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Cruise Details and Biological Information From the Pacific Ocean Perch Monitoring Survey, R/V *W. E. RICKER*, July 2-13,1996

B. M Leaman, A. M. Cornthwaite, and R. D. Stanley

Fisheries and Oceans Canada
Science Branch, Pacific Region
Pacific Biological Station
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CRUISE DETAILS AND BIOLOGICAL INFORMATION FROM THE PACIFIC OCEAN PERCH MONITORING SURVEY, R/V *W.E. RICKER*, JULY 2-13, 1996

by

B. M. Leaman, A. M. Cornthwaite, and R. D. Stanley

Fisheries and Oceans Canada

Science Branch, Pacific Region

Pacific Biological Station

Nanaimo, British Columbia

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Leaman, B. M., A. M. Cornthwaite, and R. D. Stanley. 1997. Cruise details and biological information from the Pacific ocean perch monitoring survey, R/V *W.E. RICKER*, July 2-13, 1996. Can. Manuscr. Rep. Fish. Aquat. Sci. 2436: 91 p.

The results of the second post-harvesting monitoring survey of the experimental fishing area off Langara Island (Langara Spit) are presented. The survey occurred six years after a seven-year period of unrestricted fishing on rockfish (*Sebastes* spp.) stocks. Thirty-eight bottom trawl hauls, which replicated those completed during the 1993 survey, were used to collect biological samples and catch rate data. Length, age, and reproductive maturity data are presented for *S. alutus* and for the other commercial rockfish species that were abundant in the catch. Age composition of the *S. alutus* stock showed prominent modes representing the 1980 and 1984 cohorts. The 1996 age composition showed a larger proportion of younger age groups than in 1993, but in most cases the same cohorts were represented in both years. There was no evidence of significant recruitment of new age groups over those observed in 1993. Although the emphasis of the survey was on the collection of biological data, biomass estimates and bootstrapped 95% confidence intervals were calculated for the major rockfish species. Rockfish biomass in the area was dominated by *S. alutus*, which contributed 68% (8662 t ± 35-38%) of the total. *S. aleutianus, S. brevispinis, S. reedi, S. zacentrus,* and *Sebastolobus alascanus* each accounted for 4-9% of the total. Biomass estimates for most species increased between 1993 and 1996, suggesting a modest rebuilding of the rockfish stocks in the experimental area. However, these increases appear to be associated with growth in weight of fish already recruited to the exploitable biomass in 1993.

RÉSUMÉ

Leaman, B. M., A. M. Cornthwaite, and R. D. Stanley. 1997. Cruise details and biological information from the Pacific ocean perch monitoring survey, R/V *W.E. RICKER*, July 2-13, 1996. Can. Manuscr. Rep. Fish. Aquat. Sci. 2436: 91 p.

Nous présentons les résultats du deuxième relevé de surveillance post-capture dans la zone de pêche expérimentale proche de l'île Langara (Langara Spit). Le relevé a été effectué six ans après une période de sept ans de pêche sans restrictions des stocks de sébastes (*Sebastes* spp.). Trente-huit traits de chalut de fond, qui répétaient ceux du relevé de 1993, ont servi à recueillir des échantillons biologiques et des données sur les taux de capture. Nous présentons des données sur la longueur, l'âge et la maturité génésique pour *S. alutus* et pour les autres espèces commerciales de sébastes qui étaient abondantes dans les prises. La composition par âge du stock de *S. alutus* présentait des modes marqués correspondant aux cohortes de 1980 et 1984. La composition par âge de 1996 montrait une plus forte proportion de groupes d'âge jeunes qu'en 1993, mais dans la plupart des cas les mêmes cohortes étaient représentées les deux années. Il n'y avait aucune indication d'un recrutement important de nouveaux groupes d'âge par rapport à 1993. L'objectif premier du relevé était la collecte d'échantillons biologiques, mais nous avons calculé les estimations de la biomasse et les intervalles de confiance à 95 % par bootstrap pour les principales espèces de sébastes. Dans la région, la biomasse de sébastes était dominée par *S. alutus*, qui représentait 68 % (8 662 t ± 35-38 %) du total. *S. aleutianus*, *S. brevispinis*, *S. reedi*, *S. zacentrus* et *Sebastolobus alascanus* constituaient chacun 4-9 % du total. Pour la plupart des espèces, l'estimation de la biomasse a augmenté entre 1993 et 1996, ce qui permet de miser sur un modeste rétablissement des stocks de sébastes dans la zone expérimentale. Cette augmentation semble toutefois associée à la croissance en poids de poissons qui étaient déjà recrutés dans la biomasse exploitable en 1993.

INTRODUCTION

The Department of Fisheries and Oceans (DFO) initiated several co-operative experiments with the British Columbia trawl industry beginning in 1979. These experiments were designed to use the commercial fishery as an experimental management tool, to bridge the gap in perception between harvesters and the DFO about the exploitable biomass and available yield of rockfishes (*Sebastes* spp.) (Leaman and Stanley 1993). One of these experiments created an experimental fishing area that would have a specified period of no harvesting restrictions, followed by an equivalent period of closure, the details of which are presented by Leaman and Stanley (1993). A component of this experiment was monitoring surveys of the area at regular intervals. This report details results of the second post-harvest monitoring survey, conducted in July 1996. The emphasis of the 1996 survey was on the collection of synoptic biological samples to monitor the age and size composition of selected rockfish stocks in the experimental area. Although we have previously noted significant potential biases in biomass estimates from swept-area surveys for rockfish stocks (Leaman and Nagtegaal 1982, Nagtegaal et al. 1986), we also include biomass estimates for this survey.

METHODS

VESSEL AND NETS

The research vessel *W.E. RICKER*, a 57.3 m stern trawler, was used for the survey. Bottom trawl tows were made with either of two Atlantic Western IIIa bottom trawl nets with 11.8 cm and 13.1 cm mesh in the body of the nets, respectively, and using 1200-kg oval Polyvalent steel doors (Appendix Fig. 1). Both nets used a 2.5-cm mesh liner in the codend. The nets were rigged for hard-bottom trawling and used rubber bobbins in the bosom section of the groundline and rubber discs on the sweeplines. The two nets were used interchangeably due to frequent repairs of net damage incurred during tows. Some tows were completed without sweeplines, with the doors attached directly to the bridles. A SIMRAD ITI trawl sensing system was used on some tows to limit weight of catch to 1-1.5 t. A SIMRAD EQ echo sounder was the primary echo sounder used to locate fish and determine trawlability of the bottom. This sounder was different than the SIMRAD EK38 Scientific Sounder used on the 1993 survey.

SURVEY AREA AND DESIGN

The area surveyed, known commonly as Langara Spit, is located off the north coast of British Columbia to the northwest of Graham and Langara Islands (Fig. 1). To make this survey as comparable to the previous survey as possible, we followed the same stratified-random design and sample allocation as the 1993 survey (Leaman et al. 1996). The strata boundaries were established during a 1981 survey (Lapi and Richards 1981) and were designated Outside Upper (A), Outside Lower (B), Flats (C), Rock Pile (D), Deep Trench (E), and Inside Edge (F) (Fig. 1). Tow numbers by strata were based on the 1993 optimal (Neyman) allocation (Table 1). The 1996 survey attempted to replicate the hauls completed in 1993 wherever possible and the allocation therefore relied on the randomization established in 1993. Tow duration at each site also attempted to replicate that of the 1993 survey.

SAMPLING OF TOWS

Species nomenclature used in this report follows Gillespie (1993). Catch weights and species composition were determined for all successful tows, following Leaman et al. (1988). Total catch weight was obtained using a MSI Sea Weigh Model 2200 load cell and individual species weights were estimated through subsampling. Biological data on fork length (cm), sex, maturity stage, and sagittal otoliths were collected for the rockfish species (*Sebastes* spp.) with the highest proportion of the catch for a given haul, following the methods of Leaman et al. (1988). Rockfish maturity stages were designated according to Leaman and Nagtegaal (1986) (Appendix Table 1). Age estimation of otoliths was conducted subsequent to the cruise by the Ageing Laboratory at the Pacific Biological Station (MacLellan 1997).

BIOMASS ESTIMATION

Biomass was calculated for all species of rockfish encountered during the survey using a swept-area algorithm (Leaman and Nagtegaal 1986)

$$B_{T_s} = \sum_j \left(\frac{\overline{CPUE_j}}{k_a} \right) (A_s) (c)$$

B_{Ts} = estimated total biomass in stratum s (kg)

$\overline{CPUE_j}$ = mean catch per hour trawled in stratum for species j (kg/h)

k_a = area of bottom trawled in one hour (nm^2)

A_s = total area of stratum s (nm^2)

c = catching coefficient of trawl gear

The area of bottom trawled in one hour was calculated from trawl door spread and tow speed, averaged over the hauls in each stratum where the gear configuration was the same (Appendix Table 2). Trawl door spread was calculated from the headline wing spread, a catenary parameter which measures the curvature of the ground lines, and other net measurements (Appendix Fig. 2) using Carrother's (1980) program. Different gear configurations therefore resulted in different values of trawl door spread (Appendix Table 2). We treated the catenary parameter as a constant for all net configurations and vessel speeds used in this survey because this parameter must be estimated from information given for a variety of net types and configurations, and it has been shown that trawl door spread is relatively insensitive to poor estimates (Carrothers 1980). In addition, the catenary parameter is believed to have minimal variation over the normal range of towing speeds (Carrothers 1980). To account for herding of fish by the gear, the catching coefficient of the net was assumed to be 1.0 at the trawl door spread for all tows (after Leaman and Nagtegaal 1982).

Data from hauls with different gear configurations cannot be used directly to calculate the estimated total biomass in a stratum, as different values of k_a apply to the different configurations (Appendix Table 2). Therefore, two estimates of mean CPUE and biomass were calculated. One calculation excluded data from hauls where the net was fished without sweeplines attached; the other included the data but scaled the CPUE for these hauls by the ratio of k_a values for hauls using the two configurations.

We bootstrapped 95% confidence limits for catch rates and biomass estimates. Confidence limits for each species in each stratum were calculated using the same method as in the 1993 survey (Leaman et al. 1996). We used Efron and Tibshirani's (1993) 'bcanon' function for S-PLUS (MathSoft 1995), which uses their BC_a (bias-corrected and accelerated) method to calculate non-parametric confidence intervals. Confidence intervals for the stratified mean catch rate and the total biomass for the survey area were determined using percentiles of the distribution of the bootstrapped estimates. In 1993, we had used a function which employed the method of Rao and Wu (1988) to calculate confidence intervals for stratified means, but this function was found to contain an error (Kronlund, personnal communication). The nature of this error was to overestimate the confidence interval (i.e. make it larger) because of an incorrect formulation of the skewness parameter for the distribution of observations. We therefore used the more simple percentile method for the 1996 estimates and to recalculate the 1993 estimates. We note that this method does not account for any skew in the distribution of observations and is also likely to generate an overestimate of the confidence intervals (i.e., make them larger).

RESULTS

SURVEY DESIGN AND SAMPLE DISTRIBUTION

Thirty-eight bottom trawl hauls were completed successfully (Appendix Table 3, Fig. 2) with three to twelve hauls completed in each stratum (Table 2, Fig. 3). A total of 39 hauls were attempted during the survey but only 38 provided usable data. The actual allocation of sample hauls relative to the sample design allocation departed significantly for the Outside Upper (A), Flats (C) and Rock Pile (D) strata, which were over-sampled (A, C) and under-sampled (D), respectively (Table 2; Fig. 3). These departures are related primarily to the difficulty experienced in maintaining tows in the target depth range on the steep edge between the Flats and Deep Trench strata. The over-sampling of the Flats stratum resulted from tows becoming too shallow in the Deep Trench stratum, hence data were included in the former. The Rock Pile stratum was under-sampled because not all hauls could be completed during the time allotted for the survey. These hauls would have been completed but a net was lost on Tow 34. The time spent searching and grappling for this net consumed time initially allocated for survey tows. While this tow had been completed successfully on the previous survey, the extremely rough bottom of parts of the survey area renders even small deviations in trawl paths significant for successful completion of a tow. The implications of the biases in sample distribution will be discussed later in this report.

Towing speed ranged from 3.0-3.5 kt for all hauls, with an average of 3.4 kt. Average towing speed among strata ranged from 3.3-3.5 kt. Tows 35-39 were completed without sweeplines and the bridles were attached to the trawl doors. This configuration was adopted because the original sweeplines with rubber disks were lost on tow 34 and the remaining tows were in parts of the survey area where the bottom is extremely rough. On such rough bottoms, shorter sweepline/bridle combinations help to lower the probability of net damage.

SPECIES COMPOSITION OF CATCH

Twenty-three species of fish were captured in the survey area (Appendix Table 4). Rockfish accounted for 93% of the total catch with two species, Pacific ocean perch (*S. alutus*) and sharpchin rockfish (*S. zacentrus*), accounting for 67% and 12% of the total catch, respectively (Table 3). No other species contributed more than 5% of the total catch. Pacific ocean perch accounted for 5-97% of the catch in each haul (Table 4). The proportional catches of Pacific ocean perch were 70-75% in strata A, B, and C (Outside Upper, Outside Lower, and Flats), and 45-50% in strata D, E, and F (Rock Pile, Deep Trench, and Inside Edge), with the highest proportional catch in stratum C, and the lowest in strata D and F.

Arrowtooth flounder (*Atheresthes stomias*) and Pacific halibut (*Hippoglossus stenolepis*) were the major non-rockfish contributors to the total catch, at approximately 3% and 2%, respectively. Sixty-eight percent of the halibut catch occurred in a single haul (Haul 8, Outside Upper stratum). All other non-rockfish species contributed less than 1% to the total catch from the survey area.

BIOLOGICAL SAMPLING

Biological sampling during the survey concentrated on *S. alutus* (Table 5), but *S. aleutianus*, *S. brevispinis*, and *S. reedi* were also the objects of directed samples. For each species, length and maturity frequencies by sex (Tables 6-8) and age frequencies (Tables 9-11) were determined for each stratum where sampling occurred. Major characteristics of the sampling, by species, follow.

S. alutus

Length and age frequencies of *S. alutus* are expressed as proportions of the total catch for each stratum, and weighted by catch rate (kg/hr) for each haul. Length proportions from shallower segments of the survey area (strata A, C, D, and F) show bimodal distributions for female fish with modes near 36 and 41 cm (Table 5; Figs. 4-9). Deeper water samples (strata B and F) show more variable female length proportions, particularly for the Deep Trench (stratum E) samples (Figs. 5 and 8). Length proportions for male fish are generally unimodal near 38 cm, with the exception of the Deep Trench samples which show a strong mode at 43 cm, representing the very strong 1952 cohort (Fig. 8). Both sexes of *S. alutus* were almost exclusively in maturity stage 2 (Developing).

Ages for *S. alutus* range from 5 y to 89 y (Table 9, Figs. 10-15). In all strata except E, the largest proportion of the age composition (89-98%) is concentrated in a few strong cohorts at ages ≤20 y. A major mode occurs in all strata at age 11-12 y, corresponding to the 1984 cohort. In strata A-D, additional modes occur at ages 16 and 20 y, corresponding to the 1980 and 1976 cohorts, respectively. The 1984 cohort is dominant in strata A, B, E, and F, while in strata C and D the 1980 cohort is dominant. In strata E and F, the 1987 cohort (age 9), which is relatively insignificant in the other strata, is represented as a secondary mode. In stratum E, which has received lower historical (i.e., pre-1980s) exploitation than the other strata, a large proportion (≃30%) of the fish were older than 40 y. A mode occurs at ages 43-45, corresponding to the historically significant 1952 cohort, which is absent from or very poorly represented in the other strata. In stratum F, the shallowest stratum, a small proportion of the fish are from the 1990 and 1991 cohorts (ages 5-6), which are absent from or in very low abundance in the other strata.

Other *Sebastes* spp.

Rougheye (*S. aleutianus*), silvergrey (*S. brevispinis*), and yellowmouth rockfish (*S. reedi*) are each represented by one to three samples from the survey (Table 5). For the single *S. aleutianus* sample, lengths range from 41-57 cm with frequencies peaking at 47 cm for males, and 47 and 50 cm for females (Table 7). Male and female rougheye rockfish were primarily in maturity stage 2 (Developing). The age frequency for *S. aleutianus* peaks at 37 y (the 1959 cohort), with most ages falling in the 25-46 y range (Table 10). The oldest fish was 72 y.

S. reedi length frequencies are strongly unimodal for both sexes, ranging from 42-49 cm for males and from 35-52 cm for females, with modes at 47 and 48 cm, respectively (Table 7). These yellowmouth rockfish were also primarily in maturity stage 2 (Developing). Age composition for *S. reedi* is broad and ranges from 9-52 y, with two distinct modes at 20 y and 44 y (Table 10). These modes represent the same 1976 and 1952 cohorts noted for *S. alutus.*

S. brevispinis length frequencies peak at 49 and 50 cm for males and females, respectively (Table 8). Silvergrey rockfish is one of a minority of rockfish species that spawn in the summer, hence the maturity was primarily stage 7 (Resting) for males and stage 5 (Eyed Embryo) for females. Ages for *S. brevispinis* range from 11-56 years (Table 11). Age frequencies peak at 16 y and at 23 y, corresponding to the 1980 and 1973 cohorts, respectively (Table 11).

CATCH RATES AND BIOMASS ESTIMATES

The two different net configurations (with and without sweeplines) required separate approaches to biomass calculation for the two strata involved (A, B). Calculating total biomass by combining the data directly from hauls using the two configurations was not possible because the nets had different values of area swept per hour (k_a). We therefore took two approaches to calculating biomass. The first approach was to eliminate the data for the five tows using the net without sweeplines from the calculations. The second approach was to scale the data for the tows without sweeplines by the ratio of the k_a values for the two configurations at an average towing speed of 3.5 kt. These scaled data were then incorporated into the normal biomass calculations. The scaling ratio for those tows was 1.15604 and the scaled data had no effect on the average k_a for stratum A (Appendix Table 2). The average k_a for stratum B did change with the inclusion of the scaled data, though the effect was largely due to a change in average towing speed for tows 38 and 39 compared with the other tows in the stratum (3.3 vs. 3.4 kt).

For each approach, we calculated catch rates and bootstrapped 95% confidence intervals, by species, for each stratum (Tables 12-15). The difference in the estimates for the two approaches is not large (≃5% of the total biomass). We therefore focus on the calculations including the scaled data as the most representative for the survey (Tables 14 and 15). The highest all-species catch rate was at the Rock Pile (stratum D; Table 14), while the highest

S. alutus catch rates were in the two Outside strata (A, B). In all strata, the mean catch rate of *S. alutus* was higher than for any other species. In all strata except stratum D, *S. alutus* contributed 60-80% of the all-species catch rate. In stratum D, where the contribution of *S. alutus* was only 40%, the all-species catch rate was influenced by an extremely high catch rate for *S. reedi*, which contributed 30%, compared to its contribution of less than 1% in all other strata. Additional species in higher abundance in stratum D were *S. borealis*, *S. brevispinis*, and *S. zacentrus*. The greater species diversity in stratum D is consistent with other work showing higher rockfish diversity in high-relief habitats (Leaman and Nagtegaal 1987). The species composition of the Deep Trench and Outside Lower strata are also noteworthy because of the larger CPUEs of the deepwater rockfishes *S. aleutianus* and *Sebastolobus alascanus*. Confidence intervals of strata mean CPUE, expressed as a percentage of the mean, ranged from 101-190% (Table 14).

The estimated all-species biomass of rockfishes was dominated by *S. alutus* (8662 t, 68% of the all-species total), of which the largest proportion (35%) came from the Flats (stratum C; Table 15). The 95% confidence interval for *S. alutus* total biomass is approximately 5600-12000 t. *Sebastes aleutianus*, *S. brevispinis*, *S. reedi*, *S. zacentrus*, and *Sebastolobus alascanus* each accounted for 4-9% of the total all-species biomass, while no other species accounted for >1%. The largest proportion by stratum of the total biomass came from the Flats which contributed approximately 30%, followed by the Outside Lower and Deep Trench strata (B and E), each contributing approximately 20%.

Departures from survey design sample allocation were noted for all strata, particularly strata A, C, and D. The effects of these departures are not readily apparent in the confidence intervals by stratum (Table 14, Fig. 16a). Indeed, the relatively under-sampled stratum D had the second narrowest confidence interval. However, we stress that sample sizes were small for some strata and confidence intervals in particular should be interpreted cautiously because re-sampling methods such as bootstrapping are sensitive to sample size. For strata C-F, the effects of departures from the design sample allocation are reflected in the strata coefficients of variation (c.v.) for CPUE (Fig. 16b). The largest c.v. (125%) among these strata is from the Deep Trench (E), which was under-sampled by two hauls. The Flats, Outside Upper, and Outside Lower strata (A, B, C) were over-sampled or close to the target sample allocation but present no clear link with c.v. (117, 72, and 95%, respectively), while the smallest c.v. was recorded in the strongly under-sampled Rock Pile stratum (D). The Outside Upper and Flats strata (A and C), have larger c.v.'s than would be expected (117% and 95%), as stratum A was over-sampled by three hauls and stratum C by four hauls.

COMPARISON WITH THE 1993 SURVEY

Catch rates

We recalclulated the 95% confidence intervals for the 1993 catch rates, as they had been erroneously calculated as 90% confidence intervals. In addition, it was necessary to recalculate the confidence intervals for the stratified mean catch rates because of the error noted previously. The size of the new 95% confidence intervals for the mean catch rates by stratum ranged from 92-194% of the mean, compared to the old 90% confidence intervals which ranged from 79-160% of the mean.

Strata catch rates in 1996 were higher than in 1993 for all strata except stratum C. The largest proportional increase was in stratum F, where the all-species catch rate increased from 370 kg/hr in 1993 to 1680 kg/hr in 1996, an increase of about 350%. The all-species catch rates in strata A, B, and D increased by over 3000 kg/hr per stratum from 1993 to 1996, or by 50-120%. The all-species catch rate in stratum E increased from 950 kg/hr in 1993, to 1330 kg/hr in 1996, or by 40%. The all-species catch rate in stratum C was the same in both years. The relative widths of the 95% confidence intervals and coefficients of variation differed by 5-55% between years for most strata (Fig. 16a). Only for stratum B, which was sampled close to the optimal design in both years, were the confidence intervals and c.v. similar in 1993 and 1996. The 1996 c.v.'s were larger for strata E and F (by approximately 10%) than in 1993, and smaller (by 15-40%) for all other strata. We repeat that the small sample sizes in some strata mean that these confidence intervals and c.v.'s must be interpreted cautiously.

All-species biomass estimates

In order to be directly comparable with the estimates from the 1996 survey, the 1993 biomass estimates were recalculated using average tow speed per stratum (Appendix Table 6), rather than the average towing speed over the duration of the survey as was originally calculated (Leaman et al. 1996). In strata B and C, the towing speeds were 2.7 and 3.4 kt respectively, compared to a mean of 3.0 kt for the entire survey, and the new strata biomass estimates differed from the old by 200-500 t, or about 10%. In the remaining strata, tow speeds ranged from 2.9 to 3.2 kt, and the new strata biomass estimates were similar (within about 5%) to the old estimates. The total all-species biomass was about 350 t (4%) less than that calculated using the old method.

The estimated all-species biomass (≃12750 t) was approximately 35% greater in 1996 than in 1993 for the combined strata (Table 15, Appendix Table 6). It was higher in all strata except stratum C, where the difference between the two years was only about 3%. Strata B and F showed the greatest differences in biomass between 1993 and 1996, with the 1996 biomass two times and four times larger than the 1993 biomass, respectively, an increase of approximately 1000 t in each stratum.

S. alutus biomass estimates

The estimated *S. alutus* total biomass in 1996 was approximately 2700 t greater than in 1993. The all-strata total estimate of 8700 t (95% c.i. 5600-12000 t) in 1996 compared to approximately 5900 t (95% c.i. 3500-8900 t) in 1993 reflected increases in all strata except the Flats area (C). As with the all-species biomass, the largest increases occurred in strata B and F (900-1000 t larger in 1996). In stratum F, the 1996 estimated biomass (1180 t) was almost eight times that of 1993, although the absolute biomass was relatively small. In 1993, about one-half the total biomass of *S. alutus* came from stratum C, while in 1996 the increased contributions from other strata diminished the contribution of stratum C to about one-third. *S. alutus* contributed 68% to the total all-species biomass in 1996 and 63% in 1993.

Other species' biomass estimates

Estimated *S. aleutianus* total biomass in 1996 was more than twice that in 1993, primarily due to a large increase in the contribution from stratum E. This stratum had an estimated 610 t compared to <10 t in 1993, or 71% of the 1996 total for *S. aleutianus* compared to only 2% in 1993. However, the contribution of *S. aleutianus* to the total all-species biomass between years was similar: 7% in 1996 and 4% in 1993.

Estimated *S. reedi* total biomass in 1996 was about 60% less than in 1993, primarily due to decreases in the contributions from strata C and E. In 1996 the contribution from stratum C was <30 t, only 6% of the total, while in 1993 stratum C contributed almost 700 t or 64% of the total biomass for *S. reedi*. Stratum E contributed 13% of the total in 1993, while in 1996 the *S. reedi* biomass in stratum E was negligible. In 1996, 94% of the total estimated *S. reedi* biomass came from stratum D, compared to only 23% in 1993, although the biomass increase was only about 170 t. The contribution of *S. reedi* to the total all-species biomass was 4% in 1996, compared to 11% in 1993.

Other species' biomass estimates were up to 350 t greater by species in 1996 than in 1993, but proportional contributions to the total all-species biomass were similar between years (Table 15 and Appendix Table 6). The two species recording the greatest increases were *S. zacentrus* and *Sebastolobus alascanus*.

S. alutus length/age proportions

Length frequency proportions from the 1996 survey show similar distributions to those for the same strata in the 1993 survey (Figs. 4-9). Modes in 1996 are within approximately 2 cm of the modes in 1993 and for most strata are consistently larger. The Outside Lower stratum (B) is notable because the 1993 length modes are consistently smaller than those seen in 1996. Age proportions from the 1996 survey show a larger proportion of younger age-classes (1980+ cohorts) in 1996 than in 1993, although in most strata the same cohorts <20 y are represented in both years. The 1984 cohort has increased in relative importance in the two Outside strata and the Deep Trench since 1993, while the 1980 cohort remains dominant in the Flats and Rock Pile (Figs. 10-15). The 1987 cohort was barely detectable during the 1993 survey, but by 1996 had become a secondary mode in the Deep Trench and Inside Edge strata. There does not appear to have been significant recruitment of any new cohorts to the survey area, over those observed in 1993, although the Inside Edge shows a small contribution from the 1990-91 cohorts.

Other *Sebastes* spp. length/age proportions

In order to compare other *Sebastes* species' lengths and ages between years, the frequencies were expressed as proportions of the total catch for each stratum where sampling occurred in both years, and weighted by catch rate (kg/h) for each haul (Figs. 17-21). Length data were collected in both years in only one common stratum for each species (Figs. 17-19). No age data were collected for *S. brevispinis* in 1993, but age data were collected in both years in one common stratum each for *S. aleutianus* and *S. reedi* (Figs. 20-21).

Although we present length/age comparisons for *S. aleutianus*, we stress that the sample size from the 1996 survey is only 19 males and 22 females, compared with 105 and 79 fish in 1993. Length proportions of *S. aleutianus* collected in the Outside Lower stratum during the 1996 survey were similar to those in the same stratum for 1993 (Fig. 17). Age proportions by cohort for *S. aleutianus* collected in 1996 were distinctly different than those for the 1993 survey (Fig. 20). The 1996 sample had greater contributions from the late 1950s and mid-1960s cohorts than did the 1993 samples, as well as a narrower range of ages.

The length proportions for *S. reedi* collected in the Rock Pile stratum during the 1996 and 1993 surveys showed greater proportions of larger fish for 1996, which is consistent with growth of cohorts existing in 1993 over the interim period (Fig. 18). In 1996 there were fewer fish smaller than 42 cm, suggesting a lack of significant recruitment since 1993. Age proportions for *S. reedi* in 1996 were very similar to those in 1993 and were clearly dominated by the 1952 and 1976 cohorts (Fig. 21).

Comparison of length proportions for *S. brevispinis* between 1993 and 1996 is restricted to a small number of fish collected from the Inside Edge stratum (Fig. 19). In 1996, a larger proportion of fish were in the middle length range (48-55 cm) compared to 1993, although length proportions were quite variable in both years. There were no *S. brevispinis* aged in 1993.

DISCUSSION

The 1996 monitoring survey results suggest a modest rebuilding of the rockfish stocks in the Langara Spit experimental area since the previous survey. Indices of relative abundance have increased for most species. However, we note that these increases appear to be associated with growth in weight of fish from cohorts that had already recruited to the exploitable biomass in 1993. Recruitment of cohorts born after 1987 is apparently lower than those from the early to mid-1980s in most strata, with the Inside Edge being exceptional as the only area showing the presence of a relatively strong 1990 contribution. We note that this stratum does include the shallowest regions of the survey area and that fish <6 y are generally less than 10% recruited to the commercially exploited stock. However, the survey did use a small-mesh codend liner to capture younger fish and cohorts recruiting in strength would have been detected.

Some of the species and strata cells show large relative changes between the 1993 and 1996 monitoring surveys. These changes are larger than might be reasonably expected on the basis of normal rockfish recruitment or growth patterns. In previous reports (Leaman and Nagtegaal 1982, Nagtegaal et al. 1986, Leaman and Nagtegaal 1986), we have noted the strong temporal variability in CPUE for rockfishes associated with diel, semi-diurnal and fortnightly tidal effects. We caution that the interpretation of large relative changes noted for specific strata and depths between the surveys should be tempered by knowledge of these sources of temporal variation. In addition, we note that stations on these surveys were occupied once only and within-site variation is not estimated.

While it is premature to make assessment of relative cohort strengths from spawning in the 1990s, the absence of significant recruitment of cohorts from the late 1980s into the survey area suggests that increases in biomass over the next 3-6 y will be limited primarily to contributions from existing cohorts.

Future work for this experimental area should include a detailed catch-at-age analysis, and the survey results should be useful as an index of relative abundance for tuning that analysis. A primary finding of this experimental program was the decline in CPUE associated with unrestricted fishing (Leaman and Stanley 1993). Given the results of the experimental interventions on the rockfish stocks in this area, additional experimental manipulations that take advantage of the signal injected in these populations might be considered. For example, additional fishing programs could be designed to measure the response of the stocks to specific management strategies. The baseline information from previous monitoring surveys plus the detailed fishing information available from present mandatory observer programs could produce data sets of very high quality.

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Table 1. Strata sampling schemes determined for the 1993 and 1996 Langara surveys, based on data collected aboard the M/V *SCOTIA BAY* during the 1979 two-boat survey (Leaman et al. 1996, Lapi and Richards 1981). Sample allocation was based on a projection of 40 hauls.

Stratum	Area (n.mi^2)	Biomass[1] (t)	σ as % of mean[2]	Allocation by Weighting Method: Area	Biomass	σ	Optimal
A - Outside upper	7.0	1249.86	61.47	1	7	4	5
B - Outside lower	40.4	709.72	171.24	3	4	10	7
C - Flats	198.0	1373.63	106.79	15	7	6	8
D - Rockpile	15.0	2911.19	55.41	1	15	3	8
E - Deep trench	187.0	837.05	155.29	14	4	9	7
F - Inside Edge	80.8	659.10	154.68	6	3	9	5
Total	528.4	7740.55	704.88	40	40	40	40

[1] Marketable species from 1979 Survey
[2] for *S. alutus* from 1979 Survey

Table 2. Haul locations, R/V *W.E. RICKER*, Langara survey, July 2-13, 1996.

Stratum	Coordinates	Depth Range	Hauls
A - Outside Upper	54° 00' x 133° 35' to 54° 35' x 133° 50'	120-160 fm 219-293 m	9, 10, 11, 12, 15, 35, 36, 37 [8 hauls][1]
B - Outside Lower	54° 00' x 133° 35' to 54° 30' x 133° 50'	161-300 fm 291-549 m	6, 7, 8, 16, 38, 39 [6 hauls]
C - Flats	54° 02' x 133° 10' to 54° 35' x 133° 47'	120-180 fm 219-329 m	2, 3, 13, 14, 17, 18, 19, 20, 27, 28, 29, 30 [12 hauls]
D - Rock Pile	54° 19' x 133° 20' to 54° 25' x 133° 35'	100-160 fm 183-293 m	31, 32, 33 [3 hauls]
E - Deep Trench	54° 00' x 133° 00' to 54° 28' x 133° 40'	180-260 fm 329-475 m	1, 4, 5, 25, 26 [5 hauls]
F - Inside Edge	54° 00' x 133° 00' to 54° 18' x 133° 40'	50-180 fm 91-329 m	21, 22, 23, 24 [4 hauls]
Total	--	--	38 hauls

[1]Nine hauls were attempted in Stratum A (Outside Upper) but one was unsucessful.

Table 3. Total catch by species, R/V *W.E. RICKER*, Langara survey, July 2-13, 1996.

Species name	Weight (kg)	% of Total
Sebastes aleutianus	2845	4.04
S. alutus	46895	66.51
S. babcocki	405	0.58
S. borealis	228	0.32
S. brevispinis	2231	3.16
S. crameri	137	0.19
S. diploproa	Trace	0.00
S. elongatus	Trace	0.00
S. entomelas	23	0.03
S. flavidus	5	0.01
S. helvomaculatus	140	0.20
S. proriger	888	1.26
S. reedi	1710	2.43
S. variegatus	73	0.10
S. zacentrus	8072	11.45
Sebastolobus alascanus	1624	2.30
Bigmouth sculpin	Trace	0.00
Darkfin sculpin	6	0.01
Arrowtooth flounder	1769	2.51
Petrale sole	7	0.01
Rex sole	455	0.65
Pacific halibut	1458	2.07
Slender sole	Trace	0.00
Dover sole	644	0.91
English sole	4	0.01
Whitebait smelt	3	0.00
Sablefish	471	0.67
Pacific cod	56	0.08
Pacific hake	122	0.17
Lingcod	4	0.01
Walleye pollock	86	0.12
Spotted ratfish	35	0.05
Skates	111	0.16
Spiny dogfish	1	0.00
Total	70508	100

Table 4. Estimated catch by tow (kg) for Pacific ocean perch, *Sebastes alutus*, collected aboard the R/V *W.E. RICKER*, Langara survey, July 2-13, 1996.

Haul	Location	*S. alutus* (kg)	All species (kg)	% *S. alutus*
9	Outside Upper	411	2002	20.51
10	Outside Upper	151	694	21.70
11	Outside Upper	107	1030	10.35
12	Outside Upper	622	1600	38.90
15	Outside Upper	4853	5910	82.11
35	Outside Upper	1453	1940	74.87
36	Outside Upper	59	79	74.68
37	Outside Upper	7097	7300	97.22
6	Outside Lower	940	2572	36.55
7	Outside Lower	2446	4110	59.51
8	Outside Lower	9801	11400	85.97
16	Outside Lower	151	167	90.64
38	Outside Lower	372	522	71.30
39	Outside Lower	1891	3536	53.48
2	Flats	250	610	41.03
3	Flats	597	758	78.70
13	Flats	311	426	72.89
14	Flats	659	826	79.74
17	Flats	362	526	68.76
18	Flats	798	1162	68.67
19	Flats	86	637	13.49
20	Flats	469	635	73.78
27	Flats	2822	3192	88.39
28	Flats	293	450	65.21
29	Flats	1148	1420	80.87
30	Flats	1195	1406	85.02
31	Rock Pile	55	904	6.13
32	Rock Pile	2480	4248	58.37
33	Rock Pile	47	422	11.25
1	Deep Trench	15	322	4.75
4	Deep Trench	142	435	32.54
5	Deep Trench	1820	3094	58.83
25	Deep Trench	167	506	33.05
26	Deep Trench	185	312	59.12
21	Inside Edge	413	690	59.84
22	Inside Edge	1969	2402	81.97
23	Inside Edge	171	1385	12.32
24	Inside Edge	89	878	10.16

Table 5. Summary of rockfish (*Sebastes* spp.) collected for biological sampling (sagittal otoliths and length/sex/maturity) aboard the R/V *W.E. RICKER*, Langara survey, July 2-13, 1996.

Species	No. samples	No. fish sampled
Sebastes aleutianus	1	41
S. alutus	33	1871
S. brevispinis	3	155
S. reedi	2	94
Total	39	2170

Table 6. Length frequency and maturity summaries for Pacific ocean perch, *Sebastes alutus*, R/V *W.E.RICKER*, Langara survey, July 2-13, 1996.

Stratum	Outside Upper							
Date	96/07/08		96/07/08		96/07/08		96/07/08	
Depth (m)	228		232		219		234	
Haul	9		10		11		12	
Sex	M	F	M	F	M	F	M	F
Length (cm)	Frequency							
22	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-
29	-	-	-	2	-	-	-	-
30	-	1	-	0	-	-	-	-
31	1	0	-	0	-	-	-	-
32	0	0	-	0	-	-	-	1
33	0	2	-	0	2	-	1	1
34	0	1	1	2	0	-	3	1
35	6	3	2	2	1	-	2	0
36	8	5	3	3	1	2	2	0
37	5	3	4	5	2	5	3	2
38	4	5	5	2	1	2	6	2
39	4	3	5	0	1	0	4	5
40	3	5	3	6	1	0	3	3
41	3	3	1	3	2	2	7	6
42	-	4	1	6	0	3	1	1
43	-	0	-	2	1	1	1	2
44	-	2	-	3	-	1	-	-
45	-	0	-	-	-	0	-	-
46	-	1	-	-	-	1	-	-
47	-	-	-	-	-	1	-	-
48	-	-	-	-	-	-	-	-
49	-	-	-	-	-	-	-	-
50	-	-	-	-	-	-	-	-
51	-	-	-	-	-	-	-	-
Total	34	38	25	36	12	18	33	24
Maturity	Frequency							
1	1	0	1	2	0	0	0	0
2	32	26	23	25	12	7	31	21
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	1	12	1	9	0	11	2	3

Stratum	Outside Upper (Cont.)							
Date	96/07/08		96/07/12		96/07/12		Total for Outside Upper	
Depth (m)	273		233		261			
Haul	15		35		37			
Sex	M	F	M	F	M	F	M	F
Length (cm)	Frequency							
20	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	2
30	-	-	-	-	-	-	-	1
31	-	-	-	-	-	-	1	0
32	-	-	-	-	-	-	0	1
33	-	-	-	-	1	-	4	3
34	1	-	4	-	2	-	11	4
35	9	4	1	2	1	2	22	13
36	5	4	6	0	7	3	32	17
37	5	8	6	4	4	9	29	36
38	3	3	5	3	2	5	26	22
39	1	3	2	4	3	6	20	21
40	3	0	4	2	2	2	19	18
41	1	2	2	4	-	4	16	24
42	-	6	-	3	-	3	2	26
43	-	1	-	2	-	3	2	11
44	-	1	-	1	-	2	-	10
45	-	-	-	-	-	-	-	0
46	-	-	-	-	-	-	-	2
47	-	-	-	-	-	-	-	1
48	-	-	-	-	-	-	-	-
49	-	-	-	-	-	-	-	-
50	-	-	-	-	-	-	-	-
51	-	-	-	-	-	-	-	-
Total	28	32	30	25	22	39	184	212
Maturity	Frequency							
1	1	0	0	0	0	0	3	2
2	26	22	30	25	20	37	174	163
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	1	10	0	0	2	2	7	47

Stratum	Outside Lower							
Date	96/07/06		96/07/06		96/07/06		96/07/08	
Depth (m)	279		240		273		311	
Haul	6		7		8		16	
Sex	M	F	M	F	M	F	M	F
Length (cm)	Frequency							
20	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	-
30	-	-	-	-	-	-	1	-
31	-	-	-	-	-	-	0	-
32	-	-	-	1	-	-	0	-
33	-	-	-	0	-	-	0	-
34	1	1	-	4	1	-	1	-
35	1	3	1	3	1	3	2	1
36	3	2	4	3	5	6	3	1
37	5	4	4	6	5	5	10	2
38	5	3	5	2	9	4	3	4
39	4	7	4	3	5	2	2	6
40	2	4	5	3	3	3	2	4
41	-	7	2	3	1	5	2	3
42	-	3	3	1	0	1	1	2
43	-	4	-	1	1	0	-	1
44	-	1	-	1	-	0	-	-
45	-	1	-	0	-	1	-	-
46	-	1	-	2	-	-	-	-
47	-	0	-	0	-	-	-	-
48	-	1	-	1	-	-	-	-
49	-	-	-	-	-	-	-	-
50	-	-	-	-	-	-	-	-
51	-	-	-	-	-	-	-	-
Total	21	42	28	34	31	30	27	24
Maturity	M	F	M	F	M	F	M	F
1	0	0	1	0	1	6	2	0
2	21	39	27	27	28	21	24	18
3	0	0	0	0	2	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	3	0	7	0	3	1	6

Stratum	Outside Lower (Cont.)					
Date	96/07/12		96/07/13		Total	
Depth (m)	340		309		for	
Haul	38		39		Outside Lower	
Sex	M	F	M	F	M	F
Length (cm)	Frequency					
20	-	-	-	-	-	-
21	-	-	-	-	-	-
22	-	-	-	-	-	-
23	-	-	-	-	-	-
24	-	-	-	-	-	-
25	-	-	-	-	-	-
26	-	-	-	-	-	-
27	-	-	-	-	-	-
28	-	-	-	1	-	1
29	-	-	-	0	-	0
30	-	-	-	0	1	0
31	-	-	-	0	0	0
32	-	-	-	0	0	1
33	-	4	-	0	0	4
34	1	2	2	3	6	10
35	4	1	1	1	10	12
36	15	7	4	2	34	21
37	6	10	7	5	37	32
38	3	4	3	1	28	18
39	3	2	5	5	23	25
40	1	3	1	3	14	20
41	1	3	1	3	7	24
42	-	0	1	2	5	9
43	-	1	-	0	1	7
44	-	-	-	0	-	2
45	-	-	-	2	-	4
46	-	-	-	-	-	3
47	-	-	-	-	-	0
48	-	-	-	-	-	2
49	-	-	-	-	-	-
50	-	-	-	-	-	-
51	-	-	-	-	-	-
Total	34	37	25	28	166	195
Maturity	Frequency					
1	0	0	4	1	8	7
2	32	34	21	25	153	164
3	0	0	0	0	2	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	2	3	0	2	3	24

Table 6. Continued.

Stratum				Flats						
Date	96/07/05		96/07/05		96/07/07		96/07/07		96/07/08	
Depth (m)	311		297		285		259		247	
Haul	2		3		13		14		17	
Sex	M	F	M	F	M	F	M	F	M	F
Length (cm)					Frequency					
20	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	1	-	1	-	-
26	-	-	-	-	-	1	-	1	-	-
27	2	-	-	-	-	0	-	1	-	-
28	0	-	-	-	-	0	1	1	-	-
29	0	-	1	-	1	0	2	2	-	-
30	1	-	0	-	0	0	1	2	-	-
31	0	-	0	-	0	0	0	0	-	-
32	0	-	0	-	0	0	0	1	1	-
33	2	-	1	-	0	0	1	1	1	-
34	1	-	2	2	1	0	4	1	0	-
35	3	1	4	3	1	0	3	1	0	2
36	2	1	2	1	1	1	5	1	2	2
37	2	1	10	0	2	4	3	1	2	0
38	6	1	10	2	15	1	7	4	9	0
39	0	3	7	1	5	2	3	1	6	2
40	2	1	6	3	5	2	0	4	8	3
41	11	1	2	0	2	1	2	1	2	5
42	3	1	2	1	0	1	2	1	0	2
43	4	0	-	1	1	1	-	0	3	1
44	1	1	-	0	-	0	-	0	-	2
45	1	-	-	1	-	2	-	3	-	-
46	-	-	-	-	-	-	-	-	-	-
47	-	-	-	-	-	-	-	-	-	-
48	-	-	-	-	-	-	-	-	-	-
49	-	-	-	-	-	-	-	-	-	-
50	-	-	-	-	-	-	-	-	-	-
51	-	-	-	-	-	-	-	-	-	-
Total	41	11	47	15	34	17	34	28	34	19
Maturity					Frequency					
1	2	0	3	0	1	2	3	7	1	0
2	8	6	22	10	33	13	31	14	33	18
3	30	3	22	1	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	1	2	0	4	0	2	0	7	0	1

Stratum	Flats (Cont.)							
Date	96/07/08		96/07/08		96/07/08		96/07/09	
Depth (m)	244		247		264		273	
Haul	18		19		20		27	
Sex	M	F	M	F	M	F	M	F
Length (cm)	Frequency							
20	-	-	-	-	-			
21	-	-	-	-	-			
22	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-
25	-	-	-	-	-	1	-	-
26	-	-	-	-	-	0	-	-
27	-	-	-	-	1	0	-	-
28	-	-	-	-	0	0	-	-
29	-	-	-	-	0	0	-	-
30	-	-	-	-	2	2	-	-
31	-	-	-	1	1	2	-	-
32	-	-	-	0	0	0	1	-
33	-	-	-	0	0	0	2	-
34	2	-	1	1	1	0	1	-
35	4	2	5	1	0	1	3	3
36	2	1	4	4	4	0	4	3
37	2	1	1	4	6	0	8	1
38	5	2	3	2	8	3	2	2
39	4	1	4	0	3	3	3	7
40	5	3	7	2	2	2	1	2
41	5	4	4	6	2	5	1	4
42	2	2	2	2	1	3	-	5
43	-	1	1	1	1	2	-	0
44	-	1	-	-	-	1	-	3
45	-	1	-	-	-	0	-	1
46	-	1	-	-	-	2	-	-
47	-	-	-	-	-	-	-	-
48	-	-	-	-	-	-	-	-
49	-	-	-	-	-	-	-	-
50	-	-	-	-	-	-	-	-
51	-	-	-	-	-	-	-	-
Total	31	20	32	24	32	27	26	31
Maturity	Frequency							
1	0	0	0	0	5	6	0	0
2	31	13	32	14	27	10	26	29
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	7	0	10	0	11	0	2

Table 6. Continued.

Stratum	Flats (Cont.)							
Date	96/07/10		96/07/10		96/07/10		Total	
Depth (m)	258		270		263		for	
Haul	28		29		30		Flats	
Sex	M	F	M	F	M	F	M	F
Length (cm)	Frequency							
20								
21								
22	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-
25	-	1	-	-	1	-	1	4
26	-	0	-	-	0	-	0	2
27	-	0	-	1	0	-	3	2
28	-	1	1	0	1	-	3	2
29	-	2	2	1	1	-	7	5
30	2	2	0	0	1	-	7	6
31	0	1	1	0	0	-	2	4
32	1	0	1	1	0	1	4	3
33	0	2	1	0	1	1	9	4
34	1	0	1	0	2	1	17	5
35	0	0	2	0	0	0	25	14
36	5	4	2	1	5	1	38	20
37	7	0	6	0	6	2	55	14
38	4	0	4	1	4	3	77	21
39	3	4	1	3	4	3	43	30
40	0	5	2	5	5	3	43	35
41	4	1	4	3	0	3	39	34
42	1	2	0	1	3	1	16	22
43	-	1	1	4	-	1	11	13
44	-	1	2	2	-	2	3	13
45	-	1	-	1	-	0	1	10
46	-	-	-	-	-	1	-	4
47	-	-	-	-	-	-	-	-
48	-	-	-	-	-	-	-	-
49	-	-	-	-	-	-	-	-
50	-	-	-	-	-	-	-	-
51	-	-	-	-	-	-	-	-
Total	28	28	31	24	34	23	404	267
Maturity	Frequency							
1	4	7	4	2	4	0	27	24
2	23	21	27	18	30	21	323	187
3	0	0	0	0	0	0	52	4
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	1	0	0	4	0	2	2	52

Stratum	Deep Trench									
Date	96/07/05		96/07/05		96/07/09		96/07/09		Total for Deep Trench	
Depth (m)	349		388		323		294			
Haul	4		5		25		26			
Sex	M	F	M	F	M	F	M	F	M	F
Length (cm)	Frequency									
20										
21										
22	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	1	-	1	-
30	-	-	-	-	-	-	0	-	0	-
31	-	-	-	-	-	-	0	1	0	1
32	-	-	-	-	-	-	1	0	1	0
33	-	-	-	-	-	-	0	0	0	0
34	-	2	-	1	1	-	4	1	5	4
35	2	3	3	0	0	-	2	1	7	4
36	6	3	2	1	1	-	0	0	9	4
37	2	0	7	3	0	-	1	3	10	6
38	3	3	5	1	0	-	3	3	11	7
39	4	1	16	7	0	-	0	2	20	10
40	1	1	9	0	2	-	3	5	15	6
41	1	0	6	1	5	-	2	2	14	3
42	2	3	2	2	13	2	2	2	19	9
43	3	2	-	1	10	0	4	4	17	7
44	1	2	-	-	5	1	4	1	10	4
45	1	0	-	-	1	0	-	2	2	2
46	-	0	-	-	-	0	-	-	-	0
47	-	2	-	-	-	1	-	-	-	3
48	-	1	-	-	-	-	-	-	-	1
49	-	1	-	-	-	-	-	-	-	1
50	-	-	-	-	-	-	-	-	-	-
51	-	-	-	-	-	-	-	-	-	-
Total	26	24	50	17	38	4	27	27	141	72
Maturity	Frequency									
1	0	1	0	0	0	0	1	0	1	1
2	6	13	50	15	34	2	26	24	116	54
3	20	2	0	0	2	0	0	0	22	2
4	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	0	8	0	2	2	2	0	3	2	15

Stratum	Inside Edge							
Date	96/07/09		96/07/09		96/07/09		Total	
Depth (m)	316		294		275		for	
Haul	21		22		23		Inside Edge	
Sex	M	F	M	F	M	F	M	F
Length (cm)	Frequency							
20								
21								
22	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-
27	-	-	-	-	1	-	1	-
28	-	-	1	-	1	1	2	1
29	-	-	0	-	1	2	1	2
30	-	-	0	-	1	2	1	2
31	-	-	0	-	0	0	0	0
32	-	-	0	-	1	2	1	2
33	-	4	1	2	2	0	3	6
34	5	0	4	5	5	2	14	7
35	2	2	5	3	3	0	10	5
36	6	5	10	5	3	6	19	16
37	6	2	1	6	3	7	10	15
38	5	6	3	4	3	3	11	13
39	1	1	3	0	1	1	5	2
40	3	2	0	6	0	3	3	11
41	0	0	0	1	2	-	2	1
42	1	1	1	2	0	-	2	3
43	1	2	-	-	1	-	2	2
44	-	1	-	-	-	-	-	1
45	-	2	-	-	-	-	-	2
46	-	1	-	-	-	-	-	1
47	-	-	-	-	-	-	-	-
48	-	-	-	-	-	-	-	-
49	-	-	-	-	-	-	-	-
50	-	-	-	-	-	-	-	-
51	-	-	-	-	-	-	-	-
Total	30	29	29	34	28	29	87	92
Maturity	Frequency							
1	1	1	2	0	6	10	9	11
2	29	25	27	32	22	17	78	74
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	3	0	2	0	2	0	7

Stratum	Rock Pile		All-Strata	
Date	96/07/10		Total	
Depth (m)	226		for	
Haul	32		*S. alutus*	
Sex	M	F	M	F
Length (cm)		Frequency		
20				
21				
22	-	-	-	-
23	-	-	-	-
24	-	-	-	-
25	-	-	1	4
26	-	-	0	2
27	-	-	4	2
28	-	-	5	4
29	-	-	9	9
30	-	-	9	9
31	-	-	3	5
32	-	-	6	7
33	-	-	16	17
34	2	-	55	30
35	2	-	76	48
36	2	1	134	79
37	3	2	144	105
38	5	0	158	81
39	6	2	117	90
40	4	2	98	92
41	5	2	83	88
42	1	6	45	75
43	-	2	33	42
44	-	2	13	32
45	-	2	3	20
46	-	-	-	10
47	-	-	-	4
48	-	-	-	3
49	-	-	-	1
50	-	-	-	-
51	-	-	-	-
Total	30	21	1012	859
Maturity		Frequency		
1	2	2	50	47
2	27	12	871	654
3	0	0	76	6
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	1	7	15	152

Table 7. Length frequency and maturity summaries for rougheye rockfish (*Sebastes aleutianus*) and yellowmouth rockfish (*S. reedi*), R/V *W.E. RICKER*, Langara survey, July 2-13, 1996.

Species	*S. aleutianus*		*S. reedi*					
Stratum	Outside Lower		Rock Pile					
Date	96/07/06		96/07/10		96/07/10		Total	
Depth (m)	279		228		226		for	
Haul	6		31		32		*S. reedi*	
Sex	M	F	M	F	M	F	M	F
Length (cm)				Frequency				
31	-	-	-	-	-	-	-	-
32	-	-	-	-	-	-	-	-
33	-	-	-	-	-	-	-	-
34	-	-	-	-	-	-	-	-
35	-	-	-	-	-	1	-	1
36	-	-	-	-	-	0	-	0
37	-	-	-	-	-	0	-	0
38	-	-	-	-	-	0	-	0
39	-	-	-	-	-	0	-	0
40	-	-	-	-	-	0	-	0
41	1	-	-	-	-	0	-	0
42	1	-	-	-	2	0	2	0
43	0	1	-	-	1	1	1	1
44	2	3	1	-	2	2	3	2
45	2	3	1	1	4	3	5	4
46	2	2	3	4	6	3	9	7
47	3	4	10	3	4	5	14	8
48	1	2	1	5	2	7	3	12
49	2	1	2	6	2	2	4	8
50	1	4	-	3	-	2	-	5
51	1	0	-	2	-	1	-	3
52	1	0	-	2	-	-	-	2
53	1	0	-	-	-	-	-	-
54	0	0	-	-	-	-	-	-
55	0	0	-	-	-	-	-	-
56	0	1	-	-	-	-	-	-
57	1	1	-	-	-	-	-	-
58	-	-	-	-	-	-	-	-
59	-	-	-	-	-	-	-	-
Total	19	22	18	26	23	27	41	53
Maturity				Frequency				
1	0	0	0	0	0	0	0	0
2	18	12	18	1	19	0	37	1
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	1	0	1
7	1	10	0	25	4	26	4	51

Table 8. Length frequency and maturity summaries for silvergrey rockfish (*Sebastes brevispinis*), R/V *W.E. RICKER*, Langara survey, July 2-13, 1996.

Stratum	Flats		Rock Pile		Inside Edge		Total for *S. brevispinis*	
Date	96/07/08		96/07/10		96/07/09			
Depth (m)	247		228		275			
Haul	19		31		23			
Sex	M	F	M	F	M	F	M	F
Length (cm)	Frequency							
36	-	-	-	-	-	-	-	-
37	-	-	-	-	-	-	-	-
38	-	-	-	-	-	-	-	-
39	-	-	-	-	-	-	-	-
40	-	-	-	-	-	-	-	-
41	-	-	-	-	-	-	-	-
42	-	1	-	-	-	-	-	1
43	1	0	-	-	-	1	1	1
44	1	0	-	1	-	0	1	1
45	1	3	-	0	1	0	2	3
46	5	2	1	1	3	0	9	3
47	3	4	1	1	1	0	5	5
48	2	4	0	2	2	3	4	9
49	2	6	3	1	6	0	11	7
50	2	4	0	5	3	2	5	11
51	0	2	1	5	6	1	7	8
52	1	1	0	6	3	2	4	9
53	0	1	4	2	5	2	9	5
54	2	0	1	4	0	1	3	5
55	0	1	3	3	3	0	6	4
56	0	0	1	1	2	2	3	3
57	0	1	1	3	-	0	1	4
58	0	-	-	1	-	0	0	1
59	1	-	-	1	-	0	1	1
60	-	-	-	0	-	1	-	1
61	-	-	-	0	-	-	-	0
62	-	-	-	0	-	-	-	0
63	-	-	-	0	-	-	-	0
64	-	-	-	1	-	-	-	1
65	-	-	-	-	-	-	-	-
Total	21	30	16	38	35	15	72	83
Maturity	Frequency							
1	0	0	0	0	0	0	0	0
2	4	0	3	2	6	3	13	5
3	0	0	0	0	0	0	0	0
4	0	1	0	0	0	2	0	3
5	0	26	0	28	0	2	0	56
6	0	1	1	1	0	0	1	2
7	17	2	12	7	29	8	58	17

Table 9. Age composition of Pacific ocean perch, *Sebastes alutus*, R/V *W.E. RICKER*, Langara survey, July 2-13, 1996.

Stratum	Outside Upper			
Date	96/07/08	96/07/08	96/07/08	96/07/08
Depth (m)	228	232	219	234
Haul	9	10	11	12
Age (years)	Frequency			
6	--	1	--	--
7	2	1	--	--
8	1	0	1	--
9	7	4	0	6
10	16	8	3	4
11	12	9	6	8
12	5	7	5	6
13	2	4	0	4
14	6	6	1	4
15	2	2	2	5
16	8	6	1	7
17	2	0	2	1
18	1	2	0	1
19	2	2	0	2
20	2	6	4	8
21	0	2	0	1
22	1	0	0	--
23	0	0	0	--
24	0	0	0	--
25	0	0	1	--
26	0	0	0	--
27	0	0	0	--
28	0	0	0	--
29	0	0	0	--
30	0	0	0	--
31	1	0	0	--
32	0	0	0	--
33	0	0	0	--
34	0	0	0	--
35	1	0	1	--
36	--	1	0	--
37	--	--	0	--
38	--	--	0	--
39	--	--	0	--
40	--	--	0	--
41	--	--	0	--
42	--	--	1	--
43	--	--	1	--
44	--	--	0	--
45	--	--	0	--
46	--	--	1	--
Total	71	61	30	57

Stratum	Outside Upper (Cont.)			
Date	96/07/08	96/07/12	96/07/12	Total for
Depth (m)	273	233	261	Outside
Haul	15	35	37	Upper
Age (years)	Frequency			
5	--	--	--	--
6	--	--	--	1
7	--	1	--	4
8	--	1	1	4
9	4	3	4	28
10	13	12	12	68
11	13	6	12	66
12	8	11	8	50
13	4	1	6	21
14	1	4	1	23
15	2	4	3	20
16	7	6	5	40
17	0	2	0	7
18	0	0	1	5
19	2	1	0	9
20	2	2	4	28
21	1	0	2	6
22	--	0	0	1
23	--	0	0	0
24	--	1	0	1
25	--	--	0	1
26	--	--	0	0
27	--	--	0	0
28	--	--	0	0
29	--	--	0	0
30	--	--	1	1
31	--	--	1	2
32	--	--	--	0
33	--	--	--	0
34	--	--	--	0
35	--	--	--	2
36	--	--	--	1
37	--	--	--	0
38	--	--	--	0
39	--	--	--	0
40	--	--	--	0
41	--	--	--	0
42	--	--	--	1
43	--	--	--	1
44	--	--	--	0
45	--	--	--	0
46	--	--	--	1
Total	57	55	61	392

Stratum				Outside Lower			
Date	96/07/06	96/07/06	96/07/06	96/07/08	96/07/12	96/07/13	Total for
Depth (m)	279	240	273	311	340	309	Outside
Haul	6	7	8	16	38	39	Lower
Age (years)				Frequency			
5	--	--	--	--	--	--	0
6	--	--	--	--	--	--	0
7	--	--	--	--	--	1	1
8	1	2	2	1	1	0	7
9	5	9	7	3	8	8	40
10	10	10	10	6	19	11	66
11	12	4	8	9	4	7	44
12	10	15	9	8	16	10	68
13	5	0	6	6	9	5	31
14	2	3	3	7	2	3	20
15	7	3	4	0	3	0	17
16	5	6	5	6	6	5	33
17	1	2	2	0	0	1	6
18	0	0	0	0	0	0	0
19	0	0	0	1	0	0	1
20	4	3	5	4	1	1	18
21	0	1	--	--	0	0	1
22	0	1	--	--	1	0	2
23	0	0	--	--	0	0	0
24	0	0	--	--	0	0	0
25	0	0	--	--	0	0	0
26	0	0	--	--	0	0	0
27	0	2	--	--	0	1	3
28	0	1	--	--	0	--	1
29	0	--	--	--	0	--	0
30	0	--	--	--	0	--	0
31	0	--	--	--	0	--	0
32	0	--	--	--	0	--	0
33	0	--	--	--	0	--	0
34	0	--	--	--	0	--	0
35	1	--	--	--	0	--	1
36	--	--	--	--	0	--	0
37	--	--	--	--	0	--	0
38	--	--	--	--	0	--	0
39	--	--	--	--	0	--	0
40	--	--	--	--	0	--	0
41	--	--	--	--	0	--	0
42	--	--	--	--	0	--	0
43	--	--	--	--	0	--	0
44	--	--	--	--	0	--	0
45	--	--	--	--	0	--	0
46	--	--	--	--	0	--	0
47	--	--	--	--	0	--	0
48	--	--	--	--	0	--	0
49	--	--	--	--	0	--	0
50	--	--	--	--	0	--	0
51	--	--	--	--	0	--	0
52	--	--	--	--	0	--	0
53	--	--	--	--	0	--	0
54	--	--	--	--	0	--	0
55	--	--	--	--	1	--	1
Total	63	62	61	51	71	53	361

Stratum				Flats			
Date	96/07/05	96/07/05	96/07/07	96/07/07	96/07/08	96/07/08	96/07/08
Depth (m)	311	297	285	259	247	244	247
Haul	2	3	13	14	17	18	19
Age (years)				Frequency			
5	1	--	--	--	--	--	--
6	2	1	--	1	--	--	--
7	0	0	2	6	--	--	--
8	0	0	1	5	3	--	--
9	1	10	3	10	4	3	3
10	6	9	1	4	1	7	6
11	10	3	3	9	1	3	7
12	3	4	4	6	8	5	6
13	0	5	1	4	2	3	4
14	3	2	2	2	6	1	5
15	1	3	2	0	1	1	0
16	0	4	13	3	13	10	8
17	0	7	2	1	3	2	0
18	0	3	1	0	0	0	2
19	1	1	4	3	0	4	2
20	1	2	6	3	2	8	11
21	2	2	1	0	1	0	2
22	0	1	0	0	1	0	--
23	1	0	1	0	0	0	--
24	1	0	0	0	0	0	--
25	0	0	0	1	1	0	--
26	0	0	1	1	0	0	--
27	0	0	0	1	1	0	--
28	0	0	0	0	0	0	--
29	0	0	0	1	1	0	--
30	0	1	1	1	1	0	--
31	0	0	1	--	0	0	--
32	0	0	0	--	0	0	--
33	0	0	0	--	0	1	--
34	0	1	0	--	0	0	--
35	0	1	0	--	1	0	--
36	0	0	0	--	0	0	--
37	1	0	0	--	0	1	--
38	0	0	0	--	0	1	--
39	0	0	0	--	0	0	--
40	1	1	0	--	0	0	--
41	1	0	0	--	0	0	--
42	0	0	0	--	0	0	--
43	1	0	0	--	0	1	--
44	3	0	0	--	1	--	--
45	2	1	1	--	1	--	--
46	2	--	--	--	--	--	--
47	1	--	--	--	--	--	--
48	2	--	--	--	--	--	--
49	1	--	--	--	--	--	--
50	1	--	--	--	--	--	--
51	0	--	--	--	--	--	--
52	0	--	--	--	--	--	--
53	0	--	--	--	--	--	--
54	0	--	--	--	--	--	--
55	0	--	--	--	--	--	--
56	0	--	--	--	--	--	--
57	0	--	--	--	--	--	--
58	1	--	--	--	--	--	--
59	0	--	--	--	--	--	--
60	0	--	--	--	--	--	--
61	1	--	--	--	--	--	--
62	0	--	--	--	--	--	--
63	0	--	--	--	--	--	--
64	0	--	--	--	--	--	--
65	1	--	--	--	--	--	--
Total	52	62	51	62	53	51	56

Stratum	Flats (Cont.)					
Date	96/07/08	96/07/09	96/07/10	96/07/10	96/07/10	Total
Depth (m)	264	273	258	270	263	for
Haul	20	27	28	29	30	Flats
Age (years)	Frequency					
5	2	--	1	--	--	4
6	2	--	1	4	--	11
7	2	--	2	4	5	21
8	3	2	6	1	0	21
9	1	9	2	1	5	52
10	3	7	3	4	6	57
11	5	7	5	4	5	62
12	4	13	7	3	8	71
13	7	4	2	8	5	45
14	6	2	5	3	2	39
15	3	2	3	3	3	22
16	5	5	6	6	4	77
17	1	0	4	3	1	24
18	2	0	0	2	1	11
19	1	1	2	2	0	21
20	6	4	0	2	9	54
21	0	0	3	0	1	12
22	0	0	0	1	0	3
23	0	0	0	0	0	2
24	0	0	0	0	0	1
25	0	1	0	0	0	3
26	0	--	0	0	0	2
27	3	--	0	1	0	6
28	0	--	0	0	0	0
29	0	--	0	0	0	2
30	1	--	0	0	0	5
31	0	--	0	0	0	1
32	0	--	0	0	0	0
33	0	--	0	0	0	1
34	0	--	1	0	0	2
35	0	--	0	0	0	2
36	0	--	0	0	1	1
37	0	--	1	0	0	3
38	0	--	0	0	0	1
39	0	--	0	0	0	0
40	1	--	0	1	0	4
41	0	--	0	0	0	1
42	0	--	0	0	0	0
43	0	--	0	0	0	2
44	0	--	1	0	0	5
45	1	--	1	0	0	7
46	--	--	--	0	1	3
47	--	--	--	0	--	1
48	--	--	--	0	--	2
49	--	--	--	0	--	1
50	--	--	--	1	--	2
51	--	--	--	0	--	0
52	--	--	--	0	--	0
53	--	--	--	0	--	0
54	--	--	--	0	--	0
55	--	--	--	0	--	0
56	--	--	--	0	--	0
57	--	--	--	0	--	0
58	--	--	--	0	--	1
59	--	--	--	0	--	0
60	--	--	--	0	--	0
61	--	--	--	0	--	1
62	--	--	--	0	--	0
63	--	--	--	0	--	0
64	--	--	--	0	--	0
65	--	--	--	1	--	2
Total	59	57	56	55	57	671

Table 9. Continued.

Stratum			Deep Trench		
Date	96/07/05	96/07/05	96/07/09	96/07/09	Total
Depth (m)	349	388	323	294	for
Haul	4	5	25	26	Deep Trench
Age (years)			Frequency		
5	--	--	--	--	0
6	--	--	--	--	0
7	--	--	--	2	2
8	1	--	--	1	2
9	7	2	1	4	14
10	4	7	1	3	15
11	3	8	0	4	15
12	8	21	1	12	42
13	2	7	2	5	16
14	1	3	0	1	5
15	1	5	0	1	7
16	3	6	0	5	14
17	0	1	0	0	1
18	4	0	1	1	6
19	3	1	0	1	5
20	0	2	0	6	8
21	0	2	3	0	5
22	1	0	0	0	1
23	0	0	0	0	0
24	0	0	0	0	0
25	0	0	0	0	0
26	0	1	0	1	2
27	0	0	1	0	1
28	0	0	1	0	1
29	0	0	0	0	0
30	0	0	0	0	0
31	0	1	0	0	1
32	0	--	0	0	0
33	0	--	0	0	0
34	0	--	0	0	0
35	0	--	0	0	0
36	0	--	0	0	0
37	0	--	0	0	0
38	0	--	0	0	0
39	0	--	0	1	1
40	0	--	0	0	0
41	0	--	1	0	1
42	1	--	0	0	1
43	1	--	0	0	1
44	2	--	1	1	4
45	1	--	5	1	7
46	1	--	7	0	8
47	0	--	1	1	2

Stratum			Deep Trench (Cont.)		
Date	96/07/05	96/07/05	96/07/09	96/07/09	Total
Depth (m)	349	388	323	294	for
Haul	4	5	25	26	Deep Trench
Age (years)			Frequency (Cont.)		
48	0	--	0	0	0
49	1	--	1	0	2
50	0	--	0	0	0
51	0	--	0	0	0
52	0	--	1	0	1
53	0	--	2	0	2
54	0	--	1	0	1
55	0	--	0	0	0
56	0	--	0	0	0
57	0	--	0	0	0
58	0	--	0	0	0
59	0	--	0	0	0
60	0	--	0	0	0
61	1	--	0	0	1
62	0	--	0	0	0
63	0	--	0	0	0
64	0	--	0	0	0
65	0	--	2	0	2
66	1	--	2	0	3
67	0	--	1	0	1
68	0	--	0	1	1
69	0	--	0	0	0
70	0	--	1	0	1
71	0	--	0	0	0
72	0	--	0	0	0
73	1	--	0	1	2
74	0	--	0	0	0
75	0	--	0	0	0
76	1	--	0	0	1
77	0	--	0	1	1
78	0	--	0	--	0
79	0	--	1	--	1
80	0	--	0	--	0
81	0	--	1	--	1
82	0	--	0	--	0
83	0	--	0	--	0
84	0	--	0	--	0
85	1	--	2	--	3
86	--	--	0	--	0
87	--	--	0	--	0
88	--	--	0	--	0
89	--	--	1	--	1
Total	50	0	42	54	213

Table 9. Continued.

Stratum	Inside Edge				Rock Pile
Date	96/07/09	96/07/09	96/07/09	Total	96/07/10
Depth (m)	316	294	275	for	226
Haul	21	22	23	Inside Edge	32
Age (years)	Frequency				
5	--	--	1	1	--
6	--	--	6	6	--
7	--	--	3	3	--
8	--	2	0	2	--
9	7	9	9	25	3
10	4	17	7	28	2
11	11	15	8	34	3
12	10	15	13	38	9
13	9	2	1	12	2
14	1	0	1	2	1
15	2	0	1	3	4
16	4	2	2	8	14
17	0	0	0	0	0
18	2	0	0	2	1
19	1	0	0	1	1
20	4	0	1	5	7
21	0	0	0	0	0
22	0	0	1	1	0
23	0	0	0	0	0
24	0	0	0	0	0
25	0	0	0	0	1
26	0	0	1	1	0
27	0	0	0	0	0
28	0	0	1	1	0
29	0	0	0	0	0
30	0	0	0	0	0
31	0	0	0	0	0
32	0	1	0	1	0
33	0	--	0	0	1
34	0	--	0	0	1
35	0	--	0	0	0
36	0	--	0	0	0
37	0	--	0	0	0
38	0	--	0	0	0
39	0	--	0	0	0
40	0	--	0	0	0
41	0	--	0	0	0
42	0	--	0	0	1
43	0	--	0	0	--
44	0	--	0	0	--
45	0	--	0	0	--
46	1	--	0	1	--
47	0	--	1	1	--
48	0	--	--	0	--
49	0	--	--	0	--
50	0	--	--	0	--
51	0	--	--	0	--
52	0	--	--	0	--
53	0	--	--	0	--
54	0	--	--	0	--
55	1	--	--	1	--
56	0	--	--	0	--
57	0	--	--	0	--
58	0	--	--	0	--
59	0	--	--	0	--
60	0	--	--	0	--
61	0	--	--	0	--
62	0	--	--	0	--
63	0	--	--	0	--
64	0	--	--	0	--
65	0	--	--	0	--
66	2	--	--	2	
Total	59	63	57	179	51

Total for *S. alutus*		Total for *S. alutus*(Cont.)	
Age (years)	Frequency	Age (years)	Frequency
4	--	47	4
5	5	48	2
6	18	49	3
7	31	50	2
8	36	51	0
9	162	52	1
10	236	53	2
11	224	54	1
12	278	55	2
13	127	56	0
14	90	57	0
15	73	58	1
16	186	59	0
17	38	60	0
18	25	61	2
19	38	62	0
20	120	63	0
21	24	64	0
22	8	65	4
23	2	66	5
24	2	67	1
25	5	68	1
26	5	69	0
27	10	70	1
28	3	71	0
29	2	72	0
30	6	73	2
31	4	74	0
32	1	75	0
33	2	76	1
34	3	77	1
35	5	78	0
36	2	79	1
37	3	80	0
38	1	81	1
39	1	82	0
40	4	83	0
41	2	84	0
42	3	85	3
43	4	86	0
44	9	87	0
45	14	88	0
46	13	89	1
--	--	Total	1867

Table 10. Age composition of rougheye rockfish, *Sebastes aleutianus*, and yellowmouth rockfish, *S. reedi*, R/V *W.E. RICKER*, Langara survey, July 2-13, 1996.

Species	*S. aleutianus*		*S. reedi*	
Stratum	Outside Lower		Rock Pile	
Date	96/07/06	96/07/10	96/07/10	Total
Depth (m)	279	228	226	for
Haul	6	31	32	*S. reedi*
Age (years)		Frequency		
7	--	--	--	--
8	--	--	--	--
9	--	--	1	1
10	--	--	0	0
11	--	--	0	0
12	--	--	0	0
13	--	--	0	0
14	--	--	0	0
15	--	--	3	3
16	--	--	2	2
17	--	--	1	1
18	--	1	0	1
19	--	1	0	1
20	--	5	9	14
21	--	2	9	11
22	--	1	2	3
23	--	2	1	3
24	--	1	0	1
25	2	2	1	3
26	1	0	3	3
27	4	3	0	3
28	0	1	4	5
29	4	1	0	1
30	0	0	1	1
31	0	2	1	3
32	5	2	0	2
33	5	0	1	1
34	1	1	0	1
35	3	3	0	3
36	0	1	1	2
37	6	0	0	0
38	4	0	0	0
39	0	0	2	2
40	2	1	0	1
41	0	0	0	0
42	2	2	0	2

Species	*S. aleutianus*	*S. reedi*		
Stratum	Outside Lower	Rock Pile		
Date	96/07/06	96/07/10	96/07/10	Total
Depth (m)	279	228	226	for
Haul	6	31	32	*S. reedi*
Age (years)	Frequency			
43	0	2	0	2
44	0	6	3	9
45	0	3	3	6
46	1	0	2	2
47	0	0	--	0
48	0	0	--	0
49	0	0	--	0
50	0	0	--	0
51	0	0	--	0
52	0	1	--	1
53	0	--	--	--
54	0	--	--	--
55	0	--	--	--
56	0	--	--	--
57	0	--	--	--
58	0	--	--	--
59	0	--	--	--
60	0	--	--	--
61	0	--	--	--
62	0	--	--	--
63	0	--	--	--
64	0	--	--	--
65	0	--	--	--
66	0	--	--	--
67	0	--	--	--
68	0	--	--	--
69	0	--	--	--
70	0	--	--	--
71	0	--	--	--
72	1	--	--	--
73	--	--	--	--
74	--	--	--	--
75	--	--	--	--
76	--	--	--	--
77	--	--	--	--
78	--	--	--	--
79	--	--	--	--
80	--	--	--	--
Total	41	44	50	94

Table 11. Age composition of silvergrey rockfish, *Sebastes brevispinis*, R/V *W.E. RICKER*, Langara survey, July 2-13, 1996.

Stratum Date Depth (m) Haul	Flats 96/07/08 247 19	Rock Pile 96/07/10 228 31	Inside Edge 96/07/09 275 23	Total for S. brevispinis
Age (years)		Frequency		
11	--	1	--	1
12	1	0	0	1
13	3	2	0	5
14	8	2	5	15
15	6	9	9	24
16	10	9	9	28
17	6	3	2	11
18	1	4	1	6
19	3	1	1	5
20	2	1	2	5
21	0	3	0	3
22	1	1	1	3
23	2	6	3	11
24	0	1	3	4
25	0	1	3	4
26	1	1	5	7
27	1	2	1	4
28	2	4	1	7
29	0	0	2	2
30	0	0	1	1
31	0	0	0	0
32	0	0	0	0
33	0	1	0	1
34	2	0	0	2
35	0	1	0	1
36	0	0	0	0
37	0	0	0	0
38	0	0	0	0
39	0	0	0	0
40	0	0	0	0
41	0	0	0	0
42	0	0	0	0
43	0	0	0	0
44	0	0	0	0
45	0	0	1	1
46	0	0	--	0
47	0	0	--	0
48	1	0	--	1
49	0	0	--	0
50	0	0	--	0
51	1	0	--	1
52	--	0	--	0
53	--	0	--	0
54	--	0	--	0
55	--	0	--	0
56	--	1	--	1
Total	51	54	50	155

Table 12. Mean catch rates (kg/h) by stratum for rockfish (*Sebastes* spp. and *Sebastolobus* sp.) captured aboard the R/V *W.E. RICKER*, Langara survey, July 2-13, 1996, excluding data for hauls completed without sweeplines.

	Mean Catch Rates (kg/h) by Stratum[1]						
Species	Outside Upper[2] (A)	Outside Lower[2] (B)	Flats (C)	Rock Pile (D)	Deep Trench (E)	Inside Edge (F)	Total (All Strata)
Sebastes aleutianus	--	594.01 (0.00-1777.93)	1.68 (0.00-5.04)	--	304.21 (10.94-1177.74)	5.48 (0.00-10.95)	154.54 (5.34-362.07)
S. alutus	2248.10 (532.76-7174.87)	4332.65 (1263.51-9654.76)	1443.81 (872.41-2906.46)	3447.19 (332.29-9298.29)	788.57 (161.72-1742.00)	1367.00 (211.49-3370.86)	1488.03 (924.34-2142.38)
S. babcocki	43.10 (2.30-120.31)	2.05 (0.00-4.09)	18.18 (12.18-31.22)	209.10 (24.31-351.99)	11.44 (3.77-18.39)	27.37 (9.82-44.93)	21.71 (14.54-29.80)
S. borealis	--	--	--	805.00 (0.00-1610.00)	3.13 (0.00-6.25)	18.15 (0.00-36.30)	26.73 (0.00-71.33)
S. brevispinis	239.15 (120.22-411.44)	70.60 (0.00-123.23)	87.17 (30.51-253.21)	949.70 (235.50-1336.50)	4.29 (0.00-7.12)	130.11 (28.20-293.79)	89.60 (51.97-138.62)
S. crameri	--	41.30 (0.00-100.65)	0.18 (0.00-0.54)	--	--	1.50 (0.00-3.00)	3.45 (0.23-7.99)
S. diploproa	--	--	--	--	--	--	--
S. elongatus	--	--	--	--	--	--	--
S. entomelas	--	--	3.34 (0.61-8.04)	--	--	--	1.25 (0.00-2.74)
S. flavidus	--	--	--	9.46 (0.00-18.91)	--	--	0.27 (0.00-0.81)
S. helvomaculatus	9.78 (2.30-17.80)	1.50 (0.00-3.00)	15.04 (9.75-20.26)	5.00 (0.00-10.00)	5.65 (0.00-16.34)	--	8.02 (4.64-12.25)
S. proriger	516.74 (1.04-1493.84)	--	0.39 (0.00-1.16)	80.75 (0.00-161.51)	0.40 (0.00-0.80)	11.50 (0.00-23.01)	11.18 (1.74-24.05)
S. reedi	8.65 (0.00-17.30)	--	12.69 (2.91-45.38)	2687.96 (942.00-3616.64)	--	--	81.17 (31.27-110.68)
S. variegatus	35.58 (0.00-62.39)	--	--	--	--	--	0.47 (0.10-0.84)
S. zacentrus	1460.14 (893.55-1849.99)	538.80 (40.04-1447.91)	177.56 (71.25-335.20)	775.19 (109.41-1196.72)	--	--	149.08 (73.95-228.81)
Sebastolobus alascanus	1.57 (0.00-3.13)	46.61 (7.36-84.85)	82.89 (56.84-112.37)	123.06 (109.50-134.63)	209.71 (118.76-336.93)	118.12 (70.36-191.05)	130.42 (93.44-172.39)
Total	4562.81 (2256.30-8081.46)	5627.52 (2019.40-10236.36)	1842.93 (1278.55-3781.78)	9092.42 (5332.82-15689.43)	1327.38 (406.13-3381.23)	1679.23 (533.91-3706.15)	2165.94 (1496.82-2917.20)
c.i. as % of mean	128%	146%	136%	114%	224%	189%	66%

[1]With 95% confidence limits.

[2]Does not include data for hauls completed without sweeplines.

Table 13. Estimated biomass (tonnes) by stratum for rockfish (*Sebastes* spp. and *Sebastolobus* sp.) captured aboard the R/V *W.E. RICKER* , Langara survey, July 2-13, 1996, excluding data for hauls completed without sweeplines.

	Biomass Estimates (tonnes)[1]						
Species	Outside Upper[2] (A)	Outside Lower[2] (B)	Flats (C)	Rock Pile (D)	Deep Trench (E)	Inside Edge (F)	Total (All Strata)[2]
Sebastes aleutianus	--	264.99 (0.00-793.15)	3.46 (0.00-10.39)	--	609.68 (21.92-2360.38)	4.74 (0.00-9.48)	882.88 (30.21-2058.12)
S. alutus	163.84 (38.83-522.90)	1932.83 (563.66-4307.05)	2976.32 (1798.41-5991.46)	538.34 (51.89-1452.11)	1580.42 (324.11-3491.26)	1183.78 (183.14-2919.07)	8375.52 (5195.82-12033.39)
S. babcocki	3.14 (0.17-8.77)	0.91 (0.00-1.82)	37.47 (25.11-64.36)	32.65 (3.80-54.97)	22.93 (7.56-36.85)	23.70 (8.50-38.91)	120.81 (81.14-165.81)
S. borealis	--	--	--	125.72 (0.00-251.43)	6.26 (0.00-12.53)	15.72 (0.00-31.43)	147.69 (0.00-392.86)
S. brevispinis	17.43 (8.76-29.99)	31.50 (0.00-54.97)	179.70 (62.88-521.98)	148.31 (36.78-208.72)	8.59 (0.00-14.28)	112.67 (24.42-254.41)	498.20 (290.33-771.67)
S. crameri	--	18.42 (0.00-44.90)	0.37 (0.00-1.12)	--	--	1.30 (0.00-2.60)	20.10 (1.30-46.58)
S. diploproa	--	--	--	--	--	--	--
S. elongatus	--	--	--	--	--	--	--
S. entomelas	--	--	6.89 (1.26-16.57)	--	--	--	6.89 (0.00-15.08)
S. flavidus	--	--	--	1.48 (0.00-2.95)	--	--	1.48 (0.00-4.43)
S. helvomaculatus	0.71 (0.17-1.30)	0.67 (0.00-1.34)	31.00 (20.09-41.77)	0.78 (0.00-1.56)	11.31 (0.00-32.74)	--	44.48 (25.56-68.51)
S. proriger	37.66 (0.08-108.87)	--	0.80 (0.00-2.40)	12.61 (0.00-25.22)	0.80 (0.00-1.60)	9.96 (0.00-19.92)	61.84 (9.57-133.05)
S. reedi	0.63 (0.00-1.26)	--	26.16 (6.01-93.55)	419.78 (147.11-564.81)	--	--	446.57 (172.01-608.88)
S. variegatus	2.59 (0.00-4.55)	--	--	--	--	--	2.59 (0.54-4.65)
S. zacentrus	106.41 (65.12-134.83)	240.36 (17.86-645.92)	366.03 (146.88-690.98)	121.06 (17.09-186.89)	--	--	833.87 (409.06-1284.01)
Sebastolobus alascanus	0.11 (0.00-0.23)	20.79 (3.28-37.85)	170.88 (117.17-231.64)	19.22 (17.10-21.03)	420.30 (238.01-675.26)	102.29 (60.93-165.45)	733.60 (524.62-970.10)
Total	332.53 (164.44-588.97)	2510.47 (900.87-4566.51)	3799.08 (2635.64-7795.88)	1419.95 (832.82-2450.20)	2660.30 (813.95-6776.56)	1454.17 (462.35-3209.42)	12176.50 (8398.63-16399.01)
No. Hauls	5	4	12	3	5	4	33
Stratum Area (nm^2)	7.0	40.4	198.0	15.0	187.0	80.8	528.4
Vessel Speed (kt)	3.5	3.3	3.5	3.5	3.4	3.4	

[1]With 95% confidence limits.

[2]Does not include data for hauls completed without sweeplines.

Table 14. Mean catch rates (kg/h) by stratum for rockfish (*Sebastes* spp. and *Sebastolobus* sp.) captured aboard the R/V *W.E. RICKER*, Langara survey, July 2-13, 1996, including scaled data for hauls completed without sweeplines.

Species	Mean Catch Rates (kg/h) by Stratum[1] Outside Upper[2] (A)	Outside Lower[2] (B)	Flats (C)	Rock Pile (D)	Deep Trench (E)	Inside Edge (F)	Total (All Strata)[2]
Sebastes aleutianus	--	559.68 (38.42-1580.39)	1.68 (0.00-5.04)	--	304.21 (10.18-890.57)	5.48 (0.00-10.43)	151.92 (15.38-368.83)
S. alutus	4675.68 (1514.57-12883.61)	4717.47 (2274.95-8265.54)	1443.81 (862.66-3183.39)	3447.19 (332.29-9298.29)	788.57 (193.15-1989.70)	1367.00 (211.49-3370.86)	1549.61 (1003.09-2140.17)
S. babcocki	29.07 (4.25-102.83)	3.84 (0.00-8.80)	18.18 (12.14-29.95)	209.10 (24.31-453.00)	11.44 (4.49-18.39)	27.37 (9.82-44.93)	21.66 (14.55-29.30)
S. borealis	--	7.43 (0.00-22.30)	--	805.00 (0.00-1610.00)	3.13 (0.00-6.25)	18.15 (0.00-36.30)	27.30 (1.11-72.44)
S. brevispinis	192.15 (113.33-347.97)	66.46 (17.74-123.66)	87.17 (31.53-241.67)	949.70 (235.50-1336.50)	4.29 (1.20-7.12)	130.11 (26.76-293.79)	88.66 (50.19-132.65)
S. crameri	--	27.53 (0.00-77.43)	0.18 (0.00-0.54)	--	--	1.50 (0.00-3.00)	2.40 (0.07-5.89)
S. diploproa	--	--	--	--	--	--	--
S. elongatus	--	--	--	--	--	--	--
S. entomelas	--	--	3.34 (0.61-7.56)	--	--	--	1.25 (0.00-2.52)
S. flavidus	--	--	--	9.46 (0.00-18.91)	--	--	0.27 (0.00-0.81)
S. helvomaculatus	6.11 (1.44-14.01)	17.51 (0.00-51.54)	15.04 (9.86-20.96)	5.00 (0.00-10.00)	5.65 (0.00-16.34)	--	9.20 (5.01-14.12)
S. proriger	372.52 (54.82-1222.03)	--	0.39 (0.00-1.16)	80.75 (0.00-161.51)	0.40 (0.00-0.80)	11.50 (0.00-23.01)	9.27 (2.06-18.25)
S. reedi	9.68 (0.00-21.62)	4.95 (0.00-9.91)	12.69 (3.22-37.45)	2687.96 (1796.41-3616.64)	--	--	81.57 (33.48-110.67)
S. variegatus	22.24 (0.00-45.36)	--	--	--	--	--	0.29 (0.00-0.59)
S. zacentrus	1049.32 (588.42-1540.73)	1301.53 (96.84-3800.25)	177.56 (78.24-344.05)	775.19 (109.41-1196.72)	--	--	201.95 (86.96-346.99)
Sebastolobus alascanus	0.98 (0.00-2.93)	108.84 (41.55-272.43)	82.89 (53.87-112.98)	123.06 (109.50-134.63)	209.71 (122.22-321.58)	118.12 (66.67-191.05)	135.17 (96.70-175.27)
Total	6357.75 (3002.17-13198.41)	6815.26 (3582.95-10463.60)	1842.93 (1245.51-3631.24)	9092.42 (5332.82-15689.43)	1327.38 (374.22-2892.56)	1679.23 (533.91-3706.15)	2280.53 (1616.44-3066.88)
c.i. as % of mean	160%	101%	129%	114%	190%	189%	64%

[1]With 95% confidence limits.

[2]Includes scaled data.

Table 15. Estimated biomass (tonnes) by stratum for rockfish (*Sebastes* spp. and *Sebastolobus* sp.) captured aboard the R/V *W.E. RICKER*, Langara survey, July 2-13, 1996, including scaled estimates for hauls completed without sweeplines.

	Biomass Estimates (tonnes)[1]						
Species	Outside Upper[2] (A)	Outside Lower[2] (B)	Flats (C)	Rock Pile (D)	Deep Trench (E)	Inside Edge (F)	Total (All Strata)[2]
Sebastes aleutianus	--	242.33 (16.63-684.28)	3.46 (0.00-10.39)	--	609.68 (20.40-1784.85)	4.74 (0.00-9.03)	860.22 (87.10-2088.63)
S. alutus	340.76 (110.38-938.94)	2042.60 (985.02-3578.86)	2976.32 (1778.31-6562.34)	538.34 (51.89-1452.10)	1580.42 (387.11-3987.68)	1183.78 (183.14-2919.07)	8662.22 (5611.15-11956.82)
S. babcocki	2.12 (0.31-7.49)	1.66 (0.00-3.81)	37.47 (25.03-61.74)	32.65 (3.80-70.74)	22.93 (9.01-36.85)	23.70 (8.50-38.91)	120.54 (81.27-162.80)
S. borealis	--	3.22 (0.00-9.65)	--	125.72 (0.00-251.43)	6.26 (0.00-12.53)	15.72 (0.00-31.43)	150.91 (6.26-399.13)
S. brevispinis	14.00 (8.26-25.36)	28.78 (7.68-53.54)	179.70 (64.99-498.18)	148.31 (36.78-208.72)	8.59 (2.41-14.28)	112.67 (23.17-254.41)	492.06 (280.37-734.55)
S. crameri	--	11.92 (0.00-33.53)	0.37 (0.00-1.12)	--	--	1.30 (0.00-2.60)	13.59 (0.37-33.34)
S. diploproa	--	--	--	--	--	--	--
S. elongatus	--	--	--	--	--	--	--
S. entomelas	--	--	6.89 (1.26-15.58)	--	--	--	6.89 (0.00-13.84)
S. flavidus	--	--	--	1.48 (0.00-2.95)	--	--	1.48 (0.00-4.43)
S. helvomaculatus	0.45 (0.10-1.02)	7.58 (0.00-22.32)	31.00 (20.33-43.20)	0.78 (0.00-1.56)	11.31 (0.00-32.74)	--	51.13 (27.60-78.96)
S. proriger	27.15 (4.00-89.06)	--	0.80 (0.00-2.40)	12.61 (0.00-25.22)	0.80 (0.00-1.60)	9.96 (0.00-19.92)	51.32 (11.40-100.51)
S. reedi	0.71 (0.00-1.58)	2.15 (0.00-4.29)	26.16 (6.63-77.21)	419.78 (280.54-564.81)	--	--	448.79 (184.41-608.85)
S. variegatus	1.62 (0.00-3.31)	--	--	--	--	--	1.62 (0.00-3.24)
S. zacentrus	76.47 (42.88-112.29)	563.54 (41.93-1645.46)	366.03 (161.28-709.23)	121.06 (17.09-186.89)	--	--	1127.10 (479.62-1940.50)
Sebastolobus alascanus	0.07 (0.00-0.21)	47.13 (17.99-117.96)	170.88 (111.04-232.91)	19.22 (17.10-21.03)	420.30 (244.95-644.50)	102.29 (57.73-165.45)	759.89 (541.78-986.61)
Total	463.35 (218.79-961.89)	2950.91 (1551.36-4530.59)	3799.08 (2567.53-7485.55)	1419.95 (832.82-2450.20)	2660.30 (750.01-5797.17)	1454.17 (462.35-3209.42)	12747.75 (9017.42-17139.59)
No. Hauls	8	6	12	3	5	4	38
Stratum Area (nm^2)	7.0	40.4	198.0	15.0	187.0	80.8	528.4
Vessel Speed (kt)	3.5	3.4	3.5	3.5	3.4	3.4	3.4

[1]With 95% confidence limits.

[2]Includes scaled estimates.

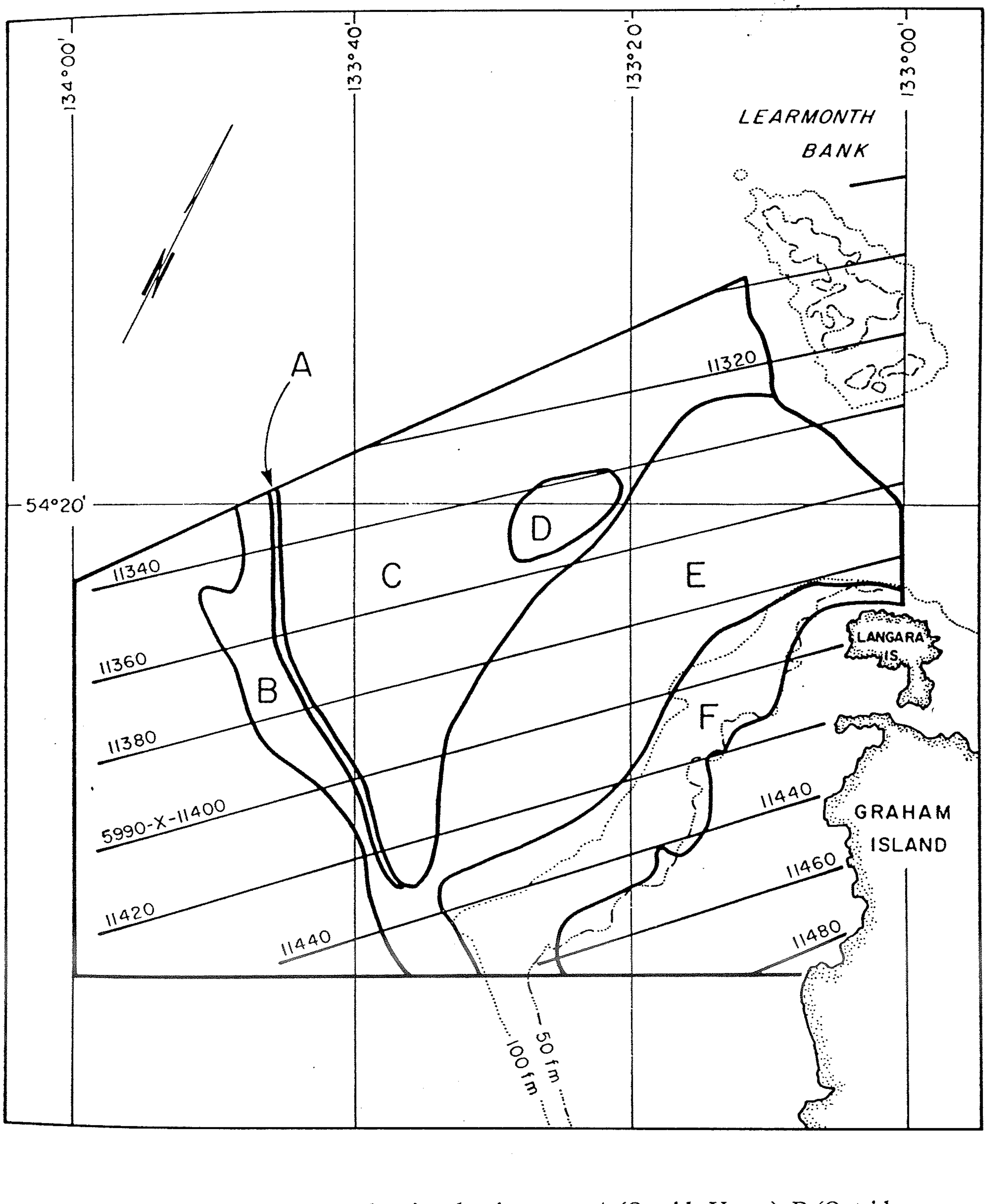


Figure 1. Langara Spit survey area showing the six strata: A (Outside Upper), B (Outside Lower), C (Flats), D (Rock Pile), E (Deep Trench), and F (Inside Edge). (From Lapi and Richards 1981.)

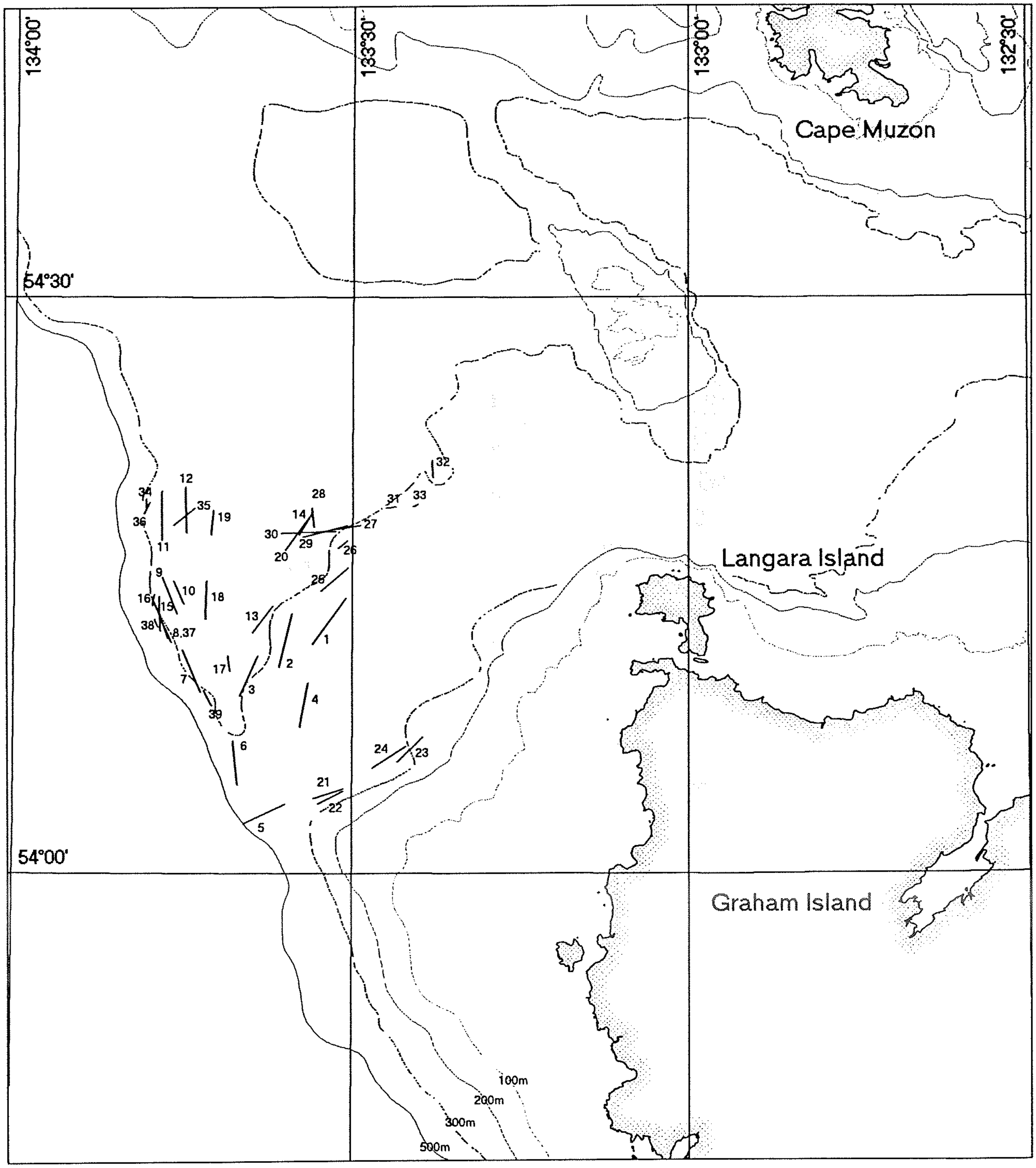


Figure 2. Survey area and haul locations, R/V *W.E.RICKER*, Langara survey, July 2-13, 1996.

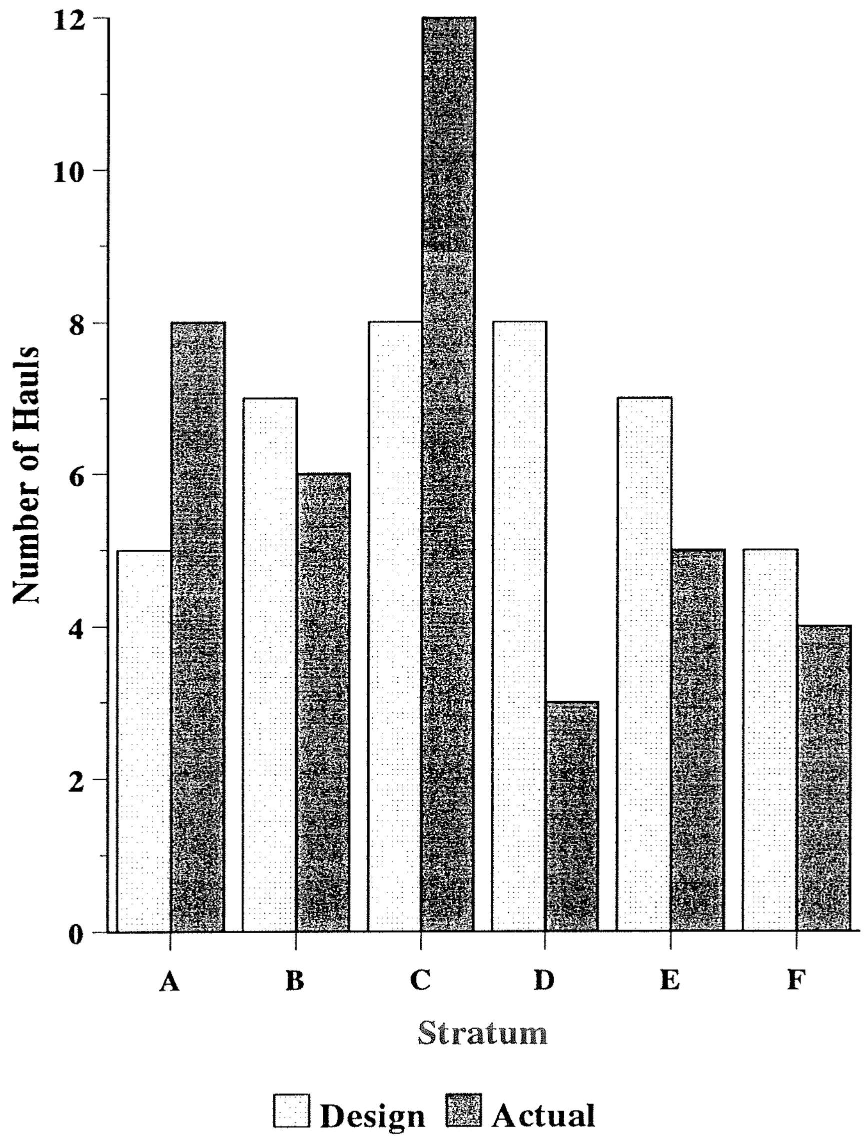
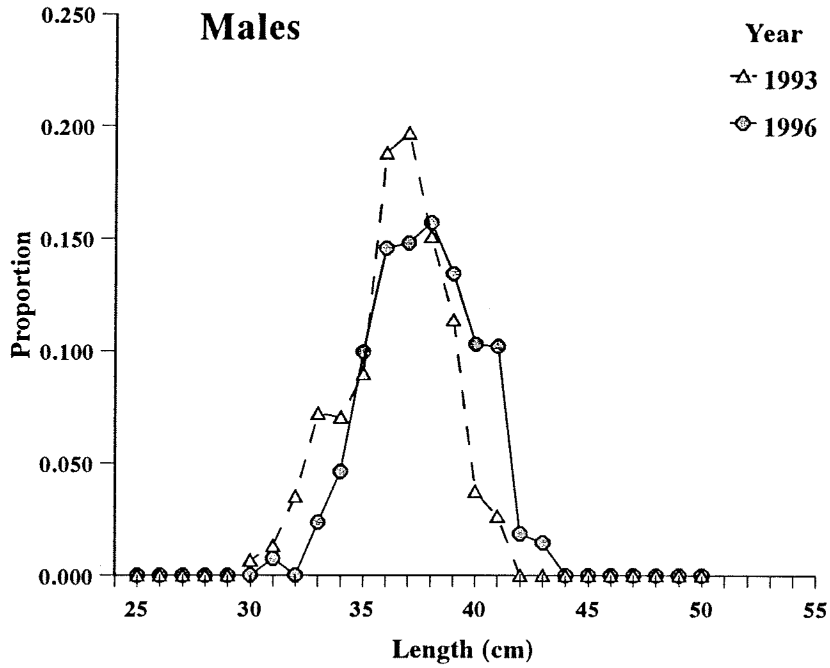


Figure 3. Actual distribution of hauls by stratum, compared to the initial survey design, R/V *W.E. RICKER*, Langara survey, July 2-13, 1996.

1993
N = 3 hauls
(151 fish)

1996
N = 7 hauls
(184 fish)



1993
N = 3 hauls
(222 fish)

1996
N = 7 hauls
(212 fish)

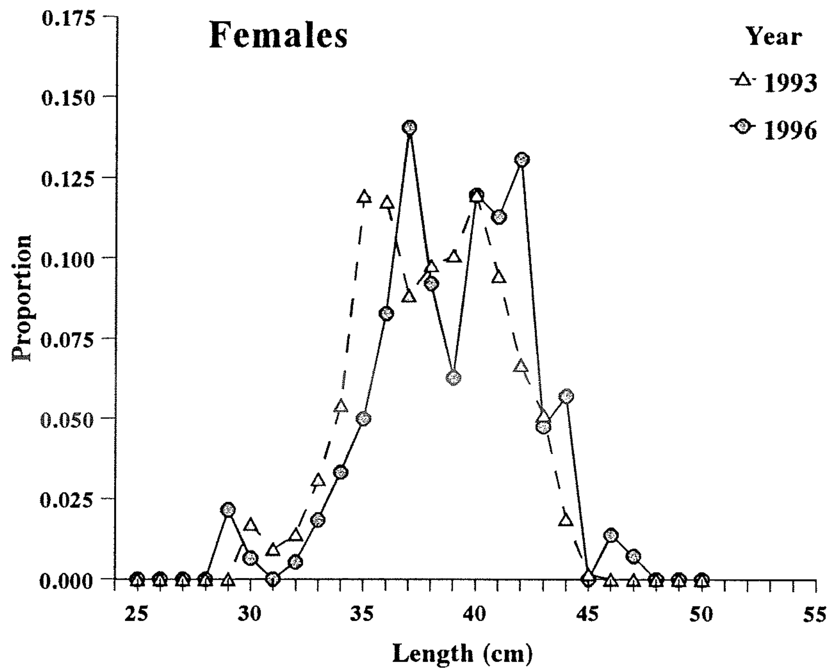
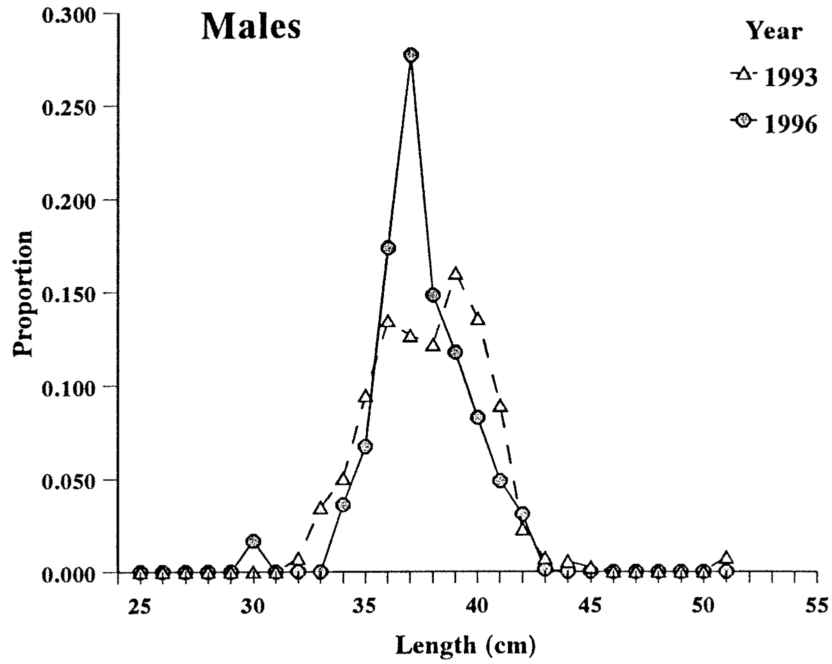


Figure 4. Length proportions for Pacific ocean perch captured in the Outside Upper stratum during the 1993 and 1996 Langara surveys. (Weighted by catch rate (kg/hr) for each haul)

1993
N = 6 hauls
(310 fish)

1996
N = 6 hauls
(166 fish)



1993
N = 6 hauls
(365 fish)

1996
N = 6 hauls
(195 fish)

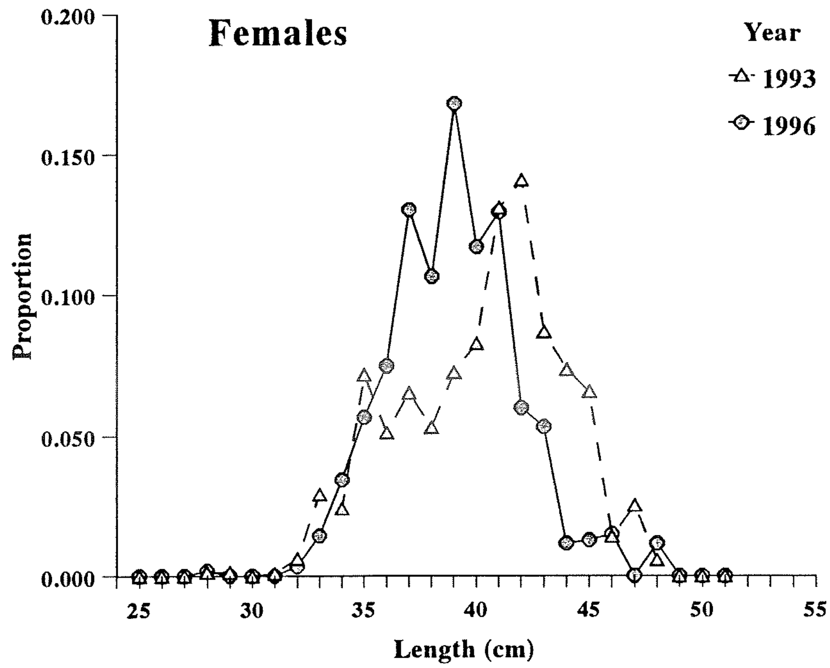
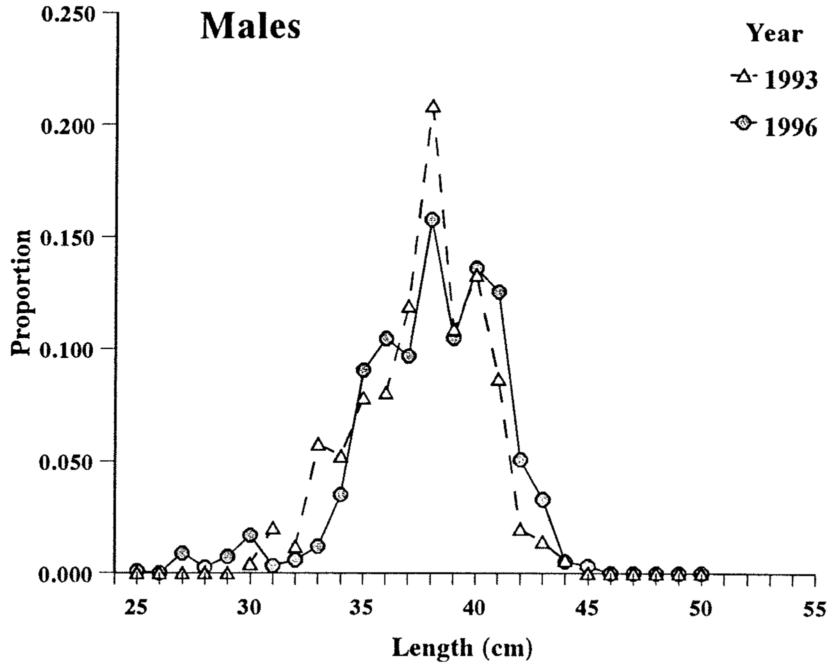


Figure 5. Length proportions for Pacific ocean perch captured in the Outside Lower stratum during the 1993 and 1996 Langara surveys. (Weighted by catch rate (kg/hr) for each haul.)

1993
N = 5 hauls
(337 fish)

1996
N = 12 hauls
(404 fish)



1993
N = 5 hauls
(236 fish)

1996
N = 12 hauls
(267 fish)

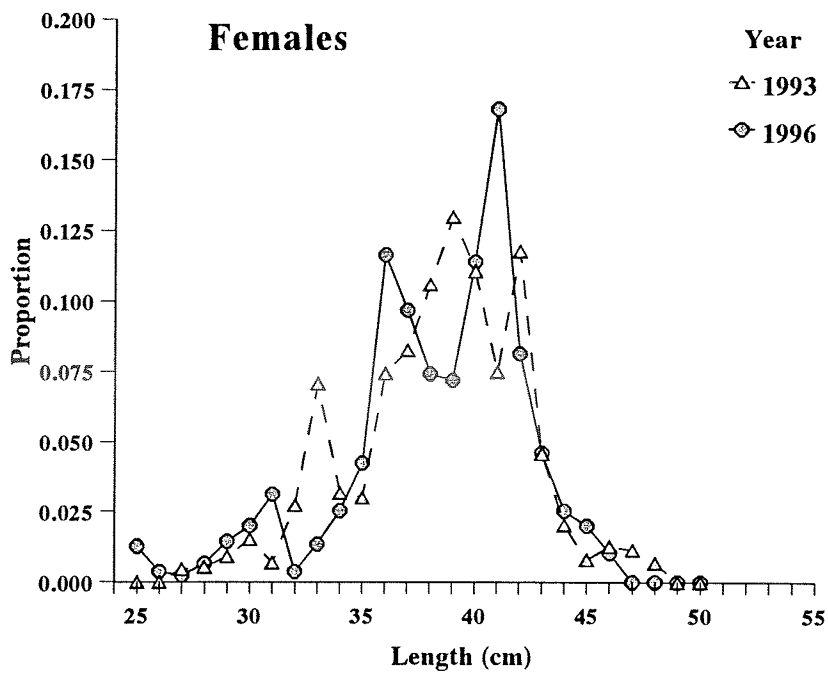
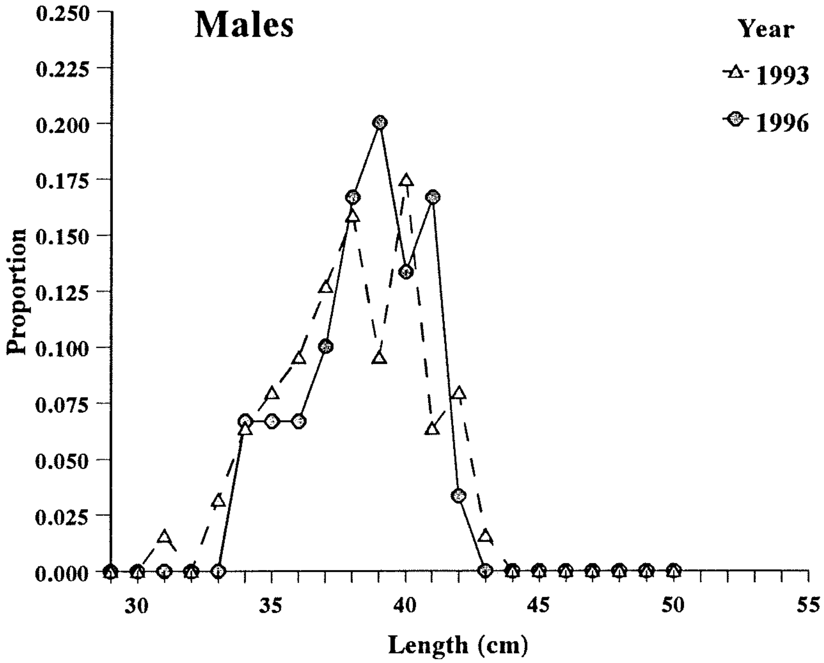


Figure 6. Length proportions for Pacific ocean perch captured in the Flats stratum during the 1993 and 1996 Langara surveys. (Weighted by catch rate (kg/hr) for each haul.)

1993
N = 1 haul
(63 fish)

1996
N = 1 haul
(30 fish)



1993
N = 1 haul
(34 fish)

1996
N = 1 haul
(21 fish)

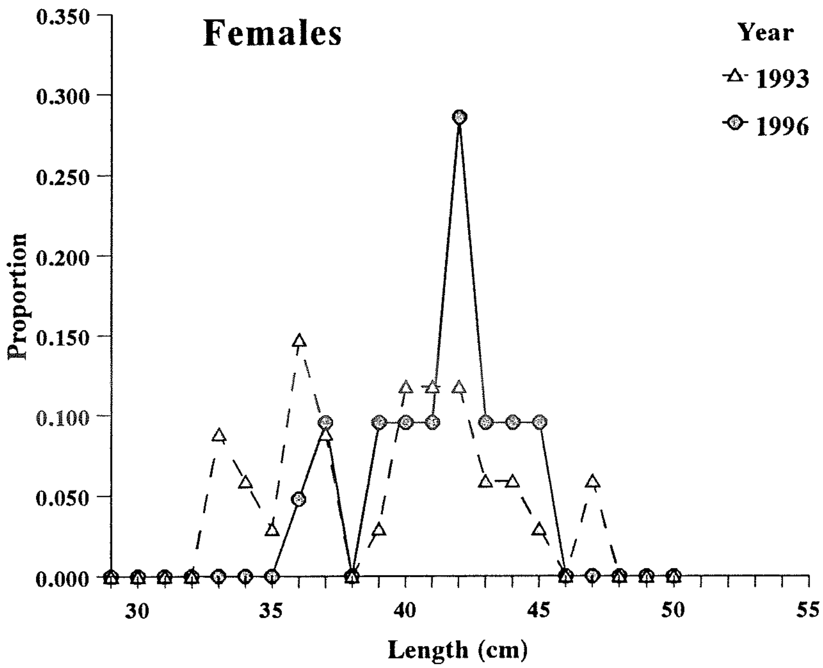
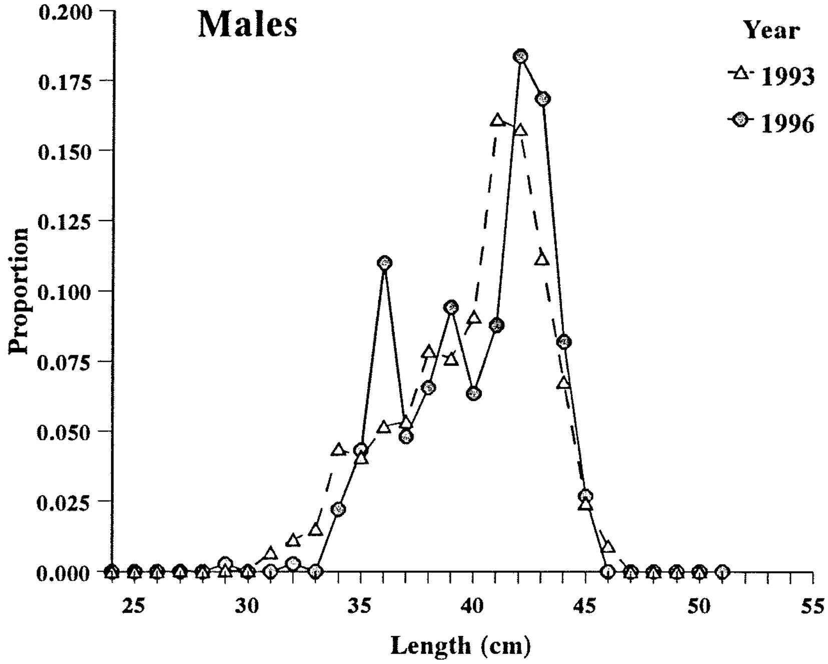


Figure 7. Length proportions for Pacific ocean perch captured in the Rock Pile stratum during the 1993 and 1996 Langara surveys. (Weighted by catch rate (kg/hr) for each haul.)

1993
N = 6 hauls
(411 fish)

1996
N = 4 hauls
(141 fish)



1993
N = 6 hauls
(192 fish)

1996
N = 4 hauls
(72 hauls)

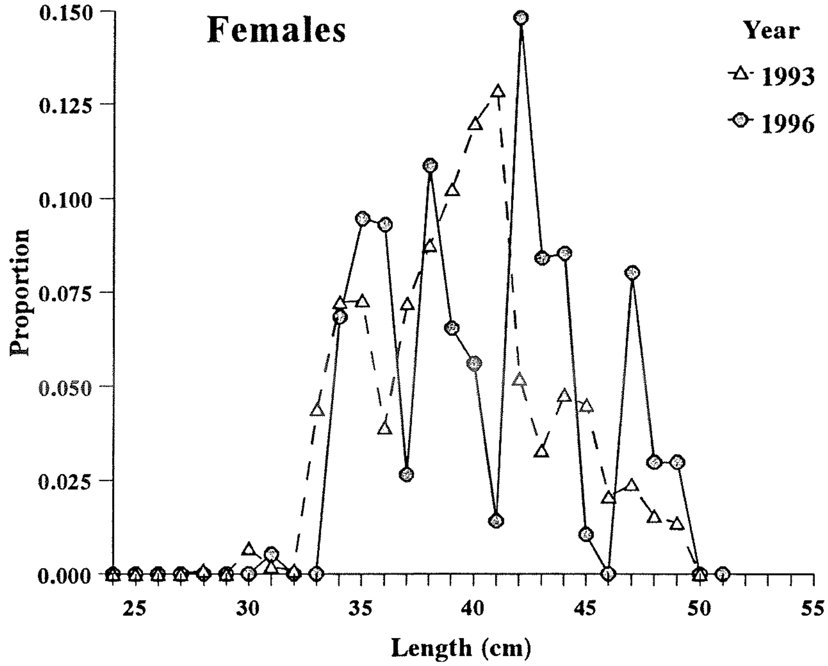
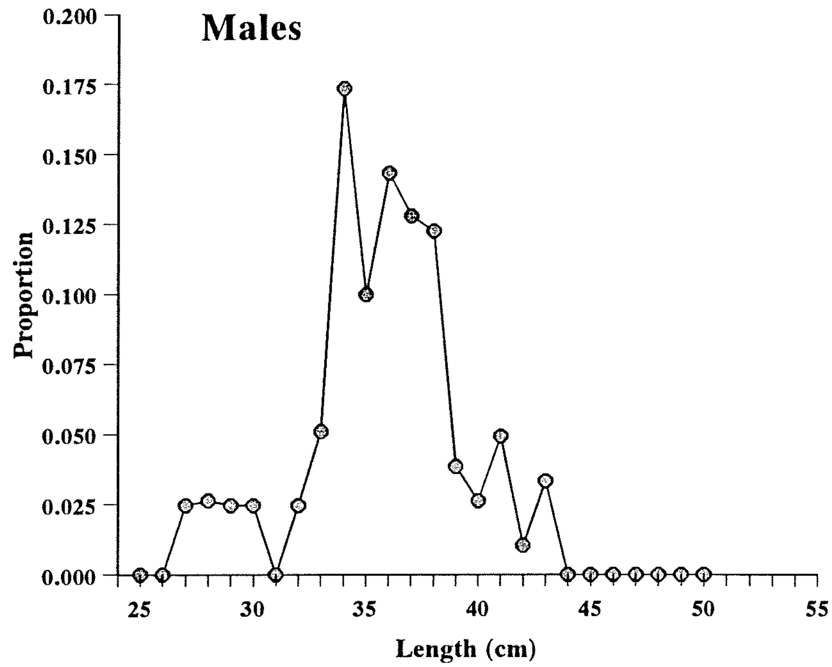


Figure 8. Length proportions for Pacific ocean perch captured in the Deep Trench stratum during the 1993 and 1996 Langara surveys. (Weighted by catch rate (kg/hr) for each haul.)

N = 3 hauls
(87 fish)



N = 3 hauls
(92 hauls)

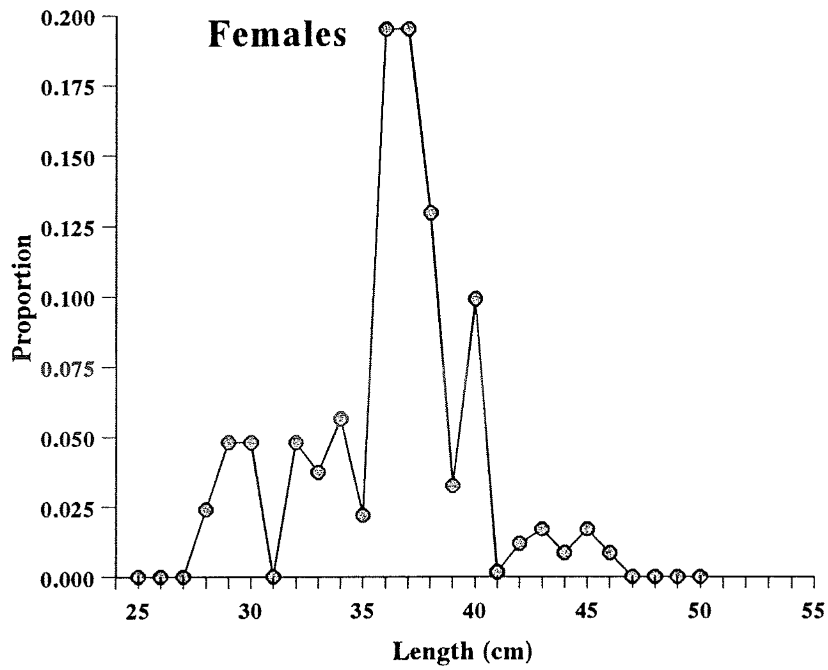
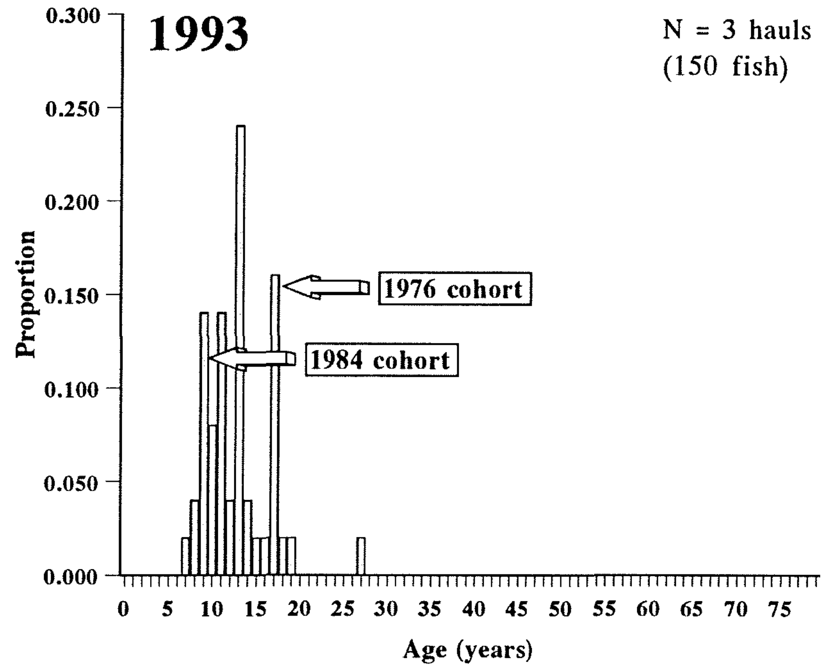


Figure 9. Length proportions for Pacific ocean perch captured in the Inside Edge stratum during the 1996 Langara survey. (Weighted by catch rate (kg/hr) for each haul.)



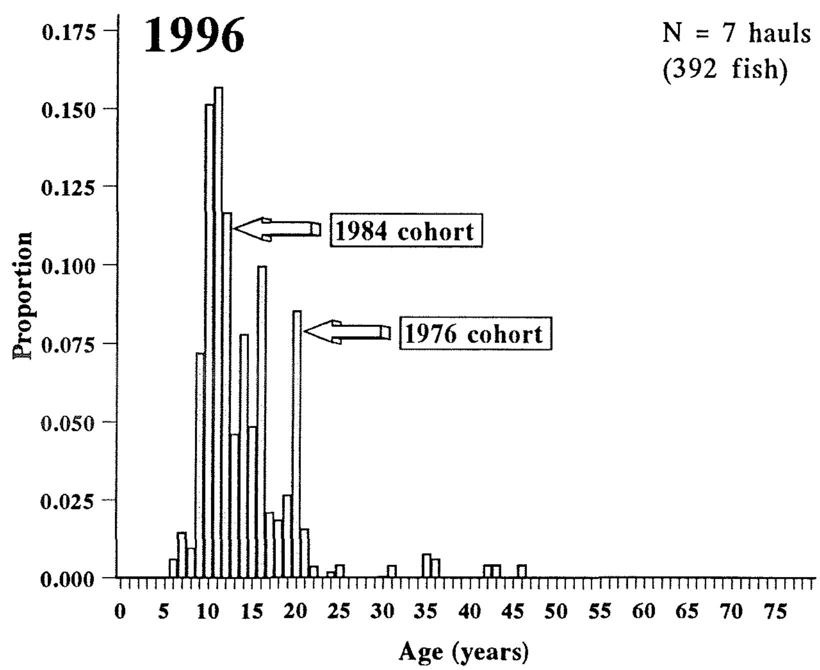
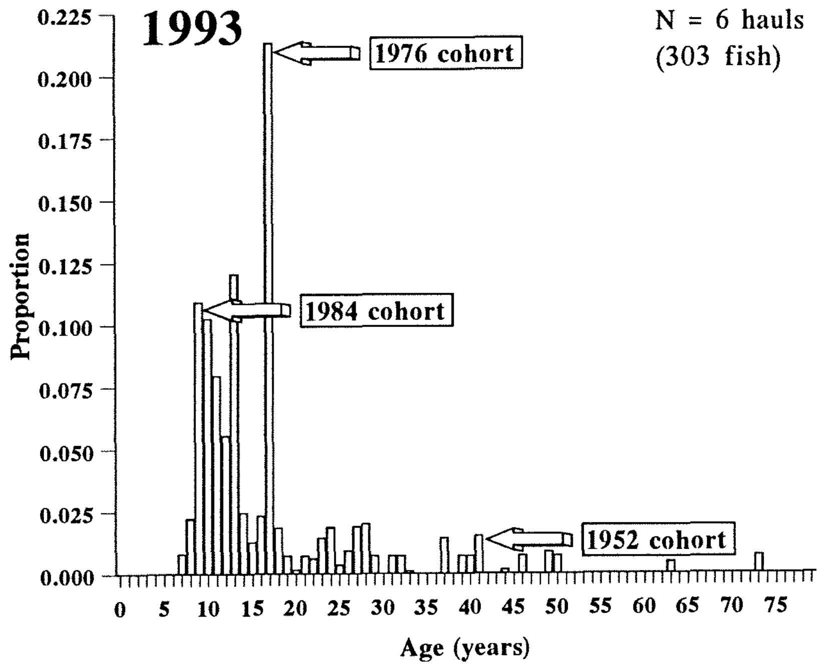


Figure 10. Age proportions for Pacific ocean perch captured in the Outside Upper stratum during the 1993 and 1996 Langara surveys. (Weighted by catch rate (kg/hr) for each haul.)



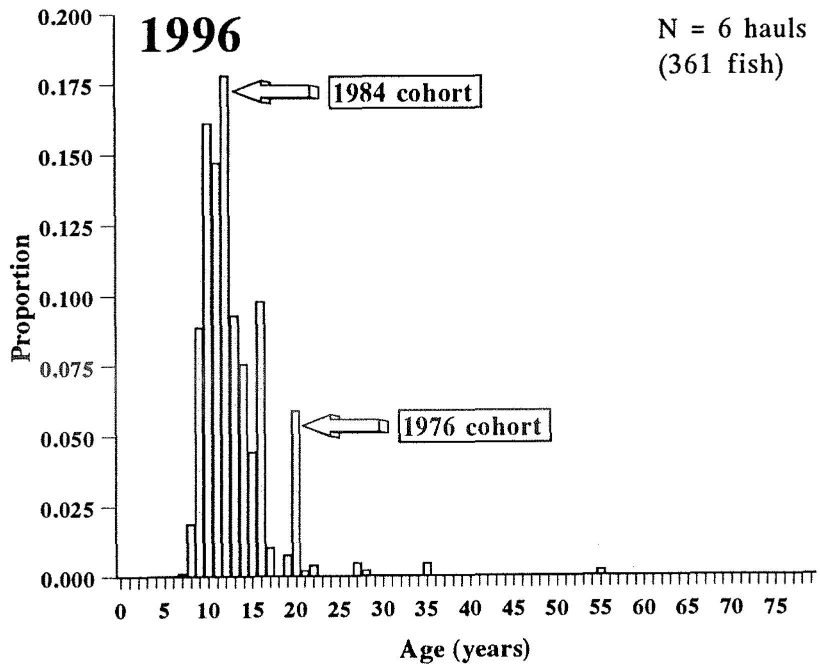
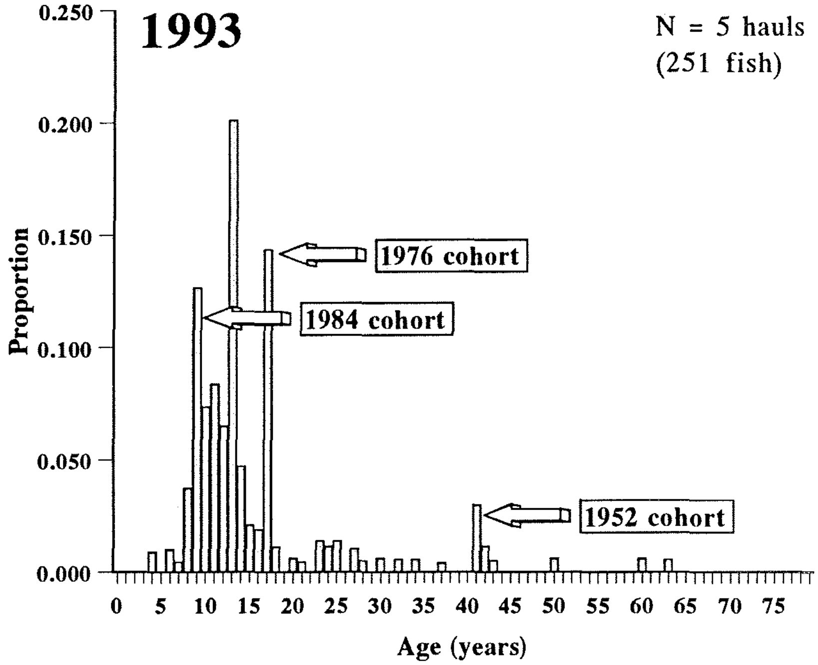


Figure 11. Age proportions for Pacific ocean perch captured in the Outside Lower stratum during the 1993 and 1996 Langara surveys. (Weighted by catch rate (kg/hr) for each haul.)



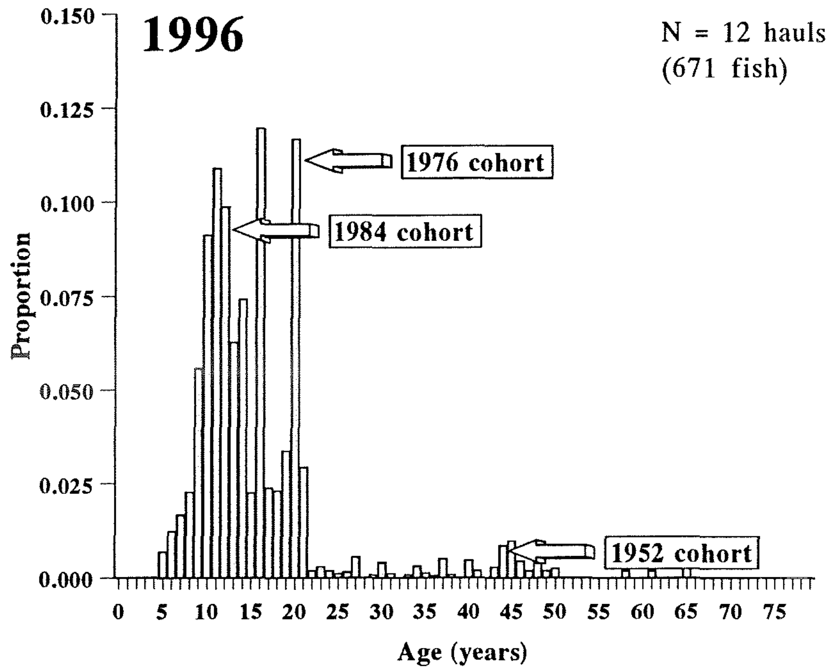
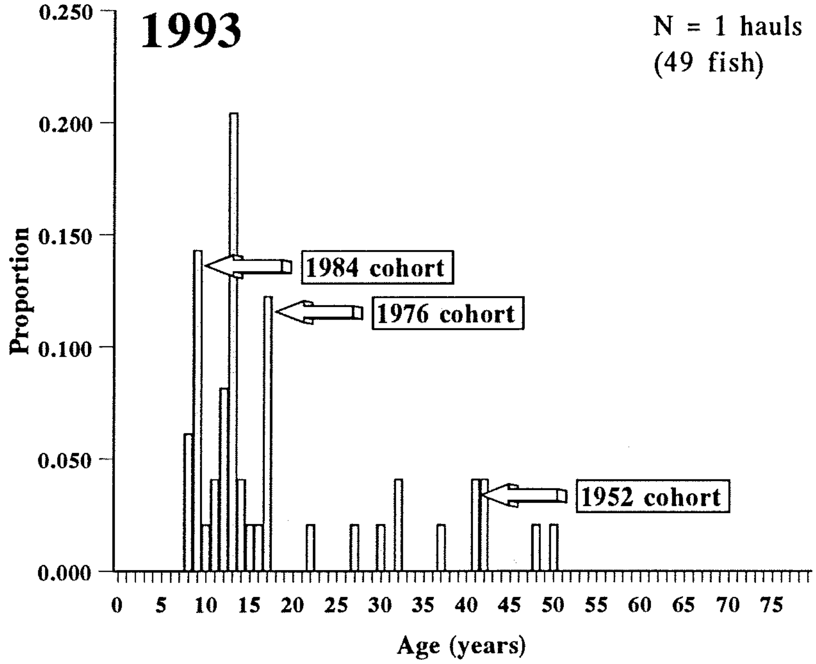


Figure 12. Age proportions for Pacific ocean perch captured in the Flats stratum during the 1993 and 1996 Langara surveys. (Weighted by catch rate (kg/hr) for each haul.)



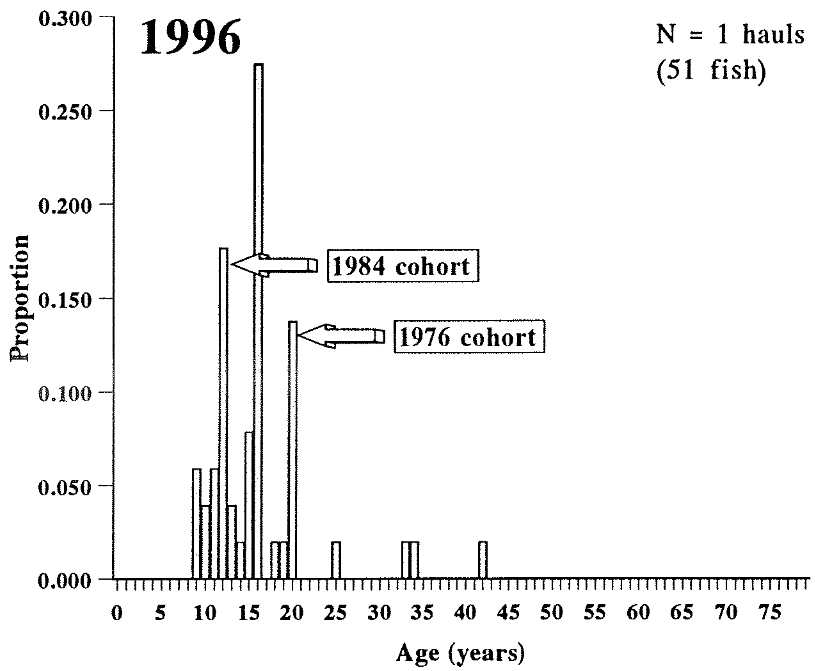
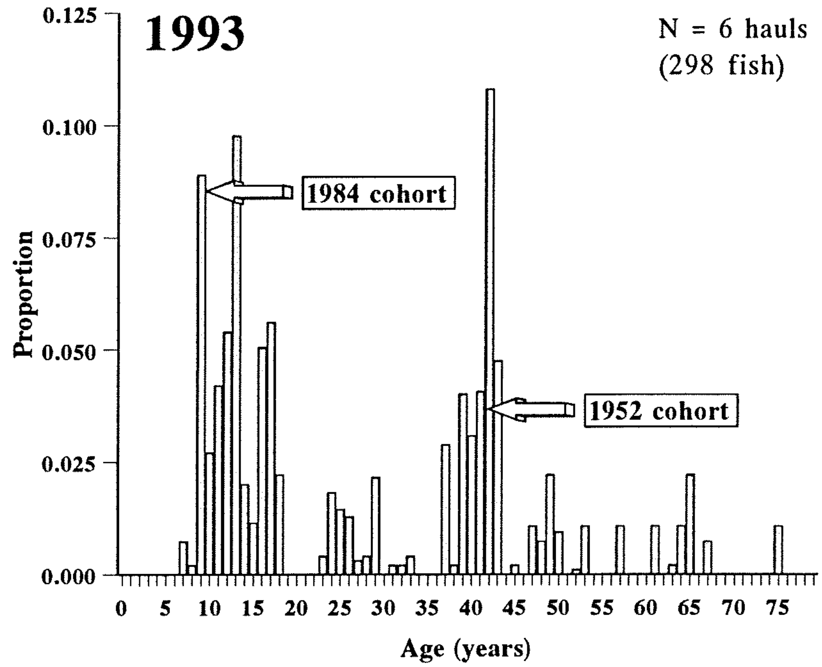


Figure 13. Age proportions for Pacific ocean perch captured in the Rock Pile stratum during the 1993 and 1996 Langara surveys. (Weighted by catch rate (kg/hr) for each haul.)



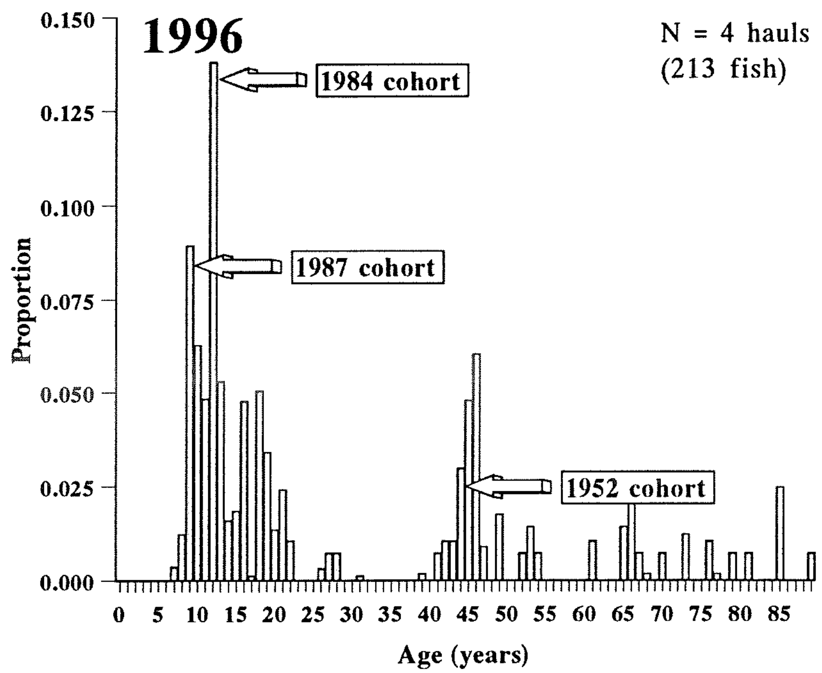


Figure 14. Age proportions for Pacific ocean perch captured in the Deep Trench stratum during the 1993 and 1996 Langara surveys. (Weighted by catch rate (kg/hr) for each haul.)

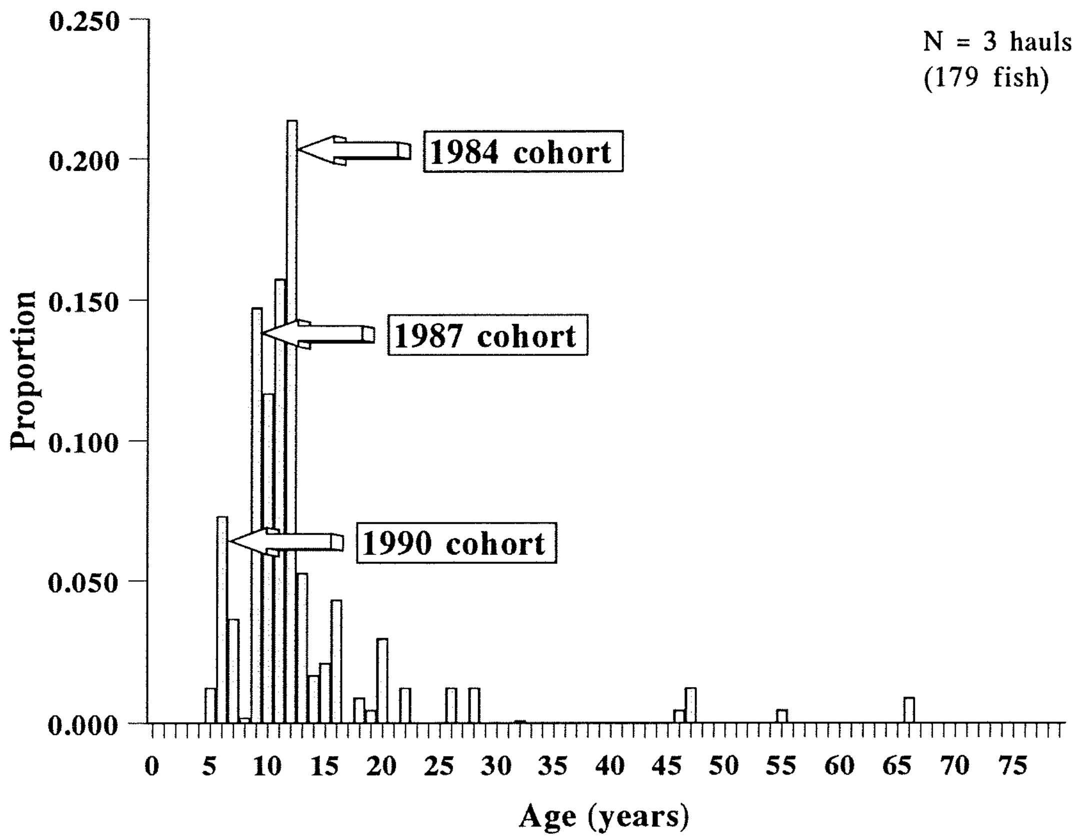


Figure 15. Age proportions for Pacific ocean perch captured in the Inside Edge stratum during the 1996 Langara survey. (Weighted by catch rate (kg/hr) for each haul.)

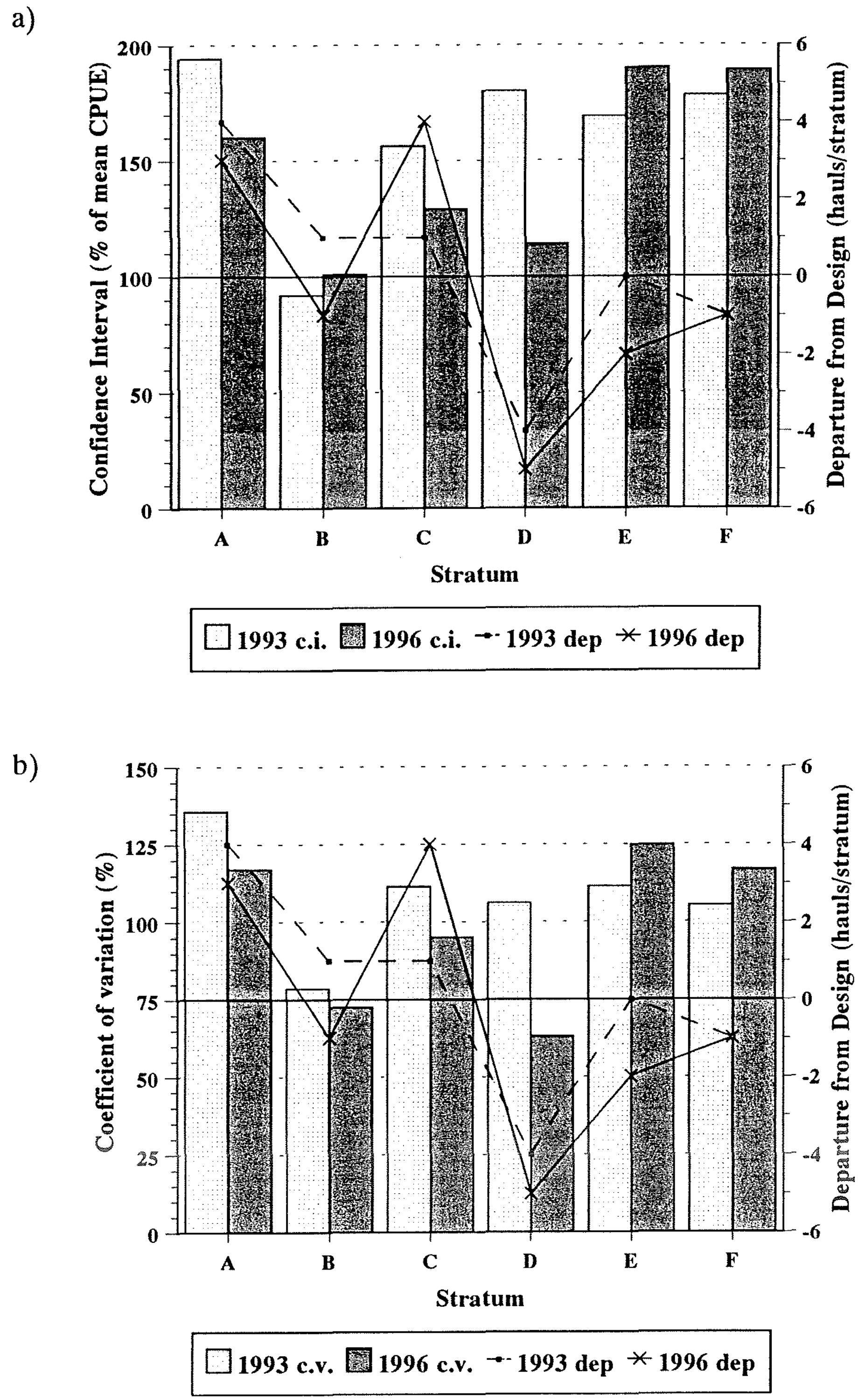
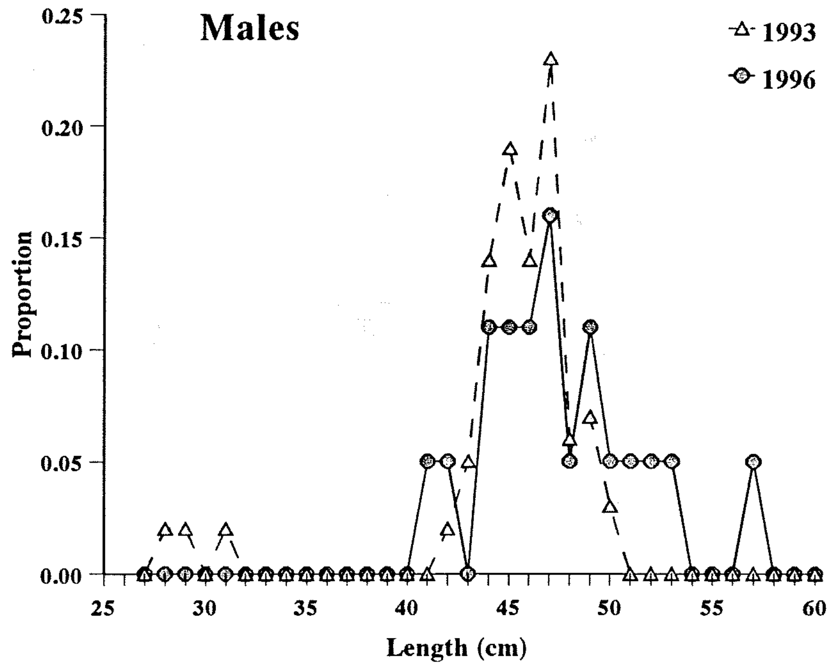


Figure 16. a) Size of 95% confidence intervals (expressed as % of strata means), and b) strata coefficients of variation, with the magnitude of departures from the design number of hauls per stratum, for all-species catch rates from the 1993 and 1996 Langara surveys. (1996 data includes scaled data for hauls completed without sweeplines.)

1993
N = 2 hauls
(105 fish)

1996
N = 1 haul
(19 fish)



1993
N = 2 hauls
(79 fish)

1996
N = 1 haul
(22 fish)

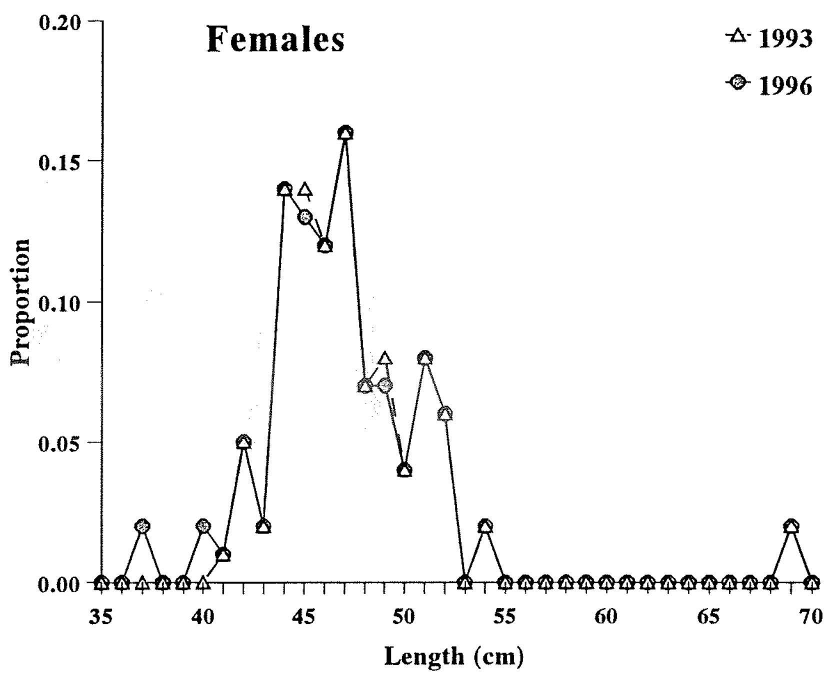


Figure 17. Length proportions for rougheye rockfish (*Sebastes aleutianus*) captured in the Outside Lower stratum during the 1993 and 1996 Langara surveys. (Weighted by catch rate (kg/hr) for each haul)

1993
N = 1 haul
(67 fish)

1996
N = 2 hauls
(41 fish)

1993
N = 1 haul
(33 fish)

1996
N = 2 hauls
(53 fish)

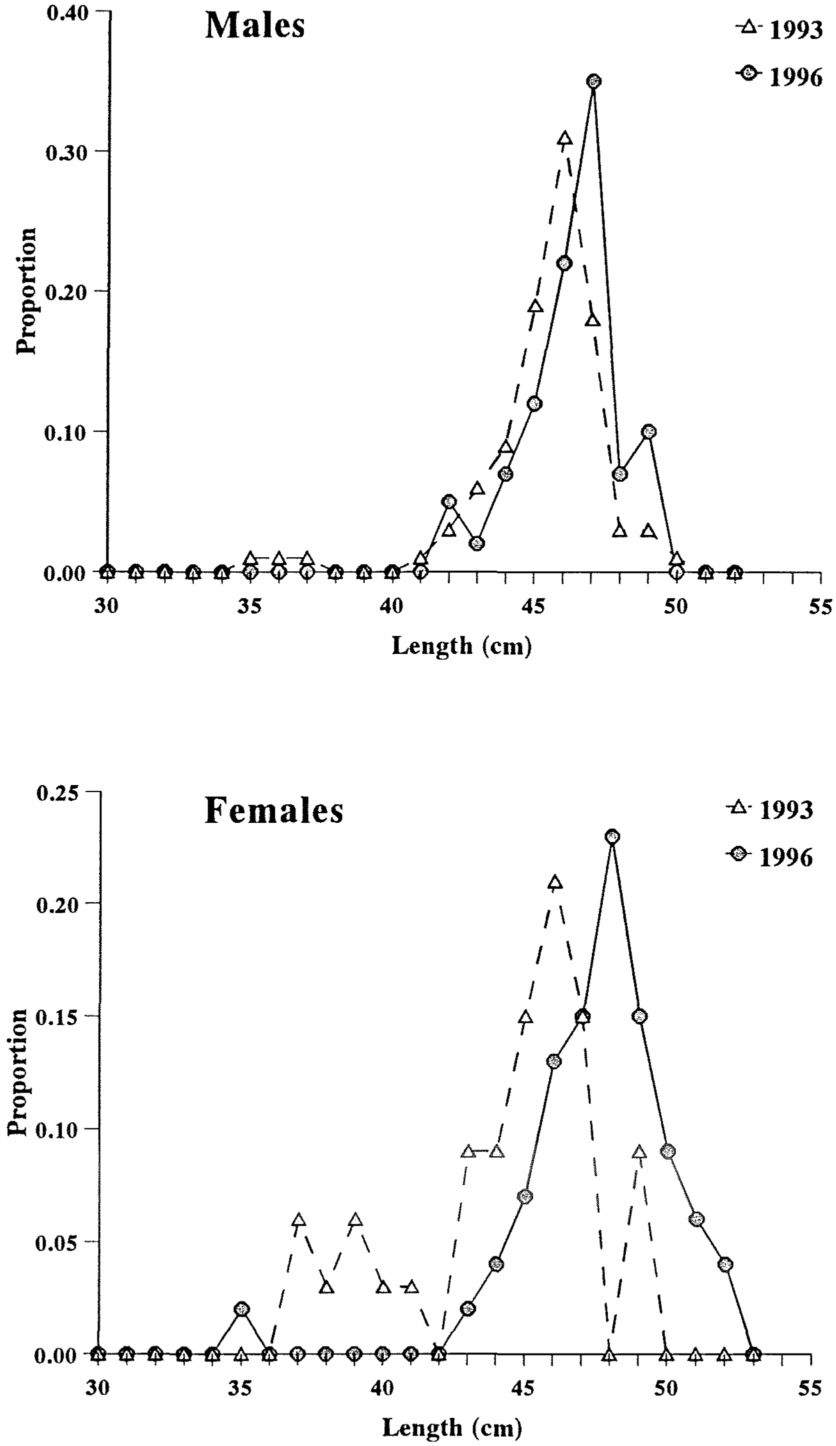
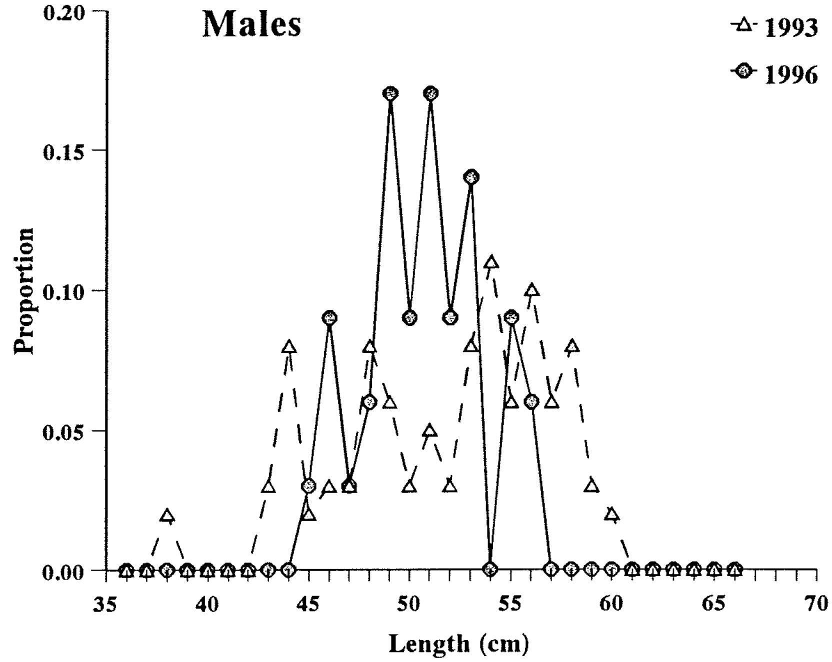


Figure 18. Length proportions for yellowmouth rockfish (*Sebastes reedi*) captured in the Rock Pile stratum during the 1993 and 1996 Langara surveys. (Weighted by catch rate (kg/hr) for each haul)

1993
N = 1 haul
(63 fish)

1996
N = 1 haul
(35 fish)



1993
N = 1 haul
(48 fish)

1996
N = 1 haul
(15 fish)

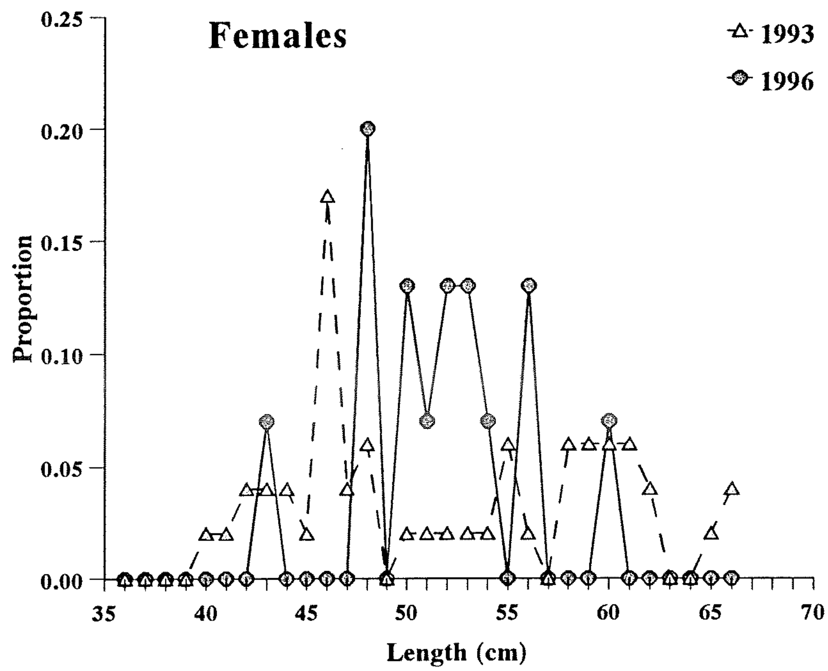


Figure 19. Length proportions for silvergrey rockfish (*Sebastes brevispinis*) captured in the Inside Edge stratum during the 1993 and 1996 Langara surveys. (Weighted by catch rate (kg/hr) for each haul)

1993
N = 2 haul
(112 fish)

1996
N = 1 hauls
(41 fish)

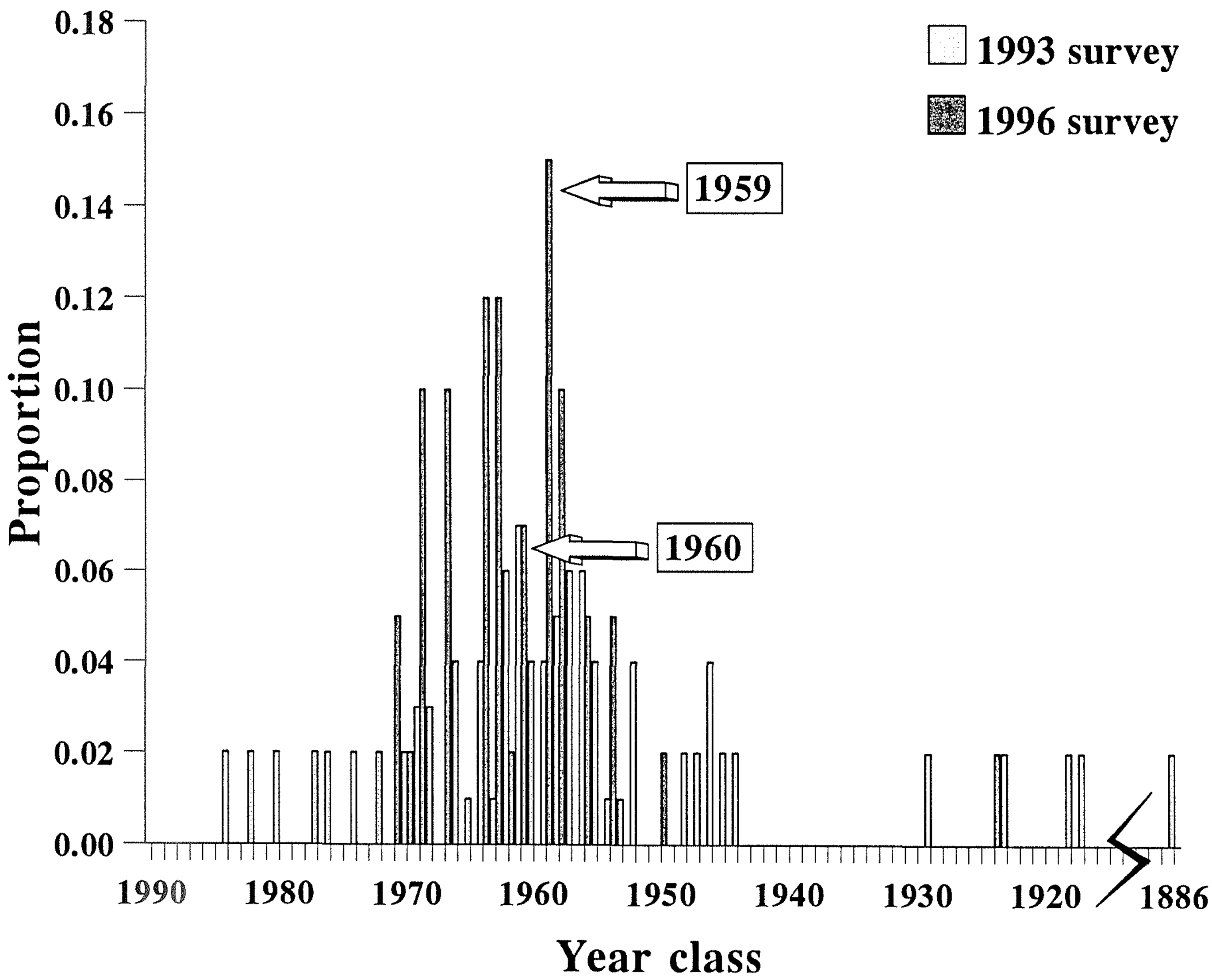


Figure 20. Age proportions for rougheye rockfish (*Sebastes aleutianus*) captured in the Outside Lower stratum during the 1993 and 1996 Langara surveys. (Weighted by catch rate (kg/hr) for each haul.)

1993
N = 1 haul
(101 fish)

1996
N = 2 hauls
(94 fish)

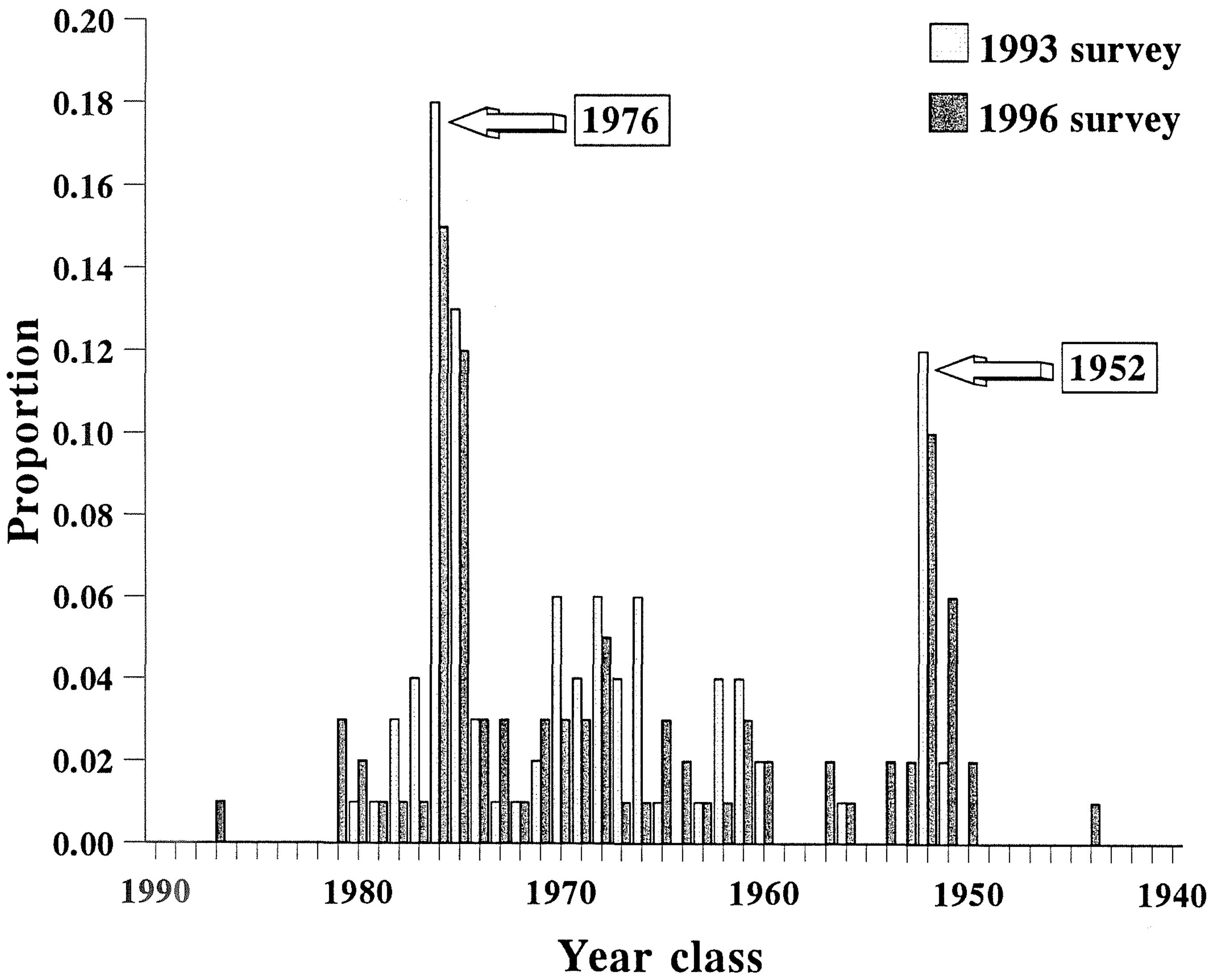


Figure 21. Age proportions for yellowmouth rockfish (*Sebastes reedi*) captured in the Rock Pile stratum during the 1993 and 1996 Langara surveys. (Weighted by catch rate (kg/hr) for each haul.)

Appendix Table 1. Description of rockfish gonad maturity stages.

Code	Gonad Condition	
	Females	Males
1	Immature (translucent, small)	Immature (translucent, string-like)
2	Developing (small, yellow eggs, opaque or translucent)	Developing (swelling, brown-white)
3	Developed (large yellow eggs, opaque)	------
4	Fertilized (large, orange-yellow eggs, translucent)	Developed (large, white, easily broken)
5	Embryos or larvae (includes eyed eggs)	Ripe (running sperm)
6	Spent (large, flaccid, red ovaries; a few larvae may be present)	Spent (flaccid, red)
7	Resting (moderate size, firm, red-grey ovaries)	Resting (ribbon-like, small brown)

Appendix Table 2. Average towing speeds, estimated trawl door spreads, and corresponding k_a values by stratum, R/V *W.E. RICKER*, Langara survey, July 2-13, 1996.

Stratum		average tow speed (kt)	trawl door spread (m)	k_a (nm^2/h)
A	(hauls with	3.5	50.87	0.0960498
B	sweeplines attached)	3.4	50.87	0.0933056
A	(hauls with	3.5	43.98	0.0960498
B	no sweeplines)	3.3	43.98	0.0905613
C		3.5	50.87	0.0960498
D		3.5	50.87	0.0960498
E		3.4	50.87	0.0933056
F		3.4	50.87	0.0933056
A and B	(no sweeplines)	3.4	43.98	0.0830849

Appendix Table 3. Bridge log information for bottom trawl tows, R/V *W.E. RICKER*, Langara survey, July 2-13, 1996.

Haul number		1	2	3	4
Date		July 05	July 05	July 05	July 05
Area		093505	093505	093506	093505
Stratum		Deep Trench	Flats	Flats	Deep Trench
Start time	(PST)	0844	1054	1307	1507
Duration	(min)	46	45	47	48
Start position					
	N. Lat	54° 14.3'	54° 10.7'	54° 11.3'	54° 9.9'
	W. Long.	133° 30.6'	133° 36.4'	133° 38.3'	133° 33.9'
Finish position					
	N. Lat	54° 11.9'	54° 13.5'	54° 9.2'	54° 7.6'
	W. Long.	133° 33.5'	133° 35.3'	133° 39.9'	133° 34.6'
Haul distance	(km)	5.4	5.3	4.3	4.3
	(naut. mi.)	2.9	2.9	2.3	2.3
Vessel speed	(kt)	3.5	3.5	3.0	3.2
Direction	(° True)	205	012	204	185
Bottom depth	(m)	353-343	315-307	300-294	347-351
	(fm)	193-188	172-168	164-161	190-192
Modal depth	(m)	348	311	297	349
Gear type		BT	BT	BT	BT
Total catch	(kg)	322	610	758	435
Remarks		Usable	Usable	Usable	Usable

Haul number	1	2	3	4
Date	July 05	July 05	July 05	July 05
Area	093505	093505	093506	093505
Stratum	Deep Trench	Flats	Flats	Deep Trench
		Estimated catch (kg)		
Arrowtooth flounder	94.2	55	6	38
Dover sole	32	46	6	63
Pacific halibut	--	--	7	38
Rex sole	13	48	10	--
Other flatfish	Trace	--	--	Trace
Sebastes aleutianus	8	15	--	4
S. alutus	15	250	597	142
S. babcocki	19	3	6	3
S. borealis	--	--	--	13
S. brevispinis	5	13	50	6
S. crameri	--	2	--	--
S. helvomaculatus	--	4	13	1
S. proriger	--	Trace	4	2
S. reedi	--	1	--	Trace
S. variegatus	Trace	Trace	--	Trace
S. zacentrus	Trace	--	6	--
Sebastolobus alascanus	57	128	48	92
Other rockfish	--	--	--	--
Pacific cod	--	--	--	--
Pacific hake	--	7	3	--
Sablefish	79	26	--	28
Sculpins	--	Trace	3	Trace
Walleye pollock	1	5	--	Trace
Other roundfish	Trace	3	--	4
Skates	--	--	--	1
Spotted ratfish	--	--	--	--
Other selachii	--	1	--	--
Total catch (kg)	322	610	758	435

Haul number		5	6	7	8
Date		July 05	July 06	July 06	July 06
Area		093502	093506	093506	093506
Stratum		Deep Trench	Outside Lower	Outside Lower	Outside Lower
Start time	(PST)	1730	0851	1316	1721
Duration	(min)	44	40	44	50
Start position					
	N. Lat	54° 3.6'	54° 4.6'	54° 9.4'	54° 12.0'
	W. Long.	133° 35.9'	133° 40.1'	133° 43.4'	133° 46.0'
Finish position					
	N. Lat	54° 2.6'	54° 6.9'	54° 11.6'	54° 14.2'
	W. Long.	133° 39.5'	133° 40.5'	133° 45.0'	133° 47.6'
Haul distance	(km)	4.3	4.3	4.4	4.4
	(naut. mi.)	2.3	2.3	2.4	2.4
Vessel speed	(kt)	3.3	3.3	3.3	3.1
Direction	(° True)	248	002	332	335
Bottom Depth	(m)	342-435	307-252	260-221	247-300
	(fm)	187-238	168-138	142-121	135-164
Modal Depth	(m)	388	279	240	273
Gear type		BT	BT	BT	BT
Total catch	(kg)	3094	2572	4110	11400
Remarks		Usable	Net torn-Usable	Usable	Usable

Appendix Table 3. Continued.

Haul number	5	6	7	8
Date	July 05	July 06	July 06	July 06
Area	093502	093506	093506	093506
Stratum	Deep Trench	Outside Lower	Outside Lower	Outside Lower
	Estimated catch (kg)			
Arrowtooth flounder	--	--	Trace	--
Dover sole	13	--	--	--
Pacific halibut	--	--	153	986
Rex sole	Trace	--	--	--
Other flatfish	--	--	Trace	--
Sebastes aleutianus	1079	1580	--	--
S. alutus	1820	940	2446	9801
S. babcocki	Trace	--	Trace	--
S. borealis	--	--	--	--
S. brevispinis	--	--	77	148
S. crameri	--	21	--	112
S. helvomaculatus	Trace	Trace	Trace	--
S. proriger	--	--	--	--
S. reedi	--	--	--	--
S. variegatus	--	--	--	--
S. zacentrus	--	31	1358	197
Sebastolobus alascanus	141	Trace	76	45
Other rockfish	--	--	--	--
Pacific cod	--	--	--	--
Pacific hake	--	--	--	112
Sablefish	42	--	--	--
Sculpins	--	--	--	--
Walleye pollock	--	--	--	--
Other roundfish	--	--	--	--
Skates	--	--	--	--
Spotted ratfish	--	--	--	--
Other selachii	--	--	--	--
Total catch (kg)	3094	2572	4110	11400

Haul number		9	10	11	12
Date		July 07	July 07	July 07	July 07
Area		093506	093506	093506	093506
Stratum		Outside Upper	Outside Upper	Outside Upper	Outside Upper
Start time	(PST)	0841	1057	1240	1405
Duration	(min)	38	23	11	47
Start position					
	N. Lat	54° 15.4'	54° 14.0'	54° 17.3'	54° 20.1'
	W. Long.	133° 46.8'	133° 44.9'	133° 46.9'	133° 44.8'
Finish position					
	N. Lat	54° 13.5'	54° 15.2'	54° 19.9'	54° 17.7'
	W. Long.	133° 45.5'	133° 45.8'	133° 46.9'	133° 44.7'
Haul distance	(km)	3.8	2.4	4.8	4.5
	(naut. mi.)	2.1	1.3	2.6	2.4
Vessel speed	(kt)	3.3	3.5	3.5	3.5
Direction	(° True)	161	003	355	178
Bottom Depth	(m)	230-225	234-230	218-221	234-234
	(fm)	126-123	128-126	119-121	128-128
Modal Depth	(m)	228	232	219	234
Gear type		BT	BT	BT	BT
Total catch	(kg)	2002	694	1030	1600
Remarks		Usable	Usable	Usable	Usable

Haul number	9	10	11	12
Date	July 07	July 07	July 07	July 07
Area	093506	093506	093506	093506
Stratum	Outside Upper	Outside Upper	Outside Upper	Outside Upper
	Estimated catch (kg)			
Arrowtooth flounder	18	11	--	--
Dover sole	7	2	--	6
Pacific halibut	65	9	7	6
Rex sole	Trace	6	Trace	Trace
Other flatfish	Trace	5	--	--
Sebastes aleutianus	--	--	--	--
S. alutus	411	151	107	622
S. babcocki	Trace	4	Trace	9
S. borealis	--	--	--	--
S. brevispinis	146	36	98	194
S. crameri	--	--	--	--
S. helvomaculatus	7	10	Trace	9
S. proriger	--	1	423	215
S. reedi	--	--	8	--
S. variegatus	47	14	12	Trace
S. zacentrus	1282	423	376	486
Sebastolobus alascanus	--	3	--	Trace
Other rockfish	--	Trace	--	Trace
Pacific cod	--	4	--	52
Pacific hake	--	--	--	--
Sablefish	19	7	--	--
Sculpins	--	Trace	--	Trace
Walleye pollock	--	--	--	--
Other roundfish	--	--	--	--
Skates	--	5	--	--
Spotted ratfish	--	4	--	--
Other selachii	--	--	--	--
Total catch (kg)	2002	694	1030	1600

Haul number		13	14	15	16
Date		July 07	July 07	July 08	July 08
Area		093506	093506	093506	093506
Stratum		Flats	Flats	Outside Upper	Outside Lower
Start time	(PST)	1627	1822	0824	1039
Duration	(min)	31	24	33	11
Start position					
	N. Lat	54° 12.5'	54° 17.6'	54° 14.4'	54° 13.9'
	W. Long.	133° 38.8'	133° 34.7'	133° 47.1'	133° 47.7'
Finish position					
	N. Lat	54° 13.9'	54° 18.8'	54° 12.6'	54° 14.5'
	W. Long.	133° 37.0'	133° 33.5'	133° 47.0'	133° 47.5'
Haul distance	(km)	3.2	2.6	3.3	1.1
	(naut. mi.)	1.8	1.4	1.8	.6
Vessel speed	(kt)	3.5	3.5	3.5	3.5
Direction	(° True)	036	029	179	353
Bottom Depth	(m)	282-289	260-258	234-313	296-326
	(fm)	154-158	142-141	128-171	162-178
Modal Depth	(m)	285	259	273	311
Gear type		BT	BT	BT	BT
Total catch	(kg)	426	826	5910	167
Remarks		Usable	Usable	Usable	Usable

Haul number	13	14	15	16
Date	July 07	July 07	July 08	July 08
Area	093506	093506	093506	093506
Stratum	Flats	Flats	Outside Upper	Outside Lower
		Estimated catch (kg)		
Arrowtooth flounder	18	--	29	--
Dover sole	15	29	--	3
Pacific halibut	--	5	44	--
Rex sole	12	20	Trace	Trace
Other flatfish	Trace	--	--	--
Sebastes aleutianus	--	--	--	1
S. alutus	311	659	4853	151
S. babcocki	3	7	106	2
S. borealis	--	--	--	--
S. brevispinis	8	23	51	--
S. crameri	--	--	--	--
S. helvomaculatus	7	13	--	1
S. proriger	--	--	--	--
S. reedi	--	--	--	--
S. variegatus	--	Trace	--	--
S. zacentrus	--	7	827	4
Sebastolobus alascanus	49	34	Trace	5
Other rockfish	--	7	--	--
Pacific cod	--	--	--	--
Pacific hake		--	--	--
Sablefish	5	17	--	--
Sculpins	Trace	--	--	Trace
Walleye pollock	--	4	--	--
Other roundfish	Trace	--	--	--
Skates	--	--	--	--
Spotted ratfish	--	--	--	--
Other selachii	--	--	--	--
Total catch (kg)	426	826	5910	167

Haul number		17	18	19	20
Date		July 08	July 08	July 08	July 08
Area		93506	93506	93506	93506
Stratum		Flats	Flats	Flats	Flats
Start time	(PST)	1332	1443	1611	1752
Duration	(min)	15	36	22	42
Start position					
	N. Lat	54° 10.5'	54° 13.2'	54° 17.6'	54° 18.6'
	W. Long.	133° 40.8'	133° 43.0'	133° 42.5'	133° 33.7'
Finish position					
	N. Lat	54° 11.3'	54° 15.2'	54° 18.9'	54° 16.8'
	W. Long.	133° 41.0'	133° 42.9'	133° 42.3'	133° 35.9'
Haul distance	(km)	1.5	3.7	2.4	4.1
	(naut. mi.)	0.8	2	1.3	2.2
Vessel speed	(kt)	--	3.5	3.5	3.5
Direction	(° True)	1	359	355	218
Bottom Depth	(m)	251-243	241-247	243-251	260-269
	(fm)	137-133	132-135	133-137	142-147
Modal Depth	(m)	247	244	247	264
Gear type		BT	BT	BT	BT
Total catch	(kg)	526	1162	637	635
Remarks		Usable	Usable	Usable	Usable

Haul number	17	18	19	20
Date	July 08	July 08	July 08	July 08
Area	93506	93506	93506	93506
Stratum	Flats	Flats	Flats	Flats
		Estimated catch (kg)		
Arrowtooth flounder	4	5	--	5
Dover sole	4	10	4	26
Pacific halibut	--	24	14	11
Rex sole	Trace	--	8	20
Other flatfish	Trace	Trace	Trace	--
Sebastes aleutianus	--	--	--	--
S. alutus	362	798	86	469
S. babcocki	2	14	22	11
S. borealis	--	--	--	--
S. brevispinis	33	--	229	27
S. crameri	--	--	--	--
S. helvomaculatus	7	15	9	6
S. proriger	Trace	--	--	--
S. reedi	--	--	Trace	Trace
S. variegatus	--	--	--	--
S. zacentrus	96	286	262	18
Sebastolobus alascanus	15	Trace	4	23
Other rockfish	--	--	--	--
Pacific cod	--	--	--	--
Pacific hake	--	--	--	--
Sablefish	--	--	--	16
Sculpins	3	Trace	Trace	Trace
Walleye pollock	--	--	--	--
Other roundfish	--	--	--	--
Skates	--	--	--	--
Spotted ratfish	2	10	--	4
Other selachii	--	--	--	--
Total catch (kg)	526	1162	637	635

Haul number		21	22	23	24
Date		July 09	July 09	July 09	July 09
Area		93502	93502	93502	93502
Stratum		Inside Edge	Inside Edge	Inside Edge	Inside Edge
Start time	(PST)	826	959	1144	1308
Duration	(min)	30	28	35	41
Start position					
	N. Lat	54° 4.4'	54° 3.6'	54° 5.8'	54° 6.6'
	W. Long.	133° 30.8'	133° 33.0'	133° 26.0'	133° 25.2'
Finish position					
	N. Lat	54° 3.9'	54° 4.3'	54° 7.1'	54° 5.5'
	W. Long.	133° 33.4'	133° 30.8'	133° 23.7'	133° 28.2'
Haul distance	(km)	3	2.7	3.5	3.8
	(naut. mi.)	1.6	1.5	1.9	2.1
Vessel speed	(kt)	3.5	3.5	3.5	3.5
Direction	(° True)	240	64	45	240
Bottom Depth	(m)	305-327	300-287	276-274	311-324
	(fm)	167-179	164-157	151-150	170-177
Modal Depth	(m)	316	294	275	317
Gear type		BT	BT	BT	BT
Total catch	(kg)	690	2402	1385	878
Remarks		Usable	Usable	Usable	Usable

Haul number	21	22	23	24
Date	July 09	July 09	July 09	July 09
Area	93502	93502	93502	93502
Stratum	Inside Edge	Inside Edge	Inside Edge	Inside Edge
	Estimated catch (kg)			
Arrowtooth flounder	50	71	858	317
Dover sole	35	17	66	153
Pacific halibut	--	8	--	17
Rex sole	54	32	Trace	141
Other flatfish	--	--	4	Trace
Sebastes aleutianus	4	--	--	9
S. alutus	413	1969	171	89
S. babcocki	3	18	29	9
S. borealis	--	--	--	50
S. brevispinis	27	53	207	--
S. crameri	3	--	--	--
S. helvomaculatus	Trace	Trace	--	Trace
S. proriger	23	--	--	--
S. reedi	--	--	--	--
S. variegatus	--	--	--	--
S. zacentrus	Trace	--	--	Trace
Sebastolobus alascanus	58	101	29	62
Other rockfish	--	--	Trace	--
Pacific cod	--	--	--	--
Pacific hake	--	--	--	--
Sablefish	--	Trace	4	32
Sculpins	Trace	Trace	--	Trace
Walleye pollock	20	14	16	--
Other roundfish	--	--	--	--
Skates	--	104	--	--
Spotted ratfish	--	15	Trace	Trace
Other selachii	--	--	--	--
Total catch (kg)	690	2402	1385	878

Haul number		25	26	27	28
Date		July 09	July 09	July 09	July 10
Area		93505	93505	93505	93506
Stratum		Deep Trench	Deep Trench	Flats	Flats
Start time	(PST)	1535	1752	1906	824
Duration	(min)	39	11	26	20
Start position					
	N. Lat	54° 14.7'	54° 16.9'	54° 18.1'	54° 18.0'
	W. Long.	133° 32.8'	133° 31.3'	133° 29.3'	133° 33.4'
Finish position					
	N. Lat	54° 15.9'	54° 17.3'	54° 17.9'	54° 19.0'
	W. Long.	133° 30.4'	133° 30.5'	133° 31.5'	133° 33.6'
Haul distance	(km)	3.4	1.1	2.4	1.9
	(naut. mi.)	1.8	0.6	1.3	1
Vessel speed	(kt)	3.5	3.5	3.5	3.5
Direction	(° True)	45	57	260	25
Bottom Depth	(m)	322-324	294-	272-274	262-254
	(fm)	176-177	161-	149-150	143-139
Modal Depth	(m)	323		273	258
Gear type		BT	BT	BT	BT
Total catch	(kg)	506	312	3192	450
Remarks		Usable	Usable	Usable	Usable

Haul number	25	26	27	28
Date	July 09	July 09	July 09	July 10
Area	93505	93505	93505	93506
Stratum	Deep Trench	Deep Trench	Flats	Flats
	Estimated catch (kg)			
Arrowtooth flounder	56	16	33	15
Dover sole	28	6	11	--
Pacific halibut	--	--	--	7
Rex sole	20	7	Trace	32
Other flatfish	Trace	--	--	--
Sebastes aleutianus	9	4	--	Trace
S. alutus	167	185	2822	293
S. babcocki	9	3	16	5
S. borealis	--	--	--	--
S. brevispinis	--	2	--	17
S. crameri	--	--	--	--
S. helvomaculatus	Trace	5	Trace	1
S. proriger	--	--	--	--
S. reedi	--	--	43	8
S. variegatus	--	--	--	--
S. zacentrus	--	Trace	181	22
Sebastolobus alascanus	165	76	44	42
Other rockfish	--	--	Trace	2
Pacific cod	--	--	--	--
Pacific hake	--	--	--	--
Sablefish	51	9	25	3
Sculpins	Trace	Trace	Trace	Trace
Walleye pollock	Trace	Trace	18	1
Other roundfish	Trace	Trace	--	--
Skates	--	1	--	--
Spotted ratfish	--	--	--	--
Other selachii	--	--	--	--
Total catch (kg)	506	312	3192	450

Haul number		29	30	31	32
Date		July 10	July 10	July 10	July 10
Area		93505	93506	93505	93507
Stratum		Flats	Flats	Rock Pile	Rock Pile
Start time	(PST)	958	1203	1445	1615
Duration	(min)	45	52	10	16
Start position					
	N. Lat	54° 17.5'	54° 17.8'	54° 19.0'	54° 21.5'
	W. Long.	133° 34.4'	133° 31.5'	133° 27.0'	133° 22.9'
Finish position					
	N. Lat	54° 18.1'	54° 17.7'	54° 19.1'	54° 20.6'
	W. Long.	133° 30.5'	133° 36.3'	133° 26.1'	133° 22.8'
Haul distance	(km)	4.4	5.2	1.0	1.7
	(naut. mi.)	2.4	2.8	0.5	0.9
Vessel speed	(kt)	3.5	3.5	3.5	3.5
Direction	(° True)	72	255	62	146
Bottom Depth	(m)	269-271	269-258	243-212	227-225
	(fm)	147-148	147-141	133-116	124-123
Modal Depth	(m)	270	263	228	226
Gear type		BT	BT	BT	BT
Total catch	(kg)	1420	1406	904	4248
Remarks		Snag-Usable	Usable	Usable	Usable

Haul number	29	30	31	32
Date	July 10	July 10	July 10	July 10
Area	93505	93506	93505	93507
Stratum	Flats	Flats	Rock Pile	Rock Pile
		Estimated catch (kg)		
Arrowtooth flounder	--	26	5	26
Dover sole	12	26	7	--
Pacific halibut	13	--	--	38
Rex sole	10	12	3	Trace
Other flatfish	--	--	--	--
Sebastes aleutianus	--	--	--	--
S. alutus	1148	1195	55	2480
S. babcocki	8	10	4	40
S. borealis	--	--	--	--
S. brevispinis	36	--	203	372
S. crameri	--	--	--	--
S. helvomaculatus	8	14	Trace	--
S. proriger	--	--	--	65
S. reedi	12	8	584	964
S. variegatus	Trace	--	Trace	Trace
S. zacentrus	6	12	18	225
Sebastolobus alascanus	114	88	19	38
Other rockfish	--	13	5	--
Pacific cod	--	--	--	--
Pacific hake	--	--	--	--
Sablefish	45	--	--	--
Sculpins	Trace	Trace	--	--
Walleye pollock	7	--	--	--
Other roundfish	--	--	--	--
Skates	--	--	--	--
Spotted ratfish	--	--	--	--
Other selachii	--	--	--	--
Total catch (kg)	1420	1406	904	4248

Haul number		33	34	35	36
Date		July 10	July 11	July 12	July 12
Area		93507	93506	93506	93506
Stratum		Rock Pile	Outside Upper	Outside Upper	Outside Upper
Start time	(PST)	1830	832	952	1145
Duration	(min)	4	10	29	13
Start position					
	N. Lat	54° 19.1'	54° 19.5'	54° 18.1'	54° 19.3'
	W. Long.	133° 24.6'	133° 48.3'	133° 45.9'	133° 48'
Finish position					
	N. Lat	54° 19.2'	54° 19.0'	54° 19.0'	54° 18.7'
	W. Long.	133° 24.2'	133° 48.3'	133° 44.0'	133° 48.5'
Haul distance	(km)	0.5	0.9	2.6	1.2
	(naut. mi.)	0.3	0.5	1.4	0.7
Vessel speed	(kt)	3.5	3.5	3.5	3.5
Direction	(° True)	75	186	39	185
Bottom Depth	(m)	234-340	278-278	232-234	254-285
	(fm)	128-186	152-152	127-128	139-156
Modal Depth	(m)	287	278	233	270
Gear type		BT	BT	BT	BT
Total catch	(kg)	422	0	1940	79
Remarks		Snag-Usable	Net Lost	No sweeps-Usable	No sweeps-Usable

Haul number	33	34	35	36
Date	July 10	July 11	July 12	July 12
Area	93507	93506	93506	93506
Stratum	Rock Pile	Outside Upper	Outside Upper	Outside Upper
	Estimated catch (kg)			
Arrowtooth flounder	5	--	--	1
Dover sole	--	--	Trace	--
Pacific halibut	--	--	5	--
Rex sole	Trace	--	Trace	Trace
Other flatfish	--	--	Trace	2
Sebastes aleutianus	--	--	--	--
S. alutus	47	--	1453	59
S. babcocki	30	--	7	--
S. borealis	161	--	--	--
S. brevispinis	16	--	93	2
S. crameri	--	--	--	--
S. helvomaculatus	1	--	Trace	Trace
S. proriger	Trace	--	149	7
S. reedi	63	--	14	--
S. variegatus	Trace	--	Trace	Trace
S. zacentrus	92	--	219	8
Sebastolobus alascanus	7	--	Trace	--
Other rockfish	--	--	--	--
Pacific cod	--	--	--	--
Pacific hake	--	--	--	--
Sablefish	--	--	--	--
Sculpins	Trace	--	--	--
Walleye pollock	--	--	--	--
Other roundfish	--	--	--	--
Skates	--	--	--	--
Spotted ratfish	--	--	--	--
Other selachii	--	--	--	--
Total catch (kg)	422	0	1940	79

Haul number		37	38	39
Date		July 12	July 12	July 13
Area		93506	93506	93506
Stratum		Outside Upper	Outside Lower	Outside Lower
Start time	(PST)	1347	1627	1240
Duration	(min)	22	7	18
Start position				
	N. Lat	54° 12.2'	54° 12.8'	54° 9.5'
	W. Long.	133° 46.3'	133° 47.2'	133° 43.1'
Finish position				
	N. Lat	54° 13.2'	54° 13.2'	54° 8.7'
	W. Long.	133° 46.9'	133° 47.5'	133° 42.4'
Haul distance	(km)	2.0	0.8	1.7
	(naut. mi.)	1.1	0.4	0.9
Vessel speed	(kt)	3.5	3.5	3.5
Direction	(° True)	334	337	159
Bottom Depth	(m)	260-262	346-335	258-360
	(fm)	142-143	189-183	141-197
Modal Depth	(m)	261	340	309
Gear type		BT	BT	BT
Total catch	(kg)	7300	522	3536
Remarks		No sweeps- Usable	No sweeps- Usable	No sweeps- Usable

Haul number	37	38	39
Date	July 12	July 12	July 13
Area	93506	93506	93506
Stratum	Outside Upper	Outside Lower	Outside Lower
		Estimated catch (kg)	
Arrowtooth flounder	--	5	--
Dover sole	--	5	16
Pacific halibut	--	--	--
Rex sole	Trace	1	Trace
Other flatfish	--	--	--
Sebastes aleutianus	--	79	53
S. alutus	7097	372	1891
S. babcocki	--	2	Trace
S. borealis	--	5	--
S. brevispinis	35	1	28
S. crameri	--	--	--
S. helvomaculatus	--	10	--
S. proriger	--	--	--
S. reedi	--	3	--
S. variegatus	--	--	--
S. zacentrus	168	2	1463
Sebastolobus alascanus	Trace	38	23
Other rockfish	--	--	--
Pacific cod	--	--	--
Pacific hake	--	--	--
Sablefish	--	--	63
Sculpins	--	Trace	--
Walleye pollock	--	--	--
Other roundfish	--	--	--
Skates	--	--	--
Spotted ratfish	--	--	--
Other selachii	--	--	--
Total catch (kg)	7300	522	3536

Appendix Table 4. Common and scientific names of fishes collected aboard the R/V *W.E. RICKER*, Langara survey, July 2-13, 1996.

Rockfish	Rougheye rockfish	*Sebastes aleutianus*
	Pacific ocean perch	*S. alutus*
	Redbanded rockfish	*S. babcocki*
	Shortraker rockfish	*S. borealis*
	Silvergray rockfish	*S. brevispinis*
	Darkblotched rockfish	*S. crameri*
	Splitnose rockfish	*S. diploproa*
	Greenstiped rockfish	*S. elongatus*
	Widow rockfish	*S. entomelas*
	Yellowtail rockfish	*S. flavidus*
	Rosethorn rockfish	*S. helvomaculatus*
	Redstripe rockfish	*S. proriger*
	Yellowmouth rockfish	*S. reedi*
	Harlequin rockfish	*S. variegatus*
	Sharpchin rockfish	*S. zacentrus*
	Shortspine thornyhead	*Sebastolobus alascanus*
Flatfish	Arrowtooth flounder	*Atheresthes stomias*
	Petrale sole	*Eopsetta jordani*
	Slender sole	*Eopsetta exilis*
	Rex sole	*Errex zachirus*
	Pacific halibut	*Hippoglossus stenolepis*
	Dover sole	*Microstomus pacificus*
	English sole	*Pleuronectes vetulus*
Roundfish	Whitebait smelt	*Allosmerus elongatus*
	Sablefish	*Anoplopoma fimbria*
	Pacific cod	*Gadus macrocephalus*
	Pacific hake	*Merluccius productus*
	Lingcod	*Ophiodon elongatus*
	Walleye pollock	*Theragra chalcogramma*
	Bigmouth sculpin	*Hemitripterus bolini*
	Darkfin sculpin	*Malacocottus zonurus*
Selachii	Skates	Family Ragidae
	Spotted ratfish	*Hydrolagus colliei*
	Spiny dogfish	*Squalus acanthias*

Appendix Table 5. Mean catch rates (kg/h) by stratum for rockfish (*Sebastes* sp. and *Sebastolobus* sp.) captured aboard the R/V *W.E. RICKER*, Langara survey, June 19-30, 1993.

Species	Mean Catch Rates (kg/h) by Stratum[1] Outside Upper (A)	Outside Lower (B)	Flats (C)	Rock Pile (D)	Deep Trench (E)	Inside Edge (F)	Total (All Strata)
Sebastes aleutianus	--	662.65 (112.75-2142.86)	2.01 (0.00-4.94)	--	3.20 (0.20-7.86)	--	52.55 (6.41-122.32)
S. alutus	1522.52 (421.08-4394.56)	2108.78 (1027.33-3748.07)	1328.85 (682.72-3091.41)	320.79 (0.00-573.18)	691.54 (218.86-1540.52)	154.51 (77.50-283.86)	956.81 (552.77-1430.17)
S. babcocki	42.44 (0.22-150.22)	31.55 (11.07-74.86)	2.07 (0.11-5.47)	86.34 (21.60-153.75)	9.93 (2.68-20.71)	5.09 (0.75-8.67)	10.49 (6.16-15.35)
S. borealis	--	98.51 (27.25-293.78)	--	37.25 (0.00-74.50)	9.63 (0.00-21.92)	--	12.00 (3.59-22.90)
S. brevispinis	91.64 (31.78-174.96)	46.83 (11.89-95.48)	54.87 (32.96-107.84)	695.66 (23.10-1817.68)	31.20 (4.07-109.91)	195.07 (18.50-459.96)	85.97 (45.91-137.35)
S. ciliatus	--	--	2.47 (0.00-7.41)	2.75 (0.00-5.50)	--	--	1.00 (0.00-2.93)
S. crameri	--	5.05 (1.38-10.16)	--	--	0.29 (0.00-0.58)	--	0.49 (0.11-0.93)
S. diploproa	--	--	--	--	--	--	--
S. entomelas	--	--	7.49 (0.22-28.86)	1.00 (0.00-2.00)	--	--	2.84 (0.06-8.22)
S. helvomaculatus	1.26 (0.00-4.15)	3.28 (0.00-7.36)	7.17 (2.78-10.83)	--	2.63 (0.63-6.29)	1.29 (0.00-2.59)	4.08 (2.19-5.97)
S. paucispinis	--	--	13.44 (0.00-40.33)	--	--	9.83 (0.00-19.66)	6.54 (0.00-18.11)
S. pinniger	--	--	--	--	--	--	--
S. proriger	318.76 (111.26-657.22)	--	11.11 (0.11-43.33)	150.43 (3.00-423.21)	1.00 (0.00-2.00)	--	13.01 (3.74-24.04)
S. reedi	10.22 (0.00-30.67)	--	325.52 (104.94-674.91)	1442.09 (127.40-3332.68)	57.24 (0.00-180.37)	1.79 (0.25-4.13)	183.58 (83.38-295.17)
S. ruberrimus	--	--	--	60.75 (0.00-180.00)	--	--	1.72 (0.00-5.11)
S. variegatus	17.89 (1.41-51.81)	--	--	121.57 (0.00-363.21)	--	--	3.69 (0.04-10.54)
S. zacentrus	885.89 (396.48-1736.04)	110.91 (38.08-226.54)	59.72 (15.61-175.44)	3028.80 (50.10-6007.50)	--	--	128.58 (40.23-219.63)
Sebastolobus alascanus	4.44 (0.00-17.11)	54.43 (29.35-85.88)	30.72 (16.22-42.74)	12.05 (0.00-24.10)	140.41 (73.25-221.99)	6.00 (0.00-11.25)	66.68 (41.87-94.38)
Total	2895.07 (1328.25-6937.85)	3121.99 (1751.95-4608.81)	1845.45 (1010.47-3883.34)	5959.48 (603.60-11315.36)	947.06 (432.85-2032.26)	373.58 (124.50-788.82)	1530.03 (983.50-2185.11)
c.i. as % of mean	194%	92%	156%	180%	169%	178%	79%

[1]With 95% confidence limits.

Appendix Table 6. Mean biomass estimates (tonnes) by stratum for rockfish (*Sebastes* sp. and *Sebastolobus* sp.) captured aboard the R/V *W.E. RICKER*, Langara survey, June 19-30, 1993, re-calculated using average tow speed by stratum.

	Biomass Estimates (tonnes)[1]						
Species	Outside Upper (A)	Outside Lower (B)	Flats (C)	Rock Pile (D)	Deep Trench (E)	Inside Edge (F)	Total (All Strata)
Sebastes aleutianus	--	361.30 (61.48-1168.38)	4.27 (0.00-10.48)	--	7.52 (0.47-18.46)	--	373.09 (44.15-869.86)
S. alutus	125.28 (34.65-361.60)	1149.80 (560.14-2043.60)	2819.91 (1448.78-6560.16)	54.79 (0.00-97.90)	1624.91 (514.26-3619.78)	151.64 (76.06-278.59)	5926.32 (3486.36-8847.66)
S. babcocki	3.49 (0.02-12.36)	17.20 (6.03-40.82)	4.39 (0.24-11.61)	14.75 (3.69-26.26)	23.32 (6.31-48.67)	4.99 (0.74-8.51)	68.15 (40.11-100.59)
S. borealis	--	53.71 (14.86-160.18)	--	6.36 (0.00-12.73)	22.63 (0.00-51.49)	--	82.70 (24.83-158.75)
S. brevispinis	7.54 (2.61-14.40)	25.53 (6.48-52.06)	116.43 (69.95-228.84)	118.83 (3.95-310.48)	73.32 (9.57-258.25)	191.45 (18.16-451.42)	533.09 (283.79-861.18)
S. ciliatus	--	--	5.24 (0.00-15.72)	0.47 (0.00-0.94)	--	--	5.71 (0.00-16.66)
S. crameri	--	2.75 (0.75-5.54)	--	--	0.68 (0.00-1.37)	--	3.43 (0.79-6.54)
S. diploproa							
S. entomelas	--	--	15.90 (0.47-61.25)	0.17 (0.00-0.34)	--	--	16.07 (0.34-46.53)
S. helvomaculatus	0.10 (0.00-0.34)	1.79 (0.00-4.01)	15.21 (5.89-22.99)	--	6.17 (1.48-14.77)	1.27 (0.00-2.54)	24.55 (13.38-36.18)
S. paucispinis	--	--	28.53 (0.00-85.59)	--	--	9.64 (0.00-19.29)	38.18 (0.00-104.88)
S. pinniger	--	--	--	--	--	--	--
S. proriger	26.23 (9.15-54.08)	--	23.58 (0.24-91.96)	25.69 (0.51-72.29)	2.35 (0.00-4.70)	--	77.85 (23.17-141.82)
S. reedi	0.84 (0.00-2.52)	--	690.77 (222.70-1432.19)	246.32 (21.76-569.25)	134.49 (0.00-423.82)	1.76 (0.25-4.05)	1074.19 (489.16-1715.44)
S. ruberrimus	--	--	--	10.38 (0.00-30.75)	--	--	10.38 (0.00-30.75)
S. variegatus	1.47 (0.12-4.26)	--	--	20.77 (0.00-62.04)	--	--	22.24 (0.23-63.46)
S. zacentrus	72.89 (32.62-142.85)	60.48 (20.76-123.52)	126.73 (33.13-372.30)	517.35 (8.56-1026.14)	--	--	777.45 (246.03-1323.02)
Sebastolobus alascanus	0.37 (0.00-1.41)	29.68 (16.00-46.82)	65.18 (34.42-90.69)	2.06 (0.00-4.12)	329.92 (172.11-521.61)	5.89 (0.00-11.04)	433.10 (268.00-616.87)
Total	238.21 (109.29-570.86)	1702.24 (955.24-2512.92)	3916.15 (2144.28-8240.67)	1017.94 (103.10-1932.77)	2225.32 (1017.07-4775.22)	366.64 (122.19-774.17)	9466.50 (6248.40-13308.64)
No. Hauls	9	9	9	4	7	4	42
Stratum Area (nm)	7.0	40.4	198.0	15.0	187.0	80.8	528.4
Vessel Speed (kt)	3.1	2.7	3.4	3.2	2.9	3.0	3.0

[1]With 95% confidence limits.

Appendix Table 5. Mean catch rates (kg/h) by stratum for rockfish (*Sebastes* spp. and *Sebastolobus* sp.) captured aboard the R/V *W.E. RICKER*, Langara survey, June 19-30, 1993.

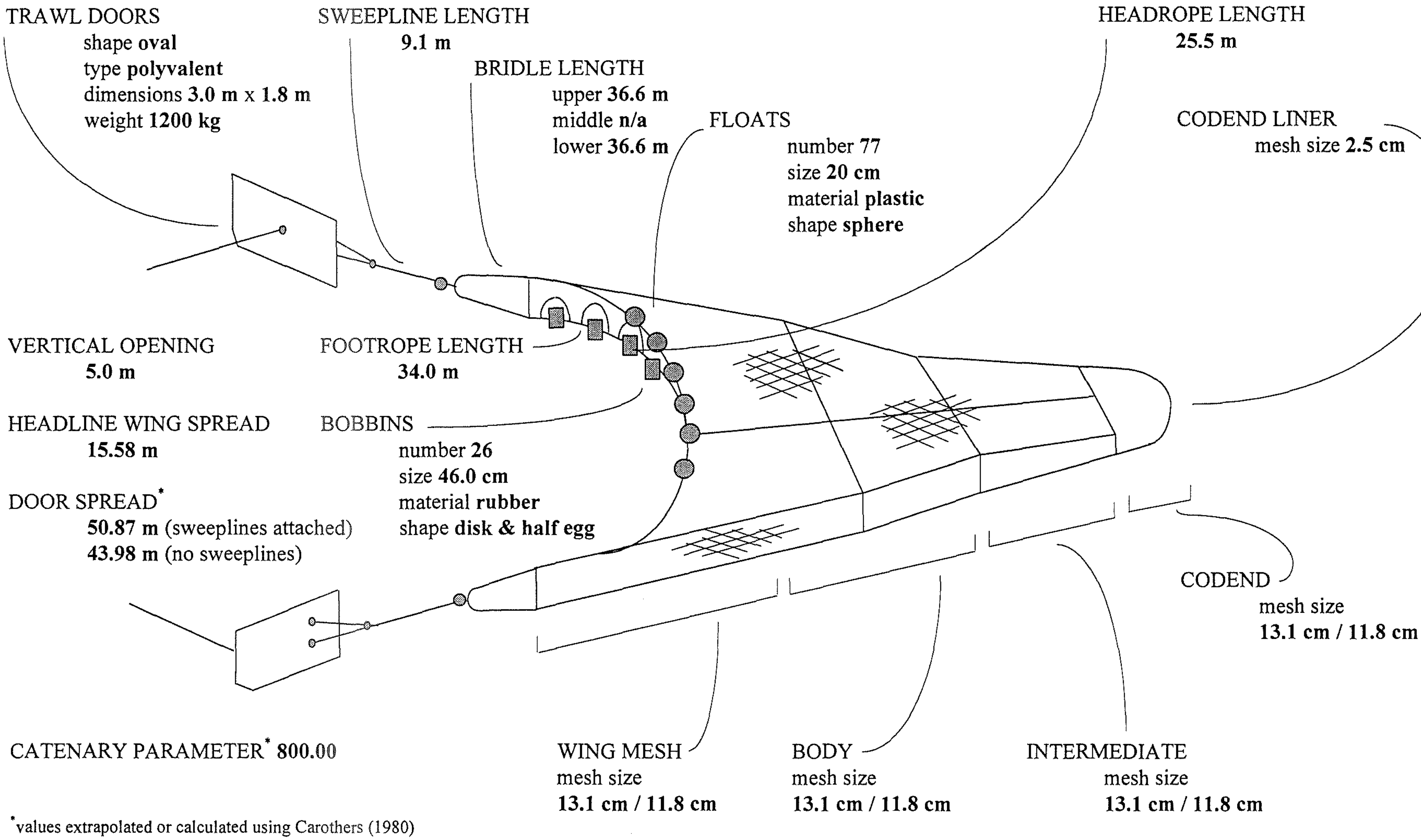
	Mean Catch Rates (kg/h) by Stratum[1]						
Species	Outside Upper (A)	Outside Lower (B)	Flats (C)	Rock Pile (D)	Deep Trench (E)	Inside Edge (F)	Total (All Strata)
Sebastes aleutianus	--	662.65 (112.75-2142.86)	2.01 (0.00-4.94)	--	3.20 (0.20-7.86)	--	52.55 (6.41-122.32)
S. alutus	1522.52 (421.08-4394.56)	2108.78 (1027.33-3748.07)	1328.85 (682.72-3091.41)	320.79 (0.00-573.18)	691.54 (218.86-1540.52)	154.51 (77.50-283.86)	956.81 (552.77-1430.17)
S. babcocki	42.44 (0.22-150.22)	31.55 (11.07-74.86)	2.07 (0.11-5.47)	86.34 (21.60-153.75)	9.93 (2.68-20.71)	5.09 (0.75-8.67)	10.49 (6.16-15.35)
S. borealis	--	98.51 (27.25-293.78)	--	37.25 (0.00-74.50)	9.63 (0.00-21.92)	--	12.00 (3.59-22.90)
S. brevispinis	91.64 (31.78-174.96)	46.83 (11.89-95.48)	54.87 (32.96-107.84)	695.66 (23.10-1817.68)	31.20 (4.07-109.91)	195.07 (18.50-459.96)	85.97 (45.91-137.35)
S. ciliatus	--	--	2.47 (0.00-7.41)	2.75 (0.00-5.50)	--	--	1.00 (0.00-2.93)
S. crameri	--	5.05 (1.38-10.16)	--	--	0.29 (0.00-0.58)	--	0.49 (0.11-0.93)
S. diploproa	--	--	--	--	--	--	--
S. entomelas	--	--	7.49 (0.22-28.86)	1.00 (0.00-2.00)	--	--	2.84 (0.06-8.22)
S. helvomaculatus	1.26 (0.00-4.15)	3.28 (0.00-7.36)	7.17 (2.78-10.83)	--	2.63 (0.63-6.29)	1.29 (0.00-2.59)	4.08 (2.19-5.97)
S. paucispinis	--	--	13.44 (0.00-40.33)	--	--	9.83 (0.00-19.66)	6.54 (0.00-18.11)
S. pinniger	--	--	--	--	--	--	--
S. proriger	318.76 (111.26-657.22)	--	11.11 (0.11-43.33)	150.43 (3.00-423.21)	1.00 (0.00-2.00)	--	13.01 (3.74-24.04)
S. reedi	10.22 (0.00-30.67)	--	325.52 (104.94-674.91)	1442.09 (127.40-3332.68)	57.24 (0.00-180.37)	1.79 (0.25-4.13)	183.58 (83.38-295.17)
S. ruberrimus	--	--	--	60.75 (0.00-180.00)	--	--	1.72 (0.00-5.11)
S. variegatus	17.89 (1.41-51.81)	--	--	121.57 (0.00-363.21)	--	--	3.69 (0.04-10.54)
S. zacentrus	885.89 (396.48-1736.04)	110.91 (38.08-226.54)	59.72 (15.61-175.44)	3028.80 (50.10-6007.50)	--	--	128.58 (40.23-219.63)
Sebastolobus alascanus	4.44 (0.00-17.11)	54.43 (29.35-85.88)	30.72 (16.22-42.74)	12.05 (0.00-24.10)	140.41 (73.25-221.99)	6.00 (0.00-11.25)	66.68 (41.87-94.38)
Total	2895.07 (1328.25-6937.85)	3121.99 (1751.95-4608.81)	1845.45 (1010.47-3883.34)	5959.48 (603.60-11315.36)	947.06 (432.85-2032.26)	373.58 (124.50-788.82)	1530.03 (983.50-2185.11)
c.i. as % of mean	194%	92%	156%	180%	169%	178%	79%

[1]With 95% confidence limits.

Appendix Table 6. Mean biomass estimates (tonnes) by stratum for rockfish (*Sebastes* spp. and *Sebastolobus* sp.) captured aboard the R/V *W.E. RICKER*, Langara survey, June 19-30, 1993, re-calculated using average tow speed by stratum.

	Biomass Estimates (tonnes)[1]						
Species	Outside Upper (A)	Outside Lower (B)	Flats (C)	Rock Pile (D)	Deep Trench (E)	Inside Edge (F)	Total (All Strata)
Sebastes aleutianus	--	361.30 (61.48-1168.38)	4.27 (0.00-10.48)	--	7.52 (0.47-18.46)	--	373.09 (44.15-869.86)
S. alutus	125.28 (34.65-361.60)	1149.80 (560.14-2043.60)	2819.91 (1448.78-6560.16)	54.79 (0.00-97.90)	1624.91 (514.26-3619.78)	151.64 (76.06-278.59)	5926.32 (3486.36-8847.66)
S. babcocki	3.49 (0.02-12.36)	17.20 (6.03-40.82)	4.39 (0.24-11.61)	14.75 (3.69-26.26)	23.32 (6.31-48.67)	4.99 (0.74-8.51)	68.15 (40.11-100.59)
S. borealis	--	53.71 (14.86-160.18)	--	6.36 (0.00-12.73)	22.63 (0.00-51.49)	--	82.70 (24.83-158.75)
S. brevispinis	7.54 (2.61-14.40)	25.53 (6.48-52.06)	116.43 (69.95-228.84)	118.83 (3.95-310.48)	73.32 (9.57-258.25)	191.45 (18.16-451.42)	533.09 (283.79-861.18)
S. ciliatus	--	--	5.24 (0.00-15.72)	0.47 (0.00-0.94)	--	--	5.71 (0.00-16.66)
S. crameri	--	2.75 (0.75-5.54)	--	--	0.68 (0.00-1.37)	--	3.43 (0.79-6.54)
S. diploproa							
S. entomelas	--	--	15.90 (0.47-61.25)	0.17 (0.00-0.34)	--	--	16.07 (0.34-46.53)
S. helvomaculatus	0.10 (0.00-0.34)	1.79 (0.00-4.01)	15.21 (5.89-22.99)	--	6.17 (1.48-14.77)	1.27 (0.00-2.54)	24.55 (13.38-36.18)
S. paucispinis	--	--	28.53 (0.00-85.59)	--	--	9.64 (0.00-19.29)	38.18 (0.00-104.88)
S. pinniger	--	--	--	--	--	--	--
S. proriger	26.23 (9.15-54.08)	--	23.58 (0.24-91.96)	25.69 (0.51-72.29)	2.35 (0.00-4.70)	--	77.85 (23.17-141.82)
S. reedi	0.84 (0.00-2.52)	--	690.77 (222.70-1432.19)	246.32 (21.76-569.25)	134.49 (0.00-423.82)	1.76 (0.25-4.05)	1074.19 (489.16-1715.44)
S. ruberrimus	--	--	--	10.38 (0.00-30.75)	--	--	10.38 (0.00-30.75)
S. variegatus	1.47 (0.12-4.26)	--	--	20.77 (0.00-62.04)	--	--	22.24 (0.23-63.46)
S. zacentrus	72.89 (32.62-142.85)	60.48 (20.76-123.52)	126.73 (33.13-372.30)	517.35 (8.56-1026.14)	--	--	777.45 (246.03-1323.02)
Sebastolobus alascanus	0.37 (0.00-1.41)	29.68 (16.00-46.82)	65.18 (34.42-90.69)	2.06 (0.00-4.12)	329.92 (172.11-521.61)	5.89 (0.00-11.04)	433.10 (268.00-616.87)
Total	238.21 (109.29-570.86)	1702.24 (955.24-2512.92)	3916.15 (2144.28-8240.67)	1017.94 (103.10-1932.77)	2225.32 (1017.07-4775.22)	366.64 (122.19-774.17)	9466.50 (6248.40-13308.64)
No. Hauls	9	9	9	4	7	4	42
Stratum Area (nm)	7.0	40.4	198.0	15.0	187.0	80.8	528.4
Vessel Speed (kt)	3.1	2.7	3.4	3.2	2.9	3.0	3.0

[1]With 95% confidence limits.



Appendix Figure 1. Net dimensions and characteristics for bottom trawl net Atlantic Western IIIa, R/V *W.E. RICKER*, Langara survey, July 2-13, 1996.