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Changes in Relative Abundance and Size Composition of Sablefish in Coastal Waters of Washington and Oregon, 1979-87

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ABSTRACT

-Changes in the relative abundance of sablefish (Anoplopoma fimbria) have been monitored in the Washington-California region by abundance indexing surveys since 1979. Survey results indicate that sablefish abundance off Oregon (north of 43°00'N) and Washington, after having increased between 1981 and 1983, declined sharply between 1983 and 1987 to record low levels. Survey catch rates declined 75% between 1979 and 1987, and 62% between 1985 and 1987. Catch rates in 1987 were lower than in 1985 at all eight sites sampled. These -results are similar to 1986 survey findings off southern-most Oregon (south of 43°00'N) and California which indicated a decrease in this sablefish abundance index of over 50% between 1984 and 1986.

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INTRODUCTION

The sablefish (Anoplopoma fimbria) became the single most valuable commercial groundfish species landed on the U.S. west coast in both 1985 and 1986 when the ex-vessel value of landings exceeded $12.0 million (Korson 1986) and $10.9 million, respectively:/. High demand and prices persisted throughout 1986 and 1987 resulting in heavy fishing pressure on the stocks. Based on 1986 and 1987 survey results by the NWAFC and other supporting information, the Groundfish Management Team (GMT) declared in November 1987 that the west coast sablefish stock is biologically stressed and that the fishery cannot support long-term landings of the same magnitude observed in recent years (13,000 to 18,000 metric ton, t) (Groundfish Management Team 1987).

Surveys to measure changes in sablefish relative abundance began in southeastern Alaska waters in 1978, were extended to Oregon and Washington waters in 1979, and to waters off California in 1980. Objectives of these surveys were to obtain catch per unit effort (CPUE) indices of sablefish abundance at predetermined index sites. Secondary objectives included collection of data on the state of maturity, and determining weight, length, and age composition. Tagging was conducted to understand movements and to identify potential management units. During the 1987 survey, double tagging was done to provide an estimate of tag loss. The results of the 1979-86 surveys in the Washington-California region have been reported by Parks and Hughes (1981), Parks (1982, 1984), and Parks and Shaw (1983, 1985, 1987, 1988). This report presents results of the 1987 survey off Washington and Oregon and compares them with results of previous surveys.

1/ Pacific Coast Fisheries Information Network (PacFIN) as of 23 July 1987. Pacific Marine Fisheries Commission, Portland, Oregon.

SURVEY METHODS AND EQUIPMENT

The original survey design and sampling gear are described in detail by Parks and Hughes (1981). In 1985, the experimental design was modified in an effort to improve the survey's sensitivity to population changes by increasing the number of index sites off Washington and Oregon (Fig. 1) from four to eight (Kimura and Balsiger 1985, Parks and Shaw 1987). A summary of the sites fished, including dates, depths, and number of sets and traps fished during sablefish indexing surveys off Washington and Oregon in 1979-87, is presented in Table 1. The exclusive use of conical traps in 1986 and 1987 was a departure from previous surveys when rectangular traps were used. Conical traps were adopted due to their greater catching efficiency and ease of use. Comparative fishing experiments in 1983 and 1985 (Parks and Shaw 1987) indicated that, on the average, conical traps were 1.41 more efficient than rectangular traps. This factor was used to express rectangular trap CPUE in terms of conical trap CPUE for annual comparisons.

In 1987, sampling was conducted with conical traps which have a bottom ring of 54 in (137 cm) (outside diameter), a top ring of 33.5 in (85 cm) (outside diameter), a height of 28 in (71 cm), and a tunnel entrance on the side. The traps were attached to 5/8-in (1.59-cm) groundlines, 550 fathoms (1,006 m) in length, at intervals of 50 fathoms (91 m). Trap bridles were attached to the groundline by means of gangions using brummel hooks or "C" hooks. Because new and used traps have different catching efficiencies (Parks 1984), new traps were soaked in seawater for at least 3 weeks prior to being used. The tunnels in all traps were adjusted to a standard conformation which is maintained from survey to survey. To maintain consistent bait quality from year to year, traps were baited with fresh frozen herring.

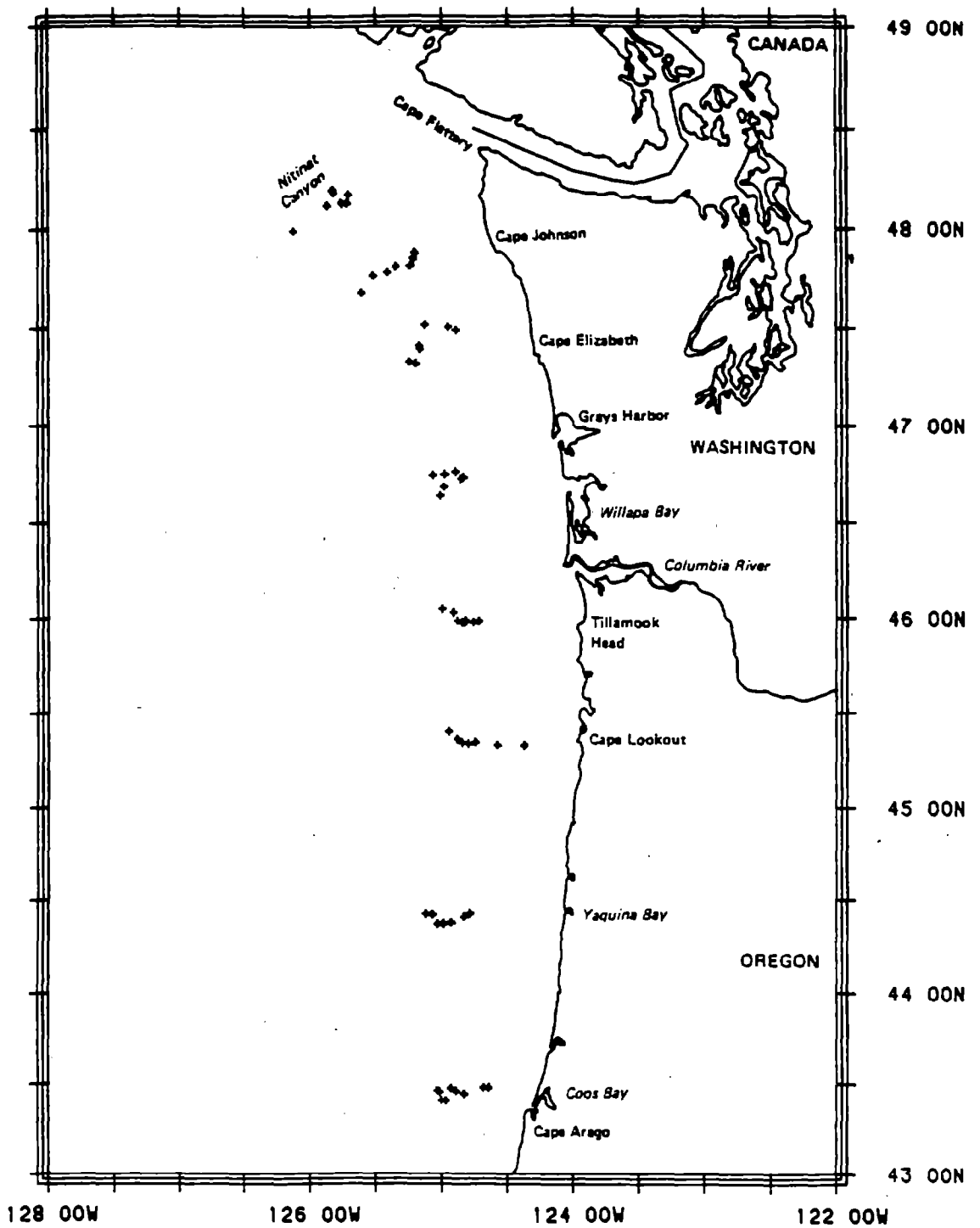

Figure 1 .--Location of sablefish abundance indexing sites off Washington and Oregon.

Table 1.--Summary of sampling information for sablefish abundance indexing surveys conducted off Washington and Oregon, 1979-87.

Site	Dates fished	Depths fished (fm)	Sets (No.)	No. of traps fished	
				Rectangular	Conical
		1979			
Cape Arago, OR	8-13 Aug	150-450	5	250	0
Cape Lookout, OR	17-23 Aug	150-450	5	250	0
Willapa Bay, WA	6-13 Sep	150-450	5	250	0
Cape Johnson, WA	16-21 Sep	150-450	5	250	0
		1980			
Cape Arago, OR	6-10 Aug	150-450	5	250	0
Cape Lookout, OR	12-19 Aug	150-450	5	250	0
Willapa Bay, WA	10-16 Sep	150-450	5	250	0
Cape Johnson, WA	21-26 Sep	150-450	5	250	0
		1981			
Cape Arago, OR	5-11 Aug	150-450	5	250	0
Cape Lookout, OR	13-19 Aug	150-450	5	250	0
Willapa Bay, WA	19-28 Sep	150-450	5	250	0
Cape Johnson, WA	11-16 Sep	150-450	5	250	0
		1983			
Cape Arago, OR	26-28 Oct	150-450	2	50	50
Cape Lookout, OR	23-24 Oct	150-450	2	50	50
Willapa Bay, WA	16-18 Oct	150-450	2	50	50
Cape Johnson, WA	13-14 Oct	150-450	2	50	50
		1985			
Cape Arago, OR	16-18 Aug	150-450	2	50	50
Yaquina Bay, OR	20-21 Aug	150-450	2	50	50
Cape Lookout, OR	23-24 Aug	150-450	2	50	50
Tillamook Head, OR	27-28 Aug	150-450	2	50	50
Willapa Bay, WA	2- 3 Sep	150-450,525	2	50	70
Cape Elizabeth, WA	5- 7 Sep	150-450,525	2	50	70
Cape Johnson, WA	9-10 Sep	150-450,525	2	50	70
Nitinat Canyon, WA	13-14 Sep	150-450,525	2	50	70
		1987			
Cape Arago, OR	22-23 Aug	150-450,525,>600	2	0	140
Yaquina Bay, OR	25-26 Aug	150-450,525,>600	2	0	140
Cape Lookout, OR	29-30 Aug	150-450,525,>600	2	0	140
Tillamook Head, OR	1- 2 Sep	150-450,525,>600	2	0	140
Willapa Bay, WA	6- 7 Sep	150-450,525,>600	2	0	140
Cape Elizabeth, WA	9-10 Sep	150-450,525,>600	2	0	140
Cape Johnson, WA	11-13 Sep	150-450,525,>600	2	0	140
Nitinat Canyon, WA	17-18 Sep	150-450-525,>600	2	0	130

A string of 10 traps was fished twice at each of five standard depths (150, 225, 300, 375, and 450 fathoms), at each indexing site. Fishing time was standardized to 24 hours per set. Loran C and depth sounders were used to position replicate sets as near as possible to the same depths and locations of first sets. Sampling was conducted from south to north during August-September 1987. Additional strings of traps were fished opportunistically at 525 fathoms and between 600 and 1,025 fathoms at each site to obtain data from beyond standard survey depths. Data collected in 1987 were similar to that collected in previous years and included: 1) Number and weight of sablefish and other species captured in each trap; 2) Lengths of all sablefish; and 3) Otoliths and sexual maturity from a random sample of 20 sablefish collected from each depth at each site. -Additional stratified samples of medium (62-67 cm fork length) and large (>67 cm fork length) sized fish were collected when available. Each of the 1,216 sablefish from which otoliths were taken were weighed to the nearest gram using a high resolution triple beam balance. All sablefish not required for biological samples were held in live tanks, double tagged, and then released.

RESULTS AND DISCUSSION

The data from all sampling sites were combined to provide a measure of sablefish relative abundance and size composition for the entire Washington and Oregon survey area. The rationale for combining site data was based on analysis of past Washington-Oregon indexing data which indicated that the survey would be able to detect substantially smaller annual changes in abundance if the number of index sites was increased in each area monitored (Kimura and Balsiger 1985). Results from individual sampling sites are not

discussed here, although catch and size data by site are given in the Appendix. Because traps fished in standard depths (150-450 fathoms) capture primarily sablefish, interspecific competition for trap space is slight.

Catch Rates and Size Composition

Annual trends in relative population abundance have been examined by utilizing data collected from the four original index sites from 1979-83 and all eight sites from 1985-87. Catch rate comparisons indicate that overall sablefish abundance dropped sharply from 1979 to 1981, increased markedly between 1981 and 1983, and then declined sharply between 1983 and 1985 and again between 1985 and 1987 (Fig. 2). The decline in average catch rates from 10.6 sablefish per trap in 1983 to 7.4 in 1985 is statistically significant at the 96.2% level, whereas the decline from 7.4 in 1985 to 2.8 in 1987 is significant at the 99.9% level using an F-test with degrees of freedom calculated using Rubin's method which incorporates a site effect and a depth effect (Knechtel 1986: Appendix C[2]/. The coefficients of variation were 13.3%, 15.5%, and 10.3% in 1983, 1985, and 1987, respectively. Standard errors associated with 1983, 1985, and 1987 mean catches per trap were 1.004, 0.830, and 0.288, respectively. Catch rates expressed in average number of pounds of sablefish captured per trap are shown in Figure 3. These catch rates dropped from 45 pounds (20.4 kg) per trap in 1979 to less than 10 pounds (4.5 kg) per trap in 1987, a decrease of 78%.

Catch rates by size groups followed the overall trend. The catch rate of marketable-size sablefish (>52 cm fork length) decreased from 6.0 fish

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[2]/ANOVA's were performed assuming the effects due to site were fixed which contradicts the assumption underlying the experimental design that site effect is random. The consequence of this contradiction on the outcome of the tests is under consideration, but preliminary findings suggest that little change may result in the statistical significance of differences in abundance attributed to year or depth if the site effect is considered to be random (Knechtel memo, 20 June 1988).

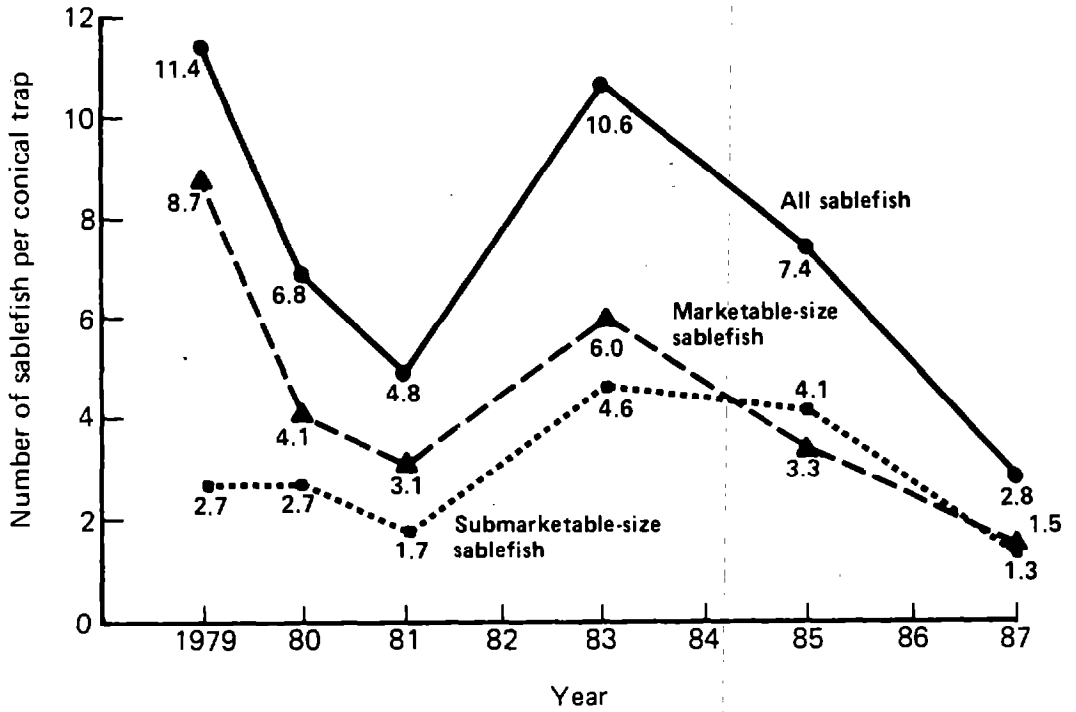


Figure 2.--Mean catch rates of all sablefish, submarketable-size sablefish (<52 cm fork length), and marketable-size sablefish (>52 cm fork length) at the four original index sites off Oregon and Washington 1979-83 and at all eight index sites in 1985 and 1987 (standard depths 150-450 fathoms). The sites were not sampled in 1982, 1984, or in 1986.

Table 2.--Average percentage abundance of submarketable and marketable-size sablefish at abundance indexing sites during 1979-87.

Year and sites	Sub-marketable[a] (%)	Marketable			
		Small[b] (%)	Medium[c] (%)	Large[d] (%)	Total (%)
1979 (Original four sites)	24	54	12	10	100
1980 (Original four sites)	37	47	8	8	100
1981 (Original four sites)	37	49	8	6	100
1983 (Original four sites)	44	45	7	4	100
1985 (Original four sites)	59	35	4	2	100
1985 (All eight sites)	56	36	5	3	100
1987 (Original four sites)	44	46	7	3	100
1987 (All eight sites)	45	44	7	4	100

[a] Less than 52 cm fork length = less than 3.0 lb round weight.
[b] 52-61 cm fork length = 3.0-5.0 lb round weight.
[c] 62-67 cm fork length = 5.0-7.0 lb round weight.
[d] 68 cm or greater fork length = more than 7.0 lb round weight.

per trap in 1983 to 1.5 in 1987. The catch rate of submarketable-size sablefish (<52 cm fork length) declined from 4.6 fish per trap in 1983 to 1.3 fish per trap in 1987 (Fig. 2).

The proportion of submarketable-size sablefish in the catches increased from 24% in 1979 to 56% in 1985, but then decreased to 45% in 1987 (Table 2). Mean catch rates of small, medium, and large marketable-size sablefish are shown in Figure 4. Catch rates for all marketable-size groups were lower in 1987 than in any previous survey year. The catch rates of small, medium, and large were 19%, 14%, and 9%, respectively, of the catch rates for these sizes in 1979.

The length frequency distributions and mean lengths of sablefish captured in the first two sets at the four original sites off Oregon and Washington during 1979, 1980, 1981, and 1983 (Parks 1984), and at all eight sites in 1985 and 1987 (Table 1) at the standard depths are shown in Figure 5. The length distributions of sablefish captured by both trap types in 1985 were nearly identical, and mean lengths were 52.1 and 52.2 cm for conical and rectangular traps, respectively (Parks and Shaw 1987), indicating that both gear types sampled the same segment of the population. The mean fork lengths have generally decreased since the surveys began (Fig. 6). Figure 7 illustrates the portions comprising the submarketable, small, medium, and large size categories. In 1979, the mean fork length was 56.7 cm near the midrange in the small size category, whereas in 1985 and 1987, the mean lengths declined to 52.1 and 53.2 cm, respectively, just into the lowest portion of the small size category (Figs. 6 and 7). The submarketable-size category showed the highest decrease in catch between 1985 and 1987.

Highest catches within the standard sampling depths (150-450 fathoms) occurred at 300, 450, and 225 fathoms (Table 3). Catch rates remained

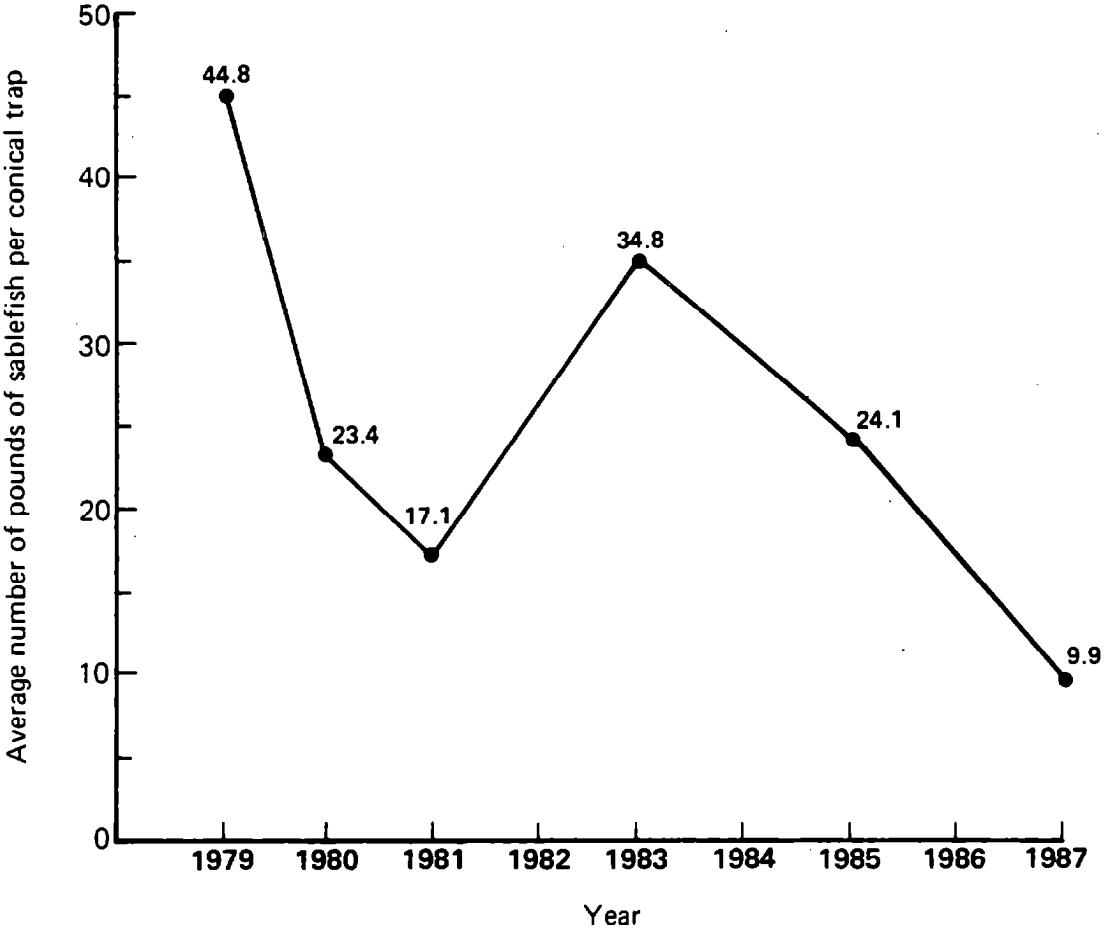


Figure 3.--Mean catch rates of sablefish in number of pounds per trap at the four original index sites off Oregon and Washington 1979-83, and at all eight sites in 1985 and 1987 (standard depths 150-450 fathoms). Surveys were not conducted in 1982, 1984, or in 1986.

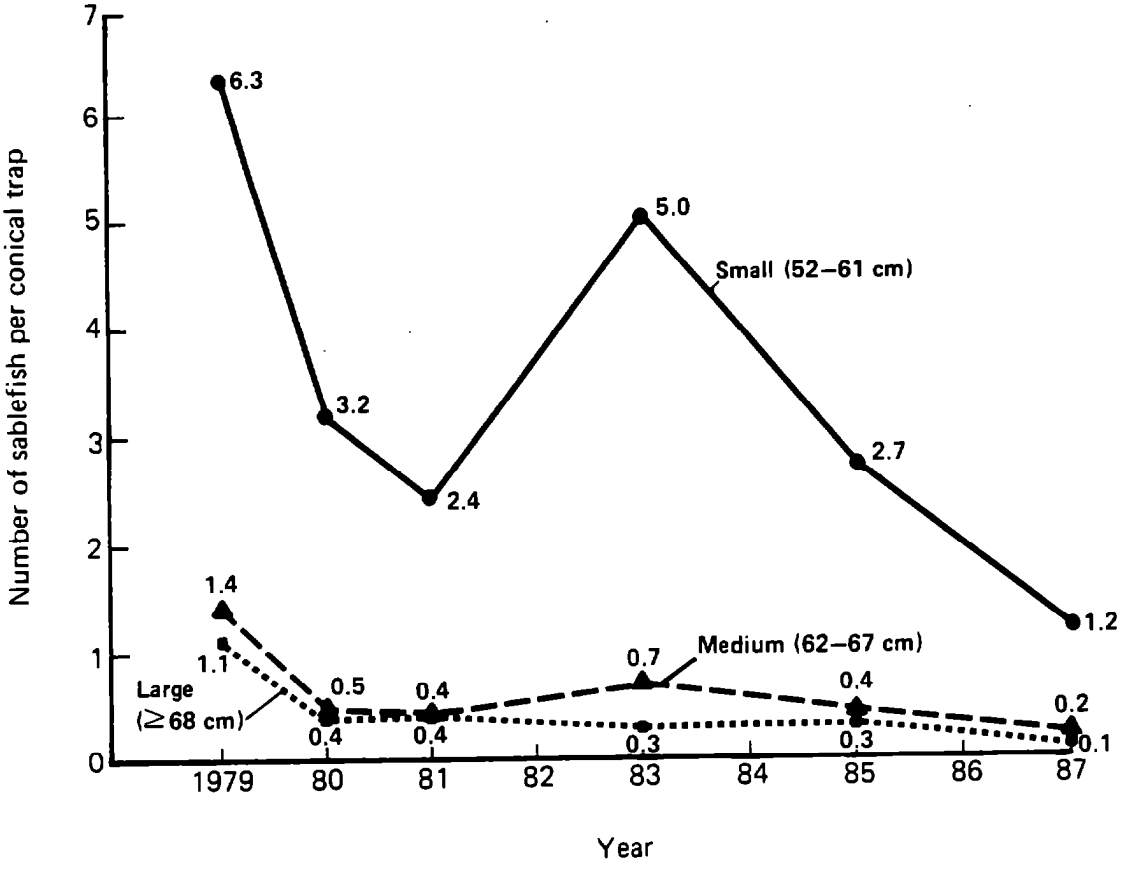


Figure 4. --Mean catch rates of small, medium, and large sablefish at the four original index sites off Oregon and Washington, 1979-83, and at eight sites in 1985 and 1987 (standard depths 150-450 fathoms).

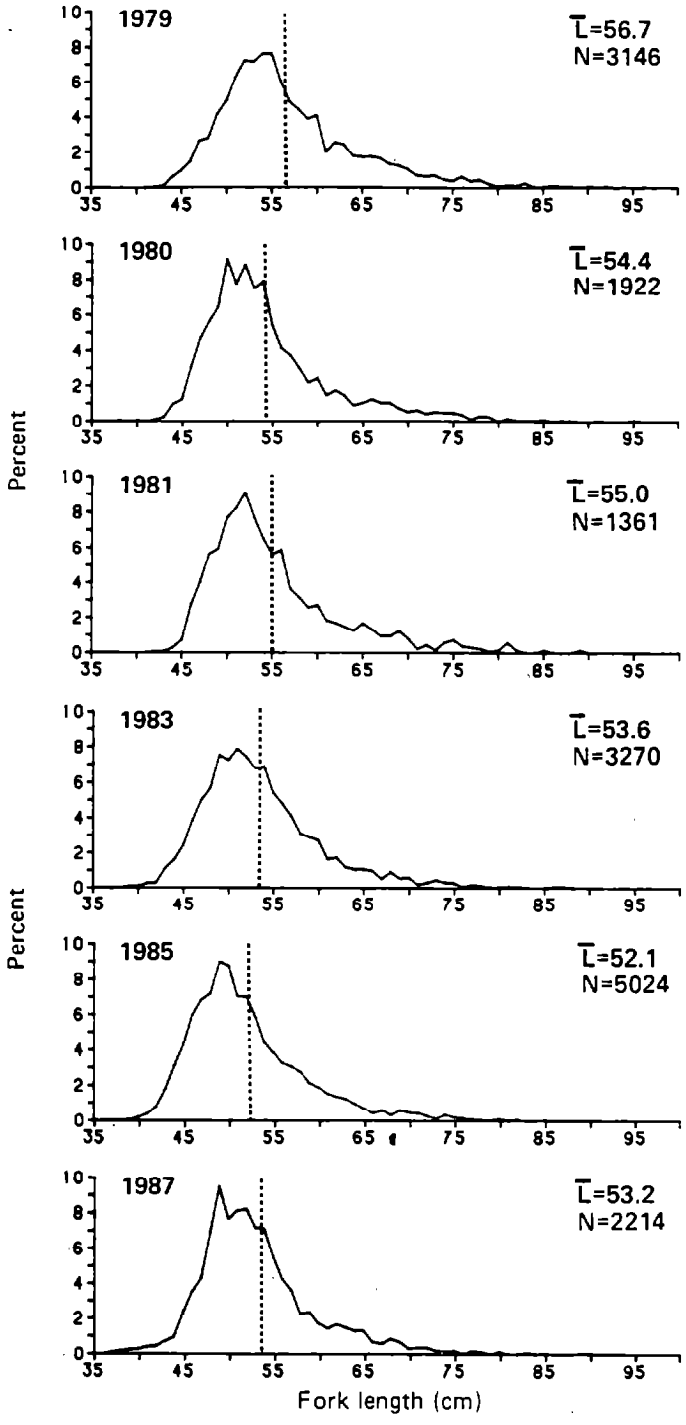


Figure 5.--Length composition of sablefish captured in the first two sets at the original sites off Oregon and Washington during the 1979, 1980, 1981, 1983, and at all eight survey sites in 1985 and 1987 (standard depths 150-450 fathoms).

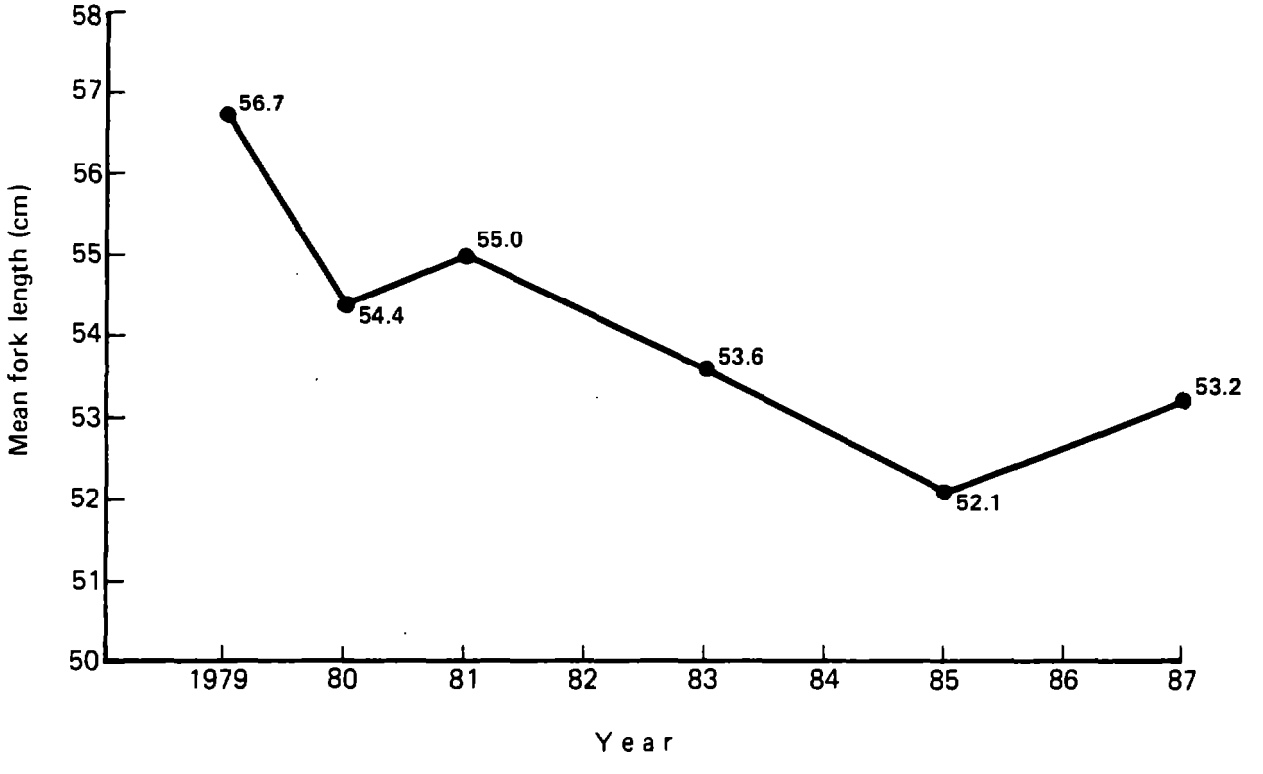


Figure 6.--Mean fork lengths of sablefish captured during Washington and Oregon abundance index surveys at standard depths (150-450 fathoms).

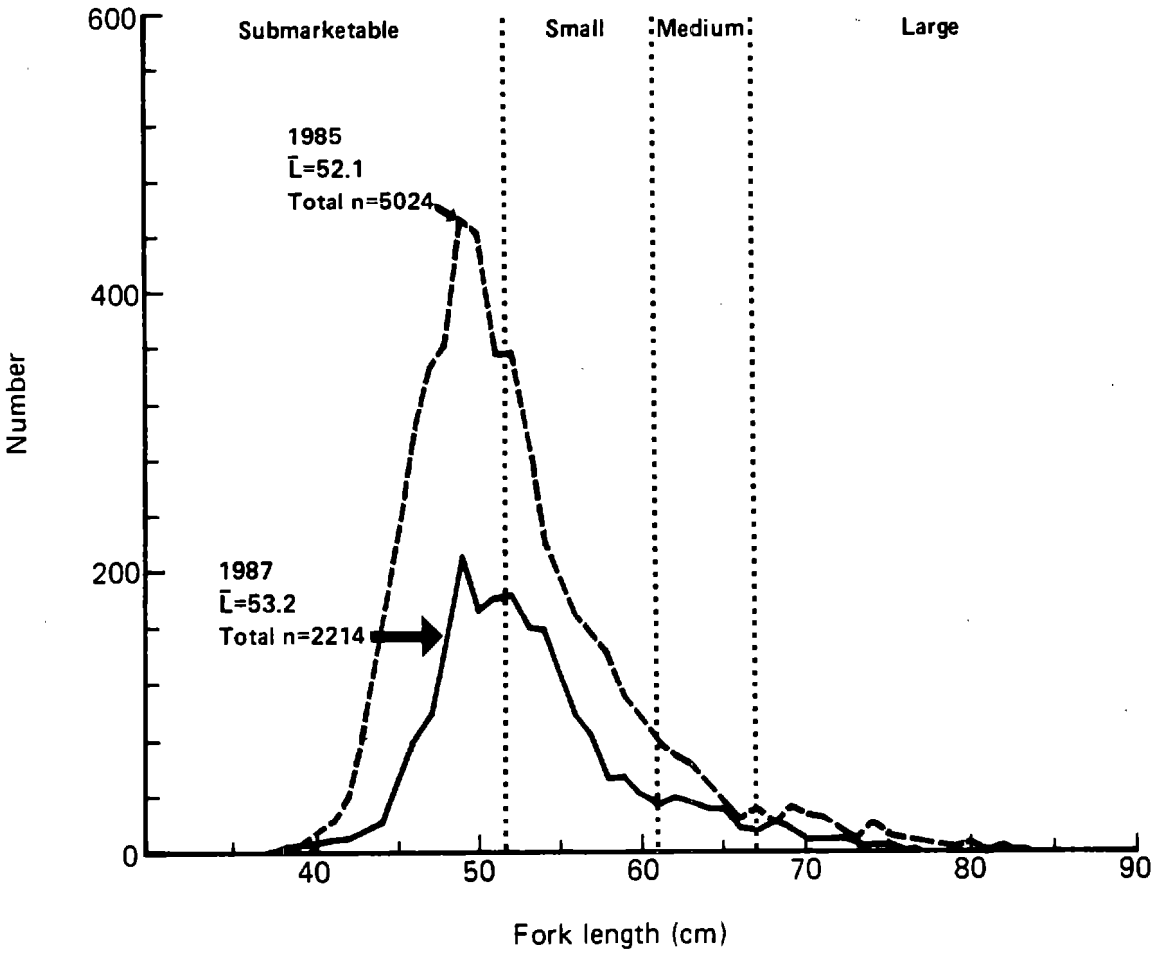


Figure 7.--Length composition of all sablefish captured in 1985 and 1987 abundance index surveys off Oregon and Washington (standard depths 150-450 fathoms).

Table 3.--Catch rates of sablefish in average numbers of fish per trap by depth in 1987.

	Depth in fathoms						
	150	225	300	375	450	525	>600
Average no. per trap	1.4	3.0	3.9	2.4	3.3	2.8	1.5

relatively high at 525 fathoms but dropped off sharply in depths greater than 600 fathoms. They were, however, slightly higher in depths greater than 600 fathoms (1.5 fish per trap) than at the shallowest depth of 150 fathoms (1.3 fish per trap).

It appears that a large proportion of sablefish are being harvested before they reach sexual maturity. The mean lengths were 51.5 cm for males and 57.1 cm for females (Fig. 8) which are very close to lengths at 50% maturity (50.8 cm, males and 55.3 cm, females) calculated for sablefish sampled off Oregon and Washington in 1985 (Parks and Shaw 1987). The length compositions for males and females were obtained from a random sample of 20 sablefish at each standard depth per site, which were then weighted by the total number of sablefish captured per site.

Changes in Size by Depth and Latitude

Length compositions by depth for 1987 are shown in Figure 9. Sablefish captured in the 525 and greater than 600 fathom depth intervals were much larger than those taken at shallower stations. Mean length generally increased with depth (Fig. 10). In 1985, mean length increased steadily from 225 to 525 fathoms, whereas in 1987, the greatest increases in size occurred between 450 (53.8 cm), 525 (57.4 cm), and greater than 600 fathoms (63.3 cm).

Mean lengths of males and females for 1985 and 1987 are regressed on latitude in Figure 11; in both years the mean lengths tended to decrease from north to south. When the much larger sablefish at the Nitinat Canyon site adjacent to the Canadian border are not included, however, the decrease in mean length from north to south becomes much less apparent (approximately 1 cm over the survey range). The slopes of all eight of the regressions shown, however, were not significantly different from zero (95% level) based on

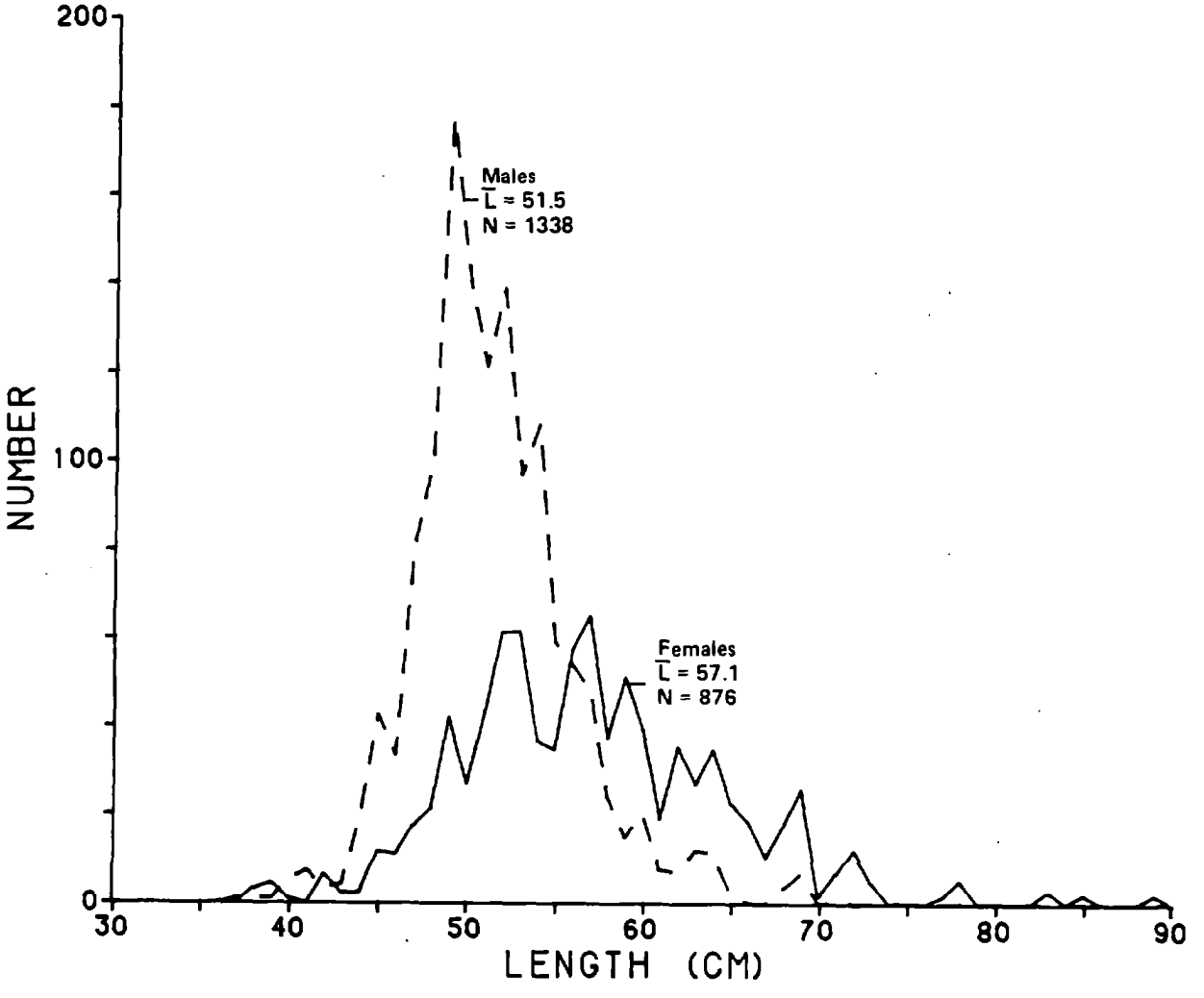


Figure 8.--Sablefish length compositions by sex based on random samples at standard depths (150-450 fathoms) and then weighted by the total number of sablefish captured per site from the 1987 abundance index survey.

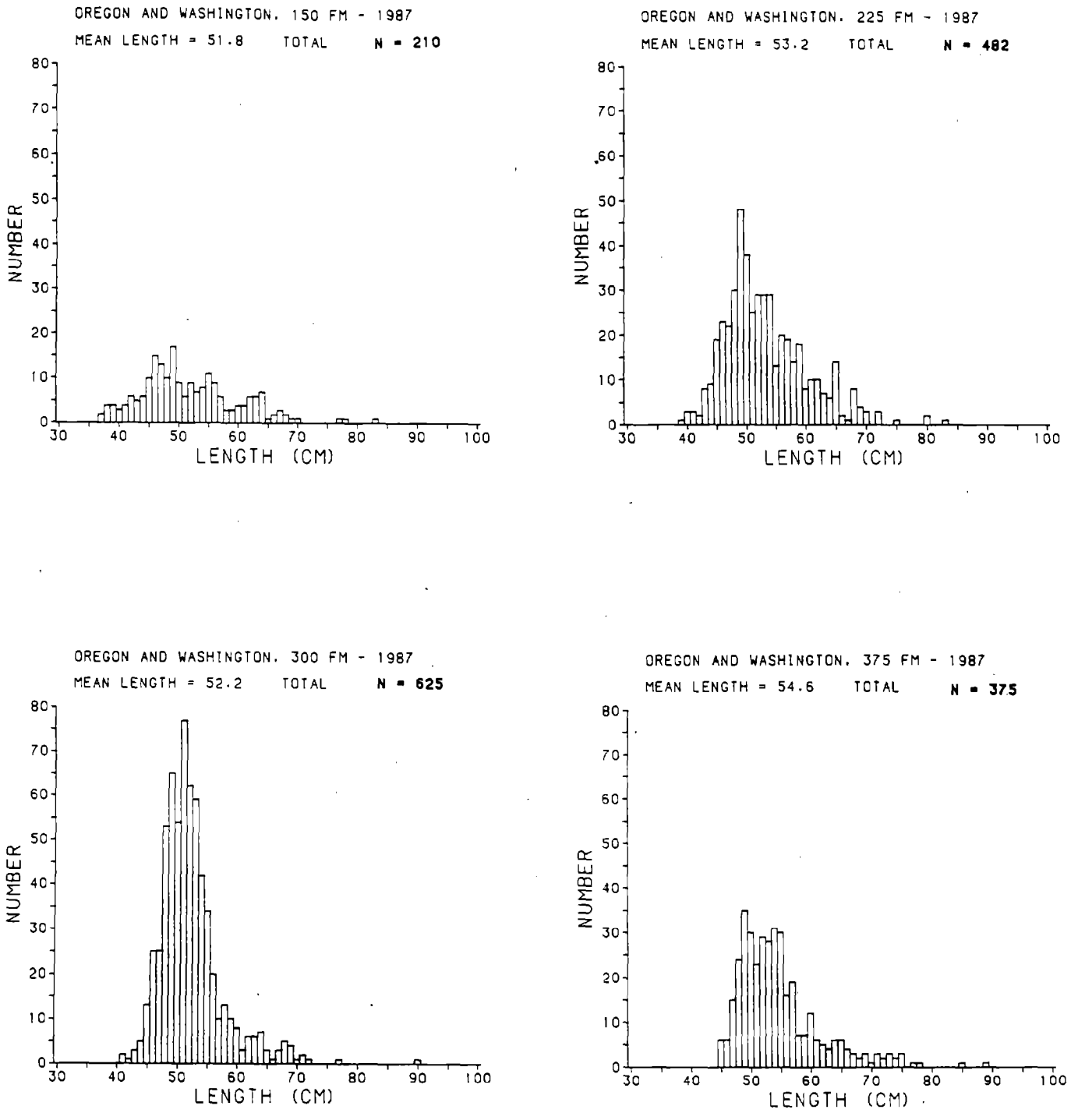
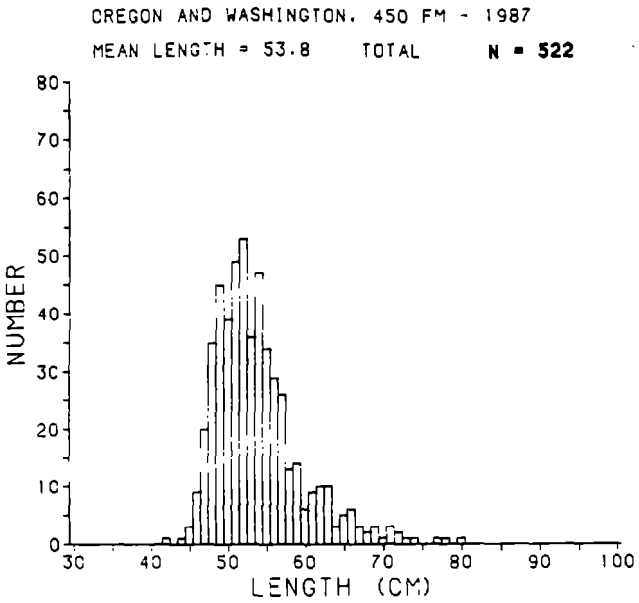
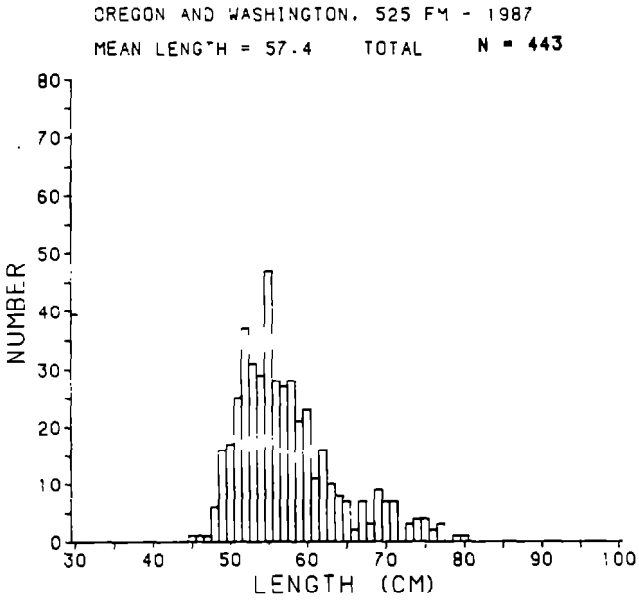


Figure 9.--Sablefish length compositions by depth, 1987 survey.





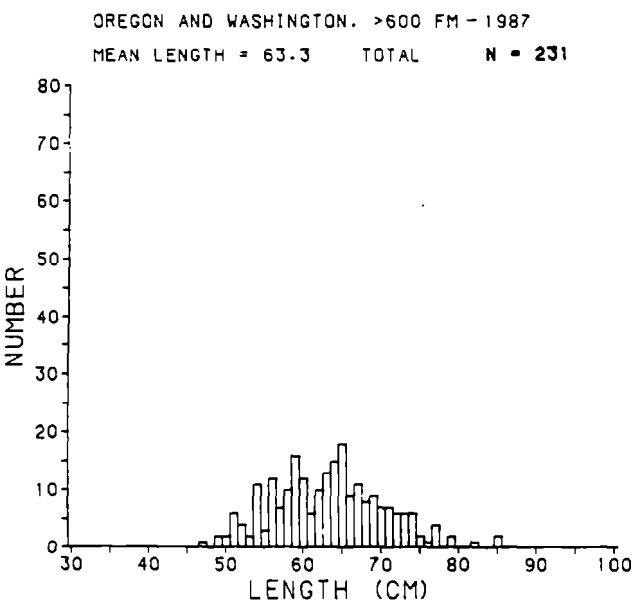


Figure 9. --Continued.

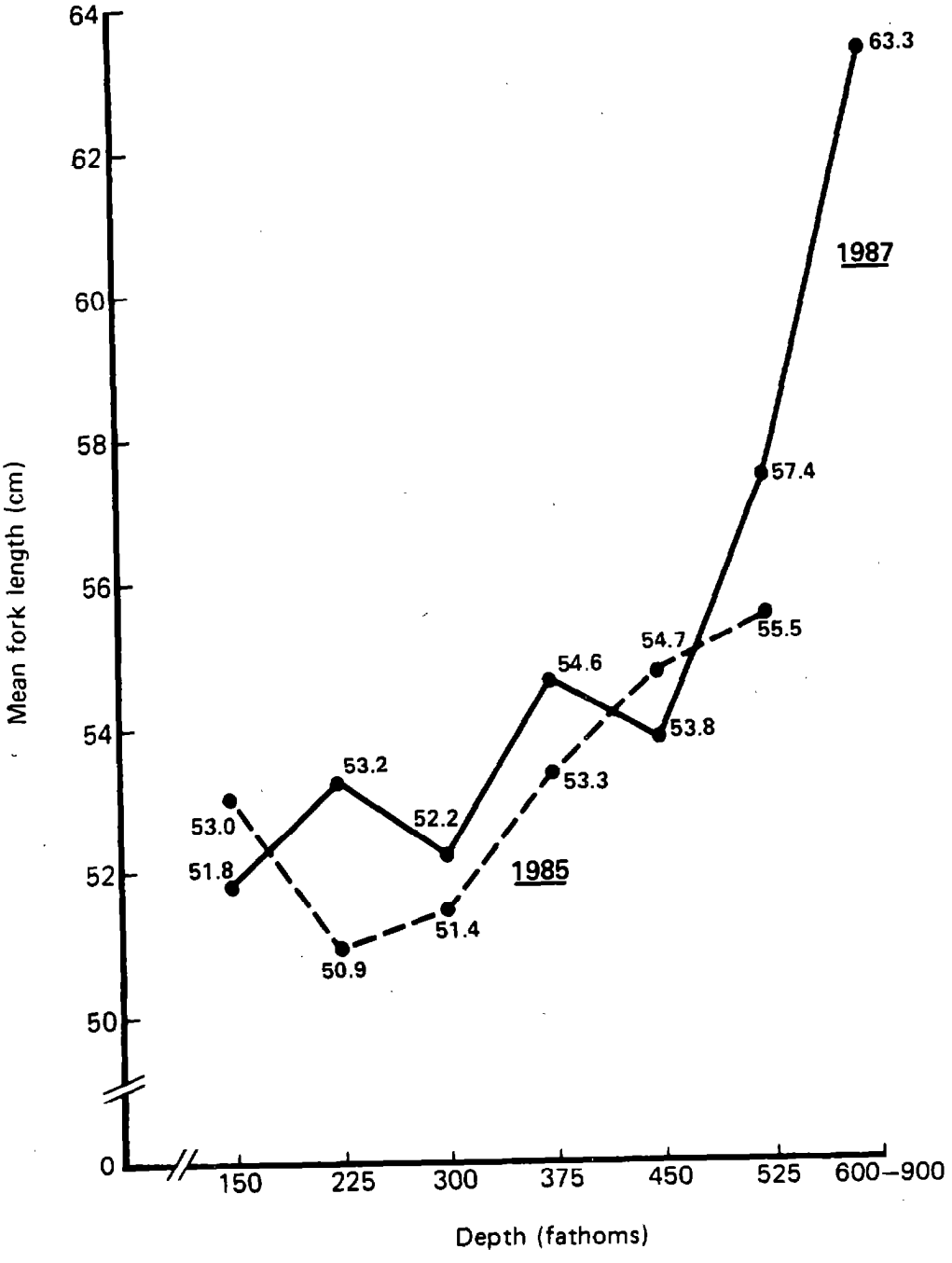


Figure l0.--Mean sablefish fork lengths (cm) by depth in 1985 and 1987.

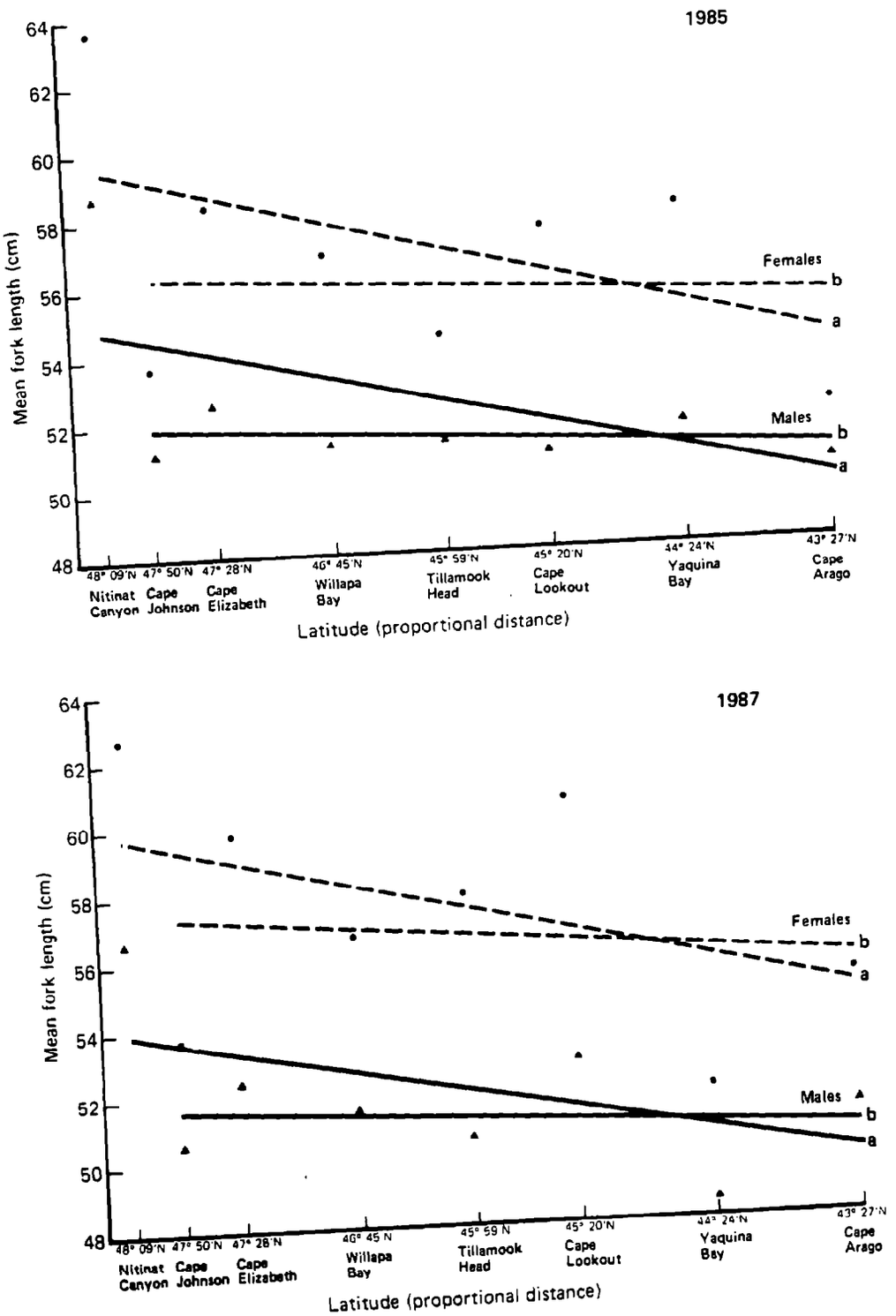


Figure 11.--Mean fork lengths (cm) by sex based on sablefish from standard depths (150-450 fathoms) regressed on latitude, 1985 and 1987 (a = with Nitinat Canyon site, b = without Nitinat Canyon site).

t tests. A decline in mean length by latitude was also observed in sablefish captured off California in 1986 (Parks and Shaw 1988).

Length-Weight Relationship

The 1987 length-weight relationship was examined using a regression technique. Male and female length-weight relationships could not be distinguished graphically, as in the 1985 comparison (Parks and Shaw 1987). On this basis, data for both sexes were combined (Fig. 12). The length-weight relationship is $W = .00499 \times L^{3.17497}$, where W = weight in grams and L = length in centimeters. Predicted weights by 1 cm intervals for 1985 and 1987 are shown in Table 4. The hypothesis that the length-weight relationship of sablefish in 1985 was different from that in 1987 was tested. Data plots indicated that the relationship between logarithms of the lengths and logarithms of the weights was essentially linear in both 1985 and 1987. Lines were fitted to each year's data and to the 1985 and 1987 data combined. An F-test ($F=61.5$; numerator df=2, denominator df=2482; $p<0.l\%$) showed that fitting separate lines to the 1985 and 1987 data resulted in a significant reduction in the residual sum of squares. The 1987 predicted weights are generally greater than those predicted from the 1985 length-weight relationship in Parks and Shaw (1987). The difference appears to be the result of sablefish at smaller lengths weighing more, on the average, in 1987 than in 1985. Predicted weights at 40, 50, 60, 70, 80, and 90 cm were, 6, 4, 3, 2, 1, and 0% heavier, respectively, in 1987 than in 1985. We believe that the sablefish weights and lengths recorded during 1985 and 1987 surveys were obtained with equal accuracy and that the difference in the length-weight relationships reflect real differences in sablefish condition. We speculate that because sablefish abundance was markedly less in 1987 than in 1985, increased growth may have been due to an increase in food availability.

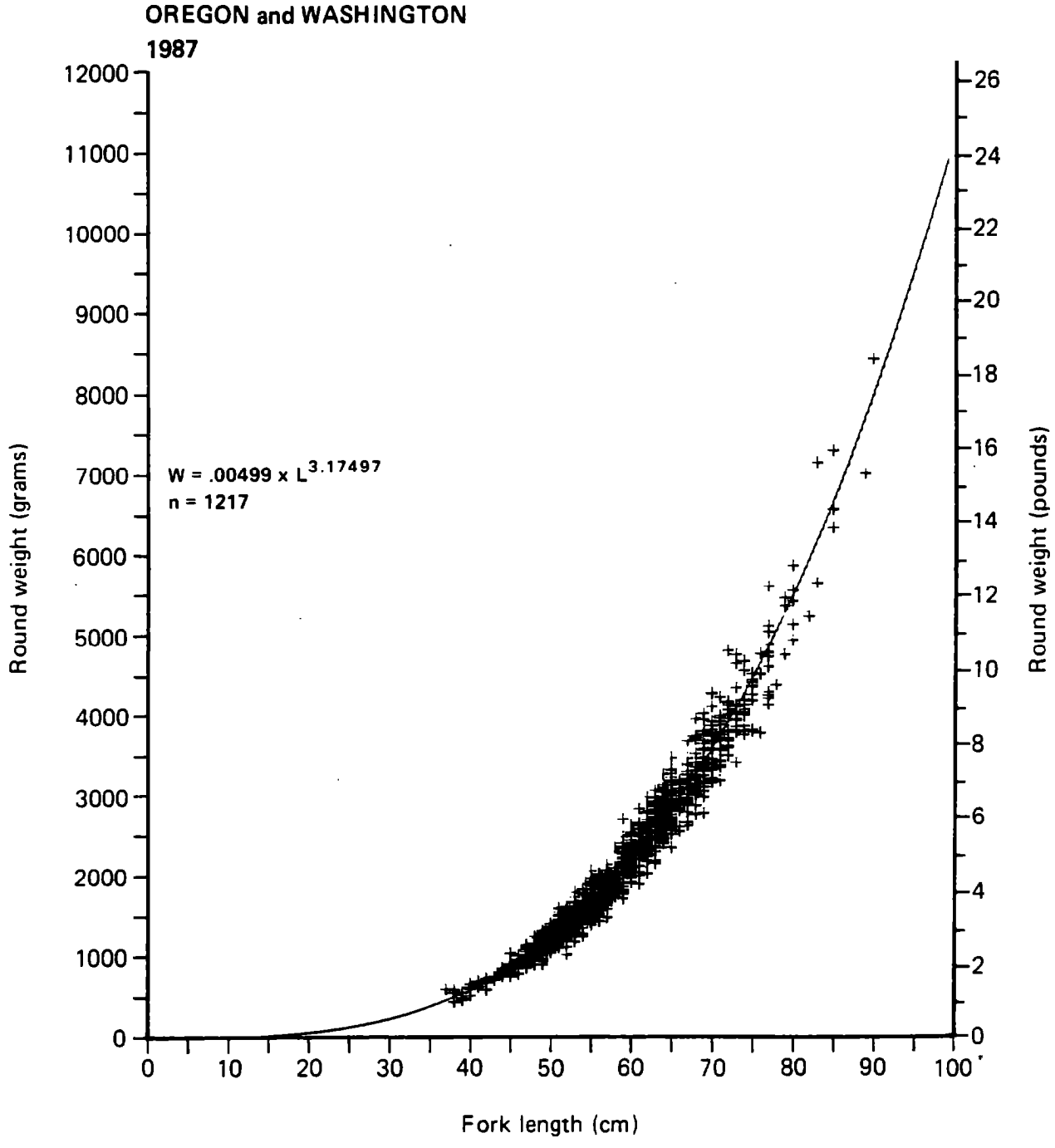


Figure 12. --Length-weight relationship derived from sablefish collected off Washington and Oregon in August-September 1987.

Table 4.--Predicted mean weights by 1 cm length intervals for sablefish (sexes combined) captured off Oregon and Washington in August-September 1985 and 1987.

Length (cm)	1987 Mean weight (g)	1987 Mean weight (lb)	1985 Mean weight (g)	1985 Mean weight (lb)	Length (cm)	1987 Mean weight (g)	1987 Mean weight (lb)	1985 Mean weight (g)	1985 Mean weight (lb)
35	399	0.88	373	0.82	68	3,283	7.24	3,216	7.09
36	436	0.96	409	0.90	69	3,439	7.58	3,372	7.43
37	475	1.05	447	0.99	70	3,599	7.93	3,533	7.79
38	517	1.14	487	1.07	71	3,765	8.30	3,699	8.15
39	562	1.24	530	1.17	72	3,936	8.68	3,870	8.53
40	609	1.34	575	1.27	73	4,112	9.07	4,048	8.92
41	659	1.45	623	1.37	74	4,294	9.47	4,230	9.33
42	711	1.57	674	1.49	75	4,481	9.88	4,418	9.74
43	766	1.69	727	1.60	76	4,673	10.30	4,612	10.17
44	824	1.82	784	1.73	77	4,871	10.74	4,812	10.61
45	885	1.95	843	1.86	78	5,075	11.19	5,018	11.06
46	949	2.09	905	2.00	79	5,285	11.65	5,229	11.53
47	1,016	2.24	971	2.14	80	5,500	12.13	5,447	12.01
48	1,086	2.39	1,039	2.29	81	5,721	12.61	5,671	12.50
49	1,160	2.56	1,111	2.45	82	5,948	13.11	5,901	13.01
50	1,237	2.73	1,186	2.62	83	6,182	13.63	6,138	13.53
51	1,317	2.90	1,265	2.79	84	6,421	14.16	6,381	14.07
52	1,401	3.09	1,347	2.97	85	6,667	14.70	6,631	14.62
53	1,488	3.28	1,433	3.16	86	6,920	15.26	6,886	15.18
54	1,579	3.48	1,523	3.36	87	7,178	15.82	7,150	15.76
55	1,674	3.69	1,616	3.56	88	7,443	16.41	7,420	16.36
56	1,772	3.91	1,713	3.78	89	7,715	17.01	7,697	16.97
57	1,875	4.13	1,814	4.00	90	7,994	17.62	7,981	17.60
58	1,981	4.37	1,920	4.23	91	8,279	18.25	8,272	18.24
59	2,092	4.61	2,029	4.47	92	8,572	18.90	8,571	18.90
60	2,206	4.86	2,143	4.72	93	8,871	19.56	8,877	19.57
61	2,325	5.13	2,251	4.98	94	9,177	20.23	9,190	20.26
62	2,448	5.40	2,383	5.25	95	9,491	20.92	9,511	20.97
63	2,576	5.68	2,510	5.53	96	9,812	21.63	9,839	21.69
64	2,708	5.97	2,642	5.82	97	10,140	22.35	10,176	22.43
65	2,845	6.27	2,778	6.12	98	10,476	23.10	10,520	23.19
66	2,986	6.58	2,929	6.43	99	10,819	23.85	10,872	23.97
67	3,132	6.90	3,065	6.76	100	11,170	24.63	11,232	24.76

SUMMARY AND CONCLUSIONS

Survey catch rates indicate that sablefish abundance off Oregon and Washington decreased between 1979 and 1981, increased between 1981 and 1983, then declined sharply between 1983 and 1985 and again between 1985 and 1987 to record low levels. Total sablefish catch rates have declined from 11.4 fish per trap in 1979 to 7.4 in 1985 and to 2.8 in 1987, indicating decreases in sablefish abundance of about 75% between 1979 and 1987 and a decrease of 62% from 1985 to 1987 alone. Catch rates for all marketable-size groups were lower in 1987 than in any previous survey year. The catch rates of small, medium, and large were 19%, 14%, and 9%, respectively, of the catch rates for these sizes in 1979 (Fig. 3). In recent surveys, declines in the relative abundance of the smaller size groups are particularly noticeable. Since 1983, catch rates of small sablefish have declined from 5.0 to 1.2 fish per trap, a decline of 76% (Fig. 31, while catch rates of submarketable-size sablefish declined from 4.1 fish per trap in 1985 to 1.3 in 1987, a decline of 68% (Fig. 2).

The mean length of male sablefish was 52.0 cm, whereas females averaged 56.9 cm for all sites combined in 1987 (Fig. 7). Sablefish size generally increased with depth and those captured at 600-900 fathoms were much larger than those captured at the standard depths (Fig. 10). As in 1985, fish captured at the Nitinat Canyon site adjacent to the Canadian Fishery Zone were much larger than at other sites (Appendix Table 1).

Since the survey catch rates for all sablefish declined about 62% between 1985 and 1987, it is apparent that there has been a substantial decline in sablefish abundance off Oregon and Washington in recent years. The decline is greatest for sablefish in the small and submarketable-size categories. These results are similar to survey results off southernmost Oregon and

California that indicated a decrease of more than 50% in sablefish abundance between 1984 and 1986 (Parks and Shaw 1988). Information from several fishermen, processors, and state biologists confirm that commercial CPUE for sablefish off Oregon and Washington had declined approximately 50% between 1986 and 1987.

ACKNOWLEDGMENTS

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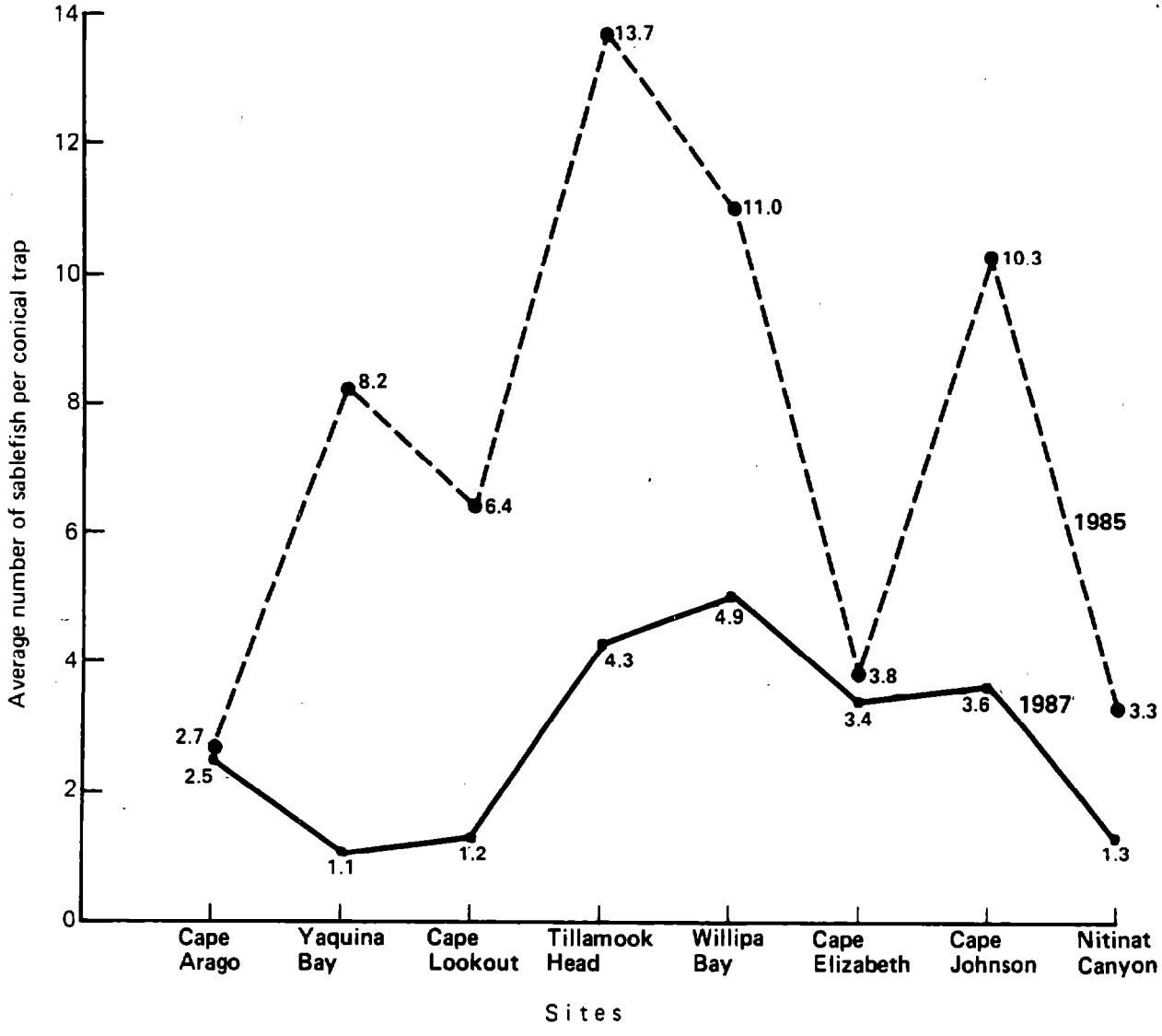
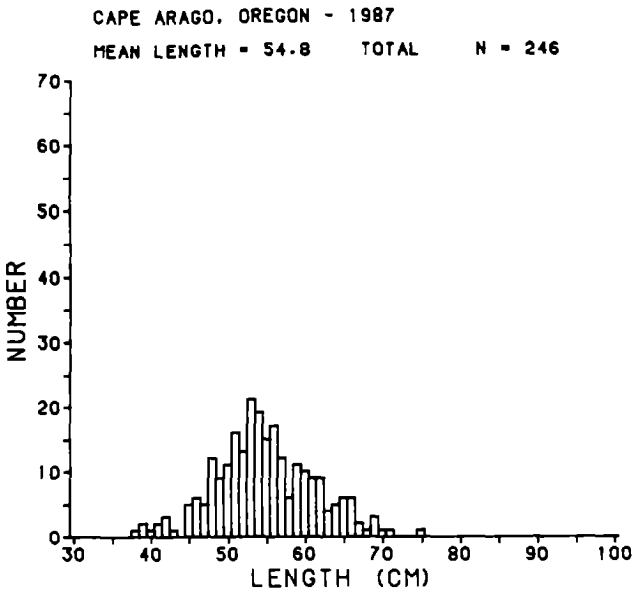
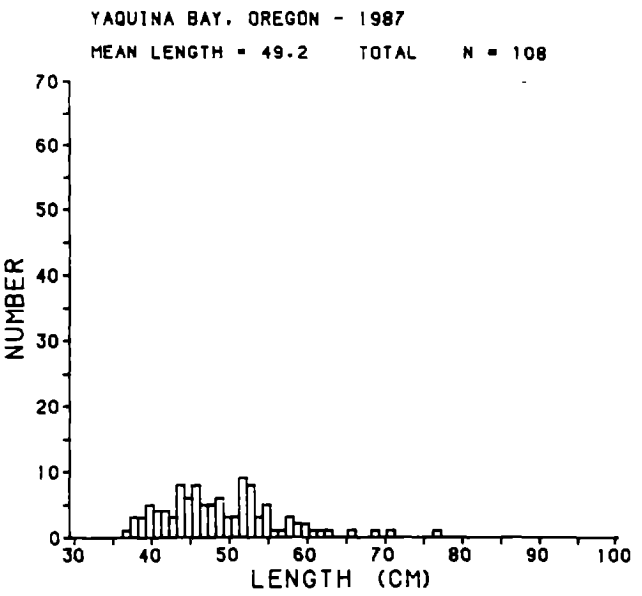
APPENDIX

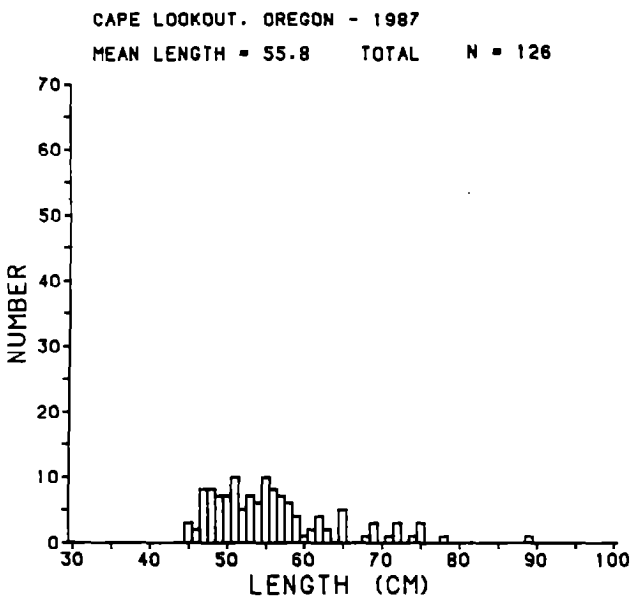
Individual Index Site Data

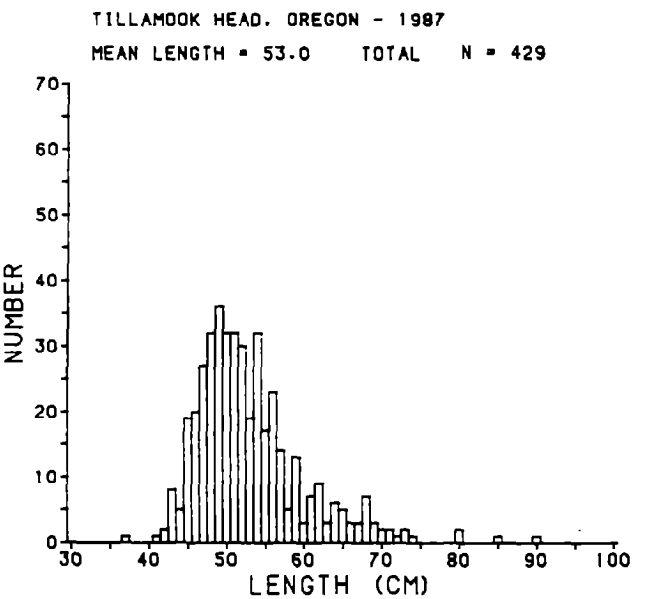


Appendix Figure 1.--Mean catch rates of sablefish at eight index sites fished off Oregon and Washington in 1985 and 1987.

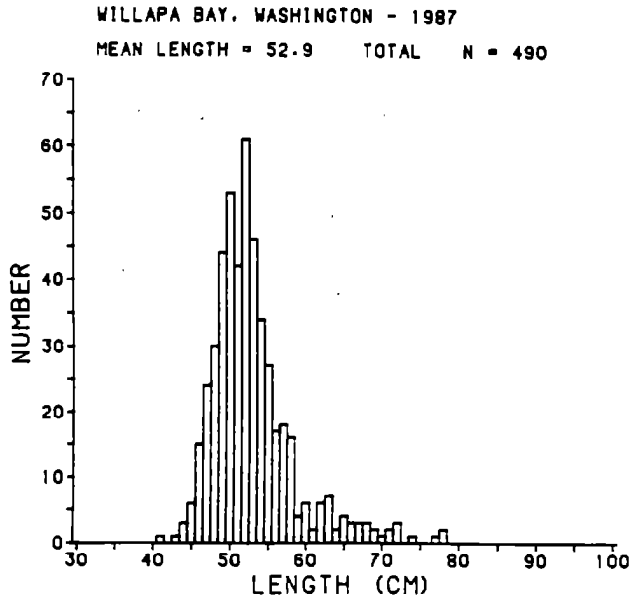


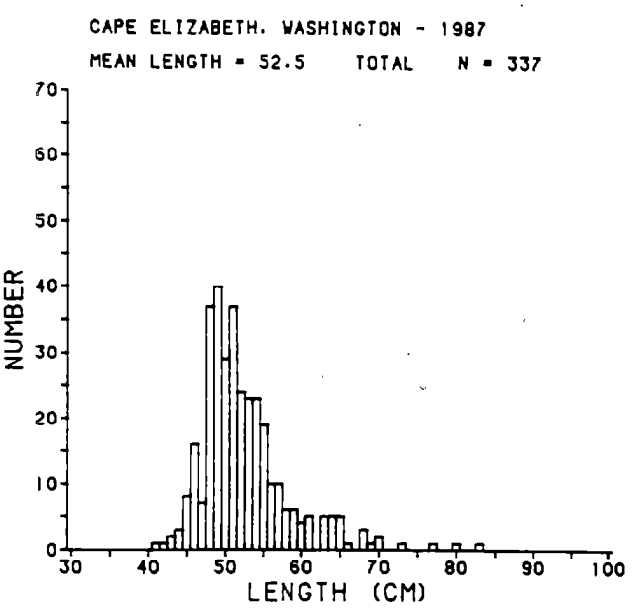


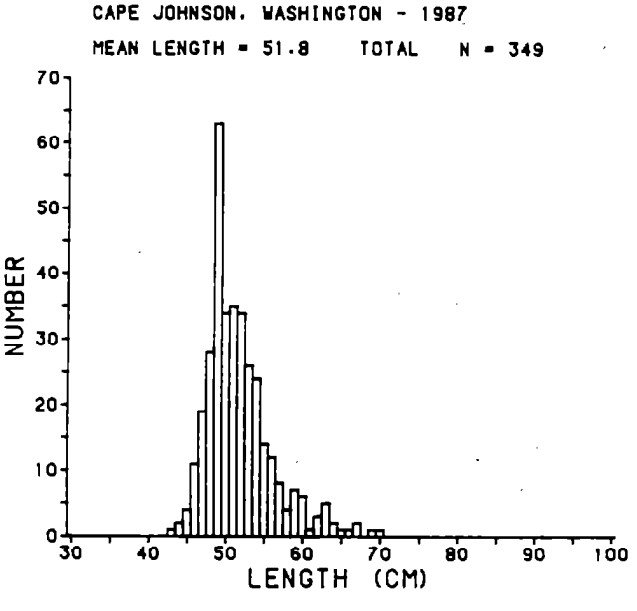


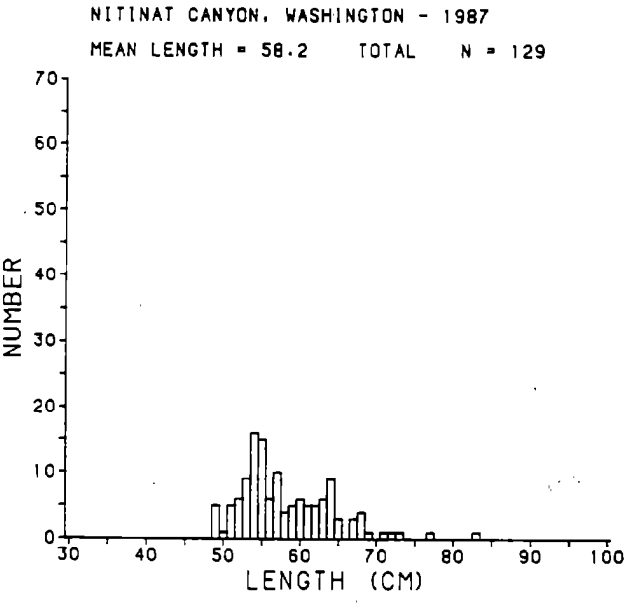


Appendix Figure 2.--Sablefish length compositions and mean lengths by indexing site at the standard depths (150-450 fathoms) from 1987 survey.









Appendix Figure 2.--Continued.

kppendix Table 1 .--Catch rates of sablefish by year, sampling site, and size group at the standard depths (150-450 fathoms). The number caught are the estimated mean numbers of sablefish captured per conical trap unit based on the relative efficiencies of conical and rectangular traps observed in 1985. The 1987 catch rates are observed values.

		Average number per trap					
		Submarket-able-sized	Marketable-sized			Total marketable sized	Total Sablefish
			Small	Medium	Large		
Site	Year	< 52 cm	52-61 cm	62-67 cm	> 67 cm		
OREGON							
Cape Arago	1979	1.6	4.2	1.1	0.7	6.0	7.6
	1980	4.8	3.5	0.5	0.4	4.4	9.2
	1981	1.1	1.1	0.2	<0.1	1.3	2.4
	1983	3.8	5.2	0.3	0.2	5.7	9.5
	1985	1.6	1.0	<0.1	<0.1	1.1	2.7
	1987	0.7	1.4	0.3	<0.1	1.8	2.5
Yaquina Bay	1985	3.7	3.6	0.6	0.2	4.5	8.2
	1987	0.7	0.4	<0.1	<0.1	0.4	1.1
Cape Lookout	1979	4.1	12.6	3.0	2.1	17.7	21.8
	1980	2.5	3.0	0.6	0.5	4.1	6.6
	1981	1.0	2.2	0.6	0.6	3.4	4.4
	1983	4.5	4.9	0.8	0.5	6.2	10.7
	1985	3.5	2.4	0.4	0.1	2.9	6.4
	1987	0.5	0.6	0.1	0.1	0.8	1.3
Tillamook Head	1985	8.9	4.0	0.4	0.4	4.8	13.7
	1987	2.2	1.6	0.3	0.2	2.1	4.3
WASHINGTON							
Willapa Bay	1979	3.9	5.2	0.7	0.7	6.6	10.5
	1980	1.8	3.0	0.4	0.5	3.9	5.7
	1981	1.8	2.7	0.5	0.6	3.8	5.6
	1983	6.0	6.0	0.9	0.4	7.3	13.3
	1985	6.3	3.8	0.5	0.4	4.7	11.0
	1987	2.2	2.3	0.3	0.2	2.8	5.0
Cape Elizabeth	1985	2.1	1.3	0.2	0.2	1.7	3.8
	1987	1.8	1.3	0.2	0.1	1.6	3.4
Cape Johnson	1979	1.3	3.1	0.6	0.7	4.4	5.7
	1980	1.5	3.2	0.5	0.4	4.1	5.6
	1981	2.8	3.5	0.4	0.2	4.1	6.9
	1983	4.1	3.9	0.6	0.3	4.8	8.9
	1985	6.6	3.0	0.4	0.3	3.7	10.3
	1987	2.0	1.4	0.1	<0.1	1.6	3.6
Nitinat Canyon	1985	0.4	2.0	0.5	0.3	2.9	3.3
	1987	0.1	0.8	0.3	0.1	1.2	1.3