## Scientific Report No. 77

# Further Studies of Area Differences in Setline Catchability of Pacific Halibut

by

Stephen M. Kaimmer and Gilbert St-Pierre

## ABSTRACT

Since the late 1970s and through the late 1980s, the stock of Pacific halibut *(Hippoglossus stenolepis)* under the management of the International Pacific Halibut Commission (IPHC) has increased throughout its range. In Alaskan waters, increased stock abundance was associated with a comparable increase in setline catch per unit effort (CPUE). Stock abundance increased in the British Columbia regions to a lesser extent than in the Alaskan regions, and the setline CPUE in British Columbia remained relatively stable. Experiments conducted by the IPHC during 1983 and 1987 were designed to investigate the relationship between local stock abundance and setline CPUE through a comparison of paired setline and trawl catches of halibut in both regions. The 1983 experiment supported a conclusion of different catchability of halibut between the two regions, some of this difference being the effect of competition with other species for the baited hooks. The 1987 experiment was similar to that of 1983, with some changes in the survey design, intended to reduce the variability of the estimates of catchability. For both experiments, the estimates of substantially higher setline catchability in Alaska depend on the assumption that trawl catchability is constant between areas. A review of the commercial fishery data supports the conclusion of a continuing difference in setline catchability between these areas.

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## INTRODUCTION

The International Pacific Halibut Commission (IPHC) manages the Pacific halibut *(Hippoglossus stenolepis)* stock in the waters of the North Pacific from California to the Bering Sea. Since its inception in 1923, the IPHC has compiled catch and effort statistics from the commercial fishery (Myhre et al. 1977). These catch and effort data are used as indicators of local abundance, and are combined with information on age and size distribution of the catch to derive estimates of biomass by IPHC Regulatory Area (Figure 1). The IPHC uses a standardized catch-per-unit-

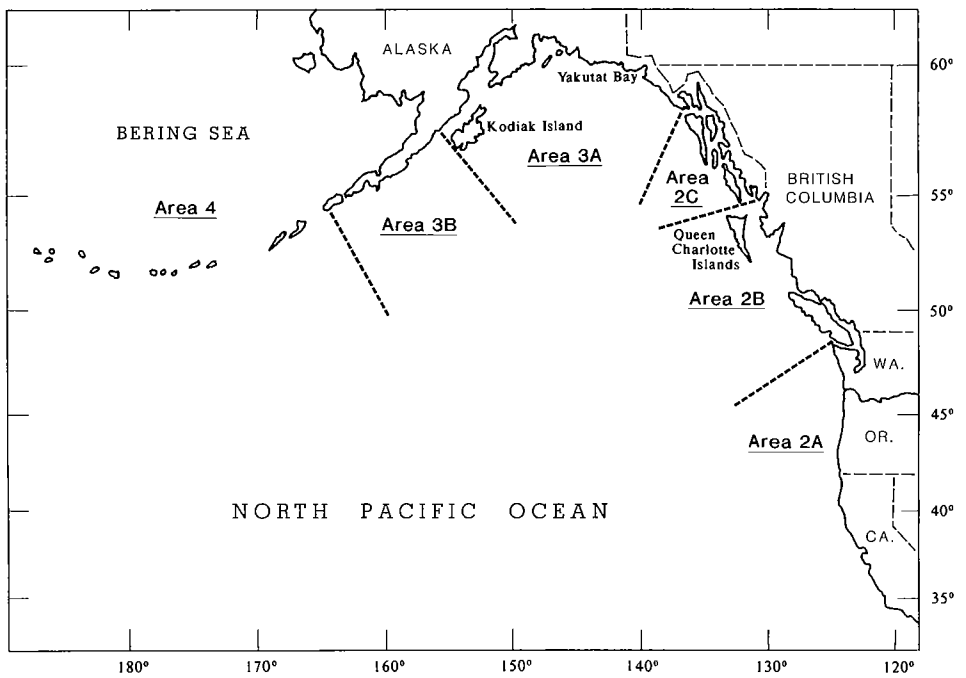


**Figure 1. IPHC Regulatory Areas.**

effort (CPUE), determined as the catch of halibut from an 1800-foot length of groundline with 100 hooks at 18-foot intervals. Over the history of the fishery, technological advances in the vessels and gear types used to fish halibut have made it necessary to introduce corrections into the CPUE calculations, to make statistics comparable between present and earlier data, between areas, or between gear types (Quinn et al. 1985; Sullivan et al. Unpub.[1]). The last major correction was made in the

[1]Sullivan, P.J., A.M. Parma, and B.A. Vienneau. Unpub. Assessment methods. IN: Int. Pac. Halibut Comm. Report of Assessment and Research Activities 1991: 71-87.

early 1980s to account for the introduction of the circle hook, which increased the effectiveness of the setline fishing gear at least two-fold in terms of CPUE (IPHC 1985).

Historically, CPUE values in Areas 3A and 3B (Gulf of Alaska) have tended to be higher than in Area 2B (British Columbia). However, the magnitude of the differences during the last decade (Figure 2) is without historical precedence (Hoag et al. 1984). In 1982, IPHC staff first noted that the commercial CPUE of halibut in Area 2B no longer tracked the CPUE indices of the more northern regulatory Areas 2C and 3A (IPHC 1982). For five decades prior to 1981, changes in CPUE in Areas 2B and 2C showed very similar trends. However, during 1981 and 1982 the CPUE in Area 2C (and 3A) increased dramatically while the Area 2B CPUE remained relatively unchanged. This divergence in trends was confirmed by CPUE trends from annual IPHC setline surveys conducted in these areas. Both the commercial and survey CPUE data showed that the CPUE trend of Area 2B extended into the southern region of Area 2C. While CPUEs remained low in Area 2B and the southern portion of Area 2C, CPUE increased dramatically in the northern portion of Area 2C and in Area 3A. Based on commercial logbook data (IPHC Annual Report series), the CPUE in Area 3A more than tripled between 1975 and 1987, with a subsequent decrease of about 45 percent from 1987 to 1991. The changes in CPUE were paralleled approximately by changes in estimated biomass. During this same period, the halibut CPUE and biomass off British Columbia remained relatively constant (Figure 2). These CPUE data suggest that the biomass of halibut increased off Alaska, but not off British Columbia, if the assumption that CPUE is proportional to fish density is valid. An alternative explanation for the divergence between areas is a change in the relative effectiveness, or catchability, of the setlines for halibut.

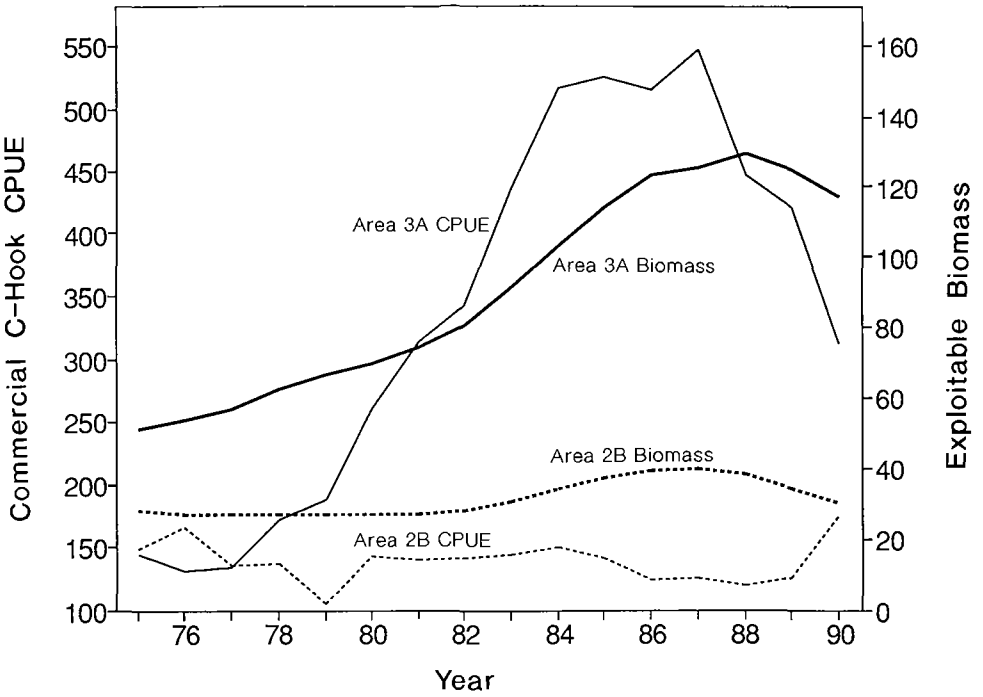


**Figure 2.** **Trends in CPUE and exploitable biomass for Areas 2B and 3A for the years 1975-1990. Note that CPUE plotted are unadjusted for area differences in catchability.**

In an experiment conducted in 1983, Hoag et al. (1984) obtained paired estimates of trawl and setline catches from Areas 2B and 3A. Assuming that the catchability of the trawl gear remained unchanged between areas, any differences in the ratio of setline to trawl catch between areas could be attributable to a difference in setline catchability. While the variability in the experimental results from the 1983 experiment was too high to demonstrate a statistically significant difference in catchability between the two areas, Hoag et al. (1984) concluded, from both the experimental data collected in 1983 and IPHC stock assessment data, that a difference in catchability did exist between the two areas, with catchability 50 percent higher in Area 3A than in Area 2B. Hoag et al.'s experiment estimated catchability differences between two areas at one point in time. Their examination of commercial catch trends over the seven year period prior to 1984 suggested that catchability changed over time, with the catchability in Area 3A nearly doubling from 1977 to 1983, but remaining relatively stable in Area 2B . Based on Hoag et al.'s conclusions, IPHC began making adjustments to the CPUE data from Areas 2 and 3 (IPHC regulatory areas 2A, 2B, 2C, 3A, and 3B). CPUEs in Areas 2A and 2B were adjusted upwards by a factor of 1.25 and CPUEs in Areas 2C, 3A, and 3B were adjusted downwards by a factor of 0.80 (Quinn et al. 1985; Sullivan et al. Unpub.[1]). These adjustments were applied to all catch data from these areas, from 1981 onwards. The divergent trends in CPUE indices noted in the 1984 report continued through 1987.

The 1983 experiment was repeated in 1987 with a modified experimental design, intended to reduce the variability and allow a statistical evaluation of any difference between areas. This paper presents the results of the 1987 experiment, along with area catchability trends as indicated by recent commercial fishery data and IPHC stock assessments. A comparison of the 1983 and 1987 results is used to determine the validity of the 1984 conclusions. We discuss possible reasons for the difference in catchability between Areas 2B and 3A, as well as the implications of this difference for the management of the halibut resource. Commercial halibut fishermen from Area 2B have suggested that the divergence observed in the pattern of CPUE between the two areas over time is due to the much higher abundance of spiny dogfish *(Squalus acanthias)* in Area 2B. Where pertinent, known aspects of dogfish behavior are included in this paper to shed light on possible inhibiting effects of this species on the CPUE of halibut.

## SURVEY DESIGN AND METHODS

The 1987 experiment was a modification of the experiment conducted in 1983 (Hoag et al. 1984). While the overall design and execution of the 1983 and 1987 experiments was generally the same, the 1987 experiment used the knowledge gained in 1983 as a starting point in finalizing the survey design, fishing grounds, gear, and analysis for the 1987 effort. A major problem in the analysis of the 1983 data, as stated by Hoag et al. (1984) was that the number of fish caught at each fishing station were "too meager to provide data for most length groups", with the result that stations had to be combined within fishing grounds. This reduced the effective number of observations in the analysis, with a resulting increase in variability of the results. Most of the modifications for the 1987 survey were directed towards increasing the sample size at each fishing location, while maximizing the number of locations which could be sampled during the survey period. The use of more effective fishing gear and bait resulted in an increase in the catch of halibut by length intervals, for both gear types and in both areas. Changes in the fishing pattern at each station increased the number of stations which could be completed in a fishing day. Stations fished successfully in

**Table 1.** **A comparison of the design and fishing power of the 1983 and 1987 experiments.**

| year | 1983 | | 1987 | |
|---|---|---|---|---|
| Area | 2B | 3A | 2B | 3A |
| number of fishing days | 10 | 14 | 10 | 12 |
| number of stations | 18 | 22 | 25 | 27 |
| number of locations | 5 | 8 | 25 | 27 |
| number of setline strings | 35 | 44 | 25 | 27 |
| total number of hooks fished | 18,072 | 22,088 | 16,675 | 18,009 |
| number of effective skates[1] | 93.0 | 136.6 | 170.0 | 183.6 |
| number of trawl hauls | 61 | 83 | 50 | 54 |
| hectares swept by trawl | 245.9 | 374.5 | 314.8 | 340.0 |
| setline length (ft)[1] | 12,546 | | 12,000 | |
| hook spacing (ft) | 25 | | 18 | |
| average hooks/string | 502 | | 667 | |
| avg hooks/station | 1004 | | 667 | |
| hook type | J | | circle | |
| relative fishing power per station (circle hooks)[1] | 548 | | 667 | |
| headrope length (ft) | 71 | | 80 | |
| footrope length (ft) | 94 | | 111 | |
| mesh size (in) | 3½ inch bag<br>4 inch intermediate | | 5½ inch throughout | |
| floats (8 inch diam.) | 9 | | 41 | |
| effective path width (ft) | 40 | | 56 | |
| vertical opening (ft) | 5.6 | | 7.5 | |

[1]calculated to adjust for less interhook competition and thus 120% increased fishing power per hook of more widely spaced (25 foot)gear (Hamley and Skud 1978), decreased fishing power of fewer hooks per skate (25 foot spacing), and increased fishing power for legal sized halibut of circle hooks (2.2 times by weight). Although the 1983 strings were set up as 8 skates per set (14,400 feet), actual number of skates retrieved per set averaged 6.97 (12,546 feet). Effective skates are given in circle hook equivalents.

1987 had halibut catches sufficient to be used individually and grouping of stations was unnecessary. Also, the Area 3A grounds fished in 1987 are believed to be more representative of the center of abundance for Area 3A overall, and receive more commercial fishing effort. Some aspects of the designs of the 1983 and 1987 experiments are contrasted here and in Table 1 to explain reasons for changes in the survey design or methods.

**Fishing Effort**

From mid-May to mid-July of 1987, two Canadian vessels, the trawler *Ocean Star* and the setliner *Snowfall,* conducted fishing operations in the Queen Charlotte Islands region of Area 2B and the Kodiak region in Area 3A. Stations were located at good fishing grounds in as many different sites and habitat types as possible, within each major area (Figure 3). This was to ensure that the catch ratio between the trawl and setline gear would be most representative of any difference which might exist between Areas 2B and 3A. Fifty-two locations were fished successfully in 1987; 25 in Area 2B and 27 in Area 3A (Table 1). Fishing depth ranged from 18 to 104 fathoms with an average of 49 fathoms in Area 2B, and from 34 to 98 fathoms with an average of 61 fathoms in Area 3A. The 52 locations in 22 fishing days compares to 40 stations sampled in 24 fishing days during the 1983 experiment. In order to increase numbers of halibut for the analysis, the 1983 stations were then combined into 13 locations for the analysis (Hoag et al. 1984). Although both experiments had a similar effort in terms of fishing days, the different methodology of the two experiments resulted in almost twice as many fishing locations being completed in 1987. A full fishing day during the 1983 experiment produced two stations sampled and represented 4 strings of setline gear and as many as eight trawls. Two, to as many as eight, stations were then combined to constitute a location for the 1983 analysis. A full fishing day during the 1987 experiment resulted in two or three stations sampled, each station consisting of one string of setline gear and two trawls. Halibut catches at each station were large enough to allow each station from the 1987 experiment to be analyzed as a location.

**Fishing Grounds**

As in 1983, fishing locations in 1987 were selected so that the trawl gear could be fished effectively, i.e., sites where the bottom was relatively smooth and regular. The same approximate grounds were sampled in both survey years in Area 2B, although the 1987 work fished on average about 6 fathoms deeper than the 1983 survey. This Charlotte region contributed 49.3 and 48.8 percent, respectively, of Area 2B catches in the two survey years (IPHC 1984; IPHC 1988). The grounds fished in Area 3A were markedly different between survey years. In 1983, fishing locations spread over the eastern portion of Area 3A in the Yakutat region and eastern portion of the Kodiak region of the Gulf of Alaska, an area which yielded 25.3 percent of the total commercial removals from Area 3A in 1983 (IPHC 1984). In contrast, the locations fished in 1987 were in the central portion of the Kodiak region near Kodiak Island, grounds which yielded 90.2 percent of the Area 3A commercial removals in 1987, and where the highest catch rates of halibut could be expected (IPHC 1988). The Kodiak region is also more representative of the fishing effort in Area 3A, representing over half the total effort in Area 3A for the years 1977 to 1987 (IPHC Annual Report series).

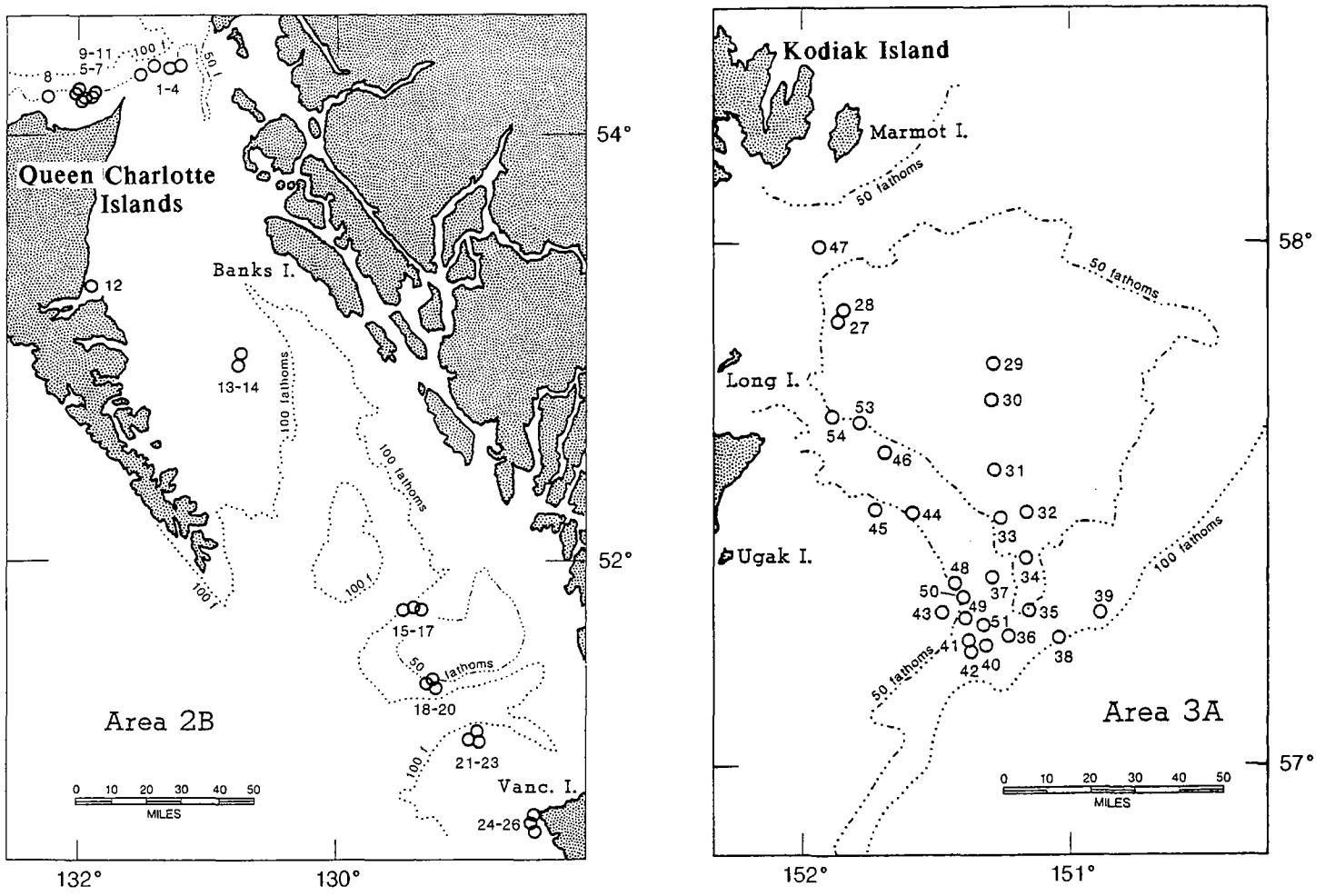


**Figure 3. Sampling locations in Areas 2B and 3A during the 1987 catchability experiment.**

**Table 2.** **Comparison of commercial fishing periods for Area 2B and Area 3A in 1983 and 1987 with corresponding survey timings in each Area.**

| | Area 2B | | Area 3A | |
|---|---|---|---|---|
| Year | Survey period | Commercial opening | Survey period | Commercial opening |
| 1983 | 5/12-5/22 | 5/03-5/15 | 5/26-6/08 | 6/16-6/23 |
| 1987 | 5/22-6/07 | 5/02-5/10 | 7/06-7/17 | 5/04-5/05, 6/01-6/02 |

### Survey Timing

Sampling in 1987 started 10 calendar days later in Area 2B and 40 days later in Area 3A compared to the 1983 starting dates (Table 2). In 1987, the survey in Area 2B started 12 days after the closure of an eight-day fishing period, thus allowing halibut some time to redistribute themselves and somewhat replenish the fishing grounds. In comparison, the survey in 1983 started 9 days after the *beginning* of a 12-day commercial fishery opening in this area, thus sampling partially depleted grounds. Sampling in Area 3A was carried out prior to the first commercial fishing period in 1983 and 34 days after the second fishing period in 1987. Survey timing in 1983 would have increased the relative Area 3A halibut CPUE over that observed in Area 2B, since sampling in Area 3A took place on undisturbed fish concentrations whereas Area 2B sampling operated on grounds partially depleted. The survey timing of Area 2B in 1987 avoided these problems. Both Area 2B and Area 3A were surveyed after a period of rest, which provided time for the fishing grounds to be replenished. Lastly, by starting the sampling at later dates in 1987, adult halibut which generally winter in waters deeper that 150 fathoms (IPHC 1987) had more time, especially in Area 2B, to complete their movement to shallower summer feeding grounds and to be fully available on the grounds sampled.

### Fish Capture

The experimental design of both the 1983 and 1987 experiments assumed a constant catchability of halibut for the trawl gear across all sampling areas. Some justification for this assumption comes from a consideration of the fish catching process of trawls. In a trawl, selection takes place at different stages of the catching process, with the primary selection process for small fish being a function of the mesh size in the codend. As long as the codend meshes are small enough to keep a small fish from passing through, trawls are recognized as a very powerful gear for the capture of small fish, especially when compared to longlines (Bjordal 1988). Trawls are less effective at catching large fish. Fishing gears such as trawls tend to herd fish ahead of the trawl mouth for differing lengths of time prior to exhaustion and capture . Using underwater cameras, this effect has been observed for several species, including Pacific halibut (S. Kaimmer, IPHC, pers. comm.)[2] It is well documented that larger fish can swim faster and with greater endurance than smaller fish (Wardle and He 1988), thus are more likely to avoid capture by the trawl. This decreases the catch of larger-sized individuals in trawl samples. Since the trawl can catch only fish which are influenced by the tow path, while longlines can attract larger fish from a greater distance, we would expect to see a further reduction in the proportion of large fish in the trawl

[2]Kaimmer, S. pers. comm. Int. Pac. Halibut Comm. Seattle, WA.

relative to the longline. Thus, while we can expect that a trawl catch might underrepresent the larger individuals of a species, as long as trawl dimension, bottom characteristics, and towing speed are maintained throughout an experiment, the catchability of a trawl for a given size of a fish should not change. As long as comparisons are made between similar sizes of fish of the same species, trawl catches between areas should be reliable indicators of relative abundance. Since the same towing vessel was used in both areas in 1987, towing at the same speed, in similar depths, and over smooth and even grounds with the same net, the assumption of a constant catchability should be valid.

**Setline Gear**

At each location, we fished a string of setline gear 12,000 feet long rigged with number 3 circle hooks spaced at 18-foot intervals and baited with frozen salmon *(Oncorhynchus* sp.). Each setline string was soaked for 85 to 105 minutes and was retrieved in an average of one hour and fifty minutes. During the 1987 experiment, the setline gear used circle hooks, while the 1983 experiment used J hooks. Studies of setline gear using the two types of hook have estimated that the circle hooks are more than twice as effective at catching (or retaining, once hooked) halibut as J hooks (IPHC 1985). Over 2.2 times the weight of halibut were caught by the circle hooks in these studies. During a setline grid survey conducted in 1984 which fished both circle and J hooks, the circle hooks caught 2.4 and 2.5 times the number of legal-sized fish in Areas 3A and 2B, respectively, and 3.3 times the number of sublegal (less than 82 cm) fish (IPHC 1986). Myhre (1969) determined that, for Area 2B, the size of maximum retention by setline gear rigged with "J" hooks was 87 cm, with a length of 50% retention estimated at 74.3 cm. Using data from tag releases and recoveries, Myhre concluded that, on the average, the gear selectivity is essentially constant for halibut greater than 87 cm. Although no similar study has been done using the circle hook, the more than threefold increase in catch by number of sublegal halibut with the circle hook relative to the "J" hook would indicate that the selectivity of the circle hook for the smaller fish is higher than that determined for the "J" hook.

In the 1987 experiment (Table 1) each setline string was shorter (12,000 feet compared to 12,546 feet used in 1983) and the hooks were more closely spaced (18 feet as compared to 25 feet in 1983). Since each station[3] in 1987 was represented by only one setline string compared to the two setline strings per station in 1983, the 1987 stations were represented by about 667 hooks as compared to about 1,004 in 1983. However, by using the more effective circle hooks (and adjusting for the differences in hook spacing) the effective fishing power for each station during the 1987 experiment was increased by approximately 22 percent from the 1983 experiment (667 as opposed to 548 in circle hook equivalents).

The hooks in the 1987 experiment were baited with frozen salmon. Hooks in the 1983 experiment were baited with frozen Pacific herring *(Clupea harengus pallasi)*, salmon, and Pacific cod *(Gadus macrocephalus)* (Hoag et al. 1984). The fact that salmon bait was used exclusively in 1987 could be an additional factor in the increased number of fish caught, when compared to 1983. Results from a bait study (IPHC 1978) have shown that "the average CPUE was highest when salmon was used, followed closely by octopus and fresh herring; frozen herring and frozen cod produced a notably lower CPUE."

[3]Note that a station in 1987 is equivalent to a location, whereas between 2 and 8 stations were combined to form a location for the 1983 analysis.

## Trawl Gear

The trawler fished for a distance of approximately two nmi at a distance of about one quarter nmi along each side of the setline. The trawl gear used in 1987 should be more effective at catching a larger number of halibut than that used in 1983. The 1987 trawl was designed to open higher, fish a wider path, and tow as easily with the same horsepower as the trawl used in 1983 (Table 1). The trawl gear used in 1983 was a 400-mesh eastern trawl with a 71-foot headrope, a 94-foot groundrope, nine 8-inch diameer metal floats, 4-inch nylon netting in the body and intermediate and 3.5-inch netting in the codend (Best and Hardman 1982; Hoag et al. 1984). The 1987 trawl was larger in all dimensions with a 80-foot headrope, a 111-foot footrope, and forty-one 8-inch aluminum floats, 4½ times more floats than on the 1983 net. Although net mensuration experiments were not included in either the 1983 or the 1987 experiments, the mean effective path width for the trawls used was estimated to be 40 feet and the mean vertical opening 5.6 feet for the 1983 trawl (NMFS 1990 Unpub.)[4], compared to 56 feet and 7.5 feet, respectively, for the 1987 trawl (Craig Rose, pers. comm.)[5]. The 1987 trawl was effectively 1.4 times wider than the 1983 net with a 34 percent higher vertical opening. While the extent to which halibut might be able to swim over an approaching net is unclear, the additional headrope floats and greater trawl width resulted in a higher vertical opening for the trawl used in 1987, and should have reduced escape by this avenue. At the suggestion of the designer of the 1987 trawl (Bill West of Nor'eastern Trawl Systems, Inc., Bainbridge Island, WA) the net was built with a slightly modified intermediate taper to ensure a reduction of back pressure and, hopefully, to increase the catch of halibut. The 1987 net was fabricated of 5½ inch polyethylene mesh throughout. While having little effect on the selectivity of the trawl to larger halibut (Myhre 1969), the larger mesh reduces the resistance of the trawl making it easier to tow than a net with smaller mesh size. Although the larger mesh would initially reduce the catch of the smallest fish species at the beginning of the tow, this effect would lessen as the codend filled with fish.

The distance fished by the trawler during each haul in 1983 was approximately 1.8 nmi in Area 2B and 2.0 nmi in Area 3A, compared to approximately 2.0 nmi in both are as in 1987. The number of hauls fished by the trawler in 1983 at each station ranged from 2 to 4, usually one haul fished at a distance of 0.25 nmi outside of each string, one haul between the two strings, and a haul in a diagonal direction across the bottom area fished by both strings. With 82 percent of the number of trawls conducted in Area 2B in 1983, the 1987 survey actually swept 28 percent more ground, while in Area 3A the comparable numbers are 65 percent as many tows sweeping 9 percent less ground.

## Handling of Catch

All halibut caught by each vessel in 1987 were enumerated and measured, and weights were estimated from a length-weight relationship (Quinn et al. 1983). On the setliner, approximately half the halibut were killed and the remaining halibut were tagged and released. All halibut caught on the trawler were measured and released well away from the next comparative tow, to make released fish unavailable for immediate recapture by the trawl gear.

[4]NMFS. 1990. ADP code book, April 1990. Unpub. U.S. Dep. Commer., NOAA, Alaska Fisheries Science Center, Res. Assess. and Conserv. Eng. Div., Seattle, WA: 78 p.

[5]Rose, C.S., NMFS, Alaska Fisheries Center, 7600 Sand Point Way NE, Seattle, WA 98115-0070.

## CATCHABILITY MODEL

Four assumptions were used in estimating the ratio of setline catchability in Area 2B to setline catchability in Area 3A, based on the setline and trawl catch results. These were: 1) the size selectivity of the setline gear was the same in both areas; 2) the size selectivity of the trawl gear was the same in both areas; 3) the catchability of trawl gear was the same in both areas; and 4) the trawl and setline gear sampled the same halibut substock at each sampling location. This last assumption was a more restrictive assumption than used in the 1983 experiment. The 1983 analysis assumed that the two gears sampled the same substock in each *area*. The 1987 design allowed a variance to be estimated for the average catchability difference within locations and allowed one to better detect real differences which might exist between areas. The basic model, excluding the stochastic component, for calculating relative setline catchability is given by the following equations.

$$CPUE_{g\,i\,l\,p} = q_{g\,i}\, S_{g\,l}\, N_{i\,l\,p},$$

where

$CPUE_{g\,i\,l\,p}$ = *CPUE of gear g for area i and length l at location p*
$q_{g\,i}$ = *catchability of gear g in area i*
$S_{g\,l}$ = *selectivity of gear g for length l*
and $N_{i\,l\,p}$ = *number of halibut of length l at location p in area i.*

The CPUE in number of fish of each gear at a location is a product of the catchability of the gear, the size selectivity of the gear, the number of halibut present, and any location effect which might influence halibut catch (tide, bottom topography, competition with other species for the baited hooks, etc.). By taking the ratio of the setline CPUE to trawl CPUE for fish of length class ***l*** in area ***i***, we get a measure of the ratio of the products of the catchability and selectivity of each gear at that location. Using a logarithmic transformation of the above formula we get

$$\ln (CPUE_{g\,i\,l\,p}) = \ln (q_{gi}) + \ln (S_{g\,l}) + \ln (N_{i\,l\,p})$$

The ratio of the trawl (***g=TR***) and setline (***g=SL***) CPUE can then be expressed as the difference between their logarithmic transformations, such that the expected difference in ln(CPUE) between trawl and setline gears at area ***i*** and location ***p*** is independent of location effects:

$$\begin{aligned} E(\delta_{ilp}) &= \ln (CPUE_{SL,\,i\,l\,p}) - \ln (CPUE_{TR,\,i\,l\,p}) \\ &= \ln (q_{SL,\,i}) - \ln (q_{TR,\,i}) + \ln (S_{SL,l}) - \ln (S_{TR,\,l}) \\ &= \ln \left(\frac{q_{SL,\,l}}{q_{TR,i}}\right) + \ln \left(\frac{S_{SL,\,l}}{S_{TR,i}}\right) \end{aligned}$$

where $\delta_{ilp}$ denotes the difference in catch per unit effort between the two gears at location ***p*** in area ***i***. Letting $T_i$ denote the number of locations sampled in area ***i***, the mean difference in the logarithm of catchability between setline and trawl gears in area ***i*** may be estimated as the mean difference in the logarithms of CPUE by:

$$\bar{\delta}_{i\,l} = \frac{1}{T_i} \sum_{p=1}^{T_i} \delta_{i\,l\,p}$$

Given assumptions 1, 2 and 3, the expected difference in ln setline catchability between Area 3A and Area 2B is:

$$\begin{aligned} E(\Delta_l) &= E(\delta_{3A,l}) - E(\delta_{2B,l}) \\ &= (\ln(q_{SL,3A}/q_{TR,3A}) + \ln(S_{SL,l}/S_{TR,l})) \\ &\quad - (\ln(q_{SL,2B}/q_{TR,2B}) + \ln(S_{SL,l}/S_{TR,l})) \\ &= \ln(q_{SL,3A}/q_{SL,2B}) \end{aligned}$$

which is estimated by subtracting the mean difference in ln CPUE in Area 2B from the mean difference in ln CPUE from Area 3A as computed from the previous equation. The relative setline catchability between Areas 3A and 2B used in the subsequent analysis is given by the reverse transformation

$$\begin{aligned} \hat{p} &= \exp(\hat{\Delta}_{ST,3A-2B}) \\ &= \frac{q_{3A}}{q_{2b}} \end{aligned}$$

After testing for homogeneity of the variance in the two areas the pooled variance of the differences in ln catchability between setline and trawl gear

$$V(\Delta_l) = \frac{(T_{3A}-1)\ (V(\delta_{3A,l}))\ +\ (T_{2B}-1)\ (V(\delta_{2B,l}))}{T_{3A}+T_{2B}-2}$$

may be derived from the area specific sampling variances $\hat{V}(\delta_{3A,l})$ *and* $\hat{V}(\delta_{2B,l})$

where

$$\hat{V}(\delta_{i,l}) = \sum_{p=1}^{T_i} \frac{(\delta_{ilp} - \delta_{il})^2}{(T_i - 1)}$$

and $T_i$ is the number of stations observed for $i$ = ***3A, 2B.*** The two-sided 95 percent confidence interval for $\hat{\Delta}_l$ is then given by

$$\hat{\Delta}_l \pm t_{(T_{3A}+T_{2B}-2,\ .05)}\, s \sqrt{\frac{1}{T_{3A}} + \frac{1}{T_{2B}}}$$

where $s^2$ is the pooled sample variance. The confidence interval for relative setline catchability $p$ results from applying the exponential transformation discussed above to the confidence limits for $\Delta_l$.

**Table 3. Summary of 1987 catch[1] by species, area and gear type for the setliner SNOWFALL and the trawler OCEAN STAR.**

| | AREA 2B | | | | | |
|---|---|---|---|---|---|---|
| | Setline[2] | | | Trawl[3] | | |
| | Number | (%) | Kg | Number | (%) | Kg |
| Halibut (≥ 82 cm.) | 896 | (17.8) | 3,190.3 | 7,700 | (10.9) | 31,526.3 |
| Halibut (≥ 82 cm.) | 277 | ( 5.5) | 1,810.7 | 518 | ( 0.7) | 3,978.8 |
| Arrowtooth flounder | 35 | ( 0.7) | 24.9 | 11,666 | (16.6) | 11,691.1 |
| Other flatfish | 3 | ( 0.1) | 3.2 | 13,181 | (18.7) | 7,441.4 |
| Blackcod (Sablefish) | 8 | ( 0.2) | 7.3 | 37 | ( 0.1) | 28.5 |
| Rockfish | 1 | ( 0.0) | 1.8 | 847 | ( 1.2) | 2,956.7 |
| Pacific cod | 3 | ( 0.1) | 3.2 | 9,324 | (13.2) | 11,338.7 |
| Lingcod | 13 | ( 0.3) | 102.1 | 1,071 | ( 1.5) | 5,290.6 |
| Other roundfish | 0 | ( 0.0) | 0 | 17 | ( 0.0) | 46.8 |
| Dogfish | 3,506 | (69.8) | 13,572.3 | 8,126 | (11.6) | 17,109.7 |
| Ratfish | 1 | ( 0.0) | 1.8 | 4,339 | ( 6.2) | 2,150.2 |
| Skates | 135 | ( 2.7) | 1,847.0 | 911 | ( 1.3) | 8,502.8 |
| Shark | 0 | ( 0.0) | 0 | 0 | ( 0.0) | 0 |
| Starfish | 142 | ( 2.8) | 153.8 | 7,950 | (11.3) | 2,028.2 |
| Shellfish | 0 | ( 0.0) | 0 | 1,472 | ( 2.1) | 223.1 |
| Misc. Invertebrates | 0 | ( 0.0) | 0 | 3,224 | ( 4.6) | 1,714.7 |
| **TOTAL** | **5,020** | | **20,718.4** | **70,383** | | **106,027.6** |

| | AREA 2B | | | | | |
|---|---|---|---|---|---|---|
| | Setline[2] | | | Trawl[3] | | |
| | Number | (%) | Kg | Number | (%) | Kg |
| Halibut (≥ 82 cm.) | 559 | (10.4) | 1,763.0 | 2,321 | ( 0.9) | 4,051.6 |
| Halibut (≥ 82 cm.) | 1,479 | (25.5) | 20,873.6 | 316 | ( 0.1) | 4,727.4 |
| Arrowtooth flounder | 259 | ( 4.8) | 382.4 | 27,756 | (10.9) | 22,332.8 |
| Other flatfish | 4 | ( 0.1) | 1.8 | 72,279 | (28.3) | 24,372.7 |
| Blackcod (Sablefish) | 114 | ( 2.1) | 178.3 | 498 | ( 0.2) | 897.8 |
| Rockfish | 0 | ( 0.0) | 0 | 358 | ( 0.1) | 337.9 |
| Pacific cod | 1,720 | (31.9) | 4,976.3 | 6,134 | ( 2.4) | 8,173.6 |
| Lingcod | 0 | ( 0.0) | 0 | 1 | ( 0.0) | 2.2 |
| Other roundfish | 62 | ( 1.2) | 81.6 | 12,558 | ( 4.9) | 10,217.5 |
| Dogfish | 21 | ( 0.4) | 47.2 | 10 | ( 0.0) | 29.8 |
| Ratfish | 0 | ( 0.0) | 0 | 0 | ( 0.0) | 0 |
| Skates | 9 | ;( 1.7) | 1,532.2 | 426 | ( 0.2) | 1,781.1 |
| Shark | 3 | ( 0.1) | 208.7 | 0 | ( 0.0) | 0 |
| Starfish | 1,065 | (19.8) | 1,674.2 | 40,626 | (15.9) | 13,065.5 |
| Shellfish | 0 | ( 0.0) | 0 | 35,603 | (13.9) | 2,967.0 |
| Misc. Invertebrates | 4 | ( 0.1) | 8.2 | 56,715 | (22.2) | 10,821.3 |
| **TOTAL** | **5,384** | | **31,727.5** | **255,602** | | **103,778.2** |

[1]Halibut weights are expressed as net weight. All other species are estimated round weight.
[2]Based on 25 sets, 200 1,500-foot skates with 18-foot hook spacing (equivalent to 170 standard skates) in Area 2Band 27 sets, 216 1,500 foot skates (183.6 standard skates) in Area 3A. A standard skate is 1,800 feet long with 100 hooks per skate.
[3]Based on 50 hauls adjusted to 2 nmi distance in Area 2B and 54 hauls adjusted to 2 nmi distance in Area 3A.

## 1987 FISHING RESULTS

The 1987 catch of halibut and other species or species groups is summarized by gear type in Table 3 and is contrasted with 1983 catches by major species or species groups in Table 4. Detailed catch data for 1987 are given in Appendix Tables 1 and 2.

Setline CPUE of legal-sized halibut ranged from 2 to 76 pounds/skate with an average of 23.5 pounds/skate in Area 2B and from 22 to 774 pounds/skate with an average of 250.7 pounds/skate in Area 3A. In terms of numbers of fish of all species, the total setline catch was similar in both regions, with just over 5000 individuals caught by the setline in each area. However, the species composition differed markedly by area, with dogfish and starfish (all species) representing over 72 percent of the total setline catch by number in Area 2B, compared to 23 percent for halibut. In Area 3A, Pacific cod and starfish comprised over 51 percent of the setline catch, compared to just under 38 percent for halibut.

The average catch in weight per trawl haul during 1987 was 2,121 kg in Area 2B and 1,922 kg in Area 3A. The total trawl catch in number was much higher in each area than the associated setline catches and more diverse between areas, with over 70,000 individuals caught in the Charlotte region and over 255,000 in the Kodiak region. In Area 2B, arrowtooth flounder *(Atheresthes stomias),* Pacific cod, dogfish, other flatfish[6], and starfish (all species) made up over 71 percent of the total trawl catch in number, with halibut making up another 12 percent of the total. In Area 3A, arrowtooth flounder, other flatfish, miscellaneous invertebrates, starfish, and shellfish comprised over 91 percent of the total trawl catch, while halibut was a mere 1 percent of the total. While overall trawl catches in number were greater in the Kodiak region, over half of the increase in number of individuals in the trawl catches was accounted for by increased catches of invertebrates.

The size composition of the halibut catches differed substantially by gear type and area in 1987 (Figure 4), and were consistent with previous juvenile halibut trawl surveys conducted in Areas 2B (Myhre 1969) and 3A (Best and Hardman 1982).

The trawler caught a large proportion (68.1%) of halibut smaller than 60 cm in Area 3A, whereas very few (5.6%) of these small halibut were caught in Area 2B. High numbers of smaller halibut in the Area 3A trawl hauls indicated that trawls catch small halibut effectively. In Area 2B, the low number of small halibut in trawl hauls indicated a relative absence of these smaller halibut, as explained in Skud's discussion of compensatory emigration (Skud 1977), rather than trawl selectivity. The smaller halibut which were caught in trawls in Area 3A had not yet reached an age (thus, a length) where they could have migrated into Area 2B. A greater number of large halibut occurred in the Area 3A setline catches; 44 percent of all halibut caught by setline were larger than 99 cm. In Area 2B halibut larger than 99 cm comprised only 1.2 percent of the setline catch. The relatively high numbers of larger halibut in Area 3A setline catches demonstrated the ability of this gear to catch these larger fish. Their relative absence in Area 2B setline catches reflected smaller numbers of these large fish in this area.

In both areas, but most prominent in Area 3A, the proportion of halibut larger than about 70 cm was much higher in setline catches than trawl catches. Even though the trawler caught large numbers of fish less than about 60 cm in Area 3A during the 1987 sampling, the setline catches had few such fish in either area. Numbers of fish caught by the setline increased with size until about 72 to 77 cm, then decreased at larger sizes. While longlines are particularly effective at capturing larger fish of a species, the low selectivity of longlines relative to trawls for smaller sized fish is well

[6]Flatfish species other than arrowtooth flounder or Pacific halibut.

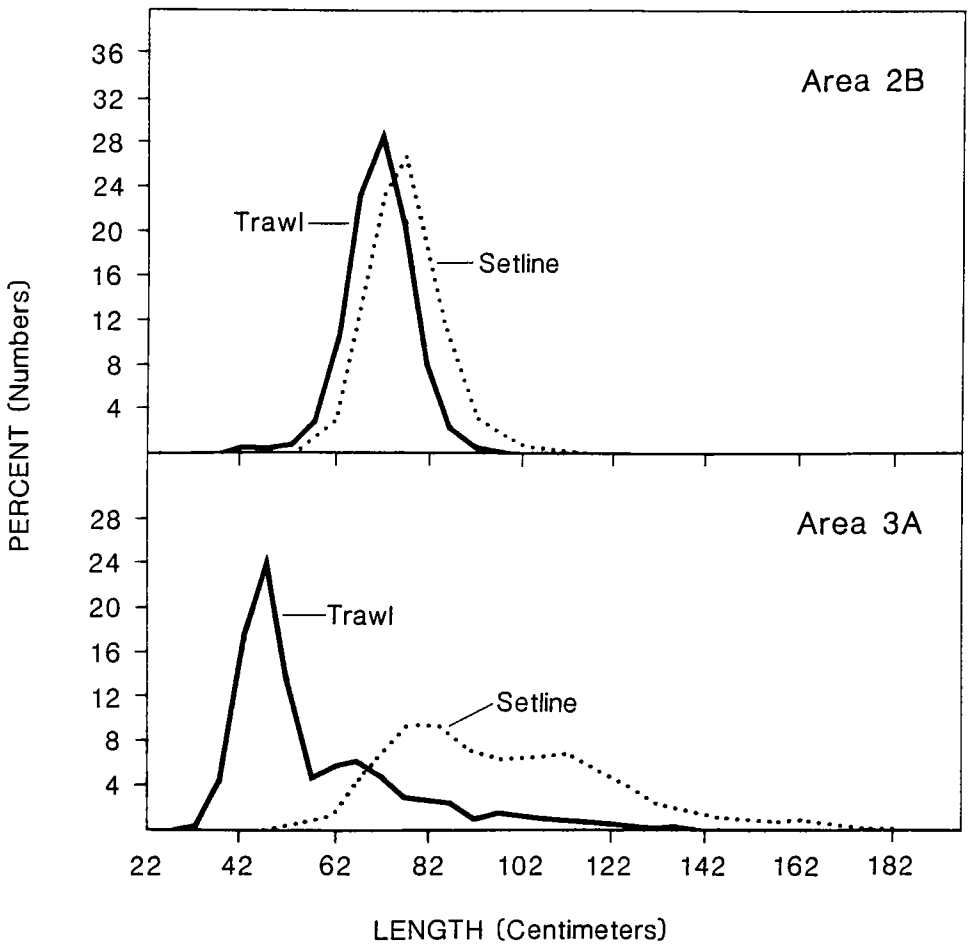


**Figure 4.** **Percentage of halibut by 5 cm length group in trawls and setlines by area in 1987.**

known (Hovgard and Riget 1992; Bjordal 1988). Lokkeborg and Bjordal (1992) gave a number of possible factors responsible for this low selectivity of small fish by longlines. These factors include bait and hook size (smaller fish being less likely to bite or become hooked on large baits or hooks), intraspecific competition (larger fish being more aggressive than smaller fish in competing for available hooks), and the increased feeding range and therefore an increased likelihood of encountering a baited hook by larger fish. These last two factors were observed in Pacific halibut during hook spacing experiments (Skud 1978).

In comparing catches between the 1983 and 1987 surveys (Table 4), immediately obvious was the increased number of individuals caught in both areas and by both gear types in 1987. The 1987 longline catch in terms of number of halibut was approximately two times higher that seen in 1983 in both areas. In both areas, the setline caught over 5000 individuals of all species during 1987. Major increases were also seen during the 1987 survey in the Area 2B catch of dogfish (two-fold) and in the Area 3A catch of Pacific cod (nine-fold) and starfish (over twelve-fold). With similar effort in each area (Table 1), the hook occupancy in both areas was 0.30 during 1987 compared to 0.20 in Area 2B and 0.10 in Area 3A during 1983. Much of this difference can be attributed to catches of halibut, dogfish, Pacific cod and starfish. Even larger

**Table 4. A comparison of trawl and setline catches in number between areas and years by species.**

| | Setline catch in number[1] | | | | Trawl catch in number[1] | | | |
|---|---|---|---|---|---|---|---|---|
| | 1983[2] | | 1987[3] | | 1983 | | 1987 | |
| | 2B | 3A | 2B | 3A | 2B | 3A | 2B | 3A |
| Halibut | | | | | | | | |
| <82 cm | 425 | 390 | 896 | 559 | 1,540 | 1,043 | 7,700 | 2,361 |
| ≥ 82 cm | 220 | 580 | 277 | 1,479 | 85 | 112 | 518 | 316 |
| Total | 645 | 970 | 1,173 | 2,038 | 1,625 | 1,155 | 8,218 | 2,637 |
| Arrowtooth | 0 | 94 | 35 | 259 | 1,970 | 32,716 | 11,666 | 27,756 |
| Other flatfish | 0 | 0 | 3 | 4 | 21,490 | 33,342 | 13,181 | 72,279 |
| Blackcod | 0 | 116 | 8 | 114 | 5 | 1,954 | 37 | 498 |
| Rockfish | 10 | 1 | 1 | 0 | 92 | 697 | 847 | 358 |
| Pacific Cod | 9 | 181 | 3 | 1,720 | 2,552 | 1,785 | 9,324 | 6,134 |
| Lingcod | 19 | 12 | 13 | 0 | 416 | 25 | 1,071 | 1 |
| Other Roundfish | 4 | 21 | 0 | 62 | 187 | 548 | 17 | 12,558 |
| Dogfish | 1,812 | 361 | 3,506 | 21 | 911 | 211 | 8,126 | 10 |
| Ratfish | 7 | 0 | 1 | 0 | 4,082 | 0 | 4,339 | 0 |
| Skates | 874 | 274 | 135 | 94 | 475 | 206 | 911 | 426 |
| Sharks | 0 | 3 | 0 | 3 | 0 | 0 | 0 | 2 |
| Starfish | 245 | 84 | 142 | 1,065 | 1,379 | 831 | 7,950 | 40,626 |
| Shellfish | 0 | 2 | 0 | 0 | 1,915 | 2,597 | 1,472 | 35,603 |
| Misc Invert. | 2 | 0 | 0 | 4 | 3,182 | 1,378 | 3,224 | 56,715 |
| TOTAL | 3,627 | 2,119 | 5,020 | 5,384 | 40,281 | 77,445 | 70,383 | 25,5603 |

[1]Catches are in terms of raw numbers caught and are not standardized to units of effort.
[2]1983 data are from Table 3 in Hoag et al. (1984).
[3]1987 data are from Table 1 of this report.

differences were seen in the trawl catches between 1987 and 1983, with a more than five-fold increase in Area 2B and a more than two-fold increase in Area 3A (Table 4). Relative size compositions within each area were similar between years, with fish less than 62 cm present only in very small numbers in Area 2B. Setline catches followed a similar pattern, with catches at most sizes being approximately two fold or more greater in 1987.

**Table 5. Number of fish caught in the 1987 experiment by gear type and estimates of setline catchability in Area 3A relative to Area 2B.**

| | number of fish | | | | | |
|---|---|---|---|---|---|---|
| | trawl | | setline | | | |
| length class | 2B | 3A | 2B | 3A | relative catchability | 95% confidence interval |
| < 50 cm | 141 | 1,286 | 0 | 2 | | |
| 50-59 cm | 323 | 509 | 11 | 27 | 1.20 | (0.13, 11.04) |
| 60-69 cm | 2,799 | 309 | 180 | 132 | 5.60 | (2.18, 14.39) |
| 70-79 cm | 4,097 | 194 | 589 | 332 | 9.29 | (5.01, 17.25) |
| 80-89 cm | 799 | 121 | 314 | 377 | 5.28 | (3.17, 8.78) |
| 90-99 cm | 56 | 70 | 65 | 272 | 4.29 | (2.47, 7.43) |
| 100-109 cm | 1 | 61 | 9 | 269 | - | |
| 110+ cm | 2 | 87 | 5 | 627 | - | |
| 82-99 cm | 515 | 168 | 263 | 583 | 5.08 | (3.08, 8.37) |

## ESTIMATES OF RELATIVE SETLINE CATCHABILITY

Table 5 provides the number of fish caught by each gear type, the point estimates, and the confidence intervals of the relative setline catchability for the 1987 comparison of Areas 3A and 2B, for fish between 50 and 109 cm. The source data for these calculations are contained in Appendix Tables 3 through 6. Too few fish less than 50 cm were caught by the setline to allow the determination of catch ratios between the two gear types. Relative catchability estimates were determined for 10-cm length intervals, including lengths from 50 to 99 cm. Significant differences were found in four intervals between 60 and 99 cm. For the four intervals between 60 and 99 cm, the relative catchability estimate ranged from 9.29 to 4.29. Estimates of setline catchability derived for the 80-89 and 90-99 cm ranges were very similar, varying by only about 20 percent, with similar ranges on the confidence intervals. For the remainder of our discussion, we grouped the halibut caught by both gear types into one length class, 82-99 cm. Since our goal was to determine whether the commercial setline fishing fleet would experience differences in the catchability of halibut between areas (legal size > 82 cm), sub-legal fish were excluded from the calculations. Halibut greater than 99 cm were excluded because few such halibut were caught by either gear type in Area 2B, making their catch ratios between areas highly suspect.

For 82-99 cm fish, the point estimate of setline catchability for the Kodiak region was calculated to be 5.08 times that for the Charlotte region (Table 5). Using at-distribution and the pooled sample variance, the 95% confidence interval about this ratio was estimated to range from 3.08 to 8.37, significantly different from the null hypothesis ratio of 1.

Hook occupancy by dogfish has been suggested by IPHC (IPHC 1979, 1985; Hoag et al. 1984) and Area 2B fishermen as a reason for a lower catchability of halibut in Area 2B than in Area 3A. The 1987 experiment indicated that locations in Area 2B with high setline catches of dogfish were associated with relatively low setline catches of halibut in the 82-99 cm size group (Figure 5). Dogfish catches ranged from 1 to 373 dogfish per set. The setline/trawl catch ratio of 82 to 99 cm halibut, plotted against setline catch of dogfish in number, ranged from almost zero to over 5. Since the overall catchability estimate generated by the analysis was a function of the average of the individual location ratios of setline to trawl catches, it is clear that the presence or absence of dogfish can have a dominant effect on the average setline to trawl ratio within an area and thus on any estimate of catchability between areas. To investigate the effect of dogfish density, we divided the Charlotte stations into two groups based on relative dogfish abundance. Hoag et al. (1984) observed that halibut CPUE "may be severely affected only when dogfish are very abundant", and determined from their experiment that the median CPUE of halibut declined dramatically when the dogfish median CPUE exceeded 15 fish per skate. An examination of Figure 5 suggested that a catch rate of 100 dogfish/set fairly well represented a division between "high" dogfish locations and "low" dogfish locations in our experiment. Using this criteria, thirteen locations in Area 2B were identified as low dogfish abundance and the remaining 12 locations were classified as high dogfish abundance. Estimates of relative catchability were performed separately for the Area 3A locations and these high and low dogfish abundance locations from Area 2B. As in the previous analysis, only halibut between 82 and 99 cm were used for comparison of catches. The results from these comparisons

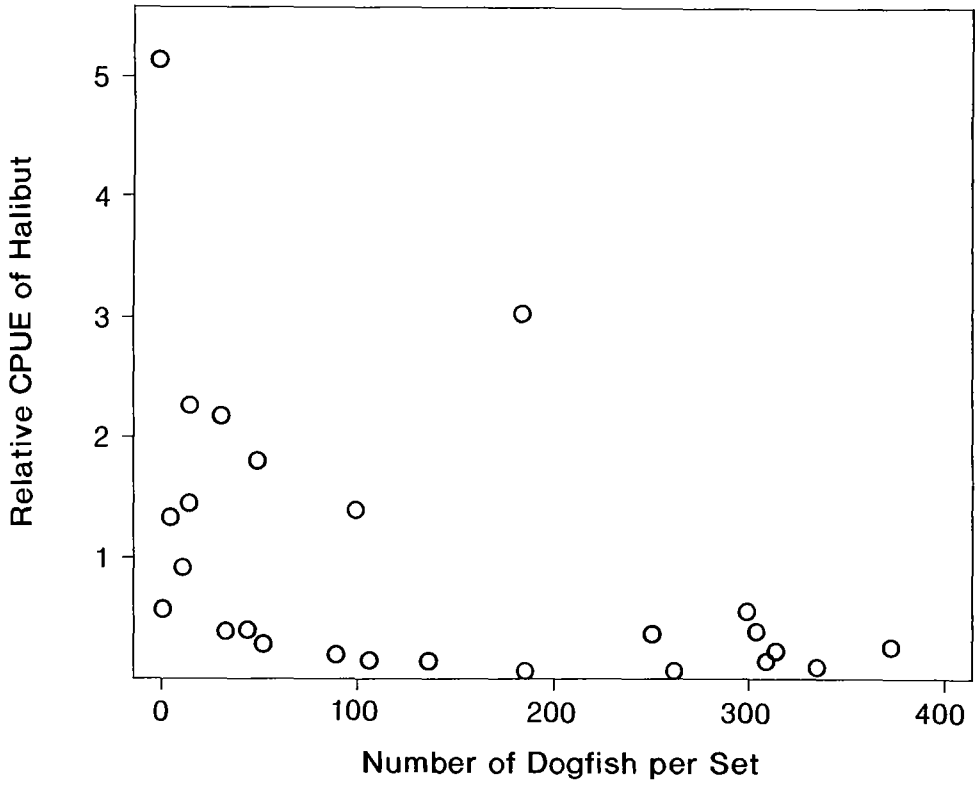


**Figure 5. Ratio of setline catch to trawl catch in numbers of 82 to 99 cm halibut in Area 2B plotted against setline catch of dogfish in numbers in 1987.**

are summarized in Table 6. By using only the "low dogfish" locations from Area 2B in the comparison with Area 3A, the resulting estimate of the catchability difference between areas for halibut from 82 to 99 cm was reduced from the previously determined value of 5.08 to a value of 2.43 with a 95% confidence interval of 1.69 to 3.51. Using only the "high dogfish" stations for the comparison increased the difference in catchability between areas over twofold to a value of 11.27 with a 95% confidence interval of 8.07 to 15.75.

We re-analyzed the data from the 1983 experiment to conform with the analysis of the 1987 experiment (source data for the 1983 analysis are given in Appendix Table 7.). Since some of the 1983 stations had catches of 82 to 99 cm halibut equal to zero, we added 1 to all catch totals to allow the log transformations used in the analysis. From the new analysis of halibut between 82 and 99 cm, the estimated relative catchability in the 1983 experiment was 1.33 with a 95% confidence interval of 0.80 to 2.22. Since the confidence interval brackets 1.0, we concluded that there was no significant difference shown by the 1983 experiment in the catchability between Areas 2B and 3A. This is consistent with the original analysis of these data. However, as noted earlier, the stations selected for the Area 3A portion of the survey in 1983 were markedly different than those selected in 1987. While there may have been no significant difference between the areas chosen during 1983, in part due to the close proximity of the Area 3A stations to the British Columbia fishing grounds, significant differences may have existed between areas further separated in distance. In comparison, the stations selected for Area 3A during the 1987 experiment are located further westward from the Area 2B grounds. Considering the three differences between the experiments as improvements in the more recent version, we conclude that the current analysis more accurately reflects experiences in the commercial fishery and employs more useful indices for comparison.

## COMMERCIAL FISHERY DATA

Since 1983, IPHC has used catch-at-age analysis for calculating estimates of exploitable halibut biomass (Quinn et al. 1985). Hoag et al. (1984) used estimates of area biomass along with estimates of the CPUE from the commercial fishery in Areas 2B and 3A to determine trends in area catchability as experienced by the commercial fishing fleet. Catchability was determined as the ratio of CPUE and density, where density was calculated as the area biomass divided by the amount of bottom area inhabited by halibut as reported by Quinn et al. (1982) . Quinn et al. (1982) indicated that the bottom area estimates were determined from charts using planimeter tracings of the depths between 19 and 279 m. However, they omitted to specify that the

**Table 6. Relative catchability estimates between Areas 3A and 2B using numbers of dogfish per setline set to divide Area 2B locations into low and high dogfish categories. Analysis is for catches of halibut between 82 and 99 cm.**

| analysis | relative catchability | 95% confidence interval |
|---|---|---|
| less than 100 dogfish per setline set | 2.43 | (1.69, 3.51) |
| more than 100 dogfish per setline set | 11.27 | (8.07, 15.75) |

estimates included grounds located at greater depths where fishing was known to have occurred or was currently taking place. Hoag et al. (1984) examined the catchability trends from 1977 through 1983 and observed that "the catchability nearly doubled in Area 3A from 1977 to 1983, whereas it remained relatively stable in Area 2B over the period."

For this report, we examined the trends in the commercial fishery from 1975 through 1991, the last year for which CPUE and biomass estimates are available (Table 7). CPUE in Area 3A increased nearly four-fold between 1975 and 1987 with a nearly three-fold increase in biomass, while in Area 2B CPUE actually decreased by 15 percent with a 35 percent increase in biomass. Table 7 suggests that catchability increased by over 46 percent in Area 3A from 1975 to 1987, whereas it decreased by over 38 percent in Area 2B over the same period. Compared to the mid 1970s, when catchability appeared to be similar in magnitude between the two areas, more recent years through 1989 showed a decline in catchability in Area 2B and increasing catchability in Area 3A.

The CPUE in Area 2B for the two most recent years, 1990 and 1991, may not be appropriate for showing trends in catchability for this area. In 1990, we see the highest setline CPUE in Area 2B of the entire time series (Table 7). This is then reflected as a record high catchability for this area. In 1990, the industry in Area 2B chose to split the

**Table 7. Estimates of biomass, density, setline CPUE and catchability in Areas 2B and 3A from commercial fishery data, 1975-1991.**

| | BIOMASS[1] | | DENSITY[2] | | SETLINE CPUE[3] | | CATCHABILITY[4] | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2B | 3A | 2B | 3A | 2B | 3A | 2B | 3A | 3A/2B |
| 1975 | 32.4 | 60.9 | 399 | 415 | 148.7 | 145.3 | 0.37 | 0.35 | 0.94 |
| 1976 | 31.9 | 64.8 | 392 | 441 | 166.7 | 131.4 | 0.42 | 0.30 | 0.70 |
| 1977 | 31.0 | 69.1 | 381 | 470 | 135.3 | 134.6 | 0.35 | 0.29 | 0.81 |
| 1978 | 31.2 | 75.8 | 384 | 516 | 138.0 | 171.9 | 0.36 | 0.33 | 0.93 |
| 1979 | 30.9 | 80.2 | 380 | 546 | 105.8 | 189.0 | 0.28 | 0.35 | 1.24 |
| 1980 | 30.5 | 85.6 | 375 | 583 | 143.7 | 260.6 | 0.38 | 0.45 | 1.17 |
| 1981 | 30.7 | 93.7 | 378 | 638 | 140.6 | 313.5 | 0.37 | 0.49 | 1.32 |
| 1982 | 32.1 | 104.1 | 395 | 709 | 141.4 | 342.6 | 0.36 | 0.48 | 1.35 |
| 1983 | 35.1 | 118.2 | 432 | 805 | 144.4 | 437.0 | 0.33 | 0.54 | 1.62 |
| 1984 | 38.9 | 133.0 | 479 | 905 | 151.1 | 516.0 | 0.32 | 0.57 | 1.81 |
| 1985 | 42.3 | 145.8 | 520 | 993 | 141.2 | 525.1 | 0.27 | 0.53 | 1.95 |
| 1986 | 43.4 | 153.9 | 534 | 1,048 | 123.8 | 514.8 | 0.23 | 0.49 | 2.12 |
| 1987 | 43.7 | 156.1 | 538 | 1,063 | 126.3 | 546.2 | 0.23 | 0.51 | 2.19 |
| 1988 | 42.5 | 161.9 | 523 | 1,102 | 120.9 | 447.3 | 0.23 | 0.41 | 1.76 |
| 1989 | 38.9 | 155.5 | 479 | 1,059 | 125.8 | 421.1 | 0.26 | 0.40 | 1.51 |
| 1990 | 35.0 | 141.6 | 431 | 964 | 174.9 | 311.6 | 0.41 | 0.32 | 0.80 |
| 1991 | 32.6 | 126.4 | 401 | 860 | 121.6 | 300.4 | 0.30 | 0.35 | 1.15 |

[1]1Exploitable biomass in millions of pounds (IPHC, 1991 Report of Assessment and Research Activities, p 67, Unpub.).

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

[3]Pounds per standard skate adjusted for circle hooks. Note that CPUE in thereference is adjusted for catchability since 1981 upwards by 1.25 in Area 2B and downwards 1.25 in Area 3A. Data in this table are *unadjusted* for area catchability. (IPHC, 1991 Report of Assessment and Research Activities, p 64, Unpub.).

[4]Catchability is calculated as CPUE divided by density.

commercial effort into two segments. The vessels fished as two "platoons", part of the vessels fishing during one opening and the remainder fishing two months later. These two fishing periods resulted in 66 percent of the total removals from Area 2B in 1990. It is unclear what effect this platooning of the fleet into two sub-fleets, had on overall area CPUE for 1990. Whether the 1990 catchability estimate from Table 7 is an indication of the true situation in Area 2B, or an artifact of the way in which the fishery was prosecuted, is not known at this time. Quinn (1987) demonstrated consistent, short-term declines in commercial CPUE over the first few fishing days of an opening. Since the fleet effectively fished an extra opening in 1990, with less competition for favored fishing locations as well as a substantial rest period for the grounds between the openings, it is possible that the CPUE observed in this year is higher than would have been observed without the platooning. In 1991, the management regime for Area 2B underwent a dramatic change. Starting in 1991, and for a probationary period of two years, each vessel was awarded an individual vessel quota, or IVQ, which it could catch at any time during a seven-month fishing season. It is unclear how CPUE from this and subsequent years will be comparable to earlier years in Area 2B. For the years up to 1990, the estimates from the commercial fishery support the finding from the 1987 experiment that catchability was higher in Area 3A than in Area 2B.

## DISCUSSION

The 1987 experiment supports a finding of a lower catchability in Area 2B than Area 3A. The magnitude of this difference is less certain. Although the calculations point to differences on the order two-fold or more, both the 1983 and 1987 surveys were conducted under conditions which make rigorous application of the results inappropriate. A fundamental assumption of both surveys is that the trawl catch of halibut is an appropriate indicator of halibut abundance, directly related to the density of the population on the grounds fished. In an absolute sense, this assumption is not true. Most fishing gear, including trawls, is selective for different species or sizes of fish. From the size distribution of trawl catches in the two survey regions and comparisons with the setline catches, it is obvious that the trawl catches were not appropriate estimators of fish larger than about 110 cm, in much the same way that setline catches were not indicative of the presence of fish smaller than about 60 cm. Since fish larger than 99 cm were not included in our estimation of relative catchability, we effectively excluded almost 61 percent of the legal-sized ($\geq$ 82 cm) Area 3A setline catch of halibut from our calculations, and 47 percent of the legal-sized trawl catch. A more appropriate but as yet unidentified baseline for abundance is needed to adequately estimate the density of these larger fish and allow their inclusion in our calculations. A further drawback of the trawl as our baseline gear came from the requirement of fishing on *trawlable* bottom; the catchability study, therefore, did not include data from untrawlable grounds. Major halibut fishing grounds include many irregular slopes and rocky areas which we were not able to include in our survey. We assumed that any differences in catchability found by comparing trawlable bottom between areas will generally hold if we could find a way to include data from untrawlable bottoms. However, the assumption will not hold if species common to non-trawlable ground in one area but not in the other compete in significant number for the baited hooks.

Also, both gear types sampled the grounds differently. The setline was demonstrated to be a more efficient gear than the trawl for capturing large halibut in numerous IPHC surveys. Setlines attract fish from a distance while the trawls sample only those fish influenced by the width of its passage. Nearby concentrations of fish

might be attracted by the smell of the baited hooks while these same fish could easily be missed by the trawl. When both large and small halibut are present, the larger fish are more successful than the smaller ones in competing for the hooks (Hamley and Skud 1978), with the result that the setline was more efficient at capturing large fish than small. Larger halibut in the path of the trawl can more successfully outswim the trawl, making the trawl less than ideal to sample their abundance. The bottom trawl gear will sample only fish on or slightly off bottom and often misses those species moving alternatively between demersal and pelagic zones.

The 1987 survey was an improvement over the 1983 effort. More locations were sampled in a similar time span but at a later time in the year, and both the trawl and the setline gear used in 1987 resulted in higher numbers of fish caught at each location. Although the confidence interval is broad, the results from the 1987 experiment showed a statistically significant difference in catchability between areas for most size groups.

A concern with the 1987 survey design involves the different size composition of the halibut stocks in each area and the effect of the size selectivity of the trawl gear on targeting the different populations. As previously stated, very few halibut at sizes over 100 cm in length were caught by either the setline or the trawl gear in Area 2B, and it was therefore not possible to include these larger fish in the calculations of relative catch by gear type. This results in a major portion of the Area 3A stocks being left out of our calculations. As well, it is possible that setline catches of fish less than 100 cm in Area 3A were lowered as the result of more successful competition for the baited hooks by the larger halibut in that area. This could in effect reduce the setline catchability of these smaller halibut, resulting in an underestimation of the setline to trawl catch ratio.

The 1987 experiment demonstrated that there is a lower catchability in Area 2B relative to Area 3A. Although the reasons for this difference in catchability are not fully understood, a strong case can be made that some, if not most, of the difference between these two areas is the direct result of competition for hooks by species other than halibut. Unlike most other fishing gears, longlines have a definite point of gear saturation, with the maximum number of fish caught being limited to the number of hooks fished (Hamley and Skud 1978; Bjordal 1988). Clearly, any factor which reduces the number of baited hooks available to halibut can reduce the effective halibut CPUE. Field observations indicate that competition is achieved either by pre-empting the hook, stealing the bait, reducing the attractiveness of the bait by decreasing its size by nibbling on it, or by covering the bait (e.g. starfish) before halibut or other species have had the chance to compete for it.

Although earlier studies suggested that halibut is the "dominant predator" on setline gear (Skud 1978), more recent IPHC setline survey data (IPHC 1979, 1981-1984, 1986, 1987 ) indicated that other species, notably dogfish, had adverse effects on halibut CPUE values obtained during setline grid surveys conducted in the Hecate Strait - Queen Charlotte sound portion of Area 2B. In reporting on the 1983 trawl-setline comparison, Hoag et al. (1984) indicated that "the CPUE of halibut at various levels of dogfish CPUE suggests that halibut CPUE may be severely affected only when dogfish are very abundant." As previously indicated, they observed that "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." Although they acknowledge that "dogfish adversely affect the setline CPUE of halibut," they concluded in the 1983 study that "the difference between areas is due to an increase in Area 3A catchability rather than a decrease in Area 2B" and doubted "that dogfish account for the apparent change in catchability between areas." In the following discussion, we will explore the apparent effects of other species, particularly dogfish, on the setline catch of halibut.

In 1987, 14 times and 47 times more individuals of all species were caught in Area 2B and Area 3A, respectively, by the trawl gear when compared to the setline gear (Table 3). In Area 2B, fish species or species groups such as arrowtooth flounder, other flatfish, sablefish (*Anoplopoma fimbria*), dogfish, spotted ratfish (*Hydrolagus colliei*), and occasionally skates, competed at different levels of effectiveness with halibut for the baited hooks. The number of a species caught in the trawl can be compared to the setline catch of that species as a first approximation of competitive ability. During the 1987 experiment, arrowtooth flounders, other flatfish, and ratfish were caught in large numbers by the trawl, while relatively few of these species were caught on the setline (Table 3). They would appear to be less effective competitors than species caught in greater number by the setline. Observations of fish behavior around baited hooks using underwater video equipment suggested that only the larger individuals were capable of taking the baited hooks, while smaller individuals probably limited their activities to nibbling at the bait because of the small mouth dimensions (Kaimmer 1992 Unpub.)[7]. Comparisons of the trawl and setline catches in 1987 indicate that Pacific cod, lingcod (*Ophiodon elongatus*), and skates were superior competitors when compared to small flatfish and ratfish but inferior to dogfish and halibut when compared to trawl catches in Area 2B and 3A. In Area 3A, large numbers of Pacific cod and starfish were caught by the setline. Large starfish are effective bait predators, covering a bait and thus keeping it from other fish (Kaimmer 1992 Unpub.)[6].

Table 4 provides a comparison of the trawl and setline catches between areas and years by major species or species group. During the 1983 experiment, dogfish and skates were 17 and 13 percent, respectively, and Pacific cod was only 8.5 percent of the setline catch by number in Area 3A. In comparison, the 1987 combined catch in numbers of dogfish and skates was barely over 2.0 percent of the setline catch, whereas Pacific cod made up almost 32 percent of the catch by number. The catch composition in each area for the trawl hauls was similar between years, with major increases in catches of halibut overall (particularly in numbers of sublegal halibut in Area 2B),and large increases in the catches of Pacific cod and starfish in both areas. The trawl catches also paralleled the setline catches in showing large increases in the numbers of dogfish caught in Area 2B in 1987 over 1983. The competition by dogfish and halibut for the baited hooks likely decreased in Area 2B in 1983 because of the timing of the commercial fishing period, which removed a good proportion of these species. The competition by skates for the baited hooks apparently increased, influenced by the combined reduction in the number of dogfish and halibut. This assumption is supported by the trawl catches which, unlike the setline catches, failed to show higher abundances of skates in 1983 compared to 1987. Catch data in Tables 3 and 4, and Appendix Table 8 indicate that the number of skates caught by the setline gear reached such a high level of abundance only during the 1983 survey, when the catch of skates by the setline gear in Area 2B was over six times that seen in 1987 in this area.

It is conceivable that the reduction in the number of dogfish caught, in spite of the increase in catch of less dominant species such as skates, may have concealed the anticipated effect of a reduced halibut abundance caused by sampling Area 2B fishing grounds during and soon after a commercial fishing opening. Hoag et al. (1984) noted that the eastern Gulf of Alaska (where the 1983 Area 3A sampling took place) had an intermediate abundance of dogfish, and to a lesser extent skates, when compared to Area 2B and to the central Gulf of Alaska. The central Gulf of Alaska has the lowest level of abundance of these species and, therefore, the presence of these species probably exerts less of an effect on halibut CPUE. The higher numbers of dogfish

[7]Kaimmer, S.M. Unpub. Underwater video observations of fish behavior to baited circle hooks. IN: Int. Pac. Halibut Comm. Report of Assessment and Research Activities 1991: 233-236.

caught in the 1983 sampling in Area 3A may reflect the transitional nature of this region between Areas 2B and 3A, and, together with the timing of the 1983 Area 2B survey, could account for some of the differences in area catchability between the 1983 and 1987 experiments.

Larger-sized invertebrates such as starfish can be efficient competitors for baited hooks. In Area 2B, the species composition of starfish caught by the trawl was limited generally to smaller-sized species such as the cookie sea star (*Ceremaster patagonicus*), and the vermilion sea star (*Mediaster aequalis*), including large numbers of non-sea star species such as brittle stars (unidentified species). It is believed that the competition for baited hooks by sea stars and brittle stars is negligible because of short average soak time of the gear and the generally modest physical size of the organisms involved. Larger individuals such as the sunflower sea star (*Pycnopodia helianthoides*), the sun sea star (*Solaster sp.*) and the intertidal sea star members (*Pisaster sp.*) made up an estimated 5 percent of the starfishes in numbers in Area 2B. Species composition of starfish in Area 3A was similar to that observed in Area 2B except that the larger species accounted for about 10 percent in number of the total catch of starfish.

Larger-sized starfish do compete for baited hooks and are observed regularly in the setline catch. They compete by covering the bait with their body during the digestion process, thus effectively removing the bait from the reach of other predators. Results of IPHC catches during grid surveys conducted in Areas 2B and 3A between 1977 and 1986 are summarized by species in Appendix Tables 8 and 9. The results suggest that the circle hook was less efficient at bringing the larger starfish to the surface than the strait-shank "J" hook. Nevertheless, the setline catch of starfish, as shown by the results in Table 3, suggests that the competition for the baited hooks was greater and had more effect on halibut CPUE in Area 3A than in Area 2B.

The summary of catch by species in Table 3 and Appendix Table 8 singles out dogfish as the most prominent competitive species in Area 2B, even superior to halibut. Of note is the relatively high incidence of dogfish in both the setline and trawl catches in the Charlotte region. It is apparent that the abundance of dogfish, when compared to other species, contributes the most to affect the setline catchability of halibut in Area 2B. Dogfish was singled out because the species made up almost 70 percent of the setline catch in Area 2B during the 1987 experiment (50% during the 1983 experiment). In contrast, dogfish were less than 1 percent of the Area 3A setline catch in the 1987 study (17% during the 1983 experiment). An examination of the 1987 trawl catch data in Area 2B reveals that dogfish when compared to halibut were captured by the trawl gear at a 1 to 1 ratio whereas the setline data showed a 3 to 1 capture ratio, indicating again that the dogfish was a superior competitor for the baited setline hooks.

The competition for baited hooks by dogfish is not new to the Area 2B setline fishery and the problem has been documented previously by IPHC research fishing and anecdotal descriptions by the halibut fishing fleet. Area 2B fishermen have reported to IPHC that when dogfish presence on their preferred grounds was unusually high they are faced with only two choices: a) move to less productive grounds or b) remove the dogfish by repetitive fishing and scattering the dogfish carcasses over the fishing grounds during a period of a few days. They claimed that such a practice chased dogfish away and report that halibut catches improved markedly. Arguably, such outcomes suggest to fishermen that halibut CPUE is inaccurate under conditions of heavy dogfish competition for the baited hooks and will not reflect the true abundance of halibut on these grounds. Such an assertion is speculative in nature but in our opinion quite plausible. Hurley et al. (1987) credited similar reports by fishermen who affirmed that "decomposing sharks on a line usually kept other sharks away from longlines used in commercial fishing operations". IPHC observed these effects of dogfish removals on halibut CPUE during an eight-day

continuous fishing experiment to examine the rates of halibut depletion and migration on a fishing ground (Kaimmer and Deriso 1988 Unpub.)[8]. In this eight-day experiment, despite estimates of high initial halibut abundance at some locations within the sampling grid, initial CPUE of halibut over the first few days was suppressed by high initial dogfish abundance. This experiment also demonstrated evidence of spatial separation of dogfish and adult halibut. The experimental data indicated a threshold effect for extremes in abundance of either species rather than a linear relationship between the two abundances. High incoming migration partially replenished the halibut population in the experimental area, whereas the initial high abundance of dogfish was reduced gradually. The decrease in abundance of dogfish was due either to the scattering of dead dogfish carcasses over the fishing ground or to low dogfish immigration, so that dogfish were effectively fished out by the middle of the experiment. The average catch of halibut through the entire experiment decreased from an initial high CPUE to a relatively stable lower CPUE level over the course of the experiment.

Appendix Table 8 shows that the dogfish catches in Area 2B between 1977 and 1986 accounted for half to three quarters of the overall catch by number during those surveys. Dogfish can travel in dense schools, the presence of which makes it "difficult if not impossible to catch halibut before the baited hooks have been pre-empted by the dogfish" (Ketchen 1986). Dogfish not only compete with halibut for available hooks but appear more successful at stealing baits without being captured than halibut. Hurley et al. (1987) reported on the destructive predatory habit of the spiny dogfish on setline gear by consuming bait, by devouring hooked fish, or by occupying most of the hooks. They concluded that "they interfere with fishing operations more than any other species."

Results from observations of baits among the stomach contents of dogfish and halibut in 1983 and 1991 suggested further that dogfish was superior to halibut as a competitor for the baited hooks. During the 1983 trawl-setline comparison, halibut over 81 cm long and dogfish (any size) caught between Cape Suckling and Seward Gully (Area 3A) by trawl gear were examined for stomach contents. Food items were found in 79 percent of the 109 trawl-caught halibut examined and four halibut stomachs contained baits which had obviously been stolen from the nearby setline gear. Stomach contents of 152 dogfish were also examined and 25 percent of them had at least one bait stolen from the setline gear ("J" hooks). An examination of the number of baits found in 482 dogfish stomachs during the 1991 hook timer experiment (circle hooks) showed that twenty-four percent of the dogfish examined had at least one bait in their stomach, with two individuals having a count as high as nine baits (Parma et al. 1992 Unpub.)[9]. Precautions were taken in that experiment to ensure that no surplus or retrieved baits were thrown over the ground fished. Preliminary underwater video observations made by IPHC in 1990 and 1991, using salmon as bait, showed a hooking success for dogfish (the proportion of bait attacks which result in capture) at less than 50 percent as compared to over 80 percent for halibut. During these one hour observations, we observed 1 in 12 bait attacks by dogfish to result in a stolen bait (Kaimmer 1992 Unpub.)[7].

[8]Kaimmer, S.M. and R.B. Deriso. Unpub. Continuous fishing studies in Areas 2B and 3A. IN: Int. Pac. Halibut Comm. Stock Assessment Document II 1987: 82-97.

[9]Parma, A., M.J. Larsen, and S.M. Kaimmer. Unpub. A progress report on the use of hook timers on longline gear. IN: Int. Pac. Halibut Comm. Report of Assessment and Research Activities 1991: 101-105.

## CONCLUSIONS

Catch per unit of effort is an important index of species abundance to fisheries managers worldwide. The magnitude and source of changes in catchability are important concerns in comparisons of catch rates and in resulting stock assessment procedures which use CPUE as an index of abundance. Changes in CPUE may reflect true changes in absolute abundance, changes in catchability, or a combination of the two. Changes in CPUE which are not related to changes in absolute abundance, if unnoticed, will influence comparisons of CPUE between areas or years or may bias stock assessments. One motivation for the 1983 study was the hypothesis that there might be area-specific differences in halibut catchability and that these differences might affect the annual halibut stock assessment. Based on conclusions from the 1983 trawl-setline comparison (Hoag et al. 1984), area-specific catchability corrections were applied to the area CPUE values from the commercial fishery, starting in 1985. As IPHC stock assessment uses information from previous years to build a picture of year classes moving through the fishery, these corrections were applied to fishery data going back to 1981. Although Hoag et al. (1984) concluded that these catchability differences did exist, they were unable to demonstrate a significant statistical difference from the experimental data. The 1987 experiment has shown that statistically significant differences in halibut catchability can be demonstrated between Areas 2B and 3A, and that at least a part of these differences are due to hook competition by other species, notably by the high catches of dogfish in Area 2B. In 1991, the IPHC solved the problem of changes in area catchability by modifying the stock assessment procedure such that biomass estimates are now calculated independently for each area. For the annual determination of biomass by IPHC statistical area, area- or time-specific correction factors for catchability are now unnecessary. However, studies comparing trends in setline catches should always consider the direct or indirect effect of non-target species on the catch and catch rate of the target species. Especially in circumstances with a high rate of hook occupancy, the presence or absence of other species can cause large changes in the catch rate of the target species.

We have demonstrated that the presence of dogfish has a marked effect on calculations of catchability in Area 2B. Prior to the introduction of individual fishing quotas in 1991, fishing periods in Area 2B ranged from two to eight days in duration, compared to one or two one-day seasons in Area 3A. Canadian fishermen have learned to either move away from areas of high dogfish concentration or fish out the dogfish in an area. For these reasons, the locations in Area 2B with low dogfish abundance are more appropriate for comparisons of catch data between the regions. However, even if the Canadian halibut fishermen identify and avoid fishing in areas of high dogfish density, the catchability of the halibut in their region is still significantly less than in Area 3A.

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## APPENDIX

**Appendix Table 1. Catch and effort by station for the trawler OCEAN STAR during the 1987 experiment.**

| Station | 1A | | 1B | | 2A | | 2B | | 3A | | 3B | | 4A | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Haul Number | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | |
| Date | 05/22/87 | | 05/22/87 | | 05/23/87 | | 05/23/87 | | 05/24/87 | | 05/24/87 | | 05/24/87 | |
| N. Lat. - W. Long. | 54:18-131:14 | | 54:18-131:13 | | 54:18-131:18 | | 54:18-131:18 | | 54:18-131:24 | | 54:18-131:25 | | 54:16-131:32 | |
| Depth Range (fm.) | 33-37 | | 33-39 | | 30-45 | | 38-50 | | 25-60 | | 26-60 | | 20-60 | |
| Duration (min.) | 40 | | 34 | | 54 | | 38 | | 32 | | 38 | | 35 | |
| Distance (nmi.) | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | 6 | 28.4 | 6 | 24.6 | 258 | 1025.9 | 1004 | 4622.8 | 317 | 1291.5 | 123 | 418.6 | 1503 | 6646.7 |
| Halibut (≥ 82 cm.) | 1 | 7.4 | 1 | 10.0 | 6 | 42.2 | 101 | 732.9 | 7 | 51.7 | 6 | 48.7 | 91 | 669.6 |
| Arrowtooth Flounder | 24 | 1.2 | 139 | 91.3 | 361 | 514.0 | 681 | 862.6 | 2863 | 3000.8 | 914 | 1126.3 | 126 | 143.1 |
| Butter Sole | 158 | 30.3 | 125 | 44.0 | 45 | 26.6 | 20 | 815.1 | 33 | 13.7 | 32 | 13.9 | 67 | 28.0 |
| Dover Sole | — | — | 42 | 10.4 | — | — | — | — | — | — | — | 3 | 7.0 | |
| English Sole | 1449 | 456.1 | 3534 | 1066.1 | 180 | 65.8 | 129 | 93.4 | 1106 | 738.3 | 347 | 212.5 | 274 | 184.3 |
| Flathead Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Petrale Sole | — | — | — | — | — | — | — | — | — | — | — | — | 5 | 11.3 |
| Rex Sole | — | — | — | — | — | — | — | — | 65 | 26.7 | — | — | 5 | 2.5 |
| Rock Sole | — | — | — | — | — | — | — | — | — | — | 610.1 | | | |
| Sand Dab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Flatfish | — | — | — | — | 23 | 65.8 | 1 | 3.1 | — | — | — | — | 1 | 3.1 |
| Black Cod | — | — | — | — | — | — | — | — | 1 | 1.0 | 2 | 1.7 | — | — |
| Lingcod | 12 | 17.7 | — | — | 65 | 413.4 | 117 | 1333.8 | 30 | 124.2 | 4 | 22.2 | 6 | 30.4 |
| Pollock | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| True Cod | 12 | 23.6 | — | — | — | — | 109 | 225.2 | 130 | 316.3 | 95 | 193.9 | 8 | 5.6 |
| Salmon | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Rockfish | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Cottids | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Roundfish | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Dogfish | 24 | 37.0 | 42 | 96.3 | 99 | 319.8 | 261 | 913.5 | 1096 | 2869.9 | 255 | 707.9 | 105 | 329.1 |
| Ratfish | — | — | 362 | 162.7 | 23 | 7.4 | — | — | — | — | — | — | 12 | 14.2 |
| Skates | 37 | 90.2 | — | — | 139 | 1306.8 | 37 | 296.0 | 17 | 62.3 | 52 | 520.0 | 53 | 530.0 |
| King Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Tanner Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Dungeness Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Crabs | — | — | — | — | — | — | 5 | 1.0 | 65 | 7.2 | 47 | 4.1 | — | — |
| Starfish | 694 | 208.7 | 181 | 77.4 | 902 | 291.9 | 229 | 77.5 | 163 | 84.3 | 205 | 126.2 | — | — |
| Other Invertebrates | 24 | 1.5 | 42 | 4.3 | — | — | 15 | 2.0 | 456 | 30.3 | 64 | 5.1 | 27 | 2.9 |
| Miscellaneous | 85 | 4.9 | — | — | 23 | 2.3 | — | — | — | — | — | — | — | — |
| Total Catch | 2526 | 907.0 | 4474 | 1587.1 | 2124 | 4081.9 | 2709 | 9978.9 | 6349 | 8618.2 | 2146 | 3401.1 | 2292 | 8617.9 |

**Appendix Table 1 (continued). Catch and effort by station for the trawler OCEAN STAR during the 1987 experiment.**

| Station | 4B | | 5A | | 5B | | 6A | | 6B | | 7A | | 7B | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Haul Number | 8 | | 9 | | 10 | | 11 | | 12 | | 13 | | 14 | |
| Date | 05/24/87 | | 05/25/87 | | 05/25/87 | | 05/25/87 | | 05/25/87 | | 05/25/87 | | 05/25/87 | |
| N. Lat. - W. Long. | 54:15-131:32 | | 54:09-132:00 | | 54:09-131:59 | | 54:10-131:53 | | 54:10-131:52 | | 54:10-132:02 | | 54:10-132:01 | |
| Depth Range (fm.) | 20-60 | | 29-33 | | 30-36 | | 22-40 | | 21-42 | | 35-50 | | 34-50 | |
| Duration (min.) | 49 | | 37 | | 35 | | 34 | | 38 | | 45 | | 34 | |
| Distance (nmi.) | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | 627 | 2783.9 | 221 | 850.6 | 69 | 260.3 | 30 | 106.3 | 86 | 320.9 | 417 | 1487.5 | 99 | 344.9 |
| Halibut (≥ 82 cm.) | 71 | 525.3 | 16 | 128.2 | 8 | 60.0 | 2 | 19.0 | 3 | 22.4 | 17 | 120.6 | 7 | 53.4 |
| Arrowtooth Flounder | 25 | 35.0 | 16 | 19.6 | 34 | 46.2 | 3 | 3.9 | 4 | 6.0 | 411 | 446.0 | 559 | 615.1 |
| Butter Sole | 32 | 9.4 | 9 | 0.8 | — | — | — | — | — | — | — | — | — | — |
| Dover Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| English Sole | 65 | 40.1 | 40 | 32.6 | 55 | 43.0 | 7 | 3.3 | 1 | 1.1 | 27 | 23.2 | 34 | 17.1 |
| Flathead Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Petrale Sole | 14 | 27.7 | 6 | 7.9 | 6 | 4.1 | 5 | 7.4 | 9 | 9.1 | — | — | 23 | 21.3 |
| Rex Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Rock Sole | — | — | 9 | 2.7 | 11 | 9.1 | — | — | 9 | 8.0 | — | — | 80 | 89.6 |
| Sand Dab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Flatfish | 11 | 38.2 | — | — | — | — | — | — | — | — | — | — | — | — |
| Black Cod | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Lingcod | 6 | 14.6 | 12 | 92.8 | 5 | 20.4 | 4 | 12.3 | 5 | 9.5 | 16 | 69.5 | 10 | 33.6 |
| Pollock | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| True Cod | 18 | 30.9 | 9 | 9.0 | 2 | 1.1 | — | — | — | — | 119 | 133.0 | 593 | 644.9 |
| Salmon | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Rockfish | 14 | 22.3 | — | — | — | — | — | — | — | — | — | — | — | — |
| Cottids | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Roundfish | — | — | — | — | 1 | 4.0 | — | — | — | — | — | — | 1 | 3.4 |
| Dogfish | 163 | 426.7 | 3 | 10.1 | 2 | 3.6 | 11 | 42.3 | 5 | 15.3 | 38 | 122.0 | 1029 | 1776.1 |
| Ratfish | 133 | 94.7 | 72 | 52.9 | 14 | 7.4 | 74 | 58.1 | 30 | 25.4 | 228 | 161.0 | 582 | 383.1 |
| Skates | 123 | 1845.0 | 3 | 15.0 | 4 | 10.8 | 4 | 23.2 | 7 | 35.0 | 6 | 21.1 | 4 | 40.0 |
| King Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Tanner Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Dungeness Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Crabs | — | — | 6 | 0.6 | 2 | 0.1 | 9 | 1.2 | 7 | 0.9 | 9 | 0.5 | — | — |
| Starfish | — | — | 234 | 58.9 | 109 | 36.2 | 42 | 29.2 | 87 | 31.3 | 219 | 65.2 | 114 | 22.8 |
| Other Invertebrates | 25 | 3.1 | 239 | 78.3 | 116 | 37.8 | 134 | 71.2 | 101 | 40.4 | 119 | 71.6 | 115 | 35.9 |
| Miscellaneous | — | — | — | — | — | — | 10 | 2.1 | 13 | 2.1 | — | — | 23 | 0.6 |
| Total Catch | 1327 | 5896.9 | 895 | 1360.0 | 438 | 544.1 | 335 | 379.5 | 367 | 527.4 | 1626 | 2721.2 | 3273 | 4081.8 |

**Appendix Table 1 (continued). Catch and effort by station for the trawler OCEAN STAR during the 1987 experiment.**

| Station | 8A | | 8B | | 9A | | 9B | | 10A | | 10B | | 11A | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Haul Number | 15 | | 16 | | 17 | | 18 | | 19 | | 20 | | 21 | |
| Date | 05/26/87 | | 05/26/87 | | 05/26/87 | | 05/26/87 | | 05/28/87 | | 05/28/87 | | 05/28/87 | |
| N. Lat. - W. Long. | 54:10-132:13 | | 54:09-132:14 | | 54:09-132:02 | | 54:10-132:00 | | 54:10-131:58 | | 54:10-131:57 | | 54:10-131:54 | |
| Depth Range (fm.) | 31-40 | | 32-40 | | 42-50 | | 42-50 | | 33-47 | | 32-48 | | 26-47 | |
| Duration (min.) | 36 | | 37 | | 40 | | 41 | | 39 | | 34 | | 36 | |
| Distance (nmi.) | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | 10 | 32.5 | 15 | 53.1 | 329 | 1212.2 | 83 | 313.0 | 32 | 137.4 | 30 | 129.5 | 100 | 386.8 |
| Halibut (≥ 82 cm.) | — | — | 3 | 27.2 | 7 | 88.1 | 2 | 13.3 | 1 | 6.6 | 12 | 88.5 | 8 | 57.8 |
| Arrowtooth Flounder | 187 | 221.8 | 501 | 542.1 | 197 | 224.3 | 2162 | 1906.2 | 1825 | 1404.2 | 99 | 78.8 | 48 | 36.4 |
| Butter Sole | 25 | 2.9 | 28 | 4.8 | — | — | — | — | — | — | — | — | — | — |
| Dover Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| English Sole | 106 | 66.3 | 284 | 195.3 | — | — | 214 | 335.8 | 162 | 75.8 | 3 | 1.1 | 4 | 1.2 |
| Flathead Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Petrale Sole | — | — | 28 | 19.5 | 88 | 111.0 | 19 | 92.4 | 46 | 92.4 | 3 | 2.7 | 18 | 16.3 |
| Rex Sole | — | — | — | — | — | — | — | — | 92 | 6.5 | — | — | — | — |
| Rock Sole | 6 | 4.4 | 9 | 7.6 | 22 | 33.8 | — | — | — | — | 3 | 1.5 | 11 | 5.2 |
| Sand Dab | 25 | 3.7 | 57 | 8.7 | — | — | — | — | — | — | — | — | — | — |
| Other Flatfish | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Black Cod | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Lingcod | 2 | 7.2 | 1 | 1. | 6 | 64.0 | — | — | 5 | 23.3 | 7 | 18.5 | 8 | 24.0 |
| Pollock | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| True Cod | 162 | 217.8 | 255 | 220.5 | 1667 | 2004.0 | 273 | 336.6 | 46 | 185.7 | 12 | 7.0 | 11 | 10.0 |
| Salmon | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Rockfish | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Cottids | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Roundfish | — | — | — | — | — | — | — | — | — | — | 3 | 0.0 | — | — |
| Dogfish | 1235 | 1032.5 | 2032 | 1891.8 | 9 | 29.0 | 172 | 203.0 | 50 | 53.9 | 38 | 39.8 | 15 | 15.6 |
| Ratfish | 112 | 102.6 | 76 | 67.4 | — | — | — | — | 69 | 70.2 | 125 | 92.1 | 176 | 105.7 |
| Skates | 1 | 1.5 | 5 | 31.0 | 5 | 24.2 | 1 | 12.2 | — | — | — | — | 12 | 60.0 |
| King Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Tanner Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Dungeness Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Crabs | — | — | 28 | 3.8 | 22 | 2.2 | — | — | 23 | 4.6 | 32 | 1.7 | 15 | 1.8 |
| Starfish | 175 | 48.2 | 66 | 12.9 | 965 | 46.9 | 97 | 19.1 | 323 | 74.4 | 113 | 33.2 | 81 | 23.8 |
| Other Invertebrates | 118 | 72.6 | 104 | 88.3 | 44 | 15.4 | 19 | 37.4 | 347 | 122.4 | 206 | 46.4 | 126 | 46.0 |
| Miscellaneous | — | — | — | — | — | — | — | — | 69 | 9.7 | 29 | 3.1 | 18 | 2.1 |
| Total Catch | 2164 | 1814.0 | 3492 | 3175.0 | 3361 | 3855.1 | 3042 | 3175.0 | 3090 | 2267.1 | 715 | 543.9 | 651 | 792.7 |

**Appendix Table 1 (continued). Catch and effort by station for the trawler OCEAN STAR during the 1987 experiment.**

| Station | 11B | | [1]13A | | 13B | | 14A | | 14B | | 15A | | 15B | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Haul Number | 22 | | 24 | | 25 | | 26 | | 27 | | 28 | | 29 | |
| Date | 05/28/87 | | 06/01/87 | | 06/01/87 | | 06/01/87 | | 06/01/87 | | 06/03/87 | | 06/03/87 | |
| N. Lat. - W. Long. | 54:10-131:53 | | 52:58-130:46 | | 52:58-130:45 | | 52:56-130:45 | | 52:56-130:46 | | 51:45-129:29 | | 51:45-129:30 | |
| Depth Range (fm.) | 26-47 | | 35-54 | | 33-54 | | 28-31 | | 27-32 | | 50-104 | | 50-104 | |
| Duration (min.) | 40 | | 35 | | 31 | | 32 | | 37 | | 35 | | 34 | |
| Distance (nmi.) | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | 177 | 660.0 | 3 | 16.7 | 35 | 61.6 | 33 | 42.5 | 40 | 51.3 | 1 | 4.5 | 684 | 2761.1 |
| Halibut (≥ 82 cm.) | 10 | 81.6 | 2 | 17.7 | 2 | 19.8 | 1 | 7.2 | 1 | 7.4 | — | — | 32 | 239.4 |
| Arrowtooth Flounder | 206 | 162.9 | — | — | — | — | — | — | — | — | 56 | 39.3 | 200 | 169.4 |
| Butter Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Dover Sole | — | — | — | — | — | — | — | — | — | — | 8 | 5.2 | — | — |
| English Sole | 10 | 5.8 | 368 | 432.5 | 740 | 152.8 | — | — | — | — | 15 | 7.1 | 80 | 33.6 |
| Flathead Sole | — | — | 19 | 16.3 | 16 | 6.8 | — | — | — | — | — | — | — | — |
| Petrale Sole | 20 | 10.0 | — | — | — | — | — | — | — | — | 15 | 12.7 | 45 | 21.5 |
| Rex Sole | 5 | 0.5 | 77 | 14.3 | — | — | — | — | — | — | 5 | 1.6 | 85 | 25.8 |
| Rock Sole | 5 | 2.2 | 19 | 16.3 | 145 | 115.5 | 31 | 22.4 | 69 | 52.1 | 10 | 5.8 | — | — |
| Sand Dab | — | — | 58 | 6.6 | 32 | 3.9 | — | — | — | — | — | — | — | — |
| Other Flatfish | 5 | 0.5 | — | — | 16 | 7.7 | 4 | 2.2 | 2 | 0.8 | — | — | — | — |
| Black Cod | — | — | — | — | — | — | — | — | — | — | 2 | 1.4 | 28 | 19.4 |
| Lingcod | 11 | 20.0 | 9 | 65.3 | — | — | — | — | 2 | 27.9 | 5 | 21.6 | 5 | 19.0 |
| Pollock | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| True Cod | 5 | 3.8 | 2382 | 2289.5 | 1609 | 2284.4 | — | — | 1 | 0.4 | 161 | 188.3 | 294 | 421.1 |
| Salmon | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Rockfish | — | — | — | — | — | — | 5 | 6.8 | — | — | 1 | 2.1 | — | — |
| Cottids | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Roundfish | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Dogfish | 12 | 12.7 | 6 | 35.8 | 6 | 29.2 | 4 | 15.7 | 10 | 39.9 | 40 | 211.3 | 189 | 970.0 |
| Ratfish | 271 | 190.2 | — | — | — | — | — | — | — | — | — | — | 89 | 53.4 |
| Skates | — | — | — | — | 4 | 27.0 | 3 | 26.0 | 1 | 19.9 | 2 | 7.1 | 1 | 8.0 |
| King Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Tanner Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Dungeness Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Crabs | 15 | 1.5 | — | — | 16 | 1.0 | 9 | 0.7 | 68 | 3.2 | — | — | 9 | 0.9 |
| Starfish | 95 | 32.5 | 97 | 28.3 | 80 | 9.3 | 193 | 99.2 | 96 | 42.9 | 110 | 34.2 | 58 | 17.8 |
| Other Invertebrates | 608 | 398.9 | 58 | 8.7 | 16 | 1.9 | 11 | 3.2 | 8 | 0.6 | 12 | 1.7 | 4 | 1.1 |
| Miscellaneous | 15 | 3.9 | — | — | — | — | — | — | 47 | 2.6 | — | — | 9 | 0.7 |
| Total Catch | 1470 | 1587.0 | 3098 | 2948.0 | 2717 | 2720.9 | 294 | 225.9 | 345 | 249.0 | 443 | 543.9 | 1812 | 4762.2 |

[1]fishing effort at 53:17 N and 131:56 W was unsuccessful. Station 12 is not used in data summaries or the analysis.

**Appendix Table 1 (continued). Catch and effort by station for the trawler OCEAN STAR during the 1987 experiment.**

| Station | 16A | | 16B | | 17A | | 17B | | 18A | | 18B | | 19A | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Haul Number | 30 | | 31 | | 32 | | 33 | | 34 | | 35 | | 36 | |
| Date | 06/03/87 | | 06/03/87 | | 06/03/87 | | 06/03/87 | | 06/04/87 | | 06/04/87 | | 06/04/87 | |
| N. Lat. - W. Long. | 51:46-129:24 | | 51:46-129:23 | | 51:45-129:20 | | 51:45-129:19 | | 51:25-129:15 | | 51:25-129:14 | | 51:23-129:16 | |
| Depth Range (fm.) | 46-65 | | 46-65 | | 54-65 | | 54-65 | | 50-60 | | 50-60 | | 60-66 | |
| Duration (min.) | 34 | | 31 | | 39 | | 34 | | 44 | | 40 | | 36 | |
| Distance (nmi.) | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | 128 | 443.9 | 51 | 175.9 | 143 | 562.8 | 10 | 31.7 | 54 | 218.3 | 11 | 36.4 | 319 | 1414.7 |
| Halibut (≥ 82 cm.) | — | — | 2 | 15.9 | 2 | 14.1 | 1 | 7.2 | 3 | 20.7 | — | — | 29 | 223.3 |
| Arrowtooth Flounder | 20 | 12.0 | — | — | — | — | — | — | — | — | — | — | 7 | 8.0 |
| Butter Sole | — | — | — | — | — | — | 2 | 0.6 | 1 | 0.2 | — | — | 7 | 2.1 |
| Dover Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| English Sole | — | — | — | — | — | — | — | — | 4 | 3.1 | 6 | 3.8 | 43 | 11.4 |
| Flathead Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Petrale Sole | — | — | — | — | — | — | 4 | 6.5 | 12 | 13.2 | 11 | 11.5 | 64 | 55.6 |
| Rex Sole | — | — | — | — | — | — | — | — | — | — | 1 | 0.1 | 7 | 1.4 |
| Rock Sole | 292 | 167.9 | 26 | 11.2 | 213 | 53.2 | 76 | 49.8 | 25 | 22.6 | 44 | 47.7 | 377 | 426.6 |
| Sand Dab | 12 | 1.8 | 2 | 0.3 | — | — | 2 | 0.5 | 13 | 2.0 | 11 | 2.3 | — | — |
| Other Flatfish | — | — | — | — | — | — | — | — | 3 | 1.4 | 12 | 5.6 | — | — |
| Black Cod | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Lingcod | 8 | 54.7 | 17 | 105.8 | 162 | 728.0 | 34 | 196.3 | 8 | 35.0 | 9 | 43.3 | 251 | 740.5 |
| Pollock | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| True Cod | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Salmon | — | — | — | — | — | — | 1 | 2.9 | — | — | — | — | — | — |
| Rockfish | — | — | — | — | 525 | 1752.0 | 234 | 1081.4 | 1 | 2.7 | — | — | — | — |
| Cottids | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Roundfish | — | — | — | — | — | — | — | — | 2 | 4.7 | — | — | — | — |
| Dogfish | 293 | 1054.8 | 503 | 2179.0 | 80 | 364.0 | 30 | 116.4 | 44 | 174.9 | 49 | 191.0 | 40 | 203.6 |
| Ratfish | 8 | 5.7 | — | — | — | — | — | — | — | — | — | — | — | — |
| Skates | 88 | 840.0 | 106 | 1100.0 | 48 | 469.0 | 25 | 275.0 | 56 | 448.0 | 33 | 198.0 | 9 | 36.0 |
| King Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Tanner Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Dungeness Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Crabs | — | — | — | — | — | — | — | — | 2 | 0.4 | — | — | — | — |
| Starfish | 75 | 14.0 | 5 | 1.6 | 1065 | 198.0 | 4 | 0.2 | 13 | 3.9 | 66 | 17.4 | 213 | 40.1 |
| Other Invertebrates | 127 | 126.2 | 13 | 11.0 | 532 | 393.9 | 4 | 0.4 | 7 | 1.7 | 10 | 2.5 | 35 | 11.6 |
| Miscellaneous | — | — | — | — | — | — | — | — | 1 | 0.1 | 1 | 0.2 | — | — |
| Total Catch | 1051 | 2721.0 | 725 | 3600.7 | 2770 | 4535.0 | 427 | 1768.9 | 249 | 952.9 | 264 | 559.8 | 1401 | 3174.9 |

**Appendix Table 1 (continued). Catch and effort by station for the trawler OCEAN STAR during the 1987 experiment.**

| Station | 19B | | 20A | | 20B | | 21A | | 21B | | 22A | | 22B | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Haul Number | 37 | | 38 | | 39 | | 40 | | 41 | | 42 | | 43 | |
| Date | 06/04/87 | | 06/04/87 | | 06/04/87 | | 06/06/87 | | 06/06/87 | | 06/06/87 | | 06/06/87 | |
| N. Lat. - W. Long. | 51:24-129.16 | | 51:22-129:15 | | 51:22-129:14 | | 51:10-128:51 | | 51:10-128:51 | | 51:08-128:52 | | 51:08-128:52 | |
| Depth Range (fm.) | 60-66 | | 60-98 | | 60-98 | | 63-69 | | 63-69 | | 53-60 | | 52-58 | |
| Duration (min.) | 37 | | 36 | | 32 | | 36 | | 37 | | 30 | | 35 | |
| Distance (nmi.) | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut ($\leq$ 81 cm.) | 36 | 140.2 | 14 | 61.4 | 13 | 52.2 | 27 | 102.9 | 37 | 145.1 | 2 | 6.0 | 4 | 13.7 |
| Halibut ($\geq$ 82 cm.) | 4 | 33.4 | 2 | 15.0 | 2 | 14.1 | 2 | 19.2 | 2 | 16.6 | — | — | 1 | 10.0 |
| Arrowtooth Flounder | — | — | 17 | 23.5 | 39 | 44.5 | 8 | 3.7 | 114 | 151.0 | 17 | 16.5 | — | — |
| Butter Sole | — | — | — | — | — | — | — | — | — | — | — | — | 1 | 0.1 |
| Dover Sole | — | — | 7 | 4.5 | 6 | 4.0 | — | — | — | — | — | — | — | — |
| English Sole | 4 | 3.2 | 3 | 0.4 | 2 | 0.8 | — | — | — | — | 57 | 28.4 | 32 | 14.8 |
| Flathead Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Petrale Sole | 7 | 8.8 | 1 | 0.1 | 2 | 1.2 | 6 | 3.9 | 57 | 34.7 | 15 | 11.1 | 30 | 23.8 |
| Rex Sole | — | — | 5 | 0.9 | 16 | 3.6 | — | — | — | — | 1 | 0.3 | — | — |
| Rock Sole | 47 | 58.2 | — | — | — | — | — | — | 11 | 4.6 | 1 | 1.0 | 6 | 6.0 |
| Sand Dab | — | — | — | — | — | — | — | — | — | — | 5 | 0.6 | 13 | 2.1 |
| Other Flatfish | 2 | 0.6 | — | — | — | — | — | — | — | — | 7 | 3.3 | 14 | 5.6 |
| Black Cod | — | — | 3 | 2.9 | 1 | 2.2 | — | — | — | — | — | — | — | — |
| Lingcod | 7 | 30.9 | 5 | 9.1 | 2 | 10.0 | 14 | 54.7 | 38 | 149.3 | 7 | 30.5 | 5 | 26.1 |
| Pollock | — | — | — | — | 1 | 0.6 | — | — | — | — | — | — | — | |
| True Cod | — | — | 39 | 34.0 | 20 | 16.4 | 83 | 78.7 | 901 | 1308.4 | 21 | 11.6 | 7 | 3.0 |
| Salmon | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Rockfish | — | — | 52 | 75.0 | 56 | 79.1 | — | — | — | — | — | — | — | — |
| Cottids | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Roundfish | — | — | — | — | — | — | — | — | — | — | 1 | 3.3 | — | — |
| Dogfish | 58 | 241.2 | 23 | 88.7 | 44 | 190.6 | — | — | 2 | 7.3 | — | — | 2 | 11.1 |
| Ratfish | — | — | 11 | 4.0 | 4 | 1.1 | 153 | 46.9 | 1289 | 429.8 | 384 | 137.1 | 62 | 21.0 |
| Skates | 5 | 50.0 | 2 | 3.4 | 1 | 1.1 | 1 | 2.9 | 1 | 3.2 | 6 | 17.8 | 2 | 11.5 |
| King Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Tanner Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Dungeness Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Crabs | — | — | 6 | 0.4 | 8 | 0.9 | — | — | — | — | 1 | 0.1 | — | — |
| Starfish | 57 | 8.0 | 59 | 8.0 | 48 | 6.3 | 18 | 2.6 | 80 | 10.9 | 82 | 8.6 | 28 | 6.4 |
| Other Invertebrates | 6 | 0.6 | 13 | 1.6 | 23 | 2.5 | 6 | 1.4 | 11 | 4.3 | 38 | 44.7 | 13 | 5.0 |
| Miscellaneous | — | — | — | — | 3 | 0.3 | 1 | 0.1 | 11 | 1.7 | 2 | 0.2 | 1 | 0.2 |
| Total Catch | 233 | 575.1 | 262 | 332.9 | 291 | 431.5 | 319 | 317.0 | 2554 | 2266.9 | 647 | 321.1 | 221 | 160.4 |

**Appendix Table 1 (continued). Catch and effort by station for the trawler OCEAN STAR during the 1987 experiment.**

| Station | 23A | | 23B | | 24A | | 24B | | 25A | | 25B | | 26A | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Haul Number | 44 | | 45 | | 46 | | 47 | | 48 | | 49 | | 50 | |
| Date | 06/06/87 | | 06/06/87 | | 06/07/87 | | 06/07/87 | | 06/07/87 | | 06/07/87 | | 06/07/87 | |
| N. Lat. - W. Long. | 51:07-128.57 | | 51:07-128:56 | | 50:41-128:27 | | 50:41-128:27 | | 50:42-128:28 | | 50:42-128:28 | | 50:42-128:28 | |
| Depth Range (fm.) | 59-63 | | 57-63 | | 41-42 | | 40-42 | | 39-49 | | 39-49 | | 41-43 | |
| Duration (min.) | 40 | | 33 | | 33 | | 40 | | 34 | | 34 | | 37 | |
| Distance (nmi.) | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | 5 | 22.0 | 7 | 27.9 | 10 | 44.0 | 62 | 264.6 | 181 | 768.1 | 65 | 250.4 | 79 | 306.5 |
| Halibut (≥ 82 cm.) | — | — | 3 | 51.8 | 2 | 14.4 | 2 | 15.8 | 22 | 180.0 | 8 | 69. | 14 | 29.0 |
| Arrowtooth Flounder | 38 | 30.4 | 32 | 25.9 | — | — | — | — | — | — | — | — | 6 | 7.4 |
| Butter Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Dover Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| English Sole | 39 | 19.7 | 25 | 13.7 | — | — | — | — | — | — | — | — | — | — |
| Flathead Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Petrale Sole | 53 | 23.5 | 26 | 11.5 | 14 | 4.7 | 23 | 23.4 | 22 | 20.2 | 19 | 24.7 | 28 | 24.7 |
| Rex Sole | 5 | 0.8 | 1 | 0.2 | — | — | — | — | — | — | — | — | 2 | 0.3 |
| Rock Sole | — | — | — | — | 14 | 10.3 | 231 | 168.9 | 115 | 114.3 | 21 | 12.0 | 51 | 31.1 |
| Sand Dab | 13 | 3.0 | 34 | 6.5 | — | — | — | — | — | — | — | — | 3 | 0.4 |
| Other Flatfish | 3 | 1.3 | 5 | 2.4 | 5 | 1.7 | 2 | 1.1 | — | — | 2 | 0.3 | 4 | 1.4 |
| Black Cod | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Lingcod | 5 | 15.9 | 1 | 0.7 | 6 | 23.1 | 69 | 270.5 | 39 | 159.5 | 19 | 88.3 | 5 | 15.5 |
| Pollock | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| True Cod | 147 | 93.4 | 61 | 46.2 | — | — | — | — | — | — | — | — | 2 | 1.2 |
| Salmon | — | — | — | — | 1 | 2.3 | — | — | — | — | — | — | — | — |
| Rockfish | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Cottids | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Roundfish | — | — | — | — | 3 | 12.0 | — | — | — | — | 1 | 4.0 | — | — |
| Dogfish | — | — | 1 | 5.9 | 2 | 9.2 | — | — | 1 | 4.7 | — | — | 1 | 4.7 |
| Ratfish | 160 | 59.6 | 143 | 52.5 | 23 | 6.3 | 13 | 7.5 | 7 | 3.1 | 17 | 4.5 | — | — |
| Skates | 2 | 14.2 | — | — | — | — | — | — | 1 | 4.5 | 1 | 5.4 | — | — |
| King Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Tanner Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Dungeness Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Crabs | — | — | 1 | 0.2 | — | — | — | — | 1 | 0.1 | — | — | — | — |
| Starfish | 47 | 8.5 | 55 | 8.8 | 48 | 4.2 | 41 | 4.4 | 58 | 9.1 | 39 | 6.0 | 45 | 5.2 |
| Other Invertebrates | 7 | 2.2 | 9 | 1.6 | 15 | 8.8 | 25 | 14.7 | 9 | 3.2 | 21 | 11.9 | 6 | 6.1 |
| Miscellaneous | 2 | 0.3 | 1 | 0.0 | 2 | 0.2 | 6 | 0.1 | 1 | 0.4 | — | — | 2 | 0.2 |
| Total Catch | 526 | 294.8 | 405 | 255.8 | 145 | 141.2 | 474 | 771.0 | 457 | 1267.2 | 213 | 476.6 | 238 | 433.7 |

**Appendix Table 1 (continued). Catch and effort by station for the trawler OCEAN STAR during the 1987 experiment.**

| Station | 26B | | 27A | | 27B | | 28A | | 28B | | 29A | | 29B | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Haul Number | 51 | | 52 | | 53 | | 54 | | 55 | | 56 | | 57 | |
| Date | 06/07/87 | | 07/06/87 | | 07/06/87 | | 07/06/87 | | 07/06/87 | | 07/07/87 | | 07/07/87 | |
| N. Lat. - W. Long. | 50:42-128.27 | | 57:50-151:52 | | 57:49-151:52 | | 57:48-151:51 | | 57:48-151:51 | | 57:45-151:17 | | 57:45-151:17 | |
| Depth Range (fm.) | 39-41 | | 34-44 | | 34-46 | | 50-63 | | 50-65 | | 36-37 | | 36-37 | |
| Duration (min.) | 35 | | 38 | | 40 | | 35 | | 35 | | 34 | | 40 | |
| Distance (nmi.) | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | 93 | 348.2 | 201 | 277.4 | 139 | 184.4 | 21 | 44.7 | 24 | 63.7 | 109 | 200.3 | 102 | 215.9 |
| Halibut (≥ 82 cm.) | 9 | 81.2 | 2 | 14.1 | — | — | 3 | 24.8 | 1 | 10.3 | 12 | 183.8 | 8 | 93.8 |
| Arrowtooth Flounder | 28 | 31.8 | 53 | 27.8 | 40 | 5.1 | 237 | 183.3 | 764 | 582.4 | — | — | — | — |
| Butter Sole | — | — | 5632 | 1271.0 | 8064 | 1730.9 | 596 | 104.6 | 1789 | 403.0 | — | — | — | — |
| Dover Sole | — | — | — | — | — | — | — | — | 46 | 23.5 | — | — | — | — |
| English Sole | 3 | 2.4 | — | — | — | — | 9 | 7.2 | 46 | 23.2 | — | — | — | — |
| Flathead Sole | — | — | — | — | — | — | 377 | 99.9 | 1162 | 311.9 | — | — | — | — |
| Petrale Sole | 426 | 227.6 | — | — | — | — | — | — | — | — | — | — | — | — |
| Rex Sole | — | — | — | — | — | — | 132 | 38.4 | 214 | 58.1 | — | — | — | — |
| Rock Sole | 331 | 250.3 | 769 | 310.6 | 1254 | 483.6 | 70 | 40.2 | 229 | 109.1 | 374 | 155.1 | 678 | 303.4 |
| Sand Dab | 159 | 32.2 | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Flatfish | — | — | 13 | 9.0 | 26 | 26.4 | — | — | — | — | — | — | — | — |
| Black Cod | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Lingcod | 7 | 16.8 | — | — | — | — | — | — | — | — | — | — | — | — |
| Pollock | — | — | — | — | — | — | 965 | 864.8 | 627 | 579.4 | 10 | 10.0 | — | — |
| True Cod | 138 | 96.2 | 146 | 277.1 | — | — | 18 | 33.0 | 31 | 66.8 | — | — | 100 | 146.2 |
| Salmon | 2 | 9.4 | 2 | 5.9 | 4 | 3.2 | 1 | 4.0 | 2 | 6.0 | — | — | — | — |
| Rockfish | — | — | — | — | — | — | — | — | 46 | 46.2 | — | — | — | — |
| Cottids | — | — | 13 | 45.1 | 26 | 28.6 | 18 | 6.7 | — | — | 489 | 203.2 | 126 | 56.3 |
| Other Roundfish | — | — | — | — | 66 | 1.3 | — | — | 15 | 2.3 | — | — | — | — |
| Dogfish | 1 | 7.6 | — | — | — | — | 1 | 3.5 | — | — | 1 | 3.8 | — | — |
| Ratfish | 18 | 7.8 | — | — | — | — | — | — | — | — | — | — | — | — |
| Skates | 2 | 12.6 | 1 | 5.5 | — | — | 1 | 2.0 | 1 | 1.4 | — | — | — | — |
| King Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Tanner Crab | — | — | — | — | — | — | 219 | 85.1 | 153 | 70.3 | — | — | — | — |
| Dungeness Crab | — | — | 13 | 8.0 | 26 | 23.8 | — | — | — | — | — | — | — | — |
| Other Crabs | — | — | 13 | 3.7 | — | — | 44 | 5.4 | 504 | 50.1 | 795 | 27.8 | 3064 | 137.6 |
| Starfish | 80 | 8.8 | — | — | — | — | 123 | 17.0 | 260 | 56.7 | 3297 | 1736.4 | 3291 | 1930.2 |
| Other Invertebrates | — | — | 40 | 9.8 | 26 | 6.6 | 150 | 19.9 | 1267 | 150.2 | 1079 | 581.3 | 904 | 54.6 |
| Miscellaneous | — | — | 27 | 2.1 | — | — | 35 | 2.6 | 107 | 15.4 | 3671 | 526.3 | 126 | 10.0 |
| Total Catch | 1297 | 1132.9 | 6925 | 2267.1 | 9671 | 2493.9 | 3020 | 1587.1 | 7288 | 2630.0 | 9837 | 3628.0 | 8399 | 2948.0 |

**Appendix Table 1 (continued). Catch and effort by station for the trawler OCEAN STAR during the 1987 experiment.**

| Station | 30A | | 30B | | 31A | | 31B | | 32A | | 32B | | 33A | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Haul Number | 58 | | 59 | | 60 | | 61 | | 62 | | 63 | | 64 | |
| Date | 07/07/87 | | 07/07/87 | | 07/07/87 | | 07/07/87 | | 07/08/87 | | 07/08/87 | | 07/08/87 | |
| N. Lat. - W. Long. | 57:41-151.18 | | 57:41-151:18 | | 57:32-151:17 | | 57:33-151:17 | | 57:27-151:10 | | 57:27-151:11 | | 57:27-151:16 | |
| Depth Range (fm.) | 35-36 | | 35-36 | | 40-41 | | 40-41 | | 43-46 | | 43-46 | | 47-51 | |
| Duration (min.) | 35 | | 36 | | 41 | | 36 | | 47 | | 32 | | 38 | |
| Distance (nmi.) | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 1.6 | | 1.4 | | 2.0 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | 65 | 99.5 | 131 | 190.0 | 24 | 39.4 | 36 | 48.4 | 15 | 20.5 | 12 | 20.2 | 88 | 208.0 |
| Halibut (≥ 82 cm.) | 4 | 127.4 | 3 | 31.3 | 4 | 70.0 | 5 | 107.5 | 8 | 245.3 | 3 | 42.0 | 5 | 65.5 |
| Arrowtooth Flounder | — | — | — | — | — | — | — | — | 8 | 1.5 | 7 | 1.7 | — | — |
| Butter Sole | — | — | — | — | — | — | — | — | — | — | 7 | 2.8 | 475 | 89.0 |
| Dover Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| English Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Flathead Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Petrale Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Rex Sole | — | — | — | — | — | — | — | — | — | — | 7 | 2.0 | — | — |
| Rock Sole | 2392 | 771.4 | 317 | 121.9 | 83 | 26.9 | 300 | 85.9 | 1249 | 458.6 | 1783 | 393.4 | 1128 | 446.0 |
| Sand Dab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Flatfish | 1 | 4.0 | 1 | 3.2 | — | — | — | — | — | — | — | — | — | — |
| Black Cod | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Lingcod | — | — | — | — | — | — | — | — | 1 | 1.8 | — | — | — | — |
| Pollock | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| True Cod | 547 | 517.5 | — | — | — | — | 150 | 145.8 | 177 | 219.8 | — | — | 40 | 58.4 |
| Salmon | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Rockfish | — | — | — | — | — | — | — | — | 23 | 21.7 | — | — | — | — |
| Cottids | 684 | 260.8 | 13 | 5.5 | 36 | 11.3 | 339 | 83.0 | 46 | 11.1 | 28 | 10.5 | — | — |
| Other Roundfish | 68 | 3.4 | — | — | — | — | 41 | 10.9 | 38 | 10.9 | 28 | 11.6 | — | — |
| Dogfish | — | — | — | — | 1 | 4.6 | 1 | 2.5 | — | — | — | — | 1 | 3.0 |
| Ratfish | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Skates | 1 | 9.3 | 13 | 195.0 | 1 | 10.0 | — | — | — | — | 2 | 55.0 | — | — |
| King Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Tanner Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Dungeness Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Crabs | 2153 | 88.9 | 701 | 32.7 | 512 | 22.4 | 1428 | 62.4 | 331 | 26.2 | 429 | 89.2 | 20 | 2.4 |
| Starfish | 3452 | 1563.6 | 727 | 411.1 | 464 | 221.1 | 1448 | 639.0 | 355 | 327.8 | 194 | 204.1 | 208 | 246.3 |
| Other Invertebrates | 1025 | 175.3 | 1012 | 1016.2 | 2096 | 1635.1 | 1977 | 991.7 | 377 | 372.8 | 718 | 296.6 | 29 | 14.5 |
| Miscellaneous | 68 | 6.8 | 416 | 34.0 | — | — | — | — | 85 | 5.2 | 28 | 3.9 | — | — |
| Total Catch | 10460 | 3627.9 | 3334 | 2040.9 | 3221 | 2040.8 | 5725 | 2177.1 | 2713 | 1723.2 | 3246 | 1133.0 | 1994 | 1133.1 |

**Appendix Table 1 (continued). Catch and effort by station for the trawler OCEAN STAR during the 1987 experiment.**

| Station | 33B | | 34A | | 34B | | 35A | | 35B | | 36A | | 36B | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Haul Number | 65 | | 66 | | 67 | | 68 | | 69 | | 70 | | 71 | |
| Date | 07/08/87 | | 07/08/87 | | 07/08/87 | | 07/09/87 | | 07/09/87 | | 07/09/87 | | 07/09/87 | |
| N. Lat. - W. Long. | 57:27-151.16 | | 57:22-151:11 | | 57:22-151:12 | | 57:16-151:10 | | 57:16-151:10 | | 57:13-151:15 | | 57:13-151:15 | |
| Depth Range (fm.) | 47-50 | | 45-49 | | 46-49 | | 47-51 | | 47-54 | | 76-85 | | 74-85 | |
| Duration (min.) | 36 | | 38 | | 25 | | 51 | | 35 | | 37 | | 48 | |
| Distance (nmi.) | 2.0 | | 2.0 | | 1.2 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut ($\leq$ 81 cm.) | 42 | 74.5 | 64 | 91.6 | 440 | 639.1 | 16 | 20.9 | 9 | 8.3 | — | — | 2 | 3.7 |
| Halibut ($\geq$ 82 cm.) | 4 | 43.7 | 4 | 82.5 | 3 | 33.9 | 1 | 33.3 | 2 | 16.4 | 4 | 48.1 | — | — |
| Arrowtooth Flounder | 10 | 5.4 | 12 | 10.9 | — | — | 52 | 11.4 | 108 | 15.6 | 42 | 42.2 | 81 | 83.0 |
| Butter Sole | 612 | 127.5 | 17 | 3.1 | — | — | — | — | — | — | 16 | 6.0 | 20 | 7.8 |
| Dover Sole | — | — | — | — | — | — | — | — | — | — | 52 | 45.7 | 36 | 28.4 |
| English Sole | — | — | — | — | — | — | — | — | — | — | — | — | 5 | 3.8 |
| Flathead Sole | — | — | — | — | — | — | — | — | — | — | 23 | 7.4 | 134 | 38.1 |
| Petrale Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Rex Sole | — | — | — | — | — | — | — | — | — | — | 156 | 93.0 | 129 | 86.4 |
| Rock Sole | 617 | 334.6 | 640 | 242.9 | 463 | 171.1 | 350 | 126.3 | 440 | 157.3 | 130 | 30.0 | 10 | 4.0 |
| Sand Dab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Flatfish | 10 | 29.0 | — | — | — | — | — | — | — | — | — | — | — | — |
| Black Cod | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Lingcod | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Pollock | — | — | — | — | — | — | — | — | — | — | 16 | 17.2 | 10 | 11.2 |
| True Cod | 233 | 283.6 | — | — | — | — | 12 | 11.0 | 8 | 4.2 | 3 | 6.9 | 5 | 8.0 |
| Salmon | 2 | 6.2 | 1 | 2.3 | — | — | — | — | — | — | — | — | — | — |
| Rockfish | — | — | — | — | — | — | — | — | — | — | — | — | 13 | 12.6 |
| Cottids | — | — | 6 | 2.2 | 19 | 4.6 | 36 | 9.0 | 16 | 3.6 | — | — | 3 | 0.7 |
| Other Roundfish | — | — | 17 | 7.9 | — | — | 24 | 6.5 | 4 | 0.9 | — | — | — | — |
| Dogfish | — | — | — | — | — | — | — | — | — | — | 1 | 3.8 | — | — |
| Ratfish | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Skates | 2 | 9.0 | — | — | — | — | — | — | — | — | 1 | 2.4 | 4 | 9.8 |
| King Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Tanner Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Dungeness Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Crabs | 25 | 1.3 | 41 | 3.9 | 65 | 6.5 | 245 | 11.7 | 276 | 26.5 | 123 | 6.1 | 8 | 0.6 |
| Starfish | 187 | 267.2 | 151 | 147.6 | 19 | 3.1 | 101 | 32.9 | 152 | 43.4 | 75 | 46.8 | 86 | 18.2 |
| Other Invertebrates | 162 | 83.7 | 1321 | 524.3 | 485 | 319.8 | 1618 | 267.1 | 1153 | 169.8 | 373 | 52.4 | 295 | 45.7 |
| Miscellaneous | 56 | 4.3 | 146 | 13.7 | 9 | 1.0 | 237 | 13.9 | 224 | 7.0 | — | — | 3 | 0.2 |
| Total Catch | 1962 | 1270.0 | 2420 | 1132.9 | 1503 | 1179.1 | 2692 | 544.0 | 2392 | 453.0 | 1015 | 408.0 | 844 | 362.2 |

**Appendix Table 1 (continued). Catch and effort by station for the trawler OCEAN STAR during the 1987 experiment.**

| Station | 37A | | 37B | | 38A | | 38B | | 39A | | 39B | | 40A | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Haul Number | 72 | | 73 | | 74 | | 75 | | 76 | | 77 | | 78 | |
| Date | 07/09/87 | | 07/09/87 | | 07/10/87 | | 07/10/87 | | 07/10/87 | | 07/10/87 | | 07/10/87 | |
| N. Lat. - W. Long. | 57:20-151.19 | | 57:20-151:18 | | 57:13-151:04 | | 57:13-151:03 | | 57:15-150:52 | | 57:15-150:53 | | 57:12-151:20 | |
| Depth Range (fm.) | 81-85 | | 81-85 | | 71-72 | | 73-81 | | 63-86 | | 62-88 | | 81-86 | |
| Duration (min.) | 38 | | 43 | | 29 | | 33 | | 36 | | 39 | | 46 | |
| Distance (nmi.) | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | — | — | 1 | 1.4 | 1 | 4.3 | 1 | 5.2 | 3 | 14.6 | 4 | 18.5 | 2 | 10.6 |
| Halibut (≥ 82 cm.) | 6 | 116.7 | 2 | 54.3 | 2 | 48.1 | 3 | 46.6 | — | — | 1 | 7.4 | 6 | 93.0 |
| Arrowtooth Flounder | 236 | 177.3 | 147 | 240.8 | 225 | 129.5 | 7 | 7.7 | 283 | 220.7 | 784 | 429.5 | 415 | 357.5 |
| Butter Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Dover Sole | 184 | 139.3 | 177 | 147.5 | 38 | 18.1 | 169 | 107.0 | 9 | 7.5 | 105 | 56.5 | 180 | 142.7 |
| English Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Flathead Sole | 194 | 54.2 | 147 | 38.3 | 14 | 2.4 | — | — | — | — | — | — | 280 | 70.4 |
| Petrale Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Rex Sole | 673 | 279.0 | 867 | 490.1 | — | — | 93 | 34.5 | 19 | 6.4 | 39 | 14.8 | 884 | 346.2 |
| Rock Sole | — | — | 6 | 1.6 | 48 | 19.8 | 10 | 4.1 | 113 | 55.0 | 105 | 50.7 | 325 | 153.6 |
| Sand Dab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Flatfish | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Black Cod | — | — | — | — | — | — | 3 | 6.4 | 19 | 20.0 | 183 | 325.2 | — | — |
| Lingcod | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Pollock | 47 | 46.7 | 61 | 66.1 | — | — | — | — | — | — | — | — | 153 | 160.2 |
| True Cod | 21 | 31.8 | 24 | 39.3 | 10 | 6.6 | 14 | 18.6 | 9 | 4.5 | 65 | 133.3 | 54 | 82.1 |
| Salmon | — | — | 1 | 3.2 | — | — | — | — | — | — | — | — | — | — |
| Rockfish | 53 | 62.8 | — | — | — | — | — | — | — | — | 13 | 0.7 | — | — |
| Cottids | 16 | 8.4 | 12 | 6.1 | — | — | — | — | — | — | — | — | 27 | 10.1 |
| Other Roundfish | — | — | — | — | 5 | 0.2 | — | — | 47 | 12.0 | 41 | 14.3 | — | — |
| Dogfish | — | — | 1 | 2.3 | — | — | — | — | — | — | — | — | — | — |
| Ratfish | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Skates | 1 | 0.6 | 4 | 5.9 | 2 | 5.6 | — | — | — | — | 1 | 6.3 | 1 | 1.8 |
| King Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Tanner Crab | — | — | — | — | 5 | 0.1 | — | — | — | — | — | — | 9 | 6.3 |
| Dungeness Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Crabs | 79 | 6.6 | — | — | 507 | 25.2 | 14 | 0.8 | 623 | 29.9 | 745 | 28.7 | — | — |
| Starfish | 415 | 118.4 | 354 | 108.5 | 277 | 47.8 | 252 | 34.0 | 547 | 90.2 | 484 | 49.3 | 993 | 116.4 |
| Other Invertebrates | 972 | 91.2 | 153 | 18.5 | 436 | 37.2 | 62 | 7.2 | 5036 | 345.6 | 2940 | 222.3 | 235 | 28.7 |
| Miscellaneous | — | — | — | — | 383 | 16.9 | — | — | 94 | 9.4 | 91 | 2.6 | 63 | 7.4 |
| Total Catch | 2897 | 1133.0 | 1957 | 1223.9 | 1953 | 361.8 | 628 | 272.1 | 6802 | 815.8 | 5601 | 1360.1 | 3627 | 1587.0 |

**Appendix Table 1 (continued). Catch and effort by station for the trawler OCEAN STAR during the 1987 experiment.**

| Station | 40B | | 41A | | 41B | | 42A | | 42B | | 43A | | 43B | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Haul Number | 79 | | 80 | | 81 | | 82 | | 83 | | 84 | | 85 | |
| Date | 07/10/87 | | 07/11/87 | | 07/11/87 | | 07/11/87 | | 07/11/87 | | 07/11/87 | | 07/11/87 | |
| N. Lat. - W. Long. | 57:12-151.19 | | 57:13-151:23 | | 57:13-151:23 | | 57:14-151:17 | | 57:15-151:22 | | 57:16-151:30 | | 57:16-151:30 | |
| Depth Range (fm.) | 82-84 | | 60-84 | | 62-85 | | 82-86 | | 82-86 | | 40-61 | | 41-61 | |
| Duration (min.) | 47 | | 51 | | 61 | | 45 | | 38 | | 52 | | 43 | |
| Distance (nmi.) | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | 3 | 12.4 | 3 | 14.5 | 1 | 3.1 | 3 | 6.2 | 1 | 0.9 | 54 | 112.8 | 25 | 35.2 |
| Halibut (≥ 82 cm.) | 3 | 29.1 | 2 | 22.7 | 3 | 32.5 | 2 | 35.2 | 5 | 79.8 | 9 | 128.1 | 3 | 65.9 |
| Arrowtooth Flounder | 725 | 642.2 | 1539 | 1278.4 | 491 | 399.7 | 148 | 334.1 | 70 | 97.2 | 1554 | 948.7 | 1485 | 1041.3 |
| Butter Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Dover Sole | 313 | 284.8 | 270 | 216.8 | 135 | 107.4 | 80 | 71.3 | 140 | 114.1 | — | — | 18 | 11.6 |
| English Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Flathead Sole | 513 | 166.9 | 146 | 55.2 | 144 | 51.8 | 445 | 96.9 | 108 | 49.7 | 30 | 4.1 | 73 | 33.7 |
| Petrale Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Rex Sole | 713 | 308.2 | 1101 | 402.1 | 1319 | 566.7 | 981 | 456.8 | 463 | 211.8 | 45 | 13.4 | — | — |
| Rock Sole | 225 | 114.8 | 124 | 43.6 | 42 | 13.5 | 23 | 6.8 | 13 | 3.7 | 754 | 308.7 | 477 | 190.0 |
| Sand Dab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Flatfish | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Black Cod | — | — | 11 | 17.3 | 34 | 55.8 | — | — | — | — | 15 | 26.9 | — | — |
| Lingcod | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Pollock | 650 | 710.8 | 11 | 15.7 | 42 | 40.0 | 23 | 26.7 | — | — | — | — | — | — |
| True Cod | 50 | 89.4 | 67 | 163.1 | 25 | 55.1 | 23 | 40.2 | 25 | 30.0 | 136 | 233.7 | 37 | 36.7 |
| Salmon | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Rockfish | — | — | 11 | 2.2 | — | — | — | — | 32 | 29.5 | — | — | — | — |
| Cottids | — | — | 11 | 3.7 | — | — | 23 | 9.7 | 6 | 1.9 | 45 | 16.0 | 55 | 23.5 |
| Other Roundfish | — | — | 11 | 0.6 | 8 | 0.3 | — | — | — | — | 181 | 32.6 | 36 | 5.3 |
| Dogfish | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Ratfish | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Skates | 2 | 3.6 | 3 | 6.2 | 1 | 1.8 | 5 | 8.9 | 7 | 12.8 | — | — | — | — |
| King Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Tanner Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Dungeness Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Crabs | — | — | — | — | 109 | 18.8 | — | — | 13 | 1.5 | 196 | 9.1 | 55 | 2.6 |
| Starfish | 725 | 131.8 | 1034 | 243.1 | 3468 | 495.1 | 3651 | 892.9 | 2321 | 436.5 | 739 | 116.5 | 385 | 43.6 |
| Other Invertebrates | — | — | 135 | 8.7 | 1859 | 198.6 | 411 | 55.4 | 387 | 63.6 | 724 | 87.5 | 2806 | 233.5 |
| Miscellaneous | — | — | — | — | 17 | 0.8 | — | — | 6 | 0.1 | 45 | 3.0 | — | — |
| Total Catch | 3922 | 2494.0 | 4479 | 2493.9 | 7698 | 2041.0 | 5818 | 2041.1 | 3597 | 1133.1 | 4527 | 2041.1 | 5455 | 1723.0 |

**Appendix Table 1 (continued). Catch and effort by station for the trawler OCEAN STAR during the 1987 experiment.**

| Station | 44A | | 44B | | 45A | | 45B | | 46A | | 46B | | 47A | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Haul Number | 86 | | 87 | | 88 | | 89 | | 90 | | 91 | | 92 | |
| Date | 07/12/87 | | 07/12/87 | | 07/12/87 | | 07/12/87 | | 07/12/87 | | 07/12/87 | | 07/13/87 | |
| N. Lat. - W. Long. | 57:28-151.38 | | 57:27-151:35 | | 57:28-151:45 | | 57:28-151:46 | | 57:35-151:42 | | 57:35-151:43 | | 58:00-151:57 | |
| Depth Range (fm.) | 40-66 | | 40-67 | | 37-45 | | 37-45 | | 59-72 | | 60-73 | | 94-95 | |
| Duration (min.) | 36 | | 42 | | 28 | | 33 | | 39 | | 41 | | 38 | |
| Distance (nmi.) | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | 4 | 13.3 | 4 | 13.9 | 74 | 94.2 | 103 | 147.5 | 2 | 6.0 | 2 | 5.9 | 5 | 9.9 |
| Halibut (≥ 82 cm.) | 7 | 178.9 | 14 | 190.8 | — | — | 8 | 99.2 | 4 | 81.5 | 3 | 28.7 | 3 | 71.0 |
| Arrowtooth Flounder | 882 | 655.4 | 3297 | 2316.5 | 127 | 65.8 | 148 | 37.9 | 357 | 514.6 | 439 | 721.4 | 622 | 530.6 |
| Butter Sole | 38 | 11.8 | — | — | 7 | 2.2 | — | — | 765 | 182.6 | 305 | 76.3 | — | — |
| Dover Sole | 13 | 6.0 | 74 | 44.5 | — | — | — | — | 51 | 52.5 | 57 | 64.3 | 19 | 21.3 |
| English Sole | — | — | — | — | — | — | — | — | 102 | 40.8 | — | — | — | — |
| Flathead Sole | 128 | 32.2 | — | — | — | — | 8 | 3.9 | 332 | 108.1 | 362 | 101.5 | 296 | 91.2 |
| Petrale Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Rex Sole | 217 | 88.7 | 37 | 6.7 | 514 | 209.1 | — | — | 179 | 117.3 | 382 | 241.9 | — | — |
| Rock Sole | 1189 | 437.3 | 482 | 162.6 | — | — | 680 | 221.7 | 51 | 23.5 | — | — | — | — |
| Sand Dab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Flatfish | — | — | — | — | — | — | — | — | 26 | 22.7 | — | — | — | — |
| Black Cod | — | — | — | — | — | — | — | — | — | — | — | — | 5 | 9.7 |
| Lingcod | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Pollock | 371 | 371.9 | 482 | 473.5 | — | — | — | — | 867 | 826.5 | 496 | 477.3 | 87 | 90.7 |
| True Cod | 38 | 80.9 | 111 | 163.0 | 89 | 105.0 | 31 | 25.9 | — | — | — | — | — | — |
| Salmon | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Rockfish | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Cottids | 13 | 5.1 | 74 | 25.2 | 15 | 2.8 | 180 | 65.8 | — | — | — | — | — | — |
| Other Roundfish | — | — | 148 | 8.9 | 7 | 0.7 | 47 | 4.9 | — | — | — | — | 12 | 53.8 |
| Dogfish | — | — | — | — | — | — | — | — | — | — | — | 23.3 | — | — |
| Ratfish | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Skates | 4 | 17.5 | — | — | — | — | — | — | 2 | 4.6 | 4 | 26.3 | — | — |
| King Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Tanner Crab | 26 | 1.5 | 111 | 5.2 | 7 | 3.1 | — | — | — | — | 19 | 8.0 | 34 | 18.6 |
| Dungeness Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Crabs | 167 | 13.6 | 629 | 60.0 | 1528 | 69.4 | 915 | 46.5 | — | — | — | — | 34 | 3.2 |
| Starfish | 792 | 135.0 | 593 | 197.1 | 470 | 219.3 | 297 | 105.5 | 153 | 47.4 | 114 | 54.9 | — | — |
| Other Invertebrates | 627 | 117.7 | 2808 | 317.0 | 387 | 70.9 | 446 | 345.2 | 26 | 12.8 | 19 | 4.2 | 61 | 7.1 |
| Miscellaneous | 141 | 10.4 | 815 | 97.1 | 1558 | 64.4 | 617 | 29.1 | — | — | — | — | — | — |
| Total Catch | 4657 | 2177.2 | 9679 | 4082.0 | 4783 | 906.9 | 3480 | 1133.1 | 2917 | 2040.9 | 2204 | 1814.0 | 1178 | 907.0 |

**Appendix Table 1 (continued). Catch and effort by station for the trawler OCEAN STAR during the 1987 experiment.**

| Station | 47B | | 48A | | 48B | | 49A | | 49B | | 50A | | 50B | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Haul Number | 93 | | 94 | | 95 | | 96 | | 97 | | 98 | | 99 | |
| Date | 07/13/87 | | 07/14/87 | | 07/14/87 | | 07/14/87 | | 07/14/87 | | 07/14/87 | | 07/14/87 | |
| N. Lat. - W. Long. | 58:00-151.57 | | 57:20-151:27 | | 57:19-151:25 | | 57:15-151:23 | | 57:17-151:24 | | 57:18-151:25 | | 57:18-151:25 | |
| Depth Range (fm.) | 94-95 | | 45-80 | | 46-73 | | 47-79 | | 47-80 | | 47-74 | | 47-74 | |
| Duration (min.) | 45 | | 32 | | 47 | | 52 | | 50 | | 46 | | 45 | |
| Distance (nmi.) | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | 2 | 2.0 | 3 | 6.1 | 15 | 26.3 | 19 | 69.7 | 77 | 293.6 | 11 | 26.7 | 6 | 16.0 |
| Halibut (≥ 82 cm.) | — | — | 4 | 106.6 | 2 | 32.7 | 8 | 99.4 | 92 | 1187.9 | 8 | 99.5 | 2 | 48.4 |
| Arrowtooth Flounder | 295 | 266.6 | 606 | 531.5 | 1014 | 968.7 | 1944 | 1139.1 | 1690 | 1515.4 | 3080 | 2865.9 | 1730 | 1247.3 |
| Butter Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Dover Sole | 12 | 6.8 | — | — | 28 | 27.6 | 15 | 12.3 | 106 | 76.8 | — | — | 23 | 16.6 |
| English Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Flathead Sole | 687 | 203.2 | 64 | 17.5 | 28 | 14.7 | — | — | 282 | 82.7 | 342 | 106.5 | 161 | 65.0 |
| Petrale Sole | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Rex Sole | — | — | 80 | 48.0 | 113 | 76.6 | — | — | 352 | 116.2 | 171 | 60.7 | 161 | 59.3 |
| Rock Sole | 12 | 5.2 | 191 | 68.2 | 507 | 133.0 | 374 | 149.3 | 246 | 75.3 | 257 | 85.6 | 392 | 141.1 |
| Sand Dab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Flatfish | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Black Cod | — | — | 16 | 39.5 | 85 | 155.5 | — | — | 35 | 64.1 | — | — | 92 | 179.0 |
| Lingcod | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Pollock | 46 | 47.9 | 175 | 191.0 | 507 | 542.1 | — | — | 422 | 504.2 | 856 | 1032.7 | 738 | 813.0 |
| True Cod | 6 | 10.2 | 223 | 376.6 | 1212 | 1065.1 | 15 | 15.7 | 951 | 1865.3 | 770 | 520.2 | 254 | 411.0 |
| Salmon | — | — | — | — | — | — | — | — | 1 | 2.3 | — | — | — | — |
| Rockfish | 29 | 31.0 | — | — | — | — | 120 | 114.6 | — | — | — | — | — | — |
| Cottids | 6 | 2.8 | 16 | 6.4 | 56 | 19.2 | 30 | 13.8 | — | — | 43 | 21.4 | 69 | 20.1 |
| Other Roundfish | — | — | 16 | 5.4 | — | — | 75 | 17.5 | — | — | — | — | 46 | 2.3 |
| Dogfish | — | — | 1 | 3.0 | — | — | — | — | — | — | — | — | — | — |
| Ratfish | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Skates | 3 | 4.7 | — | — | — | — | — | — | 1 | 1.7 | 1 | 1.8 | — | — |
| King Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Tanner Crab | 64 | 16.3 | 32 | 6.1 | — | — | — | — | 35 | 1.8 | — | — | — | — |
| Dungeness Crab | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Crabs | 156 | 16.6 | 494 | 21.4 | 704 | 35.3 | 688 | 41.3 | — | — | 171 | 8.6 | 46 | 3.7 |
| Starfish | 23 | 3.5 | 415 | 166.8 | 902 | 112.7 | 942 | 83.8 | — | — | 1540 | 233.6 | 600 | 111.2 |
| Other Invertebrates | 630 | 60.8 | 2683 | 295.7 | 1832 | 174.1 | 13745 | 794.5 | 1146 | 108.8 | 2096 | 135.6 | 322 | 38.7 |
| Miscellaneous | 46 | 2.5 | 223 | 15.3 | 282 | 17.5 | 523 | 34.1 | — | — | 171 | 17.1 | 23 | 2.3 |
| Total Catch | 2017 | 680.1 | 5242 | 1905.1 | 7287 | 3401.1 | 18498 | 2585.1 | 5436 | 5896.1 | 9517 | 5215.9 | 4665 | 3175.0 |

**Appendix Table 1 (concluded). Catch and effort by station for the trawler OCEAN STAR during the 1987 experiment.**

| Station | 51A | | 51B | | 53A | | 53B | | 54A | | 54B | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Haul Number | 100 | | 101 | | 103 | | 104 | | 105 | | 106 | |
| Date | 07/15/87 | | 07/15/87 | | 07/17/87 | | 07/17/87 | | 07/17/87 | | 07/17/87 | |
| N. Lat. - W. Long. | 57:14-151.20 | | 57:14-151:20 | | 57:38-151:47 | | 57:39-151:48 | | 57:40-151:54 | | 57:39-151:54 | |
| Depth Range (fm.) | 62-87 | | 62-88 | | 44-66 | | 45-65 | | 52-97 | | 52-94 | |
| Duration (min.) | 37 | | 47 | | 39 | | 42 | | 38 | | 43 | |
| Distance (nmi.) | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | | 2.0 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | 2 | 9.6 | 2 | 3.8 | 8 | 28.2 | 30 | 121.6 | 1 | 1.5 | 8 | 25.4 |
| Halibut (≥ 82 cm.) | 1 | 7.7 | 2 | 33.3 | 6 | 62.4 | 13 | 143.0 | 5 | 65.6 | 5 | 55.6 |
| Arrowtooth Flounder | 595 | 382.5 | 587 | 469.4 | 229 | 255.8 | 323 | 347.2 | 138 | 54.8 | 318 | 330.6 |
| Butter Sole | — | — | — | — | 2901 | 714.2 | 3685 | 854.4 | 1523 | 345.6 | 1207 | 335.6 |
| Dover Sole | 122 | 102.5 | 255 | 176.8 | 13 | 15.4 | — | — | 198 | 189.4 | 93 | 78.5 |
| English Sole | — | — | — | — | 108 | 87.2 | — | — | — | — | — | — |
| Flathead Sole | 189 | 79.8 | 77 | 24.5 | 189 | 71.1 | 81 | 23.9 | 376 | 100.8 | 146 | 37.7 |
| Petrale Sole | — | — | — | — | — | — | — | — | — | — | — | — |
| Rex Sole | 703 | 285.1 | 1404 | 636.0 | — | — | — | — | 178 | 80.1 | 93 | 49.9 |
| Rock Sole | 68 | 23.9 | 179 | 61.8 | 54 | 26.0 | 16 | 7.1 | 99 | 39.5 | 27 | 10.9 |
| Sand Dab | — | — | — | — | — | — | — | — | — | — | — | — |
| Other Flatfish | — | — | — | — | 18 | 32.1 | 16 | 36.9 | — | — | 13 | 26.0 |
| Black Cod | — | — | — | — | — | — | — | — | — | — | — | — |
| Lingcod | — | — | — | — | — | — | — | — | — | — | — | — |
| Pollock | 54 | 65.7 | 77 | 89.9 | 351 | 254.0 | 226 | 167.3 | 99 | 81.1 | 265 | 236.1 |
| True Cod | 41 | 64.5 | 13 | 21.6 | — | — | — | — | 316 | 569.1 | 66 | 167.2 |
| Salmon | — | — | 1 | 1.5 | — | — | — | — | — | — | — | — |
| Rockfish | 14 | 12.0 | — | — | — | — | — | — | — | — | — | — |
| Cottids | — | — | — | — | 13 | 16.2 | — | — | 198 | 165.3 | 40 | 26.5 |
| Other Roundfish | — | — | — | — | 27 | 2.0 | 16 | 0.8 | — | — | — | — |
| Dogfish | — | — | — | — | — | — | — | — | — | — | — | — |
| Ratfish | — | — | — | — | — | — | — | — | — | — | — | — |
| Skates | 1 | 0.8 | 5 | 11.1 | 14 | 122.7 | 20 | 255.0 | 14 | 71.3 | 28 | 152.0 |
| King Crab | — | — | — | — | — | — | — | — | — | — | — | — |
| Tanner Crab | — | — | — | — | — | — | — | — | — | — | 27 | 4.0 |
| Dungeness Crab | — | — | — | — | — | — | 1 | 0.8 | — | — | 3 | 0.9 |
| Other Crabs | 150 | 14.8 | — | — | — | — | — | — | — | — | — | — |
| Starfish | 2110 | 210.7 | 1060 | 233.5 | 418 | 117.9 | 129 | 75.8 | 119 | 87.4 | 27 | 30.6 |
| Other Invertebrates | 1556 | 98.7 | 472 | 50.6 | 96 | 8.7 | 49 | 7.2 | 437 | 186.4 | 16 | 19.4 |
| Miscellaneous | 14 | 1.4 | — | — | — | — | — | — | 79 | 3.0 | — | — |
| Total Catch | 5620 | 1359.7 | 4134 | 1813.8 | 4445 | 1813.9 | 4605 | 2041.0 | 3780 | 2040.9 | 2382 | 1586.9 |

**Appendix Table 2. Catch and effort by station for the setliner SNOWFALL during the 1987 experiment.**

| Station/Set Number | 1 | | 2 | | 3 | | 4 | |
|---|---|---|---|---|---|---|---|---|
| Date | 05/22/87 | | 05/23/87 | | 05/24/87 | | 05/24/87 | |
| N. Lat. - W. Long. | 54:20-131.10 | | 54:18-131:18 | | 54:18-131:25 | | 54:15-131:32 | |
| Depth Range (fm.) | 35-38 | | 38-48 | | 26-60 | | 18-60 | |
| Std. Skates | 8 | | 8 | | 8 | | 8 | |
| Time Set | 14:10 | | 07:50 | | 08:25 | | 14:00 | |
| Soak Time (min.) | 95 | | 90 | | 95 | | 90 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | 12 | 44.0 | 86 | 317.0 | 12 | 41.5 | 53 | 193.7 |
| Halibut (≤ 82 cm.) | 12 | 70.8 | 20 | 125.6 | 3 | 16.0 | 13 | 79.3 |
| Arrowtooth Flounder | — | — | — | — | 2 | 1.8 | — | — |
| Other Flatfish | — | — | — | — | — | — | — | — |
| Black Cod | — | — | — | — | — | — | — | — |
| Lingcod | 1 | 5.0 | — | — | — | — | — | — |
| Pollock | — | — | — | — | — | — | — | — |
| True Cod | 1 | 1.8 | — | — | — | — | — | — |
| Cottids | — | — | — | — | — | — | — | — |
| Other Roundfish | — | — | — | — | — | — | — | — |
| Dogfish | 186 | 590.6 | 138 | 313.0 | 310 | 773.4 | 187 | 719.9 |
| Other Sharks | — | — | — | — | — | — | — | — |
| Ratfish | — | — | — | — | — | — | — | — |
| Skates | 21 | 365.1 | 15 | 213.2 | 7 | 113.4 | 15 | 226.8 |
| Starfish | 25 | 22.7 | 5 | 4.5 | 7 | 6.4 | 14 | 11.3 |
| Other Invertebrates | — | — | — | — | — | — | — | — |
| Total Catch | 258 | 1101.0 | 264 | 973.3 | 341 | 952.5 | 282 | 1231.0 |

| Station/Set Number | 5 | | 6 | | 7 | | 8 | |
|---|---|---|---|---|---|---|---|---|
| Date | 05/25/87 | | 05/25/87 | | 05/25/87 | | 05/26/87 | |
| N. Lat. - W. Long. | 54:09-132.00 | | 54:09-131:52 | | 54:10-132:01 | | 54:09-132:14 | |
| Depth Range (fm.) | 30-34 | | 22-40 | | 34-48 | | 32-40 | |
| Std. Skates | 8 | | 8 | | 8 | | 8 | |
| Time Set | 07:00 | | 11:00 | | 15:20 | | 07:33 | |
| Soak Time (min.) | 90 | | 90 | | 100 | | 87 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | 109 | 393.2 | 65 | 215.1 | 108 | 373.7 | — | — |
| Halibut (≤ 82 cm.) | 34 | 199.9 | 18 | 107.3 | 17 | 101.2 | 2 | 11.2 |
| Arrowtooth Flounder | 1 | 0.9 | — | — | 1 | 1.4 | — | — |
| Other Flatfish | 1 | 0.5 | — | — | — | — | — | — |
| Black Cod | — | — | — | — | — | — | — | — |
| Lingcod | — | — | — | — | 2 | 22.7 | — | — |
| Pollock | — | — | — | — | — | — | — | — |
| True Cod | — | — | — | — | — | — | — | — |
| Cottids | — | — | — | — | — | — | — | — |
| Other Roundfish | — | — | — | — | — | — | — | — |
| Dogfish | 10 | 32.7 | 46 | 146.1 | 44 | 99.8 | 90 | 81.6 |
| Other Sharks | — | — | — | — | — | — | — | — |
| Ratfish | 1 | 1.8 | — | — | — | — | — | — |
| Skates | 11 | 136.1 | 13 | 131.5 | 4 | 34.0 | 1 | 18.1 |
| Starfish | 1 | 0.9 | 4 | 4.5 | — | — | 4 | 3.6 |
| Other Invertebrates | — | — | — | — | — | — | — | — |
| Total Catch | 168 | 766.0 | 146 | 604.5 | 176 | 631.4 | 97 | 114.5 |

**Appendix Table 2 (continued). Catch and effort by station for the setliner SNOWFALL during the 1987 experiment.**

| Station/Set Number | 9 | | 10 | | 11 | | [1]13 | |
|---|---|---|---|---|---|---|---|---|
| Date | 05/26/87 | | 05/28/87 | | 05/28/87 | | 06/01/87 | |
| N. Lat. - W. Long. | 54:10-132.01 | | 54:10-131:57 | | 54:10-131:54 | | 52:58-130:45 | |
| Depth Range (fm.) | 42-49 | | 33-48 | | 26-45 | | 35-53 | |
| Std. Skates | 8 | | 8 | | 8 | | 8 | |
| Time Set | 12:00 | | 07:40 | | 11:20 | | 11:05 | |
| Soak Time (min.) | 90 | | 90 | | 90 | | 90 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | 110 | 354.6 | 16 | 62.6 | 55 | 205.0 | 8 | 31.9 |
| Halibut (≤ 82 cm.) | 19 | 112.4 | 3 | 19.1 | 9 | 50.3 | 10 | 90.1 |
| Arrowtooth Flounder | — | — | — | — | 1 | 1.4 | — | — |
| Other Flatfish | — | — | — | — | 1 | 1.4 | — | — |
| Black Cod | — | — | — | — | — | — | — | — |
| Lingcod | — | — | — | — | — | — | 4 | 38.6 |
| Pollock | — | — | — | — | — | — | — | — |
| True Cod | — | — | — | — | — | — | — | — |
| Cottids | — | — | — | — | — | — | — | — |
| Other Roundfish | — | — | — | — | — | — | — | — |
| Dogfish | 14 | 31.8 | 104 | 113.4 | 52 | 75.3 | 98 | 453.6 |
| Other Sharks | — | — | — | — | — | — | — | — |
| Ratfish | — | — | — | — | — | — | — | — |
| Skates | 16 | 272.2 | — | — | 2 | 18.1 | — | — |
| Starfish | 1 | 0.5 | 1 | 0.9 | — | — | 3 | 1.4 |
| Other Invertebrates | — | — | — | — | — | — | — | — |
| Total Catch | 160 | 771.5 | 124 | 196.0 | 120 | 351.5 | 123 | 615.6 |

| Station/Set Number | 14 | | 15 | | 16 | | 17 | |
|---|---|---|---|---|---|---|---|---|
| Date | 06/01/87 | | 06/03/87 | | 06/03/87 | | 06/03/87 | |
| N. Lat. - W. Long. | 52:55-130:46 | | 51:45-129:29 | | 51:45-129:24 | | 51:46-129:20 | |
| Depth Range (fm.) | 27-31 | | 50-104 | | 48-64 | | 55-65 | |
| Std. Skates | 8 | | 8 | | 8 | | 8 | |
| Time Set | 15:35 | | 08:05 | | 12:25 | | 16:15 | |
| Soak Time (min.) | 90 | | 90 | | 95 | | 90 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | 3 | 12.4 | 6 | 23.2 | 3 | 12.6 | 2 | 7.3 |
| Halibut (≤ 82 cm.) | 3 | 23.8 | 6 | 39.0 | 2 | 13.3 | 4 | 25.0 |
| Arrowtooth Flounder | — | — | — | — | — | — | — | — |
| Other Flatfish | — | — | — | — | — | — | — | — |
| Black Cod | — | — | — | — | — | — | — | — |
| Lingcod | — | — | — | — | — | — | — | — |
| Pollock | — | — | — | — | — | — | — | — |
| True Cod | — | — | — | — | — | — | — | — |
| Cottids | — | — | — | — | — | — | — | — |
| Other Roundfish | — | — | — | — | — | — | — | — |
| Dogfish | 309 | 1261.5 | 340 | 1295.5 | 373 | 1861.1 | 300 | 1292.8 |
| Other Sharks | — | — | — | — | — | — | — | — |
| Ratfish | — | — | — | — | — | — | — | — |
| Skates | 6 | 31.8 | — | — | 7 | 136.1 | 5 | 45.4 |
| Starfish | 61 | 83.9 | — | — | 1 | 0.9 | 1 | 0.5 |
| Other Invertebrates | — | — | — | — | — | — | — | — |
| Total Catch | 382 | 1413.4 | 352 | 1357.7 | 386 | 2024.0 | 312 | 1371.0 |

[1]Fishing effort at 53:17 N and 131:56 W was unsuccessful. Station 12 is not used in data summaries or the analysis.

**Appendix Table 2 (continued). Catch and effort by station for the setliner SNOWFALL during the 1987 experiment.**

| Station/Set Number | 18 | | 19 | | 20 | | 21 | |
|---|---|---|---|---|---|---|---|---|
| Date | 06/04/87 | | 06/04/87 | | 06/04/87 | | 06/06/87 | |
| N. Lat. - W. Long. | 51:24-129.15 | | 51:23-129:16 | | 51:22-129:14 | | 51:10-128:51 | |
| Depth Range (fm.) | 50-60 | | 60-66 | | 60-98 | | 63-66 | |
| Std. Skates | 8 | | 8 | | 8 | | 8 | |
| Time Set | 06:50 | | 10:50 | | 14:40 | | 09:20 | |
| Soak Time (min.) | 100 | | 85 | | 90 | | 90 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | 1 | 4.1 | 22 | 84.6 | 10 | 41.5 | 59 | 222.0 |
| Halibut (≤ 82 cm.) | 1 | 5.6 | 4 | 29.1 | 3 | 22.1 | 31 | 197.9 |
| Arrowtooth Flounder | — | — | — | —5 | 4.1 | 2 | 1.8 | |
| Other Flatfish | — | — | — | — | — | — | — | — |
| Black Cod | — | — | — | — | 8 | 7.3 | — | — |
| Lingcod | — | — | — | — | — | —1 | 5.9 | |
| Pollock | — | — | — | — | — | — | — | — |
| True Cod | — | — | — | —1 | 0.9 | — | — | |
| Cottids | — | — | — | — | — | — | — | — |
| Other Roundfish | — | — | — | — | — | — | — | — |
| Dogfish | 308 | 1481.0 | 263 | 1406.2 | 248 | 1226.1 | 1 | 4.5 |
| Other Sharks | — | — | — | — | — | — | — | — |
| Ratfish | — | — | — | — | — | — | — | — |
| Skates | — | — | 1 | 6.8 | 2 | 9.1 | 1 | 6.8 |
| Starfish | 6 | 6.8 | 2 | 0.9 | — | — | — | — |
| Other Invertebrates | — | — | — | — | — | — | — | — |
| Total Catch | 316 | 1497.5 | 292 | 1527.6 | 277 | 1311.1 | 95 | 438.9 |

| Station/Set Number | 22 | | 23 | | 24 | | 25 | |
|---|---|---|---|---|---|---|---|---|
| Date | 06/06/87 | | 06/06/87 | | 06/07/87 | | 06/07/87 | |
| N. Lat. - W. Long. | 51:08-128.52 | | 51:07-128:56 | | 50:39-128:27 | | 50:41-128:28 | |
| Depth Range (fm.) | 52-60 | | 57-64 | | 40-40 | | 39-47 | |
| Std. Skates | 8 | | 8 | | 8 | | 8 | |
| Time Set | 13:05 | | 16:55 | | 07:45 | | 11:15 | |
| Soak Time (min.) | 85 | | 90 | | 90 | | 90 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | 24 | 86.4 | 14 | 48.3 | 14 | 47.9 | 43 | 156.9 |
| Halibut (≤ 82 cm.) | 9 | 61.6 | 21 | 170.2 | 10 | 61.8 | 21 | 132.5 |
| Arrowtooth Flounder | — | — | 22 | 19.1 | — | — | 1 | 0.5 |
| Other Flatfish | 1 | 1.4 | — | — | — | — | — | — |
| Black Cod | — | — | — | — | — | — | — | — |
| Lingcod | 1 | 6.8 | — | — | 1 | 5.9 | 1 | 4.5 |
| Pollock | — | — | — | — | — | — | — | — |
| True Cod | — | — | 1 | 1.4 | — | — | — | — |
| Cottids | — | — | — | — | — | — | — | — |
| Other Roundfish | — | — | 1 | 1.8 | — | — | — | — |
| Dogfish | 16 | 59.9 | 30 | 98.0 | 8 | 29.5 | 29 | 113.4 |
| Other Sharks | — | — | — | — | — | — | — | — |
| Ratfish | — | — | — | — | — | — | — | — |
| Skates | — | — | 2 | 20.4 | 3 | 31.8 | 3 | 30.4 |
| Starfish | 1 | 0.5 | — | — | — | — | — | — |
| Other Invertebrates | — | — | — | — | — | — | — | — |
| Total Catch | 52 | 216.6 | 91 | 359.2 | 36 | 176.9 | 98 | 437.7 |

**Appendix Table 2 (continued). Catch and effort by station for the setliner SNOWFALL during the 1987 experiment.**

| Station/Set Number | 26 | | 27 | | 28 | | 29 | |
|---|---|---|---|---|---|---|---|---|
| Date | 06/07/87 | | 07/06/87 | | 07/06/87 | | 07/07/87 | |
| N. Lat. - W. Long. | 50:41-128.28 | | 57:50-151:54 | | 57:51-151:28 | | 57:45-151:18 | |
| Depth Range (fm.) | 39-42 | | 34-45 | | 50-64 | | 36-38 | |
| Std. Skates | 8 | | 8 | | 8 | | 8 | |
| Time Set | 15:25 | | 07:04 | | 11:45 | | 09:05 | |
| Soak Time (min.) | 95 | | 91 | | 90 | | 91 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | 49 | 164.5 | 32 | 86.8 | 16 | 57.7 | 36 | 130.1 |
| Halibut (≤ 82 cm.) | 14 | 92.2 | 5 | 68.4 | 14 | 108.7 | 41 | 389.8 |
| Arrowtooth Flounder | — | — | — | — | 13 | 11.8 | — | — |
| Other Flatfish | — | — | — | — | — | — | — | — |
| Black Cod | — | — | — | — | 8 | 7.3 | — | — |
| Lingcod | 2 | 12.7 | — | — | — | — | — | — |
| Pollock | — | — | — | — | 2 | 1.8 | — | — |
| True Cod | — | — | 97 | 220.0 | 114 | 310.3 | 41 | 111.6 |
| Cottids | — | — | 4 | 9.5 | 7 | 10.9 | — | — |
| Other Roundfish | — | — | — | — | — | — | — | — |
| Dogfish | 2 | 12.2 | — | — | — | — | 1 | 2.3 |
| Other Sharks | — | — | — | — | — | — | — | — |
| Ratfish | — | — | — | — | — | — | — | — |
| Skates | — | — | 1 | 9.1 | 5 | 18.1 | 1 | 20.4 |
| Starfish | 5 | 3.6 | — | — | — | — | 213 | 285.3 |
| Other Invertebrates | — | — | — | — | 3 | 4.5 | — | — |
| Total Catch | 72 | 285.2 | 139 | 393.8 | 182 | 531.1 | 333 | 939.5 |

| Station/Set Number | 30 | | 31 | | 32 | | 33 | |
|---|---|---|---|---|---|---|---|---|
| Date | 07/07/87 | | 07/07/87 | | 07/08/87 | | 07/08/87 | |
| N. Lat. - W. Long. | 57:40-151.21 | | 57:33-151:21 | | 57:28-151:10 | | 57:28-151:16 | |
| Depth Range (fm.) | 36-38 | | 40-42 | | 45-47 | | 48-50 | |
| Std. Skates | 8 | | 8 | | 8 | | 8 | |
| Time Set | 13:44 | | 18:30 | | 06:40 | | 11:20 | |
| Soak Time (min.) | 91 | | 90 | | 90 | | 90 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | 34 | 98.7 | 14 | 46.5 | 22 | 83.5 | 69 | 250.7 |
| Halibut (≤ 82 cm.) | 19 | 293.8 | 46 | 919.1 | 45 | 642.0 | 56 | 422.7 |
| Arrowtooth Flounder | — | — | — | — | — | — | — | — |
| Other Flatfish | — | — | — | — | — | — | 1 | 0.5 |
| Black Cod | — | — | — | — | — | — | — | — |
| Lingcod | — | — | — | — | — | — | — | — |
| Pollock | — | — | — | — | — | — | — | — |
| True Cod | 7 | 19.1 | 2 | 3.2 | 5 | 6.8 | 25 | 46.7 |
| Cottids | — | — | 4 | 2.7 | 7 | 3.2 | — | — |
| Other Roundfish | — | — | — | — | — | — | — | — |
| Dogfish | — | — | 5 | 13.2 | — | — | 2 | 3.2 |
| Other Sharks | — | — | — | — | — | — | — | — |
| Ratfish | — | — | — | — | — | — | — | — |
| Skates | 7 | 124.7 | 16 | 353.8 | 6 | 104.3 | 6 | 152.0 |
| Starfish | 237 | 322.5 | 251 | 341.6 | 55 | 74.8 | 130 | 294.8 |
| Other Invertebrates | 1 | 6.8 | — | — | — | — | — | — |
| Total Catch | 305 | 865.6 | 338 | 1680.1 | 140 | 914.6 | 289 | 1170.6 |

**Appendix Table 2 (continued). Catch and effort by station for the setliner SNOWFALL during the 1987 experiment.**

| Station/Set Number | 34 | | 35 | | 36 | | 37 | |
|---|---|---|---|---|---|---|---|---|
| Date | 07/08/87 | | 07/09/87 | | 07/09/87 | | 07/09/87 | |
| N. Lat. - W. Long. | 57:22-151.15 | | 57:17-151:11 | | 57:18-151:16 | | 57:17-151:20 | |
| Depth Range (fm.) | 35-48 | | 48-52 | | 76-84 | | 82-85 | |
| Std. Skates | 8 | | 8 | | 8 | | 8 | |
| Time Set | 16:07 | | 06:38 | | 11:20 | | 16:10 | |
| Soak Time (min.) | 93 | | 95 | | 105 | | 90 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | 26 | 78.3 | 12 | 44.4 | 3 | 11.6 | — | — |
| Halibut (≤ 82 cm.) | 38 | 544.0 | 13 | 164.1 | 69 | 1205.6 | 60 | 936.4 |
| Arrowtooth Flounder | 1 | 1.4 | — | — | 24 | 32.7 | 9 | 12.2 |
| Other Flatfish | — | — | — | — | — | — | — | — |
| Black Cod | — | — | — | — | 2 | 2.7 | — | — |
| Lingcod | — | — | — | — | — | — | — | — |
| Pollock | — | — | — | — | 1 | 0.5 | 1 | 1.4 |
| True Cod | 1 | 1.4 | 31 | 57.6 | 74 | 201.4 | 61 | 166.0 |
| Cottids | 2 | 1.8 | — | — | 1 | 0.5 | 1 | 0.5 |
| Other Roundfish | — | — | — | — | 1 | 0.9 | — | — |
| Dogfish | 1 | 1.8 | — | — | 2 | 5.0 | 1 | 3.6 |
| Other Sharks | — | — | — | — | — | — | — | — |
| Ratfish | — | — | — | — | — | — | — | — |
| Skates | 2 | 52.2 | — | — | 2 | 3.2 | — | — |
| Starfish | 55 | 124.7 | 3 | 3.6 | — | — | — | — |
| Other Invertebrates | — | — | — | — | — | — | — | — |
| Total Catch | 126 | 803.8 | 59 | 269.7 | 179 | 1464.1 | 133 | 1120.1 |

| Station/Set Number | 38 | | 39 | | 40 | | 41 | |
|---|---|---|---|---|---|---|---|---|
| Date | 07/10/87 | | 07/10/87 | | 07/10/87 | | 07/11/87 | |
| N. Lat. - W. Long. | 57:15-151.00 | | 57:16-150:51 | | 57:14-151:18 | | 57:16-151:20 | |
| Depth Range (fm.) | 73-76 | | 63-83 | | 81-84 | | 64-84 | |
| Std. Skates | 8 | | 8 | | 8 | | 8 | |
| Time Set | 06:30 | | 11:20 | | 18:45 | | 07:50 | |
| Soak Time (min.) | 90 | | 90 | | 90 | | 95 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | — | — | 14 | 47.6 | 12 | 42.9 | 8 | 32.2 |
| Halibut (≤ 82 cm.) | 42 | 588.9 | 12 | 82.0 | 107 | 1340.9 | 85 | 1311.1 |
| Arrowtooth Flounder | 12 | 10.9 | 4 | 5.4 | 9 | 8.2 | 19 | 17.2 |
| Other Flatfish | — | — | — | — | — | — | — | — |
| Black Cod | 25 | 46.7 | 26 | 47.2 | — | — | 5 | 6.8 |
| Lingcod | — | — | — | — | — | — | — | — |
| Pollock | — | — | — | — | — | — | — | — |
| True Cod | 20 | 20.0 | 50 | 113.4 | 57 | 129.3 | 140 | 381.0 |
| Cottids | — | — | — | — | 2 | 0.9 | — | — |
| Other Roundfish | — | — | — | — | — | — | — | — |
| Dogfish | — | — | — | — | — | — | — | — |
| Other Sharks | — | — | — | — | — | — | — | — |
| Ratfish | — | — | — | — | — | — | — | — |
| Skates | — | — | — | — | 2 | 4.1 | — | — |
| Starfish | — | — | — | — | — | — | — | — |
| Other Invertebrates | — | — | — | — | — | — | — | — |
| Total Catch | 99 | 666.5 | 106 | 295.6 | 189 | 1526.3 | 257 | 1748.3 |

**Appendix Table 2 (continued). Catch and effort by station for the setliner SNOWFALL during the 1987 experiment.**

| Station/Set Number | 42 | | 43 | | 44 | | 45 | |
|---|---|---|---|---|---|---|---|---|
| Date | 07/11/87 | | 07/11/87 | | 07/12/87 | | 07/12/87 | |
| N. Lat. - W. Long. | 57:16-151.21 | | 57:19-151:31 | | 57:27-151:39 | | 57:27-151:48 | |
| Depth Range (fm.) | 84-86 | | 42-63 | | 36-66 | | 38-45 | |
| Std. Skates | 8 | | 8 | | 8 | | 8 | |
| Time Set | 13:28 | | 18:48 | | 08:08 | | 13:50 | |
| Soak Time (min.) | 92 | | 102 | | 92 | | 90 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | — | — | 34 | 121.2 | 36 | 120.9 | 51 | 167.7 |
| Halibut (≤ 82 cm.) | 66 | 973.2 | 105 | 1566.9 | 95 | 1270.8 | 77 | 1135.4 |
| Arrowtooth Flounder | 22 | 39.9 | — | — | 5 | 6.8 | — | — |
| Other Flatfish | — | — | — | — | 1 | 0.5 | 1 | 0.5 |
| Black Cod | 2 | 2.7 | 2 | 2.7 | 1 | 1.8 | — | — |
| Lingcod | — | — | — | — | — | — | — | — |
| Pollock | — | — | — | — | — | — | — | — |
| True Cod | 77 | 244.5 | 104 | 235.9 | 80 | 145.2 | 24 | 54.4 |
| Cottids | — | — | 3 | 1.8 | 3 | 4.1 | 3 | 1.4 |
| Other Roundfish | — | — | — | — | — | — | — | — |
| Dogfish | — | — | 3 | 3.6 | — | — | 2 | 4.5 |
| Other Sharks | — | — | — | — | 1 | 2.7 | — | — |
| Ratfish | — | — | — | — | — | — | — | — |
| Skates | — | — | 1 | 2.3 | 4 | 58.1 | 1 | 15.9 |
| Starfish | — | — | — | — | — | — | 22 | 29.9 |
| Other Invertebrates | — | — | — | — | — | — | — | — |
| Total Catch | 167 | 1260.3 | 252 | 1934.4 | 226 | 1610.9 | 181 | 1409.7 |

| Station/Set Number | 46 | | 47 | | 48 | | 49 | |
|---|---|---|---|---|---|---|---|---|
| Date | 07/12/87 | | 07/13/87 | | 07/14/87 | | 07/14/87 | |
| N. Lat. - W. Long. | 57:34-151.45 | | 58:00-152:02 | | 57:20-151:30 | | 57:16-151:24 | |
| Depth Range (fm.) | 62-73 | | 94-98 | | 45-78 | | 47-78 | |
| Std. Skates | 8 | | 8 | | 8 | | 8 | |
| Time Set | 18:03 | | 14:56 | | 06:33 | | 11:25 | |
| Soak Time (min.) | 91 | | 91 | | 94 | | 97 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | 9 | 38.6 | 6 | 22.3 | 17 | 61.5 | 73 | 259.4 |
| Halibut (≤ 82 cm.) | 33 | 359.9 | 19 | 213.6 | 88 | 1553.7 | 173 | 2367.2 |
| Arrowtooth Flounder | 28 | 50.8 | — | — | 20 | 36.3 | 20 | 27.2 |
| Other Flatfish | 1 | 0.5 | — | — | — | — | — | — |
| Black Cod | 1 | 0.9 | 26 | 35.4 | 2 | 3.2 | — | — |
| Lingcod | — | — | — | — | — | — | — | — |
| Pollock | 1 | 1.4 | 1 | 1.4 | — | — | — | — |
| True Cod | 71 | 161.0 | 52 | 94.3 | 144 | 587.9 | 12 | 21.8 |
| Cottids | — | — | — | — | 1 | 0.5 | 3 | 2.7 |
| Other Roundfish | — | — | — | — | — | — | — | — |
| Dogfish | — | — | — | — | — | — | — | — |
| Other Sharks | — | — | 2 | 181.4 | — | — | — | — |
| Ratfish | — | — | — | — | — | — | — | — |
| Skates | 5 | 49.9 | — | — | 1 | 1.8 | 1 | 3.2 |
| Starfish | 58 | 105.2 | — | — | — | — | 1 | 0.9 |
| Other Invertebrates | — | — | — | — | — | — | — | — |
| Total Catch | 207 | 768.2 | 106 | 548.4 | 273 | 2244.9 | 283 | 2682.4 |

**Appendix Table 2 (concluded). Catch and effort by station for the setliner SNOWFALL during the 1987 experiment.**

| Station/Set Number | 50 | | 51 | | 53 | | 54 | |
|---|---|---|---|---|---|---|---|---|
| Date | 07/14/87 | | 07/15/87 | | 07/17/87 | | 07/17/87 | |
| N. Lat. - W. Long. | 57:19-151.29 | | 57:14-151:24 | | 57:38-151:52 | | 57:41-151:56 | |
| Depth Range (fm.) | 48-70 | | 61-88 | | 45-65 | | 52-96 | |
| Std. Skates | 8 | | 8 | | 8 | | 8 | |
| Time Set | 19:35 | | 07:52 | | 08:55 | | 13:25 | |
| Soak Time (min.) | 90 | | 90 | | 90 | | 105 | |
| Catch | No. | Kg. | No. | Kg. | No. | Kg. | No. | Kg. |
| Halibut (≤ 81 cm.) | 15 | 59.2 | 6 | 22.5 | 16 | 61.5 | 8 | 27.6 |
| Halibut (≥ 82 cm.) | 54 | 760.3 | 36 | 567.7 | 44 | 564.0 | 27 | 318.0 |
| Arrowtooth Flounder | 33 | 59.9 | 22 | 29.9 | 1 | 0.9 | 17 | 30.8 |
| Other Flatfish | — | — | — | — | — | — | — | — |
| Black Cod | 4 | 6.4 | 7 | 6.4 | — | — | 3 | 8.2 |
| Lingcod | — | — | — | — | — | — | — | — |
| Pollock | — | — | — | — | — | — | — | — |
| True Cod | 138 | 500.8 | 61 | 110.7 | 22 | 79.8 | 210 | 952.6 |
| Cottids | — | — | — | — | 3 | 8.2 | 11 | 24.9 |
| Other Roundfish | — | — | — | — | — | — | — | — |
| Dogfish | — | — | 1 | 1.8 | — | — | 3 | 0.5 |
| Other Sharks | — | — | — | — | — | — | — | — |
| Ratfish | — | — | — | — | — | — | — | — |
| Skates | 1 | 20.4 | 1 | 2.3 | 7 | 129.3 | 24 | 407.3 |
| Starfish | — | — | — | — | 38 | 86.2 | 2 | 4.5 |
| Other Invertebrates | — | — | — | — | — | — | — | — |
| Total Catch | 245 | 1407.0 | 134 | 741.3 | 131 | 929.9 | 305 | 1774.4 |

**Appendix Table 3.** **1987 Area 2B setline catch in number per eight skate set of halibut by centimeter size groups and of dogfish.**

| | Halibut by centimeter size group | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Location | 50-59 | 60-69 | 70-79 | 80-89 | 90-99 | 100-109 | 110+ | 82-99 | Dogfish |
| 1 | 0 | 2 | 7 | 14 | 1 | 0 | 0 | 12 | 186 |
| 2 | 0 | 14 | 61 | 28 | 2 | 0 | 1 | 19 | 138 |
| 3 | 0 | 3 | 8 | 4 | 0 | 0 | 0 | 3 | 310 |
| 4 | 1 | 7 | 38 | 16 | 4 | 0 | 0 | 13 | 187 |
| 5 | 1 | 21 | 74 | 43 | 3 | 1 | 0 | 33 | 10 |
| 6 | 1 | 17 | 43 | 19 | 3 | 0 | 0 | 18 | 46 |
| 7 | 3 | 23 | 72 | 23 | 3 | 1 | 0 | 16 | 44 |
| 8 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 90 |
| 9 | 3 | 37 | 65 | 20 | 4 | 0 | 0 | 19 | 14 |
| 10 | 0 | 1 | 11 | 6 | 1 | 0 | 0 | 3 | 104 |
| 11 | 0 | 10 | 35 | 18 | 1 | 0 | 0 | 9 | 52 |
| 13 | 0 | 1 | 5 | 4 | 6 | 0 | 2 | 8 | 98 |
| 14 | 0 | 0 | 2 | 2 | 1 | 1 | 0 | 2 | 309 |
| 15 | 0 | 1 | 5 | 4 | 2 | 0 | 0 | 6 | 340 |
| 16 | 0 | 0 | 2 | 2 | 1 | 0 | 0 | 2 | 373 |
| 17 | 0 | 0 | 2 | 3 | 1 | 0 | 0 | 4 | 300 |
| 18 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 308 |
| 19 | 0 | 1 | 18 | 5 | 1 | 1 | 0 | 3 | 263 |
| 20 | 0 | 0 | 9 | 2 | 2 | 0 | 0 | 3 | 248 |
| 21 | 1 | 9 | 40 | 29 | 11 | 0 | 0 | 31 | 1 |
| 22 | 0 | 6 | 15 | 8 | 4 | 0 | 0 | 9 | 16 |
| 23 | 1 | 2 | 8 | 15 | 5 | 2 | 2 | 17 | 30 |
| 24 | 0 | 2 | 12 | 7 | 3 | 0 | 0 | 10 | 8 |
| 25 | 0 | 8 | 28 | 23 | 4 | 1 | 0 | 20 | 29 |
| 26 | 0 | 15 | 28 | 16 | 2 | 2 | 0 | 12 | 2 |

**Appendix Table 4. 1987 Area 3A setline catch in number per eight skate set of halibut by centimeter size groups.**

| | Halibut by centimeter size group | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Location | 50-59 | 60-69 | 70-79 | 80-89 | 90-99 | 100-109 | 110+ | 82-99 |
| 27 | 5 | 29 | 38 | 20 | 3 | 3 | 1 | 15 |
| 27 | 5 | 29 | 38 | 20 | 3 | 3 | 1 | 15 |
| 28 | 0 | 4 | 10 | 9 | 4 | 2 | 1 | 11 |
| 29 | 0 | 5 | 26 | 24 | 9 | 5 | 8 | 28 |
| 30 | 5 | 11 | 14 | 10 | 6 | 1 | 5 | 13 |
| 31 | 1 | 2 | 11 | 8 | 7 | 6 | 25 | 15 |
| 32 | 1 | 4 | 13 | 18 | 13 | 7 | 11 | 27 |
| 33 | 1 | 12 | 47 | 46 | 12 | 1 | 6 | 49 |
| 34 | 8 | 3 | 10 | 18 | 8 | 4 | 13 | 21 |
| 35 | 0 | 2 | 8 | 8 | 3 | 1 | 3 | 9 |
| 36 | 1 | 1 | 1 | 5 | 3 | 12 | 49 | 8 |
| 37 | 0 | 0 | 0 | 1 | 4 | 17 | 38 | 5 |
| 38 | 0 | 0 | 0 | 1 | 3 | 18 | 20 | 4 |
| 39 | 0 | 5 | 7 | 10 | 3 | 0 | 1 | 11 |
| 40 | 2 | 2 | 3 | 15 | 24 | 24 | 49 | 34 |
| 41 | 0 | 0 | 6 | 5 | 11 | 25 | 46 | 14 |
| 42 | 0 | 0 | 0 | 3 | 5 | 18 | 40 | 8 |
| 43 | 0 | 8 | 24 | 22 | 19 | 24 | 42 | 39 |
| 44 | 1 | 13 | 18 | 17 | 32 | 12 | 38 | 45 |
| 45 | 2 | 19 | 27 | 24 | 11 | 16 | 29 | 32 |
| 46 | 0 | 0 | 7 | 11 | 8 | 9 | 7 | 17 |
| 47 | 0 | 1 | 4 | 7 | 6 | 2 | 5 | 12 |
| 48 | 0 | 3 | 13 | 14 | 10 | 12 | 53 | 23 |
| 49 | 0 | 16 | 44 | 57 | 39 | 23 | 67 | 83 |
| 50 | 0 | 1 | 10 | 10 | 10 | 11 | 27 | 16 |
| 51 | 0 | 1 | 4 | 7 | 7 | 4 | 19 | 13 |
| 53 | 0 | 3 | 9 | 19 | 5 | 9 | 15 | 20 |
| 54 | 0 | 2 | 6 | 4 | 9 | 5 | 9 | 13 |

**Appendix Table 5.** **1987 Area 2B trawl catch in number per four nm trawl of halibut by centimeter size groups and of dogfish.**

| | Halibut by centimeter size group | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Location | 50-59 | 60-69 | 70-79 | 80-89 | 90-99 | 100-109 | 110+ | 82-99 | Dogfish |
| 1 | 0 | 4 | 7 | 2 | 1 | 0 | 0 | 2 | 66 |
| 2 | 14 | 345 | 808 | 195 | 6 | 0 | 0 | 107 | 360 |
| 3 | 22 | 210 | 200 | 20 | 1 | 0 | 0 | 13 | 1,351 |
| 4 | 34 | 572 | 1398 | 271 | 11 | 0 | 0 | 162 | 268 |
| 5 | 22 | 132 | 121 | 31 | 3 | 0 | 0 | 24 | 5 |
| 6 | 12 | 38 | 51 | 7 | 1 | 0 | 0 | 5 | 16 |
| 7 | 66 | 231 | 198 | 30 | 2 | 0 | 0 | 24 | 1,067 |
| 8 | 3 | 13 | 8 | 1 | 2 | 0 | 0 | 3 | 3,267 |
| 9 | 20 | 228 | 156 | 15 | 0 | 0 | 1 | 8 | 181 |
| 10 | 3 | 11 | 41 | 19 | 0 | 0 | 0 | 13 | 88 |
| 11 | 22 | 140 | 109 | 20 | 4 | 0 | 0 | 18 | 27 |
| 13 | 3 | 1 | 7 | 3 | 2 | 0 | 0 | 4 | 12 |
| 14 | 3 | 6 | 4 | 2 | 0 | 0 | 0 | 2 | 14 |
| 15 | 22 | 290 | 354 | 47 | 4 | 0 | 0 | 32 | 229 |
| 16 | 20 | 114 | 44 | 2 | 1 | 0 | 0 | 2 | 796 |
| 17 | 4 | 84 | 62 | 5 | 0 | 0 | 0 | 3 | 110 |
| 18 | 3 | 30 | 31 | 3 | 0 | 0 | 0 | 3 | 93 |
| 19 | 13 | 100 | 219 | 52 | 4 | 0 | 0 | 33 | 98 |
| 20 | 0 | 9 | 17 | 5 | 0 | 0 | 0 | 4 | 67 |
| 21 | 4 | 35 | 23 | 4 | 2 | 0 | 0 | 4 | 2 |
| 22 | 0 | 3 | 2 | 0 | 1 | 0 | 0 | 1 | 2 |
| 23 | 2 | 0 | 10 | 2 | 0 | 0 | 1 | 2 | 1 |
| 24 | 1 | 30 | 34 | 11 | 0 | 0 | 0 | 4 | 2 |
| 25 | 11 | 94 | 126 | 37 | 6 | 1 | 0 | 29 | 1 |
| 26 | 19 | 79 | 67 | 15 | 5 | 0 | 0 | 13 | 2 |

**Appendix Table 6.** **1987 Area 3A trawl catch in number per four nm of halibut by centimeter size groups.**

| | Halibut by centimeter size group | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Location | 50-59 | 60-69 | 70-79 | 80-89 | 90-99 | 100-109 | 110+ | 82-99 |
| 27 | 79 | 27 | 11 | 3 | 0 | 0 | 0 | 2 |
| 28 | 8 | 13 | 7 | 2 | 2 | 0 | 0 | 4 |
| 29 | 40 | 37 | 30 | 7 | 7 | 3 | 5 | 12 |
| 30 | 61 | 23 | 5 | 3 | 0 | 1 | 3 | 3 |
| 31 | 12 | 3 | 3 | 4 | 1 | 2 | 4 | 3 |
| 32 | 5 | 4 | 2 | 7 | 0 | 2 | 7 | 7 |
| 33 | 30 | 33 | 19 | 4 | 3 | 0 | 2 | 7 |
| 34 | 217 | 64 | 25 | 1 | 5 | 0 | 3 | 6 |
| 35 | 2 | 0 | 2 | 2 | 0 | 0 | 1 | 2 |
| 36 | 2 | 0 | 0 | 2 | 0 | 1 | 1 | 2 |
| 37 | 1 | 0 | 0 | 0 | 0 | 2 | 6 | 0 |
| 38 | 0 | 0 | 2 | 1 | 0 | 0 | 4 | 1 |
| 39 | 0 | 3 | 3 | 2 | 0 | 0 | 0 | 1 |
| 40 | 3 | 2 | 5 | 4 | 1 | 3 | 3 | 5 |
| 41 | 0 | 1 | 3 | 1 | 2 | 2 | 0 | 3 |
| 42 | 2 | 1 | 0 | 0 | 0 | 4 | 3 | 0 |
| 43 | 9 | 12 | 9 | 5 | 2 | 3 | 5 | 4 |
| 44 | 0 | 3 | 2 | 5 | 7 | 3 | 7 | 11 |
| 45 | 15 | 19 | 9 | 3 | 1 | 3 | 1 | 4 |
| 46 | 0 | 2 | 1 | 4 | 0 | 1 | 2 | 4 |
| 47 | 2 | 0 | 1 | 2 | 0 | 0 | 1 | 2 |
| 48 | 2 | 7 | 0 | 2 | 0 | 0 | 4 | 2 |
| 49 | 11 | 31 | 32 | 40 | 31 | 21 | 19 | 60 |
| 50 | 4 | 6 | 3 | 1 | 3 | 3 | 3 | 4 |
| 51 | 0 | 1 | 2 | 1 | 0 | 1 | 1 | 1 |
| 53 | 3 | 16 | 16 | 12 | 3 | 4 | 2 | 13 |
| 54 | 4 | 2 | 3 | 4 | 2 | 2 | 2 | 6 |

**Appendix Table 7.** **1983 catch in number of 82 to 99 cm halibut and effort by area and sampling location.**

| Area 2B | | | | | Area 3A | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Location | Setline Catch | Setline Effort (Skates) | Trawl Catch | Trawl Effort (nmi) | Location | Setline Catch (skates) | Setline Effort | Trawl Catch (nmi) | Trawl Effort |
| 1 | 4 | 5 | 1 | 3.8 | 19 | 21 | 16 | 1 | 6.5 |
| 2 | 10 | 16 | 3 | 6.9 | 20 | 25 | 16 | 1 | 6.6 |
| 3 | 21 | 16 | 23 | 8.9 | 21 | 13 | 16 | 1 | 7.8 |
| 4 | 22 | 16 | 1 | 6.3 | 22 | 13 | 16 | 2 | 8.9 |
| 5 | 14 | 16 | 1 | 6.1 | 23 | 8 | 16 | 2 | 8.5 |
| 6 | 15 | 15 | 2 | 7.4 | 24 | 10 | 16 | 1 | 0.5 |
| 7 | 13 | 15 | 8 | 9.2 | 25 | 4 | 16 | 1 | 8.4 |
| 8 | 14 | 12 | 6 | 6.9 | 26 | 5 | 12 | 1 | 6.3 |
| 9 | 10 | 12 | 1 | 4.7 | 27 | 5 | 16 | 3 | 8.4 |
| 10 | 6 | 12 | 4 | 6.2 | 28 | 8 | 16 | 3 | 8.4 |
| 11 | 1 | 12 | 1 | 2.9 | 29 | 8 | 16 | 2 | 8.4 |
| 12 | 2 | 6 | 1 | 3.1 | 30 | 1 | 16 | 1 | 8.4 |
| 13 | 1 | 16 | 7 | 5.5 | 31 | 11 | 16 | 1 | 3 |
| 14 | 3 | 12 | 5 | 4.6 | 32 | 10 | 16 | 6 | 9 |
| 15 | 15 | 16 | 5 | 3.8 | 33 | 13 | 16 | 4 | 8.9 |
| 16 | 10 | 10 | 1 | 5.8 | 34 | 13 | 16 | 11 | 8.6 |
| 17 | 1 | 16 | 1 | 8.4 | 35 | 10 | 16 | 4 | 9.1 |
| 18 | 1 | 16 | 4 | 8.4 | 36 | 15 | 16 | 4 | 8.3 |
| | | | | | 37 | 14 | 16 | 15 | 9 |
| | | | | | 38 | 1 | 16 | 1 | 6.5 |
| | | | | | 39 | 2 | 16 | 2 | 7.9 |
| | | | | | 40 | 3 | 16 | 2 | 8.5 |

**Appendix Table 8.** **Percent catch in number by species in the Hecate Strait - Queen Charlotte Sound setline grid surveys (Area 2B) between 1977 and 1986[1].**

| | Straight-shank "J" hook gear | | | | | | | Circle hook gear | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1977 | 1978 | 1980 | 1981 | 1982 | 1983 | 1984 | 1984 | 1985 | 1986 |
| Halibut | 5.0 | 4.3 | 9.8 | 5.0 | 9.5 | 6.8 | 9.6 | 16.4 | 12.9 | 12.3 |
| Dogfish | 60.1 | 73.7 | 47.8 | 62.6 | 43.6 | 76.3 | 60.8 | 50.6 | 71.0 | 55.7 |
| Sablefish | 11.0 | 5.5 | 13.1 | 9.0 | 12.2 | 2.4 | 7.6 | 11.8 | 4.3 | 8.2 |
| Rockfish | 6.4 | 5.1 | 7.9 | 6.0 | 10.8 | 2.8 | 7.6 | 10.3 | 6.3 | 10.4 |
| Skates | 6.1 | 3.8 | 8.6 | 6.7 | 13.2 | 5.5 | 8.7 | 6.6 | 4.3 | 8.0 |
| Starfish | 8.0 | 4.4 | 9.0 | 9.0 | 7.7 | 5.2 | 3.1 | 1.1 | 0.2 | 1.7 |
| P. cod | 0.2 | 0.1 | 0.3 | Tr | 0.2 | Tr | 0.2 | 0.4 | Tr | 0.2 |
| Arrowtooth | 0.8 | 1.0 | 1.6 | 0.5 | 1.2 | 0.2 | 0.8 | 1.7 | 0.3 | 1.6 |
| Cottids | — | — | — | — | — | — | — | — | — | — |
| Other | 2.4 | 2.1 | 1.9 | 1.2 | 1.6 | 0.8 | 1.6 | 1.1 | 0.7 | 1.9 |

[1]No setline grid survey in 1979.

**Appendix Table 9.** **Percent catch in number by species in the Portlock - Albatross setline grid surveys (Area 3A) between 1977 and 1986[1].**

| | Straight-shank "J" hook gear | | | | | | | Circle hook gear | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1977 | 1978 | 1980 | 1981 | 1982 | 1983 | 1984 | 1984 | 1985 | 1986 |
| Halibut | 21.3 | 23.5 | 34.2 | 53.3 | 57.0 | 49.9 | 50.1 | 61.8 | 62.5 | 47.3 |
| Dogfish | 0.3 | 0.2 | 0.2 | 0.4 | 0.4 | 2.1 | 1.4 | 0.9 | 3.7 | 1.0 |
| Sablefish | 2.3 | 3.0 | 6.7 | 3.1 | 4.7 | 2.4 | 5.0 | 8.8 | 2.8 | 14.2 |
| Rockfish | 0.1 | 0.3 | 0.6 | 0.2 | 0.4 | 0.2 | Tr | 0.8 | 0.3 | 1.0 |
| Skates | Tr | 0.6 | 0.2 | 2.3 | 0.4 | 1.1 | 1.8 | 0.7 | 1.2 | 1.4 |
| Starfish | 30.1 | 31.9 | 30.1 | 22.3 | 19.6 | 18.4 | 13.1 | 2.7 | 1.3 | 0.7 |
| P. cod | 26.6 | 21.6 | 7.6 | 9.0 | 11.2 | 18.2 | 20.6 | 17.9 | 23.0 | 28.7 |
| Arrowtooth | 0.9 | 0.2 | 1.1 | 1.0 | 1.0 | 3.1 | 3.5 | 4.1 | 3.2 | 3.5 |
| Cottids | 17.2 | 16.6 | 13.9 | 6.7 | 4.3 | 2.9 | 3.3 | 2.1 | 1.3 | 0.1 |
| Other | 1.2 | 2.1 | 5.4 | 1.7 | 1.0 | 1.7 | 1.2 | 0.2 | 0.7 | 2.1 |

[1]No setline grid survey in 1979.