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# Relative Abundance and Size Composition of Sablefish in Coastal Waters of Southeast Alaska, 1978-81

by
Harold H. Zenger, Jr.

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ABSTRACT

Sablefish abundance index catches off southeast Alaska increased 45% from 1978 to 1980 due to recruitment of premarketable-size fish. In 1981, survey catches of marketable-size sablefish decreased 53% from 1980 survey levels. At least two years are required for sablefish to grow to small marketable size after migration to the coastal fishing grounds at age 3. During the following three years, those fish grow to large marketable size and their value to the fisherman increases. Additional data on migration patterns of juvenile and pre-adult sablefish are required to study the effect that recruitment off southeast Alaska has on sablefish stocks in the entire Gulf of Alaska. It appears that the abundance of marketable-size fish is decreasing in southeast Alaska and that recruitment is not replacing the adults being harvested by a relatively small amount of domestic fishing effort.

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# INTRODUCTION

Sablefish (Anoplopoma fimbria) is one of the most widely distributed coastal species and highly valued groundfish resources of the United States in the northeastern Pacific Ocean. They are captured from Baja California northward through the Gulf of Alaska, along the Aleutian chain, and in the Bering Sea. Prior to 1977 foreign fleets (primarily Japanese) dominated the fishery. In 1977 the Magnuson Fishery Conservation and Management Act (MFCMA) of 1976 took effect providing the means for U.S. management of foreign fisheries conducted within the U.S. fishery conservation zone (200-mile limit).

During the 1960's and 70's, prior to enactment of the MFCMA, U.S. scientists monitored sablefish catch records and, with evidence of declining stock condition, negotiated for reduced foreign catch quotas. However, catches of sablefish by foreign fisheries in the northeastern Pacific Ocean, Bering Sea, and Aleutian Islands increased from about 38,000 metric tons (t) in 1968 to over 57,000 t in 1972 and ranged from 36,000 to 48,000 t between 1973 and 1976 (Hughes 1979-l. Declines in the catch per unit effort (CPUE) among Japanese longliners from 1967 to 1977 (Low 1977) necessitated a reduction in fishing effort on the depressed sablefish stocks. In 1978 regulations were applied to exclude foreign longlining for sablefish east of 140°W longitude. This measure was taken to allow sablefish stock recovery and to promote the small but viable U.S. fishery operating in southeast Alaska.

With the exclusion of foreign sablefish longlining, the primary data source used to determine stock condition in southeast Alaska ceased to exist. To provide an alternate index of stock condition, the NMFS Northwest and Alaska Fisheries Center in May 1978 implemented a research program to monitor sablefish abundance and stock composition. Four annual surveys have been performed since 1978 at sites between Cross Sound and Dixon Entrance. In addition to work at

the four offshore sites, sablefish abundance indexing began in the inside waters of southeast Alaska during 1981. In May the Alaska Department of Fish and Game surveyed two sites in upper and lower Chatham Strait. In July NMFS sampled a test site in upper Chatham Strait. Results of that work are included here.

Since 1978 a Japan-U.S. joint longline survey has been conducted to determine the relative abundance of sablefish in the Gulf of Alaska and Aleutian Islands. In his most recent report, Sasaki (1981) notes a large increase since 1979 in the relative abundance of sablefish that we refer to as prerecruit size. This report augments data presented in a previous paper (Zenger and Hughes 1981), with a summary of the results of those efforts, and provides current information on changes in sablefish stock conditions in coastal southeast Alaska.

## LANDINGS BACKGROUND

Annual sablefish catches off southeast Alaska and associated Japanese longline catch and effort data, which were used to monitor changes in that area's sablefish resource during 1966-77, are summarized in Table 1. Since 1977 southeastern Alaska sablefish landings were compiled for smaller geographic regions for the 12-month periods (survey years) that preceded each survey (Table 2). Landings from fishing grounds in the northern half of coastal southeast Alaska include areas where the Cape Cross and Cape Ommaney abundance index sites are located. Landings from fishing grounds in the southern half include areas where the Cape Addington and Cape Muzon sites are located (Figure 1). Landings are also presented from the northern and southern management districts within inside waters of southeast Alaska.

In addition to the landings listed in Table 2, the Canadian longline fishery, located between the northern tip of Graham Island (54°10'N latitude) and Cape Muzon, landed 53 t during calendar year 1979 and 106 t during 1980. Catch

Table 1.--Summary of southeast Alaska sablefish catches 1966-77 and Japanese longline catch and effort data previously used by U.S. scientists to monitor annual changes in sablefish abundance (Low et al. 1977).

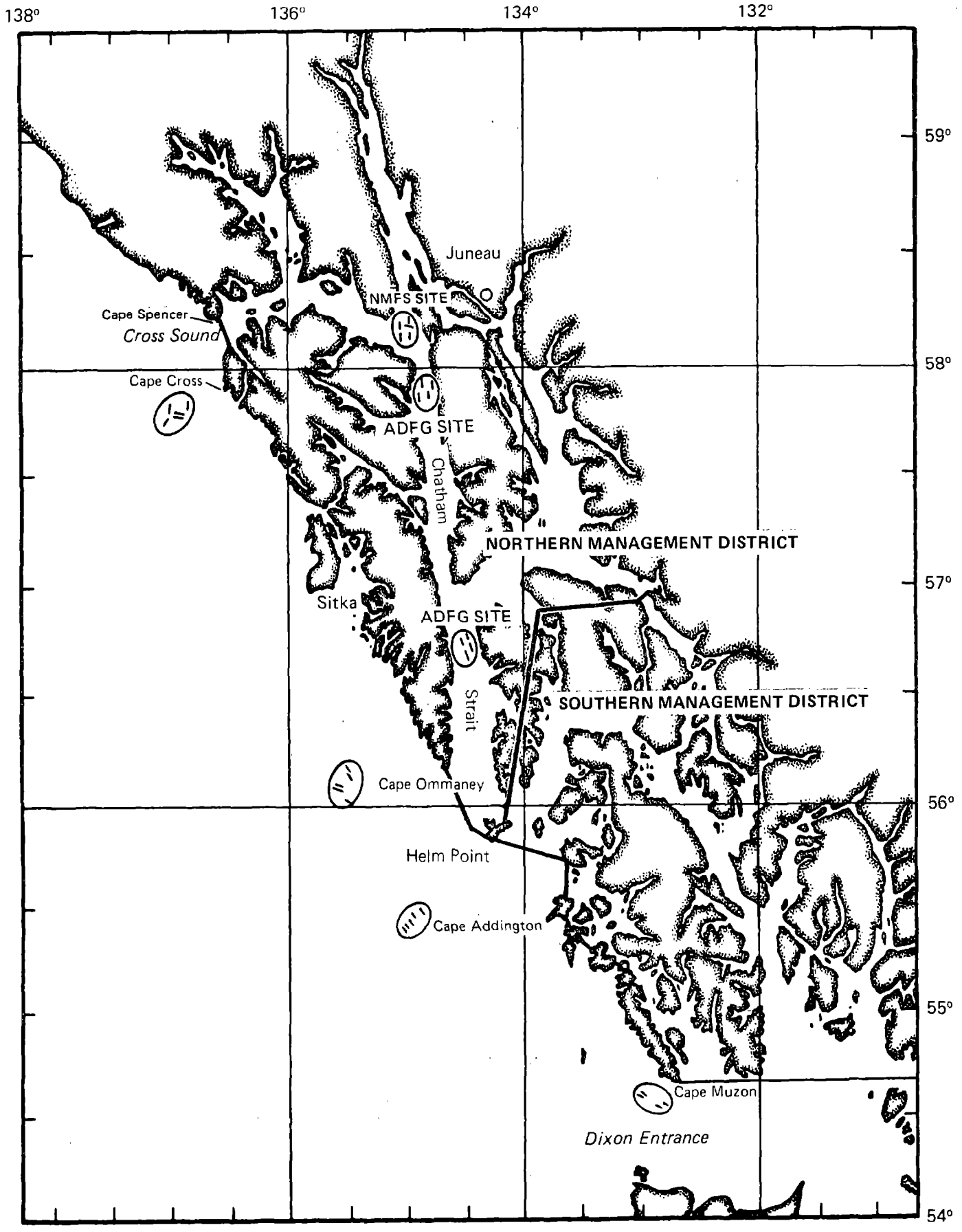
| Year | Total catch (t) | Japanese longline catch (t) | Japanese longline effort (10 hachi units) | Japanese CPLE (t/10 hachi units)1/ |
|---|---|---|---|---|
| 1966 | 19 | - | - | - |
| 1967 | 862 | 217 | 720 | 0.301 |
| 1968 | 7,224 | 6,364 | 25,958 | 0.245 |
| 1969 | 7,064 | 6,169 | 26,835 | 0.230 |
| 1970 | 7,888 | 6,805 | 29,681 | 0.229 |
| 1971 | 8,695 | 7,737 | 37,980 | 0.204 |
| 1972 | 11,012 | 9,311 | 44,844 | 0.208 |
| 1973 | 6,527 | 5,949 | 29,327 | 0.203 |
| 1974 | 7,377 | 6,574 | 33,653 | 0.195 |
| 1975 | 6,358 | 5,604 | 30,417 | 0.184 |
| 1976 | 6,648 | 5,489 | 28,717 | 0.191 |
| 1977 | 3,730 | 3,586 | 25,749 | 0.139 |

1/ Hachi unit = standard unit of Japanese longline gear.

Table 2.--Sablefish landings, domestic and foreign, taken from coastal and inside waters of southeast Alaska from June 1977 through May 1981.

| | Catch | |
|---|---|---|
| 1978 Survey Year (June 1977-May 1978) | Weight (t) | Percentage |
| Domestic, Cape Spencer to Cape Ommaney1/ | 864.6 | 29 |
| Domestic, Helm Point to Cape Muzon | 76.6 | 3 |
| Foreign (coastal waters, all gear)2/ | 2,040.7 | 68 |
| Subtotal | 2,981.9 | 100 |
| Inside waters, northern management district | 353.6 | |
| Inside waters, southern management district | 58.2 | |
| Total | 3,393.7 | |
| 1979 Survey Year (June 1978-May 1979) | | |
| Domestic, Cape Spencer to Cape Ommaney | 1,069.4 | 92 |
| Domestic, Helm Point to Cape Muzon | 70.7 | 6 |
| Foreign (coastal waters, trawl) | 21.4 | 2 |
| Subtotal | 1,161.5 | 100 |
| Inside waters, northern management district | 521.1 | |
| Inside waters, southern management district | 129.6 | |
| Total | 1,812.2 | |
| 1980 Survey Year (June 1979-May 1980) | | |
| Domestic, Cape Spencer to Cape Ommaney | 1,139.6 | 66 |
| Domestic, Helm Point to Cape Muzon | 501.0 | 29 |
| Foreign (coastal waters, trawl) | 97.6 | 5 |
| Subtotal | 1,738.2 | 100 |
| Inside waters, northern management district | 737.4 | |
| Inside waters, southern management district | 106.8 | |
| Total | 2,582.4 | |
| 1981 Survey Year (June 1980-May 1981) | | |
| Domestic, Cape Spencer to Helm Point | 1,422.8 | 84 |
| Domestic, Helm Point to Cape Muzon | 218.8 | 13 |
| Foreign (coastal Waters, trawl) | 55.6 | 3 |
| Subtotal | 1,697.2 | 100 |
| Inside waters, northern management district | 565.6 | |
| Inside waters, southern management district | 29.3 | |
| Total | 2,292.1 | |

l/ Data provided by the Alaska Department of Fish and Game, Juneau.
2/ Data provided by the NMFS Observer Program, Seattle.




Fiqure 1.--Locations of sablefish abundance index sites surveyed off southeast Alaska in 1978, 1979, 1980, and 1981 and sites surveyed in Chatham Strait in 1981. (Alaska Department of Fish and Game management districts are shown for reference only.)

per unit effort (CPUE) was reported as 0.29 t/1000 hooks and 0.26 t/l000 hooks, respectively.l/

In 1981 landing data from coastal waters were reported to the Alaska Department of Fish and Game (ADFG) from Cape Spencer to Helm Point and from Helm Point to Cape Muzon. This modification allows landings from lower Chatham Strait to he separated from fish taken in coastal state waters between Cape Ommaney and Helm Point.

## SURVEY METHODS AND GEAR

The fishery assessment technique employed in this study is known as "abundance indexing." Using standardized fishing procedures and sablefish trap gear, changes in relative abundance and size composition of sablefish are monitored at specific sites at the same time each year. Since traps are a passive fishing gear, their sphere of influence while on-bottom is unknown. Absolute fish abundance or biomass cannot he calculated from trap catches. The basic premise of the abundance index technique is that changes in the absolute number and the sizes of sablefish in the survey area are reflected directly by relative changes in annual survey catches.

In general, changes in fishable stock abundance are due to loss by harvest and natural mortality and to increases from growth and recruitment of juveniles to the fishing grounds. The abundance index can be partitioned to reflect changes in the marketable-size and prerecruit-size (premarketable-size) portions of the stock. This allows us to assess changes that fishing and natural mortalities have caused to older fish and also helps us to anticipate the relative magnitude of prerecruit year classes.

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l/ Data provided by Environment Canada, Nanaimo, British Columbia.

If the abundance index reflects actual conditions of the stock, the annual percentage change in survey catch levels may he used to adjust harvest levels. As an example, if there had been a 20% increase in the abundance of marketable-size fish during the 1980 survey year (the period between the 1979 and 1980 surveys) and prerecruits were of equal strength for both years, harvest levels for 1981 might he increased 20% above the harvest taken during the 1980 survey year. This harvest level would maintain the 1979 to 1980 level of abundance. If stock recovery was desirable as an alternative to increased harvest, a lesser increase in harvest would he advisable.

At present, four fishing sites on the southeast Alaska coastal fishing grounds near Cape Cross, Cape Ommaney, Cape Addington, and Cape Muzon are surveyed annually (Figure 1). Four years of survey data from 1978 to 1981 are available for the first three sites and 3 years of data from 1979 to 1981 for the site near Cape Muzon. All surveys were conducted from the NOAA ship John N. Cobb during the period May 25 to July 15.

During each year's survey, fishing strategy remained the same. At the Cape Cross, Cape Ommaney, and Cape Addington sites, lo-trap strings of gear were located near depths of 150, 225, 300, 375, and 450 fathoms (fm) (275-825 m). Each string was set and hauled five times resulting in 250 trap lifts per site. Although sampling at depths of 150-450 fm is desirable as it encompasses most of the depth range where the resource and fishery occurs, topography and seabed conditions at Cape Muzon limited depth coverage at that site to 205-231 fm. At Cape Muzon, four strings of gear were set and hauled four times for a total effort of 160 trap lifts. At all sites locations of strings of gear were replicated as nearly as possible from year to year employing Loran-C, radar, and depth sounder as navigational aids.

Sampling gear consisted of five strings of sablefish traps (Figure 2). Each string held 10 identical metal-framed rectangular, collapsible traps measuring 34 in x 34 in x 8 ft. Traps were covered with 3-l/2 in mesh white nylon web and were equipped with a single entrance tunnel constructed of green 2-l/2 in mesh green nylon web. Each trap was baited with 2 lb of chopped Pacific herring (Clupea harengus pallasi) held in perforated plastic jars.

Previous studies have indicated that catch rates of sablefish traps decrease with increasing soak time (Hughes et al. 1970). Therefore, fishing time was standardized by use of corrodible magnesium timed-release devices which were calibrated to close trap entrances via a noose arrangement after a 24 + 1 hr period (Figure 3). Thus, when gear could not he hauled on schedule due to weather or operational problems, effective trap fishing time was standardized.

Trap gear was selected for index fishing of sablefish because standardization is critical in determining annual changes in resource condition. The effective fishing time of these traps can be easily standardized and they are very selective in capturing sablefish. Most commercial fishermen in southeast Alaska prefer longline gear for sablefish because of its versatility for varying seabed conditions; but, for research purposes, longline effort is difficult to standardize. Variations in catch rates can occur due to bait loss from hooks, incidental catches which occupy hooks, and the general problem of hauling gear after a standardized fishing period.

Data collected during the 4 yr of research included:

1. Number of sablefish captured in each trap;
2. Number and estimated weight of other species captured in each trap;
3. Fork lengths of all sablefish;

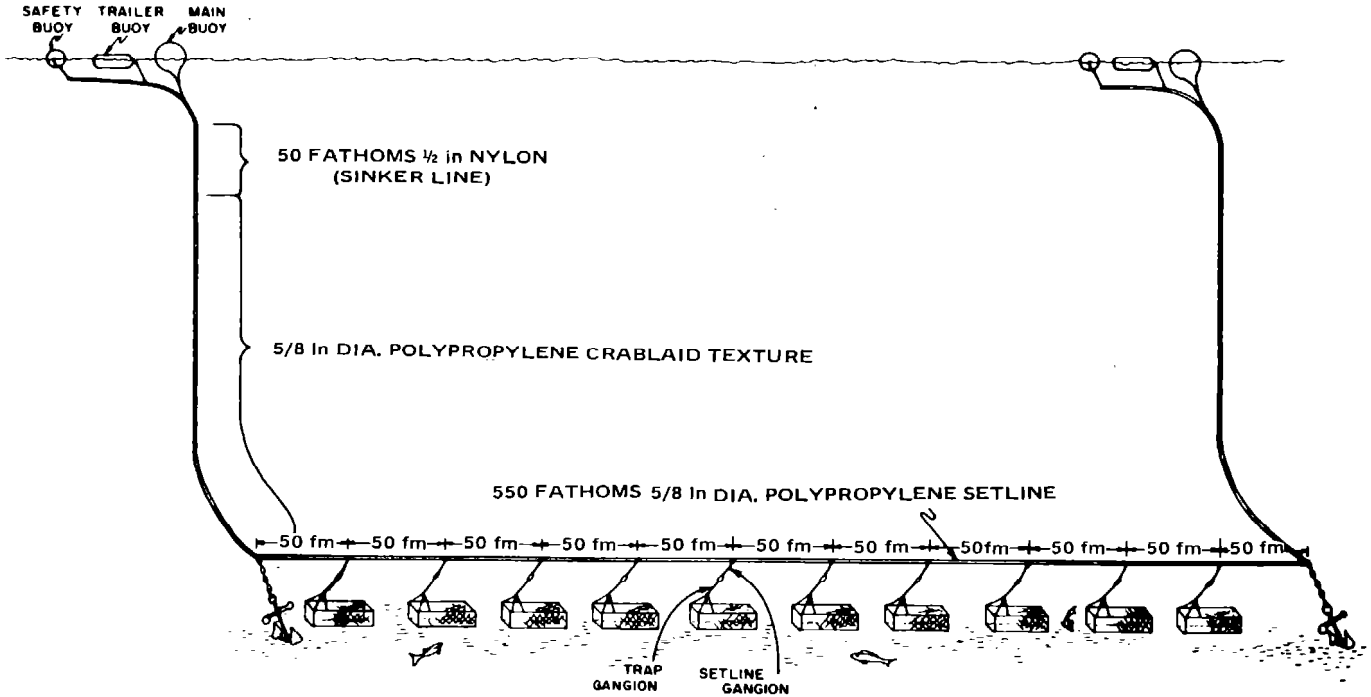
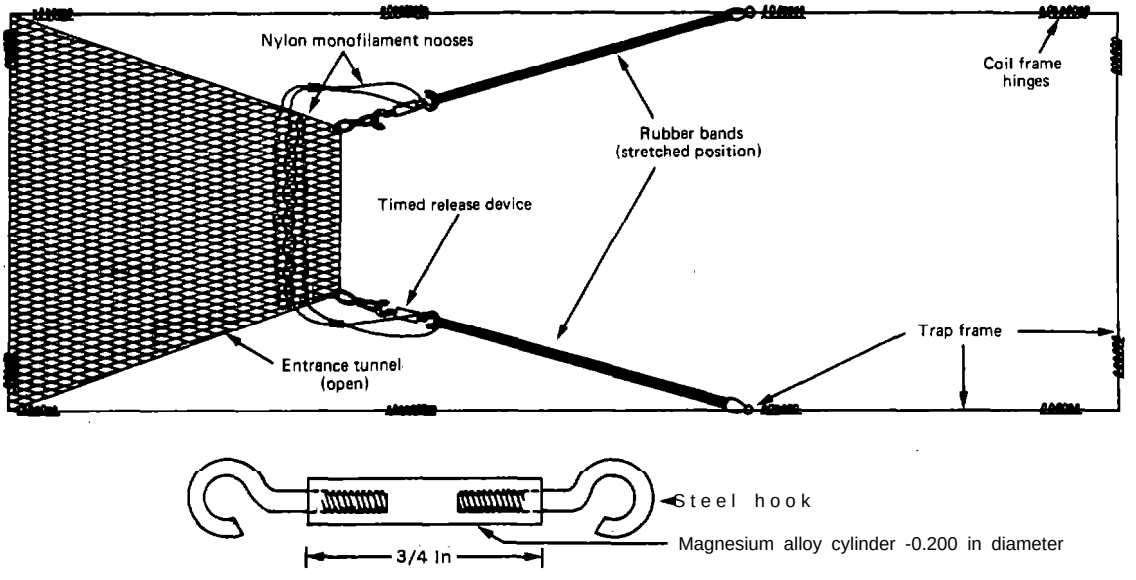



Figure 2. --A pictoral view of a string of trap gear used in the sablefish abundance index studies (from Hipkins 1974).

Schematic sablefish trap tunnel open and armed
with timed release device (top view)




Schematic sablefish trap tunnel in closed position
after timed release devices have disintegrated (top view)

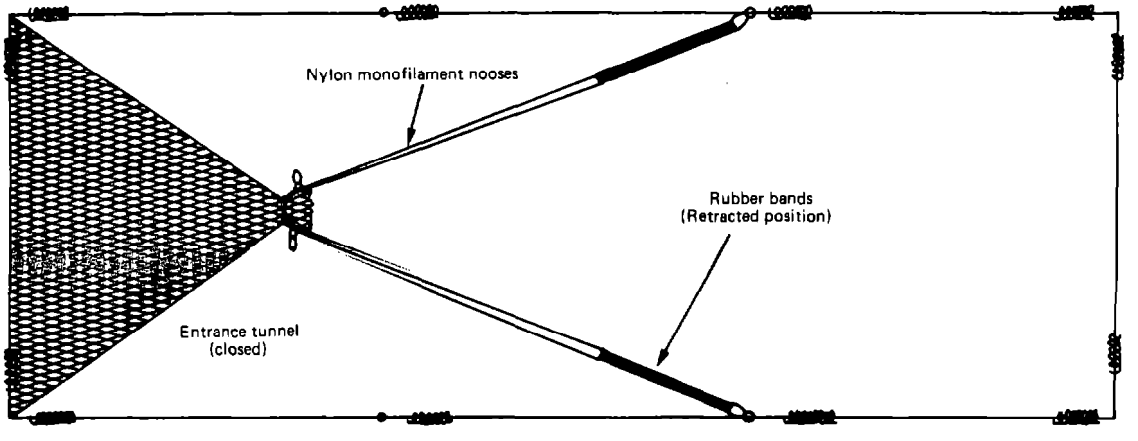



Figure 3. --Diagrams of sablefish trap tunnels, open and equipped with timed release devices and closed with the nooses pulled tight.

4. Biological data to support life history studies which include length-weight relationships, age indicators, sex ratio, and sexual maturity;

5. Tissue samples for stock identification studies; and

6. Sablefish not required for bioloqical samples were tagged and released to study migration.

Annual survey catch data have been presented in tables which summarize the numbers of sablefish caught for each lo-trap string and depth at each site. Also indicated is the percentage change in abundance between years sampled. Length compositions of the sablefish captured annually at each site are shown in figures. Because all sablefish were measured each year at each site, the length compositions are a direct reflection of changes in abundance by fish size.

The southeast Alaska fishing industry regards marketable-size dressed sablefish as those 3 lb or heavier. This coincides with a fork length measurement of 57 *cm* or greater. Those fish measuring less than 57 cm are classified as prerecruits which have not entered the fishery. Small marketable sablefish weigh 3-5 lb dressed and large marketable sablefish weigh more than 5 lb dressed and are 67 cm or more in fork length.

In addition to the standard abundance index survey, 14 strings of sablefish traps were set in upper Chatham Strait (Figure 1). Tissue samples were collected from 50 fish for stock identification studies and the remainder of the catch was tagged and released.

## RESULTS

### Area-wide sablefish abundance

Abundance index data by site, size, depth and year are presented in Tables 3-6. Table 7 summarizes sablefish catch data collected from coastal southeast Alaska during the annual abundance index surveys. Numbers of fish

Table 3.--Numbers of total sablefish and marketable-sized sablefish (in parentheses) captured by depth and set at the Cape Cross site during the 1978, '79, '80, and '81 abundance index surveys. Each catch was obtained from one string of 10 sablefish traps fished for 24 hr.

| Year and set | Depth (fathom/meter) 150/275 | 225/412 | 300/550 | 375/686 | 450/824 | Total catch |
|---|---|---|---|---|---|---|
| | Number of fish | | | | | |
| 1978 | | | | | | |
| 1 | 0 (0) | 22 (14) | 23 (20) | 8 (7) | 15 (12) | 68 (53) |
| 2 | 3 (1) | 4 (3) | 28 (24) | 30 (27) | 16 (16) | 81 (71) |
| 3 | 0 (0) | 11 (10) | 36 (33) | 38 (35) | 55 (52) | 140 (130) |
| 4 | 1 (1) | 12 (11) | 34 (31) | 35 (32) | 31 (31) | 113 (106) |
| 5 | 0 (0) | 7 (7) | 15 (13) | 33 (29) | 56 (50) | 111 (99) |
| Total | 4 (2) | 56 (45) | 136 (121) | 144 (130) | 173 (161) | 513 (459) |
| Mean | 1 (<1) | 11 (9) | 27 (24) | 29 (26) | 35 (32) | 103 (92) |
| 1979 | | | | | | |
| 1 | 4 (0) | 8 (7) | 36 (28) | 26 (25) | 26 (24) | 100 (84) |
| 2 | 3 (1) | 20 (9) | 31 (26) | 37 (33) | 14 (14) | 105 (83) |
| 3 | 4 (2) | 10 (9) | 37 (28) | 32 (28) | 23 (21) | 106 (88) |
| 4 | 4 (3) | 16 (10) | 18 (15) | 29 (27) | 25 (25) | 92 (80) |
| 5 | 5 (3) | 11 (10) | 17 (15) | 17 (16) | 20 (20) | 70 (64) |
| Total | 20 (9) | 65 (45) | 139 (112) | 141 (129) | 108 (104) | 473 (399) |
| Mean | 4 (2) | 13 (9) | 28 (22) | 28 (26) | 22 (21) | 95 (80) |
| 1980 | | | | | | |
| 1 | 30 (16) | 5 (4) | 20 (11) | 20 (15) | 13 (12) | 88 (58) |
| 2 | 13 (6) | 4 (2) | 34 (22) | 14 (11) | 19 (19) | 84 (60) |
| 3 | 33 (2) | 24 (12) | 32 (14) | 22 (18) | 17 (17) | 128 (63) |
| 4 | 16 (1) | 13 (8) | 34 (19) | 24 (22) | 25 (22) | 112 (72) |
| 5 | 11 (0) | 9 (4) | 31 (19) | 19 (16) | 24 (23) | 94 (62) |
| Total | 103 (25) | 55 (30) | 151 (85) | 99 (82) | 98 (82) | 506 (315) |
| Mean | 21 (5) | 11 (6) | 30 (17) | 20 (16) | 20 (19) | 101 (63) |
| 1981 | | | | | | |
| 1 | 11 (5) | 31 (13) | 16 (3) | 9 (6) | 9 (6) | 76 (33) |
| 2 | 5 (4) | 12 (7) | 23 (8) | 13 (11) | 4 (3) | 57 (33) |
| 3 | 11 (7) | 33 (17) | 19 (12) | 11 (5) | 6 (6) | 80 (47) |
| 4 | 8 (4) | 10 (6) | 12 (7) | 19 (14) | 7 (5) | 56 (36) |
| 5 | 15 (7) | 27 (16) | 18 (7) | 3 (3) | 7 (7) | 70 (40) |
| Total | 50 (27) | 113 (59) | 88 (37) | 55 (39) | 33 (27) | 339 (189) |
| Mean | 10 (5) | 23 (12) | 18 (7) | 11 (8) | 7 (5) | 68 (38) |

Table 4.--Numbers of total sablefish and marketable-sized sablefish (in parentheses) captured by depth and set at the Cape Ommaney site during the 1978, '79, '80, and '81 abundance index surveys. Each catch was obtained from one string of 10 sablefish traps fished for 24 hr.

| Year and set | Depth (fathom/meter) 150/275 | 225/412 | 300/550 | 375/686 | 450/824 | Total catch |
|---|---|---|---|---|---|---|
| | Number of fish | | | | | |
| 1978 | | | | | | |
| 1 | 3 (2) | 6 (5) | 12 (10) | 42 (40) | 24 (19) | 87 (76) |
| 2 | 6 (6) | 8 (8) | 22 (19) | 32 (23) | 35 (32) | 103 (88) |
| 3 | 6 (6) | 9 (9) | 27 (24) | 26 (19) | 47 (41) | 115 (99) |
| 4 | 3 (3) | 15 (15) | 15 (13) | 34 (29) | 35 (28) | 102 (88) |
| 5 | 9 (9) | 4 (4) | 20 (20) | 25 (25) | 10 (8) | 68 (66) |
| Total | 27 (26) | 42 (41) | 96 (86) | 159 (136) | 151 (128) | 475 (417) |
| Mean | 5 (5) | 8 (8) | 19 (17) | 32 (27) | 30 (27) | 95 (83) |
| 1979 | | | | | | |
| 1 | 9 (4) | 36 (36) | 44 (40) | 37 (34) | 61 (59) | 187 (173) |
| 2 | 6 (2) | 41 (41) | 30 (27) | 45 (44) | 55 (51) | 177 (165) |
| 3 | 8 (4) | 36 (36) | 21 (20) | 48 (44) | 25 (24) | 138 (128) |
| 4 | 6 (0) | 24 (24) | 27 (24) | 66 (63) | 44 (42) | 167 (153) |
| 5 | 3 (1) | 34 (33) | 42 (39) | 39 (37) | 70 (67) | 188 (177) |
| Total | 32 (11) | 171 (170) | 164 (150) | 235 (222) | 255 (243) | 857 (796) |
| Mean | 6 (2) | 34 (34) | 33 (30) | 47 (44) | 51 (49) | 171 (159) |
| 1980 | | | | | | |
| 1 | 8 (2) | 26 (26) | 38 (23) | 66 (49) | 71 (67) | 209 (167) |
| 2 | 6 (3) | 14 (13) | 33 (23) | 35 (33) | 51 (46) | 139 (118) |
| 3 | 5 (0) | 22 (22) | 36 (26) | 33 (32) | 34 (33) | 130 (113) |
| 4 | 3 (1) | 10 (9) | 41 (33) | 36 (33) | 32 (31) | 122 (107) |
| 5 | 16 (10) | 11 (11) | 34 (27) | 18 (18) | 24 (20) | 103 (86) |
| Total | 38 (16) | 83 (81) | 182 (132) | 188 (165) | 212 (197) | 703 (591) |
| Mean | 8 (3) | 17 (16) | 36 (26) | 38 (33) | 42 (39) | 141 (118) |
| 1981 | | | | | | |
| 1 | 12 (8) | 19 (14) | 11 (4) | 24 (13) | 24 (20) | 90 (59) |
| 2 | 7 (4) | 11 (7) | 50 (14) | 49 (15) | 21 (14) | 138 (54) |
| 3 | 4 (1) | 14 (9) | 20 (11) | 22 (10) | 10 (6) | 70 (37) |
| 4 | 10 (6) | 29 (22) | 38 (24) | 21 (10) | 16 (10) | 114 (72) |
| 5 | 11 (1) | 14 (10) | 14 (6) | 38 (10) | 16 (14) | 93 (41) |
| Total | 44 (20) | 87 (62) | 133 (59) | 154 (58) | 87 (64) | 505 (263) |
| Mean | 9 (4) | 17 (12) | 27 (12) | 31 (12) | 17 (13) | 101 (53) |

Table 5.--Numbers of total sablefish and marketable-sized sablefish (in parentheses) captured by depth and set at the Cape Addington site during the 1978, '79, '80, and '81 abundance index surveys. Each catch was obtained from one string of 10 sablefish traps fished for 24 hr.

| Year and set | Depth (fathom/meter) 150/275 | 225/412 | 300/550 | 375/686 | 450/824 | Total catch |
|---|---|---|---|---|---|---|
| | Number of fish | | | | | |
| 1978 | | | | | | |
| 1 | 1 (0) | 10 (8) | 25 (20) | 25 (15) | 15 (14) | 76 (57) |
| 2 | 6 (4) | 9 (8) | 20 (17) | 21 (17) | 24 (19) | 80 (65) |
| 3 | 3 (0) | 6 (2) | 21 (12) | 40 (26) | 12 (10) | 82 (50) |
| 4 | 13 (10) | 28 (27) | 38 (24) | 49 (45) | 39 (37) | 167 (143) |
| 5 | 8 (4) | 21 (19) | 51 (36) | 34 (28) | 21 (19) | 135 (106) |
| Total | 31 (18) | 74 (64) | 155 (109) | 169 (131) | 111 (99) | 540 (421) |
| Mean | 6 (4) | 15 (13) | 31 (22) | 34 (26) | 22 (20) | 108 (84) |
| 1979 | | | | | | |
| 1 | 9 (3) | 89 (88) | 32 (6) | 43 (25) | 42 (40) | 215 (162) |
| 2 | 9 (0) | 35 (35) | 36 (13) | 82 (34) | 38 (36) | 200 (118) |
| 3 | 28 (6) | 14 (12) | 25 (14) | 33 (12) | 31 (27) | 131 (71) |
| 4 | 7 (1) | 33 (32) | 28 (18) | 47 (11) | 24 (23) | 139 (85) |
| 5 | 7 (0) | 32 (30) | 26 (9) | 25 (7) | 10 (10) | 100 (56) |
| Total | 60 (10) | 203 (197) | 147 (60) | 230 (89) | 145 (136) | 785 (492) |
| Mean | 12 (2) | 41 (39) | 29 (12) | 46 (18) | 29 (27) | 157 (98) |
| 1980 | | | | | | |
| 1 | 36 (32) | 54 (54) | 86 (65) | 48 (40) | 34 (31) | 258 (222) |
| 2 | 29 (20) | 30 (28) | 61 (44) | 11 (10) | 23 (23) | 154 (125) |
| 3 | 12 (7) | 59 (53) | 98 (67) | 45 (42) | 41 (40) | 255 (209) |
| 4 | 19 (11) | 59 (56) | 91 (61) | 40 (28) | 42 (42) | 251 (198) |
| 5 | 17 (14) | 35 (35) | 16 (11) | 8 (7) | 17 (17) | 93 (84) |
| Total | 113 (84) | 237 (226) | 352 (248) | 152 (127) | 157 (153) | 1,011 (838) |
| Mean | 23 (17) | 47 (45) | 70 (50) | 30 (25) | 31 (31) | 202 (168) |
| 1981 | | | | | | |
| 1 | 9 (0) | 5 (1) | 69 (48) | 20 (4) | 10 (9) | 113 (62) |
| 2 | 6 (0) | 29 (19) | 11 (6) | 79 (30) | 6 (5) | 131 (60) |
| 3 | 3 (2) | 51 (36) | 19 (9) | 16 (10) | 8 (3) | 97 (60) |
| 4 | 18 (6) | 19 (14) | 51 (24) | 14 (9) | 9 (9) | 111 (62) |
| 5 | 14 (9) | 20 (16) | 9 (3) | 6 (4) | 3 (3) | 52 (35) |
| Total | 50 (17) | 124 (86) | 159 (90) | 135 (57) | 36 (29) | 504 (279) |
| Mean | 10 (3) | 25 (17) | 32 (18) | 27 (11) | 7 (6) | 101 (56) |

Table 6.--Numbers of total sablefish and marketable-sized sablefish (in parentheses) captured by string and set at the Cape Muzon site during the 1979, '80, and '81 abundance index surveys. Each catch was obtained from one string of 10 sablefish-traps fished for 24 hr.

| Year and set | String 1 | String 2 | String 3 | String 4 | Total catch |
|---|---|---|---|---|---|
| | Number of fish | | | | |
| 1979 | | | | | |
| 1 | 24 (24) | 75 (71) | 75 (66) | 43 (40) | 217 (201) |
| 2 | 49 (47) | 42 (38) | 23 (20) | 79 (72) | 193 (177) |
| 3 | 21 (21) | 40 (38) | 49 (36) | 47 (44) | 157 (139) |
| 4 | 25 (24) | 47 (42) | 43 (39) | 72 (70) | 187 (175) |
| Total | 119 (116) | 204 (189) | 190 (161) | 241 (226) | 754 (692) |
| Mean | 30 (29) | 51 (47) | 48 (40) | 60 (56) | 188 (173) |
| 1980 | | | | | |
| 1 | 37 (33) | 62 (56) | 81 (74) | 95 (81) | 275 (244) |
| 2 | 36 (33) | 38 (34) | 61 (54) | 62 (51) | 197 (172) |
| 3 | 24 (18) | 58 (54) | 62 (54) | 33 (25) | 177 (151) |
| 4 | 35 (31) | 39 (31) | 58 (54) | 51 (42) | 183 (158) |
| Total | 132 (115) | 197 (175) | 262 (236) | 241 (199) | 832 (725) |
| Mean | 33 (29) | 49 (44) | 66 (59) | 60 (50) | 208 (181) |
| 1981 | | | | | |
| 1 | 26 (20) | 37 (27) | 31 (24) | 25 (19) | 119 (90) |
| 2 | 36 (28) | 12 (7) | 31 (27) | 69 (48) | 148 (110) |
| 3 | 32 (25) | 27 (25) | 42 (29) | 39 (30) | 140 (109) |
| 4 | 51 (42) | 19 (17) | 46 (30) | 32 (25) | 148 (114) |
| Total | 145 (115) | 95 (76) | 150 (110) | 165 (122) | 555 (423) |
| Mean | 36 (29) | 24 (19) | 38 (28) | 41 (30) | 139 (106) |

Table 7.--Numbers Of total, marketable-size and prerecruit-size sablefish captured at southeastern Alaska abundance index sites during the 1978-81 annual surveys. Annual percentage change in numbers of sablefish, and the percentage change from the baseline year are indicated by site and size category.

| | Total sablefish | | | Marketable-size?/ | | | Prerecruit-size2/ | | |
|---|---|---|---|---|---|---|---|---|---|
| Site/year | Number | Annual change (%) | Change from baseline year (%) | Number | Annual change (%) | Change from baseline Year (%) | Number | Annual change (%) | Change from baseline year (%) |
| Cape Cross | | | | | | | | | |
| 1978 | 513 | | | 459 | | | 54 | | |
| | | - 8 | | | - 13 | | | + 37 | |
| 1979 | 473 | | - 8 | 399 | | - 13 | 74 | | + 37 |
| | | + 7 | | | - 21 | | | +158 | |
| 1980 | 506 | | - 1 | 315 | | - 31 | 191 | | +254 |
| | | - 33 | | | - 40 | | | - 21 | |
| 1981 | 339 | | - 34 | 189 | | - 59 | 150 | | +178 |
| Cape Ommaney | | | | | | | | | |
| 1978 | 475 | | | 417 | | | 58 | | |
| | | + 80 | | | + 91 | | | + 5 | |
| 1979 | 857 | | + 80 | 796 | | + 91 | 61 | | + 5 |
| | | - 18 | | | - 26 | | | + 84 | |
| 1980 | 703 | | + 48 | 591 | | + 42 | 112 | | + 93 |
| | | - 28 | | | - 55 | | | +116 | |
| 1981 | 505 | | + 6 | 263 | | - 37 | 242 | | +317 |
| Cape Addington | | | | | | | | | |
| 1978 | 540 | | | 421 | | | 119 | | |
| | | + 45 | | | + 17 | | | +146 | |
| 1979 | 785 | | + 45 | 492 | | + 17 | 293 | | +146 |
| | | + 29 | | | + 70 | | | - 41 | |
| 1980 | 1,011 | | + 87 | 838 | | + 99 | 173 | | + 45 |
| | | - 50 | | | - 67 | | | + 30 | |
| 1981 | 504 | | - 7 | 279 | | - 34 | 225 | | + 89 |
| Cape Muzon | | | | | | | | | |
| 1979 | 754 | | | 692 | | | 62 | | |
| | | + 10 | | | + 5 | | | + 73 | |
| 1980 | 832 | | + 10 | 725 | | + 5 | 107 | | + 73 |
| | | - 33 | | | - 42 | | | + 23 | |
| 1981 | 555 | | - 26 | 423 | | - 39 | 132 | | +113 |
| Cape Cross Cape Ommaney Cape Addington | | | | | | | | | |
| 1978 | 1,528 | | | 1,297 | | | 231 | | |
| | | + 38 | | | + 30 | | | + 85 | |
| 1979 | 2,115 | | + 38 | 1,687 | | + 30 | 428 | | + 85 |
| | | + 5 | | | + 3 | | | + 11 | |
| 1980 | 2,220 | | + 45 | 1,744 | | + 34 | 476 | | +106 |
| | | - 39 | | | - 58 | | | + 30 | |
| 1981 | 1,348 | | - 12 | 731 | | - 44 | 617 | | +167 |
| All four sites | | | | | | | | | |
| 1979 | 2,869 | | | 2,379 | | | 490 | | |
| | | + 6 | | | + 4 | | | + 19 | |
| 1980 | 3,052 | | + 6 | 2,469 | | + 4 | 583 | | + 19 |
| | | - 38 | | | - 53 | | | + 28 | |
| 1981 | 1,903 | | - 34 | 1,154 | | - 51 | 749 | | + 53 |

1/ 57 cm or greater fork length
2/ Less than 57 cm fork length

captured at each site and the annual percentage changes in catches of total sablefish (all sizes), marketable-size, and prerecruit-size sablefish are presented.

As stated previously, the Cape Muzon site is unique in its depth distribution and sampling density. Its distance from port and the strong currents that sweep Dixon Entrance have not encouraged the development of an Alaskan sablefish fishery there. Approximately three to six Canadian longliners have fished in the Canadian waters to the immediate south of this area in the past 2 yr. Since the three northern sites best represent the coastal area fished by the bulk of domestic sablefish vessels, they were considered separately from the Cape Muzon site in this report.

Survey data from the combined Cape Cross, Cape Ommaney, and Cape Addington sites indicated substantial reductions in sablefish abundance during the 1981 survey year. The abundance index of marketable-size sablefish decreased 58%. The index of prerecruit abundance increased 30%. Marketable-size sablefish were 44% less abundant in survey catches than in the baseline year 1978 (Table 7). Prerecruits have increased steadily from 15% of the survey catch in 1978 to 46% in 1981 (Table 8).

Dividing the marketable-size category into small (57-66 cm) and large sizes (67 cm and greater) we find that the small marketable portion of the annual sablefish survey catches has decreased steadily since 1978. urge marketable-size sablefish maintained a steady 38-39% of the total survey catches in 1979 and 1980 but dropped to 21% in 1981 (Table 8).

Table 9 pools the data from those three sites and shows the relative abundance of prerecruit-size, small and large marketable-size sablefish for the 1978-1981 survey period.

Table 8.--Relative abundance of prerecruit-size, small marketable, and large marketable sablefish at the Cape Cross, Cape Ommaney, and Cape Addington abundance index sites during four annual surveys, 1978-1981.

| Year and site | Prerecruit1/ (%) | Small2/ (%) | Large3/ (%) | Total (%) |
|---|---|---|---|---|
| 1978 | | | | |
| Cape Cross | 4 | 18 | 12 | 34 |
| Cape Ommanev | 4 | 18 | 9 | 31 |
| Cape Addington | 7 | 21 | 7 | 35 |
| Total | 15 | 57 | 28 | 100 |
| 1979 | | | | |
| Cape Cross | 4 | 11 | 7 | 22 |
| Caps Ommaney | 3 | 17 | 20 | 40 |
| Cape Addington | 14 | 13 | 11 | 38 |
| Total | 21 | 41 | 38 | 100 |
| 1980 | | | | |
| Cape Cross | 9 | 7 | 7 | 23 |
| Cape Ommaney | 5 | 14 | 12 | 31 |
| Cape Addington | 8 | 18 | 20 | 46 |
| Total | 22 | 39 | 39 | 100 |
| 1981 | | | | |
| Cape Cross | 11 | 8 | 6 | 25 |
| Cape Ommaney | 18 | 12 | 8 | 38 |
| Cape Addington | 17 | 13 | 7 | 37 |
| Total | 46 | 33 | 21 | 100 |

1/ Less than 57 cm fork length.
2/ 57-66 cm fork length.
3/ 67 cm or greater fork lenqth.

Table 9.--Relative abundance of prerecruit-size, small marketable, and large marketable sablefish for the combined 1978, 1979, 1980, and 1981 survey period at Capes Cross, Ommaney, and Addington.

| Year | Prerecruit[1] (%) | Small[2] (%) | Large[3] (%) | Total (%) |
|---|---|---|---|---|
| 1978 | 3 | 12 | 6 | 21 |
| 1979 | 6 | 12 | 11 | 29 |
| 1980 | 7 | 12 | 12 | 31 |
| 1981 | 9 | 6 | 4 | 19 |
| | | | Total | 100 |

1/ Less than 57 cm fork length.
2/ 57-66 cm fork length.
3/ 67 cm and greater fork length.

As shown previously in Table 7, 1979 and 1980 yielded the largest catches. Prerecruits made steady gains in abundance over the 4 yr. Small marketable sablefish maintained a steady proportion of the overall catch until 1981 when their relative abundance dropped by half. In 1981 the prerecruit-size sablefish were more abundant than the other two size classes.

Figure 4 shows the length frequencies of sablefish captured at Capes Cross, Ommaney, and Addington. The dominant mode(s) found at 60-65 cm in 1978, 1979, and 1980 virtually disappeared during the 1981 survey year. Mean lengths of sablefish captured at the three northern sites were stable at about 64 cm from the 1978 through the 1980 survey years, decreasing to 59 cm in 1981.

Sex composition of the survey catches changed from male dominance in 1978-1980 to a slight numerical superiority for females in 1981. Prerecruit size groups moving onto the coastal fishing grounds were composed of mostly females in 1979 and 1980. The average male measured 61-62 cm through the 1980 survey year, decreasing to 58 cm during the 1981 survey year. Female mean length in 1981 was 62 cm, a 5 cm decline from the three previous annual surveys (Figure 5).

Cape Cross site

Sablefish survey catches at Cape Cross remained relatively stable during the 1978, 1979, and 1980 survey years. However, mean lengths decreased (Figure 6) and marketable-size fish represented a diminishing percentage of the index catch (Table 7). Until 1980, prerecruits increased as marketable-size sablefish survey catches decreased, maintaining overall sablefish survey catch levels. The largest decrease in relative abundance was found during the 1981 survey when a 33% drop in total sablefish survey catches was detected. Catches of marketable and prerecruit-size sablefish decreased 40 and 21%, respectively.

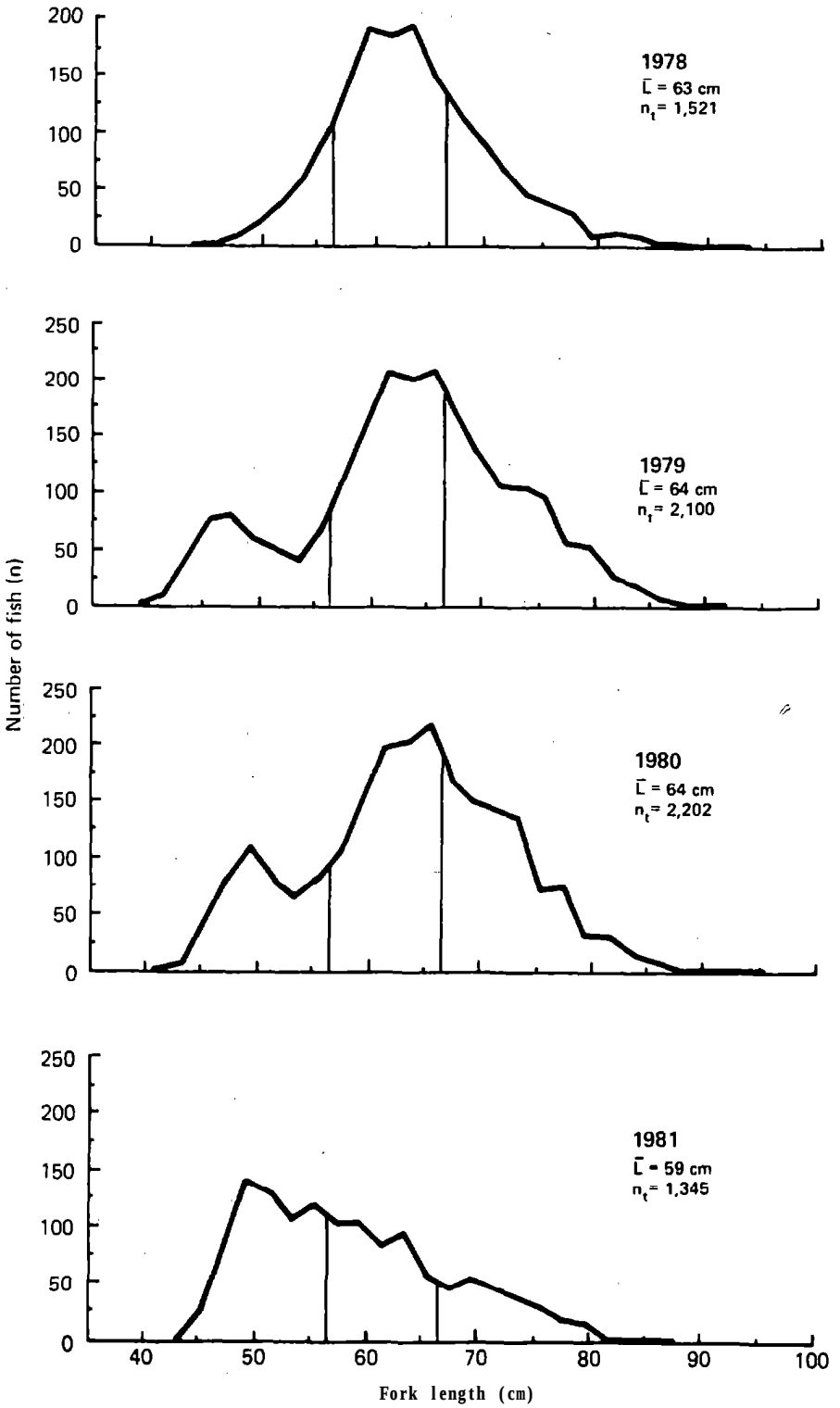



Figure 4.--Length compositions of sablefish captured at the Cape Cross, Cape Ommaney, and Cape Addington abundance index sites, 1978-1981. Vertical lines at 56.5 and 66.5 cm separate prerecruit, small marketable, and large marketable-size fish.

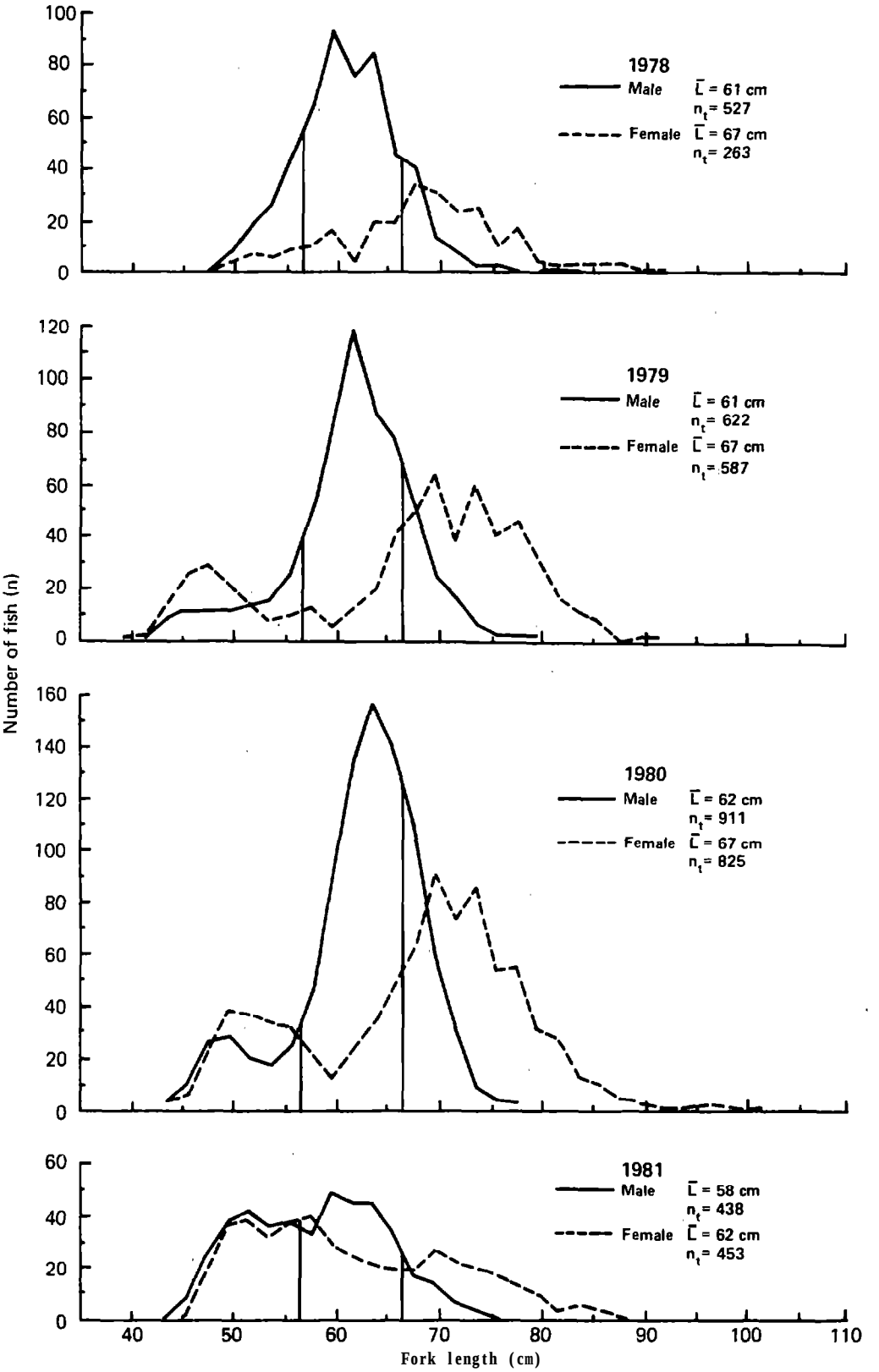



Figure 5.--Length compositions of male and female sablefish captured at the combined coastal abundance index sites during annual surveys, 1978-1981. Vertical lines at 56.5 and 66.5 cm separate pre-recruit, small marketable, and large marketable-size fish.

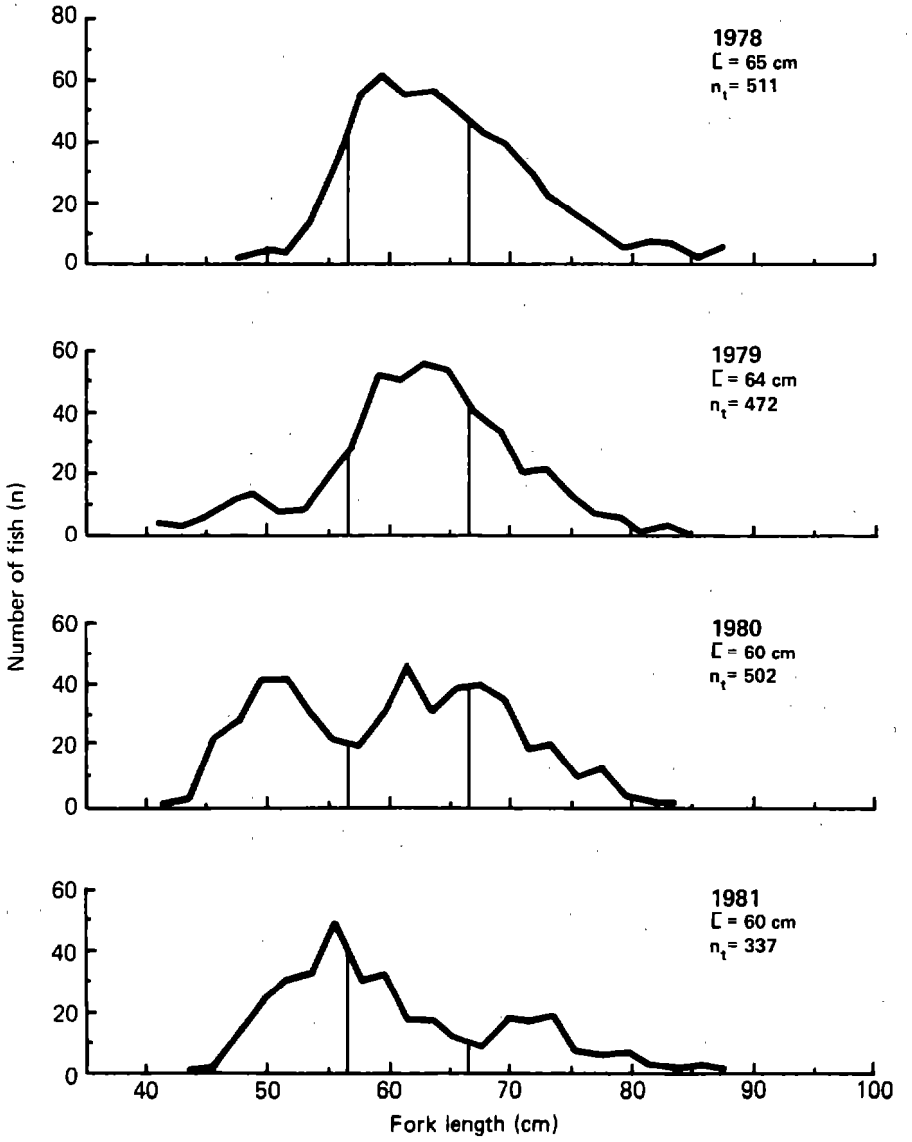



Figure 6. --Length compositions of sablefish captured at the Cape Cross abundance index site, 1978-1981. Vertical lines at 56.5 and 66.5 cm separate prerecruit, small marketable, and large marketable-size fish.

Since 1978 the relative abundance of marketable-size sablefish has decreased 59% at the Cape Cross index site. It appears that the year class(es) that moved onto the coastal fishing grounds in 1979 have already begun to enter the fishery in this area.

In 1952 mean lengths of sablefish from the Cape Spencer area were 65 cm and 74 cm for males and females, with a range of 51-96 cm (Edson 1954). The mean fork length of combined sexes was 68 cm. Cur survey data show that in June 1978 the mean length of sablefish off Cape Cross was 65 cm; in 1979, 64 cm; and in 1980 and 1981, 60 cm.

Edson reported that 70% of the fish captured near Cape Spencer were males. Our survey data show that in 1978 67% of the sablefish captured at this site were males. By 1981 the percentage had dropped to 49% as juveniles and small adults began to dominate.

Cape Ommaney site

Annual survey catches at Cape Ommaney have shown considerable variability in numbers and size composition., In 1978 the area yielded the lowest survey catch rates of the 4-yr period. During the 1979 survey overall sablefish catch increased by 80%, primarily due to increased numbers of large, recently spawned fish. The survey catch of marketable-size fish almost doubled from the previous year's total (Table 7). During the 1980 and 1981 survey years, the apparent abundance of marketable sablefish decreased. In 1981 the survey catch of marketable-size fish was 37% below the 1978 level. Figure 7 shows the changes in size composition at Cape Ommaney over the 4-yr survey period. Two trends are apparent: one is the decrease in marketable-size sablefish after 1979, and the other is the growing strength of prerecruit abundance. Mean fork length decreased to 58 cm in 1981 from a high of 67 cm during the 1979 survey.

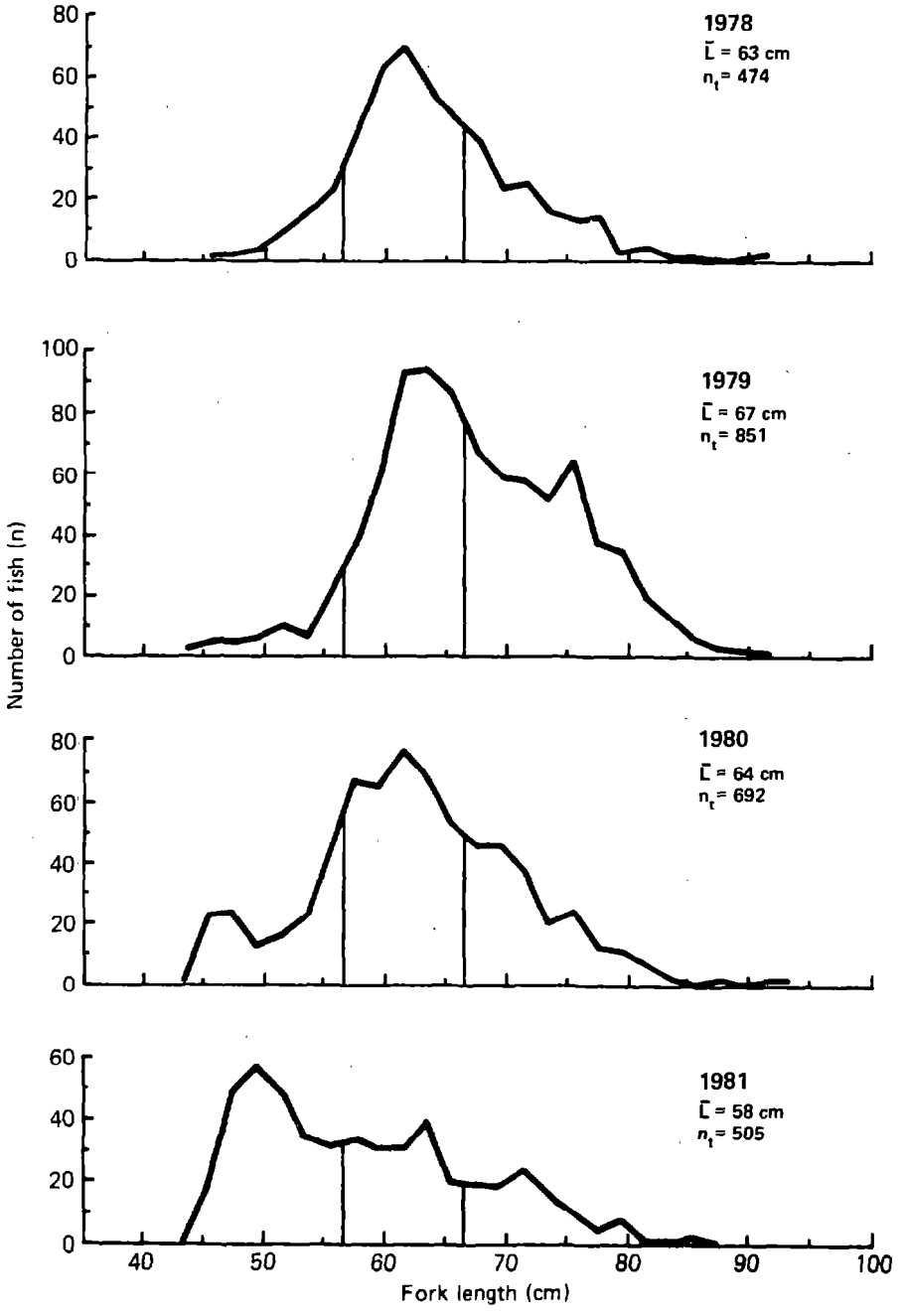



Figure 7.--Length compositions of sablefish captured at the Cape Ommaney abundance index site, 1978-1981. Vertical lines at 56.5 and 66.5 cm separate prerecruit, small marketable, and large marketable-size fish.

Cape Addington site

Indication of a strong prerecruit year class in 1979 was most evident at the Cape Addington site. By the 1981 survey, prerecruits dominated the size composition and the mean length of 65 cm found in 1980 had decreased to 59 cm (Figure 8). Sablefish abundance has been subject to relatively large fluctuations during the four survey years. Abundance of marketable-size sablefish is presently 34% below that of the baseline year 1978.

Cape Muzon site

The 1981 sablefish index catch at Cape Muzon was 26% below the 1979 figure. Marketable-size fish were 39% less numerous and prerecruits were 113% more abundant than during the 1979 survey. Mean length of sablefish at the Cape Muzon site has decreased from 67 cm in 1979 to 62 cm in 1981. This is due to decreases in the abundance of large marketable fish and increases in the number of prerecruits (Figure 9).

Chatham Strait sites

Three locations were surveyed in the inside waters of Chatham Strait in 1981. The ADFG sampled sites in the northern and southern portions of the strait in May. Depths varied from 220 to 380 fm. An additional site was occupied by NMFS at the northern extremity of Chatham Strait in late June and early July (Figure 1) when survey work in coastal waters was completed ahead of schedule. Depths fished were 308-379 fm.

Size composition data show that prerecruit-size sablefish dominated catches at all three sites (Table 10). The highest proportion of marketable-size fish was found in the southern portion of Chatham Strait. Females made up 70% of the total ADFG catch (Figure 10). Sex ratios are not available for the NMFS site, because the fish were tagged and released. In

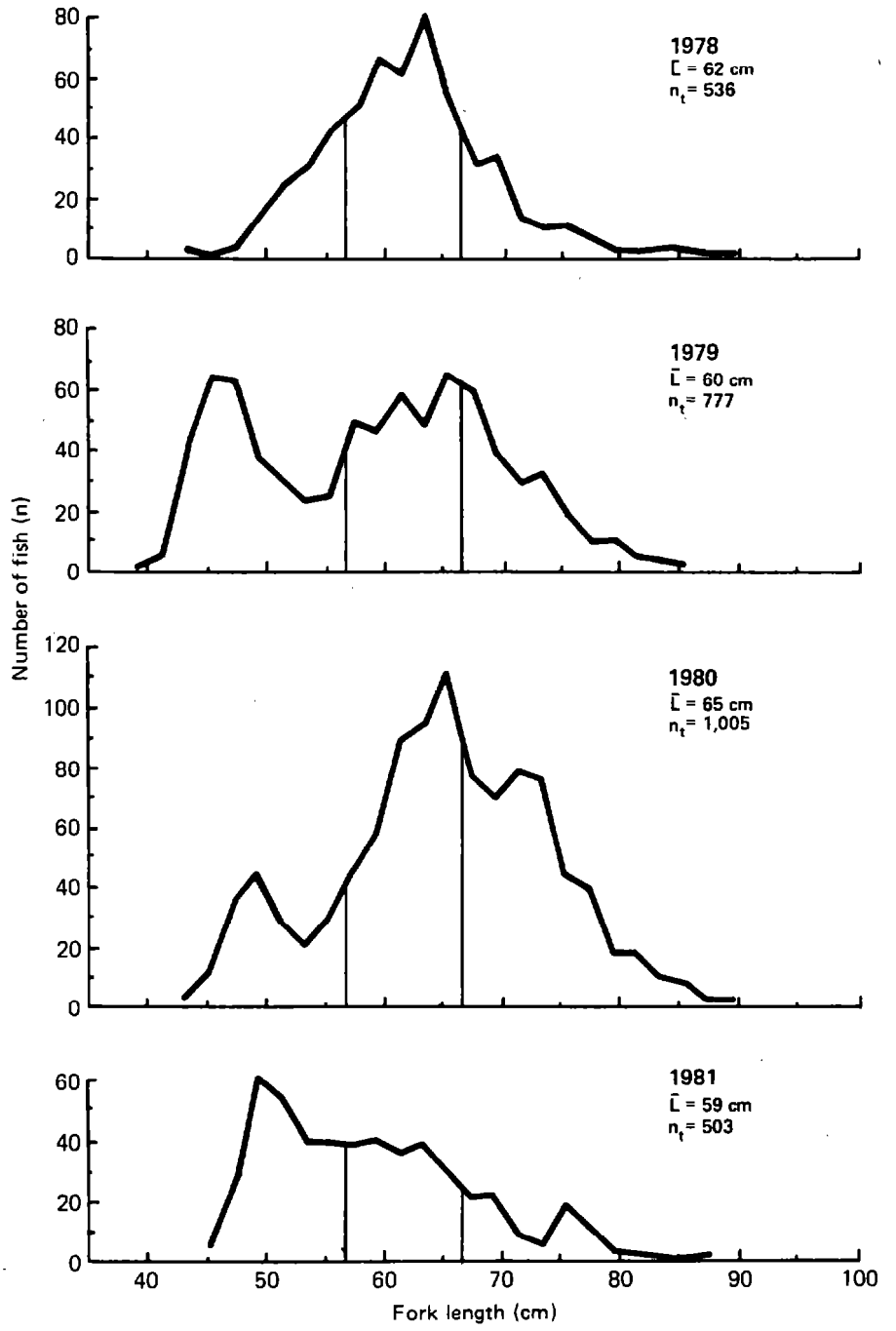



Figure 8.--Length compositions of sablefish captured at the Cape Addington abundance index site, 1978-1981. Vertical lines at 56.5 and 66.5 cm separate prerecruit, small marketable, and large marketable-size fish.

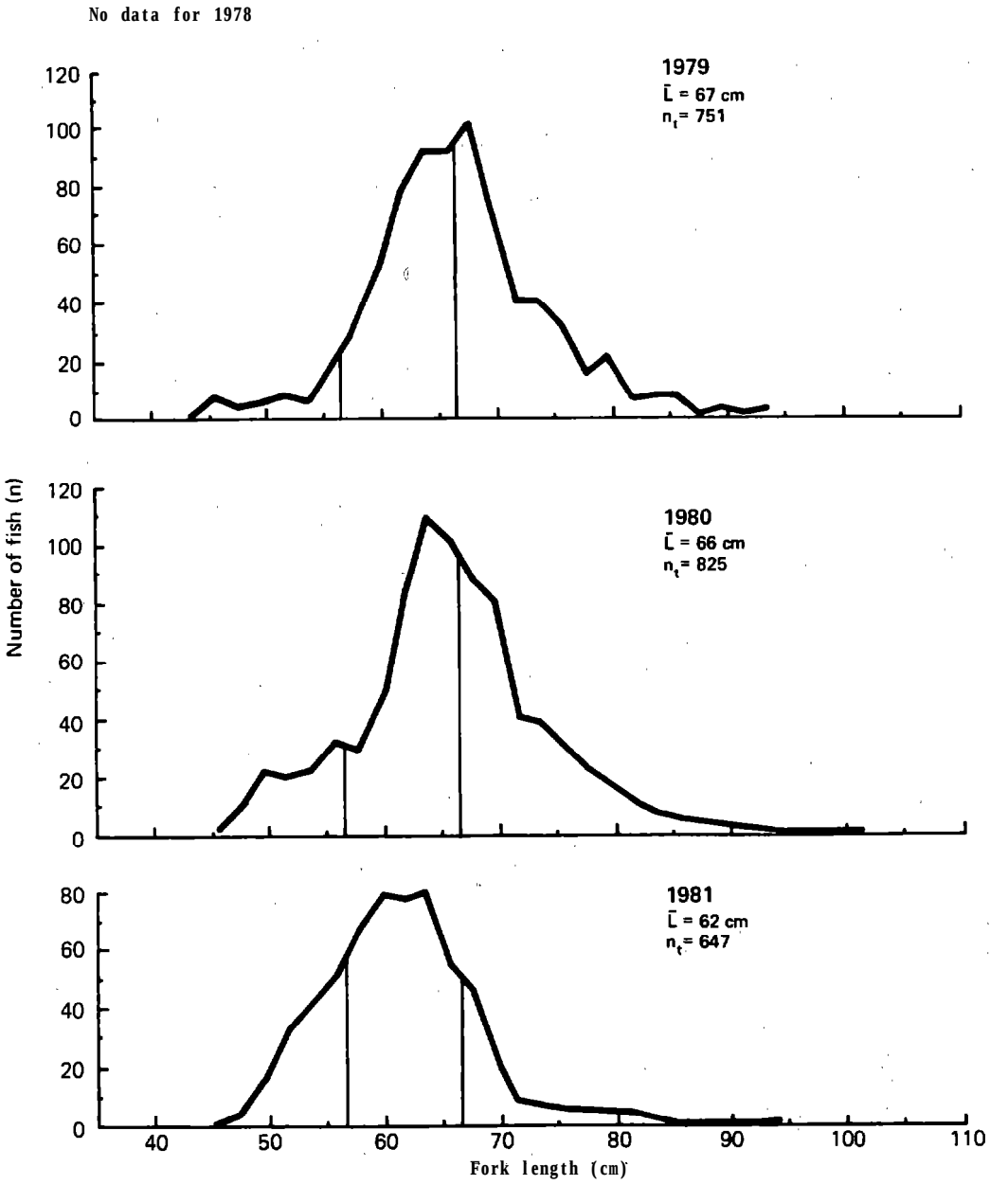



Figure 9.--Length compositions of sablefish captured at the Cape Muzon abundance index site, 1979-1981: Vertical lines at 56.5 and 66.5 cm separate prerecruit, small marketable, and large marketable-size fish.

Table 10.--Percentage composition of prerecruit-size small marketable and large marketable sablefish at three sites in Chatham Strait, May and July 1981.

| | Prerecruit (%) | Small (%) | Large (%) | Total (%) |
|---|---|---|---|---|
| NMFS site (July) | 54 | 41 | 5 | 100 |
| ADFG northern site (May) | 59 | 37 | 4 | 100 |
| ADFG southern site (May) | 63 | 27 | 10 | 100 |

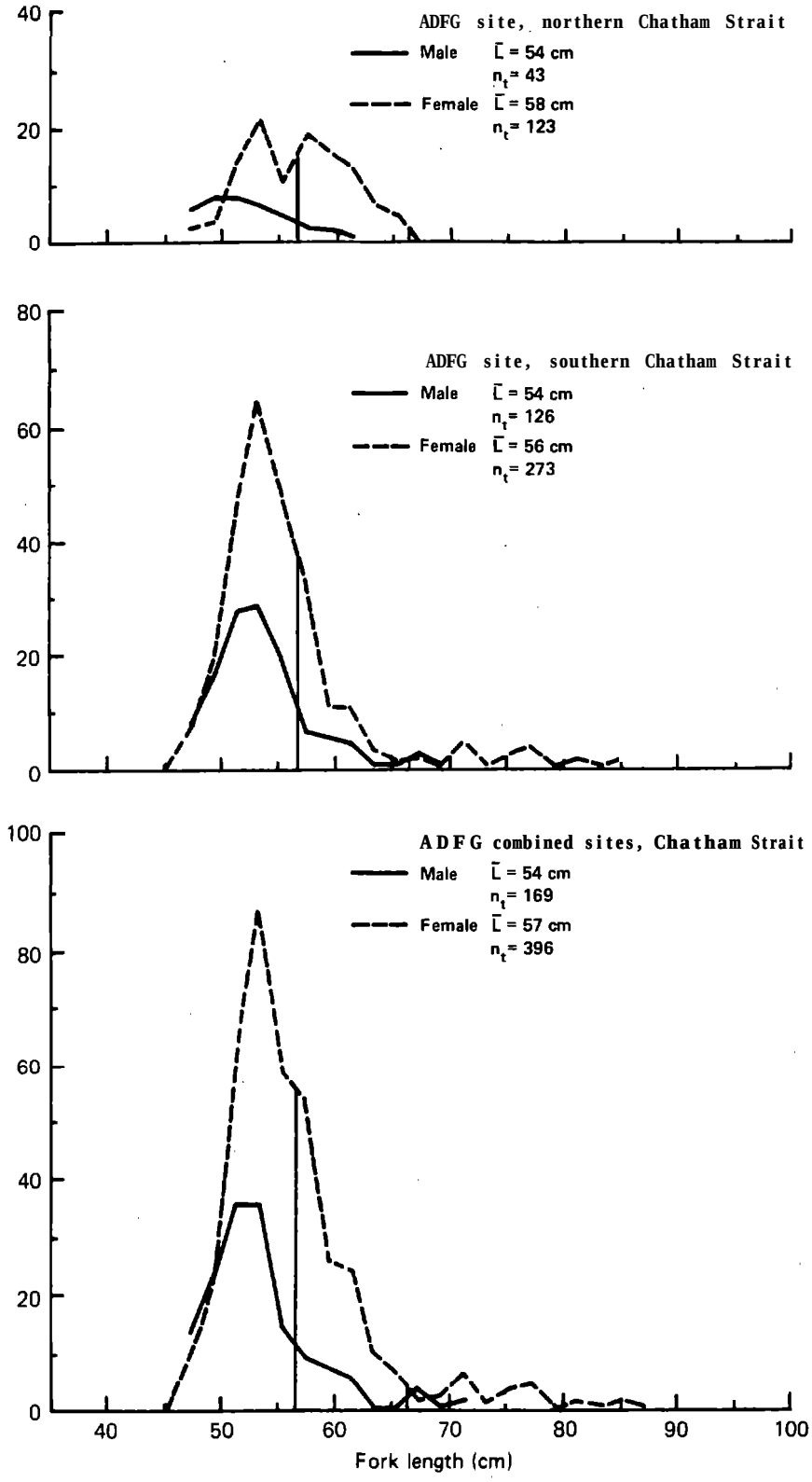



Figure 10.--Length compositions of male and female sablefish captured at abundance index sites in Chatham Strait, May 1981. Vertical lines at 56.5 and 66.5 cm separate prerecruit, small marketable, and large marketable-size fish.

contrast Edson (1954) found that 62% of the sablefish captured in Chatham Strait in 1952 were males.

Comparisons of sablefish size compositions from inside and outside waters show large marketable fish were more frequently captured in coastal waters (Figures 4 and 11).

Mean lengths of sablefish captured in Chatham Strait have decreased since 1952 when Edson (1954) reported mean lengths of 64 and 72 cm for males and females, respectively. In May 1981 those lengths were 54 and 57 cm. The mean length for combined sexes in 1952 was 67 cm: in February 1972 and April 1973 during NMFS tagging operations mean lengths were 59 and 60 cm, respectively (Figure 12); and in May and July 1981 mean lengths were 56 and 57 cm (Figure 11).

Sablefish length-weight relationships

Sablefish length-weight data were collected at all sites surveyed in 1978 and at the Cape Muzon site in 1979. Length-weight regression equations are contained in Table 11. Females were usually heavier than comparable-size males. Dressed weight with pectoral girdle left on was 71% of the round weight of marketable-size sablefish.

Sablefish length at age

The validity of present aging techniques for sablefish is under discussion. Research aimed at defining the most reliable technique is under way at the Pacific Biological Station in Nanaimo, BC.

Age data from NMFS surveys conducted off SE Alaska are available from scales for 1978 and otoliths for 1979 and 1980. Otoliths processed at NWAFC were surface read. Table 12 summarizes the mean lengths at age for male and female sablefish captured in 1978-80.

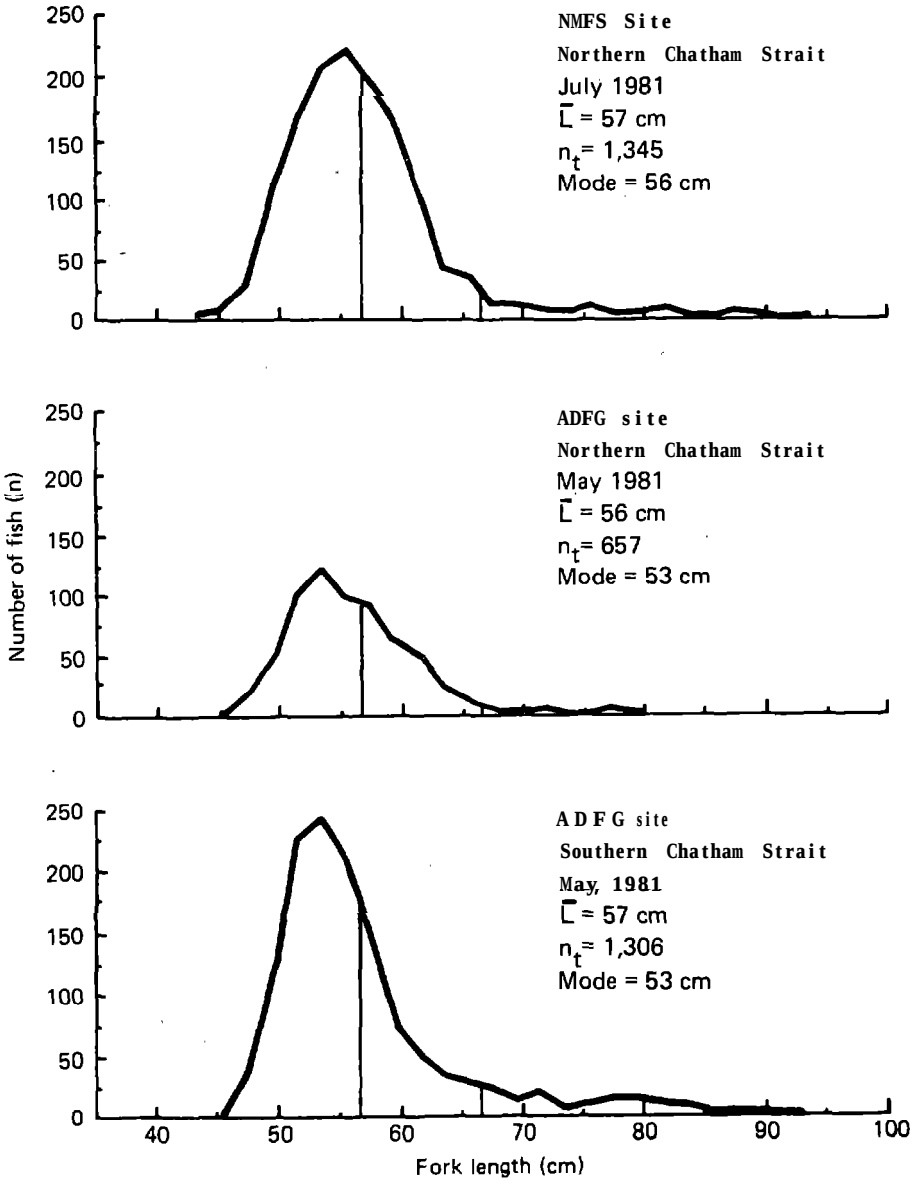



Figure 11.--Length compositions of sablefish captured in Chatham Strait during May and July 1981. Vertical lines at 56.5 and 66.5 cm separate prerecruit, small marketable, and large marketable-size fish. (Data furnished by ADFG, Juneau, Alaska).

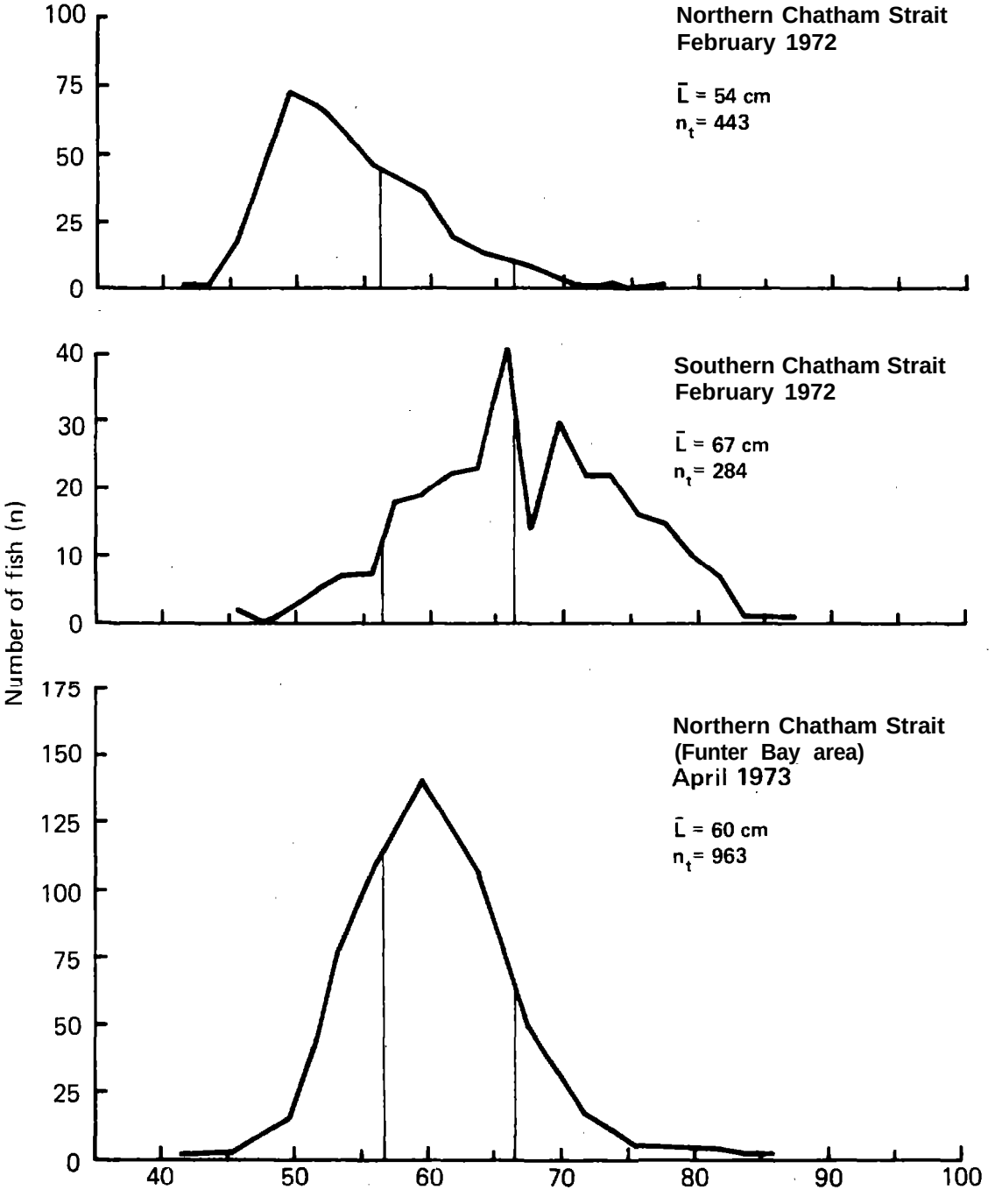



Figure 12.--Length compositions of sablefish captured during tagging operations conducted in Chatham Strait, 1972 and 1973. Vertical lines at 56.5 and 66.5 cm separate prerecruit, small marketable, and large marketable-size fish.

Table 11.--Length-weight relationships for round and dressed sablefish captured off southeast Alaska during the sablefish abundance index surveys, 1978-1979.

| Sex | Round/ dressed | Regression equation | Number | Correlation coefficient |
|---|---|---|---|---|
| Male | round | $W=7.7x10^{-3}\ L^{3.0766}$ | 469 | 0.90 |
| Female | round | $W=3.5x10^{-3}\ L^{3.2738}$ | 246 | 0.95 |
| Combined | round | $W=4.3x10^{-3}\ L^{3.2196}$ | 715 | 0.94 |
| Combined | dressed | $W=3.9x10^{-6}\ L^{3.1638}$ | 112 | 0.95 |

Table 12.--Mean lengths at age, for male and female sablefish captured during abundance index surveys off southeast Alaska, 1978-1980.

| Age (in years) | Males | | | Females | | |
|---|---|---|---|---|---|---|
| | 1978 | 1979 | 1980 | 1978 | 1979 | 1980 |
| 3 | 50.9 | 49.0 | 50.1 | 48.4 | 47.6 | 50.9 |
| 4 | 55.1 | 55.4 | 52.2 | 54.6 | 53.3 | 54.6 |
| 5 | 59.6 | 58.5 | 56.7 | 58.5 | 60.8 | 59.2 |
| 6 | 62.1 | 62.3 | 61.1 | 65.7 | 66.1 | 63.8 |
| 7 | 65.3 | 66.7 | 63.2 | 71.6 | 72.5 | 67.2 |
| 8 | 68.6 | 69.7 | 64.6 | 76.1 | 74.2 | 69.8 |
| 9 | - | 75.7 | 65.3 | 80.1 | 76.7 | 75.1 |
| 10 | - | - | 65.7 | - | 82.6 | 78.5 |
| 11 | - | - | 64.9 | - | 79.4 | 78.2 |
| 12 | - | - | 66.3 | - | 80.5 | 82.2 |
| 13 | - | - | 67.6 | - | - | 84.9 |
| 14 | - | - | 70.0 | - | - | - |
| 15 | - | - | 70.6 | - | - | - |

It appears that juvenile sablefish arrive on the coastal fishing grounds at an age of 3+ years and an average length of 47-51 cm. At approximately 5 yr of age,' sablefish reach marketable size. The average female reaches large marketable size at 6-7 yr and males measuring 67 cm or more are 7-8 yr of age.

During the 1978 survey year relatively few juveniles were found on the coastal fishing grounds. During the 1979 survey year 3 and 4 year old fish appeared offshore, principally at the Cape Addington site. Indications are that the size at which juveniles recruited to the coastal grounds was smaller than usual in 1979. The normal mean length appears. to be 50-51 cm and 3+ years old, judging from 1980 length and age data, and from 1981 length data. (Otoliths collected during the 1981 survey have not yet been read). Minimum lengths reported by Edson (1954) in length frequency diagrams suggest that 50 cm is a realistic mean length at recruitment to the fishing grounds.

## DISCUSSION

When NMFS began sablefish abundance index surveys in 1978, sablefish resources in the Gulf of Alaska were regarded as being in a state of low and declining abundance. (Low 1977 and Hughes 1979). In the Gulf of Alaska region, which includes coastal southeast Alaska, Low (1977) determined that the sablefish catch per boat-day by Japanese longliners decreased from 10,800 kg in 1971 to 3,660 kg in 1977. He also determined that in coastal southeast Alaska the average Japanese longline CPUE decreased from 0.301 t per 10 hachi of longline gear in 1967 to 0.139 t per 10 hachi of longline gear in 1977 (Table 1).

Results of the 1978-80 sablefish abundance index surveys indicated that decreases in sablefish,abundance in coastal southeast Alaska had halted and,

based on survey catch indices, stock abundance (all sizes of fish) had increased 45% between 1978 and 1980 (Table 7). While this percentage increase in abundance seemed substantial, it occurred from a low base level of abundance relative to pre-1966 conditions. Thirty-eight percent of the increased survey catches (all sizes of fish) occurred during the 1979 survey year. During the 1980 survey year, sablefish survey catches (all sizes of fish) increased only 6%, and the relative abundance of the coastal marketable-size population increased by only 4%. A 27% increase in the abundance of marketable-size sablefish during the 1979 survey year in the Cape Cross - Cape Ommaney area was the result of catches made on a concentration of recently spawned adult fish located off Cape Ommaney. This singular occurrence may have caused us to place unwarranted confidence in the recovery potential of the stock(s) at that time.

Data presented in Table 2 show 94% (1979 survey year) and 71% (1980 survey year) of the coastal southeast Alaska domestic and foreign landing& resulted from catches in the Cape Spencer - Cape Ommaney statistical reporting area. During the 1981 survey year 87% of the coastal landings resulted from catches in the Cape Spencer - Helm Point area. Coastal southeast Alaska landings for the 1981 survey year were 1,697 t, a 2% decrease from the 1980 survey year. Total landings decreased 11% for all southeast Alaska. Marketable-size fish were 58% less abundant during the 1981 abundance index survey than during the 1980 survey at Capes Cross, Ommaney, and Addington where the bulk of the landings originated.

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2/ After mid-1978 foreign sablefish landings from southeast Alaska have resulted from incidental catches by coastal trawl fisheries. Since the majority of trawlable bottom is located north of Cape Addington, foreign landings are grouped with those from the northern coastal area.

Distinct recruit classes (mean fork length 'of 47-50 cm) were detected during the 1979, 1980, and 1981 abundance index surveys. Present growth and mortality parameters are not considered to be reliable, and this complicates the job of predicting the influence of each year's recruitment on overall stock abundance. In fact, it is not known whether most of the small sablefish that recruit to the fishing grounds off southeast Alaska remain there. The Alaska Department of Fish and Game has tagged juvenile and pre-adult sablefish in the inside waters of southeast Alaska since 1978. Limited numbers of tag returns indicated that westward movement across the Gulf of Alaska toward Kodiak Island is a possibility (Parry Bracken, pers. commun. ADFG, Petersburg, AK, 1981): This has led to speculation that young sablefish (3-5 yr) may move extensively in the eastern and central Gulf of Alaska, becoming resident in a given area later, perhaps at sexual maturity. If that hypothetical migration does not exist or involves relatively few fish,as reported by Wespestad (in. press), then one would be led to believe that the reproductive capacity of the stock(s) in southeast Alaska cannot support the relatively low sablefish catches of the past 3 yr.

On the other hand, unusually high mortality rates may be a factor contributing to falling sablefish abundance. That hypothesis does not seem to be realistic from the standpoint of natural mortality, and the probability that "shaker" mortality (hook mortality of undersize fish) caused such a reduction seems unlikely. No estimates of "shaker" mortality are available, but fishermen customarily move out of areas where catches of nonmarketable fish are high.

An historical series of length composition data does not exist for southeast Alaska sablefish, but data collected in 1952 near Cape Spencer and during 1973 and 1974 in Chatham Strait do show that the present length frequency distributions contain a smaller proportion of marketable-size fish.

## SUMMARY AND CONCLUSIONS

From 1978 to 1980 the overall trend in sablefish abundance index catches off southeast Alaska was toward slowly increasing numbers of marketable-size fish and substantially increased numbers of prerecruit-size fish. It appears that the abundance of marketable-size sablefish peaked in 1980 and fell sharply during the 1981 survey year.

Decreases in marketable-size sablefish abundance have been greatest on the northern coastal fishing grounds where the majority of domestic fishing effort is concentrated. It is likely that area-wide decreases began during the 1979 survey year but went undetected until 1980 because of high catch rates at a single index site. Relatively large survey catches of marketable fish near Cape Ommaney in 1979 may not have represented increases in the resident sablefish stock but rather the remnants of a spawning concentration.

An aspect of special concern is the reduction in numbers of large marketable-size fish. Those fish have the greatest reproductive capacity, the highest value per pound, and have suffered the largest decreases in abundance. It appears that at least 3 yr pass before the fish that enter the fishery at small marketable size grow into the large marketable category.

With the modest harvest level of 1,238 t which was taken from the northern coastal grounds (Cape Spencer to Helm Point) during survey year 1980, a 24% decrease in the abundance of marketable-size survey-caught sablefish occurred. Since that area bears the brunt of the fishing effort and produces the highest landings, changes in CPUE and fish size there will have the most direct effect on industry.

Sablefish otolith aging techniques employed by NMFS are undergoing review, but our age and length data suggest that sablefish first move into the coastal

fishing grounds at age 3 and 4 and some grow to marketable size by age 5. Uncertainty in growth and mortality parameters make it difficult to determine the effect that present recruitment levels have on overall sablefish abundance. Additional data on migration patterns of juvenile or pre-adult sablefish would enhance our knowledge of the effect that recruitment off southeast Alaska has on the sablefish stocks in the entire Gulf of Alaska.

We draw no conclusions with respect to harvest levels other than to reiterate that, at present, abundance of marketable-size sablefish is decreasing and that recruitment does not appear to be replacing those harvested.

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