Cruise Details and Biological Information from the Pacific Ocean Perch Monitoring Survey, *R/V W.E. RICKER*, June 19-30, 1993

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CRUISE DETAILS AND BIOLOGICAL INFORMATION FROM THE PACIFIC OCEAN PERCH MONITORING SURVEY, *R/V W.E. RICKER*, JUNE 19-30, 1993.

by

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ABSTRACT

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*, June 19-30, 1993. Can. Manuscr. Rep. Fish. Aquat. Sci. 2388: 71pp.

The results of the first monitoring cruise to the experimental fishing area off Langara Island (Langara Spit) are presented. The survey occurred three years after a seven year experimental period of unrestricted fishing on rockfish (*Sebastes* spp.) stocks. Forty-two bottom trawl hauls, deployed in a stratified random design, were used to collect biological samples and catch rate data. Length, age, and maturity data for all commercial species of rockfish in the survey area are presented by subarea. Age composition of the *S. alutus* stock showed prominent modes representing the 1984, 1980, and 1976 cohorts. Comparison of Pacific ocean perch age composition with that of other areas subject to quota management during the same period shows the strong 1976 cohort reduced to subordinate status in the experimental area, while it remains the dominant cohort in quota-managed areas. Although the emphasis of the survey was on biological data collection, biomass estimates and bootstrapped 95% confidence intervals were calculated for major rockfish species. The rockfish biomass in the area (9824 t ± 32%) was dominated by Pacific ocean perch (*S. alutus*) which accounted for over 62% of the biomass (6143 t ± 47%), with *S. brevispinis*, *S. reedi*, and *S. zacentrus* contributing from 6-12% of the biomass.

RÉSUMÉ

Leaman, B. M., A. M. Cornthwaite, and R. D. Stanley. 1996. Cruise details and biological information from the Pacific ocean perch monitoring survey, *R/V W.E. RICKER*, June 19-30, 1993. Can. Manuscr. Rep. Fish. Aquat. Sci. 2388: 71pp.

Le rapport présente les résultats de la première campagne de surveillance de la zone de pêche expérimentale proche de l'île Langara (flèche Langara). La campagne a été menée trois ans après une période expérimentale de sept ans de pêche sans restrictions des stocks de sébastes (*Sebastes* spp.). Quarante-deux traits de chalut de fond, réalisés selon un plan d'échantillonnage aléatoire stratifié, ont permis de prélever des échantillons biologiques et de recueillir des données sur les taux de capture. Les données sur la longueur, l'âge et la maturité, pour toutes les espèces commerciales de sébastes de la zone de pêche expérimentale, sont présentées par sous-zone. Dans la composition par âge du stock de *S. alutus*, on observe des modes prédominants correspondant aux cohortes de 1984, 1980 et 1976. La comparaison de la composition par âge du stock de sébaste à longue mâchoire avec celle d'autres zones soumises à une gestion par quotas pendant la même période montre que la forte cohorte de 1976 est réduite à un statut subordonné dans la zone expérimentale, tandis qu'elle demeure prédominante dans les zones gérées par quotas. La campagne visait avant tout le prélèvement d'échantillons biologiques, mais nous avons tout de même calculé les estimations de la biomasse et les intervalles de confiance à 95 % par auto-amorçage pour les principales espèces de sébastes. La biomasse de sébastes de la région (9 824 t ± 32 %) était dominée par le sébaste à longue mâchoire (*S. alutus*), qui représentait plus de 62 % de la biomasse (6 143 t ± 47 %), tandis que *S. brevispinis*, *S. reedi* et *S. zacentrus* constituaient entre 6 et 12 % de la biomasse.

INTRODUCTION

Management of rockfish (*Sebastes* spp.) populations has proven to be a difficult challenge to fisheries agencies everywhere in the world. In part, the reasons for the lack of success are linked to the underlying biology of the species. Rockfishes are ill suited to withstand exploitation because of their slow growth, infrequent strong recruitment, and determinate growth pattern, in which fish reach a large proportion of their asymptotic size early in life. Traditional fisheries management paradigms suggest little benefit to delayed harvest for individuals whose growth has effectively ceased and who contribute little to population biomass increase. Rockfishes are also acoustically dense, thus highly visible to modern echo sounders, and are detected readily by harvesters even when biomass levels are low. Under existing management policies, annual exploitation rates are set at approximately 5% for a species such as Pacific ocean perch (*Sebastes alutus*), so that a harvester can expect to see about 20 times the biomass that can be harvested safely. Harvesters therefore perceive a large biomass and have questioned the validity of management limits they view as excessively conservative.

In 1979, the Department of Fisheries and Oceans (DFO) initiated several cooperative experimental management programs to address the gap in perception of exploitable biomass and available yield between harvesters and the DFO (Leaman and Stanley 1993). One of these programs involved the creation of 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 program was monitoring surveys of the area at regular intervals. This report details results of the first post-harvest monitoring survey, conducted in June 1993. The emphasis of the 1993 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 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 for the cruise was the *R/V W.E. RICKER*, a 57.3 m stern trawler. 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). The nets were rigged for hard-bottom trawling and used rubber bobbins in the bosom section of the groundline. We switched between nets whenever one net became damaged and needed repair. Both nets used a 2.5-cm mesh liner in the codend.

SURVEY AREA AND DESIGN

The area surveyed is off the north coast of British Columbia, to the northwest of Graham and Langara Islands, and is commonly referred to as Langara Spit (Fig. 1). Prior to the initiation of the experiment, the area had been surveyed to only a limited extent by bottom

trawling in 1965-1966 and 1971 (Westrheim 1967, 1972), but more extensively in 1979 (Lapi and Richards 1981). Langara Spit and the area to 55° 30′ N were surveyed by two vessels in 1983, at the beginning of the open-fishing portion of the experiment (Leaman and Nagtegaal 1986). The fishery was open without harvest restriction from 1983-1990. The original design of the experiment called for surveys at three year intervals following closure.

A stratified-random design was used for this survey. The survey area was stratified previously into six sub-areas based on depth and bottom topography (Lapi and Richards 1981). The strata were designated Outside Upper (A), Outside Lower (B), Flats (C), Rock Pile (D), Deep Trench (E), and Inside Edge (F) (Fig. 1). The total area of each stratum was established from the 1979 survey and was calculated using a planimeter. Information from that survey was used as a basis for allocation of sampling effort among strata. Information on strata areas, variances, and biomass were used to derive a sample allocation scheme among strata (after Sukhatme and Sukhatme 1970). Several allocation methods were considered, all based on a projected total of 40 hauls being possible during the cruise (Table 1). The optimal (Neyman) allocation combines consideration of the strata sampling fractions (i.e., proportional allocation) and strata variance (S_h^2), with a fixed total sample size (n), to obtain a minimum-variance sample number n_h. Estimates of strata variances were taken from the 1979 survey (Table 1). For the 1993 survey the computation is:

$$n_h = n \frac{N_h S_h}{\sum_{h=1}^{k} N_h S_h} \qquad 1.0$$

where:

- n — fixed sample number
- N_h — total number of sample units (total area)
- S_h — stratum "true" standard deviation, approximated by the sample standard deviation, s_h.

At each sampling site, the trawl was deployed for a minimum of 60 minutes where bottom topography permitted.

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 MSI Sea Weigh Model 2200 load cell and individual species weights were estimated through subsampling. Biological data on fork length (cm), sex, and maturity stage were recorded, and sagittal otoliths were collected from commercial rockfish species. Rockfish maturity stages were assigned numeric codes after Leaman and Nagtegaal (1986) (Appendix Table 2). Samples were taken for the one or two species with the highest proportion of the catch for a given haul, following the methods of Leaman et al. (1988). Fish were aged subsequent to the cruise by the Aging Laboratory at the Pacific Biological Station.

BIOMASS ESTIMATION

Although the survey of this area was conducted primarily to obtain synoptic biological samples of selected rockfish species, biomass was calculated for all species of rockfish encountered during the survey using a swept-area algorithm (Leaman and Nagtegaal 1986).

$$B_{T_s} = \sum_j \left(\frac{\overline{CPUE_j}}{k_a} \right) (A_s) (c) \qquad 1.1$$

B_{T_s} = 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 to be 0.082328 nm^2. Carrothers' (1980) algorithm was used to estimate trawl door spread from data on wing spread, headline length, bridle length, sweep length, and a catenary parameter describing the curvature of the sweepline/bridle (Appendix Fig. 1). An average towing speed of 3.0 kt was used for all hauls. The catching coefficient of the gear was assumed to be 1.0, at the trawl door width (Leaman and Nagtegaal 1982).

Efron and Tibshirani's (1993) bcanon function for S-PLUS (MathSoft 1995) was used to bootstrap 95% confidence limits for the mean catch rate of each species, in each stratum. The original data from each stratum were resampled 1000 times to create the bootstrap samples. The catch rate confidence limits were then used to produce confidence limits for the biomass estimates. Total biomass from the survey area was calculated from the stratified mean catch rate (using the bootstrapped strata means) by species, applied to the entire survey area. The stratified mean catch rate and biomass estimate for each species were calculated using the method of Rao and Wu (1988) to correct for strata variances. The resampled values were rescaled to a new sample size m_h, ($m_h = n_h$-1).

RESULTS AND DISCUSSION

SURVEY DESIGN AND SAMPLE DISTRIBUTION

An attempt was made to randomize the selection of sampling units (hauls) within strata. However, each sampling unit in a stratum did not have equal probability of being sampled, due to the rough bottom in segments of some strata. Ideally, these locations should be removed from the sampling frame but we did not have sounding information in sufficient detail and extent to determine the available sampling fraction. Haul locations within a stratum were therefore

selected randomly by the feasibility of trawling in the selected location. The resulting distribution of samples by strata departed from the initial survey design, particularly in strata A and D, which were over and under-sampled, respectively (Table 2 , Fig. 2). The implications of this departure will be presented later in this report.

SPECIES COMPOSITION OF CATCH

Forty-two bottom trawls were completed successfully (Appendix Table 2, Fig. 3). Four to nine hauls were completed in each stratum (Table 2, Fig. 2); two sets had to be repeated due to excessive net damage. Twenty-nine species of fish were captured in the survey area (Appendix Table 3). Rockfish accounted for 94% of the total catch with three species, Pacific ocean perch (*S. alutus*), sharpchin rockfish (*S. zacentrus*), and yellowmouth rockfish (*S. reedi*), accounting for 54%, 15%, and 7% of the total catch, respectively (Table 3). No other species contributed more than 5% of the total catch. Pacific ocean perch accounted for 0-93% of the catch in each haul (Table 4). The highest proportional catches of Pacific ocean perch were in strata B and C (Outer Lower and Flats), while the lowest proportional catch was in stratum F (Inside Edge).

Arrowtooth flounder (*Atheresthes stomias*) and sablefish (*Anoplopoma fimbria*) were the major non-rockfish contributors to the total catch, at approximately 3% and 2%, respectively. All other non-rockfish species contributed less than 1% to the total catch from the survey area.

BIOLOGICAL SAMPLING

Biological sampling concentrated on *S. alutus* (Table 5). However, data on length and sex were collected from *S. aleutianus*, *S. alutus*, *S. brevispinis*, *S. proriger*, *S. reedi*, *S. variegatus*, and *S. zacentrus*, and reproductive maturity stage was determined for all sampled fish except *S. zacentrus* (Tables 6-11). Otoliths were collected and processed for *S. aleutianus*, *S. alutus*, *S. brevispinis*, *S. proriger*, and *S. reedi* (Tables 12-15).

S. alutus

Length and age frequencies of *S. alutus* were expressed as proportions of the total catch for each stratum, and weighted by catch rate (kg/hr) for each haul. Length proportions (Figs. 4-8) generally showed modes in the mid-30 cm and low-40 cm ranges, which corresponded to modes for males and females, respectively. The major exception to this pattern was in Stratum E (Deep Trench, Fig. 8) where male and female length proportions had a similar mode at 41 cm.

The age composition of *S. alutus* samples showed prominent modes representing the 1984, 1980, and 1976 cohorts in all strata for which age data were available (Table 12, Figs. 9-11). Representatives of the historically strong 1952 cohort were absent from stratum A (Outside Upper) (Fig. 9), and prominent only in stratum E (Deep Trench, Fig. 11), which has received lower exploitation than other parts of the experimental area. Aging imprecision for these older age groups can be seen in the 'smearing' of the 1952 cohort over ages 40-43 y.

Other *Sebastes* spp.

Length frequencies of rougheye rockfish (*S. aleutianus*) show a broad, unimodal distribution with modes at 47 cm for males and 48 cm for females (Table 7). Rougheye rockfish have been a minor species in the landings but have acquired importance as a frozen, processed product for some vessels. The age composition for the samples collected on the survey is broad, with the majority of the individuals in the 25-40 y range (Table 13).

Silvergrey (*S. brevispinis*) and harlequin (*S. variegatus*) rockfish are each represented by a single sample from the survey (Table 8), reflecting their relative abundance. Length frequencies for *S. brevispinis* peak in the 44-48 cm and 54 cm ranges, while almost all *S. variegatus* are smaller than the minimum commercial landing size (32-35 cm) for rockfishes.

Redstripe (*S. proriger*), sharpchin (*S. zacentrus*), and yellowmouth (*S. reedi*) rockfish were sampled more extensively. Male *S. proriger* are generally smaller than acceptable commercial size limits (Table 9) and the fishery for this species is almost totally for females. Age composition for *S. proriger* is dominated by the 1981-1982 cohorts, with a minor contribution from the 1966 and adjacent cohorts (Table 14). *S. zacentrus* are even smaller, with only a small proportion of the females exceeding the minimum size limit (Table 10). Yellowmouth rockfish length frequencies for both males and females peak in the 45-49 cm range (Table 11), while the age composition is dominated by the 1975-1976 cohorts (Table 15). Notably, there is also a contribution from the 1952 cohort, similar to the age composition for *S. alutus*, reflecting the similarity in habitat and biology for these two species. However, the reduction of cohorts from the 1960s and early 1970s has not been as substantial for *S. reedi* as that for *S. alutus*.

CATCH RATES AND BIOMASS ESTIMATES

We calculated catch rates and bootstrapped 95% confidence intervals, by species, for each stratum (Table 16). The highest all-species catch rate was in stratum D (Rock Pile). This all-species catch rate is strongly influenced by an extremely high catch rate for *S. zacentrus*, a species which is generally smaller than commercial size limits for rockfishes (32-35 cm) (Table 10). With the exception of stratum D, the mean catch rates for *S. alutus* in all strata were 2-3 times higher than for other *Sebastes* spp. Catch rates for total commercial-sized rockfishes were highest in the Outside (Upper and Lower) and Rockpile strata (strata A, B, and D). *S. alutus* comprised the majority of the commercial rockfish biomass in all strata except stratum D, where *S. brevispinis* and *S. reedi* were the most abundant species. The different species composition in this rough-bottom stratum is consistent with observations of species distribution elsewhere on the coast (Leaman and Nagtegaal 1987).

The estimated all-species biomass of rockfishes was dominated by *S. alutus* (63% of the total), primarily from the Flats (Stratum C; Table 17). The 95% confidence interval for *S. alutus* biomass is approximately 3880-9030 t. *S. reedi* accounted for approximately 12% of the total while no other species accounted for >10% of the total biomass (Table 17). By stratum, the Flats and Deep Trench accounted for the majority of the estimated biomass. However, we caution that these strata have large strata expansion factors and larger confidence intervals than the Outer Lower stratum, the other major contributor to the commercial rockfish biomass.

The survey generally achieved target sample distribution but there were departures from the sampling design for strata A and D. The impact on these departures on the variance of estimated catch rates conforms to expectations (Table 16). The proportional sampling variance for catch rate is approximately equal for strata sampled to target intensity, with the 'over-sampled' stratum B showing lower variance than other strata. Stratum D was 'under-sampled' relative to the design and shows the second highest proportional variation.

COMPARISON WITH PREVIOUS SURVEYS

The pattern of change in length frequency proportions over time for the experimental area is neither consistent among strata nor informative (Figs. 4-8). For strata having reasonable sampling, no consistent pattern emerges over the survey series. Instances of larger and smaller modal sizes since the 1979 survey are present among the strata. In contrast, the age frequency proportions for most areas show major differences over the time series (Figs. 9-11). We have noted elsewhere (Leaman and Stanley 1993), that these changes were associated with large removals relative to historical catches (5-10 times 1976-1983 yields), steadily declining catch rates throughout the course of the open-fishing portion of the experiment, as well as declining participation and fishing effort after the year of peak landings from the area (1986). Comparison of commercial sample age frequencies during this period shows major alterations in the relative abundance of cohorts in the Langara area, compared with areas immediately to the south that were managed under sustainable harvest rates (Fig. 12). In particular, the 1976 cohort appears to have been reduced to subordinate status in the Langara area, while it was maintained as the dominant cohort off the west coast of the Queen Charlotte Islands. The conjunction of these observations suggests declines in rockfish biomass available to the fishery and the surveys. The reduced contribution from cohorts generated during the mid to late 1960s compared with the 1983 survey indicates these cohorts as the primary source for the removals during the open fishing period.

Changes in the design and objectives of surveys conducted during this experiment limit the interpretation of survey-based abundance changes. The common objective of all surveys has been the collection of comprehensive biological data for rockfishes in the area. While biomass estimates have been calculated for this and other surveys, the data collection objective of the surveys renders both the underlying validity and the comparability of biomass estimates low.

PRESENT STATUS AND FUTURE SURVEYS

The Langara Spit experimental area remains closed to commercial trawling. The next survey of the area is planned for 1996, after which the status of the experiment will be reviewed with fishery managers and industry. The design of the experiment specified a period of closure equivalent to the period of unrestricted fishing (1983-1990).

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LITERATURE CITED

Carrothers, P. J. G. 1980. Estimation of trawl door spread from wing spread. J. Northw. Atl. Fish. Sci. vol. 1:81-89.

Efron, B. and R. J. Tibshirani. 1993. An Introduction to the Bootstrap. Chapman and Hall. New York. 436 p.

Gillespie, G. E. 1993. An updated list of the fishes of British Columbia, and those of interest in adjacent waters, with numeric code designations. Can. Tech. Rep. Fish. Aquat. Sci. 1918:116 p.

Lapi, L. A. and J. E. Richards. 1981. Data collected during rockfish (*Sebastes* spp.) assessments of the West Langara Island and West Coast Vancouver Island fishing grounds in 1979. Can. Data Rep. Fish. Aquat. Sci. 286:113 p.

Leaman, B. M. 1987. Incorporating reproductive value into Pacific ocean perch management. p. 355-368. *In* Proceedings of the International Rockfish Symposium. University of Alaska Sea Grant Report 87-2.

Leaman, B. M. 1993. Reference points for fisheries management: the western Canadian experience. p. 15-30. *In* S. J. Smith, J. J. Hunt and D. Rivard [ed.] Risk evaluation and biological reference points for fisheries management. Can. Spec. Publ. Fish. Aquat. Sci. 120:442 p.

Leaman, B. M., G. E. Gillespie, D. A. Nagtegaal, and R. D. Stanley. 1988. Biomass survey of rockfish stocks off the southwest coast of Vancouver Island, September 8-22, 1985 (*M/V HOWE BAY*). Can. Tech. Rep. Fish. Aquat. Sci. 1611:99 p.

Leaman, B. M. and D. A. Nagtegaal. 1982. Biomass estimation of rockfish stocks off the west coast of the Queen Charlotte Islands during 1978 and 1979. Can. Man. Rep. Fish. Aquat. Sci. 1652:46 p.

Leaman, B. M. and D. A. Nagtegaal. 1986. Biomass survey of rockfish stocks in the Dixon Entrance - Southeast Alaska region, July 5-22, 1983 (R/V G.B. REED and M/V FREE ENTERPRISE NO.). Can. Tech. Rep. Fish. Aquat. Sci. 1510:61 p.

Leaman, B. M. and D. A. Nagtegaal. 1987. Identification of species assemblages and results of applications for shelf and slope rockfishes off British Columbia. p. 309-328. *In* Proceedings of the International Rockfish Symposium. University of Alaska Sea Grant Report 87-2.

Leaman, B. M. and R. D. Stanley. 1993. Experimental management programs for two rockfish stocks of British Columbia, Canada. p. 401-418. *In* S. J. Smith, J. J. Hunt and D. Rivard [ed.] Risk evaluation and biological reference points for fisheries management. Can. Spec. Publ. Fish. Aquat. Sci. 120:442 p.

MathSoft. 1995. S-PLUS, Advanced Data Analysis Software. MathSoft Inc. Seattle WA.

Nagtegaal, D. A., B. M. Leaman, and R. D. Stanley. 1986. Catches and trawl locations of *R/V G.B. REED* and *M/V EASTWARD HO* during the Pacific ocean perch assessment cruise to Queen Charlotte Sound, August-September, 1984.

Rao, J. N. K. and C. F. J. Wu. 1988. Resampling inference with complex survey data. J. Amer. Statist. Assoc. 83(401):231-241

Sukhatme, P. V. and B. V. Sukhatme. 1970. Sampling Theory of Surveys with Applications. Iowa State University Press. Ames, Iowa. 452 p.

Westrheim, S. J. 1967. Catch rates, size composition and sex ratio of Pacific ocean perch (*Sebastodes alutus*) caught in the eastern north Pacific ocean (Vancouver Island, B.C., to southeastern Alaska) by the G.B. Reed, August-October 1966. Fish. Res. Board. Can Tech. Rep. 16: 32 p.

Westrheim, S. J. 1972. Exploration of rockfish grounds off British Columbia in 1971. Fish. Res. Board Can. MS Rep. 1200: 29 p.

Table 1. Strata sampling schemes for the 1993 Langara survey, based on data collected aboard the *M/V SCOTIA BAY* during the 1979 two-boat survey. Sample allocation was based on a projection of 40 hauls.

Stratum	Area	Biomass[1]	σ as %	Allocation by Weighting Method			
	($n.mi^2$)	(t)	of mean[2]	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, June 19-30, 1993.

Stratum	Coordinates	Depth Range	Hauls
A - Outside upper	54° 00' to 54° 35' and 133° 35' to 133° 50'	120-160 fm 219-293 m	2, 3, 6, 7, 8, 22, 23, 24, 39 [9 Hauls]
B - Outside lower	54° 00' to 54° 30' and 133° 35' to 133° 50'	161-300 fm 291-549 m	1 , 4, 5, 9, 25, 27, 30, 40 [8 Hauls]
C - Flats	54° 02' to 54° 35' and 133° 10' to 133° 47'	120-180 fm 219-329 m	11, 12, 14, 28, 29, 32, 41, 42, 44 [9 Hauls]
D - Rockpile	54° 19' to 54° 25' and 133° 20' to 133° 35'	100-160 fm 183-293 m	33, 35, 36, 43 [4 Hauls]
E - Deep trench	54° 00' to 54° 28' and 133° 00' to 133° 40'	180-260 fm? 329-475 m?	10, 13, 15, 20, 34, 37, 38 [7 Hauls]
F - Inside Edge	54° 00' to 54° 18' and 133° 00' to 133° 40'	50-180 fm? 91-329 m?	16, 17, 18, 19 [4 Hauls]
Total	--	--	42 Hauls

Table 3. Total catch by species, *R/V W.E. RICKER*, Langara survey, June 19-30, 1993.

Species Name	Weight (kg)	% of Total
Sebastes aleutianus	3562	4.90
S. alutus	39211	53.99
S. babcocki	685	0.94
S. borealis	1062	1.46
S. brevispinis	2917	4.02
S. ciliatus	21	0.03
S. crameri	41	0.06
S. diploproa	Trace	0.00
S. elongatus	Trace	0.00
S. entomelas	36	0.05
S. helvomaculatus	108	0.15
S. paucispinis	159	0.22
S. pinniger	Trace	0.00
S. proriger	2977	4.10
S. reedi	4804	6.61
S. ruberrimus	59	0.08
S. variegatus	246	0.34
S. zacentrus	10783	14.85
Sebastolobus alascanus	1646	2.27
Darkfin sculpin	Trace	0.00
Arrowtooth flounder	1951	2.69
Slender sole	Trace	0.00
Petrale sole	19	0.03
Rex sole	142	0.20
Pacific halibut	276	0.38
Dover sole	154	0.21
English sole	Trace	0.00
Grenadiers	94	0.13
Sablefish	1117	1.54
Pacific cod	254	0.35
Pacific hake	14	0.02
Lingcod	204	0.28
Walleye pollock	20	0.03
Spotted ratfish	18	0.02
Longnose skate	39	0.05
Spiny dogfish	9	0.01
Total	72628	100

Table 4. Estimated catch by tow (kg) for Pacific ocean perch, *Sebastes alutus*, collected aboard the *R/V W.E. RICKER*, Langara survey, June 19-30, 1993.

Haul	Location	*S. alutus* (kg)	All Species (kg)	% *S. alutus*
2	Outside Upper	26	142	18.31
3	Outside Upper	1480	2451	60.38
6	Outside Upper	41	1254	3.27
7	Outside Upper	108	2342	4.61
8	Outside Upper	4333	6349	68.25
22	Outside Upper	53	1617	3.28
23	Outside Upper	11	590	1.86
24	Outside Upper	1337	1580	84.62
39	Outside Upper	10	13	76.92
1	Outside Lower	4401	5497	80.06
4	Outside Lower	477	2766	17.25
5	Outside Lower	1475	1786	82.59
9	Outside Lower	149	331	45.02
21	Outside Lower	9	1202	0.75
25	Outside Lower	6417	6873	93.37
27	Outside Lower	72	285	25.26
30	Outside Lower	1145	1576	72.65
40	Outside Lower	1955	3170	61.67
11	Flats	839	930	90.22
12	Flats	5551	7029	78.97
14	Flats	135	196	68.88
28	Flats	70	224	31.25
29	Flats	671	1172	57.25
32	Flats	635	984	64.53
41	Flats	830	1243	66.77
42	Flats	610	769	79.32
44	Flats	618	1737	35.58
33	Rock Pile	0	3007	0.00
35	Rock Pile	62	311	19.94
36	Rock Pile	597	1238	48.22
43	Rock Pile	347	4567	7.60
10	Deep Trench	341	685	49.78
13	Deep Trench	1959	2535	77.28
15	Deep Trench	167	306	54.58
20	Deep Trench	1245	1367	91.08
34	Deep Trench	314	821	38.25
37	Deep Trench	2	5	40.00
38	Deep Trench	148	610	24.26
16	Inside Edge	325	1218	26.68
17	Inside Edge	93	1385	6.71
18	Inside Edge	61	288	21.18
19	Inside Edge	94	177	53.11

Hauls 26 and 31 void due to net dammage.

Table 5. Biological sampling summary for rockfish (*Sebastes* sp.) captured aboard the *R/V W.E. RICKER*, Langara survey, June 19-30, 1993.

Species	No. samples	No. fish collected for each sample type		Total
		Len/Sex/Mat/Oto	Len/Sex only	
Sebastes aleutianus	2	112	104	216
S. alutus	21	1051	1004	2055
S. brevispinis	1	50	111	161
S. proriger	3	150	327	477
S. reedi	3	151	294	445
S. variegatus	1	0	179	179
S. zacentrus	3	0	370	370
Total	34	1514	2389	3903

Table 6. Length frequency and maturity summaries for Pacific ocean perch, *Sebastes alutus*, *R/V W.E.RICKER*, Langara survey, June 19-30, 1993.

Stratum	Outside Upper							
Date	93/06/19		93/06/20		93/06/23		Total	
Depth (m)	276		284		272		for	
Haul	3		8		24		Outside Upper	
Sex	M	F	M	F	M	F	M	F
Length (cm)	Frequency							
22	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	-
30	1	-	-	1	-	2	1	3
31	0	-	1	1	1	1	2	2
32	3	1	2	1	1	1	6	3
33	2	3	2	1	5	2	9	6
34	3	1	8	2	3	6	14	9
35	4	7	4	11	5	9	13	27
36	8	8	7	7	11	9	26	24
37	11	8	7	8	10	5	28	21
38	10	8	4	9	7	6	21	23
39	9	9	5	8	4	6	18	23
40	5	11	2	14	0	6	7	31
41	1	9	4	4	1	6	6	19
42	-	6	-	5	-	4	-	15
43	-	6	-	0	-	3	-	9
44	-	3	-	3	-	-	-	6
45	-	-	-	1	-	-	-	1
46	-	-	-	-	-	-	-	-
47	-	-	-	-	-	-	-	-
48	-	-	-	-	-	-	-	-
49	-	-	-	-	-	-	-	-
50	-	-	-	-	-	-	-	-
51	-	-	-	-	-	-	-	-
Total	57	80	46	76	48	66	151	222
Maturity	Frequency							
1	1	0	2	0	0	0	3	0
2	21	10	20	16	16	23	57	49
3	8	0	3	0	2	0	13	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	10	0	9	0	9	0	28
Total	30	20	25	25	18	32	73	77

Table 6. Continued.

Stratum	Outside Lower							
Date	93/06/19		93/06/19		93/06/20		93/06/23	
Depth (m)	304		360		312		299	
Haul	1		4		5		25	
Sex	M	F	M	F	M	F	M	F
Length (cm)	Frequency							
19			-	-	-	-	-	-
20			-	-	-	-	-	-
21			-	-	-	-	-	-
22			-	-	-	-	-	-
23			-	-	-	-	-	-
24			-	-	-	-	-	-
25	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-
28	-	1	-	-	-	-	-	-
29	-	1	-	-	-	-	-	-
30	-	0	-	-	-	-	-	-
31	-	0	-	-	-	-	-	1
32	3	0	-	-	1	-	-	4
33	2	2	-	-	3	2	2	0
34	3	1	-	1	5	3	7	4
35	3	4	-	4	4	9	9	8
36	5	4	2	1	10	11	7	5
37	9	5	4	3	7	6	5	5
38	11	5	0	2	5	3	2	8
39	15	6	5	2	9	1	8	7
40	3	10	7	2	5	3	3	6
41	4	10	3	10	2	3	3	5
42	1	11	0	17	1	3	-	3
43	2	5	0	12	0	1	-	1
44	1	2	0	10	0	1	-	-
45	-	3	0	10	1	2	-	-
46	-	-	0	2	-	-	-	-
47	-	-	0	4	-	-	-	-
48	-	-	0	1	-	-	-	-
49	-	-	0	-	-	-	-	-
50	-	-	0	-	-	-	-	-
51	-	-	1	-	-	-	-	-
Total	62	70	22	81	53	48	46	57
Maturity	Frequency							
1	0	0	0	0	2	0	0	1
2	17	8	4	2	18	19	3	4
3	4	0	2	0	8	0	16	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	4	19	1	41	0	4	0	26
Total	25	27	7	43	28	23	19	31

Table 6. Continued.

Stratum	Outside Lower (Cont.)					
Date	93/06/24		93/06/26		Total	
Depth (m)	262		341		for	
Haul	30		40		Outside Lower	
Sex	M	F	M	F	M	F
Length (cm)	Frequency					
19	-	-	-	-	-	-
20	-	-	-	-	-	-
21	-	-	-	-	-	-
22	-	-	-	-	-	-
23	-	-	-	-	-	-
24	-	-	-	-	-	-
25	-	-	-	-	-	-
26	-	-	-	-	-	-
27	-	-	-	-	-	-
28	-	-	-	-	-	1
29	-	-	-	-	-	1
30	-	-	-	-	-	0
31	-	-	-	-	-	1
32	-	-	-	1	4	5
33	3	2	2	6	12	12
34	3	1	3	2	21	12
35	9	5	7	2	32	32
36	11	3	7	3	42	27
37	9	5	4	4	38	28
38	13	3	7	5	38	26
39	9	7	6	8	52	31
40	8	11	6	4	32	36
41	2	6	11	12	25	46
42	-	4	5	4	7	42
43	-	0	1	4	3	23
44	-	3	1	1	2	17
45	-	-	-	1	1	16
46	-	-	-	1	0	3
47	-	-	-	1	0	5
48	-	-	-	-	0	1
49	-	-	-	-	0	-
50	-	-	-	-	0	-
51	-	-	-	-	1	-
Total	67	50	60	59	310	365
Maturity	Frequency					
1	0	0	2	0	4	1
2	4	1	0	0	46	34
3	23	0	19	0	72	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	2	20	2	27	9	137
Total	29	21	23	27	131	172

Table 6. Continued.

Stratum			Flats			
Date	93/06/21		93/06/21		93/06/24	
Depth (m)	292		279		250	
Haul	11		12		29	
Sex	M	F	M	F	M	F
Length (cm)			Frequency			
19	1	-	-	-	-	-
20	0	-	-	-	-	-
21	1	-	-	-	-	-
22	0	-	-	-	-	-
23	0	1	1	-	-	-
24	1	0	0	-	-	-
25	0	0	0	-	-	-
26	0	0	0	-	-	-
27	0	0	0	-	-	-
28	0	1	0	-	-	-
29	0	0	0	-	-	-
30	0	0	0	-	-	1
31	4	0	0	-	1	0
32	2	1	1	3	0	0
33	5	2	1	5	1	2
34	5	6	2	1	2	1
35	10	2	6	3	3	0
36	9	2	6	1	5	4
37	6	1	9	9	5	3
38	14	7	7	5	15	6
39	5	5	6	9	15	5
40	6	10	5	11	12	3
41	2	5	3	4	10	1
42	1	6	1	5	1	5
43	2	3	-	2	1	1
44	1	2	-	1	-	0
45	-	2	-	0	-	1
46	-	1	-	1	-	0
47	-	-	-	1	-	1
48	-	-	-	-	-	-
49	-	-	-	-	-	-
50	-	-	-	-	-	-
51	-	-	-	-	-	-
Total	75	57	48	61	71	34
Maturity			Frequency			
1	3	0	6	3	0	1
2	14	12	7	6	16	8
3	8	0	14	0	15	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	13	1	14	0	10
Total	25	25	28	23	31	19

Table 6. Continued.

Stratum	Flats (Cont.)						Rock Pile	
Date	93/06/24		93/06/27		Total		93/06/25	
Depth (m)	270		262		for		231	
Haul	32		44		Flats		36	
Sex	M	F	M	F	M	F	M	F
Length (cm)					Frequency			
19	-	-	-	-	1	-	-	-
20	-	-	-	-	0	-	-	-
21	-	-	-	-	1	-	-	-
22	-	-	-	-	0	-	-	-
23	-	1	-	-	1	2	-	-
24	-	0	-	-	1	0	-	-
25	-	0	-	-	0	0	-	-
26	-	0	-	-	0	0	-	-
27	-	1	-	-	0	1	-	-
28	-	1	-	-	0	2	-	-
29	-	2	-	-	0	2	-	-
30	-	2	1	-	1	3	-	-
31	-	0	1	1	6	1	1	-
32	2	1	0	1	5	6	0	-
33	5	4	6	2	18	15	2	3
34	6	2	3	1	18	11	4	2
35	11	3	1	0	31	8	5	1
36	4	5	5	3	29	15	6	5
37	9	4	13	0	42	17	8	3
38	21	7	12	1	69	26	10	0
39	5	5	5	4	36	28	6	1
40	5	5	13	1	41	30	11	4
41	0	7	10	2	25	19	4	4
42	0	2	3	7	6	25	5	4
43	0	3	1	2	4	11	1	2
44	1	-	-	2	2	5	-	2
45	-	-	-	0	-	3	-	1
46	-	-	-	1	-	3	-	0
47	-	-	-	0	-	2	-	2
48	-	-	-	1	-	1	-	-
49	-	-	-	-	-	-	-	-
50	-	-	-	-	-	-	-	-
51	-	-	-	-	-	-	-	-
Total	69	55	74	29	337	236	63	34
Maturity					Frequency			
1	5	7	1	1	15	12	0	0
2	14	9	6	5	57	40	20	13
3	2	0	24	2	63	2	10	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	3	0	0	0	3	0	0
7	0	10	7	4	8	51	0	6
Total	21	29	38	12	143	108	30	19

Table 6. Continued.

Stratum	Deep Trench							
Date	93/06/21		93/06/21		93/06/21		93/06/22	
Depth (m)	332		305		327		348	
Haul	10		13		15		20	
Sex	M	F	M	F	M	F	M	F
Length (cm)	Frequency							
19	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-
23	-	-	1	-	-	-	-	-
24	-	-	0	-	-	-	-	-
25	-	-	0	-	-	-	-	-
26	-	-	0	-	-	-	-	-
27	-	-	1	-	-	-	-	-
28	-	-	0	1	-	-	-	-
29	-	-	1	0	-	-	-	-
30	-	1	1	0	-	-	-	-
31	1	0	0	0	1	-	-	1
32	0	0	2	1	0	-	2	0
33	2	0	8	3	1	1	0	1
34	4	3	7	7	3	1	5	7
35	2	3	8	4	4	3	2	2
36	4	0	10	5	4	0	5	2
37	3	3	8	8	4	2	4	1
38	4	3	9	4	8	3	4	2
39	2	4	4	8	7	5	7	2
40	9	0	2	5	3	6	16	2
41	13	2	1	5	14	7	13	2
42	15	0	0	3	10	1	18	1
43	15	2	1	3	7	0	9	1
44	9	1	-	1	5	1	11	0
45	3	1	-	2	1	2	-	1
46	-	1	-	1	-	-	-	3
47	-	0	-	-	-	-	-	1
48	-	2	-	-	-	-	-	1
49	-	2	-	-	-	-	-	-
50	-	-	-	-	-	-	-	-
51	-	-	-	-	-	-	-	-
Total	86	28	64	61	72	32	96	30
Maturity	Frequency							
1	1	1	1	2	1	1	1	0
2	28	8	18	13	10	4	4	2
3	6	0	2	0	20	0	35	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	1	0	0	0	0
7	0	6	1	12	0	9	2	6
Total	35	15	22	28	31	14	42	8

Table 6. Continued.

Stratum	Deep Trench (Cont.)							
Date	93/06/25		93/06/25		Total		Total	
Depth (m)	356		361		for		for	
Haul	34		38		Deep Trench		*S. alutus*	
Sex	M	F	M	F	M	F	M	F
Length (cm)				Frequency				
19	-	-	-	-	-	-	1	-
20	-	-	-	-	-	-	0	-
21	-	-	-	-	-	-	1	-
22	-	-	-	-	-	-	0	-
23	-	-	-	-	1	-	2	2
24	-	-	-	-	0	-	1	0
25	-	-	-	-	0	-	0	0
26	-	-	-	-	0	-	0	0
27	-	-	-	-	1	-	1	1
28	-	-	-	-	0	1	0	4
29	-	-	-	-	1	0	1	3
30	-	-	-	-	1	1	3	7
31	-	-	-	-	2	1	11	5
32	1	-	1	-	6	1	21	15
33	1	4	0	-	12	9	53	45
34	5	1	0	1	24	20	81	54
35	3	0	1	1	20	13	101	81
36	6	0	0	2	29	9	132	80
37	8	1	0	1	27	16	143	85
38	6	2	2	1	33	15	171	90
39	4	2	4	0	28	21	140	104
40	8	5	3	1	41	19	132	120
41	6	3	7	1	54	20	114	108
42	3	3	9	1	55	9	73	95
43	4	2	4	0	40	8	48	53
44	1	2	2	1	28	6	32	36
45	0	2	2	-	6	8	7	29
46	1	1	1	-	2	6	2	12
47	-	3	-	-	-	4	0	13
48	-	-	-	-	-	3	0	5
49	-	-	-	-	-	2	0	2
50	-	-	-	-	-	-	0	-
51	-	-	-	-	-	-	1	-
Total	57	31	36	10	411	192	1272	1049
Maturity				Frequency				
1	1	0	0	3	5	7	27	20
2	12	17	22	2	94	46	274	182
3	19	0	9	0	91	0	249	2
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	4
7	0	4	1	13	4	50	21	272
Total	32	21	32	18	194	104	571	480

Table 7. Length frequency and maturity summaries for rougheye rockfish, *Sebastes aleutianus*, *R/V W.E. RICKER*, Langara survey, June 19-30, 1993.

Stratum	Outer Lower					
Date	93/06/19		93/06/26		Total for *S. aleutianus*	
Depth (m)	360		341			
Haul	4		40			
Sex	M	F	M	F	M	F
Length (cm)	Frequency					
28	-	-	1	-	1	-
29	-	-	1	-	1	-
30	-	-	0	-	0	-
31	-	-	1	-	1	-
32	-	-	0	-	0	-
33	-	-	0	-	0	-
34	-	-	0	-	0	-
35	-	-	0	-	0	-
36	-	-	0	-	0	-
37	-	-	0	1	0	1
38	-	-	0	0	0	0
39	-	-	0	0	0	0
40	-	1	0	1	0	2
41	1	2	0	0	1	2
42	0	0	1	3	1	3
43	1	0	3	1	4	1
44	7	6	7	8	14	14
45	4	4	10	8	14	12
46	2	3	8	7	10	10
47	3	6	13	9	16	15
48	2	8	3	3	5	11
49	1	9	4	3	5	12
50	3	4	1	2	4	6
51	1	5	-	4	1	9
52	1	0	-	4	1	4
53	-	0	-	0	-	0
54	-	0	-	1	-	1
55	-	0	-	0	-	0
56	-	1	-	0	-	1
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	-	-	-	0	-	0
67	-	-	-	0	-	0
68	-	-	-	0	-	0
69	-	-	-	1	-	1
Total	26	49	53	56	79	105
Maturity	Frequency					
1	0	0	0	4	0	4
2	12	10	14	15	26	25
3	7	0	4	0	11	0
4	0	0	0	0	0	0
5	0	1	0	0	0	1
6	0	0	0	0	0	0
7	0	32	0	13	0	45
Total	19	43	18	32	37	75

Table 8. Length frequency and maturity summaries for silvergrey and harlequin rockfish, *Sebastes brevispinis* and *S. variegatus*, *R/V W.E. RICKER*, Langara survey, June 19-30, 1993.

Species	*S. brevispinis*		*S. variegatus*	
Stratum	Inside Edge		Outside Upper	
Date	93/06/22		93/06/23	
Depth (m)	292		251	
Haul	16		22	
Sex	M	F	M	F
Length (cm)	Frequency			
17	-	-	1	-
18	-	-	2	-
19	-	-	1	1
20	-	-	6	2
21	-	-	15	5
22	-	-	22	16
23	-	-	11	21
24	-	-	20	15
25	-	-	7	10
26	-	-	4	7
27	-	-	2	3
28	-	-	3	1
29	-	-	-	1
30	-	-	-	2
31	-	-	-	0
32	-	-	-	0
33	-	-	-	0
34	-	-	-	1
35	-	-	-	-
36	-	-	-	-
37	-	-	-	-
38	1	-	-	-
39	0	-	-	-
40	0	1	-	-
41	0	1	-	-
42	0	2	-	-
43	2	2	-	-
44	5	2	-	-
45	1	1	-	-
46	2	8	-	-
47	2	2	-	-
48	5	3	-	-
49	4	0	-	-
50	2	1	-	-
51	3	1	-	-
52	2	1	-	-
53	5	1	-	-
54	7	1	-	-
55	4	3	-	-
56	6	1	-	-
57	4	0	-	-
58	5	3	-	-
59	2	3	-	-
60	1	3	-	-
61	-	3	-	-
62	-	2	-	-
63	-	0	-	-
64	-	0	-	-
65	-	1	-	-
66	-	2	-	-
Total	63	48	94	85
Maturity	Frequency			
1	0	1	-	-
2	20	5	-	-
3	0	2	-	-
4	0	1	-	-
5	0	3	-	-
6	0	3	-	-
7	8	7	-	-
Total	28	22	-	-

Table 9. Length frequency and maturity summaries for redstripe rockfish, *Sebastes proriger*, *R/V W.E. RICKER*, Langara survey, June 19-30, 1993.

Stratum	Outer Upper							
Date	93/06/20		93/06/20		93/06/23		Total	
Depth (m)	239		243		251		for	
Haul	6		7		23		*S. proriger*	
Sex	M	F	M	F	M	F	M	F
Length (cm)	Frequency							
22	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-
28	-	1	-	-	-	-	-	1
29	-	0	-	-	-	-	-	0
30	2	1	-	2	-	-	2	3
31	8	0	4	0	-	-	12	0
32	12	3	3	1	9	-	24	4
33	15	5	7	4	12	3	34	12
34	15	8	5	4	9	11	29	23
35	1	9	5	3	5	8	11	20
36	4	8	0	21	3	21	7	50
37	-	4	1	11	1	5	2	20
38	-	4	0	10	-	8	0	22
39	-	2	1	5	-	4	1	11
40	-	4	-	3	-	3	-	10
41	-	8	-	7	-	4	-	19
42	-	3	-	1	-	2	-	6
43	-	1	-	1	-	1	-	3
44	-	1	-	-	-	-	-	1
45	-	-	-	-	-	-	-	-
46	-	-	-	-	-	-	-	-
47	-	-	-	-	-	-	-	-
48	-	-	-	-	-	-	-	-
49	-	-	-	-	-	-	-	-
50	-	-	-	-	-	-	-	-
51	-	-	-	-	-	-	-	-
Total	57	62	26	73	39	70	122	205
Maturity	Frequency							
1	1	0	0	1	0	0	1	1
2	30	11	25	11	12	21	67	43
3	3	0	0	0	1	0	4	0
4	0	0	0	0	0	0	0	0
5	1	2	0	1	0	1	1	4
6	0	0	0	3	0	0	0	3
7	0	2	0	9	0	15	0	26
Total	35	15	25	25	13	37	73	77

Table 10. Length frequency summary for sharpchin rockfish, *Sebastes zacentrus*, *R/V W.E. RICKER*, Langara survey, June 19-30, 1993.

Stratum			Rock Pile				Outside Upper			
Date	93/06/24		93/06/27		Total		93/06/23		Total	
Depth (m)	268		338		for		227		for	
Haul	33		43		Rock Pile		22		*S. zacentrus*	
Sex	M	F	M	F	M	F	M	F	M	F
Length (cm)					Frequency					
19	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-
21	-	-	2	-	2	-	-	-	2	-
22	-	-	1	-	1	-	2	-	3	-
23	-	1	2	-	2	1	11	2	13	3
24	1	0	9	-	10	0	15	0	25	0
25	5	0	13	2	18	2	10	4	28	6
26	3	0	8	3	11	3	16	5	27	8
27	4	0	7	8	11	8	13	13	24	21
28	7	1	6	8	13	9	5	15	18	24
29	8	3	2	7	10	10	0	10	10	20
30	7	4	2	8	9	12	2	8	11	20
31	4	7	-	4	4	11	-	7	4	18
32	0	7	-	13	0	20	-	2	0	22
33	1	5	-	11	1	16	-	3	1	19
34	1	6	-	4	1	10	-	2	1	12
35	-	9	-	3	-	12	-	-	-	12
36	-	5	-	3	-	8	-	-	-	8
37	-	8	-	2	-	10	-	-	-	10
38	-	-	-	-	-	-	-	-	-	-
39	-	-	-	-	-	-	-	-	-	-
40	-	-	-	-	-	-	-	-	-	-
41	-	-	-	-	-	-	-	-	-	-
42	-	-	-	-	-	-	-	-	-	-
43	-	-	-	-	-	-	-	-	-	-
44	-	-	-	-	-	-	-	-	-	-
45	-	-	-	-	-	-	-	-	-	-
46	-	-	-	-	-	-	-	-	-	-
47	-	-	-	-	-	-	-	-	-	-
48	-	-	-	-	-	-	-	-	-	-
49	-	-	-	-	-	-	-	-	-	-
50	-	-	-	-	-	-	-	-	-	-
51	-	-	-	-	-	-	-	-	-	-
Total	41	56	52	76	93	132	74	71	167	203

Table 11. Length frequency and maturity summary for yellowmouth rockfish, *Sebastes reedi*, *R/V W.E. RICKER*, Langara survey, June 19-30, 1993.

Stratum	Flats						Rock Pile			
Date	93/06/21		93/06/24		Total		93/06/27		Total	
Depth (m)	279		268		for		338		for	
Haul	12		33		Flats		43		*S. reedi*	
Sex	M	F	M	F	M	F	M	F	M	F
Length (cm)					Frequency					
22	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	-	-	-
30	-	-	-	-	-	-	-	-	-	-
31	-	-	-	-	-	-	-	-	-	-
32	-	-	-	-	-	-	-	-	-	-
33	-	-	-	-	-	-	-	-	-	-
34	-	-	-	-	-	-	-	-	-	-
35	-	-	-	-	-	-	1	-	1	-
36	-	-	-	-	-	-	1	-	1	-
37	-	-	-	-	-	-	1	2	1	2
38	-	-	-	-	-	-	0	1	0	1
39	-	1	-	-	-	1	0	2	0	3
40	-	0	-	-	-	0	0	1	0	1
41	1	0	-	-	1	0	1	1	2	1
42	1	0	-	-	1	0	2	0	3	0
43	1	4	1	-	2	4	4	3	6	7
44	5	4	8	-	13	4	6	3	19	7
45	6	10	11	2	17	12	13	5	30	17
46	8	6	20	3	28	9	21	7	49	16
47	8	10	21	6	29	16	12	5	41	21
48	4	14	11	6	15	20	2	0	17	20
49	-	5	2	4	2	9	2	3	4	12
50	-	5	1	3	1	8	1	-	2	8
51	-	2	-	1	-	3	-	-	-	3
Total	34	61	75	25	109	86	67	33	176	119
Maturity					Frequency					
1	0	0	0	0	0	0	0	0	0	0
2	13	2	24	2	37	4	31	3	68	7
3	2	0	12	1	14	1	0	1	14	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	33	0	13	0	46	0	15	0	61
Total	15	35	36	16	51	51	31	19	82	70

Table 12. Age composition of Pacific ocean perch, *Sebastes alutus*, *R/V W.E. RICKER*, Langara survey, June 19-30, 1993.

Stratum	Outside Upper				Outside Lower		
Date	93/06/19	93/06/20	93/06/23	Total for	93/06/19	93/06/19	93/06/20
Depth (m)	276	284	272	Outside	304	360	312
Haul	3	8	24	Upper	1	4	5
Age (years)				Frequency			
6	-	2	-	2	-	-	-
7	1	1	-	2	-	-	-
8	2	2	2	6	2	1	3
9	7	10	16	33	6	2	21
10	4	8	7	19	5	1	9
11	7	6	4	17	4	3	8
12	2	4	3	9	3	2	0
13	12	10	10	32	9	1	3
14	2	1	1	4	1	1	2
15	1	0	0	1	4	0	0
16	1	1	2	4	1	1	0
17	8	4	5	17	13	14	0
18	1	0	-	1	0	1	1
19	1	0	-	1	0	1	0
20	0	0	-	0	1	0	0
21	0	0	-	0	0	1	0
22	0	0	-	0	1	0	0
23	0	0	-	0	0	2	0
24	0	0	-	0	0	2	2
25	0	0	-	0	0	0	0
26	0	0	-	0	0	1	1
27	1	0	-	1	0	2	0
28	-	0	-	0	0	2	1
29	-	0	-	0	0	1	-
30	-	0	-	0	0	0	-
31	-	0	-	0	0	1	-
32	-	0	-	0	0	1	-
33	-	0	-	0	0	0	-
34	-	0	-	0	0	0	-
35	-	0	-	0	0	0	-
36	-	0	-	0	0	0	-
37	-	0	-	0	0	2	-
38	-	0	-	0	0	0	-
39	-	0	-	0	0	1	-
40	-	0	-	0	0	1	-
41	-	0	-	0	0	1	-
42	-	0	-	0	0	0	-
43	-	1	-	1	0	0	-
44	-	-	-	-	1	0	-
45	-	-	-	-	0	0	-
46	-	-	-	-	0	1	-
47	-	-	-	-	0	0	-
48	-	-	-	-	0	0	-
49	-	-	-	-	1	1	-
50	-	-	-	-	-	1	-
51	-	-	-	-	-	0	-
52	-	-	-	-	-	0	-
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	-	-	-	-	-	0	-
73	-	-	-	-	-	1	-
Total	50	50	50	150	52	50	51

Table 12. Continued.

Stratum	Outside Lower (Cont.)				Flats		
Date	93/06/23	93/06/24	93/06/26	Total for	93/06/21	93/06/21	93/06/24
Depth (m)	299	262	347	Outer	292	279	250
Haul	25	30	40	Lower	11	12	29
Age (years)				Frequency			
4	-	-	-	-	2	-	-
5	-	-	-	-	0	-	-
6	-	-	-	-	1	-	1
7	-	1	1	2	1	-	0
8	1	0	1	8	2	5	0
9	10	1	6	46	5	8	6
10	4	8	8	35	3	6	6
11	8	1	5	29	4	4	3
12	3	3	5	16	2	7	4
13	6	13	9	41	15	8	9
14	1	3	0	8	5	4	2
15	2	0	1	7	1	1	0
16	1	0	3	6	1	4	0
17	10	14	7	58	3	2	11
18	2	2	0	6	0	0	2
19	0	0	0	1	0	0	0
20	0	0	0	1	0	0	0
21	0	0	0	1	1	0	0
22	0	0	1	2	0	0	0
23	0	0	0	2	1	0	1
24	0	0	0	4	0	0	1
25	0	1	0	1	0	0	0
26	0	0	0	2	0	0	0
27	1	1	0	4	1	0	0
28	0	1	0	4	1	1	0
29	0	0	0	1	0	0	0
30	0	0	0	0	0	0	0
31	0	0	0	1	0	0	0
32	0	0	0	1	0	0	1
33	1	0	0	1	0	0	0
34	-	0	0	0	0	0	1
35	-	0	0	0	0	0	0
36	-	0	0	0	0	0	0
37	-	0	0	2	0	0	0
38	-	0	0	0	0	0	0
39	-	0	0	1	0	0	0
40	-	0	0	1	0	0	0
41	-	1	1	3	0	0	0
42	-	-	0	0	0	0	1
43	-	-	0	0	1	1	0
44	-	-	1	2	-	-	0
45	-	-	0	0	-	-	0
46	-	-	0	1	-	-	0
47	-	-	0	0	-	-	0
48	-	-	0	0	-	-	0
49	-	-	0	2	-	-	0
50	-	-	0	1	-	-	0
51	-	-	0	0	-	-	0
52	-	-	0	0	-	-	0
53	-	-	0	0	-	-	0
54	-	-	0	0	-	-	0
55	-	-	0	0	-	-	0
56	-	-	0	0	-	-	0
57	-	-	0	0	-	-	0
58	-	-	0	0	-	-	0
59	-	-	0	0	-	-	0
60	-	-	0	0	-	-	0
61	-	-	0	0	-	-	0
62	-	-	0	0	-	-	0
63	-	-	1	1	-	-	1
64	-	-	-	0	-	-	-
65	-	-	-	0	-	-	-
66	-	-	-	0	-	-	-
67	-	-	-	0	-	-	-
68	-	-	-	0	-	-	-
69	-	-	-	0	-	-	-
70	-	-	-	0	-	-	-
71	-	-	-	0	-	-	-
72	-	-	-	0	-	-	-
73	-	-	-	1	-	-	-
Total	50	50	50	303	50	51	50

Table 12. Continued.

Stratum		Flats (Cont.)			Rock Pile		Deep Trench	
Date	93/06/24	93/06/27	Total	93/06/25	93/06/21	93/06/21	93/06/21
Depth (m)	270	262	for	231	332	305	327
Haul	32	44	Flats	36	10	13	15
Age (years)				Frequency			
4	-	-	2	-	-	-	-
5	-	-	0	-	-	-	-
6	-	-	2	-	-	-	-
7	-	-	1	-	1	-	-
8	5	1	13	3	0	-	-
9	11	4	34	7	7	8	2
10	3	2	20	1	3	3	0
11	6	4	21	2	2	6	2
12	3	3	19	4	2	3	3
13	7	9	48	10	1	14	6
14	3	0	14	2	1	2	1
15	1	2	5	1	1	0	0
16	0	2	7	1	1	5	3
17	7	7	30	6	2	6	2
18	0	0	2	0	1	0	1
19	0	0	0	0	0	0	0
20	0	1	1	0	0	0	0
21	0	0	1	0	0	0	0
22	0	0	0	1	0	0	0
23	1	0	3	0	0	0	0
24	0	1	2	0	1	0	1
25	2	1	3	0	1	1	0
26	0	0	0	0	0	0	1
27	0	1	2	1	0	1	0
28	0	0	2	0	0	0	0
29	0	0	0	0	0	0	2
30	0	1	1	1	0	0	0
31	0	0	0	0	0	0	0
32	0	0	1	2	0	0	0
33	0	0	0	0	0	0	0
34	0	0	1	0	0	0	0
35	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0
37	1	0	1	1	1	0	2
38	-	0	0	0	0	0	0
39	-	0	0	0	4	0	1
40	-	0	0	0	1	0	2
41	-	5	5	2	5	0	0
42	-	1	2	2	3	0	8
43	-	0	2	0	3	0	2
44	-	0	0	0	0	0	0
45	-	0	0	0	0	0	0
46	-	0	0	0	0	0	0
47	-	0	0	0	0	0	1
48	-	0	0	1	1	0	0
49	-	0	0	0	3	0	0
50	-	1	1	1	1	0	0
51	-	3	3	-	0	0	0
52	-	0	0	-	0	1	0
53	-	0	0	-	0	-	1
54	-	0	0	-	0	-	0
55	-	0	0	-	0	-	0
56	-	0	0	-	0	-	0
57	-	0	0	-	0	-	1
58	-	0	0	-	0	-	0
59	-	0	0	-	0	-	0
60	-	1	1	-	0	-	0
61	-	-	0	-	0	-	1
62	-	-	0	-	0	-	0
63	-	-	1	-	0	-	0
64	-	-	-	-	0	-	1
65	-	-	-	-	3	-	0
66	-	-	-	-	0	-	0
67	-	-	-	-	1	-	0
68	-	-	-	-	-	-	0
69	-	-	-	-	-	-	0
70	-	-	-	-	-	-	0
71	-	-	-	-	-	-	0
72	-	-	-	-	-	-	0
73	-	-	-	-	-	-	0
74	-	-	-	-	-	-	1
75	-	-	-	-	-	-	
Total	50	50	251	49	50	50	45

Stratum	Deep Trench (Cont.)				
Date	93/06/22	93/06/25	93/06/25	Total	Grand Total
Depth (m)	348	356	361	for	for
Haul	20	34	38	Deep Trench	*S. alutus*
Age (years)			Frequency		
4	-	-	-	-	2
5	-	-	-	-	0
6	-	-	-	-	4
7	-	-	-	1	6
8	1	-	-	1	31
9	4	4	2	27	147
10	1	4	3	14	89
11	0	3	1	14	83
12	2	1	0	11	59
13	6	9	4	40	171
14	0	0	0	4	32
15	2	3	0	6	20
16	3	5	1	18	36
17	7	8	5	30	141
18	2	0	0	4	13
19	0	0	0	0	2
20	0	0	0	0	2
21	0	0	0	0	2
22	0	0	0	0	3
23	2	1	1	4	9
24	0	0	1	3	9
25	3	0	0	5	9
26	1	0	1	3	5
27	1	0	0	2	10
28	2	0	0	2	8
29	0	0	0	2	3
30	0	0	0	0	2
31	1	1	0	2	3
32	1	0	1	2	6
33	2	0	0	2	3
34	0	0	0	0	1
35	0	0	0	0	0
36	0	0	0	0	0
37	0	0	0	3	7
38	1	0	3	4	4
39	0	0	1	6	7
40	1	1	1	6	7
41	2	3	7	17	27
42	0	2	5	18	22
43	2	0	2	9	12
44	0	1	0	1	3
45	1	0	1	2	2
46	0	3	1	4	5
47	0	0	0	1	1
48	0	0	0	1	2
49	0	0	0	3	5
50	1	0	1	3	6
51	0	1	0	1	4
52	0	0	1	2	2
53	0	0	0	1	1
54	0	0	1	1	1
55	0	0	0	0	0
56	0	0	0	0	0
57	0	0	0	1	1
58	0	0	0	0	0
59	0	0	0	0	0
60	0	0	0	0	1
61	0	0	0	1	1
62	0	0	0	0	0
63	1	1	1	3	5
64	-	0	2	3	3
65	-	0	1	4	4
66	-	0	1	1	1
67	-	0	0	1	1
68	-	0	0	0	0
69	-	1	1	2	2
70	-	0	-	0	0
71	-	0	-	0	0
72	-	0	-	0	0
73	-	1	-	1	2
74	-	-	-	0	0
75	-	-	-	1	1
Total	50	53	50	298	1051

Table 13. Age composition of rougheye rockfish, *Sebastes aleutianus*, *R/V W.E. RICKER*, Langara survey, June 19-30, 1993.

Stratum	Outer Lower		
Date	93/06/19	93/06/26	Total
Depth (m)	360	341	for
Haul	4	40	*S. aleutianus*
Age (years)	Frequency		
4	--	--	--
5	--	--	--
6	--	--	--
7	--	--	--
8	--	--	--
9	--	1	1
10	--	0	0
11	--	1	1
12	--	0	0
13	--	1	1
14	--	0	0
15	--	0	0
16	--	1	1
17	--	1	1
18	--	0	0
19	2	1	3
20	0	0	0
21	0	1	1
22	1	0	1
23	2	1	3
24	3	1	4
25	3	1	4
26	0	0	0
27	3	2	5
28	2	0	2
29	2	2	4
30	4	0	4
31	3	3	6
32	3	4	7
33	2	2	4
34	3	2	5
35	5	2	7
36	0	4	4
37	0	4	4
38	4	2	6
39	4	0	4
40	2	0	2
41	1	2	3
42	0	0	0
43	1	0	1
44	1	0	1
45	1	1	2
46	0	1	1
47	3	2	5
48	0	1	1
49	0	1	1
50	1	0	1
51	0	0	0
52	0	0	0
53	0	0	0
54	0	0	0
55	0	0	0

Table 13. Continued.

Stratum	Outer Lower		
Date	93/06/19	93/06/26	Total
Depth (m)	360	341	for
Haul	4	40	*S. aleutianus*
Age (years)	Frequency		
56	0	0	0
57	1	0	1
58	0	0	0
59	0	0	0
60	0	0	0
61	0	0	0
62	0	0	0
63	0	0	0
64	0	1	1
65	1	0	1
66	0	0	0
67	0	0	0
68	0	0	0
69	1	0	1
70	0	1	1
71	0	0	0
72	0	0	0
73	0	0	0
74	0	0	0
75	0	1	1
76	0	1	1
77	0	0	0
78	0	0	0
79	0	0	0
80	1	0	1
81	0	0	0
82	0	0	0
83	0	0	0
84	0	0	0
85	0	0	0
86	0	0	0
87	0	0	0
88	0	0	0
89	0	0	0
90	1	0	1
91	0	0	0
92	0	0	0
93	0	0	0
94	0	0	0
95	0	0	0
96	0	0	0
97	0	0	0
98	1	0	1
99	--	0	0
100	--	0	0
101	--	0	0
102	--	0	0
103	--	0	0
104	--	0	0
105	--	0	0
106	--	0	0
107	--	1	1
108	--	--	--
Total	62	50	112

Table 14. Age composition of redstripe rockfish, *Sebastes proriger*, *R/V W.E. RICKER*, Langara survey, June 19-30, 1993.

Stratum		Outer Upper		
Date	93/06/20	93/06/20	93/06/23	Total
Depth (m)	239	243	251	for
Haul	6	7	23	*S. proriger*
Age (years)			Frequency	
1	--	--	--	--
2	--	--	--	--
3	--	--	--	--
4	--	--	--	--
5	--	--	--	--
6	--	--	--	--
7	--	--	--	--
8	2	--	--	2
9	1	--	1	2
10	6	1	2	8
11	13	5	8	26
12	18	17	18	53
13	0	3	4	7
14	0	2	1	3
15	0	2	0	2
16	0	0	2	2
17	0	3	2	5
18	0	1	2	3
19	1	1	0	2
20	4	0	0	4
21	1	1	1	3
22	1	2	2	5
23	0	0	2	2
24	1	0	0	1
25	0	4	1	5
26	1	2	1	4
27	0	3	3	6
28	0	1	--	1
29	0	0	--	0
30	0	0	--	0
31	1	0	--	1
32	--	0	--	0
33	--	1	--	1
34	--	--	--	--
35	--	--	--	--
Total	50	49	50	149

Table 15. Age composition of yellowmouth rockfish, *Sebastes reedi*, *R/V W.E. RICKER*, Langara survey, June 19-30, 1993.

Stratum	Flats		Rock Pile		
Date	93/06/21	93/06/24	93/06/27	Total	Grand Total
Depth (m)	279	268	338	for	for
Haul	12	33	43	Rock Pile	*S. reedi*
Age (years)			Frequency		
10	--	--	--	--	--
11	--	--	--	--	--
12	--	--	--	--	--
13	1	0	1	1	2
14	2	0	1	1	3
15	1	0	2	2	3
16	3	0	3	3	6
17	10	9	9	18	28
18	10	5	7	12	22
19	2	0	2	2	4
20	0	1	0	1	1
21	0	0	1	1	1
22	2	1	1	2	4
23	0	3	3	6	6
24	0	4	1	5	5
25	2	1	4	5	7
26	2	0	3	3	5
27	1	3	3	6	7
28	0	1	0	1	1
29	1	0	0	0	1
30	1	1	0	1	2
31	1	2	2	4	5
32	0	4	1	5	5
33	0	3	0	3	3
34	0	0	0	0	0
35	0	0	0	0	0
36	1	0	0	0	1
37	1	0	1	1	2
38	0	0	0	0	0
39	1	0	0	0	1
40	0	0	0	0	0
41	4	13	3	16	10
42	2	1	1	2	4
43	2	--	0	0	2
44	--	--	--	--	--
Total	50	52	49	101	151

Table 16. 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*						
	Outside Upper (A)	Outside Lower (B)	Flats (C)	Rock Pile (D)	Deep Trench (E)	Inside Edge (F)	Total (All Strata)
Sebastes aleutianus	—	662.65 (154.29 - 2139.35)	2.01 (0.00 - 4.02)	—	3.20 (0.40 - 6.71)	—	52.55 (7.50 - 131.31)
S. alutus	1522.52 (438.96 - 3765.30)	2108.78 (1168.86 - 3513.18)	1328.85 (732.88 - 2897.81)	320.79 (31.00 - 544.09)	691.54 (318.86 - 1407.52)	154.51 (77.50 - 267.41)	956.81 (604.46 - 1407.33)
S. babcocki	42.44 (6.22 - 150.22)	31.55 (12.46 - 61.95)	2.07 (0.22 - 4.85)	86.34 (21.60 - 124.44)	9.93 (3.19 - 18.43)	5.09 (0.75 - 7.67)	10.49 (6.56 - 14.68)
S. borealis	—	98.51 (27.45 - 246.27)	—	37.25 (0.00 - 74.50)	9.63 (0.00 - 21.92)	—	12.00 (3.75 - 21.90)
S. brevispinis	91.64 (41.86 - 155.04)	46.83 (15.35 - 80.70)	54.87 (34.93 - 96.83)	695.66 (122.57 - 1702.11)	31.20 (4.93 - 84.66)	195.07 (60.00 - 414.96)	85.97 (44.68 - 130.78)
S. ciliatus	—	—	2.47 (0.00 - 4.94)	2.75 (0.00 - 5.50)	—	—	1.00 (0.00 - 3.12)
S. crameri	—	5.05 (1.44 - 9.49)	—	—	0.29 (0.00 - 0.58)	—	0.49 (0.12 - 0.87)
S. diploproa	—	—	—	—	—	—	—
S. entomelas	—	—	7.49 (0.22 - 22.37)	1.00 (0.00 - 2.00)	—	—	2.84 (0.05 - 9.06)
S. helvomaculatus	1.26 (0.00 - 3.33)	3.28 (0.00 - 6.57)	7.17 (3.44 - 10.50)	—	2.63 (0.85 - 5.57)	1.29 (0.00 - 2.59)	4.08 (2.39 - 5.78)
S. paucispinis	—	—	13.44 (0.00 - 26.89)	—	—	9.83 (0.00 - 19.66)	6.54 (0.00 - 15.35)
S. pinniger	—	—	—	—	—	—	—
S. proriger	318.76 (125.17 - 618.66)	—	11.11 (0.22 - 32.89)	150.43 (13.29 - 412.43)	1.00 (0.00 - 2.00)	—	13.01 (4.08 - 23.69)
S. reedi	10.22 (0.00 - 20.44)	—	325.52 (134.23 - 574.24)	1442.09 (180.10 - 2936.93)	57.24 (0.00 - 147.42)	1.79 (0.25 - 3.09)	183.58 (86.86 - 289.12)
S. ruberrimus	—	—	—	60.75 (0.00 - 121.50)	—	—	1.72 (0.00 - 4.57)
S. variegatus	17.89 (2.81 - 51.55)	—	—	121.57 (0.00 - 243.14)	—	—	3.69 (0.07 - 9.56)
S. zacentrus	885.89 (461.71 - 1622.14)	110.91 (44.40 - 196.73)	59.72 (18.89 - 155.22)	3028.80 (50.10 - 4685.55)	—	—	128.58 (3.95 - 217.09)
Sebastolobus alascanus	4.44 (0.00 - 12.89)	54.43 (33.48 - 80.06)	30.72 (18.11 - 41.58)	12.05 (0.00 - 24.10)	140.41 (79.94 - 201.66)	6.00 (0.00 - 9.75)	66.68 (42.96 - 92.47)
Total	2895.07 (1500.96 - 6093.47)	3121.99 (1913.16 - 4380.00)	1845.45 (1118.20 - 3536.47)	5959.48 (603.60 - 9747.86)	947.06 (489.97 - 1779.11)	373.58 (135.00 - 731.61)	1530.03 (1138.87 - 2022.15)

*With 95% confidence limits.

Table 17. Estimated biomass (tonnes) by stratum for rockfish (*Sebastes* sp. and *Sebastolobus* sp.) captured aboard the *R/V W.E. RICKER* , Langara survey, June 19-30, 1993.

Species	Biomass Estimates (tonnes)*						
	Outside Upper (A)	Outside Lower (B)	Flats (C)	Rock Pile (D)	Deep Trench (E)	Inside Edge (F)	Total (All Strata)
Sebastes aleutianus	---	325.17 (75.71 - 1049.82)	4.84 (0.00 - 9.68)	---	7.27 (0.91 - 15.25)	---	337.41 (48.11 - 842.77)
S.alutus	129.45 (37.32 - 320.15)	1034.82 (573.58 - 1723.98)	3195.90 (1762.58 - 6969.23)	58.45 (5.65 - 99.13)	1570.7 (724.25 - 3197.03)	151.64 (76.06 - 262.44)	6143.33 (3879.52- 9032.50)
S.babcocki	3.61 (0.53 - 12.77)	15.48 (6.12 - 30.40)	4.98 (0.53 - 11.66)	15.73 (3.94 - 22.67)	22.55 (7.25 - 41.86)	4.99 (0.74 - 7.53)	67.36 (45.47 - 92.99)
S. borealis	---	48.34 (13.47 - 120.85)	---	6.79 (0.00 - 13.57)	21.87 (0.00 - 49.78)	---	77.03 (24.09 - 140.57)
S. brevispinis	7.79 (3.56 - 13.18)	22.98 (7.53 - 39.60)	131.95 (84.01 - 232.87)	126.75 (22.33 - 310.12)	70.88 (11.20 - 192.29)	191.45 (58.89 - 407.25)	552.00 (386.75- 839.50)
S. ciliatus	---	---	5.94 (0.00 - 11.88)	0.50 (0.00 - 1.00)	---	---	6.44 (0.00 - 20.05)
S. crameri	---	2.48 (0.71 - 4.66)	---	---	0.66 (0.00 - 1.32)	---	3.14 (0.77 - 5.59)
S. diploproa	---	---	---	---	---	---	---
S. entomelas	---	---	18.02 (0.53 - 53.80)	0.18 (0.00 - 0.36)	---	---	18.21 (0.30 - 58.14)
S. helvomaculatus	0.11 (0.00 - 0.28)	1.61 (0.00 - 3.22)	17.24 (8.28 - 25.25)	---	5.97 (1.95 - 12.65)	1.27 (0.00 - 2.54)	26.20 (15.36- 37.12)
S. paucispinis	---	---	32.33 (0.00 - 64.67)	---	---	9.65 (0.00 - 19.29)	41.99 (0.00 - 98.51)
S. pinniger	---	---	---	---	---	---	---
S. proriger	27.10 (10.64 - 52.60)	---	26.72 (0.53 - 79.10)	27.41 (2.42 - 75.14)	2.27 (0.00 - 4.54)	---	83.51 (26.17 - 152.02)
S. reedi	0.87 (0.00 - 1.74)	---	782.88 (322.82 - 1381.05)	262.75 (32.81 - 535.10)	130.01 (0.00 - 334.85)	1.76 0.25 - 3.03)	1178.70 (557.50 - 1855.62)
S. ruberrimus	---	---	---	11.07 (0.00 - 22.14)	---	---	11.07 (0.00 - 29.34)
S. variegatus	1.52 (0.24 - 4.38)	---	---	22.15 (0.00 - 44.30)	---	---	23.67 (0.43 - 61.33)
S. zacentrus	75.32 (39.26 - 137.92)	54.43 (21.79 - 96.54)	143.63 (45.43 - 373.31)	551.84 (9.13 - 853.69)	---	---	825.53 (253.47- 1393.33)
Sebastolobus alascanus	0.38 (0.00 - 1.10)	26.71 (16.43 - 39.29)	73.88 (43.56 - 100.01)	2.20 (0.00 - 4.39)	318.93 (181.57 - 458.05)	5.89 (0.00 - 9.57)	428.14 (275.70 - 593.51)
Total Biomass	246.15 (127.62 - 518.10)	1532.02 (938.82 - 2149.34)	4438.31 (2689.27 - 8505.22)	1085.80 (109.97 - 1776.03)	2151.14 (1112.92 - 4034.24)	366.64 (132.49 - 718.03)	9823.77 (7309.46 - 12978.59)
No. Hauls	9	9	9	4	7	4	42
Stratum Area (nm^2)	7.0	40.4	198.0	15.0	187.0	80.8	528.4

*With 95% confidence limits.

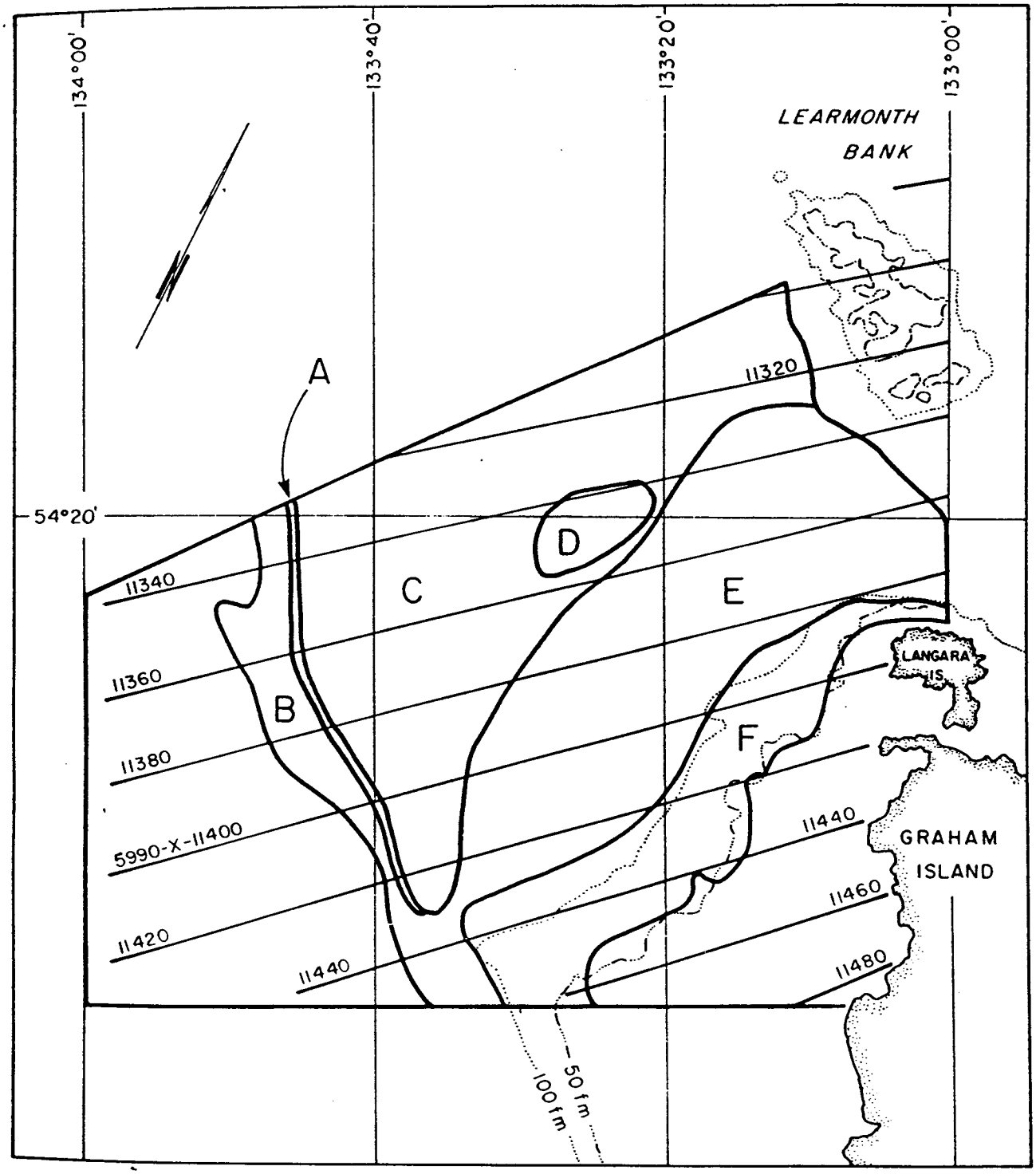


Figure 1. Langara Spit survey area showing the six strata: A (Outside Upper), B (Outside Lower), C (Flats), D (Rock Pile), E (Deep Trench), and F (Inside Edge). (From Lapi and Richards 1981.)

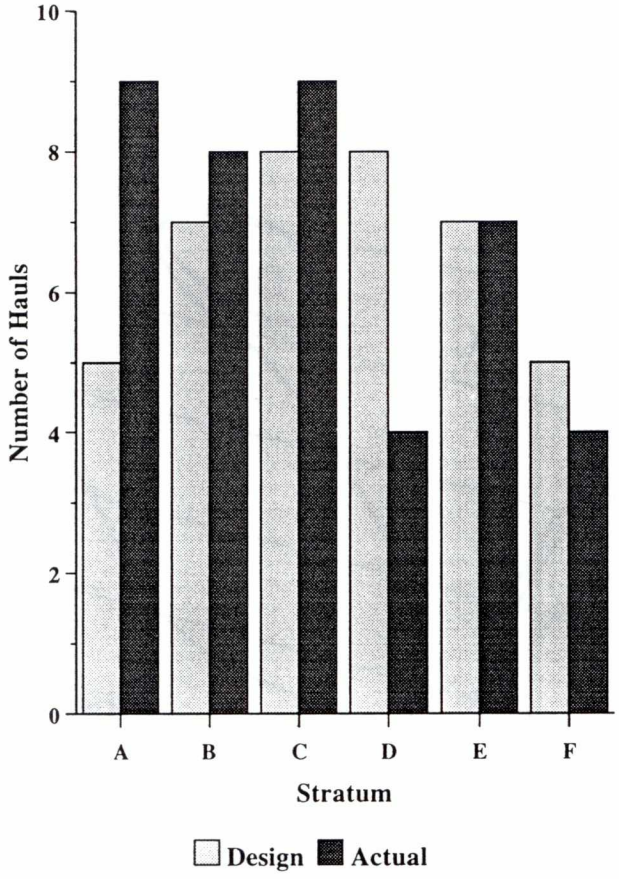


Figure 2. Actual distribution of hauls by stratum, compared to the initial survey design, *R/V W.E. RICKER*, Langara survey, June 19-30, 1993.

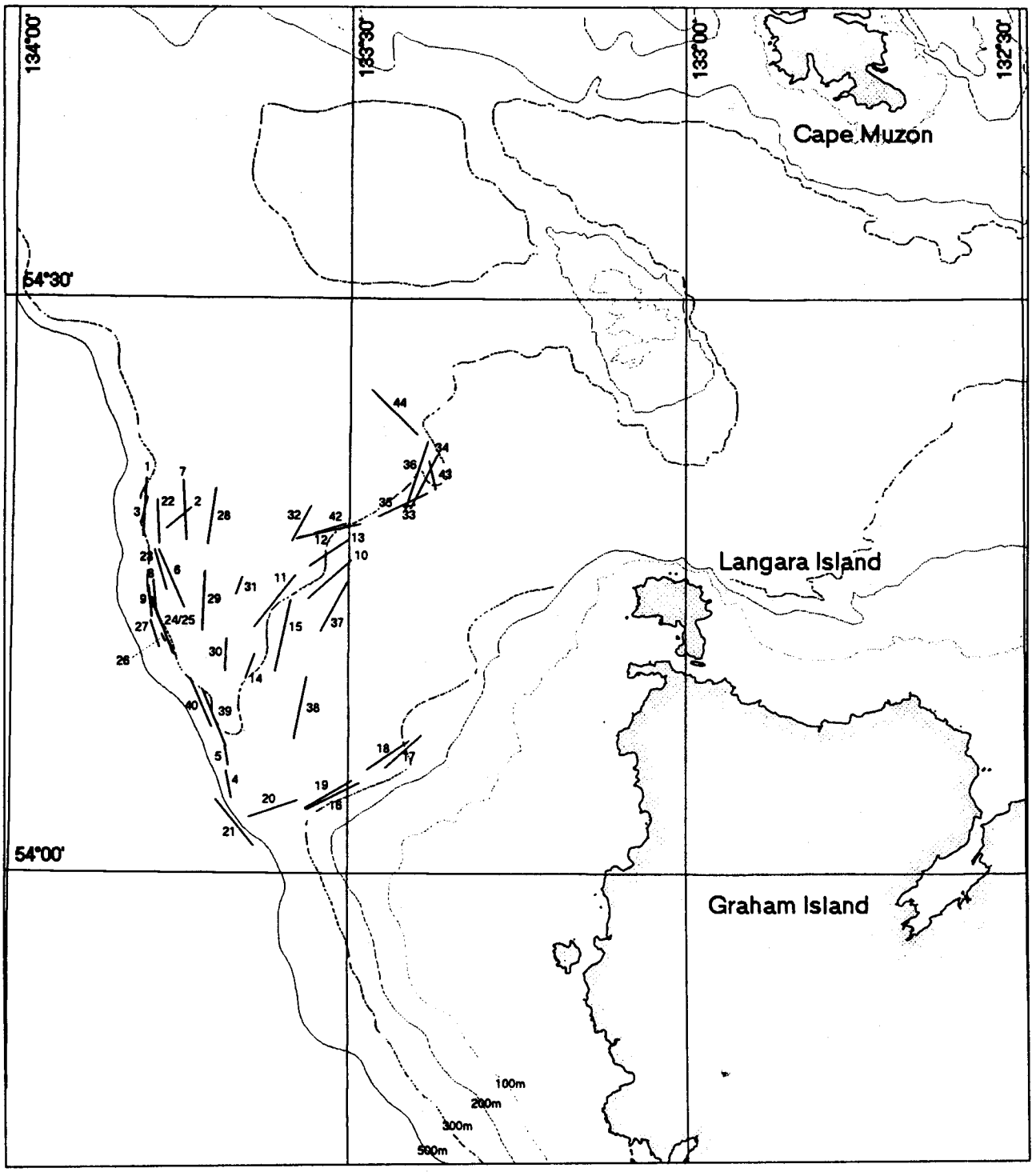
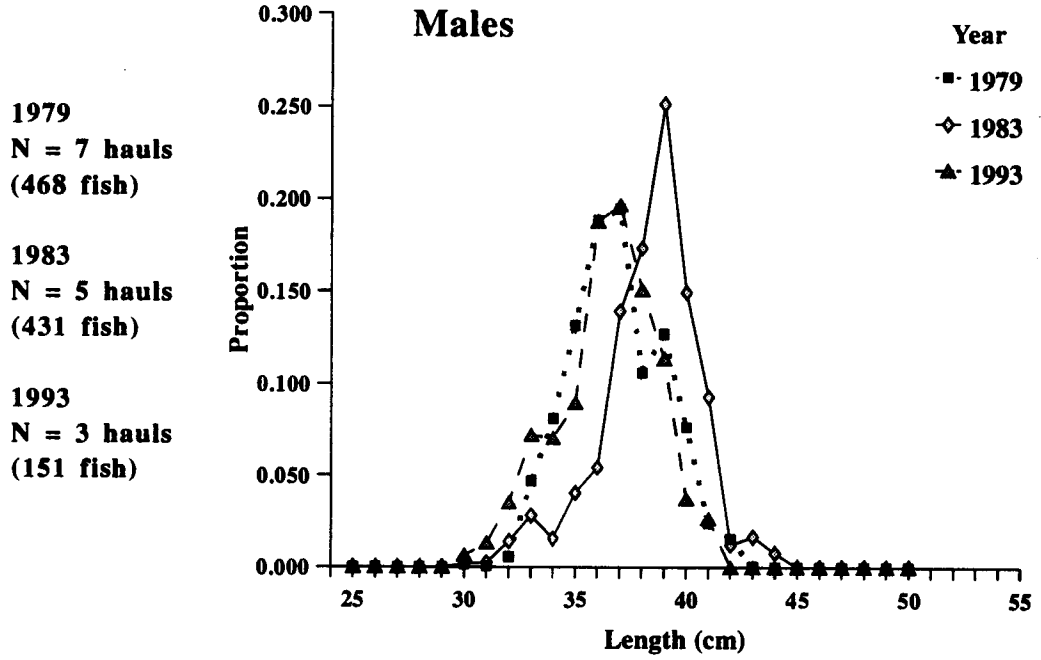


Figure 3. Survey area and haul locations, *R/V W.E. RICKER*, Langara survey, June 19-30, 1993.



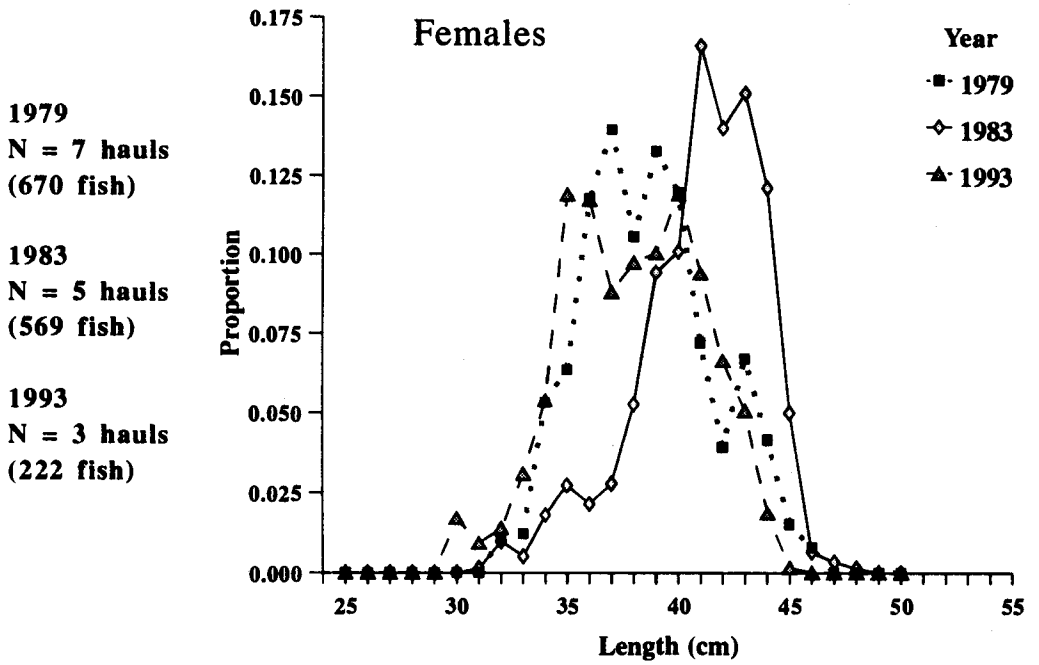


Figure 4. Length proportions for Pacific ocean perch captured in the Outside Upper stratum during the 1979, 1983, and 1993 Langara surveys. (Weighted by catch rate (kg/hr) for each haul)

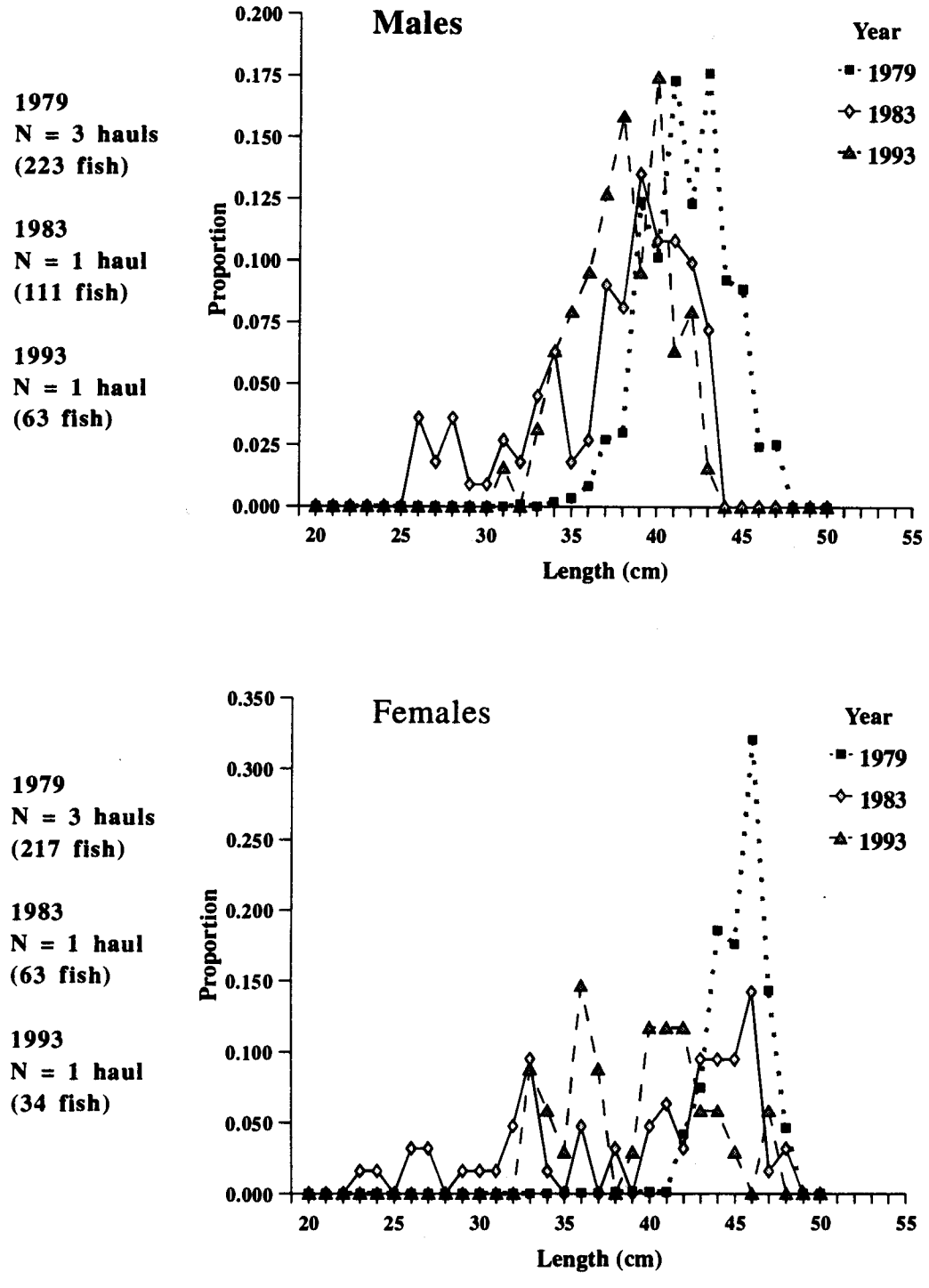


Figure 5. Length proportions for Pacific ocean perch captured in the Rock Pile stratum during the 1979, 1983, and 1993 Langara surveys. (Weighted by catch rate (kg/hr) for each haul)

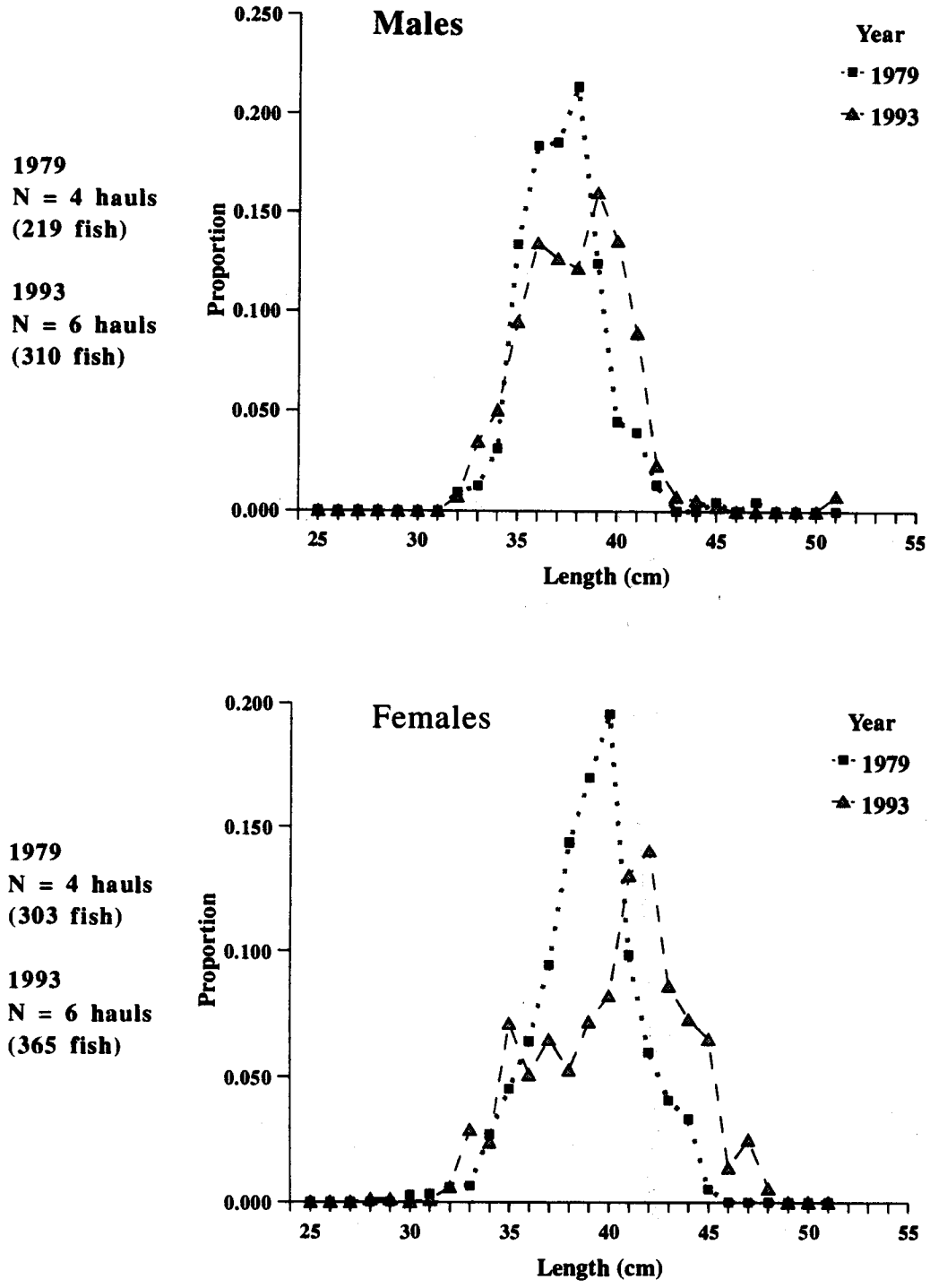
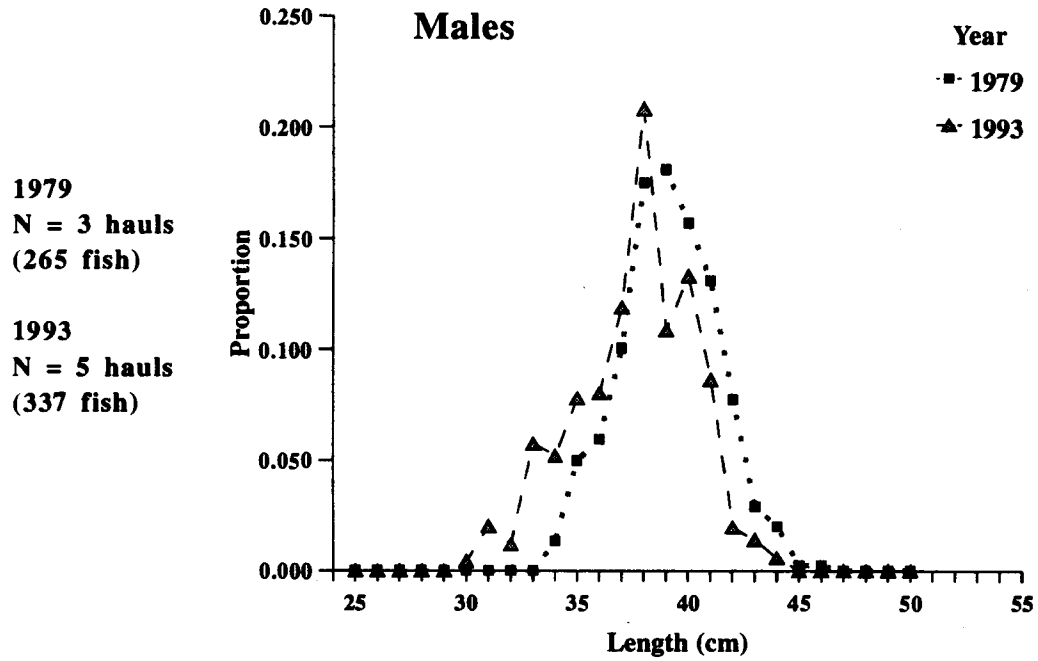


Figure 6. Length proportions for Pacific ocean perch captured in the Outside Lower stratum during the 1979 and 1993 Langara surveys. (Weighted by catch rate (kg/hr) for each haul)



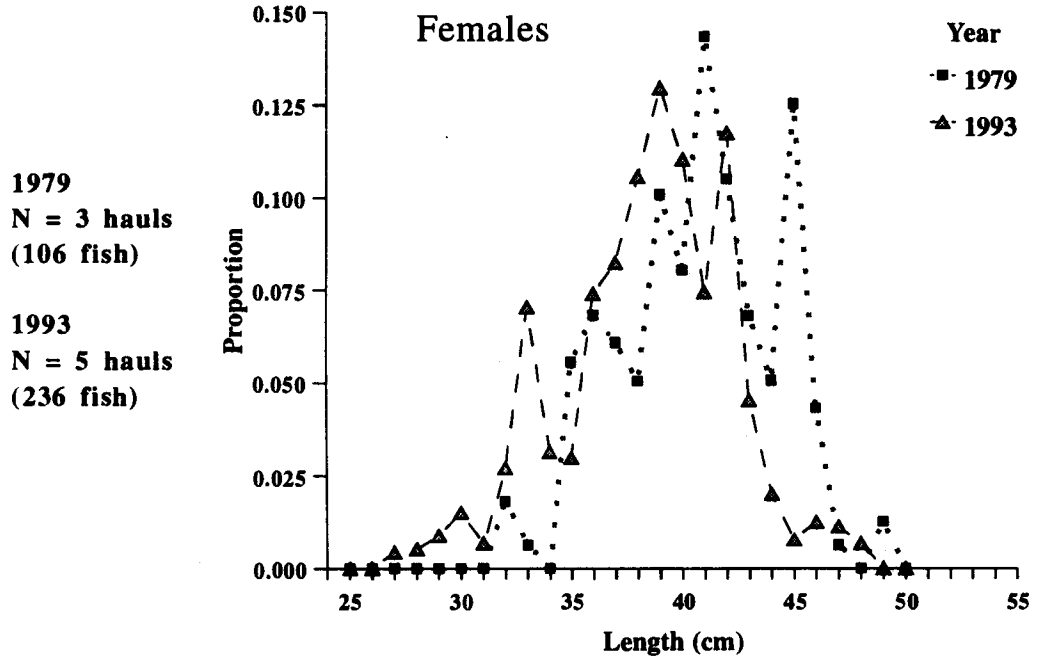


Figure 7. Length proportions for Pacific ocean perch captured in the Flats stratum during the 1979 and 1993 Langara surveys. (Weighted by catch rate (kg/hr) for each haul)

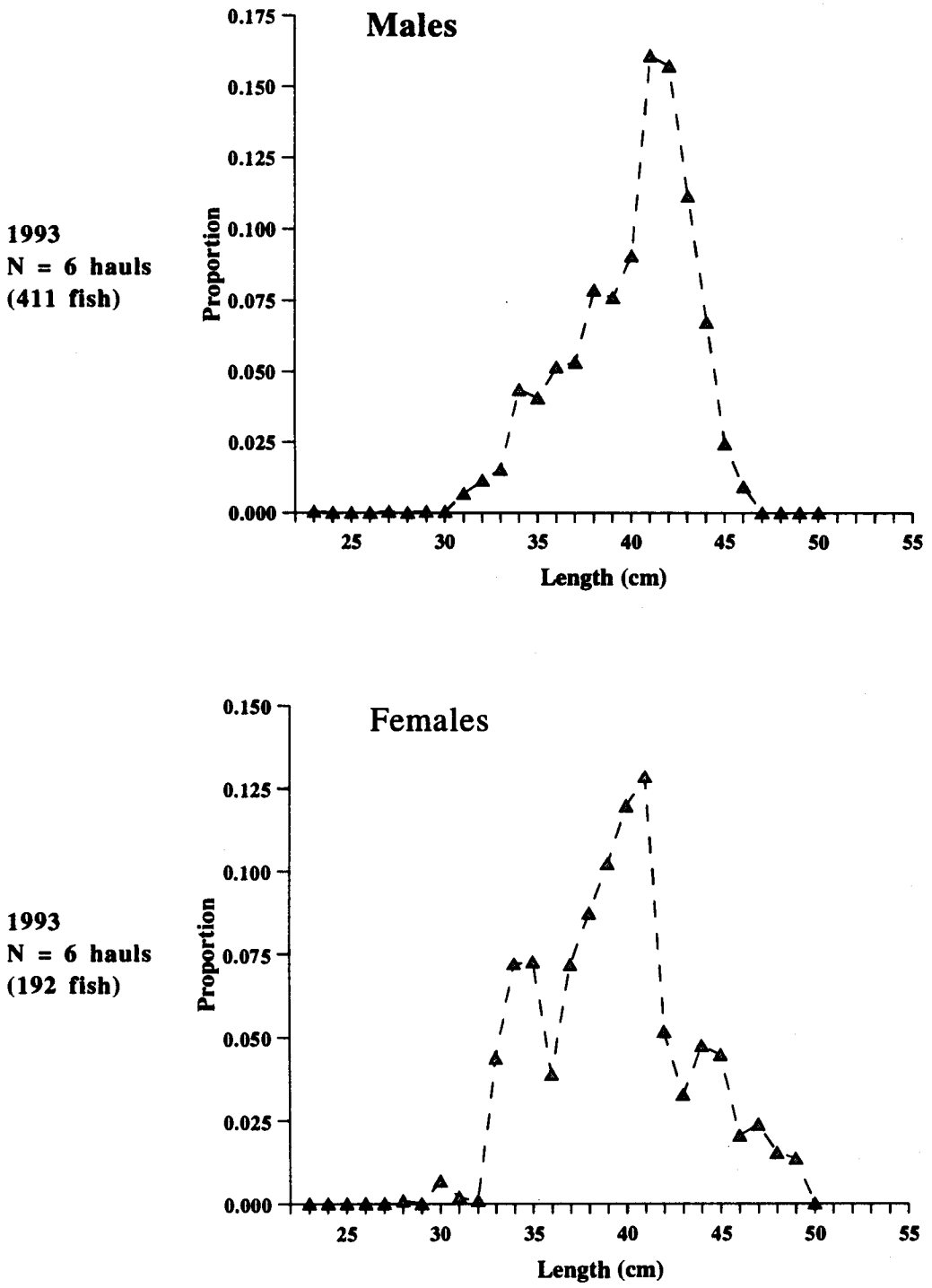


Figure 8. Length proportions for Pacific ocean perch captured in the Deep Trench stratum during the 1993 Langara survey. (Weighted by catch rate (kg/hr) for each haul)

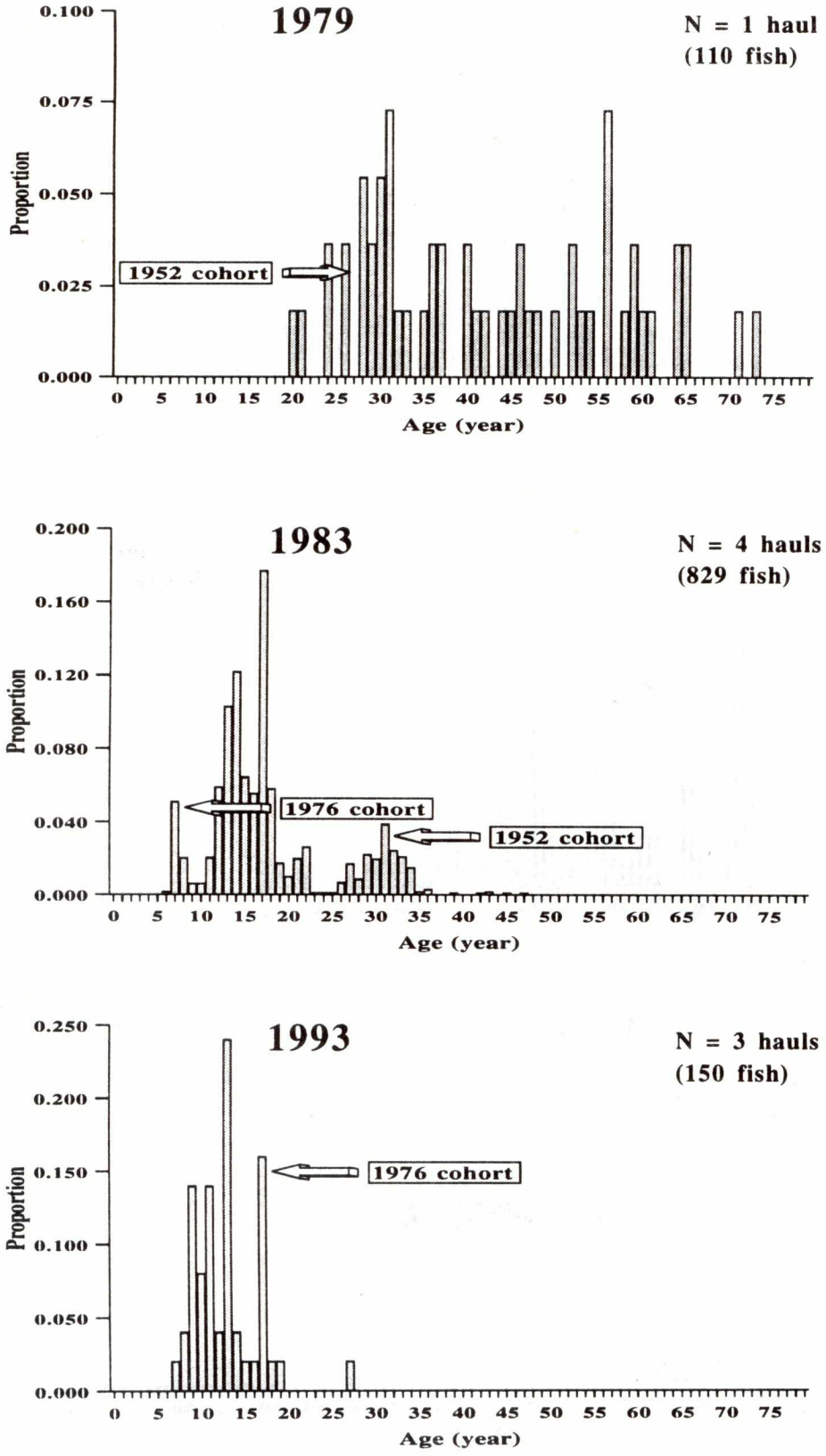


Figure 9. Age proportions of Pacific ocean perch captured in the Outside Upper stratum during the 1979, 1983, and 1993 Langara surveys. (Weighted by CPUE (kg/hr) for each haul)

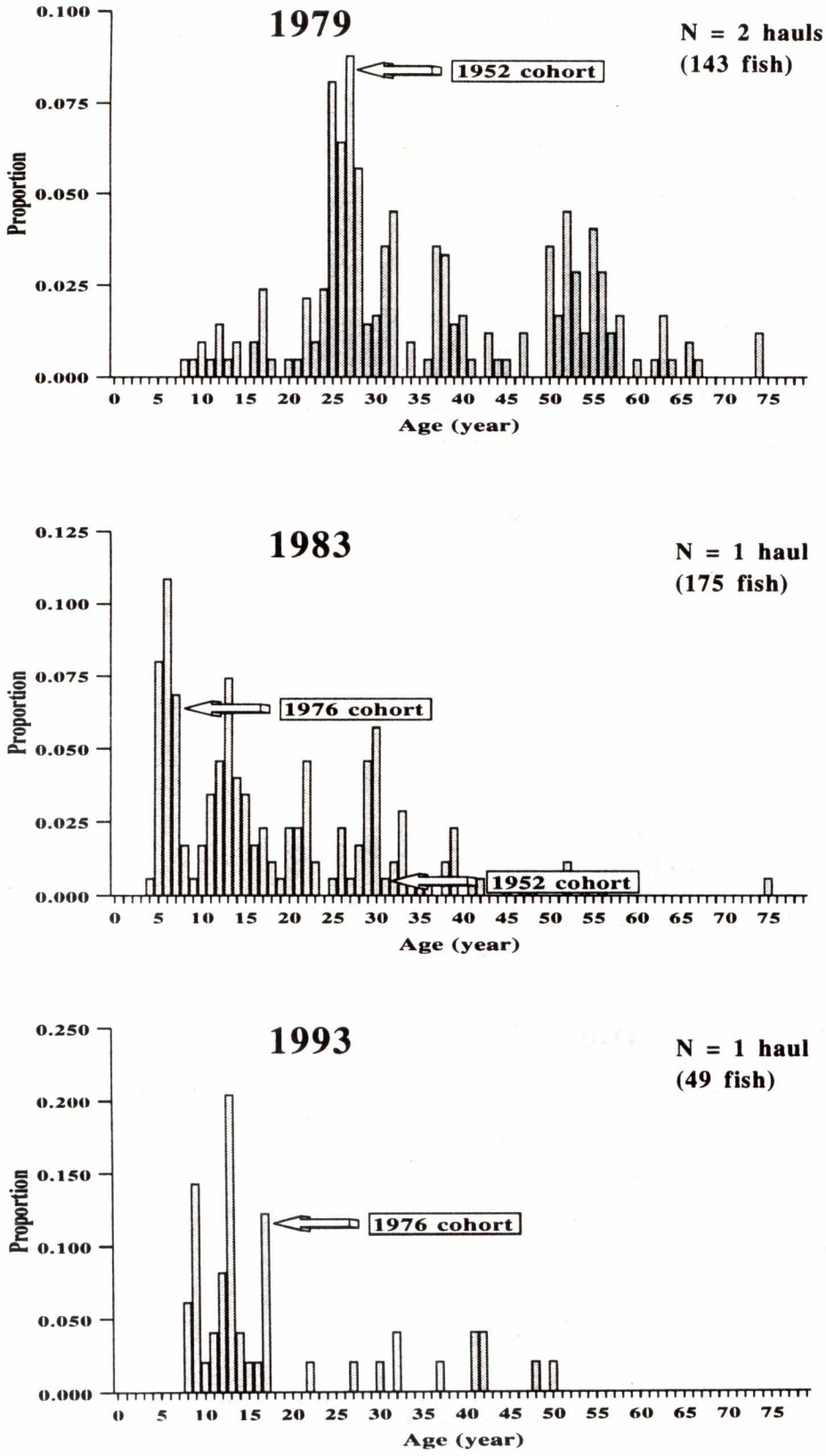


Figure 10. Age proportions of Pacific ocean perch captured in the Rock Pile stratum during the 1979, 1983, and 1993 Langara surveys. (Weighted by CPUE (kg/hr) for each haul)

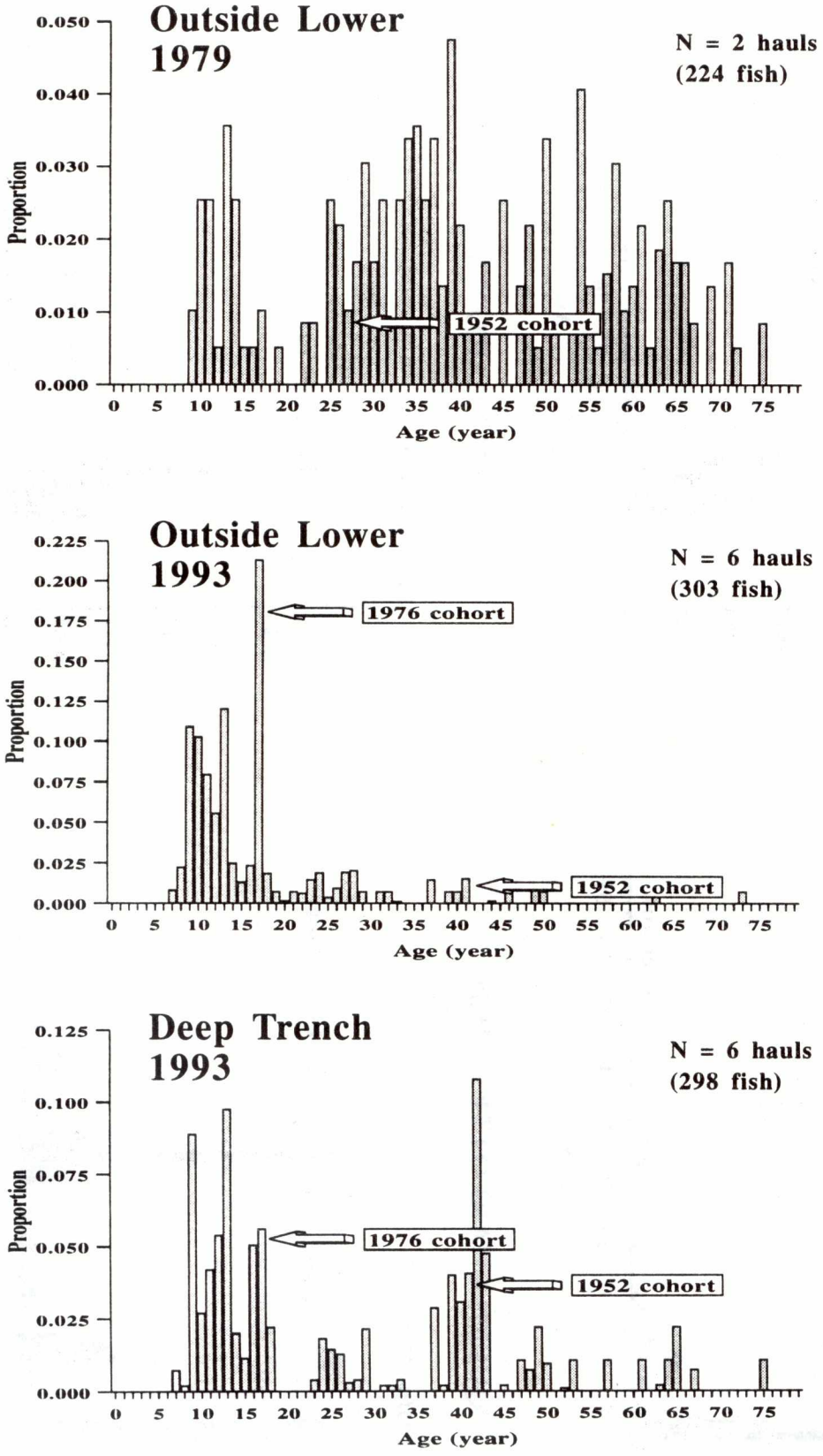


Figure 11. Age proportions of Pacific ocean perch captured in the Outside Lower and Deep Trench strata during the 1979 and 1993 Langara surveys. (Weighted by CPUE (kg/hr) for each haul)

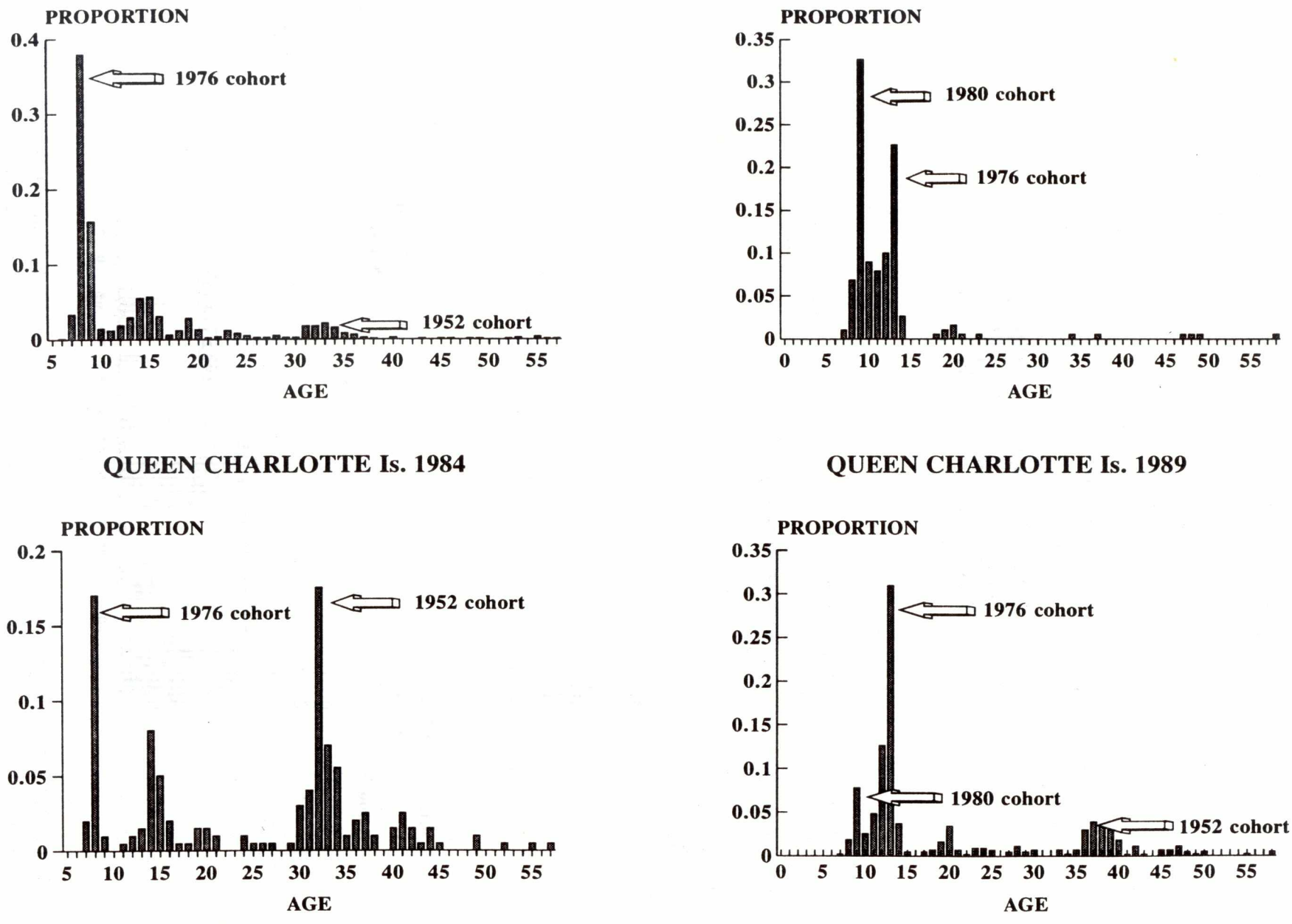


Figure 12. Age composition of Pacific ocean perch stocks from the Langara spit area and from the west coast of the Queen Charlotte Islands in 1984 and 1988. (From Leaman and Stanley 1993.)

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)

Spent (large, flaccid, red ovaries; a few larvae may be present)

Appendix Table 2. Bridge log information for bottom trawl tows, *R/V W.E. RICKER*, Langara survey, June 19-30, 1993

Haul number		1	2	3	4
Date		June 19	June 19	June 19	June 19
Area	(major, minor)	5E,35	5E,35	5E,35	5E,35
Stratum		Outer Lower	Outer Upper	Outer Upper	Outer Lower
Start time	(PDT)	0845	1303	1411	1724
Duration	(min)	60	30	30	30
Start position					
	N. Lat	54° 20.5'	54° 17.9'	54° 19.5'	54° 05.3'
	W. Long.	133° 48.1'	133° 46.3'	133° 48.0'	133° 40.8'
Finish position					
	N. Lat	54° 17.5'	54° 19.0'	54° 18.23'	54° 03.9'
	W. Long.	133° 48.3'	133° 44.1'	133° 48.5'	133° 40.3'
Haul distance	(km)	5.6	2.8	2.8	--
	(naut. mi.)	3.0	1.5	1.5	--
Direction	(° True)	185	058	185	180
Bottom depth	(m)	295-312	235-242	273-279	354-366
	(fm)	161-171	128-132	149-153	194-200
Modal depth	(m)	304	239	276	360
Gear type		BT	BT	BT	BT
Total catch	(kg)	5497	142	2451	2766
Remarks		Usable	Usable	Usable	Usable

Haul number	1	2	3	4
Date	June 19	June 19	June 19	June 19
Area (major, minor)	5E,35	5E,35	5E,35	5E,35
Stratum	Outer Lower	Outer Upper	Outer Upper	Outer Lower
Arrowtooth flounder	Trace	6	57	24
Dover sole	Trace	--	--	Trace
Pacific halibut	--	32	Trace	Trace
Petrale sole	--	--	--	--
Rex sole	Trace	Trace	--	--
Other flatfish	--	--	--	--
Sebastes aleutianus	122	--	Trace	2254
S. alutus	4401	26	1480	477
S. babcocki	20	1	28	--
S. borealis	608	--	--	Trace
S. brevispinis	122	5	123	--
S. ciliatus	--	--	--	--
S. crameri	20	--	--	--
S. entomelas	Trace	--	Trace	--
S. helvomaculatus	Trace	1	Trace	--
S. paucispinis	Trace	--	--	--
S. proriger	Trace	29	38	--
S. reedi	Trace	--	Trace	--
S. ruberrimus	--	--	--	--
S. variegatus	--	1	--	--
S. zacentrus	81	40	679	--
Sebastolobus alascanus	122	1	19	12
Other rockfish	--	--	--	--
Grenadiers	--	--	--	--
Lingcod	--	--	--	--
Pacific cod	--	--	--	--
Pacific hake	--	--	--	Trace
Sablefish	--	--	28	--
Walleye pollock	Trace	--	--	--
Other roundfish	Trace	--	Trace	--
Longnose skate	--	--	--	--
Spiny dogfish	--	--	--	--
Spotted ratfish	--	--	--	--
Other selachii	--	--	--	--
Total catch (kg)	5497	142	2451	2766

Haul number		5	6	7	8
Date		June 20	June 20	June 20	June 20
Area	(major, minor)	5E,35	5E,35	5E,35	5E,35
Stratum		Outer Lower	Outer Upper	Outer Upper	Outer Upper
Start time	(PDT)	0822	1009	1222	1423
Duration	(min)	27	61	60	30
Start position					
	N. Lat	54° 05.6'	54° 13.8'	54° 17.3'	54° 15.2'
	W. Long.	133° 40.6'	133° 44.6'	133° 44.5'	133° 47.4'
Finish position					
	N. Lat	54° 06.6'	54° 16.8'	54° 20.4'	54° 13.6'
	W. Long.	133° 40.9'	133° 46.9'	133° 44.8'	133° 47.1'
Haul distance	(km)	1.7	6.1	5.6	--
	(naut. mi.)	0.9	3.3	3.0	--
Direction	(° True)	352	336	000	170
Bottom depth	(m)	316-308	242-235	244-242	295-273
	(fm)	173-168	132-128	133-132	161-149
Modal depth	(m)	312	239	243	284
Gear type		BT	BT	BT	BT
Total catch	(kg)	1786	1254	2342	6349
Remarks		Usable	Usable	Usable	Usable

Haul number	5	6	7	8
Date	June 20	June 20	June 20	June 20
Area (major, minor)	5E,35	5E,35	5E,35	5E,35
Stratum	Outer Lower	Outer Upper	Outer Upper	Outer Upper
Arrowtooth flounder	7	15	Trace	--
Dover sole	--	--	--	--
Pacific halibut	--	67	Trace	Trace
Petrale sole	--	5	--	--
Rex sole	--	Trace	Trace	--
Other flatfish	--	--	--	--
Sebastes aleutianus	14	--	--	--
S. alutus	1475	41	108	4333
S. babcocki	35	Trace	Trace	162
S. borealis	--	--	--	--
S. brevispinis	14	15	Trace	139
S. ciliatus	--	--	--	--
S. crameri	--	--	--	--
S. entomelas	--	--	--	--
S. helvomaculatus	Trace	Trace	--	--
S. paucispinis	--	--	--	--
S. proriger	--	763	1207	46
S. reedi	--	Trace	Trace	46
S. ruberrimus	--	--	--	--
S. variegatus	--	41	--	--
S. zacentrus	142	302	1027	1599
Sebastolobus alascanus	Trace	Trace	Trace	Trace
Other rockfish	--	--	Trace	--
Grenadiers	--	--	--	--
Lingcod	64	--	--	--
Pacific cod	--	5	Trace	--
Pacific hake	14	--	--	--
Sablefish	21	--	--	23
Walleye pollock	--	--	--	Trace
Other roundfish	--	--	--	--
Longnose skate	--	--	--	--
Spiny dogfish	--	--	--	--
Spotted ratfish	--	--	--	--
Other selachii	--	--	--	--
Total catch (kg)	1786	1254	2342	6349

Haul number		9	10	11	12
Date		June 20	June 21	June 21	June 21
Area	(major, minor)	5E,35	5E,35	5E,35	5E,35
Stratum		Outer Lower	Deep Trench	Flats	Flats
Start time	(PDT)	1722	0818	1010	1223
Duration	(min)	29	60	60	60
Start position					
	N. Lat	54° 14.9'	54° 16.3'	54° 12.8'	54° 17.5'
	W. Long.	133° 47.8'	133° 29.8'	133° 38.4'	133° 34.5'
Finish position					
	N. Lat	54° 13.3'	54° 14.3'	54° 15.5'	54° 18.2
	W. Long.	133° 47.5'	133° 33.6'	133° 34.8'	133° 29.0'
Haul distance	(km)	--	5.2	6.3	5.6
	(naut. mi.)	--	2.8	3.4	3.0
Direction	(° True)	120	229	038	040
Bottom depth	(m)	341	333-330	288-295	275-282
	(fm)	186	182-180	157-161	150-154
Modal depth	(m)	341	332	292	279
Gear type		BT	BT	BT	BT
Total catch	(kg)	331	685	930	7029
Remarks		Usable	Usable	Usable	Usable

Haul number	9	10	11	12
Date	June 20	June 21	June 21	June 21
Area (major, minor)	5E,35	5E,35	5E,35	5E,35
Stratum	Outer Lower	Deep	Flats	Flats
Arrowtooth flounder	6	Tracerench	8	73
Dover sole	6	6	4	Trace
Pacific halibut	--	Trace	Trace	Trace
Petrale sole	--	--	--	--
Rex sole	2	22	4	Trace
Other flatfish	--	--	--	--
Sebastes aleutianus	54	8	Trace	--
S. alutus	149	341	839	5551
S. babcocki	5	8	Trace	Trace
S. borealis	18	--	--	--
S. brevispinis	--	6	12	24
S. ciliatus	--	--	--	--
S. crameri	6	--	--	--
S. entomelas	--	--	--	--
S. helvomaculatus		8	3	12Trace
S. paucispinis	--	--	--	121
S. proriger	--	--	Trace	--
S. reedi	--	--	4	1212
S. ruberrimus	--	--	--	--
S. variegatus	--	--	Trace	--
S. zacentrus	5	--	Trace	Trace
Sebastolobus alascanus	47	238	39	48
Other rockfish	Trace	--	--	--
Grenadiers	--	--	--	--
Lingcod	--	--	--	--
Pacific cod	5	--	--	--
Pacific hake	--	Trace	--	--
Sablefish	15	36	8	Trace
Walleye pollock	2	--	Trace	--
Other roundfish	--	--	Trace	--
Longnose skate	--	--	--	--
Spiny dogfish	--	3	--	--
Spotted ratfish	3	3	--	--
Other selachii	--	--	--	--
Total catch (kg)	331	685	930	7029

Haul number		13	14	15	16
Date		June 21	June 21	June 21	June 22
Area	(major, minor)	5E,35	5E,35	5E,35	5E,35
Stratum		Deep Trench	Flats	Deep Trench	Inside Edge
Start time	(PDT)	1508	1720	1831	0813
Duration	(min)	46	30	43	58
Start position					
	N. Lat	54° 17.4'	54° 10.1'	54° 10.5'	54° 03.3'
	W. Long.	133° 30.0'	133° 39.1'	133° 36.5'	133° 33.7'
Finish position					
	N. Lat	54° 16.0'	54° 11.4'	54° 14.2'	54° 04.7'
	W. Long.	133° 33.5'	133° 38.3	133° 35.2'	133° 29.0'
Haul distance	(km)	--	--	--	5.7
	(naut. mi.)	--	--	--	3.1
Direction	(° True)	210	028	015	063
Bottom depth	(m)	308-302	295-297	329-324	305-279
	(fm)	168-165	161-162	180-177	167-153
Modal depth	(m)	305	296	327	292
Gear type		BT	BT	BT	BT
Total catch	(kg)	2535	196	306	1218
Remarks		Usable	Usable	Usable	Usable

Haul number	13	14	15	16
Date	June 21	June 21	June 21	June 22
Area (major, minor)	5E,35	5E,35	5E,35	5E,35
Stratum	Deep	Flats	Deep	Inside Edge
Arrowtooth flounder	Trace	6	Trace	129
Dover sole	--	--	17	Trace
Pacific halibut	40	Trace	7	Trace
Petrale sole	--	--	--	5
Rex sole	Trace	3	8	14
Other flatfish	--	--	--	--
Sebastes aleutianus	--	--	1	--
S. alutus	1959	135	167	325
S. babcocki	--	6	1	10
S. borealis	--	--	--	--
S. brevispinis	141	24	11	530
S. ciliatus	--	--	--	--
S. crameri	--	--	--	--
S. entomelas	--	1	--	--
S. helvomaculatus	Trace	4	1	5
S. paucispinis	--	--	--	38
S. proriger	--	1	--	Trace
S. reedi	242	--	--	5
S. ruberrimus	--	--	--	--
S. variegatus	--	--	Trace	--
S. zacentrus	--	1	--	Trace
Sebastolobus alascanus	71	16	54	Trace
Other rockfish	--	--	Trace	Trace
Grenadiers	--	--	--	--
Lingcod	20	--	--	--
Pacific cod	--	--	--	138
Pacific hake	--	Trace	--	--
Sablefish	20	--	23	--
Walleye pollock	--	--	3	10
Other roundfish	Trace	Trace	--	--
Longnose skate	--	--	--	--
Spiny dogfish	--	--	--	5
Spotted ratfish	--	--	--	5
Other selachii	--	--	--	--
Total catch (kg)	2535	196	306	1218

Haul number		17	18	19	20
Date		June 22	June 22	June 22	June 22
Area	(major, minor)	5E,35	5E,35	5E,35	5E,35
Stratum		Inside Edge	Inside Edge	Inside Edge	Deep Trench
Start time	(PDT)	0950	1212	1350	1530
Duration	(min)	44	60	60	60
Start position					
	N. Lat	54° 05.5'	54° 06.9'	54° 04.8'	54° 03.8'
	W. Long.	133° 26.7'	133° 24.6'	133° 29.7'	133° 34.5'
Finish position					
	N. Lat	54° 07.2'	54° 05.4'	54° 03.4'	54° 02.9'
	W. Long.	133° 23.5'	133° 28.3'	133° 33.8'	133° 38.8'
Haul distance	(km)	4.6	5.2	5.0	--
	(naut. mi.)	2.5	2.8	2.7	--
Direction	(° True)	047	240	250	270
Bottom depth	(m)	277-268	324	324-320	349-346
	(fm)	151-147	177	177-175	191-189
Modal depth	(m)	273	324	322	348
Gear type		BT	BT	BT	BT
Total catch	(kg)	1385	288	177	1367
Remarks		Usable	Usable	Usable	Usable

Haul number	17	18	19	20
Date	June 22	June 22	June 22	June 22
Area (major, minor)	5E,35	5E,35	5E,35	5E,35
Stratum	Inside Edge	Inside Edge	Inside Edge	Deep
Arrowtooth flounder	1049	155	28	Trace
Dover sole	13	11	3	Trace
Pacific halibut	--	2	--	--
Petrale sole	Trace	--	--	--
Rex sole	Trace	25	4	--
Other flatfish	Trace	--	Trace	--
Sebastes aleutianus	--	--	--	--
S. alutus	93	61	94	1245
S. babcocki	Trace	7	3	22
S. borealis	--	--	--	--
S. brevispinis	143	15	22	--
S. ciliatus	--	--	--	--
S. crameri	--	--	--	--
S. entomelas	--	--	--	--
S. helvomaculatus	--	--	Trace	11
S. paucispinis	--	--	--	--
S. proriger	--	--	--	--
S. reedi	--	1	1	Trace
S. ruberrimus	--	--	--	--
S. variegatus	--	--	--	--
S. zacentrus	--	Trace	--	Trace
Sebastolobus alascanus	--	9	15	61
Other rockfish	Trace	--	--	--
Grenadiers	--	--	--	--
Lingcod	42	--	6	--
Pacific cod	46	--	--	--
Pacific hake	--	--	--	--
Sablefish	--	--	--	Trace
Walleye pollock	Trace	1	1	--
Other roundfish	--	Trace	Trace	--
Longnose skate	--	--	--	--
Spiny dogfish	Trace	--	--	--
Spotted ratfish	--	Trace	Trace	--
Other selachii	--	--	--	--
Total catch (kg)	1385	288	177	1367

Haul number		21	22	23	24
Date		June 22	June 23	June 23	June 23
Area	(major, minor)	5E,35	5E,35	5E,35	5E,35
Stratum		Outer Lower	Outer Upper	Outer Upper	Outer Upper
Start time	(PDT)	1747	0817	0943	1100
Duration	(min)	57	45	45	45
Start position					
	N. Lat	54° 03.8'	54° 17.1'	54° 16.8'	54° 13.5'
	W. Long.	133° 41.7'	133° 46.9'	133° 47.3'	133° 47.1'
Finish position					
	N. Lat	54° 01.4'	54° 19.4'	54° 14.7'	54° 11.3'
	W. Long.	133° 38.3'	133° 47.1'	133° 46.2'	133° 45.4'
Haul distance	(km)	--	4.3	4.1	4.4
	(naut. mi.)	--	2.3	2.2	2.4
Direction	(° True)	000	357	162	156
Bottom depth	(m)	529-533	227	251	279-264
	(fm)	289-291	124	137	153-144
Modal depth	(m)	531	--	--	272
Gear type		BT	BT	BT	BT
Total catch	(kg)	1202	1617	590	1580
Remarks		Usable	Usable	Usable	Usable

Haul number	21	22	23	24
Date	June 22	June 23	June 23	June 23
Area (major, minor)	5E,35	5E,35	5E,35	5E,35
Stratum	Outside Lower	Outside Upper	Outside Upper	Outside Upper
Arrowtooth flounder	24	Trace	4	7
Dover sole	47	--	Trace	--
Pacific halibut	--	Trace	16	Trace
Petrale sole	--	--	--	7
Rex sole	4	Trace	--	--
Other flatfish	--	--	--	--
Sebastes aleutianus	59	--	--	--
S. alutus	8	52	11	1337
S. babcocki	--	--	--	Trace
S. borealis	94	--	--	--
S. brevispinis	--	131	2	74
S. ciliatus	--	--	--	--
S. crameri	--	--	--	--
S. entomelas	--	--	--	--
S. helvomaculatus	--	7	--	--
S. paucispinis	--	--	--	--
S. proriger	--	33	481	--
S. reedi	--	Trace	--	--
S. ruberrimus	--	--	--	--
S. variegatus	--	85	4	--
S. zacentrus	--	1296	71	142
Sebastolobus alascanus	110	Trace	--	--
Other rockfish	--	--	--	--
Grenadiers	94	--	--	--
Lingcod	--	--	--	--
Pacific cod	--	13	--	14
Pacific hake	--	--	--	--
Sablefish	762	--	--	--
Walleye pollock	--	--	--	--
Other roundfish	--	--	--	--
Longnose skate	--	--	--	--
Spiny dogfish	--	--	--	--
Spotted ratfish	--	--	--	--
Other selachii	--	--	--	--
Total catch (kg)	1202	1617	590	1580

Haul number		25	26	27	28
Date		June 23	June 23	June 23	June 24
Area	(major, minor)	5E,35	5E,35	5E,35	5E,35
Stratum		Outer Lower	Outer Lower	Outer Lower	Flats
Start time	(PDT)	1258	1530	1749	0814
Duration	(min)	60	10	33	60
Start position					
	N. Lat	54° 11.4'	54° 12.4'	54° 13.1'	54° 20.0'
	W. Long.	133° 45.6'	133° 46.6'	133° 47.6'	133° 41.9'
Finish position					
	N. Lat	54° 14.3'	54° 12.0'	54° 11.7'	54° 17.1'
	W. Long.	133° 47.5'	133° 46.3'	133° 46.8'	133° 42.6'
Haul distance	(km)	5.2	--	--	5.4
	(naut. mi.)	2.8	--	--	2.9
Direction	(° True)	310	170	000	188
Bottom depth	(m)	284-313	311	357	246-251
	(fm)	155-171	170	195	135-137
Modal depth	(m)	299	311	357	249
Gear type		BT	BT	BT	BT
Total catch	(kg)	6873	0	285	224
Remarks		Usable	Snagged: No Sample	Snagged but usable	Usable

Haul number	25	26	27	28
Date	June 23	June 23	June 23	June 24
Area (major, minor)	5E,35	5E,35	5E,35	5E,35
Stratum	Outer Lower	Outer Lower	Outer Lower	Flats
Arrowtooth flounder	27	--	12	18
Dover sole	--	--	3	Trace
Pacific halibut	Trace	--	--	Trace
Petrale sole	--	--	--	2
Rex sole	Trace	--	Trace	1
Other flatfish	--	--	--	--
Sebastes aleutianus	--	--	127	--
S. alutus	6417	--	72	70
S. babcocki	134	--	1	1
S. borealis	--	--	20	--
S. brevispinis	107	--	--	8
S. ciliatus	--	--	--	--
S. crameri	--	--	--	--
S. entomelas	--	--	--	1
S. helvomaculatus	--	--	Trace	1
S. paucispinis	--	--	--	--
S. proriger	--	--	--	1
S. reedi	--	--	--	--
S. ruberrimus	--	--	--	--
S. variegatus	--	--	--	--
S. zacentrus	161	--	Trace	115
Sebastolobus alascanus	27	--	30	1
Other rockfish	--	--	--	--
Grenadiers	--	--	--	--
Lingcod	--	--	--	2
Pacific cod	--	--	--	--
Pacific hake	--	--	--	--
Sablefish	Trace	--	6	3
Walleye pollock	Trace	--	--	Trace
Other roundfish	--	--	Trace	Trace
Longnose skate	--	--	14	--
Spiny dogfish	--	--	--	--
Spotted ratfish	--	--	--	--
Other selachii	--	--	--	--
Total catch (kg)	6873	0	285	224

Haul number		29	30	31	32
Date		June 24	June 24	June 24	June 24
Area	(major, minor)	5E,35	5E,35	5E,35	5E,35
Stratum		Flats	Outer Lower	Flats	Flats
Start time	(PDT)	0939	1215	1318	1520
Duration	(min)	60	45	21	40
Start position					
	N. Lat	54° 15.7'	54° 10.5'	54° 14.5'	54° 17.3'
	W. Long.	133° 42.8'	133° 40.9'	133° 40.0'	133° 35.1'
Finish position					
	N. Lat	54° 12.6'	54° 12.2'	54° 15.4'	54° 19.1'
	W. Long.	133° 43.0'	133° 40.8'	133° 39.5'	133° 33.4'
Haul distance	(km)	5.7	3.3	--	--
	(naut. mi.)	3.1	1.8	--	--
Direction	(° True)	182	010	010	000
Bottom depth	(m)	255-244	259-264	268	275-264
	(fm)	139-133	142-144	147	150-144
Modal depth	(m)	250	262	268	270
Gear type		BT	BT	BT	BT
Total catch	(kg)	1172	1576	0	984
Remarks		Usable	Usable	Snagged: No sample	Usable

Haul number	29	30	31	32
Date	June 24	June 24	June 24	June 24
Area (major, minor)	5E,35	5E,35	5E,35	5E,35
Stratum	Flats	Outer Lower	Flats	Flats
Arrowtooth flounder	24	7	--	22
Dover sole	Trace	--	--	Trace
Pacific halibut	Trace	Trace	--	112
Petrale sole	Trace	--	--	--
Rex sole	Trace	7	--	9
Other flatfish	--	--	--	--
Sebastes aleutianus	--	--	--	--
S. alutus	671	1145	--	635
S. babcocki	Trace	--	--	Trace
S. borealis	--	--	--	--
S. brevispinis	29	121	--	39
S. ciliatus	--	--	--	--
S. crameri	--	--	--	--
S. entomelas	--	--	--	--
S. helvomaculatus	15	Trace	--	9
S. paucispinis	--	--	--	--
S. proriger	97	Trace	--	Trace
S. reedi	--	--	--	121
S. ruberrimus	--	--	--	--
S. variegatus	Trace	--	--	--
S. zacentrus	336	283	--	17
Sebastolobus alascanus	Trace	7	--	9
Other rockfish	--	--	--	--
Grenadiers	--	--	--	--
Lingcod	--	--	--	--
Pacific cod	--	--	--	--
Pacific hake	--	--	--	--
Sablefish	--	--	--	13
Walleye pollock	--	--	--	--
Other roundfish	Trace	--	--	Trace
Longnose skate	--	--	--	--
Spiny dogfish	--	--	--	--
Spotted ratfish	--	7	--	--
Other selachii	--	--	--	--
Total catch (kg)	1172	1576	0	984

Haul number		33	34	35	36
Date		June 24	June 25	June 25	June 25
Area	(major, minor)	5E,35	5E,35	5E,35	5E,35
Stratum		Rock Pile	Deep Trench	Rock Pile	Rock Pile
Start time	(PDT)	1715	0825	1011	1226
Duration	(min)	14	60	60	75
Start position					
	N. Lat	54° 19.1'	54° 21.8'	54° 18.6'	54° 18.9'
	W. Long.	133° 25.2'	133° 22.2'	133° 27.4'	133° 25.0'
Finish position					
	N. Lat	54° 19.2'	54° 19.0'	54° 19.8'	54° 22.5'
	W. Long.	133° 24.2'	133° 24.5'	133° 23.1'	133° 23.0'
Haul distance	(km)	--	5.7	5.2	8.0
	(naut. mi.)	--	3.1	2.8	4.3
Direction	(° True)	090	205	064	050
Bottom depth	(m)	208-328	316-395	270-313	199-262
	(fm)	114-179	173-216	148-171	109-143
Modal depth	(m)	268	356	292	231
Gear type		BT	BT	BT	BT
Total catch	(kg)	3007	821	312	1238
Remarks		Usable	Usable	Usable	Usable

Haul number	33	34	35	36
Date	June 24	June 25	June 25	June 25
Area (major, minor)	5E,35	5E,35	5E,35	5E,35
Stratum	Rock Pile	Deep	Rock Pile	Rock Pile
Arrowtooth flounder	--	Tracerench	1	20
Dover sole	--	--	1	Trace
Pacific halibut	--	--	--	--
Petrale sole	--	--	--	--
Rex sole	--	Trace	Trace	Trace
Other flatfish	--	--	--	--
Sebastes aleutianus	--	13	Trace	--
S. alutus	--	314	62	597
S. babcocki	34	33	4	49
S. borealis	--	43	149	--
S. brevispinis	529	3	7	49
S. ciliatus	--	--	11	--
S. crameri	--	--	--	--
S. entomelas	--	--	--	5
S. helvomaculatus	Trace	3	Trace	--
S. paucispinis	--	--	--	--
S. proriger	11	7	2	5
S. reedi	912	85	22	291
S. ruberrimus	56	--	3	--
S. variegatus	113	--	2	Trace
S. zacentrus	1351	Trace	33	84
Sebastolobus alascanus	--	281	13	44
Other rockfish	--	--	--	--
Grenadiers	--	--	--	--
Lingcod	--	Trace	1	69
Pacific cod	--	26	--	--
Pacific hake	--	Trace	--	--
Sablefish	--	Trace	--	--
Walleye pollock	--	Trace	--	Trace
Other roundfish	--	Trace	Trace	Trace
Longnose skate	--	--	--	25
Spiny dogfish	--	--	1	--
Spotted ratfish	--	--	--	Trace
Other selachii	--	--	--	--
Total catch (kg)	3007	821	312	1238

Haul number		37	38	39	40
Date		June 25	June 25	June 26	June 26
Area	(major, minor)	5E,35	5E,35	5E,35	5E,35
Stratum		Deep Trench	Deep Trench	Outer Upper	Outer Lower
Start time	(PDT)	1519	1735	0828	1010
Duration	(min)	60	59	62	60
Start position					
	N. Lat	54° 15.2'	54° 10.2'	54° 09.5'	54° 07.6'
	W. Long.	133° 30.1'	133° 33.7'	133° 42.9'	133° 42.1'
Finish position					
	N. Lat	54° 12.6'	54° 07.0'	54° 06.6'	54° 10.1'
	W. Long.	133° 32.5'	133° 34.8'	133° 40.8'	133° 44.0'
Haul distance	(km)	--	--	5.9	5.0
	(naut. mi.)	--	--	3.2	2.7
Direction	(° True)	210	180	157	336
Bottom depth	(m)	354-358	358-363	266-288	383-299
	(fm)	194-196	196-198	145-157	209-163
Modal depth	(m)	356	361	277	341
Gear type		BT	BT	BT	BT
Total catch	(kg)	5	610	13	3170
Remarks		Usable	Usable	Usable	Usable

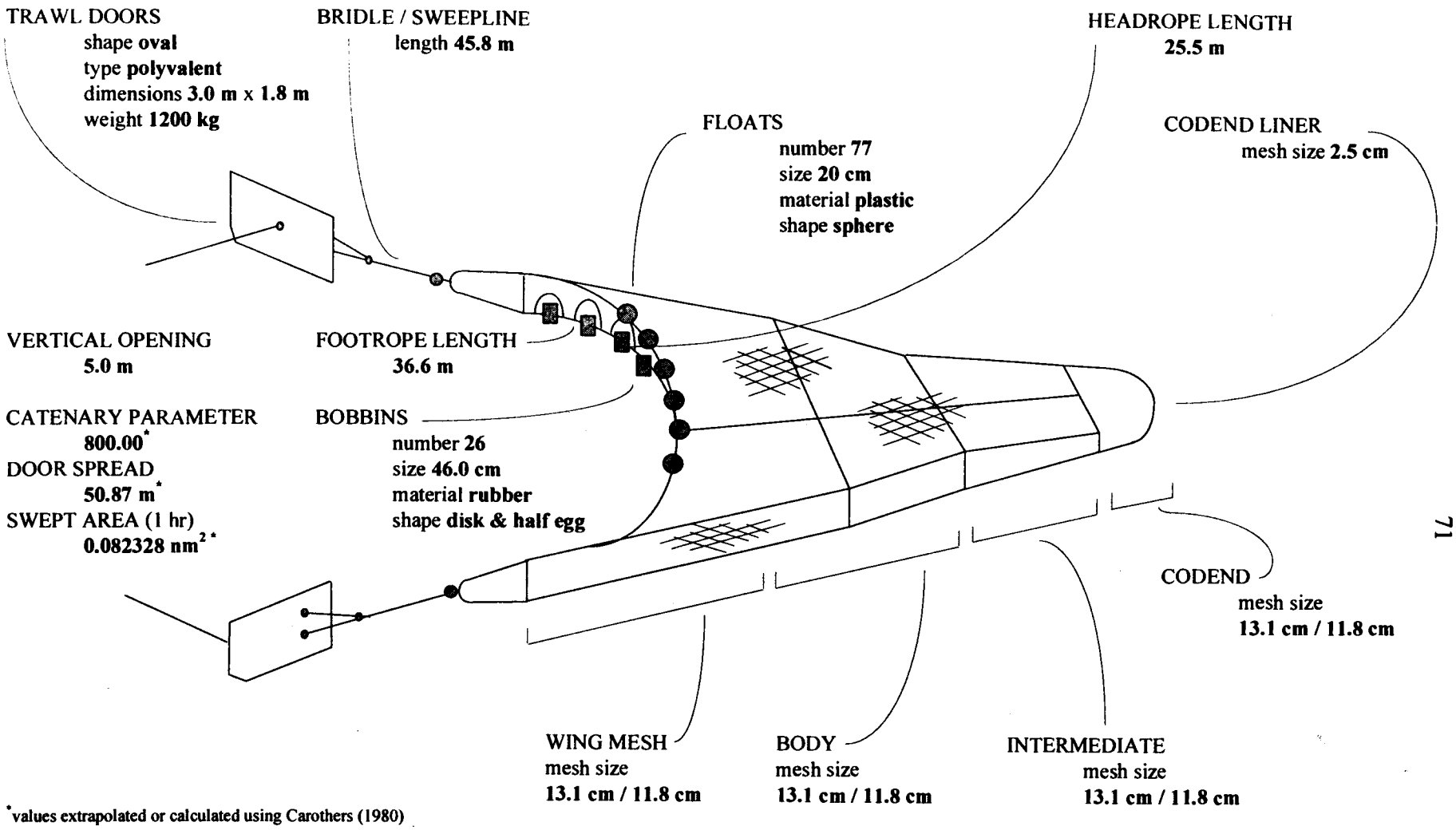
Haul number	37	38	39	40
Date	June 25	June 25	June 26	June 26
Area (major, minor)	5E,35	5E,35	5E,35	5E,35
Stratum	Deep	Deep	Outer Upper	Outer Lower
Arrowtooth flounder	Trace	Trace	1	Trace
Dover sole	--	10	--	26
Pacific halibut	--	Trace	--	--
Petrale sole	--	--	--	--
Rex sole	Trace	24	--	--
Other flatfish	--	--	--	--
Sebastes aleutianus	Trace	--	--	898
S. alutus	2	148	10	1955
S. babcocki	--	5	Trace	40
S. borealis	--	24	--	106
S. brevispinis	--	10	--	--
S. ciliatus	--	--	--	--
S. crameri	--	2	--	13
S. entomelas	--	--	--	--
S. helvomaculatus	--	Trace	--	13
S. paucispinis	--	--	--	--
S. proriger	--	--	--	--
S. reedi	--	--	--	--
S. ruberrimus	--	--	--	--
S. variegatus	--	--	--	--
S. zacentrus	Trace	Trace	1	53
Sebastolobus alascanus	Trace	231	Trace	40
Other rockfish	--	--	--	--
Grenadiers	--	--	--	--
Lingcod	--	--	--	--
Pacific cod	--	--	--	--
Pacific hake	--	--	--	--
Sablefish	--	104	1	26
Walleye pollock	--	--	--	--
Other roundfish	--	Trace	--	Trace
Longnose skate	--	--	--	--
Spiny dogfish	--	--	--	--
Spotted ratfish	--	--	--	--
Other selachii	--	--	--	--
Total catch (kg)	5	610	13	3170

Haul number		41	42	43	44
Date		June 26	June 26	June 27	June 27
Area	(major, minor)	5E,35	5E,35	5E,35	5E,35
Stratum		Flats	Flats	Rock Pile	Flats
Start time	(PDT)	1327	1444	0933	1325
Duration	(min)	27	32	28	60
Start position					
	N. Lat	54° 17.4'	54° 17.7'	54° 21.5'	54° 25.2'
	W. Long.	133° 34.7'	133° 33.1'	133° 22.9'	133° 28.1'
Finish position					
	N. Lat	54° 17.8'	54° 18.2'	54° 20.0'	54° 22.9'
	W. Long.	133° 32.2'	133° 30.3'	133° 22.3'	133° 24.0'
Haul distance	(km)	3.0	3.5	2.8	9.3
	(naut. mi.)	1.6	1.9	1.5	5.0
Direction	(° True)	075	075	167	130
Bottom depth	(m)	275	279-275	231-445	262
	(fm)	150	153-150	126-243	143
Modal depth	(m)	--	277	338	--
Gear type		BT	BT	BT	BT
Total catch	(kg)	1243	769	4567	1737
Remarks		Usable	Usable	Usable	Usable

Haul number	41	42	43	44
Date	June 26	June 26	June 27	June 27
Area (major, minor)	5E,35	5E,35	5E,35	5E,35
Stratum	Flats	Flats	Rock Pile	Flats
Arrowtooth flounder	5	10	18	29
Dover sole	--	--	--	7
Pacific halibut	Trace	Trace	Trace	--
Petrale sole	--	--	--	--
Rex sole	Trace	Trace	--	15
Other flatfish	--	--	--	--
Sebastes aleutianus	5	Trace	--	7
S. alutus	830	610	347	618
S. babcocki	Trace	3	73	--
S. borealis	--	--	--	--
S. brevispinis	39	27	219	177
S. ciliatus	10	--	Trace	--
S. crameri	--	--	--	--
S. entomelas	29	--	--	--
S. helvomaculatus	Trace	Trace	--	15
S. paucispinis	--	--	--	--
S. proriger	--	--	256	Trace
S. reedi	295	67	749	751
S. ruberrimus	--	--	--	--
S. variegatus	--	--	--	Trace
S. zacentrus	--	Trace	2905	59
Sebastolobus alascanus	15	27	Trace	59
Other rockfish	--	--	--	--
Grenadiers	--	--	--	--
Lingcod	--	--	Trace	--
Pacific cod	--	7	Trace	--
Pacific hake	--	--	--	--
Sablefish	15	13	--	--
Walleye pollock	--	3	Trace	--
Other roundfish	--	Trace	--	Trace
Longnose skate	--	--	--	--
Spiny dogfish	--	--	--	--
Spotted ratfish	--	--	--	--
Other selachii	--	--	--	--
Total catch (kg)	1243	769	4567	1737

Appendix Table 3. Common and scientific names of fishes collected aboard the *R/V W.E. RICKER*, Langara survey, June 19-30, 1993.

Rockfish	Rougheye rockfish	*Sebastes aleutianus*
	Pacific ocean perch	*S. alutus*
	Redbanded rockfish	*S. babcocki*
	Shortraker rockfish	*S. borealis*
	Silvergray rockfish	*S. brevispinis*
	Dusky rockfish	*S. ciliatus*
	Darkblotched rockfish	*S. crameri*
	Widow rockfish	*S. entomelas*
	Rosethorn rockfish	*S. helvomaculatus*
	Bocaccio	*S. paucispinis*
	Redstripe rockfish	*S. proriger*
	Yellowmouth rockfish	*S. reedi*
	Yelloweye rockfish	*S. ruberrimus*
	Harlequin rockfish	*S. variegatus*
	Sharpchin rockfish	*S. zacentrus*
	Shortspine thornyhead	*Sebastolobus alascanus*
Flatfish	Arrowtooth flounder	*Atheresthes stomias*
	Petrale sole	*Eopsetta jordani*
	Rex sole	*Errex zachirus*
	Pacific halibut	*Hippoglossus stenolepis*
	Dover sole	*Microstomus pacificus*
Roundfish	Sablefish	*Anoplopoma fimbria*
	Pacific cod	*Gadus macrocephalus*
	Pacific hake	*Merluccius productus*
	Lingcod	*Ophiodon elongatus*
	Walleye pollock	*Theragra chalocogramma*
Selachii	Spotted ratfish	*Hydrolagus colliei*
	Longnose skate	*Raja rhina*
	Spiny dogfish	*Squalus acanthias*



*values extrapolated or calculated using Carothers (1980)

Appendix Figure 1. Net dimensions and characteristics for bottom trawl net Atlantic Western IIIa, *R/V W.E. RICKER*, Langara survey, June 19-30, 1993.