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## 1982 Status Report on the 4VWX Redfish

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### Abstract

Due to a lack of aged materials available for redfish in divisions 4VWX no cohort analyses are possible. We therefore examined several indices of stock status. Landings have increased since 1979 to a provisional total of 18,267 mt in 1981. Second, three of four catch rate series indicate increasing catch rates over the past few years. Finally, the results of a recent research vessel survey for redfish indicated substantially higher biomass estimates than general groundfish surveys conducted previously in the same areas. In addition this survey indicated substantial concentrations of redfish between 200-300 fathoms depths, which have not been surveyed previously.

### Résumé

Le manque de matériel d'âge connu nous a empêché de faire des analyses de cohortes du sébaste des divisions 4VWX. Nous avons donc recouru à plusieurs indices de la condition du stock. Depuis 1979, les débarquements ont augmenté à un total provisoire de 18 267 tm en 1981. En second lieu, trois ou quatre séries de taux de capture indiquent une augmentation en ces dernières années. Enfin, les résultats d'un récent relevé du sébaste par navire de recherche reflètent des estimations de biomasse substantiellement supérieures à celles des relevés de poissons de fond effectués auparavant dans les mêmes régions. En outre, le relevé du sébaste indique la présence de fortes concentrations de cette espèce aux profondeurs de 200-300 brasses, qui n'avaient pas encore été explorées dans les relevés.

## SUMMARY OF FISHERY TO 1981

Redfish landings from the Scotian Shelf reached a maximum of over 60,000 mt in 1971, declined until 1979 to 13,154 mt and have increased in 1981 to 18,267 mt (provisional data). At least a portion of the 1981 increase can be attributed to diversion of fishing efforts following the early filling of cod and haddock quotas.

A total allowable catch (TAC) was first imposed in 1974 (40,000 mt) and subsequently reduced to 20,000 mt between 1976 and 1979 whereupon it was increased to 30,000 mt. This TAC remained in effect to 1982. This level of TAC was originally chosen because research vessel surveys were thought to indicate a trawlable biomass of about 200,000 mt, and it was believed that redfish could support a 15% exploitation rate (CAFSAC 1980).

## METHODS

Previous work has shown that available data do not allow the conduct of satisfactory analytical assessments of Scotian Shelf redfish populations and hence none has been attempted. We present an update of available data on stock status. These data include landings (by division, country, and major gear types), catch rate series by major gear types, research vessel biomass estimates (using both arithmetic and geometric means), and research vessel length frequency distributions (both for the entire Scotian Shelf and by individual NAFO Division). Commercial length frequencies, although available, involve too many uncertainties (eg. mesh size employed, discards; Clay 1979) to be of use and are not presented.

## RESULTS AND DISCUSSION

### Landings

Landings since 1928 are shown in Figure 1, the increase through the 1930's and 1940's has been interpreted as the initial exploitation of the surplus biomass of an unexploited population (Mayo and Miller 1975). This phase of exploitation was completed by the late 40's culminating in a landing of over 84,000 mt. in 1951. Landings decreased through the early 1950's, then rose slowly to a level of approximately 30,000 mt through the early 1960's (landings by Division are given on Fig. 2). Landings reached a second major peak in 1971 with a total 65,893 mt. These high values were the results of record landings by both Canada and the Soviet Union (25,000 and 20,000 mt respectively). From 1972 to 1976 landings declined rapidly to a little over 18,000 mt in 1976. This decline has resulted both from a withdrawal of the foreign fishery and a general decline in landings by Canadian vessels.

### Commercial Catch Rate Series

Kenchington (1981) presented catch rate series for Canadian (Maritimes and Quebec) side trawlers (tonnage class 4), stern trawlers (tonnage class 5), and midwater trawlers (tonnage class 4). In addition catch rate series for U.S.A. side trawlers (tonnage class 4) were presented.

The fishery by United States vessels is now limited to the Jordan Basin (5Y - 4X) and contributes only a very small proportion of the totals landings for Division 4VWX (see Table 1). Since the American catch rate series represents only a small proportion of the Division's landings, this series has been discontinued. A similar fate has befallen the midwater trawl series which in the past several years has contributed only a few tons to the total redfish landings from Division 4VWX.

The remaining catch rate series are presented in Figure 3. For each of the gear types, two series are presented simultaneously. The first represent catch rate estimates calculated on the basis of the total yearly catch for that gear type and tonnage class divided by total yearly effort. The second series for each gear type has catch rates calculated from third quarterly totals of catch and effort. The reason for this second series stems from the fact that the major portion of the total landings for any given year are made during this time.

All of the catch rate series presented in Figure 3 show the same general patterns over time. The yearly series show a general increase in catch rates from the late 1950's to the mid-sixties whereupon each shows a decline. Since the mid-sixties all four time-series are complete. The yearly side trawler (OTB-1) catch rate series was relatively stable from 1967 to 1972 with catch rates of a little over  $0.6 \text{ mt}\cdot\text{hr}^{-1}$ . From 1972 to 1978 this catch rate declined steadily reaching about  $0.45 \text{ mt}\cdot\text{hr}^{-1}$  in 1978. From 1978 to 1981 the side trawler catch rates have increased to nearly  $0.6 \text{ mt}\cdot\text{hr}^{-1}$ .

Side trawler catch rates based on third quarter data show an almost identical time series with the exception of the fact that this series begins its decline in 1969, while the yearly time series showed steady catch rates through 1972.

The two stern trawler time series show a rather more precipitous decline in catch rates from the late 1960's to 1974. From 1974 to 1981 these catch rates have been steadily increasing to a present level of about  $0.7 \text{ mt}\cdot\text{hr}^{-1}$ .

A similar set of time series of catch rates for Newfoundland based vessels operating in Division 4VWX is given in Figure 4. In these series, both the yearly and third quarterly catch rates for side trawlers declined from 1966-67 to 1979. Between 1979 and 1981 these

rates have remained relatively stable. The stern trawler (OTB-2) series declined from 1967 to 1976, whereupon both the yearly and third quarterly rates increased sharply. Between 1977 and 1979 these rates declined, following which they increased to 1981.

To aid in the interpretation of these catch rate series, we have presented proportions of total landings, represented by each the aforementioned effort series, in Figure 5. These data indicate that the Maritime and Quebec tonnage class 4 side trawlers have accounted for a relatively constant proportion of total landings in the Division, since 1958. This proportion began to decline somewhat in 1978, whereupon tonnage class 5 stern trawlers increased in importance. The Newfoundland based vessels have, as would be expected, caught a smaller share of the redfish landings than did Maritimes based vessels. However, during the mid 1970's the Newfoundland based side trawlers were equalling or even surpassing the amounts caught by the Maritimes and Quebec based vessels.

#### Research Vessel Biomass Estimates

Arithmetic and geometric mean redfish biomass estimates for 1970 to 1981 are shown in Figure 6. The arithmetic series is extremely variable with year to year fluctuations of over 200,000 mt between some years. Since redfish is a slow growing, long-lived species these cannot represent variations in actual biomass. It is difficult to state with certainty what this time series indicates in terms of redfish biomass, although in an extremely general sense there does appear to have been a decrease throughout the 1970's.

The geometric mean series is somewhat less variable. A decrease throughout the 1970's is indicated. In this series, as opposed to the arithmetic one, the decline continues through to 1981, although at a rate much reduced from that observed between 1978 and 1980.

On theoretical grounds, the geometric mean series is thought to better represent the trend in biomass, but its absolute values are depressed (Kenchington 1981, Sokal and Rohlf 1969). The trend indicated by the geometric series indicates that redfish biomass is currently low, and hence that the arithmetic mean value is indicating a correct trend.

During March and April of 1982 a survey for redfish was conducted in Division 4VWX. Preliminary results indicate biomass estimates in the deeper (100-200 fathoms) zones at approximately 5 times the level estimated from the July 1981 groundfish survey (Zwanenburg 1982). These redfish survey estimates are derived from a much higher number of sets within each of these strata and are thus associated with somewhat lower variance estimates.

Since this survey was designed specifically for redfish, strata down to 300 fathoms were also surveyed. Although no biomass estimates are yet available from these deep strata, mean catch rates were higher than those observed at any shallower depths (Zwanenburg 1982). These

findings may be indicative of the inadequacy of the present general groundfish surveys with regard to surveying redfish. It appears as if too few sets, and a lack of deep water trawling may be resulting in population biomass underestimates. However, no information is available on biomass trends in these deeper strata.

### Research Vessel Length Frequencies

Figure 7 shows length frequencies based on research vessel estimates combined for all of Division 4VWX on a year by year basis. All data from years 1970 to 1981 is given in millions of fish per centimeter length groupings. Data for 1982 are the total combined length frequency for cruise H073 conducted during March and April 1982. Figure 8 was taken from Clay (1980) and Kenchington (1981) with additions. These show research vessel estimates of redfish length frequency distributions by Division and year.

Data for 1970-1973, 1975, 1977, and 1978 shown in Figure 7 show a large group of fish with a modal length frequency which gradually increases from 23 to 28 cm. Data for the remaining years are rather less clear, mainly because of the smaller catches of redfish by the research vessel during these years. Within this time series there is clear evidence of relatively strong recruitment in 1974 (modal length 17 cm) and 1977, modal length 14 cm in 1977, and 17 cm in 1978. This latter recruitment event can be readily followed from 1977 to 1981. The large mode at 17 cm seen in 1974 is almost certainly the large 1971 year-class identified by previous investigators (eg. Mayo 1980).

The length frequencies shown in Figure 8 suggests that 4Vn contains larger (30 - 40 cm) fish and shows significant recruitment in 1972 as well as in 1977. The latter mode can be traced through to 1981.

Division 4Vs has rather smaller fish than the 4VWX average (15-25 cm) and shows the 1977 recruitment quite clearly. Division 4W accounts for most of the fish in the 4VWX length frequencies, and indicates large modes of fish at 20-30 cm. Again the 1977 recruitment is obvious in this time series. The 1976 length frequency distribution indicates the beginning of this strong recruitment in 1977. Division 4X (East) is the only division to show an abundance of recruits in 1974. This large mode again appears in 1976 at 23 cm. Division 4X (West) is interesting in that it consistently contains larger than average fish (30 - 40+) and has shown little or no evidence of recruitment. Only in 1974 is there some indication of recruitment with a group of fish whose modal length is approximately 17 cm.

The recent redfish survey (Zwanenburg 1982) provides some interesting information (Fig. 7). These data indicate a large mode of 7 cm fish, and another centered on 11 cm. These fish are too small to be fully recruited, even to the survey gear, and thus may be even more abundant than the catches suggest. Although this cruise covered only a

restricted area (parts of 4Vs, 4W, and 4X), reports from scientists on the spring 1982 groundfish survey cruise suggest that the abundance of these small fish is much more widespread.

The 7 cm fish almost certainly represent the 1981 year-class, suggesting that the 11 cm ones are 1980 fish. Following this reasoning it may be that the recruitment observed in 1977 was the result of the 1974 year-class, and that the recruitment observed in 1974 in 4X (East) was the result of the abundant 1971 year-class which is known to have been strong in the Gulf of Maine (Mayo 1980).

In summary, the length frequency data indicate that the average size of Scotian Shelf redfish has changed little since 1970. The 1971 year-class provided notable recruitment in the 4X (East) area while the 1974 year-class appears to have contributed more generally to the 4VWX redfish population. There is some evidence that there will be very strong recruitment resulting from the apparently abundant 1980 and 1981 year-classes. These year-classes may sustain the fishery in several years time.

#### SUMMARY

\* If commercial catch rate indices are indicators of redfish stock abundance these indicate that redfish biomass declined during the early to mid 1970's whereupon a substantial resurgence became evident. This increase continues.

\* Research vessel survey abundance estimates are highly variable but generally a decline in redfish biomass was in evidence during the 1970's. This decline continued until 1980. Data for 1981 indicate, if not a slight increase, at least a more stable redfish biomass estimate. Preliminary data from a 1982 redfish survey indicate higher biomass levels than in 1981 for some strata, and high catch rates of redfish in waters previously not surveyed (366-550 m).

\* Research vessel length frequency estimates for 4VWX redfish indicate that recruitment from both the 1980 and 1981 year-classes could be significant in the next few years.

\* In conclusion, a decline in redfish abundance in Divisions 4VWX appears to have occurred from 1970-1975/6, when catches reached approximately 18,000 mt. Following these landings, some stock abundance indicators (catch rates) reversed their downward trend. This may be interpreted as an indication of stock resurgence under these levels of fishing pressure.

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Table 1. TAC's, quotas, allowances, and catches since 1974.

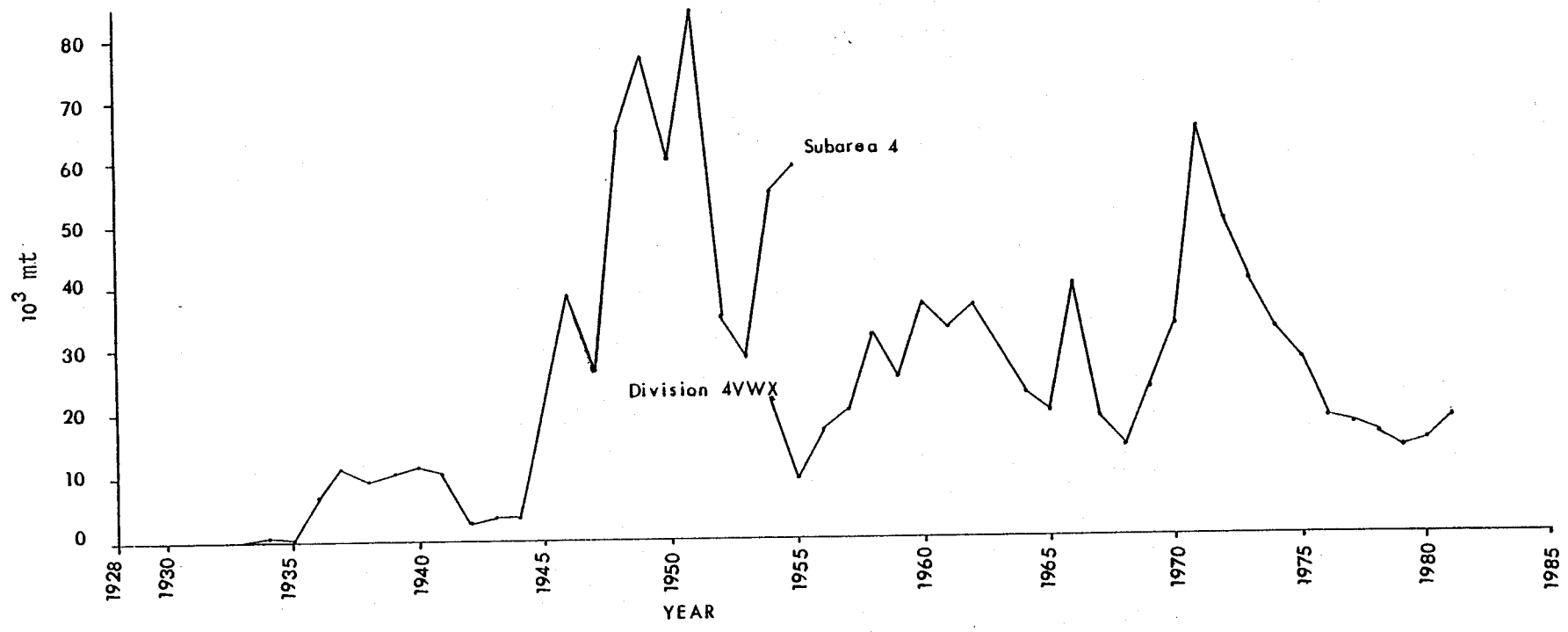
	1974	1975	1976	1977	1978	1979		1980		1981
TAC	40000	30000	20000	20000	20000	20000		30000		30000
Landings	32837	27983	18459	17845	16094	13154		14114		18267*
Canada:										
Quota	20000	14860	12000	13000	17500	13000	18000	18500	29000	18500
Landings	15739	17025	12625	14712	13576		12240		13085	17576
France:										
Quota	1000	740	250	250	250	500 <sup>a</sup>	500 <sup>a</sup>	500 <sup>a</sup>	500 <sup>a</sup>	500 <sup>a</sup>
Landings	420	186	279	63	121		20		-	-
Poland:										
Quota	1300	970	Subsequent catches included with "Others".							
Landings	803	230								
USSR:										
Quota	6600	4900	1000	500	Subsequent catches included with "Others".					
Landings	6692	4849	1021							
USA:										
Quota	10000	7430	6000	6000	1500	See "Others"	10500	0	0	
Landings	8891	5465	4446	2876	2147			883	661	
Others:										
Quota	1100	1100	750	250 <sup>b</sup>	250 <sup>b</sup>	6500	1500	500	500	11000
Landings	288	228	88	19	250		894		-	30

- data not yet available  
<sup>a</sup> St. Pierre vessels only  
<sup>b</sup> By-catch only  
\* Provisional Statistics

Landings to 1978 are from ICNAF Statistical Bulletins.  
Since 1979 quotas have been amended during the year; initial and final ones are given.



Figure 1. Commercial Redfish Landings from Subarea 4 (to 1955) and Division 4VWX (since 1954).



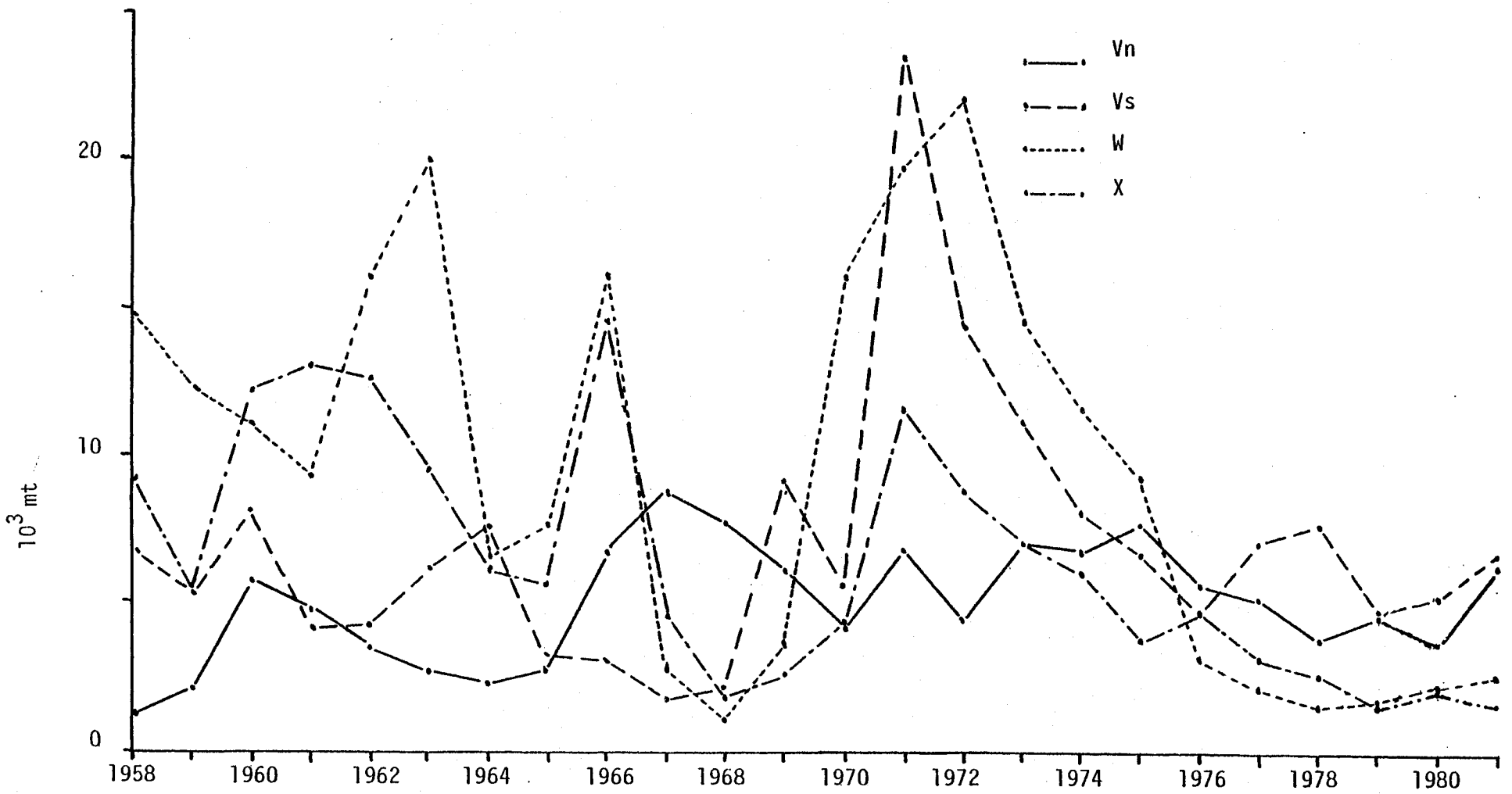


Figure 2. Landings by division

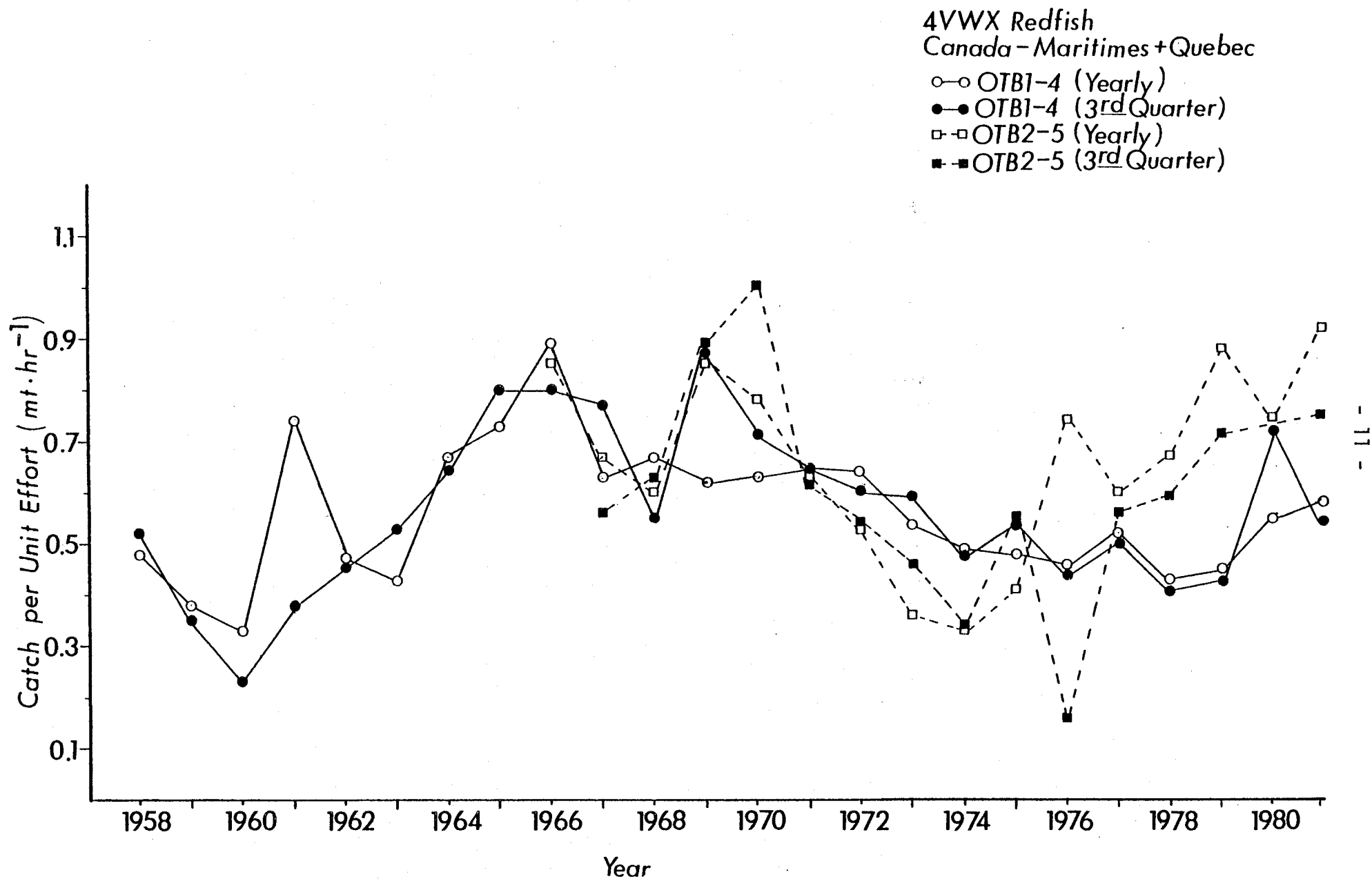


Figure 3. Yearly and third quarterly catch rate series for side trawlers (tonnage class 4) and stern trawlers (tonnage class 5) based in the Maritimes and Quebec.

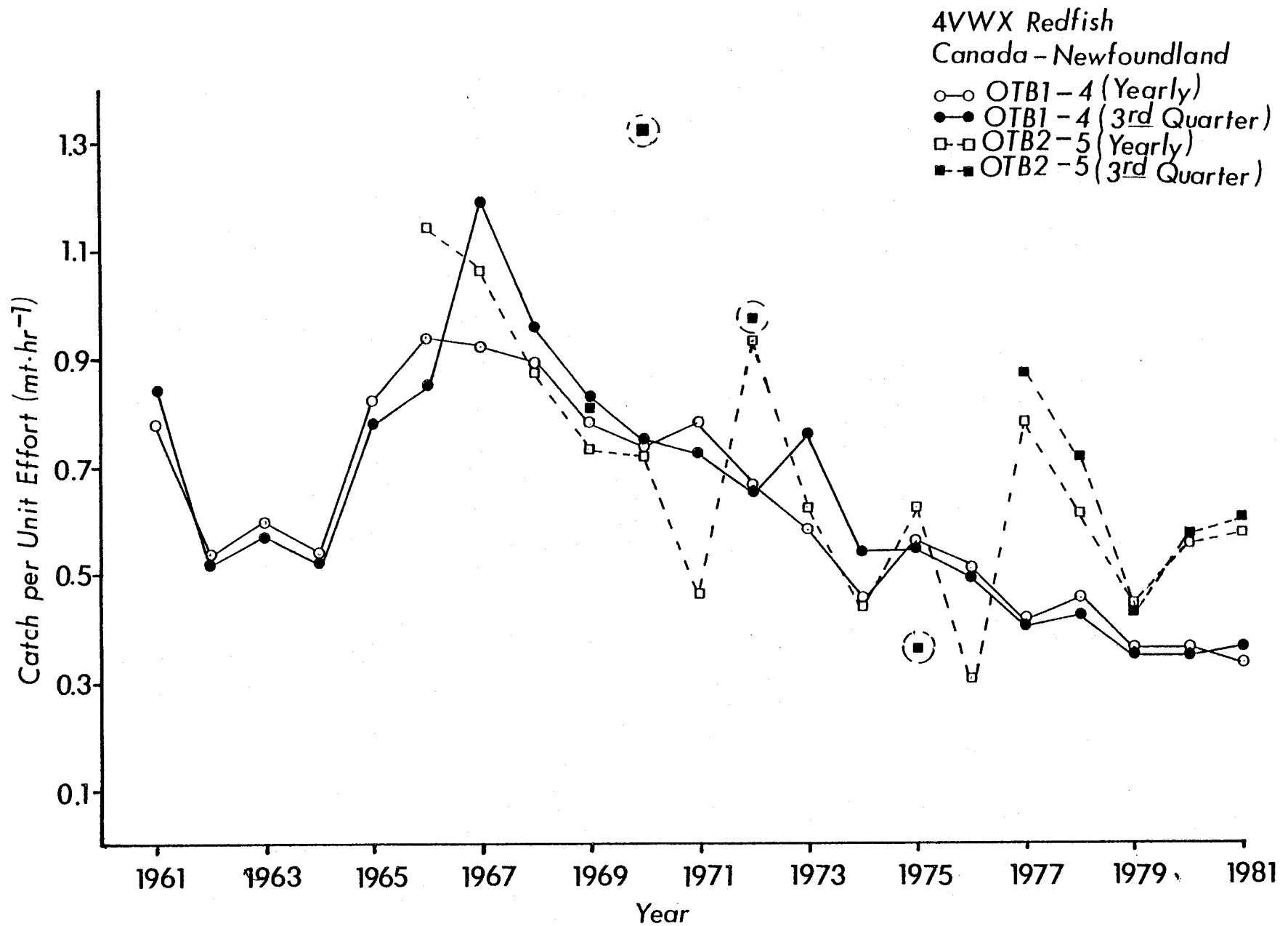


Figure 4. Yearly and third quarterly catch rate series for side trawlers (tonnage class 4) and stern trawlers (tonnage class 5) based in Newfoundland. (■) Indicates that data points for adjacent years in that series are missing.

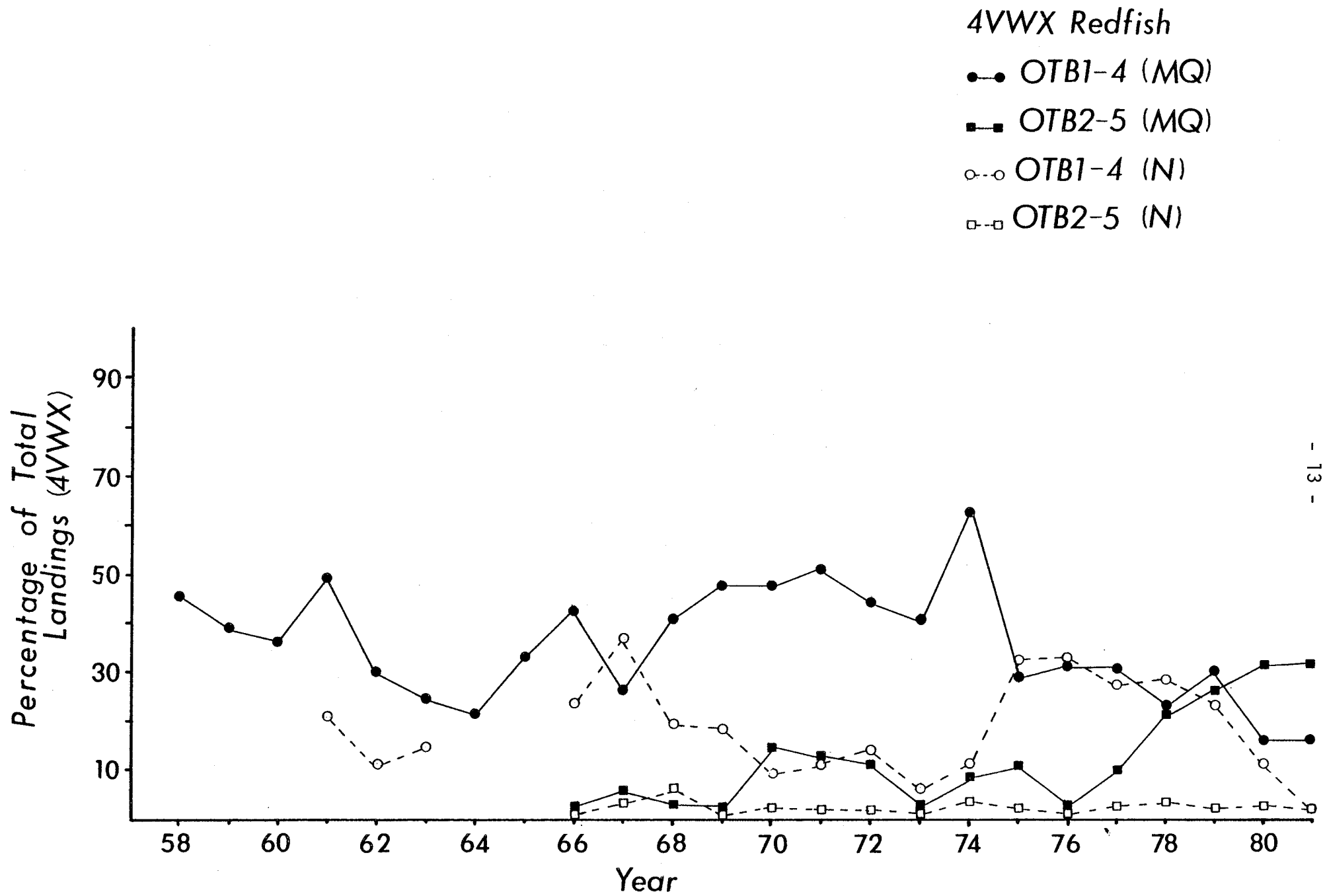


Figure 5. Proportion of total landings (Division 4VWX) represented by catch of the catch rate series discussed in the text.

Figure 6. Redfish biomass from R.V. surveys, 4VWX

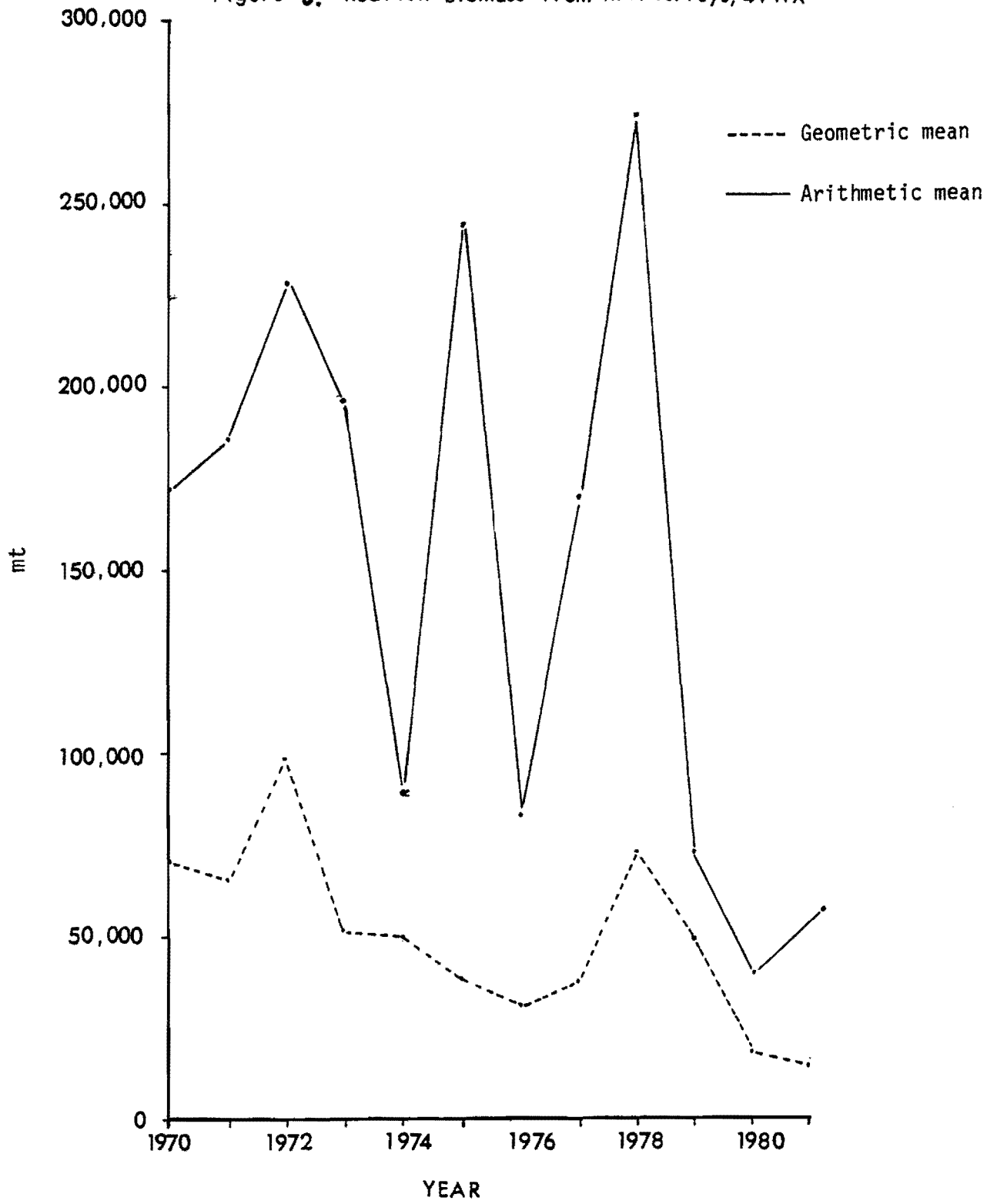
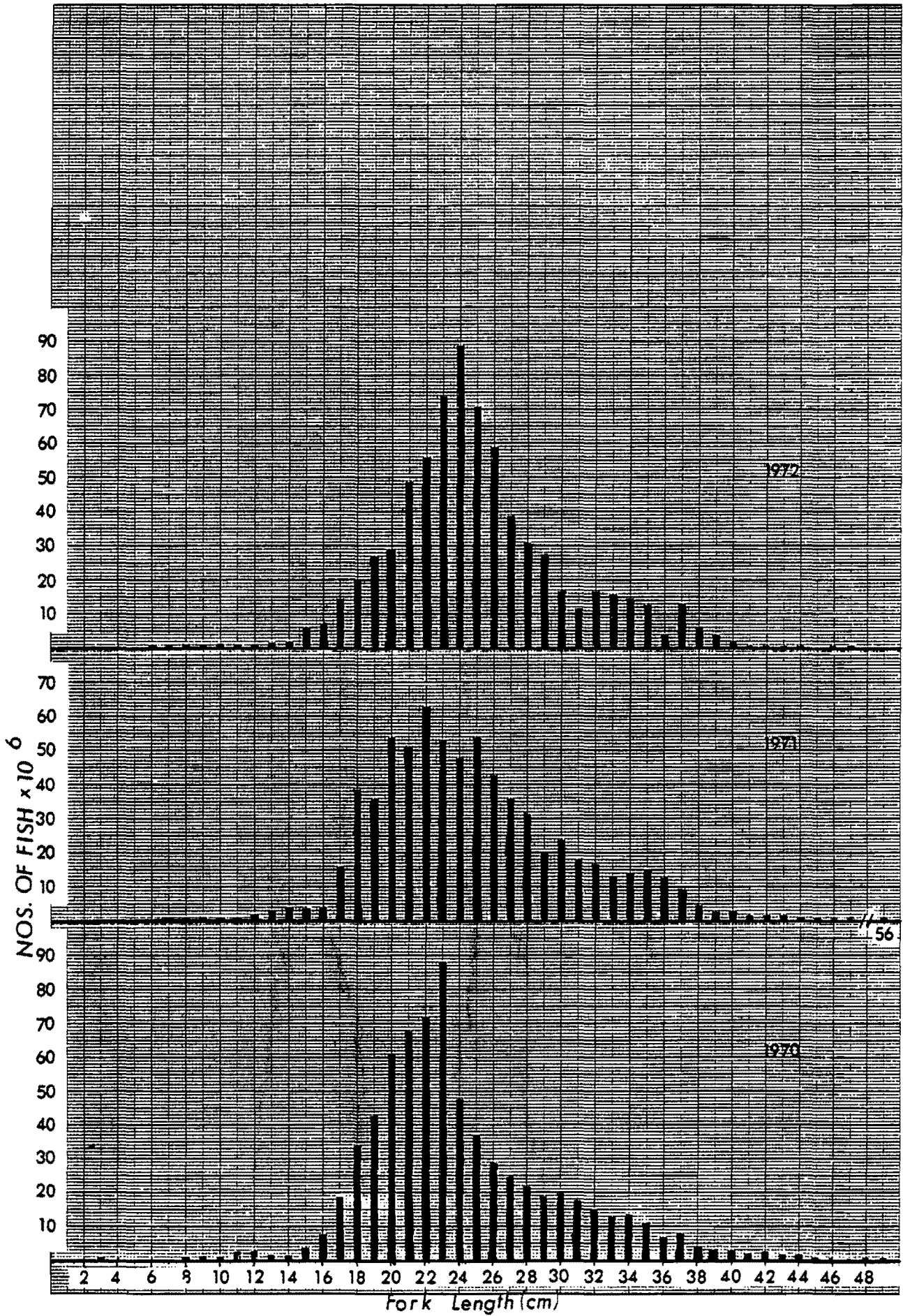
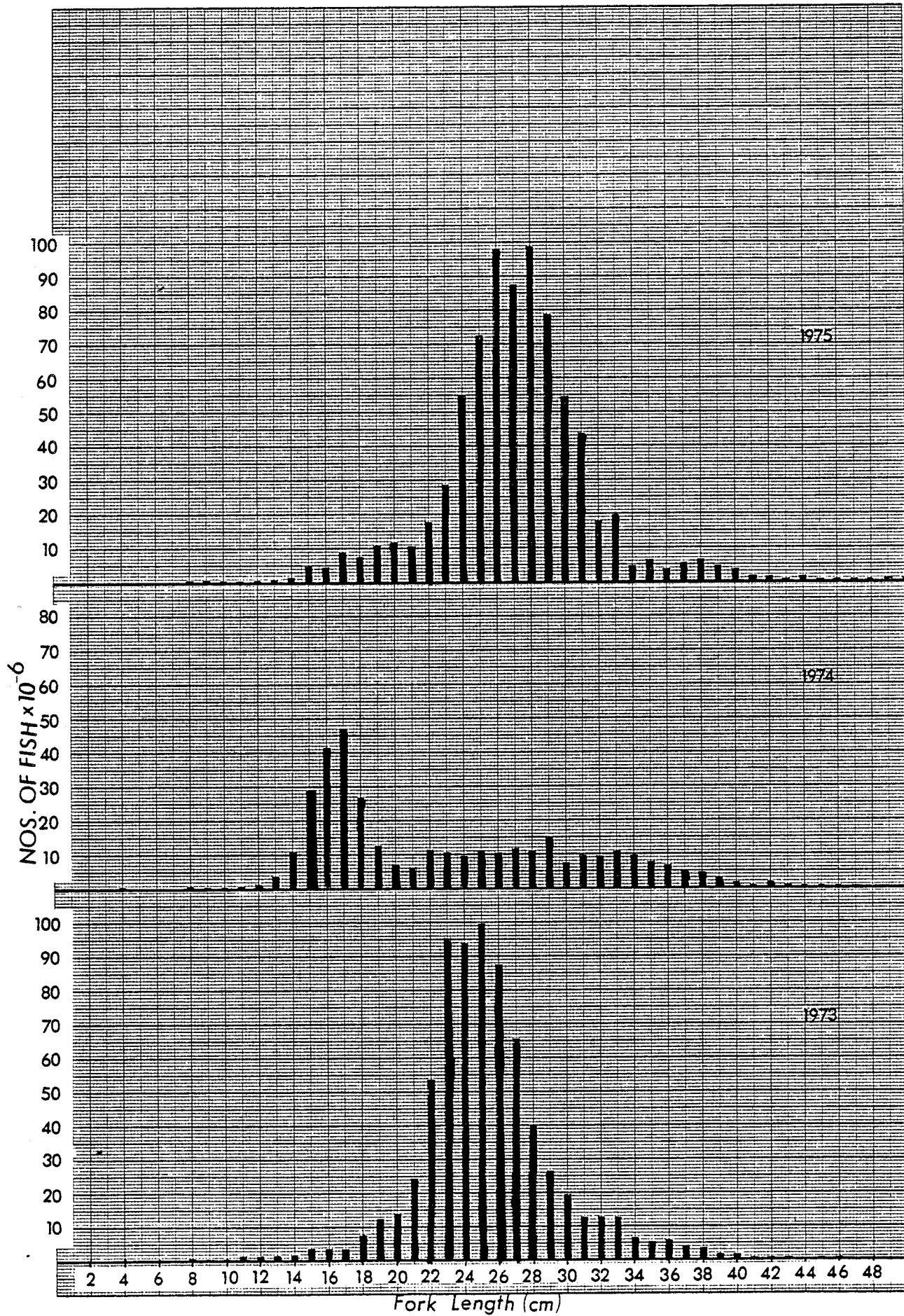


Figure 7. Research vessel estimates of Length-Frequency distribution for Division 4VWX from 1970 to 1982 on a year by year basis. Pages 16, 17 and 18 inclusive.







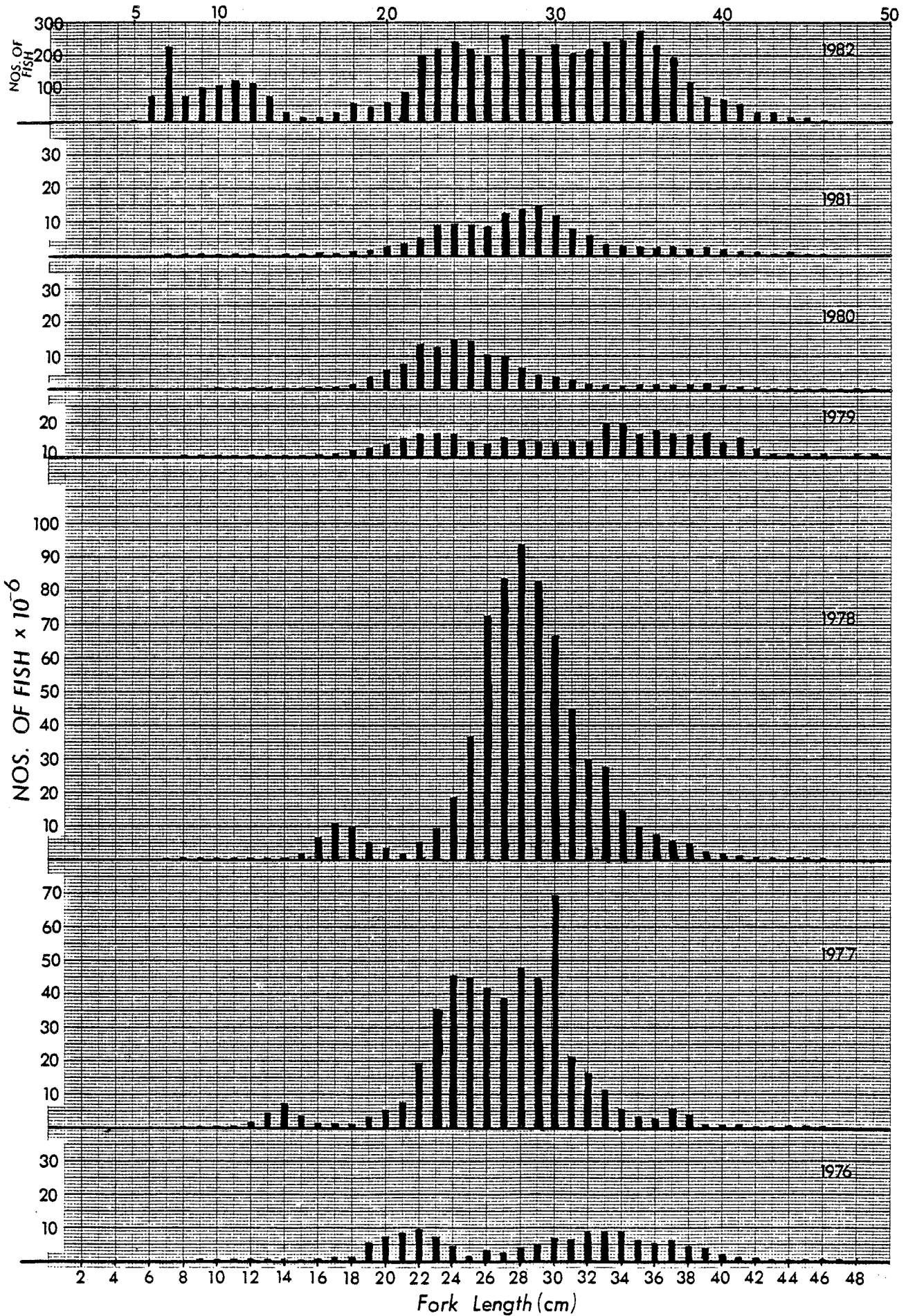
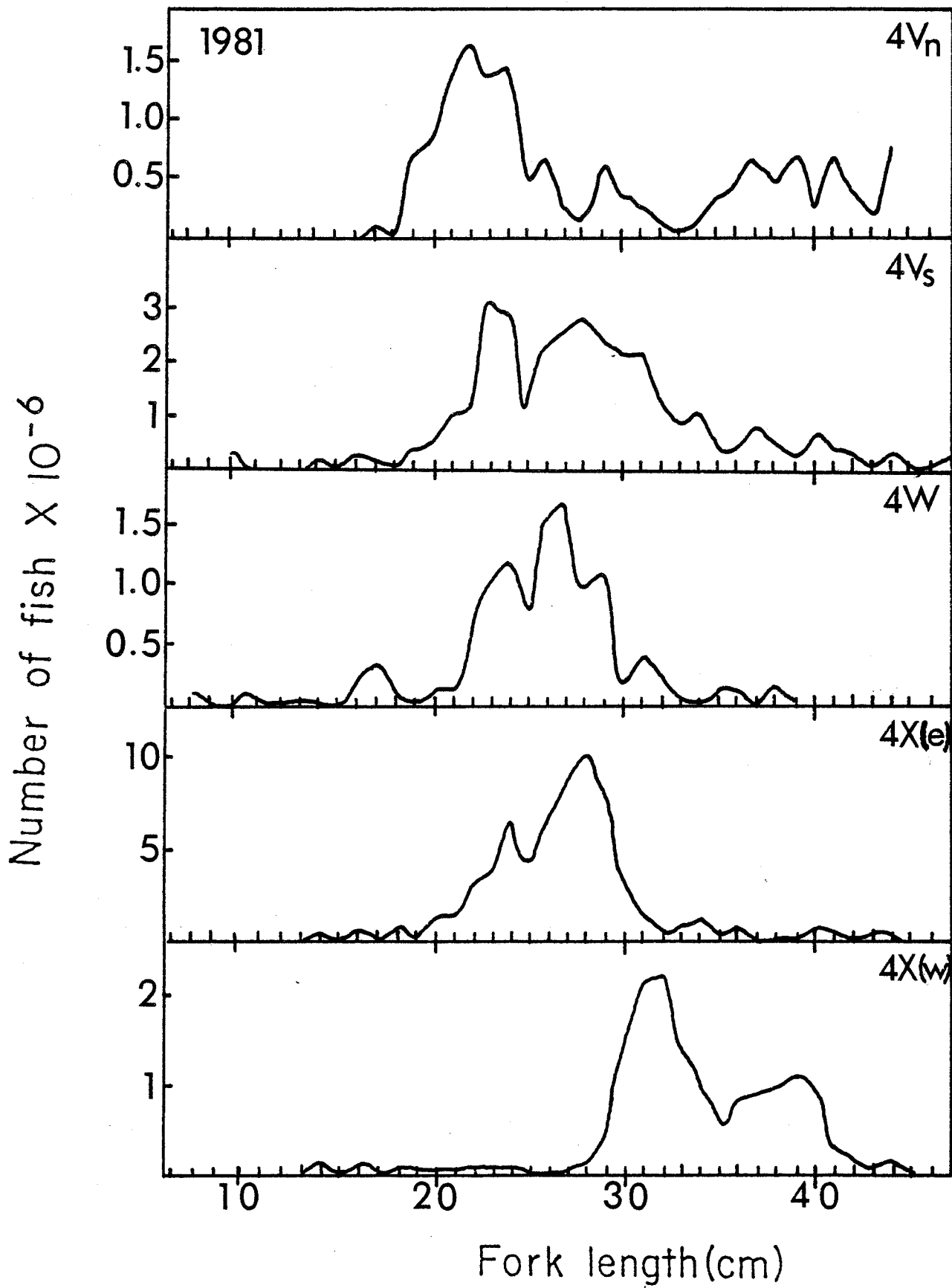
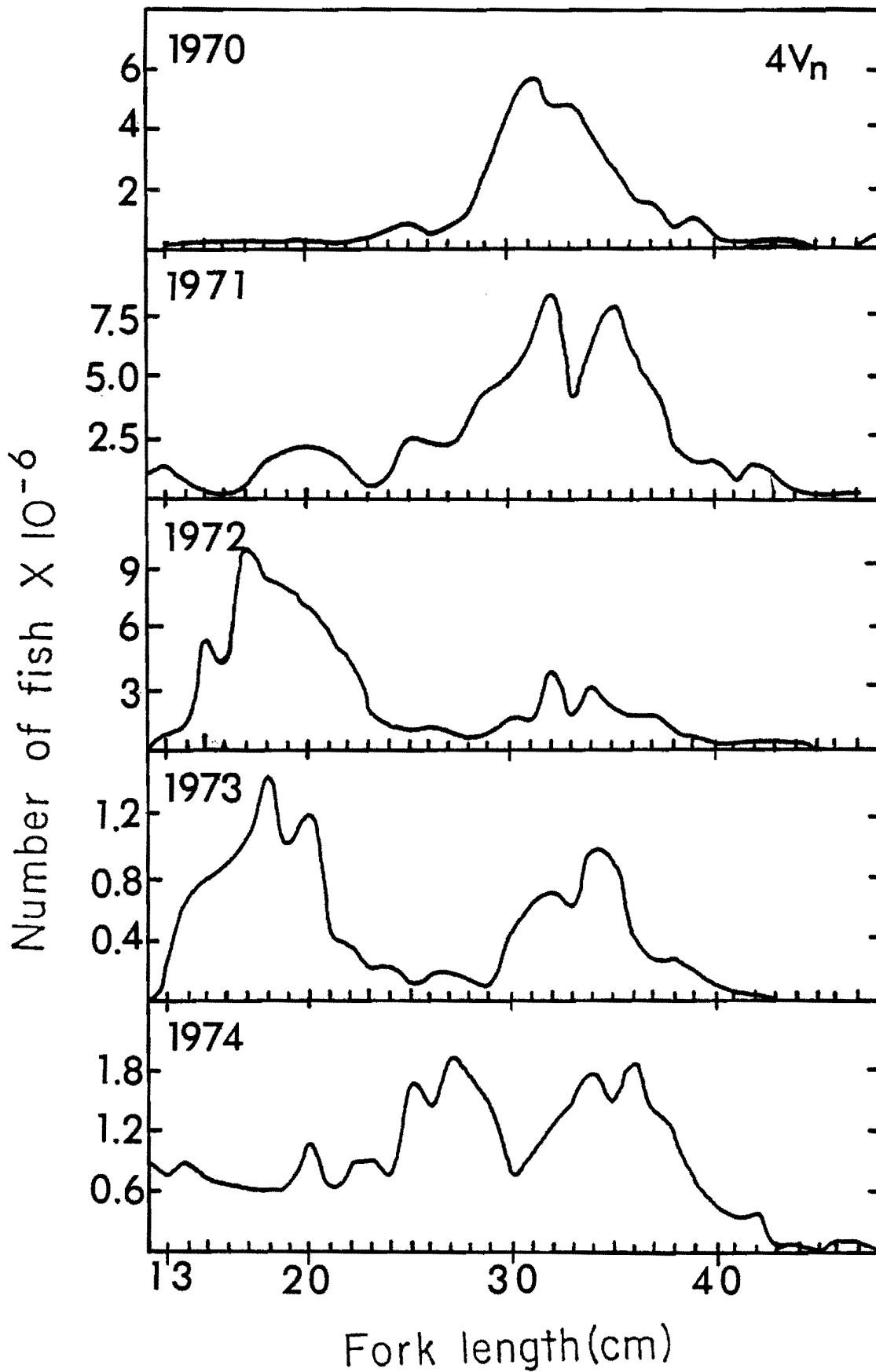
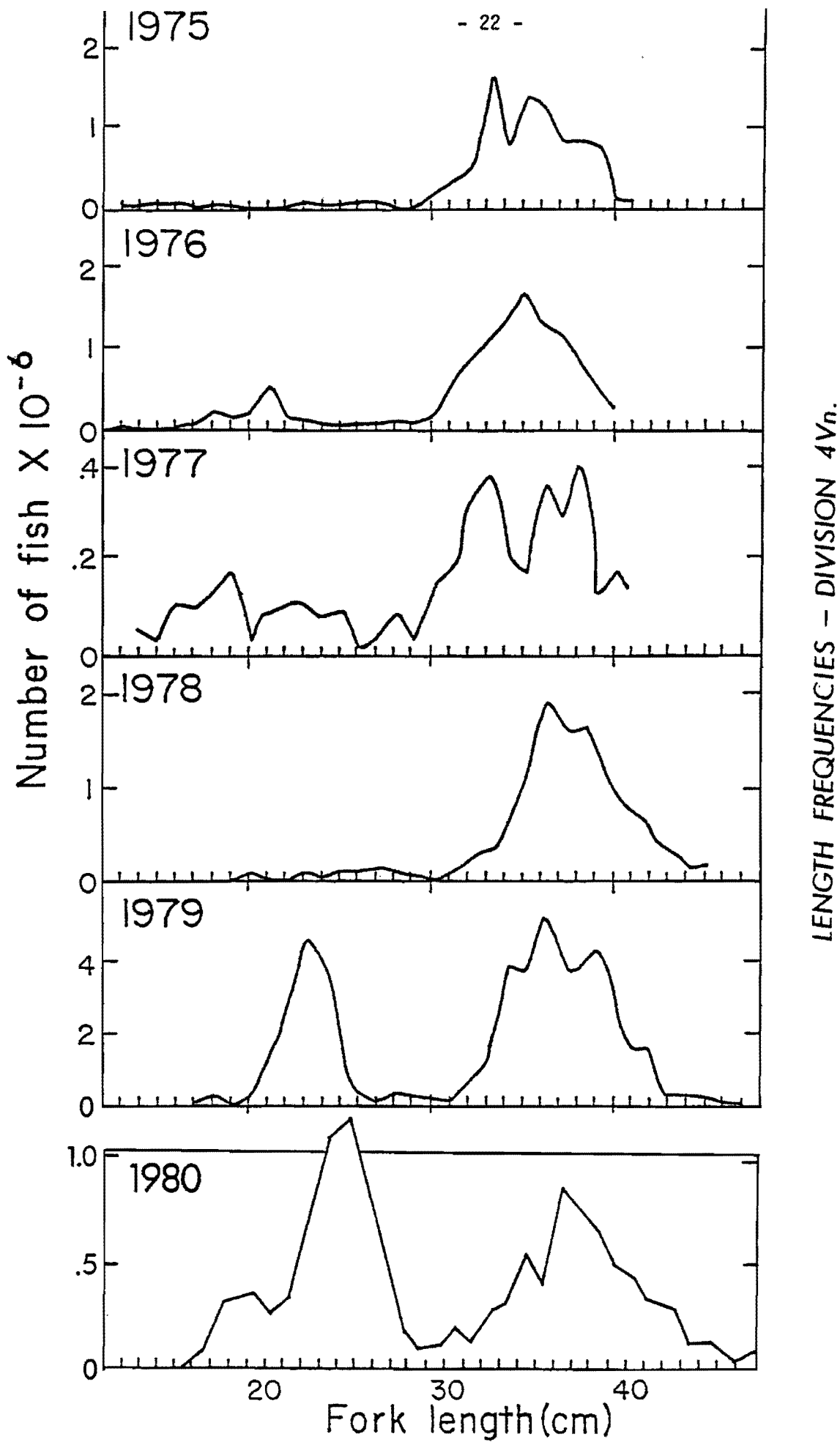
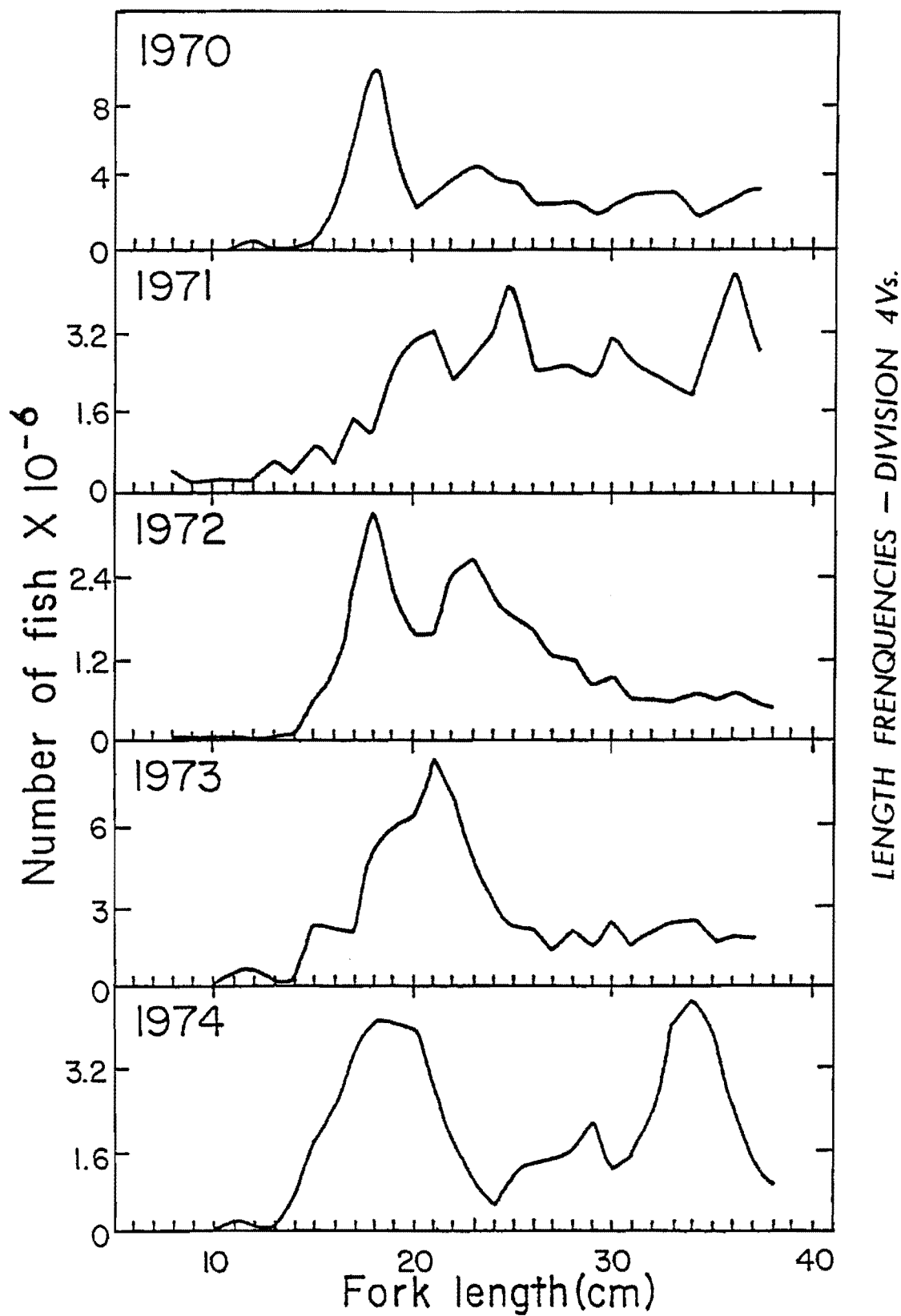


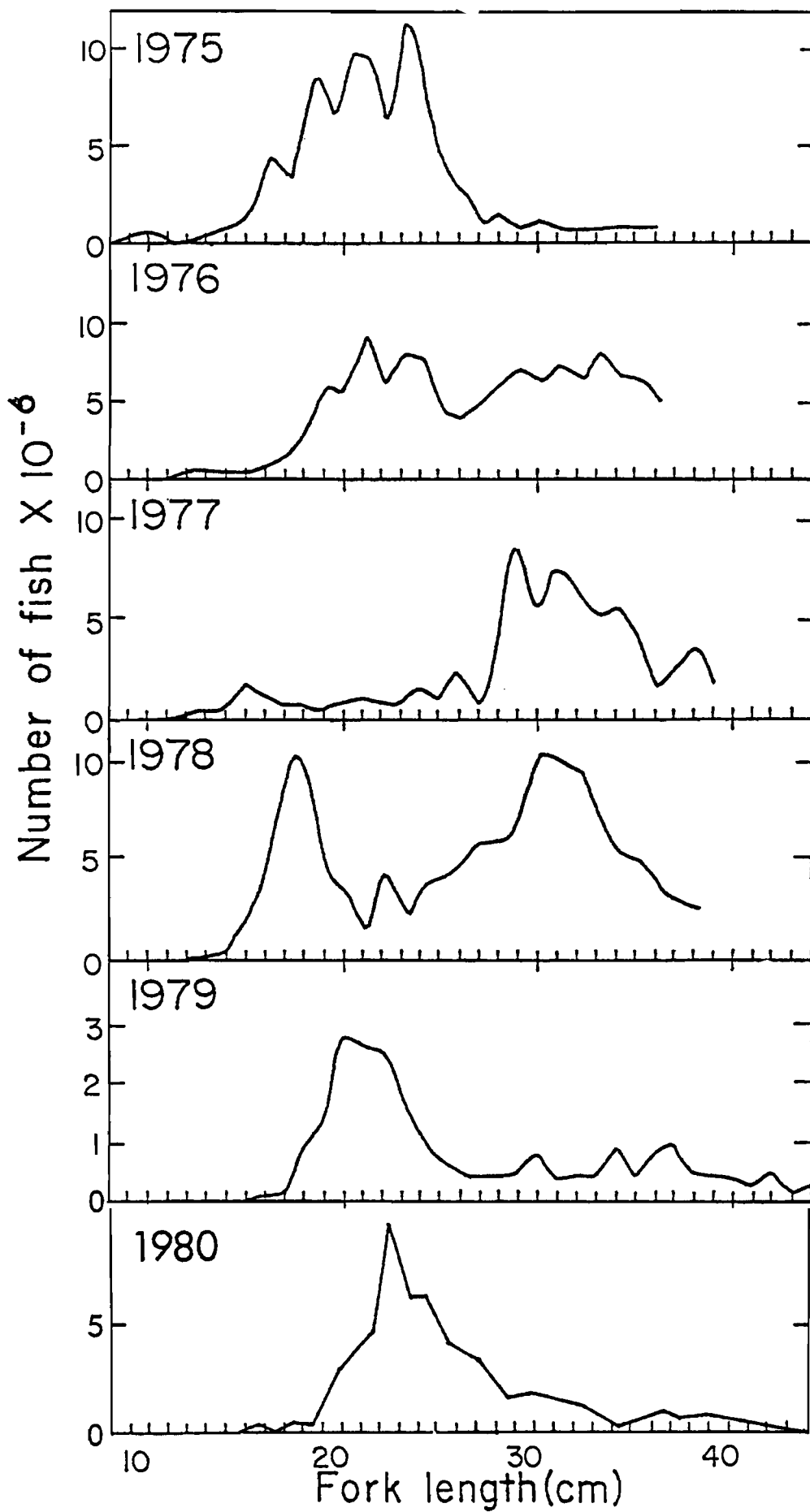
Figure 8. Research vessel estimates of redfish Length-Frequency distribution by Division for 1970-1981. Pages 20-30 inclusive.





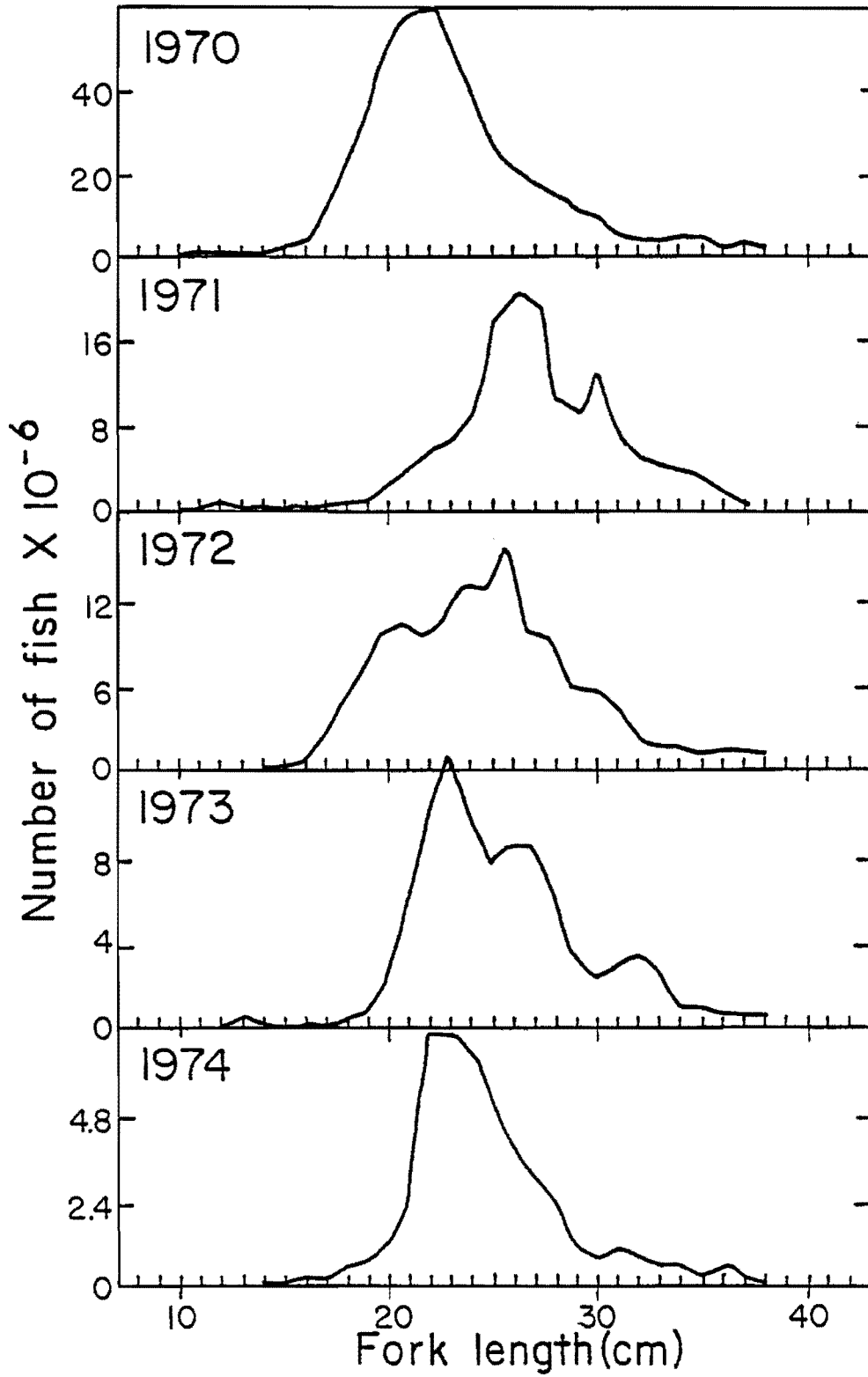




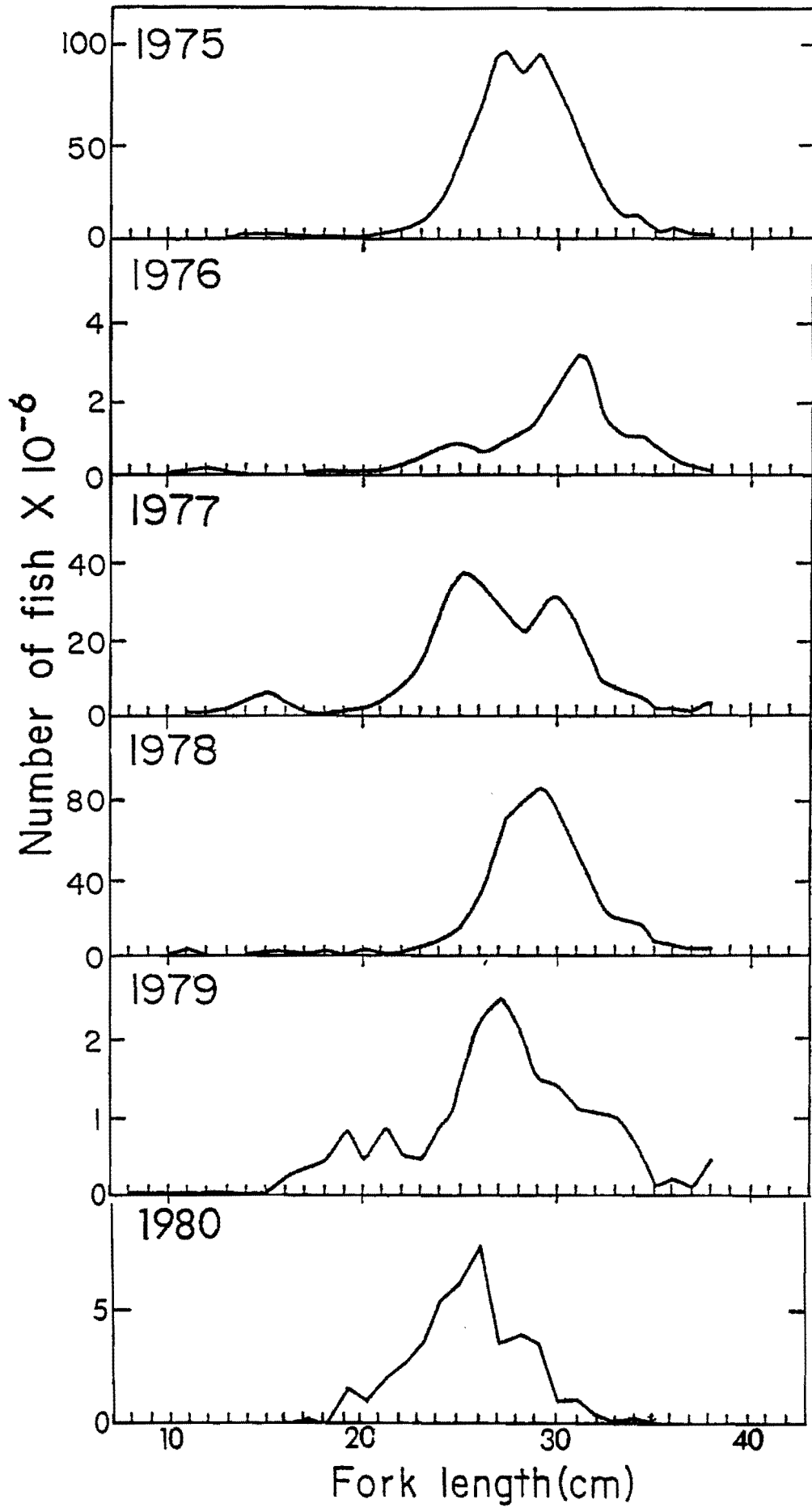


LENGTH FREQUENCIES - DIVISION 4Vs.

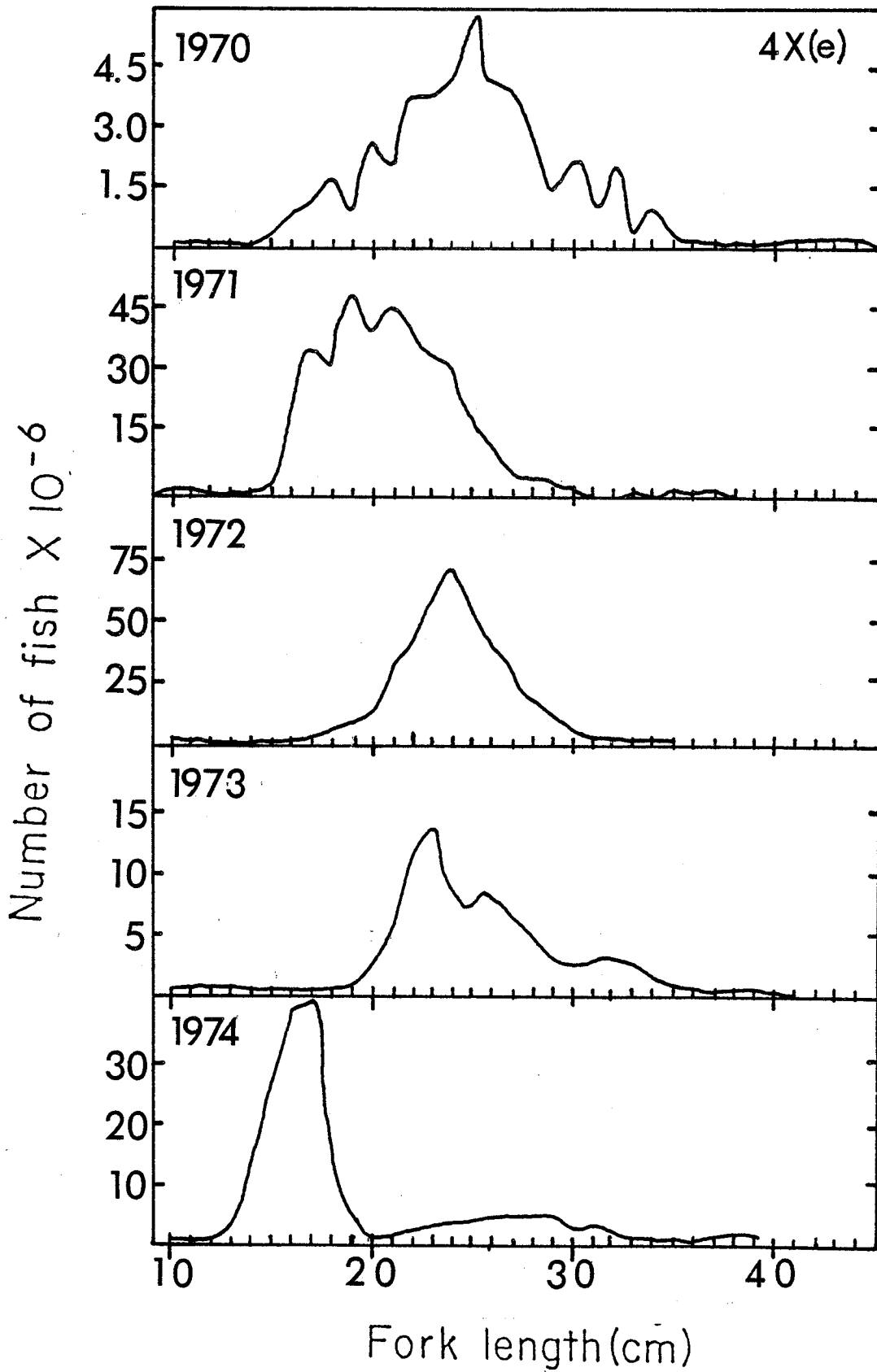




LENGTH FREQUENCIES - DIVISION 4W.



LENGTH FREQUENCIES - DIVISION 4W.



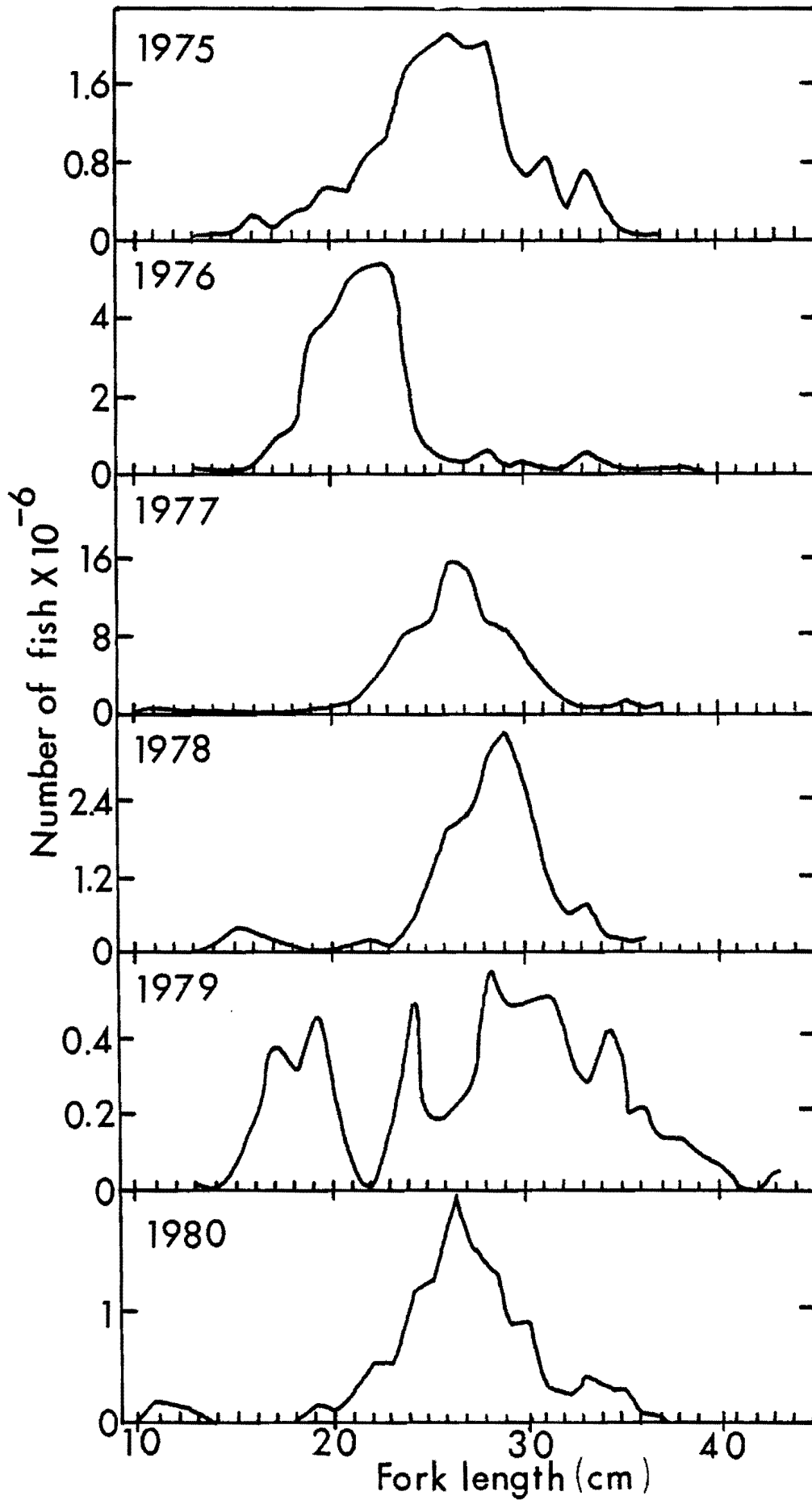
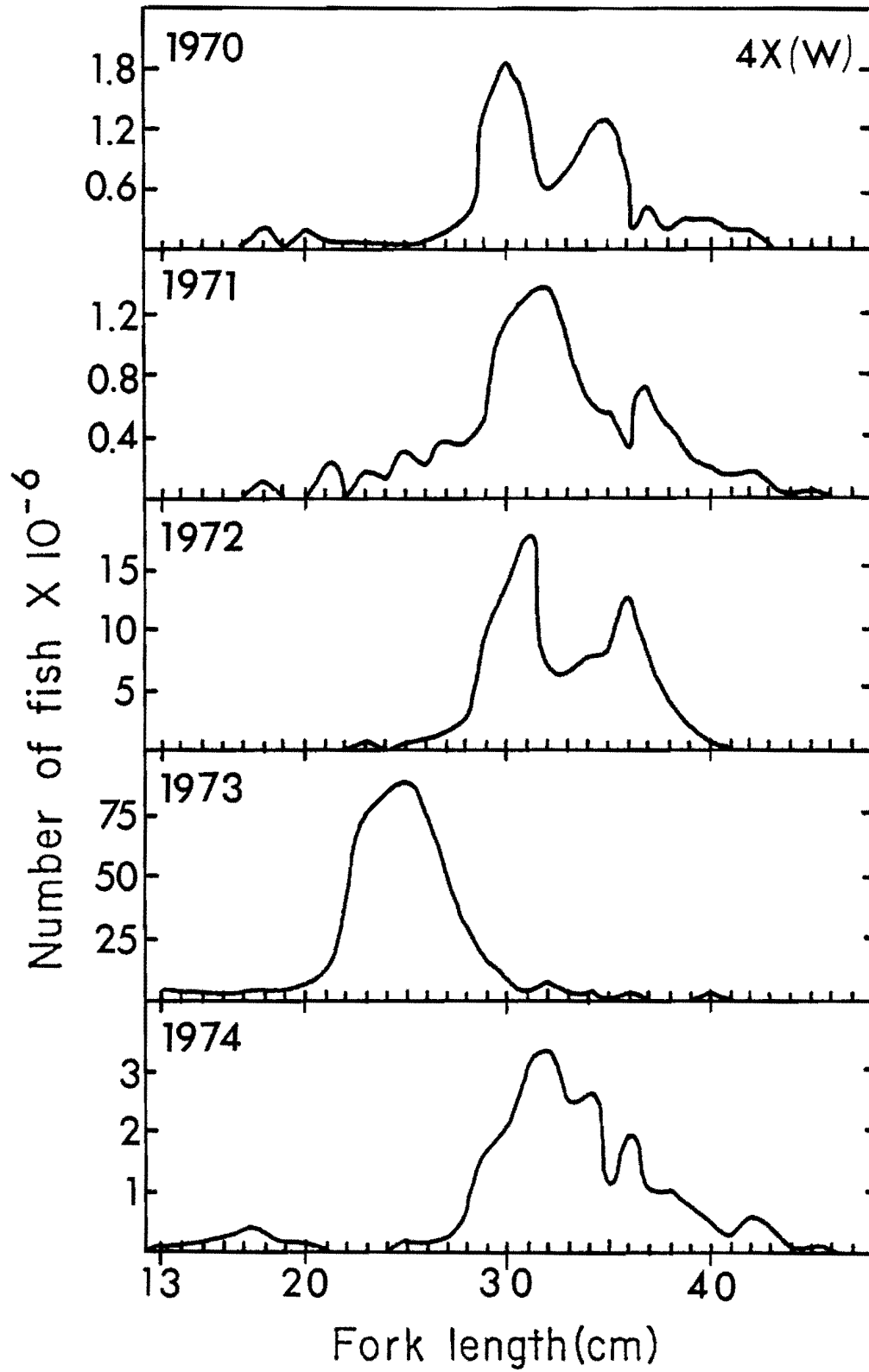


Figure : Length Frequencies - Division 4X (East)



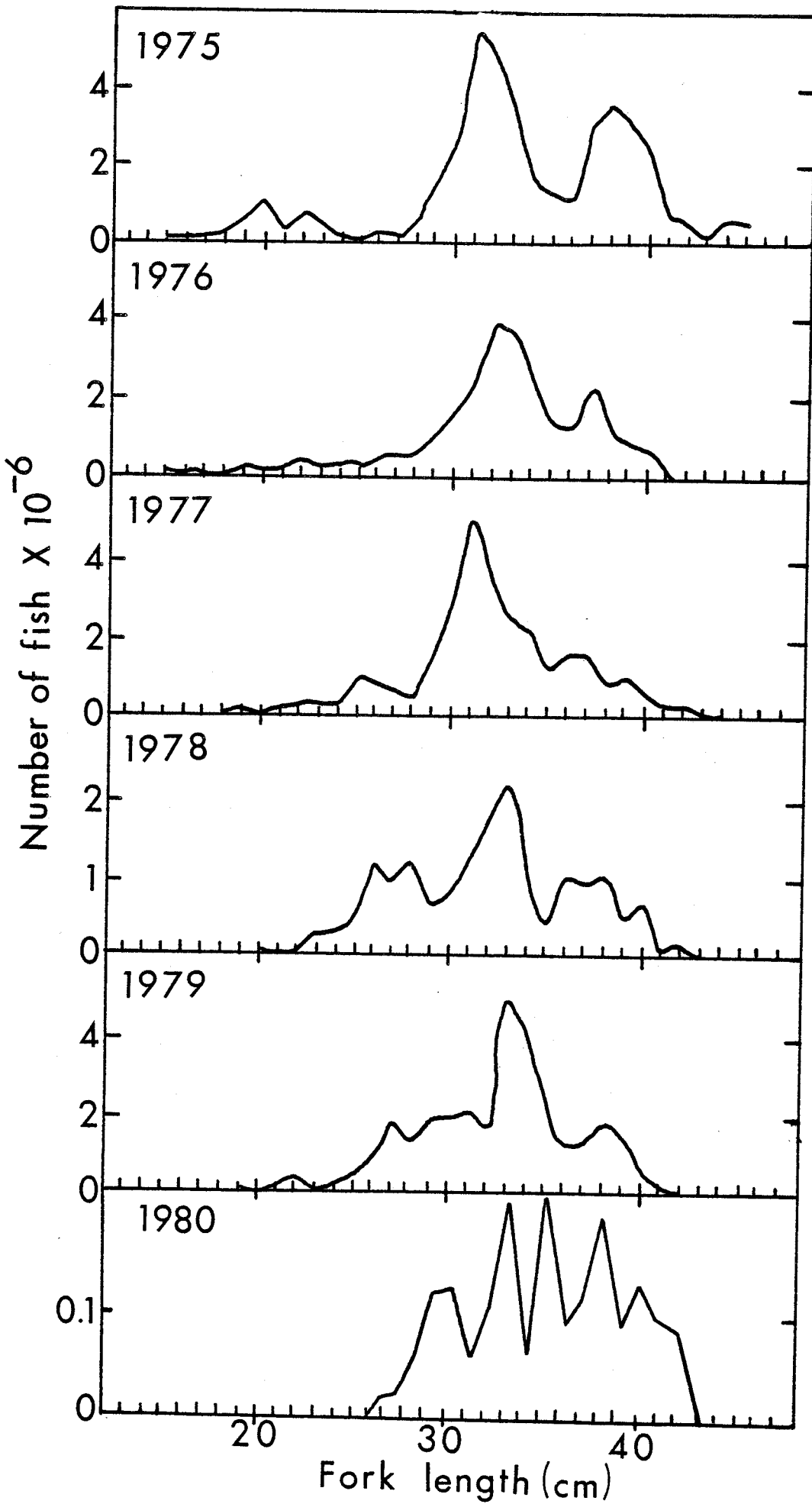


Figure : Length Frequencies - Division 4X (West)