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Data Report: National Marine Fisheries Service Longline Surveys, 1991-96

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U.S. DEPARTMENT OF COMMERCE
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ABSTRACT

This report summarizes the results of the 1991-96 National Marine Fisheries Service longline surveys of the Gulf of Alaska and eastern Aleutian Islands. Sablefish, ***Anoplopoma fimbria,*** was the principal target species, although shortspine thornyhead, ***Sebastolobus alascanus,*** rougheye rockfish, ***Sebastes aleutianus,*** and shortraker rockfish, ***Sebastes borealis,*** populations appear to have been sampled adequately to derive meaningful abundance indices. The survey area in the Gulf of Alaska extends from Islands of Four Mountains (170°W long.) eastward to Dixon Entrance (133°25'W long.) and covers the upper continental slope and selected gullies. Beginning in 1996, the eastern Aleutian Islands were surveyed from Amchitka Pass (178°58'W long.) to the western end of Umnak Island (170°12'W long.).

Sablefish abundance indices (relative population number, RPN) for the Gulf of Alaska declined slightly from 1991 to 1996. The two large annual declines in 1992 and 1994 were followed by slight increases in 1993 and 1995. Sablefish relative biomass (relative population weight, RPW) changes were similar to those for sablefish RPN in the Gulf of Alaska. The length compositions for both sexes of sablefish increased from 1991 to 1996.

Gulfwide, shortspine thornyhead RPN and RPW increased during 1996 to the highest number for any survey year, exceeding the previous high in 1992. For all years, their length modes changed slightly.

Gulfwide, RPN and RPW for rougheye rockfish varied without a discernable trend from 1991 to 1994, then increased substantially in 1995 and 1996. Their length modes were generally 42-44 cm fork length (FL).

Shortraker rockfish RPN and RPW declined from 1991 to 1994 and then increased in 1995 and 1996. Their length modes were generally 56-63 cm FL.

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INTRODUCTION

From 1978 through 1994, Japan and the United States cooperatively conducted an annual longline survey covering the upper continental slope of the Gulf of Alaska. In the later years, the survey was expanded to the eastern Bering Sea and Aleutian Islands region. The research supplied information needed to estimate the abundance of sablefish, ***Anoplopomafimbria,*** and other groundfish species (Sasaki 1985, Sigler and Fujioka 1988).

Since 1987, the Alaska Fisheries Science Center, National Marine Fisheries Service (NMFS), has conducted an independent annual longline survey designed to continue the time series of data should Japan discontinue as a partner. Since the cooperative survey was discontinued, the NMFS survey has been the primary method for assessing sablefish and other groundfish species in Alaska. The cooperative survey covered the Gulf of Alaska, eastern Bering Sea, and Aleutian Islands region, whereas the NMFS survey covered only the Gulf of Alaska until 1996, when the survey was expanded to cover the Aleutian Islands. Sampling of the eastern Bering Sea is planned for 1997.

The NMFS longline survey covers the same stations (Fig. 1) and season and uses similar sampling gear as the cooperative longline survey. In addition, the NMFS longline survey has expanded areal coverage from the upper continental slope to major deepwater gullies on the continental shelf. The primary purpose of the NMFS longline survey is to determine the relative annual abundance and length composition of sablefish, shortspine thornyhead, ***Sebastolobus alascanus,*** rougheye rockfish, ***Sebastes aleutianus,*** and shortraker rockfish, ***Sebastes borealis,*** in the Gulf of Alaska, Aleutian Islands, and eastern Bering Sea; only these species will be discussed in this report. This report presents the 1991-96 survey results and updates the report on the 1987 (Sigler and Zenger 1989) and 1988-90 surveys (Zenger and Sigler 1992).

MATERIALS AND METHODS

Vessels and Gear

The chartered fishing vessel ***Ocean Prowler (47*** m) was used for the 1991-93 and 1995 surveys, and the chartered fishing vessel ***Alaskan Leader (46*** m) was used for the 1994 and 1996 surveys. As in the 1988-90 surveys, 16 km (8.6 nautical miles, nmi) of groundline containing 7,200 hooks were set each day. The groundline consisted of 160 sections called skates, and each skate was 100 m (55 fathoms) long with 45 size 13/0 Mustad circle hooks spaced 2 m apart. The groundline was weighted with 3.2-kg lead balls snapped onto the end of each skate. Each hook was hand baited with about 5.5 kg of chopped squid, ***Illex illecebrosus,*** mantles per 100 hooks. The squid mantles were 15-23 cm long. Each mantle was cut into 3 or 4 pieces, each about 4-6 cm long.

Survey Area and Operations

The survey area in the Gulf of Alaska extends from Islands of Four Mountains (170°W long.) eastward to Dixon Entrance (133°25'W long.) and covers the upper continental slope and selected gullies. The survey area in the eastern Aleutian Islands extends from Amchitka Pass (178°58'W long.) to the western end of Umnak Island (170°12'W long.). The western half of the Aleutian Islands region also was sampled during the cooperative longline surveys from 1980 to 1994, but is not sampled in the NMFS longline survey because of the low sablefish catch rate (Fig. 2).

Most stations were sampled at 200-1,000 m depths, but some at 150 m depths or less. From 1988 through 1990, the survey period was 26 June to 12 September. From 1991 through 1994, the survey was shifted about 2 1/2 weeks later, to 13 July to 27 September, to avoid conflicts with the commercial sablefish fishery, which started 45 days later in these years than it had in 1988-90. Implementation of the Individual Fishery Quota (IFQ) system in the longline fishery for sablefish and Pacific halibut, ***Hippoglossus stenolepis,*** started in 1995, and the survey was moved back to near the 1988-90 periods. During 1996, the eastern Aleutian Islands were surveyed from 20 May to 4 June and the Gulf of Alaska from 6 June to 18 August; the Gulf of Alaska was surveyed 16 days earlier than in 1995 to avoid conflicts with the rockfish trawl fishery in the Kodiak Island and west Yakutat areas.

The sampling gear was set from shallow to deep water and usually was retrieved in the same order. Setting began about 0630 hours; retrieval began about 0930 hours and was completed about 1900 hours. Soak time, defined as the time between last buoy deployment and first buoy retrieval, ranged from 3 to 11 hours. This variation in soak time has little effect on the survey index for sablefish (Sigler 1993).

Until 1995, 73 stations were sampled in the Gulf of Alaska: 45 along the upper slope, 27 in gullies, and 1 on the continental shelf (Table l).[1] Because of the low (2-4% of total) relative number of sablefish there, two stations each in Alsek Strath and Iphigenia Gully were discontinued in 1995 and the two Shumagin Gully stations in 1996. These deletions allowed increased sampling in Amatuli Gully (six stations added in 1995) because it has accounted for about 10-l5% of the total relative number of sablefish (Fig. 3f) and because commercial fishing effort was concentrated in the eastern half of Amatuli Gully, implying that sablefish density was higher there. Previously, only the eastern half was sampled and, therefore, any spatial differences within the gully were not measured. Hence, sampling was extended to the western half of Amatuli Gully as well as to two nearby gullies. During 1996, 14 stations were sampled in the eastern Aleutian Islands, whereas 17 stations had been sampled during the cooperative survey; the 3 stations were eliminated because of excessive gear loss.

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[1]The 45 stations on the upper continental slope correspond to station numbers 62-86, 88-102, and 104-108 of the Japan-U.S. cooperative longline survey (Sasaki and Yano 1990). Gully station 26 corresponds to station 87 of the cooperative longline survey. Shelf station 42 (station 103 of the cooperative longline survey) is on the continental shelf off Baranof Island. The remaining 26 gully stations are additional to the original 47 stations of the cooperative longline survey.

Data Collection

Catch data were recorded on a handheld electronic data logger. During gear retrieval, a scientist recorded the species of each hooked fish, the condition of each unoccupied hook (absent, broken, or tangled), and whether bait remained on the hook. Time of day was recorded continuously from an internal clock, and depth was entered when the first skate came aboard, at the beginning of each fifth skate, when crossing into a new depth interval (0-100 m, 101-200 m, 201-300 m, 301-400 m, 401-600 m, 601-800 m, 801-1,000 m, or l,00l-1,200 m), and when the last skate came aboard.

Fish lengths were recorded using 4 bar-code-based measuring board and a bar-code reader and data-storage device (Sigler 1994). Fish lengths were grouped by depth interval for sablefish, Pacific cod, ***Gadus macrocephalus,*** grenadiers (Macrouridae), arrowtooth flounder, ***Atheresthes stomias,*** rockfishes, ***Sebastes*** spp., and shortspine thornyhead. Lengths of sablefish and Pacific cod also were recorded by sex. Pacific halibut were counted and released at the rail without being measured. Catch and length frequency data were transferred to a computer and electronic backup media twice a day. As in the previous surveys, the conditions of the charter allowed the charter vessel to retain most of the catch after the scientific data were recorded, except for prohibited species and those retained as scientific specimens.

Other Biological Sampling

Otoliths were collected, individual lengths and weights recorded, and maturity determined from a random sample of sablefish at each station starting in 1996. Previously, biological sampling was conducted on the cooperative survey but not the NMFS survey. The catch was sampled randomly, rather than stratified by length, because the important variance of proportion-at-age estimates was examined from previous otolith collections and found to be lower for random sampling, which is also true in general (Kimura 1977). A random sample was taken as follows. The first hook of each skate was examined at gear retrieval. If a sablefish occupied the hook, that fish was set aside for other biological sampling. If no sablefish occupied the first hook, then no fish was set aside from that skate. As catch rate varies with station, depth, etc., examining a fixed fraction of the gear ensures that a fixed fraction of the sablefish catch is sampled. The otolith sample was stratified by station and depth stratum (hereafter referred to ***as stratum).*** As the selected fish came aboard, the fisherman at the rail separated the fish into tubs, according to depth strata. Length, weight, and maturity were determined; both otoliths were extracted and put in vials filled with 50% ethanol. Fork length and weight were recorded as accurately as possible. Separate specimen forms were maintained for each station and stratum.

Analytical Methods

The following is an overview; more detailed treatment of these analytical methods may be found in Sigler and Zenger (1989). The number of fish caught per skate (catch per unit effort [CPUE]) was calculated by species for each stratum sampled at a station. Relative population number (RPN, an index of relative abundance in numbers) was computed for each species (Quinn et al. 1982, Gulland 1983, Sasaki 1985) for strata from 201 to 1,000 m, but not for shallower waters because we considered that the shallower depths were not sampled adequately to compute an RPN. The CPUE for each station-stratum was multiplied by the area of the stratum. Then the resulting products for all stations within a stratum were averaged to obtain an RPN.

To examine the size distribution of the principal species, RPN-weighted length frequencies were computed for depths 201-l,000 m, then multiplied by the sample length frequencies. The resultant RPN length frequencies by station and stratum were averaged within stratum to calculate a RPN length frequency by stratum. Finally, to assess relative biomass, we computed relative population weights (RPWs) by using the size distributions and length-weight equations.

Rougheye and shortraker rockfish were grouped together as catches were recorded because they cannot be separated readily while the longline comes in. Length frequencies were tallied separately, allowing estimation of RPN and RPW for each species.

The survey area includes most of the adult habitat of sablefish, rougheye and shortraker rockfishes, and shortspine thornyhead and, therefore, samples the adult fraction of their populations in the Gulf of Alaska and eastern Aleutian Islands. In contrast, large portions of the habitat of adult Pacific cod, Pacific halibut, rockfish species other than rougheye and shortraker rockfishes, grenadiers, and arrowtooth flounder are not included in the survey area and, thus, the RPN does not reflect the total abundance of those species. Consequently, the survey results for those species are not reported here.

RESULTS

Sablefish

Relative Abundance

Overall, sablefish numbers declined slightly from 1991 to 1996. The two large annual declines in 1992 and 1994 were followed by slight increases in 1993 and 1995 (Table 2). The RPW also decreased from 1991 to 1996, but less than RPN because the largest decreases in RPN were in gullies, where the fish are generally smaller than in the upper slopes.

Length Compositions

The length compositions for each sex generally shifted toward larger fish from 1991 to 1996 (Figs. 3a-n). Few fish of either sex were less than 50 cm fork length (FL). Generally, only one length mode was evident for each sex by area for all years. Length modes were generally between 60 and 63 cm FL for males and between 67 and 70 cm FL for females.

Shortspine Thornyhead

Relative Abundance

Total shortspine thornyhead RPN increased in 1996 to the highest number of any survey year, exceeding the previous high in 1992 (Table 3). The RPN on slopes was greater than in gullies. Shortspine thornyhead were more abundant in the central and western gulf areas (Shumagin, Chirikof, and Kodiak) than in the eastern gulf areas (Yakutat and Southeast) during all years, but none has ever been caught in Shumagin Gully or Shelikof Trough in a survey. RPW paralleled RPN in all years.

Length Compositions

Shortspine thornyhead length modes changed slightly each year. Length modes were generally between 36 and 44 cm FL (Figs. 4a-1). Usually only one length mode was evident.

Rougheye Rockfish

Relative Abundance

RPN and RPW of rougheye rockfish varied without a discernable trend from 1991 to 1994. They increased substantially in 1995 and 1996; 1996 values were record highs (Table 4).

In most years, rougheye rockfish RPN was highest in the Southeast area.

Length Compositions

Rougheye rockfish length modes were generally between 42 and 44 cm FL for all years (Figs. 5a-f). Usually only one length mode was evident.

Shortraker Rockfish

Relative Abundance

Shortraker rockfish RPN and RPW declined in 1992 and 1994 and then increased in 1993, 1995, and 1996 (Table 5). The RPN and RPW were always highest in the Southeast area.

Length Compositions

Shortraker rockfish length modes were generally between 56 and 63 cm FL for all years (Figs. 6a-f). Usually only one length mode was evident.

Aleutian Area

Inasmuch as this was the first year of sampling in the Aleutian area, length compositions are merely shown (Figs. 7-16). Catches of Greenland turbot in the Gulf of Alaska have been low. Now that sampling has expanded to the Aleutian Islands and Bering Sea where catch rates are higher, they will be discussed in future reports.

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TABLES

Table 1 .--Area, number of stations, and year surveyed (x) for the National Marine Fisheries Service longline survey, 1991-96. Dash indicates no sampling.

Area	No. of stations	1991	1992	1993	1994	1995	1996
Northeast Aleutians	6	—	—	—	—	—	x
Southeast Aleutians	8	—	—	—	—	—	x
Shumagin Slope	10	x	x	x	x	x	x
Shumagin Gully[1]	2	x	x	x	x	x	—
Chirikof Slope	7	x	x	x	x	x	x
Shelikof Trough	8	x	x	x	x	x	x
Kodiak Slope	9	x	x	x	x	x	x
Amatuli Gully[2]	9	x	x	x	x	x	x
West Yakutat Slope	8	x	x	x	x	x	x
East Yakutat Slope	3	x	x	x	x	x	x
W-Grounds	2	x	x	x	x	x	x
Yakutat Valley	2	x	x	x	x	x	x
Alsek Strath[3]	2	x	x	x	x	—	—
Southeast Slope	8	x	x	x	x	x	x
Southeast Shelf	1	x	x	x	x	x	x
Spencer Gully	2	x	x	x	x	x	x
Ommaney Trench	2	x	x	x	x	x	x
Iphigenia Trench[3]	2	x	x	x	x	—	—
Dixon Entrance	2	x	x	x	x	x	x

[1]Deleted from survey in 1996.

[2]3 stations from 1991 to 1994; 9 stations from 1995 to 1996.

[3]Deleted from survey in 1995.

Table 2.--Relative population number (RPN) and relative population weight (RPW) of sablefish by area, 1991-96. Dash indicates no sampling.

	Relative Population Number					
Area	1991	1992	1993	1994	1995	1996
Northeast Aleutians	—	—	—	—	—	29,810
Southeast Aleutians	—	—	—	—	—	13,438
Shumagin Slope	62,034	35,428	72,053	58,698	62,484	62,739
Shumagin Gully	9,402	3,596	4,270	7,680	3,985	—
Chirikof Slope	85,877	69,513	79,301	65,748	62,210	77,003
Shelikof Trough	90,958	107,497	100,714	42,147	59,575	90,743
Kodiak Slope	103,208	95,802	105,609	88,560	102,836	115,611
Amatuli Gully	114,366	80,019	67,629	72,256	53,747	68,317
West Yakutat Slope	76,698	87,283	80,005	63,623	58,702	54,936
East Yakutat Slope	17,750	18,526	17,216	16,320	9,799	11,009
W-Grounds	12,306	14,535	16,951	5,248	9,320	7,331
Yakutat Valley	29,721	23,677	20,040	11,683	24,804	3,835
Alsek Strath	6,649	6,308	2,810	2,290	—	—
Southeast Slope	73,088	69,160	69,516	54,030	49,786	44,879
Spencer Gully	16,598	15,410	12,997	12,287	8,312	8,797
Ommaney Trench	14,414	11,475	9,389	8,929	11,541	7,019
Iphigenia Trench	15,564	8,757	8,822	6,141	—	—
Dixon Entrance	21,395	15,420	20,970	12,303	23,872	24,378
Total	750,030	662,405	688,293	527,941	540,974	619,845

	Relative Population Weight					
Area	1991	1992	1993	1994	1995	1996
Northeast Aleutians	—	—	—	—	—	97,924
Southeast Aleutians	—	—	—	—	—	42,453
Shumagin Slope	203,357	94,874	234,169	176,820	198,247	213,126
Shumagin Gully	25,517	10,999	10,200	21,607	10,136	—
Chirikof Slope	296,493	244,006	270,738	254,702	203,120	302,201
Shelikof Trough	287,853	315,253	285,021	126,673	152,952	290,202
Kodiak Slope	345,200	324,468	368,423	349,238	392,783	481,562
Amatuli Gully	389,512	271,678	261,742	283,128	183,960	235,183
West Yakutat Slope	287,103	316,770	304,701	275,281	245,075	248,847
East Yakutat Slope	75,495	78,026	73,143	80,365	46,425	52,431
W-Grounds	31,546	35,004	47,528	16,837	27,544	23,592
Yakutat Valley	85,365	54,960	57,040	27,248	59,623	12,410
Alsek Strath	26,487	24,902	9,372	11,404	—	—
Southeast Slope	277,139	255,441	248,488	234,606	199,416	181,990
Spencer Gully	62,640	55,890	46,141	54,962	28,715	34,163
Ommaney Trench	47,407	37,193	28,781	33,789	46,557	22,927
Iphigenia Trench	43,291	21,790	19,871	22,206	—	—
Dixon Entrance	69,561	48,977	50,810	31,118	67,745	99,185
Total	2,553,965	2,190,230	2,316,166	1,999,983	1,862,298	2,338,276

Table 3.--Relative population number (RPN) and relative population weight (RPW) of shortspine thornyhead by area, 1991-96. Dash indicates no sampling.

Relative Population Number

Area	1991	1992	1993	1994	1995	1996
Northeast Aleutians	—	—	—	—	—	12,125
Southeast Aleutians	—	—	—	—	—	9,142
Shumagin Slope	9,300	20,075	11,211	11,040	11,961	15,305
Shumagin Gully	0	0	0	0	0	—
Chirikof Slope	12,813	16,531	10,602	9,289	7,740	11,706
Shelikof Trough	0	0	0	0	0	0
Kodiak Slope	10,081	10,582	12,520	7,822	9,951	9,089
Amatuli Gully	3,596	5,582	5,002	3,489	2,874	3,858
West Yakutat	5,552	5,959	6,962	6,803	8,019	6,545
East Yakutat	982	1,358	1,882	1,266	1,203	1,168
W-Grounds	758	859	703	862	1,108	949
Yakutat Valley	2,272	2,337	3,050	1,407	1,638	1,450
Alsek Strath	92	124	100	59	—	—
Southeast Slope	3,571	4,274	4,462	2,891	5,441	5,367
Spencer Gully	59	619	886	469	1,431	1,593
Ommaney Trench	4,597	2,698	6,210	1,840	5,059	4,708
Iphigenia Trench	1,056	608	523	206	—	—
Dixon Entrance	1,886	1,625	2,054	1,748	2,127	4,654
Total	56,615	73,233	66,166	49,191	58,553	87,659

Relative Population Weight

Area	1991	1992	1993	1994	1995	1996
Northeast Aleutians	—	—	—	—	—	9,765
Southeast Aleutians	—	—	—	—	—	7,028
Shumagin Slope	4,511	9,544	5,776	6,174	6,128	7,692
Shumagin Gully	0	0	0	0	0	—
Chirikof Slope	6,998	10,413	5,950	6,846	4,863	7,861
Shelikof Trough	0	0	0	0	0	0
Kodiak Slope	4,255	4,403	5,755	4,145	4,878	4,806
Amatuli Gully	1,636	2,365	2,172	1,341	1,330	1,777
West Yakutat	2,332	2,557	3,313	3,441	3,677	3,035
East Yakutat	452	551	842	618	472	563
W-Grounds	393	417	411	480	538	473
Yakutat Valley	948	847	1,243	568	607	499
Alsek Strath	42	45	31	18	—	—
Southeast Slope	1,740	2,070	2,568	1,643	2,395	2,712
Spencer Gully	31	267	379	220	612	748
Ommaney Trench	1,720	986	2,408	840	1,925	1,892
Iphigenia Trench	276	179	157	65	—	—
Dixon Entrance	1,286	1,276	1,458	1,367	1,372	2,907
Total	26,618	35,921	32,462	27,766	28,797	51,759

Table 4.--Relative population number (RPN) and relative population weight (RPW) of rougheye rockfish by area, 1991-96. Dash indicates no sampling.

	Relative Population Number					
Area	1991	1992	1993	1994	1995	1996
Northeast Aleutians	—	—	—	—	—	7,906
Southeast Aleutians	—	—	—	—	—	19,545
Shumagin Slope	3,670	7,425	6,774	3,923	9,487	5,686
Shumagin Gully	8	71	29	0	7	—
Chirikof Slope	1,091	970	1,507	743	1,476	1,009
Shelikof Trough	839	196	1,211	365	233	1,072
Kodiak Slope	5,005	4,196	4,028	1,951	4,526	4,494
Amatuli Gully	787	841	457	720	2,565	1,640
West Yakutat	3,391	3,152	3,467	2,254	2,470	3,773
East Yakutat	1,543	945	1,634	719	1,698	844
W-Grounds	31	21	0	0	37	54
Yakutat Valley	283	1,137	669	841	1,160	1,393
Alsek Strath	51	50	69	143	—	—
Southeast Slope	11,370	4,996	6,027	10,184	7,555	10,224
Spencer Gully	6	18	22	844	25	17
Ommaney Trench	484	391	1,303	505	523	927
Iphigenia Trench	64	15	163	76	—	—
Dixon Entrance	126	65	933	598	118	129
Total	28,750	24,490	28,293	23,865	31,882	58,713

	Relative Population Weight					
Area	1991	1992	1993	1994	1995	1996
Northeast Aleutians	—	—	—	—	—	6,511
Southeast Aleutians	—	—	—	—	—	18,122
Shumagin Slope	3,914	7,681	6,303	3,970	11,624	5,519
Shumagin Gully	10	60	26	0	9	—
Chirikof Slope	1,287	1,279	1,743	914	1,787	1,375
Shelikof Trough	841	169	1,377	468	433	1,246
Kodiak Slope	5,338	4,504	4,091	1,994	4,728	4,621
Amatuli Gully	525	570	312	468	2,126	1,450
West Yakutat	4,280	3,466	3,522	2,355	2,675	4,107
East Yakutat	2,200	1,047	1,503	958	1,719	962
W-Grounds	17	11	0	0	40	45
Yakutat Valley	262	1,042	775	891	1,205	1,414
Alsek Strath	48	39	78	158	—	—
Southeast Slope	15,555	6,871	8,807	15,593	10,311	14,001
Spencer Gully	5	25	21	1,029	34	20
Ommaney Trench	551	546	1,802	749	586	1,072
Iphigenia Trench	47	5	332	170	—	—
Dixon Entrance	210	114	988	1,060	199	325
Total	35,091	27,430	31,681	30,776	37,475	60,790

Table 5.--Relative population number (RPN) and relative population weight (RPW) of shortraker rockfish by area, 1991-96. Dash indicates no sampling.

	Relative Population Number					
Area	1991	1992	1993	1994	1995	1996
Northeast Aleutians	—	—	—	—	—	4,872
Southeast Aleutians	—	—	—	—	—	7,374
Shumagin Slope	3,074	1,660	1,523	2,549	5,765	4,098
Shumagin Gully	0	7	0	0	0	—
Chirikof Slope	776	572	229	613	531	646
Shelikof Trough	43	0	21	32	0	48
Kodiak Slope	2,412	1,374	1,067	1,040	1,325	2,231
Amatuli Gully	0	0	0	0	21	138
West Yakutat	5,197	4,373	3,788	2,478	3,714	4,990
East Yakutat	5,378	4,757	3,333	2,744	4,278	3,418
W-Grounds	0	4	89	63	32	43
Yakutat Valley	324	286	166	111	185	192
Alsek Strath	6	9	0	0	0	0
Southeast Slope	2,247	1,479	2,199	1,862	2,427	1,967
Spencer Gully	31	23	92	81	200	169
Ommaney Trench	98	163	123	76	204	202
Iphigenia Trench	0	0	0	0	—	—
Dixon Entrance	1	0	1	7	0	260
Total	19,588	14,706	12,631	11,655	18,681	30,649

	Relative Population Weight					
Area	1991	1992	1993	1994	1995	1996
Northeast Aleutians	—	—	—	—	—	4,612
Southeast Aleutians	—	—	—	—	—	7,359
Shumagin Slope	5,953	2,078	2,192	3,956	7,940	5,946
Shumagin Gully	0	4	0	0	0	—
Chirikof Slope	1,384	914	293	1,174	812	1,007
Shelikof Trough	170	0	89	130	0	112
Kodiak Slope	4,874	2,802	1,912	2,649	2,554	4,657
Amatuli Gully	0	0	0	0	77	267
West Yakutat	11,219	9,251	8,322	5,569	8,027	10,749
East Yakutat	9,366	7,782	6,089	5,477	7,221	6,603
W-Grounds	0	9	191	209	48	108
Yakutat Valley	761	407	338	339	389	495
Alsek Strath	16	28	0	0	—	—
Southeast Slope	3,546	2,053	4,124	3,102	4,034	3,377
Spencer Gully	59	45	197	198	343	314
Ommaney Trench	252	320	297	237	491	608
Iphigenia Trench	0	0	0	0	—	—
Dixon Entrance	1	0	1	10	0	301
Total	37,600	25,694	24,044	23,050	31,936	34,542

FIGURES

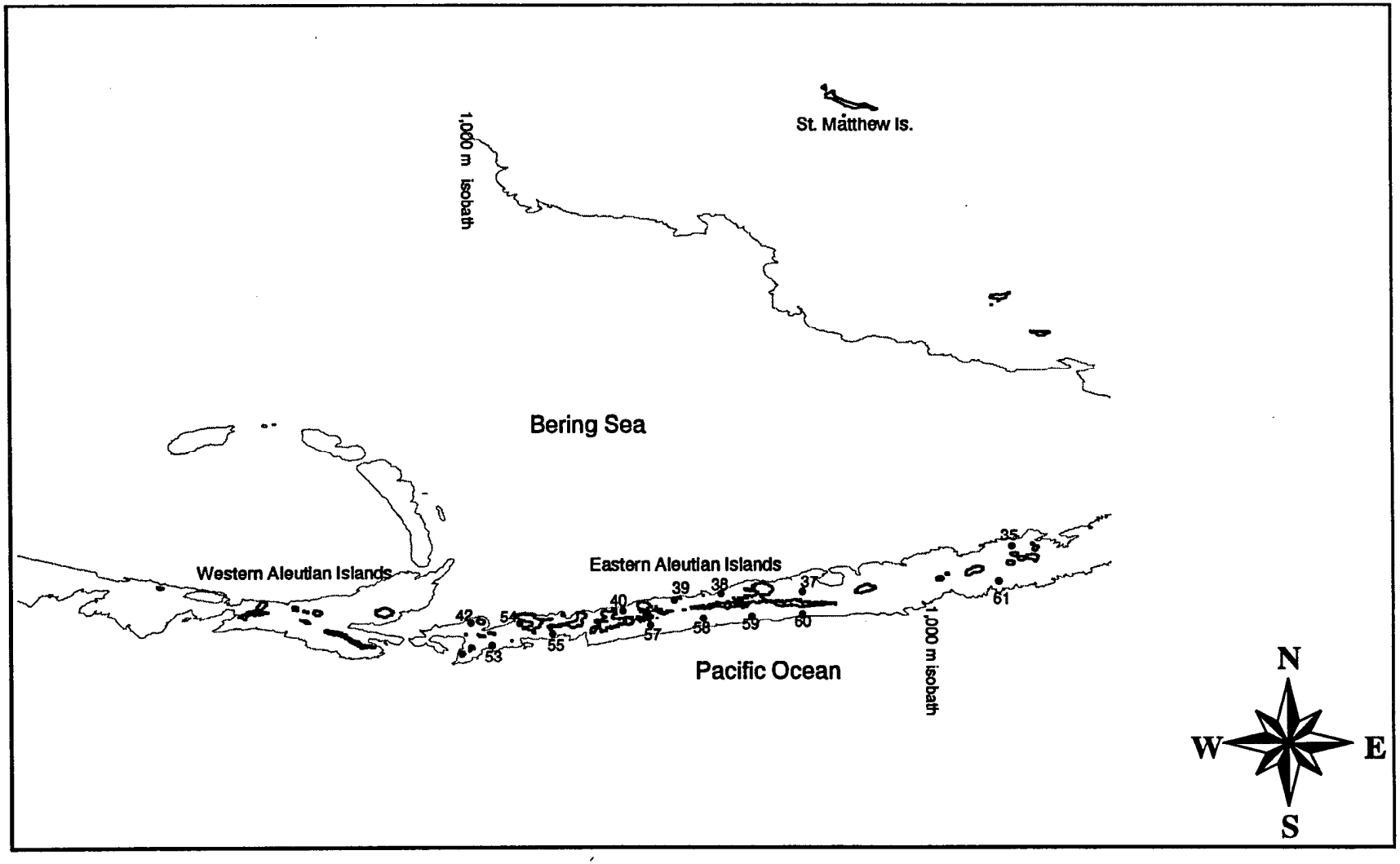

Figure 1 .--NMFS sablefish longline survey, Aleutian Island; stations.

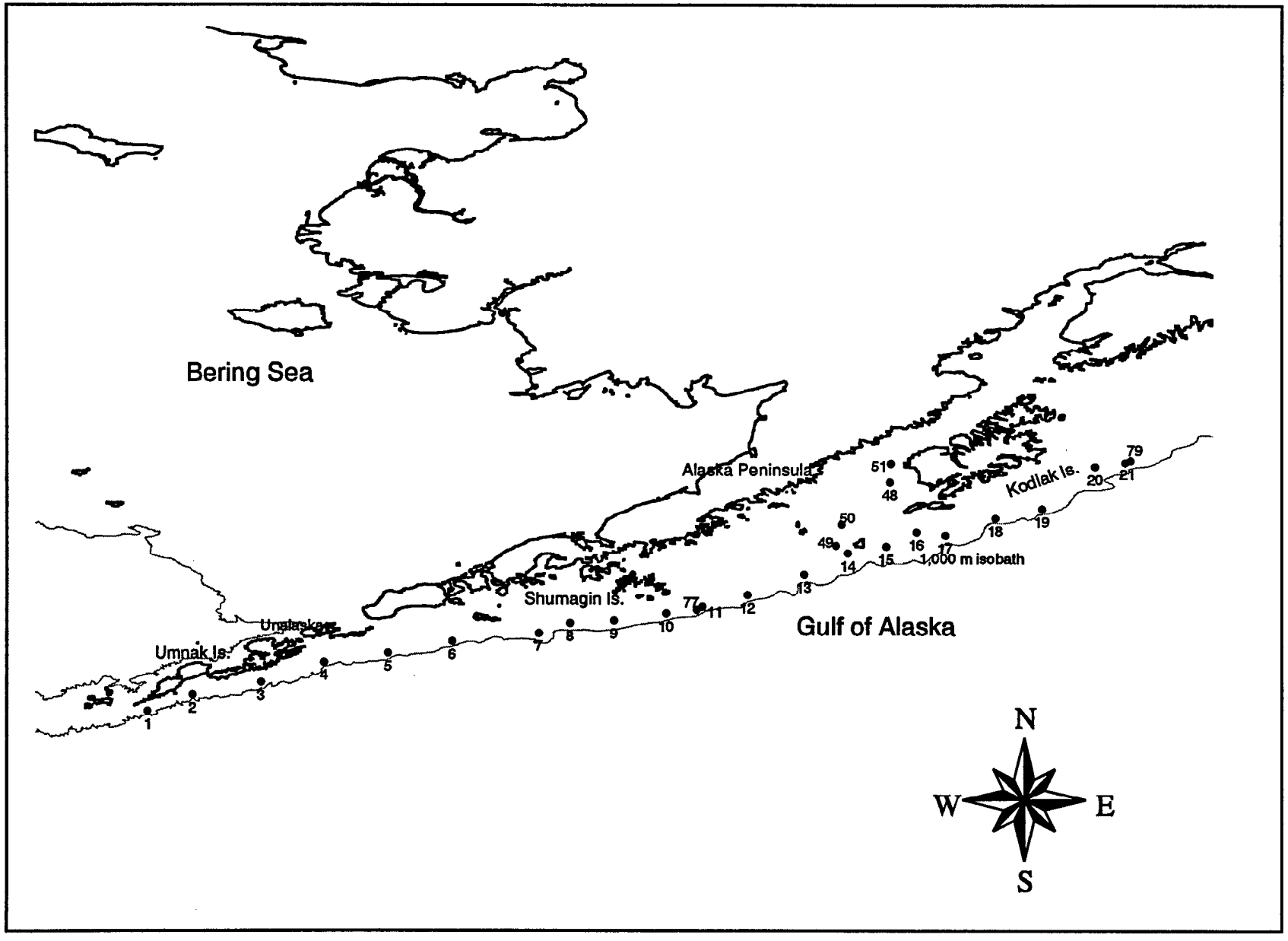

Figure l.--Extended. NMFS sablefish longline survey, western Gulf of Alaska stations.

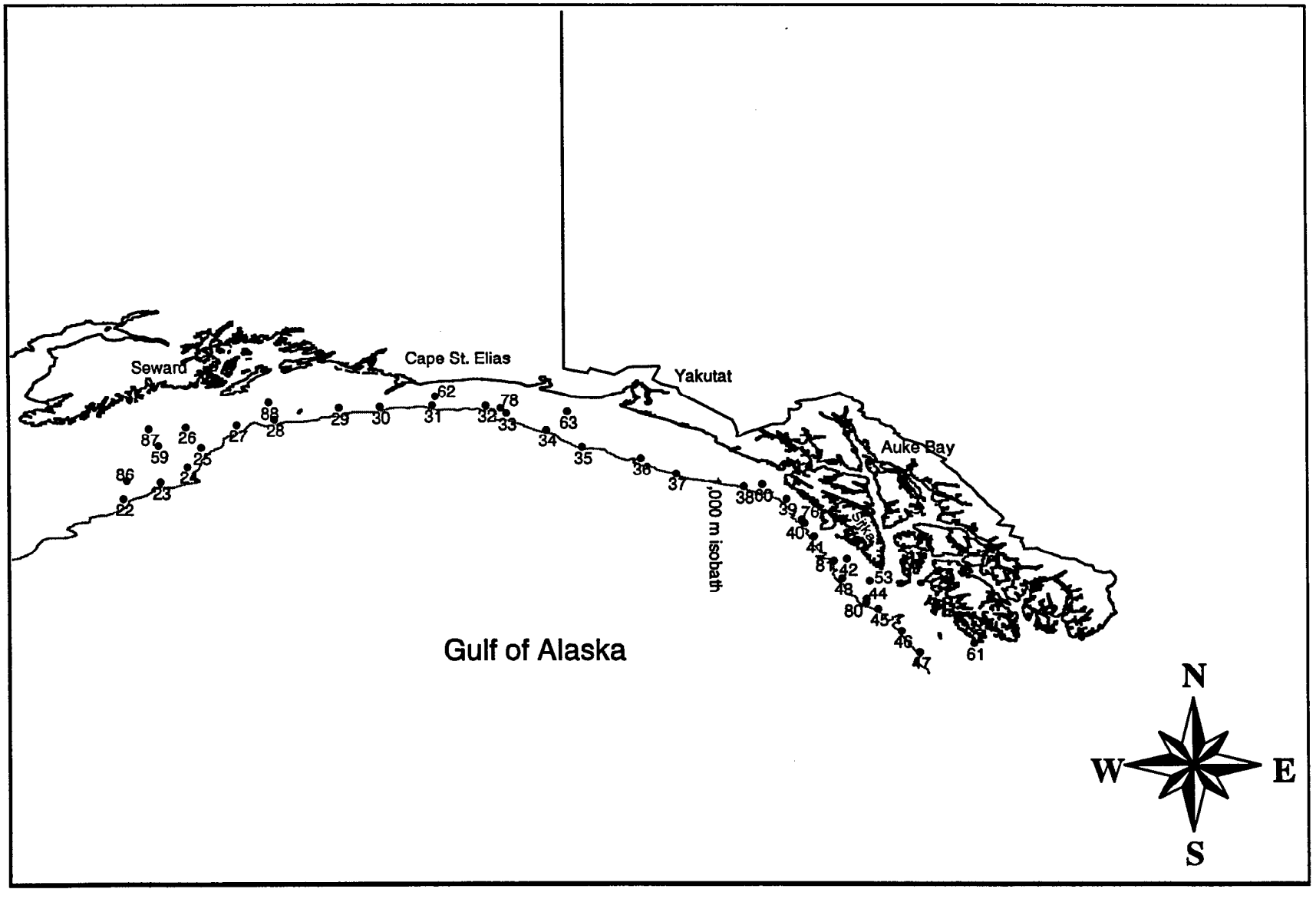

Figure l.--Extended. NMFS sablefish longline survey, eastern Gulf of Alaska stations.

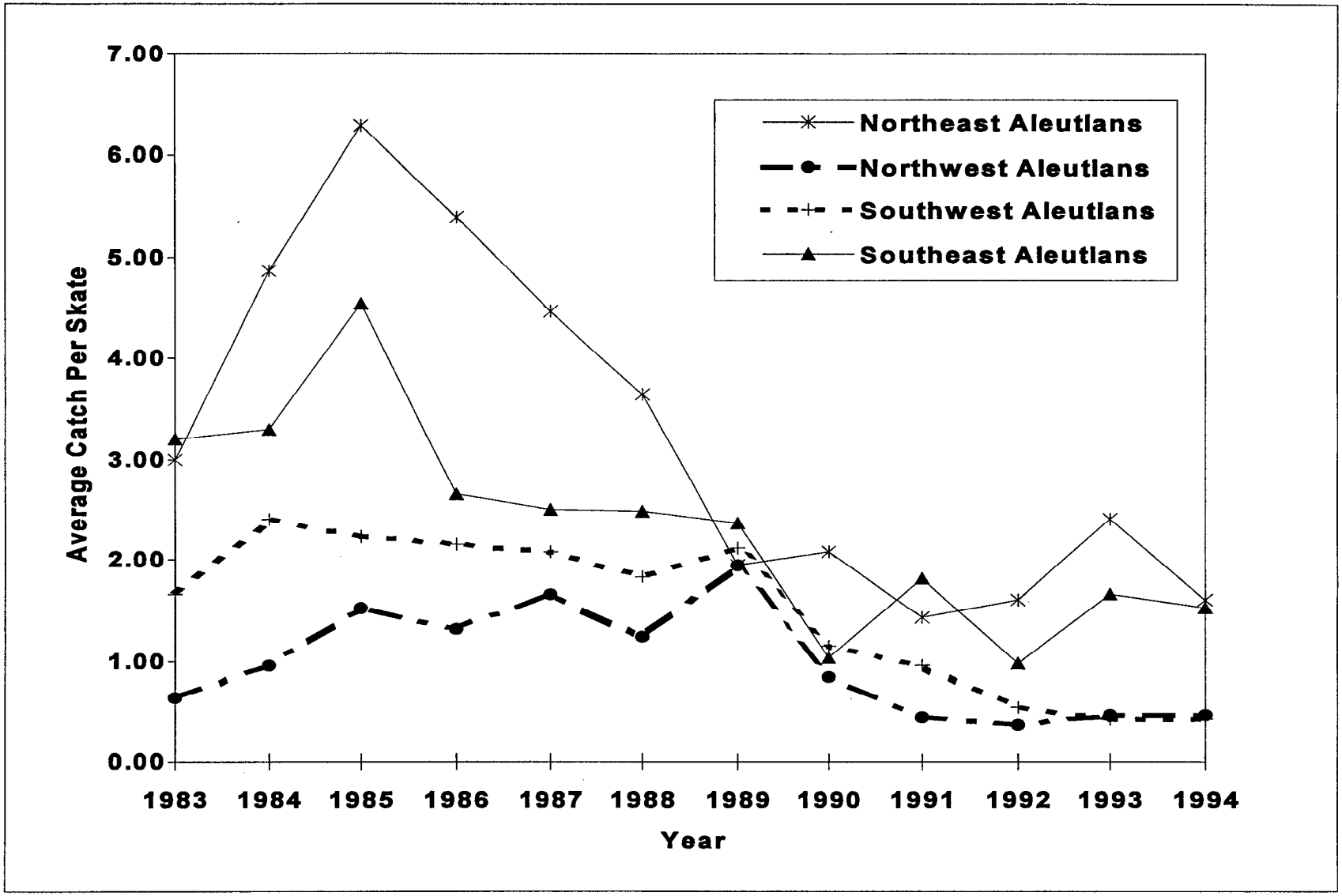

Figure 2.--Average sablefish catch per skate by region in the Aleutian Islands for the Japan-U.S. cooperative longline survey, 1983-94.

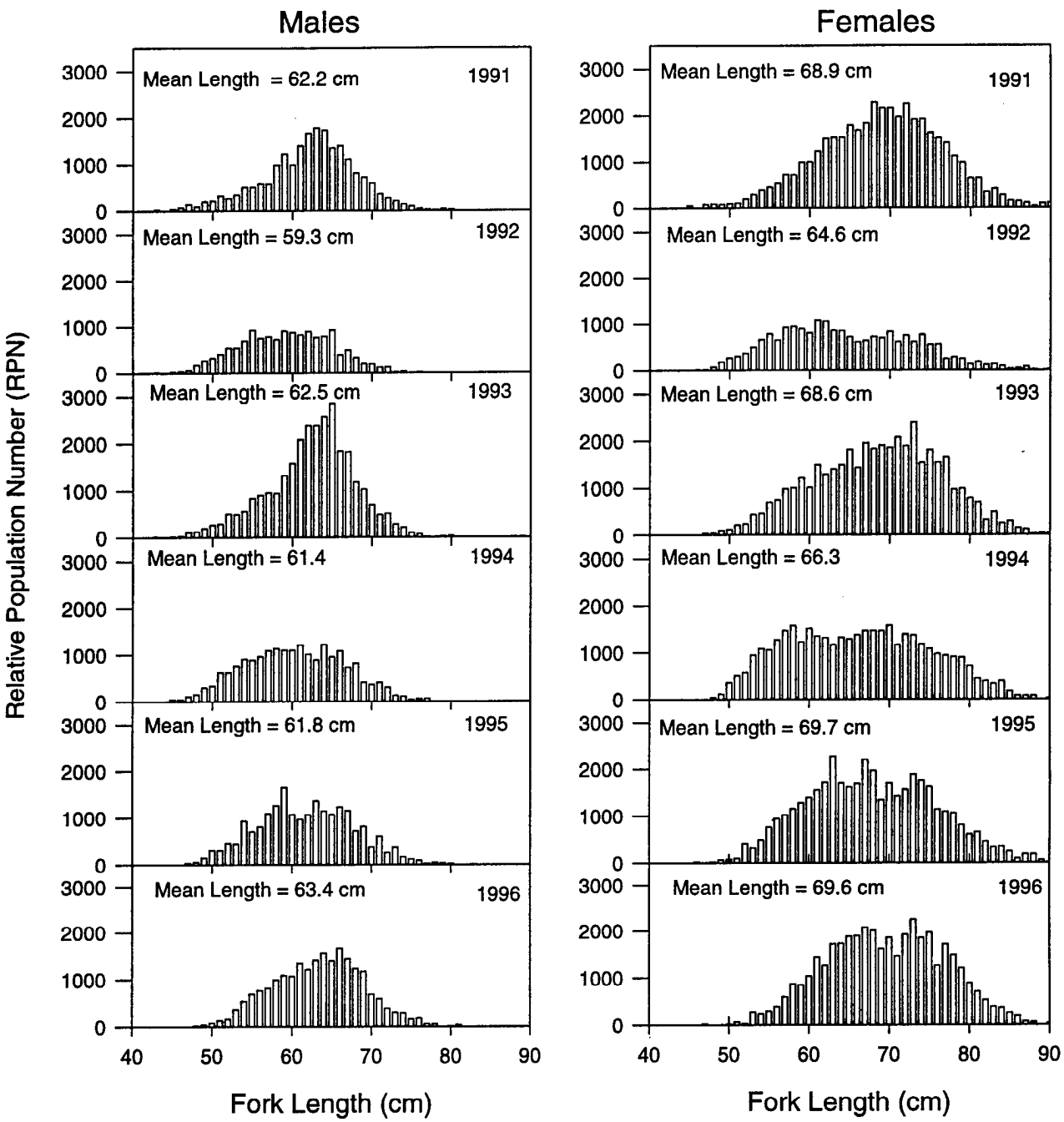

Figure 3a.--Sablefish length frequencies weighted for relative population number for the Shumagin slope by sex, 1991-96.

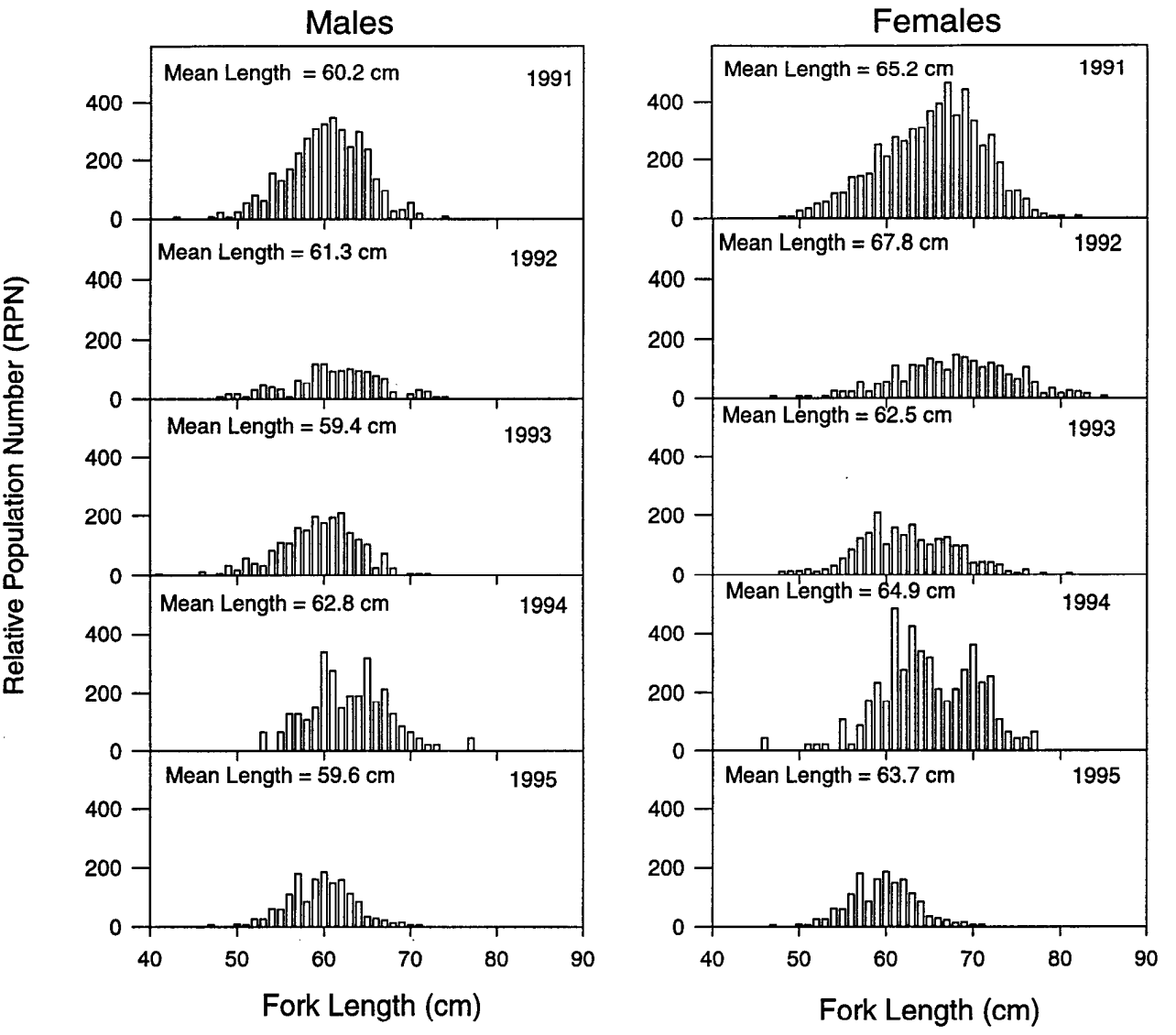

Figure 3b.--Sablefish length frequencies weighted for relative population number for Shumagin Gully by sex, 1991-95.

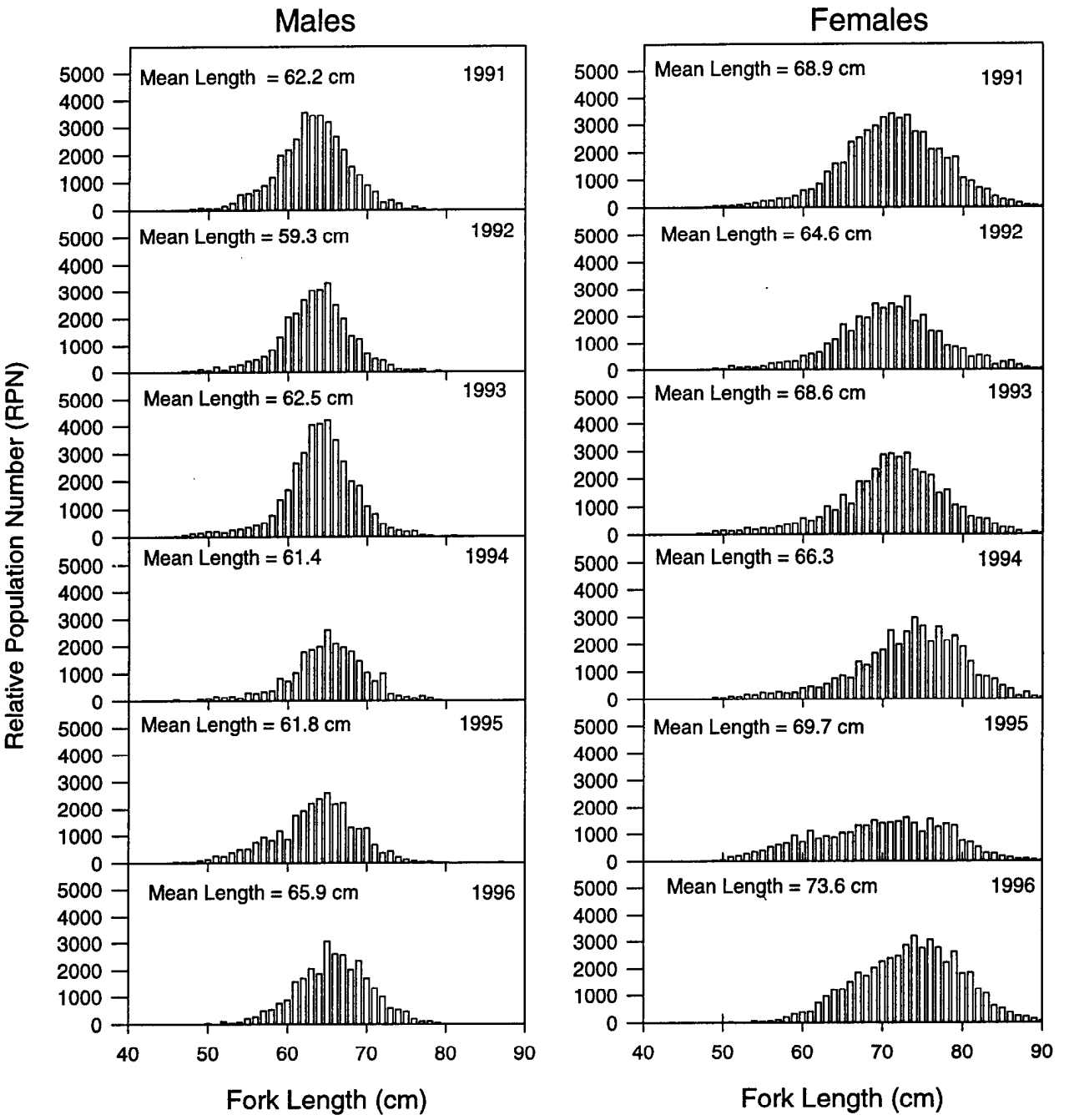

Figure 3c.--Sablefish length frequencies weighted for relative population number for the Chirikof slope by sex, 1991-96.

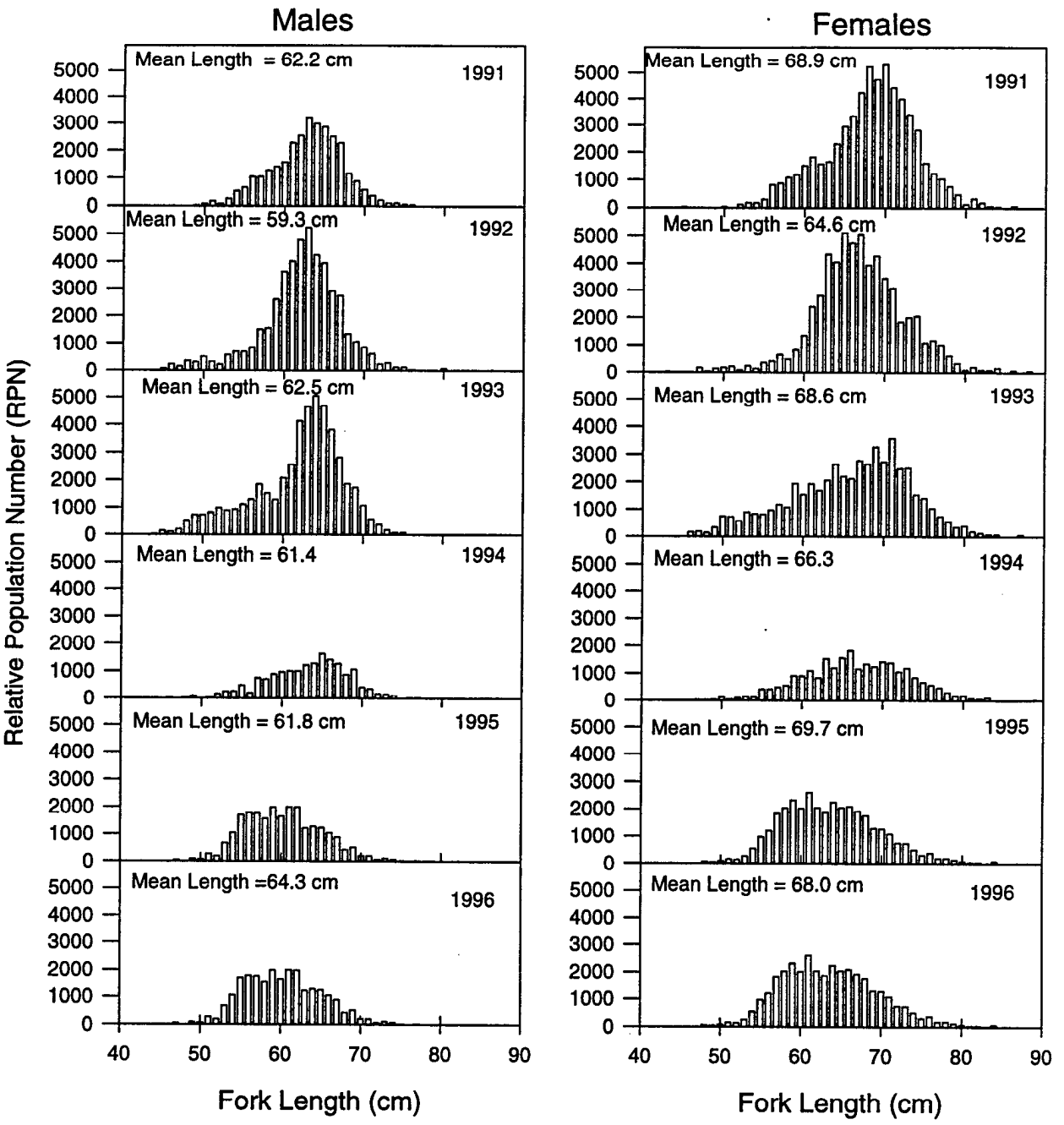

Figure 3d.--Sablefish length frequencies weighted for relative population number for Shelikof Trough by sex, 1991-96.

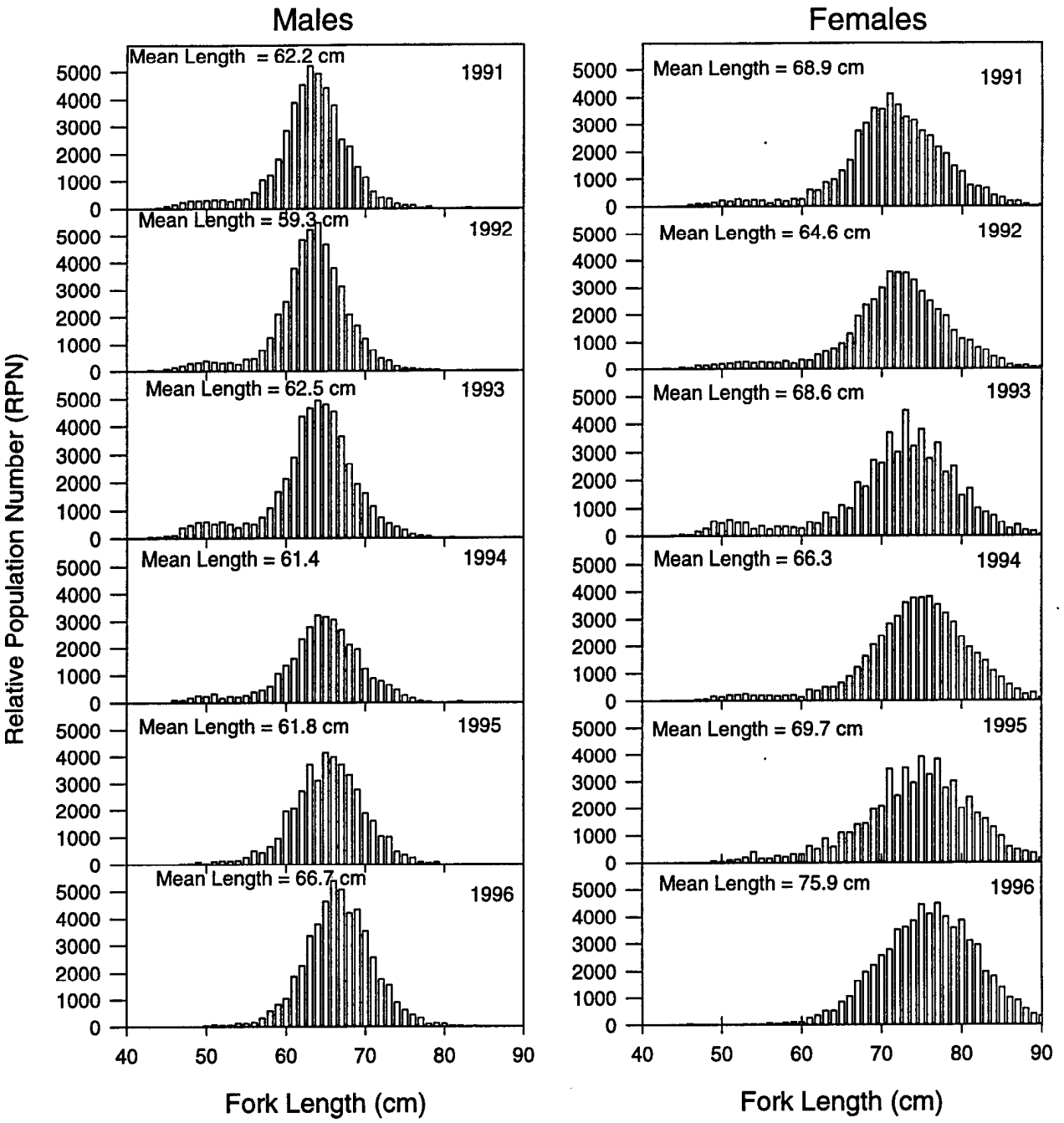

Figure 3e.--Sablefish length frequencies weighted for relative population number for the Kodiak slope by sex, 1991-96.

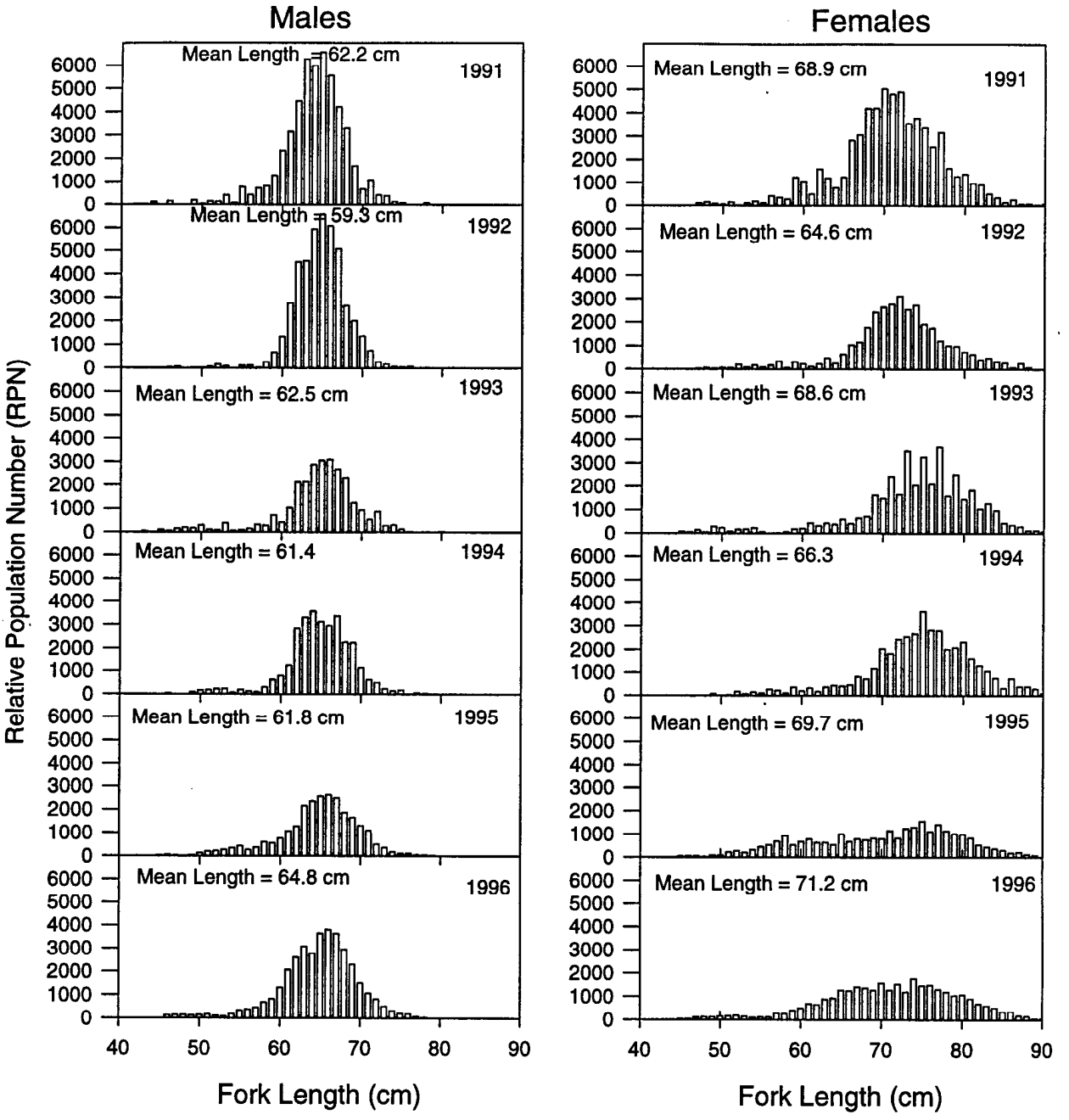

Figure 3f.--Sablefish length frequencies weighted for relative population number for Amatuli Gully by sex, 1991-96.

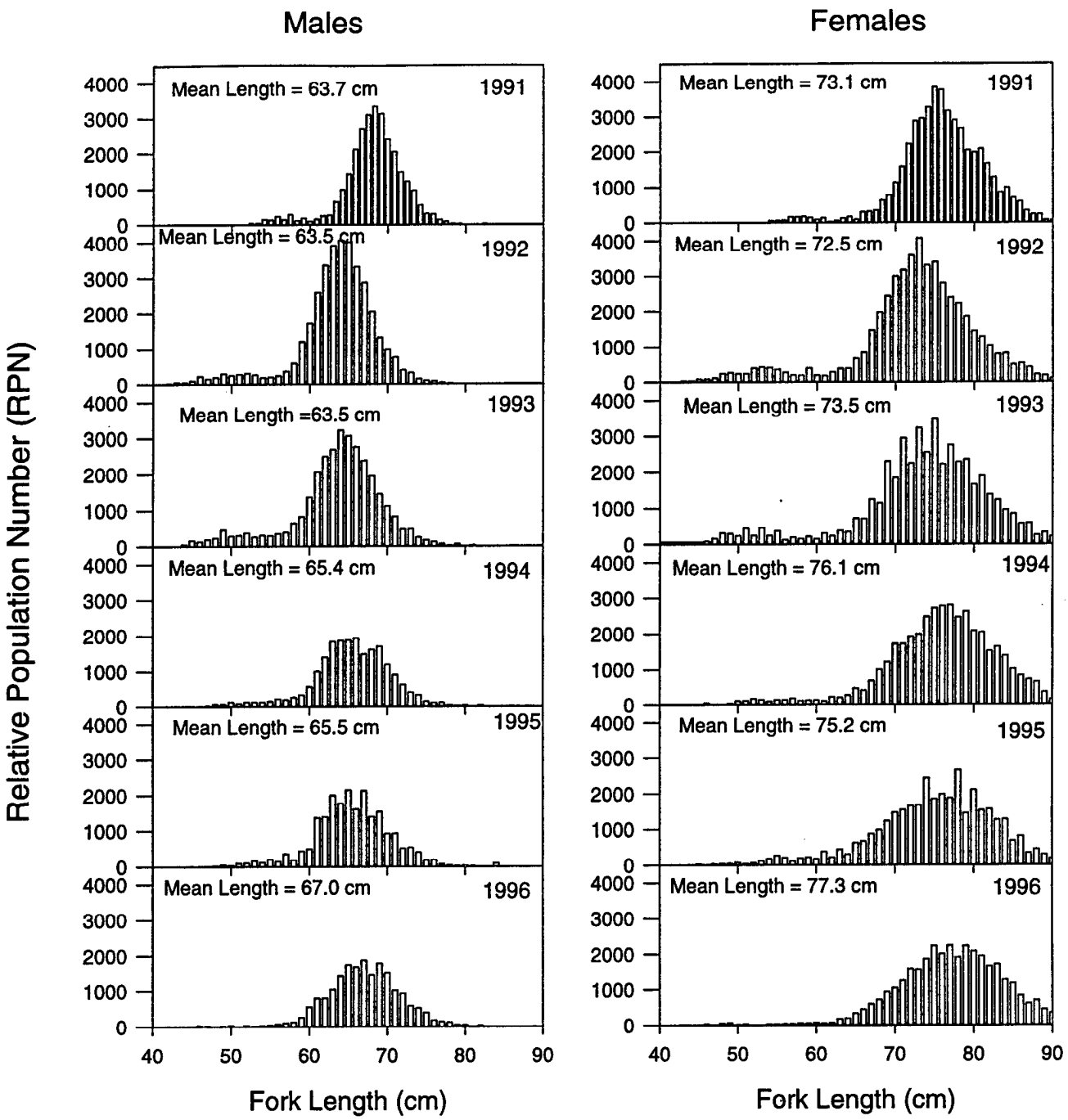

Figure 3g.--Sablefish length frequencies weighted for relative population number for the West Yakutat slope by sex, 1991-96.

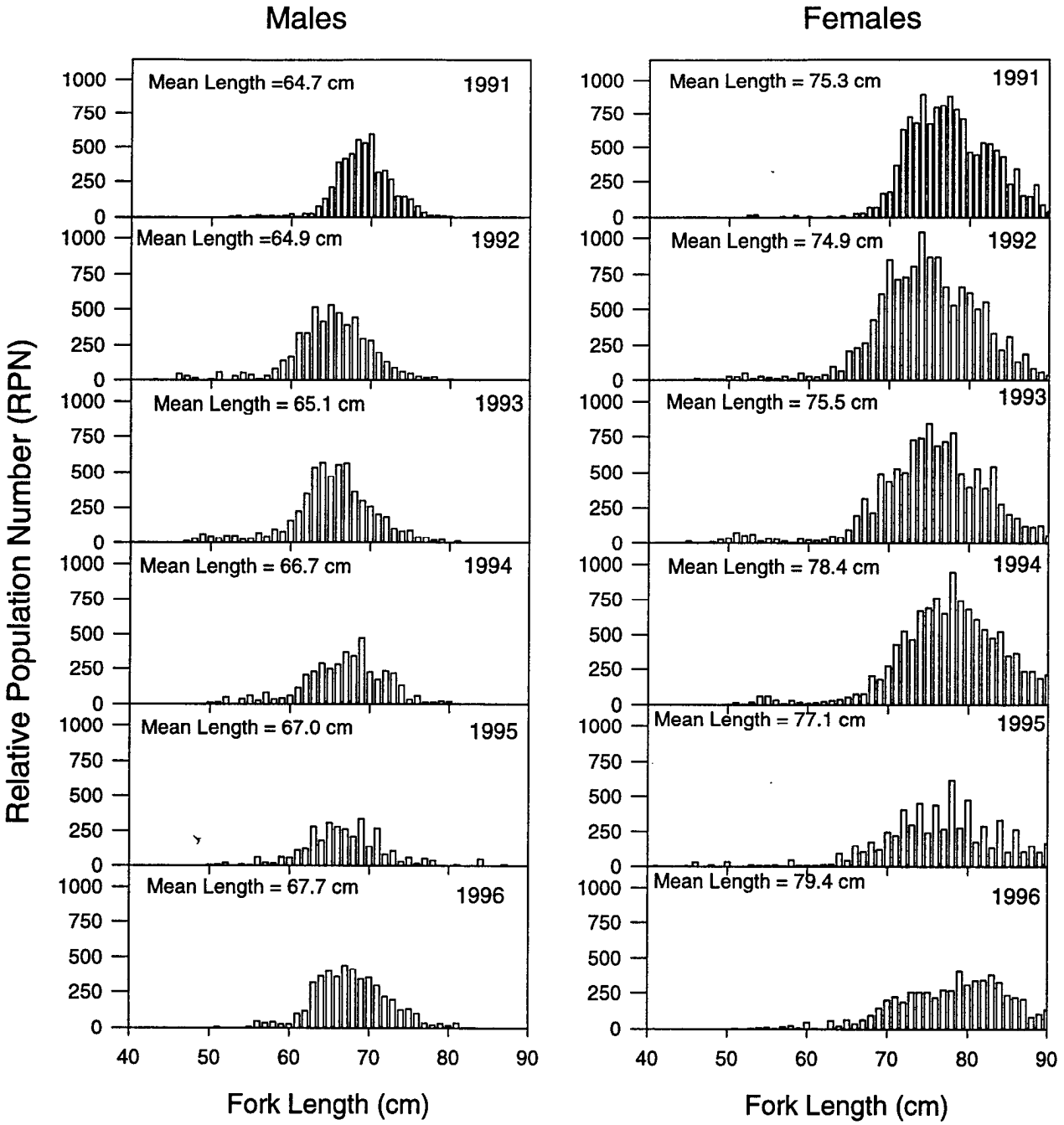

Figure 3h.--Sablefish length frequencies weighted for relative population number for the East Yakutat slope by sex, 1991-96.

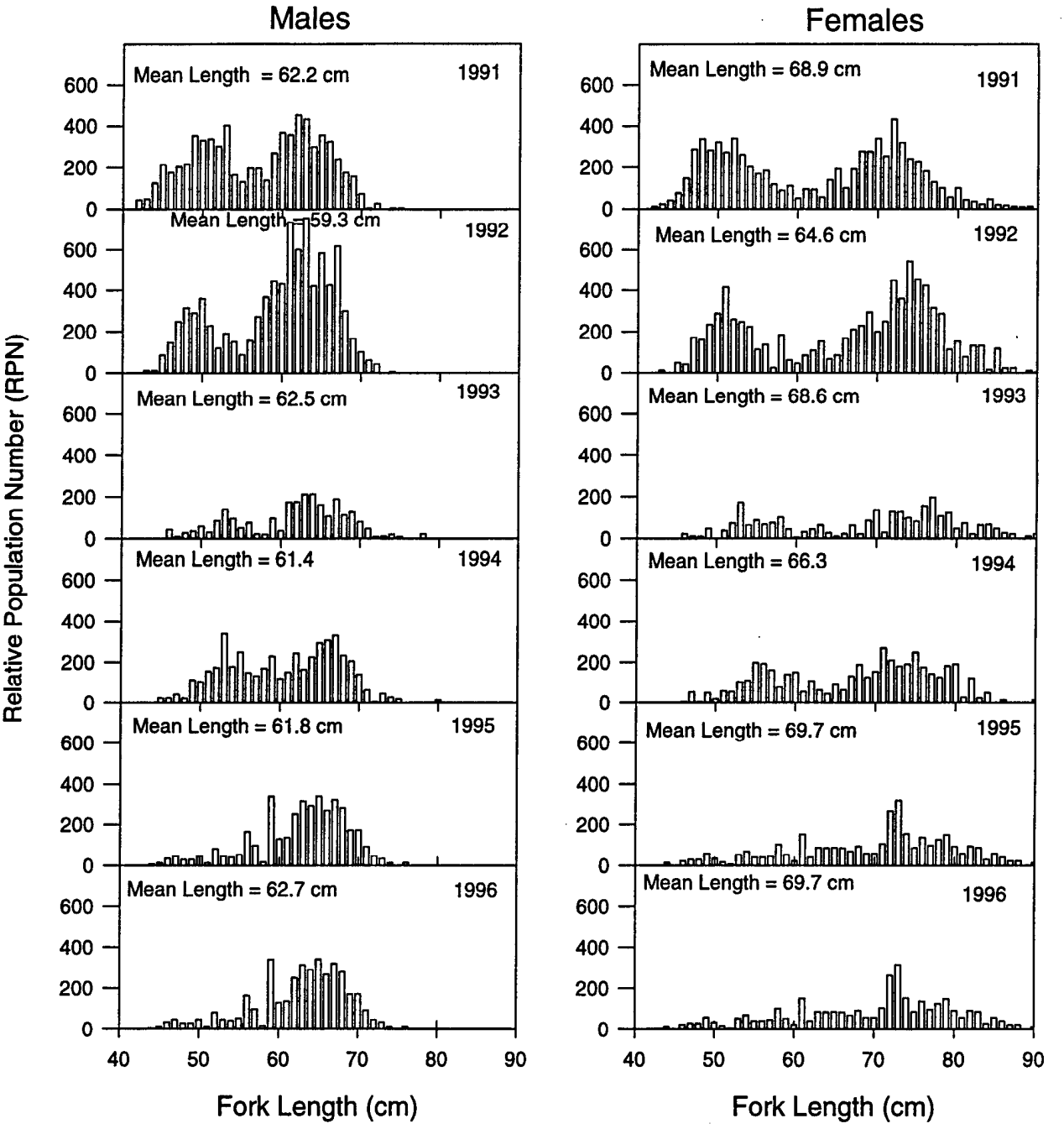

Figure 3i.--Sablefish length frequencies weighted for relative population number for the W-Grounds by sex, 1991-96.

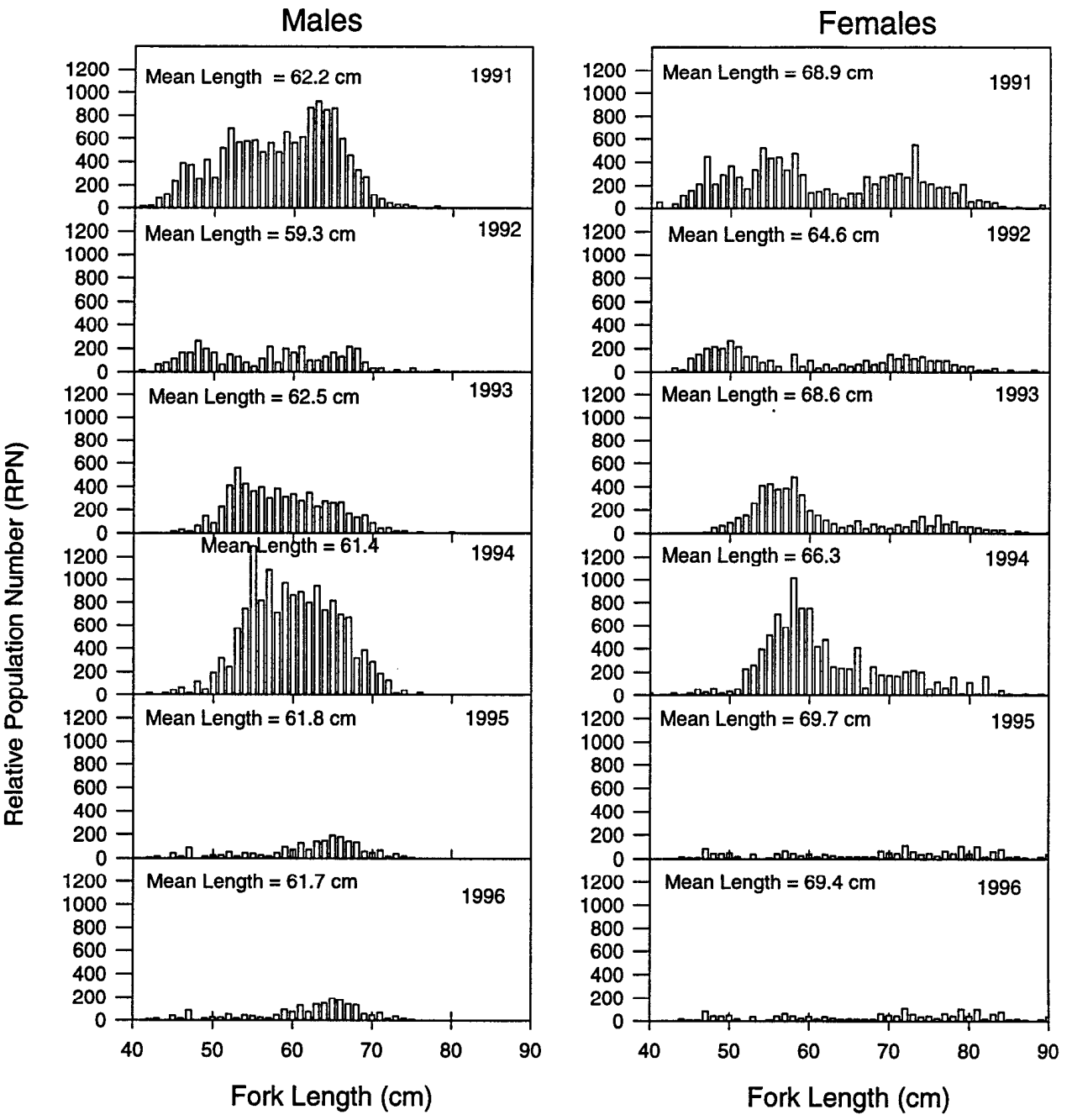

Figure 3j.--Sablefish length frequencies weighted for relative population number for Yakutat Valley by sex, 1991-96.

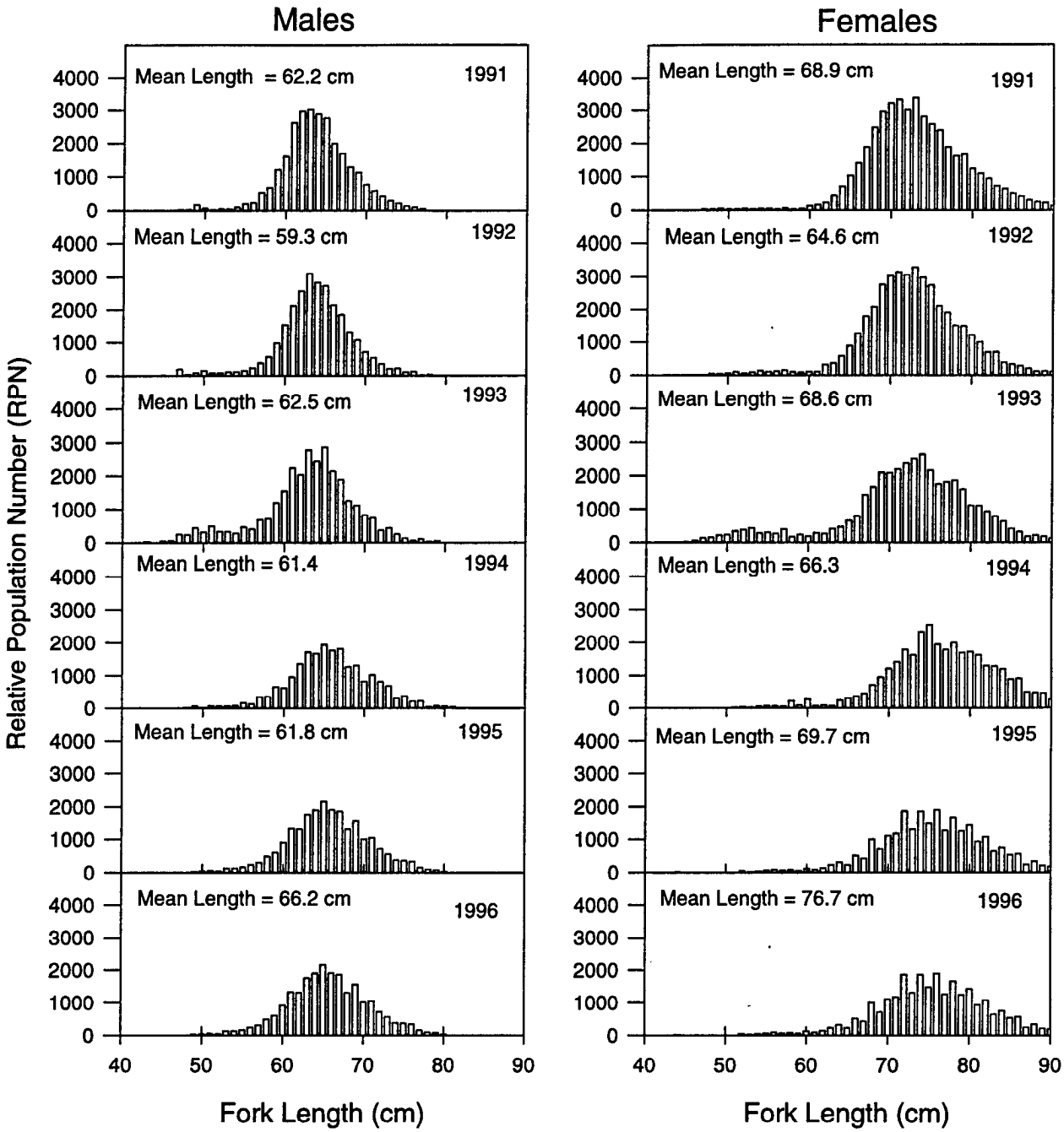

Figure 3k.--Sablefish length frequencies weighted for relative population number for the Southeast slope by sex, 1991-96.

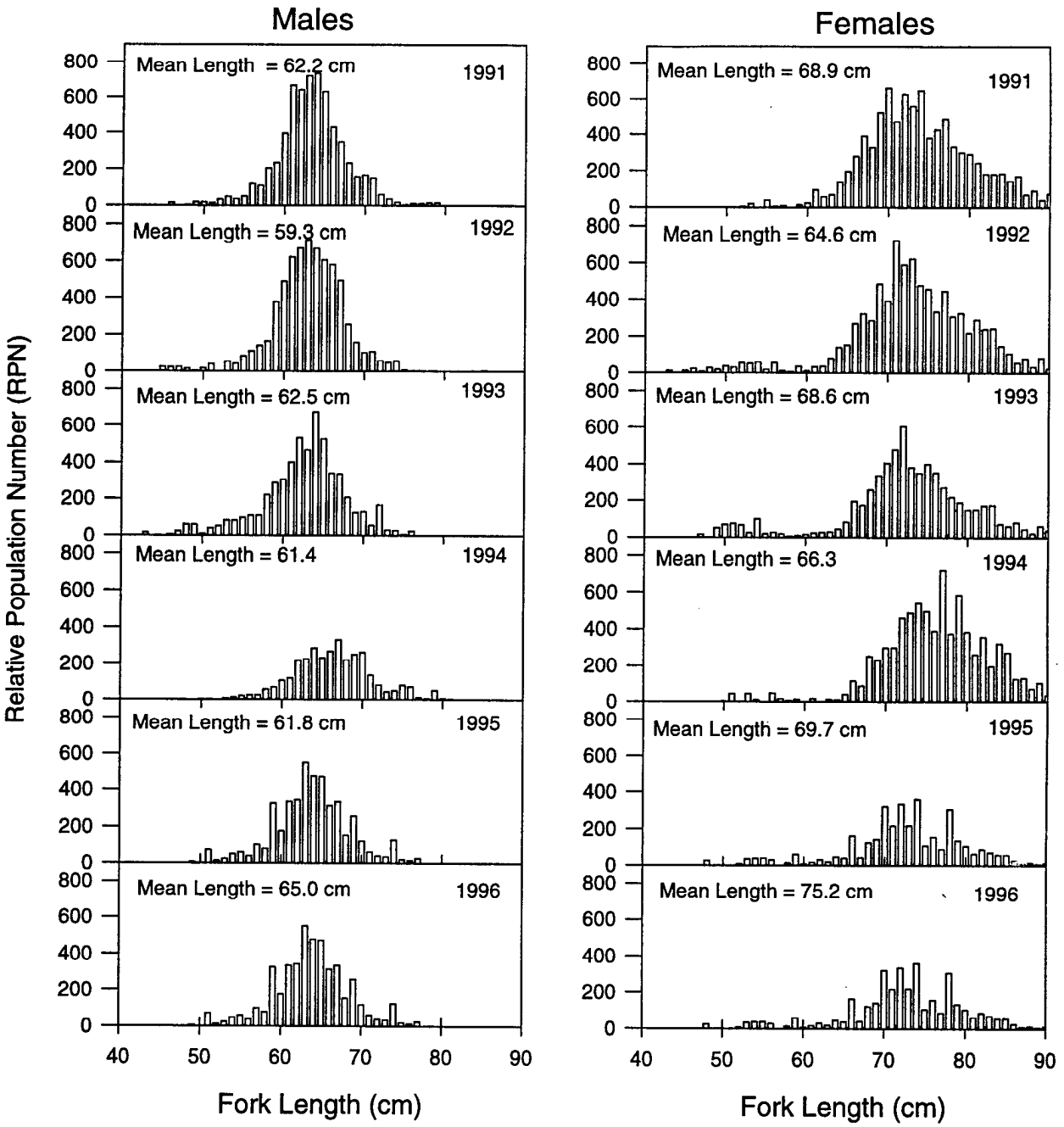

Figure 31.--Sablefish length frequencies weighted for relative population number for Spencer Gully by sex, 1991-96.

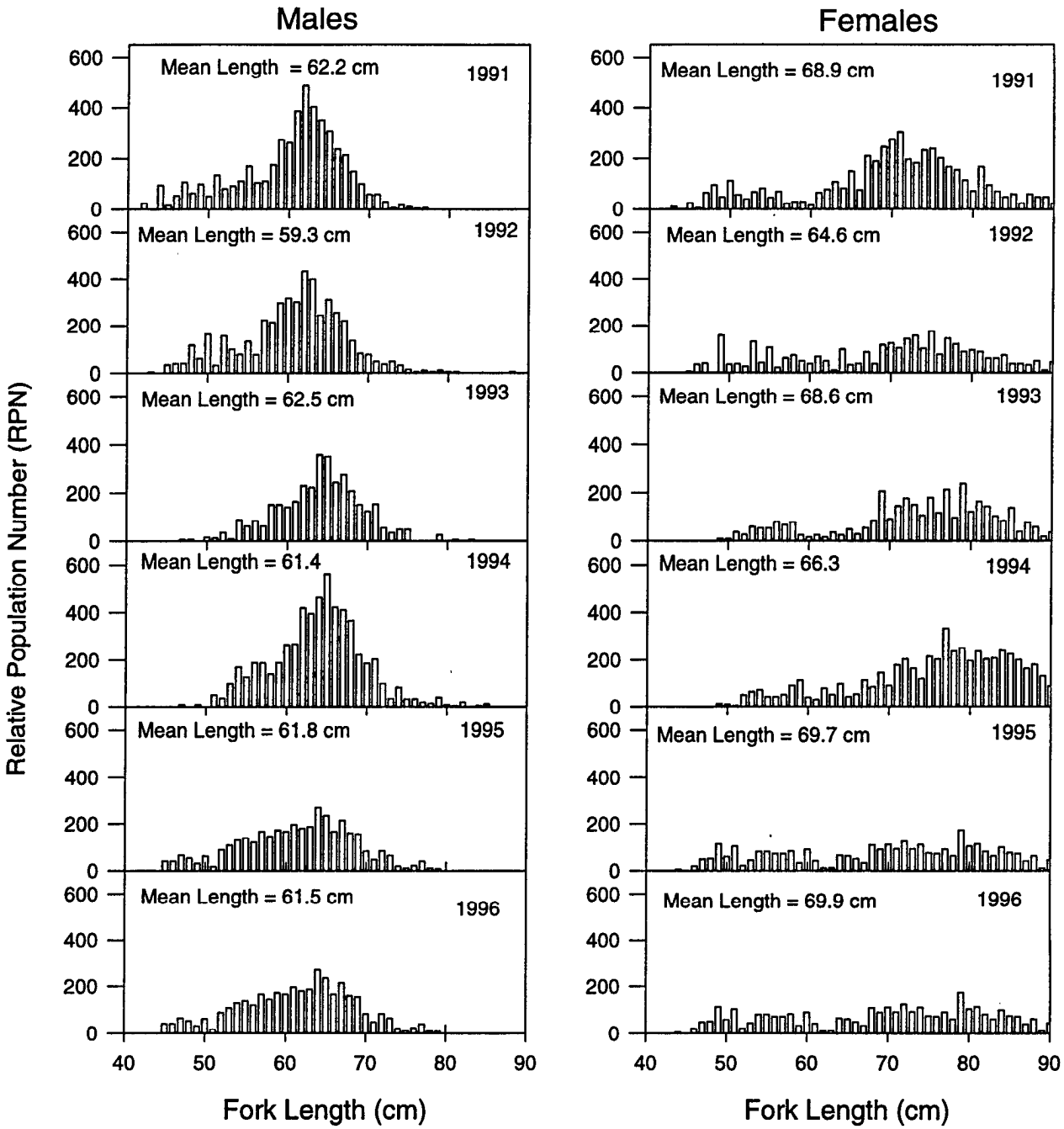

Figure 3m.--Sablefish length frequencies weighted for relative population number for Ommaney Trench by sex, 1991-96.

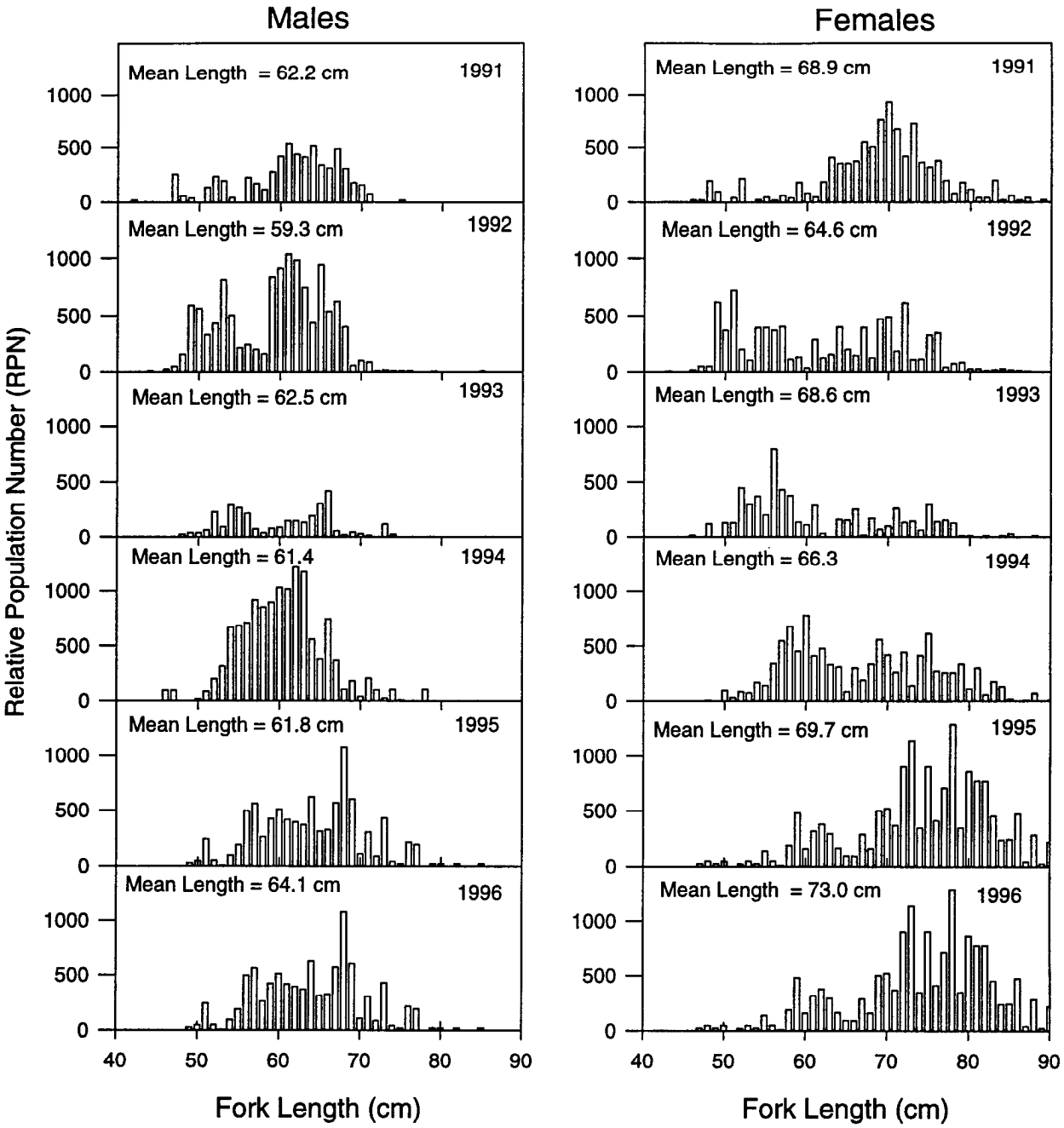

Figure 3n.--Sablefish length frequencies weighted for relative population number for Dixon Entrance by sex, 1991-96.

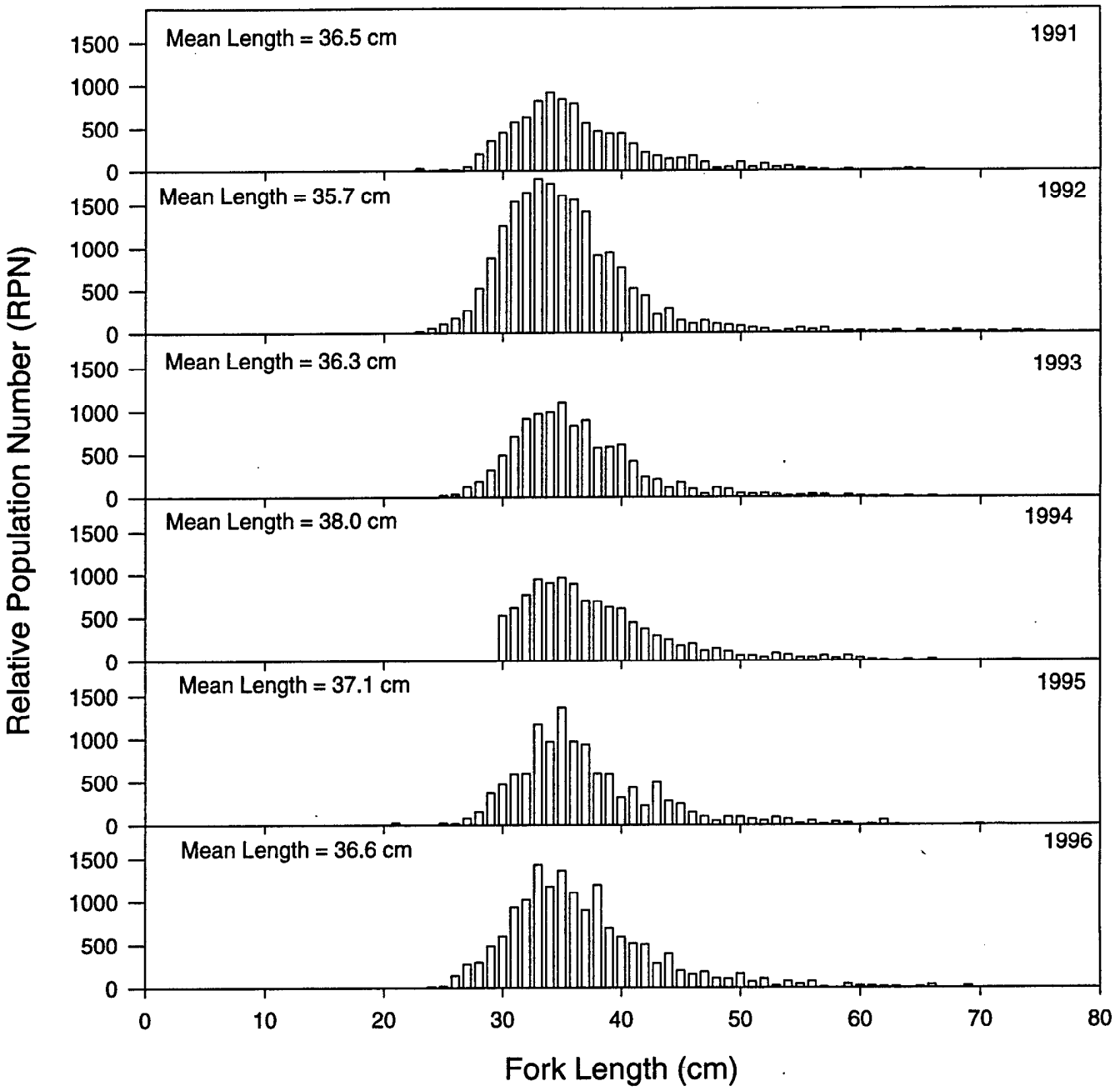

Figure 4a.--Shortspine thornyhead length frequencies weighted by relative population number for the Shumagin slope, 1991-96.

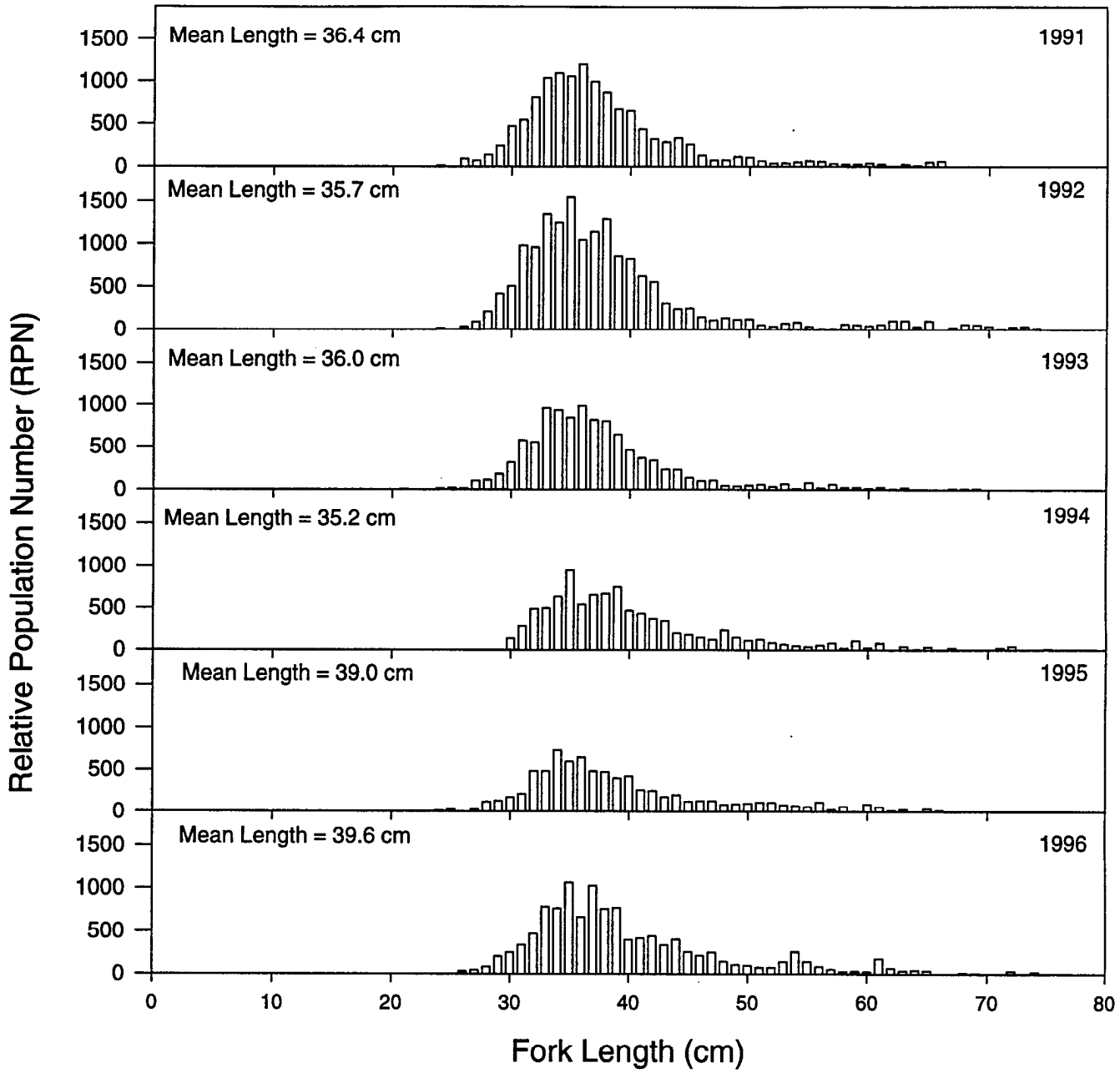

Figure 4b.--Shortspine thornyhead length frequencies weighted by relative population number for the Chirikof slope, 1991-96.

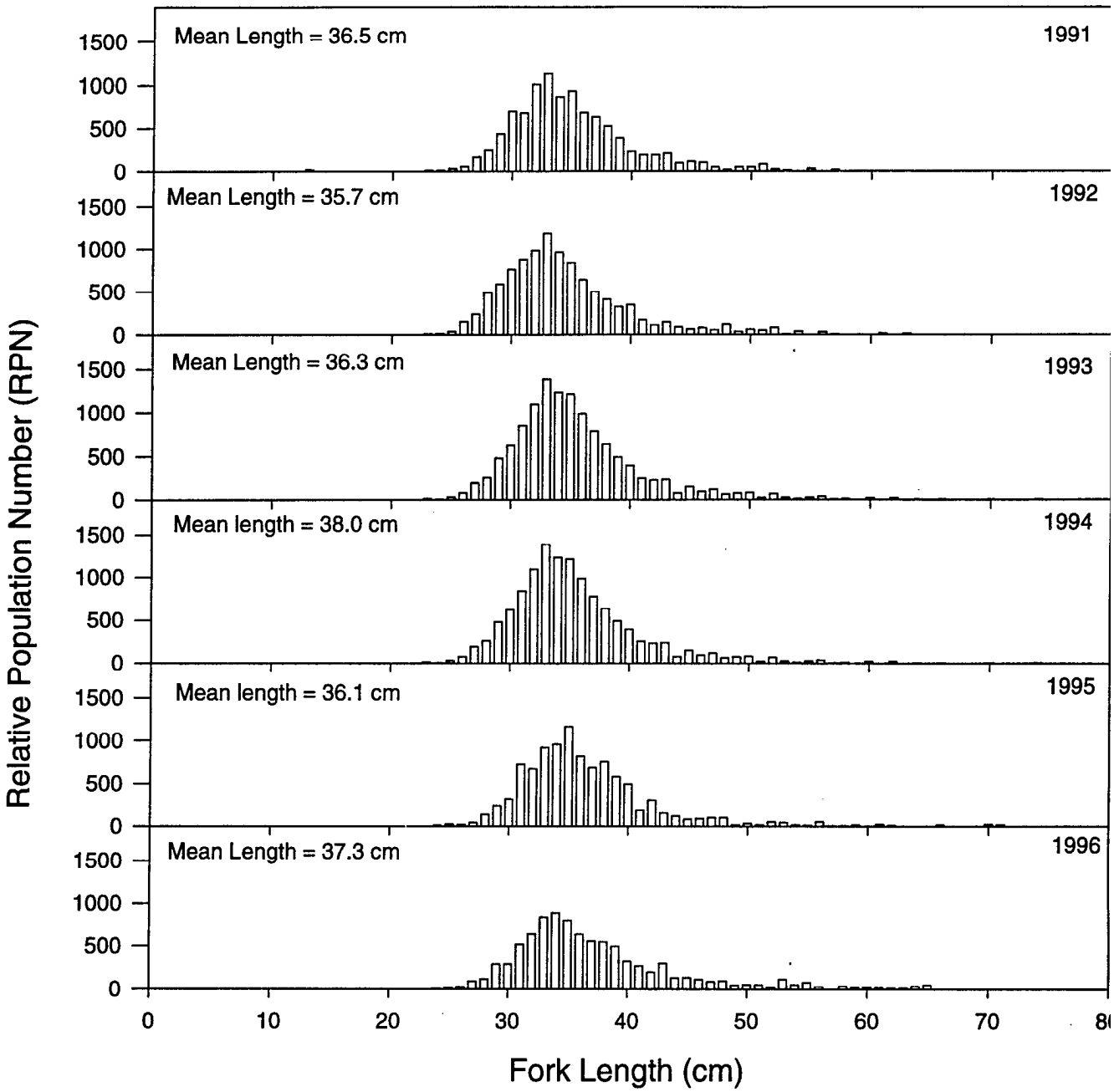

Figure 4c.--Shortspine thornyhead length frequencies weighted by relative population number for the Kodiak slope, 1991-96.

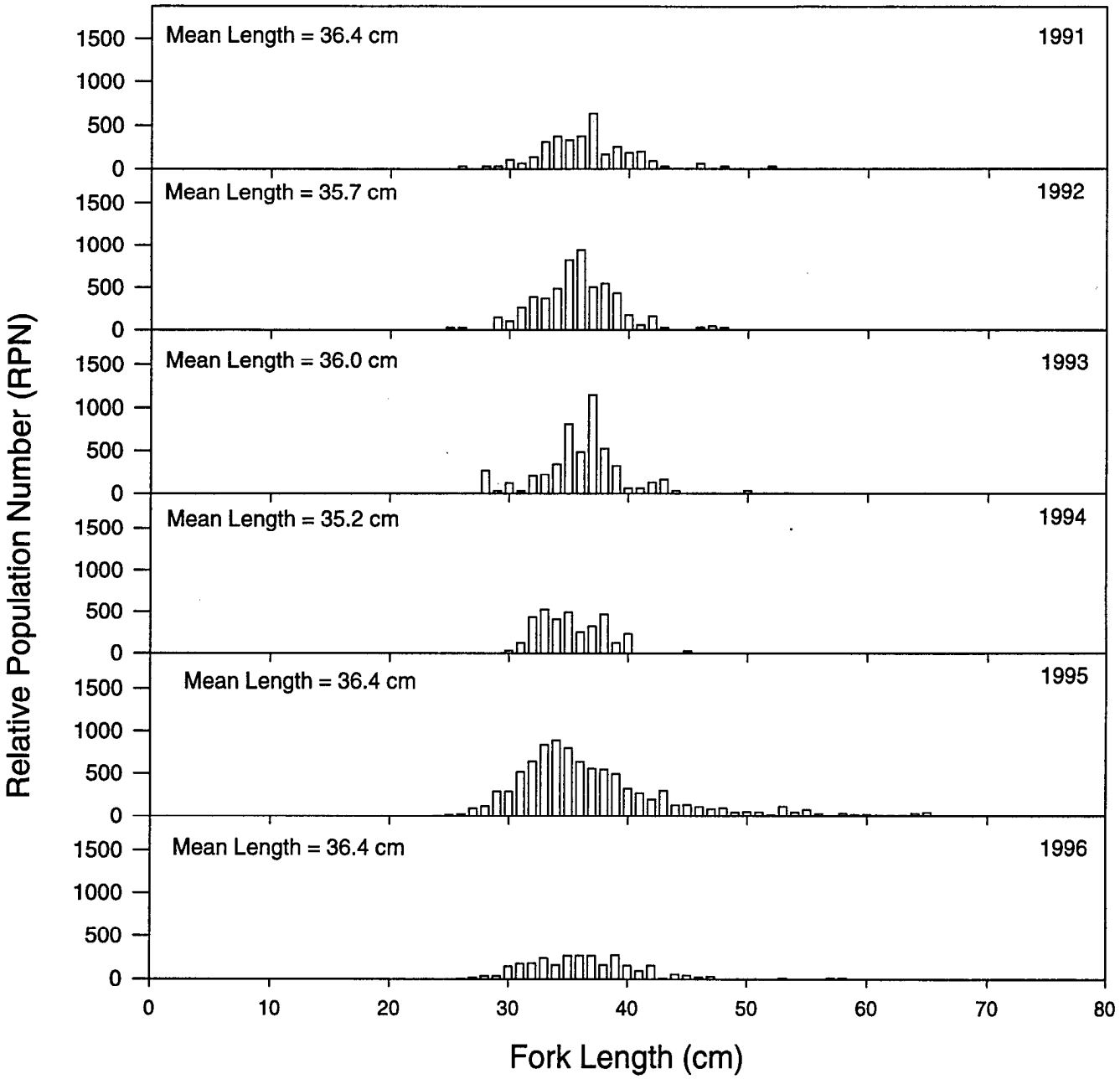

Figure 4d.--Shortspine thornyhead length frequencies weighted by relative population number for Amatulli Gully, 1991-96.

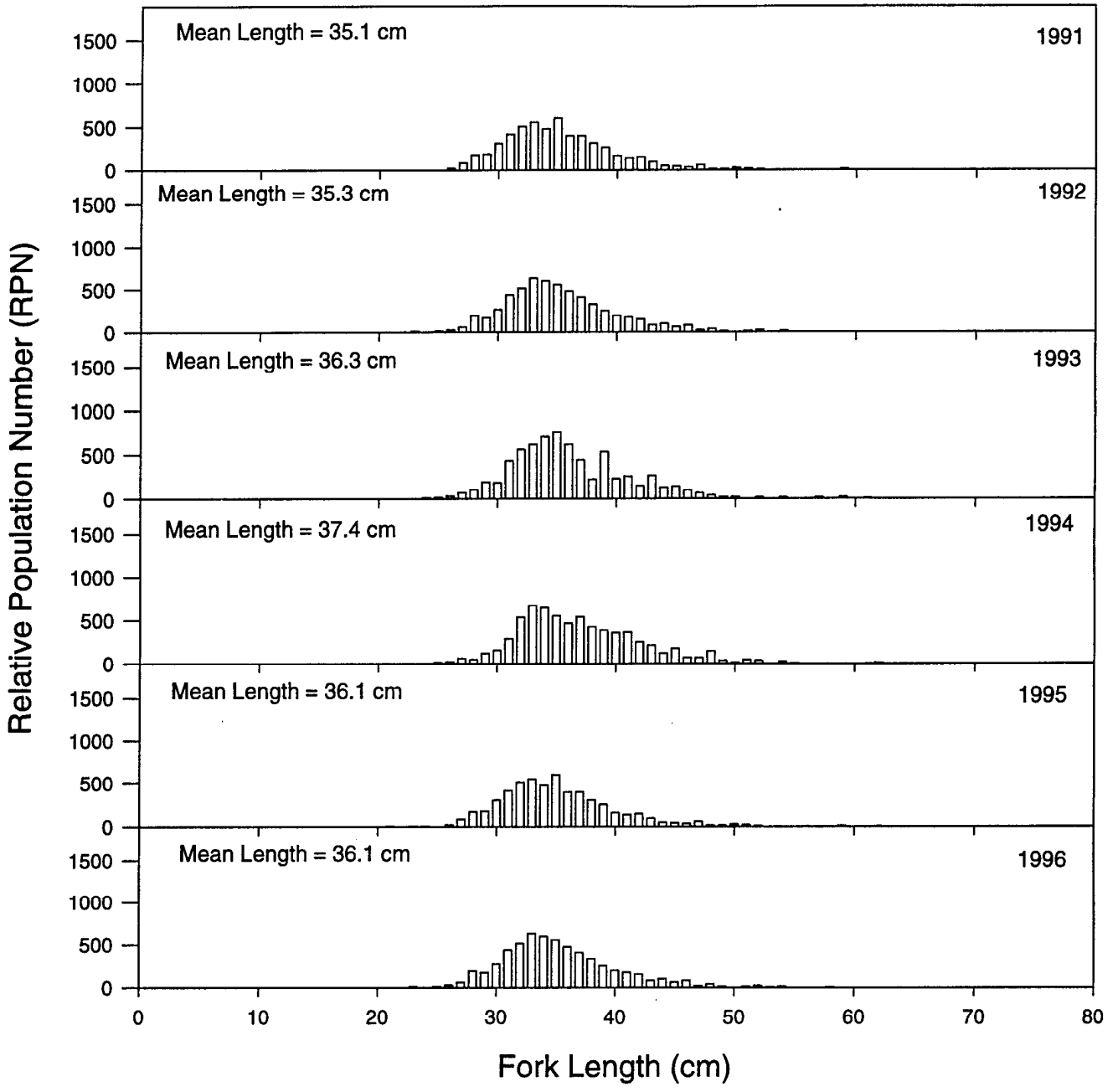

Figure 4e.--Shortspine thornyhead length frequencies weighted by relative population number for the West Yakutat slope, 1991-96.

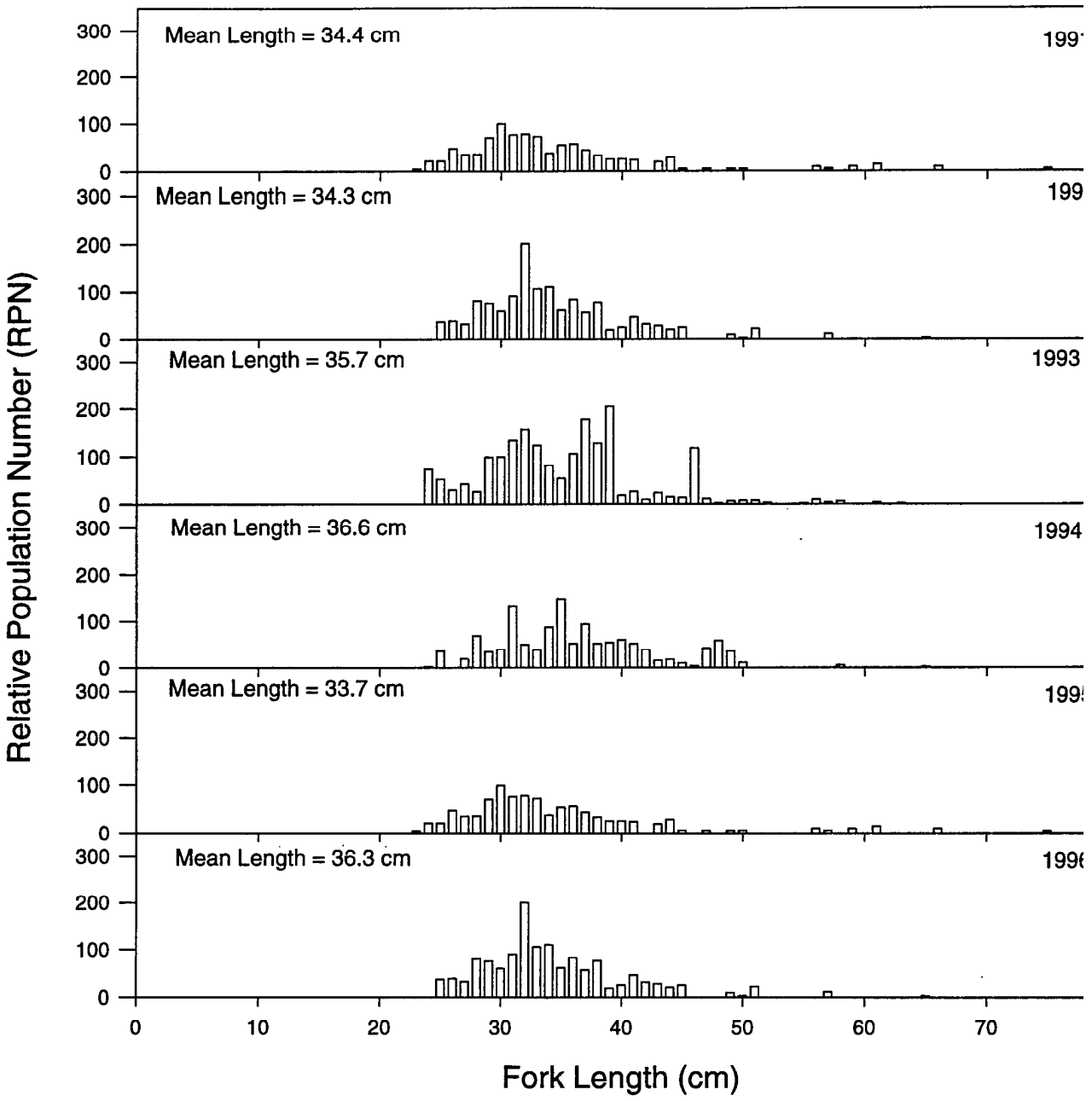

Figure 4f.--Shortspine thornyhead length frequencies weighted by relative population number for the East Yakutat slope, 1991-96.

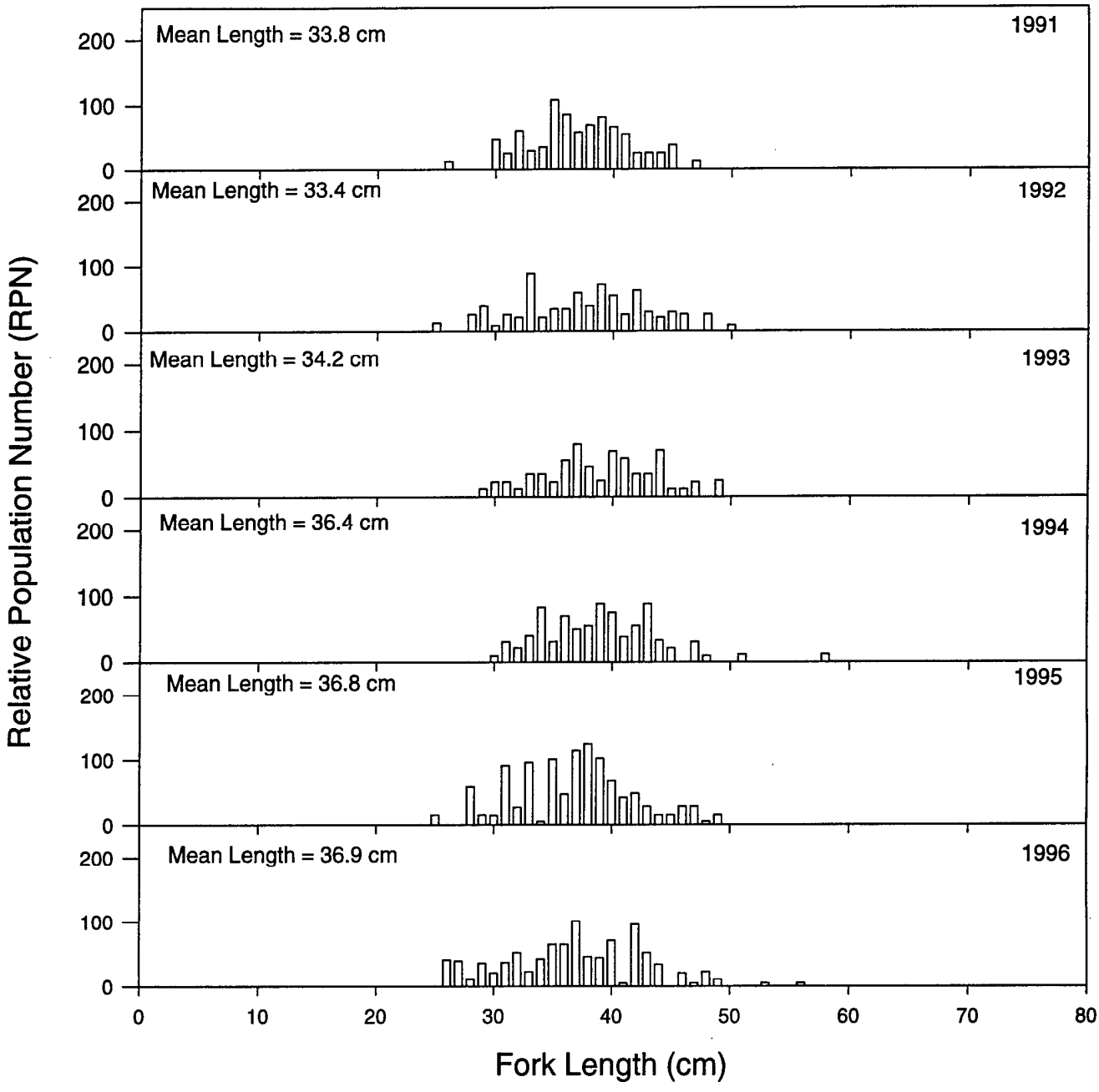

Figure 4g.--Shortspine thornyhead length frequencies weighted by relative population number for the W-Grounds. 1991-96.

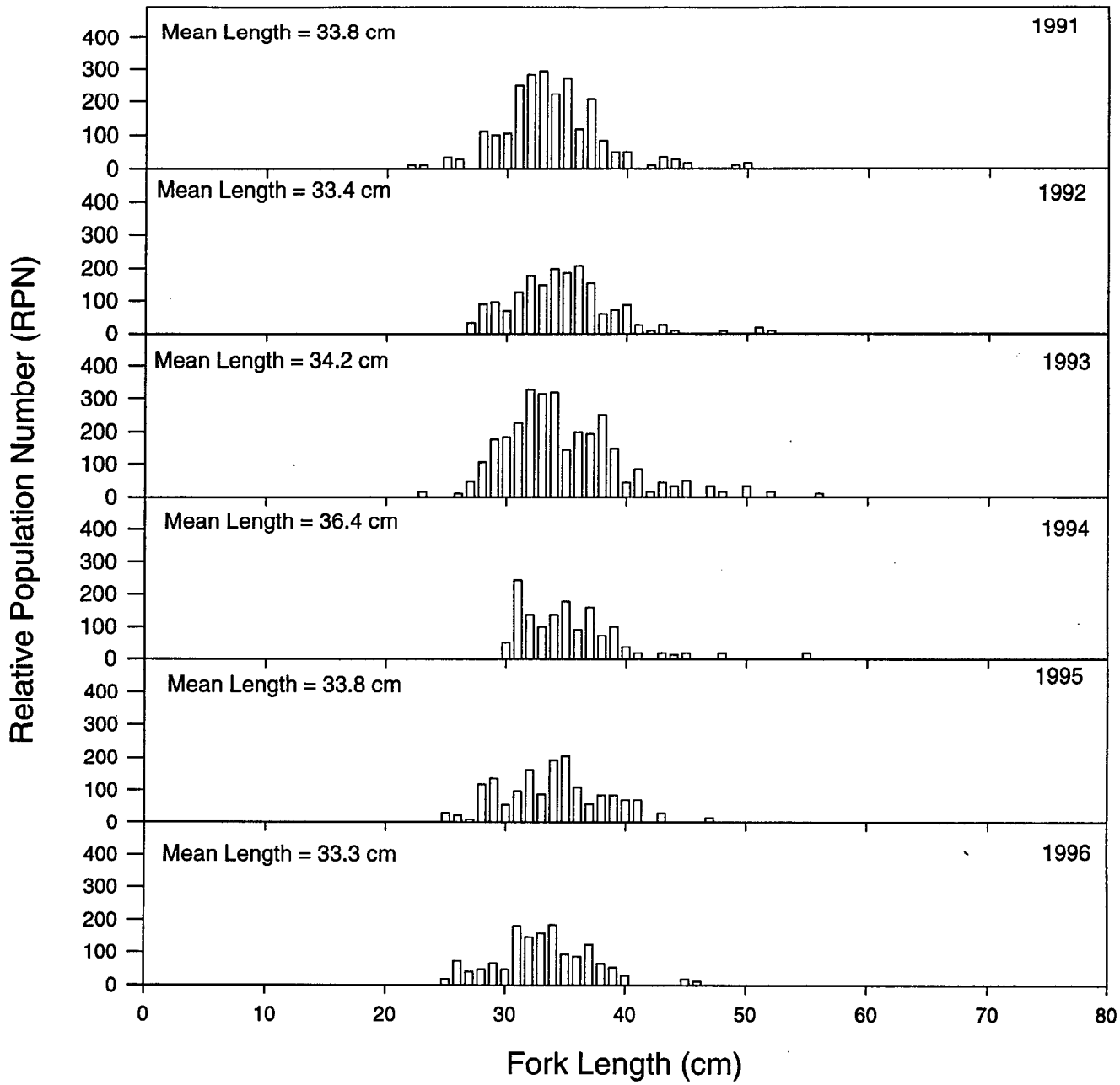

Figure 4h.--Shortspine thornyhead length frequencies weighted by relative population number for Yakutat Valley, 1991-96.

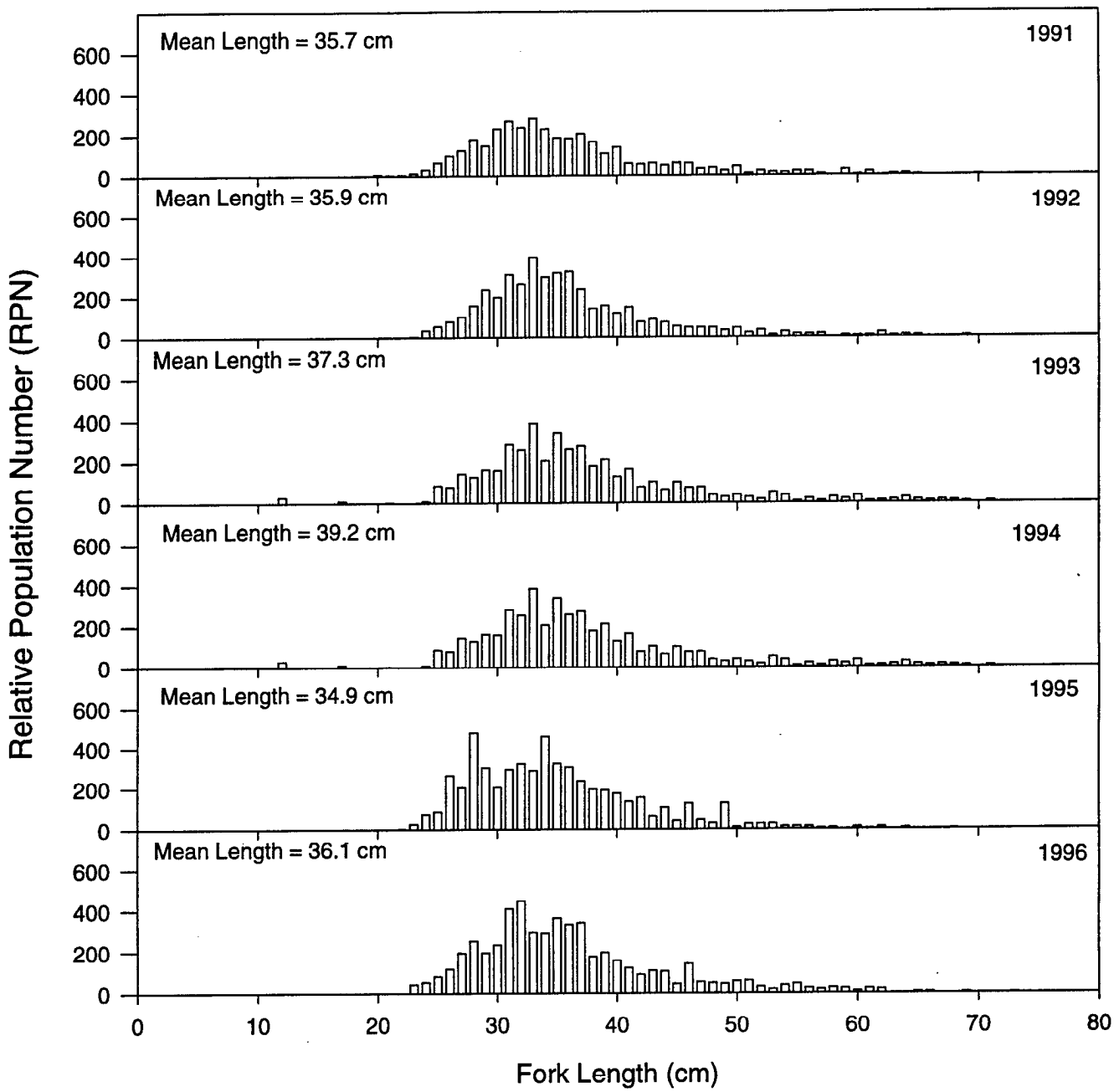

Figure 4i.--Shortspine thornyhead length frequencies weighted by relative population number for the Southeast slope, 1991-96.

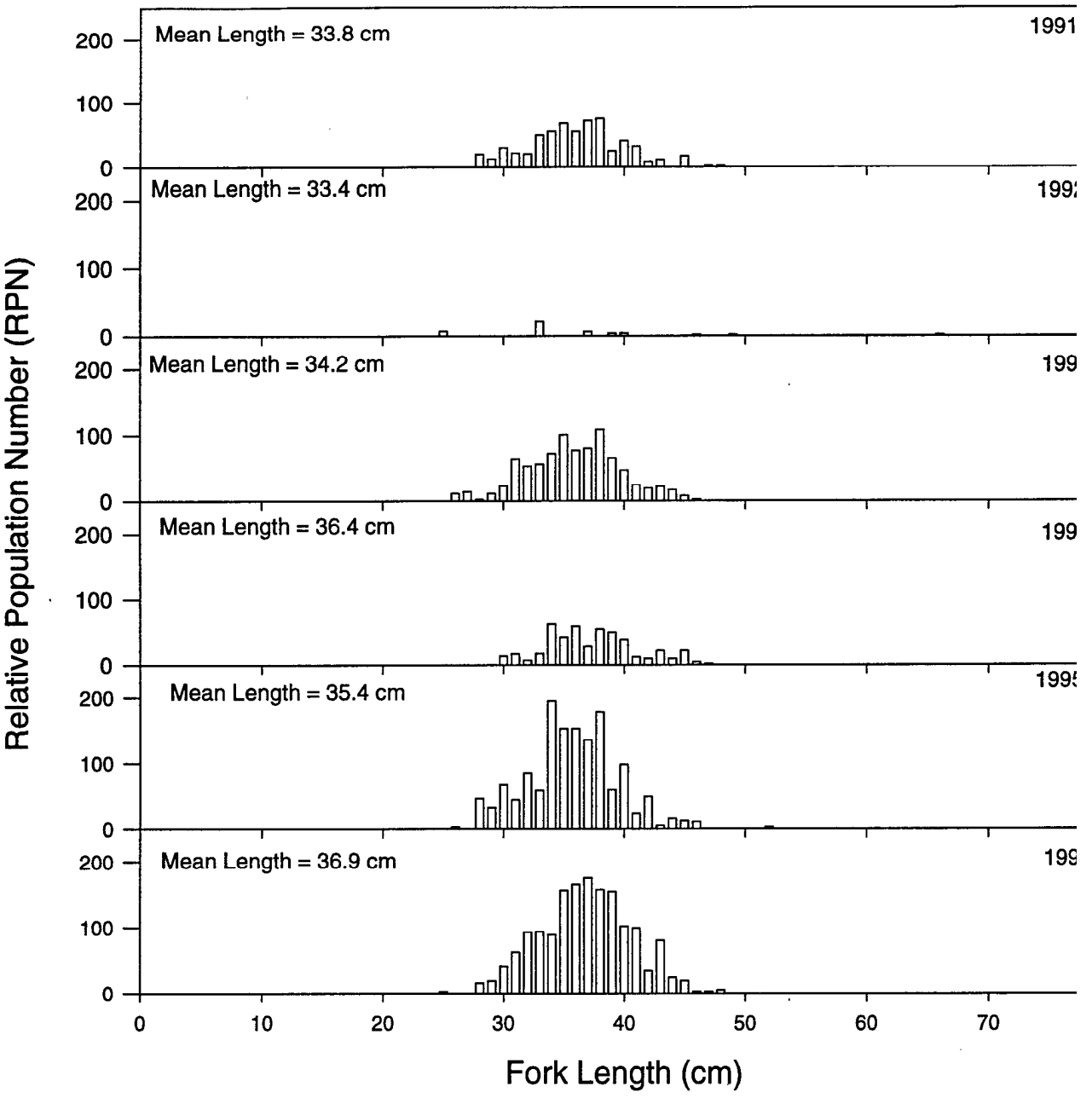

Figure 4j .--Shortspine thornyhead length frequencies weighted by relative population number for Spencer Gully, 1991-96.

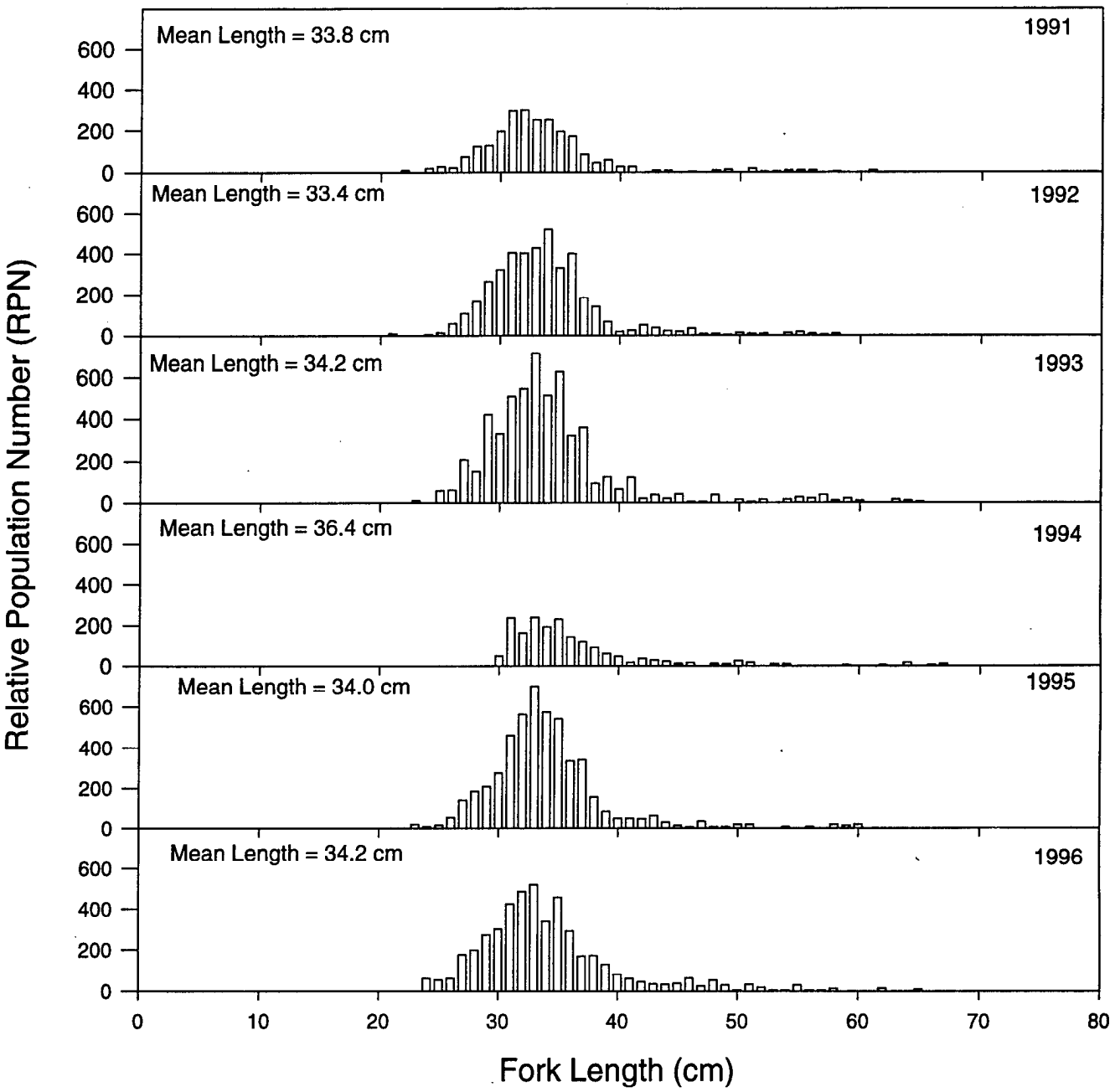

Figure 4k.--Shortspine thornyhead length frequencies weighted by relative population number for Ommaney Trench, 1991-96.

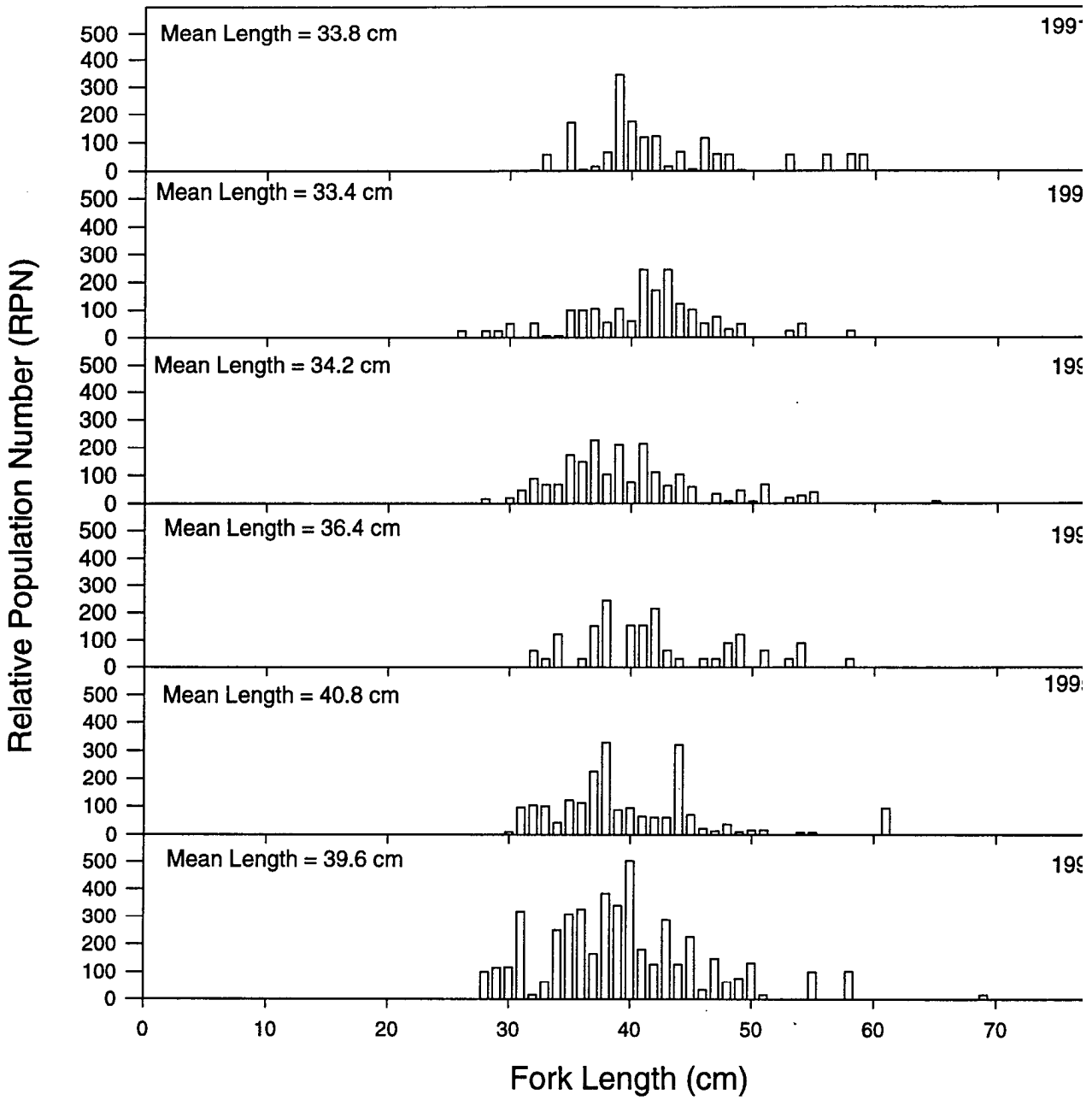

Figure 4l.--Shortspine thornyhead length frequencies weighted by relative population number for Dixon Entrance, 1991-96.

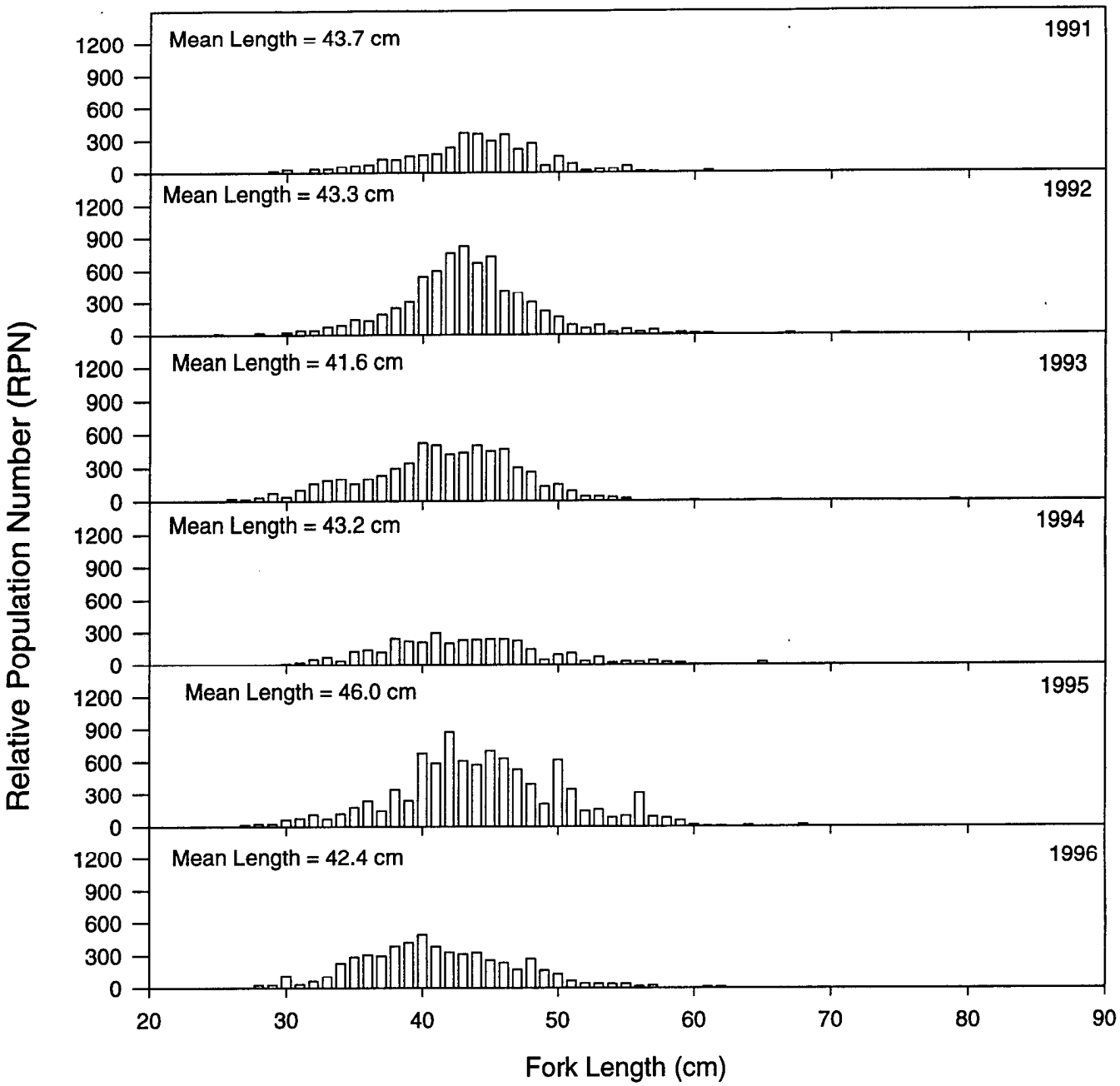

Figure 5a.--Rougheye rockfish length frequencies weighted by relative population number for the Shumagin slope, 1991-96.

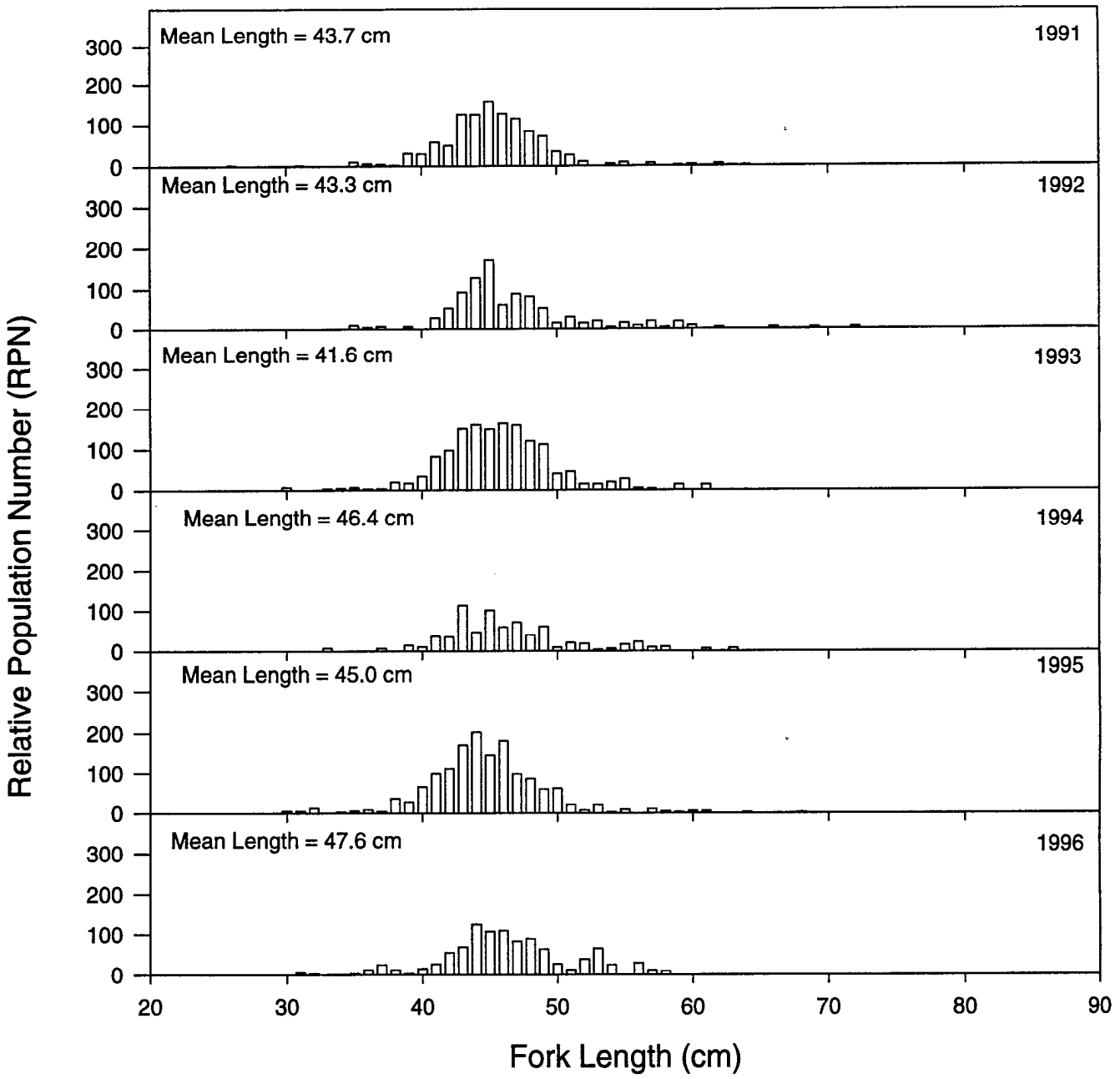

Figure Sb.--Rougheye rockfish length frequencies weighted by relative population number for the Chirikof slope, 1991-96.

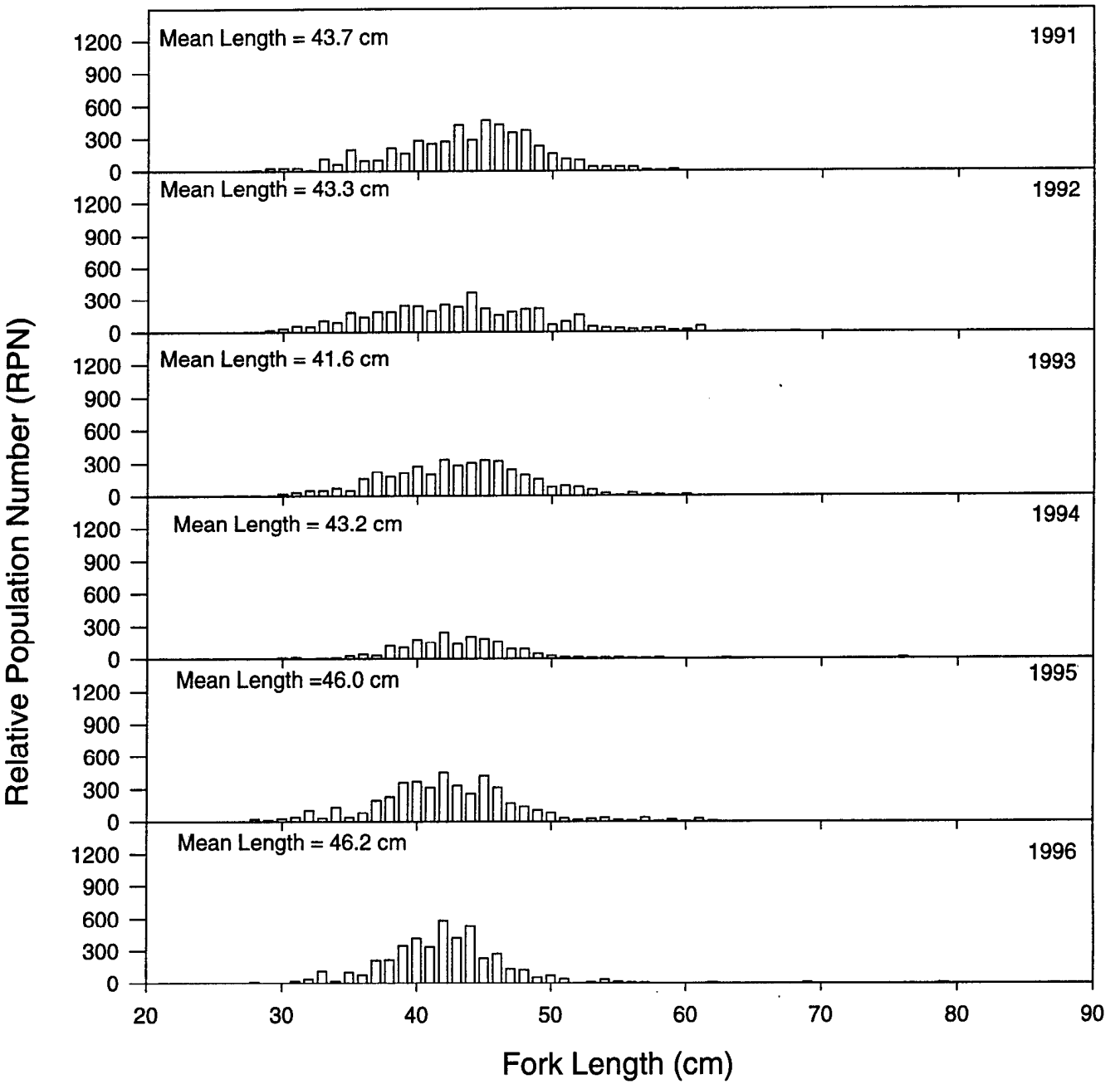

Figure Sc.--Rougheye rockfish length frequencies weighted by relative population number for the Kodiak slope, 1991-96.

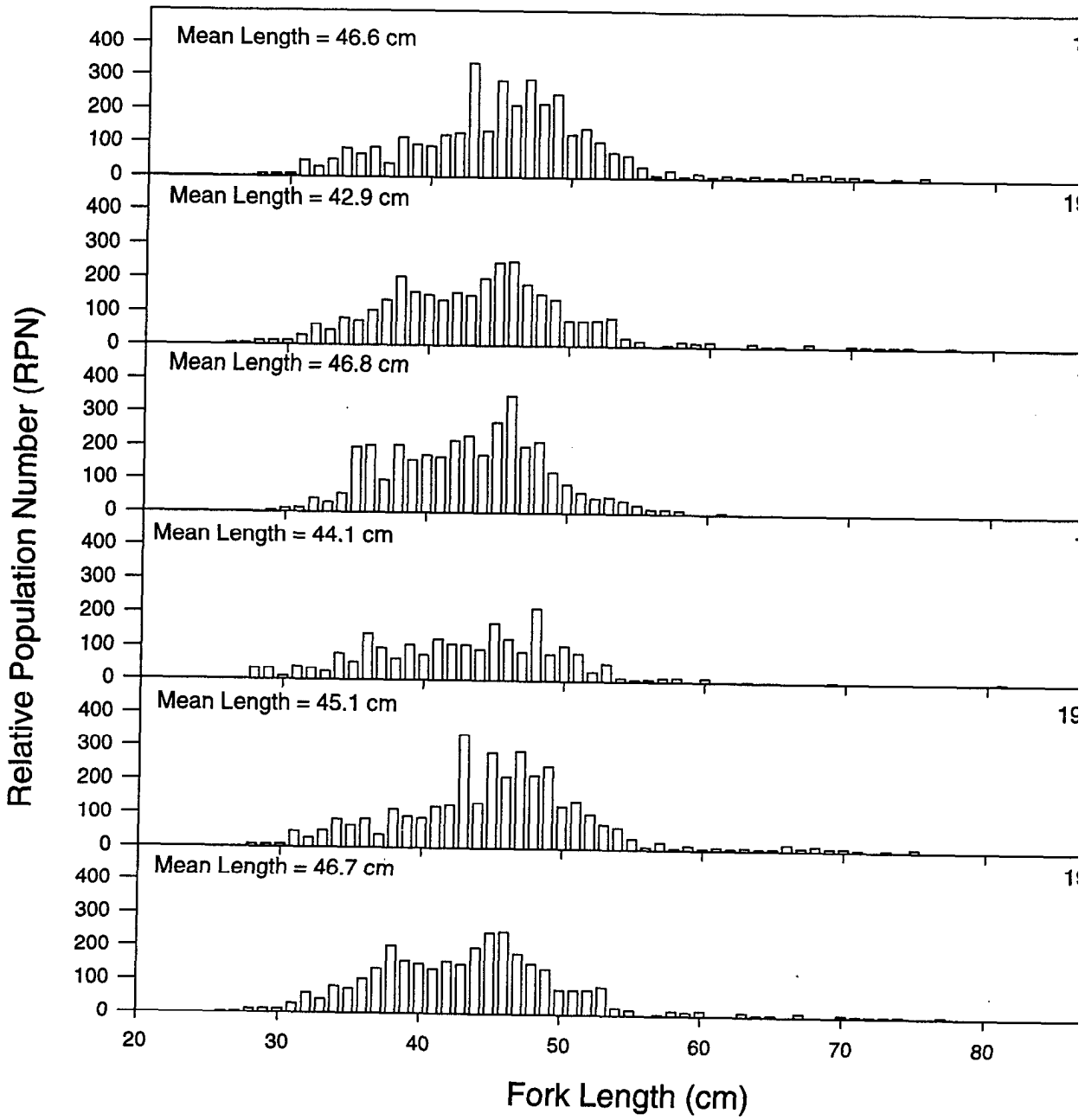

Figure 5d.--Rougheye rockfish length frequencies weighted by relative population number for the West Yakutat slope, 1991-96.

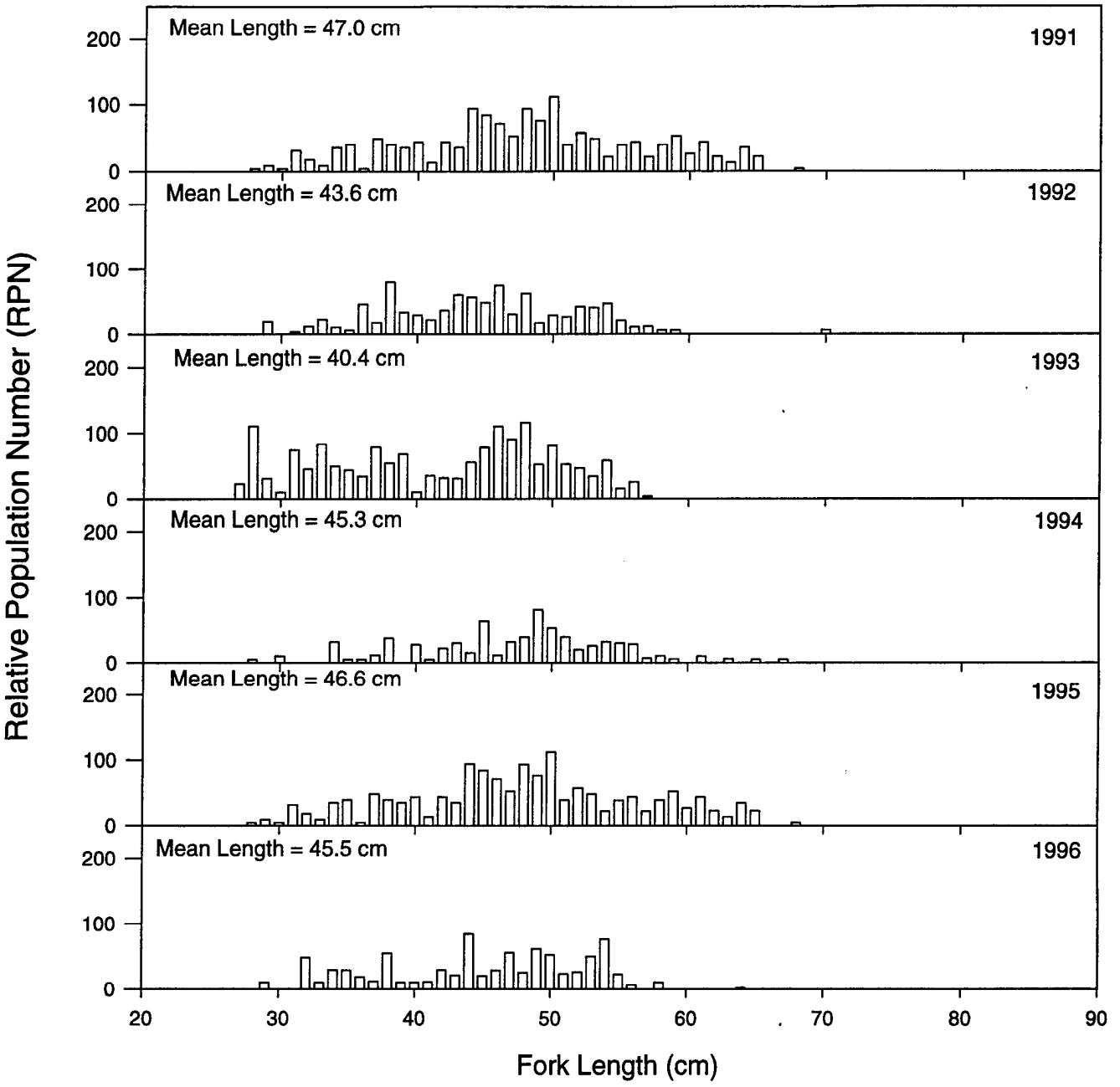

Figure Se.--Rougheye rockfish length frequencies weighted by relative population number for the East Yakutat slope, 91-96.

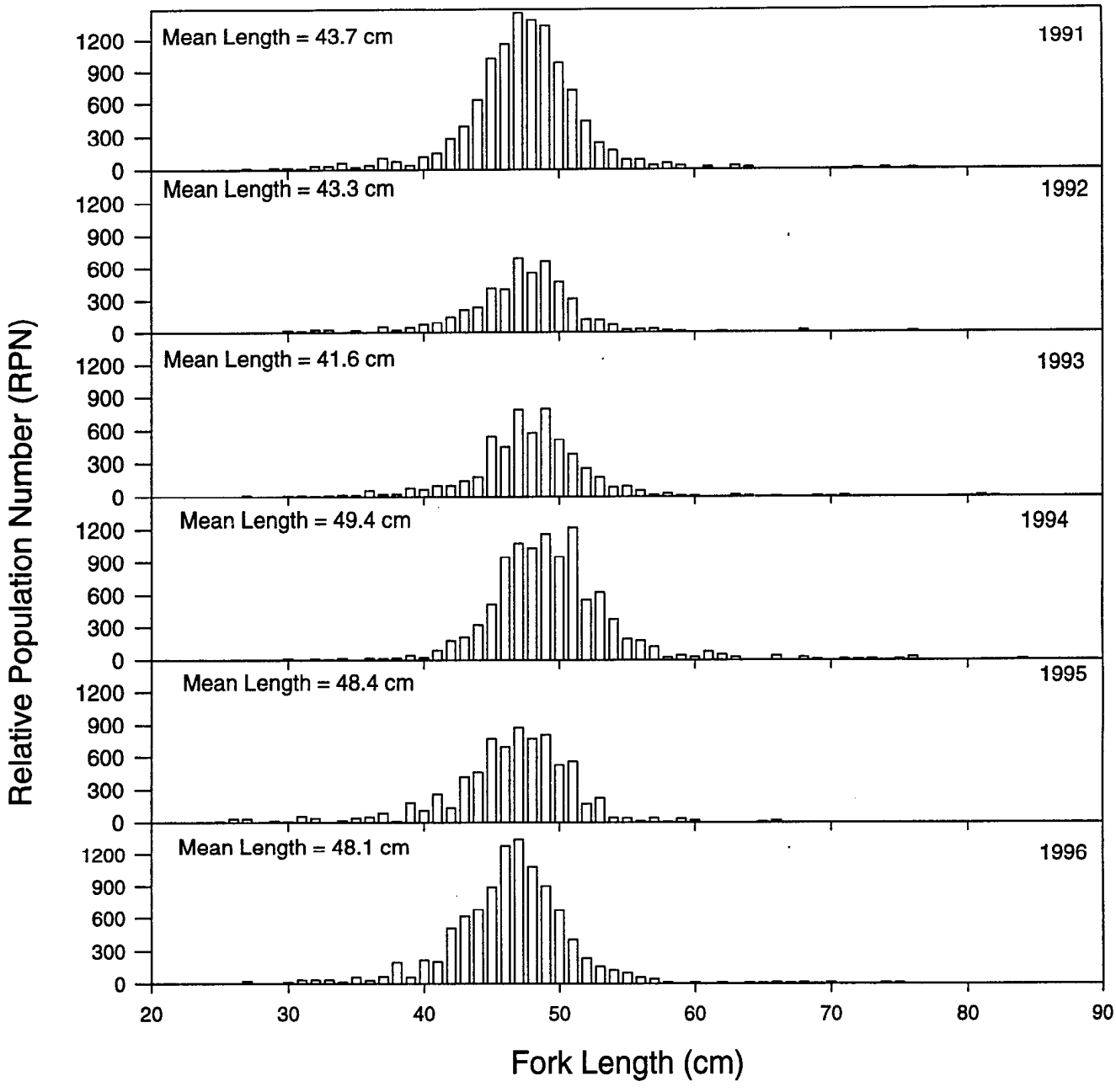

Figure 5f.--Rougheye rockfish length frequencies weighted by relative population number for the Southeast slope, 1991-96.

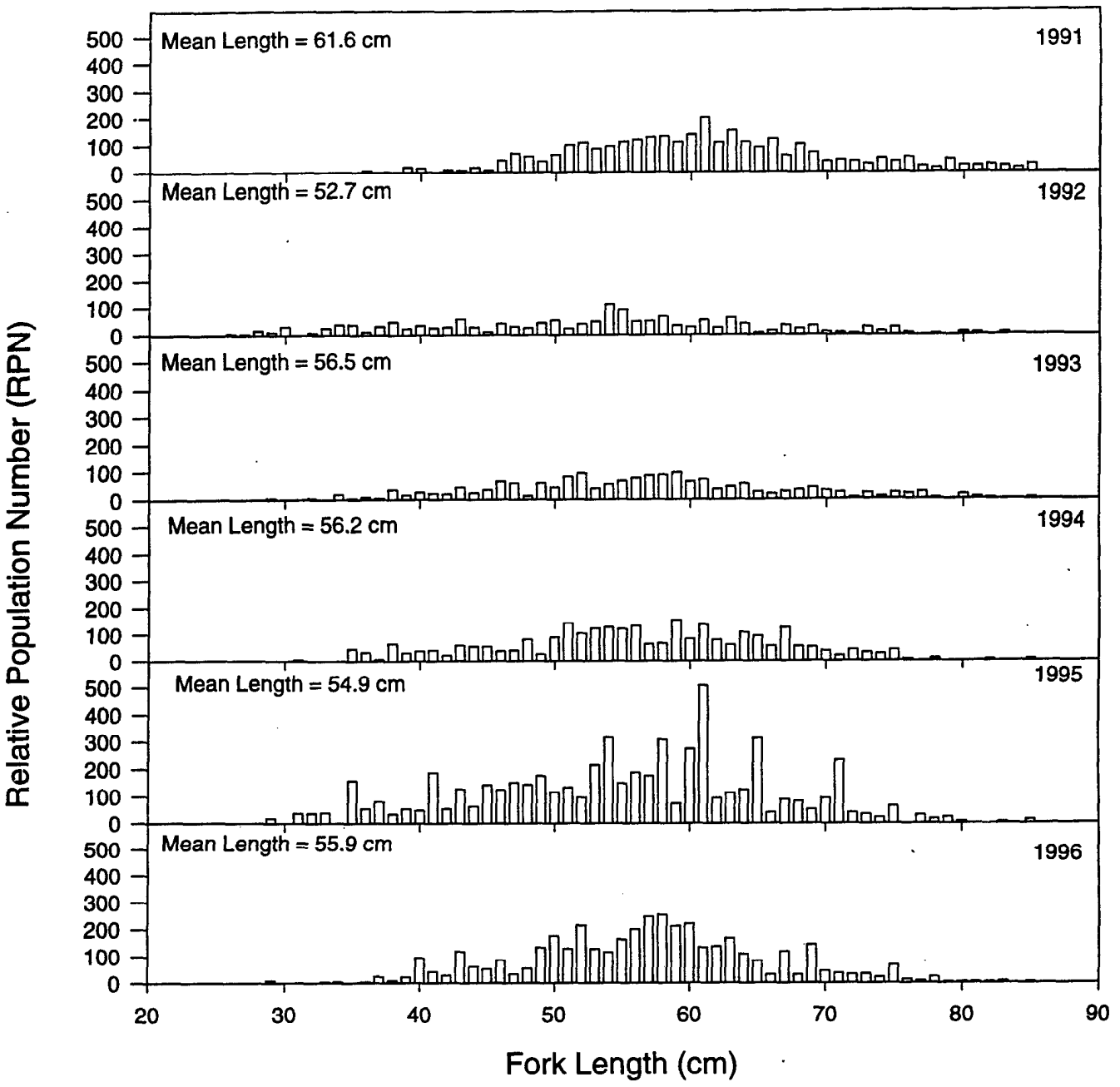

Figure 6a.--Shortraker rockfish length frequencies weighted by relative population number for the Shumagin slope, 1991-96.

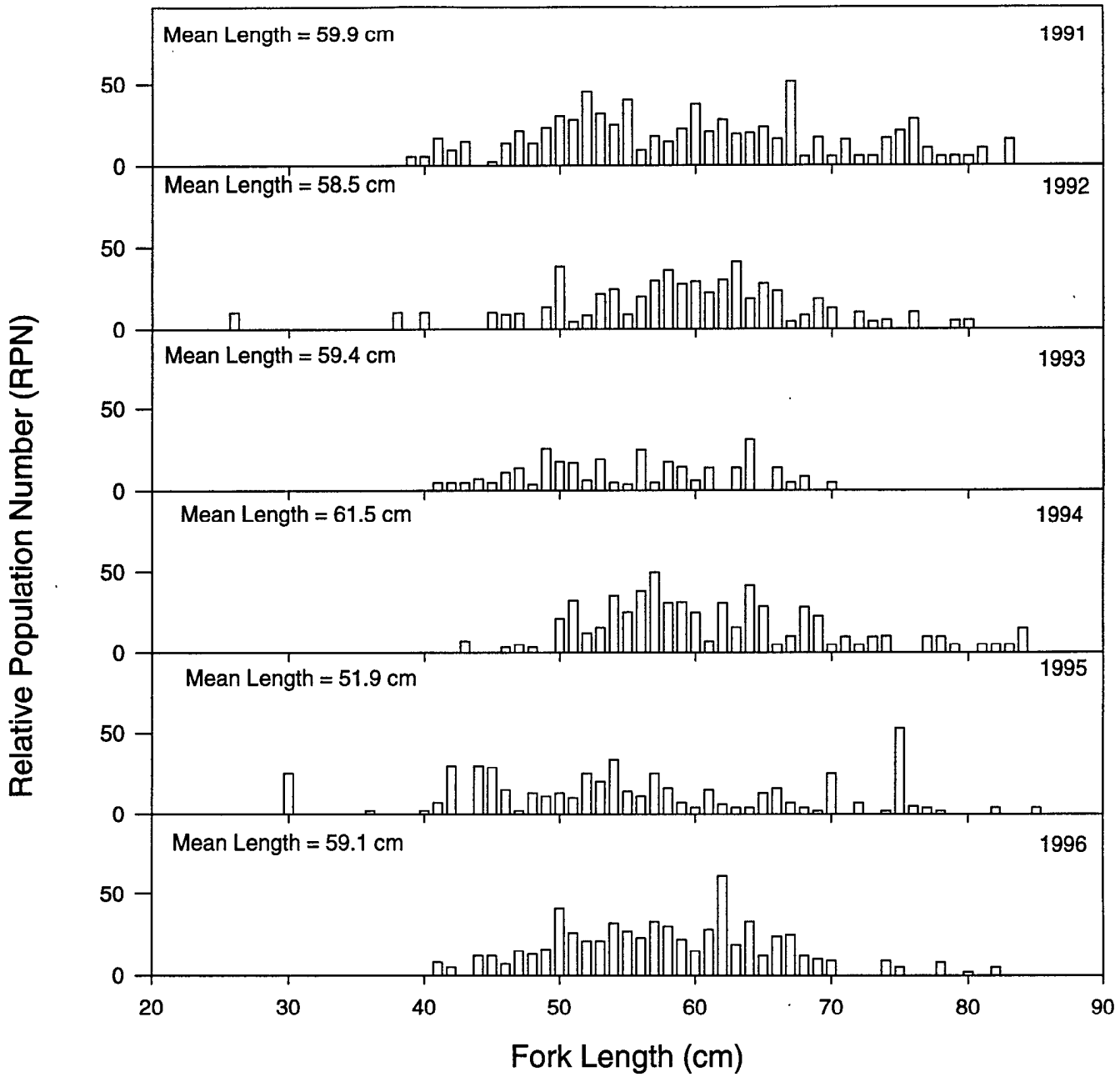

Figure 6b.--Shortraker rockfish length frequencies weighted by relative population number for the Chirikof slope, 1991-96.

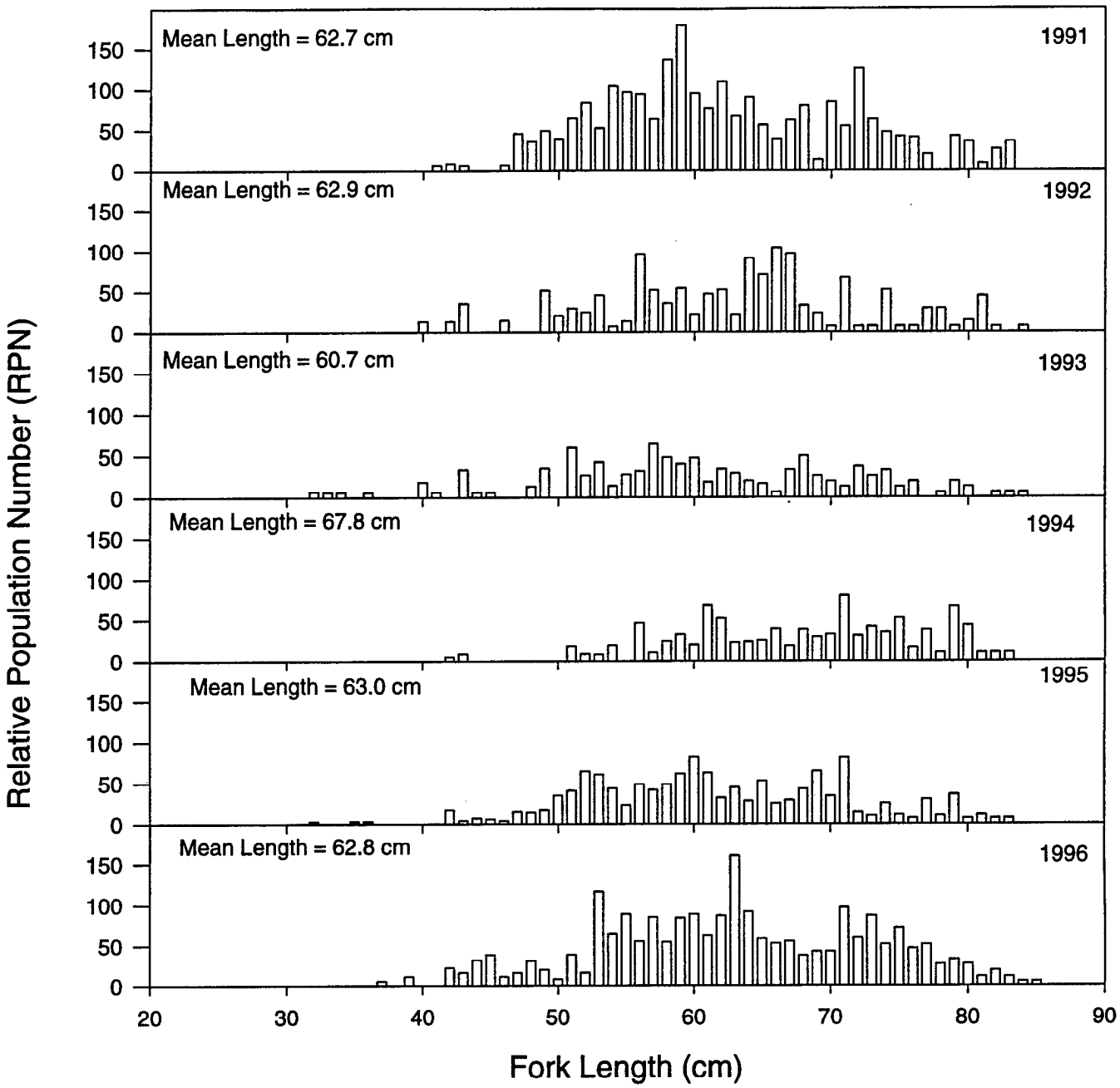

Figure 6c.--Shortraker rockfish length frequencies weighted by relative population number for the Kodiak slope. 1991-96.

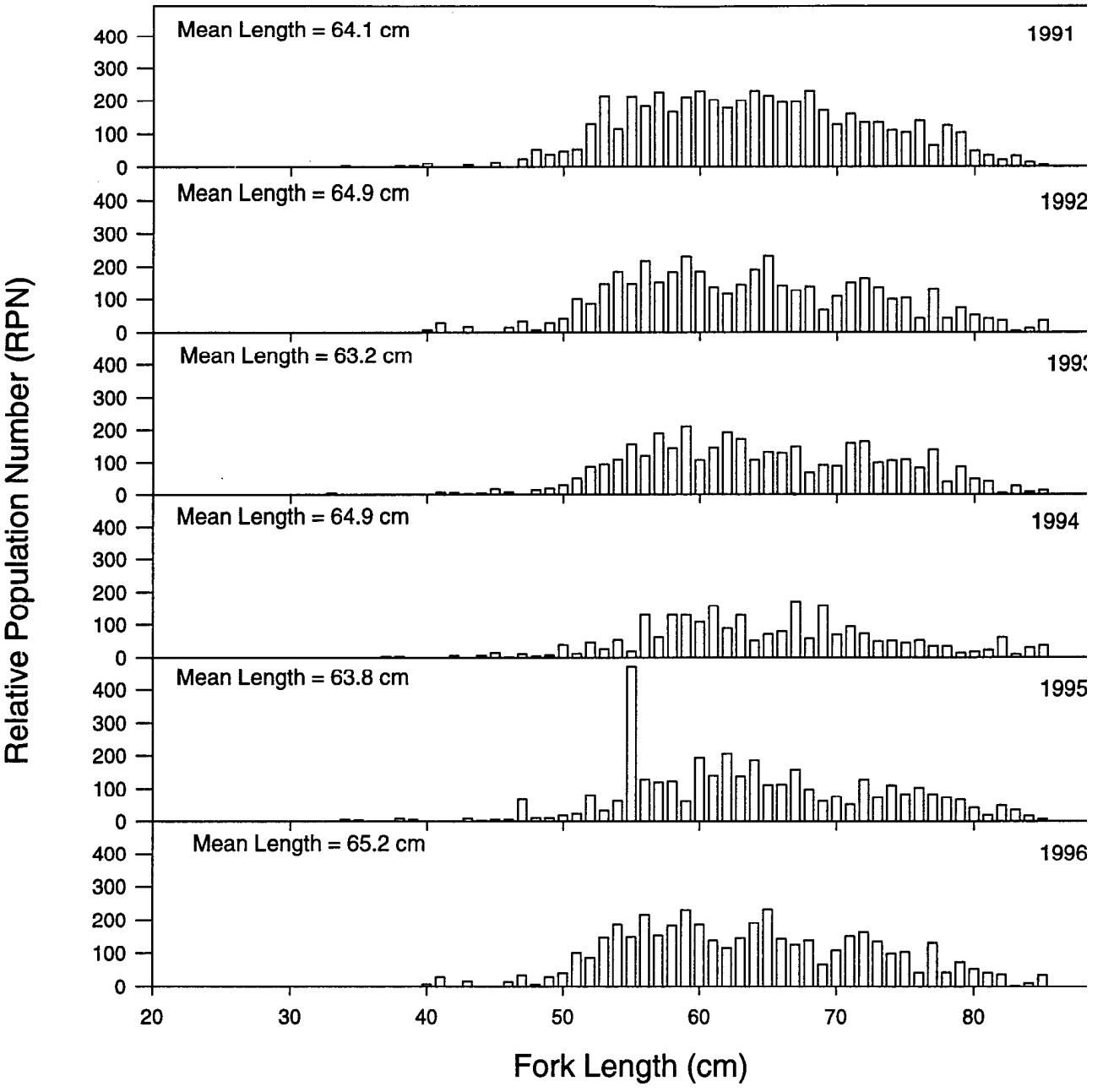

Figure 6d.--Shortraker rockfish length frequencies weighted by relative population number for the West Yakutat slope, 1991-96.

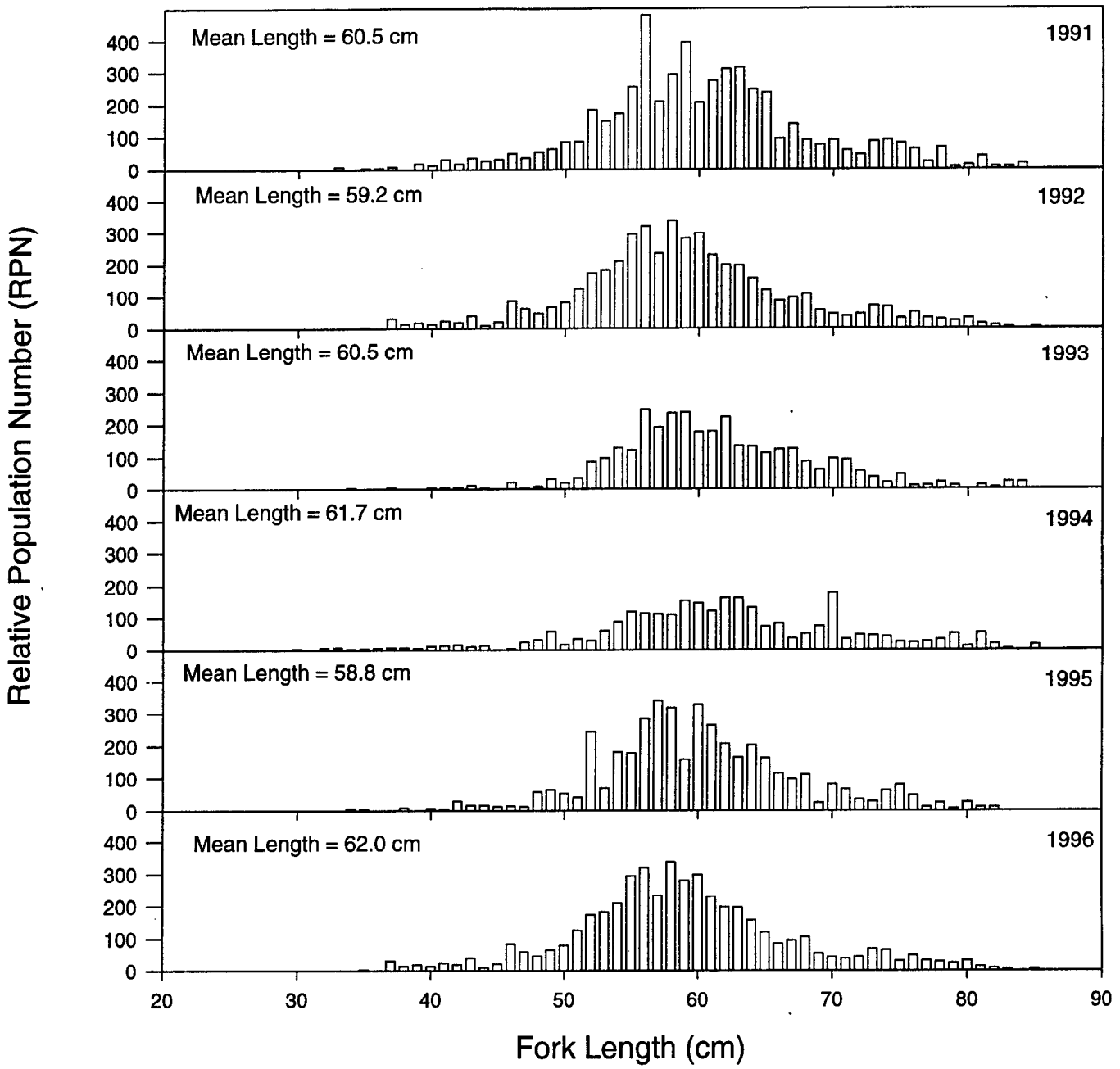

Figure 6e.--Shortraker rockfish length frequencies weighted by relative population number for the East Yakutat slope, 1991-96.

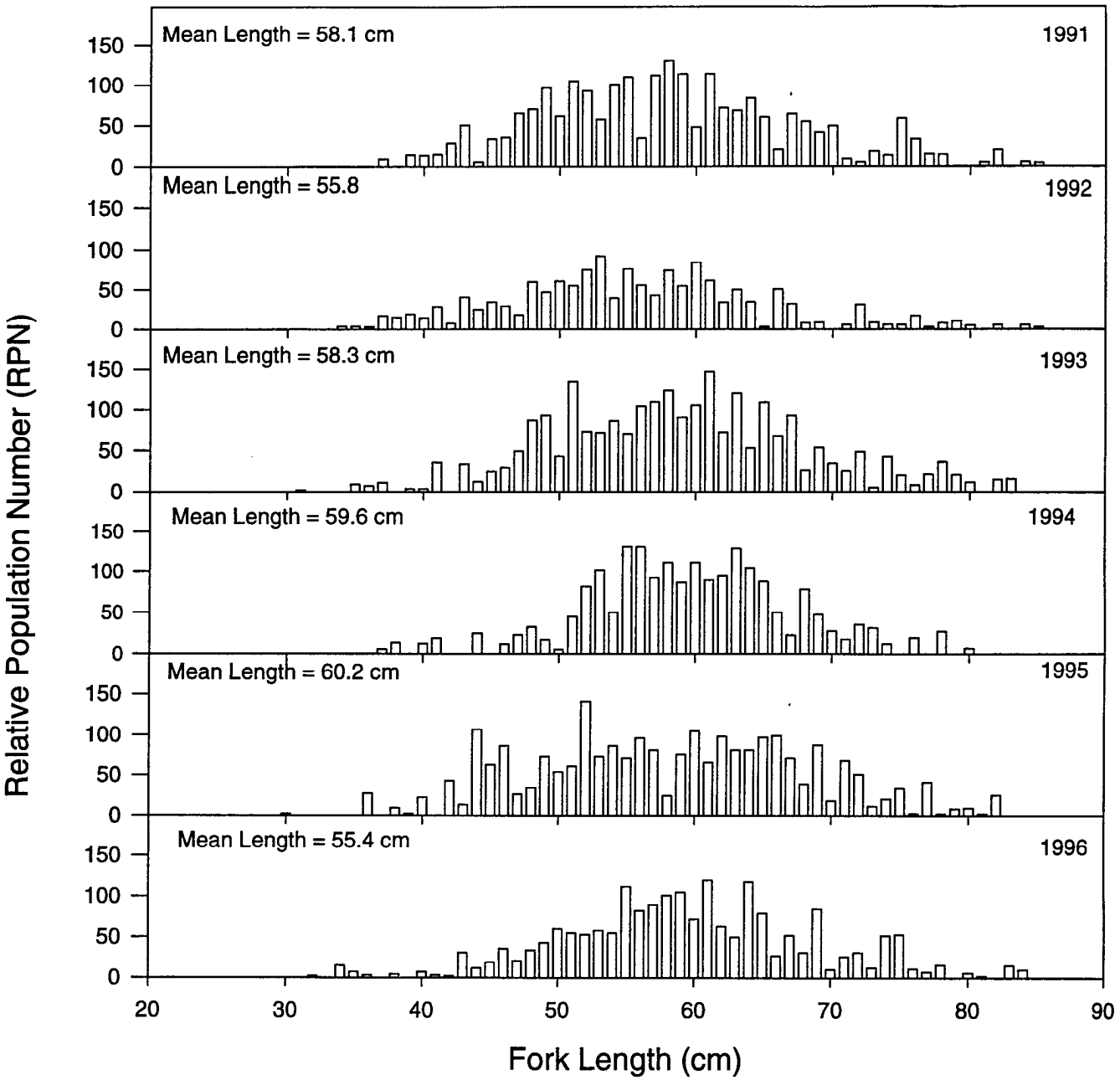

Figure 6f.--Shortraker rockfish length frequencies weighted by relative population number for the Southeast slope, 1991-96.

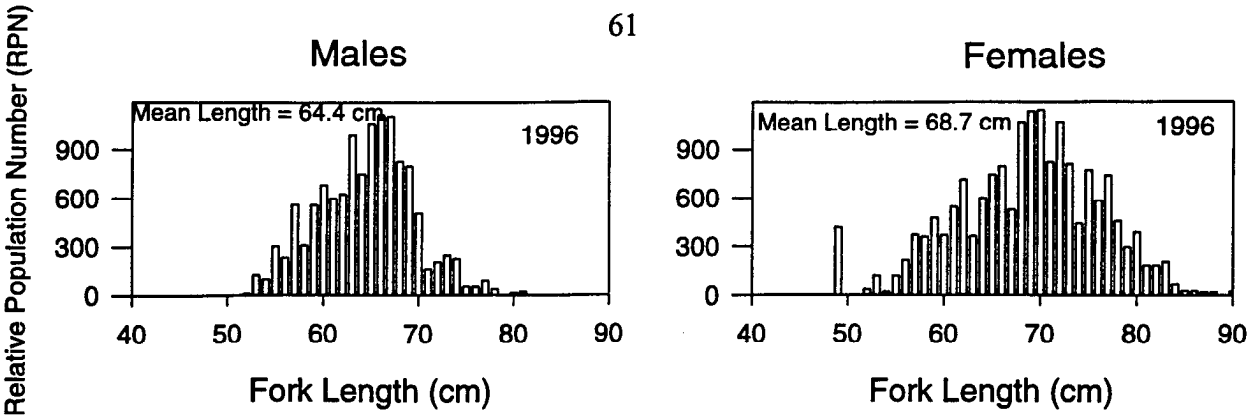

Figure 7.--Sablefish length frequencies weighted by relative population number for the Northeastern Aleutian area, 1996.

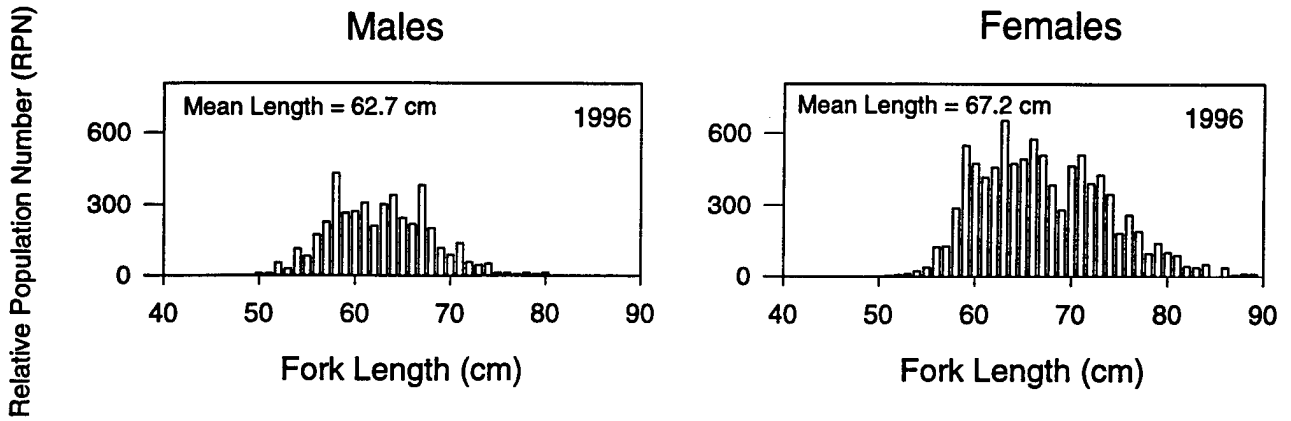

Figure 8.--Sablefish rockfish length frequencies weighted by relative population number for the Southeastern Aleutian area, 1996.

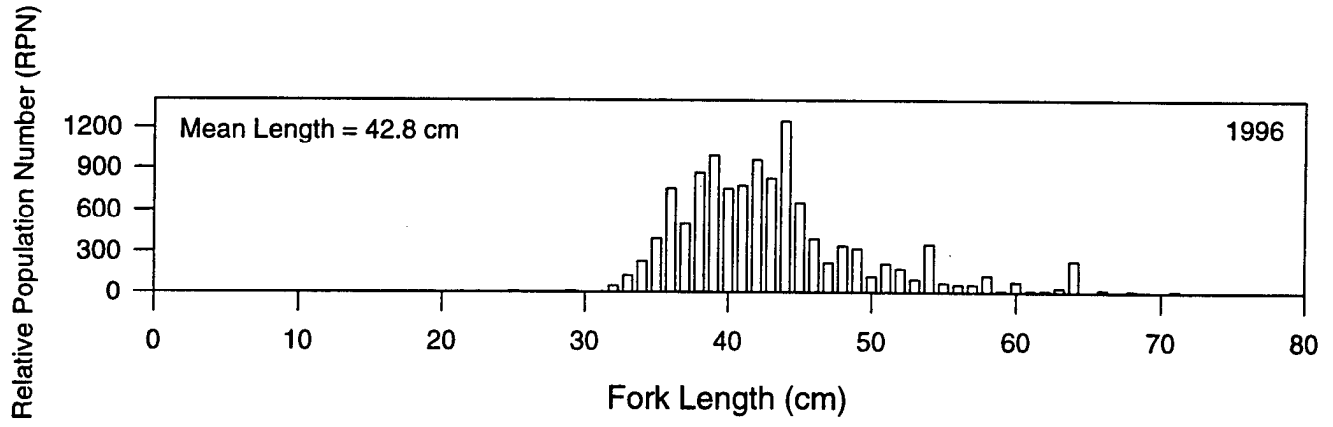

Figure 9.--Shortspine thornyhead length frequencies weighted by relative population number for the Northeastern Aleutian area, 1996.

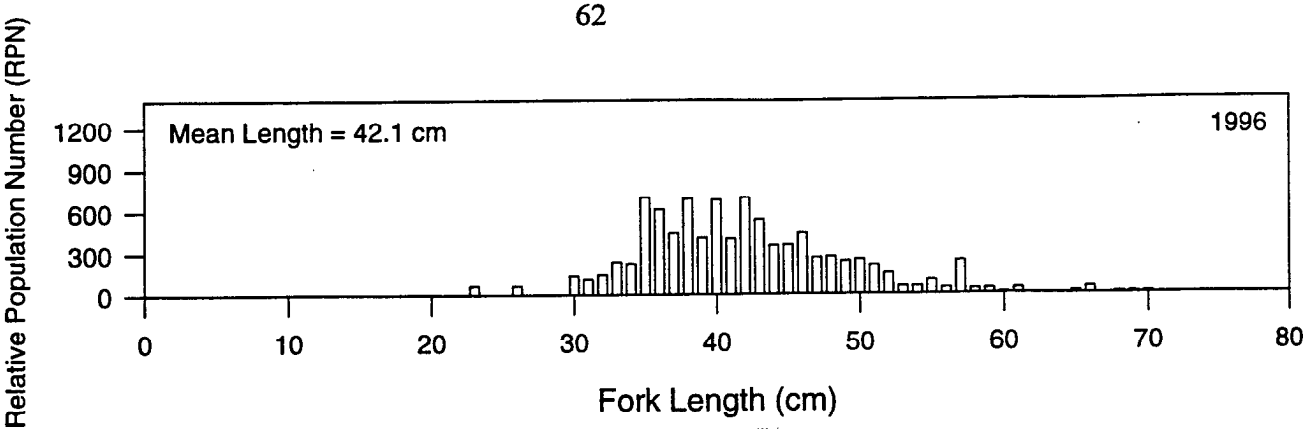

Figure l0.--Shortspine thornyhead length frequencies weighted by relative population number for the Southeastern Aleutian area, 1996.

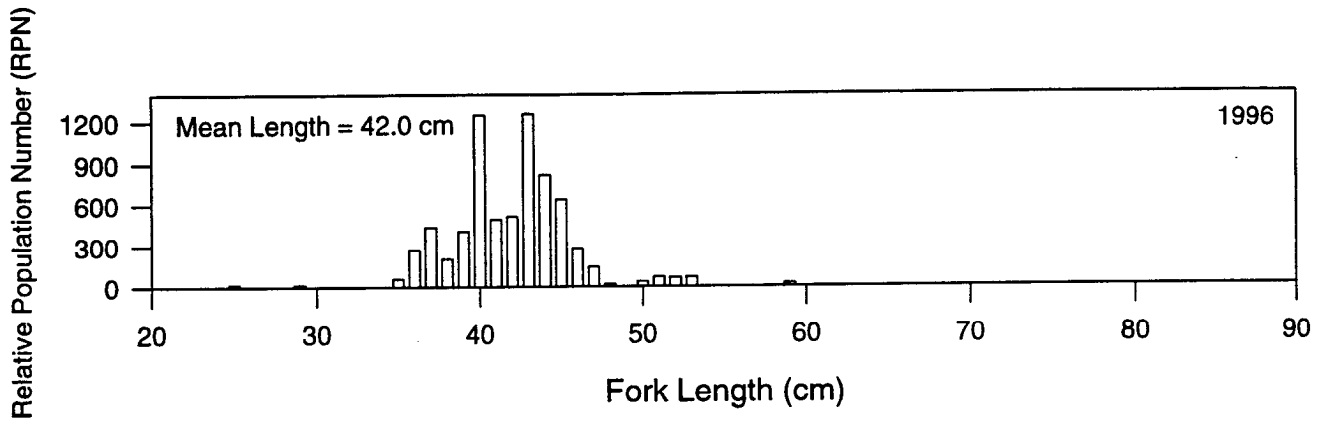

Figure 11 .--Rougheye rockfish length frequencies weighted by relative population number for the Northeastern Aleutian area, 1996.

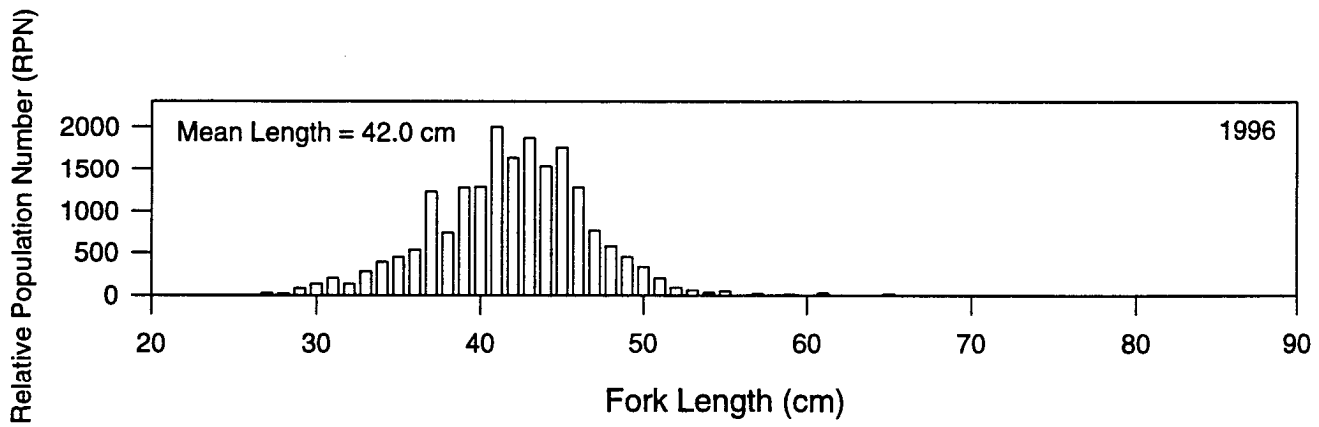

Figure 12.--Rougheye rockfish length frequencies weighted by relative population number for the Southeastern Aleutian area, 1996.

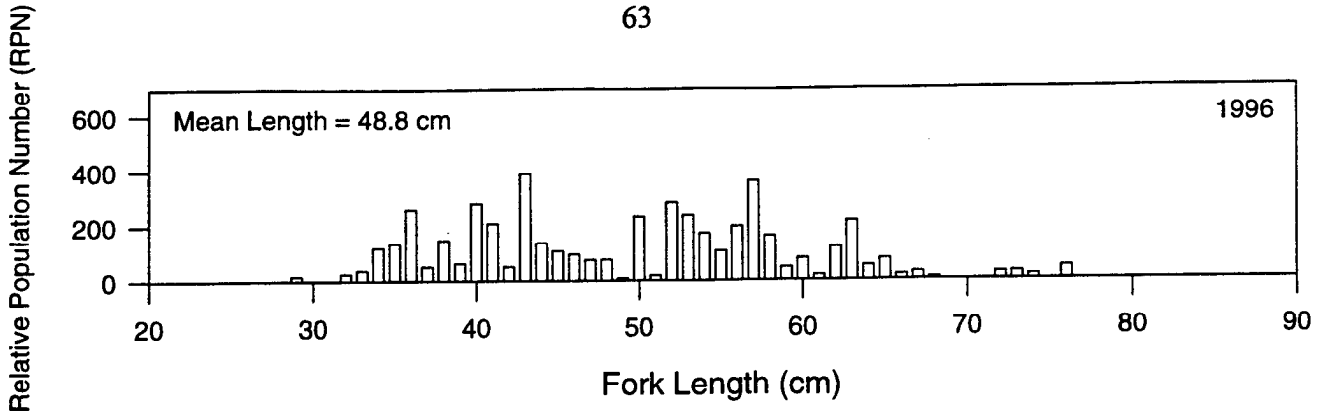

Figure 13.--Shortraker rockfish length frequencies weighted by relative population number for the Northeastern Aleutian area, 1996.

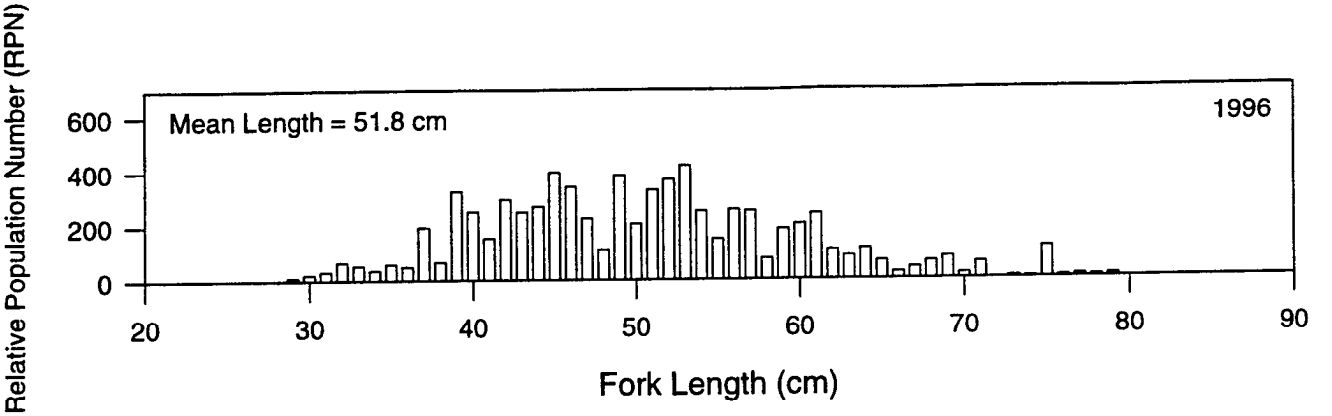

Figure 14.--Shortraker rockfish length frequencies weighted by relative population number for the Southeastern Aleutian area, 1996.

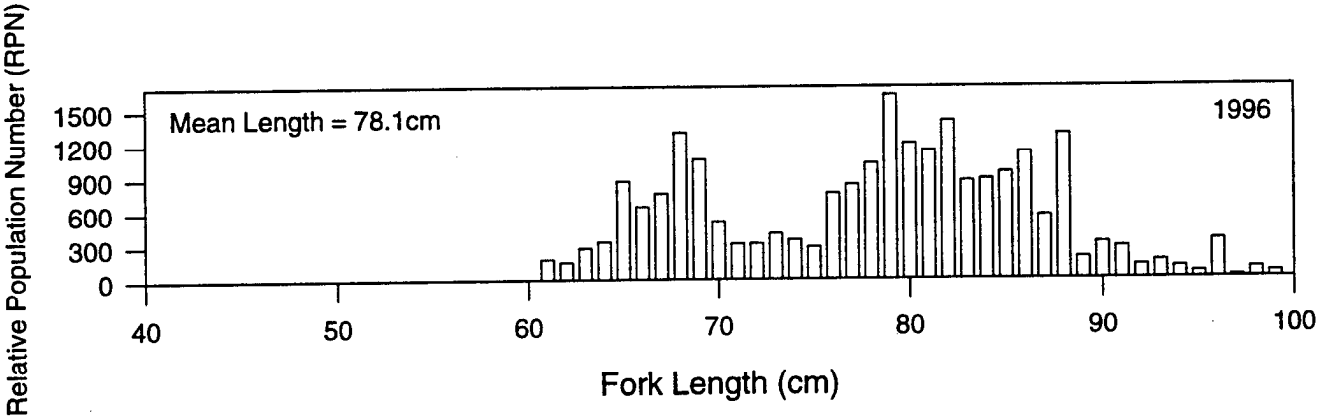

Figure 15.--Greenland turbot length frequencies weighted by relative population number for the Northeastern Aleutian area, 1996.

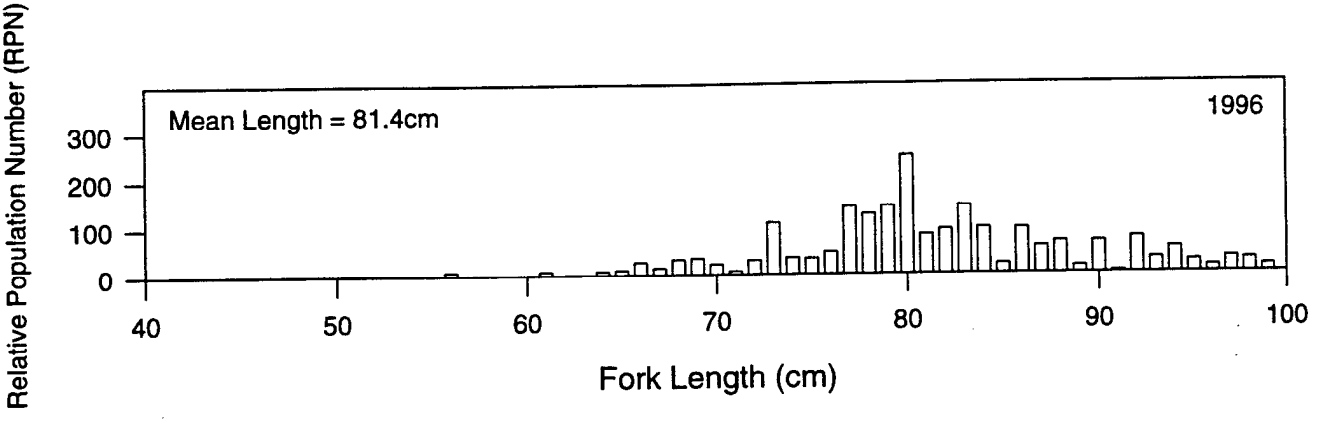

Figure 16.--Greenland turbot length frequencies weighted by relative population number for the Southeastern Aleutian area, 1996.

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