LABORATORY REFERENCE DOCUMENT NO. 81-27

STATUS OF THE NORTHWESTERN ATLANTIC BUTTERFISH STOCK

by

Gordon T. Waring and Emory D. Anderson

☑ Approved for Distribution

☑ Distribution to F/NWC, F/SWC, F/SEC, F/NWR1, & F/NEC (Technical Writer-Editor)

Signature _____

Date 11/3/81

National Marine Fisheries Service
Northeast Fisheries Center
Woods Hole Laboratory
Woods Hole, Massachusetts 02543

SUMMARY

Total 1980 butterfish catches off the US Atlantic coast were 6,062 metric tons (mt). The US catch of 5,262 mt was the highest ever reported. The distant-water-fleet (DWF) catch (800 mt) was the lowest since 1977.

Analysis of commercial length samples from the DWF and domestic catches indicated that the DWF catch was comprised of younger age groups than the US catch. This was apparently due to the smaller mesh sizes utilized by the DWF in the mixed squid/butterfish fishery.

US 1980 autumn bottom trawl data indicate the stock is building due to growth of the good 1979 year class and a good recruiting 1980 year class. These year classes should be able to sustain a catch of 10,000-15,000 mt per year for the period 1981-1983.

INTRODUCTION

This report describes the current status of the butterfish (Peprilus triacanthus) stock in the Northwest Atlantic (NAFO Subareas 5-6) based on an examination of research vessel survey and commercial fishery data.

COMMERCIAL CATCH

The international butterfish nominal catch in 1980 totalled 6,062 metric tons (mt), and was 71% above the 1979 level of 3,552 mt (Table 1). Additionally, the 1980 catch was the highest since 1977, the first year of extended fisheries jurisdiction by the US. The distant-water-fleet (DWF) butterfish catch decreased slightly from 845 mt in 1979 to 800 mt in 1980. Only 27% (1,013 mt) of the 1 April 1980 - 31 March 1981 foreign allocation (3,685 mt) from TALFF (Total Allowable Level of Foreigh Fishing) (4,000 mt) was caught. The low catch was due, in large part, to by-catch limitations in the squid fisheries.

The US catch increased 94% from 2,707 mt in 1979 to 5,262 mt in 1980, the highest ever recorded. The 1980 catch was 112% above the 1963-1980 average (2,482 mt). The development of a Japanese export market for this species contributed significantly to increased US landings.

LENGTH FREQUENCY OF COMMERCIAL CATCH

Length frequencies collected aboard DWF vessels by US observers and from US food fishery catches in 1980 are compared in Figure 1. The samples from Mexican, Italian, and Spanish vessels were collected during the first six months of 1980. Japanese data were from the winter and autumn period, while the Romanian data were collected during the autumn. US data encompassed the entire year but were principally from autumn catches when the domestic fishery was at its peak. There were no samples

collected in 1980 from the US Southern New England industrial fishery. DWF length frequencies ranged between 8 and 24 cm (fork length) with modal lengths occurring between 13 and 15 cm for samples from most countries. US length frequencies exhibited a similar range but had a pronounced mode at 17 cm. The difference in modes between the DWF and US catches resulted from differences in mesh sizes used. (DWF vessels employed 45 mm and 66 mm mesh nets, whereas US fishermen principally used 66, 75, or 88 mm mesh nets in mixed squid, butterfish, and scup fisheries.)

The age composition of the 1980 commercial catch was estimated by applying age/length keys from spring 1981 and autumn 1980 bottom trawl survey catches (spring 1980 age/length key not available) to the January - June and July - December length frequencies, respectively. For the January - June period, the US catch were 68% age 2 and 25% age 3, while the DWF (except Japan) catch was 75% age 1 and 23% age 2; the Japanese catch was 52% age 1 and 38% age 2. In the July - December period, the US catch was 47% age I and 44% age 2; the Japanese catch was 91% age 0 whereas the Romanian catch was 94% age 1.

SURVEY ABUNDANCE INDICES

The catch-per-tow index (in numbers) for butterfish determined from the NEFC, NMFS autumn offshore (>27 m) bottom trawl survey (strata 1-12, 61-76, Figure 2) declined 19% from 453.9 in 1979 to 366.5 in 1980; however, the 1980 index was still the second highest (next to 1979) recorded for the 13-year (1968-1980) period (Table 2). The catch-per-tow index (in weight) increased 16% from 17.8 kg in 1979 to 20.6 kg in 1980, the highest observed for the 13-year period. Mean weight per fish from the autumn offshore survey

catches increased from 39 g in 1979 to 56 g in 1980, reflecting growth of the good 1979 year class (Figure 3). The increase in catch per tow (in weight) from 1979 to 1980 was due, therefore, to the increase in mean weight per fish.

The catch-per-tow abundance indices (weight and number) from the 1974-1980 inshore (<27 m) (strata 1-46, Figure 4) autumn bottom trawl survey are presented in Table 2. Although inshore surveys began in 1972, data from 1972 and 1973 are not presented since the standard Yankee #36 trawl, which has been used in these surveys since 1974, was not used in those years inshore. The 1980 indices in weight and number were the highest observed for the 7-year period.

Correlation coefficients (r) were calculated to examine the relationship between the inshore and offshore autumn survey catch-per-tow indices. The coefficients in weight and number were 0.68 and 0.22, respectively. These low coefficients are due primarily to the fact that the relationship did not hold for the 1978 and 1979 indices (Table 2). Additional data points and analysis will be required to determine the cause for the inconsistency between the inshore and offshore indices.

The recruitment index (number per tow at age 0) in the 1980 autumn offshore survey (232.6) was 41% below the 1979 index (392.8) but is the third highest observed since 1968 (Table 3). It appears that both the 1979 and 1980 year classes are relatively strong. The indices at age 0 for these two year classes are 4.7 (1979) and 2.8 (1980) times higher than the 1968-1978 average. This is the first time that consecutive strong year classes have been observed in the autumn survey data.

The catch-per-tow index (in numbers) for age 1 and older butterfish increased sharply in 1980 from past levels (Table 3). This increase reflects the presence of the strong 1979 year class.

LENGTH FREQUENCY OF SURVEY CATCHES

Length frequencies of the mean catch per tow of butterfish from 1968-1980 autumn offshore bottom trawl surveys is plotted in Figures 5-9. Strong recruitment is evident in several years (1971, 1973, 1976, 1979 and 1980). The 1976 and 1979 year classes appear to have been the strongest at age 1 (second major mode in 1977 and 1980, respectively).

The length frequencies of the 1974-1980 autumn inshore survey catch per tow were subdivided into strata north (1-23, 45-46) and south (24-44) of Delaware Bay (Figures 10-12; 13-15). This subdivision was deemed appropriate since the numbers of butterfish <10 cm were consistently greater north of Delaware Bay than south. The reasons for these size differences may be related to later spawning in the region north of Delaware Bay, movement of small butterfish from the south into the estuaries of Delaware and Chesapeake Bays, or coastal and northward migration of age 0 butterfish. The length frequency histograms for the southern inshore strata (Figures 13-15) are similar to those from the offshore strata (Figures 7-9) for the 1974-1980 period, suggesting that butterfish in the southern inshore area are an extension of the group sampled in the offshore region.

DISCUSSION

Based on the 1980 autumn offshore survey abundance index (kg/tow), the butterfish biomass has increased due to recruitment of two consecutive strong year classes (1979 and 1980). This, combined with an apparent reduction in international catches and fishing mortality in recent years, has resulted in a more balanced age structure as evidenced by autumn survey length frequency data.

The inshore length frequency data indicate that age 0 butterfish are concentrated in the region between Cape Cod and the eastern border of Delaware Bay. Except for discards, for which data are not available, the only fishing mortality on these small fish in the autumn is from the limited domestic Southern New England industrial fishery.

The biomass in 1980, due in part to the 1979 and 1980 year classes, was the highest observed since 1968. The increased abundance of larger individuals (≥15 cm) in 1980 has increased spawning potential. However, as with most fish species, there is no obvious stock-recruitment relationship and a large spawning stock does not guarantee the production of strong year classes. Due to their short life span of 3-5 years (natural mortality (M)=0.8), these fish will not remain in the stock for long. If the management objective is to harvest these fish, they should be taken within their first three years of life (in 1980-1983) before they are lost due to natural mortality. During the 1968-1976 international fishery, based on the catch-at-age data reported by Murawski and Waring (1979), about 78% of the catch in weight was age 1 and 2 fish and about 16% of the catch in weight was age 3 fish. Consistent with this pattern of fishing, the 1979 and 1980 year classes will contribute to the fishery

mainly during 1980-1982 and 1981-1983, respectively. Catches during 1981-1983 of 10,000-15,000 mt per year could be supported by the 1979 and 1980 year classes.

LITERATURE CITED

Murawski, S. A., and G. T. Waring. 1979. A population assessment of butterfish, Peprilus triacanthus, in the northwestern Atlantic Ocean. Trans. Am. Fish. Soc. 108:427-439.

Table 1. Nominal landings (mt, NAFO SA 4-6) by country, and adjusted total catches, 1963-1980.

Year	USA	JAPAN	USSR	POLAND	BULGARIA	GDR	ROMANIA	OTHERS	NOMINAL TOTAL	ADJUSTED[1] CATCH
1963	4,513	-	2,285	-	-	-	-	-	6,798	6,798
1964	2,461	-	748	-	-	-	-	-	3,209	3,209
1965	3,340	-	749	-	-	-	-	-	4,089	4,089
1966	2,615	-	3,865	-	-	-	-	-	6,480	6,480
1967	2,452	146	2,170	-	-	-	-	-	4,768	4,768
1968	1,804	3,526	1,911	-	-	-	-	-	7,241	7,241
1969	2,438	3,930	11,107	-	36	-	-	-	17,511	17,816
1970	1,869	8,624	404	-	-	-	-	-	10,897	14,319
1971	1,570	5,771	486	-	26	-	-	-	7,853	10,483
1972	819	3,675	1,848	-	114	34	-	-	6,490	13,040
1973	1,557	12,172	2,334	2,804	239	196	152	-	19,454	33,236
1974	2,528	5,457	1,372	3,508	-	-	-	-	12,865	17,993
1975	2,088	3,624	789	3,754	298	1	-	612[2]	11,165	14,852
1976	1,528	7,884	420	1,518	4	3	62	-	11,419	15,837
1977	1,448	1,741	419	280	-	-	16	749[3]	4,653	4,653
1978	3,676	657	14	-	-	-	83	572[4]	5,002	5,002
1979	2,707	262	2	-	-	-	10	571[5]	3,552	3,552
1980	5,262	660	-	3	-	-	3	134[6]	6,062	6,062

[1]Adjusted to account for discards of countries not reporting butterfish catches from the Loligo fishery.

[2]Ireland.

[3]Spain-117, Italy-107, Cuba-110, Ireland-415.

[4]Spain-124, Italy-355, Mexico-93.

[5]Spain-90, Italy-138, Mexico-343.

[6]Spain-59, Italy-65, Cuba-10.

Table 2. USA autumn bottom trawl survey butterfish catch-per-tow indices.

Year	Offshore (>27 m)		Inshore (<27 m)	
	Numbers	Weight(kg)	Numbers	Weight(kg)
1968	121.09	10.44	ND	ND
1969	76.93	5.32	ND	ND
1970	48.29	3.07	ND	ND
1971	242.17	5.45	ND	ND
1972	86.67	3.21	ND	ND
1973	178.03	8.39	ND	ND
1974	116.32	5.12	205.06	1.36
1975	52.47	2.94	72.53	0.64
1976	160.31	6.71	257.86	6.71
1977	94.69	6.87	150.57	6.45
1978	80.38	4.59	421.76	9.22
1979	453.93	17.79	153.56	5.66
1980	366.50	20.60	475.35	15.96

ND = no data.

Table 3. USA autumn offshore bottom trawl butterfish abundance indices, in numbers, for age 0 and age 1 and older fish.

Year	Age 0	Age 1 and older
1968	46.19	74.90
1969	44.61	32.32
1970	30.06	18.23
1971	231.58	10.59
1972	79.59	7.08
1973	135.02	43.01
1974	92.02	24.30
1975	29.95	22.52
1976	127.50	32.81
1977	37.20	57.50
1978	60.70	20.30
1979	392.80	61.13
1980	232.60	133.90

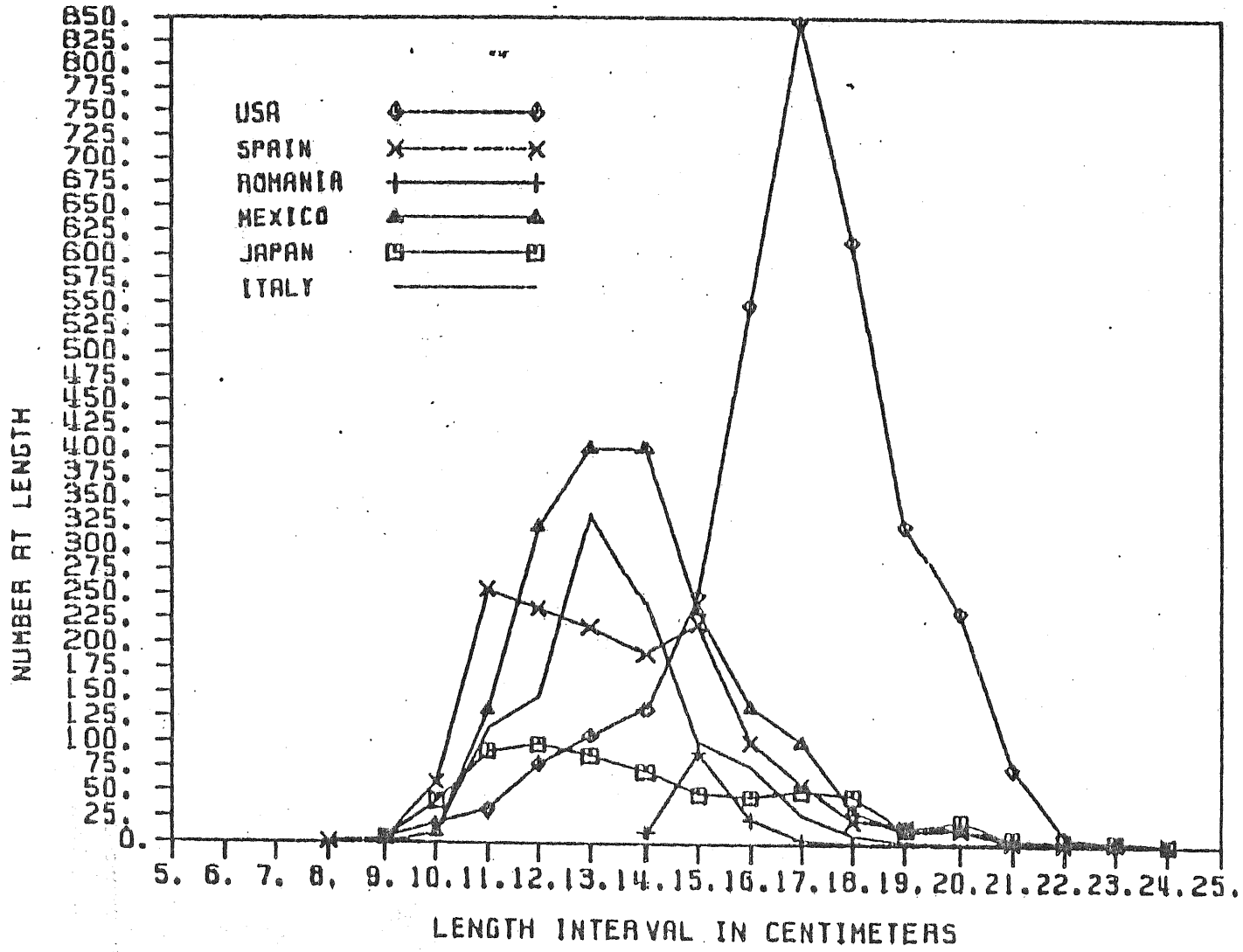


Figure 1. Butterfish length distributions from commercial samples by country for 1980.

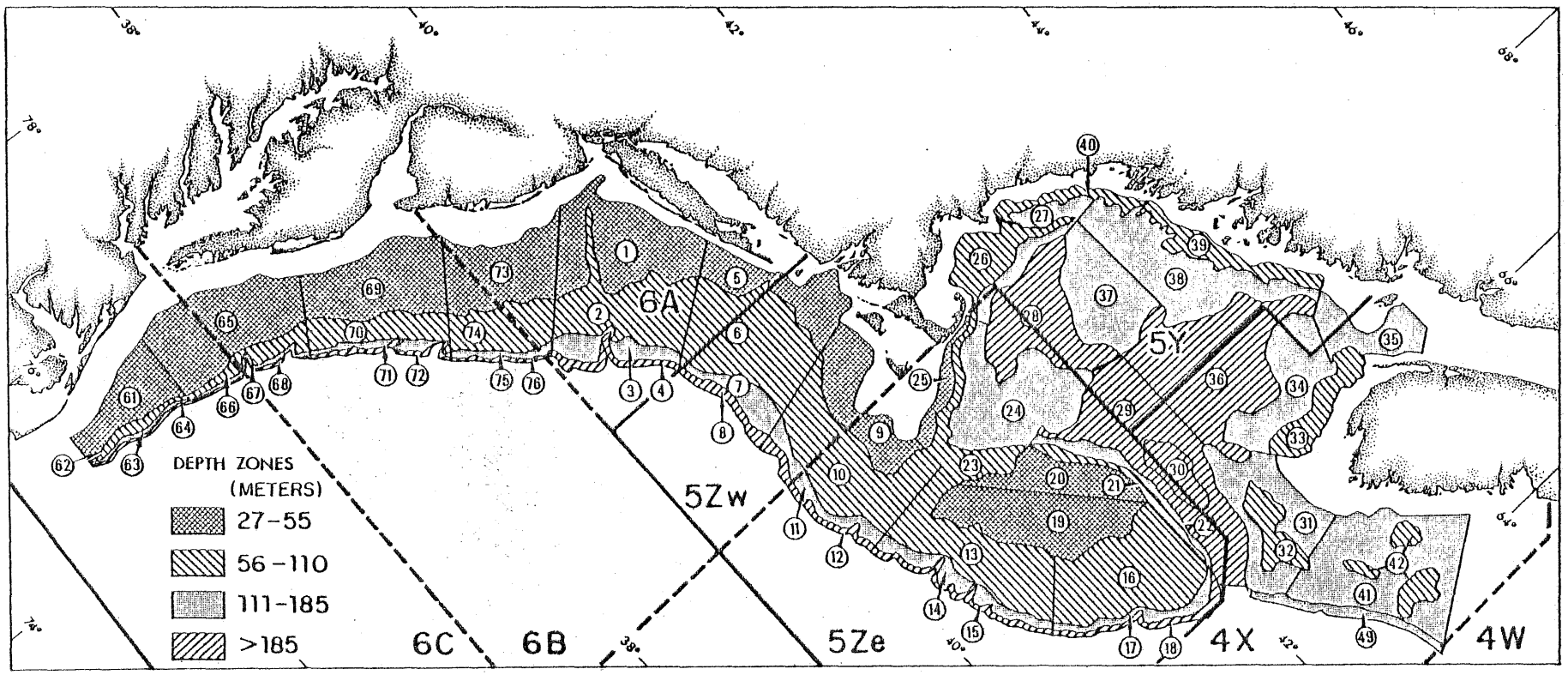


Figure 2. USA offshore bottom trawl survey sampling strata.

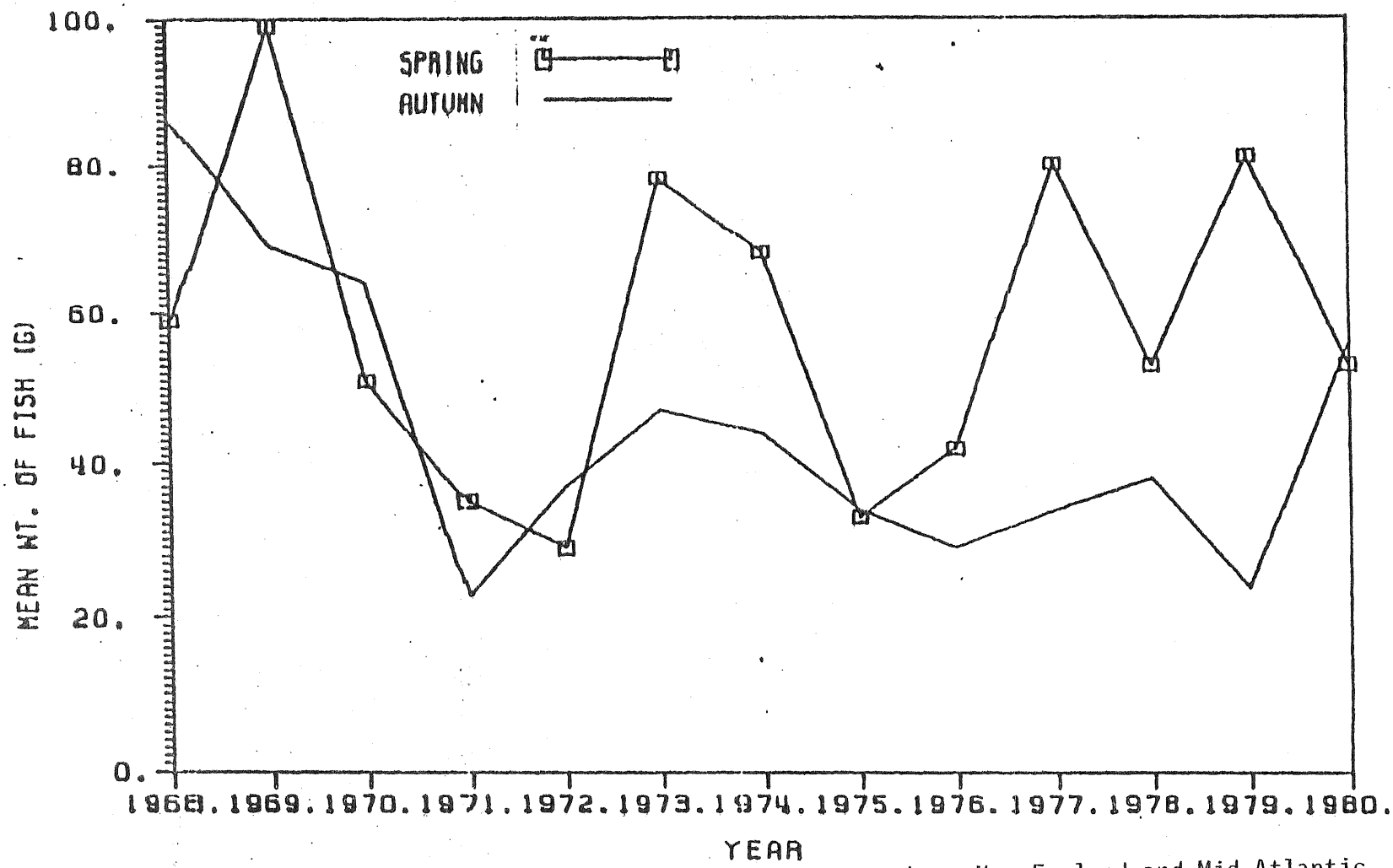
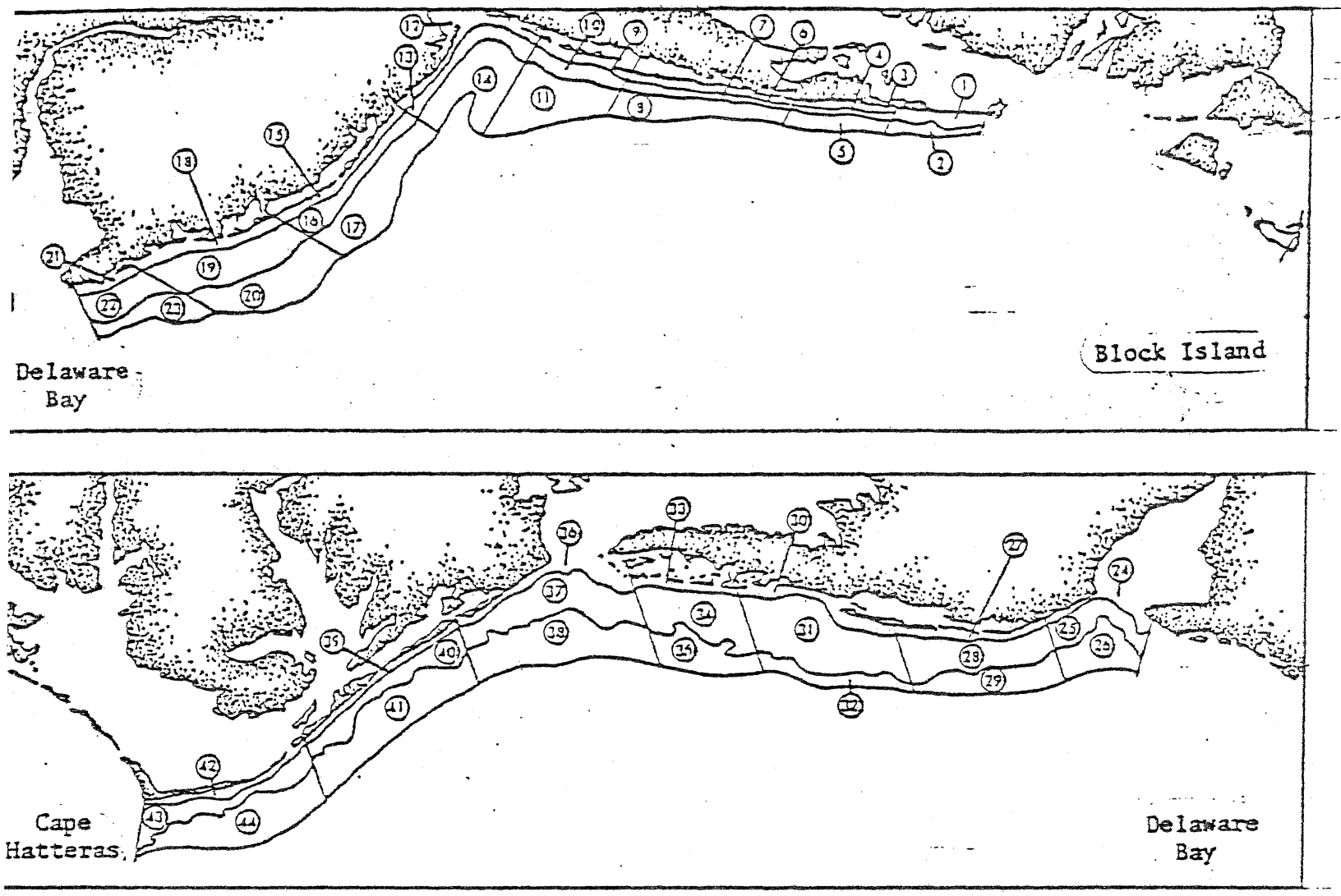


Figure 3. Mean weight of butterfish (g) taken from Southern New England and Mid-Atlantic areas during NEFC bottom trawl surveys 1968-1980.

COASTAL STRATA

CAPE HATTERAS TO BLOCK ISLAND

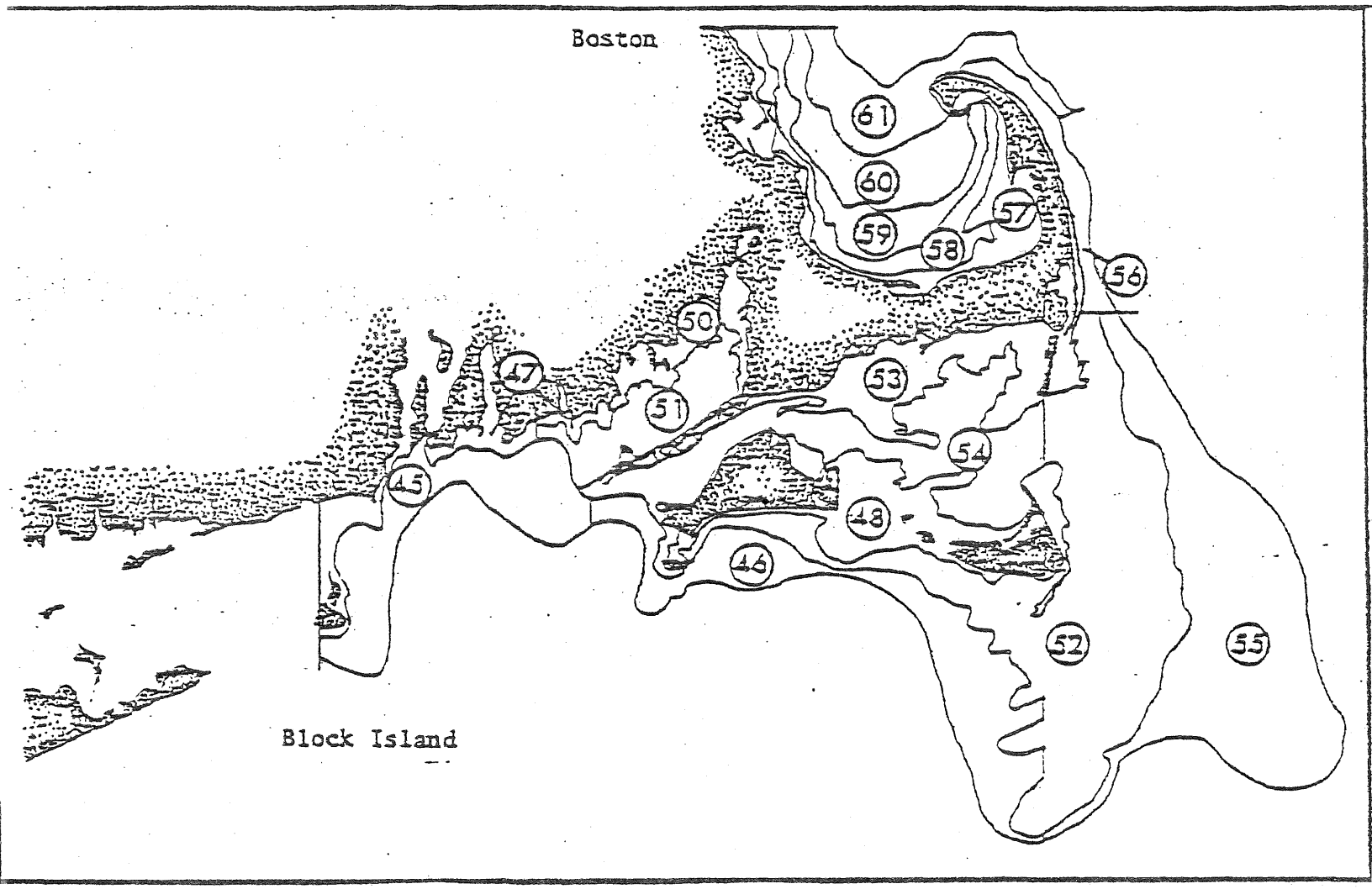


Strata No.	Square Miles	Depth (fms)	Strata No.	Square Miles	Depth (fms)	Strata No.	Square Miles	Depth (fms)
1	44	0-10	16	62	5-10	31	299	5-10
2	62	10-15	17	238	10-15	32	106	10-15
3	13	0-5	18	97	0-5	33	92	0-5
4	26	5-10	19	216	5-10	34	167	5-10
5	62	10-15	20	356	10-15	35	88	10-15
6	26	0-5	21	22	0-5	36	119	0-5
7	35	5-10	22	154	5-10	37	312	5-10
8	150	10-15	23	167	10-15	38	224	10-15
9	40	0-5	24	53	0-5	39	35	0-5
10	48	5-10	25	172	5-10	40	176	5-10
11	242	10-15	26	154	10-15	41	383	10-15
12	44	0-5	27	35	0-5	42	40	0-5
13	88	5-10	28	220	5-10	43	172	5-10
14	110	10-15	29	185	10-15	44	304	10-15
15	22	0-5	30	75	0-5			

Figure 4. USA inshore bottom trawl survey sampling strata.

COASTAL STRATA

BLOCK ISLAND TO BOSTON



Strata No.	Square Miles	Depth (fms)	Strata No.	Square Miles	Depth (fms)
45	170	10-15	54	277	5-10*
46	273	10-15	55	495	10-15*
47	45	0-10	56	57	5-15*
48	113	0-5	57	34	0-5
50	15	0-5	58	88	5-10
51	117	5-10*	59	93	10-15
52	521	5-10*	60	126	15-23
53	142	0-5	61	133	23-30

*Intermixed depths

Figure 4. (continued)

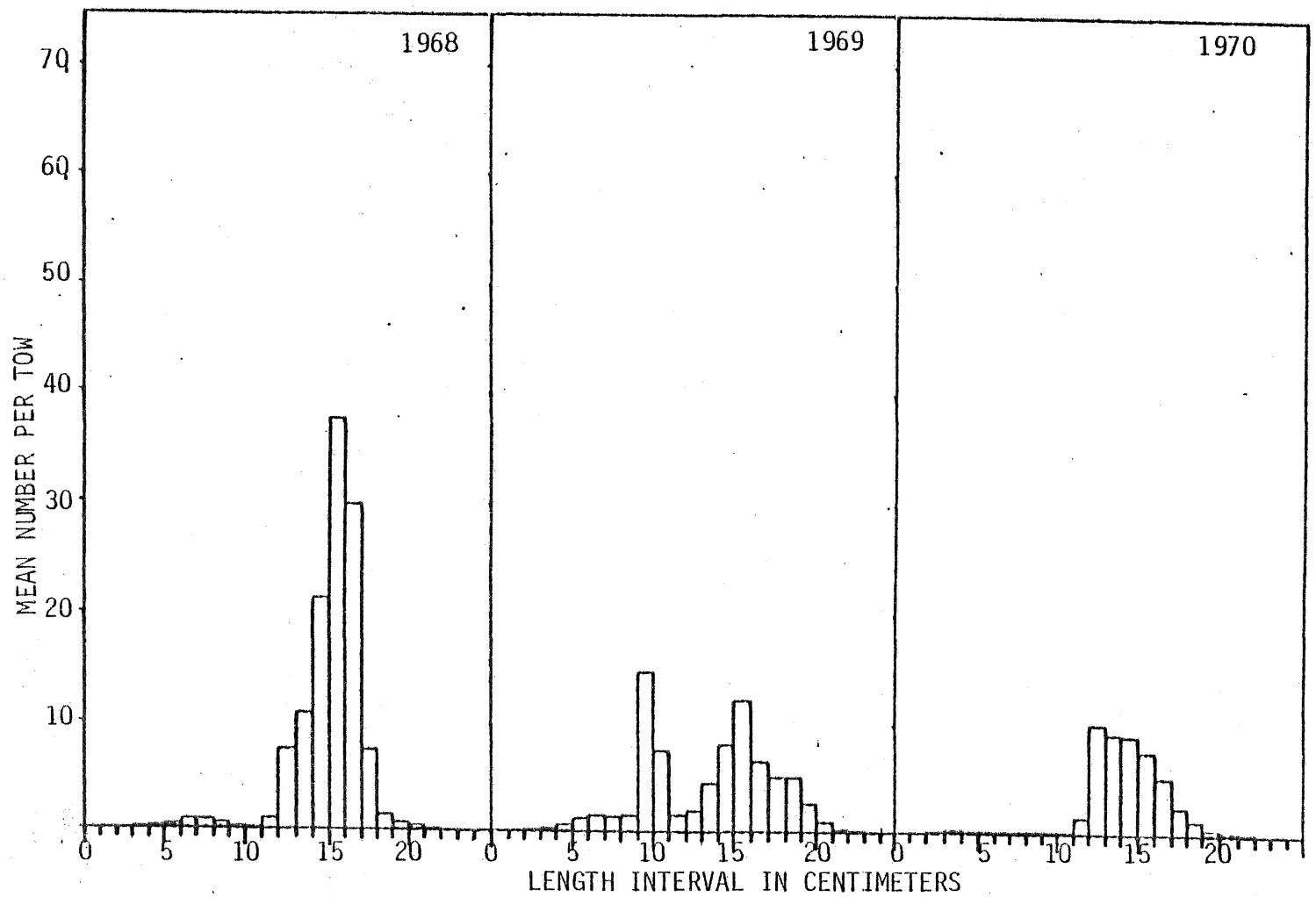


Figure 5. Butterfish length frequency histograms from autumn offshore bottom trawl surveys 1968-1970.

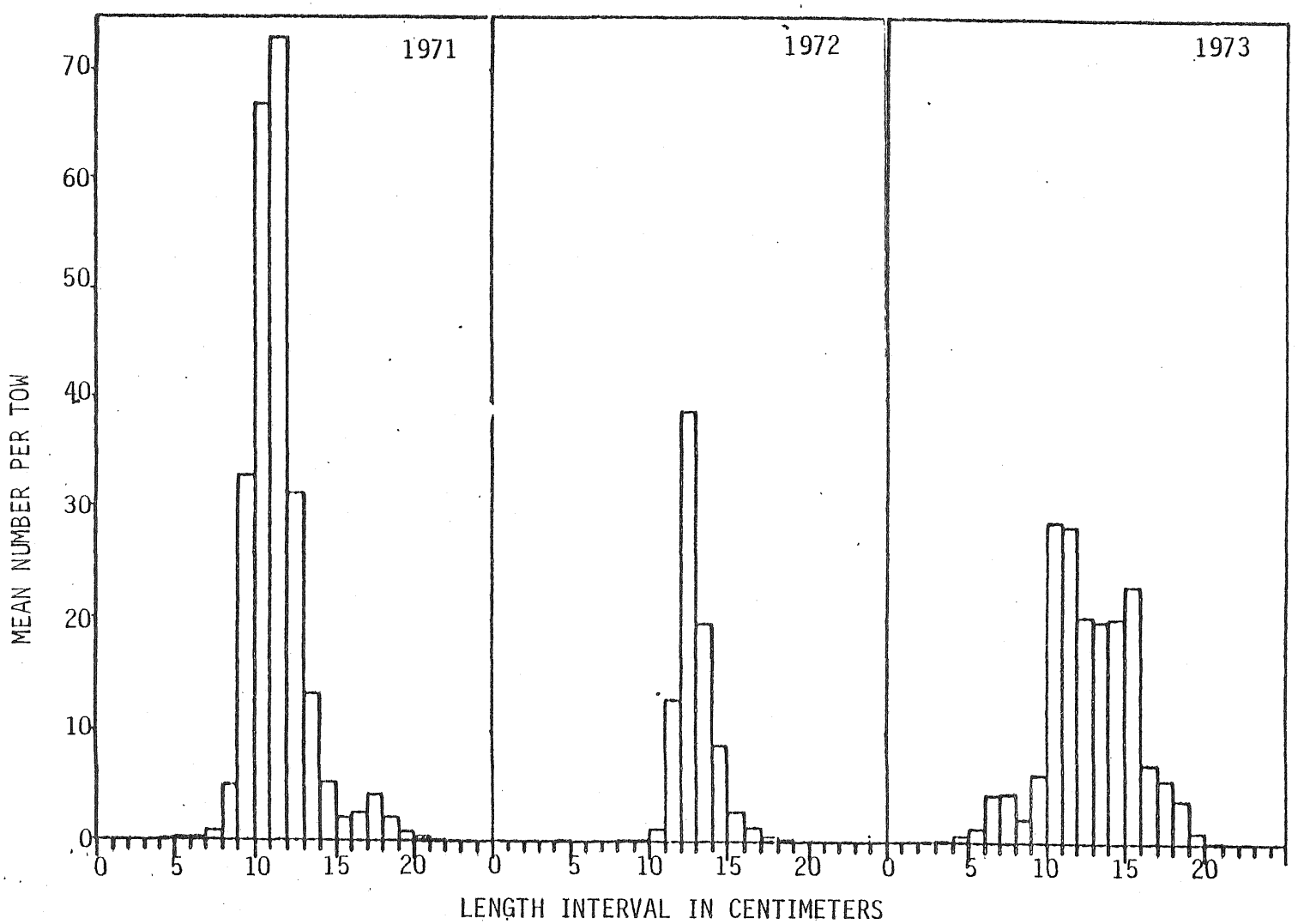


Figure 6. Butterfish length frequency histograms from autumn offshore bottom trawl surveys, 1971-1973.

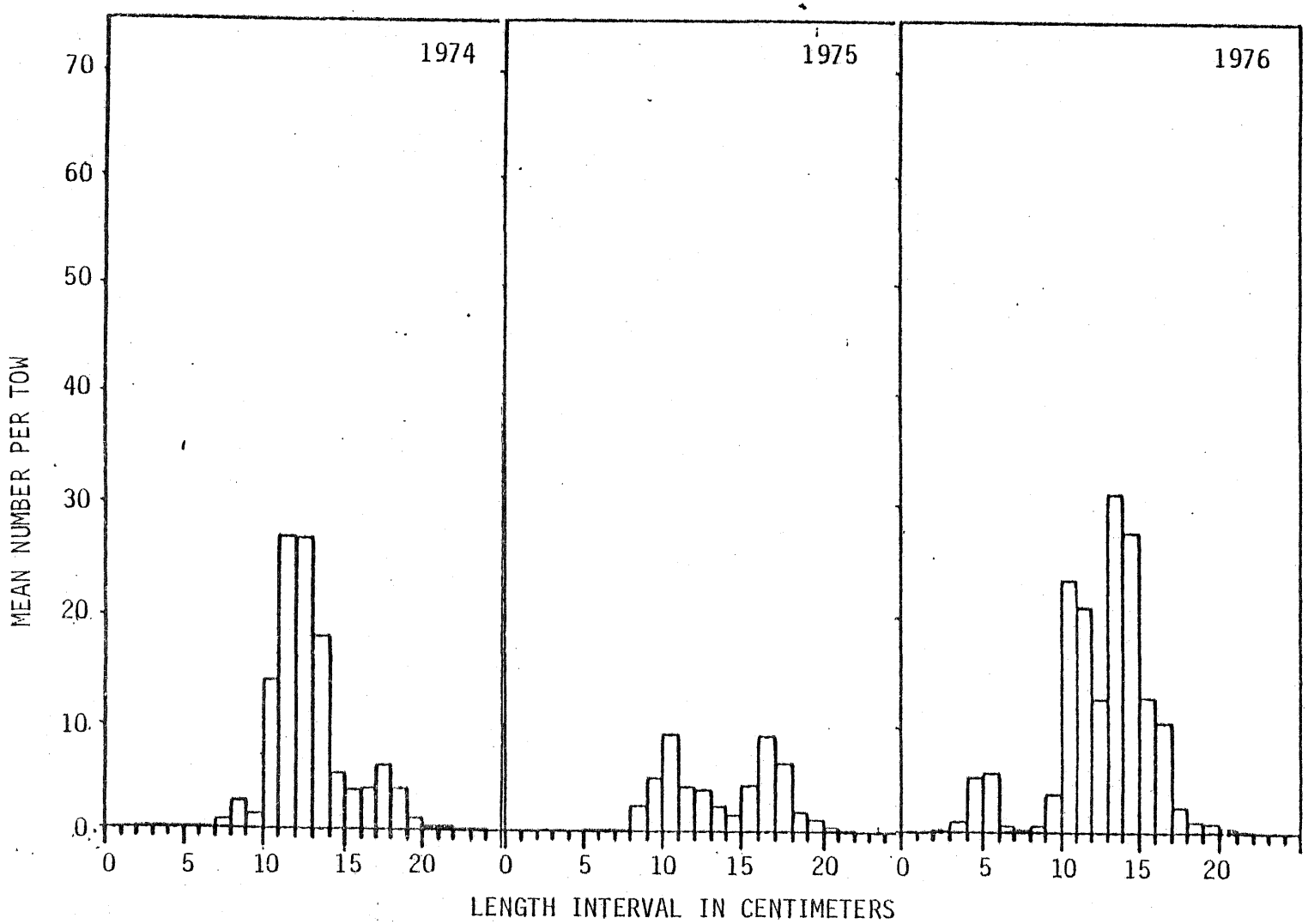


Figure 7. Butterfish length frequency histograms from autumn offshore bottom trawl surveys, 1974-1976.

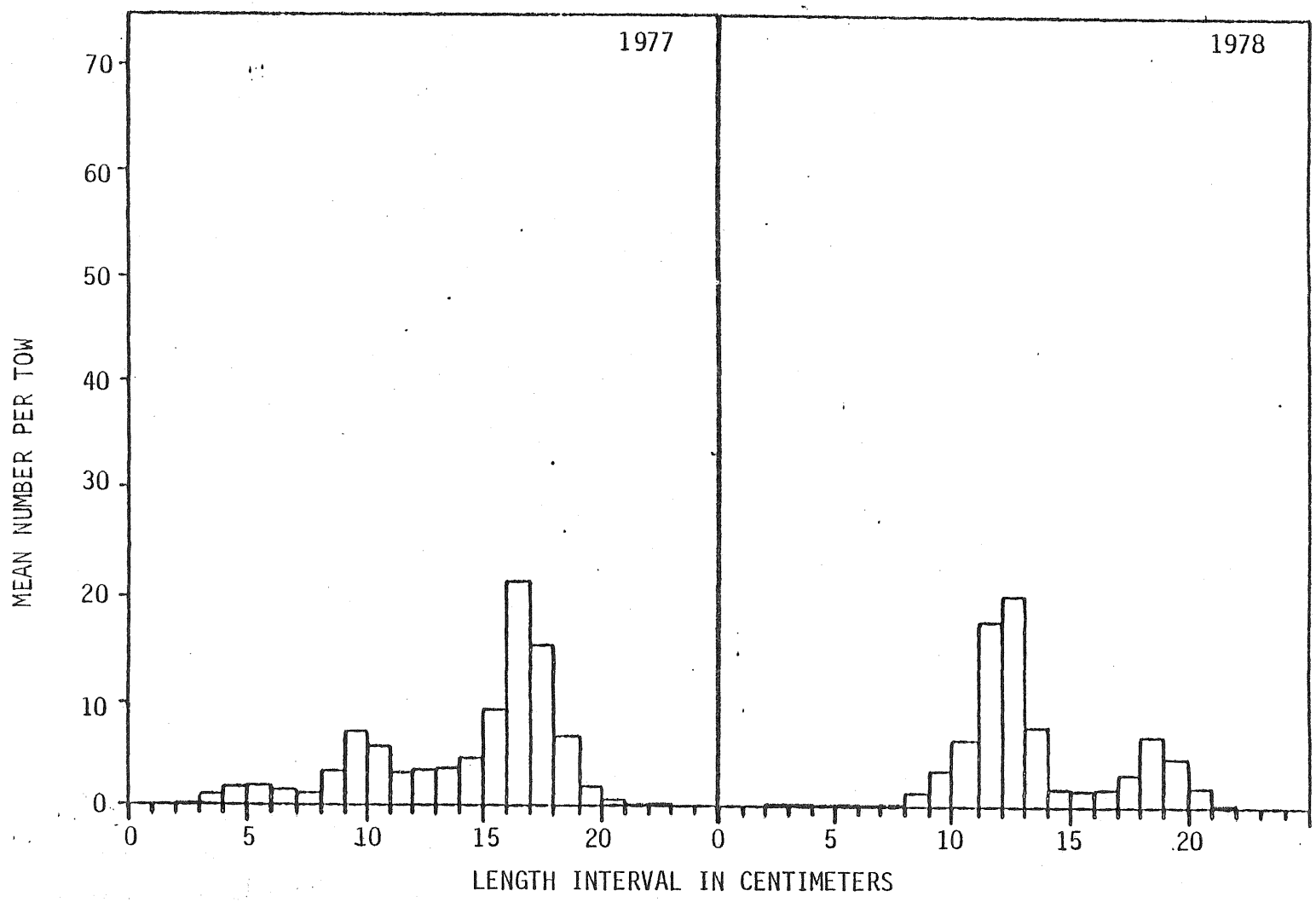


Figure 8. Butterfish length frequency histograms from offshore autumn bottom trawl surveys, 1977-1978.

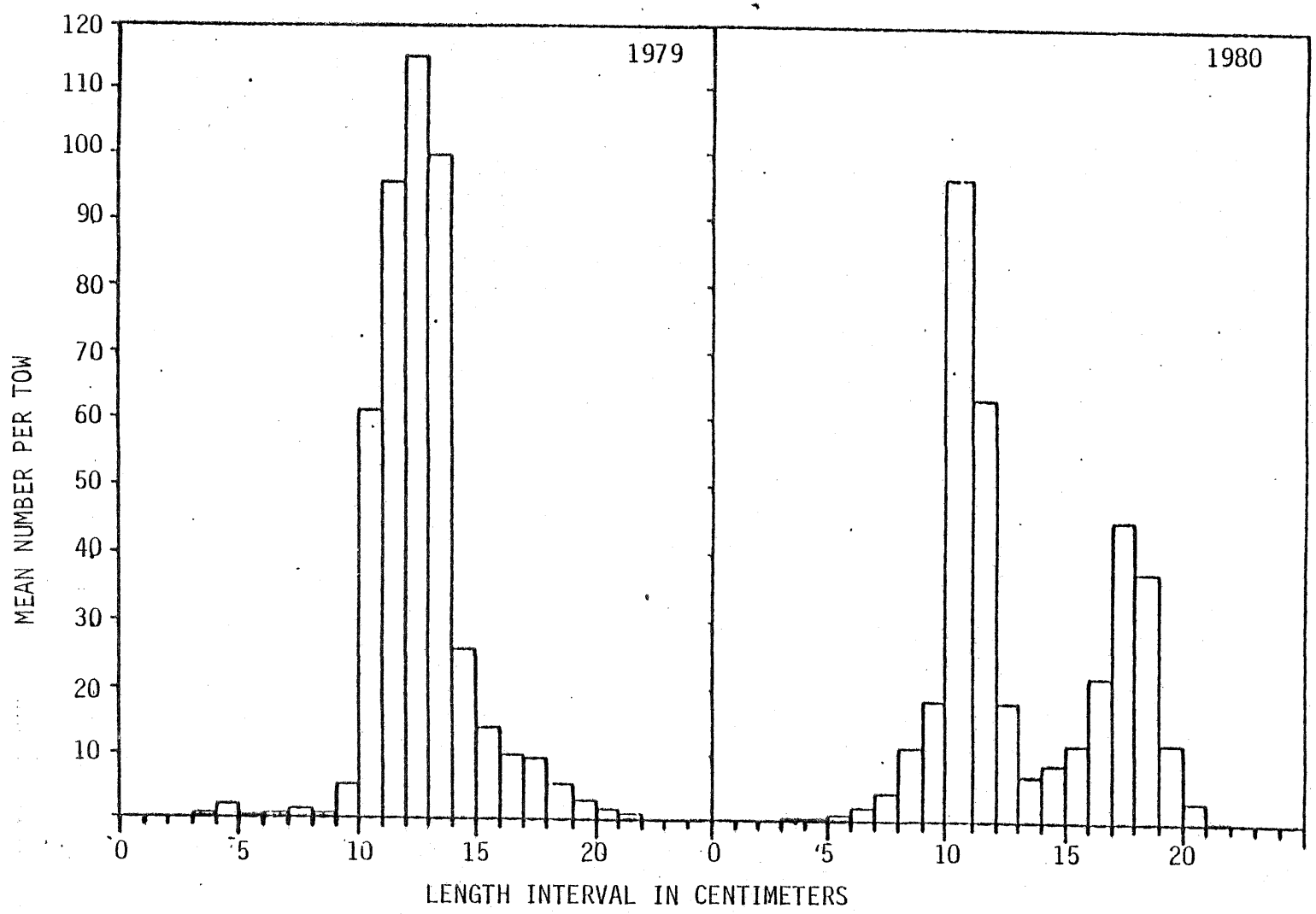


Figure 9. Butterfish length frequency histograms from offshore autumn bottom trawl surveys, 1979-1980.

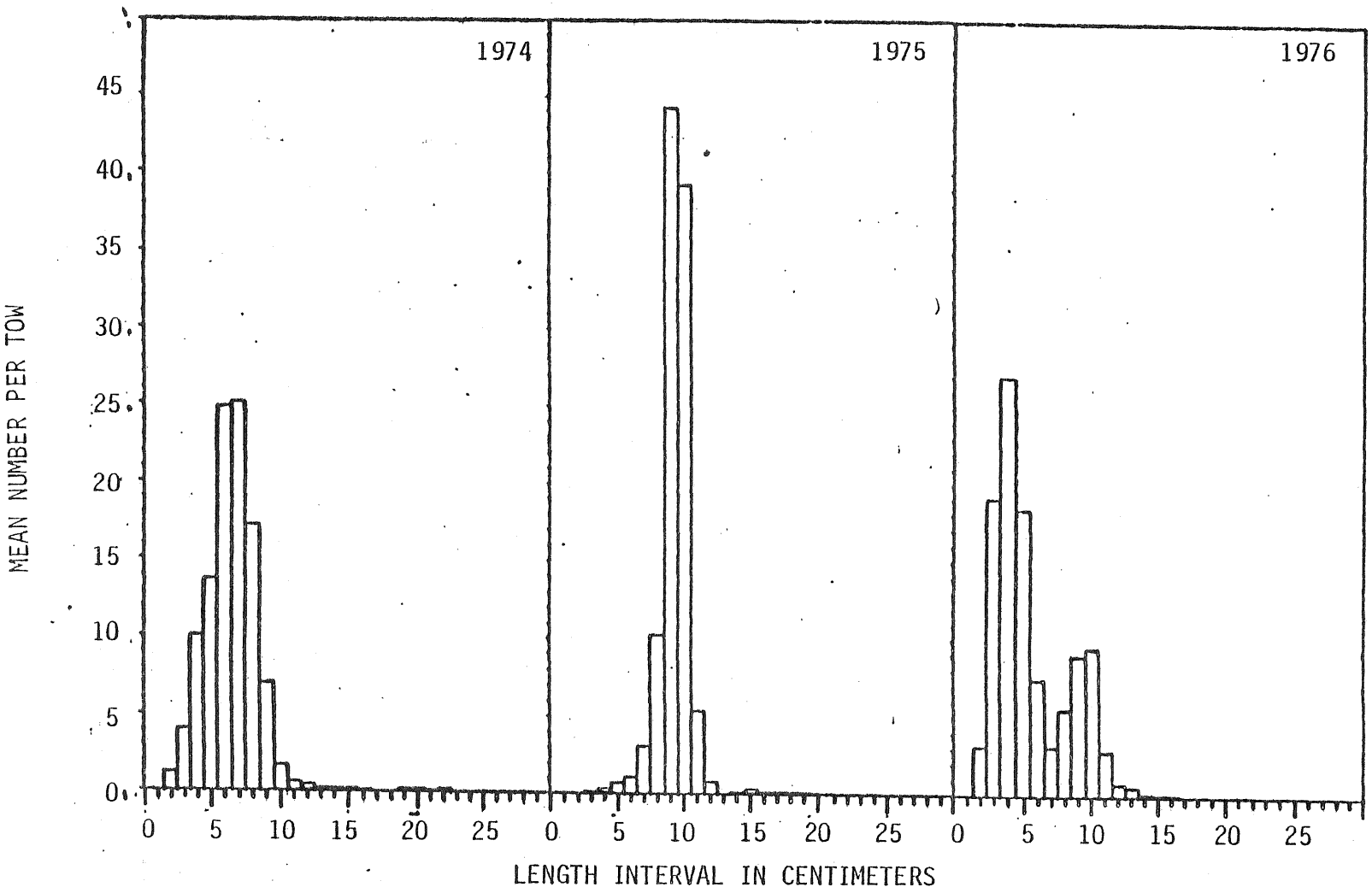


Figure 10. Butterfish length frequency histograms from inshore north bottom trawl surveys, 1974-1976.

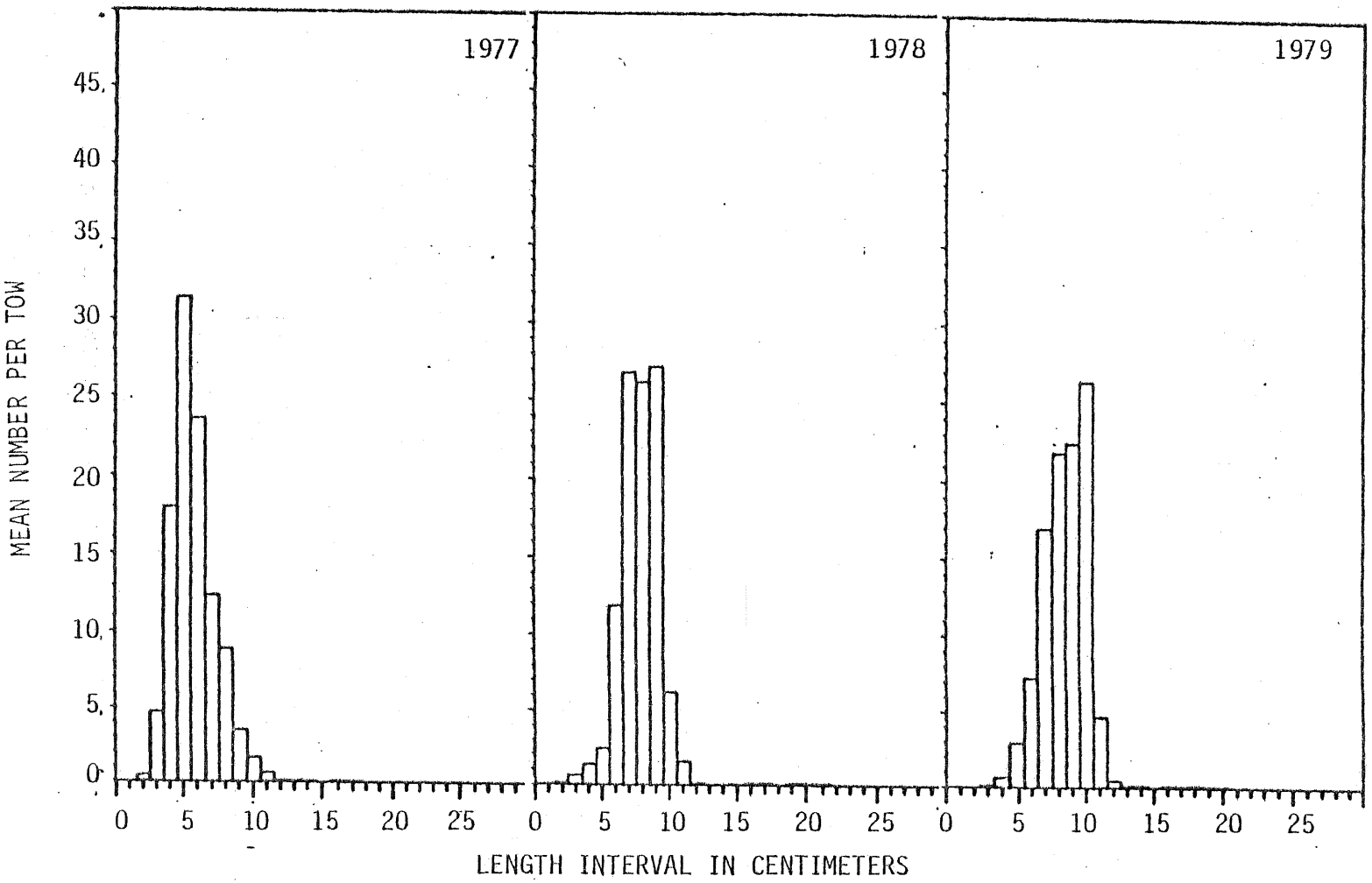


Figure 11. Butterfish length frequency histograms from inshore north bottom trawl trawl surveys, 1977-1979.

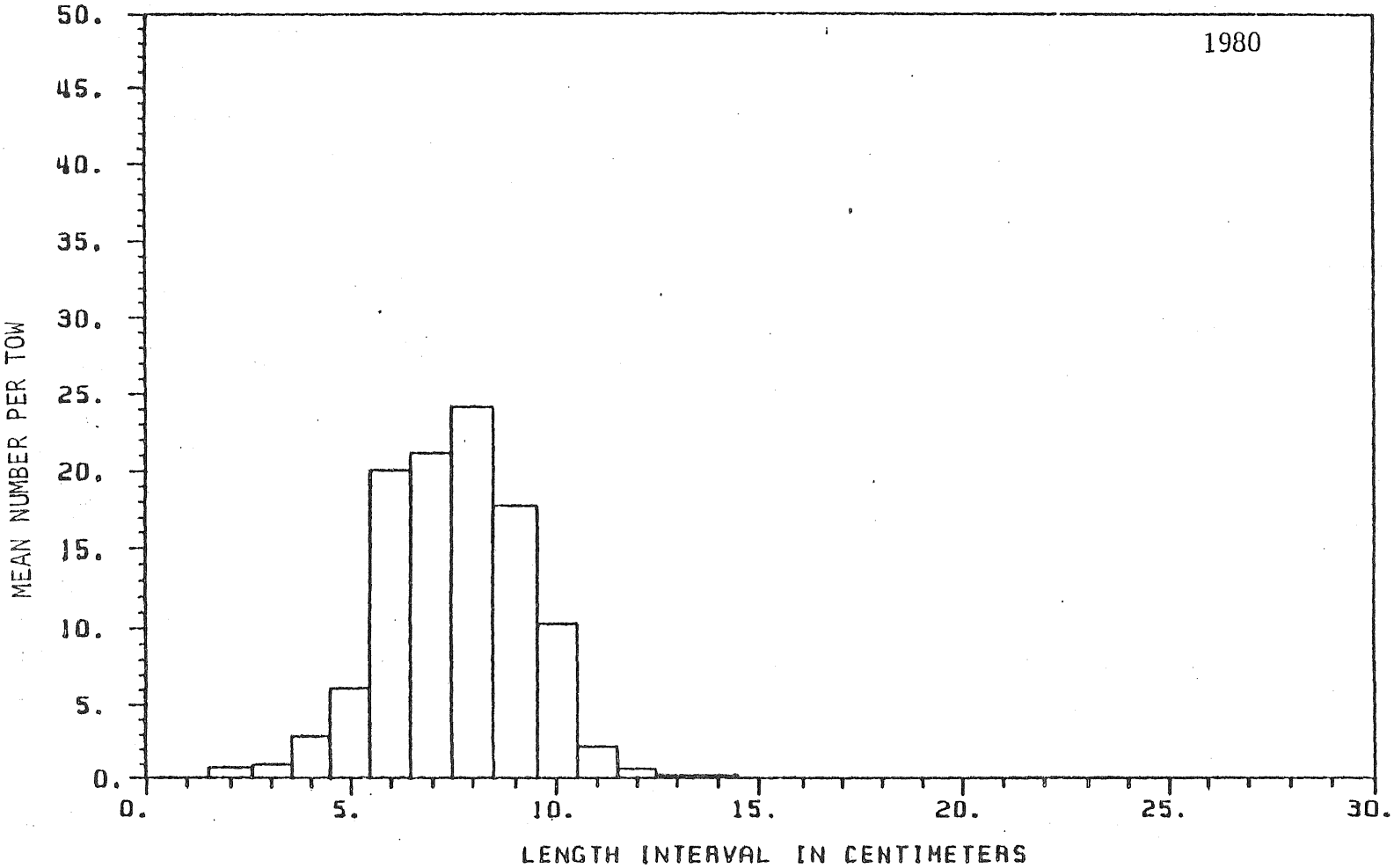


Figure 12. Butterfish length frequency histograms from inshore north bottom trawl surveys, 1980.

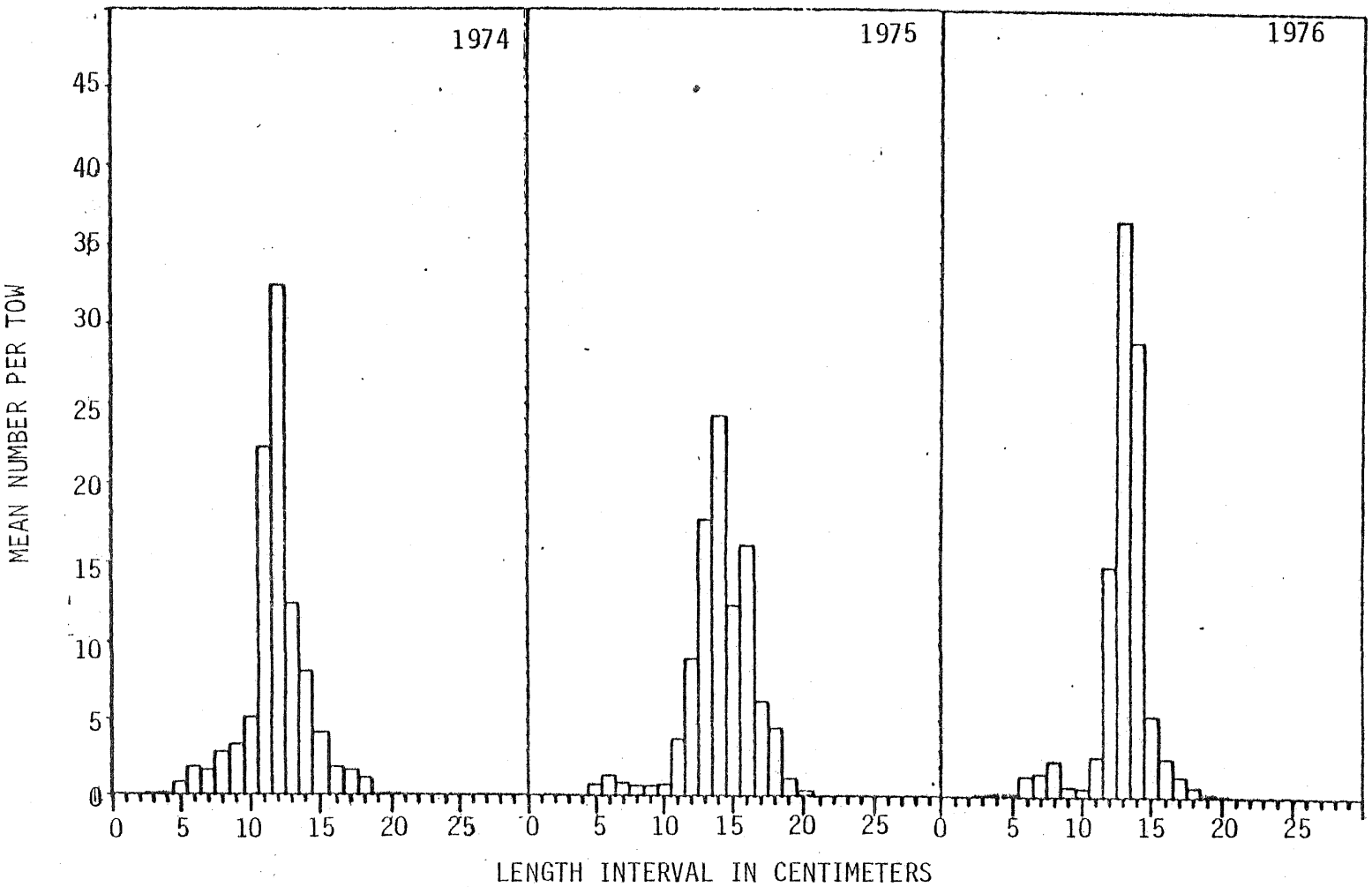


Figure 13. Butterfish length frequency histograms from inshore south bottom trawl surveys, 1974-1976.

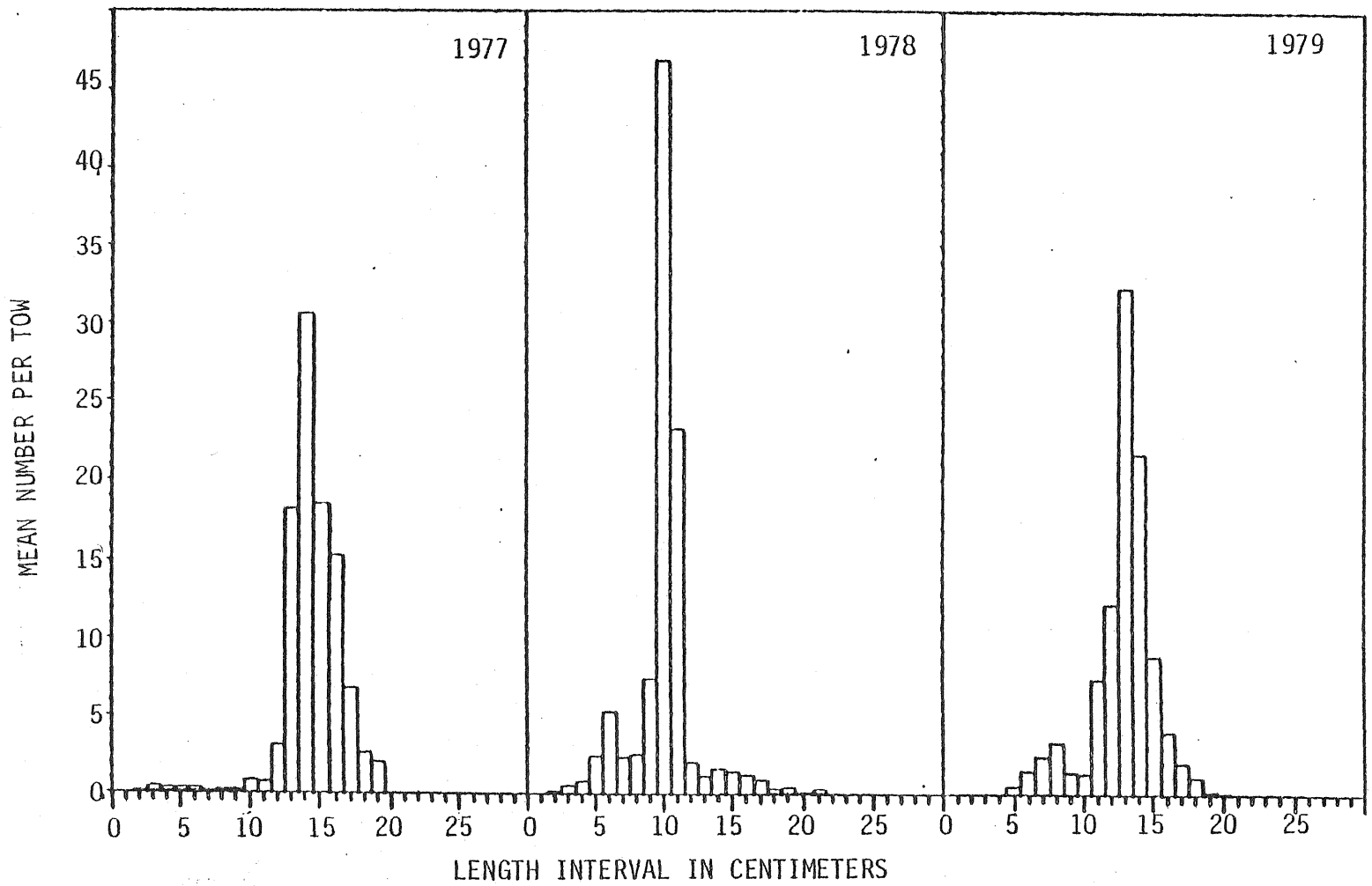


Figure 14. Butterfish length frequency histograms from inshore south bottom trawl surveys, 1977-1979.

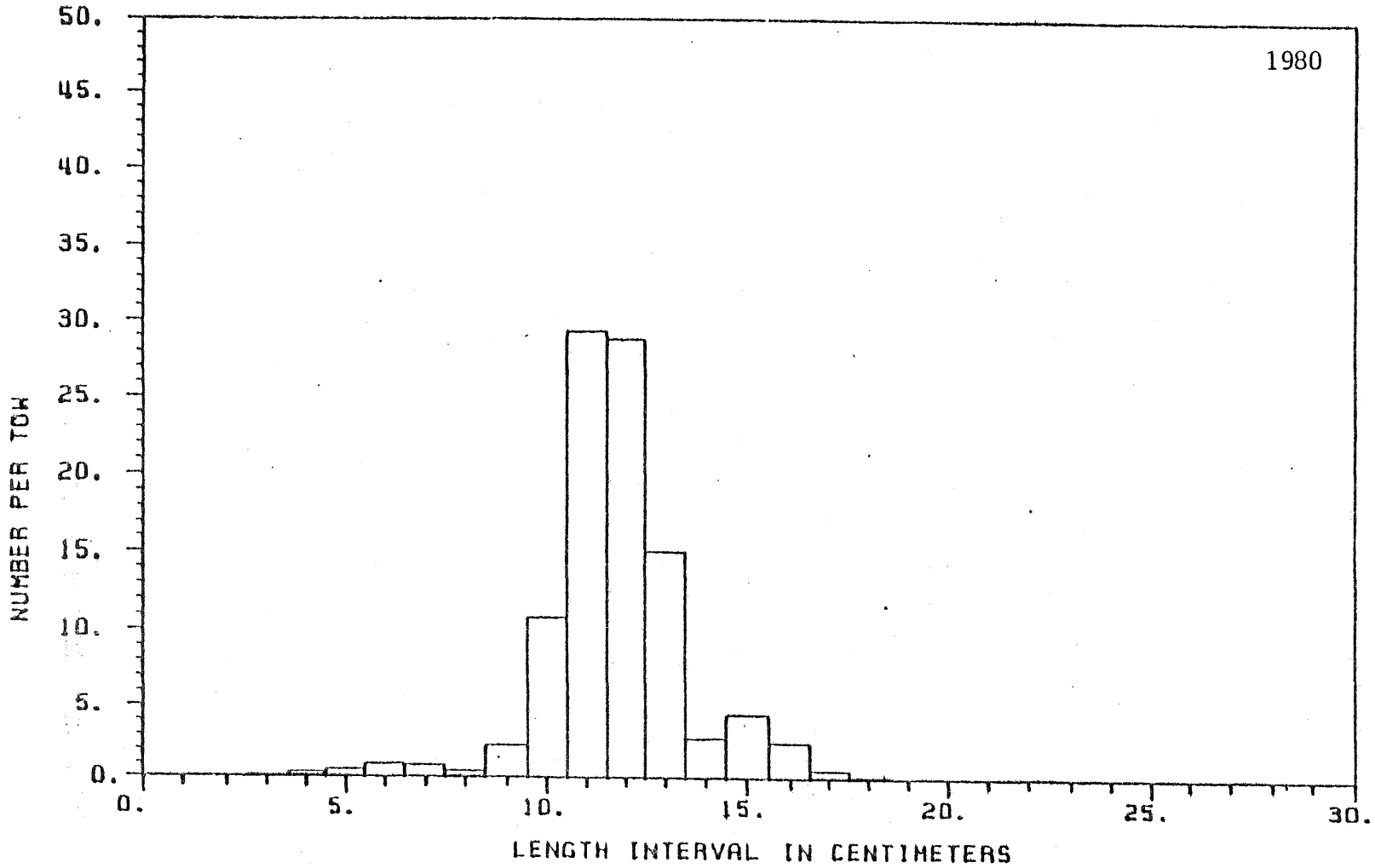


Figure 15. Butterfish length frequency histograms from autumn inshore south bottom trawl surveys