skud's results suggest that the CPUE of halibut may not be seriously distorted by a change in relative abundance of other species. Skud, however, did not specifically examine bait competition with dogfish and much of his data were collected in areas where dogfish were not abundant. Dogfish may be unique among competitors for bait in that they may take the bait before it reaches bottom and becomes available to bottom-dwelling species like halibut.

A second factor that could affect the CPUE of halibut in British Columbia is trawling. The effect of the direct loss of incidentally caught halibut has been examined by Hoag (1971, 1975, 1976) and Quinn et al. (1983), but trawling may also indirectly affect CPUE. Trawl fishermen occasionally report high catches of halibut while setline catches on the same grounds are very low. Halibut fishermen report that their fishing success often declines when trawlers are operating nearby, suggesting that trawling may somehow affect the distribution or feeding behavior of halibut. (Trawling also occurs off Alaska, but is relatively infrequent on halibut grounds during the halibut season.)

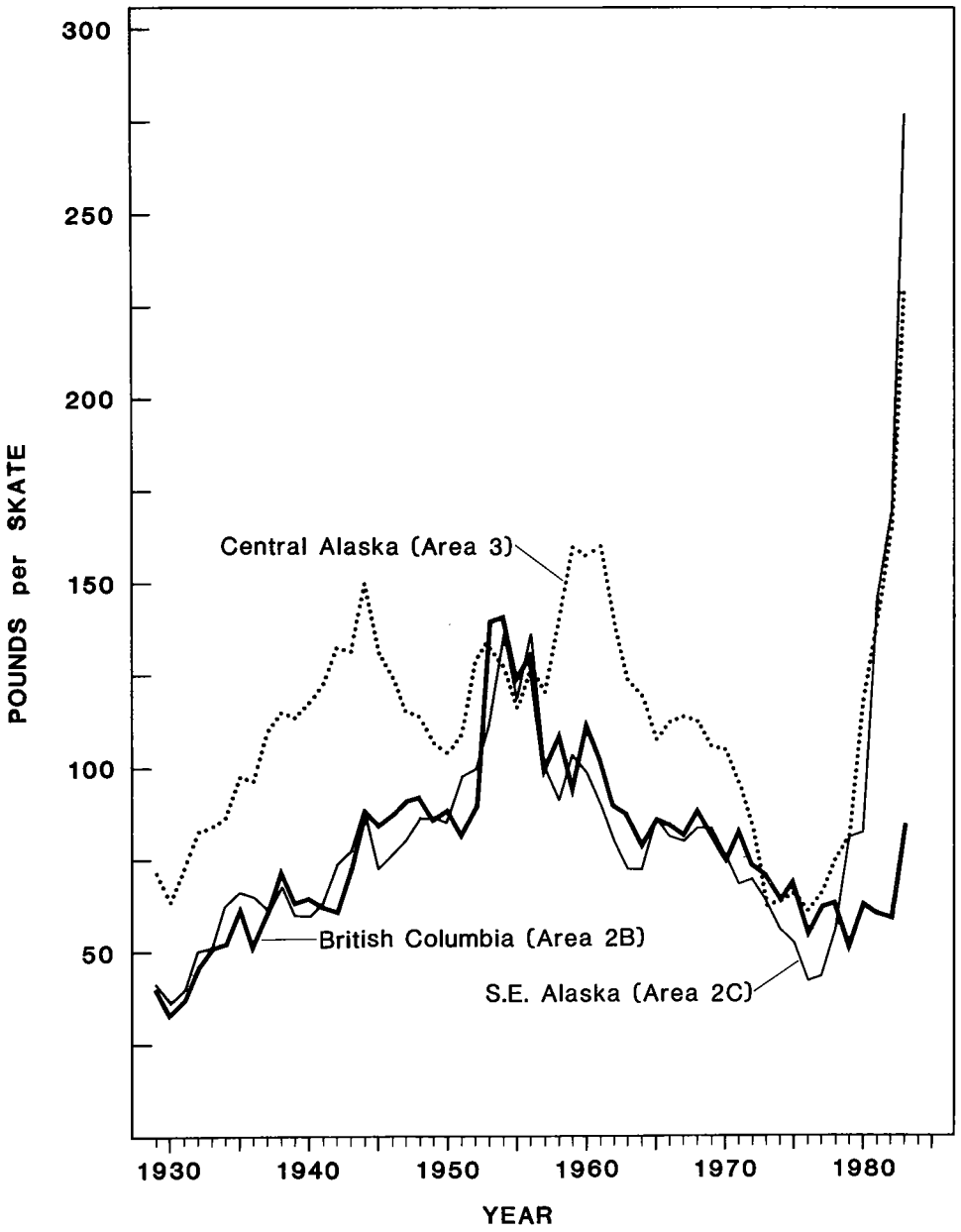

Figure 1. CPUE (pounds per skate) in the commercial halibut fishery by IPHC Area.

To further examine setline catchability for halibut, trawl gear was fished comparatively with setline gear in several areas to provide an independent measure of fish density. Two experiments were conducted: one in 1982 and the other in 1983. The first was designed specifically to examine the effect of dogfish and trawl disturbance on setline CPUE in British Columbia. The second was designed to estimate the catchability of setlines in British Columbia relative to areas where setline CPUE was much higher. In addition, setline catchability was estimated from commercial fisheries data to compare with the 1983 experimental estimates. This paper presents the results of these studies.

1982 EXPERIMENT

Sampling Design

A sampling design was chosen that allowed a comparison between setline and trawl catches with a minimum of operational problems. Specific hypotheses tested were: (1) halibut CPUE with setlines is proportional to halibut CPUE with trawls, (2) the ratio of the two CPUE's is independent of the dogfish catch by setlines, and (3) the ratio of the two CPUE's is independent of prior trawling on the same grounds.

The setliner M/V PROUD CANADIAN (88 gt, 365 hp) and the trawler M/V NORE-DICK (136 gt, 635 hp) conducted the experiment during July 24-August 2, 1982. A total of 36 fishing locations (stations) was sampled: 28 stations at Masset and 8 stations on the Horseshoe grounds (Figure 2). The stations were located along depth contours on grounds where the bottom was smooth enough to avoid damage to the trawl net. Each station was approximately 1.6 mi (2.6 km) long and could be covered in about 30 minutes of trawling and 6 skates of setline gear. The trawl gear consisted of a standard 400-mesh eastern trawl with a 3½-inch (90 mm) mesh codend (Best and Hardman 1982). The setline gear consisted of 5-line skates (Drykorn groundline) with 69 hooks per skate spaced at 21-foot intervals; straight-shank hooks (Mustad No. 6282) with herring, salmon, and Pacific cod baits were used.

To avoid physical interference between the two types of gear and provide an indication of the effect of trawl disturbance, we alternated the days each gear type was fished on each station, e.g., the stations fished by setline on the first day were fished by trawl on the second day, and vice versa. This sequence was repeated throughout the experiment. Thus, the effect of trawl disturbance could be tested by comparing the catches on stations where the trawl was used first with those where the setline was fished first.

The number of stations fished each day was determined by the fishing capabilities of the two gears. The setlines were set in the morning (starting about 0600 hours). Hauling began about 5 hours after setting (1100 hours) and continued until finished (about 1800 hours). This schedule allowed 4 stations to be fished each day. Because the trawl could fish faster than the setline, each station was usually fished twice by the trawl — once in the morning and once later in the day. Fishing the trawl twice on each station allowed an examination of variability in the catches within a day.

On the setline vessel, all fish caught at each station were counted and identified by species or species group. The halibut were measured (fork length) and their weight (heads off, eviscerated) estimated from a length-weight relationship (described by Hoag et al. 1979). The weight of other species was estimated by weighing up to 10 individuals in each species group on each station and extrapolating the average weight to the total count. A dynameter scale was used to estimate the total weight of the trawl catch at each station. All of the halibut were counted and measured, and the dogfish were counted and a sample for each haul was weighed. A subsampling procedure was used to estimate the number and weight of other species.

Comparison of Catches

Detailed catch and effort data by station are provided in Appendix I. A standardized CPUE was calculated at each station. Setline CPUE was in terms of catch per skate and was based on a standard skate of 100 hooks spaced at 18-foot intervals (Skud 1972; Myhre et al. 1977). Trawl CPUE was standardized by adjusting the catch to a haul duration of 60 minutes.

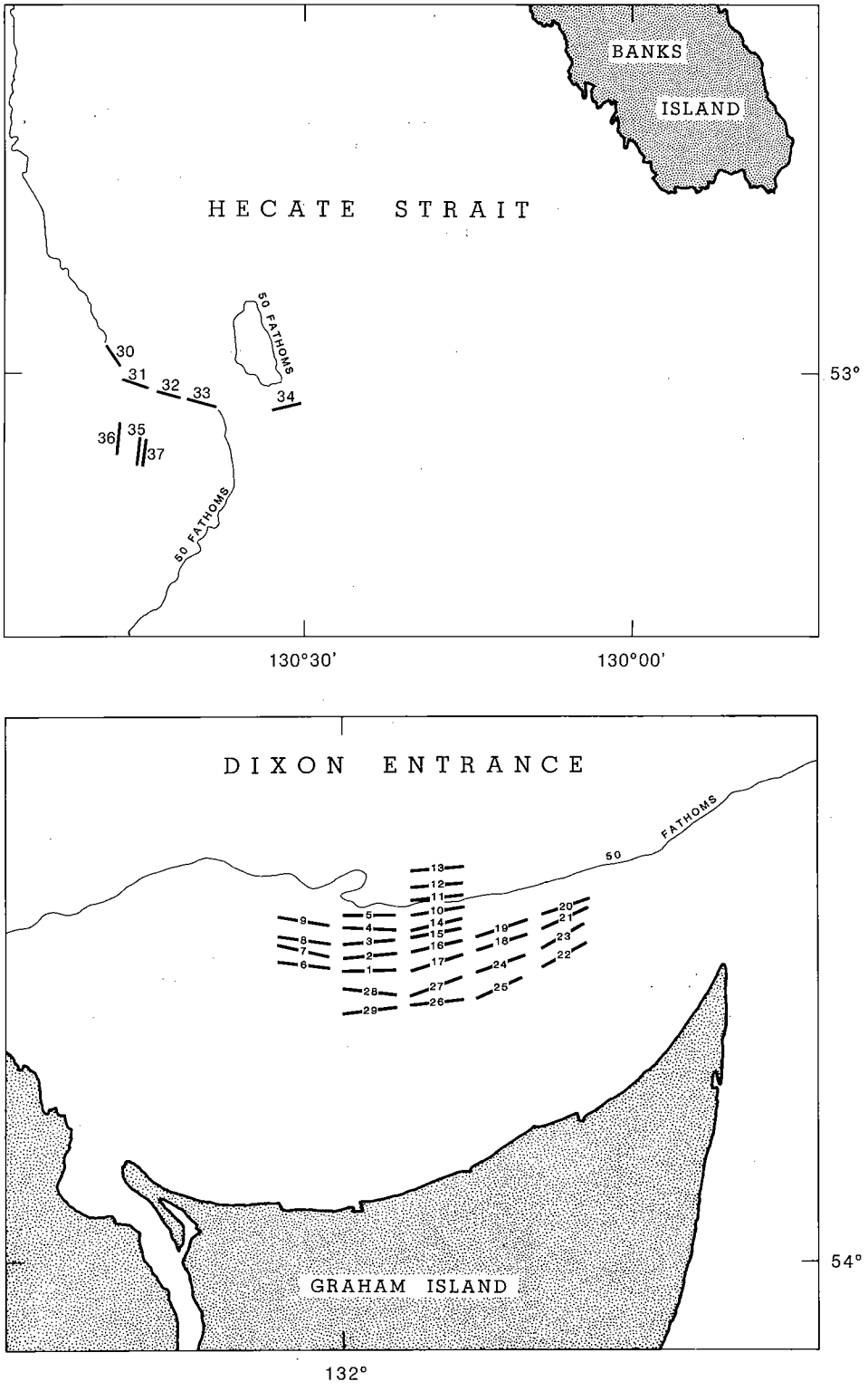

Figure 2. Stations sampled in 1982 Experiment.

An average catch per linear distance fished was also calculated to provide a comparison of the catching capabilities of the two gears (Table 1). The values reflect the catch per 2.6 km fished (one station) and are based on 4.51 standard setline skates and 30 minutes of trawling. However, the linear distances covered by the setline may be slightly overestimated (perhaps 10%) because the gear does not lie in a straight line on the bottom.

Table 1. A comparison of the average catch* per 2.6 km fished for setline and trawl gear.

	Setline				Trawl			
	Number	(%)	Kg	(%)	Number	(%)	Kg	(%)
Halibut	14.3	(19.7)	65.7	(18.7)	30.9	(1.8)	105.1	(8.2)
Arrowtooth flounder	1.1	(1.5)	1.8	(0.5)	890.4	(52.4)	566.0	(44.0)
English sole	0.0	(0.0)	0.0	(0.0)	259.8	(15.3)	79.4	(6.2)
Rex sole	0.0	(0.0)	0.0	(0.0)	120.7	(7.1)	25.8	(2.0)
Dover sole	0.0	(0.0)	0.0	(0.0)	84.3	(5.0)	45.4	(3.5)
Rock sole	0.0	(0.0)	0.0	(0.0)	53.9	(3.2)	45.8	(3.6)
Other flatfish	0.1	(0.1)	0.1	(Tr.)	18.6	(1.1)	12.9	(1.0)
Blackcod (sablefish)	0.2	(0.3)	0.2	(0.1)	9.1	(0.5)	5.7	(0.4)
Rockfish	Tr.	(Tr.)	0.1	(Tr.)	4.2	(0.2)	3.0	(0.2)
Pacific cod	0.4	(0.6)	1.4	(0.4)	23.0	(1.3)	36.1	(2.8)
Lingcod	0.1	(0.1)	1.0	(0.3)	4.1	(0.2)	25.4	(2.0)
Other roundfish	0.0	(0.0)	0.0	(0.0)	1.3	(0.1)	0.8	(0.1)
Dogfish	47.8	(66.0)	189.8	(53.9)	19.9	(1.2)	63.7	(5.0)
Ratfish	0.0	(0.0)	0.0	(0.0)	109.3	(6.4)	58.2	(4.5)
Skates	5.0	(6.9)	87.8	(25.0)	11.5	(0.7)	163.6	(12.7)
Shark	Tr.	(Tr.)	0.8	(0.2)	0.0	(0.0)	0.0	(0.0)
Shellfish	0.0	(0.0)	0.0	(0.0)	13.3	(0.8)	7.2	(0.6)
Misc. Invertebrates	3.5	(4.8)	3.1	(0.9)	45.7	(2.7)	40.9	(3.2)
TOTAL	72.5	(100%)	351.8	(100%)	1700.0	(100%)	1285.0	(100%)

*Catches were standardized, based on 4.51 standard skates and 30 minutes of trawling per station, and represent the catch per linear distance covered (about 2.6 km).

The magnitude of the trawl catch of all species was generally much larger than the setline catch: 1700.0 vs. 72.5 in terms of numbers and 1285.0 kg vs. 351.8 kg. The difference was most apparent when comparing the catch of flatfish and invertebrates and was expected because the large hooks used with the setline gear preclude the capture of some species entirely and small individuals of nearly all species.

The setlines caught more dogfish than the trawl: the number of dogfish per 2.6 km averaged 47.8 for the setlines compared to 19.9 for the trawl, an indication that dogfish were attracted to the baited hooks, perhaps from a considerable distance. Dogfish are known to congregate in schools and are often found throughout the water column from surface to bottom. In addition to having a well-developed olfactory sense, dogfish may cover more distance in search of food than most species and, thus, have a better chance of encountering a baited hook. Certainly, dogfish have an opportunity to take a baited hook before it reaches the bottom. Conversely, when dogfish are off bottom they are not available to bottom trawls and this partly accounts for the lower dogfish catch by trawls.

The halibut catch by trawls was more than twice that by setlines in terms of numbers of fish: 30.9 vs. 14.3. However, part of the difference reflects the size composition of the halibut available to the two gears.

Halibut in the trawl catch were smaller than those in the setline catch (Figure 3). Fish less than 70 cm accounted for 57% of the trawl catch of halibut compared to only 24% of the setline catch. This size difference apparently results from differences in the selective characteristics of the two gears. Myhre (1969) estimated the selection curves for trawls and setlines with respect to halibut length. He showed that setline selectivity increases with length up to about 85 cm whereas trawl selectivity (3.5-inch codend mesh) increases up to about 40 cm, remains fairly stable from 40 to 75 cm, and then drops sharply from 75 to 100 cm.

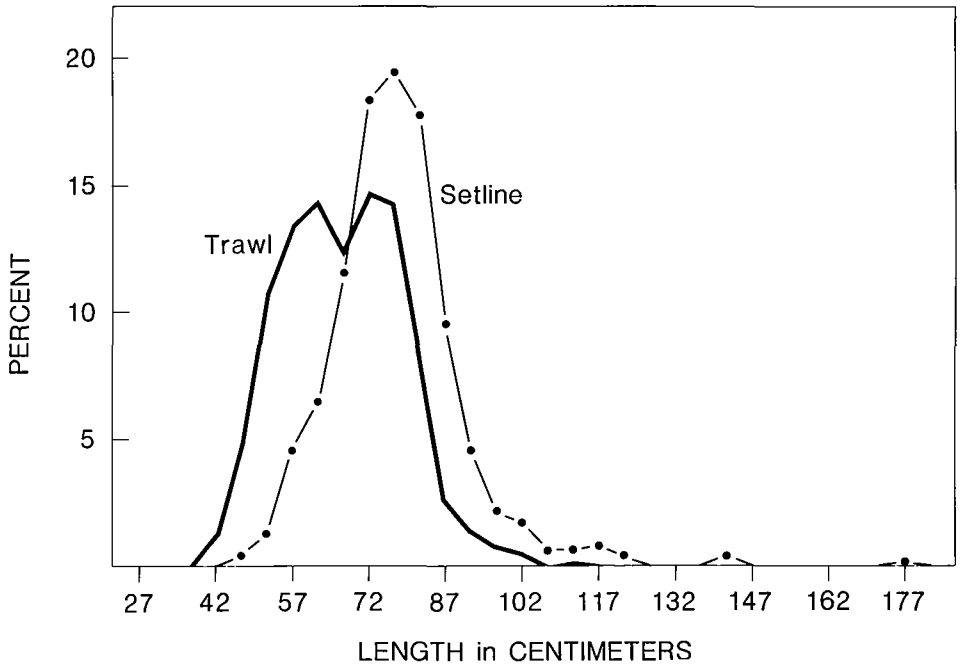

Figure 3. Percentage of halibut by length group in the trawl and setline catches.

Differences in size selectivity between the trawl and setline require that the catches be adjusted before comparing the results of the experiment. We adjusted the trawl catch of halibut at each station so that the relative size composition is the same as that for setlines. The adjustment factors (A_L) were based on the total trawl and setline catches for all stations combined and were estimated for each length interval (L) as follows:

$\hat{A}_L = (C_{SL}/C_S) / (C_{TL}/C_T)$

C_{SL} = total setline catch of halibut in each length interval for all stations,

C_S = total setline catch of halibut for all stations,

C_{TL} = total trawl catch of halibut in each length interval for all stations,

C_T = total trawl catch of halibut for all stations.

In other words, the adjustment factor is the ratio of the relative size composition of halibut taken by the two gears. The trawl catch of halibut at each station was adjusted by multiplying size-specific catch at each station by the appropriate A_L.

In essence, the adjustment procedure re-weights the trawl catch of halibut by size group, with progressively more emphasis given to the catch of relatively large-sized halibut. This procedure may increase the variability in the estimated trawl catch because less weight is given to the most frequently caught sizes of halibut. However, the additional variability is unavoidable if the trawl catch is used as a measure of halibut available to setlines. Relatively few halibut in the catch were less than 45 cm or over 104 cm in length, so catches of these lengths were not adjusted nor used in any further analyses. The adjustment factors by length interval are given in Table 2.

Table 2. Relative size composition of halibut caught by gear type and estimated adjustment factor for trawl catches.

	Percent size composition		
Length (cm)	Setline	Trawl	Adjustment Factor*
45-49	0.4	4.8	0.083
50-54	1.2	10.7	0.112
55-59	4.5	13.4	0.336
60-64	6.4	14.4	0.444
65-69	11.5	12.5	0.920
70-74	18.3	14.7	1.245
75-79	19.4	14.3	1.357
80-84	17.7	8.4	2.107
85-89	9.5	2.6	3.654
90-94	4.5	1.4	3.214
95-99	2.1	0.8	2.625
100-104	1.7	0.5	3.400

*Setline size composition ÷ trawl size composition

After adjusting the trawl catch of halibut, we examined the relationship between trawl and setline CPUE at each station. The results (Figure 4) show that the halibut CPUE of setlines is poorly correlated with that of trawls ($\hat{r} = 0.19$), indicating that factors other than fishing location have a major effect on the CPUE of the two gears. On two stations, the trawl CPUE was very high (over 500 halibut per hour), yet the setline CPUE was only moderate (3 to 7 halibut per skate). A poor correlation also occurred between the dogfish CPUE of the trawl and setline at each station ($\hat{r} = 0.13$), suggesting that dogfish CPUE is also affected by other factors. One explanation for the low correlations is that halibut and dogfish are highly mobile and abundance on a station may vary greatly. Fishing the two gears on different days at each station may have contributed to the variability. Perhaps poor estimates of the adjustment factor, A_L, also contributed to the variability.

Stations where two trawl hauls were made provide evidence of movement within the same day. The $\hat{r}$ value relating CPUE between morning and afternoon hauls was 0.65 for halibut and 0.92 for dogfish. The $\hat{r}$ values are lower (0.59 and 0.45, respectively) if one influential data point is eliminated for each correlation, although we have no valid reason to reject that influential data point. In any event, a change in the

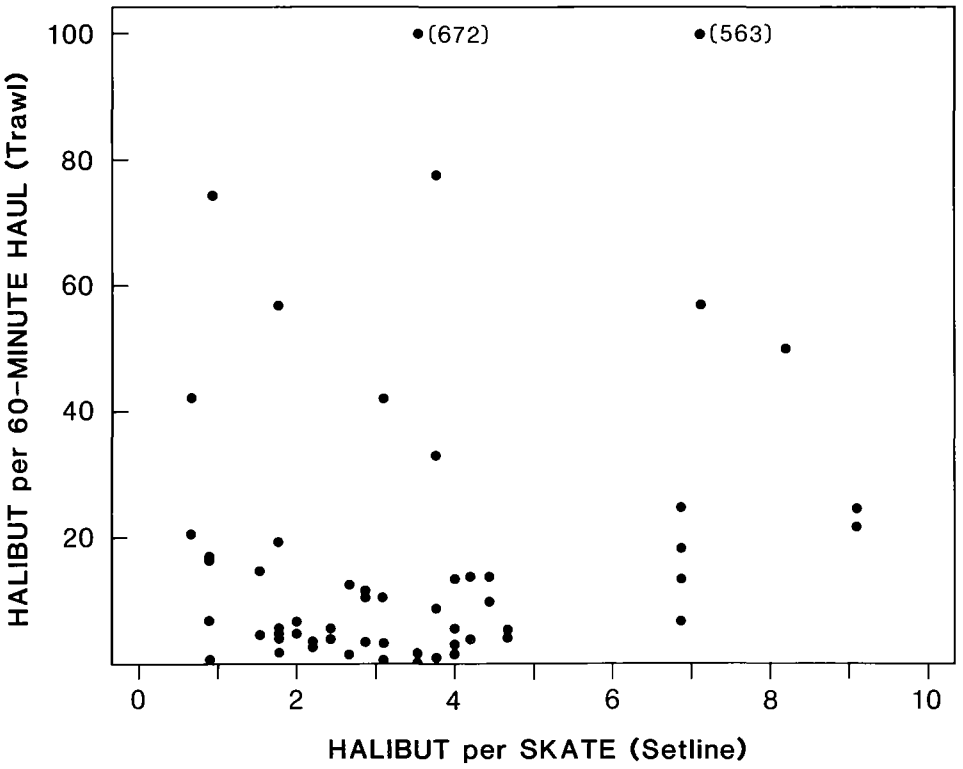

Figure 4. Comparison of halibut CPUE by trawl and setline at each station ($\hat{r} = 0.19$).

availability of fish within a day apparently contributes to the variability in CPUE on a station.

Afternoon trawl hauls produced higher halibut catches than morning hauls on 17 of 28 stations where halibut were caught, an indication that the trawl did not disturb the halibut. Although the statistical significance of the observation is questionable, the higher afternoon catches suggest that halibut may have been attracted by food organisms uncovered or killed by the morning haul. Data on stomach contents were not collected, but the scientist on board noted a higher frequency of full stomachs from halibut caught in the afternoon hauls.

Conversely, the CPUE of dogfish tended to decline from morning to afternoon: dogfish catches were higher in the morning on 18 of 28 stations where dogfish were caught. The reason for the decline is unknown, but may be related to vertical movements of dogfish in the water column.

Effect of Trawl Disturbance and Dogfish

Two factors that could at least partially account for the poor correlation between trawl and setline CPUE are prior trawling on stations and the setline catch of dogfish. The effect of these factors was tested by assuming that the adjusted trawl CPUE of halibut was not affected by the above factors and was proportional to the abundance of halibut available to setlines on a station. Although these assumptions are somewhat speculative, we consider that dogfish and prior trawling would more likely affect the halibut catch of "passive gear" (setlines) than "active gear" (trawls). Nonetheless, the above assumptions are critical to the interpretation of the results.

The ratio of the setline and trawl CPUE was used as a measure of the effectiveness of setlines in catching halibut on a station. A comparison of CPUE on stations where the trawl fished first with those where the setline fished first is as follows:

	No. of Stations	Median CPUE of Halibut (No. of fish)		
		Setline	Trawl	Ratio*
Setline First	20	2.439	4.743	0.4410
Trawl First	16	3.104	16.525	0.0735

*Ratio of setline CPUE to trawl CPUE at each station

Both setline and trawl CPUE were higher when the trawl fished first, apparently reflecting a larger abundance of halibut on these stations. The difference in the trawl CPUE, however, appears unreasonably large (3.5 times), and suggests that conditions may have varied with the order of fishing each gear type. Nonetheless, the ratio of setline to trawl CPUE was considerably lower when the trawl fished first. Although the difference was large, the Mann-Whitney non-parametric-rank-sum test was only marginally significant ($p = 0.065$). A non-parametric test was used because the observations were apparently not distributed normally.

The reason for the lower relative CPUE by setlines following trawling is not clear. The small sample size and the unexplained increase in CPUE by trawls when trawls were fished first make us cautious about drawing conclusions. We doubt that the observed reduction in setline CPUE where trawls were fished first is from lower abundance because there was no indication of reduced abundance from morning to afternoon on stations where two hauls were made. Rather, the reduction may be due to a change in behavior. The trawl could improve feeding opportunities and, hence, reduce the effectiveness of the baited hooks. Fishing the trawl both before and after the setline in another experiment could help to clarify a change in behavior. If the trawl CPUE is still high after the setline has fished, this would support the hypothesis that the reduced setline CPUE is due to behavioral changes. Another useful study would be to compare stomach volumes of halibut caught by trawls and setlines in various setting sequences.

Dogfish accounted for only a small part of the total variability in the setline CPUE of halibut within the range of dogfish abundance observed on most stations (Figure 5). The linear correlation coefficient between halibut CPUE and dogfish CPUE, estimated as $\hat{r} = -0.29$, was not significantly different from zero ($t = 1.6991$ with 33 d.f.). Figure 5, however, suggests that the relationship between halibut CPUE and dogfish abundance may be non-linear, and a log transformation of both variables improved the $\hat{r}$ value to about -0.4.

Further examination of the CPUE of halibut at various levels of dogfish CPUE suggests that halibut CPUE may be severely affected only when dogfish are very abundant. The median CPUE of halibut declined dramatically when the dogfish CPUE exceeded 15 fish per skate, whereas median CPUE declined only slightly at lower levels of dogfish CPUE (Figure 5). These results indicate that a high abundance of dogfish substantially reduces the CPUE of halibut, although the number of observations is probably too small to determine the precise relationship between dogfish abundance and halibut CPUE.

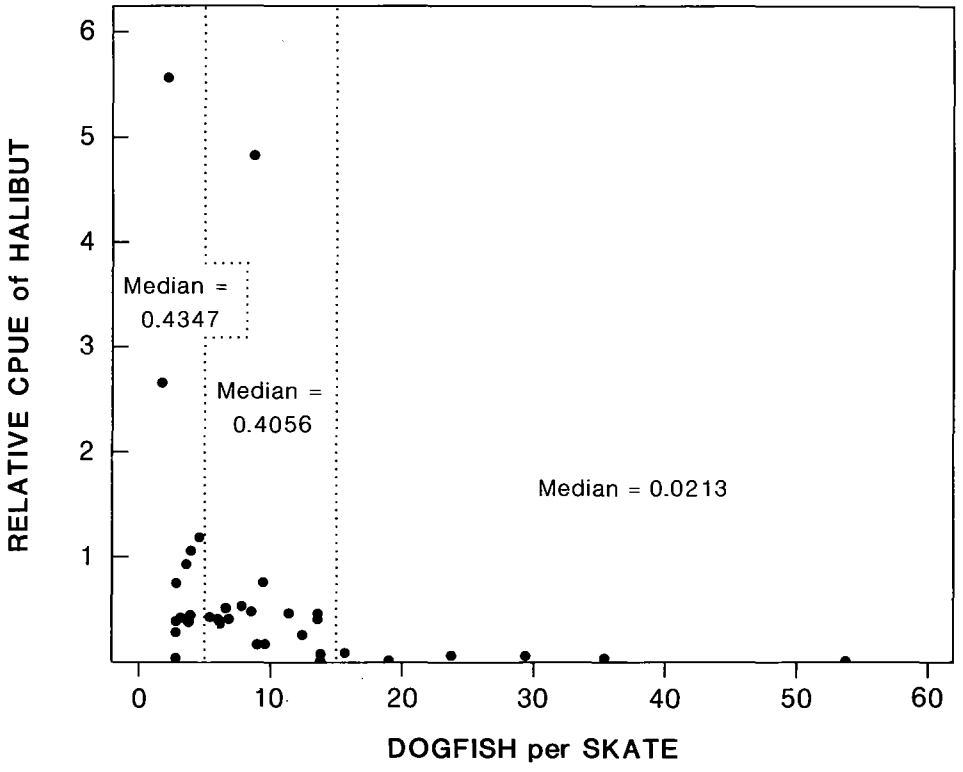

Figure 5. Comparison of the relative CPUE of halibut by setlines (ratio of setline to trawl CPUE), and the CPUE of dogfish by setlines ($\hat{r}$ = -0.29).

1983 EXPERIMENT

Sampling Design

The 1983 Experiment was designed to determine if setlines are less effective at catching halibut in British Columbia than in Alaska, where commercial CPUE is much higher. Results from the 1982 experiment indicated that dogfish and trawl disturbance reduce setline CPUE in British Columbia, but did not compare the efficiency of setlines among areas. In 1983, trawl and setlines were fished on stations in both Alaska and British Columbia. The sampling design varied from that used in 1982 in that fishing effort was increased on each station and both gears were fished during the same day.

The setliner M/V LORELEI II (50 gt, 235 hp) and trawler M/V PACIFIC HARVESTER (149 gt, 565 hp) were chartered during May 12-June 8, 1983. A total of 40 stations was sampled: 18 in Area 2B and 22 in Area 3A (Figure 6). The stations were located on grounds where the bottom was smooth enough to avoid damage to the trawl net. Area 2C was not chosen for comparison because the bottom is generally too rough for trawling. On each station, 2 strings of setline gear with 6 skates per string were usually fished. The setline gear consisted of 6-line skates (Mittet groundline) with 72

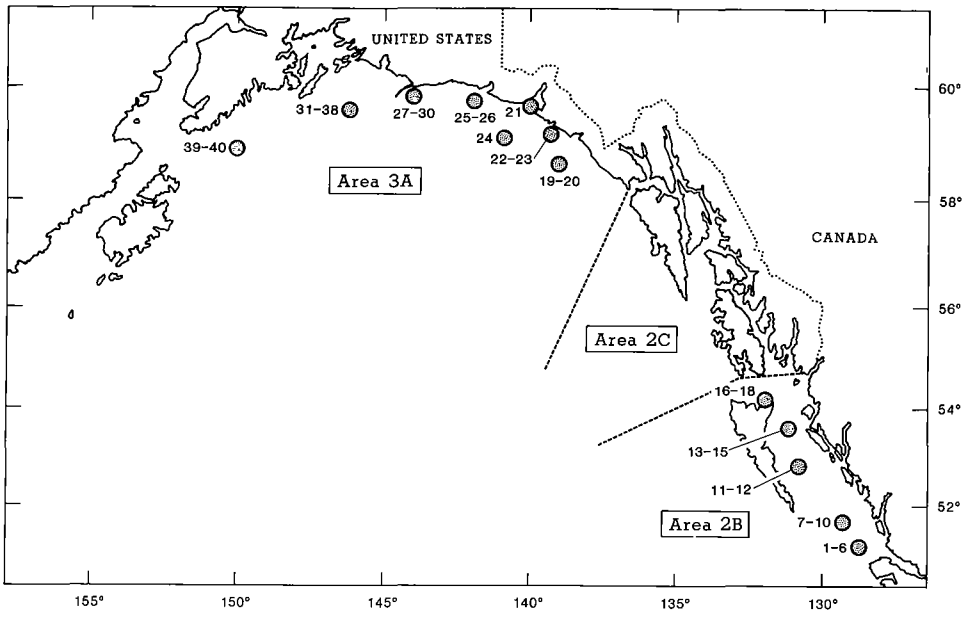

Figure 6. Sampling locations (circles) and station numbers in the 1983 Experiment.

hooks per skate spaced at 25-foot intervals; straight-shank hooks (Mustad No. 6282) with herring, salmon, and Pacific cod baits were used. The trawl gear was then fished systematically between and around the setline sets. The number of trawl hauls ranged from 2 to 4 per station. The trawl gear consisted of a standard 400-mesh eastern trawl with a 3½-inch (90 mm) mesh codend. Two stations were usually fished per day: the first between 0500 and 1200 hours, and the second between 1300 and 1900 hours.

On the setline vessel, all fish caught at each station were counted and identified by species or species group. The halibut were measured (fork length) and their weight (heads off, eviscerated) estimated from a length-weight relationship (described by Hoag et al. 1979). The weight of other species was estimated by weighing up to 10 individuals in each species group on each station and extrapolating the average weight to the total count. The total weight of the trawl catch was estimated with a dynameter scale. All trawl-caught halibut were counted and measured, but a subsampling procedure was used to estimate the number and weight of other species.

Comparison of Catches

The catch of halibut and other species is summarized in Table 3 by area and gear type. Detailed catch and effort data are provided in Appendix II. As in the 1983 Experiment, the total setline catch in terms of numbers of fish was much lower than the trawl catch in both areas. The setline catch of total fish was higher in Area 2B than in Area 3A relative to the trawl catch because of the high dogfish catch in Area 2B. Dogfish accounted for 50% of the Area 2B setline catch compared to 17% in Area 3A. Pacific cod and sablefish were relatively more prevalent in the Area 3A setline catch. The relative trawl catch in Area 3A was higher than in Area 2B, primarily as a result of a large catch of arrowtooth flounder and other flatfish.

Table 3. Summary of catch and species, area, and gear type: setliner M/V LORELEI II and trawler M/V PACIFIC HARVESTER, 1983.

	AREA 2B							
	Setline*				Trawl**			
	Number	(%)	Kg	(%)	Number	(%)	Kg	(%)
Halibut	645.0	(17.8)	3200.2	(16.9)	1625.0	(4.0)	4862.6	(17.2)
Arrowtooth flounder	0.0	(0.0)	0.0	(0.0)	1970.0	(4.9)	1444.4	(5.1)
Other flatfish	0.0	(0.0)	0.0	(0.0)	21490.0	(53.4)	7152.7	(25.3)
Blackcod (sablefish)	0.0	(0.0)	0.0	(0.0)	5.0	(Tr.)	2.5	(Tr.)
Rockfish	10.0	(0.3)	27.1	(0.1)	92.0	(0.2)	136.6	(0.5)
Pacific cod	9.0	(0.2)	22.7	(0.1)	2552.0	(6.3)	1295.3	(4.6)
Lingcod	19.0	(0.5)	152.8	(0.8)	416.0	(1.0)	2146.3	(7.6)
Other roundfish	4.0	(0.1)	31.8	(0.2)	187.0	(0.5)	112.4	(0.4)
Dogfish	1812.0	(50.0)	6844.9	(36.1)	911.0	(2.3)	2131.6	(7.5)
Ratfish	7.0	(0.2)	9.1	(0.1)	4082.0	(10.1)	2464.5	(8.7)
Skates	874.0	(24.1)	8039.9	(42.5)	475.0	(1.2)	4502.3	(15.9)
Shark	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)
Shellfish	0.0	(0.0)	0.0	(0.0)	1915.0	(4.8)	126.8	(0.5)
Misc. Invertebrates	247.0	(6.8)	606.4	(3.2)	4561.0	(11.3)	1892.1	(6.7)
TOTAL	3627.0	(100%)	18934.9	(100%)	40281.0	(100%)	28270.1	(100%)
	AREA 3A							
Halibut	970.0	(45.8)	10290.0	(66.3)	1155.0	(1.5)	3146.3	(6.7)
Arrowtooth flounder	94.0	(4.4)	144.3	(0.9)	32716.0	(42.2)	20015.4	(42.6)
Other flatfish	0.0	(0.0)	0.0	(0.0)	33342.0	(43.1)	14389.4	(30.7)
Blackcod (sablefish)	116.0	(5.5)	206.0	(1.3)	1954.0	(2.5)	1648.1	(3.5)
Rockfish	1.0	(0.1)	6.4	(0.1)	697.0	(0.9)	354.6	(0.8)
Pacific cod	181.0	(8.5)	569.2	(3.7)	1785.0	(2.3)	3426.9	(7.3)
Lingcod	12.0	(0.6)	32.2	(0.2)	25.0	(Tr.)	35.1	(0.1)
Other roundfish	21.0	(1.0)	83.5	(0.5)	548.0	(0.7)	491.2	(1.0)
Dogfish	361.0	(17.0)	891.8	(5.8)	211.0	(0.3)	427.1	(0.9)
Ratfish	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)
Skates	274.0	(12.9)	2663.1	(17.2)	206.0	(0.3)	989.3	(2.1)
Shark	3.0	(0.1)	513.0	(3.3)	0.0	(0.0)	0.0	(0.0)
Shellfish	2.0	(0.1)	1.9	(Tr.)	2597.0	(3.4)	713.1	(1.5)
Misc. Invertebrates	84.0	(4.0)	109.7	(0.7)	2209.0	(2.8)	1315.6	(2.8)
TOTAL	2119.0	(100%)	15511.1	(100%)	77445.0	(100%)	46952.1	(100%)

*Based on 35 sets and 204.7 standard skates in Area 2B and 44 sets and 300.6 standard skates in Area 3A. A standard skate is 100 hooks spaced at 18-foot intervals.

**Based on 61 hauls and 35.2 hours of trawling in Area 2B and 83 hauls and 52.0 hours in Area 3A.

The halibut catch in Area 2B by setlines was less than by trawls in terms of number and weight, but the halibut catch in Area 3A by setlines was several times higher than by trawls in terms of weight. CPUE and average weight of halibut by gear and area were as follows:

	Setline			Trawl		
Area	No. per skate	Kg per skate	Kg per fish	No. per hour	Kg per hour	Kg per fish
2B	3.2	15.6	5.0	46.2	138.1	3.0
3A	3.2	34.2	10.6	22.2	60.5	2.7

Setline CPUE in numbers of halibut was similar in Areas 2B and 3A, but setline CPUE in weight was higher in Area 3A, reflecting a larger size in the setline catch. On the other hand, trawl CPUE in Area 2B was about twice that in Area 3A. The higher trawl CPUE in Area 2B does not necessarily indicate greater abundance. Size composition varied by area, and sampling locations may not have been representative of the entire area.

The length composition of trawl- and setline-caught halibut is shown in Figure 7. Halibut in the trawl catch were smaller than those in the setline catch in both areas, apparently as a result of differences in the selective characteristics of the two gears previously discussed in the 1982 Experiment. The length distribution of the trawl and setline catch was wider in Area 3A than in Area 2B, probably due to greater availability of both small and large fish in Area 3A. Skud (1977) noted the scarcity of halibut less than 40 cm long in British Columbia, apparently a result of the distribution and migration of juvenile halibut.

Methodology for Calculating Relative Setline Catchability

The ratio of setline catchability in Area 3A to setline catchability in Area 2B was estimated from the trawl and setline experiment results based on four assumptions: (1) that the size selectivity of setline gear is the same in both areas (for example, if the setline is 50% as efficient at catching an 80 cm halibut as it is at catching a 100 cm halibut in Area 2B, then the 50% size selectivity also applies in Area 3 — note that size selectivity refers to the fishing gear and not to the fisheries in each area), (2) size selectivity of trawl gear is the same in both areas, (3) the catchability of trawl gear is the same in both areas, and (4) the trawl and setline gear randomly sample the same halibut substock within each area. Our basic model for calculating relative setline catchability is given by the following series of equations.

$$CPUE_{siL} = q_{si}S_{sL}N_{iL} \quad (1)$$

where $CPUE_{siL}$ = CPUE of setline gear s for area i and length L,

q_{si} = catchability of setline gear in area i,

S_{sL} = selectivity of setline gear for length L,

and N_{iL} = number of halibut of length L in area i.

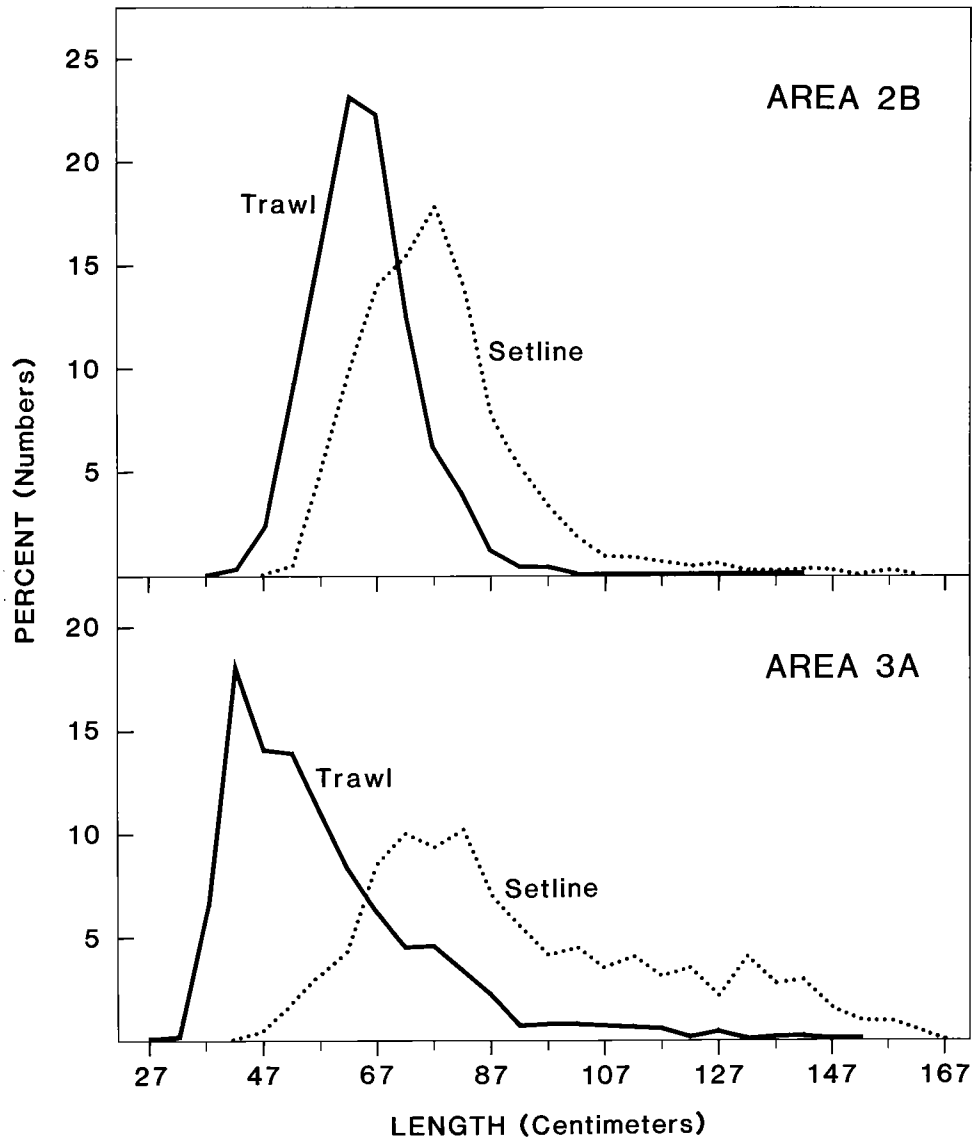

Figure 7. Percentage of halibut by length group for trawls and setlines in Areas 2B and 3A.

$$CPUE_{tiL} = q_{ti} S_{tL} N_{iL} \quad (2)$$

where $CPUE_{tiL}$ = CPUE of trawl gear t for area i and length L,

q_{ti} = catchability of trawl gear in area i,

S_{tL} = selectivity of trawl gear for length L.

By taking the ratio of CPUE of setline to CPUE of trawl catches of length L halibut in area i we get

$$\text{ratio}_{i,L} = (CPUE_{siL}/CPUE_{tiL}) \quad (3)$$
$$= (q_{si}/q_{ti})\,(S_{sL}/S_{tL}),$$

and the ratio of results from Area 3A to Area 2B gives us relative catchability of setline gear, viz.,

$$\text{relative } q_s = \text{ratio}_{3A,L}/\text{ratio}_{2B,L} \quad (4)$$
$$= q_{S,3A}/q_{S,2B}.$$

since assumption (3) states that $q_{t,3A} = q_{t,2B}$. In theory, data for halibut in any given length category could be used in equation (4) to estimate relative catchability, since catchability is assumed to be independent of size. In practice, we find estimates differ by size class, as discussed below.

Application of this model for relative catchability was made to logarithmically transformed CPUE data from our trawl and setline experiment. The logarithm transformation was applied to reduce the right skewness apparent in histograms of data from the experiments; this basically arises from a few sampling stations where unusually large catches were taken.

We first calculate the logarithmic version of equation (3), as the mean difference in logarithm CPUE, averaged over our (N) sample units in an area, viz.

$$r_{i,L} = \ln(\text{ratio}_{i,L}) \quad (5)$$
$$= \frac{1}{N} \sum_{j=1}^{N} [\ln(CPUE_{siL,j}) - \ln(CPUE_{tiL,j})]$$

where j indicates the jth sample unit in area i. Variance estimates were also made for the log-ratios ($r_{3A,L}$ and $r_{2B,L}$) based on the sample variances of setline and trawl data and adjusted for sample covariance between setline and trawl results since they both fished the same sample units:

$$\hat{V}ar(r_{iL}) = \hat{V}ar(\text{average ln } (CPUE_{siL}))$$
$$+ \hat{V}ar(\text{average ln } (CPUE_{tiL}))$$
$$- 2\,\hat{C}ov(\text{average ln } (CPUE_{siL}), \text{average ln } (CPUE_{tiL}))$$

Relative catchability of setline gear can be estimated using the log-ratio estimates above. We estimate the logarithm of relative catchability for each length category as

$$\text{log-relative } q_{sL} = r_{3A,L} - r_{2B,L}$$

the logarithmic version of equation (4), of which the anti-log gives an estimate of the median relative catchability for setline gear (assuming the log-transformed data are approximately normally distributed). We consider the median a better measure of central tendency than the mean. We estimate the variance of log-relative q_L simply as the sum of variances calculated for $r_{3A,L}$ and $r_{2B,L}$.

An overall estimate of log-relative catchability was made with a weighted average of log-relative q_{sL} over all length categories above 80 cm. This weighted average is given by

$$\text{log-relative } q_s = \Sigma\, P_L\, (\text{log-relative } q_{sL})$$

where:
$$P_L = \frac{\text{Var}^{-1}\,(\text{log-relative } q_{sL})}{\Sigma\ \text{Var}^{-1}\,(\text{log-relative } q_{sL})}$$

and summations extend over all length categories above 80 cm. This form of weighted average was chosen since it corresponds to the minimum variance estimate when covariances are zero between different length categories. We doubt those covariances are zero, but nevertheless use this weighted average because it gives more weighting to the estimates with higher precision than to those with low precision (such as occurs for the infrequently caught fish over 120 cm in length).

Our best estimate of relative catchability of setline gear in the two areas is given by the exponential of the above estimate:

$$\text{relative setline } q = \exp\,(\text{log-relative } q).$$

Approximate 95% confidence intervals were calculated for estimates of the relative catchability of setline gear. These intervals are computed from the anti-log of the logarithm of relative catchability plus/minus two standard deviations.

Estimates of Relative Setline Catchability

Estimates of relative setline catchability were made by 5 cm length group. The length interval was kept small because of the difference in size selective properties of the two fishing gears. We initially tried to use stations as the basic sampling unit, but catches by station were too meager to provide data for most length groups. Hence, we combined stations within fishing grounds (Figure 6) to increase catches by length interval. In estimating catchability by length group, only fishing grounds where halibut were caught by both gear types for that length group were used.

The estimates of setline catchability in Area 3A relative to Area 2B are given in Table 4. The estimated catchability was higher in Area 3A than in Area 2B for most length groups. The minimum variance estimates show a relative catchability of 2.37 for all length groups and 1.48 for fish over 80 cm. However, the variance estimates indicate that the relative catchability estimates are not precise and approximate .95 confidence intervals bracket 1.0 for several length groups including the over 80 cm group, suggesting that more sampling is required to statistically reject the hypothesis that catchability is the same between areas. There was a tendency for relative catchability to be higher for lengths less than about 85 cm, although the confidence intervals are wide.

Hook occupancy by dogfish in Area 2B has been hypothesized as a reason for lower halibut catchability in Area 2B. The 1982 study suggested that halibut CPUE declined as dogfish CPUE increased. To further examine the effect of dogfish on halibut catchability with setlines, we excluded grounds where dogfish catches were relatively high and recalculated the estimates of relative catchability. Excluding stations 11-15, where dogfish catches averaged over 15 fish per skate, the estimated catchability in Area 3A was almost identical to that in Area 2B for halibut over 80 cm: relative catchability = 0.989. (Note that excluding stations 11-15 further reduced the number of length groups available for comparison and that the estimated catchability of halibut over 80 cm was based on 3 length groups: 80-84 cm, 85-89 cm, and 95-99 cm). These results provide

Table 4. Estimates of setline catchability in Area 3A relative to Area 2B.

Length (cm)	No. Grounds[1] 2B	No. Grounds[1] 3A	Log-relative Catchability Estimate	Log-relative Catchability Variance	Relative Catchability Estimate	Relative Catchability .95 Confidence Interval	
50- 54	2	5	1.024	0.903	2.785	18.616	0.416
55- 59	3	5	0.538	0.442	1.712	6.474	0.453
60- 64	4	5	1.090	0.791	2.976	17.602	0.503
65- 69	4	6	2.091	0.401	8.097	29.584	2.214
70- 74	4	5	1.490	0.299	4.435	13.248	1.486
75- 79	4	6	0.868	0.298	2.383	7.099	0.799
80- 84	5	6	0.733	0.237	2.082	5.511	0.786
85- 89	4	4	0.509	0.352	1.664	5.448	0.508
90- 94	3	2	-0.765	2.281	0.465	9.538	0.023
95- 99	3	4	-0.044	0.343	0.957	3.088	0.296
100-104	1	3	-0.158	0.254	0.854	2.340	0.312
110-114	1	2	0.762	—	2.143	—	
120-124	1	1	1.790	—	5.992	—	
125-129	1	3	0.370	0.217	1.448	3.676	0.570
140-144	1	1	2.158	—	8.653	—	
All Lengths[2]	—	—	0.863	0.041	2.370	3.550	1.582
>80[2]	—	—	0.392	0.096	1.480	2.751	0.796

[1] A total of 6 grounds were fished in Area 2B, and 8 in Area 3A.
[2] Minimum variance estimates

further evidence that dogfish catches reduce the catchability of halibut by setlines in Area 2B.

Another possible explanation for an area difference in catchability is feeding behavior. An examination of stomach contents from fish over 81 cm long indicates that fish were the primary diet item in both areas: herring (*clupea harengus*) and sandlance (*Ammodytes hexapterus*) were the most common species in Area 2B, whereas herring, pollock (*Theragra chalcogramma*) and Pacific cod (*Gadus macrocephalus*) were the most common in Area 3A. In Area 2B, stomachs from 70 fish were examined: 11 (16%) were empty, and the average weight of the contents was 0.17 kg. Stomachs from 109 fish in Area 3A showed 23 (21%) empty, and an average weight per stomach of 0.25 kg.

COMMERCIAL FISHERY DATA

CPUE and catch-at-age data from the halibut fishery have been used successfully to estimate biomass for the total stock, but methods of estimating biomass by area have not been satisfactory because they depend on assumptions of constant catchability or a closed population, i.e., no immigration or emigration, or are restricted to year classes which have passed through the fishery (Deriso and Quinn II 1983). Consequently, we do not consider previously published estimates of biomass reliable for calculating relative catchability among areas. Quinn II, Deriso and Neal (unpublished IPHC Stock Assessment Report for 1983) outlined a new methodology which has less restrictive assumptions, and provides area estimates of biomass which may be more reliable. The method, called migratory catch-at-age analysis does not assume constant catchability among areas, but does assume migration rates are constant over time. The method also is not completely independent of CPUE data, as catch-effort data were

used to stabilize the estimates. Nevertheless, we used the estimates of biomass from Quinn II, Deriso and Neal to provide estimates of catchability to compare with the results from the 1983 Experiment. These results, however, should be considered speculative until a complete study of the strengths and limitations of the new method can be published.

Estimates of biomass, density, and CPUE, along with the estimated catchability in Areas 2B and 3A are given in Table 5. Catchability was estimated as the ratio of CPUE and density, where density was estimated from biomass using bottom area estimates from Quinn II et al. (1982).

Table 5. Estimates of biomass, density, setline CPUE and catchability in Areas 2B and 3A from commercial fishery data, 1977-1983.

	Biomass[1]		Density[2]		Setline CPUE[3]		Catchability[4]		
	2B	3A	2B	3A	2B	3A	2B	3A	3A/2B
1977	26.6	52.1	327	355	62.5	61.2	0.19	0.17	0.89
1978	26.8	58.6	330	399	64.1	78.1	0.19	0.20	1.05
1979	27.4	65.0	337	442	52.0	85.9	0.15	0.19	1.27
1980	28.0	71.2	345	485	64.3	118.4	0.19	0.24	1.26
1981	28.4	74.9	349	510	60.7	137.7	0.17	0.27	1.59
1982	29.7	77.9	365	530	60.3	167.4	0.17	0.32	1.88
1983	32.7	81.7	402	556	85.4	213.4	0.21	0.38	1.81

[1] Exploitable biomass in millions of pounds (Quinn II, Deriso, and Neal Table 2, unpublished IPHC Stock Assessment Rept. 1983)

[2] Biomass (lbs) per km² of bottom area. Area estimates are from Quinn II et al. (1982): Area 2B = 81,275 km² and Area 3A = 146,896 km².

[3] Pounds per standard skate (IPHC, unpublished)

[4] CPUE divided by density

The results suggest that catchability nearly doubled in Area 3A from 1977 to 1983, whereas it remained relatively stable in Area 2B over the period. (CPUE in Area 3A more than tripled between 1977 and 1983, but the estimated biomass increased only about 60%.) The estimates from the commercial fishery support the findings from the 1983 Experiment that catchability is higher in Area 3A than in Area 2B. The reason for the apparent increase in Area 3A catchability is not fully understood, but some factors contributing to the sharp increase in CPUE in Area 3A are discussed in the following section of the report.

DISCUSSION AND CONCLUSIONS

Results from the 1982 Experiment indicate a poor correlation between setline and trawl CPUE when the same grounds are fished on different days by the two gears, and support the hypothesis that setline CPUE in British Columbia may not provide an accurate measure of halibut density. The analyses suggest that dogfish adversely affect the setline CPUE of halibut. Trawling may also affect setline CPUE, but sample size

was generally too small to provide statistical confidence in the results. Other species such as skates were also frequently caught and could have further reduced setline CPUE. Even if these factors reduce the CPUE of setline gear, it is still not possible to evaluate the impact on estimates of CPUE in the commercial fishery without information on the occurrence of these factors during commercial fishing. The commercial fishery may be able to mitigate the effects by avoiding areas where trawling or dogfish are prevalent.

The 1983 Experiment suggests that setline catchability in Area 2B was less than in Area 3A, although the sample size was small and the estimates of relative catchability were highly variable. Estimates from commercial fishery data support the findings from the 1983 Experiment that catchability is higher in Area 3A, and indicate that the difference between areas is due to an increase in Area 3A catchability rather than a decline in Area 2B catchability. Although the results from the 1982 Experiment indicated that dogfish may adversely affect setline catchability, there is no evidence that dogfish populations increased during the 1970's or 1980's. In fact, the model by Wood et al. (1979) would indicate that dogfish abundance was relatively stable during the 1970's and 1980's. Therefore, we doubt that dogfish account for the apparent change in catchability between areas during the 1970's.

Setline catchability in British Columbia as well as other areas appears to be very complex, and the results presented in this paper do not provide sufficient information to standardize setline CPUE and fishing effort. Other factors have altered the relationship between catch and fishing effort in recent years. A brief discussion of these problems is included below.

The number of vessels using conventional fixed-hook setline gear has declined as vessels switch to snap gear — setline gear where the gangions and hooks are attached to the groundline with snaps. This has reduced the amount of logbook data available to IPHC for estimating CPUE, because IPHC has not been able to satisfactorily standardize effort from snap vessels. Myhre and Quinn II (1984) compared the efficiency of the two gears and found no intrinsic difference, but data from the fishery indicate that the CPUE from fixed-hook gear is much higher than from snap gear. Fishermen who use fixed-hook gear tend to have greater fishing experience and this may account for their higher CPUE. Another possibility may be that the number of hooks actually fished by snap gear is overestimated in the log records; most snap vessels do not record the actual number of hooks fished, but rather estimate the number of skates fished and the hook spacing.

Halibut fishermen have recently started converting to circle-shaped hooks from the traditional J-shaped hooks. The conversion began several years ago but became widespread in 1983. Based on logbooks at the beginning of 1983 fishing, about 20% of fishing effort involved some use of circle hooks in the U.S. fleet; only a few vessels in Canada converted in 1983. However, most vessels in the U.S. fleet probably were using at least some circle hooks by the end of the fishing season. Unfortunately, a precise estimate of total effort with circle hooks in 1983 is not available.

IPHC conducted several studies during 1983 to provide information on relative efficiency of circle hooks. The results clearly indicated a higher CPUE with circle hooks, but further investigations will be needed to precisely determine the efficiency of the circle hooks and to develop a CPUE conversion factor.

Since the 1970's, fishing seasons in British Columbia have been much longer than seasons in Alaska where CPUE had been higher and the number of vessels participating has increased. Logbook data indicate that CPUE tends to decline during a fishing period, and the decline has been largest in Alaska where the seasons have been short and

intense. This probably is a result of local depletion on popular fishing grounds and competition among vessels during closed periods. Halibut apparently redistribute themselves over the grounds as CPUE often will again be high at the beginning of the next fishing period. Prospecting prior to the season may also contribute to the high CPUE at the start of the season. An associated factor is illegal fishing where the catch prior to the season may be claimed as part of the first day's catch. These "opening day" effects suggest that CPUE from short fishing periods cannot be compared directly with CPUE from long periods, and an adjustment may be needed for season length.

In summary, recent investigations indicate that setlines in British Columbia were less effective in catching halibut than in Alaska during the early 1980's. Although experimental data indicated that dogfish and trawling may reduce CPUE in the British Columbia fishery, the major difference between areas appears to be due to an increase in setline catchability in Alaska rather than a decline in British Columbia. Estimates of fishing mortality that are completely independent of fishing effort (e.g., tagging studies) however, are needed to confirm this conclusion. The relationship between catch and setline effort is apparently complex, and further investigations are probably required before CPUE and effort data can be standardized among regions. In the meantime, we recommend caution in the use of setline CPUE or effort data in assessing the condition of Pacific halibut stocks.

Setline catchability, however, is only one of many factors that may have contributed to recent changes in setline CPUE. Abundance has also changed, and estimates of biomass (Table 5) account for a 57% increase in CPUE in Area 3A between 1977 and 1983. Although beyond the scope of this paper, environmental factors may be critical in determining the distribution of halibut stocks along the coast. Warm water temperatures, for example, could have reduced the migration rate of halibut from Alaska to British Columbia. Fishing (both direct and incidental) may also affect relative productivity among areas. These and other factors need to be thoroughly examined before changes in setline CPUE can be fully understood.

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LITERATURE CITED

Best, Edgar A., and William H. Hardman. 1982. Juvenile halibut surveys, 1973-1980. International Pacific Halibut Commission, Technical Report No. 20, 38 p.

Deriso, Richard B., and Terrance J. Quinn II. 1983. The Pacific Halibut Resource and Fishery in Regulatory Area 2, II. Estimates of Biomass, Surplus Production, and Reproductive Value. International Pacific Halibut Commission, Scientific Report No. 67, pp. 55-89.

Hoag, Stephen H. 1971. Effects of domestic trawling on the halibut stocks of British Columbia. International Pacific Halibut Commission, Scientific Report No. 53, 18 p.

_____. 1975. Survival of halibut released after capture by trawls. International Pacific Halibut Commission, Scientific Report No. 57, 18 p.

_____. 1976. The effect of trawling on the setline fishery for halibut. International Pacific Halibut Commission, Scientific Report No. 61, 20 p.

Hoag, Stephen H., Cyreis C. Schmitt, and William H. Hardman. 1979. Size, age, and frequency of male and female halibut: Setline research catches, 1925-1977. International Pacific Halibut Commission, Technical Report No. 17, 112 p.

Myhre, Richard J. 1969. Gear selection and Pacific halibut. International Pacific Halibut Commission, Report No. 51, 35 p.

Myhre, Richard J., Gordon J. Peltonen, Gilbert St-Pierre, Bernard E. Skud, and Raymond E. Walden. 1977. The Pacific halibut fishery: catch, effort and CPUE, 1929-1975. International Pacific Halibut Commission, Technical Report No. 14, 96 p.

Myhre, Richard J., and Terrance J. Quinn II. 1984. Comparison of efficiency of snap gear to fixed-hook setline gear for catching Pacific halibut. International Pacific Halibut Commission, Scientific Report No. 69, 37 p.

Quinn II, Terrance J., Richard B. Deriso, Stephen H. Hoag, and Richard J. Myhre. 1983. A summary of methods of estimating annual surplus production for the Pacific halibut fishery. Presented at International North Pacific Fisheries Commission, Special Scientific Sessions, October 28-30, 1981.

Quinn II, T. J., S. H. Hoag, and G. M. Southward. 1982. Comparison of two methods of combining catch-per-unit-effort data from geographic regions. Canadian Journal of Fisheries and Aquatic Sciences 39(6): 837-846.

Skud, Bernard E. 1972. A reassessment of effort in the halibut fishery. International Pacific Halibut Commission, Scientific Report No. 54, 11 p.

_____. 1977. Drift, Migration, and Intermingling of Pacific Halibut Stocks. International Pacific Halibut Commission, Scientific Report No. 63, 42 p.

_____. 1978. Factors affecting longline catch and effort: III. Bait loss and competition. International Pacific Halibut Commission, Scientific Report No. 64, pp. 26-66.

Wood, C. C., K. S. Ketchen, and R. J. Beamish. 1979. Population dynamics of spiny dogfish (*Squalus acanthias*) in British Columbia waters. Journal Fisheries Research Board of Canada 36: 647-656.

APPENDIX

Appendix Table Ia. Catch and effort by station for the trawler M/V NORE-DICK during the 1982 Experiment.

Appendix Table Ib. Catch and effort by station for the setliner M/V PROUD CANADIAN during the 1982 Experiment.

Appendix Table IIa. Catch and effort by station for the trawler M/V PACIFIC HARVESTER during the 1983 Experiment.

Appendix Table IIb. Catch and effort by station for the setliner M/V LORELEI II during the 1983 Experiment.

Appendix Table Ia. Catch and effort by station for the trawler M/V NORE-DICK during the 1982 Experiment.

Station	1		2		3		4		6		7		8		9	
Date	7/25/82		7/25/82		7/25/82		7/25/82		7/24/82		7/24/82		7/24/82		7/24/82	
Lat./Long.	54:09-131:58		54:09-131:59		54:10-131:58		54:10-131:58		54:09-132:02		54:10-132:02		54:10-132:02		54:11-132:02	
Depth Range	35-35		40-42		45-45		49-50		34-35		40-41		45-46		50-51	
No. of Haul	2		2		2		2		2		2		1		1	
Duration	60		60		60		60		60		60		30		30	
Distance	3.2		3.1		3.0		3.2		3.4		3.2		1.6		1.6	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	35	156.3	22	98.0	10	34.6	4	16.2	637	2130.3	35	94.2	3	4.5	6	10.4
Arrowtooth	533	502.8	4216	3402.5	4860	3490.6	8088	5317.2	699	691.2	1124	997.2	870	821.8	3054	1880.0
Butter S.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dover S.	-	-	53	100.6	199	123.6	266	152.2	-	-	-	-	7	8.2	254	391.9
English S.	702	276.0	1230	485.2	575	225.3	518	241.9	79	47.5	467	203.4	256	118.4	254	150.9
Flathead S.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Petrale S.	28	20.3	23	24.6	100	50.6	-	-	45	60.6	10	11.4	-	-	-	-
Rex S.	4	0.2	55	10.4	382	72.0	359	83.3	-	-	12	1.1	59	15.4	36	12.4
Rock S.	115	102.4	23	29.7	-	-	-	-	370	398.8	293	283.9	7	13.8	-	-
Sand Dab	20	2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Ftfsh	-	-	11	2.8	-	-	-	-	-	-	1	0.3	-	-	-	-
Sablefish	-	-	-	-	-	-	9	6.6	-	-	-	-	-	-	-	-
Cottid	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ling Cod	-	-	-	-	-	-	-	-	12	28.9	8	20.9	-	-	-	-
Pollock	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pacific Cod	111	264.8	293	616.2	50	177.1	33	103.0	53	104.7	179	309.4	29	41.3	-	-
Rockfish	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Rdfsh	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dogfish	4	13.4	17	62.6	8	31.8	36	151.8	2	11.0	2	9.6	2	7.0	1	4.2
Ratfish	10	9.2	21	9.2	105	66.3	121	94.1	344	259.2	266	116.3	475	409.3	218	231.2
Skate	5	29.8	-	-	-	-	9	56.8	9	35.2	-	-	15	68.2	36	46.2
Box Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dungen Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hermit Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tanner Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scallop	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Shrimp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Inver.	35	28.6	23	7.2	156	37.1	19	13.9	145	146.6	122	102.3	59	21.1	73	30.8
Total Catch	1602	1406.0	5987	4849.0	6445	4309.0	9462	6237.0	2395	3914.0	2519	2150.0	1782	1529.0	3932	2758.0

Appendix Table Ia (continued). Catch and effort by station for the trawler M/V NORE-DICK during the 1982 Experiment.

Station	10		11		12		13		14		15		16		17	
Date	7/27/82		7/27/82		7/27/82		7/27/82		7/26/82		7/26/82		7/26/82		7/26/82	
Lat./Long.	54:11-131:55		54:11-131:55		54:12-131:55		54:12-131:55		54:10-131:55		54:10-131:56		54:10-131:56		54:09-131:55	
Depth Range	55-55		60-60		63-66		70-70		50-50		45-45		40-40		35-35	
No. of Haul	2		2		2		2		2		2		2		2	
Duration	60		60		60		60		60		53		60		60	
Distance	2.7		3.2		3.2		3.1		3.1		2.6		3.1		3.3	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	-	-	6	24.9	8	40.6	8	39.1	9	51.3	11	43.1	17	60.0	46	155.7
Arrowtooth	2847	1684.3	2492	1327.0	1301	771.8	625	484.1	5945	3434.8	2118	1183.7	1649	1097.5	402	247.2
Butter S.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dover S.	449	242.0	562	307.2	913	517.5	653	450.0	238	95.8	99	38.9	118	34.8	-	-
English S.	118	58.9	-	-	37	24.5	-	-	250	93.1	299	117.8	1588	527.9	413	111.0
Flathead S.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Petrale S.	-	-	-	-	7	5.2	-	-	-	-	-	-	4	4.3	11	10.6
Rex S.	236	76.3	111	38.7	86	27.5	123	41.8	544	137.0	294	71.8	141	28.8	-	-
Rock S.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	1.2
Sand Dab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	82	12.8
Other Ftfsh	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sablefish	13	7.2	59	38.9	53	35.7	83	54.4	94	63.2	-	-	-	-	-	-
Cottid	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ling Cod	13	40.7	-	-	-	-	-	-	33	229.3	-	-	7	25.4	9	35.4
Pollock	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11	0.5
Pacific Cod	-	-	9	28.2	8	3.4	-	-	-	-	10	6.8	27	8.0	45	22.7
Rockfish	-	-	-	-	33	18.2	163	53.0	-	-	-	-	-	-	-	-
Other Rdfsh	-	-	-	-	-	-	-	-	38	51.7	-	-	-	-	5	0.3
Dogfish	8	27.7	16	58.1	36	133.8	22	90.7	20	83.4	22	100.0	15	83.5	2	6.7
Ratfish	29	16.9	81	58.4	112	90.6	58	60.6	375	247.4	104	71.5	345	132.5	636	656.7
Skate	-	-	9	0.7	7	12.9	33	47.7	-	-	15	37.2	-	-	4	25.7
Box Crab	-	-	-	-	8	4.6	-	-	-	-	-	-	-	-	-	-
Dungen Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	2.1
Hermit Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tanner Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scallop	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Shrimp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Inver.	-	-	68	22.9	57	14.7	13	5.6	400	140.0	290	257.2	63	38.3	178	117.4
Total Catch	3713	2154.0	3413	1905.0	2666	1701.0	1781	1327.0	7946	4627.0	3262	1928.0	3974	2041.0	1853	1406.0

Appendix Table Ia (continued). Catch and effort by station for the trawler M/V NORE-DICK during the 1982 Experiment.

Station	18		19		20		21		22		23		24		25	
Date	7/29/82		7/29/82		7/29/82		7/29/82		7/31/82		7/31/82		7/31/82		7/31/82	
Lat./Long.	54:10-131:52		54:10-131:52		54:11-131:48		54:11-131:48		54:10-131:49		54:10-131:48		54:10-131:51		54:09-131:52	
Depth Range	34-35		39-40		39-43		35-36		25-25		30-30		30-31		25-25	
No. of Haul	2		2		2		2		2		2		2		2	
Duration	60		60		60		60		60		60		60		60	
Distance	3.1		3.2		3.2		3.1		3.2		3.1		3.1		3.2	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	14	42.2	8	29.8	11	49.1	10	24.2	46	78.5	2	6.6	19	44.4	35	88.0
Arrowtooth	4430	2416.4	5363	2963.5	4340	2311.0	2890	1531.7	1	1.6	-	-	14	8.3	-	-
Butter S.	-	-	-	-	-	-	-	-	19	2.2	-	-	-	-	5	0.7
Dover S.	190	50.7	249	60.1	560	194.2	89	32.7	-	-	-	-	-	-	-	-
English S.	1080	251.2	938	240.9	212	73.4	666	164.1	2	0.3	-	-	1	0.1	2	0.3
Flathead S.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Petrale S.	6	0.6	-	-	21	29.5	20	25.4	90	145.1	-	-	7	9.9	9	16.5
Rex S.	203	25.2	221	40.6	537	138.9	531	129.4	-	-	-	-	1	0.1	-	-
Rock S.	-	-	-	-	-	-	-	-	85	68.1	19	9.5	163	65.2	259	150.3
Sand Dab	105	19.0	-	-	-	-	-	-	5	0.6	-	-	-	-	-	-
Other Ftfsh	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sablefish	-	-	-	-	96	77.6	8	3.1	-	-	-	-	-	-	-	-
Cottid	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ling Cod	-	-	24	28.4	10	28.0	-	-	3	6.6	1	6.5	5	14.4	-	-
Pollock	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
True Cod	-	-	240	167.9	42	60.4	70	57.6	1	3.1	-	-	-	-	-	-
Rockfish	-	-	-	-	19	18.3	-	-	-	-	-	-	-	-	-	-
Other Rdfsh	-	-	-	-	-	-	-	-	-	-	1	0.2	-	-	-	-
Dogfish	3	11.0	5	18.8	4	14.1	5	12.2	-	-	-	-	14	40.8	31	109.9
Ratfish	262	173.8	285	172.5	131	87.9	130	116.6	-	-	4	0.8	1358	393.4	1218	229.0
Skate	-	-	-	-	-	-	12	1.4	1	12.1	1	28.0	-	-	-	-
Box Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dungen Crab	34	21.7	12	17.9	191	92.6	197	95.3	85	40.5	30	20.0	31	18.4	20	10.3
Hermit Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tanner Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scallop	12	1.3	-	-	-	-	12	5.3	4	6.0	-	-	-	-	9	9.7
Shrimp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Inver.	68	48.9	180	115.6	-	-	51	23.0	1*	51.1	2*	835.4	35	36.5	26	20.3
Total Catch	6407	3062.0	7525	3856.0	6174	3175.0	4691	2222.0	343	415.8	60	907.0	1648	631.5	1614	635.0

*Seaweed

Appendix Table Ia (continued). Catch and effort by station for the trawler M/V NORE-DICK during the 1982 Experiment.

Station	26		27		28		29		30		31		32		33	
Date	7/28/82		7/28/82		7/28/82		7/28/82		8/02/82		8/02/82		8/02/82		8/02/82	
Lat./Long.	54:08-131:55		54:08-131:55		54:08-131:58		54:08-131:58		53:00-130:49		52:59-130:47		52:58-130:43		52:58-130:41	
Depth Range	25-26		29-30		30-31		24-25		52-53		52-53		52-53		48-54	
No. of Haul	2		2		2		2		2		2		2		2	
Duration	60		60		60		60		60		60		60		60	
Distance	3.2		3.2		3.2		3.3		2.6		3.0		3.3		2.9	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	43	121.5	70	215.3	200	383.8	205	458.9	2	4.9	6	21.0	25	52.5	6	12.7
Arrowtooth	-	-	9	6.4	20	16.1	-	-	34	36.3	69	43.6	14	8.0	12	0.8
Butter S.	8	2.8	-	-	13	2.7	-	-	-	-	22	3.6	38	6.6	4	0.8
Dover S.	-	-	-	-	-	-	-	-	178	31.7	132	29.5	-	-	-	-
English S.	-	-	-	-	-	-	-	-	1593	342.6	2315	707.7	1348	243.2	1453	278.6
Flathead S.	-	-	-	-	-	-	-	-	47	6.2	104	11.6	-	-	-	-
Petrale S.	8	11.6	22	25.5	121	125.2	151	167.2	19	12.5	-	-	18	11.3	2	1.0
Rex S.	-	-	-	-	1	0.1	-	-	2240	421.0	1539	269.8	4	0.7	40	5.8
Rock S.	277	274.6	137	73.6	774	675.8	775	681.9	7	10.0	-	-	28	25.4	-	-
Sand Dab	15	1.7	-	-	6	1.3	5	1.2	-	-	-	-	-	-	-	-
Other Ftfsh	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sablefish	-	-	-	-	-	-	-	-	32	14.0	133	59.1	-	-	-	-
Cottid	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ling Cod	8	23.6	5	15.6	1	6.5	-	-	-	-	17	220.0	39	107.4	67	669.4
Pollock	-	-	-	-	-	-	-	-	-	-	8	0.8	-	-	-	-
Pacific Cod	-	-	-	-	65	90.8	-	-	21	14.1	207	277.7	11	8.4	-	-
Rockfish	-	-	-	-	-	-	-	-	7	12.0	-	-	-	-	-	-
Other Rdfsh	-	-	-	-	-	-	-	-	-	-	15	1.0	5	1.1	-	-
Dogfish	2	7.3	3	12.5	17	60.3	8	27.7	10	46.1	12	48.9	35	124.9	399	1129.8
Ratfish	-	-	-	-	-	-	-	-	151	27.2	98	20.9	255	79.0	4	1.6
Skate	4	12.1	1	6.0	1	1.4	6	67.4	3	3.2	-	-	1	35.0	-	-
Box Crab	-	-	-	-	-	-	-	-	7	5.2	-	-	-	-	-	-
Dungen Crab	19	10.8	-	-	7	4.4	11	6.0	-	-	-	-	-	-	-	-
Hermit Crab	-	-	-	-	-	-	-	-	37	5.8	-	-	-	-	-	-
Other Crab	-	-	-	-	-	-	-	-	-	-	23	13.3	-	-	-	-
Tanner Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scallop	55	39.7	39	28.0	6	3.4	22	13.9	-	-	-	-	-	-	-	-
Shrimp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Inver.	120	61.3	45	28.6	65	49.0	61	26.8	54	28.2	84	108.5	75	22.5	6	2.6
Total Catch	559	567.0	331	411.5	1297	1420.8	1244	1451.0	4442	1021.0	4784	1837.0	1896	726.0	1993	2103.1

Appendix Table Ia (continued). Catch and effort by station for the trawler M/V NORE-DICK during the 1982 Experiment.

Station	34		35		36		37		TOTAL	
Date	8/01/82		8/01/82		8/01/82		8/1/82		1982	
Lat./Long.	52:58-130:33		52:55-130:47		52:56-130:47		52:55-130:46		2B	
Depth Range	55-69		28-30		25-27		28-32		24-70	
No. of Haul	1		1		1		1		66	
Duration	30		30		15		20		1948	
Distance	1.6		1.5		0.8		1.0		101.4	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	1	1.7	415	2051.3	10	60.9	29	106.0	2014	6812.5
Arrowtooth	519	546.3	-	-	-	-	-	-	58538	37223.7
Butter S.	-	-	-	-	-	-	-	-	109	19.4
Dover S.	354	135.7	-	-	-	-	-	-	5563	2997.3
English S.	718	243.2	-	-	-	-	-	-	17114	5227.4
Flathead S.	-	-	-	-	-	-	-	-	151	17.8
Petrale S.	-	-	-	-	-	-	-	-	722	768.9
Rex S.	177	44.2	-	-	-	-	-	-	7936	1692.5
Rock S.	-	-	-	-	48	53.9	83	33.9	3467	2952.0
Sand Dab	-	-	-	-	-	-	-	-	238	38.8
Other Ftfsh	-	-	-	-	-	-	-	-	12	3.1
Sablefish	22	15.1	-	-	-	-	-	-	602	374.9
Cottid	-	-	-	-	-	-	-	-	-	-
Ling Cod	-	-	8	160.0	1	4.5	-	-	271	1671.5
Pollock	-	-	-	-	-	-	-	-	19	1.3
Pacific Cod	11	12.4	-	-	-	-	-	-	1515	2378.0
Rockfish	55	98.9	-	-	-	-	-	-	277	200.4
Other Rdfsh	-	-	-	-	-	-	-	-	64	54.3
Dogfish	4	20.5	300	900.0	81	249.7	57	152.4	1203	3862.2
Ratfish	11	3.5	-	-	-	-	-	-	7207	3835.6
Skate	-	-	275	6600.0	54	710.7	138	1500.6	639	9338.3
Box Crab	-	-	-	-	-	-	-	-	15	9.8
Dungen Crab	-	-	-	-	-	-	-	-	642	340.0
Hermit Crab	-	-	-	-	-	-	-	-	37	5.8
Other Crab	-	-	-	-	-	-	-	-	23	13.3
Tanner Crab	-	-	-	-	-	-	-	-	-	-
Scallop	-	-	-	-	-	-	-	-	159	107.3
Shrimp	-	-	-	-	-	-	-	-	-	-
Other Inver.	22	12.5	50	25.0	101	54.3	71	44.1	2818	2577.9
Total Catch	1894	1134.0	1048	9736.3	295	1134.0	378	1837.0	111,355	82524.0

Appendix Table Ib. Catch and effort by station for the setliner M/V PROUD CANADIAN during the 1982 Experiment.

Station	1		2		3		4		6	
Date	7/24/82		7/24/82		7/24/82		7/24/82		7/25/82	
Lat./Long.	54:09-131:58		54:09-131:59		54:10-131:58		54:10-131:58		54:09-132:02	
Depth Range	35-35		40-42		45-45		49-50		34-35	
Std. Skates	4.51		4.51		4.51		4.51		4.51	
Time Set	05:40		06:40		07:20		08:00		06:10	
Soak Time	4:55		5:25		6:40		8:05		4:50	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	31	129.3	32	116.3	21	160.3	18	84.1	32	130.4
Arrowtooth	-	-	-	-	-	-	-	-	4	7.7
Petrale	-	-	-	-	-	-	-	-	-	-
Black Cod	-	-	-	-	-	-	-	-	-	-
Cottid	-	-	-	-	-	-	-	-	-	-
Ling Cod	-	-	-	-	-	-	-	-	-	-
True Cod	2	9.1	2	6.8	2	5.4	-	-	-	-
Rockfish	-	-	-	-	-	-	-	-	-	-
Other Rdfsh	-	-	-	-	-	-	-	-	-	-
Dogfish	15	61.2	18	81.6	16	70.3	21	74.4	13	41.3
Ratfish	-	-	-	-	-	-	-	-	-	-
Shark	-	-	-	-	-	-	-	-	-	-
Skate	3	24.5	12	204.1	4	90.7	11	174.6	10	167.8
Starfish	1	0.5	1	0.5	-	-	-	-	-	-
Inver.	-	-	-	-	-	-	-	-	-	-
Total Catch	52	224.6	65	409.3	43	326.7	50	333.1	59	347.2

Station	7		8		9		10		11	
Date	7/25/82		7/25/82		7/25/82		7/26/82		7/26/82	
Lat./Long.	54:10-132:02		54:10-132:02		54:11-132:02		54:11-131:55		54:11-131:55	
Depth Range	40-41		45-46		50-51		55-55		60-60	
Std. Skates	4.51		4.51		4.51		4.51		4.51	
Time Set	06:50		07:35		08:25		06:30		07:20	
Soak Time	5:55		6:55		7:50		5:12		5:51	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	20	80.3	14	53.0	8	35.7	6	27.0	11	61.2
Arrowtooth	2	6.8	2	3.6	5	9.1	-	-	1	2.3
Petrale	-	-	-	-	-	-	-	-	-	-
Black Cod	-	-	-	-	-	-	1	0.9	-	-
Cottid	-	-	-	-	-	-	-	-	-	-
Ling Cod	-	-	-	-	-	-	-	-	-	-
True Cod	-	-	1	4.5	2	7.7	-	-	-	-
Rockfish	-	-	-	-	-	-	-	-	-	-
Other Rdfsh	-	-	-	-	-	-	-	-	-	-
Dogfish	12	49.0	10	45.4	18	77.6	49	177.8	35	182.8
Ratfish	-	-	-	-	-	-	-	-	-	-
Shark	-	-	-	-	-	-	-	-	-	-
Skate	9	151.0	8	108.9	4	77.1	5	54.0	3	40.8
Starfish	2	1.8	1	0.9	-	-	1	0.9	-	-
Inver.	-	-	-	-	-	-	-	-	-	-
Total Catch	45	288.9	36	216.3	37	207.2	62	260.6	50	287.1

Appendix Table Ib (continued). Catch and effort by station for the setliner M/V PROUD CANADIAN during the 1982 Experiment.

Station	12		13		14		15		16	
Date	7/26/82		7/26/82		7/27/82		7/27/82		7/27/82	
Lat./Long.	54:12-131:55		54:12-131:55		54:10-131:55		54:10-131:56		54:10-131:56	
Depth Range	63-66		70-70		50-50		45-45		40-40	
Std. Skates	4.51		4.51		4.51		4.51		4.51	
Time Set	08:15		09:00		06:10		06:55		07:30	
Soak Time	6:30		7:35		4:50		5:45		6:55	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	13	105.9	8	39.0	12	50.3	7	28.5	19	70.4
Arrowtooth	-	-	-	-	1	1.4	4	2.7	1	1.4
Petrale	-	-	-	-	-	-	-	-	-	-
Black Cod	-	-	-	-	-	-	-	-	-	-
Cottid	-	-	-	-	-	-	-	-	-	-
Ling Cod	-	-	-	-	-	-	-	-	-	-
True Cod	-	-	-	-	1	3.6	-	-	-	-
Rockfish	-	-	-	-	-	-	-	-	-	-
Other Rdfsh	-	-	-	-	-	-	-	-	-	-
Dogfish	24	98.0	17	73.5	61	276.7	41	176.4	39	186.0
Ratfish	-	-	-	-	-	-	-	-	-	-
Shark	-	-	-	-	-	-	-	-	-	-
Skate	10	61.2	3	95.3	2	10.0	1	4.5	-	-
Starfish	-	-	-	-	1	0.9	-	-	3	1.8
Inver.	-	-	-	-	-	-	-	-	-	-
Total Catch	47	265.1	28	207.8	78	342.9	53	212.1	62	259.6

Station	17		18		19		20		21	
Date	7/27/82		7/28/82		7/28/82		7/28/82		7/28/82	
Lat./Long.	54:09-131:55		54:10-131:52		54:10-131:52		54:11-131:48		54:11-131:48	
Depth Range	35-35		34-35		39-40		39-43		35-36	
Std. Skates	4.51		4.51		4.51		4.51		4.51	
Time Set	08:10		06:10		06:45		07:15		07:55	
Soak Time	7:40		4:49		5:51		6:57		7:40	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	41	162.3	9	40.8	8	29.5	18	61.7	10	41.0
Arrowtooth	1	0.9	6	9.5	2	2.7	1	1.4	1	1.4
Petrale	-	-	-	-	-	-	-	-	-	-
Black Cod	-	-	-	-	-	-	-	-	-	-
Cottid	-	-	-	-	-	-	-	-	-	-
Ling Cod	-	-	-	-	-	-	-	-	-	-
True Cod	-	-	2	8.2	1	3.6	-	-	-	-
Rockfish	-	-	-	-	-	-	-	-	-	-
Other Rdfsh	-	-	-	-	-	-	-	-	-	-
Dogfish	18	89.8	19	73.9	22	119.7	21	95.3	13	62.1
Ratfish	-	-	-	-	-	-	-	-	-	-
Shark	-	-	-	-	-	-	-	-	-	-
Skate	2	9.1	7	112.0	5	70.3	2	10.9	1	31.8
Starfish	-	-	1	0.5	1	0.5	1	0.5	-	-
Inver.	-	-	-	-	-	-	-	-	-	-
Total Catch	62	262.1	44	244.9	39	226.3	43	169.8	25	136.3

Appendix Table Ib (continued). Catch and effort by station for the setliner M/V PROUD CANADIAN during the 1982 Experiment.

Station	22		23		24		25		26	
Date	7/30/82		7/30/82		7/30/82		7/30/82		7/31/82	
Lat./Long.	54:10-131:49		54:10-131:48		54:10-131:51		54:09-131:52		54:08-131:55	
Depth Range	25-25		30-30		30-31		25-25		25-26	
Std. Skates	4.51		4.51		4.51		4.51		4.51	
Time Set	06:20		07:00		08:00		08:40		07:30	
Soak Time	4:56		5:50		6:19		7:22		4:30	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	14	51.5	16	49.5	17	67.3	13	58.0	4	13.3
Arrowtooth	-	-	-	-	-	-	-	-	-	-
Petrale	1	3.2	1	1.8	-	-	-	-	-	-
Black Cod	-	-	-	-	-	-	-	-	-	-
Cottid	-	-	-	-	-	-	-	-	-	-
Ling Cod	-	-	-	-	-	-	-	-	-	-
True Cod	-	-	-	-	-	-	-	-	-	-
Rockfish	-	-	-	-	-	-	-	-	-	-
Other Rdfsh	-	-	-	-	-	-	-	-	-	-
Dogfish	61	268.5	40	150.6	42	175.1	56	215.9	133	512.6
Ratfish	-	-	-	-	-	-	-	-	-	-
Shark	-	-	-	-	-	-	-	-	-	-
Skate	-	-	1	22.7	-	-	2	24.0	-	-
Starfish	4	3.2	-	-	3	3.2	10	11.8	2	3.2
Inver.	-	-	-	-	-	-	-	-	-	-
Total Catch	80	326.4	58	224.6	62	245.6	81	309.7	139	529.1

Station	27		28		29		30		31	
Date	7/31/82		7/31/82		7/31/82		8/01/82		8/01/82	
Lat./Long.	54:08-131:55		54:08-131:58		54:08-131:58		53:00-130:49		52:59-130:47	
Depth Range	29-30		30-31		24-25		52-53		52-53	
Std. Skates	4.51		4.51		4.51		4.51		4.51	
Time Set	08:25		09:40		10:15		06:15		06:40	
Soak Time	5:00		7:03		4:57		5:20		6:45	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	3	10.0	8	32.5	17	64.2	-	-	4	27.7
Arrowtooth	-	-	-	-	-	-	-	-	-	-
Petrale	-	-	-	-	-	-	-	-	-	-
Black Cod	-	-	-	-	-	-	-	-	-	-
Cottid	-	-	-	-	-	-	-	-	-	-
Ling Cod	-	-	-	-	-	-	-	-	-	-
True Cod	-	-	-	-	-	-	-	-	-	-
Rockfish	-	-	-	-	-	-	-	-	-	-
Other Rdfsh	-	-	-	-	-	-	-	-	-	-
Dogfish	160	580.6	107	378.3	62	215.9	243	937.1	13	54.9
Ratfish	-	-	-	-	-	-	-	-	-	-
Shark	-	-	-	-	-	-	-	-	-	-
Skate	1	4.5	1	13.6	-	-	-	-	6	55.8
Starfish	2	0.9	-	-	-	-	1	0.9	17	11.3
Inver.	-	-	-	-	-	-	-	-	-	-
Total Catch	166	596.0	116	424.4	79	280.1	244	938.0	40	149.7

Appendix Table Ib (continued). Catch and effort by station for the setliner M/V PROUD CANADIAN during the 1982 Experiment.

Station	32		33		34		35		36	
Date	8/01/82		8/01/82		8/02/82		8/02/82		8/02/82	
Lat./Long.	52:58-130:43		52:58-130:41		52:58-130:33		52:55-130:47		52:56-130:47	
Depth Range	52-53		48-54		55-69		28-30		25-27	
Std. Skates	4.51		4.51		4.51		4.51		4.51	
Time Set	07:00		07:25		07:05		08:20		09:10	
Soak Time	7:52		8:59		4:20		7:49		5:24	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	11	88.8	-	-	4	30.8	16	79.3	14	89.3
Arrowtooth	-	-	-	-	9	13.6	-	-	-	-
Petrale	-	-	-	-	-	-	-	-	-	-
Black Cod	-	-	-	-	6	5.4	-	-	-	-
Cottid	-	-	-	-	-	-	-	-	-	-
Ling Cod	-	-	-	-	-	-	1	15.9	-	-
True Cod	-	-	-	-	-	-	-	-	-	-
Rockfish	-	-	-	-	1	4.5	-	-	-	-
Other Rdfsh	-	-	-	-	-	-	-	-	-	-
Dogfish	51	166.5	86	304.4	8	37.6	62	239.0	70	269.9
Ratfish	-	-	-	-	-	-	-	-	-	-
Shark	-	-	-	-	-	-	-	-	-	-
Skate	5	98.9	1	21.8	-	-	20	485.3	19	392.4
Starfish	2	1.8	2	3.6	1	0.9	6	5.4	53	48.1
Inver.	-	-	-	-	-	-	-	-	-	-
Total Catch	69	356.0	89	329.8	29	92.8	105	824.9	156	799.7

Station	37		TOTAL 1982 2B	
Date	8/02/82			
Lat./Long.	52:55-130:46			
Depth Range	28-32		24-70	
Std. Skates	4.51		162.36	
Time Set	09:50		7:56	
Soak Time	8:02		6:30	
	No.	Wt.	No.	Wt.
Halibut	37	195.3	516	2364.5
Arrowtooth	-	-	40	64.5
Petrale	-	-	2	5.0
Black Cod	-	-	7	6.3
Cottid	-	-	-	-
Ling Cod	1	19.1	3	35.0
True Cod	-	-	13	48.9
Rockfish	-	-	1	4.5
Other Rdfsh	-	-	-	-
Dogfish	43	214.5	1719	6834.2
Ratfish	-	-	-	-
Shark	1	27.2	1	27.2
Skate	23	542.0	181	3159.6
Starfish	11	10.0	127	113.1
Inver.	-	-	-	-
Total Catch	116	1008.1	2609	12662.8

Appendix Table IIa. Catch and effort by station for the trawler M/V PACIFIC HARVESTER during the 1983 Experiment.

Station	1		2		3		4		5		6		7		8		9	
Date	5/13/83		5/13/83		5/14/83		5/14/83		5/15/83		5/15/83		5/16/83		5/16/83		5/17/83	
Lat./Long.	51:07-128:43		51:06-128:46		51:08-128:45		51:09-128:49		51:10-128:54		51:08-128:59		51:26-129:07		51:25-129:11		51:44-129:21	
Depth Range	44-62		34-50		40-64		48-64		58-68		54-69		30-63		49-78		44-51	
No. of Haul	2		4		4		3		3		4		4		4		3	
Duration	80		145		174		130		127		142		160		132		83	
Distance	3.8		6.9		8.9		6.3		6.1		7.4		9.2		6.9		4.7	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	85	260.4	34	106.7	530	1657.7	84	240.2	18	74.3	14	79.1	49	214.4	66	229.5	14	42.4
Arrowtooth	-	-	-	-	1	0.1	1	0.9	7	3.7	57	59.5	-	-	3	0.1	-	-
Butter S.	-	-	5	0.5	1	0.1	-	-	-	-	-	-	11	0.7	-	-	-	-
Dover S.	-	-	-	-	-	-	-	-	1	0.4	-	-	-	-	-	-	-	-
English S.	-	-	3	1.3	1	0.4	10	5.3	1	0.4	328	136.2	74	13.4	5	1.3	-	-
Flathead S.	3	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Petrale S.	-	-	-	-	24	28.7	28	22.5	75	48.7	121	78.7	6	13.1	10	7.9	-	-
Rex S.	-	-	-	-	-	-	3	0.5	21	3.8	81	16.8	-	-	-	-	-	-
Rock S.	688	225.2	1316	628.3	276	138.8	220	155.9	59	28.1	15	6.8	388	375.1	202	129.1	184	133.6
Sand Dab	-	-	112	13.8	10	1.5	58	6.1	3	0.7	183	41.0	516	84.6	29	3.7	2	0.1
Other Ftfsh	-	-	14	4.5	10	4.1	18	9.3	-	-	-	-	24	11.7	51	21.0	17	4.6
Black Cod	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cottid	-	-	-	-	-	-	-	-	-	-	20	7.2	-	-	-	-	-	-
Ling Cod	16	123.7	8	63.0	20	105.8	7	35.3	29	146.5	13	55.1	26	204.0	127	632.6	26	155.4
Pollock	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
True Cod	-	-	-	-	-	-	-	-	133	29.1	138	110.3	-	-	8	8.1	-	-
Rockfish	-	-	15	40.1	1	).3	-	-	4	2.5	34	17.0	-	-	-	-	-	-
Other Rdfsh	10	3.6	16	7.1	27	30.5	29	12.2	-	-	-	-	6	38.0	2	9.8	-	-
Dogfish	-	-	-	-	1	7.5	-	-	33	167.9	1	10.8	-	-	16	75.8	7	15.1
Ratfish	-	-	5	3.0	-	-	17	11.1	2297	1044.1	796	414.6	-	-	8	1.0	-	-
Skate	5	82.5	-	-	6	25.1	4	12.8	7	19.9	-	-	77	762.5	27	112.2	47	545.8
Box Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dungen Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hermit Crab	-	-	5	0.3	1	0.4	-	-	-	-	-	-	6	0.6	2	0.1	-	-
Other Crab	-	-	-	-	1	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Tanner Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scallop	-	-	-	-	6	0.1	-	-	-	-	-	-	4	0.3	-	-	-	-
Shrimp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Inver.	6	1.0	16	2.4	125	12.1	13	1.8	769	50.9	338	22.0	128	73.6	150	62.9	20	8.5
Total Catch	813	698.2	1549	871.0	1041	2013.2	492	513.9	3457	1621.0	2139	1055.1	1315	1792.0	706	1295.1	317	905.5

Appendix Table IIa (continued). Catch and effort by station for the trawler M/V PACIFIC HARVESTER during the 1983 Experiment.

Station	10		11		12		13		14		15		16		17		18	
Date	5/17/83		5/18/83		5/18/83		5/19/83		5/19/83		5/20/83		5/21/83		5/22/83		5/22/83	
Lat./Long.	51:47-129:22		52:55-130:48		52:57-130:49		53:33-131:09		53:31-131:12		53:38-131:04		54:09-131:56		54:10-131:52		54:11-131:48	
Depth Range	45-78		22-26		26-38		20-34		16-36		20-36		24-41		24-52		20-62	
No. of Haul	4		2		2		3		3		4		4		4		4	
Duration	123		53		53		112		92		79		105		158		163	
Distance	6.2		2.9		3.1		5.5		4.6		3.8		5.8		8.4		8.4	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	100	323.8	26	80.8	8	22.8	20	190.4	13	94.0	14	70.6	190	394.6	143	317.8	217	463.2
Arrowtooth	10	8.3	-	-	-	-	5	1.0	-	-	-	-	272	283.5	272	232.0	1342	855.3
Butter S.	-	-	-	-	29	2.7	2800	619.7	91	18.8	1	0.1	-	-	5	0.1	24	7.7
Dover S.	-	-	-	-	-	-	250	19.1	31	6.9	-	-	7	8.1	10	3:4	128	48.7
English S.	-	-	-	-	949	226.2	3153	492.2	200	65.5	365	127.8	130	69.5	229	129.0	1049	410.7
Flathead S.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Petrale S.	1	1.5	-	-	-	-	-	-	-	-	-	-	19	15.0	44	30.6	25	32.2
Rex S.	-	-	-	-	-	-	15	0.3	-	-	-	-	-	-	4	0.8	196	45.6
Rock S.	21	10.0	50	17.2	17	6.2	3205	1242.5	1470	607.5	337	168.2	109	31.4	22	8.2	21	3.0
Sand Dab	-	-	-	-	319	55.3	579	113.2	43	11.6	34	6.0	2	0.1	5	2.0	236	53.8
Other Ftfsh	-	-	-	-	2	0.9	5	2.6	40	12.7	11	8.0	-	-	-	-	-	-
Black Cod	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	2.5
Cottid	-	-	-	-	-	-	15	0.1	-	-	-	-	-	-	-	-	-	-
Ling Cod	94	535.7	-	-	2	14.3	15	3.0	-	-	25	59.6	4	6.8	4	5.5	-	-
Pollock	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
True Cod	41	80.8	-	-	21	6.8	1740	750.6	150	55.6	237	143.6	54	87.0	5	17.1	25	6.3
Rockfish	20	59.7	-	-	-	-	-	-	-	-	18	17.0	-	-	-	-	-	-
Other Rdfsh	-	-	-	-	2	0.1	51	0.5	-	-	9	3.3	-	-	-	-	-	-
Dogfish	44	90.5	162	422.9	52	158.3	63	160.3	27	94.7	11	38.5	127	208.6	133	342.6	234	338.1
Ratfish	5	0.2	-	-	-	-	-	-	-	-	175	82.0	218	226.2	534	659.0	27	23.3
Skate	57	982.9	22	180.3	26	297.4	66	657.2	37	235.5	44	438.3	5	27.1	17	69.7	28	53.1
Box Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dungen Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	2.5
Hermit Crab	1	0.1	15	0.4	51	2.8	938	56.2	183	16.0	94	6.8	2	0.1	2	0.1	-	-
Other Crab	-	-	-	-	2	0.1	542	16.8	8	0.2	8	0.9	-	-	-	-	-	-
Tanner Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scallop	-	-	-	-	-	-	-	-	-	-	-	-	30	18.9	5	1.0	4	2.0
Shrimp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Inver.	60	4.1	25	6.4	22	14.1	766	309.3	633	371.0	806	376.8	247	109.1	363	452.1	74	14.0
Total Catch	454	2097.6	300	708.0	1502	808.0	14228	4635.0	2926	1590.0	2189	1547.5	1416	1486.0	1797	2271.0	3640	2362.0

Appendix Table IIa (continued). Catch and effort by station for the trawler M/V PACIFIC HARVESTER during the 1983 Experiment.

Station	19		20		21		22		23		24		25		26		27	
Date	5/26/83		5/27/83		5/28/83		5/29/83		5/29/83		5/30/83		5/31/83		5/31/83		6/01/83	
Lat./Long.	54:34-139:05		54:42-139:00		59:42-140:01		59:14-139:18		59:13-139:24		59:06-140:55		59:44-141:53		59:45-142:02		59:50-144:00	
Depth Range	62-74		61-120		53-70		29-46		51-78		98-98		47-58		59-74		42-54	
No. of Haul	4		3		4		4		4		1		4		4		4	
Duration	132		121		147		171		162		10		165		126		161	
Distance	6.5		6.6		7.8		8.9		8.5		0.5		8.4		6.3		8.4	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	11	19.2	2	4.7	8	32.0	376	441.5	21	52.0	-	-	14	42.5	18	40.5	140	246.7
Arrowtooth	33	23.3	676	384.0	55	22.2	4511	3259.9	2195	1249.6	18	14.6	872	424.2	360	185.2	714	387.4
Butter S.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dover S.	-	-	-	-	4	0.7	38	9.2	53	15.8	-	-	76	20.1	24	6.6	194	50.8
English S.	-	-	-	-	-	-	70	28.0	-	-	-	-	-	-	-	-	-	-
Flathead S.	-	-	6	2.7	117	30.2	1449	613.5	313	82.1	-	-	4434	2480.3	229	138.8	689	262.8
Petrale S.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rex S.	12	1.6	33	4.3	24	2.0	88	17.1	62	10.9	-	-	10	1.7	10	1.3	78	15.6
Rock S.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Dab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Ftfsh	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Black Cod	-	-	25	16.6	2	0.7	23	12.2	41	30.7	-	-	27	20.2	13	11.9	183	162.1
Cottid	-	-	-	-	6	0.5	-	-	-	-	-	-	-	-	-	-	-	-
Ling Cod	1	2.5	5	5.6	-	-	8	20.7	-	-	-	-	-	-	-	-	-	-
Pollock	-	-	-	-	11	8.2	-	-	8	0.2	-	-	-	-	-	-	-	-
True Cod	-	-	5	16.9	26	76.3	412	912.6	3	1.5	1	1.1	-	-	1	0.5	-	-
Rockfish	2	2.8	2	4.8	5	2.1	-	-	4	0.8	-	-	18	8.8	-	-	-	-
Other Rdfsh	2	0.1	-	-	9	0.3	-	-	5	0.2	-	-	-	-	-	-	-	-
Dogfish	-	-	-	-	4	6.9	-	-	8	8.8	-	-	11	22.7	8	20.2	6	22.7
Ratfish	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Skate	3	17.5	-	-	20	109.0	8	12.2	23	97.9	-	-	29	43.9	6	15.9	-	-
Box Crab	47	25.9	-	-	-	-	26	36.1	-	-	-	-	9	5.7	7	2.2	20	9.6
Dungen Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hermit Crab	3	0.1	-	-	1	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Other Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		2	0.2
Tanner Crab	1	0.1	-	-	7	4.4	-	-	7	2.7	-	-	-	-	-	-	-	-
Scallop	-	-	-	-	1	0.1	1347	356.2	4	0.7	-	-	141	72.5	-	-	165	59.0
Shrimp	-	-	-	-	353	3.7	-	-	8	0.1	-	-	-	-	-	-	-	-
Other Inver	231	16.5	10	2.7	30	5.4	104	28.8	83	11.0	18	3.4	105	82.4	52	38.6	27	8.1
Total Catch	346	109.6	764	442.3	683	304.8	8460	5748.0	2838	1565.0	37	19.1	5746	3225.0	728	461.7	2218	1225.0

Appendix Table IIa (continued). Catch and effort by station for the trawler M/V PACIFIC HARVESTER during the 1983 Experiment.

Station	28		29		30		31		32		33		34		35		36	
Date	6/01/83		6/02/83		6/02/83		6/03/83		6/04/83		6/04/83		6/05/83		6/05/83		6/06/83	
Lat./Long.	59:48-144:06		59:50-144:10		59:47-144:00		59:43-144:48		59:38-146:12		59:38-146:06		59:36-146:09		59:32-146:08		59:28-146:03	
Depth Range	44-56		38-50		56-65		46-50		47-56		48-56		52-68		61-81		54-82	
No. of Haul	4		4		4		4		4		4		4		4		4	
Duration	163		153		165		66		168		156		156		158		144	
Distance	8.4		8.4		8.4		3.0		9.0		8.9		8.6		9.1		8.3	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	140	353.9	99	157.3	26	84.0	3	39	78	300.9	78	285.3	44	246.5	16	154.2	13	109.3
Arrowtooth	1373	707.6	407	199.2	4044	1717.7	110	42.9	2129	1198.1	1548	649.0	2348	1627.3	3398	2856.9	1220	752.6
Butter S.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dover S.	54	14.6	219	50.6	20	4.3	-	-	18	2.4	205	24.3	110	27.2	272	71.1	202	51.7
English S.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Flathead S.	710	295.1	475	185.2	2059	803.0	210	65.1	3345	1503.0	3509	1380.1	4154	1912.0	1844	1043.4	774	441.8
Petrale S.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rex S.	100	21.4	119	21.7	159	32.3	8	1.2	83	25.0	307	52.8	40	4.0	30	4.6	432	71.8
Rock S.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	11.3
Sand Dab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Ftfsh	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Black Cod	67	65.0	59	30.2	76	72.6	9	5.4	111	68.0	678	428.9	105	83.9	76	81.7	-	-
Cottid	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	0.5	36	12.0
Ling Cod	-	-	-	-	-	-	4	1.0	7	5.3	-	-	-	-	-	-	-	-
Pollock	-	-	21	7.5	12	7.3	-	-	-	-	-	-	-	-	-	-	-	-
True Cod	11	16.9	55	59.2	12	25.5	32	56.4	27	33.4	-	-	8	17.9	5	4.1	8	15.5
Rockfish	-	-	-	-	-	-	5	2.8	-	-	-	-	-	-	139	84.8	285	119.3
Other Rdfsh	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	5.0
Dogfish	11	21.1	12	23.5	6	14.0	4	6.3	23	54.5	9	20.8	14	25.2	9	20.0	7	16.0
Ratfish	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Skate	-	-	3	0.1	7	9.0	-	-	-	-	-	-	22	125.0	15	26.5	-	-
Box Crab	8	9.1	9	9.1	12	4.9	10	6.5	-	-	6	3.6	-	-	-	-	4	0.8
Dungen Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hermit Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Crab	-	-	-	-	-	-	2	0.1	-	-	-	-	-	-	-	-	-	-
Tanner Crab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scallop	68	23.5	62	15.0	64	23.3	-	-	-	-	-	-	-	-	-	-	-	-
Shrimp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Inver.	29	16.8	31	12.4	54	18.3	20	18.0	37	13.4	211	63.2	71	20.0	81	14.2	682	482.9
Total Catch	2571	1545.0	1571	771.0	6551	2816.0	417	209.6	5858	3204.0	6551	2908.0	6916	4089.0	5890	4362.0	3701	2090.0

Appendix Table IIa (continued). Catch and effort by station for the trawler M/V PACIFIC HARVESTER during the 1983 Experiment.

Station	37		38		39		40		1-18		19-40	
Date	6/06/83		6/07/83		6/08/83		6/08/83		1983		1983	
Lat./Long.	59:35-146:11		59:32-146:36		58:57-149:41		58:56-150:15		2B		3A	
Depth Range	54-66		59-64		120-128		84-104		20-78		29-128	
No. of Haul	4		3		4		4		61		83	
Duration	166		118		158		154		2111		3120	
Distance	9.0		6.5		7.9		8.5		108.9		165.9	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	54	425.5	1	10.0	4	19.2	9	117.2	1625	4862.6	1155	3146.3
Arrowtooth	2334	1384.9	483	324.2	884	592.1	3004	2012.5	1970	1444.4	32716	20015.4
Butter S.	-	-	-	-	-	-	-	-	2967	650.4	-	-
Dover S.	223	38.6	8	3.6	82	52.8	329	197.2	427	86.6	2131	641.6
English S.	-	-	-	-	-	-	-	-	6497	1679.2	70	28.0
Flathead S.	3732	1738.4	205	44.3	188	65.0	660	185.8	3	1.8	29102	13272.6
Petrale S.	-	-	-	-	-	-	-	-	353	278.9	-	-
Rex S.	37	9.3	15	0.9	223	78.6	156	57.8	320	67.8	2026	435.9
Rock S.	-	-	-	-	-	-	-	-	8600	3915.1	13	11.3
Sand Dab	-	-	-	-	-	-	-	-	2131	393.5	-	-
Other Ftfsh	-	-	-	-	-	-	-	-	192	79.4	-	-
Black Cod	49	46.0	-	-	42	94.3	368	417.7	5	2.5	1954	1648.1
Cottid	-	-	52	5.6	-	-	31	64.9	35	7.3	130	83.5
Ling Cod	-	-	-	-	-	-	-	-	416	2146.3	25	35.1
Pollock	-	-	-	-	77	83.1	194	294.7	-	-	323	401.0
True Cod	-	-	15	44.9	31	92.8	1133	2051.4	2552	1295.3	1785	3426.9
Rockfish	101	45.7	16	6.7	38	34.3	82	41.7	92	136.6	697	354.6
Other Rdfsh	12	0.2	-	-	35	0.8	7	0.1	152	105.1	95	6.7
Dogfish	23	35.7	53	102.6	3	6.1	-	-	911	2131.6	211	427.1
Ratfish	-	-	-	-	-	-	-	-	4082	2464.5	-	-
Skate	24	175.0	34	326.4	12	30.9	-	-	475	4502.3	206	989.3
Box Crab	-	-	-	-	-	-	-	-	-	-	158	113.5
Dungen Crab	-	-	-	-	-	-	-	-	5	2.5	-	-
Hermit Crab	-	-	-	-	-	-	7	0.7	1300	83.9	11	0.9
Other Crab	2	0.1	-	-	-	-	-	-	561	18.1	6	0.4
Tanner Crab	17	0.4	102	33.5	4	2.3	-	-	-	-	138	43.4
Scallop	-	-	-	-	-	-	-	-	49	22.3	1852	550.3
Shrimp	-	-	3	0.1	31	0.5	37	0.2	-	-	432	4.6
Other Inver.	133	52.2	37	5.2	5	27.2	158	375.1	4561	1892.1	2209	1315.6
Total Catch	6741	3952.0	1024	908.0	1659	1180.0	6175	5817.0	40281	28270.1	77445	46952.1

Appendix Table IIb. Catch and effort by station for the setliner M/V LORELEI II during the 1983 Experiment.

Station	1		2		3		4		5	
Date	5/13/83		5/13/83		5/14/83		5/14/83		5/15/83	
Lat./Long.	51:07-128:43		51:06-128:46		51:08-128:45		51:09-128:49		51:10-128:54	
Depth Range	44-62		34-50		40-64		48-64		58-68	
Std. Skates	4.32		13.82		13.82		13.82		13.82	
Time Set*	05:45	-	12:30	13:20	06:00	06:21	14:10	14:40	05:45	06:10
Soak Time*	2:50	-	3:20	4:55	3:15	5:14	3:00	4:30	3:30	5:30
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	28	89.7	46	191.3	90	366.5	74	302.0	56	368.8
Arrowtooth	-	-	-	-	-	-	-	-	-	-
Petrale	-	-	-	-	-	-	-	-	-	-
Sablefish	-	-	-	-	-	-	-	-	-	-
Cottid	-	-	-	-	-	-	-	-	-	-
Ling Cod	1	11.3	6	61.2	-	-	4	25.9	-	-
Pacific Cod	-	-	-	-	-	-	-	-	4	9.1
Rockfish	-	-	-	-	-	-	-	-	1	4.5
Other Rdfsh	1	9.1	3	22.7	-	-	-	-	-	-
Dogfish	3	9.1	-	-	5	15.9	5	15.9	116	362.9
Ratfish	-	-	1	0.5	-	-	-	-	3	3.6
Shark	-	-	-	-	-	-	-	-	-	-
Skate	35	317.5	8	97.5	26	235.9	27	274.4	31	294.8
Starfish	-	-	-	-	2	4.5	2	2.3	-	-
Inver.	-	-	-	-	-	-	-	-	-	-
Total Catch	68	436.7	64	373.2	123	622.8	112	620.5	211	1043.7

Station	6		7		8		9		10	
Date	5/15/83		5/16/83		5/16/83		5/17/83		5/17/83	
Lat./Long.	51:08-128:59		51:26-129:07		51:25-129:11		51:44-129:21		51:47-129:22	
Depth Range	54-69		30-63		49-78		44-51		45-78	
Std. Skates	12.96		12.96		10.36		10.36		10.36	
Time Set*	14:22	14:45	06:11	06:43	14:40	15:05	07:30	08:00	14:28	14:53
Soak Time*	3:13	4:15	3:04	5:12	3:00	4:35	3:00	4:45	3:02	4:42
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	54	296.5	47	199.9	41	201.8	27	118.7	27	112.4
Arrowtooth	-	-	-	-	-	-	-	-	-	-
Petrale	-	-	-	-	-	-	-	-	-	-
Sablefish	-	-	-	-	-	-	-	-	-	-
Cottid	-	-	-	-	-	-	-	-	-	-
Ling Cod	6	31.7	1	13.6	-	-	1	9.1	-	-
Pacific Cod	4	9.1	-	-	-	-	-	-	1	4.5
Rockfish	-	-	-	-	-	-	-	-	3	11.3
Other Rdfsh	-	-	-	-	-	-	-	-	-	-
Dogfish	19	88.5	22	102.1	47	163.3	26	113.4	30	95.3
Ratfish	3	5.0	-	-	-	-	-	-	-	-
Shark	-	-	-	-	-	-	-	-	-	-
Skate	32	290.3	220	1814.4	102	662.2	228	2268.0	57	646.4
Starfish	4	9.1	37	104.3	23	59.0	5	11.3	-	-
Inver.	-	-	-	-	-	-	-	-	-	-
Total Catch	122	730.2	327	2234.3	213	1086.3	287	2520.5	118	869.9

*For stations where two sets were fished, both times are given.

Appendix Table IIb (continued). Catch and effort by station for the setliner M/V LORELEI II during the 1983 Experiment.

Station	11		12		13		14		15	
Date	5/18/83		5/18/83		5/19/83		5/19/83		5/20/83	
Lat./Long.	52:55-130:48		52:57-130:49		53:33-131:09		53:31-131:12		53:38-131:04	
Depth Range	22-26		26-38		20-34		16-36		20-36	
Std. Skates	8.64		5.18		13.82		10.36		13.82	
Time Set*	09:40	10:00	16:00	-	07:35	08:05	15:00	15:24	06:30	07:00
Soak Time*	3:00	4:10	3:30	-	2:55	4:40	3:45	4:21	4:15	5:40
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	3	56.3	5	52.3	13	290.1	4	36.8	21	176.3
Arrowtooth	-	-	-	-	-	-	-	-	-	-
Petrale	-	-	-	-	-	-	-	-	-	-
Sablefish	-	-	-	-	-	-	-	-	-	-
Cottid	-	-	-	-	-	-	-	-	-	-
Ling Cod	-	-	-	-	-	-	-	-	-	-
Pacific Cod	-	-	-	-	-	-	-	-	-	-
Rockfish	-	-	-	-	-	-	-	-	6	11.3
Other Rdfsh	-	-	-	-	-	-	-	-	-	-
Dogfish	282	997.9	158	573.3	367	1587.6	161	584.7	290	1088.6
Ratfish	-	-	-	-	-	-	-	-	-	-
Shark	-	-	-	-	-	-	-	-	-	-
Skate	7	90.7	-	-	34	340.2	15	131.5	36	396.9
Starfish	12	27.2	2	3.6	45	113.4	61	136.1	51	102.1
Inver.	-	-	-	-	1	13.6	-	-	-	-
Total Catch	304	1172.1	165	629.2	460	2344.9	241	889.1	404	1775.2

Station	16		17		18		19		20	
Date	5/21/83		5/22/83		5/22/83		5/26/83		5/27/83	
Lat./Long.	54:09-131:56		54:10-131:52		54:11-131:48		58:34-139:05		58:42-139:00	
Depth Range	24-41		24-52		20-62		62-74		61-120	
Std. Skates	8.64		13.82		13.82		13.82		13.82	
Time Set*	15:30	15:45	05:40	06:10	12:45	13:10	13:15	14:15	06:00	07:15
Soak Time*	3:00	3:55	3:00	4:20	3:00	4:30	3:05	4:15	3:10	4:30
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	36	114.8	33	105.9	40	120.1	111	704.5	64	588.1
Arrowtooth	-	-	-	-	-	-	-	-	6	8.6
Petrale	-	-	-	-	-	-	-	-	-	-
Sablefish	-	-	-	-	-	-	-	-	1	0.9
Cottid	-	-	-	-	-	-	-	-	-	-
Ling Cod	-	-	-	-	-	-	-	-	11	18.1
Pacific Cod	-	-	-	-	-	-	-	-	8	27.2
Rockfish	-	-	-	-	-	-	1	6.4	-	-
Other Rdfsh	-	-	-	-	-	-	-	-	-	-
Dogfish	28	89.4	120	471.7	133	485.3	-	-	-	-
Ratfish	-	-	-	-	-	-	-	-	-	-
Shark	-	-	-	-	-	-	-	-	-	-
Skate	4	43.1	6	63.5	6	72.6	1	10.0	2	16.3
Starfish	1	1.8	-	-	-	-	-	-	-	-
Inver.	-	-	1	18.1	-	-	-	-	-	-
Total Catch	69	249.1	160	659.2	179	678.0	113	720.9	92	659.2

* For stations where two sets were fished, both times are given.

Appendix Table IIb (continued). Catch and effort by station for the setliner M/V LORELEI II during the 1983 Experiment.

Station	21		22		23		24		25	
Date	5/28/83		5/29/83		5/29/83		5/30/83		5/31/83	
Lat./Long.	59:42-140:01		59:14-139:18		59:13-139:24		59:06-140:55		59:44-141:53	
Depth Range	53-70		29-46		51-78		98-98		47-58	
Std. Skates	13.82		13.82		13.82		13.82		13.82	
Time Set*	08:55	09:20	06:00	06:30	13:30	14:00	06:20	06:50	05:45	06:30
Soak Time*	3:05	5:00	3:05	4:20	3:00	4:25	3:10	5:10	3:15	5:00
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	45	683.7	42	179.8	28	156.9	38	371.6	21	186.4
Arrowtooth	1	1.8	17	23.1	11	22.7	2	5.0	2	3.2
Petrale	-	-	-	-	-	-	-	-	-	-
Sablefish	-	-	1	0.9	6	3.6	1	0.9	13	13.2
Cottid	-	-	-	-	-	-	-	-	-	-
Ling Cod	-	-	1	14.1	-	-	-	-	-	-
Pacific Cod	31	29.0	37	150.1	9	24.9	5	20.0	-	-
Rockfish	-	-	-	-	-	-	-	-	-	-
Other Rdfsh	4	5.4	-	-	3	21.8	-	-	2	5.0
Dogfish	20	39.9	3	10.0	20	34.9	4	17.2	41	102.1
Ratfish	-	-	-	-	-	-	-	-	-	-
Shark	-	-	-	-	-	-	-	-	-	-
Skate	49	450.0	37	126.1	33	340.2	5	36.7	12	205.0
Starfish	13	4.5	14	28.1	4	2.7	-	-	26	44.0
Inver.	-	-	-	-	-	-	-	-	-	-
Total Catch	163	1214.3	152	532.2	114	607.7	55	451.4	117	558.9

Station	26		27		28		29		30	
Date	5/31/83		6/01/83		6/01/83		6/02/83		6/02/83	
Lat./Long.	59:45-142:02		59:50-144:00		59:48-144:06		59:50-144:10		59:47-144:00	
Depth Range	59-74		42-54		44-56		38-50		56-65	
Std. Skates	10.36		13.82		13.82		13.82		13.82	
Time Set*	14:25	14:50	05:05	05:40	13:05	13:35	05:35	06:05	13:00	13:35
Soak Time*	3:05	4:15	3:05	4:40	3:10	4:40	3:05	4:30	3:00	4:10
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	30	317.5	47	414.0	57	560.4	51	297.0	19	235.2
Arrowtooth	1	0.9	-	-	2	1.8	2	3.2	2	1.8
Petrale	-	-	-	-	-	-	-	-	-	-
Sablefish	2	1.8	5	5.0	3	2.7	3	3.2	8	10.9
Cottid	-	-	-	-	-	-	-	-	-	-
Ling Cod	-	-	-	-	-	-	-	-	-	-
Pacific Cod	1	0.9	1	3.2	-	-	-	-	1	5.0
Rockfish	-	-	-	-	-	-	-	-	-	-
Other Rdfsh	-	-	-	-	-	-	-	-	-	-
Dogfish	10	21.8	2	10.9	7	29.9	6	19.1	37	87.1
Ratfish	-	-	-	-	-	-	-	-	-	-
Shark	-	-	-	-	-	-	-	-	-	-
Skate	4	74.8	1	3.2	2	6.8	3	11.8	3	15.0
Starfish	6	2.7	-	-	1	0.5	1	0.9	-	-
Inver.	-	-	-	-	-	-	-	-	-	-
Total Catch	54	420.4	56	436.3	72	602.1	66	335.2	70	355.0

*For stations where two sets were fished, both times are given.

Appendix Table IIb (continued). Catch and effort by station for the setliner M/V LORELEI II during the 1983 Experiment.

Station	31		32		33		34		35	
Date	6/03/83		6/04/83		6/04/83		6/05/83		6/05/83	
Lat./Long.	59:43-144:48		59:38-146:12		59:38-146:06		59:36-146:09		59:32-146:08	
Depth Range	46-50		47-56		48-56		52-68		61-81	
Std. Skates	13.82		13.82		13.82		13.82		13.82	
Time Set*	09:20	09:51	05:45	06:15	13:30	14:00	05:35	06:35	13:55	14:25
Soak Time*	2:55	4:14	3:00	4:15	3:00	4:15	5:20	2:30	2:50	4:20
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	39	472.5	57	582.7	56	407.8	49	609.8	44	634.0
Arrowtooth	-	-	3	5.0	6	6.8	4	5.0	17	31.8
Petrale										
Sablefish	2	1.8	4	4.1	3	5.0	4	4.1	7	13.2
Cottid	2	0.9	-	-	-	-	-	-	1	0.9
Ling Cod	-	-	-	-	-	-	-	-	-	-
Pacific Cod	9	43.1	5	23.1	1	3.2	4	16.3	-	-
Rockfish	-	-	-	-	-	-	-	-	-	-
Other Rdfsh	-	-	-	-	-	-	1	5.0	3	24.9
Dogfish	13	54.0	11	44.0	11	34.9	21	83.9	19	39.9
Ratfish	-	-	-	-	-	-	-	-	-	-
Shark	-	-	-	-	1	226.8	1	150.1	-	-
Skate	1	20.0	8	174.6	9	94.8	21	305.3	40	274.9
Starfish	2	3.6	7	14.1	-	-	-	-	2	0.9
Inver.	-	-	-	-	-	-	-	-	-	-
Total Catch	68	595.9	95	847.6	87	779.3	105	1179.5	133	1020.5

Station	36		37		38		39		40	
Date	6/06/83		6/06/83		6/07/83		6/08/83		6/08/83	
Lat./Long.	59:28-146:03		59:35-146:11		59:32-146:36		58:57-149:41		58:56-150:15	
Depth Range	54-82		54-66		59-64		120-128		84-104	
Std. Skates	13.82		13.82		13.82		13.82		13.82	
Time Set*	05:35	06:05	14:10	14:40	05:10	05:35	05:00	05:30	14:40	15:10
Soak Time*	2:55	5:15	3:05	4:25	3:00	4:25	2:55	4:45	3:05	4:25
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Halibut	54	670.4	69	932.4	2	51.6	31	994.6	16	239.1
Arrowtooth	1	1.8	7	8.2	-	-	2	3.2	8	10.4
Petrale	-	-	-	-	-	-	-	-	-	-
Sablefish	-	-	3	3.6	-	-	27	81.2	23	49.9
Cottid	1	0.5	-	-	-	-	-	-	-	-
Ling Cod	-	-	-	-	-	-	-	-	-	-
Pacific Cod	7	15.9	-	-	8	32.2	24	85.3	30	89.8
Rockfish	-	-	-	-	-	-	-	-	-	-
Other Rdfsh	1	3.2	-	-	1	1.8	2	14.1	-	-
Dogfish	16	60.8	26	49.9	89	134.7	4	15.0	1	1.8
Ratfish	-	-	-	-	-	-	-	-	-	-
Shark	-	-	1	136.1	-	-	-	-	-	-
Skate	2	20.0	20	169.6	19	294.8	2	13.2	-	-
Starfish	2	3.6	2	0.9	4	3.2	-	-	-	-
Inver.	-	-	-	-	2	1.9	-	-	-	-
Total Catch	84	776.2	128	1300.7	125	520.2	92	1206.6	78	391.0

*For stations where two sets were fished, both times are given.

NOTE: Totals for M/V LORELEI II are found in Table 3, page 16 of this report.