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Bottom Trawl and Exploratory Hydroacoustic Survey for Rockfish in Queen Charlotte Sound, June 20 to July 7, 1994

Hand, C. M., G. D. Workman, L. J. Richards, R. Kieser, R. I. Perry

Biological Sciences Branch
Department of Fisheries and Oceans
Pacific Biological Station
Nanaimo, British Columbia V9R 5K6

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BOTTOM TRAWL AND EXPLORATORY HYDROACOUSTIC SURVEY FOR ROCKFISH IN QUEEN CHARLOTTE SOUND, JUNE 20 TO JULY 7, 1994

by

C.M. Hand, G.D. Workman, L.J. Richards, R. Kieser and R.I. Perry

Department of Fisheries and Oceans

Biological Sciences Branch

Pacific Biological Station

Nanaimo, British Columbia V9R 5K6

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ABSTRACT

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A joint trawl/hydroacoustic survey of rockfish stocks in Goose Island Gully, Queen Charlotte Sound, was conducted by the M/V OCEAN SELECTOR and the R/V W.E. RICKER from June 20 to July 7, 1994. The purpose of this survey was to update the time series of biomass estimates of Pacific ocean perch from standard trawl surveys, to investigate the potential for hydroacoustic techniques to measure rockfish abundance, and to collect oceanographic information to explore the relationship between rockfish and their environment. The trawl survey followed the stratified-systematic approach of previous surveys and produced a Pacific ocean perch relative biomass estimate of 16,100 t. The previous two-vessel survey in 1984 had produced Pacific ocean perch relative biomass estimates of 13,700 t and 7,600 t. Because different vessels participated in these surveys, a vessel effect and/or a true abundance increase could account for the higher measured abundance in 1994. Echograms compiled during the 1994 hydroacoustic survey were composed of distinctive structures which could be interpreted as species categories. However, Pacific ocean perch could not be reliably identified. The acoustic biomass estimate of all fish from depths where rockfish dominate (180 to 300 m) was 15,600 t, based on a fish target strength of -35 dB/kg. Acoustic detection was limited, however, to approximately 14 m above the bottom. Therefore, an unknown quantity of near and on-bottom fish were undetected.

RÉSUMÉ

Hand, C. M., G. D. Workman, L. J. Richards, R. Kieser and R. I. Perry. 1995. Bottom Trawl and Exploratory Hydroacoustic Survey for Rockfish in Queen Charlotte Sound, June 20 to July 7, 1994. Can. Manus. Rep. Fish. Aquat. Sci. 2300: 87p.

Un relevé mixte chalut-sonde hydroacoustique des stocks de sébaste a été effectué dans le détroit de la Reine Charlotte, du 20 juin au 7 juillet 1994, à partir du Ocean Selector et du W.E. Ricker, un navire de recherche. Le relevé avait pour objet de compléter la série chronologique des estimations de biomasse du sébaste à longue mâchoire obtenues par relevés standards au chalut, d'examiner la possibilité d'appliquer les techniques hydroacoustiques à la mesure de l'abondance du sébaste et d'obtenir des données océanographiques pour l'étude des relations entre le sébaste et son environnement. Le relevé au chalut, du type stratifié systématique utilisé pour les relevés antérieurs, a permis d'estimer une biomasse relative de sébaste à longue mâchoire de 16 100 tonnes. Le relevé précédent, réalisé à partir de deux bateaux en 1984, avait permis d'estimer des biomasses relatives de 13 700 et 7 600 tonnes. Les bateaux utilisés n'étant pas les mêmes, la plus grande abondance notée en 1994 peut s'expliquer par un effet lié aux bateaux ou par une augmentation réelle de l'abondance. Les échogrammes obtenus au cours du relevé de 1994 présentaient des structures particulières qui peuvent être interprétées comme des catégories d'espèces. Il a cependant été impossible d'identifier l'espèce de façon fiable. La biomasse estimée par relevé acoustique de tous les poissons se trouvant dans la gamme de profondeur où domine le sébaste (180 à 300 m) s'élevait à 15 600 t, cela pour un indice de réflexion des cibles de -35 dB par kg. La détection acoustique étant limitée à 14 m environ au-dessus du fond, les poissons se trouvant sur ou près du fond ne pouvaient être decelés.

INTRODUCTION

Rockfish stocks in Queen Charlotte Sound occur in three submarine canyons: Moresby Gully at the south end of the Queen Charlotte Islands, Mitchell's Gully north of Goose Island bank and Goose Island Gully, south of the bank and the southernmost canyon in the Sound (Fig. 1). Pacific ocean perch is the dominant species in the rockfish bottom trawl catch from these gullies and is caught at depths ranging from 150 m (80 fa) to the gully floor at approximately 300 m (160 fa). These Pacific ocean perch stocks have been variously exploited by U.S., Soviet, Japanese and Canadian vessels since the 1950's. Total removals by all nations between 1956 and 1993 are approximately 176,300 t, of which 70% has come from Goose Island Gully (Richards 1994a). Foreign fishing ceased in 1981 and, since that time, Canadian landings from Goose Island Gully have averaged 887 t annually.

Since 1965, the Department of Fisheries and Oceans has conducted nine standardized trawl surveys directed at the Goose Island Gully stock of Pacific ocean perch (Westrheim 1966; Westrheim et al. 1968, 1976; Harling et al. 1969, 1970, 1971, 1973; Harling and Davenport 1977; Nagtegaal et al. 1986). The purpose of these surveys was to provide a fisheries-independent estimate of relative abundance that could be used for Pacific ocean perch stock assessments. The most recent survey of this series was conducted in 1984 by two vessels, the R/V G.B. REED and the M/V EASTWARD HO, a commercial fishing vessel. The purpose was to produce a biomass estimate of Pacific ocean perch stocks and to compare catch rates between vessels, since the G.B. REED was slated for replacement.

With the introduction of trip limits in 1981 as a primary management tool, commercial CPUE has become unreliable as an estimator of abundance (Richards 1994b) and, consequently, the need for a fisheries-independent abundance index has become imperative. The purpose of the present survey was to update and continue the time-series of survey data with which to tune catch-age models for stock assessment purposes. In conjunction with the standard swept-area survey, a hydroacoustic survey of rockfish was conducted simultaneously to investigate the potential of hydroacoustics as a survey tool. Oceanographic studies were also undertaken to explore the relationship between rockfish and their environment and to determine whether environmental correlates could be used to help interpret the observed variability in survey catch rate.

This report documents the trawl and hydroacoustic survey design and sampling procedures, summarizes the catch, biological and oceanographic data collected, and presents new relative biomass calculations for Pacific ocean perch in Goose Island Gully.

METHODS

VESSELS AND GEAR

The F/V OCEAN SELECTOR, a 47.9-m 850-hp stern trawler, was chartered to conduct the trawl survey and perform target identification tows for the hydroacoustic vessel between June 20 and July 7. All bottom tows were completed with a Western IIA bottom trawl net, with 4.5 inch cod end mesh, 21 inch rollers and a pair of Thybron trawl doors. Net dimensions are summarized in Table 7. A cod-end liner was in place for the first haul, however it was irreparably torn upon retrieval. For some of the target identification tows, a Jonsson supermesh midwater trawl with 217 foot headrope and footrope, 5 inch cod end mesh and a FURUNO trawl sonar was used. The R/V W.E. RICKER, a 58-m, 2500-hp stern trawler, was used to conduct an exploratory hydroacoustic survey and oceanographic studies between June 29 and July 7, 1994.

TRAWL SURVEY DESIGN AND CATCH PROCESSING

The swept-area trawl survey design followed the methods of previous surveys (e.g., Nagtegaal et al. 1986). The original design was based on a stratified systematic approach, where trawling effort was allocated into 36.5 m (20 fa) depth strata between 146 and 293 m (80 - 160 fa) along selected LORAN A lines. These sample locations were retained in subsequent surveys, despite the replacement of LORAN A with LORAN C. Based on an examination of fishing locations from all previous surveys, 23 standard tow locations were identified. For the 1994 survey, two additional stations were added in the central area of the gully to improve coverage and to increase sampling density at certain depth intervals (Fig. 2). Each station was occupied twice during the course of the survey and all tows were completed during daylight hours. Standard tows were 30 minutes in duration, measured from the time the warps were locked to the time net retrieval began.

Once the net was retrieved, the cod-end was opened into the fish holding area in the stern of the vessel and the catch was moved by conveyers to the sorting area and vessel holds. For tows larger than approximately 750 kg, catches were subsampled by sorting the catch until there were at least ten baskets of the most abundant species. Thereafter, the crew sorted the remainder of the catch into two groups, 'keepers' and 'discards', since the fish caught during the survey were used as partial payment for the charter. Visual estimates of the weights of these groups were added to the weights of the subsample for the total haul weight. Species compositions were derived separately for 'keepers', 'discards' and the subsample, because flatfish were over-represented in the subsample and the two groups sorted by the crew also differed in composition. Species weights were obtained using a digital platform scale (Marel M-2000).

Length-frequency data were collected for all rockfish species where possible, with Pacific ocean perch and yellowmouth rockfish the first priority. The process whereby Pacific ocean perch were sorted was, in retrospect, judged to be faulty such that random samples of over all sizes were not obtained. Therefore, adult (> 31 cm) and juvenile Pacific ocean perch length-frequencies could not be combined for a single size-composition. For large catches, subsampling for length involved selecting baskets from the beginning, middle and end of the sort. For major rockfish species (Pacific ocean perch, yellowmouth rockfish, redstripe rockfish), length, sex, maturity and double sagittal otoliths were collected from 20 randomly selected specimens from each tow. Visual estimates of stomach content volume and prey identity were also recorded for some rockfish species.

HYDROACOUSTIC SURVEY METHODOLOGY AND DATA ANALYSIS

A calibrated echo integration system was installed on the W.E. RICKER. Its 'dry end' consisted of a Biosonics 38 kHz echo sounder, a BioSonics chart recorder, a BioSonics digital echo integrator and a PCM/VCR tape recording system. The 'wet end' included a towed body with a Simrad ceramic transducer and armoured tow cable. A personal computer was used to log echo integration and navigation data and for data analysis. In addition, a Femto Hydroacoustic Data Processing System (HDPS) was used for real time data display, target strength measurement, echo editing and post processing.

To permit a biomass comparison, the hydroacoustic survey encompassed the entire area that was covered by the swept-area trawl stations. It included Goose Island Gully, adjacent slopes and a small portion of the surrounding plateau. The acoustic transects followed the direction of the LORAN A lines that were used for the layout of the original trawl survey stations (Fig. 3). Appendix Table 1 gives an overview of all acoustic and oceanographic activities on the W.E. RICKER and a list of the principal transects is given in Appendix Table 2.

Two acoustic surveys of the Goose Island Gully area (transects T01-T08; T11-T18) and two 24-hour transect loops (transects C101-C214; D101-D110) were conducted. The OCEAN SELECTOR was completing its first swept-area survey of the Goose Island Gully area when the RICKER arrived in Queen Charlotte Sound and began its first acoustic area survey (transects T01-T08). The grid for the second acoustic area coverage (T18-T11), carried out five days later, was shifted west by half of the distance between adjacent transects. This provided an opportunity to examine systematic local variations in the measurements. All transects were executed once during daylight hours, and transects T04-T06 and T12-T14 were also covered at night.

The 24-hour transect loops (C101-C201 and D11-D41) were aligned along transects T08 and T03, respectively, on the southern slope of Goose Island Gully (Fig. 3). The areas were selected on the basis of distinct acoustic signatures and fish concentrations. The loops were conducted to explore diurnal fish behaviour patterns and to identify optimal times for the acoustic assessment of rockfish aggregations. The first transect loop (C101-C201) was executed 14 times over a 40.5 hour period. The second transect loop (D11-D41) was covered nine times over a 20.25 hour period. One additional coverage of the D-loop (transects F1-F4) was completed to measure scattering of the sea bed.

The BioSonics echo integrator was programmed to analyze the return echoes for a series of depth strata starting 5 m below the transducer and continuing to the bottom. Bottom tracking was obtained with an 8 m bottom window. An echo integration sequence was completed every 60 pings (1 minute). The echo integrator and chart recorder thresholds were set to 0.2 V to display all integrated echoes on the echogram. Standard data acquisition and analysis procedures were followed (Burczynski 1982, Clay and Medwin 1977, Kieser et al. 1987). A nominal fish target strength of -35.0 dB/kg was used throughout.

During the cruise, the echogram provided an indication of the proper operation of the acoustic system. It also was used to delineate fish aggregations and to direct fishing for target identification. The integrated echo intensity was processed with custom software to obtain fish density and biomass estimates and to exclude ocean bottom, noise, and echoes from unwanted sources in the water column. A raster GIS (Langford 1993) was employed to display and analyze acoustic fish density maps, trawl sets, bathymetry and related data.

OCEANOGRAPHIC DATA COLLECTION

Vertical profiles of temperature and salinity, from the surface to 5 m above bottom, were collected at 55 locations within the study area at approximately 5 nm intervals along the acoustic transect lines (Fig. 4). Sampling was conducted using a Guildline CTD, Series 8770, Model 87107; sampling procedures followed the description in Shaw (1994). Raw CTD data were edited and processed to 1 m averages. In addition, one bongo set was completed for the COPRA program (Shaw 1994).

RESULTS AND DISCUSSION

GENERAL

A total of 52 biomass survey hauls were completed within Goose Island Gully, of which 50 were usable (Fig. 5). Sampling densities were 2.6 hauls/100 nm^2 for the 80-99 fa depth interval, 4.2 hauls/100 nm^2 for the 100-119 fa depth interval, 5.3 hauls/100 nm^2 for the 120-139 fa depth interval and 5.7 hauls/100 nm^2 for the 140-160 fa depth interval. In addition, the Ocean Selector completed 19 species identification hauls to verify judging of the echograms that were obtained by the W.E. RICKER (Fig. 6a and 6b). A total of 35 fish species was encountered over the course of the survey (Appendix Table 3). Tables 1 and 2 summarize the catch weight by major species for the swept area survey and the acoustic target identification tows. Appendix Tables 4 and 5 list the bridge log and catch data for individual tows.

BIOLOGICAL DATA

Random length-frequency samples were obtained from thirteen species of rockfish, shortspine thornyhead and Pacific hake. Length/sex/maturity/otolith samples were collected from seven species of rockfish, while nine rockfish species were examined for stomach contents (Table 3). Length-frequency data for each species sampled are listed by haul in Appendix Table 6.

The sex ratio of Pacific ocean perch ranged from 57% to 66% female and changed with depth (Table 4). Female Pacific ocean perch were larger and older than males in all depth intervals and show a general decrease in size with increasing depth (Table 4). The overall size composition of Pacific ocean perch (30 cm or greater) shows a strong mode at 37 to 39 cm and a smaller mode at 43 cm (Fig. 7). The Pacific ocean perch age composition ranges from 3 to 58 years and is dominated by modes at 10, 14 and 18 years, corresponding to the 1984, 1980 and 1976 year-classes, respectively (Fig. 8).

The sex ratio of yellowmouth rockfish ranged from 42% to 77% female, increasing with depth (Table 4). Redstripe rockfish averaged 70% female. Female redstripe rockfish were significantly larger than males at each depth interval. There was no difference in size between male and female yellowmouth rockfish (Table 4). The yellowmouth rockfish size composition showed a strong mode at 37 to 39 cm and a smaller mode at 46 cm (Fig. 7). Their age ranged from 8 to 50 years and exhibited a strong mode at 12 years of age (Fig. 8). The redstripe rockfish size composition, combined over sex, was trimodal with modes at 30 cm, 34 cm and 37 cm (Fig. 7). Redstripe rockfish ranged in age from 8 to 33 years and exhibited a mode at 12 years of age (Fig. 8).

Most rockfish examined were sexually mature (Table 5). The maturity condition of male Pacific ocean perch was primarily developing or resting while the majority of females were in the resting stage. The majority of male and female yellowmouth rockfish were in the resting stage. Male redstripe rockfish were divided into developing and resting while females were either resting or with eyed larvae. Other rockfish species examined for maturity are summarized in Table 5.

The majority of Pacific ocean perch stomachs examined from bottom hauls were either empty (29% of stomachs examined) or everted (39%). All non-empty stomachs contained euphausiids; squid and pink shrimp were also found in two specimens. Pacific ocean perch from midwater tows had a 30% incidence of empty stomachs while the remaining 70% contained euphausiids. Euphausiids also dominated the stomach contents of yellowmouth, redstripe and splitnose rockfish. Redbanded rockfish stomach contents included benthic shrimp and isopods while widow rockfish stomachs contained sandlance, larval flatfish and squid. Sarcotaces parasitic infestations were observed in 10 Pacific ocean perch (1.1% of specimens examined), 2 silvergray rockfish (10%) and 8 yellowmouth rockfish (6%).

OCEANOGRAPHIC RESULTS

A temperature-salinity plot of all data collected indicates a relatively narrow range of water mass conditions in Goose Island Gully at the time of the survey (Fig. 9). Greater variability in temperature and salinity is apparent at shallow, near-surface depths. The lower salinity values were collected at three stations (E1-E3) off Cape Scott (Fig. 4). Near-bottom temperature and salinity (mostly sampled 5m above bottom) (Fig. 10) indicate uniform water mass conditions in the deep areas of the gully while changes are observed for the sides and shallow top of the survey area. CTD profiles are presented in Appendix Figure 1, with header information that identifies the cast number, station number, date, time (PST) and position. Cast numbers 42-57 represent repeat casts at selected locations, taken five to seven days after the original cast. Data have been archived with the Institute of Ocean Sciences (Sidney, B.C.) data manager, with cruise identifier RICKER9413.

CATCH RATES AND BIOMASS ESTIMATES

Table 6 summarizes total catch, rockfish catch, and rockfish CPUE for replicate hauls at each standard station completed in 1994. The overall mean difference in rockfish

CPUE between replicate hauls (expressed as the percentage of the mean of the two values) was 75.4%, indicating substantial short-term variability in rockfish availability to trawl gear.

Vessels and fishing gear used to conduct the Pacific ocean perch surveys since 1966 have remained constant for most of the time series. However, in 1984 the trawl net sweep- length on the G.B. REED was altered and a commercial fishing vessel was concurrently used for the first time. In 1994, another commercial vessel was chartered to conduct the survey. A comparison of catch rates over time must therefore consider differences in fishing efficiency between vessels.

In order to standardize for the different net dimensions, catch per unit effort is expressed in terms of catch per area of bottom fished per unit of time, or catch density. An estimate of the area swept in one hour fishing, K_a, is calculated as the product of vessel speed (nm/h) and effective path width of the trawl net (nm). This value, used in previous surveys to calculate Pacific ocean perch biomass, has been modified over the years with changing assumptions about the path width and vessel speed, as documented in Nagtegaal et al. (1986). In particular, Nagtegaal et al. (1986) considered the distance between trawl doors as the effective path width rather than the traditionally-used wingspread, since there was convincing evidence that the doors and sweeps serve to herd fish toward the net opening (Kimura et al. 1978, Leaman and Nagtegaal 1982, Krieger 1993). We continue to use this as a measure of path width and employ the method of Carrothers (1980) to determine the distance between trawl doors. Specifications used to calculate the path width for the OCEAN SELECTOR bottom trawl net and for recalculating that value for nets used in previous surveys are listed in Table 7. For nets where the wingspan was not directly measured with acoustic equipment, that distance was calculated by adding the headrope and footrope lengths and dividing by four (B.M. Leaman, pers. comm.). The K_a value for the G.B. REED was recalculated using this method of estimating wingspread and with a revised estimate of trawling speed of 3.2 knots, based on a re-examination of original bridge log information. A further change to the G.B. REED K_a value for 1966-77 resulted from the realization that the sweep length was, in fact, 210 ft rather than the 180 ft which had erroneously been used.

Mean catch densities and 90% confidence intervals of Pacific ocean perch obtained in 1994 and for all previous standard surveys are presented by depth interval in Table 8. Catch densities were calculated by

$$\frac{\overline{CPUE_i}}{K_a}$$

where $CPUE_i$ is mean catch (t) per hour trawled in the i^{th} depth interval. In the re-analysis of old survey data, only those hauls completed at standard stations were included to ensure consistency between years.

The biomass of Pacific ocean perch was calculated according to the method described by Nagtegaal et al. (1986) as follows

$$B=\sum_{i=1}^{n}\left(\frac{\overline{CPUE_i}}{K_a}\right)(A_i)(M_i)$$

where B is an estimate of the total marketable biomass over all depth intervals (i), A_i is the bottom area of the i^{th} depth interval (nm^2), and M_i is the proportion of the catch, by weight, of Pacific ocean perch greater than 31 cm for the i^{th} depth interval. Values of A_i for Goose Island Gully were recalculated in 1994 using new electronic charts and GIS software (Table 9). Values of M_i from old surveys were calculated by converting published length-frequency data to weight per size interval using the length-weight formula (Westrheim and Thomson 1971):

$$W=0.0088955\ L^{3.13325}$$

and computing the proportion greater than 31 cm. This procedure is particularly important for comparing historical data with 1994, since a cod-end liner had been used for all previous surveys but not for 1994, after it was destroyed on the first haul.

Estimates of Pacific ocean perch marketable biomass in Goose Island Gully for 1994 and recalculated estimates from all previous years are presented in Table 10, along with the published estimates from Nagtegaal et al. (1986). Differences between the published and recalculated estimates are due to new estimates of K_a, possible differences in $CPUE_i$ arising from including only the standard stations in CPUE calculations, and new estimates of A_i.

The Pacific ocean perch biomass obtained from this survey can only be accepted as an absolute estimate if a number of assumptions are met. These are that (1) haul locations are representative of each strata and hence the whole gully, (2) all of the area comprising the 1,200 nm^2 is suitable rockfish habitat, (3) Pacific ocean perch are evenly distributed throughout the gully, and (4) all fish within the area swept by the doors are captured. The first assumption cannot be supported since only those areas with trawlable bottom were included in the survey (less than 0.2% of the 1200 nm^2 of Goose Island Gully was actually covered). This may not present a problem because Pacific ocean perch have been shown to prefer smooth (trawlable) substrates (Matthews and Richards 1991, Krieger 1993), however an unknown proportion of the total measured bottom is comprised of 'unsuitable' habitat. Adjustments to estimates of rockfish habitat must be made to calculate absolute biomass. Pacific ocean perch have also been observed by submersible to occur in sporadic aggregations and densities varied considerably among geographically close sites (Krieger 1993). Therefore, dense schools would likely be missed by the survey coverage, leading to an underestimate of biomass. Furthermore, some fish within the doors may have escaped over or under the net. However, the biomass estimate derived from this survey is useful as a relative index of abundance because all the surveys conducted since 1966 have followed the same stratified systematic design.

The uneven pattern of rockfish distribution is one source of variability in catch rates (see the large 90% confidence intervals in Table 8). Differences in environmental conditions during the survey can affect the spatial distribution of fish as well as gear performance. Another source of variability stems from vessel effects, for example vessel type, horsepower, noise level, skipper and crew. Pacific ocean perch biomass estimates for 1984 from two different vessels, using different bottom trawl nets, were 7663 t and 13652 t (Table 10), an almost twofold difference. Clearly, trawl net characteristics as well as differences in the fishing vessel itself can substantially influence fishing success. The estimate of Pacific ocean perch biomass in 1994 must therefore be viewed with caution since the results using the F/V OCEAN SELECTOR may have a different vessel bias than any previous survey.

HYDROACOUSTIC RESULTS

Typical day and night echograms from transect T08 are shown in Figs. 11a and 11b. The day echogram shows the following structures:

1. Near surface plankton layer. At times plankton also is observed between near bottom schools.

2. Dense columnar schools, depth 20-100 m, near-surface, midwater and slope or basin oriented, solitary and flat-topped. Yellowtail rockfish?

3. Loose midwater aggregations, at times merging into a ribbon, depth 100-200 m, basin oriented. Moderate density aggregations, do not include single fish echoes. Pacific hake?

4. Columnar schools, depth 100-150 m, extending from the slope to the centre of the basin, often over hard bottom. Vertical extent often 30 m or more. Low density, may appear as columns composed of single fish echoes. Midwater rockfish?

5. Small, round or pyramid shaped near-bottom schools, depth 200-300 m, follow bottom slope. Pacific ocean perch?

6. Dense pillar-shaped schools, extending from the top of the slope into the basin, near bottom. Rockfish or herring?

Night-time echograms (Fig. 11b) primarily indicate single fish aggregations that are often well separated from the bottom but generally show little structure. The bottom expanded colour display of the Femto HDPS frequently indicated moderate quantities of single fish near bottom that were not visible on the un-expanded black and white echograms.

Echogram interpretation was based on experience gained during previous hydroacoustic surveys (Matthews et al. 1989, Leaman et al. 1990, Kieser et al. 1992, Saunders et al. 1993, Kieser et al. 1993) and results from species identification tows. The OCEAN SELECTOR completed 19 species identification tows (Fig. 6, Appendix Table 5) in addition to its swept volume trawl stations. Echograms were judged on several occasions during and following the cruise and an effort was made to define clear and reproducible echogram patterns. However, boundaries between aggregations and even aggregation types were often poorly defined. In general, reasonable rockfish, hake and plankton identification was achieved. However, we were unable to reliably identify Pacific ocean perch on our echograms, even in areas that produced good trawl catches with little by-catch from other species.

Without reliable Pacific ocean perch identification, we chose simple horizontal partitioning of the echogram and prepared separate acoustic biomass estimates for fish in the 'upper' and 'lower' water column only. Echograms and catches indicated that hake dominated the upper portion of the water column to a range (distance below the transducer; depth minus 10 m) of approximately 180 m while rockfish dominated at deeper depths. Therefore, ranges of 30-180 m and 180-300 m were selected as meaningful partitions for biomass estimation.

The following relative daytime biomass estimates were obtained for the total, upper and lower water column in Goose Island Gully:

Transect	Area (km^2)	Biomass (t) 30-300 m	30-180 m	180-300 m
T01-T08	2624	65,200	52,700	12,500
T11-T18	3281	102,000	83,400	18,600

Biomass estimates are considered relative, as acoustic backscatter measurements are scaled by fish target strength to obtain biomass estimates. Target strength is not well known and a standard value of -35 dB/kg was used (Kieser 1992).

Biomass estimates for the lower part of the water column are much smaller than those for the upper part. Biomass estimates for the lower part will be limited by our ability to measure fish close to the bottom. The echo integration bottom window of 8 m limited acoustic detection in shallow water to 4 m above the bottom, while at 200 m depth and for our transducer (8x13° full beam width between half power points), unbiased detection was limited to 14 m above the bottom. An unknown quantity of near and on bottom fish were undetected. Pacific ocean perch have been observed by submersible to be no greater than 7 m off the bottom (Krieger 1993).

Fish surface density maps for transects T01-T08 and T11-T18 are shown in Fig. 12a and 12b. All depths below approximately 40 m are included. The largest upright lines indicate a maximum surface density of 0.3 kg/m^2. In general, we obtained higher densities for transects conducted during the second area survey than during the first coverage. Fig. 13a and 13b give the corresponding information for fish below about 190 m depth. Transect T18 has the highest fish densities for the upper and lower layer. Appendix Table 7 gives day time surface densities and biomass estimates by transect for T01-T08 and T11-T18.

Although night time echograms (Fig. 11b) in general indicate low and poorly aggregated distributions, a comparison of day and night time surface densities is important to assess available biomass. Transects T04-T06 and T14-T16 were covered during the day and night. A summary of surface densities is given in Appendix Table 8. In general, much smaller densities are found in the upper layer during the night than in the day. For all but one transect (T14), day and night time densities are similar for the lower layer.

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Table 1. Summary of catch by species ranked in order of abundance of all fish caught during the F/V OCEAN SELECTOR rockfish survey, June 20 - July 7, 1994.

Species	Catch (kg)	Percent Occurrence
Pacific ocean perch	36076	61.2
Turbot	3965	6.7
Yellowmouth rockfish	3635	6.2
Shortspine thornyhead	2305	3.9
Dover sole	2099	3.6
Rex sole	1964	3.3
Walleye pollock	1744	3.0
Blackcod	1645	2.8
Redbanded rockfish	1226	2.1
Redstripe rockfish	1118	1.9
Sharpchin rockfish	887	1.5
Splitnose rockfish	373	0.6
Darkblotched rockfish	198	0.3
Silvergray rockfish	182	0.3
Ratfish	172	0.3
Dogfish	171	0.3
Bocaccio	141	0.2
Rosethorn rockfish	126	0.2
Pacific cod	106	0.2
English sole	103	0.2
Lingcod	89	0.2
Flathead sole	88	0.2
Greenstriped rockfish	80	0.1
Rougheye rockfish	63	0.1
Longnose skate	63	0.1
Yellowtail rockfish	53	0.1
Canary rockfish	52	0.1
Skates	49	0.1
Rock sole	47	0.1
Widow rockfish	40	0.1
Halibut	36	0.1
Pacific hake	36	0.1
Others[a]	43	0.1
Total	58,975	100

[a] Includes all species that comprised < 0.1 % of the total catch.

Table 2. Summary of catch by species ranked in order of abundance, of fish caught during the F/V Ocean Selector acoustic target identification tows, June 20 - July 7, 1994.

Species	Catch (kg)	Percent of Total Catch
Pacific hake	5448	34.9
Yellowmouth rockfish	3586	23.0
Pacific ocean perch	2576	16.5
Redstripe rockfish	2256	14.4
Yellowtail rockfish	635	4.1
Arrowtooth flounder	199	1.3
Silvergray rockfish	153	1.0
Sharpchin rockfish	142	0.9
Blackcod	87	0.6
Canary rockfish	77	0.5
Shortspine thornyhead	67	0.4
Rex sole	60	0.4
Dover sole	52	0.3
Spiny dogfish	50	0.3
Widow rockfish	46	0.3
Redbanded rockfish	34	0.2
Walleye pollock	28	0.2
Longnose skate	23	0.2
Halibut	14	0.1
Rougheye rockfish	14	0.1
Bocaccio	13	0.1
Darkblotched rockfish	12	0.1
Splitnose rockfish	11	0.1
Lingcod	10	0.1
English sole	10	0.1
Rosethorn rockfish	8	0.1
Pacific cod	8	0.1
Others[a]	3	<0.1
Total	15,622	100

[a] Includes all species that comprised < 0.1% of the total catch.

Table 3. Number of length measurements, combined length, sex, maturity and otoliths collected (L/S/M/O), and stomach examinations for species sampled during biomass survey and acoustic identification hauls on the F/V OCEAN SELECTOR rockfish survey, June 20 - July 7, 1994.

Species	Sample Type		
	Lengths	L/S/M/O	Stomach
Pacific ocean perch	11148	890	41
Yellowmouth rockfish	1165	133	46
Redstripe rockfish	1031	120	41
Shortspine thornyhead	875	0	0
Pacific hake	590	0	0
Sharpchin rockfish	266	40	0
Redbanded rockfish	168	67	5
Rosethorn rockfish	134	25	8
Splitnose rockfish	108	0	23
Yellowtail rockfish	70	0	0
Silvergrey rockfish	64	20	0
Canary rockfish	36	0	0
Widow rockfish	31	0	16
Darkbloched rockfish	6	0	6
Greenstriped rockfish	16	0	7

Table 4. Sex composition, and median length and age by sex and depth interval for Pacific ocean perch, yellowmouth rockfish and redstripe rockfish (greater than 30 cm) sampled from Goose Island Gully, June 20 - July 7, 1994. Sample sizes are shown in brackets.

Depth Interval (fm)	Percent Female	Median Length (cm)			Median Age (yrs)	
		Total	Male	Female	Male	Female
Pacific ocean perch						
80-99	57	40.0 (1085)	38.5 (46)	43.0 (62)	15.5 (46)	18.0 (62)
100-119	66	40.5 (2945)	38.2 (79)	42.2 (172)	17.0 (73)	18.0 (168)
120-139	63	39.0 (2459)	37.1 (68)	40.6 (135)	14.0 (68)	17.0 (135)
120-139	60	38.0 (2719)	36.6 (83)	39.5 (124)	14.0 (66)	16.5 (110)
Total	64	(9208)	(276)	(493)	(253)	(475)
Yellowmouth rockfish						
80-99	42	38.6 (622)	38.8 (34)	38.7 (25)	12.0 (34)	12.0 (25)
100-119	49	43.0 (290)	44.8 (20)	45.7 (19)	34.0 (20)	41.0 (19)
120-139	65	40.0 (112)	37.0 (7)	41.0 (13)	12.0 (7)	14.0 (13)
140-160	77	39.0 (143)	38.4 (6)	39.6 (20)	13.0 (4)	13.0 (12)
Total	53	(1167)	(67)	(77)	(65)	(69)
Redstripe rockfish						
80-99	76	33.0 (708)	30.5 (19)	34.3 (60)	12.0 (19)	13.0 (60)
100-119	42	32.0 (30)	31.0 (11)	34.0 (8)	-	-
120-139	75	35.0 (79)	31.5 (5)	36.4 (15)	25.0 (5)	18.0 (15)
140-160	-	35.0 (35)	-	-	-	-
Total	70	(852)	(35)	(83)	(24)	(75)

Table 5. Summary of maturity data for male (M) and female (F) rockfish species examined on the OCEAN SELECTOR, June 20-July 7, 1994.

	Pacific ocean perch[1]		Redstripe rockfish		Yellowmouth rockfish		Redbanded rockfish		Sharpchin rochfish		Rosethorn rockfish		Silvergrey rockfish	
Maturity[2]	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1	13	10	1	1	13	0	12	13	0	0	1	1	2	0
2	8	19	0	1	10	10	3	9	0	0	0	0	0	2
3	141	8	30	1	4	1	1	1	0	0	0	0	0	0
4	20	0	4	2	1	0	0	0	0	6	0	0	0	2
5	0	1	0	24	0	0	0	0	0	27	0	14	0	2
6	0	1	0	9	0	1	0	0	0	4	0	1	0	0
7	95	457	21	47	39	65	14	18	1	2	13	2	4	8

[1] Includes only fish greater than 30 cm.

[2] Description of rockfish maturity codes.

Maturity Code		Gonad Condition
	0	unknown
	1	immature
Females		
	2	maturing (small, yellow eggs; translucent or opaque)
	3	mature (large, yellow or orange eggs; opaque)
	4	fertilized (large, orange-yellow eggs; translucent)
	5	embryos or larvae (include eyed eggs; translucent)
	6	spent (large, flaccid, red ovaries. A few larvae may be present)
	7	resting (moderate size, firm, orange-grey ovaries: some with dark blotches)
Males		
	2	maturing (stringlike, slight swelling, translucent)
	3	developing (swelling, brown-white)
	4	developed (large, white; easily broken)
	5	running (running sperm)
	6	spent (white-brown; sperm still in duct)
	7	resting (triangular in cross-section; small, brown)

Table 6. Summary of total and rockfish catch (kg), and rockfish CPUE (kg/h) by station and haul for the F/V OCEAN SELECTOR trawl survey, Goose Island Gully, June 20 - July 7, 1994. The difference in rockfish CPUE between replicate hauls is expressed as the percentage of the mean of the two values.

Station	Haul	Depth Strata[1]	Total Catch	Rockfish Catch	% Rockfish	Rockfish CPUE	Difference, as % of mean
1	10	4	1650	1616	98	2693	47.4
	28	4	548	526	96	1661	
2	43	4	922	856	93	1712	25.8
	9	4	1195	1109	93	2218	
3	44	2	2329	2179	94	4358	106.3
	8	2	929	689	74	1334	
4	13	2	1109	865	78	1573	29.5
	31	2	1468	1058	72	2116	
5	12	3	1417	1133	80	2193	91.3
	30	3	623	409	66	818	
6	11	4	1126	927	82	1854	34.7
	29	4	1634	1316	81	2632	
7	42	4	1323	1235	93	2390	6.4
	7	4	1335	1270	95	2241	
8	14	1	468	260	56	520	74.4
	32	1	198	123	62	238	
9	15	2	1460	1141	78	2139	145.7
	38	2	305	168	55	336	
10	16	3	695	482	69	964	12.2
	39	3	707	563	80	1090	
11	17	4	2881	497	16	962	102.5
	40	4	1742	1492	86	2984	
12	45	4	1863	1748	94	3496	49.1
	6	4	1180	1129	96	2117	
13	37	2	3287	3103	94	6420	80.4
	5	2	1663	1460	88	2738	
14	21	3	1325	860	65	1720	111.0
	48	3	324	164	51	492	
15	19	1	378	228	60	456	8.8
	50	1	529	249	47	498	
16	20	2	360	139	39	278	97.5
	49	2	360	269	75	807	
17	22	3	649	534	82	1034	117.4
	47	3	2111	1985	94	3970	
18	34	2	1522	1124	74	2248	6.3
	4	2	1331	1197	90	2394	
19	23	1	609	107	18	207	142.5
	51	1	1030	658	64	1234	
20	1	1	3297	3189	97	6378	190.6
	36	1	169	77	46	154	
21	25	3	1653	984	60	1968	66.1
	3	3	2192	2020	92	3910	
22	24	2	703	470	69	940	63.4
	52	2	915	695	76	1813	
23	2	2	1399	1256	90	2512	15.9
	35	2	1232	1071	87	2142	
24	18	3	422	187	44	374	137.1
	41	3	1509	1003	66	2006	
25	33	1	734	601	82	1202	122.9
	46	1	201	153	76	287	

[1] 1 - 80-99 fa; 2 - 100-119 fa; 3 - 120-139 fa; 4 - 140-160 fa.

Table 7. Summary of net dimensions, sweep lengths, trawling speed and published and re-calculated values for doorspread and K_a (nm^2/h).

Vessel	Year	Net Type	Net Dimensions (feet)				Trawling Speed	Doorspread		K_a (nm^2/h), based on		
			Footrope	Headrope	Wingspread	Sweeps	(nm/h)	(ft)	(nm.)	Wingspread	Doorspread	Ref.[1]
G.B. REED	1966-76	Granton	116.8	78.1	29.0	-	3.0			0.014319		1
	1977				50.0	-	3.25			0.026727		2
	1984				50.0	180[2]	3.0	196.9[2]	0.032406[2]		0.097217	3
	1966-77				48.7	210	3.2	209.3	0.034446		0.110228	4
	1984				48.7	180	3.2	187.8	0.030908		0.098905	4
Eastward Ho	1984	Rockhopper Box	139.8	116.8	55.0	120	3.0	115.2[2]	0.018960[2]		0.0568804	3
					64.1	120	3.2	141.1	0.023222	0.033781	0.074311	4
Ocean Selector	1994	Western IIA	108.3	79.1	46.8	180	3.2	176.5	0.029048	0.024666	0.092954	4

[1] References:
1. Westrheim, 1972
2. Harling et al. 1979
3. Nagtegaal et al. 1986
4. Calculated, this study.

[2] Backcalculated from published K_a values and listed vessel speed.

Table 8. Pacific ocean perch mean catch rates (tonnes per square nautical mile) with 90% confidence intervals, by depth strata and year, from all standard surveys conducted in Queen Charlotte Sound from 1966 to 1994. Confidence intervals were based on a transformation of the CPUE data. Included are the percent of the catch, by weight, greater than 31 cm, used to calculate marketable biomass.

Depth (fathoms)	Vessel	YEAR	N	CPUE (t/nm²)	90% C.I. Lower	90% C.I. Upper	% by weight ≥ 31 cm
80-99	GBR	1966	2	2.72	-	-	95[1]
	"	1967	6	6.99	2.20	12.00	63
	"	1969	7	18.28	7.33	27.39	84
	"	1970	5	3.22	0.00	6.78	73
	"	1971	5	0.19	0.00	0.46	85
	"	1973	7	3.57	0.12	6.56	88
	"	1976	7	1.88	0.33	3.29	93
	"	1977	13	0.75	0.07	1.22	83
	"	1984	11	2.96	1.07	4.13	55
	EHO	1984	2	1.58	-	-	55
	OSEL	1994	10	4.30	1.30	5.03	83
100-119	GBR	1966	5	12.73	8.27	17.29	95[1]
	"	1967	10	19.60	9.22	27.67	86
	"	1969	11	8.36	5.58	10.41	87
	"	1970	10	16.01	7.29	21.61	85
	"	1971	15	9.38	4.81	11.51	90
	"	1973	11	5.35	1.75	7.19	90
	"	1976	15	10.50	4.05	12.80	94
	"	1977	14	7.31	3.08	9.97	94
	"	1984	15	10.87	5.40	13.35	93
	EHO	1984	9	18.02	9.65	25.33	93
	OSEL	1994	17	19.78	12.09	23.53	95
120-139	GBR	1966	3	16.34	7.24	27.96	95[1]
	"	1967	5	20.35	14.67	26.12	92
	"	1969	6	12.92	8.56	17.11	84
	"	1970	6	14.37	4.38	23.50	86
	"	1971	9	21.44	12.90	28.10	96
	"	1973	7	6.73	1.54	10.77	99
	"	1976	8	10.10	6.76	12.97	97
	"	1977	14	7.52	2.96	10.93	97
	"	1984	10	7.81	5.73	9.50	84
	EHO	1984	7	11.04	5.18	17.73	84
	OSEL	1994	11	13.81	7.35	17.95	97
140-160	GBR	1966	2	30.80	-	-	95[1]
	"	1967	6	23.04	12.23	34.17	98
	"	1969	6	17.36	6.54	27.37	95
	"	1970	4	8.82	4.01	14.33	79
	"	1971	10	18.82	15.07	22.04	95
	"	1973	7	10.99	3.45	17.06	96
	"	1976	5	13.50	7.40	19.78	97
	"	1977	8	9.87	6.12	13.45	97
	"	1984	6	8.87	2.10	15.00	90
	EHO	1984	8	25.40	18.65	31.38	90
	OSEL	1994	12	21.15	14.60	25.82	100

[1] Length-frequency data unavailable for 1966. Percent of catch weight ≥ 31 cm was calculated from Table 4 in Westrheim (1972).

Table 9. Total trawlable area (nm^2), by depth interval, of Goose Island Gully fishing grounds; previous and recalculated estimates.

Depth Interval (fa)	Nagtegaal et al. (1986)	1994 Survey
80- 99	432	386
100-119	351	382
120-139	190	228
140-160	174	210

Table 10. Estimated biomass (t) of Pacific ocean perch from 1994 and recalculated estimates from all previous surveys in Goose Island Gully. Estimates should be interpreted as relative rather than absolute biomass.

YEAR	Vessel	Pacific ocean perch biomass (t)	
		Published (Nagtegaal et al.)	Recalculated
1966	G.B. REED	12508	15300
1967	"	14901	17147
1969	"	14240	14644
1970	"	10116	10388
1971	"	10749	11734
1973	"	6130	6787
1976	"	9099	9430
1977	"	6323	6577
1984	"	6763	7663
1984	Eastward Ho	16201	13652
1994	Ocean Selector	-	16050

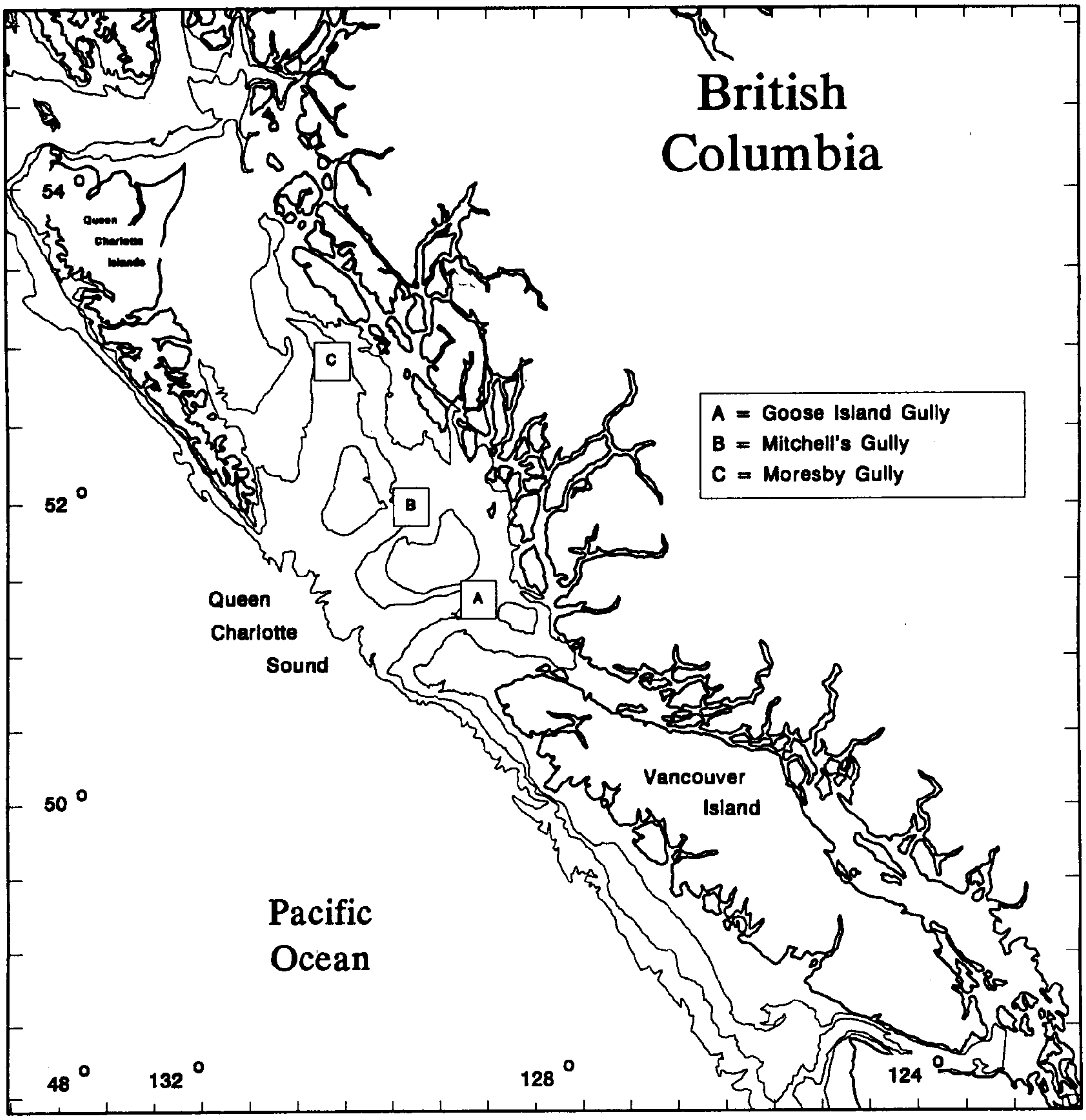


Fig. 1. Map of the British Columbia coast showing the location of Goose Island Gully in Queen Charlotte Sound.

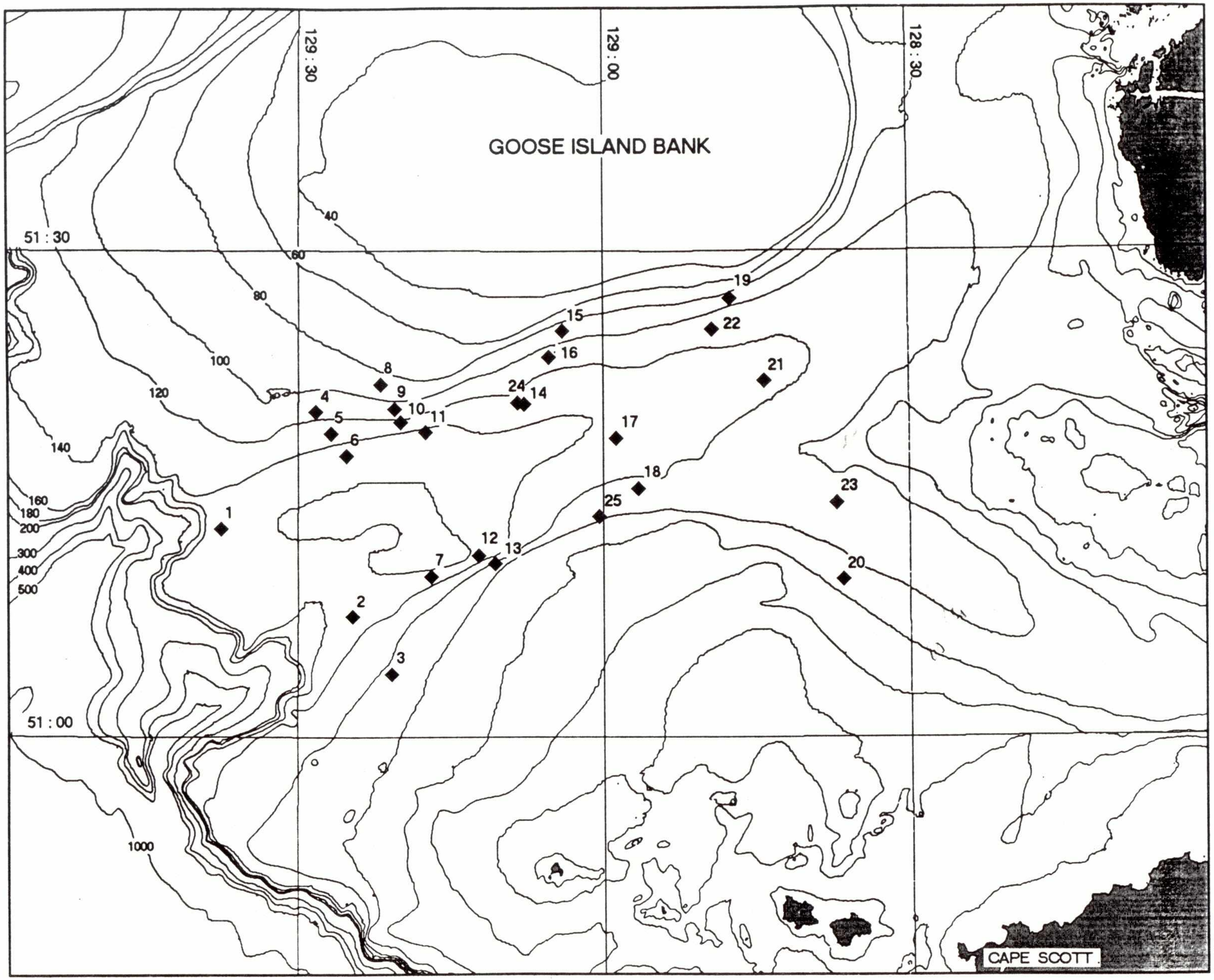


Fig. 2. Location of standard bottom trawl survey stations within the Goose Island Gully rockfish survey area, June 20 - July 7, 1994.

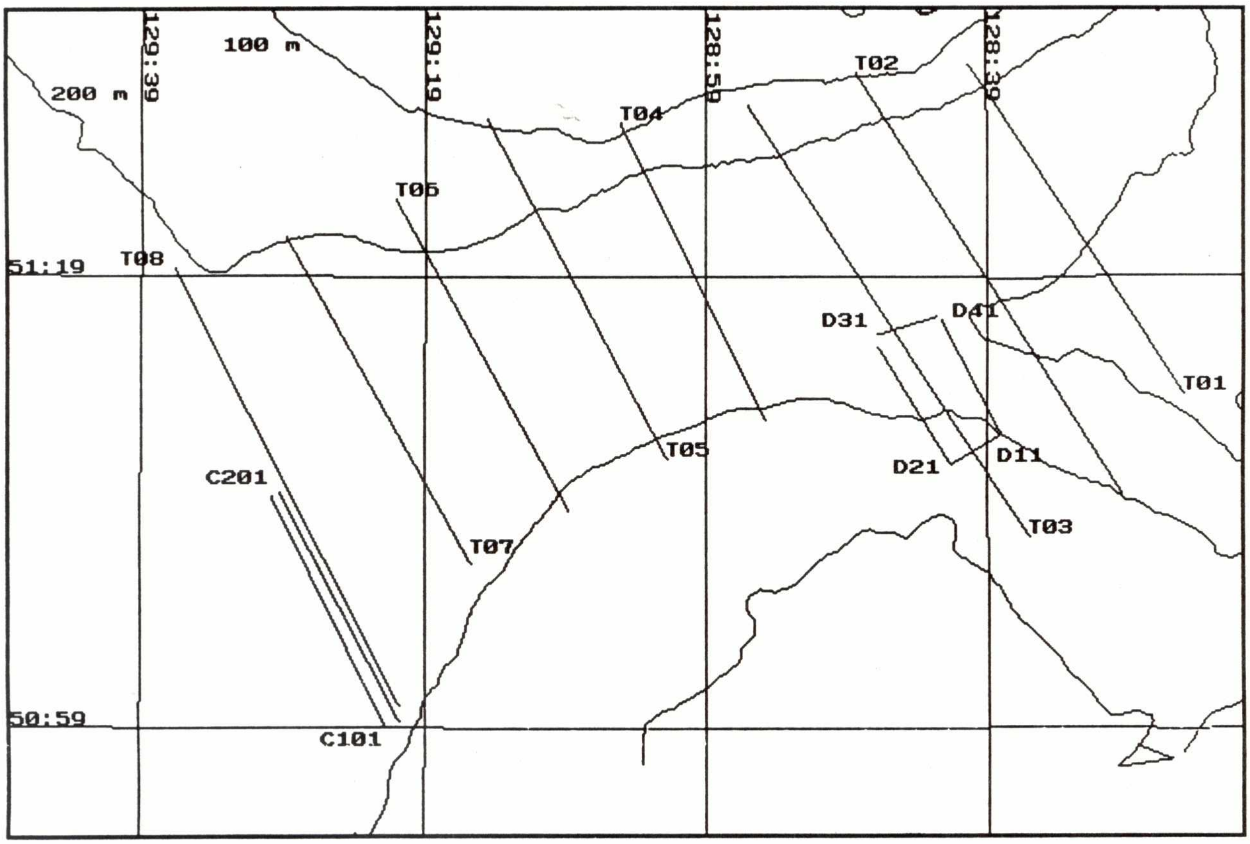


Fig. 3. Hydroacoustic transects T01-T08 and transect loops C101-C201 and D11-D41 completed by the W.E. RICKER during the rockfish survey in Goose Island Gully, June 27 - July 7, 1994.

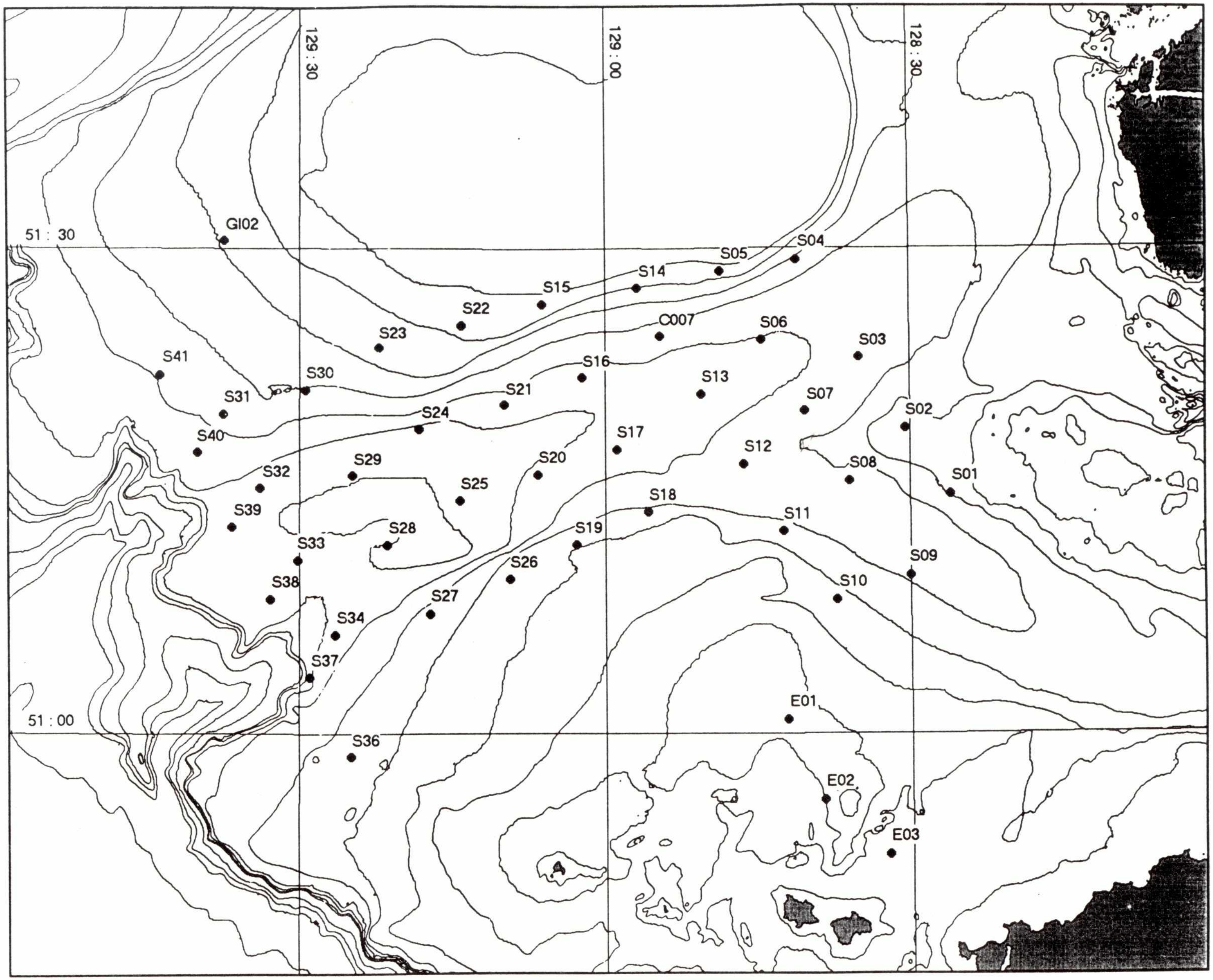


Fig. 4. Location of CTD stations within Goose Island Gully survey area, June 27 - July 7, 1994. Alpha-numeric codes represent the CTD station identifier, solid lines are bathymetric contours in fathoms.

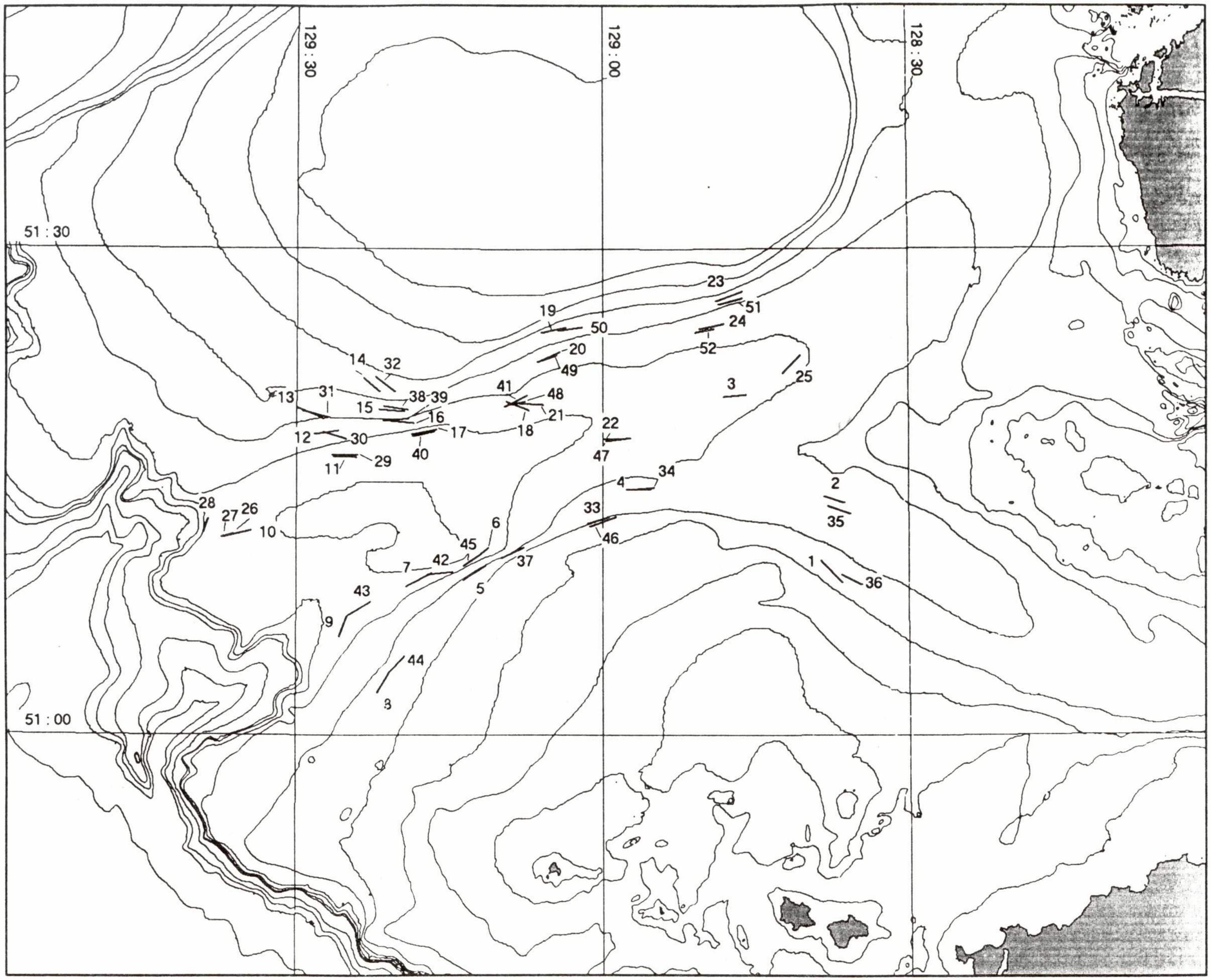


Fig. 5. Biomass survey haul locations completed by the M/V OCEAN SELECTOR within the Goose Island Gully survey area, June 20 - July 7, 1994.

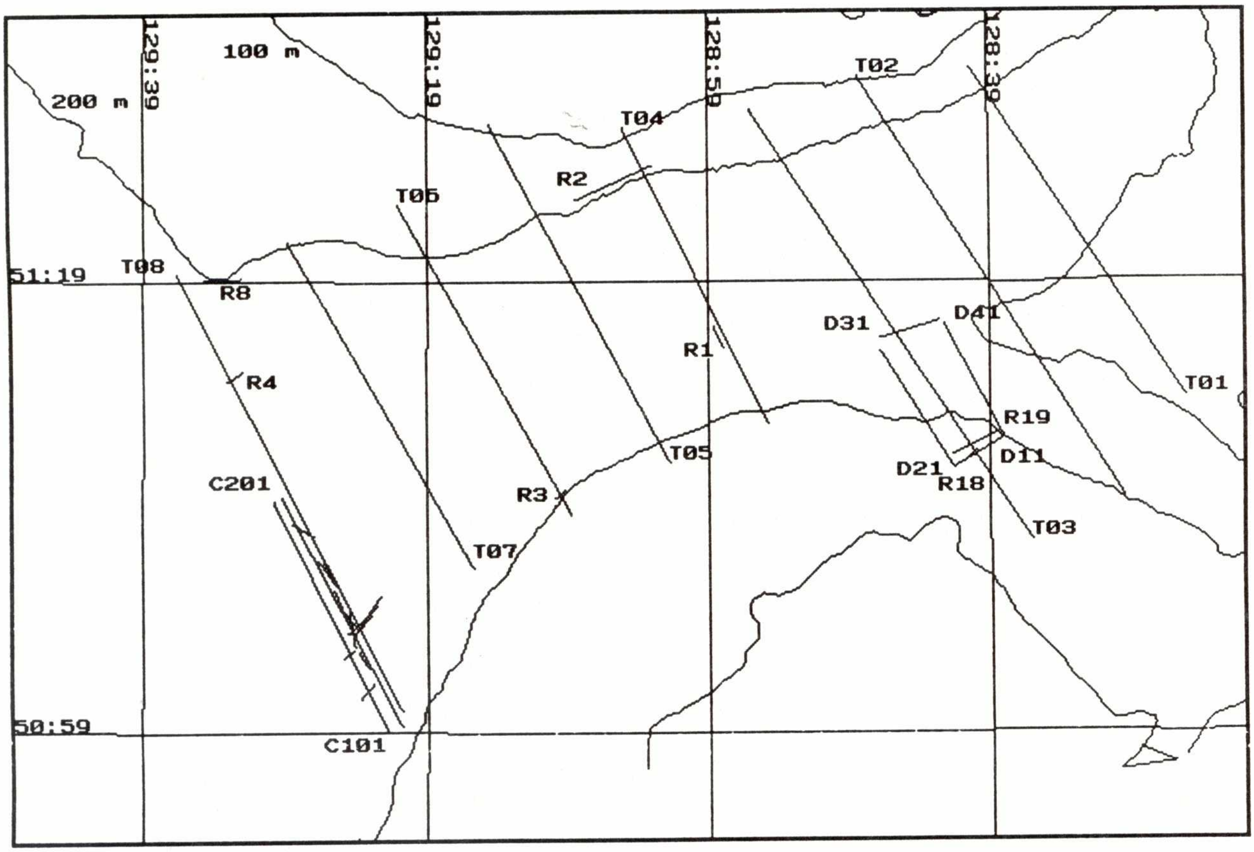


Fig. 6a. Target identification haul locations completed by the M/V OCEAN SELECTOR within the Goose Island Gully survey area, June 27 - July 7, 1994.

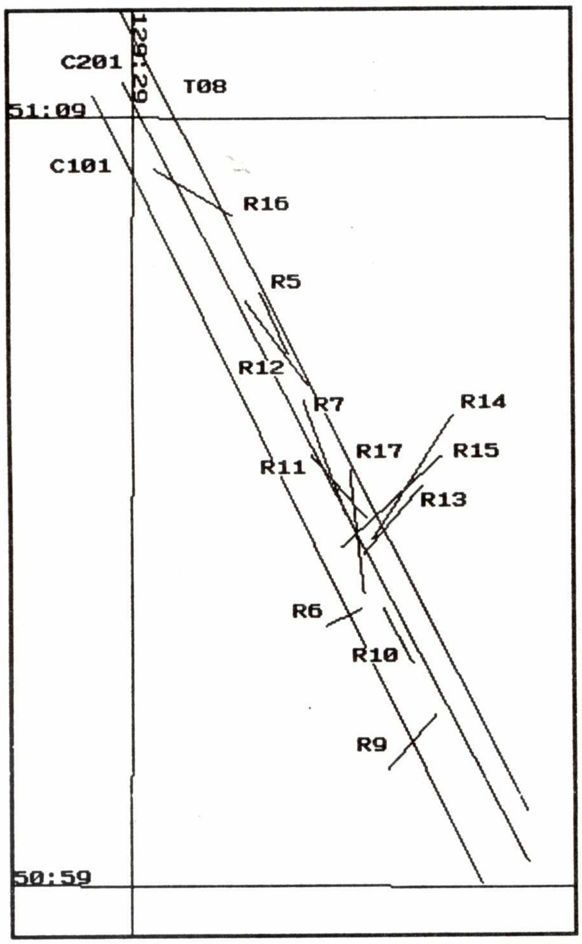


Fig. 6b. Detail of target identification haul locations completed on T08.

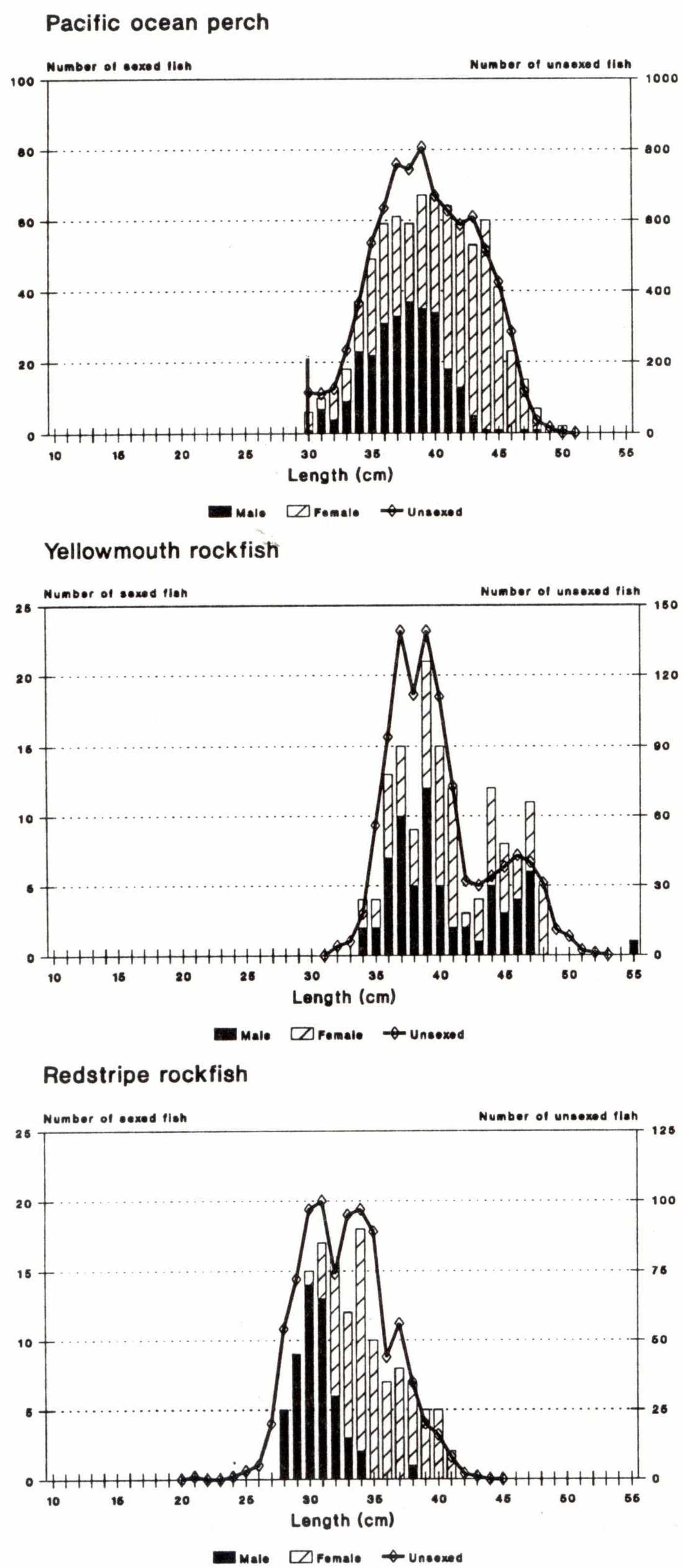
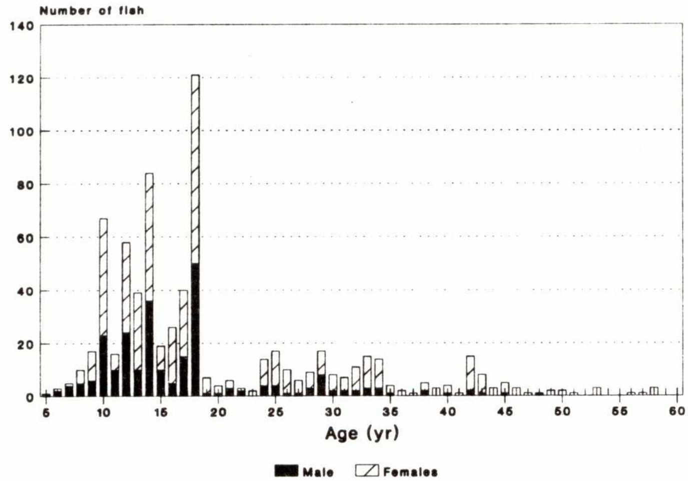
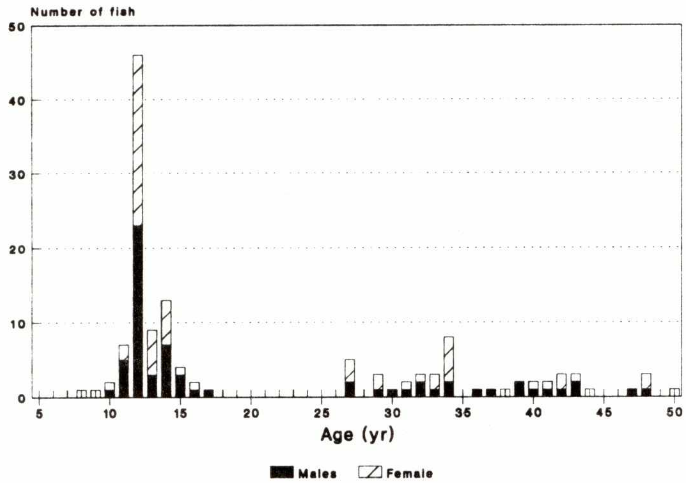


Fig. 7. Length-frequency distributions for Pacific ocean perch (> 30 cm), redstripe rockfish and yellowmouth rockfish for males, females and unsexed fish.

Pacific ocean perch



Yellowmouth rockfish



Redstripe rockfish

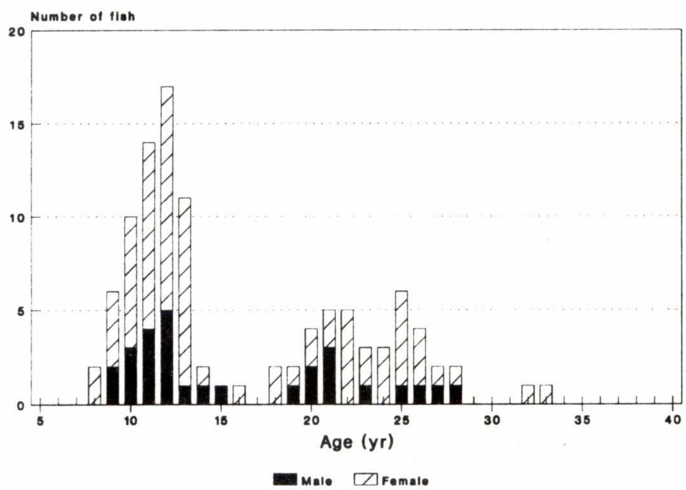


Fig. 8. Age-frequency distributions for Pacific ocean perch (>30 cm), redstripe rockfish and yellowmouth rockfish by sex.

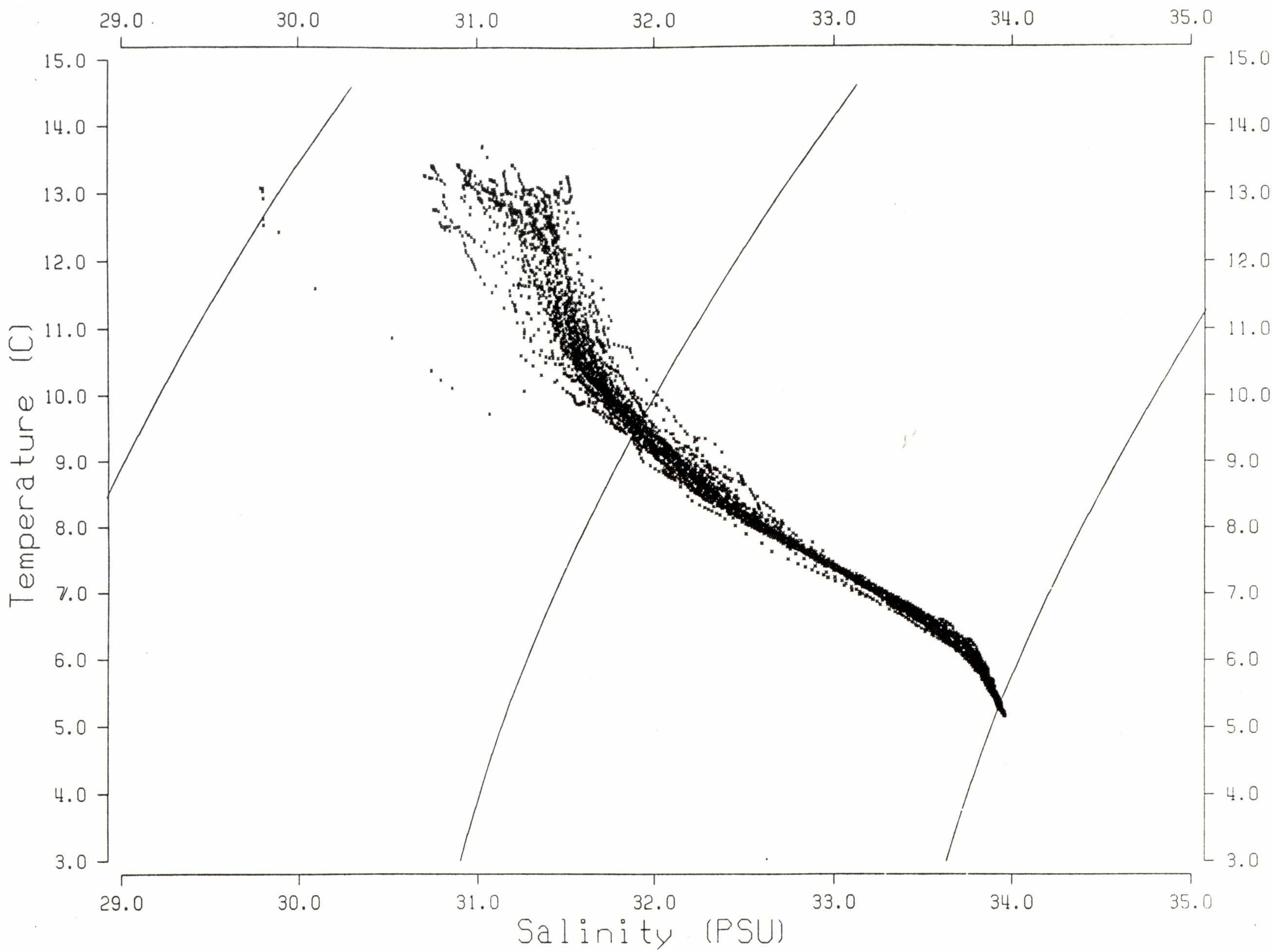


Figure 9. Temperature - salinity plot of the data from all CTD casts completed within the Goose Island Gully survey area, June 27 - July 7, 1994.

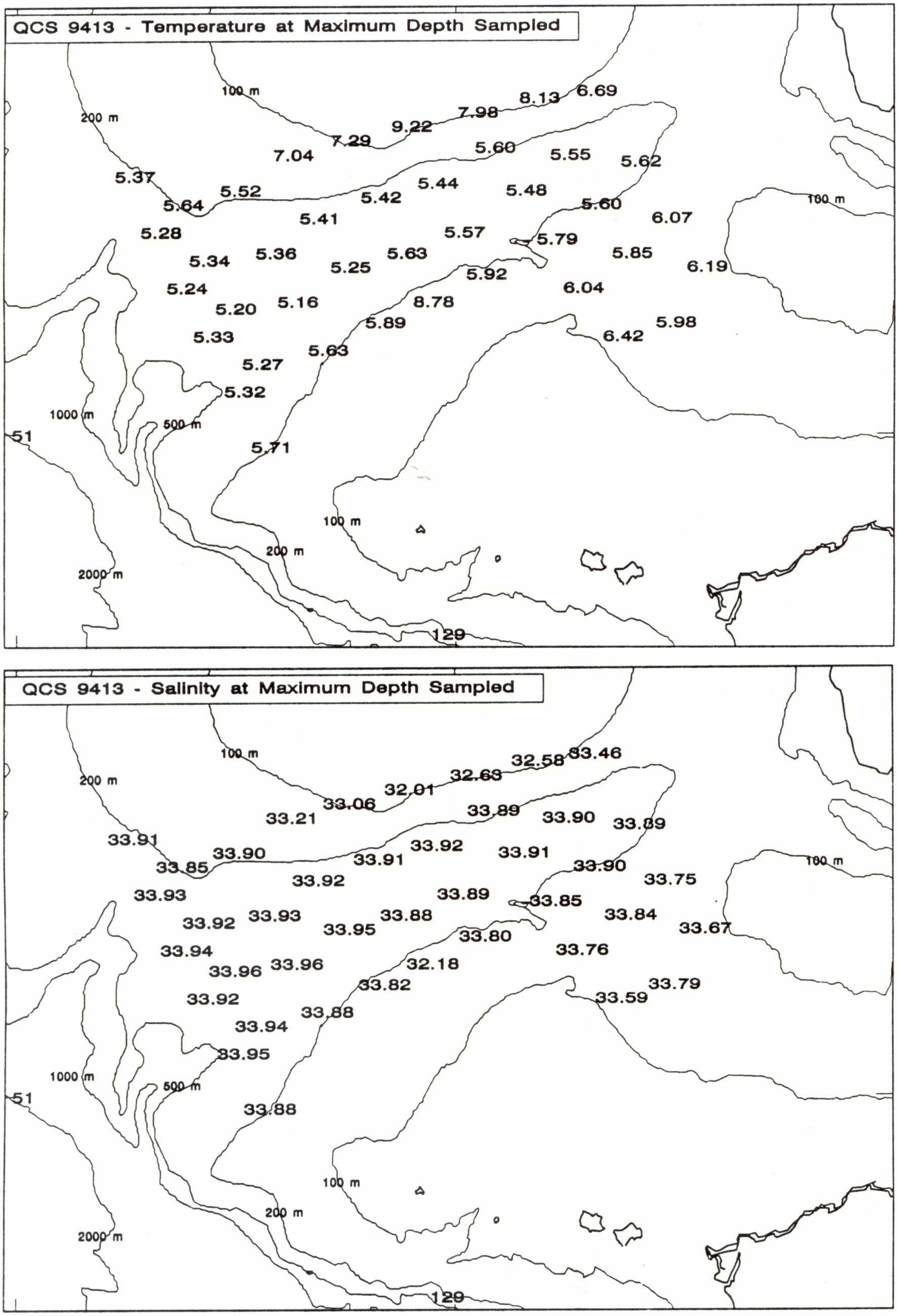


Fig. 10. Temperature (top panel) and salinity (bottom panel) at the maximum depth sampled (generally 5 m above bottom) at each of the CTD stations in the Goose Island Gully survey area, June 27 - July 7, 1994.

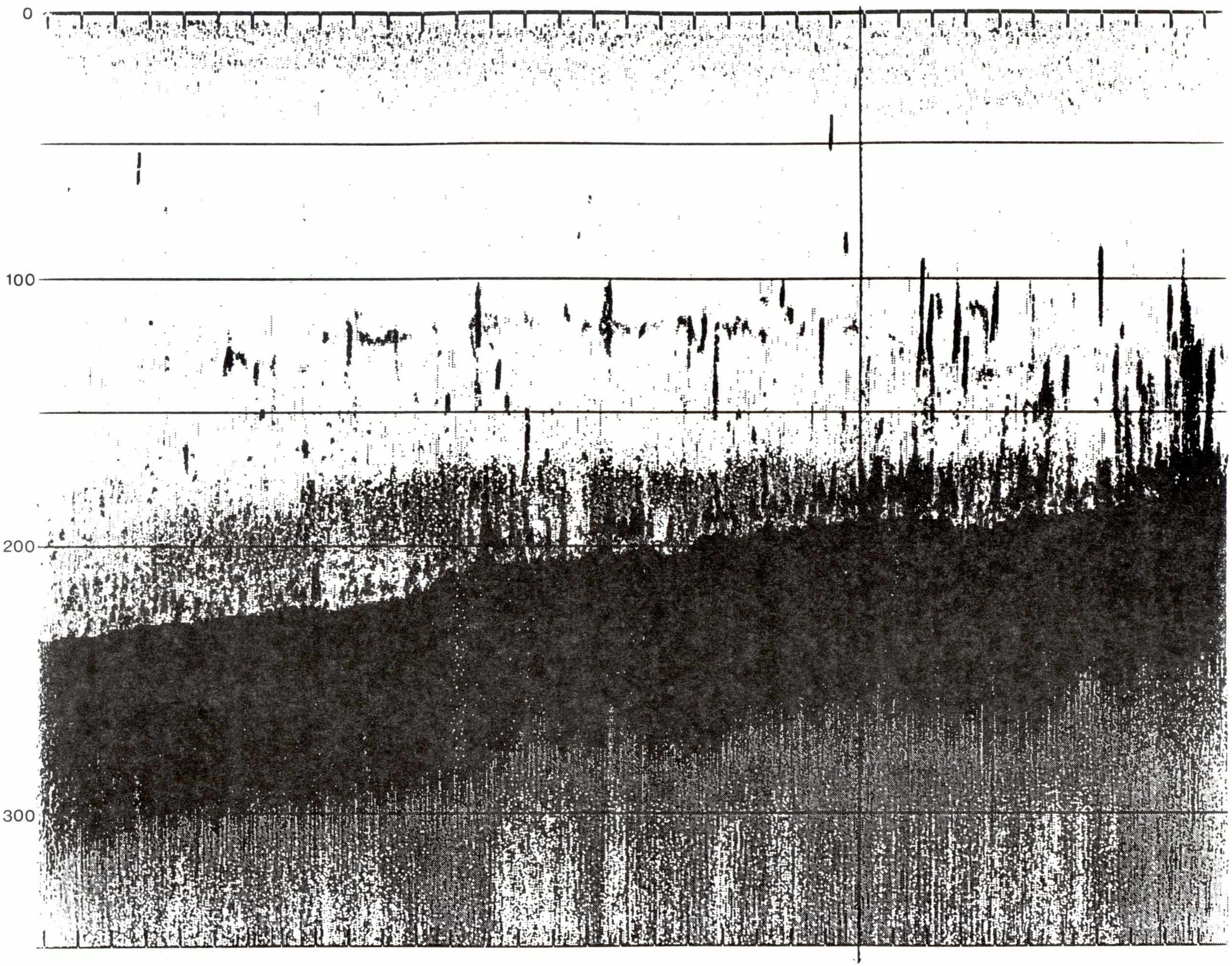


Fig. 11a. Typical day-time echogram from transect T08. Minute marks and 50 m range marks are shown.

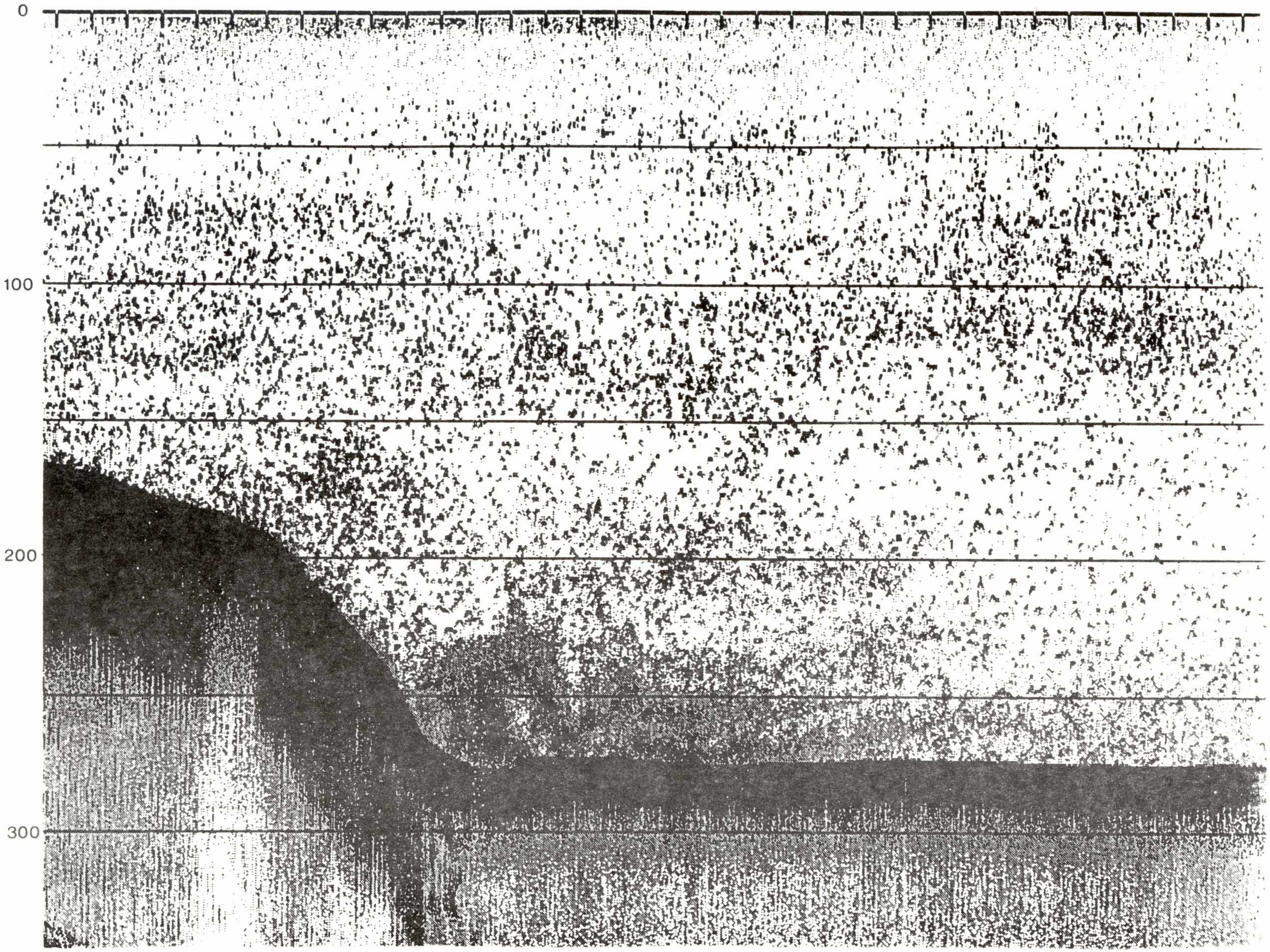


Fig. 11b. Typical night-time echogram, from transect T08. Minute marks and 50 m range marks are shown.

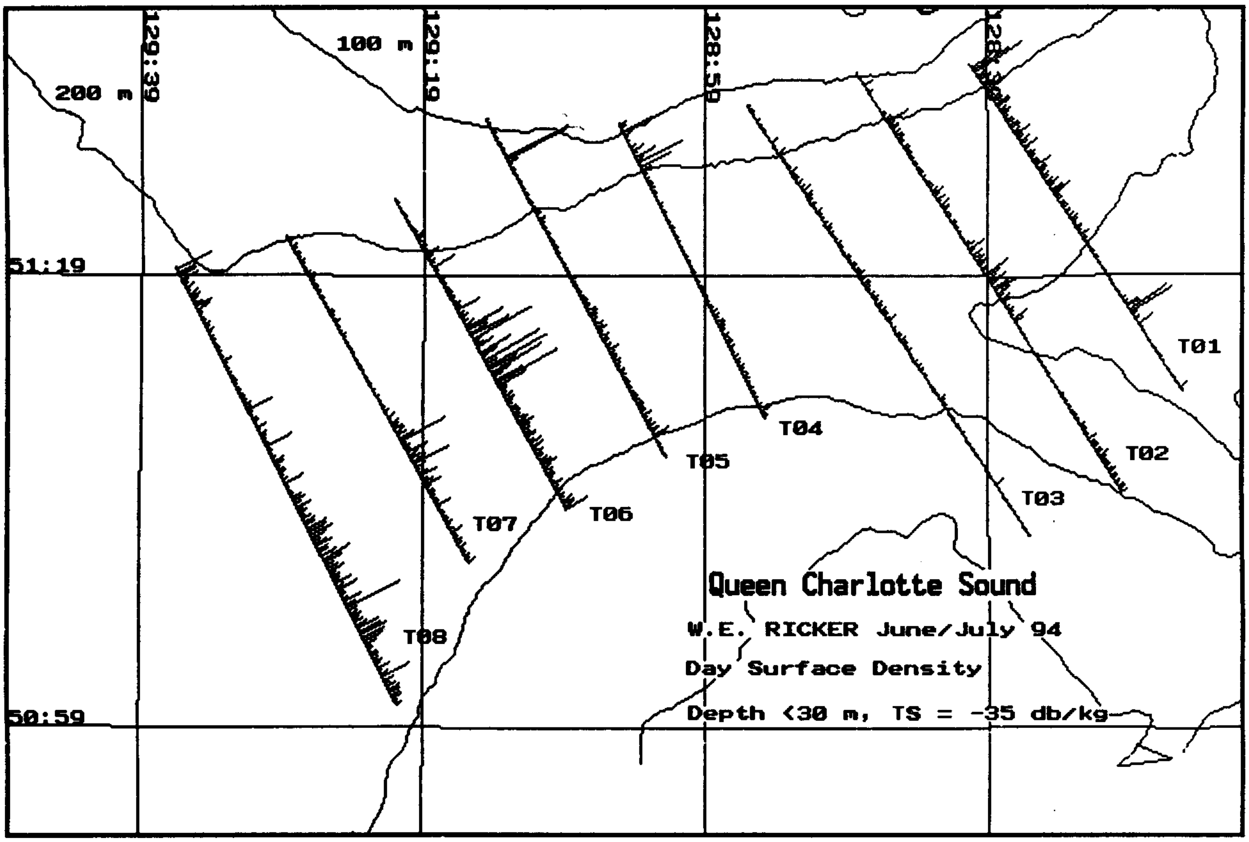


Fig. 12a. Fish surface density map for all fish deeper than 40 m on transects T01-T08. The largest upright lines indicate a maximum surface density of 0.3 kg/m^2. A target strength of -35.0 dB/kg was used.

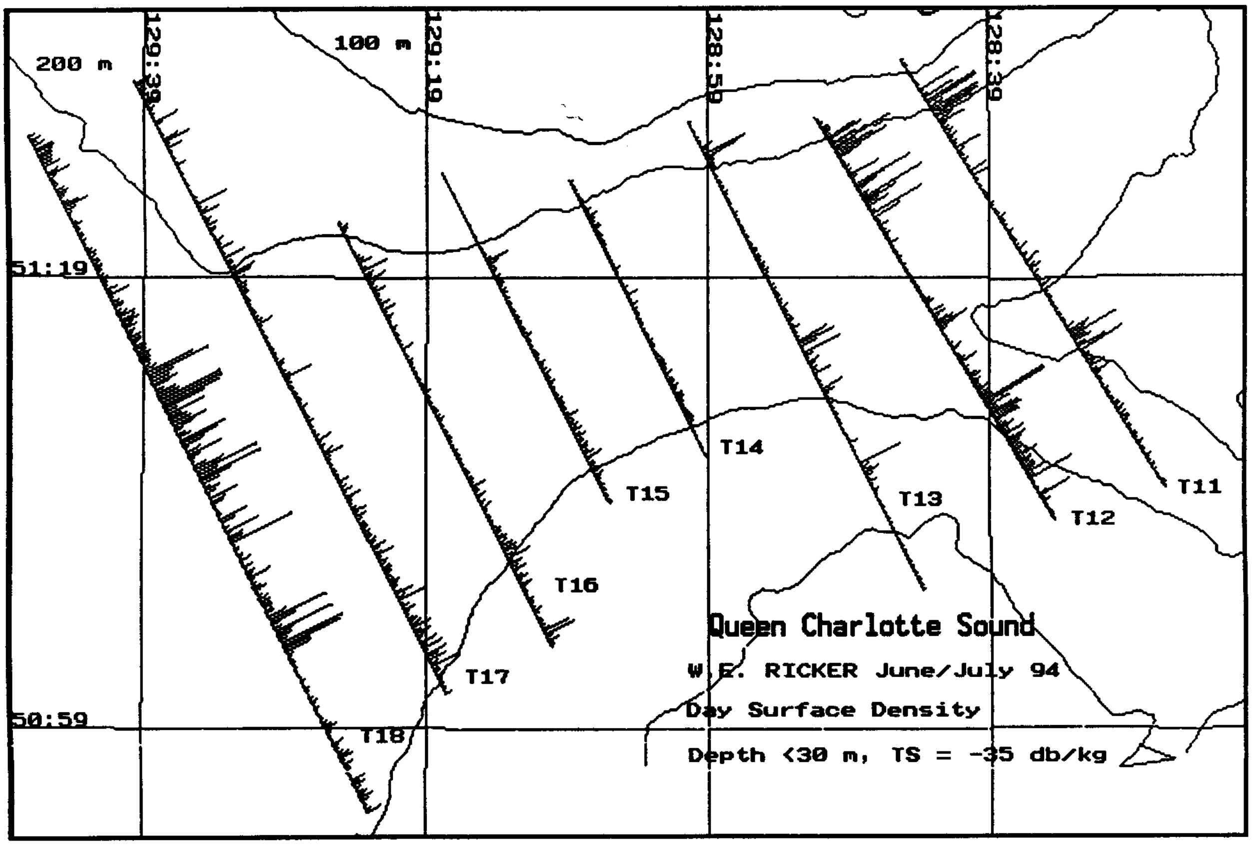


Fig. 12b. Fish surface density map for all fish deeper than 40 m on transects T11-T18. The largest upright lines indicate a maximum surface density of 0.3 kg/m^2. A target strength of -35.0 dB/kg was used.

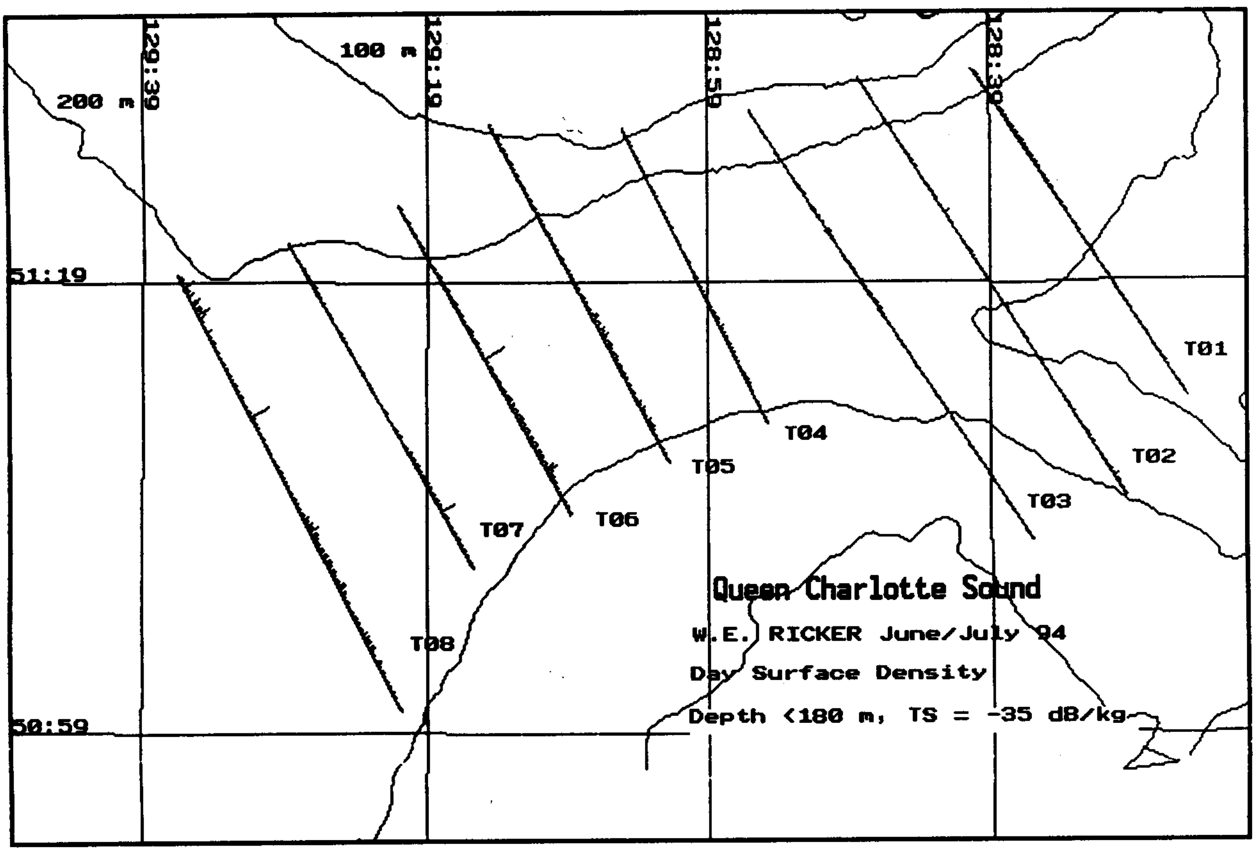


Fig. 13a. Fish surface density map for all fish deeper than 190 m on transects T 01-T08. The largest upright lines indicate a maximum surface density of 0.3 kg/m^2. A target strength of -35.0 dB/kg was used.

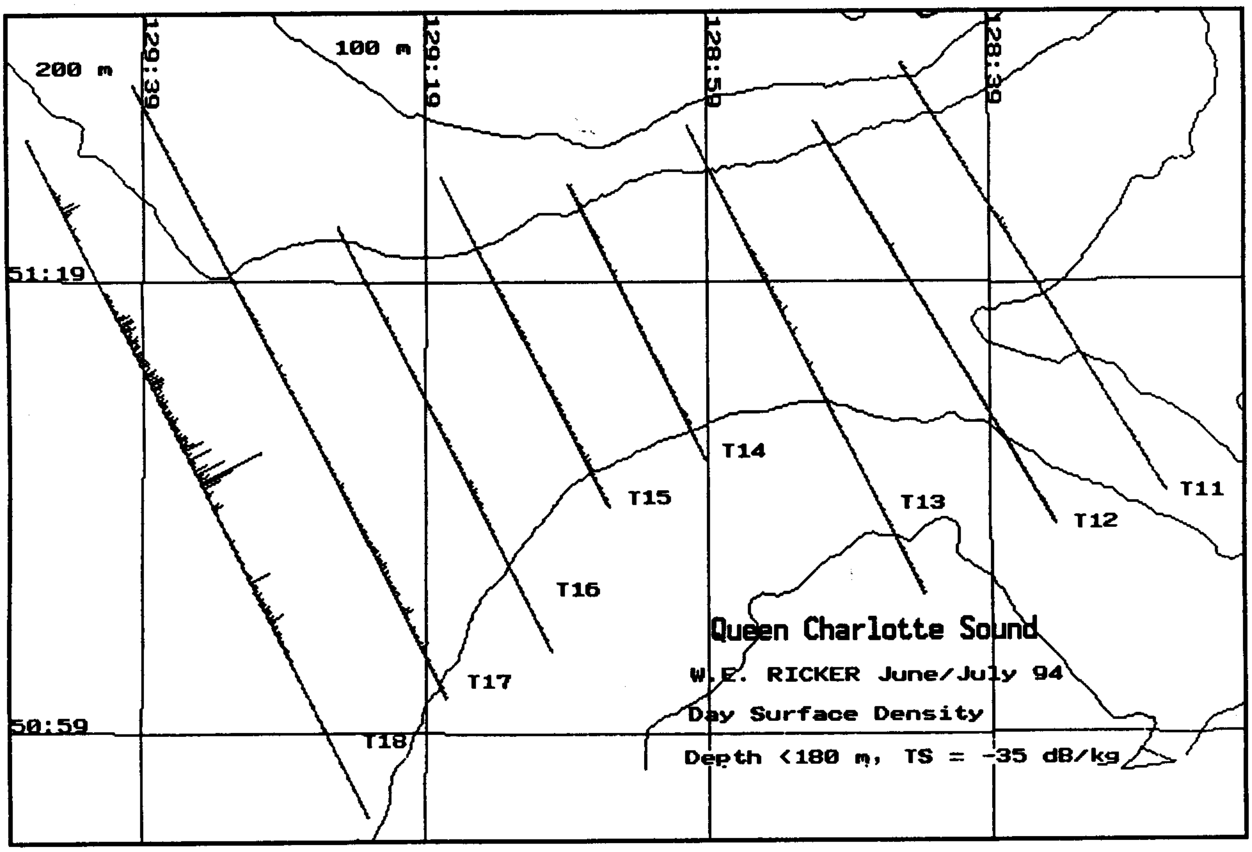


Fig. 13b. Fish surface density map for all fish deeper than 190 m on transects T11-T18. The largest upright lines indicate a maximum surface density of 0.3 kg/m^2. A target strength of -35.0 dB/kg was used.

Appendix Table 1. Summary of W.E. RICKER activities, June 27 to July 7, 1994.

Mon.	27,	12:00	Leave Nanaimo
Tue.	28,	11:00	Arrive in Queen Charlotte Sound
Tue.	28,	11:46	First area coverage T01 to T08
Wed.	29,	18:50	Complete
			Transect T01 T02 T03 T04 T05 T06 T04 T05 T06 T07 T08
			Day/Night D D D N N N D D D D D
Wed.	29,	20:00	CTD, bottle cast and bongo sets
Thu.	30,		.....
Fri.	1,	15:00	Complete
Fri.	1,	15:27	First repeat coverage C101 to C214
Sat.	2,		.....
Sun.	3,	08:00	Complete
Sun.	3,	08:28	Second area coverage T18 to T11
Mon.	4,	20:03	Complete
			Transect T18 T17 T16 T15 T14 T13 T12 T14 T13 T12 T11
			Day/Night D D D D N N N D D D D
Mon.	4,	21:15	Second repeat coverage D101 to D110
Tue.	5,	17:36	Complete
Wed.	5,	17:54	Measure bottom scattering transects F2, F3, F4, F1
Wed.	5,	20:02	Complete
Wed.	5,	20:15	Repeat CTD, cover COPRA and 2 additional stations
Thu.	6,	18:00	Complete, head for Nanaimo
Fri.	7,	18:30	Arrive in Nanaimo

Appendix Table 2. Start and end positions for major acoustic transects completed by the W.E. RICKER. All cruise activities are logged with a sequential event number.

					Start				End			
Event	Tr.	Date	Time	Length	Latitude		Longitude		Latitude		Longitude	
				(km)	deg.	min.	deg.	min.	deg.	min.	deg.	min.
6	T01	28-JUN	11:46	32.0	51	14.86	128	26.15	51	29.40	128	41.11
10	T02	28-JUN	14:25	40.9	51	29.07	128	49.21	51	10.35	128	30.42
15	T03	28-JUN	17:53	42.2	51	8.45	128	37.10	51	27.56	128	56.98
41	T04	29-JUN	06:12	27.1	51	26.83	129	6.03	51	13.71	128	55.70
48	T05	29-JUN	08:21	31.6	51	11.98	129	2.66	51	27.02	129	15.51
54	T06	29-JUN	11:19	29.2	51	23.40	129	21.98	51	9.66	129	9.66
58	T07	29-JUN	13:48	30.7	51	7.31	129	16.69	51	21.72	129	29.80
64	T08	29-JUN	16:23	40.3	51	20.29	129	37.60	51	0.97	129	21.69
86	C101	01-JUL	15:27	21.2	51	0.03	129	22.66	51	10.28	129	30.76
90	C201	01-JUL	16:54	21.2	51	10.44	129	30.18	51	0.32	129	21.69
276	T11	04-JUL	17:30	41.3	51	29.68	128	46.09	51	10.61	128	27.56
265	T12	04-JUL	13:21	38.4	51	9.20	128	35.36	51	27.04	128	52.18
260	T13	04-JUL	09:53	43.2	51	26.93	129	1.35	51	6.11	128	44.57
254	T14	04-JUL	07:14	25.2	51	12.10	129	0.12	51	24.32	129	9.71
230	T15	03-JUL	20:01	30.5	51	24.63	129	18.90	51	9.98	129	6.90
225	T16	03-JUL	16:59	39.1	51	3.61	129	11.02	51	22.44	129	26.22
214	T17	03-JUL	12:56	56.6	51	28.71	129	40.70	51	1.54	129	18.40
205	T18	03-JUL	08:28	62.2	50	56.28	129	24.07	51	26.25	129	48.28
283	D11	04-JUL	21:15	4.7	51	13.05	128	39.07	51	11.74	128	42.49
285	D21	04-JUL	21:34	11.2	51	11.74	128	42.49	51	16.88	128	47.56
287	D31	04-JUL	22:34	4.9	51	17.53	128	47.72	51	18.22	128	43.60
289	D41	04-JUL	22:55	10.3	51	18.11	128	43.19	51	13.19	128	39.14

Appendix Table 3. List of common and scientific names of all species encountered during the Ocean Selector rockfish survey in Goose Island Gully, June 20 - July 7, 1994.

ROCKFISH	
Shortspine thornyhead	*Sebastolobus alacanus*
Rougheye rockfish	*Sebastes aleutianus*
Pacific ocean perch	*S. alutus*
Redbanded rockfish	*S. babcocki*
Silvergray rockfish	*S. brevispinis*
Darkblotched rockfish	*S. crameri*
Splitnose rockfish	*S. diploproa*
Greenstriped rockfish	*S. elongatus*
Widow rockfish	*S. entomelas*
Yellowtail rockfish	*S. flavidus*
Rosethorn rockfish	*S. helvomaculatus*
Bocaccio	*S. paucispinis*
Canary rockfish	*S. pinniger*
Redstripe rockfish	*S. proriger*
Yellowmouth rockfish	*S. reedi*
Sharpchin rockfish	*S. zacentrus*
ROUNDFISH	
Pacific hake	*Merluccius productus*
Walleye pollock	*Theragra chalcogramma*
Sablefish	*Anoplopoma fimbria*
Pacific cod	*Gadus macrocephalus*
Lingcod	*Ophiodon elongatus*
Eulachon	*Thaleichthys pacificus*
Pacific herring	*Clupea pallasi*
FLATFISH	
Arrowtooth flounder	*Atheresthes stomias*
Dover sole	*Microstomus pacificus*
Rex sole	*Errex zachirus*
English sole	*Pleuronectes vetulus*
Rock sole	*P. bilineatus*
Flathead sole	*Hippoglossoides elassodon*
Pacific halibut	*Hippoglossus stenolepis*
Slender sole	*Eopsetta exilis*
SELACHII	
Spotted Ratfish	*Hydrolagus colliei*
Dogfish	*Squalus acanthus*
Longnose skate	*Raja rhina*
Sandpaper skate	*Bathyraja interrupta*

APPENDIX TABLE 4. Haul information for the F/V OCEAN SELECTOR Pacific ocean perch biomass survey, June 20 - July 7, 1994.

SET NO.	1	2	3	4	5	6	7	8	9	10	11	12	13
DATE	JUNE 21	JUNE 22	JUNE 22	JUNE 22	JUNE 22	JUNE 22	JUNE 21	JUNE 22	JUNE 22	JUNE 22	JUNE 22	JUNE 22	JUNE 23
AREA	5 11	5 11	6 8	6 8	5 11	5 11	5 11	5 11	5 11	5 11	6 8	6 1	6 1
TIME START (LST)	1355	752	933	1235	1424	1537	1646	800	931	1129	1350	1517	1629
DURATION(MIN)	30	30	31	30	32	32	34	31	30	36	30	31	33
START N. LAT.(DEG)	51 9.5	51 14.5	51 21.5	51 15.3	51 10.6	51 11.1	51 10.1	51 3.9	51 7.4	51 12.3	51 17.3	51 18.1	51 20.3
W. LONG.(DEG)	128 36.5	128 36.3	128 45.9	128 55.3	129 11.5	129 12.5	129 16.9	129 20.9	129 25.0	129 37.3	129 26.4	129 28.5	129 30.0
START LORAN-C X	13560.1	13541.7	13463.2	13442.2	13384.4	13377.1	13360.9	13369.5	13334.3	13254.2	13281.9	13265.1	13249.8
Y	41149.4	41173.9	41200.8	41166.2	41139.6	41141.2	41135.9	41112.3	41124.5	41139.9	41161.9	41167.2	41172.9
FINISH N. LAT.(DEG)	51 10.9	51 14.9	51 21.0	51 15.3	51 9.7	51 11.7	51 9.3	51 2.6	51 6.1	51 12.7	51 17.3	51 18.7	51 19.7
W.LONG.(DEG)	128 38.6	128 38.3	128 48.1	128 57.7	129 13.7	129 11.3	129 19.3	129 22.1	129 25.8	129 34.5	129 24.2	129 26.3	129 27.5
FINISH LORAN-C X	13546.1	13528.9	13452.1	13430.3	13377.8	13380.5	13352.9	13369.3	13336.6	13265.3	13292.3	13275.5	13264.4
Y	41153.8	41174.6	41198.5	41165.0	41135.5	41143.7	41132.3	41107.6	41119.7	41142.1	41162.8	41168.7	41171.1
LENGTH OF SET KM.	3.6	2.4	2.6	2.8	3.1	1.8	3.2	2.8	2.6	3.3	2.6	2.8	3.1
DIRECTION (DEG.TRUE)	315	270	262	268	243	078	251	222	233	078	095	098	111
DEPTH RANGE (m)	154-163	198-198	218-218	208-209	208-209	274-282	262-278	203-207	273-274	262-285	263-273	236-236	205-210
ROCKFISH													
S. ALUTUS	637	1207	1471	1168	1264	1059	1202	599	917	1147	861	1002	718
S. REEDI	1678	23	18	10	129	22	..	53	60	90	..	5	4
SEB. ALASCANUS	..	2	102	..	5	6	48	2	33	254	50	25	15
S. BABCOCKI	..	..	166	18	29	35	11	12	10	..	5	7	14
S. PRORIGER	832	17	..	..	..	..	..	13	..	..	..	..	..
S. ZACENTRUS	..	..	191	..	..	..	TRACE	..	..	20	TRACE	..	85
S. DIPLOPROA	..	..	..	..	..	..	TRACE	..	59	23	8	82	8
S. CRAMERI	..	..	..	..	TRACE	1	..	..	20	75	..	12	3
S. BREVISPINIS	22	5	11	..	14	..	..	..	..	..	..	..	..
S. PAUCISPINIS	..	..	..	..	..	..	..	..	..	..	..	..	7
S. HELVOMACULATUS	..	..	43	..	TRACE	..	8	TRACE	TRACE	7	TRACE	..	3
S. ELONGATUS	..	2	18	1	2	TRACE	..	10	TRACE	..	..	..	8
OTHERS*	20	..	..	..	16	6	..	..	9	..	2	TRACE	TRACE
ROUNDFISH													
WALLEYE POLLOCK	..	..	44	54	28	3	1	14	..	..	..	5	45
SABLEFISH	..	..	8	17	96	30	16	35	14	..	44	93	43
PACIFIC COD	1	..	..	..	8	..	3	3	..	..	..	..	..
LINGCOD	..	42	..	..	..	..	7	2	..	..	..	..	4
PACIFIC HAKE	..	..	..	..	..	3	..	..	4	2	..	..	..
FLATFISH													
ARROWTOOTH FLOUNDER	57	20	16	10	36	10	22	73	21	14	27	42	26
DOVER SOLE	1	53	26	22	TRACE	1	1	49	29	4	117	78	47
REX SOLE	34	18	31	31	10	2	4	49	10	14	11	65	69
ENGLISH SOLE	5	..	..	..	..	..	..	..	..	..	..	..	..
FLATHEAD SOLE	4	1	..	..	..	..	..	..	..	..	TRACE	..	..
ROCK SOLE	..	..	..	..	..	..	..	..	..	..	..	..	..
PACIFIC HALIBUT	..	..	..	..	..	..	..	..	..	..	..	..	..
OTHERS	1	2	..	..	TRACE	..	..	TRACE	..	..	..	TRACE	TRACE
SELACHII													
SPOTTED RATFISH	3	7	13	..	20	2	2	..	..	..	..	..	TRACE
SPINY DOGFISH	2	..	..	..	4	..	4	14	8	..	..	..	8
LONGNOSE SKATE	..	..	34	..	..	..	5	..	..	..	..	..	..
SANDPAPER SKATE	..	..	..	..	..	..	..	..	..	..	..	..	..
TOTAL WEIGHT (KG)	3297	1399	2192	1331	1661	1180	1334	928	1194	1650	1125	1416	1107
REMARKS	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE

*Other rockfish includes: *S. alutianus S. flavidus, S. pinniger, S. entomelas, S. borealis, S. emphaeus, S. rubberrimus, S. auriculatus*

APPENDIX TABLE 4. (Cont'd.)

SET NO.	14	15	16	17	18	19	20	21	22	23	24	25	26
DATE	JUNE 24	JUNE 24	JUNE 24	JUNE 24	JUNE 24	JUNE 24	JUNE 25	JUNE 25	JUNE 25	JUNE 25	JUNE 25	JUNE 25	JUNE 26
AREA	6 8	6 8	6 8	6 8	6 8	6 8	6 8	6 8	6 8	6 8	6 8	6 8	5 11
TIME START (LST)	753	925	1046	1244	1415	1533	800	927	1056	1250	1419	1542	812
DURATION(MIN)	30	32	30	31	30	30	30	30	31	31	30	30	15
START N. LAT. (DEG)	51 22.1	51 20.2	51 19.5	51 18.7	51 20.7	51 24.9	51 23.1	51 20.6	51 18.4	51 26.8	51 25.1	51 23.5	51 12.5
W. LONG.(DEG)	129 23.5	129 22.0	129 20.8	129 18.8	129 9.5	129 6.1	129 6.5	129 8.2	128 59.9	128 48.9	128 50.5	128 42.3	129 36.3
START LORAN-C X	13271.9	13288.1	13299.2	13311.6	13346.9	13343.6	13350.5	13354.2	13403.6	13420.8	13420.2	13478.5	13253.6
Y	41182.7	41175.4	41173.4	41170.6	41183.4	41204.7	41195.7	41183.2	41177.8	41227.6	41217.	41217.8	41140.0
FINISH N. LAT.(DEG)	51 21.3	51 20.1	51 19.4	51 19.0	51 20.2	51 25.2	51 23.7	51 20.5	51 18.4	51 27.4	51 25.4	51 22.4	51 12.5
W.LONG.(DEG)	129 21.9	129 19.5	129 18.6	129 16.4	129 7.3	129 3.7	129 4.3	129 5.9	128 57.8	128 46.3	128 48.1	128 42.3	129 36.3
FINISH LORAN-C X	13283.7	13301.2	13308.4	13321.4	13355.7	13353.9	13350.5	13365.9	13415.7	13430.9	13431.2	13475.2	13258.0
Y	41179.9	41176.1	41174.8	41172.6	41186.7	41207.4	41200.0	41184.5	41179.4	41232.9	41200.6	41210.2	41140.8
LENGTH OF SET KM.	2.4	2.9	2.6	2.8	2.7	2.8	2.8	2.7	2.4	3.2	2.8	2.8	1.3
DIRECTION (DEG.TRUE)	116	090	092	080	102	064	066	085	090	076	077	234	074
DEPTH RANGE (m)	150-161	194-199	218-223	265-265	230-234	154-163	198-199	232-243	241-245	159-161	201-201	219-219	260-269
ROCKFISH													
S. ALUTUS	13	1086	419	72	93	169	81	727	465	78	337	848	..
S. REEDI	17	28	..	..	2	12	8	..	..	..	5	..	..
SEB. ALASCANUS	..	..	51	148	59	7	35	118	47	2	93	124	..
S. BABCOCKI	..	6	8	277	23	19	15	10	19	4	31	12	..
S. PRORIGER	172	TRACE	TRACE	..	..	..	..	..	..	TRACE	..	..	..
S. ZACENTRUS	..	TRACE	..	..	..	..	..	..	..	..	..	..	..
S. DIPLOPROA	..	..	3	TRACE	5	2	..	3	TRACE	..	..	..	..
S. CRAMERI	..	..	TRACE	..	5	4	..	1	2	..	2	..	..
S. BREVISPINIS	40	..	..	..	..	9	..	..	..	4	1	..	..
S. PAUCISPINIS	..	17	..	..	..	5	..	..	..	6	..	..	..
S. HELVOMACULATUS	TRACE	TRACE	..	..	..	..	..	..	..	..	..	..	..
S. ELONGATUS	10	3	..	..	..	1	..	..	TRACE	TRACE	TRACE	..	..
OTHERS*	8	..	..	..	..	..	..	1	TRACE	12	TRACE	..	..
ROUNDFISH													
WALLEYE POLLOCK	68	153	2	7	24	23	12	2	5	331	..	..	..
SABLEFISH	18	18	24	148	18	5	26	83	38	10	36	100	..
PACIFIC COD	2	..	..	..	..	4	..	..	2	6	..	4	..
LINGCOD	..	6	..	7	..	5	..	..	..	2	..	..	..
PACIFIC HAKE	..	..	..	..	..	..	..	2	..	5	..	..	..
FLATFISH													
ARROWTOOTH FLOUNDER	67	64	72	1770	35	19	46	47	6	39	98	233	..
DOVER SOLE	9	13	49	239	51	23	48	186	15	16	36	293	..
REX SOLE	11	46	43	194	75	..	61	131	38	46	49	25	..
ENGLISH SOLE	TRACE	15	12	..	2	2	..	1	..	7	TRACE	..	..
FLATHEAD SOLE	..	TRACE	..	..	TRACE	11	17	6	..	1	5	8	..
ROCK SOLE	..	..	..	..	..	47	..	..	..	..	..	..	..
PACIFIC HALIBUT	3	..	..	..	..	..	8	..	..	..	2	..	..
OTHERS	TRACE	..	TRACE	..	TRACE	..	3	2	..	..	TRACE	TRACE	..
SELACHII													
SPOTTED RATFISH	3	TRACE	..	7	2	1	..	3	..	30	1	4	..
SPINY DOGFISH	26	3	10	12	8	..	..	2	..	9	2	2	..
LONGNOSE SKATE	..	..	..	..	19	10	..	..	11	..	3	..	..
SANDPAPER SKATE	..	..	..	..	..	..	TRACE	..	..	..	TRACE	..	..
TOTAL WEIGHT (KG)	467	1458	693	2881	421	378	360	1325	648	608	701	1652	0
REMARKS	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	UNUSABLE

*Other rockfish includes: *S. alutianus S. flavidus, S. pinniger, S. entomelas, S. borealis, S. emphaeus, S. rubberrimus, S. auriculatus*

APPENDIX TABLE 4. (Cont'd.)

SET NO.	27	28	29	30	31	32	33	34	35	36	37	38	39
DATE	JUNE 26	JUNE 26	JUNE 26	JUNE 26	JUNE 26	JUNE 26	JUNE 27	JUNE 27	JUNE 27	JUNE 27	JUNE 29	JULY 1	JULY 1
AREA	5 11	5 11	6 8	6 8	6 8	6 8	5 11	6 8	5 11	5 11	5 11	6 8	6 8
TIME START (LST)	858	1000	1141	1348	1505	1642	745	905	1151	1307	1605	1018	1128
DURATION(MIN)	09	19	30	30	30	31	30	30	30	30	29	30	31
START N. LAT. (DEG)	51 13.4	51 17.4	51 17.4	51 18.8	51 20.1	51 22.2	51 13.2	51 15.3	51 13.8	51 10.0	51 11.7	51 20.4	51 19.5
W. LONG.(DEG)	129 37.2	129 38.7	129 26.5	129 27.4	129 29.4	129 22.3	129 1.5	128 57.3	128 35.7	128 36.6	129 7.8	129 21.5	129 21.6
START LORAN-C X	13254.4	13242.7	13280.6	13269.2	13256.0	13277.9	13421.3	13432.3	13547.8	13558.9	13397.7	13290.5	13293.7
Y	41140.1	41143.9	41162.1	41167.2	41171.9	41183.3	41153.5	41166.6	41171.8	41150.9	41145.0	41176.2	41172.6
FINISH N. LAT. (DEG)	51 12.4	51 12.6	51 17.4	51 18.4	51 19.7	51 21.3	51 13.6	51 15.4	51 14.3	51 9.4	51 11.1	51 20.2	51 19.7
W.LONG. (DEG)	129 37.1	129 39.1	129 24.1	129 25.2	129 26.8	129 20.4	128 59.4	128 55.0	128 37.9	128 34.6	129 9.9	129 19.2	129 19.1
FINISH LORAN-C X	13255.0	13243.9	13292.0	13281.6	13268.1	13291.1	13403.4	13443.7	13534.6	13572.6	13389.7	13302.7	13305.0
Y	41140.0	41140.8	41163.2	41167.0	41171.1	41180.7	41156.3	41166.6	41171.8	41148.8	41142.2	41176.4	41174.4
LENGTH OF SET KM.	.2	1.6	2.8	2.7	3.1	2.8	2.6	2.7	2.7	2.6	2.7	2.7	2.9
DIRECTION (DEG.TRUE)	055	204	084	097	120	122	084	088	281	115	251	108	088
DEPTH RANGE (m)	263-263	283-287	260-267	234-249	209-216	148-161	179-179	207-207	196-196	157-157	205-210	190-201	219-219
ROCKFISH													
S. ALUTUS	..	443	1152	216	324	71	91	1102	1025	71	2797	122	502
S. REEDI	..	18	1	14	10	..	452	16	..	..	89	36	2
SEB. ALASCANUS	..	32	146	50	60	..	..	4	TRACE	..	TRACE	2	40
S. BABCOCKI	..	6	8	11	19	1	1	..	33	..	77	4	6
S. PRORIGER	..	..	..	..	..	33	19	..	2	3	..	TRACE	TRACE
S. ZACENTRUS	..	7	TRACE	..	572	..	..	..	..	..	..	1	1
S. DIPLOPROA	..	..	8	115	50	..	..	..	..	..	..	..	7
S. CRAMERI	..	8	..	..	..	..	..	..	..	..	..	..	5
S. BREVISPINIS	..	..	..	..	1	13	12	..	10	3	31	2	..
S. PAUCISPINIS	..	..	..	..	..	..	4	..	..	..	90	..	..
S. HELVOMACULATUS	..	5	1	TRACE	13	1	..	..	..	..	..	..	..
S. ELONGATUS	..	..	..	3	9	4	..	..	TRACE	..	..	1	..
OTHERS*	..	7	..	..	..	..	22	2	..	..	19	..	..
ROUNDFISH													
WALLEYE POLLOCK	..	..	..	2	173	17	12	95	10	3	36	53	66
SABLEFISH	..	..	51	37	72	..	9	14	..	TRACE	95	7	12
PACIFIC COD	..	..	..	..	..	8	TRACE	2	7	..	20	..	2
LINGCOD	..	..	..	..	..	7	3	2	..	..	..	..	..
PACIFIC HAKE	..	TRACE	..	..	..	..	..	..	..	..	..	..	..
FLATFISH													
ARROWTOOTH FLOUNDER	..	14	94	..	5	27	90	172	51	48	13	8	14
DOVER SOLE	..	3	171	87	78	..	..	35	23	TRACE	TRACE	5	4
REX SOLE	..	4	..	75	78	TRACE	3	64	29	28	6	41	31
ENGLISH SOLE	..	..	..	TRACE	..	2	7	TRACE	5	8	..	15	12
FLATHEAD SOLE	..	..	..	..	..	..	..	1	2	TRACE	..	..	..
ROCK SOLE	..	..	..	..	..	..	..	..	..	..	..	..	..
PACIFIC HALIBUT	..	..	..	7	..	9	..	..	..	..	..	..	..
OTHERS	..	TRACE	..	2	2	..	..	1	TRACE	..	..	TRACE	1
SELACHII													
SPOTTED RATFISH	..	..	TRACE	TRACE	TRACE	..	9	10	34	3	TRACE	5	..
SPINY DOGFISH	..	..	1	3	2	5	..	..	..	1	13	2	..
LONGNOSE SKATE	..	..	..	..	..	..	..	..	..	..	..	..	..
SANDPAPER SKATE	..	..	..	..	..	..	..	..	..	..	..	..	..
TOTAL CATCH (KG)	0	547	1633	622	1468	198	734	1521	1234	168	3286	304	713
REMARKS	UNUSABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE

*Other rockfish includes: *S. alutianus S. flavidus, S. pinniger, S. entomelas, S. borealis, S. emphaeus, S. rubberrimus, S. auriculatus*

APPENDIX TABLE 4. (Cont'd.)

SET NO.	40	41	42	43	44	45	46	47	48	49	50	51	52
DATE	JULY 1	JULY 1	JULY 5	JULY 5	JULY 5	JULY 6	JULY 6	JULY 6	JULY 6	JULY 6	JULY 6	JULY 6	JULY 6
AREA	6 8	6 8	5 11	5 11	5 11	5 11	5 11	6 8	6 8	6 8	6 8	6 8	6 8
TIME START (LST)	1307	1421	749	938	1100	805	945	1104	1300	1400	1452	1628	1731
DURATION(MIN)	30	30	31	30	30	30	32	30	20	20	30	32	23
START N. LAT. (DEG)	51 18.6	51 20.4	51 10.0	51 7.5	51 3.8	51 11.4	51 13.0	51 18.3	51 20.7	51 23.2	51 25.0	51 26.6	51 25.1
W. LONG.(DEG)	129 18.7	129 9.7	129 17.2	129 24.9	129 21.0	129 11.8	129 1.3	128 59.7	129 7.7	129 6.1	129 4.4	128 48.6	128 50.9
START LORAN-C X	13311.7	13347.5	13359.7	13335.0	13370.0	13379.6	13423.8	13406.6	13356.3	13352.0	13351.8	13422.9	13428.0
Y	41170.1	41181.6	41135.6	41124.8	41111.9	41142.5	41153.1	41178.0	41182.4	41196.8	41205.9	41226.5	41218.3
FINISH N. LAT.(DEG)	51 18.9	51 21.1	51 10.2	51 8.3	51 4.9	51 10.6	51 13.6	51 18.5	51 20.5	51 23.5	51 25.2	51 27.0	51 24.9
W.LONG.(DEG)	129 16.6	129 7.5	129 14.8	129 22.8	129 19.4	129 13.7	128 58.7	128 57.3	129 9.3	129 4.6	129 2.1	128 46.3	128 50.9
FINISH LORAN-C X	13320.5	13355.2	13370.0	13340.5	13372.6	13373.9	13433.3	13417.8	13349.3	13358.2	13362.2	13433.2	13420.0
Y	41172.0	41185.9	41137.2	41128.2	41115.9	41138.5	41156.7	41180.1	41182.4	41198.9	41208.5	41231.0	41215.5
LENGTH OF SET KM.	2.5	2.9	2.8	2.9	2.8	2.7	3.2	2.8	1.9	1.8	2.7	2.7	2.1
DIRECTION (DEG.TRUE)	088	083	087	052	041	234	069	094	272	079	089	087	254
DEPTH RANGE (m)	265-267	230-230	265-280	274-276	207-209	265-280	168-176	240-245	234-234	201-203	165-166	172-172	201-201
ROCKFISH													
S. ALUTUS	1270	821	1103	573	1350	1657	98	1859	113	222	200	621	633
S. REEDI	..	11	..	6	770	16	5	..	10	15	..	..	..
SEB. ALASCANUS	74	142	98	191	..	7	TRACE	106	25	10	4	32	56
S. BABCOCKI	83	17	23	25	21	68	..	20	14	10	37	5	6
S. PRORIGER	..	..	..	..	18	..	9	..	..	..	..	..	..
S. ZACENTRUS	..	..	..	10	..	..	..	..	..	..	..	..	..
S. DIPLOPROA	TRACE	..	TRACE	TRACE	..	..	..	..	TRACE	TRACE	..	..	..
S. CRAMERI	14	12	..	16	..	..	..	..	2	12	4	..	..
S. BREVISPINIS	..	..	..	..	..	..	..	..	..	..	4	..	..
S. PAUCISPINIS	..	..	..	..	12	..	..	..	..	..	..	..	..
S. HELVOMACULATUS	..	..	10	35	..	..	..	..	..	..	..	..	..
S. ELONGATUS	..	..	TRACE	..	8	..	TRACE	TRACE	..	..	..	TRACE	..
OTHERS	51	..	..	..	..	..	40	..	..	..	..	..	TRACE
ROUNDFISH													
WALLEYE POLLOCK	..	45	..	2	56	3	..	9	18	18	153	145	7
SABLEFISH	104	66	33	26	20	53	3	20	40	11	5	14	33
PACIFIC COD	..	..	7	..	20	3	2	..	..	..	TRACE	..	2
LINGCOD	..	..	..	..	..	..	..	..	2	..	..	..	..
PACIFIC HAKE	..	..	4	5	..	3	..	..	4	1	3	..	TRACE
FLATFISH													
ARROWTOOTH FLOUNDER	53	83	31	18	20	47	27	35	15	12	48	104	66
DOVER SOLE	45	60	3	..	10	TRACE	TRACE	27	14	18	15	28	67
REX SOLE	43	215	3	13	24	TRACE	2	35	50	17	38	63	35
ENGLISH SOLE	5	..	..	..	..	..	5	..	..	TRACE	TRACE	TRACE	..
FLATHEAD SOLE	..	..	..	..	..	..	..	..	3	3	8	10	8
ROCK SOLE	..	..	..	..	..	..	..	..	..	..	..	..	..
PACIFIC HALIBUT	..	..	..	..	..	..	..	..	4	..	3	..	..
OTHERS	..	6	..	..	..	..	..	..	1	..	TRACE	..	1
SELACHII													
SPOTTED RATFISH	..	..	7	..	..	..	6	..	..	..	TRACE	TRACE	..
SPINY DOGFISH	..	..	..	..	..	5	3	..	..	10	5	7	TRACE
LONGNOSE SKATE	..	19	..	2	..	..	..	..	9	..	..	..	..
SANDPAPER SKATE	..	12	..	..	..	..	..	..	..	..	..	..	..
TOTAL CATCH (KG)	1742	1509	1322	922	2329	1862	203	2114	234	361	531	1032	917
REMARKS	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE

*Other rockfish includes: *S. alutianus S. flavidus, S. pinniger, S. entomelas, S. borealis, S. emphaeus, S. rubberrimus, S. auriculatus*

APPENDIX TABLE 5. Haul information for target identification tows, F/V OCEAN SELECTOR and R/V W.E. RICKER, June 27 - July 7, 1994. Gear type: BT=bottom trawl, MW=midwater trawl.

SET NO.		1	2	3	4	5	6	7	8	9	10	11	12
GEAR TYPE		BT	MW	BT	BT	BT	BT	MW	MW	BT	MW	MW	MW
DATE		JUNE 29	JUNE 29	JUNE 29	JUNE 30	JUNE 30	JUNE 30	JUNE 30	JULY 1	JULY 1	JULY 2	JULY 2	JULY 2
AREA		6 8	6 8	5 11	6 8	5 11	5 11	5 11	6 8	5 11	5 11	5 11	5 11
TIME START (LST)		744	1235	1734	1330	1536	1648	1747	834	2345	52	147	312
DURATION(MIN)		17	75	18	17	17	15	38	39	19	19	26	34
START N. LAT.	(DEG)	51 17.1	51 23.6	51 10.4	51 16.0	51 6.9	51 3.6	51 4.8	51 20.1	51 1.5	51 2.9	51 4.8	51 6.5
W. LONG.	(DEG)	128 58.9	129 9.5	129 10.9	129 33.0	129 26.7	129 25.2	129 25.5	129 35.7	129 24.6	129 24.1	129 25.1	129 26.3
STAR LORAN-C	X	13416.3	13333.1	13390.9	13256.9	13328.6	13350.7	13344.0	13224.5	13362.6	13358.9	13345.9	13332.3
	Y	41172.8	41196.5	41137.4	41154.8	41122.5	41111.0	41114.9	41169.7	41103.8	41108.4	41114.9	41121.2
FINISH N. LAT.	(DEG)	51 18.0	51 25.2	51 10.8	51 15.6	51 7.8	51 3.4	51 6.3	51 20.2	51 2.2	51 3.6	51 5.6	51 7.6
W.LONG.	(DEG)	128 59.5	129 4.0	129 10.2	129 34.1	129 27.3	129 25.9	129 26.4	129 33.0	129 23.6	129 24.7	129 26.2	129 27.6
FINISH LORAN-C	X	13409.8	13352.5	13389.7		13322.4	13347.8	13332.6	13236.2	13364.4	13352.8	13337.0	13321.6
	Y	41175.9	41207.5	41140.8		41125.2	41109.9	41120.5	41171.3	41106.3	41111.1	41117.9	41124.9
LENGTH OF SET KM.		1.8	7.0	1.1	1.5	1.6	0.9	3.0	3.1	1.7	1.5	2.0	2.5
DIRECTION (DEG.TRUE)		330	50	33	230	343	248	337	71	43	336	331	333
DEPTH RANGE (m)		328-328	153-160	180-187	262-265	283-288	232-236	248-280	183-192	212-212	225-229	247-271	280-285
NET DEPTH RANGE (m)		-	109-146	-	-	-	-	128-146	90-146	-	110-110	146-146	227-230
ROCKFISH													
S. REEDI		15	63	71	..	4	19	56	..	8	8	70	26
S. ALUTUS		760	22	484	19	615	135	..	..	46	..	..	18
S. PRORIGER		..	11	4	..	..	..	4	25	34	34	22	TRACE
S. FLAVIDUS		..	408	..	..	..	..	1	..	..	..	..	..
S. BREVISPINIS		..	..	7	..	..	2	..	..	..	..	..	..
S. ZACENTRUS		..	..	TRACE	..	..	142	..	..	..	..	..	..
S. PINNIGER		..	..	76	1	..	..	..	..	..	..	..	..
SEB. ALASCANUS		10	..	TRACE	10	40	7	..	..	..	..	..	..
S. ENTOMELAS		..	2	..	..	..	..	..	..	3	3	26	3
S. BABCOCKI		10	2	TRACE	7	6	7	..	..	2	..	..	..
S. ELONGATUS		3	..	TRACE	..	..	9	..	..	2	..	..	..
S. PAUCISPINIS		..	6	7	..	..	..	..	..	..	..	..	..
OTHERS*		TRACE	..	..	13	12	6	..	..	..	..	..	..
ROUNDFISH													
PACIFIC HAKE		..	4085	..	..	3	..	1130	..	10	54	42	38
SABLEFISH		16	..	30	5	3	3	..	..	30	..	..	..
WALLEYE POLLOCK		7	8	8	..	..	..	..	..	5	..	..	..
LINGCOD		..	..	..	..	..	..	..	..	10	..	..	..
PACIFIC COD		..	..	3	2	..	1	..	..	2	..	..	..
EULACHON		..	TRACE	..	..	..	..	..	..	..	..	..	..
PACIFIC HERRING		..	TRACE	..	..	..	..	..	..	..	..	..	..
FLATFISH													
ARROWTOOTH FLOUNDER		15	..	18	7	22	3	..	..	40	..	..	..
REX SOLE		21	..	13	4	3	7	..	..	4	..	..	..
DOVER SOLE		12	..	7	11	TRACE	16	..	..	6	..	..	..
PACIFIC HALIBUT		..	..	..	..	..	..	..	..	14	..	..	..
ENGLISH SOLE		..	..	TRACE	..	..	..	..	..	TRACE	..	..	..
SLENDER SOLE		TRACE	..	..	..	..	..	..	..	..	..	..	..
SELACHII													
SPINY DOGFISH		2	..	5	4	..	4	..	..	..	8	2	..
LONGNOSE SKATE		8	..	..	..	15	TRACE	..	..	TRACE	..	..	..
SPOTTED RATFISH		..	..	2	..	..	..	..	..	1	..	..	..
SANDPAPER SKATE		..	..	..	..	..	TRACE	..	..	..	..	..	..
TOTAL CATCH (KG)		879	4607	735	83	723	361	1191	25	217	107	162	85
REMARKS		USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE

*Other rockfish includes: *S. crameri, S. diploproa, S. helvomaculatus*

APPENDIX TABLE 5. (Cont'd.)

SET NO.	13	14	15	16	17	18	19
GEAR TYPE	MW	MW	MW	MW	MW	BT	MW
DATE	JULY 2	JULY 2	JULY 2	JULY 2	JULY 3	JULY 5	JULY 5
AREA	5 11	5 11	5 11	5 11	6 8	5 11	5 11
TIME START (LST)	1240	1345	1512	2245	15	1510	1623
DURATION(MIN)	25	45	37	28	33	12	47
START N. LAT. (DEG)	51 4.3	51 6.1	51 4.4	51 8.7	51 5.4	51 12.5	51 12.3
W. LONG. (DEG)	129 25.1	129 23.3	129 25.6	129 27.9	129 25.4	128 41.0	128 42.6
START LORAN-C X	13348.0	13340.8	13345.5	13315.1	13341.4	13527.2	13519.1
Y	41113.4	41120.0	41113.4	41128.5	41117.2	41160.6	41158.7
FINISH N. LAT. (DEG)	51 5.2	51 4.5	51 5.6	51 9.3	51 3.8	51 12.1	51 13.2
W.LONG. (DEG)	129 23.9	129 24.9	129 23.5	129 29.5	129 25.1	128 41.7	128 39.6
FINISH LORAN-C X	13349.6	13347.9	13349.7	13305.2	13350.2	13525.0	13531.2
Y	41116.4	41114.9	41117.9	41130.5	41111.6	41157.9	41164.6
LENGTH OF SET KM.	2.5	3.5	3.3	2.2	3.0	1.1	3.9
DIRECTION (DEG.TRUE)	28	214	45	303	162	240	70
DEPTH RANGE (m)	240-240	238-240	233-242	280-284	235-248	167-176	173-180
NET DEPTH RANGE (m)	155-155	155-155	191-200	200-200	182-186	-	128-146
ROCKFISH							
S. REEDI	..	..	67	2	25	3152	..
S. ALUTUS	..	..	5	2	3	467	..
S. PRORIGER	..	..	..	1	..	2111	10
S. FLAVIDUS	..	..	..	..	..	198	28
S. BREVISPINIS	..	..	..	..	..	144	..
S. ZACENTRUS	..	..	..	..	..	..	..
S. PINNIGER	..	..	..	..	..	..	..
SEB. ALASCANUS	..	..	..	..	..	..	..
S. ENTOMELAS	..	..	2	2	5	..	..
S. BABCOCKI	..	..	..	..	..	..	..
S. ELONGATUS	..	..	..	..	..	..	..
S. PAUCISPINIS	..	..	..	..	..	..	..
OTHERS*	..	..	..	..	..	..	..
ROUNDFISH							
PACIFIC HAKE	..	13	21	18	34	..	..
SABLEFISH	..	..	..	..	..	..	..
WALLEYE POLLOCK	..	..	..	..	..	..	..
LINGCOD	..	..	..	..	..	..	..
PACIFIC COD	..	..	..	..	..	..	..
EULACHON	..	..	..	..	..	..	..
PACIFIC HERRING	..	..	..	..	..	..	TRACE
FLATFISH							
ARROWTOOTH FLOUNDER	..	..	..	..	..	91	3
REX SOLE	..	..	..	..	..	8	..
DOVER SOLE	..	..	..	..	..	..	..
PACIFIC HALIBUT	..	..	..	..	..	..	..
ENGLISH SOLE	..	..	..	..	..	10	..
SLENDER SOLE	..	..	..	..	..	..	..
SELACHII							
SPINY DOGFISH	..	..	..	..	..	25	..
LONGNOSE SKATE	..	..	..	..	..	..	..
SPOTTED RATFISH	..	..	..	TRACE	..	..	..
SANDPAPER SKATE	..	..	..	..	..	..	..
TOTAL CATCH (KG)	0	13	95	25	0	6206	41
REMARKS	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE	USABLE

*Other rockfish includes: *S. crameri, S. diploproa, S. helvomaculatus*

Appendix Table 6. Length-frequency (nos. measured), by haul, of all species collected during F/V OCEAN SELECTOR rockfish biomass survey, Goose Island Gully, Queen Charlotte Sound, June 20 - July 7, 1994.

Species: *S. alutus*

Fork	Haul no.																			
Length (cm)	1	2	3	4	5	6	7	8	9	10	11	12	13	15	16	17	18	19	20	21
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
20	-	1	-	-	-	-	1	1	-	-	-	-	-	-	1	-	-	-	-	-
21	-	0	-	-	-	-	0	0	-	-	-	-	-	-	0	-	-	-	-	-
22	-	0	-	-	-	-	0	0	-	-	-	-	-	-	2	-	-	-	-	-
23	-	0	-	-	-	-	0	0	-	-	-	-	-	3	3	-	-	-	-	-
24	-	1	-	-	-	-	0	0	-	-	1	-	-	11	5	-	-	-	-	-
25	-	1	-	-	-	-	0	0	-	-	0	-	-	17	7	-	-	-	-	-
26	-	0	-	-	-	-	0	0	-	-	3	-	-	24	14	-	-	-	-	-
27	-	1	-	-	-	-	0	1	-	-	0	1	-	17	19	-	-	-	2	-
28	-	0	-	-	-	-	0	0	-	1	0	0	-	23	22	-	-	-	1	2
29	-	0	-	-	-	1	0	0	-	0	1	1	-	27	20	-	-	-	1	2
30	-	0	-	-	-	0	0	0	-	0	8	0	1	27	20	-	-	10	2	7
31	-	0	-	-	-	2	0	1	3	1	9	1	0	15	18	-	-	4	2	6
32	2	0	1	-	1	2	0	2	0	1	10	2	1	5	12	-	0	3	0	7
33	0	0	0	1	0	5	5	3	7	2	27	5	4	9	10	-	4	5	0	11
34	4	0	5	2	3	8	8	3	12	7	31	9	7	7	15	-	5	3	3	12
35	7	1	6	1	5	10	17	4	9	9	45	9	9	9	12	1	5	5	3	15
36	9	2	12	5	7	11	19	5	14	12	46	13	12	4	5	6	4	4	1	18
37	10	9	15	12	7	13	23	7	17	14	34	21	20	3	4	4	4	9	2	17
38	6	15	11	19	9	19	20	10	14	13	14	25	16	0	0	2	4	4	1	16
39	18	20	17	18	10	23	24	10	14	13	22	20	23	-	-	3	7	7	3	20
40	20	24	15	21	15	23	14	10	24	10	9	14	13	-	-	2	6	10	1	7
41	13	20	9	12	17	10	12	12	17	10	6	22	15	-	-	3	2	6	0	8
42	20	18	13	16	16	18	15	13	12	12	8	18	19	-	-	4	6	2	0	7
43	15	16	15	19	23	17	16	13	11	15	6	14	17	-	-	3	4	5	3	4
44	12	8	8	14	29	14	11	12	12	17	2	10	21	-	-	1	6	1	3	3
45	10	6	6	14	20	16	12	18	11	10	2	14	11	-	-	1	3	4	3	9
46	9	4	20	7	12	4	4	9	5	3	1	5	9	-	-	1	4	3	4	2
47	7	3	1	2	6	1	1	6	3	1	0	6	7	-	-	1	2	0	2	0
48	0	1	0	0	1	0	0	4	0	-	-	0	2	-	-	0	1	1	0	0
49	-	1	-	-	0	-	-	5	1	-	-	-	0	-	-	-	0	0	-	1
50	-	-	-	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	0
51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	162	152	154	163	181	197	202	149	186	151	285	210	207	201	190	32	68	86	37	174

Appendix Table 6. (continued)

Species: *S. alutus*

Fork Length (cm)	Haul no. 22	23	24	25	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	1	-
27	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	0	0	-
28	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	0	1	-
29	-	1	1	1	-	2	1	-	-	-	-	-	-	-	1	-	5	1	0	-
30	-	1	3	2	-	6	1	-	-	-	-	1	-	-	0	-	9	2	0	-
31	-	0	4	2	-	9	1	-	-	-	-	1	-	-	1	2	6	2	0	-
32	1	0	2	4	1	9	5	-	1	-	2	1	-	-	0	0	11	6	3	3
33	2	0	7	5	1	25	12	3	1	2	2	0	-	1	5	5	14	13	0	4
34	5	0	4	6	2	42	19	10	4	5	3	1	2	0	6	3	21	29	3	4
35	11	3	6	15	8	54	19	7	1	7	4	6	0	0	14	14	43	21	9	14
36	15	3	14	17	17	38	30	13	5	11	11	6	0	1	22	18	37	24	6	13
37	13	1	19	29	15	28	33	13	4	15	11	13	2	4	11	23	27	25	26	28
38	17	6	24	21	18	15	24	10	9	11	16	5	3	5	17	15	27	36	25	23
39	25	10	19	28	18	12	13	7	10	11	14	19	8	5	17	24	14	20	21	22
40	16	4	17	11	15	5	7	10	5	9	10	16	15	17	12	26	8	20	14	19
41	14	10	16	17	21	2	9	8	3	16	23	20	7	10	9	14	3	13	16	20
42	22	9	22	14	17	5	11	7	10	8	11	12	0	22	6	7	1	11	18	13
43	22	9	12	11	12	3	13	11	6	5	23	11	5	19	9	12	2	5	18	19
44	13	2	9	8	9	1	8	5	4	3	29	18	9	16	5	18	2	5	13	16
45	18	10	8	5	9	0	5	7	5	2	8	9	4	27	5	4	2	2	11	8
46	5	3	4	3	5	-	0	3	6	2	7	7	7	18	5	6	3	1	12	1
47	0	0	1	0	0	-	1	0	2	1	3	8	0	11	1	2	0	0	0	0
48	1	-	0	-	-	-	0	-	1	0	3	0	1	3	0	3	-	-	1	-
49	2	-	-	-	-	-	-	-	0	-	0	1	0	0	1	0	-	-	0	-
50	0	-	-	-	-	-	-	-	-	-	-	0	-	-	0	-	-	-	-	-
51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	202	72	192	199	168	258	212	114	77	108	180	155	63	159	147	196	236	237	198	207

Appendix Table 6. (continued)

Species: *S. alutus*

Fork Length (cm)	Haul no. 44	45	47	48	49	50	51	52	R1	R3	R5	R9	R12
19	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	1	-	-	-	-	-	-
28	-	-	-	-	-	2	1	-	-	-	-	-	-
29	-	-	-	-	1	0	3	2	-	-	-	-	-
30	-	-	-	1	2	7	4	1	-	-	1	-	-
31	-	-	-	1	5	10	2	1	1	-	2	-	-
32	-	2	-	1	6	10	3	2	0	-	4	-	-
33	-	2	1	3	9	9	2	0	2	2	7	1	-
34	-	3	4	3	9	9	4	12	2	0	10	2	-
35	3	8	10	2	19	11	5	15	1	2	25	1	1
36	1	15	8	7	15	15	12	19	4	5	20	6	1
37	4	10	24	8	27	18	22	25	11	7	19	3	0
38	7	16	18	17	20	25	20	29	14	3	29	3	2
39	6	14	23	13	17	20	22	42	27	12	23	6	0
40	6	15	27	15	11	14	19	14	19	16	20	3	2
41	6	18	16	14	16	18	20	17	23	18	12	5	1
42	10	15	10	6	17	13	15	12	14	17	12	8	1
43	13	18	13	14	16	8	17	15	13	22	14	4	3
44	10	15	16	11	9	11	11	7	19	21	8	2	5
45	23	11	8	4	6	7	4	8	17	15	3	2	1
46	24	5	5	9	4	7	3	2	8	15	2	1	0
47	14	4	3	2	1	4	2	1	2	5	1	2	-
48	2	5	1	0	0	2	0	0	0	3	0	0	-
49	1	0	0	-	-	0	-	-	1	2	-	-	-
50	0	-	-	-	-	0	-	-	0	0	-	-	-
51	-	-	-	-	-	1	-	-	-	-	-	-	-
52	-	-	-	-	-	0	-	-	-	-	-	-	-
Total	130	176	187	131	210	221	192	224	178	165	212	49	17

Appendix Table 6. (continued)

Species: Juvenile *S. alutus*

Fork Length (cm)	Haul no. 18	19	20	21	23	24	25	29	30	31	33	34	36	50	R1
13	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-
15	-	1	-	-	0	-	-	-	1	-	-	-	-	1	-
16	-	3	-	-	0	-	-	-	0	-	1	1	-	0	-
17	-	3	-	1	0	-	1	-	1	1	3	0	-	3	-
18	-	4	-	1	0	1	0	-	5	0	9	0	-	11	-
19	3	25	3	3	1	0	0	1	6	1	32	9	5	28	-
20	0	66	10	3	3	6	0	0	9	0	54	17	14	30	1
21	1	48	10	2	4	0	0	0	10	2	36	5	25	20	0
22	5	24	5	3	0	2	1	3	5	2	3	3	16	15	0
23	10	19	12	3	2	2	1	4	9	2	3	1	7	20	0
24	5	21	14	3	5	4	3	8	14	1	1	3	13	17	2
25	15	26	24	8	5	17	6	8	32	2	0	4	12	40	3
26	18	24	22	5	4	17	4	4	14	2	3	1	14	38	1
27	14	27	13	6	6	17	6	5	8	1	2	0	19	32	1
28	7	16	10	8	4	12	5	4	7	0	2	0	20	10	2
29	7	11	7	2	3	6	4	5	2	-	0	0	6	8	1
30	6	0	3	0	0	3	1	4	2	-	-	1	1	2	0
31	6	-	2	3	-	4	1	2	0	-	-	0	0	1	-
32	2	-	0	0	-	1	1	1	-	-	-	-	-	0	-
33	-	-	-	-	-	2	0	0	-	-	-	-	-	-	-
34	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-
Total	99	318	135	51	38	94	34	49	125	14	149	45	152	276	11

Appendix Table 6. (continued)

Species: *S. reedi*														Species: *S. brevispinus*	
Fork	Haul no.													Haul no.	
Length (cm)	1	5	10	33	38	44	R2	R3	R11	R12	R15	R17	R18	1	14
32	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-
33	3	-	-	1	-	1	-	-	-	-	1	-	-	-	-
34	3	-	-	5	-	3	-	-	2	1	2	1	1	-	-
35	23	-	-	5	-	10	-	-	5	4	4	1	4	-	-
36	35	-	-	24	2	11	1	1	7	3	4	1	5	-	-
37	35	-	-	44	0	31	1	0	5	0	3	1	19	-	-
38	20	-	-	35	0	12	3	1	11	5	12	1	12	-	-
39	34	-	1	19	1	22	4	0	22	4	9	2	21	-	1
40	18	-	0	24	1	20	1	2	12	1	7	2	23	-	0
41	7	-	0	24	0	10	1	2	5	1	8	2	13	-	2
42	2	-	1	13	0	5	0	0	0	0	4	3	4	-	0
43	3	3	1	4	3	2	5	1	1	2	2	1	2	1	2
44	4	4	2	1	3	2	5	0	1	2	4	4	2	0	3
45	1	4	2	2	5	3	10	2	4	0	2	1	2	2	3
46	2	4	4	5	3	2	6	9	0	2	4	0	2	2	0
47	0	1	1	1	5	4	3	16	3	2	0	0	4	1	6
48	-	5	0	1	2	5	0	11	0	0	0	4	3	0	4
49	-	2	-	0	1	0	2	4	-	-	2	0	0	2	3
50	-	1	-	1	0	0	0	5	-	-	0	-	1	0	4
51	-	0	-	0	-	0	-	2	-	-	-	-	0	1	0
52	-	-	-	-	-	1	-	0	-	-	-	-	-	0	0
53	-	-	-	-	-	0	-	-	-	-	-	-	-	2	0
54	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1
55	-	-	-	-	-	-	-	-	-	-	-	-	-	0	1
56	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
57	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-
58	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
59	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-
Total	193	24	12	210	26	144	42	56	78	27	68	24	118	14	30

Appendix Table 6. (continued)

Species: *S. babcocki* Species: *S. proriger*

Fork Length (cm)	Haul no.					Haul no.							
	6	20	22	24	30	1	2	14	32	33	R10	R11	R18
20	-	-	-	-	1	-	-	-	-	-	-	-	-
21	-	-	1	-	1	-	1	-	-	-	-	-	-
22	-	1	0	-	0	-	0	-	-	-	-	-	-
23	-	0	2	-	2	-	0	-	-	-	-	-	-
24	-	0	1	1	1	-	1	-	-	-	-	-	-
25	2	0	4	0	2	2	1	-	-	-	-	-	-
26	0	0	1	1	1	0	1	-	-	-	1	-	3
27	0	1	3	0	0	9	3	-	-	4	0	-	4
28	0	0	1	0	0	27	2	9	1	3	0	-	12
29	1	0	1	1	0	23	2	17	5	5	1	-	19
30	1	0	1	0	1	27	2	25	9	7	3	-	24
31	1	0	1	1	0	33	3	23	5	8	4	5	19
32	0	0	1	0	2	14	1	21	9	1	4	6	18
33	0	0	0	2	1	12	1	42	15	1	7	2	15
34	2	2	0	1	2	19	2	38	13	2	8	4	11
35	1	1	0	1	1	20	1	32	9	5	10	7	5
36	3	1	2	1	2	14	0	11	1	3	8	3	4
37	0	1	1	2	0	29	0	4	1	3	7	2	10
38	2	1	0	3	0	21	1	2	0	0	3	2	6
39	1	1	0	1	1	10	0	0	1	0	3	3	3
40	0	1	0	0	0	9	-	1	0	1	1	0	4
41	0	0	3	0	0	3	-	0	-	2	1	0	2
42	0	1	0	1	2	0	-	-	-	0	0	1	1
43	2	1	1	0	0	-	-	-	-	-	-	0	1
44	0	0	0	0	-	-	-	-	-	-	-	-	0
45	0	0	0	0	-	-	-	-	-	-	-	-	-
46	0	1	0	1	-	-	-	-	-	-	-	-	-
47	1	0	0	0	-	-	-	-	-	-	-	-	-
48	0	-	1	1	-	-	-	-	-	-	-	-	-
49	1	-	0	0	-	-	-	-	-	-	-	-	-
50	0	-	0	0	-	-	-	-	-	-	-	-	-
51	-	-	0	0	-	-	-	-	-	-	-	-	-
52	-	-	0	0	-	-	-	-	-	-	-	-	-
53	-	-	0	1	-	-	-	-	-	-	-	-	-
54	-	-	0	1	-	-	-	-	-	-	-	-	-
55	-	-	0	0	-	-	-	-	-	-	-	-	-
56	-	-	0	-	-	-	-	-	-	-	-	-	-
57	-	-	1	-	-	-	-	-	-	-	-	-	-
Total	18	13	26	20	20	272	22	225	69	45	61	35	161

Appendix Table 6: (continued)

Species: *Sebastolobus alascanus*

Fork Length (cm)	Haul no. 3	6	7	9	10	16	18
11	-	-	1	-	-	-	-
12	-	-	1	-	-	-	-
13	3	4	1	3	-	-	-
14	1	0	4	0	2	-	-
15	0	5	7	1	7	1	-
16	1	5	8	3	5	7	-
17	0	3	8	2	0	8	1
18	2	5	16	1	0	7	1
19	0	4	11	4	2	25	3
20	11	5	18	5	1	18	1
21	8	5	22	2	5	21	3
22	3	3	11	7	2	21	4
23	4	2	16	6	4	23	6
24	1	5	12	2	2	13	10
25	2	4	15	7	9	11	11
26	6	1	12	5	16	10	6
27	7	0	18	4	16	11	5
28	5	-	12	3	17	11	11
29	3	-	7	2	8	11	11
30	3	-	6	2	11	0	8
31	1	-	1	1	12	8	6
32	3	-	1	2	11	2	7
33	1	-	0	0	6	3	10
34	0	-	-	1	5	2	0
35	1	-	-	0	4	1	2
36	1	-	-	-	4	0	2
37	0	-	-	-	5	0	1
38	-	-	-	-	1	1	2
39	-	-	-	-	0	1	0
40	-	-	-	-	-	0	0
41	-	-	-	-	-	-	0
42	-	-	-	-	-	-	0
43	-	-	-	-	-	-	0
44	-	-	-	-	-	-	1
45	-	-	-	-	-	-	0
46	-	-	-	-	-	-	0
47	-	-	-	-	-	-	0
48	-	-	-	-	-	-	1
49	-	-	-	-	-	-	1
50	-	-	-	-	-	-	1
51	-	-	-	-	-	-	0
Total	67	51	208	63	155	216	115

Species: *Merluccius productus*

Fork Length (cm)	Haul no. R2	R7	R10	R11	R15	R16	R17
36	-	-	-	-	-	-	1
37	-	-	-	-	-	-	0
38	-	1	-	-	-	-	0
39	-	0	-	-	-	-	0
40	-	0	-	-	-	-	0
41	-	4	1	-	-	-	1
42	-	1	4	-	-	-	0
43	-	5	1	1	-	-	2
44	-	12	4	1	2	5	0
45	1	26	3	3	1	2	4
46	1	26	14	7	3	2	7
47	1	25	14	8	2	6	7
48	3	34	11	12	6	3	7
49	5	31	10	14	1	3	9
50	4	18	6	4	6	3	2
51	11	13	3	3	2	1	6
52	15	6	3	1	1	1	0
53	11	4	2	2	3	0	2
54	10	0	0	0	1	-	1
55	14	2	0	1	0	-	0
56	14	0	0	0	-	-	-
57	8	-	0	0	-	-	-
58	7	-	0	1	-	-	-
59	12	-	0	0	-	-	-
60	6	-	0	-	-	-	-
61	4	-	0	-	-	-	-
62	5	-	0	-	-	-	-
63	3	-	1	-	-	-	-
64	1	-	0	-	-	-	-
65	1	-	-	-	-	-	-
66	1	-	-	-	-	-	-
67	5	-	-	-	-	-	-
68	1	-	-	-	-	-	-
69	0	-	-	-	-	-	-
Total	144	208	77	58	28	26	49

Appendix Table 6. (continued)

Species: *S. zacentrus*, *S. elongatus*, *S. diploproa*, *S. helvomaculatus*

Fork Length (cm)	Haul no. 3	31	3	9	3	43
16	-	-	-	-	-	2
17	1	-	-	1	-	0
18	1	1	-	0	-	0
19	0	0	-	1	-	0
20	2	5	-	1	-	5
21	2	0	-	12	1	3
22	2	3	-	12	0	3
23	2	1	-	11	0	5
24	4	2	-	10	0	2
25	5	9	1	9	1	4
26	5	8	0	11	5	4
27	5	9	2	10	4	8
28	1	14	2	6	6	9
29	3	11	2	1	3	10
30	0	15	2	0	2	9
31	-	7	0	-	0	8
32	-	5	-	-	1	2
33	-	11	-	-	0	3
34	-	12	-	-	-	1
35	-	33	-	-	-	0
36	-	24	-	-	-	-
37	-	13	-	-	-	-
38	-	6	-	-	-	-
39	-	2	-	-	-	-
40	-	2	-	-	-	-
41	-	0	-	-	-	-
Total	33	193	9	85	23	78

Appendix Table 6. (continued)

Species: *S. flavidus, S. pinniger, S. entomelas, Gadus macrocephalus*

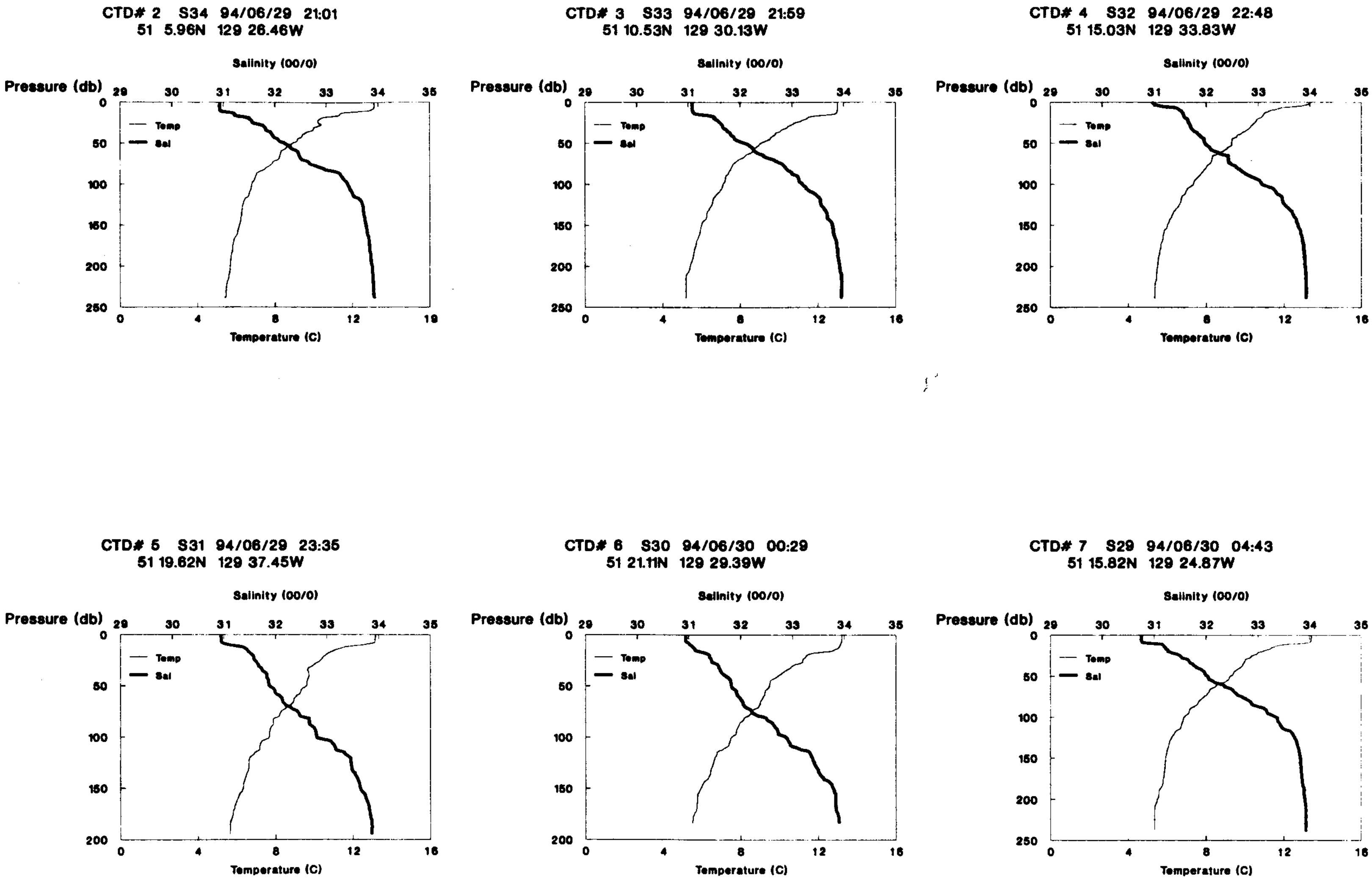
Fork Length (cm)	Haul no.			
	R2	R3	R11	R3
25	-	-	-	1
26	-	-	-	2
27	-	-	-	5
28	-	-	-	1
29	-	-	-	1
30	-	-	-	2
31	-	-	-	0
32	1	-	-	0
33	0	-	-	1
34	0	-	-	0
35	4	-	-	-
36	1	-	-	-
37	2	-	-	-
38	3	-	-	-
39	4	-	-	-
40	5	-	-	-
41	7	-	-	-
42	3	-	-	-
43	9	-	1	-
44	8	-	1	-
45	9	-	2	-
46	4	-	1	-
47	1	2	2	-
48	4	4	2	-
49	2	7	1	-
50	2	4	2	-
51	0	1	1	-
52	1	6	1	-
53	0	4	0	-
54	-	4	0	-
55	-	2	1	-
56	-	1	0	-
57	-	0	-	-
58	-	1	-	-
59	-	0	-	-
Total	70	36	15	13

Appendix Table 7. Day time surface densities and biomass for transects T01-T08 and T11-T18.

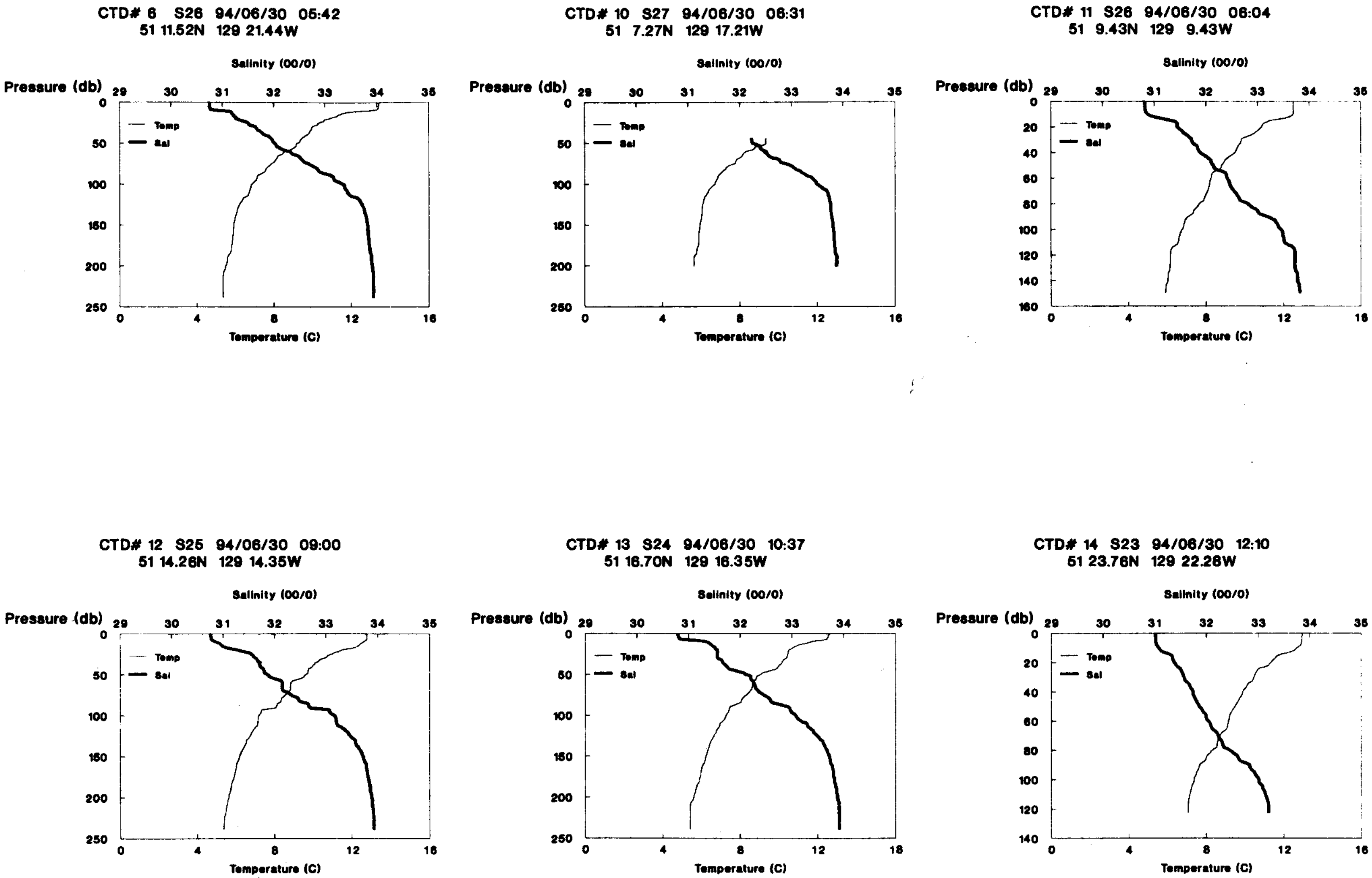
Event #	Trans.	Len (km)	Area (km^2)	Range 30-300 m Surf D (kg/m^2)	Range 30-300 m Biomass (t)	Range 180-300 m Surf D (kg/m^2)	Range 180-300 m Biomass (t)
6	T01	32	272	2.72E-02	7.43E+03	1.86E-03	5.07E+02
10	T02	40	367	1.92E-02	7.06E+03	1.94E-03	7.14E+02
15	T03	42	437	1.17E-02	5.11E+03	2.37E-03	1.04E+03
41	T04	27	280	1.69E-02	4.74E+03	2.75E-03	7.71E+02
48	T05	31	295	2.23E-02	6.58E+03	3.72E-03	1.10E+03
54	T06	29	275	4.58E-02	1.26E+04	6.90E-03	1.90E+03
58	T07	30	298	2.16E-02	6.46E+03	5.79E-03	1.73E+03
64	T08	40	395	3.86E-02	1.53E+04	1.20E-02	4.72E+03
		Total	2624		6.52E+04		1.25E+04
276	T11	41	367	3.18E-02	1.17E+04	8.62E-04	3.17E+02
265	T12	38	383	4.00E-02	1.53E+04	8.12E-04	3.12E+02
260	T13	43	475	1.64E-02	7.82E+03	2.28E-03	1.08E+03
254	T14	25	252	8.64E-03	2.18E+03	2.19E-03	5.53E+02
230	T15	30	276	1.30E-02	3.60E+03	4.39E-03	1.21E+03
225	T16	39	358	2.05E-02	7.33E+03	3.63E-03	1.30E+03
214	T17	56	544	2.39E-02	1.30E+04	3.80E-03	2.07E+03
205	T18	62	622	6.60E-02	4.10E+04	1.89E-02	1.18E+04
		Total	3281		1.02E+05		1.86E+04

Appendix Table 8. Day and night time surface densities (kg/m^2) for transects T04-T06 and T14-T16.

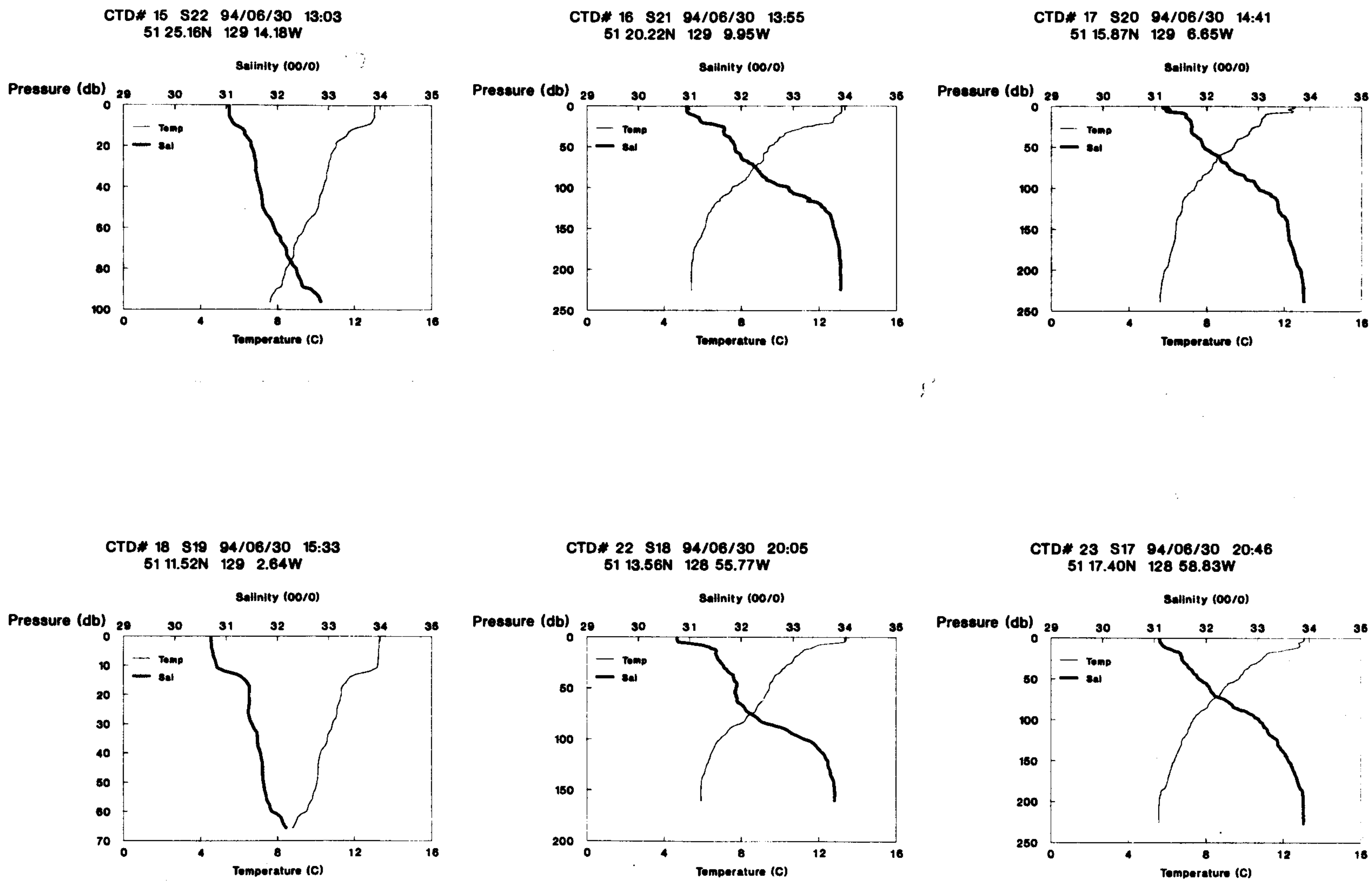
EVE #	TRA #	Length (km)	Day Depth Range 30-300 m	Day Depth Range 180-300 m	EVE #	Length (kg)	Night Depth Range 30-300 m	Night Depth Range 180-300 m
41	T04	27	1.69E-02	2.75E-03	20	26	1.05E-02	3.15E-03
48	T05	31	2.23E-02	3.72E-03	29	28	7.82E-03	2.62E-03
54	T06	29	4.58E-02	6.90E-03	34	13	2.16E-02	7.36E-03
254	T14	25	8.64E-03	2.19E-03	246	20	1.70E-02	3.04E-07
230	T15	30	1.30E-02	4.39E-03	238	43	9.39E-03	1.83E-03
225	T16	39	2.05E-02	3.63E-03	234	24	8.13E-03	3.20E-03



Appendix Fig. 1. Temperature and salinity profiles from the Goose Island Gully rockfish survey, June 27-July 7, 1994.

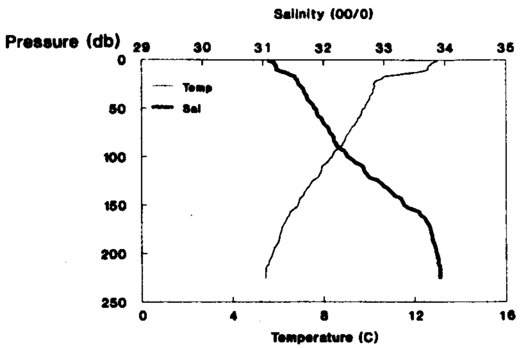


Appendix Fig. 1. (con't)

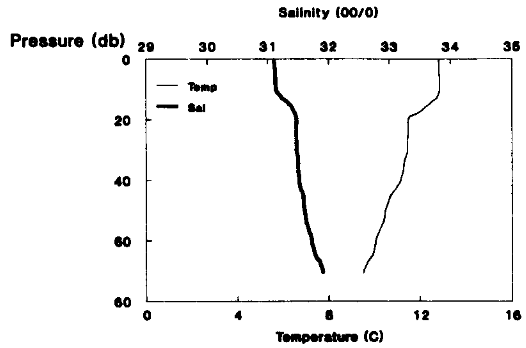


Appendix Fig. 1. (con't)

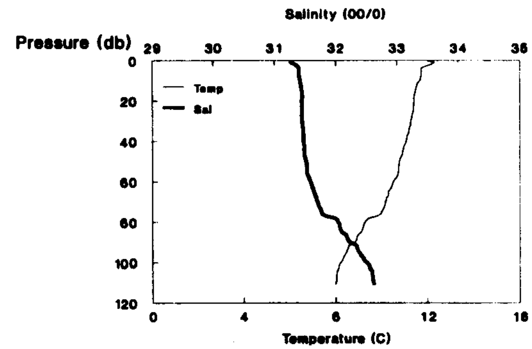
CTD# 24 S16 94/06/30 21:33
51 21.86N 129 2.25W



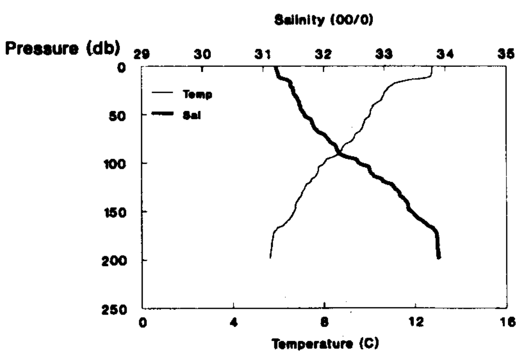
CTD# 25 S15 94/06/30 22:23
51 26.45N 129 6.21W



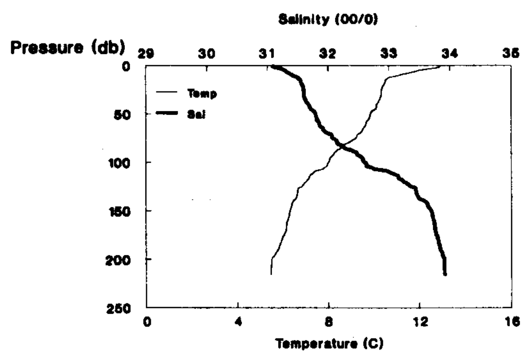
CTD# 26 S14 94/06/30 23:14
51 27.42N 128 56.84W



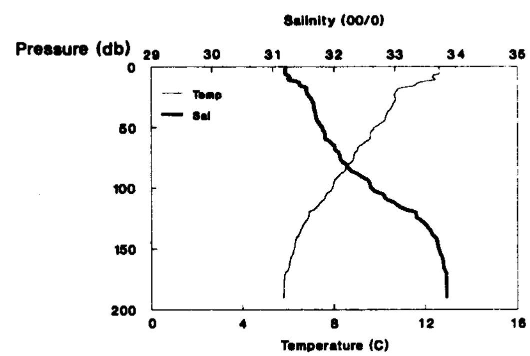
CTD# 27 C007 94/06/30 23:44
51 24.45N 126 54.58W



CTD# 28 S13 94/07/01 00:27
51 20.65N 128 50.50W

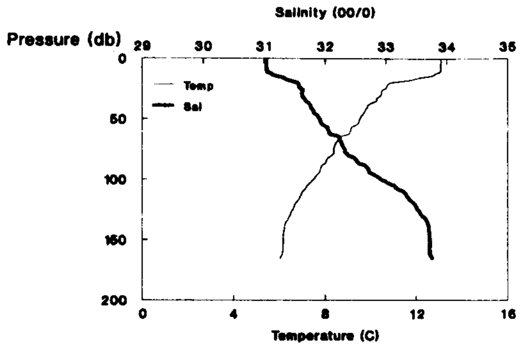


CTD# 29 S12 94/07/01 01:16
51 16.50N 128 46.35W

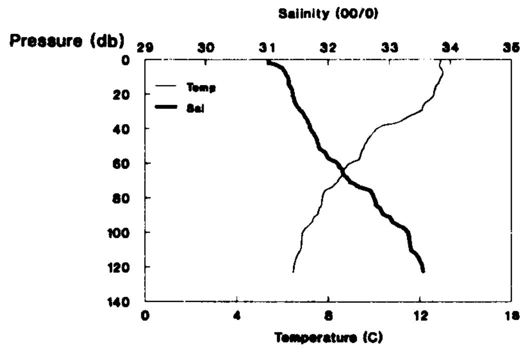


Appendix Fig. 1. (con't)

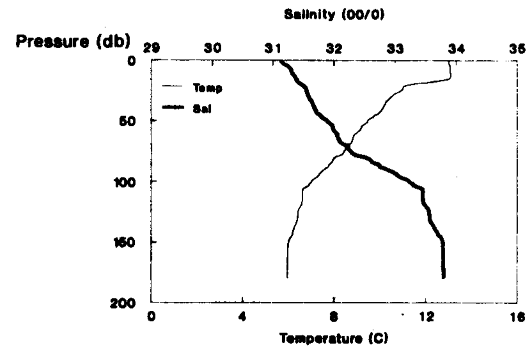
CTD# 30 S11 94/07/01 02:00
51 12.37N 128 42.43W



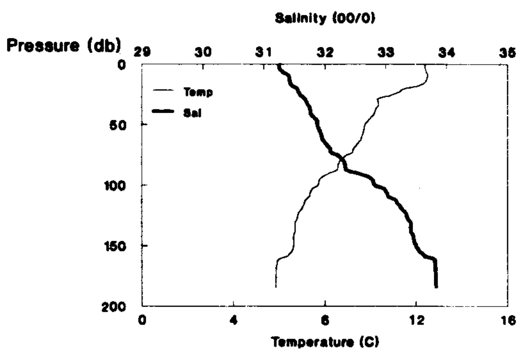
CTD# 31 S10 94/07/01 02:46
51 8.14N 128 37.27W



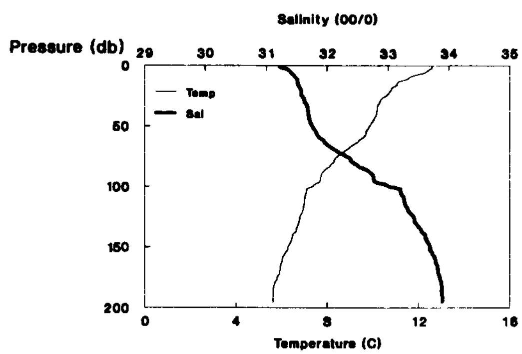
CTD# 32 S09 94/07/01 03:36
51 9.62N 128 30.03W



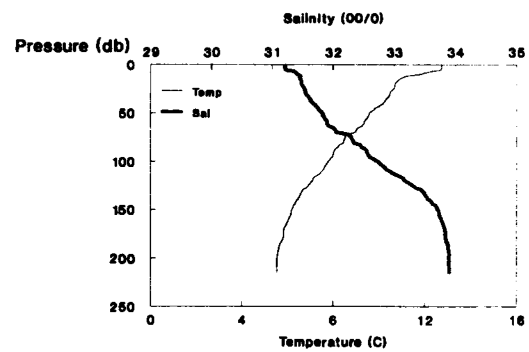
CTD# 34 S08 94/07/01 04:34
51 15.45N 128 35.97W



CTD# 35 S07 94/07/01 05:24
51 19.81N 128 40.31W

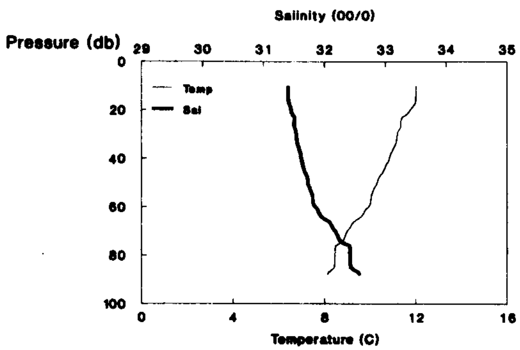


CTD# 36 S06 94/07/01 06:10
51 24.21N 128 44.52W

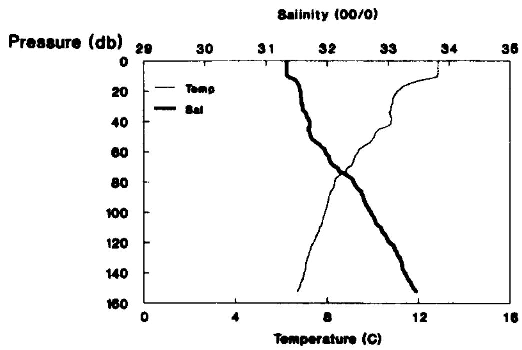


Appendix Fig. 1. (con't)

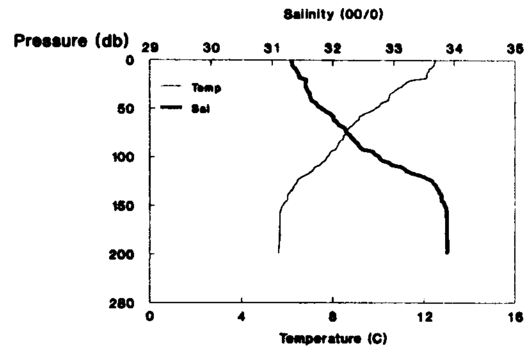
CTD# 37 S05 94/07/01 06:54
51 28.50N 128 48.58W



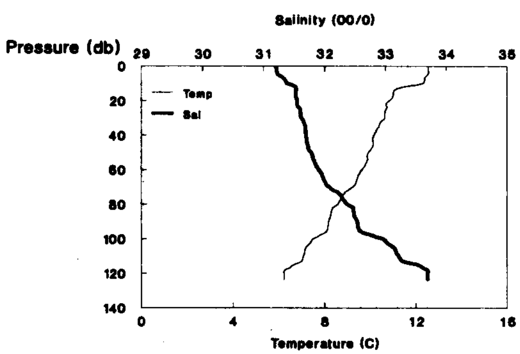
CTD# 38 S04 94/07/01 08:00
51 29.18N 128 41.08W



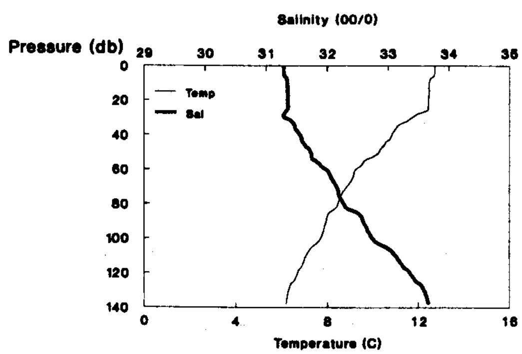
CTD# 39 S03 94/07/01 08:58
51 23.15N 128 34.99W



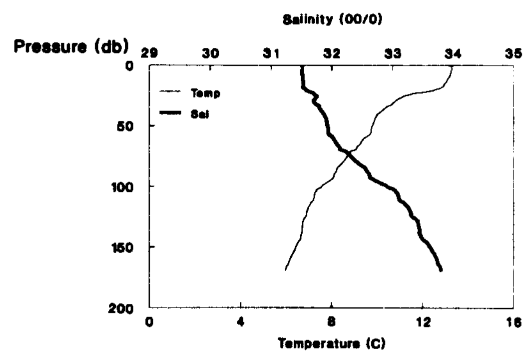
CTD# 40 S02 94/07/01 09:41
51 18.73N 128 30.45W



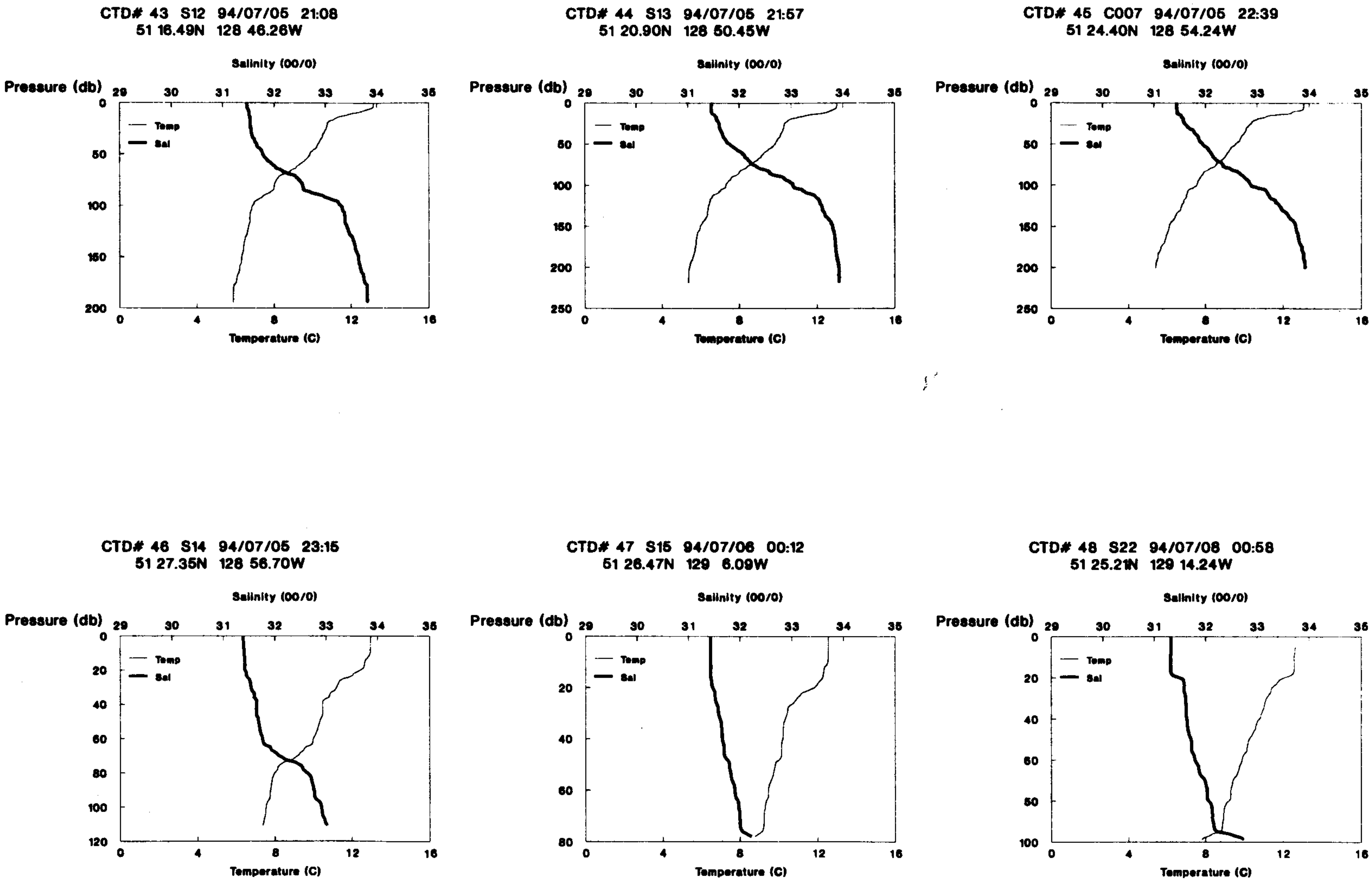
CTD# 41 S01 94/07/01 10:21
51 14.80N 128 26.07W



CTD# 42 S11 94/07/05 20:23
51 12.44N 128 42.60W

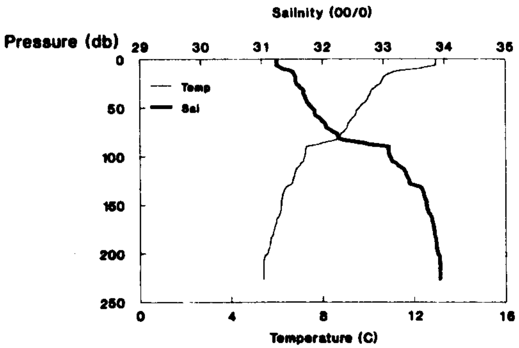


Appendix Fig. 1. (con't)

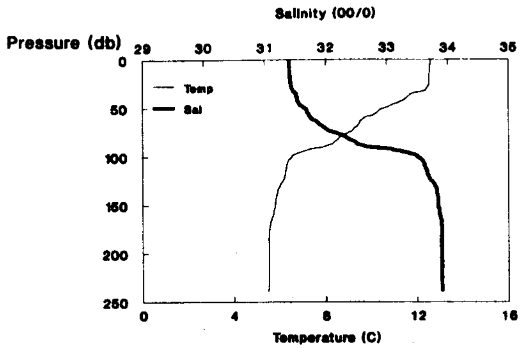


Appendix Fig. 1. (con't)

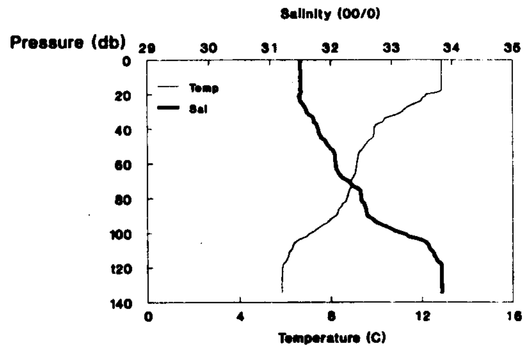
CTD# 49 S21 94/07/06 01:47
51 20.48N 129 10.20W



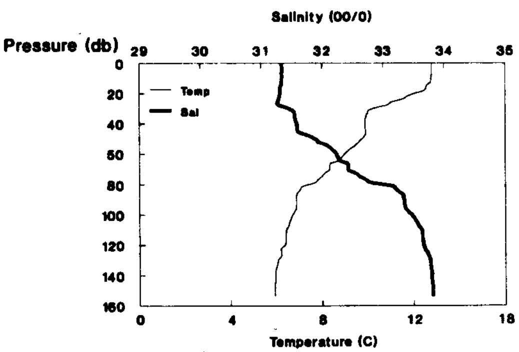
CTD# 52 S20 94/07/06 02:36
51 15.86N 129 6.44W



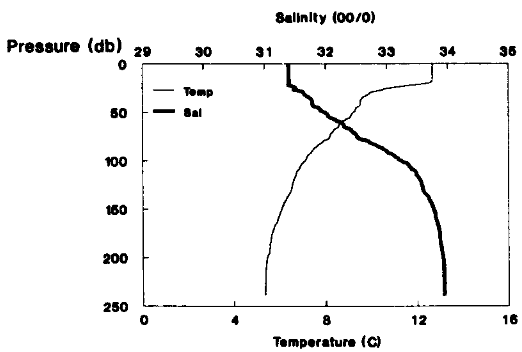
CTD# 53 S19 94/07/06 03:25
51 11.59N 129 2.87W



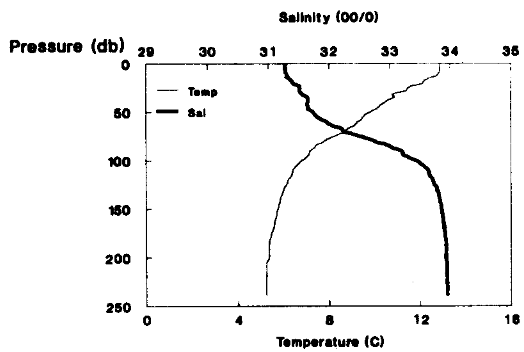
CTD# 54 S26 94/07/06 04:10
51 9.75N 129 9.65W



CTD# 55 S25 94/07/06 05:01
51 14.47N 129 13.90W

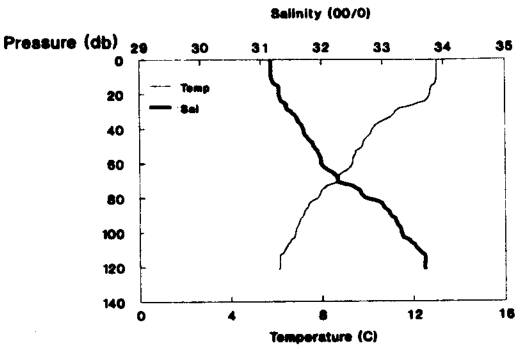


CTD# 56 S24 94/07/06 05:47
51 18.60N 129 18.15W

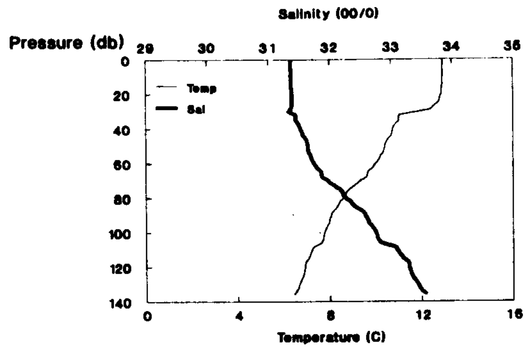


Appendix Fig. 1. (con't)

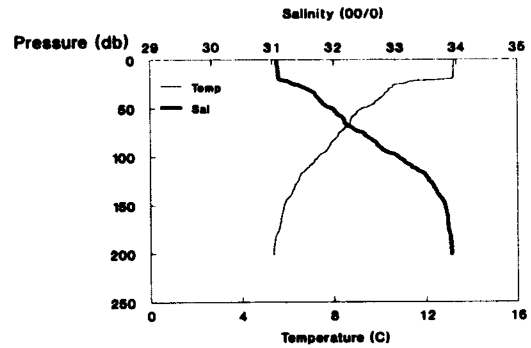
CTD# 57 S23 94/07/06 06:34
51 23.79N 129 22.05W



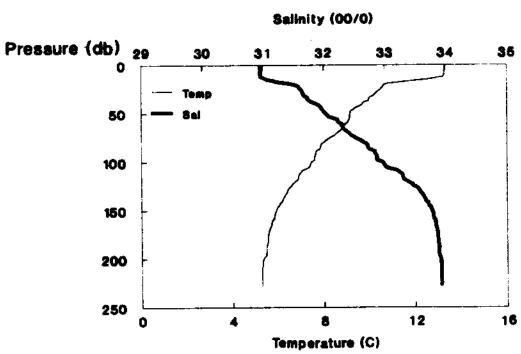
CTD# 58 GI02 94/07/06 08:04
51 30.40N 129 37.40W



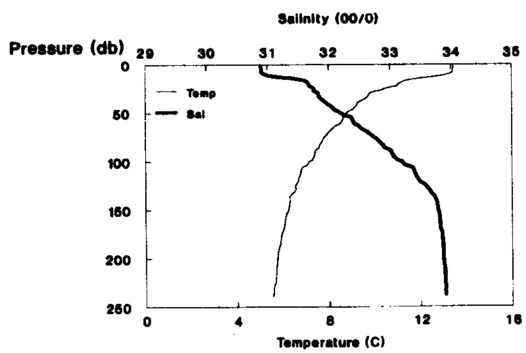
CTD# 59 S41 94/07/06 09:41
51 22.06N 129 43.77W



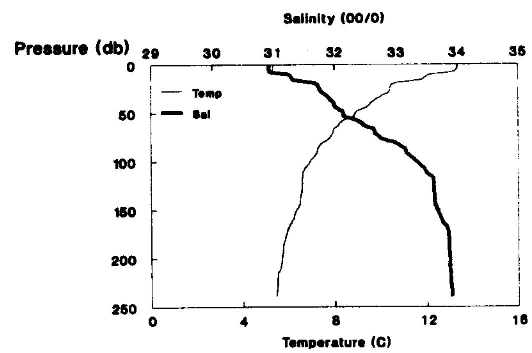
CTD# 60 S40 94/07/06 10:24
51 17.25N 129 40.05W



CTD# 61 S39 94/07/06 11:09
51 12.60N 129 38.60W

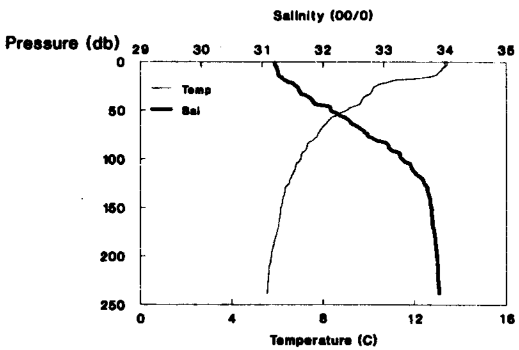


CTD# 62 S38 94/07/06 12:06
51 8.16N 129 32.80W

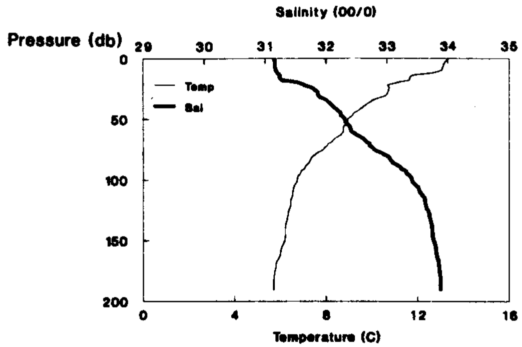


Appendix Fig. 1. (con't)

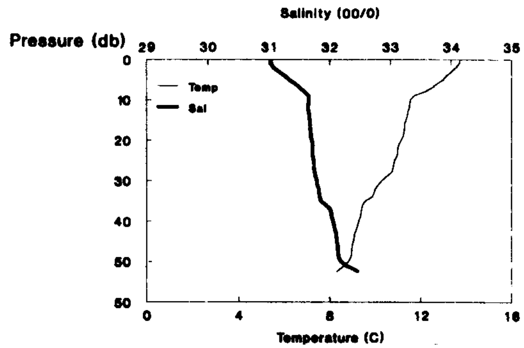
CTD# 64 S37 94/07/06 12:58
51 3.36N 129 26.94W



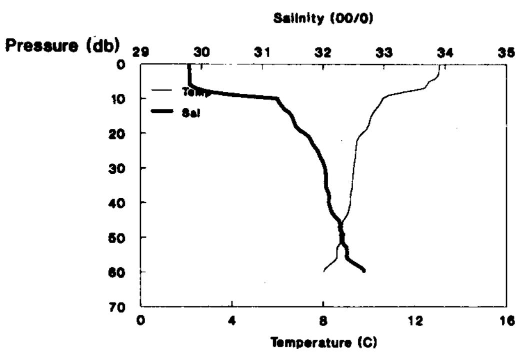
CTD# 85 S36 94/07/08 13:48
50 58.51N 129 24.94W



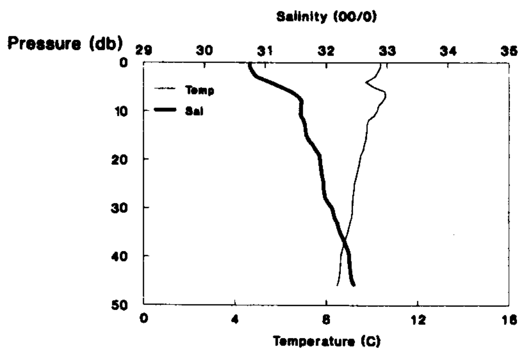
CTD# 87 E01 94/07/06 17:02
51 0.78N 128 42.11W



CTD# 88 E02 94/07/08 17:45
50 55.89N 128 38.59W



CTD# 89 E03 94/07/08 18:27
50 52.51N 128 32.27W



Appendix Fig. 1. (con't)