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Changes in Relative Abundance and Size Composition of Sablefish in Coastal Waters of Washington and Oregon, 1979-81, and California, 1980-81

by
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CHANGES IN RELATIVE ABUNDANCE AND SIZE COMPOSITION OF SABLEFISH IN COASTAL WATERS OF WASHINGTON AND OREGON, 1979-81, AND CALIFORNIA, 1980-81

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ABSTRACT

Sablefish (Anoplopoma fimbria) abundance in index survey areas off Oregon and Washington appears to have decreased substantially from 1979 to 1981. Catch rates decreased about one-third between the 1980 and 1981 surveys and catch rates suggest about equal reductions in the abundance of marketable-size and submarketable-size sablefish. Abundance index catches also showed some decline between 1980 and 1981 surveys at the site off San Diego, California. The abundance index catches also indicated significant reductions in numbers of medium and large marketable-size sablefish off southern Oregon and off northern Washington. It is not known whether these reductions are a result of relatively low recruitment to the medium and large size categories or fishing or a combination of the two.

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INTRODUCTION

Since 1978, the Northwest and Alaska Fisheries Center has been conducting a long-range research program aimed at monitoring the annual changes in sablefish (Anoplopoma fimbria) abundance and size composition in the northeastern Pacific Ocean. This research was begun in southeast Alaskan waters and was expanded to include Washington and Oregon coastal waters in 1979 and waters off California in 1980. In accordance with a comprehensive cooperative federal-state research plan through 1984 (Hughes 1980), abundance indexing is to be expanded to include the central Gulf of Alaska as well.

Results of the 1978-81 surveys of sablefish resource conditions in southeast Alaska have been reported to the fishing industry and the North Pacific Fishery Management Council (Zenger and Hughes 1981; Zenger 1981). Management of sablefish resources in southeast Alaska is being administered under a fishery management plan, but such a plan for the Washington-Oregon-California region will probably not be in effect until sometime in 1982. The 1979-81 surveys of sablefish resource conditions in the Washington-Oregon-California region, described in this report, represent initial stages of a long-range study on sablefish. This study will provide additional information on the species, which should facilitate management of that resource.

Historic accounts of sablefish landings off the Washington-Oregon-California coasts and background information on survey methods and gear were described by Parks and Hughes (1981). Table 1 shows Pacific west coast domestic sablefish landings through 1981. Trawl landings of sablefish in all three states were relatively stable from 1979 through 1981. Trap (Hipkins 1974) and longline gear are used in "directed" sablefish fisheries. Trap landings increased drastically in Washington and decreased sharply in Oregon and California in 1981. The increased trap landings in Washington were due to steady fishing by several vessels using large numbers of sablefish traps. Longline landings in Washington and Oregon increased gradually from 1976 to 1978 and increased greatly in 1979; but in 1980 and 1981, the landings decreased drastically.

Market demand and exvessel prices, for the most part, remained depressed during 1980-81. As a result of greatly reduced fishing effort, total sablefish landings dropped from 17,317 metric tons (t) in 1979 to 9,504 t in 1980 and 8,906 t in 1981, well below the 13,400 t optimum yield recommended by the Pacific Fisheries Management Council in the "Draft Pacific Coast Groundfish Plan."

SURVEY METHODS AND GEAR

The "abundance indexing" techniques employed in this study and the trap gear used are described in detail by Parks and Hughes (1981). Information on changes in relative abundance from year to year was determined from the catch per unit of effort (CPUE) obtained from standardized trap catches at four sites off the Washington-Oregon coast (which were monitored during the August-September period in 1979-81 and at two sites off California (monitored during November 1980). Adverse weather precluded operations at one California site in 1981.

Table 1.--Sablefish domestic landings by state and gear type, 1976-81.

State and gear	Sablefish landings, round weight (t)					
	1976	1977	1978	1979	1980	1981
Washington						
Trawl	314.2	480.2	676	669	441	550
Trap	121.4	358.8	491	435	387	1,305
Longline	203.8	299.2	666	1,564	577	603
Troll	1.0	1.8	-	-	1	1
Shrimp trawl	0.7	6.5	-	-	7	11
Set net	-	-	-	-	45	29
Handline	-	-	-	-	4	4
Total	641.1	1,146.5	1,833	2,668	1,462	2,503[1/]
Oregon						
Trawl	443.2	326.2	958	1,494	1,024	1,316
Trap	44.5	40.0	290	4,351	1,241	304[2/]
Longline	0	6.0	268	1,819	379	682
Troll	-	-	28	-	-	1
Shrimp trawl	20.0	13.0	70	77	63	36
Total	507.7	385.2	1,614	7,741	2,709	2,339[1/]
California						
Trawl	1,853.6	2,474.1	2,345	2,272	2,902	2,724
Trap and longline[3/]	4,205.9	3,578.6	4,827	4,772	2,431	1,340
Total	6,059.5	6,052.7	7,172	7,044	5,333	4,064[1/]
GRAND TOTAL	7,208.3	7,584.4	10,619	17,317	9,504	8,906

1/ Preliminary data.
2/ Includes 26 t taken by set net.
3/ Longline catch in California was a very small percentage of combined trap and longline catch until 1980 when longline catch rose to 28%.

Survey index sites were established on commercial fishing grounds off Cape Arago and Cape Lookout, Oregon, and off Willapa Bay and Cape Johnson, Washington (Figure 1). The California sites were on Patton Escarpment west of San Diego and near Bodega Canyon just northwest of Point Reyes (Figure 2). To standardize fishing time, trap tunnel entrances were equipped with calibrated, corrodible magnesium clips which closed trap entrances via a noose arrangement after 24 ± 1 h periods in seawater (Figure 3).

At index sites off Washington and Oregon, lo-trap strings were set as near as possible to the 150, 225, 300, 375, and 450 fathom (fm) isobaths. Off California the fishing depths were at the 225, 300, 375, 450, and 550 fm isobaths. The gear was set 5 times at each depth resulting in a total of 50 traps hauled at each depth interval and 250 traps hauled at each site. Detailed charts using Loran C and depth sounder were prepared and maintained to assure that replicate sets were fished at the positions initially established. The surveys off Oregon and Washington were conducted from the 92 ft NOAA ship John N. Cobb beginning with the Cape Arago site off southern Oregon in early August and finishing at the Cape Johnson site off northern Washington during late September. The 1980 California survey was conducted by the NOAA ship Chapman and the 1981 California survey by the John N. Cobb. The California surveys took place primarily during November.

Data collected during the surveys included:

1. Number and weight of sablefish captured in each trap;
2. Number and weight of other species captured in each trap;
3. Fork lengths of all sablefish;
4. Biological data to support life history studies which included

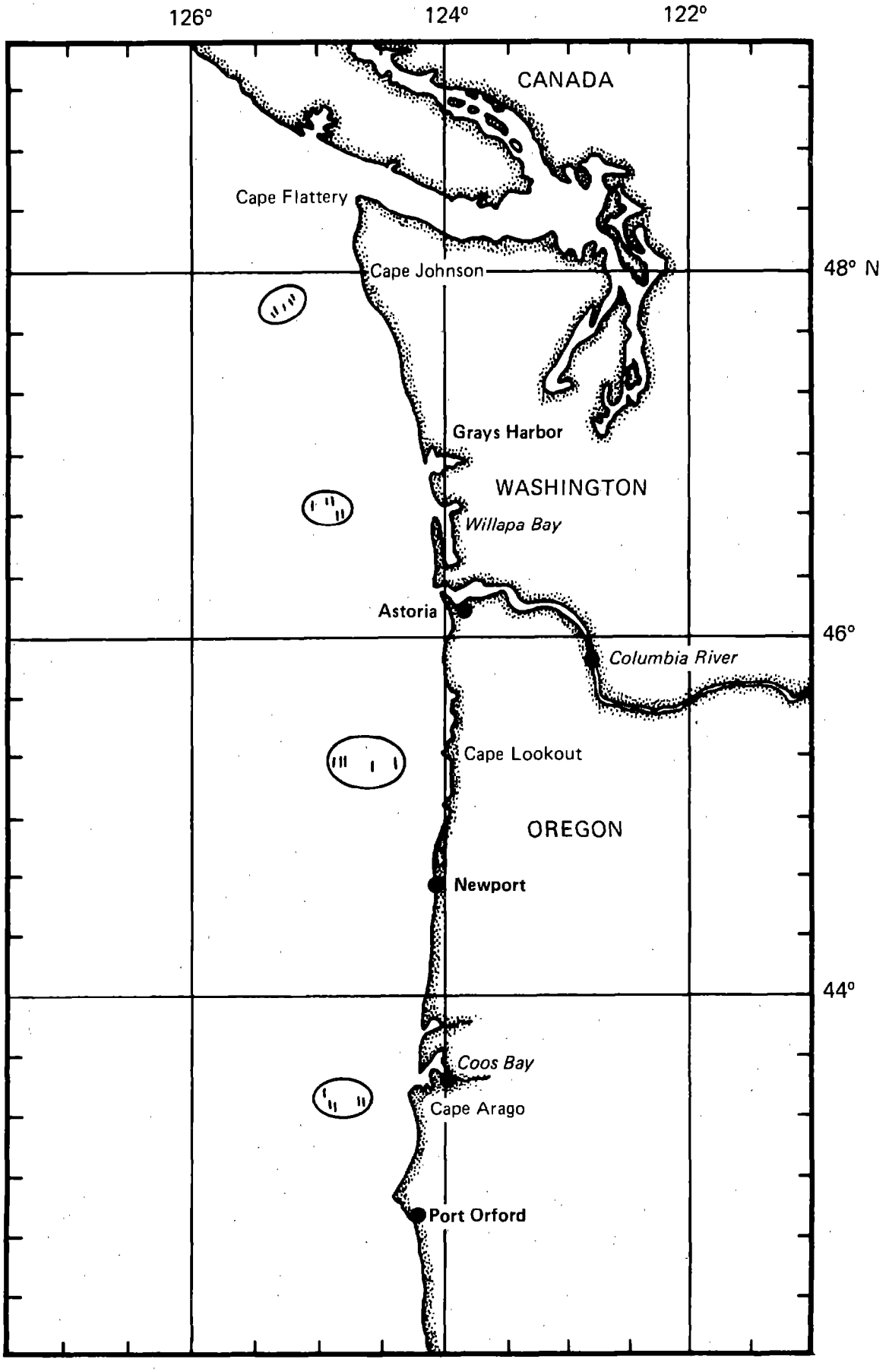

Figure 1.--Sites fished off Washington and Oregon during the 1979-81 sablefish index surveys by the NOAA ship John N. Cobb.

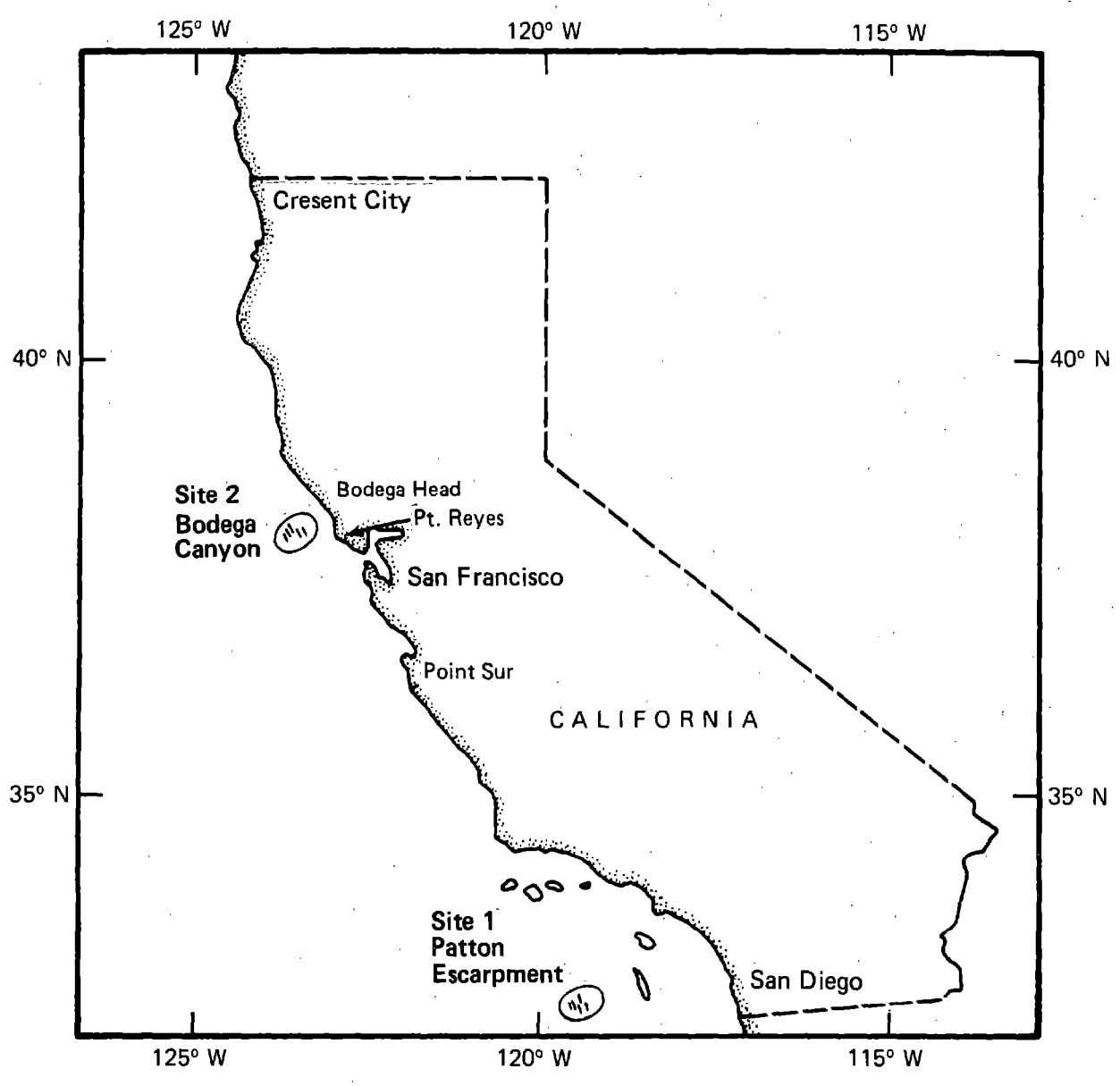

Figure 2. --Sites fished off California during the 1980-81 sablefifah index surveys by the NOAA ships Chapman and John N. Cobb.

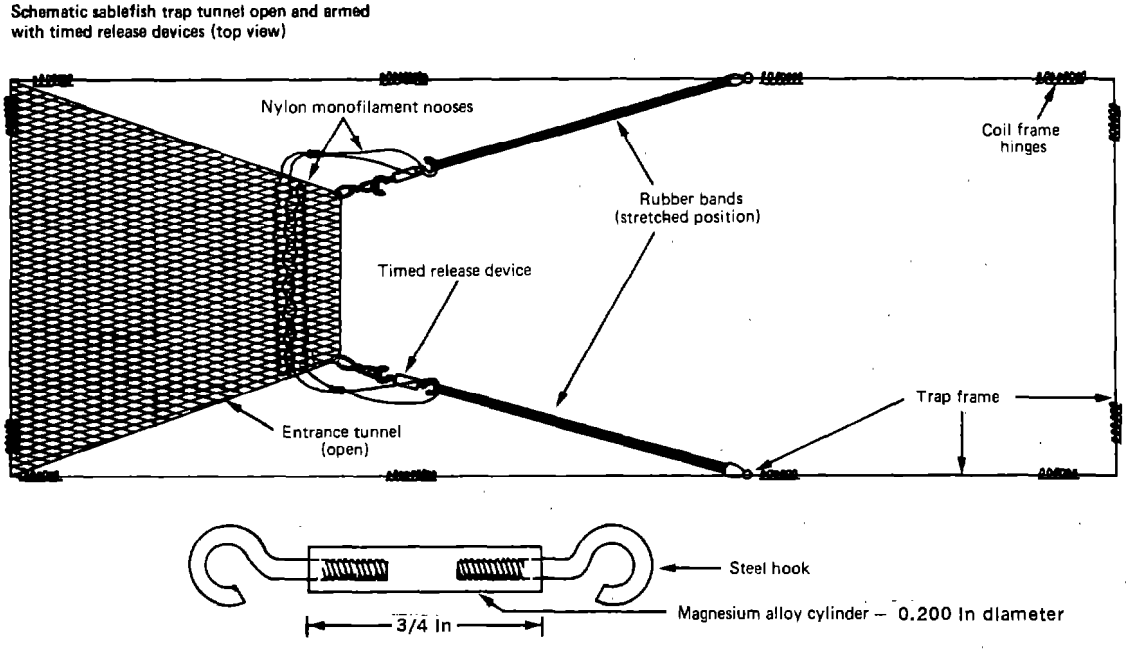

Figure 3. --**Diagrams** of sablefish trap tunnels, open and equipped with timed release devices and closed with the nooses pulled tight.

length-weight relationships, age structures[1/], sex ratio, and sexual maturity;

5. Tissue samples for stock identification studies; and

6. All sablefish not required for biological samples were tagged and released in support of ongoing coastwide migration studies.

Based upon information from the sablefish processors of Oregon and Washington, marketable-size sablefish were defined as fish measuring 52 cm or greater in fork length. Fish measuring 52 cm averaged 3 lb round weight. Small marketable sablefish weighed 3.0-5.0 lb round weight (head on, ungutted), medium sablefish weighed 5.0-7.0 lb, and large sablefish weighed more than 7.0 lb round weight. Submarketable-size sablefish were defined as those fish retained by the trap gear which measured 51 cm or less and hence weighed less than 3 lb round weight. Weight at length data for Washington are presented in Figure 4. In California, there is no minimum size accepted by processors; those sablefish under 4-l/4 lb round weight were considered small, 4-l/4-7 lb medium, and more than 7 lb large. Research catches were categorized accordingly.

RESULTS

Oregon Coast

Sablefish catches at the Cape Arago site decreased sharply between the 1980 and 1981 surveys after having increased between the 1979 and 1980 surveys (Table 2). This large decrease off Cape Arago between 1980 and 1981 was evident in both submarketable and marketable categories. The percentage abundance of sablefish captured at Cape Arago are shown by size category in Table 3. Cape Arago produced the highest percentage of submarketable sablefish

1/ Age determinations are being postponed until present techniques are more fully evaluated.

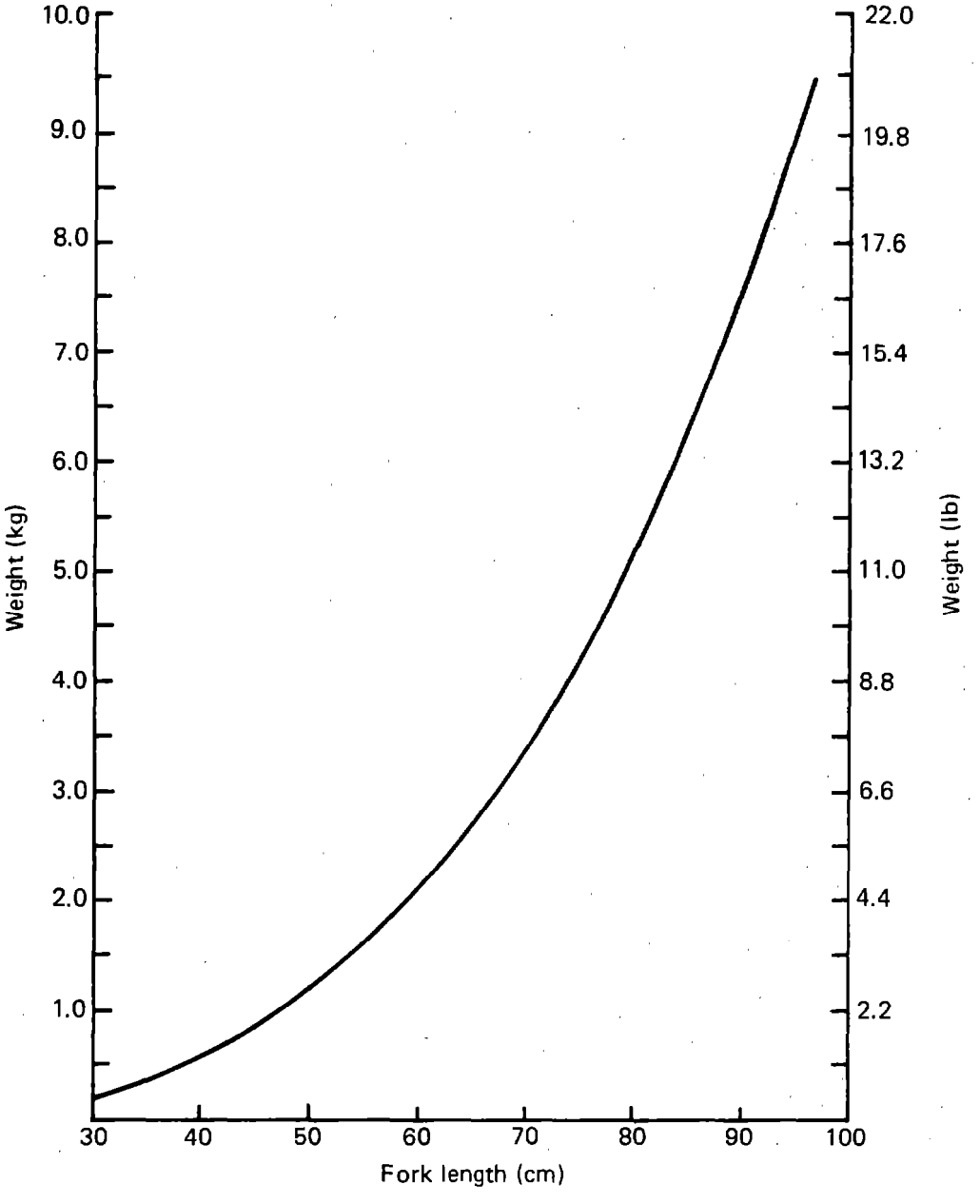

Figure 4.--Length-weight relationship derived from Washington sablefish sampled in 1981.

Table 2.--Total numbers of sablefish and numbers of marketable-size and submarketable-size sablefish captured at Oregon and Washington abundance index sites during the 1979-81 surveys and at the California sites during the 1980-81 surveys. Annual percentage change in numbers of sablefish and percentage change from the baseline year 1979 are indicated by site and size category.

	Total sablefish			Marketable-size [1]			Submarketable-size [2]		
Site/year	Number	Annual change (%)	Change from baseline year (%)	Number	Annual change (%)	Change from baseline year (%)	Number	Annual change (%)	Change from baseline year (%)
OREGON									
Cape Arago									
1979	1,222			929			293		
		+43			+ 1			+179	
1980	1,753		+43	936 [3]		+ 1	817 [3]		+179
		-67			-67			-66	
1981	587		-52	313		-66	274		- 6
Cape Lookout									
1979	2,874			2,319			555		
		-61			-70			-23	
1980	1,125		-61	700		-70	425		-23
		-31			-21			-48	
1981	774		-73	551		-76	223		-60
Cape Arago and Cape Lookout									
1979	4,096			3,248			848		
		-30			-50			+46	
1980	2,878		-30	1,636		-50	1,242		+46
		-53			-47			-60	
1981	1,361		-67	864		-73	497		-41
WASHINGTON									
Willapa Bay									
1979	1,310			846			464		
		-26			-20			-36	
1980	974		-26	675		-20	299		-36
		+10			+ 6			+21	
1981	1,074		-18	713		-16	361		-22
Cape Johnson									
1979	952			760			192		
		+44			+24			+122	
1980	1,370		+44	944		+24	426		+122
		-31			-38			-14	
1981	950		0	584		-23	366		+91
Willapa and Cape Johnson									
1979	2,262			1,606			656		
		+ 4			+ 1			+11	
1980	2,344		+ 4	1,619		+ 1	725		+11
		-14			-20			0	
1981	2,024		-11	1,297		-19	727		+11
CALIFORNIA									
Patton Escarpment									
1980	1,524			1,524			--		
		-18			-18			--	
1981	1,247			1,247			--		
Bodega Canyon									
1980	1,267			1,267			--		
1981 [4]									

1/ 52 cm or greater fork length for Washington and Oregon only. California has no minimum size.
2/ 51 cm or less fork length, which is below minimum marketable size in Washington and Oregon.
3/ A correction of the number presented in the report by Parks and Hughes (1981).
4/ The Bodega Canyon site was not fished in 1981 because of adverse weather conditions.

Table 3.--Percentage abundance of submarketable-size and marketable-size sablefish at the four Oregon and Washington abundance index sites during the 1979-81 annual surveys.

Year and area	Submarketable[1] (%)	Marketable			
		Small[2] (%)	Medium[3] (%)	Large[4] (%)	Total (%)
1979					
Cape Arago	24	53	13	10	100
Cape Lookout	19	57	13	11	100
Willapa Bay	35	51	7	7	100
Cape Johnson	20	55	13	12	100
Average	24	54	12	10	100
1980					
Cape Arago	47	39	8	6	100
Cape Lookout	38	44	9	9	100
Willapa Bay	31	52	8	9	100
Cape Johnson	31	54	8	7	100
Average	37	47	8	8	100
1981					
Cape Arago	47	44	6	3	100
Cape Lookout	29	46	12	13	100
Willapa Bay	34	52	7	7	100
Cape Johnson	39	52	6	3	100
Average	37	49	8	6	100

1/ Less than 52 cm fork length = less than 3.0 lb round weight.
2/ 52-61 cm fork length = 3.0-5.0 lb round weight.
3/ 62-67 cm fork length = 5.0-7.0 lb round weight.
4/ 68 cm or greater fork length = more than 7.0 lb round weight.

of any site. Table 4 shows actual catches by depth and indicates catch rates were down at all depth intervals, especially at 150 fm where 1,028 sablefish were captured in 1980 and 41 in 1981. In comparing length composition, the sharply decreased abundance appeared to occur in all size categories, and mean lengths declined from 57 cm in 1979 to 53 cm in 1981 (Figure 5).

Sablefish catches at Cape Lookout have dropped sharply since 1979 in all size categories, with decreases ranging from 60 to 76% (Table 2,). This site had the lowest percentage of submarketables and the highest percentage of medium and large sablefish of any site as shown in Table 3. In 1981, catch rates declined at all depth intervals, except at 225 fm where a small increase occurred (Table 4). Comparing the length composition (Figure 5), numbers of fish measuring 58 cm and greater remained relatively constant between the 1980 and 1981 surveys, while the substantial decrease in 1981 abundance occurred primarily among fish measuring 57 cm and less. As a result, average size increased from 55 cm in 1980 to 57 cm in 1981.

Combined Cape Arago and Cape Lookout data show that index catches for the Oregon coast decreased 53% from 1980 to 1981 (Table 2). The 1981 catch figures represent sharp decreases from 1979 in both marketable-size and submarketable-size sablefish as well. Comparing the length composition for the Oreqon coast it is apparent that the decline in catches occurred in almost all length groups (Figure 6). The average length of sablefish for the Oregon coast dropped from 57 cm in 1979 to 54 cm in 1980 and increased slightly to 55 cm in 1981 as a result of a higher percentage of larger fish at the Cape Lookout site. The mean lengths of males declined from 54 cm in 1979 to 52 cm in 1981, and the mean length of females declined from 61 cm to 59 cm.

The sex composition of sablefish captured during the 1979-81 index surveys off Oregon ranged from 48 to 53% males.

Table 4.--Total numbers of sablefish and marketable-size sablefish[1/] (in parentheses) captured by depth and set at the Cape Arago and Cape Lookout, Oregon, sites during the 1979-81 abundance index surveys. Each catch was obtained from one string of 10 sablefish traps fished for 24 hours.

and set	150/275	225/412	300/550	375/686	450/824	catch
	Number of fish					
Cape Arago						
1979						
1	39 (36)	88 (70)	61 (50)	86 (63)	74 (58)	348 (277)
2	39 (19)	54 (42)	42 (35)	26 (21)	34 (31)	195 (148)
3	51 (27)	48 (41)	64 (46)	77 (60)	54 (41)	294 (215)
4	21 (17)	50 (46)	19 (12)	50 (35)	52 (30)	192 (140)
5	22 (11)	33 (30)	21 (11)	33 (30)	84 (67)	193 (149)
Total	172 (110)	273 (229)	207 (154)	272 (209)	298 (227)	1,222 (929)
Mean	34 (22)	55 (46)	41 (31)	54 (42)	60 (45)	244 (186)
1980						
1	171 (70)	54 (30)	40 (19)	36 (19)	20 (14)	321 (152)
2	166 (71)	80 (44)	61 (30)	17 (8)	10 (6)	334 (159)
3	303 (115)	48 (22)	44 (27)	19 (14)	6 (4)	420 (182)
4	150 (92)	86 (56)	51 (34)	15 (9)	9 (5)	311 (196)
5	238 (147)	83 (70)	12 (8)	23 (14)	11 (8)	367 (247)
Total	1,028 (495)	351 (222)	208 (118)	110 (64)	56 (37)	1,753 (936)
Mean	206 (106)	70 (50)	42 (25)	22 (13)	11 (7)	351 (187)
1981						
1	1 (1)	24 (16)	47 (12)	20 (13)	14 (10)	106 (52)
2	10 (6)	22 (15)	20 (10)	10 (6)	6 (3)	68 (40)
3	10 (3)	80 (45)	12 (8)	20 (10)	7 (5)	129 (71)
4	11 (6)	90 (51)	39 (26)	37 (12)	14 (9)	191 (104)
5	9 (3)	50 (25)	13 (6)	12 (6)	9 (6)	93 (46)
Total	41 (19)	266 (152)	131 (62)	99 (47)	50 (33)	587 (313)
Mean	8 (4)	53 (30)	26 (12)	20 (9)	10 (7)	117 (63)
Cape Lookout						
1979						
1	158 (103)	138 (131)	360 (293)	222 (177)	213 (158)	1,091 (862)
2	30 (24)	72 (68)	134 (111)	87 (74)	132 (106)	455 (383)
3	25 (14)	97 (95)	146 (123)	114 (93)	99 (74)	481 (399)
4	57 (45)	92 (89)	98 (76)	116 (92)	116 (88)	479 (390)
5	23 (16)	85 (65)	66 (54)	83 (67)	111 (83)	368 (285)
Total	293 (202)	484 (448)	804 (657)	622 (503)	671 (509)	2,874 (2,319)
Mean	59 (40)	97 (90)	161 (131)	124 (101)	134 (102)	575 (464)
1980						
1	93 (54)	24 (18)	60 (41)	29 (18)	35 (22)	241 (153)
2	55 (35)	26 (20)	95 (59)	28 (15)	23 (16)	227 (145)
3	85 (50)	74 (45)	50 (28)	40 (23)	10 (7)	259 (153)
4	45 (25)	53 (36)	102 (54)	44 (33)	29 (12)	273 (160)
5	28 (18)	30 (28)	23 (14)	27 (20)	17 (9)	125 (89)
Total	306 (182)	207 (147)	330 (196)	168 (109)	114 (66)	1,125 (700)
Mean	61 (36)	41 (29)	66 (39)	34 (22)	23 (13)	225 (140)
1981						
1	22 (20)	25 (22)	31 (25)	35 (24)	14 (9)	127 (100)
2	35 (30)	73 (59)	27 (16)	30 (21)	23 (15)	188 (141)
3	40 (33)	48 (35)	30 (16)	22 (18)	39 (24)	179 (126)
4	40 (32)	36 (27)	27 (14)	16 (11)	8 (3)	127 (87)
5	31 (24)	49 (42)	30 (9)	22 (13)	21 (9)	153 (97)
Total	168 (139)	231 (185)	145 (80)	125 (87)	105 (60)	774 (551)
Mean	34 (28)	46 (37)	29 (16)	25 (17)	21 (12)	155 (110)

1/ Sablefish measuring 52 cm or greater in fork length.

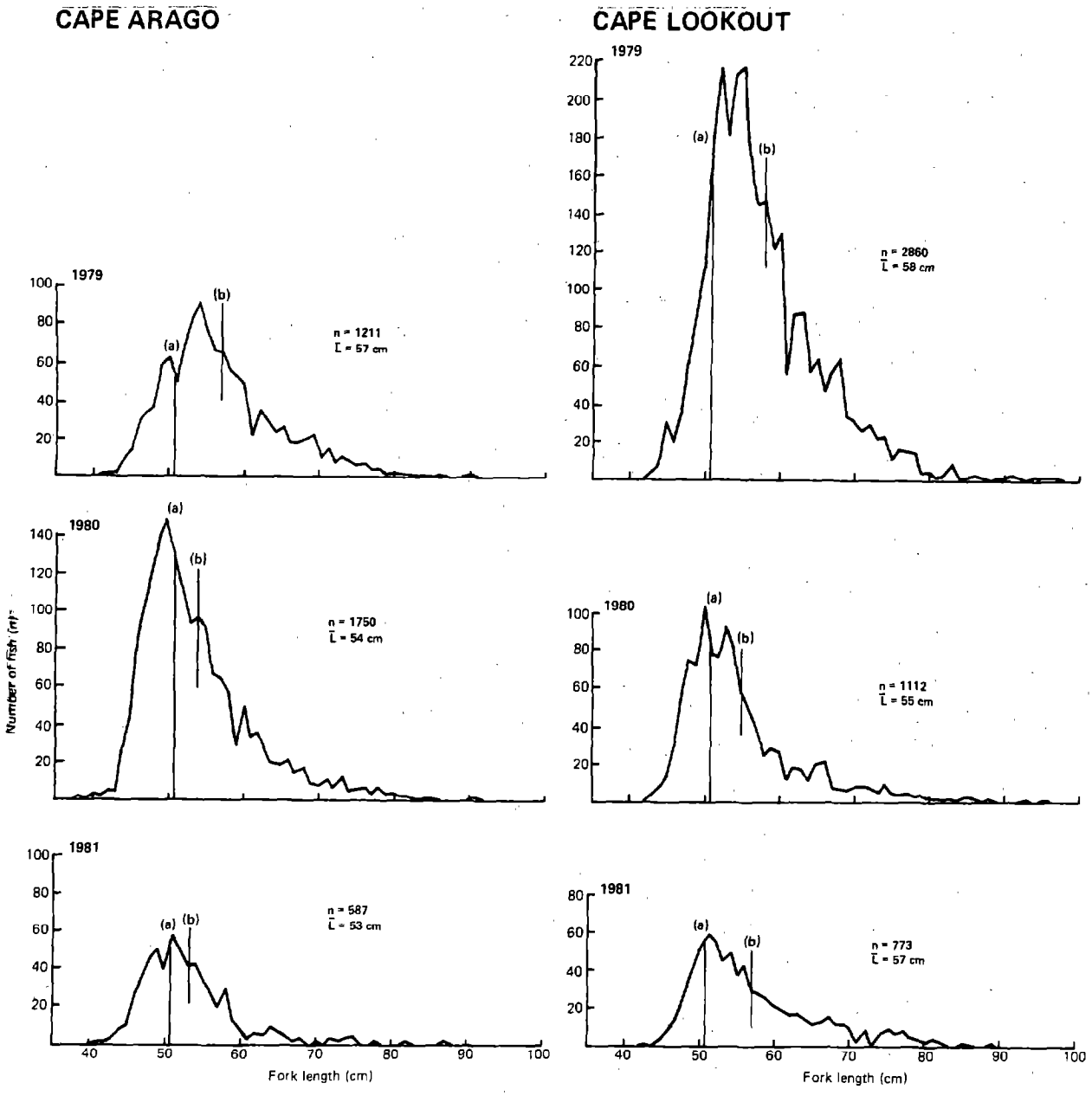

Figure 5.--Length composition of sablefish captured at the Cape Arago and Cape Lookout, Oregon, sites during the 1979-81 index surveys. Vertical line (a) is the division between submarketable-size and marketable-size sablefish, and vertical line (b) is the mean length.

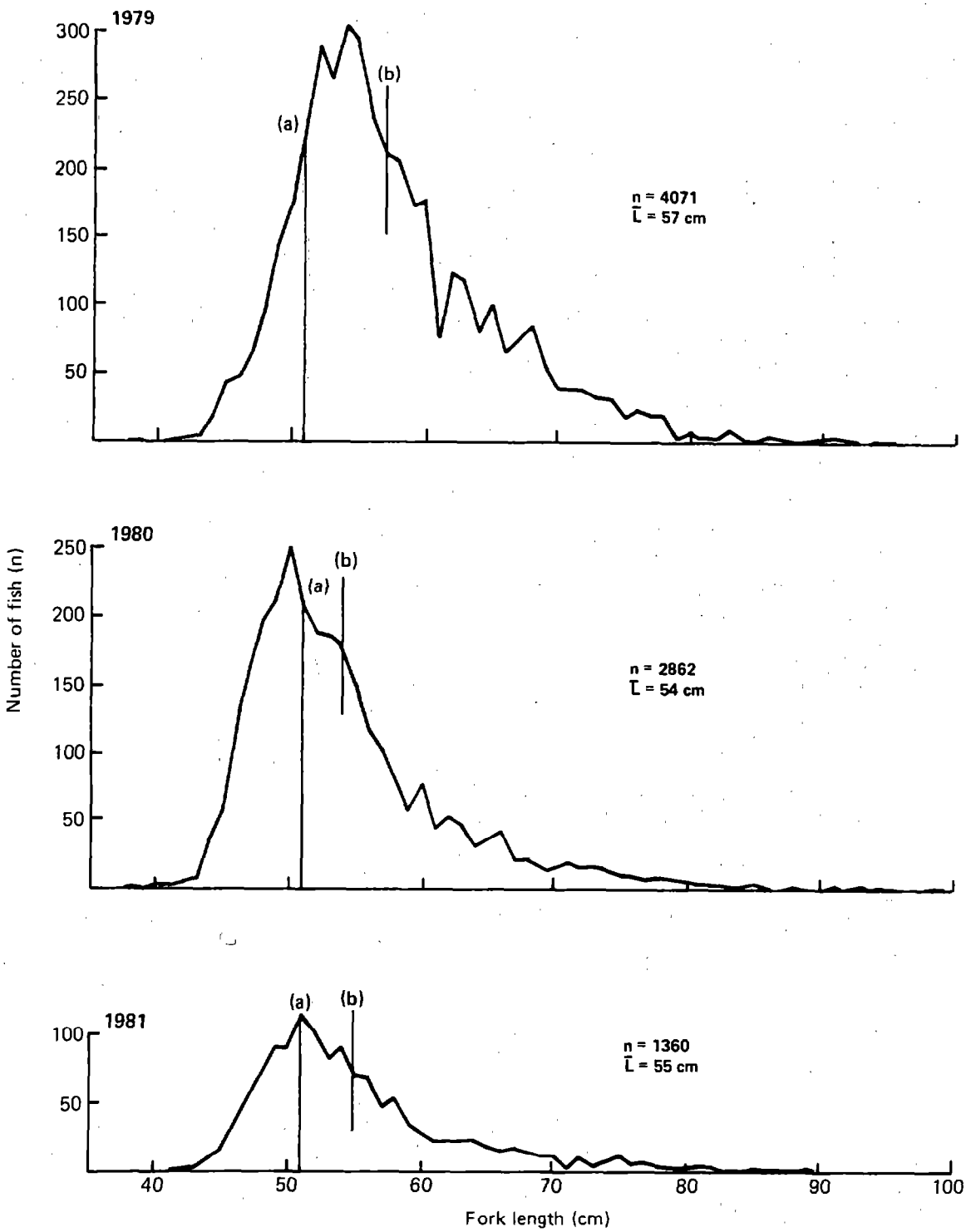

Figure 6.--Combined length composition of sablefish captured at Cape Arago and Cape Lookout, Oregon, sites during the 1979-81 index surveys. Vertical line (a) is the division between submarketable-size and marketable-size sablefish, and vertical line (b) is the mean length.

Washington Coast

The sablefish catch at the Willapa Bay site off the southern Washington coast has decreased since 1979, but slight increases in both size categories were noted between 1980 and 1981 (Table 2). The percentages of marketable and submarketable sizes have remained relatively stable since 1979 (Table 3). Willapa Bay was the only site which showed increased catches in 1981--a result of higher than usual catch rates at the 225 fm depth interval (Table 5). The length composition and mean length of sablefish captured at the Willapa Bay site is similar in all 3 years (Figure 7).

Total sablefish catches at Cape Johnson in 1981 were essentially unchanged from 1979; however, moderately lower catches occurred in both size categories between 1980 and 1981 (Table 2). A sharp increase in the percentage of submarketable-size fish and a major decrease in percentage of medium and large-size sablefish at Cape Johnson was evident since 1979 (Table 3). There was decreased abundance in all sizes 47 cm and greater between 1980 and 1981, and the mean length decreased from 58 cm in 1979 to 54 cm in 1981 (Figure 7). Decreased catches were observed at all depth-intervals except at 375 fm in 1981 (Table 5).

The data obtained by combining catch information from the Willapa Bay and Cape Johnson sites indicate that the abundance of sablefish stocks off the Washington coast decreased slightly between 1979 and 1981 (Table 2). Catches of sablefish off the Washington coast declined between 1980 and 1981 and this decline occurred primarily in fish 54 cm and longer (Figure 8). Marketable-size sablefish decreased 20%, while the abundance of submarketable-size sablefish remained stable. The mean length decreased slightly to 54 cm in 1981.

Table S.--Total numbers of sablefish and marketable-size sablefish[1/] (in parentheses) captured by depth and set at the Willapa Bay and Cape Johnson, Washington, sites during them 1979-81 abundance index surveys. Each catch was obtained from one string of 10 sablefish traps fished for 24 hours.

Area, year and set	Depth (fathom/meter) 150/275	225/412	300/550	375/686	450/824	Total catch
	Number of fish					
Willapa Bay						
1979						
1	34 (18)	80 (24)	102 (81)	109 (81)	184 (106)	509 (310)
2	23 (13)	39 (15)	83 (62)	47 (40)	45 (33)	237 (163)
3	8 (6)	57 (23)	82 (71)	32 (23)	32 (22)	211 (145)
4	18 (12)	27 (8)	29 (18)	48 (35)	56 (42)	178 (115)
5	6 (5)	20 (7)	39 (26)	56 (40)	54 (35)	175 (113)
Total	89 (54)	223 (77)	335 (258)	292 (219)	371 (238)	1,310 (846)
Mean	18 (11)	45 (15)	67 (52)	58 (44)	74 (48)	262 (169)
1980						
1	57 (33)	42 (23)	72 (52)	31 (23)	42 (24)	244 (155)
2	21 (15)	35 (21)	27 (21)	28 (24)	53 (42)	164 (123)
3	59 (37)	54 (42)	42 (35)	32 (29)	56 (36)	243 (179)
4	32 (19)	32 (14)	44 (34)	25 (18)	27 (22)	160 (107)
5	29 (18)	38 (21)	49 (41)	23 (19)	24 (12)	163 (111)
Total	198 (122)	201 (121)	234 (183)	139 (113)	202 (136)	974 (675)
Mean	40 (24)	40 (24)	47 (37)	28 (23)	40 (27)	195 (135)
1981						
1	42 (31)	81 (49)	38 (27)	27 (11)	29 (19)	217 (137)
2	20 (20)	80 (50)	25 (20)	31 (24)	25 (18)	181 (132)
3	15 (11)	124 (72)	28 (18)	23 (12)	28 (22)	218 (135)
4	50 (36)	139 (93)	18 (14)	16 (12)	36 (26)	259 (181)
5	16 (11)	83 (45)	9 (6)	31 (19)	60 (47)	199 (128)
Total	143 (109)	507 (309)	118 (85)	128 (78)	178 (132)	1,074 (713)
Mean	29 (22)	101 (62)	24 (17)	26 (16)	36 (26)	215 (143)
Cape Johnson						
1979						
1	30 (22)	30 (23)	24 (21)	79 (51)	72 (59)	235 (176)
2	20 (14)	9 (6)	18 (17)	47 (38)	75 (64)	169 (139)
3	11 (10)	15 (12)	27 (22)	31 (23)	68 (63)	152 (130)
4	27 (22)	10 (7)	16 (14)	28 (20)	93 (76)	174 (139)
5	74 (54)	24 (24)	26 (22)	35 (26)	63 (50)	222 (176)
Total	162 (122)	88 (72)	111 (96)	220 (158)	371 (312)	952 (760)
Mean	32 (24)	18 (14)	22 (19)	44 (32)	74 (62)	190 (152)
1980						
1	7 (6)	69 (52)	54 (33)	45 (24)	58 (52)	233 (167)
2	6 (6)	47 (39)	46 (30)	20 (13)	46 (37)	165 (125)
3	22 (21)	72 (58)	67 (40)	65 (38)	81 (59)	307 (216)
4	15 (11)	99 (86)	52 (33)	34 (25)	77 (50)	277 (205)
5	23 (15)	71 (52)	119 (58)	80 (42)	95 (64)	388 (231)
Total	73 (59)	358 (287)	338 (194)	244 (142)	357 (262)	1,370 (944)
Mean	15 (12)	72 (57)	68 (39)	49 (28)	71 (52)	274 (189)
1981						
1	15 (13)	66 (46)	15 (7)	68 (32)	47 (33)	211 (131)
2	4 (3)	77 (50)	33 (20)	58 (26)	108 (61)	280 (160)
3	6 (6)	33 (18)	10 (5)	51 (29)	45 (35)	145 (93)
4	25 (22)	21 (15)	29 (23)	39 (14)	43 (24)	157 (98)
5	12 (9)	14 (8)	27 (23)	28 (16)	76 (46)	157 (102)
Total	62 (53)	211 (137)	114 (78)	244 (117)	319 (199)	950 (584)
Mean	12 (11)	42 (27)	23 (16)	49 (23)	64 (40)	190 (117)

1/ Sablefish measuring 52 cm or greater in fork length.

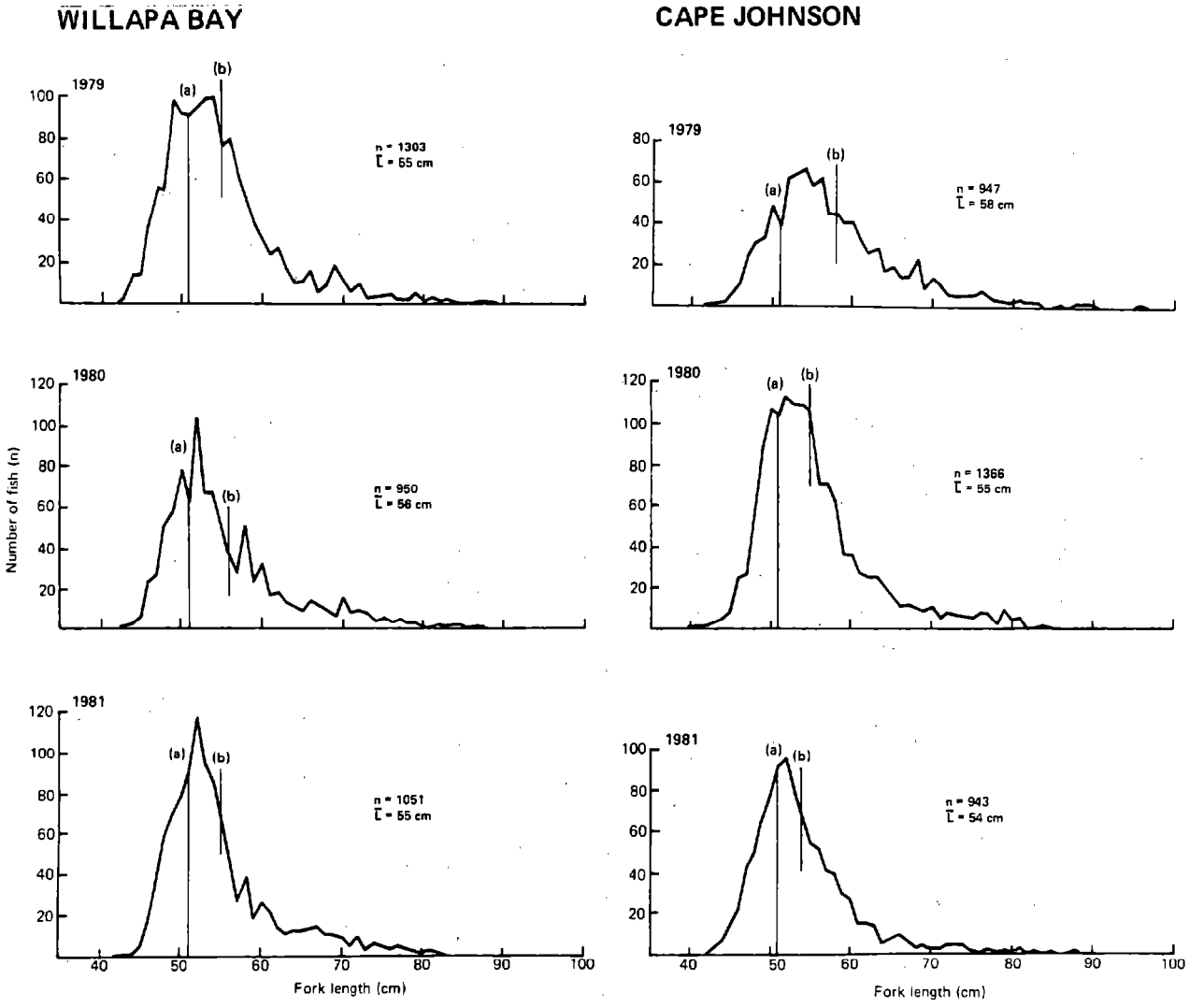

figure 7.--Length composition of sablefish captured at the Willapa Bay and Cape Johnson, Washington, sites during the 1979-81 index surveys. Vertical line (a) is the division between submarketable-size and marketable-size sablefish, and vertical line (b) is the mean length.

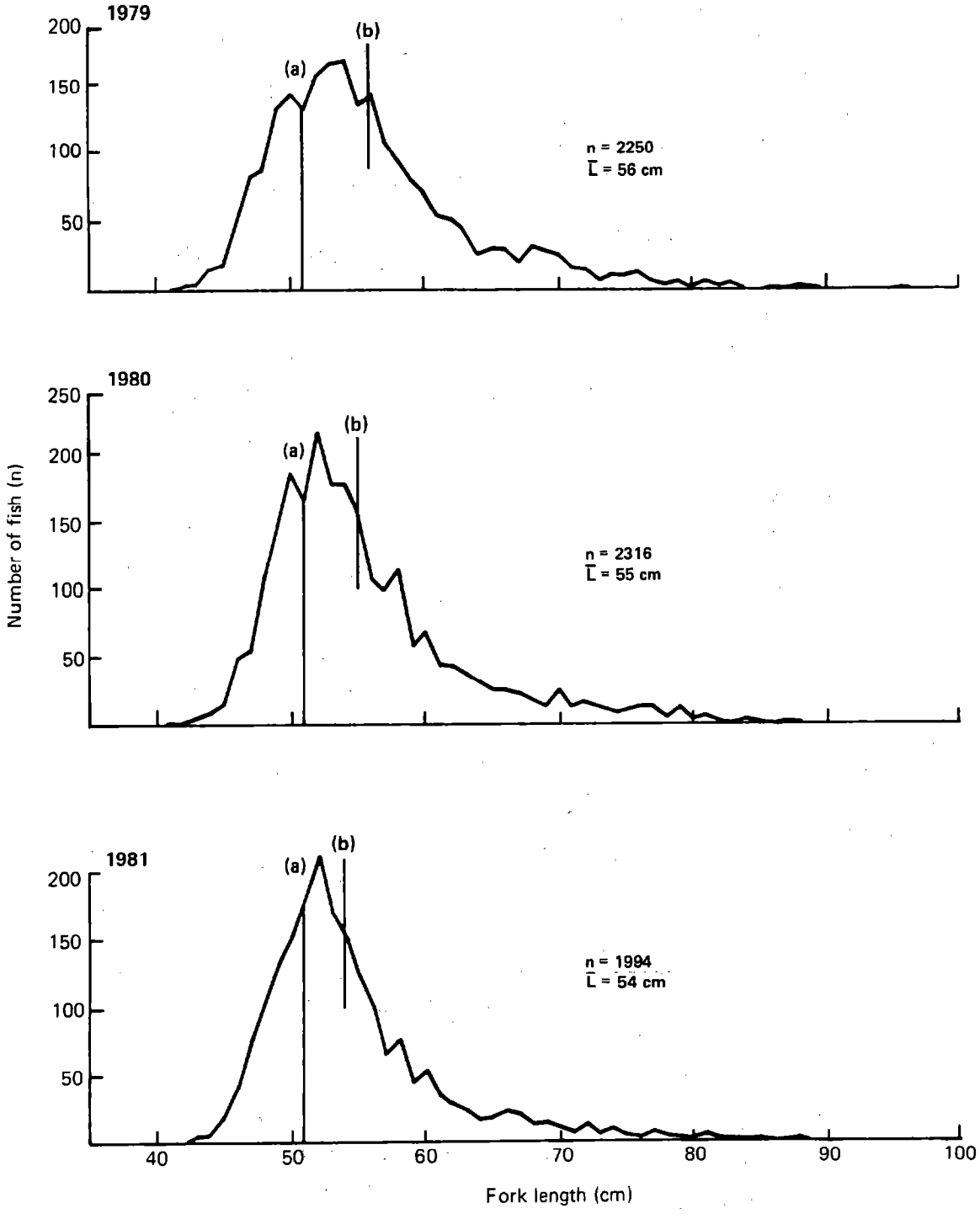

Figure 8.--Combined length composition of sablefish captured at the Willapa Bay and Cape Johnson, Washington, sites during the 1979-81 index surveys.. Vertical line (a) is the division between submarketable-size and marketable-size sablefish, and vertical line (b) is the mean length.

Males were predominant in the sex composition of sablefish captured during all years, making up 53 to 570 of the catches. The mean lengths of males changed only slightly (53, 54, 52 cm), whereas female mean length declined from 61 cm in 1979 to 57 cm in 1981. As in waters off Oregon, a large decrease in the number of females greater than 57-58 cm has occurred since the 1979 survey.

California Coast

Sablefish catches at the Patton Escarpment site off San Diego showed a moderate decrease between the 1980 and 1981 surveys and this decrease occurred in all size categories (Table 2). The decrease occurred at all depth intervals except at 550 fm where the catch rate was higher in 1981 (Table 6). Highest catch rates were made at 300, 225, and 375 fm in 1980 and 1981. Small sablefish dominated the catch off San Diego and made up 90-92% of the fish captured in both years, while 8-9% were medium and less than 1% were large (Table 7). The length composition (Figure 9) shows the large, generally singular, mode which is very similar to the length modes observed at the Bodega Canyon (Figure 9) and Cape Arago sites (Figure 5) up to a length of approximately 59 cm. Sablefish over 59 cm in length were much less abundant off San Diego than at index sites to the north.

Extended adverse weather conditions during the 1981 survey prevented sampling at the Bodega Canyon site off northern California (Figure 2). Data from this site in 1980 are presented for general information and to illustrate substantial differences in sablefish size and sex composition off southern and northern California. Catch rates at this site in 1980 are found in Table 6. They were highest at 300 fm, decreasing progressively at 375 fm and 225 fm depths.

Table 6.--Total number of sablefish captured by depth and set at the Patton Escarpment and Bodega Canyon, California, sites during the 1980-81 abundance index surveys. Each catch was obtained from one string of 10 sablefish traps fished 24 hours.

Area, year, and set	Depth (fathom/meter) 225/412	300/550	375/686	450/824	550/1,006	Total catch
	----------Number of fish----------					
Patton Escarpment						
1980						
1	85	139	92	69	35	420
2	60	100	99	92	38	389
3	54	68	72	40	25	259
4	77	78	21	30	25	231
5	74	48	36	52	15	225
Total	350	433	320	283	138	1,524
Mean	70	87	64	57	28	305
1981						
1	76	146	97	39	53	412
2	74	86	35	50	23	268
3	64	87	55	33	31	270
4	18	45	28	17	36	144
5	36	38	14	32	34	154
Total	268	402	229	171	177	1,247
Mean	54	80	46	34	35	249

Area, year, and set	Depth (fathom/meter) 225/412	300/550	375/686	450/824	550/1,006	Total catch
Bodega Canyon						
1980						
1	39	112	115	32	37	335
2	54	81	34	18	66[1/]	253
3	49	82	60	29	25	245
4	61	61	38	14	24[1/]	198
5	57	87	52	16	24[1/]	236
Total	260	423	299	109	176	1,267
Mean	52	85	60	22	35	253

1/ These strings had only five traps;, therefore, catches were doubled to equal the standard 10 traps per string.

Table 7.--Percentage abundance of small, medium, and large-size sablefish captured at California index sites during the 1980-81 surveys.

Year and area	Small[1] (%)	Medium[2] (%)	Large[3] (%)	Total (%)
1980				
Patton Escarpment (off San Diego)	90	9	<1	100
Bodega Canyon	78	16	6	100
Average	84	12	4	100
1981				
Patton Escarpment (off San Diego)	92	8	<1	100
Bodega Canyon[4]	--	--	--	--
Average	--	--	--	--

1/ Sablefish under 4.25 lb round weight = less than 59 cm fork length.
2/ Sablefish between 4.25 lb and 7.0 lb round weight = 59 cm-68 cm fork length.
3/ Sablefish greater than 7.0 lb round weight = greater than 68 cm fork length.
4/ The Bodega Canyon site was not fished in 1981 because of adverse weather conditions.

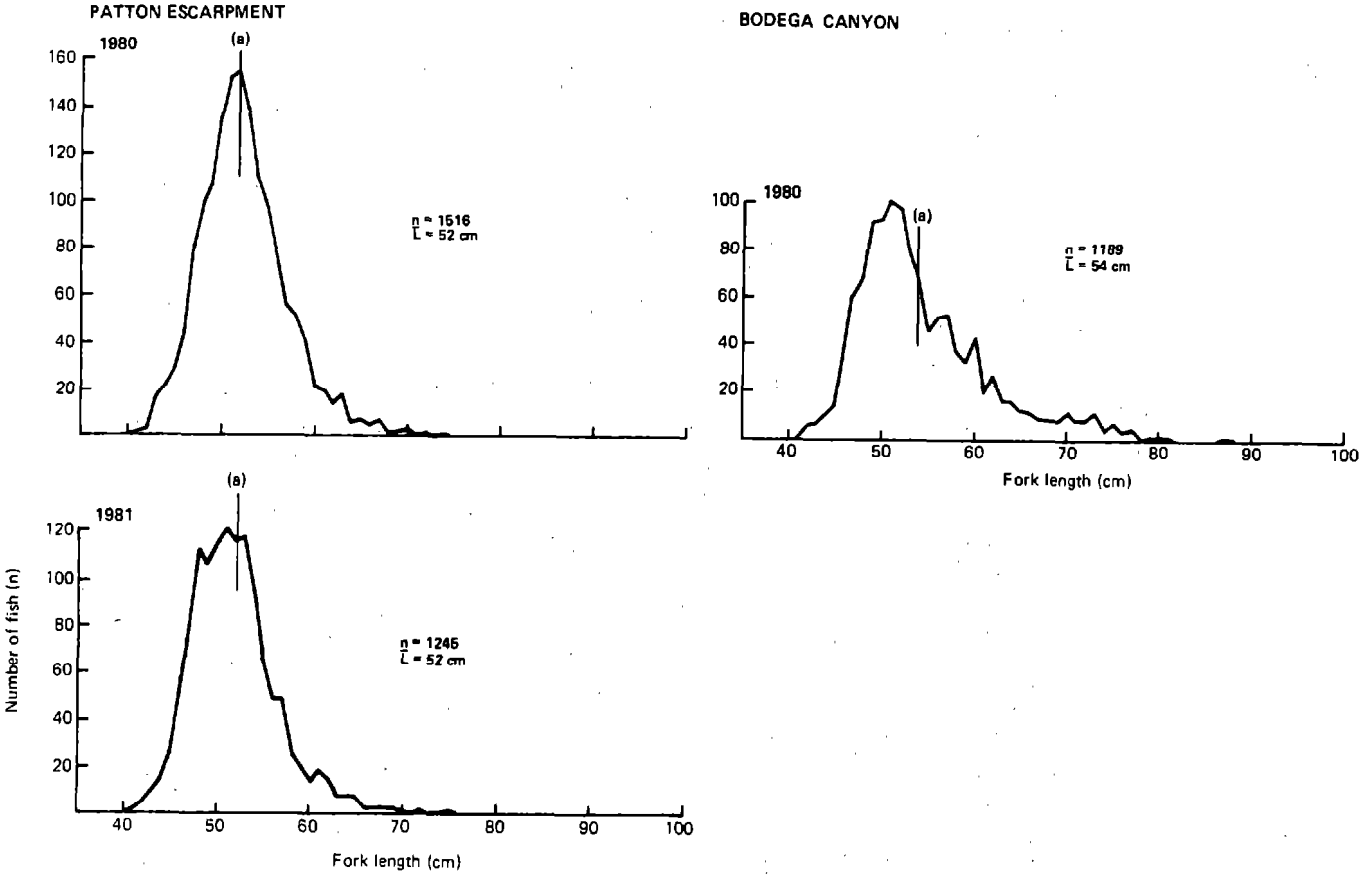

Figure 9.--Length composition of sablefish captured at the Patton Escarpment and Bodega Canyon, California, sites during the 1980-81 index surveys. Vertical line (a) is the mean length.

Considerable differences were apparent in the sex ratios and size compositions of females at the two California abundance index sites in 1980 (Figure 10). Female dominance was found at the Patton Escarpment site; however, males predominated (53%) the catch at the Bodega Canyon site. The mean length of males was 51 cm at the southern site and 52 cm at the northern California site. The mean length of females was 55 cm at the southern site but increased substantially to 59 cm at the northern California site. At the Bodega Canyon site, no prominent mode was apparent in the length composition of females, whereas the male sablefish showed a mode similar to the male mode at the Patton Escarpment site.

During the 1980 California index survey an additional depth interval at 700 fm was fished at both sites, but catch and biological data from that depth are not included in annual comparisons because that depth interval was not fished in 1981. It is interesting to note that although catch rates were generally lower at 700 fm, the mean lengths were greater and catches were predominately females. At Patton Escarpment at the 700 fm depth, females made up 70% of the catch and had a mean length of 58 cm, while males had a mean length of 54 cm. At the 700 fm interval at the Bodega Canyon site, females made up 92% of the catch and had a mean length of 68 cm, whereas males were smaller having a mean length of 63 cm.

The combined length composition for all sablefish captured at the two California sites in 1980 is shown in Figure 11. Mean length of all California sablefish captured between 225 and 550 fm in 1980 was 53 cm.

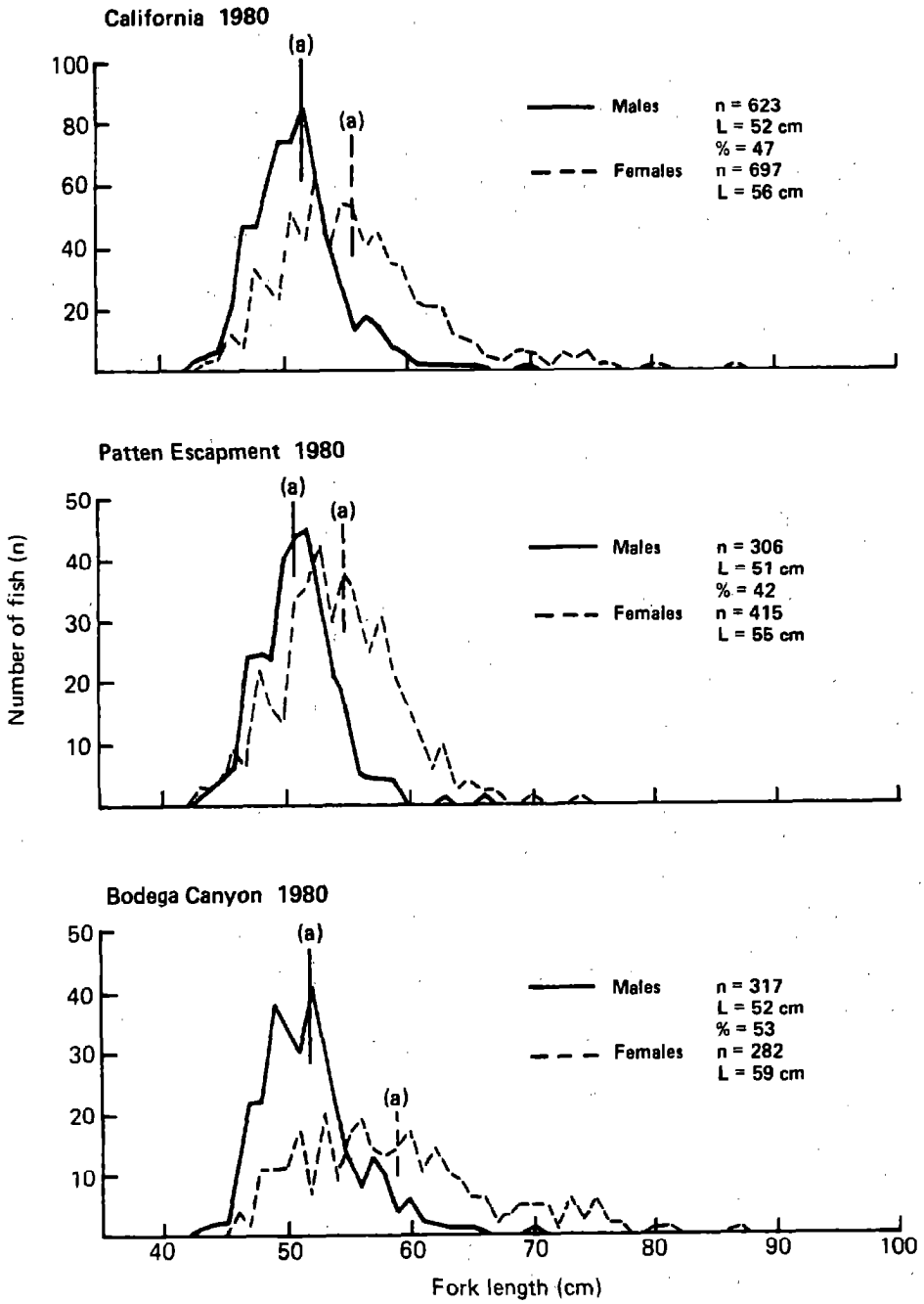

Figure 10.--Length composition of male and female sablefish captured at the combined and at separate California coastal abundance index sites during the 1980 survey. Vertical lines (a) are the mean lengths.

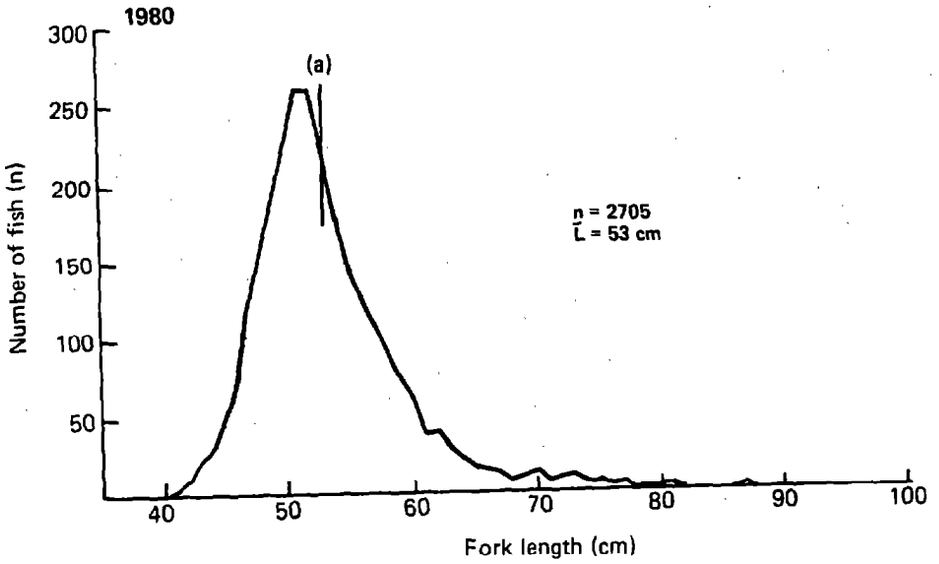

Figure 11.--Combined length composition of all sablefish captured at the Patton Escarpment and Bodega Canyon, California, sites during the 1980 index survey. Vertical line (a) is the mean length.

SUMMARY AND CONCLUSIONS

Survey catch rates suggest that sablefish abundance off Oregon has been decreasing since 1979. Catch rates decreased sharply at both index sites since the 1980 and 1979 surveys. Catches taken off Cape Arago in 1981 had a relatively large proportion of submarketable-size sablefish and, at the same time, there had been a significant reduction in the numbers of medium and large marketable-size sablefish captured off southern Oregon.

Off Washington, survey catch rates indicated that sablefish stocks had declined only slightly since 1979. However, while size composition had remained stable off Willapa Bay, there was a large reduction in numbers of medium and large marketable-size sablefish captured at the northern Washington site off Cape Johnson.

These reductions in numbers of medium and large marketable-size sablefish off southern Oregon and northern Washington are of special concern, as those fish have the greatest reproductive capacity and a much higher commercial value.

Off San Diego, California, 1980 and 1981 survey results indicated moderate declines in sablefish stocks in all size categories. Small sablefish made up 90-92% of the catches in both years, and the mean length of female sablefish captured off San Diego was considerably less than at sites to the north. While the mode and the mean length of male sablefish were similar at the Patton Escarpment and Bodega Canyon sites, large females were much more abundant in catches at the Bodega Canyon site.

Index survey data alone are not adequate to determine sablefish stock condition but may indicate abundance trends. Analyses based on commercial catch and effort data should be used to more fully evaluate the results of the survey data. Adequate commercial CPUE data are not available at present from either Oregon or Washington but should be added to this analyses when available.

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