Hook and Line Survey of Lingcod (*Ophiodon elongatus*) and Rockfish (*Sebastes sp.*) Stocks in Southern Strait of Georgia (Statistical Areas 17, 18 and 19) October 2003

D.R. Haggarty and J.R. King

Fisheries and Oceans Canada
Science Branch, Pacific Region
Pacific Biological Station
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HOOK AND LINE SURVEY OF LINGCOD (*Ophiodon elongatus)* AND ROCKFISH *(Sebastes sp.)* STOCKS IN SOUTHERN STRAIT OF GEORGIA (STATISTICAL AREAS 17, 18 AND 19) OCTOBER 2003

By

D.R. Haggarty and J.R. King

Fisheries and Oceans Canada
Science Branch, Pacific Region
Pacific Biological Station
Nanaimo, B.C.
V9T 6N7

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ABSTRACT

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Research fishing methods using handline gear were developed in 1985 to assess near shore reef fish abundance. Several handline surveys for rockfishes and lingcod were subsequently completed between 1985 and 1993. Historical catch per unit of effort (CPUE) data is therefore available in parts of Statistical Areas 18 and 19 from 1993, and part of Statistical Area 17 from 1985, 1987 and 1988. Between October 6-31, 2003, we revisited the sites sampled in previous surveys using similar gear and methodology and compared current to historical catch rates. This survey included new sites in the Nanaimo region of Statistical Area 17 as well as in the Southern Gulf Islands (Statistical Area 18). There were no significant differences in median lingcod catch rates in Statistical Areas 18-19 between 1993 and 2003. Median lingcod catch rates in Statistical Area 17 improved from 1987-88 and were comparable to CPUE data from 1985. Dramatic declines in copper and quillback rockfish median CPUE were observed in all Statistical Areas. We found no difference in median lingcod CPUE between depth strata sampled (0-25 m and 26-50 m) or among Statistical Areas in the 2003 survey. This report details CPUE as well as the biological data collected

RÉSUMÉ

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Il a été élaboré en 1985 des méthodes de pêche à la ligne à main dans le but d'évaluer l'abondance de poissons de récifs à proximité du littoral. Par la suite, plusieurs relevés de sébastes et de morue-lingue ont été effectués entre 1985 et 1993 au moyen de lignes à main. C'est ainsi que l'on dispose de données historiques sur les prises par unité d'effort (PPUE) dans certaines parties des secteurs statistiques 18 et 19, pour l'année 1993, et dans une partie du secteur statistique 17, pour les années 1985, 1987 et 1988. Du 6 au 31 octobre 2003, nous avons effectué des relevés aux endroits échantillonnés précédemment, en utilisant des engins et une méthodologie similaires et nous avons comparé les taux de capture obtenus aux taux de capture passés. Ce relevé a porté sur de nouveaux points dans la région de Nanaimo du secteur statistique 17 ainsi que dans les îles du sud du golfe (secteur statistique 18). Nous n'avons relevé aucun écart significatif des taux de capture médians de morue-lingue dans les secteurs statistiques 18 et 19, entre 1993 et 2003. Les taux de capture médians de morue-lingue dans le secteur statistique 17 se sont améliorés depuis 1987-1988 et sont comparables aux PPUE de 1985. Nous avons observé des diminutions marquées des PPUE médianes de sébaste cuivré et de sébaste à dos épineux dans tous les secteurs statistiques. Nous n'avons constaté aucune différence dans les PPUE médianes de morue-lingue entre les strates de profondeur échantillonnées (0-25 m et 26-50 m) ni entre les secteurs statistiques, lors du relevé de 2003. Le présent rapport fait état des PPUE et des données biologiques recueillies.

INTRODUCTION

Lingcod, *Ophiodon elongatus*, populations in the Strait of Georgia have been depressed for several decades (Richards and Hand 1989; King 2001). The commercial fishery was closed in 1991. The recreational fishery, prior to 2002, was subject to regulations including an eight month winter non-retention period to protect nest guarding males, non-retention of fish less than 65 cm, a one per day bag limit, and an annual catch limits of 10 lingcod per year. In 2002, the recreational fishery was closed for the retention of lingcod as an additional measure to protect this stock (King and Surry 2000).

A stock assessment framework for lingcod (*Ophiodon elongatus*) recommended development of fishery independent sources of relative abundance to monitor changes in the Strait of Georgia lingcod population (King *et al.* 2003). One recommendation was to resume the handline surveys of nearshore reef fishes conducted in 1985, 1987-88 and 1993. In 1985, 1987 and 1988 handline surveys were developed to estimate lingcod catch per unit of effort (CPUE) and conducted in the Gulf Islands Region of Statistical Area 17 (Cass and Richards 1987; Hand and Richards 1987; Hand and Richards 1989). Fishing was conducted in November and December of 1985; and December to February in 1987 and 1988. The survey area was divided into 1 min latitude by 1 min longitude blocks, and those blocks encompassing known lingcod fishing areas were identified. Ten blocks were randomly selected and used as the fishing sites for the survey. Fishing at each site was stratified by depth: 10-25 m; 26-45 m; and 46-55 m. In 1993, a handline survey for lingcod was conducted in Statistical Areas 18 and 19 during three sampling periods, June, August and October (Yamanaka and Murie 1995). Ten fishing sites were identified by fishermen as sites with frequent lingcod catches and another ten sites were randomly selected from 1 minute latitude by 1 minute longitude blocks that encompassed rocky habitat. Fishing events were stratified by depth: 0-25 m and 25-50 m. Effort was measured as the sum of fishing time for each angler.

In all surveys, lingcod CPUE decreased as depth increased (Cass and Richards 1987, Yamanaka and Murie 1995). In 1993, lingcod catch rates were highest in October, though the difference in CPUE was not significant (Yamanaka and Murie 1995).

A handline survey was conducted in October 2003 in Statistical Areas 17, 18 and 19. Sites sampled in previous surveys were sampled in 2003 and additional sites were selected in the Nanaimo region of Statistical Area 17 as well as in Statistical Areas 18 and 19 to provide even spatial coverage. Nearshore reef fishes such as lingcod, rockfishes (*Sebastes* spp.), kelp greenling (*Hexagrammos decagrammus*), cabezon (*Scorpaenichthys marmoratus*) and spiny dogfish (*Squalus acanthias*) were caught in all survey years. The 2003 lingcod survey provides an estimate of relative abundance for these species, particularly copper rockfish (*S. caurinus*) and quillback rockfish (*S. maliger*) as well.

METHODS

The vessel used as a platform for fishing is a 6.7 m aluminium "Lifetimer" boat equipped with twin 115-horse power engines, a depth sounder and a GPS. Fishing was conducted using the handline survey methodology developed by Richards *et al.* (1985) and Richards and Cass (1985).The fishing crew consisted of four to five research personnel, with three or four people fishing at a time. We used Zebco® Rhino® rods with Rhino® RBCXL or Shakespeare ® Tidewater ® 30LCL reels, rigged with 30 lb (13.6 kg) test mono-filament line with 25 lb (11.3 kg) test leaders. Two single Mustad #92553 size 3/0 hooks with a 6-cm spacing were used on each line. The line was separated from the leader and hooks using a large (50.8 cm or 20 inch) spreader bar with a 170 g (6 oz) mooching weight. As in previous surveys, 12-cm frozen herring were used as bait. Herring were hooked through the snout and near the dorsal fin. Previous surveys used 9-kg test mono-filament with a 7-kg leader. We used stronger line than previous surveys in order to increase our chances of landing larger lingcod. Another modification of the research methodology was the use of the spreader bar. Hook size and spacing, bait type and size, and the 170 g (6 oz) mooching weight were all consistent among surveys.

Sampling sites surveyed in 1985, 1987, 1988 and 1993 were revisited (Figure 1). Historical sites were chosen using a stratified random design. All sites represented areas of presumed lingcod (age 2+) habitat. In October of 1993, 14 sites were sampled in Statistical Areas 18 and 19. Two of these sites are now Rockfish Conservation Areas (RCA) and were therefore not fished. Eleven of the fourteen sites were re-visited. Eight of ten sites in Statistical Area 17 that were sampled in the fall or winter of 1985, 1987 and 1988 were also revisited. One site, Hidden Reef, could not be located, and another, Porlier Pass, could not be fished due to strong currents.

New sampling sites were chosen in order to extend the spatial coverage of the survey. These sites were selected for their geographic location and without *a-priori* knowledge of reef fish abundance. All sites consisted of rocky reefs of appropriate depths as indicated on nautical charts. We also tried to target areas adjacent to Rockfish Conservation Areas (RCAs). Two new sites adjacent to RCAs were selected for monitoring and at least two other historical sites were in close proximity to RCAs. An additional 11 sites in Statistical Area 17 near Nanaimo and Ladysmith were also sampled. In total, we sampled 7 sites in Statistical Area 19, 10 sites in Statistical Area 18, and 19 in Statistical Area 17. Two depth strata per site were sampled (1=0-25 m, 2=26-50 m). Because lingcod CPUE decreased with depth in all previous hook and line studies, and since we wanted to reduce the bycatch of yelloweye (*S. rubberimus*) and quillback rockfish (*S. maliger*), we did not sample a third depth strata. Seventeen depth strata-site combinations were sampled on more than one occasion to assess fisher bias (improvement with time).

Similar to previous studies, fishing effort was defined as the total fishing time of all fishers. Each fisher kept track of their fishing time using a digital stop watch strapped to the butt of the rod and represented the time the bait was on or near the bottom. Fishing time started when the fishing gear touched the bottom and stopped whenever a fish was hooked, there was a bite, the gear become fouled on the bottom, or the line was reeled in.

Each site and depth strata was fished for a total of 60 minutes. We would adjust our position within the site if no fish were caught within 10 minutes, if we felt we were no longer in appropriate lingcod habitat, or if we were no longer within the depth stratum. Variables recorded for each set included weather conditions, tide, currents, sea state and the minimum, maximum and medium depths encountered. We stopped fishing if currents were too strong for fishing to be effective.

A catch was recorded if the fish was brought to the surface and could be identified to species. Lingcod, rockfishes and kelp greenling were sampled for fork length (mm), weight (g), sex, and stage of maturity. Fin rays of lingcod and otoliths of rockfishes were collected for age estimation. Fin rays, otoliths and scales of kelp greenling were also collected to develop ageing methodology.

ANALYSIS

Catch Per Unit of Effort (CPUE) was calculated as the number of fish per hour for total fish catches (all species together), lingcod, copper rockfish and quillback rockfish. Effort was taken as the total fishing time of all fishers.

Species CPUE were also calculated for each fisher in order to investigate bias among fishers as well as bias over time. For the sites that were sampled on more than one occasion, fisher bias was investigated using the repeated sites as pairs in a two-tailed Wilcoxon Signed Rank Test (non-parametric paired-t test). A significant result could indicate a possible bias due to changes or improvements in fishing technique. Differences among fishers were also investigated using the Kruskal Wallis test (non-parametric ANOVA). All analyses were performed using Statistix version 7.0 software.

Differences in median CPUE between sites, depth strata and conditions (tide, current, time of day, and weather) were also analysed by the Kruskal-Wallis test (non-parametric ANOVA) or Mann-Whitney test (non-parametric t-test).

CPUE were compared between years using the Kruskal-Wallis test or Mann-Whitney test. If other variables (such as depth) significantly influenced any of the data, effects of these variables were taken into consideration either by using them as a co-variate in a rank-transformed ANOVA, or by limiting data analysis to certain depth strata.

In Statistical Area 17, there were no significant differences between months in lingcod CPUE in the 1985, 1987 or 1988 data sets, so data from November through February were pooled. These surveys also included deeper depth strata. Records deeper than 55 metres were excluded from the analysis.

Male and female lingcod lengths were compared using an ANOVA. Difference in lingcod length between depth strata and among years was investigated with an ANCOVA with sex as a co-variate. We estimated the relationship between lingcod length and weight for male and female lingcod using a non-linear least squares function ($y = ax^b$).

RESULTS

We sampled thirty-six sites from October 6-October 31, 2003. Sampling site locations are shown in Figure 1. We repeated the shallow depth strata on two separate occasions at 10 sites, and the deep strata at 7 sites (Table 1). We fished for a total of 92.7 hours over the entire survey. Fifty-one hours were spent fishing in Statistical Area 17, 20 hours in Statistical Area 18 and 22 hours in Statistical Area 19. Data for each set are reported in Appendix Table 1. Appendix Table 2 shows the catch and effort data for each set including the effort by each fisher. Length, weight, sex and stage of maturity data for lingcod, copper rockfish (*Sebastes caurinus*) and quillback rockfish (*Sebastes maliger*) are presented in Appendix Table 3.

CATCH RATES

We calculated total catch per unit of effort (TCPUE) and lingcod catch per unit of effort (LCPUE) for each site and depth strata (Table 1). We did not find bias in the TCPUE for any fisher when we compared catch rates at sites that were re-sampled (Table 2). This suggests that catch rates were not influenced by fishing technique over time. Similarly, we compared the total and lingcod CPUEs among the four primary fishers and found no significant differences in catch rates, indicating that the individual CPUEs are comparable. Therefore, further analyses were done using the cumulative CPUEs and not individual fisher CPUEs.

Lingcod median catch rates did not differ between the two depth strata, nor did they differ among sites or Statistical Areas (Table 3, Figure 2, and Figure 3). Current, tide and sea state did not appear to affect median catch rates (Table 3); however, we did not fish in high currents. The time of day did seem to affect catch rates as a significant difference was observed with more fish being caught in the late afternoon/evening (approximately 4 pm) (Table 3). Relatively few sets (only 5) were completed at this time due to falling daylight.

Since sites in Statistical Areas 18 and 19 were sampled in 1993 and sites in Statistical Area 17 were sampled in 1985, 1987 and 1988, we could only investigate temporal changes between 1993 and 2003 in Statistical Areas 18-19, and 1985, 1987, 1988 and 2003 in Statistical Area 17. We only used October data from the 1993 survey in Statistical Areas 18-19. There was no significant difference in 2003 lingcod catch rates in Statistical Areas 18-19 as compared to the 1993 survey data (Table 4, Figure 4a). Significant differences do exist in Statistical Area 17 when the 2003 data are compared to data from the surveys in 1985, 1988 and 1987. A post-hoc comparison revealed that median lingcod CPUE from 1985 and 2003 are significantly higher than catch rates from 1987 and 1988; however, lingcod median CPUE does not differ between 1985 and 2003 (Table 4, Figure 4b).

The total fish CPUE was significantly lower in 2003 for all Statistical Areas. This difference is mainly attributed to differences in the catch of rockfishes. Therefore, we also compared copper and quillback rockfish catch rates among years in Statistical Areas 18 and19, and 17.

Copper rockfish median CPUE varied with depth strata in 1985, 1987, 1988 and 1993, with more fish being caught in shallow stratum. When depth was accounted for by using it as a co-variate, a significant decline in copper rockfish catch rates was apparent in both Statistical Areas (Table 5, Figure 5a and b). Likewise, we found a significant decline in quillback median catch rates in both Statistical Areas over the years (Table 6, Figure 6a and b). Quillback median CPUE was higher in the deep depth stratum in 1993; therefore, we accounted for depth in the analysis for Statistical Areas 18 and 19 by using depth as a covariate in a rank-transformed ANCOVA. Quillback catch rates did not vary between depth strata 1 and 2 in Statistical Area 17 in any year so data from both depth strata were pooled.

BIOLOGICAL DATA

The mean length of male and female lingcod was 53.7 cm and 63.1 cm, respectively (Figure 7). Female lingcod were significantly longer than males (Table 7). There was no relationship between the length of lingcod and the depth caught when sex was used as a covariate (Table 7). The length of lingcod caught did not vary with fisher.

The mean length of lingcod caught in 2003 was also compared to 1993 in Statistical Areas 18 and 19 (Table 8). For Statistical Area 17, only data from 1985 was compared to 2003 due the low catch of lingcod in 1987 and 1988. We did not observe a difference in length between years in any Statistical Area.

The length-weight relationship for male and female lingcod was estimated using a non-linear least squares function ($y = ax^b$). Male and female lingcod exhibit a similar length-weight relationship (Figure 8).

Of the 64 male and 29 female lingcod caught, 72% and 100%, respectively, were immature or maturing (Table 9).

DISCUSSION

Lingcod median catch rates in Statistical Areas 18 and 19 do not differ significantly between 1993 and 2003. If lingcod CPUE does track lingcod abundance, then there appears to be no change in abundance over the last ten years in Statistical Areas 18 and

19. Lingcod research catch rates in 2003 have increased in Statistical Area 17 since the 1987 and 1988 surveys. The median 2003 lingcod catch rates are similar to the 1985 lingcod catch rates. Lingcod stocks in this Statistical Area may have increased to levels comparable to levels in the mid 1980's. Hand and Richards (1989) raised the possibility that the low catches observed in 1987 and 1988, as compared to 1985, were due to seasonal differences since the 1987 and 1988 samples were from December, January and February while 1985 catch rates were from November and December. Although the January and February CPUE data were lower, we did not find a significant difference in catch rates between months in a pair-wise comparison. Seasonal differences may, however, contribute to the low catch rates in 1987 and 1988. Our survey results indicate an improvement over time in lingcod catch rates in Statistical Area 17 but not in 18 and 19. There were, however, no differences in 2003 median lingcod catch rates among the Statistical Areas sampled.

Our catch rates are comparable to previous surveys since the same sampling methodology and fishing gear was used. Although we spent a longer time fishing at each site (a total of 60 minutes versus approximately 20 minutes); all catch rates were standardized to an hour. In addition, if we did not catch any fish within about 10 minutes of fishing, we would adjust our position within the sampling site.

Copper and quillback rockfish catch rates showed statistically significant declines between sampling years in all Statistical Areas. This result may be reflective of rockfish abundance in the Strait of Georgia; however, minor changes to fishing gear and methodology may have affected catch rates.

CPUE data can be used as an index of relative abundance and compared among locations and time. Understanding how CPUE relates to actual abundance of reef fish is, however, not straight-forward (Richards and Schnute 1986). In their comparison of CPUE, as determined by research angling and visual counts from a submersible, Richards and Schnute (1986) found the relationship between CPUE and density was most reliable for the most abundant species. Further investigation concerning how CPUE relates to the density of lingcod and rockfishes should be undertaken in order to explore the relationship between CPUE and density under various abundance levels of the different reef fish species. CPUE at some reference sites could be compared to visual estimates from SCUBA surveys or towed video camera work

Other factors may influence catch rates. Environmental conditions such as tide and weather did not influence our data significantly. Time of day did affect our lingcod catch rates. Lingcod are described as "voracious predators" (Cass *et al.* 1990). Many predatory fishes have been observed to increase feeding rates during low light periods at dawn and dusk (Helfman *et al.* 1997). Lingcod may also display this behaviour. Anecdotal information suggests that moon phase may also affect catch rates. We did not, however, test this factor due to the lack of replication of moon phases.

Bait loss and competition for bait have been shown to affect CPUE in the longline fishery for halibut (*Hippoglossus stenolepis*) (Skud and Hamley 1978). We found that bait loss was higher at some sites than at others and fishers had to check their bait often if bait loss rates were high. We don't feel as though competition for bait among lingcod and other fishes should be high since lingcod are know to be aggressive predators. Competition may be a consideration for other species particularly when other fishes are at lower densities. These factors should, however, be consistent among surveys.

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Table 1. 2003 lingcod CPUE (LCPUE) and total fish CPUE (TCPUE) (number of fish per hour) data by site, date and depth strata. (Shallow=0-25 m; deep=26-50m).

Site	Date	LCPUE Shallow	LCPUE Deep	TCPUE Shallow	TCPUE Deep
Forest Island	06-Oct	0	0	2.94	2.88
Little Group	06-Oct	0	0	5.82	14.46
Mouat Point	07-Oct	5.52		7.38	
Tilly Point	07-Oct	0	1.08	0	2.1
Wallace Point	07-Oct	3.78	0	8.52	0.96
D'arcy Island	09-Oct	0	0.9	0.96	0.9
Gooch Island	09-Oct	8.58	0.84	9.54	4.98
Halibut Island	09-Oct	0	0	0	1.14
Isabella Island	10-Oct	1.98		1.98	
Moresby Island	10-Oct	1.02	0	1.02	0
Patey Rock	10-Oct	0.9	0	0.9	2.76
Russell Island	10-Oct	0.84	0.9	1.74	0.9
Fane Island	13-Oct	0.96	0	2.82	0
Georgson Island	13-Oct	1.02	0.96	3	5.82
Taylor Point	13-Oct	0	0.96	0	3.78
Tilly Point	13-Oct	1.8	2.1	2.7	2.1
Imrie Island	14-Oct	0	0	0	1.98
Moresby Island	14-Oct	0		5.94	
Prevost Island	14-Oct		0		0
Forest Island	15-Oct	0	0	0	1.86
Forest Island	17-Oct	0	5.4	0	7.2
Imrie Island	17-Oct	0	0	0.96	2.7
Little Group	17-Oct	0	2.82	0	3.72
Alarm Rock	21-Oct	0	3.96	0	5.94
Dionisio Point	21-Oct	5.7	1.98	5.7	1.98
NE Galino	21-Oct	0	0	0	1.62
Coffin Island	22-Oct	1.8	0.96	3.6	3.78
Alcala Point	23-Oct	4.74	0.96	4.74	1.98
Detwiller Point	23-Oct	0	0.96	0	2.82
Thrasher Rock	23-Oct	0		0	
Danger Reef	24-Oct		5.82		10.68
Noel Bay	23-Oct	1.98	0	3.96	1.02
Dionisio Point	24-Oct	3.9		3.9	
NE Galino	24-Oct	2.76		2.76	
Noel Bay	24-Oct		1.86		1.86
Danger Reef	24-Oct	0	1.02	0.9	1.98
Alarm Rock	27-Oct	1.8	0	2.76	0
Alcala Point	27-Oct	0		0	
Danger Reef	27-Oct	0	0.9	0	0.9
Round Rock	27-Oct	0	1.02	0	1.02
Entrance Island	28-Oct	0	7.68	0	7.68
Malaspina Point	28-Oct	2.1		3.18	
Snake Island	28-Oct	0	0	0	0
DeCourcy Island	29-Oct	0	0	0.96	0
Round Rock	29-Oct	0	0	1.8	0
Five Fingers	30-Oct	0	0	0.9	0.9
Hudson Rocks	30-Oct	3.78	0.96	16.02	3.78
Neck Point	30-Oct	1.92	0	3.84	0
Douglas Island	31-Oct	0		0	
Entrance Island	31-Oct	0	0	4.86	0
Grey Rock	31-Oct		1.98		1.98
Malaspina Point	31-Oct		0		0
Snake Island	31-Oct				

Table 2. Total Catch Per Unit of Effort (TCPUE) (number of fish per hour) by fishers 1-4 is shown for repeated sites. Fisher bias for each fisher was analysed with a two-tailed Wilcoxon Signed Rank Test (non-parametric paired-t test) using repeated sites as pairs. No significant differences were observed (p>0.05).

Set	Date	Stat Area	Site name	Depth strata	TCPUE 1	TCPUE 2	TCPUE 3	TCPUE 4
43	21-Oct	17	Alarm Rock	shallow	0	0	0	0
65	27-Oct	17	Alarm Rock	shallow	0	4.38	0	0
51	23-Oct	17	Alcala Point	shallow	3.72	5.04	2.64	0
68	27-Oct	17	Alcala Point	shallow	3.96	0	0	8.46
62	24-Oct	17	Danger Reef	shallow	0	0	0	0
66	27-Oct	17	Danger Reef	shallow	0	0	0	0
47	21-Oct	17	Dionisio Point	shallow	0	0	0	
58	24-Oct	17	Dionisio Point	shallow	3.42	5.52	6.24	0
71	28-Oct	17	Entrance Island	shallow	0	0	0	
88	31-Oct	17	Entrance Island	shallow	0	0	0	
1	06-Oct	19	Forest Island	shallow	0	0	2.76	0
39	17-Oct	19	Forest Island	shallow	0	0	0	0
30	14-Oct	19	Imrie Island	shallow	0	6.84	3.42	0
42	17-Oct	19	Imrie Island	shallow	0	0	0	0
3	06-Oct	19	Little Group	shallow	3.18	9.84	2.58	0
37	17-Oct	19	Little Group	shallow	0	0	0	3.06
45	21-Oct	17	NE Galino	shallow	3.66	3.18	8.82	8.4
60	24-Oct	17	NE Galino	shallow	0	11.4	3.48	4.26
69	27-Oct	17	Round Rock	shallow	0	0	0	0
79	29-Oct	17	Round Rock	shallow	0	7.68	0	0
44	21-Oct	17	Alarm Rock	deep	11.94	8.82	0	0
64	27-Oct	17	Alarm Rock	deep	0	4.5	0	0
52	23-Oct	17	Alcala Point	deep	3.12	2.88	3	22.38
67	27-Oct	17	Alcala Point	deep	0	0	0	0
48	21-Oct	17	Dionisio Point	deep	5.16	14.88	2.34	
59	24-Oct	17	Dionisio Point	deep	0	4.14	3	0
2	06-Oct	19	Forest Island	deep	0		0	2.52
40	17-Oct	19	Forest Island	deep	3.54	4.92	0	0
31	14-Oct	19	Imrie Island	deep	3.54	4.02	0	0
41	17-Oct	19	Imrie Island	deep	4.8	13.32	3.3	12.36
4	06-Oct	19	Little Group	deep	8.76	0	3.18	0
38	17-Oct	19	Little Group	deep	4.14	0	3	3
70	27-Oct	17	Round Rock	deep	0	3.78	0	0
78	29-Oct	17	Round Rock	deep	0		0	0
				Significance:	**p=0.185**	**p=0.965**	**p=0.415**	**p=0.800**

Table 3. Lingcod CPUE (LCPUE) (number of fish per hour) descriptive statistics by site, statistical area, depth strata, current, tide, sea state and time. Significance was tested by Kruskal-Wallis non-parametric Anova or Mann-Whitney two-sample test.

	N	Mean	SD	CV	Median	Minimum	Maximum
Depth Strata							
Shallow	46	1.2	1.9	157	0.0	0.0	8.6
Deep	43	0.9	1.4	150	0.9	0.0	5.8
Significance	p=0.982, U=0.0005, df=1						
Site							
Alarm Rock	4	0.7	1.4	200	0.0	0.0	2.8
Alcala Point	4	1.1	0.9	76	1.4	0.0	1.8
Coffin I.	2	0.0	0.0	-	0.0	0.0	0.0
D'arcy I.	2	1.9	2.7	141	1.9	0.0	3.8
Danger Reef	3	0.6	1.1	173	0.0	0.0	1.9
DeCourcy I.	2	0.0	0.0	-	0.0	0.0	0.0
Detwiller Point	2	2.8	2.6	93	2.8	1.0	4.7
Dionisio Point	4	1.7	1.7	97	3.9	0.0	3.9
Douglas I.	2	1.0	1.4	141	1.0	0.0	1.9
Entrance I.	3	0.3	0.6	173	0.0	0.0	1.0
Fane I.	2	0.9	0.01	2	0.9	0.9	0.9
Five Fingers	2	0.0	0.0	-	0.0	0.0	0.0
Forest I.	5	0.2	0.4	224	0.0	0.0	1.0
Georgeson I.	2	0.5	0.7	141	0.5	0.0	0.9
Gooch I.	2	0.4	0.6	141	0.4	0.0	0.9
Grey Rock	2	0.0	0.0	-	0.0	0.0	0.0
Halibut I.	2	4.7	5.5	117	4.7	0.8	8.6
Hudson Rock	2	0.0	0.0	-	0.0	0.0	0.0
Imrie I.	4	2.3	2.3	97	1.9	0.0	5.4
Isabella I.	2	0.0	0.0	-	0.0	0.0	0.0
Little Group	4	0.0	0.0	-	0.0	0.0	0.0
Malaspina Pt.	2	1.0	1.3	141	1.0	0.0	2.0
Moresby I.	2	1.0	1.4	141	1.0	0.0	2.0
Mouat Point	2	0.0	0.0	-	0.0	0.0	0.0
NE Galiano	3	3.9	1.9	49	3.9	2.0	5.7
Neck Point	2	2.4	2.0	85	2.4	1.0	3.8
Noel Bay	2	4.3	2.1	50	4.3	2.8	5.8
Patey Rock	2	0.5	0.7	141	0.5	0.0	1.0
Prevost I.	1	0.0	0.0	-	0.0	0.0	0.0
Round Rock	4	0.2	0.5	200	0.0	0.0	0.9
Russel I.	2	0.4	0.6	141	0.4	0.0	0.9
Snake I.	2	1.1	1.5	141	1.1	0.0	2.1
Taylor Point	2	1.0	0.02	2	1.0	1.0	1.0
Thrasher Rock	2	0.5	0.7	141	0.5	0.0	0.9
Tilly Point	2	3.2	3.3	100	3.2	0.9	5.5
Wallace Point	2	0.5	0.8	141	0.5	0.0	1.1
Significance	p=0.099, T=46.115, df=35						
Statistical Area							
19	21	1.3	2.2	177	0.0	0.0	8.6
18	19	0.7	1.3	170	0.9	0.0	5.5
17	49	1.1	1.6	141	0.0	0.0	5.8
Significance	p=0.833, T=0.365, df=2						

Table 3 (continued)

	N	Mean	SD	CV	Median	Minimum	Maximum
Current							
None	14	0.5	0.8	150	0.0	0.0	2.0
Weak	52	0.9	1.4	153	0.0	0.0.	5.8
Moderate	23	1.8	2.4	135	0.8	0.0	8.6
Significance	p=0.276, T=2.576, df=2						
Tide							
Ebb	23	0.6	1.1	196	0.0	0.0	3.8
Flood	46	1.3	2.0	146	0.9	0.0	8.6
High Slack	9	1.5	2.0	133	0.9	0.0	5.4
Low Slack	11	0.7	0.8	124	0.0	0.0	2.0
Significance	p=0.218, T=4.438, df=3						
Sea State							
Calm	40	1.5	1.8	126	0.9	0.0	5.8
Ripple	27	0.6	1.0	156	0.0	0.0	3.8
Chop	13	1.1	2.4	217	0.0	0.0	8.6
Swell	9	0.6	1.2	197	0.0	0.0	3.8
Significance	p=0.134, T=5.58, df=3						
Time of day							
800	2	1.0	1.4	141	1.0	0.0	2.0
900	9	0.9	1.1	121	0.0256	0.0	4.0
1000	11	0.2	0.6	332	0.0	0.0	2.1
1100	15	0.6	1.0	163	0.0	0.0	2.8
1200	12	1.0	2.4	238	0.0	0.0	8.6
1300	12	1.8	2.2	124	0.9	0.0	5.7
1400	12	1.2	1.4	112	0.9	0.0	4.7
1500	8	0.6	0.7	122	0.4	0.0	2.0
1600	5	3.6	2.2	61	3.9	0.9	5.8
Significance	**p=0.024,** T=17.61, df=8						

Table 4. Lingcod CPUE (number of fish per hour) was compared between years with a Mann-Whitney test in Statistical Areas 18 and 19, and among years in Statistical Area 17 with a Kruskal-Wallis test. A significant difference was observed in Statistical Area 17.

	N	Mean	SD	CV	Median	Minimum	Maximum
Areas 18-19							
1993	80	1.9	3.2	170	0.0	0.0	17.9
2003	40	1.0	1.8	180	0.0	0.0	8.6
Significance	p=0.783, U=0.076, df=1						
Area 17							
1985	38	1.7	3.4	201	0.0	0.0	12.8
1987	104	0.5	1.5	327	0.0	0.0	6.0
1988	71	0.1	0.5	366	0.0	0.0	2.0
2003	24	1.8	1.9	104	1.4	0.0	5.8
Significance	**p=<0.0001**, T=48.4, df=3; 2003 is significantly different from 1987 and 1988 but not 1985.						

Table 5. Copper Rockfish CPUE (number of fish per hour) was compared among years. For the Area 18-19 comparison, depth strata was used as a covariate in a rank-transformed ANCOVA since more copper rockfish were caught in shallow depth strata in 1993. Only the shallow depth strata is compared in Area 17 due to greater catches in the shallow strata in the 1980's and since an unbalanced data set did not allow for an ANCOVA.

	N	Mean	SD	CV	Median	Minimum	Maximum
Areas 18-19							
1993	80	5.1	5.9	117	3.0	0.0	27.5
2003	40	0.5	1.2	220	0.0	0.0	6.0
Significance	**p=<0.0001**, F=26.31, df=1, 117						
Area 17							
1985	14	4.1	5.5	136	1.1	0.0	16.0
1987	45	6.9	8.1	118	5.0	0.0	33.4
1988	34	3.1	2.9	95	3.0	0.0	10.0
2003	26	0.5	0.9	192	0.0	0.0	3.9
Significance	**p=0.0005**, T=17.881, df=3; 2003 significantly different from all other years						

Table 6. Quillback Rockfish CPUE (number of fish per hour) was compared among years. For the Area 18-19 comparison, depth strata was used as a covariate in a rank-transformed ANCOVA since more quillback rockfish were caught in deep depth strata in 1993. Depth strata were pooled in Area 17 since catch rates did not vary with depth.

	N	Mean	SD	CV	Median	Minimum	Maximum
Areas 18-19							
1993	80	6.5	9.6	149	3.0	0.0	62.7
2003	40	0.2	0.5	233	0.0	0.0	1.9
Significance	**p=<0.0001**, F=53.28, df=1, 117						
Area 17							
1985	42	6.5	9.8	152	3.0	0.0	46.1
1987	128	4.4	6.6	150	0.0	0.0	36.0
1988	86	2.7	3.8	140	0.9	0.0	15.0
2003	49	0.4	1.5	324	0.0	0.0	9.4
Significance	**p=<0.0001**, T=22.88, df=3; 2003 is significantly different from all other years						

Table 7. We tested for a difference in lingcod length between males and females using an ANOVA. Female lingcod were significantly larger than males. Accordingly, sex was used as a covariate when we used an ANCOVA to test for differences in lingcod length between depth strata and among fishers. No other significant differences in length were observed.

		Male	Female
	N	68	29
	Mean ± SD	536.6 ± 95.6	630.8 ± 116.9
	Range	368.0-830.0	446.0-868.0
Significance		**p=0.0001**, F=17.24, df=1, 95	
Depth Strata			
Shallow	N	44	13
	Mean ± SD	545.8 ± 93.7	600.2 ± 103.2
	Range	369.0-830.0	471.0-815.0
Deep	N	24	16
	Mean ± SD	519.6 ± 98.6	655.6 ± 124.6
	Range	368.0-760.0	446.0-868.0
Significance		p=0.9845, F=0.00, df=1, 94	
Fisher			
F1	N	13	10
	Mean ± SD	558.4 ± 132.3	611.3 ± 107.3
	Range	405.0-830.0	446.0-760.0
F2	N	22	8
	Mean ± SD	513.8 ± 82.2	664.1 ± 121.0
	Range	435.0-743.0	546.0-856.0
F3	N	19	5
	Mean ± SD	546.6 ± 93.1	589.2 ± 14.6
	Range	369.0-755.0	510.0-712.0
F4	N	13	5
	Mean ± SD	542.7 ± 82.3	621.0 ± 150.9
	Range	368.0-645.0	480.0-868.0
Significance		p=0.9059, F=0.26, df=4, 91	

Table 8. The length of lingcod did not vary between 1993 and 2003 in Statistical Areas 18 and 19 when the data were compared using an ANCOVA with sex as a covariate. The length of male and female lingcod did not vary between 1985 and 2003 in Statistical Area 17 when tested with an ANOVA. An ANCOVA could not be used Statistical Area 17 due to unbalanced data.

Areas 18-19		**Both Sexes**	
1993	N	45	
	Mean ± SD	622.8 ± 87.0	
	Range	262.0-811.0	
2003	N	38	
	Mean ± SD	540.1 ± 92.6	
	Range	368.0-830.0	
Significance		p=0.50, F=0.44, df=1, 79	
Area 17		Females	Males
1985	N	10	9
	Mean ± SD	572.3 ± 183.3	543.9 ± 93.8
	Range	352.0-932.0	417.0-753.0
2003	N	20	38
	Mean ± SD	642.3 ± 134.1	549.8 ±98.9
	Range	446.0-868.0	405.0-760.0
Significance		p=0.24, F=1.42, df=1, 28	p=0.87, F=0.03, df=1, 45

Table 9. Maturity classes of male and female lingcod caught October 2003. Most lingcod were immature or maturing. (See Appendix Table 4 for a description of maturity classes).

	Male		Female	
Maturity Class	Frequency	Percent %	Frequency	Percent %
1-Immature	18	28.1	9	31.0
2-Maturing-small	28	43.8	9	31.0
3-Maturing-large	15	23.4	11	37.9
4-Mature	2	3.1	0	
5-Ripe	1	1.6	0	
Total	64	100	29	100

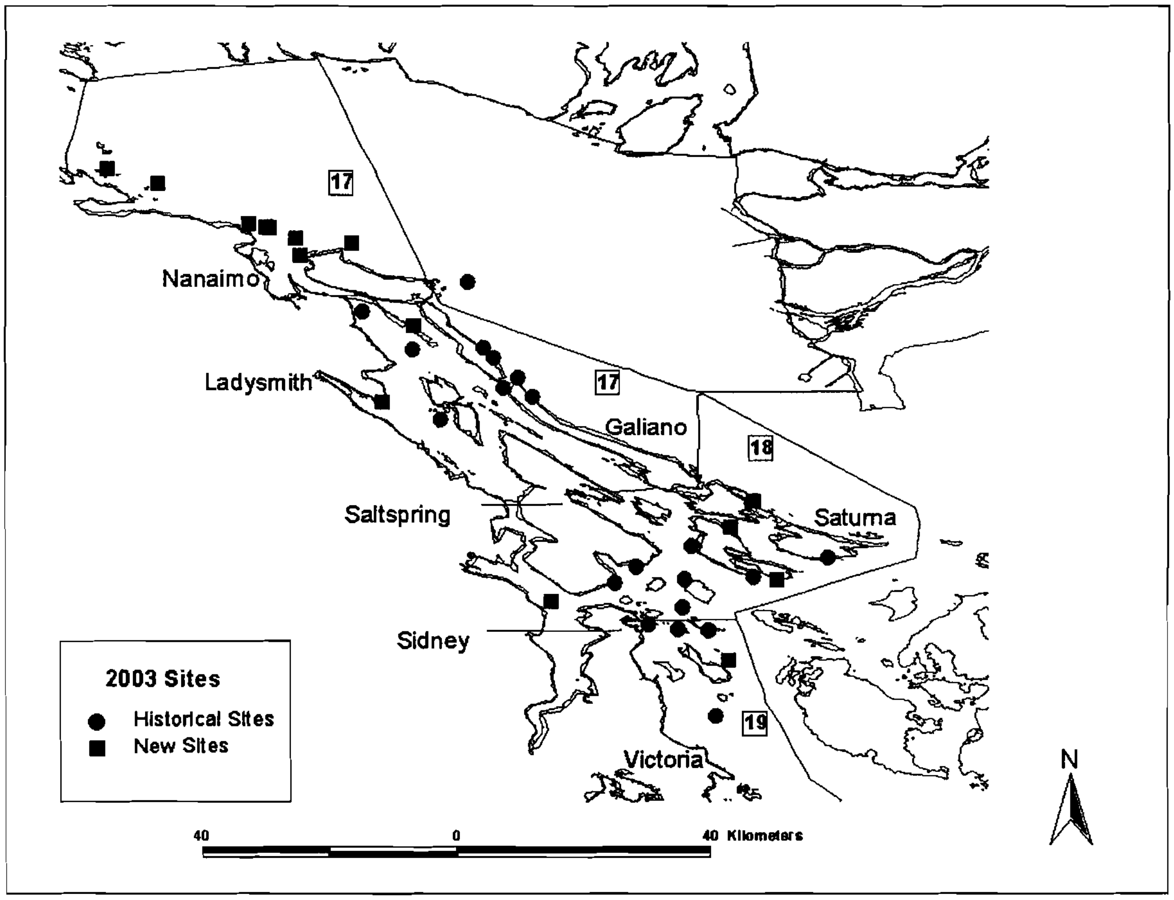


Figure 1. Locations of sites sampled Statistical Areas 17, 18 and 19 during the 2003 Hook and Line Survey for lingcod and rockfishes.

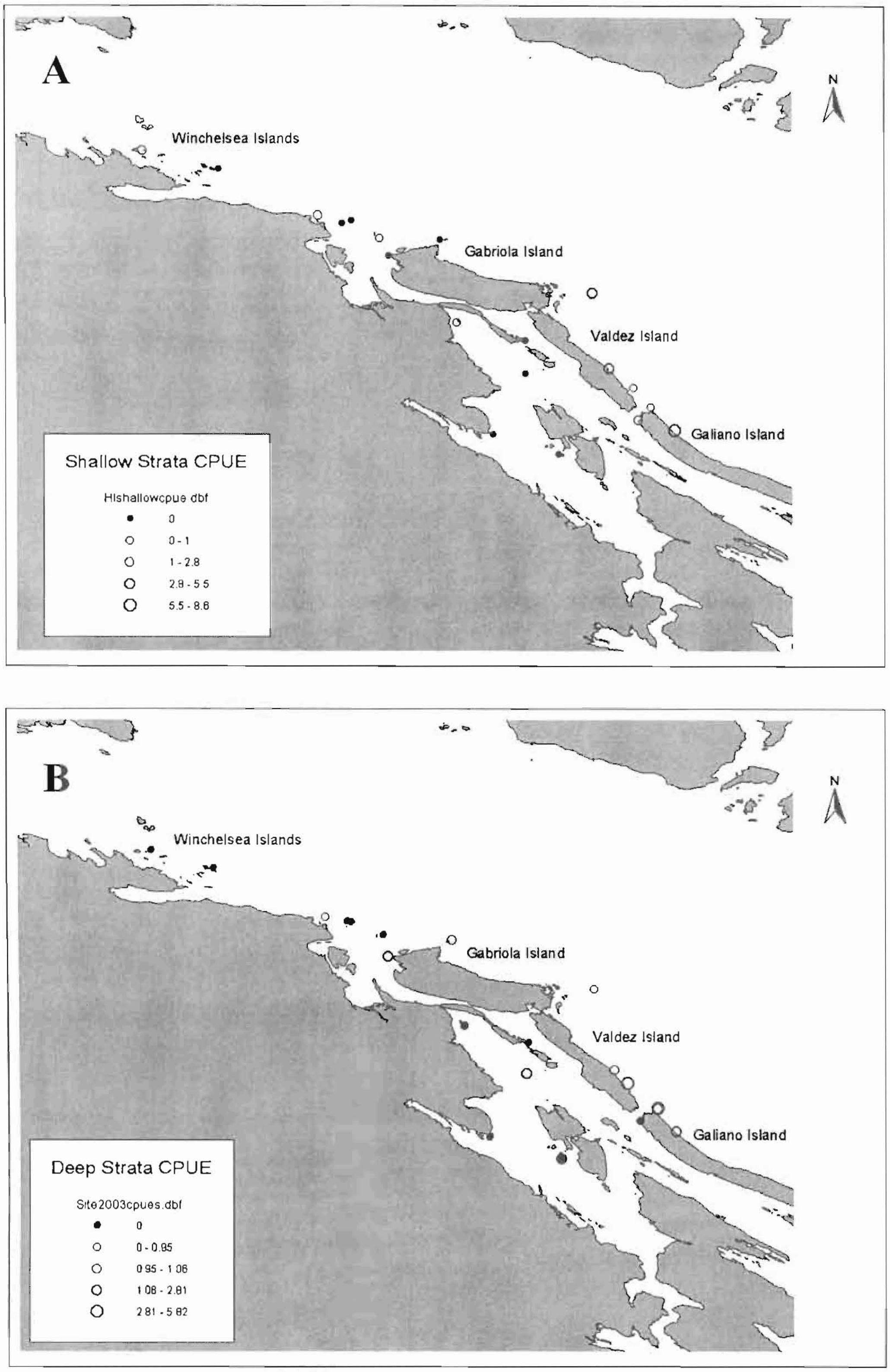


Figure 2. Lingcod CPUE observed at each site in Statistical Area 17 in October 2003. **A**: shallow depth strata (0-25 m); **B**: deep depth strata (26-50 m).

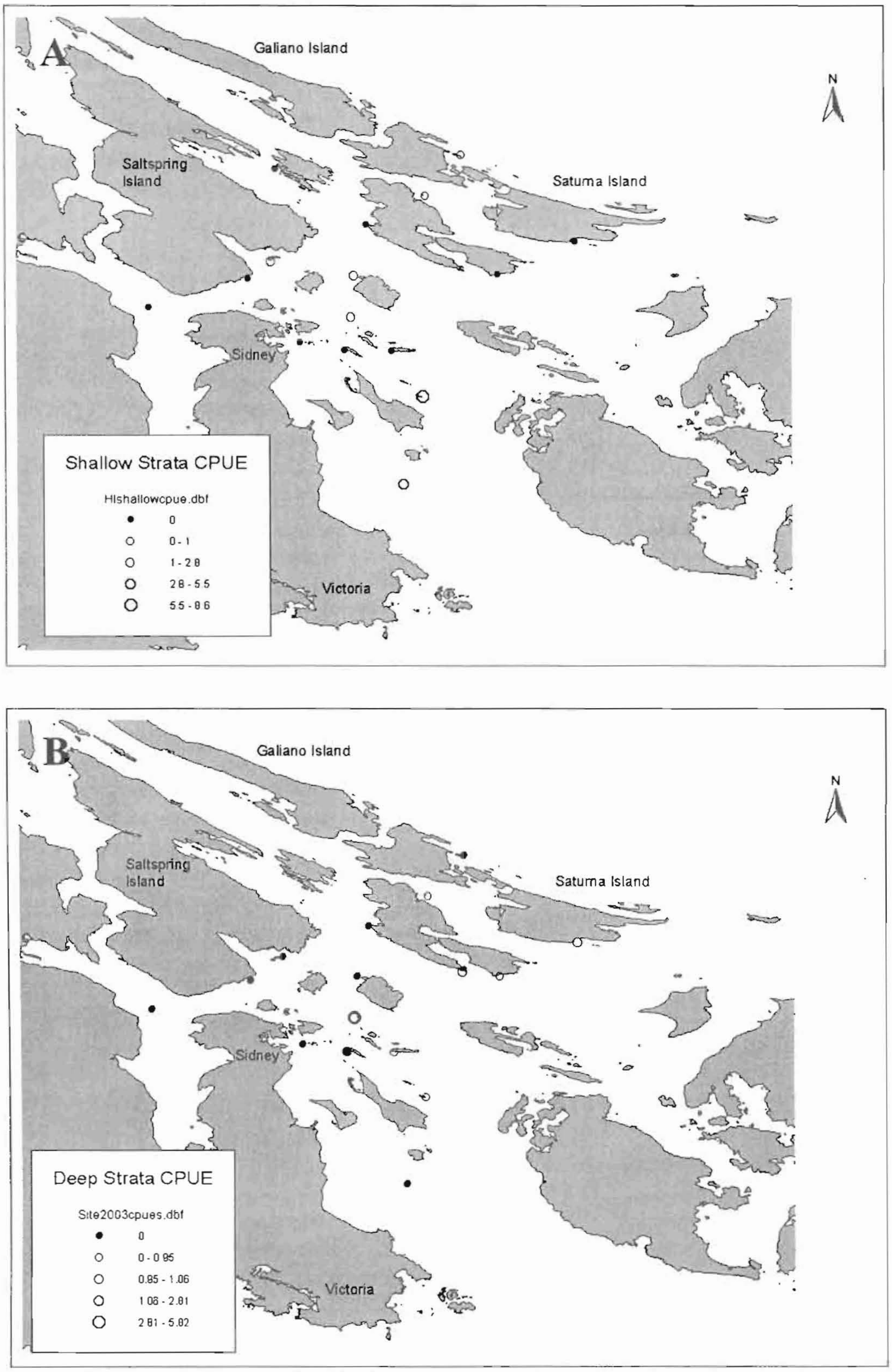


Figure 3. Lingcod CPUE observed at each site in Statistical Areas 18 and 19 in October 2003. **A**: shallow depth strata (0-25 m); **B**: deep depth strata (26-50 m).

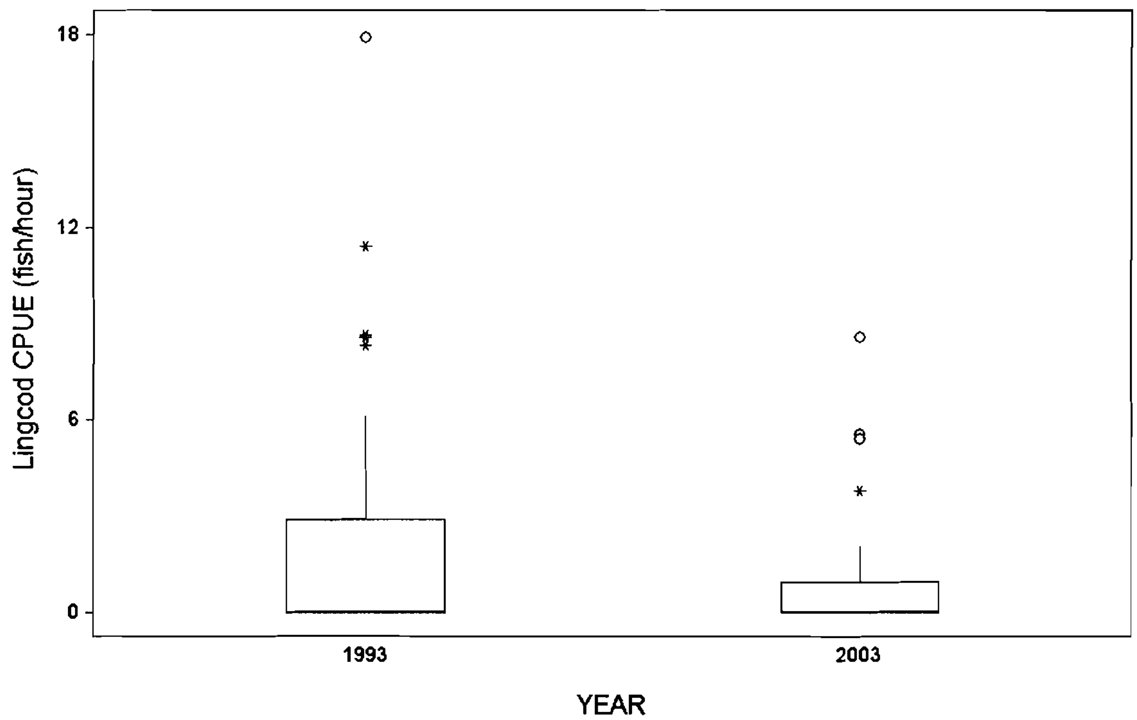


Figure 4a. Box and whisker plot depicting lingcod CPUE (fish per hour) in Statistical Areas 18-19 between years.

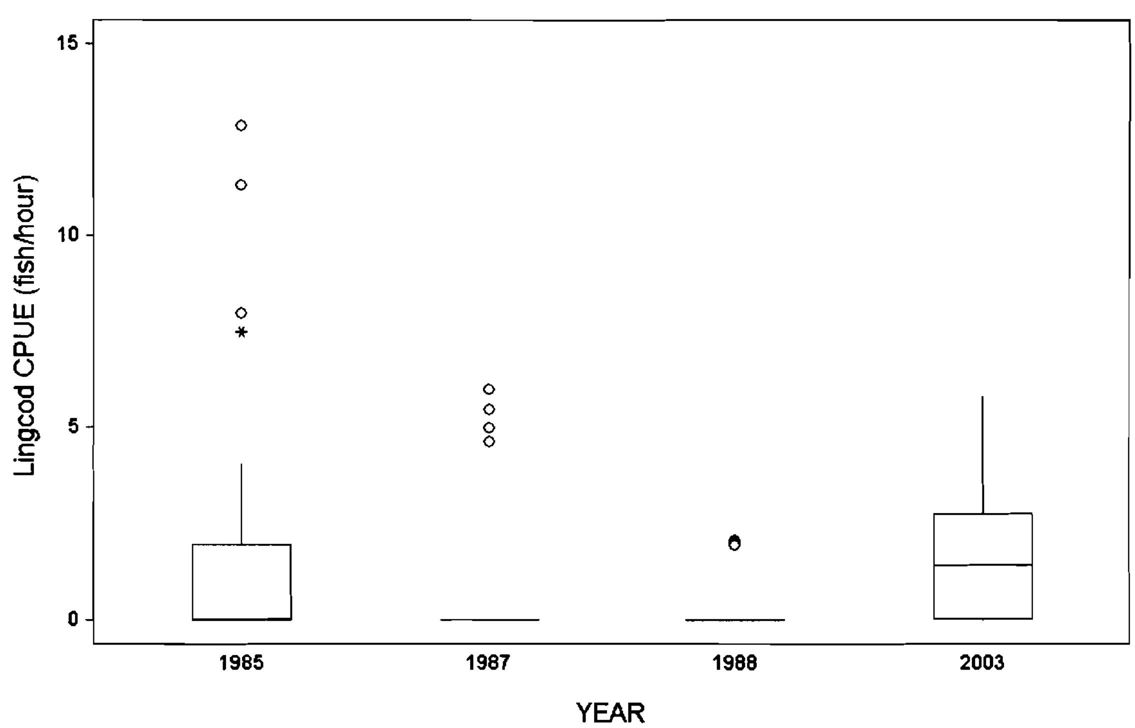


Figure 4b. Box and whisker plot depicting lingcod CPUE (fish per hour) in Statistical Area 17 among years.

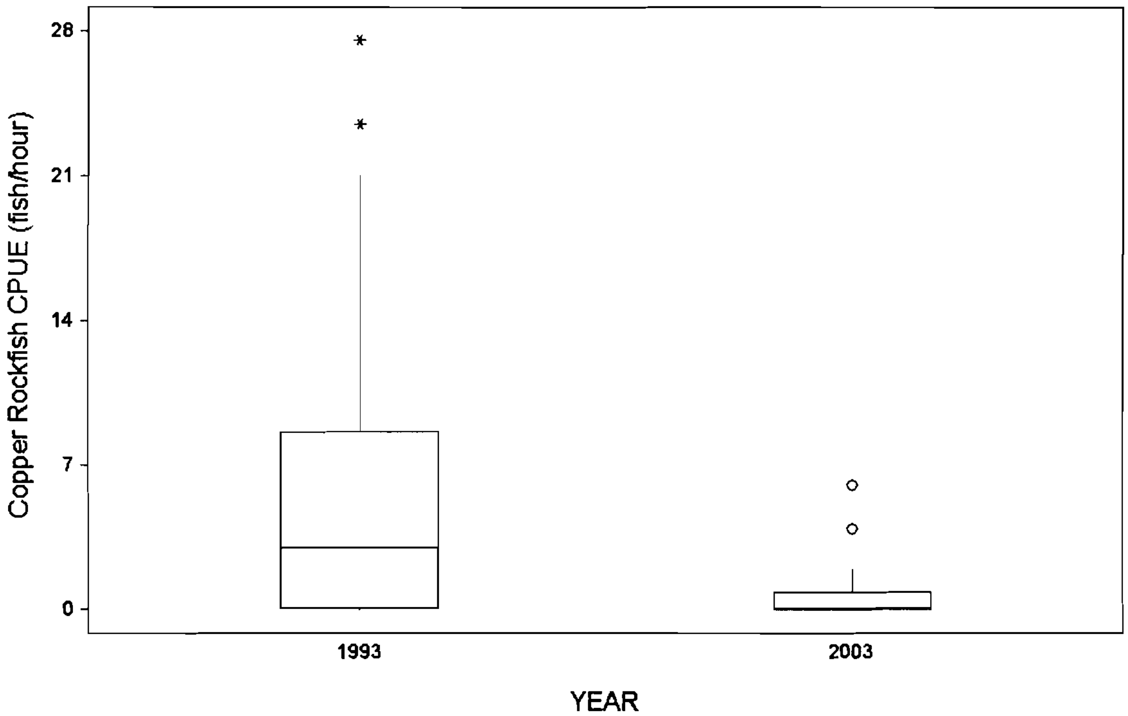


Figure 5a. Box and whisker plot depicting copper rockfish CPUE (fish per hour) in Statistical Areas 18-19 between years.

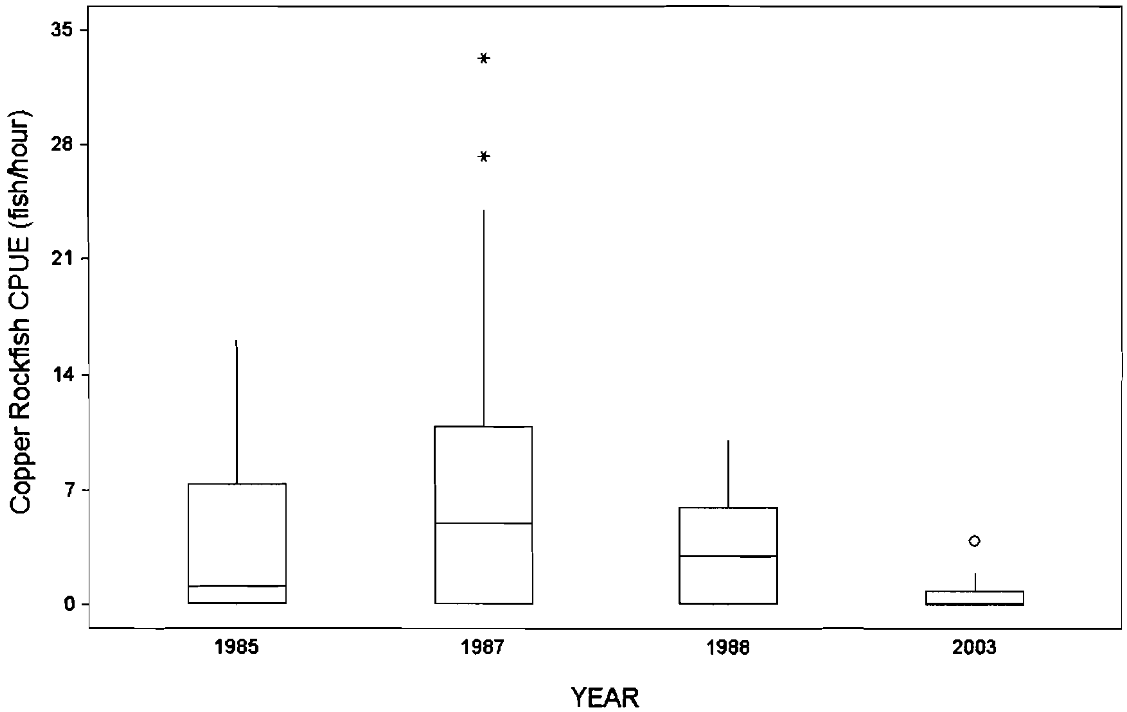


Figure 5b. Box and whisker plot depicting copper rockfish CPUE (fish per hour) in Statistical Area 17 among years

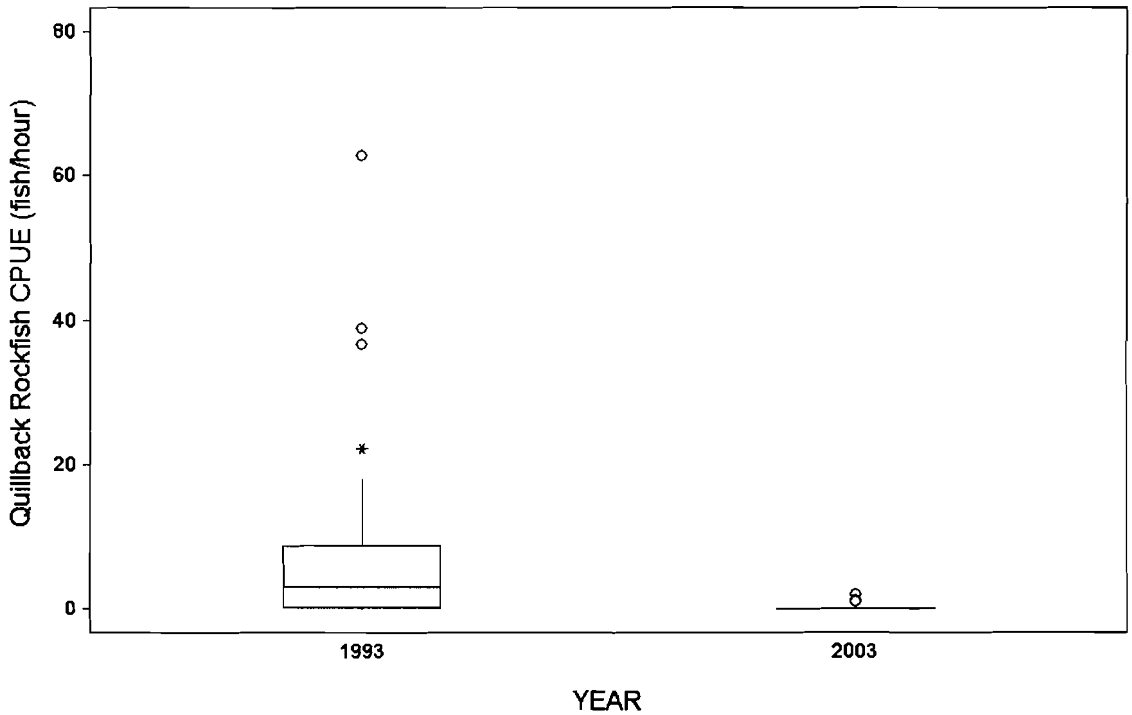


Figure 6a. Box and whisker plot depicting quillback rockfish CPUE (fish per hour) in Statistical Areas 18-19 between years.

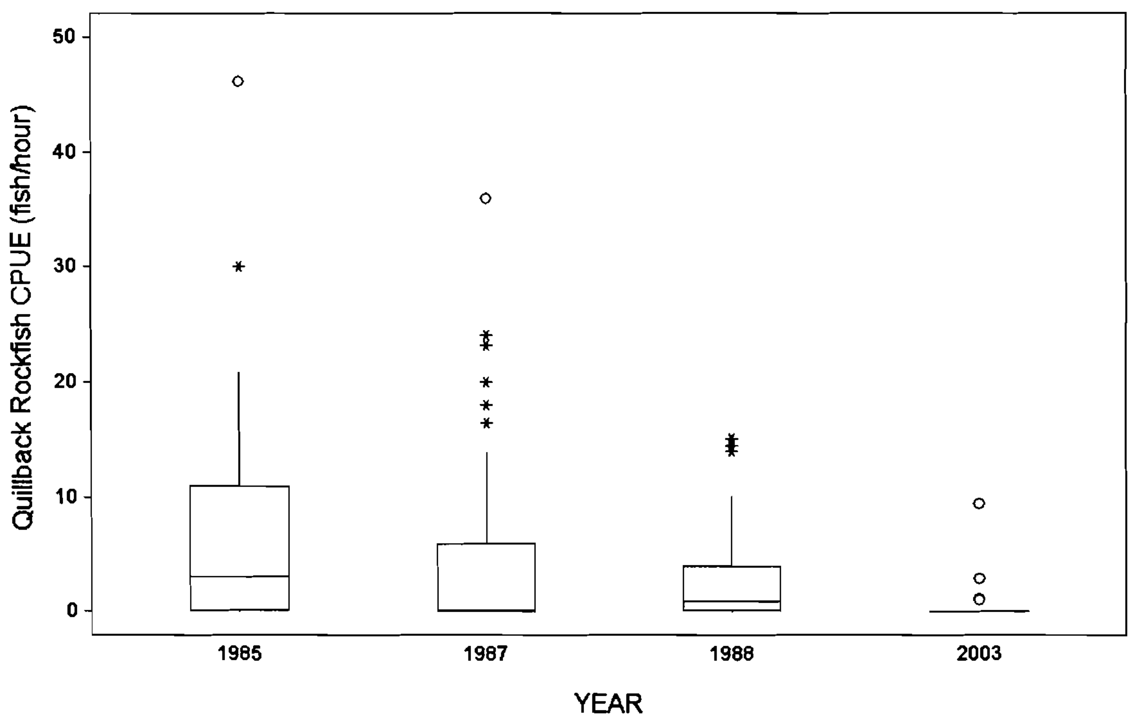
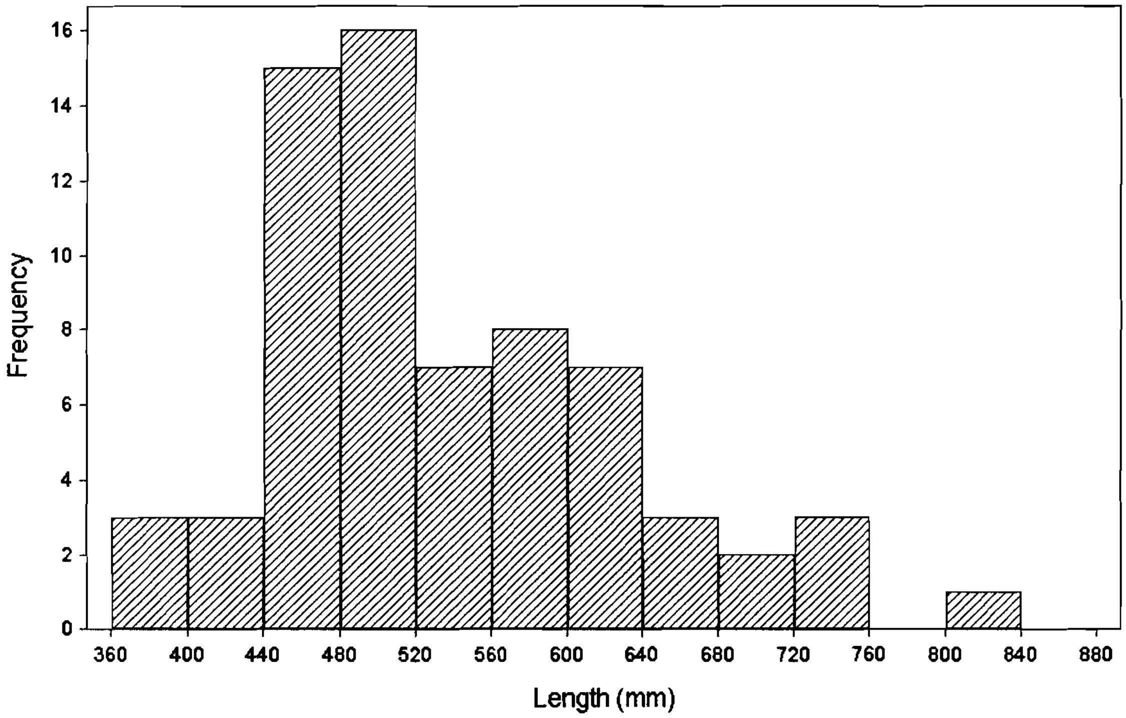


Figure 6b. Box and whisker plot depicting quillback rockfish CPUE (fish per hour) in Statistical Area 17 among years.

A



B

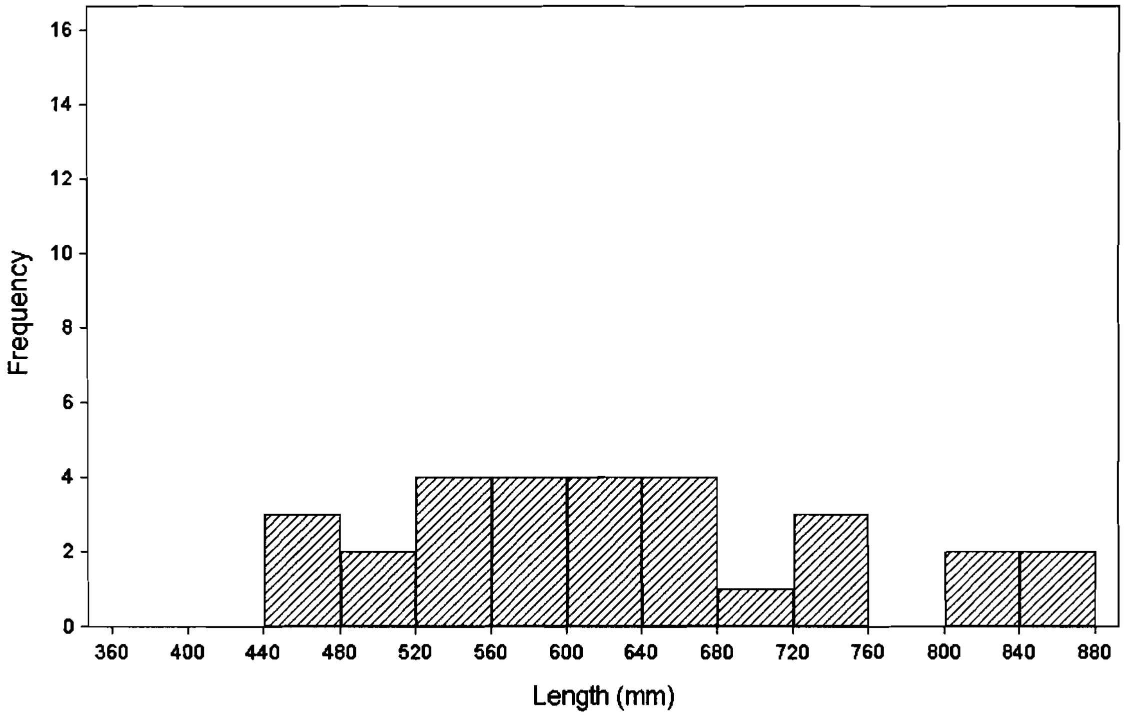


Figure 7. Length frequency histogram for lingcod caught in the Hook and Line Survey in Statistical Areas 17, 18 and 19, October 2003. A: male lingcod; B: female lingcod.

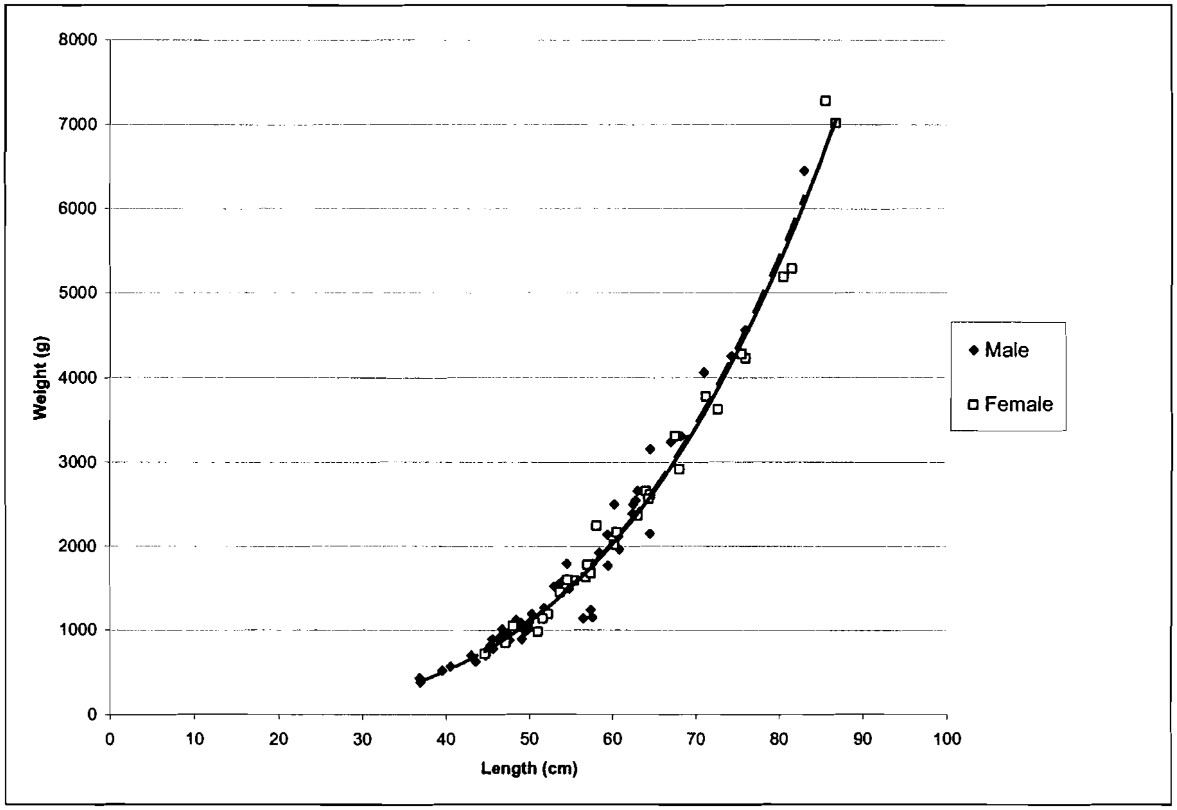


Figure 8. Lingcod length to weight relationship for male and female lingcod. The equations of the line of best fit are as follows: Male: $y = 0.002\,x^{3.391}$ R^2=0.960; Female: $y = 0.002\,x^{3.376}$ R^2=0.986.

Appendix Table 1. Site, location, Statistical Area (SA) and environmental characteristics for each fishing set. See appendix 5 for sea state, tide, current and weather codes. Depth strata 1=0-25m; depth strata 2=26-50 m.

Set	Site #	Site Name	SA	Depth Strata	Latitude Deg	Latitude Min	Latitude Sec	Longitude Deg	Longitude Min	Longitude Sec	Sea State	Tide	Current	Weather	Med. Depth	Start Time	End Time
1	207	Forest I.	19	1	48	39	44.5	123	20	29.0	1	2	2	4	18	11:20	12:10
2	207	Forest I.	19	2	48	39	44.5	123	20	29.0	1	2	3	4	45	13:20	14:20
3	104	Little Grp.	19	1	48	40	10.0	123	22	58.1	2	2	1	2	15	14:55	15:36
4	104	Little Grp.	19	2	48	40	10.0	123	22	58.1	2	2	1	4	32	15:44	16:30
5	205	Mouat Pt.	18	1	48	46	43.8	123	19	17.5	1	4	2	3	13	9:30	10:22
6	205	Mouat Pt.	18	2	48	46	43.8	123	19	17.5	2	4	3	3	41	10:25	11:48
7	208	Wallace Pt.	18	1	48	44	10.1	123	14	4.3	1	2	1	5	16	12:22	12:51
8	208	Wallace Pt.	18	2	48	44	10.1	123	14	4.3	1	2	2	5	38	13:00	15:30
9	314	Tilly Pt.	18	1	48	43	57.0	123	12	0.4	1	2	2	1	14	16:00	17:00
10	203	D'arcy I.	19	1	48	32	21.3	123	17	13.5	2	1	3	4	18	9:20	10:40
11	203	D'arcy I.	19	2	48	32	21.3	123	17	13.5	3	4	1	4	30	10:50	12:00
12	312	Halibut I.	19	1	48	37	12.6	123	16	8.8	3	2	2	4	15	12:00	13:41
13	312	Halibut I.	19	2	48	37	12.6	123	16	8.8	3	2	2	4	40	13:49	14:35
14	110	Gooch I.	19	1	48	39	42.0	123	17	54.8	3	2	1	4		14:49	15:38
15	110	Gooch I.	19	2	48	39	42.0	123	17	54.8	1	2	1	4	33	15:40	16:40
16	103	Russell I.	18	1	48	44	44.6	123	24	32.1	3	1	1	4	14	9:20	10:04
17	103	Russell I.	18	2	48	45	1.2	123	24	3.0	3	1	1	3	33	10:15	11:03
18	210	Isabella I.	18	1	48	43	42.0	123	25	50.8	2	4	1	3	12	11:18	12:00
19	210	Isabella I.	18	2	48	43	42.0	123	25	50.8	2	4	1	3	37	12:05	13:05
20	313	Patey Rk.	18	2	48	42	7.3	123	31	17.1	2	2	1	3	30	13:30	13:56
21	313	Patey Rk.	18	1	48	42	7.3	123	31	17.1	1	2	1	3	17	14:01	14:30
22	205	Moresby I.	19	1	48	43	57.0	123	19	56.5	2	2	1	3	15	15:15	15:53
23	314	Tilly Pt.	18	2	48	43	57.0	123	12	0.4	1	3	1	4	33	9:30	10:45
24	109	Taylor Pt.	18	1	48	45	47.0	123	7	41.4	1	1	1	4	13	11:00	11:40
25	109	Taylor Pt.	18	2	48	45	47.0	123	7	41.4	1	1	1	4	38	11:50	13:04
26	317	Georgson I.	18	2	48	50	38.9	123	14	1.1	1	4	0	4	31	13:35	14:15
27	317	Georgson I.	18	1	48	50	38.9	123	14	1.1	1	4	0	4	12	14:15	15:11
28	315	Fane I.	18	1	48	48	22.9	123	15	59.9	2	2	1	1	12	15:30	16:04
29	315	Fane I.	18	2	48	48	22.9	123	15	59.9	1	2	0	1	28	16:15	16:45
30	204	Imrie I.	19	1	48	41	36.5	123	20	5.8	3	2	1	1	9	9:00	9:42

Set	Site #	Site Name	SA	Depth Strata	Latitude Deg	Latitude Min	Latitude Sec	Longitude Deg	Longitude Min	Longitude Sec	Sea State	Tide	Current	Weather	Med. Depth	Start Time	End Time
31	204	Imrie I.	19	2	48	41	36.5	123	20	5.8	1	3	1	1	31	10:04	10:50
32	205	Moresby I.	19	2	48	43	57.0	123	19	56.5	3	1	1	1	30	11:05	11:50
33	316	Prevost I.	18	1	48	49	50.0	123	24	20.0	1	1	1	1	20	13:45	14:29
35	207	Forest I.	19	2	48	59	27.3	123	32	53.3	1	2	3	2	30	10:20	11:14
36	207	Forest I.	19	1	48	59	27.3	123	32	53.3	3	2	3	2			
37	104	Little Grp.	19	1	49	1	6.3	123	34	31.1	2	2	2	4	17	10:20	10:50
38	104	Little Grp.	19	2	49	1	3.0	123	34	8.0	2	2	1	4	31	11:15	11:40
39	207	Forest I.	19	1	48	59	8.3	123	45	19.3	1	2	1	4	19	11:55	12:23
40	207	Forest I.	19	2	48	59	2.9	123	45	41.2	1	3	2	2	40	12:20	13:00
41	204	Imrie I.	19	2	49	0	12.8	123	35	19.3	1	3	1	2	40	13:10	14:20
42	204	Imrie I.	19	1	49	0	11.1	123	35	21.3	2	1	1	2	12	14:28	14:52
43	53	Alarm Rk.	17	1	49	8	56.7	123	38	30.5	1	2	1	4	23	10:55	11:49
44	53	Alarm Rk.	17	2	49	9	15.6	123	38	28.6	1	2	1	4	35	11:49	12:35
45	30	NE Galiano	17	1	49	3	44.0	123	37	22.0	1	2	1	4	7	13:15	14:10
46	30	NE Galiano	17	2	49	3	41.7	123	37	6.8	1	2	2	4	30	14:15	15:15
47	27	Dionisio Pt.	17	1	49	2	46.3	123	36	14.2	1	3	2	4	17	15:30	16:30
48	27	Dionisio Pt.	17	2	49	2	24.0	123	35	42.0	1	3	2	3	38	16:35	17:49
49	301	Coffin I.	17	1	49	3	20.4	123	43	6.1	3	2	1	4	17	11:30	12:13
50	301	Coffin I.	17	2	49	3	26.2	123	43	5.8	3	2	1	4	39	12:20	13:20
51	19	Alcala Pt.	17	1	48	57	34.3	123	40	44.1	2	4	1	1	10	9:10	9:55
52	19	Alcala Pt.	17	2	48	57	45.3	123	40	51.2	2	4	1	1	45	9:55	11:11
53	3	Thrasher Rk.	17	1	49	6	54.9	123	47	47.4	1	2	1	1	8	12:12	12:41
54	3	Thrasher Rk.	17	2	49	6	44.3	123	47	24.3	2	2	1	1	34	12:50	13:51
55	12	Detwiller Pt.	17	1	49	12	31.0	123	48	58.0	1	2	1	1	8	14:15	15:13
56	12	Detwiller Pt.	17	2	49	12	39.2	123	48	14.8	1	2	1	1	30	15:20	15:52
57	13	Noel Bay	17	2	49	11	26.0	123	52	28.0	1	2	1	1	31	16:05	17:25
58	27	Dionisio Pt.	17	1	49	12	40.5	123	53	5.3	2	4	2	4	11	11:22	12:24
59	27	Dionisio Pt.	17	2	49	5	34.5	123	43	7.1	2	2	1	1	40	12:37	13:30
60	30	NE Galiano	17	1	49	5	33.3	123	42	59.7	1	2	1	1	8	13:40	14:20
61	13	Noel Bay	17	1	49	13	49.7	123	55	2.5	1	2	1	1	15	14:30	15:17
62	51	Danger Rf.	17	1	49	13	52.7	123	55	11.0	1	2	0	4	12	15:30	16:20
63	51	Danger Rf.	17	2	49	13	56.3	123	55	26.0	1	2	0	4	30	16:20	16:59
64	53	Alarm Rk.	17	2	49	13	39.2	123	55	40.6	1	1	1	4	39	9:00	9:40

Set	Site #	Site Name	SA	Depth Strata	Latitude Deg	Latitude Min	Latitude Sec	Longitude Deg	Longitude Min	Longitude Sec	Sea State	Tide	Current	Weather	Med. Depth	Start Time	End Time
65	53	Alarm Rk.	17	1	49	14	15.3	123	57	15.3	1	1	1	4	14	9:45	10:30
66	51	Danger Rf.	17	1	49	14	15.3	123	56	55.1	1	1	1	4	12	10:50	11:17
67	19	Alcala Pt.	17	2	49	11	30.9	123	52	36.4	2	1	0	4	42	11:40	12:13
68	19	Alcala Pt.	17	1	49	13	1.0	123	52	58.7	1	4	1	4	13	12:20	13:00
69	303	Round Rk.	17	1	49	17	22.7	124	4	7.6	1	2	1	4	11	13:30	14:10
70	303	Round Rk.	17	2	49	17	34.4	124	4	33.4	1	2	1	4	27	14:20	14:44
71	304	Entrance I.	17	1	49	18	48.9	124	8	48.2	4	3	1	4	16	8:48	9:29
72	304	Entrance I.	17	2	49	18	42.7	124	9	15.3	4	3	1	4		9:30	10:19
73	305	Malaspina Pt.	17	1	48	39	44.5	123	20	29.0	3	2	1	4	11	10:35	11:17
74	305	Malaspina Pt.	17	2	48	39	44.5	123	20	29.0	3	2	1	4	29	11:19	11:36
75	306	Snake I.	17	1	48	40	10.0	123	22	58.1	3	2	1	4	17	11:45	12:41
76	302	DeCourcy I.	17	1	48	40	10.0	123	22	58.1	2	1	1	1	7	11:40	12:17
77	302	DeCourcy I.	17	2	48	46	43.8	123	19	17.5	2	1	1	1	40	12:20	13:00
78	303	Round Rk.	17	2	48	46	43.8	123	19	17.5	2	1	1	1	37	14:20	14:50
79	303	Round Rk.	17	1	48	44	10.1	123	14	4.3	2	1	1	4	10	15:00	15:35
80	307	Five Fingers	17	1	48	44	10.1	123	14	4.3	4	2	1	3	15	9:20	10:11
81	307	Five Fingers	17	2	48	43	57.0	123	12	0.4	4	2	2	3	33	10:16	10:47
82	308	Hudson Rk.	17	2	48	32	21.3	123	17	13.5	4	3	1	3	40	11:27	12:09
83	308	Hudson Rk.	17	1	48	32	21.3	123	17	13.5	4	1	1	3	18	12:13	13:00
84	309	Neck Pt.	17	1	48	37	12.6	123	16	8.8	4	1	1	3	10	13:40	14:46
85	309	Neck Pt.	17	2	48	37	12.6	123	16	8.8	4	1	1	3	39	14:49	15:23
86	305	Malaspina Pt.	17	2	48	39	42.0	123	17	54.8	2	2	1	1	35	8:48	9:35
87	306	Snake I.	17	2	48	39	42.0	123	17	54.8	3	2	2	1	30	9:48	10:24
88	304	Entrance I.	17	1	48	44	44.6	123	24	32.1	4	2	1	1	9	10:40	11:13
89	310	Grey Rk.	17	1	48	45	1.2	123	24	3.0	2	1	1	1		11:48	12:45
90	310	Grey Rk.	17	2	48	43	42.0	123	25	50.8	2	1	1	1	35	12:52	13:28
91	311	Douglas I.	17	2	48	43	42.0	123	25	50.8	2	1	1	1	43	13:50	14:30
92	311	Douglas I.	17	1	48	42	7.3	123	31	17.1	2	1	1	1	15	14:38	15:26

Appendix Table 2. Effort data by set (depth strata 1=0-25m; depth strata 2=26-50 m) for each fisher (F1-F5) and number of fish caught by species. Species codes are as follows: LC=lingcod, CR=copper rockfish, QR=quillback rockfish, YR=yelloweye rockfish, KG=kelp greenling, BS=buffalo sculpin, RI=red Irish lord, GS=great sculpin, CA=cabezon, PS=Pacific sanddab, SS=speckled sanddab, RS=rock sole, SD=spiny dogfish.

Set	Depth	Effort (min)					Total	Total	Number of fish caught												
	strata	F1	F2	F3	F4	F5	effort	fish	LC	CR	QR	YR	KG	BS	RI	GS	CA	PS	SS	RS	SD
1	1	17.8	10.3	21.8	20.0		70.0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
2	2	17.5	0.0	20.3	24.0		61.8	1	1	0	0	0	0	0	0	0	0	0	0	0	0
3	1	19.0	6.1	23.1	13.2		61.4	3	0	0	0	0	0	2	0	1	0	0	0	0	0
4	2	13.7	15.3	19.0	15.1		63.0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
5	1	20.7	0.0	20.4	20.6		61.6	6	0	2	1	0	0	0	2	0	0	0	0	1	0
6	2	17.5	12.7	21.8	10.2		62.2	15	0	1	2	0	0	0	0	0	0	11	0	1	0
7	1	18.4	15.2	15.2	11.9		60.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	2	15.3	8.0	18.2	15.1		56.6	2	1	0	1	0	0	0	0	0	0	0	0	0	0
9	1	18.5	10.6	24.5	11.4		65.0	8	6	0	0	0	1	0	0	0	1	0	0	0	0
10	1	20.4	4.4	18.9	19.6		63.3	9	4	1	0	0	2	0	2	0	0	0	0	0	0
11	2	22.6	18.4	20.8	0.0		61.8	1	0	0	0	0	0	0	0	0	0	0	0	0	1
12	1	21.0	15.1	17.0	10.0		63.1	10	9	1	0	0	0	0	0	0	0	0	0	0	0
13	2	21.8	21.2	9.6	20.1		72.7	6	1	0	0	0	0	0	0	0	0	1	0	4	0
14	1	16.0	11.6	20.5	16.5		64.5	1	0	0	0	0	0	0	0	0	0	0	0	1	0
15	2	26.0	3.4	19.0	19.0		67.5	1	1	0	0	0	0	0	0	0	0	0	0	0	0
16	1	11.7	8.4	23.2	24.9		68.0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
17	2	19.5	10.0	20.1	15.7		65.3	3	0	0	1	0	0	0	0	0	0	2	0	0	0
18	1	21.9	11.0	18.9	8.5		60.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	2	13.6	0.0	17.1	21.2		51.8	1	0	1	0	0	0	0	0	0	0	0	0	0	0
20	2	21.5	12.8	20.0	19.5		73.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	1	19.0	10.3	14.7	16.5		60.4	1	1	0	0	0	0	0	0	0	0	0	0	0	0
22	1	21.9	7.9	20.0	11.1		60.8	2	2	0	0	0	0	0	0	0	0	0	0	0	0
23	2	15.7	15.4	13.4	19.4		63.8	4	1	0	1	0	0	0	0	0	2	0	0	0	0
24	1	16.1	14.9	14.5	14.7		60.2	3	1	1	0	0	1	0	0	0	0	0	0	0	0
25	2	13.4	11.9	19.6	17.0		61.9	6	1	4	1	0	0	0	0	0	0	0	0	0	0
26	2	18.5	13.1	17.1	14.6		63.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	1	14.5	10.5	19.6	18.9		63.5	3	1	2	0	0	0	0	0	0	0	0	0	0	0
28	1	19.0	16.8	19.4	14.1		69.2	2	1	1	0	0	0	0	0	0	0	0	0	0	0
29	2	17.1	20.3	20.1	10.0		67.4	1	1	0	0	0	0	0	0	0	0	0	0	0	0
30	1	19.4	17.6	17.4	13.0		67.4	3	2	0	1	0	0	0	0	0	0	0	0	0	0

Appendix Table 2

Set	Depth strata	Effort (min) F1	F2	F3	F4	F5	Total effort	Total fish	Species LC	CR	QR	YR	KG	BS	RI	GS	CA	PS	SS	RS	SD
31	2	17.0	14.9	19.0	6.9		57.8	2	2	0	0	0	0	0	0	0	0	0	0	0	0
32	2	20.1	2.5	19.4	19.1		61.1	2	0	0	0	0	0	0	0	0	0	1	0	1	0
33	1	22.7	17.3	9.8	10.8		60.5	6	0	6	0	0	0	0	0	0	0	0	0	0	0
35	2	0.0	6.3	8.6	11.2		26.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	1	18.1	7.0	17.2	19.8		62.1	1	0	1	0	0	0	0	0	0	0	0	0	0	0
38	2	14.6	12.3	20.1	20.0		67.0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
39	1	20.9	10.0	18.4	16.9		66.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	2	17.1	12.3	18.5	16.0		63.9	2	0	0	0	0	0	0	0	0	0	0	0	0	2
41	2	25.0	9.0	18.2	14.5		66.7	8	6	0	0	0	0	0	0	0	0	2	0	0	0
42	1	15.7	12.0	17.0	17.0		61.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	1	17.1	16.0	16.6	12.4		62.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	2	10.1	13.6	21.4	19.0		64.1	4	3	0	0	0	0	0	0	0	0	1	0	0	0
45	1	16.3	18.8	13.7	14.3		63.1	6	6	0	0	0	0	0	0	0	0	0	0	0	0
46	2	18.0	19.3	17.5	6.0		60.8	2	2	0	0	0	0	0	0	0	0	0	0	0	0
47	1	21.0	20.1	19.7	0.0		60.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	2	23.4	12.1	25.4	0.0		60.8	6	4	0	1	0	0	0	0	0	1	0	0	0	0
49	1	21.3	0.0	18.1	21.2		60.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	2	8.8	0.0	14.8	13.9		37.5	1	0	0	0	0	0	0	0	0	0	1	0	0	0
51	1	16.1	23.7	22.6	4.0		66.3	4	2	2	0	0	0	0	0	0	0	0	0	0	0
52	2	19.3	21.0	20.1	2.7		63.0	4	1	0	3	0	0	0	0	0	0	0	0	0	0
53	1	15.8	18.9	17.0	9.2		60.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	2	16.7	17.8	15.8	14.0		64.3	3	1	0	1	1	0	0	0	0	0	0	0	0	0
55	1	12.9	19.7	19.5	11.6		63.7	5	5	0	0	0	0	0	0	0	0	0	0	0	0
56	2	13.7	15.2	16.6	16.1		61.4	2	1	0	0	0	0	0	0	0	0	1	0	0	0
57	2	18.3	12.0	16.6	14.9		61.8	11	6	0	1	0	0	0	0	0	0	3	0	1	0
58	1	17.7	10.9	19.2	12.8		60.6	4	2	1	1	0	0	0	0	0	0	0	0	0	0
59	2	19.5	14.6	20.0	5.7		59.8	2	1	0	0	1	0	0	0	0	0	0	0	0	0
60	1	20.1	10.5	17.2	14.0		61.8	4	4	0	0	0	0	0	0	0	0	0	0	0	0
61	1	14.0	14.1	18.2	18.3		64.6	3	3	0	0	0	0	0	0	0	0	0	0	0	0
62	1	18.9	13.3	17.0	16.3		65.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	2	14.7	18.7	16.4	15.2		64.9	2	2	0	0	0	0	0	0	0	0	0	0	0	0
64	2	15.0	13.4	17.3	14.9		60.5	1	0	0	0	0	0	0	0	0	0	0	1	0	0

Appendix Table 2

Set	Depth strata	Effort (min) F1	F2	F3	F4	F5	Total effort	Total fish	Species LC	CR	QR	YR	KG	BS	RI	GS	CA	PS	SS	RS	SD
65	1	12.5	13.7	17.5	21.4		65.1	1	0	1	0	0	0	0	0	0	0	0	0	0	0
66	1	18.2	14.0	16.0	14.7		62.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	2	14.7	17.4	14.9	14.7		61.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	1	15.3	20.0	16.2	14.2		65.6	3	2	1	0	0	0	0	0	0	0	0	0	0	0
69	1	12.1	17.8	17.7	15.2		62.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	2	14.1	16.0	17.0	18.7		65.8	1	1	0	0	0	0	0	0	0	0	0	0	0	0
71	1	15.3	14.7	15.0	0.0	16.5	61.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	2	16.8	16.1	14.0	0.0	13.0	59.9	1	1	0	0	0	0	0	0	0	0	0	0	0	0
73	1	13.5	16.8	14.0	1.3	21.3	66.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74	2	0.3	0.0	4.0	0.0	3.5	7.8	1	1	0	0	0	0	0	0	0	0	0	0	0	0
75	1	13.0	11.8	15.5	0.0	16.7	56.9	3	2	0	1	0	0	0	0	0	0	0	0	0	0
76	1	18.8	13.0	18.0	14.0		63.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	2	20.3	0.0	21.5	19.3		61.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	2	20.0	0.0	20.0	20.0		60.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	1	17.9	7.8	20.1	16.7		62.4	1	0	1	0	0	0	0	0	0	0	0	0	0	0
80	1	15.5	18.6	15.2	0.0	17.0	66.3	2	0	0	0	0	0	0	0	0	2	0	0	0	0
81	2	16.0	14.8	16.2	0.0	12.7	59.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	2	18.5	9.5	18.7	0.0	18.1	64.7	1	0	0	0	0	0	0	0	0	0	1	0	0	0
83	1	12.0	20.1	19.4	0.0	14.0	65.5	1	0	0	0	0	0	0	0	0	1	0	0	0	0
84	1	11.3	15.1	18.0	0.0	19.3	63.7	17	4	2	10	0	1	0	0	0	0	0	0	0	0
85	2	20.0	16.8	13.0	0.0	13.8	63.7	4	1	0	3	0	0	0	0	0	0	0	0	0	0
86	2	13.0	14.3	17.6	0.0	16.5	61.4	2	2	0	0	0	0	0	0	0	0	0	0	0	0
87	2	16.5	12.5	13.9	0.0	21.0	63.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
88	1	17.5	18.1	15.0	0.0	16.0	66.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
89	1	12.0	16.8	15.8	0.0	17.0	61.6	5	0	4	1	0	0	0	0	0	0	0	0	0	0
90	2	16.0	13.3	16.0	0.0	17.0	62.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
91	2	15.7	13.0	16.0	0.0	17.0	61.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92	1	19.0	18.2	18.0	0.0	6.8	62.0	4	2	1	1	0	0	0	0	0	0	0	0	0	0
Total		1514	1141	1586	1044	278	5561.5	232	102	35	31	2	5	2	4	1	7	24	1	9	9

Appendix Table 3a. Fork length (mm), weight (g), sex (1=male, 2=female) and stage of maturity for lingcod caught. Stage of maturity codes: 1=immature, 2=maturing, 3=maturing, 4=mature, 5=ripe, 6=spent, 7=resting. Missing data indicate the fish was not landed. Depth strata 1=0-25 m; depth strata 2=26-50 m.

Set	Statistical Area	Depth Strata	Depth Caught (m)	Length (mm)	Weight (g)	Sex	Maturity	Fisher
2	19	2	30					4
8	18	2	37	712	3780	2	3	3
9	18	1	10	584	1920	1	2	4
9	18	1	12	500	1090	1	2	1
9	18	1	16	576	1150	1	2	4
9	18	1	17	518	1260	1	2	3
9	18	1	13				1	1
9	18	1	13					3
10	19	1	10.5	395	520	1	1	3
10	19	1	13.3	470	890	1	2	4
10	19	1	14	476	880	1	2	1
10	19	1	15.5	465	930	1	1	2
12	19	1	13	574	1240	1	2	3
12	19	1	16	491	890	1	1	1
12	19	1	20	456	780	1	1	2
12	19	1	20	490	1090	1	2	3
12	19	1	20	492	1040	1	2	4
12	19	1	23	500	1020	1	1	3
12	19	1	25	548	1490	1	2	3
12	19	1	13					1
12	19	1	22					3
13	19	2	42	576	1790	1	2	3
15	19	2	31.3	368	430	1	1	4
16	18	1	13	369	380	1	1	3
21	18	1	14	545	1610	1	3	4
22	19	1	24	455	790	1	1	3
22	19	1	16	630	2370	2	2	4
23	18	2	38	607	2120	1	2	2
24	18	1	18	624	2390	1	2	3
25	18	2	38	455	890	1	1	2
27	18	1	15	830	6450	1		1

Appendix Table 3a.

Set	Statistical Area	Depth Strata	Depth Caught (m)	Length (mm)	Weight (g)	Sex	Maturity	Fisher
28	18	1	9	545	1790	1	3	1
29	18	2	30	675	3310	2	2	2
30	19	1	18	447	700	1	1	2
30	19	1	10	546	1600	2	2	2
31	19	2	26	602	2500	1	2	1
31	19	2	29	581	2250	2	2	2
41	19	2	39	608	1960	1	1	4
41	19	2	40	530	1520	1	2	2
41	19	2	40	498	1003	1	1	4
41	19	2	40	574	1680	2	1	1
41	19	2	40	570	1780	2	2	2
41	19	2	45	643	2570	2	2	1
44	17	2	31	760	4560	1	3	1
44	17	2	30	760	4230	2	3	1
44	17	2	41	726	3630	2	3	2
45	17	1	4	540	1580	1	3	3
45	17	1	4	630	2660	1	3	4
45	17	1	10	514	1160	1	2	2
45	17	1	10	628	2550	1	3	3
45	17	1	7	755	4280	2	3	1
45	17	1	10	605	2170	2	3	4
46	17	2	35	805	5190	2	3	2
46	17	2	37	868	7020	2	3	4
48	17	2	29	467	1010	1	2	1
48	17	2	37	473	870	1	2	1
48	17	2	37	462	890	1	2	2
48	17	2	39	856	7280	2	3	2
51	17	1	10	594	2140	1	3	3
51	17	1	14	450	780	1	1	2
52	17	2	49	640	2660	2	3	3
54	17	2	27	625	2500	1	2	2
55	17	1	6	645	3160	1	4	4

Appendix Table 3a.

Set	Statistical Area	Depth Strata	Depth (m)	Caught	Length (mm)	Weight (g)	Sex	Maturity	Fisher
55	17	1	7		484	1120	1	2	2
55	17	1	8		488	1050	1	3	3
55	17	1	15		594	1770	1	3	3
55	17	1	16		680	2920	2	3	1
56	17	2	27		494	1000	1	1	2
57	17	2	31		447	730	1	1	2
57	17	2	31		520	1180	1	2	4
57	17	2	35		495	980	1	2	3
57	17	2	38		448	760	1	1	2
57	17	2	29		522	1190	2	1	4
57	17	2	31		510	980	2	1	3
58	17	1	17		743	4250	1	3	2
58	17	1	10		516	1140	2	1	3
59	17	2	47		453	820	1	2	2
60	17	1	6		645	2150	1	3	4
60	17	1	7		565	1140	1	3	2
60	17	1	9		515	1180	1	2	2
60	17	1	9		682	3310	1	3	3
61	17	1	12		670	3240	1	4	2
61	17	1	12		645	2620	2	1	1
61	17	1	14		568	1630	2	1	3
63	17	1	25		474	960	1	1	4
63	17	2	30		602	2020	2	2	1
68	17	1	17		710	4060	1	5	1
68	17	1	16		480	1050	2	1	4
70	17	2	27		435	630	1	2	2
72	17	2	42		755		1		3
74	17	2	30		446	720	2	1	1
75	17	1	7		570		1		1
75	17	1	10		560		1		3
84	17	1	15		554	1590	2	2	2
84	17	1	16		537	1450	2	2	1

Appendix Table 3a.

Set	Statistical Area	Depth Strata	Depth (m)	Caught	Length (mm)	Weight (g)	Sex	Maturity	Fisher
84	17	1	19		471	850	2	1	1
85	17	2	34		503	1190	1	3	2
84	17	1	21		815	5290	2	3	5
86	17	2	27		484	1030	1	2	5
86	17	2	28		405	570	1	1	1
92	17	1	15		535	1540	1	3	2
92	17	1	23		430	700	1	2	1

Apendix Table 3b. Fork length (mm), weight (g), sex (1=male, 2=female) and stage of maturity for copper rockfish caught. Stage of maturity codes: 1=immature, 2=maturing, 3=maturing, 4=mature, 5=ripe, 6=spent, 7=resting. Missing data indicate the fish was not landed. Depth strata 1=0-25 m; depth strata 2=26-50 m.

Set	Statistical Area	Depth Strata	Depth Caught (m)	Length (mm)	Weight (g)	Sex	Maturity	Fisher
1	19	1	20	310	560	1	2	3
5	18	1	24.5	275	370	1	2	1
5	18	1	10.1	220	210	1	2	4
6	18	2	34.5	360	850	1	4	4
10	19	1	13	311	580	1	4	1
12	19	1	25	380	1030	1	4	1
19	18	2	28	313	450	2	2	4
24	18	1	16.5	354	750	1	3	1
25	18	2	45	359	785	1	7	1
25	18	2	30	301	630	2	7	3
25	18	2	29	388	970	2	7	4
25	18	2	29	355	675	1	4	2
27	18	1	16	275	340	1	4	3
27	18	1	14	315	555	2	3	1
28	18	1	14	268	320	2	3	3
33	18	1	10	265	310	1	4	1
33	18	1	10	327	630	1	2	4
33	18	1	10	280	380	2	2	2
33	18	1	9	330	620	1	3	3
33	18	1	10	266	280	1	4	2
33	18	1	10	291	410	2	2	1
37	19	1	18	239	250	2	1	4
51	17	1	15	281	360	1	2	2
51	17	1	16	382	1020	1	4	1
58	17	1	12	314	590	1	4	3
65	17	1	18	320	650	2	2	2
68	17	1	13	290	400	1	3	4
79	17	1	7	345				2
84	17	1	16	316	515	2	3	5
84	17	1	21	386		1		2
89	17	1	20	375	825	1	4	5
89	17	1	19	392	985	1	4	5
89	17	1	19	368	980	1	4	5
89	17	1	19	341	670	1	4	1
92	17	1	15	305	550	2	2	5

Appendix Table 3c. Fork length (mm), weight (g), sex (1=male, 2=female) and stage of maturity for quillback rockfish caught. Stage of maturity codes: 1=immature, 2=maturing, 3=maturing, 4=mature, 5=ripe, 6=spent, 7=resting. Missing data indicate the fish was not landed. Depth strata 1=0-25 m; depth strata 2=26-50 m.

Set	Statistical Area	Depth Strata	Depth Caught (m)	Length (mm)	Weight (g)	Sex	Maturity	Fisher
5	18	1	24.5	255	330	1	1	3
6	18	2	38	260	310	1	1	3
6	18	2	27	279	390	2	2	3
8	18	2	38	235	280	1	1	3
17	18	2	33	309	470	1	3	2
23	18	2	38	279	395	1	3	4
25	18	2	45	323	740	1	3	4
30	19	1	13	309	530	2	2	3
48	17	2	29	312	580	2	2	3
52	17	1	25	263	360	2	2	1
52	17	1	25	363	880	1	2	2
52	17	2	41	390	1110	2	2	4
54	17	2	33	335	710	2	1	1
57	17	2	28	245	270	2	1	1
58	17	1	10	333	650	2	5	1
75	17	1	14	360	890	2	5	5
84	17	1	16	325				1
84	17	1	17	240	255	2	2	2
84	17	1	21	272	360	1	3	2
84	17	1	21	285	405	2	3	3
84	17	1	20	249	270	1	2	3
84	17	1	20	328	655	2	7	1
84	17	1	18	321		1		5
84	17	1	21	524				1
84	17	1	21	348		2		2
84	17	1	24	348		1		1
85	17	2	34	398	1255	2	3	5
85	17	2	34	395	1245	2	3	3
85	17	2	42	313	485	1	3	5
89	17	1	19	257	320	1	2	1
92	17	1	12	243	260	2	2	3

Appendix Table 4. Description of maturity stages for male and female lingcod.

Maturity Stage	Male	Female
STAGE 1: Immature	• Testes are threadlike to ribbonlike. • Colour is transparent white to white	• Ovaries are small and translucent. • Colour is pink or white-pink. • Eggs are not visible
STAGE 2: Maturing - small	• Testes are larger ribbonlike. • Colour is white to very light brown	• Ovaries fill about 1/4 to 1/3 of body cavity. • Colour is orange and opaque or semi-translucent. • Blood vessels are pronounced on the ovary
STAGE 3: Maturing - large	• Testes fill 1/3 of body cavity. • Colour is whiter than in Stage 2	• Ovaries fill about 1/3 to 2/3 of body cavity • Colour is orange. • Blood vessels are pronounced on the ovary. • Eggs are opaque
STAGE 4: Mature	• Testes fill 1/3 to 2/3 of body cavity • Colour is white. • A cross sectioning of testis will produce sperm at the • centre of the tissue	• Ovaries fill 2/3 to 4/5 of the body cavity. • Eggs are opaque. • Colour is orange to white
STAGE 5: Ripe	• Testes fill 2/3 or more of the body cavity. • Colour is white. • Testis lobes are fully developed. • Sperm is released from the vent with slight pressure • on the body exterior.	• Ovaries fill near all of the body cavity. • Colour is opaque orange to white. • Eggs may be loose inside the ovary
STAGE 6: Spent	• Testes are moderate in size • Colour is tan brown with some white colour still • evident. • A cross sectioning of testis will reveal some • remaining sperm in centre of the gonad.	• Ovaries fill 1/3 to 2/3 of the body cavity. • Colour is purple and may be bloodshot. • Ovaries are flaccid and some eggs may remain • within. • Reabsorbing • Recovering
STAGE 7: Resting	• Testes are relatively smaller and firm. • Colour is tan brown	• Ovaries fill less than 1/3 of the body cavity. • Colour is often pink. • Ovaries are firm.

Appendix Table 5. Codes used for sea state, tide, current and weather.

Code	
Sea State	
1	calm
2	ripple
3	chop
4	swell
Tide	
1	ebb
2	flood
3	high
4	low
Current	
0	none
1	minimal
2	moderate
3	moderate-strong
Weather	
1	sun
2	rain
3	partly cloudy
4	overcast
5	high cloud