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PURSE-SEINE SURVEYS OF POST-LARVAL LINGCOD (*OPHIODON ELONGATUS*) IN THE STRAIT OF GEORGIA, 1989-90

by

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ABSTRACT

Hand C. M., and L. J. Richards. 1991. Purse-seine surveys of post-larval lingcod (*Ophiodon elongatus*) in the Strait of Georgia, 1989-90. Can. Manuscr. Rep. Fish. Aquat. Sci. 2106: 23 p.

Purse-seine surveys of post-larval lingcod were conducted in May 1989 and May 1990, near Nanaimo in the Strait of Georgia, British Columbia. Peak densities reached 2543 lingcod/km^2 in 1989 and 588 lingcod/km^2 in 1990. These densities were significantly lower than the density obtained from the 1980 survey at the same sites. However, lingcod tended to be caught at a larger size in 1989-90, and the differences may simply reflect sampling problems. Low densities were also obtained in 1975-76 and 1981 surveys. Because of the large sample variance, purse-seine surveys are a poor method for monitoring lingcod abundance.

RÉSUMÉ

Hand C. M., and L. J. Richards. 1991. Purse-seine surveys of post-larval lingcod (*Ophiodon elongatus*) in the Strait of Georgia, 1989-90. Can. Manuscr. Rep. Fish. Aquat. Sci. 2106: 23 p.

Des campagnes de dénombrement de morues-lingues post-larvaires utilisant une seine coulissante ont été menées en mai 1989 et 1990, près de Nanaimo dans le détroit de Géorgie, en Colombie-Britannique. Les densités maximales observées étaient de 2 543 morues-lingues/km^2, en 1989, et de 588 morues-lingues/km^2, en 1990. Ces densités sont nettement inférieures à celles obtenues au même endroit en 1980. Cependant, la taille des morues-lingues capturées en 1989-1990 était supérieure; les différences observées entre ces périodes sont donc peut-être simplement attribuables à des problèmes d'échantillonnage. De faibles densités avaient également été obtenues lors des campagnes de 1975-1976 et 1981. En raison de la grande variance des échantillons, les campagnes utilisant une seine coulissante s'avèrent une mauvaise méthode pour surveiller les abondances de morue-lingue.

INTRODUCTION

Lingcod (*Ophiodon elongatus*) have been heavily exploited in the Strait of Georgia, British Columbia, since the early 1900s (Cass et al. 1990). Catches of over 2000 t occurred regularly through the 1940s. Since the 1950s, however, catch, effort, and size of the fishing fleet have decreased. The 1989 commercial catch was only 74 t and the recreational catch was approximately 84 t (Richards and Hand 1991). A number of management strategies have been adopted to prevent further stock declines and to rebuild depleted stocks. A winter closure to commercial fishing and a size limit of 58 cm was in effect as early as 1940. In 1979, the closed season was extended by two months and then, in 1988, by another 2 weeks, from November 15 to April 30. In 1990, commercial lingcod fishing was prohibited in the majority of the Strait of Georgia (statistical areas 13-19, 28, 29).

With the loss of commercial fishery statistics in 1990, other methods are required for monitoring lingcod abundance. In 1989, a program began to evaluate potential monitoring strategies. Three types of surveys were initiated: (1) a SCUBA survey of lingcod nests; (2) a purse-seine survey of post-larval lingcod; and (3) surveys of juvenile lingcod. The purpose of this report is to summarize the results of post-larval surveys conducted in May 1989 and May 1990. Similar surveys were conducted in 1975-76 (Phillips and Barraclough 1977) and 1980-81 (Cass and Scarsbrook 1984).

Lingcod biology is reviewed by Cass et al. (1990). Briefly, lingcod migrate to shallow reef areas in December and January and lay their eggs in adhesive masses in rock crevices. Male lingcod guard the nests until the eggs hatch in 5-11 weeks. In the Strait of Georgia, most of the nests hatch during March and April (Low and Beamish 1978). Newly hatched lingcod larvae are initially dispersed by currents in surface waters. By May, they have moved inshore as pelagic post-larvae and concentrate in shallow areas. After a few weeks, they disappear from surface waters and become demersal. The goal of the purse-seine surveys was to sample the larvae while they were concentrated in shallow areas.

METHODS

Purse-seine surveys were conducted near Nanaimo, in the southern Strait of Georgia (Fig. 1), during May 1989 and May 1990. All sites were sampled once in each week of the three-week study period. The 20 sites selected for the survey were a subset of the sites sampled during the 1980-81 surveys. Thus, the results from the 1980-81 and 1989-90 surveys should be directly comparable. The timing of the surveys was intended to bracket the buildup, peak, and decline of post-larval concentrations (Phillips and Barraclough 1977).

Unfortunately, the purse seine used in the 1980-81 surveys (275 m x 18 m purse seine, with a 5 mm stretched mesh bunt end) had deteriorated and was not useable for the 1989-90 surveys. In 1989, sampling was conducted from the R/V CALIGUS using a 210 m x 22 m purse seine, with a 6 mm stretched mesh bunt end. In 1990, sampling was conducted from the R/V CALIGUS using a 375 m x 25 m purse seine with a 5 mm stretched mesh bunt end. Site 2 at Brandon Island was not surveyed in 1990 because net depth exceeded water depth.

Catches of lingcod were preserved in 5% formalin and were later counted and measured for fork length by set. Measurements of large catches were collected from subsamples. The distribution of counts was highly skewed for sets during a one-week period. A ln(N+1) transform was applied to the raw counts for the calculation of weekly means and confidence intervals. Density calculations assumed that the length of the purse seine represented the circumference of the circle formed by the net during sampling.

RESULTS

Numbers of post-larval lingcod caught during purse seining in 1989 and 1990 are given in Tables 1 and 2. There is little consistency in the counts from week to week at a site or in the ranking of the sites between years. For example, between May 8-12, 1989, the greatest number of post-larval lingcod were caught at site 9 (Malaspina Point). However, only three lingcod were caught at this site in the remaining two time periods. Sites 2, 3, 8, and 9 (Brandon Island, Five Fingers, McKay Point, and Malaspina Point) were the most productive in 1989. In 1990, site 17 (Lock Bay) was more than twice as productive as any other site.

In previous surveys, peak lingcod densities have generally occurred in the middle of May (Table 3). Similarly in 1989, peak densities occurred in the second sampling period, between May 15-19. In 1990, however, peak densities occurred in the first sampling period, between May 7-14. As densities were also lower in 1990, it is possible that the majority of the lingcod may have disappeared from the plankton before the beginning of the survey.

Peak post-larval densities were 2543 fish/km^2 in 1989 and 588 fish/km^2 in 1990. It is apparent from the 95% confidence intervals that peak 1989-90 densities were similar to peak densities in 1976 and 1981, and that peak 1989 densities were also similar to densities in 1975. The 1980 survey found the highest lingcod densities. Comparing sites that were sampled in each of the 1980, 1989, and 1990 surveys, peak densities from the 1980 survey were significantly greater than from the 1989 and 1990 surveys (Kruskal-Wallis test, $p<0.001$). In addition, peak densities in 1990 were significantly below those in 1989 (Wilcoxon test, $p=0.02$).

Because different nets were used in each of the recent surveys, some of the between-survey differences may be accounted for by gear selectivity. In the 1980 survey, length-frequency distributions (Fig. 2) indicate a clear progression in modal size between sampling periods. At the time of peak densities, the modal size was 35 mm. Lingcod of this size were rarely caught in 1989 (Fig. 3) or 1990 (Fig. 4), although the mesh size used in 1980 was identical to that used in 1990. Length-frequency information by set is listed in Appendix Table 1.

Lingcod length-frequency distributions in 1989 and 1990 were similar, in spite of differences in mesh size. Both 1989 and 1990 distributions were suggestive of two periods of lingcod hatching. For the May 8-12, 1989 period, there were modes in the size distribution at 45 and 65 cm. The larger mode disappeared in subsequent periods while the smaller mode increased in size to 55 and 65 cm. For the May 7-14, 1990 period, there was a single mode at 55 cm. By the May 14-18, 1990 period, a smaller mode had appeared at 50 cm. Thus, differences between 1980 and 1989-90 could simply reflect a prolonged hatching period and the inability of the net to sample lingcod smaller than 40 cm.

To enable more meaningful comparisons between 1980, 1989, and 1990 surveys, we computed mean densities for large lingcod ($\geq$50 mm) (Table 4). Lingcod of this size appeared to be adequately sampled in at least one of the May sampling periods. Furthermore, we only included densities from the 19 sites that were surveyed in all three years. Although peak densities by this method were greater in 1980 than in 1989, the differences were no longer significant (Wilcoxon test, $p>0.1$). However, densities in 1990 were significantly lower than in 1980 or 1989 (Kruskal-Wallis test, $p=0.01$).

DISCUSSION

These results suggest that post-larval surveys are a poor method for monitoring changes in lingcod abundance. Among-site variances were large for each sampling period in each year. In addition, density at a given site varied inconsistently among sampling periods and years. Difficulties in precisely repeating the surveys in different years complicated the interpretation. For example, different nets were used in different years, and a different vessel and crew participated in the 1989-90 surveys. Furthermore, the timing and duration of larval hatching obviously varied among years.

The post-larval surveys indicated minor differences only in lingcod densities since 1975. However, based on commercial catch statistics (Richards and Hand 1991) and adult lingcod surveys (Hand and Richards 1989), there have been substantial decreases in abundance over this period. It is unclear how to reconcile these sources of information. It is possible that large annual changes in larval lingcod abundance have occurred, but are not accurately sampled by the surveys. For example, changes in abundance could affect distribution more than density at a given site. Alternatively, adult lingcod densities may have been relatively stable in the region of the surveys. It is hoped that juvenile surveys will provide a better method for monitoring lingcod populations.

ACKNOWLEDGEMENTS

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Table 1. Numbers of post-larval lingcod caught with a 210 m purse seine in the Strait of Georgia in May 1989, by site and sampling period.

Site Number	May 8-12	May 15-19	May 23-25	Total
1	0	17	2	19
2	53	83	37	173
3	0	141	8	149
4	18	7	3	28
5	87	10	1	98
6	0	23	0	23
7	3	2	25	30
8	0	136	0	136
9	120	2	1	123
11	30	56	5	91
12	0	5	0	5
13	1	5	5	11
14	16	0	6	22
16	0	3	5	8
17	14	47	6	67
19	9	4	0	13
20	0	10	0	10
21	0	0	9	9
25	37	3	20	60
26	2	1	12	15
Total	390	555	145	1090

Table 2. Numbers of post-larval lingcod caught with a 375 m purse seine in the Strait of Georgia in May 1990, by site and sampling period.

Site Number	May 7-14	May 14-18	May 21-25	Total
1	9	3	0	12
2	-	-	-	-
3	32	36	0	68
4	20	10	0	30
5	0	3	0	3
6	0	1	1	2
7	47	7	11	65
8	63	10	2	75
9	70	4	4	78
11	15	10	4	29
12	0	3	6	9
13	5	10	0	15
14	0	1	1	2
16	23	0	1	24
17	191	15	0	206
19	0	5	0	5
20	0	0	0	0
21	0	5	0	5
25	3	5	2	10
26	4	5	0	9
Total	482	133	32	647

Table 3. Mean post-larval lingcod densities per set and per km^2 and the corresponding 95% confidence intervals, determined from purse-seine surveys in the Strait of Georgia, 1975-90.

Sampling Period	Lingcod per set	95% C.I.	Lingcod per km^2	95% C.I.
		1975 Survey		
May 5-7	4.8	2.2-10.3	1371	629-2943
May 12-15	17.2	5.8-51.0	4914	1657-14571
May 21-22	3.7	1.0-13.2	1057	286-3771
May 27-30	3.4	1.7-6.8	971	486-1943
		1976 Survey		
May 3-4	0.8	0.5-1.3	229	143-371
May 10-11	0.4	0.3-0.6	114	89-171
May 18-20	3.1	1.3-7.5	886	371-2143
May 25-June 3	0.1	0.7-0.8	28	20-229
		1980 Survey		
April 21-23	5.9	2.0-17.6	1000	338-2983
April 30-May 2	21.6	12.8-36.4	3661	2169-6170
May 7-8	19.2	7.8-47.1	3254	1322-7983
May 13-17	60.3	28.8-126.4	10220	4881-21424
May 21-28	13.0	6.7-25.3	2203	1136-4288
May 31-June 6	1.2	0.8-1.8	203	136-305
		1981 Survey		
May 7	8.7	3.0-23.8	1475	536-4036
May 15-16	30.4	8.4-110.5	5152	1423-18729
May 27-28	1.9	1.0-3.9	322	169-661
		1989 Survey		
May 8-12	4.9	2.2-11.2	1405	616-3204
May 15-19	8.9	4.4-18.2	2543	1250-5175
May 23-25	4.0	2.4-6.8	1150	684-1933
		1990 Survey		
May 7-14	7.1	3.0-16.8	588	248-1396
May 14-18	5.5	3.5-8.5	458	295-712
May 21-25	1.9	1.3-2.8	156	106-230

Table 4. Mean densities of large (≥50 mm) post-larval lingcod per set and per km^2 and the corresponding 95% confidence intervals for 1980, 1989, and 1990, determined from the 19 sites that were surveyed by purse seine in all three years.

Sampling Period	Lingcod per set	95% C.I. 95%	Lingcod per km^2	95% C.I.
		1980 Survey		
May 7-8	1.3	1.0-1.7	219	169-283
May 13-17	12.0	4.6-31.4	1997	764-5220
May 21-28	15.7	6.8-36.3	2603	1124-6028
		1989 Survey		
May 8-12	3.8	1.9-7.8	1080	527-2210
May 15-19	8.7	4.3-17.5	2479	1129-5001
May 23-25	4.0	2.4-6.7	1139	678-1912
		1990 Survey		
May 7-14	6.0	2.6-13.8	503	229-1146
May 14-18	4.4	2.9-6.7	369	244-557
May 21-25	1.9	1.3-2.7	155	106-222

Figure 1. Location of survey sites near Nanaimo, in the Strait of Georgia, British Columbia.

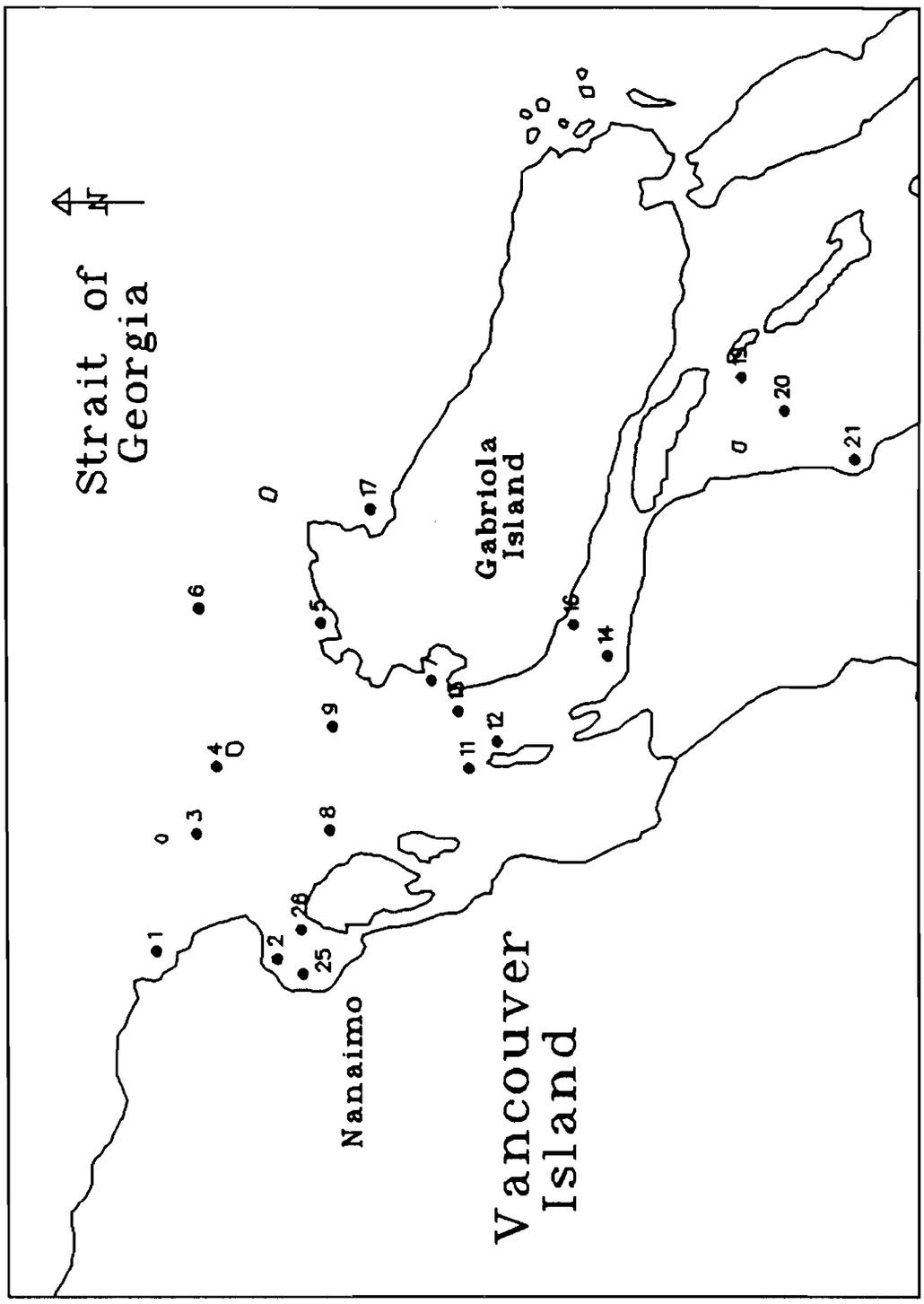
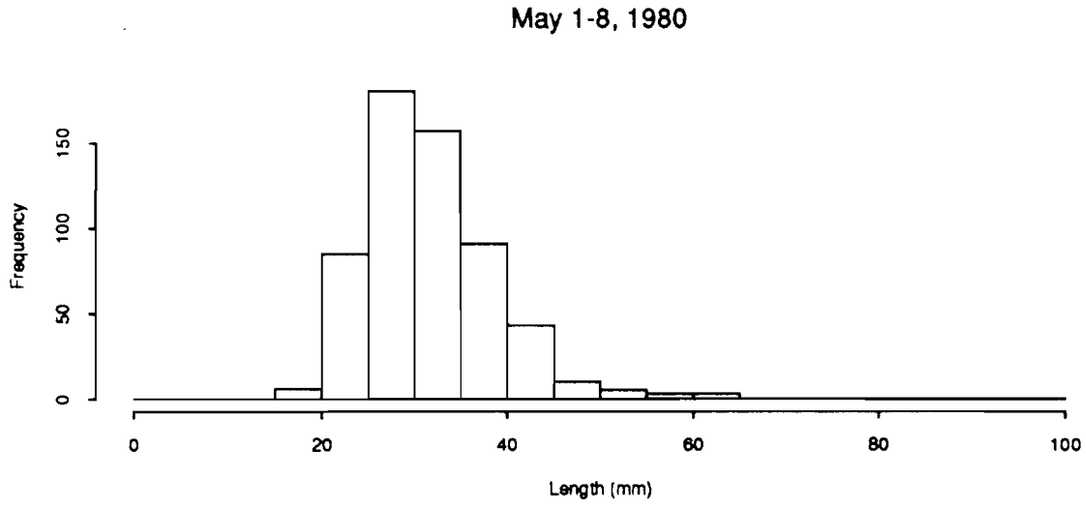
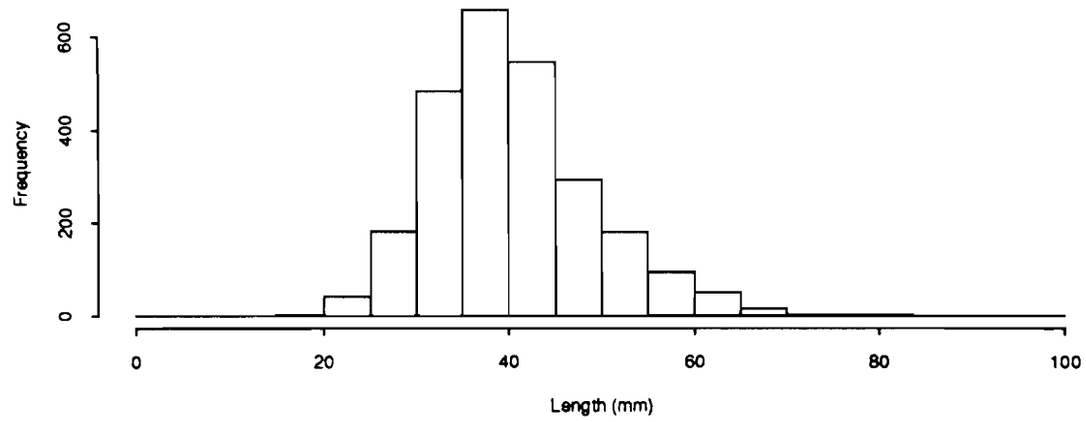

Strait of Georgia
N
Gabriola Island
Vancouver Island
Nanaimo
1
2
3
4
5
6
7
8
9
11
12
14
16
17
20
21
25
26

Figure 1

Figure 2. Length-frequency distributions of post-larval lingcod sampled during the May 1980 purse-seine surveys. Sample sizes are 437, 2551, and 1563 lingcod for the three consequtive sampling periods.


May 1-8, 1980
Frequency
0
50
100
150
0
20
40
60
80
100
Length (mm)


May 13-17, 1980
Frequency
0
200
400
600
0
20
40
60
80
100
Length (mm)

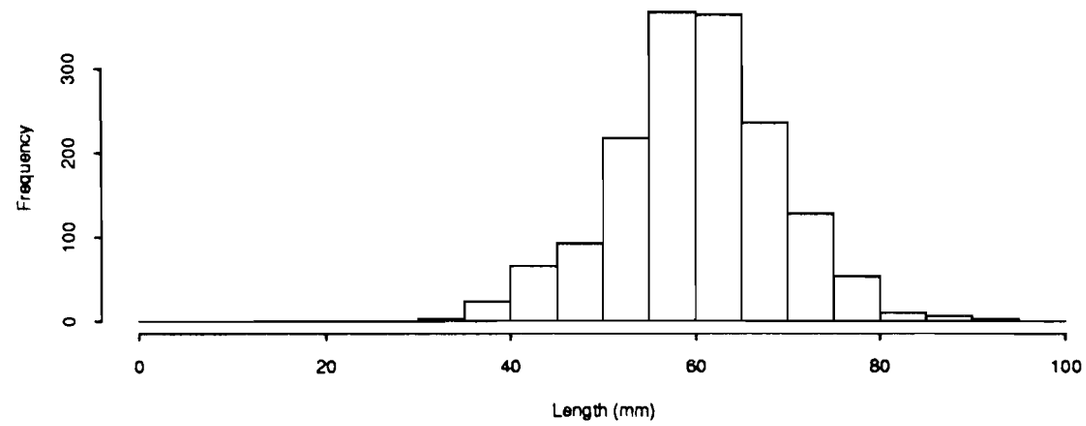
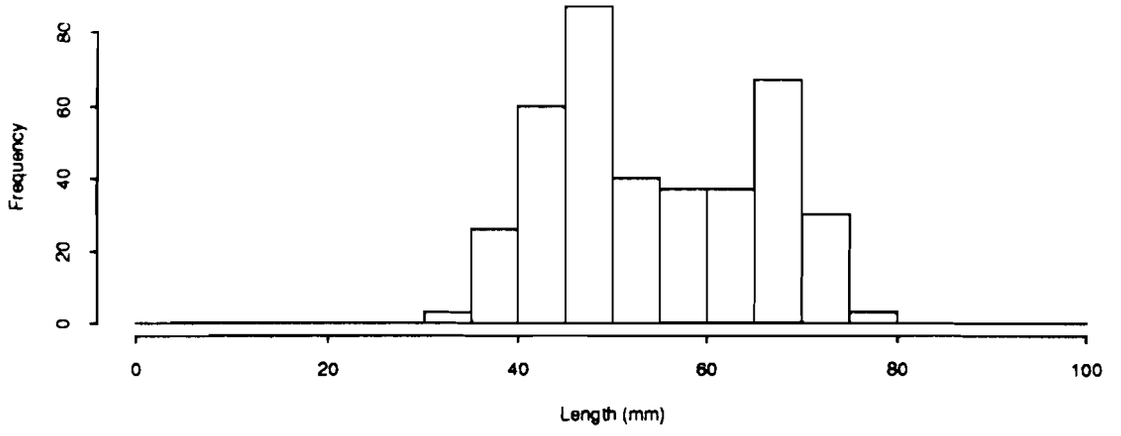

May 21-28, 1980
Frequency
0
100
200
300
0
20
40
60
80
100
Length (mm)

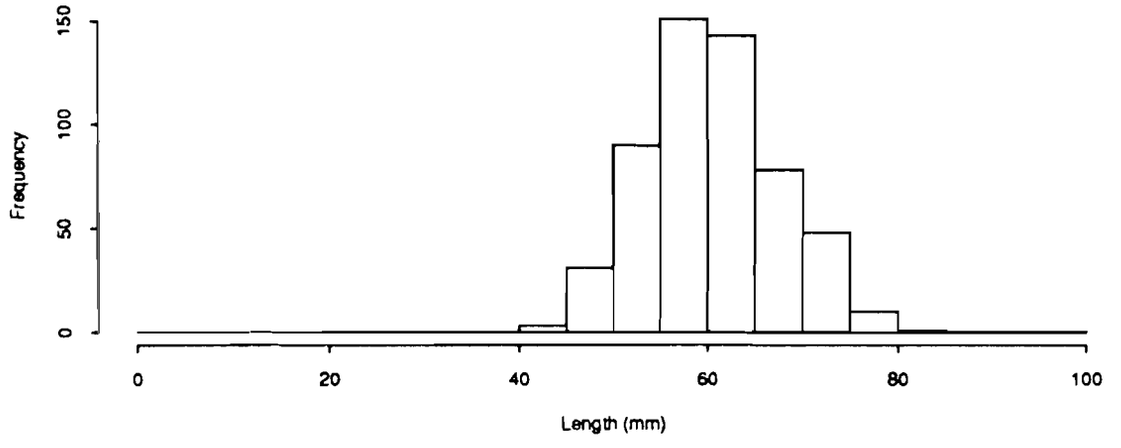
Figure 2

Figure 3. Length-frequency distributions of post-larval lingcod sampled during the May 1989 purse-seine surveys. Sample sizes are 390, 555, and 144 lingcod for the three consequtive sampling periods.

May 8-12, 1989



May 15-19, 1989



May 23-25, 1989

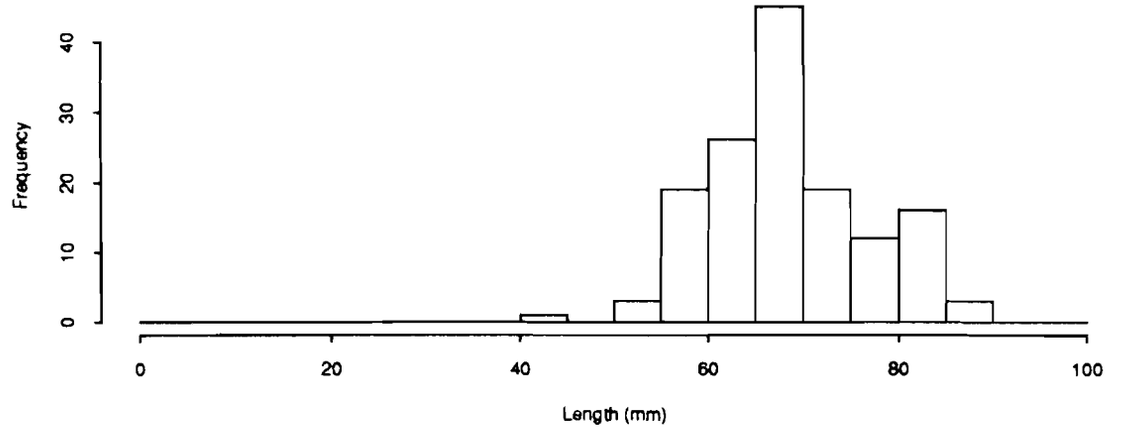
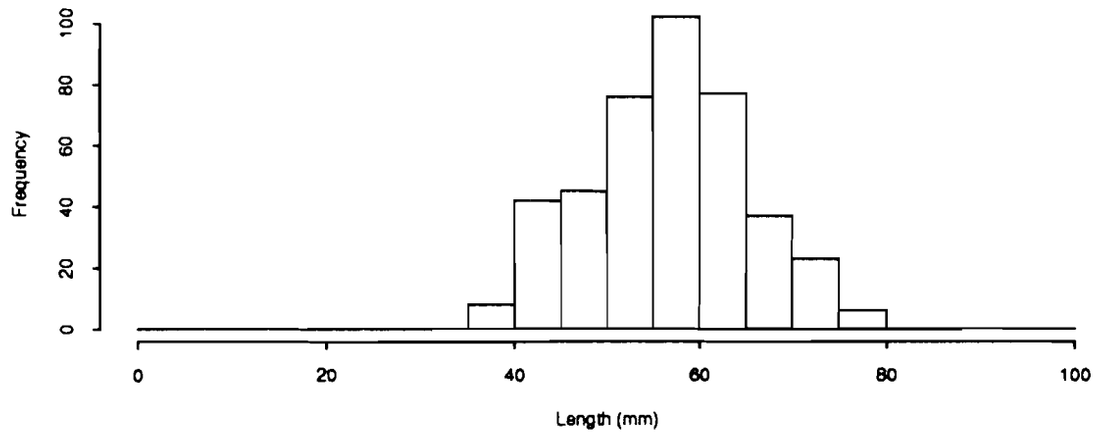


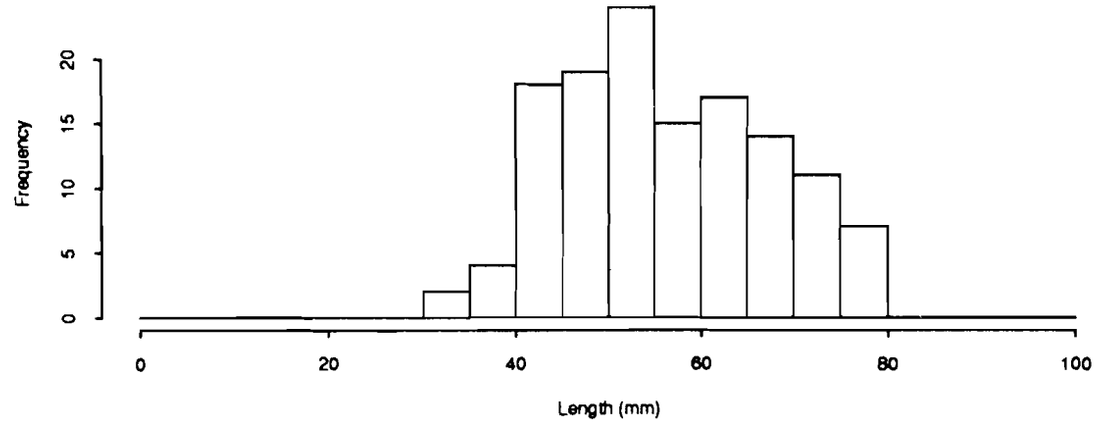
Figure 3

Figure 4. Length-frequency distributions of post-larval lingcod sampled during the May 1990 purse-seine surveys. Sample sizes are 482, 133, and 32 lingcod for the three consequtive sampling periods.

May 7-14, 1990



May 14-18, 1990



May 21-25, 1990

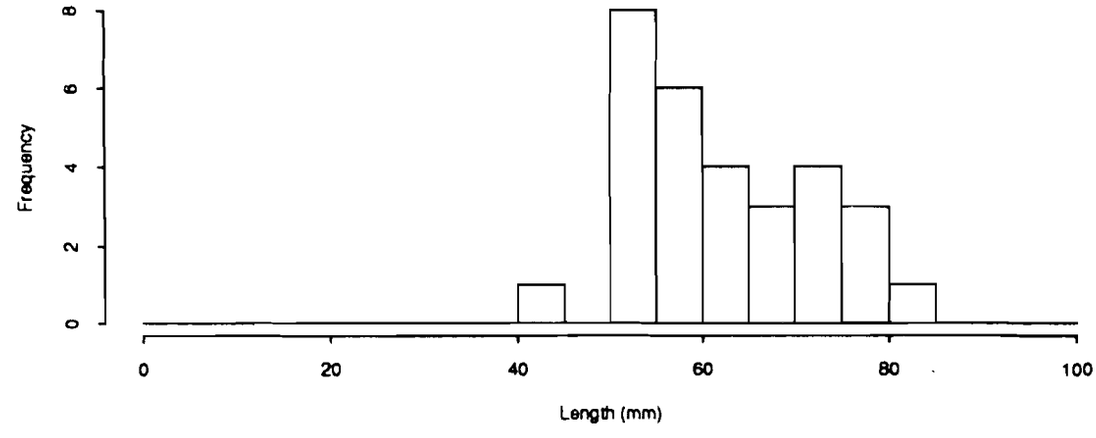


Figure 4

Appendix Table 1. Date, site number, length, and frequency of post-larval lingcod of that length in the purse-seine catch.

Date	Site	Len	Freq	Date	Site	Len	Freq	Date	Site	Len	Freq
890508	11	58	1	890511	2	72	4	890511	9	44	8
890508	11	59	1	890511	2	73	3	890511	9	45	7
890508	11	60	2	890511	2	74	1	890511	9	46	13
890508	11	62	1	890511	2	75	2	890511	9	47	6
890508	11	63	1	890511	2	76	1	890511	9	48	7
890508	11	64	2	890511	2	78	1	890511	9	49	9
890508	11	65	5	890511	4	35	1	890511	9	50	4
890508	11	66	2	890511	4	40	1	890511	9	51	6
890508	11	67	3	890511	4	41	1	890511	9	52	4
890508	11	68	3	890511	4	42	1	890511	9	53	1
890508	11	69	1	890511	4	44	1	890511	9	54	2
890508	11	70	3	890511	4	45	1	890511	9	55	2
890508	11	72	1	890511	4	46	1	890511	9	56	3
890508	11	73	1	890511	4	47	3	890511	9	58	1
890508	11	74	1	890511	4	48	2	890511	9	60	1
890508	11	75	1	890511	4	50	1	890511	9	65	1
890508	11	76	1	890511	4	51	1	890511	25	54	1
890508	14	54	1	890511	4	54	1	890511	25	57	1
890508	14	55	1	890511	4	55	1	890511	25	60	2
890508	14	57	1	890511	4	56	1	890511	25	62	1
890508	14	60	1	890511	4	65	1	890511	25	63	2
890508	14	61	1	890511	5	40	2	890511	25	64	3
890508	14	62	2	890511	5	41	3	890511	25	65	2
890508	14	63	1	890511	5	42	1	890511	25	66	1
890508	14	64	1	890511	5	43	1	890511	25	67	6
890508	14	65	1	890511	5	44	2	890511	25	68	4
890508	14	67	2	890511	5	45	9	890511	25	69	3
890508	14	68	1	890511	5	46	7	890511	25	70	6
890508	14	70	1	890511	5	47	8	890511	25	71	3
890508	14	72	1	890511	5	48	5	890511	25	73	2
890508	14	75	1	890511	5	49	8	890512	13	73	1
890509	17	40	2	890511	5	50	6	890512	19	56	1
890509	17	41	1	890511	5	51	6	890512	19	61	1
890509	17	47	2	890511	5	52	3	890512	19	64	1
890509	17	48	1	890511	5	53	4	890512	19	67	1
890509	17	49	1	890511	5	54	2	890512	19	68	1
890509	17	50	3	890511	5	55	3	890512	19	69	1
890509	17	54	1	890511	5	56	4	890512	19	70	2
890509	17	56	1	890511	5	57	4	890512	19	73	1
890509	17	57	1	890511	5	58	5	890515	11	46	1
890509	17	60	1	890511	5	59	1	890515	11	56	1
890510	26	38	1	890511	5	60	1	890515	11	58	2
890510	26	42	1	890511	5	65	1	890515	11	59	3
890511	2	59	1	890511	5	66	1	890515	11	60	1
890511	2	60	2	890511	7	69	1	890515	11	61	1
890511	2	61	1	890511	7	72	1	890515	11	62	1
890511	2	62	1	890511	7	75	1	890515	11	63	4
890511	2	63	2	890511	9	34	1	890515	11	64	3
890511	2	64	2	890511	9	35	1	890515	11	65	5
890511	2	65	3	890511	9	37	5	890515	11	66	3
890511	2	66	4	890511	9	38	2	890515	11	67	3
890511	2	67	4	890511	9	39	4	890515	11	68	2
890511	2	68	4	890511	9	40	9	890515	11	69	1
890511	2	69	4	890511	9	41	11	890515	11	70	5
890511	2	70	8	890511	9	42	6	890515	11	71	3
890511	2	71	5	890511	9	43	6	890515	11	72	6

Appendix Table 1 (cont.). Date, site number, length, and frequency of post-larval lingcod of that length in the purse-seine catch.

Date	Site	Len	Freq	Date	Site	Len	Freq	Date	Site	Len	Freq
890515	11	73	4	890516	8	59	11	890518	6	66	1
890515	11	74	3	890516	8	60	10	890518	6	68	2
890515	11	75	1	890516	8	61	9	890518	6	70	1
890515	11	77	2	890516	8	62	8	890518	6	71	1
890515	11	78	1	890516	8	63	4	890518	6	76	1
890515	16	62	1	890516	8	64	14	890518	7	64	1
890515	16	63	1	890516	8	65	4	890518	7	72	1
890515	16	64	1	890516	8	66	5	890518	9	62	1
890516	1	48	1	890516	8	67	2	890518	9	65	1
890516	1	51	1	890516	8	68	4	890518	12	52	1
890516	1	54	1	890516	8	70	1	890518	12	59	1
890516	1	55	3	890516	8	71	2	890518	12	61	1
890516	1	56	1	890516	8	72	1	890518	12	64	1
890516	1	57	1	890516	8	73	1	890518	12	72	1
890516	1	58	2	890516	8	74	2	890518	13	61	3
890516	1	60	3	890516	8	75	1	890518	13	65	1
890516	1	61	2	890516	17	50	1	890518	13	68	1
890516	1	65	2	890516	17	52	1	890518	19	56	1
890516	3	45	1	890516	17	53	3	890518	19	60	1
890516	3	48	4	890516	17	54	2	890518	19	68	1
890516	3	49	7	890516	17	55	3	890518	19	70	1
890516	3	50	10	890516	17	56	3	890518	20	53	1
890516	3	51	6	890516	17	57	1	890518	20	57	2
890516	3	52	8	890516	17	58	1	890518	20	59	1
890516	3	53	7	890516	17	59	2	890518	20	60	1
890516	3	54	10	890516	17	60	6	890518	20	62	3
890516	3	55	10	890516	17	61	5	890518	20	65	1
890516	3	56	12	890516	17	62	7	890518	20	74	1
890516	3	57	8	890516	17	63	1	890519	2	55	1
890516	3	58	10	890516	17	64	4	890519	2	56	1
890516	3	59	11	890516	17	65	1	890519	2	58	1
890516	3	60	10	890516	17	66	2	890519	2	59	2
890516	3	61	6	890516	17	68	3	890519	2	60	1
890516	3	62	5	890516	17	78	1	890519	2	61	2
890516	3	63	3	890517	5	54	1	890519	2	62	7
890516	3	64	5	890517	5	61	1	890519	2	63	1
890516	3	65	1	890517	5	63	2	890519	2	64	4
890516	3	66	3	890517	5	65	2	890519	2	65	11
890516	3	67	1	890517	5	69	1	890519	2	66	8
890516	3	70	1	890517	5	70	2	890519	2	67	3
890516	3	71	1	890517	5	71	1	890519	2	68	6
890516	3	75	1	890517	25	59	1	890519	2	69	6
890516	4	43	1	890517	25	66	1	890519	2	70	6
890516	4	51	1	890517	25	70	1	890519	2	71	5
890516	4	53	1	890518	6	44	1	890519	2	72	2
890516	4	55	2	890518	6	47	1	890519	2	73	2
890516	4	57	1	890518	6	49	2	890519	2	74	2
890516	4	60	1	890518	6	50	3	890519	2	75	6
890516	8	48	1	890518	6	52	1	890519	2	76	1
890516	8	52	1	890518	6	53	2	890519	2	77	2
890516	8	53	5	890518	6	55	1	890519	2	78	1
890516	8	54	9	890518	6	56	1	890519	2	80	1
890516	8	55	8	890518	6	58	2	890519	2	81	1
890516	8	56	16	890518	6	59	1	890519	26	66	1
890516	8	57	11	890518	6	61	1	890523	5	68	1
890516	8	58	6	890518	6	62	1	890523	17	58	1

Appendix Table 1 (cont.). Date, site number, length, and frequency of post-larval lingcod of that length in the purse-seine catch.

Date	Site	Len	Freq	Date	Site	Len	Freq	Date	Site	Len	Freq
890523	17	61	1	890525	2	86	3	900508	4	51	1
890523	17	63	2	890525	3	60	1	900508	4	55	1
890523	17	67	1	890525	7	55	1	900508	4	56	2
890523	17	70	1	890525	7	58	1	900508	4	58	1
890523	21	57	1	890525	7	59	1	900508	4	59	2
890523	21	59	1	890525	7	60	2	900508	4	60	2
890523	21	61	2	890525	7	61	1	900508	4	61	2
890523	21	62	1	890525	7	62	1	900508	8	49	1
890523	21	65	1	890525	7	63	1	900508	8	51	1
890523	21	66	1	890525	7	64	1	900508	8	52	3
890523	21	68	1	890525	7	65	1	900508	8	53	4
890524	1	58	1	890525	7	67	2	900508	8	54	3
890524	1	66	1	890525	7	68	1	900508	8	55	3
890524	3	62	1	890525	7	69	3	900508	8	56	6
890524	3	65	1	890525	7	70	3	900508	8	57	6
890524	3	67	2	890525	7	71	1	900508	8	58	3
890524	3	68	1	890525	7	72	3	900508	8	59	5
890524	3	70	1	890525	7	73	1	900508	8	60	4
890524	3	71	1	890525	7	75	1	900508	8	61	5
890524	4	55	1	890525	13	61	1	900508	8	62	3
890524	4	62	1	890525	13	62	1	900508	8	63	5
890524	4	68	1	890525	13	66	1	900508	8	64	4
890524	9	61	1	890525	13	67	1	900508	8	65	5
890524	11	45	1	890525	13	69	1	900508	8	67	1
890524	11	58	1	890525	25	58	1	900508	8	68	1
890524	11	60	1	890525	25	60	1	900509	16	39	2
890524	11	65	1	890525	25	61	1	900509	16	46	1
890524	11	66	1	890525	25	63	1	900509	16	50	1
890524	14	57	1	890525	25	65	1	900509	16	53	1
890524	14	59	1	890525	25	67	2	900509	16	54	3
890524	14	60	1	890525	25	68	3	900509	16	55	1
890524	14	65	1	890525	25	69	3	900509	16	56	1
890524	14	67	1	890525	25	70	1	900509	16	57	4
890524	14	69	1	890525	25	71	2	900509	16	58	4
890524	16	54	1	890525	25	73	1	900509	16	59	1
890524	16	57	1	890525	25	75	1	900509	16	61	1
890524	16	58	1	890525	25	77	2	900509	16	62	1
890524	16	60	1	890525	26	65	1	900509	16	65	1
890524	16	61	1	890525	26	67	1	900509	16	66	1
890525	2	65	1	890525	26	68	3	900509	17	41	3
890525	2	66	1	890525	26	69	1	900509	17	42	4
890525	2	68	1	890525	26	70	2	900509	17	43	6
890525	2	70	1	890525	26	71	1	900509	17	44	3
890525	2	72	2	890525	26	72	2	900509	17	45	7
890525	2	73	1	890525	26	76	1	900509	17	46	4
890525	2	75	2	900508	1	51	1	900509	17	48	6
890525	2	76	1	900508	1	54	1	900509	17	49	4
890525	2	77	1	900508	1	57	5	900509	17	50	7
890525	2	78	3	900508	1	58	1	900509	17	51	4
890525	2	79	2	900508	1	73	1	900509	17	52	8
890525	2	80	2	900508	4	39	1	900509	17	53	10
890525	2	81	5	900508	4	44	1	900509	17	54	10
890525	2	82	3	900508	4	45	2	900509	17	55	10
890525	2	83	6	900508	4	47	1	900509	17	56	5
890525	2	84	1	900508	4	49	2	900509	17	57	5
890525	2	85	1	900508	4	50	2	900509	17	58	7

Appendix Table 1 (cont.). Date, site number, length, and frequency of post-larval lingcod of that length in the purse-seine catch.

Date	Site	Len	Freq	Date	Site	Len	Freq	Date	Site	Len	Freq
900509	17	59	6	900511	9	49	1	900515	4	64	1
900509	17	60	3	900511	9	50	2	900515	4	65	2
900509	17	61	3	900511	9	51	1	900515	4	70	1
900509	17	62	2	900511	9	52	1	900515	4	72	1
900509	17	63	4	900511	9	53	2	900515	4	79	1
900509	17	64	1	900511	9	54	1	900515	5	39	2
900509	17	68	1	900511	9	55	1	900515	5	43	1
900509	17	72	1	900511	9	56	1	900515	8	51	1
900509	17	74	1	900511	9	57	2	900515	8	58	1
900509	25	41	1	900511	9	58	5	900515	8	60	2
900509	25	43	1	900511	9	59	4	900515	8	62	1
900509	25	54	1	900511	9	60	4	900515	8	63	2
900511	3	36	1	900511	9	61	5	900515	8	66	1
900511	3	37	1	900511	9	62	9	900515	8	67	1
900511	3	38	1	900511	9	63	5	900515	8	68	1
900511	3	40	2	900511	9	64	3	900515	17	40	1
900511	3	41	4	900511	9	65	3	900515	17	41	1
900511	3	42	2	900511	9	66	3	900515	17	42	1
900511	3	43	2	900511	9	67	2	900515	17	43	2
900511	3	45	3	900511	9	68	2	900515	17	44	3
900511	3	46	2	900511	9	69	2	900515	17	45	1
900511	3	47	2	900511	9	70	4	900515	17	52	2
900511	3	48	2	900511	9	71	1	900515	17	55	1
900511	3	49	2	900511	9	72	1	900515	17	58	1
900511	3	50	3	900511	9	76	1	900515	17	60	1
900511	3	51	1	900511	11	57	1	900515	17	62	1
900511	3	53	1	900511	11	59	1	900516	9	52	1
900511	3	54	1	900511	11	61	1	900516	9	54	1
900511	3	55	1	900511	11	62	1	900516	9	55	1
900511	3	57	1	900511	11	66	2	900516	9	67	1
900511	7	47	1	900511	11	68	2	900516	12	50	1
900511	7	56	2	900511	11	69	2	900516	12	73	1
900511	7	57	1	900511	11	71	2	900516	12	79	1
900511	7	58	1	900511	11	73	1	900516	14	75	1
900511	7	59	3	900511	11	77	1	900517	11	48	1
900511	7	60	2	900511	11	79	1	900517	11	49	1
900511	7	61	2	900511	13	59	1	900517	11	54	2
900511	7	62	1	900511	13	69	1	900517	11	56	1
900511	7	63	2	900511	13	72	1	900517	11	61	1
900511	7	64	4	900511	13	73	1	900517	11	66	1
900511	7	65	4	900511	13	74	1	900517	11	69	1
900511	7	66	1	900511	26	67	1	900517	11	70	1
900511	7	67	2	900511	26	68	1	900517	11	73	1
900511	7	68	4	900511	26	71	1	900517	13	49	1
900511	7	69	2	900511	26	79	1	900517	13	64	1
900511	7	70	2	900514	19	47	1	900517	13	74	2
900511	7	71	3	900514	19	54	2	900517	13	75	1
900511	7	72	1	900514	19	58	1	900517	13	77	3
900511	7	73	2	900514	19	61	1	900517	13	78	1
900511	7	74	3	900515	1	66	1	900517	21	49	1
900511	7	75	2	900515	1	72	1	900517	21	53	1
900511	7	76	2	900515	1	73	1	900517	21	58	2
900511	9	42	1	900515	4	48	1	900517	21	63	1
900511	9	44	1	900515	4	52	1	900518	3	35	1
900511	9	45	1	900515	4	56	1	900518	3	38	1
900511	9	46	1	900515	4	59	1	900518	3	41	1

Appendix Table 1 (cont.). Date, site number, length, and frequency of post-larval lingcod of that length in the purse-seine catch.

Date	Site	Len	Freq	Date	Site	Len	Freq
900518	3	43	1	900524	25	84	1
900518	3	44	4				
900518	3	45	1				
900518	3	46	3				
900518	3	47	1				
900518	3	49	5				
900518	3	50	2				
900518	3	51	3				
900518	3	52	3				
900518	3	53	2				
900518	3	54	3				
900518	3	56	3				
900518	3	63	2				
900518	7	33	1				
900518	7	43	1				
900518	7	44	1				
900518	7	50	1				
900518	7	61	1				
900518	7	64	1				
900518	7	70	1				
900518	25	57	1				
900518	25	66	1				
900518	25	69	1				
900518	25	71	1				
900518	25	73	1				
900518	26	61	1				
900518	26	63	1				
900518	26	67	1				
900518	26	70	1				
900518	26	76	1				
900522	6	60	1				
900522	8	58	1				
900522	8	67	1				
900522	14	80	1				
900524	7	43	1				
900524	7	53	2				
900524	7	54	1				
900524	7	55	2				
900524	7	62	1				
900524	7	63	1				
900524	7	71	1				
900524	7	79	1				
900524	9	59	1				
900524	9	66	1				
900524	9	70	1				
900524	9	72	1				
900524	11	53	1				
900524	11	55	1				
900524	11	73	1				
900524	11	80	1				
900524	12	55	1				
900524	12	57	2				
900524	12	60	1				
900524	12	63	1				
900524	12	64	1				
900524	25	75	1				