OCEAN SALMON STUDIES IN THE PACIFIC SUBARCTIC BOUNDARY AREA



by

R. LeBrasseur, B. Riddell, and T. Gjernes

Dept. of Fisheries and Oceans

Biological Sciences Branch

Pacific Biological Station

Nanaimo. B.C. V9R 5K6

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## INTRODUCTION

The various species of Pacific Salmonids have been demonstrated to range widely across the North Pacific Ocean using the oceanic resources as a common pasture. However, there are seasonal and interannual variations in the numbers of fish using this pasture, the feeding conditions of the pasture, and the size of the pasture. Superimposed on this natural variability is an exploitation rate by commercial fisheries which is only partially documented, and there are concerns that the undocumented portion has recently increased through the incidental catch of salmon in fisheries directed at other species. One of Canada's research goals is to improve understanding of salmon biology and thereby to protect and improve the Canadian salmonid stocks. Clearly a part of this goal lies in understanding the events which may impact on the production of salmon while they are in the ocean and in identifying constraints. This report deals with the first Canadian salmon research cruise in two decades directed at mid-ocean salmonid biology.

## OBJECTIVES

1. Develop testable hypotheses for evaluating the effect(s) of ocean variability on salmonids.

2. Develop guidelines for assessing the potential impact of commercial mid-ocean fisheries on Canadian salmon and the effect of these fisheries on other surface fish species.

3. Evaluate the Canadian research trawler, W. E. Ricker, for fishing surface gillnets and longlines.

The survey area (38-45 N latitude, 150-180 W longitude) straddles an identifiable oceanographic feature, Pacific Subarctic Boundary, (Dodimead et al. 1963), and was considered likely to contain varying numbers of all species of interest during the spring and early summer. In addition, commercial vessels could be expected to begin fishing for squid with surface gillnets near the southern portion of this area in June. The W. E. Ricker departed Nanaimo May 25, commenced fishing June 3, refuelled in Hawaii June 15, and returned to the fishing grounds June 23. The survey terminated in Nanaimo July 5. Two transects were made through the survey area. The scope of the study was constrained by available time and the ship's cruising range.

Surface gillnets (each panel consisted of 50 m of 115 mm mesh monofilament netting 90 mesh deep (10.4 m) and floating longline (each skate consisted of a 138 m mainline with floats and 49 hooks on 1 m gangions at approximately 1.5 m intervals) were the primary gear used for the test fishing. Once in the fishing area the local weather determined fishing activities. In general, gillnets were fished where salmon were expected to be rare or absent and longlines fished where salmon were sufficiently abundant to tag. Usually about 2-3 km of gear was fished, more could have been fished but large samples of fish were not wanted and the methods of handling gear, new to the vessel, were being modified from one fishing station to the next.

Gillnets were fished from early evening to sunrise, a soak time of 10-12 hours. The gillnets (50-60 panels) were laid out on the deck prior to setting. Each end was marked with a radio beacon and a flashing xenon light. In addition, on the pickup end was a radar reflector. The nets were set with the ship travelling upwind at about 2 knots. About 30 minutes was required to set 60 panels. After the net was in the water the ship returned downwind and maintained a position off the end of the net. Hauling usually commenced about 0700 hr and was completed 3-5 hours later, rough weather having a significant impact on the hauling time. When fishing with longline, the gear was set about 30 minutes before civil twilight and was allowed to soak for 40-50 minutes. Between 10-30 skates of longline baited with salted anchovy ca., 8-10 cm length were set. The longline was retrieved by hand hauling. The total time for longline fishing required 3 to 4 1/2 hr. Due to space constraints along the bulwarks near the hauling position the fish had to be lifted from the water on the line rather than by dip net. A number of fish suffered severe hook damage as a result.

Oceanographic observations were collected in three ways: CTD casts (temperature, conductivity and transparency) were made nightly to 1000 m, temperature profiles of the upper 450 m were made at 6 hour intervals (XBT) and surface temperature and conductivity were continuously monitored (Institute Ocean Sciences participation). These data were used to characterize the water where fish were caught. In addition, during the outbound transect an oblique tow from approximately 500 m depth with a 1.9 m Isaacs-Kidd (IK) trawl (B.C. Provincial Museum participation) and an oblique tow from 50 m with a bongo net were made nightly. These tows took approximately 1.5 hr. The purpose of the IK tows was to obtain mesopelagic fish specimens for the Museum, while the bongo tows were to obtain samples of near surface zooplankton communities. An independent watch was maintained for sightings of marine mammals and debris whenever light and sea conditions permitted (USA, N.O.A.A. participation).

Data from the ancillary observations outlined above will be reported separately.

Salmonids taken in the gillnet were identified, fork length measured to the nearest cm and examined for marks and missing fins. Samples collected from each salmon included: stomach contents, scales, and tissue samples for electrophoretic stock identification. Carcasses were frozen and retained. Heads of salmonids with an adipose fin clipped were retained for examination for coded-wire tags. Other species were identified, counted, measured and samples retained for specific studies by other investigators, e.g., albacore - otoliths, shark-vertebrae etc. Salmon taken by longline were identified, measured, scales taken, and then tagged with Peterson disc tags and released. Fish with missing fins were treated similarly. Salmonids that were dead when landed were treated as for the gillnet samples. Other species were counted and measured. Birds caught on either gear were released alive if possible otherwise formalin was put down the throat of the dead birds to preserve stomach contents and the bird frozen for subsequent examination at the Bamfield Marine Station. The one mammal landed, a Dall Porpoise, was dissected aboard and body parts preserved for examination at U.S. National Marine Mammal Laboratory, Seattle.

## RESULTS AND DISCUSSION

Table 1 lists the positions of observations made while the vessel was stopped (CTD,tows,fishing). Most of the 11 gillnet stations were made within 2 degrees of 40 N latitude . However, two sets were made to the south (34 N lat.) to estimate how broadly (latitudinally) squid were distributed. At Station 9, 9 skates of longline was lost due to a combination of rough seas and a large catch of pomfret. (The response of pomfret when caught was to swim downwards and with large numbers they were able to pull the floats below the surface).

Salmonids were caught at 6 locations from 39:37 N-50 N latitude, Table 2. Previous fishing for salmon by Canadian vessels in the area west of 150 W longitude had not sampled waters south of 42 N latitude and no salmon had been previously caught south of 46 N during June in this area. It is also of interest that all 6 species of North American salmonids were caught. The catch of coho salmon was larger than expected on the basis of earlier studies. A total of 158 salmonids were landed of which 124 were taken on the longline with 102 being tagged and released (Appendix 1).

Identification of some of the tagged salmon was uncertain due to unfamiliarity with the appearance of salmon beyond coastal waters where they acquire distinctive coloration and to the lack of time for examining fish to be tagged in order to minimize handling stress. Some errors in identification were corrected from subsequent scale or electrophoresis analyses made at the Pacific Biological Station; these corrections have been incorporated in all salmonid data.

Among the 19 species of fish caught by gillnet, pomfret (*Brama japonica*), flying squid (*Ommastrephes bartrami*) and blue shark (*Prionace glauca*) and salmonids were the most numerous. The longline caught salmonids and pomfret. The catch of birds and marine mammals was low and might have been further reduced by hauling the gear earlier and faster. It was apparent that with increasing light levels and/or soak time more animal life collected near the gear. Gillnets caught a greater variety of fish species than the longline but the longline gear was not fished south of 39 N.

Squid were caught as far south as the Ricker fished. However, in the southern area the catch was small and the specimens had a conspicuous load of parasites embedded in the mantle flesh.

It is significant to note that flying squid and salmonids can cohabit the same areas and at surface water temperatures more commonly associated with salmon than squid. This finding has been reported previously to INPFC (Burgner and Meyer 1983), and serves to emphasize that surface temperatures are at best only an indication of the species that might be expected. Some of the best catches of pomfret and squid in the gillnet were at locations where salmon were caught. Salmonids were caught in 3 of the 5 largest catches of squid (including the largest). At all these stations the surface temperature was less than 12 C. Also, with respect to surface water temperature it was observed that squid catches in excess of 1 per panel were all made at temperatures less than 12 C while at temperatures of 14 C or greater the squid catch was less than 0.1 per panel, Table 2. The commercial Japanese squid fishing vessels were observed to be fishing immediately to the south, Table 3, in waters where the surface temperature was 12 C or greater. In the area of Japanese squid fishing, the Ricker squid catches were less than the maximum observed at stations within 100 nautical miles to the north. On the return transect a second group of vessels (unidentified) were observed north of 40 N fishing at surface temperatures of less than 12 C, in an area where salmonids were present.

Surface gillnets fished by individual commercial vessels were observed to extend from 40 to 50 km, approximately 16-20 times the amount of gear fished by the Ricker. The discrepancy between commercial scale operations and that of the Ricker will lead to an underestimate of the potential impact of squid fishing. In areas where salmon are rare there will be a lower likelihood of salmon being caught by smaller amounts of gear. However, in areas where repeated test fishing shows no salmonids it is unlikely that the squid fishery has any direct effect on salmonid populations. In the present situation the northern licenced boundary for the Japanese commercial squid fishery (40 N for June) appeared to provide a degree of protection for salmonids. Further, salmonids might have been expected to range further south than normal since surface water temperatures were approximately 2 degrees C cooler this year than the reported long term mean values (Robinson 1976).

Previous high seas fishing which has included comparisons of longline and monofilament gillnet catches has shown that the principle advantage of the longline is the condition of the fish, i.e., alive. In addition, the longline catches a wider size range of salmonids, more small fish, than 115 mm mesh gillnet. However, both gears are known to be highly selective (Hart 1975; Takagi and Ishida 1971). Each gear type offers different advantages depending upon the research objectives. In the boundary area where flying squid distributions can overlap with salmonids the gillnet is clearly the more suitable gear since it catches both groups.

On 8 of 10 occasions pomfret were taken by the gillnet in larger numbers than squid and on three occasions they were more abundant by a factor of 10 or more, Table 4. At three of the four locations where pomfret were most abundant salmon were caught. One feature with respect to catches of salmonids, pomfret and squid would be to determine to what extent pomfret tend to occupy waters between salmon and squid and whether or not their presence could be used to indicate the likely presence of the other species in sharply defined oceanographic boundary areas. Such an association could be particularly useful for avoiding salmon in areas where salmon are scarce but not absent.

During the recovery of the gillnet 2 persons made independent counts of the catch per species per panel (the frequency with which a species was clumped with other fish of the same species), and the numbers of fish that dropped out before the net was cleared. Differences in the deck count (fish processed on deck) and those of the observers were seldom substantive, but where discrepancies occurred it was generally a result of the deck count being higher than the observer count. Thus, particularly in the case of large catches or when hauling the net required that a portion of it be let out again while the ship manoeuvred, differences in counts were inevitable. In the case of fish dropping from the net before the reaching the deck, Table 5, there are some interesting comparisons. For example, both observers were able to note that a steelhead with an adipose fin missing fell out. In addition, sometimes there was more than a twofold difference in counts (at Station 8 where one person reported 26 pomfret and 5 squid lost but the other person noted none it seems likely that factors other than counting were operating). In general, the incidence of dropouts reflected the size of the catch but no set was made without some fish being lost.

Counts by panel indicate a contagious (aggregated) distribution for squid and pomfret. Counts from panels at the far end of the net were often low or missed because the net was tangled and doubled back on itself. Thus the number of panel counts did not always correspond with the number of panels fished. Pomfret catch per panel per set for all sets made are recorded in Table 6 and for squid in Table 7. Spatial aggregation was analyzed for all sets which caught more than 100 pomfret or squid.

Catch aggregation by panel was evaluated by comparing the observed cumulative catch (over the panels fished each night) to the expected cumulative catch if the squid and pomfret were evenly distributed between panels. The expected catch distribution simply being calculated as the average number of squid or pomfret caught (observed catch divided by the number of panels fished). The Kolmogorov-Smirnov test for goodness of fit (Sokal and Rolf 1981) was used to compare expected and observed distributions. Pomfret were more evenly distributed than squid but even the least aggregated pattern (pomfret at Station 26, Table 6) deviated significantly ($D = 0.1093$, $P > 0.01$) from a uniform catch per panel (Fig. 1, 2). Further, these statistics do not account for the sequence of catches per panel. Frequently, adjacent panels had large catches and the separation between panels is an artifact of how the catch were recorded. Groups of animals were often observed at the end of one panel and the beginning of the next. This recording artifact would result in minimal estimates of the aggregation.

Observations of the Japanese squid fishing operation clearly indicate that large numbers of pomfret are discarded. The mortality of these fish is unknown but information on pomfret catch per kilometer (20 panels gillnet) can be used in approximation of the numbers of pomfret encountering surface drift nets. A range of pomfret caught per kilometer was estimated from the observer counts per panel (Table 6) and the calculated mean ± 1 stnd. dev. multiplied by 20 panels for each set. The minimum catch rate was estimated as mean catch minus 1 stnd. dev. in each set averaged across 9 sets; similarly, the maximum rate was estimated as the mean plus 1 stnd. dev. The estimated range is 85.3 to 224.0 pomfret per kilometer. Using these values and applying conservative estimates about the number of vessels (350 vessels), amount of gear fished (40 km gillnet per vessel per night) and the number of fishing days (100 days out of a 180 day fishing season) it is apparent that

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numbers of pomfret may be discarded as an unwanted bycatch (100 million pomfret).

jor weakness of the foregoing is that the commercial vessels ng in the areas where the Ricker obtained maximum catches thus their average catch per km. could be lower and to some extent under the control of the individual commercial vessels. Further, the assessment assumes that the catch rates observed for one area are transferable to all areas. Other studies show that this is not the case (Jamieson and Heritage 1987). Nevertheless the conclusion that the gillnets can destroy large numbers of non-commercial species seems indisputable.

Steelhead were the only salmonid observed with missing adipose fins. A total of 22 steelhead were caught by gillnet and longline, Table 8. Among these, 13 were found with missing or damaged fins, two of these were tagged and released, and three were found with coded-wire tags. The coded-wire tagged fish were all recovered from the same set (Station 8) and all had multiple fin marks. Two were missing the left pectoral and the adipose fin ( pin #'s 102844, 633303), the other was missing the adipose, left pelvic and the left pectoral (pin # 102841). Each tagged steelhead was from a separate release of summer steelhead smolts from three hatcheries in the Snake River (upper Columbia R. drainage, USA). At the time of recovery these fish were 53, 55, and 51 cm fork length respectively. The other steelhead in the catch ranged in length from 51-61 cm, Table 9.

? pelvic

inconsistent w/ Table 8

Selectivity by the gillnet is suggested by the fork length measurements for salmonids, Table 9. However, the number of meaningful comparisons are limited. In the one instance where the gillnet and longline were fished together the catch was too few to permit comparison; and it is possible that the smaller salmon caught on the longline were more common in the areas fished by the longline. Salmon less than 40 cm are generally classed as immature and it is thought they will remain in the ocean for another year before undertaking their spawning migration. It is clear that these fish if they are present in the boundary area fished by gillnet vessels would not be caught by the 115 mm mesh (or larger) nets. Approximately, 25% of the longline catch included salmonids less than 40 cm fork length and many of these fish have completed less than one year in the ocean. It is of interest that they are as far from the nearest land as it is possible for salmon to get and still remain within the Pacific Subarctic. Repeated fishing in subsequent years along the Subarctic Boundary would indicate if these distributions of immature salmon are typical, in which case the distributions reported from ocean salmon studies conducted two decades earlier require further examination.

Length frequency distributions were also collected for flying squid, pomfret and blue shark (Fig. 3, 4, and 5), respectively. The squid were of one size group which ranged from 30 to 48 cm mantle length with only slight variations between stations or between sampling periods 20 days apart, Table 10. The distribution of pomfret lengths suggests a bimodal distribution, Table 11. The sample distribution deviates significantly from an hypothesized single normal distribution with the mean length and standard deviation of the sample (mean = 38.7 ± 2.87 cm; Kolmogorov-Smirnov test D = 0.132, n = 1624, P>0.01). Further, fewer small pomfret were collected in later sets (Stations 23-26), but the sample means of earlier and later samples were the same. Blue shark were the most numerous fish caught at the southernmost gillnet station where virtually all the sharks caught were less than 100 cm fork length, Figure 5. The largest blue shark (163 cm) caught during the cruise was caught at the most northerly gillnet station (Station 8).

Steelhead and coho are targets of intensive hatchery production in Canada and USA and they are a source of interest and concern to the fishing public and industry. Thus the concentration of steelhead and coho salmon at Station 8 and at nearby locations is also of interest. These sites are approximately 1000 km south of the areas fished intensively during the earlier studies. Catch rates in these more southerly areas were low but low catch rates in the presence of large amounts of fishing gear could still result in substantial catches of salmon, particularly if some fishing occurs at or north of 40 N latitude during June and early July. However, one year of observations are obviously inadequate for commenting on what the impact of this potential catch may be. Our observations in the area about 40 N latitude may not be repeatible since water temperatures in this area were cooler than normal. Further, although the catch of salmon in this area is unknown, it is likely to be low relative to the directed salmon fisheries. Consequently, the catches in this area are likely to only have significant impact on a salmon stock if the catch composition involves relatively few stocks. Impact assessment of this catch will therefore have to be closely associated with stock identification programs.

On the basis of the data collected during the W. E. Ricker survey of the salmon boundary region and the satisfactory experience gained in handling salmon gear, similar studies by this vessel in future years seem likely. However, the knowledge gained from one vessel operating in one area for one period of the year is limited, opportunities for furthering joint international fisheries-related research needs to be explored.

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Table 1. Observations made during W.E. RICKER salmon cruise, May 25-July 5, 1987.

| Station | Date | Julian day | Position Lat. | Position Long. | SFC Temp. | Fishing Effort Gillnet panels | Fishing Effort L-Line skates |
|---|---|---|---|---|---|---|---|
| 1 | 26-May | 146 | 4816.8 | 12510.1 | 10.1 | | |
| 2 | 27-May | 147 | 4551.4 | 12946.6 | 11.1 | | |
| 3 | 28-May | 148 | 4354.8 | 13351.2 | 12.0 | | |
| 4 | 30-May | 150 | 4134.1 | 13952.2 | 11.0 | | |
| 5 | 31-May | 151 | 4100.9 | 14439.5 | 10.8 | | |
| 6 | 1-Jun | 152 | 4059.5 | 14935.5 | 10.1 | | |
| 7 | 2-Jun | 153 | 4101.3 | 15502.9 | 10.6 | | |
| 8 | 3-Jun | 154 | 4058.7 | 15939.7 | 11.0 | 55 | 10 |
| 9 | 4-Jun | 155 | 3937.6 | 16104.4 | 11.9 | 54 | 1 |
| 10 | 5-Jun | 156 | 3850.0 | 16159.0 | 12.8 | | |
| 11 | 6-Jun | 157 | 3824.2 | 16224.1 | 12.9 | 54 | |
| 12 | 7-Jun | 158 | 3815.7 | 16213.7 | 13.4 | 53 | |
| 13 | 8-Jun | 159 | 3806.4 | 16226.2 | 14.4 | 53 | |
| 14 | 9-Jun | 160 | 3621.7 | 16158.7 | 15.5 | 51 | |
| 15 | 10-Jun | 161 | 3424.3 | 16122.2 | 17.2 | 52 | |
| 16 | 11-Jun | 162 | 3152.5 | 16047.6 | 18.1 | | |
| 17 | 12-Jun | 163 | 2732.0 | 15950.8 | 22.4 | | |
| 18 | 13-Jun | 164 | 2339.3 | 15859.4 | 24.0 | | |
| 19 | 19-Jun | 170 | 2650.4 | 15841.3 | 23.8 | | |
| 20 | 20-Jun | 171 | 3100.9 | 15851.4 | 21.7 | | |
| 21 | 21-Jun | 172 | 3509.2 | 15853.6 | 16.7 | | |
| 22 | 22-Jun | 173 | 3805.3 | 15942.8 | 13.3 | | |
| 23 | 23-Jun | 174 | 3940.7 | 16037.1 | 11.7 | 62 | |
| 24 | 24-Jun | 175 | 4015.2 | 15902.6 | 11.9 | 62 | |
| 25 | 25-Jun | 176 | 3948.4 | 15725.3 | 11.7 | 60 | |
| 26 | 26-Jun | 177 | 4119.8 | 15720.5 | 10.6 | 62 | |
| 27 | 27-Jun | 178 | 4241.9 | 15712.0 | 8.8 | | |
| 28 | 28-Jun | 179 | 4609.3 | 15437.4 | 6.9 | | |
| 29 | 29-Jun | 180 | 4648.8 | 15334.5 | 7.2 | | 20 |
| 29 | 29-Jun | 180 | 4806.7 | 15012.3 | 7.4 | | |
| 30 | 30-Jun | 181 | 4836.0 | 14852.0 | 7.6 | | 29 |
| 31 | 1-Jul | 182 | 5000.5 | 14459.4 | 8.2 | | 20 |
| 32 | 2-Jul | 183 | 4926.0 | 13640.0 | 10.9 | | |
| 33 | 2-Jul | 183 | 4917.0 | 13440.0 | 11.6 | | |
| 34 | 3-Jul | 184 | 4907.4 | 13240.0 | 11.7 | | |
| 35 | 3-Jul | 184 | 4858.2 | 13040.0 | 13.0 | | |
| 36 | 3-Jul | 184 | 4853.6 | 12940.0 | 13.3 | | |
| 37 | 3-Jul | 184 | 4849.0 | 12840.0 | 13.3 | | |
| 38 | 4-Jul | 185 | 4846.6 | 12810.0 | 13.5 | | |
| 39 | 4-Jul | 185 | 4844.6 | 12740.0 | 13.5 | | |
| 40 | 4-Jul | 185 | 4841.6 | 12710.0 | 13.4 | | |
| 41 | 4-Jul | 185 | 4839.0 | 12640.0 | 12.9 | | |
| 42 | 4-Jul | 185 | 4837.5 | 12620.0 | 12.9 | | |
| 43 | 4-Jul | 185 | 4836.0 | 12600.0 | 13.7 | | |
| 44 | 4-Jul | 185 | 4834.5 | 12530.0 | 13.1 | | |

Table 2. Fishing catch summary.

| Species | Station<br>Sfc. Temp. | 8<br>11.0 | 9<br>11.9 | 11<br>12.9 | 12<br>13.4 | 13<br>14.4 | 14<br>15.5 | 15<br>17.2 | 23<br>11.7 | 24<br>11.9 | 25<br>11.7 | 26<br>10.6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | A. GILLNET | | | | | | |
| Oncorhynchus Nerka | | | | | | | | | | | | |
| O. keta | | | 3 | | | | | | | | | |
| O. gorbuscha | | 2 | | | | | | | | | | |
| O. kisutch | | 10 | | | | | | | | | | 1 |
| O. tschawytscha | | | | | | | | | | | | |
| Salmo gairdnerii | | 17 | 1 | | | | | | | | | |
| Squalus acanthias | | | | | | | | | | | | 1 |
| lamna ditropis | | 1 | 1 | | 1 | 3 | | | | | | |
| Prionace glauca | | 1 | | | | | 32 | 130 | | | | |
| Alepisaurus ferox | | | | | | 1 | | | | | 1 | |
| Thunnus alalunga | | | | | | | 9 | | | | | |
| T. thynnus | | | | | | 1 | | 9 | | | | |
| Seriola dorsalis | | | | | | | | 5 | | | | |
| Mola mola | (released) | | | | | | | | 1 | 1 | | |
| Naucrates ductor | | | | | | | | 1 | | | | |
| Tetragonurus cuvieri | | | | | 1 | | | | | | | |
| Brama japonica | | 436 | 225 | 54 | 68 | 213 | 3 | | 135 | 1467 | 239 | 1292 |
| Tractes sp. | | | | 4 | 2 | | | | | | | |
| Ommastrephes bartrami | | 211 | 286 | 36 | 34 | 3 | 1 | 6 | 240 | 37 | 206 | 107 |
| Petrel sp. | | | 1 | | | | | | | | | |
| Tufted puffin sp. | | 3 | | | | | | | | | | |
| Laysan albatross | (released) | | 1 | | | | | | | | | |
| Black footed albatross | (released) | | | | | | | | 1 | | | |
| Sooty shearwater | (released-2) | | | | | | | | | 4 | 1 | |
| Dall porpoise | | | | | | | | | | 1 | | |
| Fur seal sp. | (drop out) | 1 | | | | | | | | | | |

| Species | Station<br>No. skates | 8<br>10 | 9<br>1 | 29<br>20 | 30<br>29 | 31<br>20 | Total | T&R |
|---|---|---|---|---|---|---|---|---|
| | | | | B. LONGLINE CATCH, TAG AND RELEASE | | | | |
| Oncorhynchus nerka | | | | 14 | 20 | 15 | 49 | 46 |
| O. keta | | 3 | | 3 | 34 | 2 | 42 | 32 |
| O. gorbuscha | | | | 3 | 13 | 3 | 19 | 16 |
| O. kisutch | | 1 | | 2 | 2 | 3 | 8 | 7 |
| O. tschawytscha | | | | 1 | | 1 | 2 | 2 |
| Salmo gairdnerii | | | | 3 | | 1 | 4 | 2 |
| Brama japonica | | 54 | 11 | | | | | |
| | | | | | | | 124 | 105 |

Notes: 1) Station 9, 9 skates lost.

Table 3. Sightings of offshore fishing vessels, W.E. RICKER, 1987.

| Date | Approx. Station | No. Vessels | Position | | Remarks |
|---|---|---|---|---|---|
| | | | Lat. | Long. | |
| 2 | 7 | 1 | 41 02 | 155 02 | Moving slowly, displaying fishing lights. |
| 6-9 | 11-13 | 6+ | 38 24 | 162 25 | Fishing along with J. squid gillnetters. |
| 22 | 21 | 1 | 35 26 | 158 47 | Radar sighting, drifting. |
| 25 | 25 | 4 | 40 04 | 158 07 | Running to south, confirmed gillnetters. |
| 27 | 26 | 3 | 41 14 | 157 19 | Running to west, radio contact re. fishing. |

NB. Radar contact generally less than 10 miles, attempts at radio contact generally ignored, visual contact usually brief under foggy conditions.

Table 4. Relative catch of salmonids, pomfret, and squid by gillnet.

| Station | Panels fished | Catch per 100 | | Panels squid | Catch per squid | |
|---|---|---|---|---|---|---|
| | | Salmon | Pomfret | | Salmon | Pomfret |
| 8 | 55 | 53 | 793 | 384 | 0.10 | 2.00 |
| 9 | 54 | 7 | 417 | 586 | 0.01 | 0.70 |
| 11 | 54 | 0 | 100 | 50 | | 2.00 |
| 12 | 53 | 0 | 130 | 33 | | 4.00 |
| 13 | 53 | 0 | 389 | 5 | | 78.00 |
| 14 | 51 | 0 | 6 | 2 | | 3.00 |
| 15 | 52 | 0 | 0 | 11 | | |
| 23 | 62 | 0 | 218 | 385 | | 0.60 |
| 24 | 62 | 0 | 2366 | 60 | | 39.00 |
| 25 | 60 | 0 | 398 | 343 | | 1.16 |
| 26 | 62 | 2 | 2082 | 172 | 0.01 | 12.10 |

Table 5. Fish lost from gillnet while hauling, observers (A, B).

| | Salmonid | | Pomfret | | Squid | | B. Shark | | Other Sp. | |
|---|---|---|---|---|---|---|---|---|---|---|
| Station | A | B | A | B | A | B | A | B | A | B |
| 8 | 1 | 1 | 26 | 0 | 5 | 0 | | | 1 | 0 |
| 9 | | | 7 | 5 | 5 | 3 | | | | |
| 11 | | | 6 | 3 | 0 | 1 | | | | |
| 12 | | | 5 | 4 | 1 | 1 | | | | |
| 13 | | | 7 | 7 | | | | | | |
| 14 | | | 1 | 1 | 1 | 1 | 1 | 4 | 1 | 1 |
| 15 | | | | | | | 9 | 5 | 1 | 0 |
| 23 | | | 10 | 19 | 4 | 4 | | | | |
| 24 | | | 16 | 48 | 2 | 1 | | | | |
| 25 | | | 8 | 10 | 1 | 1 | | | | |
| 26 | 1* | 1* | 14 | 30 | 1 | 1 | | | | |

*Steelhead with adipose clip.

Table 6. Observer counts of pomfret catch per gillnet panel.

**Station 8**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | Sum |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 3 | 8 | 4 | 13 | 7 | 5 | 8 | 12 | 8 | 72 |
| 6 | 9 | 14 | 12 | 16 | 11 | 8 | 5 | 9 | 3 | 93 |
| 8 | 10 | 5 | 9 | 18 | 12 | 13 | 8 | 4 | 3 | 90 |
| 17 | 16 | 4 | 9 | 6 | 6 | 9 | 4 | 0 | 8 | 79 |
| | | | | | | | | | Mean | 8.3 |
| | | | | | | | | | Std. Div. | 4.2 |

**Station 9**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | Sum |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8 | 11 | 4 | 3 | 8 | 3 | 6 | 3 | 3 | 50 |
| 7 | 8 | 4 | 2 | 4 | 4 | 5 | 5 | 2 | 3 | 44 |
| 4 | 5 | 4 | 7 | 9 | 3 | 3 | 5 | 1 | 4 | 45 |
| 7 | 4 | 4 | 3 | 2 | 10 | 7 | 2 | 3 | 5 | 47 |
| 4 | 3 | 4 | 1 | 0 | 5 | 1 | 2 | 2 | 3 | 25 |
| 3 | 1 | | | | | | | | | 4 |
| | | | | | | | | | Mean | 4.1 |
| | | | | | | | | | Std. Div. | 2.4 |

**Station 11**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | Sum |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 5 |
| 0 | 2 | 0 | 0 | 1 | 0 | 2 | 0 | 3 | 1 | 9 |
| 1 | 0 | 3 | 2 | 5 | 1 | 1 | 3 | 1 | 2 | 19 |
| 4 | 0 | 1 | 6 | 0 | 3 | 1 | 1 | 0 | 2 | 18 |
| 0 | | | | | | | | | | |
| | | | | | | | | | Mean | 1.2 |
| | | | | | | | | | Std. Div. | 1.4 |

**Station 12**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | Sum |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 2 | 0 | 1 | 0 | 1 | 1 | 2 | 7 |
| 2 | 1 | 1 | 1 | 3 | 0 | 1 | 4 | 1 | 4 | 18 |
| 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 3 | 0 | 7 |
| 0 | 3 | 1 | 0 | 6 | 1 | 1 | 0 | 0 | 3 | 15 |
| 0 | 3 | 3 | 3 | 5 | 0 | 3 | | | | 17 |
| | | | | | | | | | Mean | 1.3 |
| | | | | | | | | | Std. Div. | 1.5 |

**Station 13**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | Sum |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 6 | 1 | 3 | 6 | 5 | 2 | 2 | 2 | 28 |
| 5 | 2 | 5 | 1 | 6 | 8 | 5 | 0 | 19 | 4 | 55 |
| 2 | 3 | 5 | 3 | 4 | 2 | 5 | 5 | 5 | 6 | 40 |
| 4 | 12 | 3 | 2 | 0 | 6 | 3 | 8 | 12 | 4 | 54 |
| 3 | 4 | 4 | 2 | 2 | 3 | 1 | 7 | 5 | 1 | 32 |
| 5 | 2 | | | | | | | | | 7 |
| | | | | | | | | | | 3 |
| | | | | | | | | | Mean | 4.1 |
| | | | | | | | | | Std. Div. | 3.3 |

**Station 23**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | Sum |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 6 | 0 | 12 |
| 1 | 0 | 2 | 2 | 3 | 0 | 4 | 5 | 0 | 3 | 20 |
| 4 | 5 | 2 | 1 | 3 | 3 | 0 | 3 | 4 | 2 | 27 |
| 3 | 2 | 5 | 5 | 8 | 2 | 6 | 5 | 4 | 2 | 42 |
| 8 | 0 | 2 | 2 | 1 | 0 | 2 | 1 | 0 | 1 | 17 |
| 7 | 2 | 4 | 3 | 3 | 6 | 1 | 3 | 4 | 3 | 36 |
| 1 | | | | | | | | | | 4 |
| | | | | | | | | | Mean | 2.5 |
| | | | | | | | | | Std. Div. | 2.0 |

**Station 24**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | Sum |
|---|---|---|---|---|---|---|---|---|---|---|
| 30 | 21 | 20 | 17 | 29 | 13 | 39 | 22 | 14 | 13 | 218 |
| 32 | 36 | 29 | 25 | 34 | 33 | 12 | 29 | 25 | 23 | 278 |
| 28 | 28 | 33 | 33 | 27 | 17 | 39 | 9 | 28 | 37 | 279 |
| 18 | 23 | 31 | 29 | 22 | 36 | 25 | 9 | 18 | 21 | 232 |
| 14 | 14 | 25 | 19 | 16 | 18 | 28 | 45 | 26 | 10 | 215 |
| 23 | 0 | | | | | | | | | 23 |
| | | | | | | | | | Mean | 24. |
| | | | | | | | | | Std. Div. | 8.4 |

**Station 25**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | Sum |
|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 3 | 3 | 0 | 1 | 1 | 3 | 7 | 1 | 3 | 37 |
| 3 | 3 | 5 | 6 | 6 | 2 | 7 | 0 | 8 | 3 | 43 |
| 4 | 3 | 6 | 1 | 4 | 6 | 3 | 7 | 11 | 6 | 51 |
| 1 | 2 | 5 | 3 | 7 | 7 | 0 | 3 | 0 | 0 | 28 |
| 0 | 0 | | | | | | | | | 0 |
| | | | | | | | | | Mean | 3.9 |
| | | | | | | | | | Std. Div. | 2.9 |

**Station 26**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | Sum |
|---|---|---|---|---|---|---|---|---|---|---|
| 8 | 17 | 17 | 19 | 18 | 27 | 22 | 20 | 14 | 28 | 190 |
| 17 | 23 | 24 | 21 | 20 | 19 | 19 | 26 | 13 | 18 | 200 |
| 19 | 20 | 37 | 17 | 19 | 16 | 18 | 27 | 21 | 18 | 212 |
| 20 | 20 | 29 | 29 | 22 | 26 | 19 | 32 | 23 | 14 | 234 |
| 18 | 13 | 28 | 12 | 21 | 26 | 14 | 19 | 22 | 24 | 197 |
| 10 | 8 | 9 | | | | | | | | 27 |
| | | | | | | | | | Mean | 20. |
| | | | | | | | | | Std. Div. | 5.3 |

Table 7. Observer counts of squid catch per gillnet panel.

**Station 8**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | Sum |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 2 | 4 | 1 | 11 | 0 | 3 | 11 | 0 | 0 | 35 |
| 1 | 1 | 1 | 15 | 7 | 3 | 1 | 3 | 4 | 3 | 39 |
| 2 | 2 | 0 | 7 | 0 | 0 | 8 | 1 | 1 | 8 | 29 |
| 57 | 0 | 3 | 0 | 9 | 0 | 0 | | | | 69 |

Mean 4.3
Std. Div. 9.2

**Station 9**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | Sum |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | 0 | 4 | 18 | 0 | 0 | 0 | 2 | 26 |
| 1 | 5 | 3 | 1 | 1 | 5 | 1 | 3 | 3 | 1 | 24 |
| 4 | 1 | 3 | 1 | 2 | 0 | 0 | 1 | 0 | 2 | 14 |
| 0 | 3 | 16 | 4 | 5 | 4 | 1 | 3 | 7 | 25 | 68 |
| 35 | 18 | 8 | 14 | 1 | 1 | 2 | 7 | 1 | 1 | 88 |
| 7 | 1 | 0 | | | | | | | | 8 |

Mean 4.3
Std. Div. 6.7

**Station 11**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | Sum |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 1 | 7 |
| 2 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 1 | 7 |
| 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 1 | 5 |
| 0 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 1 | 0 | 5 |
| 0 | | | | | | | | | | |

Mean 0.5
Std. Div. 0.7

**Station 12**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | Sum |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 4 |
| 0 | 0 | 3 | 2 | 1 | 1 | 2 | 0 | 2 | 0 | 11 |
| 0 | 0 | 0 | 2 | 2 | 0 | 2 | 1 | 1 | 0 | 8 |
| 0 | 3 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 6 |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | | | | 1 |

Mean 0.6
Std. Div. 0.9

**Station 13**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | Sum |
|---|---|---|---|---|---|---|---|---|---|---|

**Station 23**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | Sum |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 4 | 5 | 9 | 0 | 4 | 1 | 8 | 6 | 38 |
| 7 | 1 | 5 | 10 | 7 | 4 | 4 | 3 | 7 | 3 | 51 |
| 1 | 2 | 2 | 3 | 13 | 4 | 4 | 6 | 3 | 10 | 48 |
| 12 | 1 | 5 | 0 | 6 | 3 | 3 | 6 | 12 | 0 | 48 |
| 5 | 3 | 3 | 4 | 6 | 2 | 3 | 2 | 1 | 8 | 37 |
| 3 | 0 | 1 | 4 | 1 | 1 | 3 | 5 | 2 | 0 | 20 |
| 0 | 0 | | | | | | | | | |

Mean 4.4
Std. Div. 3.2

**Station 24**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | Sum |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 3 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 5 |
| 0 | 0 | 2 | 0 | 1 | 1 | 1 | 2 | 0 | 0 | 7 |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 3 | 3 | 3 | 11 |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 3 | 1 | 7 |
| 1 | 0 | 0 | 0 | 2 | 1 | 1 | 1 | 0 | 0 | 6 |
| 0 | 0 | | | | | | | | | |

Mean 0.6
Std. Div. 0.9

**Station 25**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | Sum |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 4 | 1 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 9 |
| 0 | 3 | 3 | 0 | 0 | 5 | 2 | 0 | 0 | 2 | 15 |
| 1 | 0 | 0 | 0 | 2 | 0 | 3 | 25 | 1 | 0 | 32 |
| 0 | 3 | 0 | 2 | 0 | 3 | 10 | 1 | 0 | 0 | 19 |
| 10 | 12 | 7 | 4 | 50 | 3 | 1 | 0 | 1 | 1 | 89 |
| 1 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 5 |
| 0 | 0 | | | | | | | | | 12 |

Mean 2.8
Std. Div. 7.2

**Station 26**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | Sum |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 1 | 0 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 8 |
| 1 | 4 | 1 | 0 | 1 | 0 | 9 | 0 | 0 | 0 | 16 |
| 0 | 1 | 1 | 0 | 1 | 7 | 4 | 3 | 3 | 2 | 22 |
| 3 | 0 | 1 | 0 | 0 | 2 | 0 | 2 | 1 | 3 | 12 |
| 1 | 1 | 2 | 0 | 1 | 1 | 0 | 1 | 3 | 0 | 10 |
| 0 | 6 | 4 | 0 | 4 | 7 | 0 | 6 | 1 | 0 | 28 |
| 4 | 1 | | | | | | | | | 17 |

Mean 1.7
Std. Div. 2.4

Table 8. Steelhead catch and numbers with missing fins.

| Station | Location | Date | Number | Missing fins | No. caught |
|---|---|---|---|---|---|
| 8 | 4058N 15939W | 3/6 | 17 | Adipose only | 6 |
| | | | | " + Left Pelvic | 2 |
| | | | | " + LP+LPectoral | 1 |
| | | | | None | 8 |
| 9 | 3937N 16104W | 4/6 | 1 | None | 1 |
| 29 | 4648N 15354W | 29/6 | 3 | Adipose...tagged | 1 |
| | | | | Adipose | 1 |
| | | | | Dorsal cut...tagged | 1 |
| 31 | 5000N 14959W | 1/7 | 1 | Adipose | 1 |

Table 9. Length frequency of salmonids.

| Fork Length (cm) | Gillnet | | | | | | Longline | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ch | Pi | Co | St | Ttl | % T | So | Ch | Pi | St | Ck | Co | Ttl | % T |
| 30 | | | | | | | 1 | | | | | | 1 | 0.8 |
| 31 | | | | | | | 1 | | | | | | 1 | 0.8 |
| 32 | | | | | | | | | | | | | | |
| 33 | | | | | | | 1 | 1 | | | | | 2 | 1.6 |
| 34 | | | | | | | 1 | | | | | | 1 | 0.8 |
| 35 | | | | | | | 1 | | | | | | 1 | 0.8 |
| 36 | | | | | | | 2 | | | | | | 2 | 1.6 |
| 37 | | | | | | | 2 | 1 | | | | | 3 | 2.4 |
| 38 | | | | | | | 2 | | | | | | 2 | 1.6 |
| 39 | | | | | | | 1 | 4 | | | | | 5 | 4.1 |
| 40 | | | | | | | | 3 | | | | | 3 | 2.4 |
| 41 | | | | | | | 1 | 6 | | | | | 7 | 5.7 |
| 42 | | | | | | | 1 | 5 | 1 | | | | 7 | 5.7 |
| 43 | | | | | | | 2 | 5 | | | | | 7 | 5.7 |
| 44 | | | | | | | 5 | 3 | 1 | | | | 9 | 7.3 |
| 45 | | | | | | | 8 | 2 | 1 | | | | 11 | 8.9 |
| 46 | | 1 | | | 1 | 2.9 | 3 | 5 | 2 | | | | 10 | 8.1 |
| 47 | | | | | | | 3 | 2 | 2 | | | | 7 | 5.7 |
| 48 | 1 | | | | 1 | 2.9 | 2 | 3 | 6 | | | | 11 | 8.9 |
| 49 | | 1 | | | 1 | 2.9 | 2 | | 1 | | | | 3 | 2.4 |
| 50 | | | 2 | | 2 | 5.9 | 1 | | 4 | | | 1 | 6 | 4.9 |
| 51 | | | | 2 | 2 | 5.9 | 2 | 1 | | | | | 3 | 2.4 |
| 52 | 1 | | | | 1 | 2.9 | 1 | | | | | 1 | 2 | 1.6 |
| 53 | 1 | | | 3 | 4 | 11.8 | 1 | | | 1 | | 1 | 3 | 2.4 |
| 54 | | | 1 | | 1 | 2.9 | | 1 | 1 | 1 | | | 3 | 2.4 |
| 55 | | | | 1 | 1 | 2.9 | 1 | | | 1 | | 1 | 3 | 2.4 |
| 56 | | | 1 | | 1 | 2.9 | | | | | | | | |
| 57 | | | 3 | 4 | 7 | 20.6 | | | | | | | | |
| 58 | | | 2 | 2 | 4 | 11.8 | | | | 1 | | | 1 | 0.8 |
| 59 | | | 1 | 2 | 3 | 8.8 | 1 | | | | | | 1 | 0.8 |
| 60 | | | | 1 | 1 | 2.9 | | | | | | | | |
| 61 | | | 1 | 2 | 3 | 8.8 | | | | | | 3 | 3 | 2.4 |
| 62 | | | | | | | | | | | | 1 | 1 | 0.8 |
| 63 | | | | | | | | | | | | | | |
| 64 | | | | | | | 1 | | | | | | 1 | 0.8 |
| 65 | | | | | | | 1 | | | | | | 1 | 0.8 |
| 66 | | | | | | | | | | | | | | |
| 67 | | | | 1 | 1 | 2.9 | | | | | 1 | | 1 | 0.8 |
| 87 | | | | | | | | | | | 1 | | 1 | 0.8 |
| Sum | 3 | 2 | 11 | 18 | 34 | | 48 | 42 | 19 | 4 | 2 | 8 | 123 | |

So = sockeye, Ch = chum, Pi = pink, St = steelhead, Ck = chinook, Co = coho.

Table 10. length frequency of gillnet caught squid, June 1987.

| Mantle length (cm) | Station | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 8 | 9 | 11 | 12 | 13 | 14 | 15 | Ttl | 23 | 24 | 25 | 26 | Ttl | Sum |
| <30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| 31 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 4 |
| 32 | 4 | 5 | 1 | 4 | 0 | 0 | 1 | 15 | 1 | 0 | 3 | 0 | 4 | 19 |
| 34 | 19 | 22 | 3 | 6 | 2 | 0 | 0 | 52 | 24 | 0 | 12 | 6 | 42 | 94 |
| 35 | 30 | 35 | 3 | 2 | 0 | 0 | 0 | 70 | 30 | 6 | 30 | 13 | 79 | 149 |
| 36 | 34 | 40 | 8 | 3 | 0 | 0 | 1 | 86 | 46 | 3 | 33 | 14 | 96 | 182 |
| 37 | 28 | 33 | 0 | 2 | 1 | 0 | 0 | 64 | 25 | 6 | 23 | 14 | 68 | 132 |
| 38 | 19 | 22 | 1 | 4 | 0 | 0 | 1 | 47 | 29 | 4 | 14 | 6 | 53 | 100 |
| 39 | 14 | 12 | 2 | 1 | 0 | 0 | 0 | 29 | 16 | 3 | 10 | 3 | 32 | 61 |
| 40 | 10 | 12 | 0 | 3 | 0 | 0 | 1 | 26 | 12 | 3 | 10 | 7 | 32 | 58 |
| 41 | 7 | 12 | 0 | 1 | 0 | 1 | 0 | 21 | 11 | 3 | 14 | 7 | 35 | 56 |
| 42 | 8 | 9 | 0 | 0 | 0 | 0 | 2 | 19 | 6 | 0 | 11 | 12 | 29 | 48 |
| 43 | 3 | 9 | 0 | 0 | 0 | 0 | 0 | 12 | 9 | 2 | 9 | 10 | 30 | 42 |
| 44 | 2 | 9 | 2 | 2 | 0 | 0 | 0 | 15 | 6 | 2 | 5 | 5 | 18 | 33 |
| 45 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 5 | 7 | 1 | 7 | 2 | 17 | 22 |
| 46 | 1 | 3 | 0 | 1 | 0 | 0 | 0 | 5 | 2 | 2 | 9 | 4 | 17 | 22 |
| 47 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 1 | 1 | 1 | 4 | 7 |
| 48 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 4 | 4 |
| 49 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 4 | 4 |
| 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sample sum | 201 | 254 | 25 | 33 | 3 | 1 | 6 | 523 | 239 | 37 | 204 | 107 | 587 | 1110 |
| Total catch | 211 | 286 | 36 | 34 | 3 | 1 | 6 | 577 | 240 | 37 | 206 | 107 | 590 | 1167 |

Table 11. length frequency of gillnet caught pomfret, June 1987.

| Mantle length (cm) | Station | | | | | | | | | | | | Sum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 8 | 9 | 11 | 12 | 13 | Ttl | 14 | 23 | 24 | 25 | 26 | Ttl | |
| <30 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| 30 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 |
| 32 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 2 |
| 33 | 2 | 16 | 1 | 0 | 1 | 20 | 0 | 1 | 3 | 4 | 0 | 8 | 28 |
| 34 | 4 | 36 | 5 | 5 | 9 | 59 | 0 | 3 | 17 | 10 | 4 | 34 | 93 |
| 35 | 7 | 47 | 9 | 9 | 16 | 88 | 0 | 14 | 44 | 22 | 7 | 87 | 175 |
| 36 | 6 | 29 | 8 | 14 | 24 | 81 | 0 | 25 | 88 | 32 | 14 | 159 | 240 |
| 37 | 8 | 19 | 3 | 6 | 17 | 53 | 0 | 21 | 52 | 19 | 23 | 115 | 168 |
| 38 | 16 | 17 | 2 | 4 | 11 | 50 | 0 | 15 | 16 | 26 | 62 | 119 | 169 |
| 39 | 26 | 15 | 5 | 6 | 19 | 71 | 0 | 20 | 6 | 29 | 58 | 113 | 184 |
| 40 | 39 | 21 | 6 | 4 | 29 | 99 | 0 | 9 | 10 | 42 | 69 | 130 | 229 |
| 41 | 27 | 12 | 5 | 7 | 23 | 74 | 0 | 11 | 6 | 23 | 29 | 69 | 143 |
| 42 | 10 | 6 | 8 | 2 | 14 | 40 | 0 | 8 | 3 | 13 | 14 | 38 | 78 |
| 43 | 6 | 4 | 1 | 1 | 17 | 29 | 0 | 3 | 1 | 11 | 2 | 17 | 46 |
| 44 | 0 | 0 | 1 | 5 | 12 | 18 | 0 | 2 | 0 | 3 | 4 | 9 | 27 |
| 45 | 0 | 2 | 0 | 2 | 9 | 13 | 2 | 2 | 0 | 2 | 0 | 6 | 19 |
| 46 | 0 | 0 | 0 | 2 | 6 | 8 | 0 | 0 | 1 | 2 | 1 | 4 | 12 |
| 47 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 48 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 2 | 3 |
| 49 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 3 |
| 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sample sum | 151 | 225 | 54 | 68 | 212 | 710 | 3 | 135 | 250 | 2239 | 287 | 914 | 1624 |
| Total catch | 436 | 225 | 54 | 68 | 213 | 996 | 3 | 135 | 1467 | 239 | 1292 | 3136 | 4132 |

Appendix table 1. Salmonids tagged and released, W. E. Ricker, 1987.

| Tag No. | Area | Position Lat. | Position Long. | Date dd/mm/yy | Species | Length (cm) | Scale:ID |
|---|---|---|---|---|---|---|---|
| W41200 | W5940 | 40 59 | 159 40 | 03/06/87 | Chum | 47.0 | Coho |
| 201 | | | | | | 50.0 | |
| 202 | | | | | | 40.0 | |
| W41203 | | | | | | 39.0 | |
| W41204 | W5346 | 46 47 | 153 38 | 29/06/87 | Sockeye | 44.0 | |
| 205 | | | | | Pink | 48.0 | |
| 206 | | | | | Sockeye | 49.0 | |
| 207 | | | | | Sockeye | 47.0 | |
| 208 | | | | | Sockeye | 43.0 | |
| 209 | | | | | Sockeye | 45.0 | |
| 210 | | | | | Chinook | 67.0 | |
| 211 | | | | | Sockeye | 50.0 | |
| 212 | | | | | Sockeye | 43.0 | |
| 213 | | | | | Sockeye | 42.0 | Chum |
| 214 | *adipose missing | | | | Steelhead | 53.0 | |
| 215 | | | | | Sockeye | 30.0 | |
| 216 | | | | | Sockeye | 34.0 | |
| 217 | | | | | Chum | 55.0 | Coho |
| 218 | | | | | Sockeye | 42.0 | |
| 219 | | | | | Sockeye | 36.0 | |
| 220 | *half dorsal | | | | Steelhead | 55.0 | |
| 221 | | | | | Pink | 48.0 | |
| 222 | | | | | Sockeye | 47.0 | |
| 223 | | | | | Sockeye | 43.0 | Chum |
| 224 | *224 missing | | | | Sockeye | 44.0 | Chum |
| 226 | | | | | Sockeye | 44.0 | |
| W41227 | | | | | Sockeye | 47.0 | |
| W41228 | W4848 | 48 35 | 148 53 | 30/06/87 | Sockeye | 44.0 | Chum |
| 229 | | | | | Sockeye | 46.0 | Chum |
| 230 | | | | | Sockeye | 45.0 | |
| 231 | | | | | Sockeye | 51.0 | Chum |
| 232 | | | | | Sockeye | 54.0 | Chum |
| 233 | | | | | Sockeye | 41.0 | Chum |
| 234 | | | | | Sockeye | 33.0 | |
| 235 | | | | | Pink | 46.0 | |
| 236 | | | | | Sockeye | 37.0 | |
| 237 | | | | | Pink | 48.0 | |
| 238 | | | | | Sockeye | 42.0 | Chum |
| 239 | | | | | Sockeye | 47.0 | Chum |
| 240 | | | | | Sockeye | 38.0 | |
| 241 | | | | | Sockeye | 48.0 | Chum |
| 242 | | | | | Sockeye | 53.0 | |
| 243 | | | | | Sockeye | 41.0 | Chum |
| W4124 | | | | | Sockeye | 46.0 | Chum |

Appendix table 1 (cont'd).

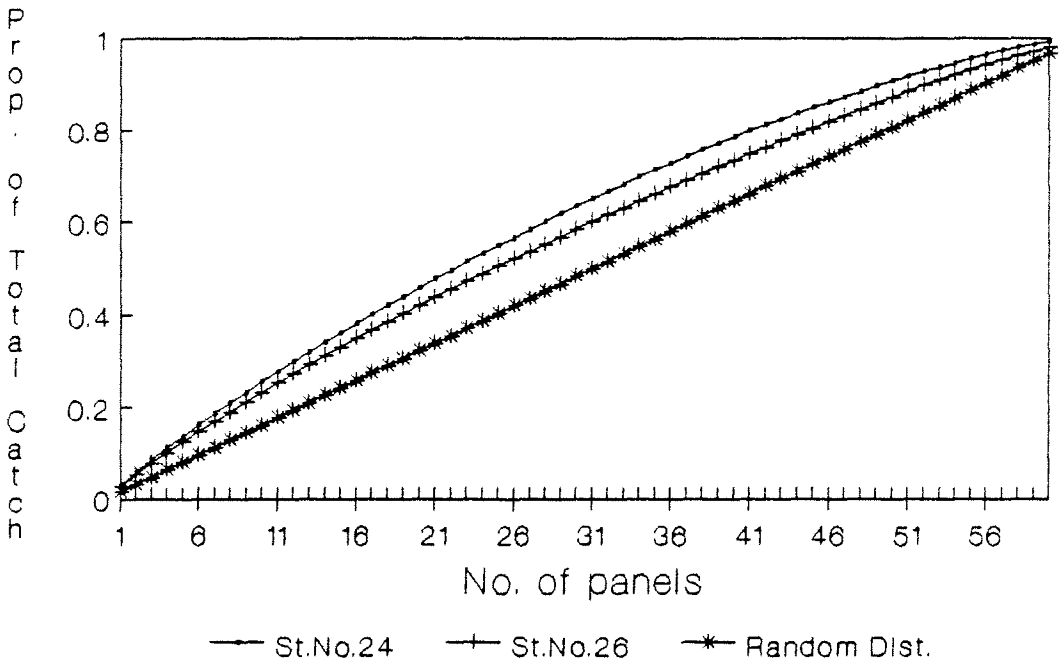
| Tag No. | Area | Position Lat. | Position Long. | Date dd/mm/yy | Species | Length (cm) | Scale:ID |
|---|---|---|---|---|---|---|---|
| W41245 | | | | | Sockeye | 40.0 | Chum |
| 246 | | | | | Sockeye | 45.0 | |
| 247 | | | | | Pink | 49.0 | |
| 248 | | | | | Pink | 46.0 | |
| 249 | | | | | Sockeye | 43.0 | Chum |
| 250 | | | | | Sockeye | 41.0 | Chum |
| 251 | | | | | Pink | 50.0 | |
| 252 | | | | | Sockeye | 46.0 | |
| 253 | | | | | Sockeye | 45.0 | |
| 254 | | | | | Pink | 50.0 | |
| 255 | | | | | Sockeye | 46.0 | Chum |
| 256 | | | | | Sockeye | 37.0 | |
| 257 | | | | | Pink | 48.0 | |
| 258 | | | | | Sockeye | 39.0 | Chum |
| 259 | | | | | Sockeye | 45.0 | |
| 260 | | | | | Sockeye | 45.0 | Chum |
| 261 | | | | | Pink | 41.0 | |
| 262 | | | | | Sockeye | 44.0 | |
| 263 | | | | | Sockeye | 41.0 | Chum |
| 264 | | | | | Sockeye | 44.0 | |
| 265 | | | | | Sockeye | 46.0 | Chum |
| 266 | | | | | Sockeye | 48.0 | Chum |
| 267 | | | | | Sockeye | 41.0 | |
| 268 | | | | | Sockeye | 39.0 | |
| 269 | | | | | Pink | 42.0 | |
| 270 | | | | | Sockeye | 39.0 | Chum |
| 271 | | | | | Sockeye | 45.0 | |
| 272 | | | | | Sockeye | 31.0 | |
| 273 | | | | | Pink | 50.0 | |
| 274 | | | | | Sockeye | 53.0 | Coho |
| 275 | | | | | Sockeye | 39.0 | Chum |
| 276 | | | | | Pink | 47.0 | |
| 277 | | | | | Sockeye | 44.0 | |
| 278 | | | | | Sockeye | 42.0 | Chum |
| 279 | | | | | Sockeye | 43.0 | Chum |
| 280 | | | | | Sockeye | 35.0 | |
| 281 | | | | | Sockeye | 42.0 | Chum |
| 282 | | | | | Sockeye | 36.0 | |
| 283 | | | | | Sockeye | 62.0 | Coho |
| W41284 | | | | | Pink | 48.0 | |
| W41285 | W4550 | 50 00 | 145 00 | 01/07/87 | Sockeye | 59.0 | |
| 286 | | | | | Sockeye | 55.0 | |
| 287 | | | | | Chum | 38.0 | Sockeye |

Appendix table 1 (cont'd).

| Tag No. | Area | Position Lat. | Position Long. | Date dd/mm/yy | Species | Length (cm) | Scale:ID |
|---|---|---|---|---|---|---|---|
| 288 | | | | | Sockeye | 45.0 | |
| 289 | | | | | Sockeye | 49.0 | |
| 290 | | | | | Sockeye | 51.0 | |
| 291 | | | | | Sockeye | 52.0 | Coho |
| 292 | | | | | Sockeye | 45.0 | |
| 293 | | | | | Pink | 54.0 | |
| 294 | | | | | Sockeye | 48.0 | |
| 295 | | | | | Sockeye | 48.0 | |
| W41296 | | | | | Chinook | 87.0 | |
| W41297 | | | | | Chum | 45.0 | |
| 298 | | | | | Chum | 61.0 | Coho |
| 299 | | | | | Sockeye | 38.0 | |
| W42200 | *NB. series changes | | | | Chum | 65.0 | Sockeye |
| 201 | | | | | Chum | 61.0 | Coho |
| 202 | | | | | Chum | 64.0 | Sockeye |
| 203 | | | | | Chum | 46.0 | |
| 204 | | | | | Pink | 47.0 | |
| W42205 | | | | | Sockeye | 52.0 | |

*Scale:ID shown when different from field identification.

## Figure 1. Cumulative Catch By Panel for Pomfret




## Figure 2. Cumulative Catch By Panel for Squid

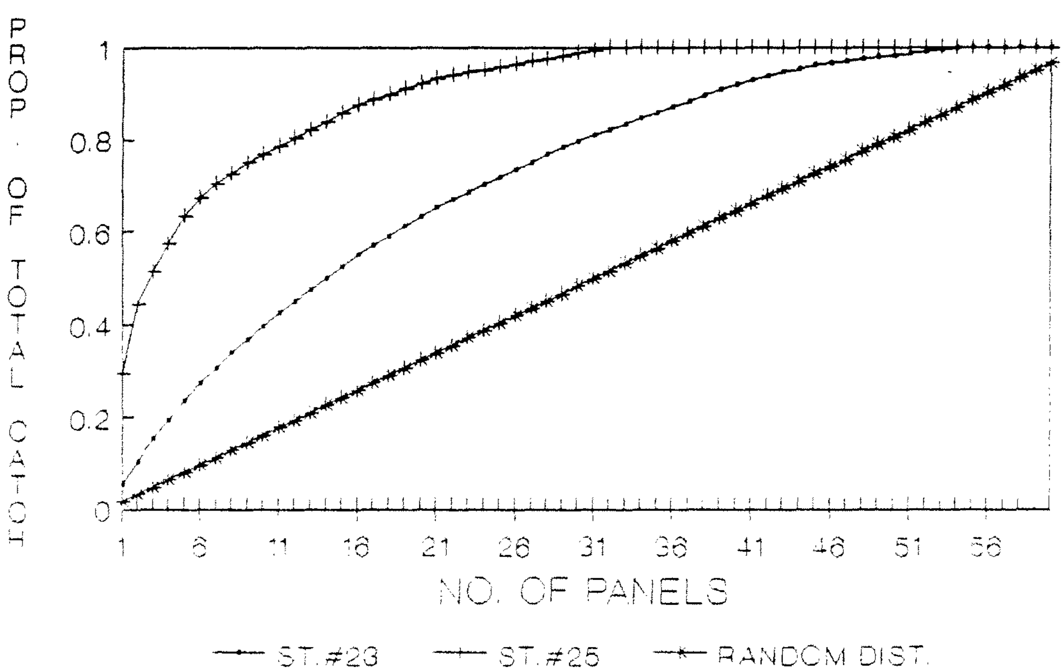


**Figure 3. Length distribution of Squid (mantle length).**

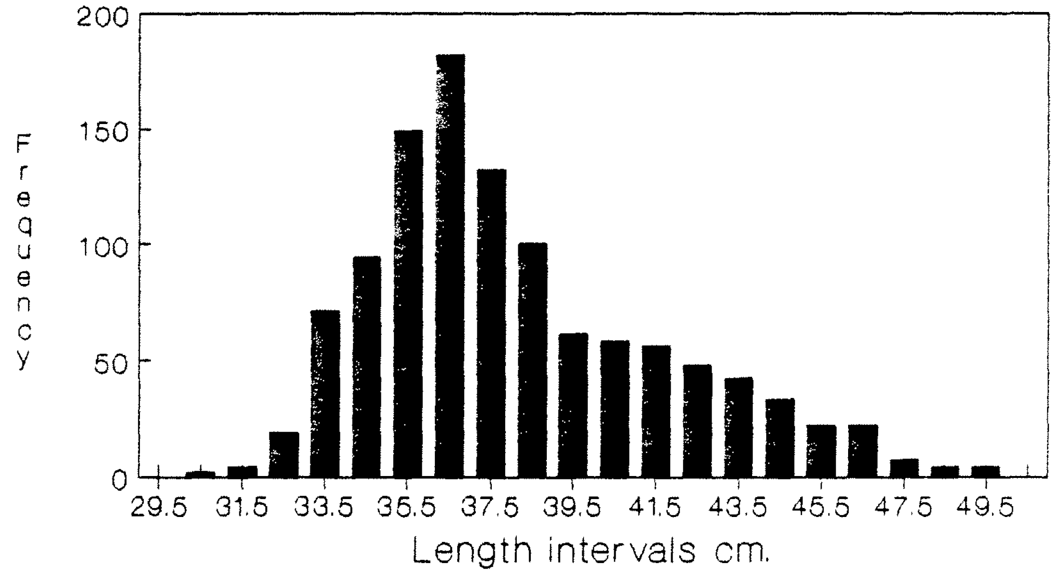



**Figure 4. Length frequency of Pomfret (fork length).**

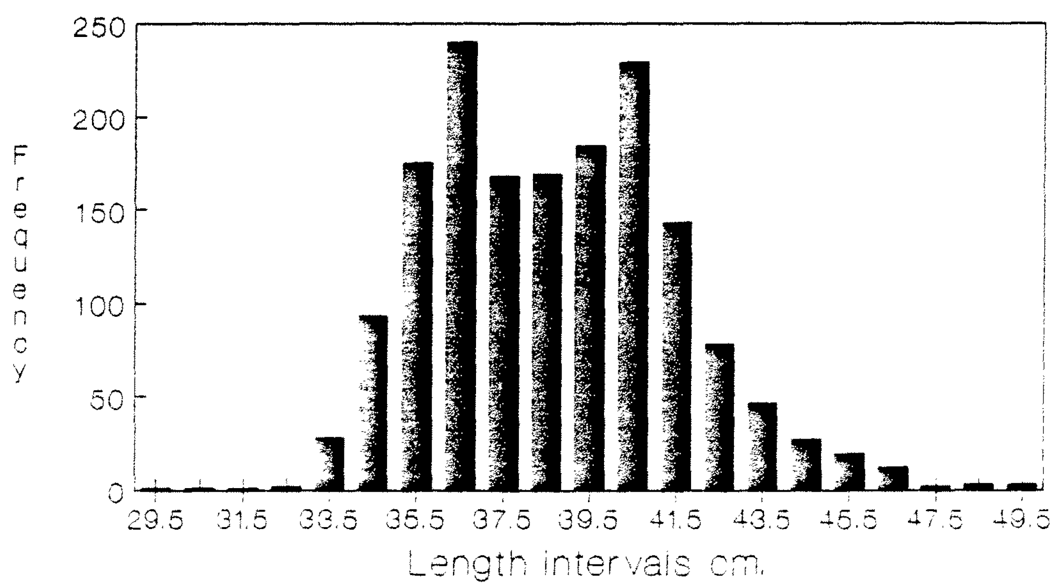


**Figure 5. Length distribution of Blue sharks (fork length).**