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Assessment of 4VWX Redfish for 1984

by

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Abstract

The total landed weight of redfish from Divisions 4VWX decreased to 12,863 t in 1983. This is a decrease of 20% from landings observed in 1982 and represents 43% of the total allowable catch. Commercial catch rate indices for the two major gear categories prosecuting this fishery indicate an increasing trend since the mid 1970s. Research vessel survey estimates of redfish stock biomass also indicate a generally stable or increasing population. Redfish length frequency distributions from the research surveys show the presence of a very large group of fish in the population with a modal length of 11-12 cm. This year-class may be the strongest to have entered the population since the surveys were initiated in 1970.

Résumé

Le poids des débarquements de sêbaste des div. 4VWX en 1983 a diminué à 12 863 t. C'est une diminution de 20 % par rapport à ceux de 1982 et qui représente 43 % du total des prises admissibles. Les indices des taux de capture commerciaux des deux principales catégories d'engins montrent une tendance à la hausse depuis le milieu des années 1970. Les estimations de biomasse de stock par navires de recherche indiquent une population généralement stable ou en voie d'augmentation. La distribution des fréquences de longueur dans ces relevés révèle la présence, dans la population, d'un très important groupe de poissons, dont la longueur modale est de 11-12 cm. Il se peut que cette classe d'âge soit la plus abondante à rallier la population depuis le début des relevés par navires de recherche en 1970.

Summary of the Fishery to 1983

Redfish landings from the Scotian Shelf, which reached a maximum of over 60,000 t in 1971, have declined in 1983 to a level of 12,863 t (provisional data). The landings in 1983 represent a decrease of 20% from those of 1982. The total allowable catch (TAC) of 30,000 t, imposed in 1980, remained in effect for 1983. The provisional total landings represent 43% of the TAC for this stock.

Methods

Previous work has shown that available data do not allow for satisfactory analytical assessments of Scotian Shelf redfish population. An update of available data on stock status is presented. These data include landings (by Division and country), catch rate series by major gear types, research vessel biomass estimates, and research vessel length frequency distributions (both for the entire Scotian Shelf and by individual NAFO Division). Since 1982, three surveys specifically designed to estimate redfish abundance have been conducted in addition to the regular summer groundfish surveys. The data from these surveys were used to obtain biomass and length frequency estimates from areas not previously covered by the summer groundfish surveys. Commercial length frequencies, although available, involve too many uncertainties (eg. mesh size employed, discards; Clay 1979) to be of use in ascertaining stock status and are not presented.

Results and Discussion

Landings

Landings since 1928 are shown in Figure 1, the increase through the 1930s and 1940s has been interpreted as the initial exploitation of the surplus biomass of an unexploited population (Mayo and Miller 1975). This phase of exploitation appears to have been completed by the late '40s culminating in a landing of over 84,000 t in 1951. Landings decreased through the early 1950s, then rose slowly to a level of approximately 30,000 t through the early 1960s. Landings reached a second major peak in 1971 with a total of 65,893 t. These high values were the result of record landings by both Canada and the Soviet Union (25,000 and 20,000 t respectively). From 1972 to 1976 landings declined rapidly to a little over 18,000 t in 1976 (Table 1). This decline resulted from a cessation of the foreign fishery and a general decline in landings by Canadian vessels. This decline continued through the late 1970s. From 1979 to 1983 catches have fluctuated from 13,154 in 1979 to 18,944 in 1981 and decreased to a low of 12,863 in 1983.

The greatest declines in landings since 1971 have occurred in Divisions 4Vs and 4W (Figure 2). Landings in 4X declined until 1975 and have fluctuated around 5000 t since then. Division 4Vn has provided relatively stable landings between 4000 and 7000 t since 1965.

Commercial Catch Rate Series

As in the previous assessment of this stock (Zwanenburg 1983) four catch rate series are presented, two for Maritimes (M) based vessels and two for Newfoundland (N) based vessels fishing in 4VWX (Tables 2 and 3). During 1983 the Newfoundland based vessels landed a total of 1447 t of redfish from 4VWX. In 1982 the N based side (OTB-1) and stern (OTB-2) trawlers (tonnage classes 4 and 5, respectively) accounted for 12 and 18% of the total Canadian landings from 4VWX respectively. The equivalent figures for 1983 are 9% for the OTB1-TC4 vessels and 1% for OTB2-TC5 vessels. These levels of landings were not considered high enough to allow for calculation of reliable catch per unit effort values.

The catch rate series for the M based side and stern trawlers accounted for 34 and 27% of total Canadian landings respectively. The side trawler catch rates increased over the 1982 values both for full year values and third quarter values (Tables 2 and 3; Figures 3 and 4). These catch rates have been increasing since 1980 for the full year values and since 1979 for the third quarterly values. Catch rates for the third quarter were calculated because a large proportion of the total effort expended by this gear category is traditionally expended during these three months (1983 = 56%). This protracted period of fishing effort results in a less variable catch rate series.

The stern trawler catch rates declined from their 1982 values (Tables 2 and 3; Figures 3 and 4) for each series examined; whether these declines represent a reversal of the generally upward trend initiated in 1973 or a fluctuation in a continuing trend is difficult to determine with certainty. Interpretation of this decrease as a fluctuation in an increasing trend seems more reasonable since the stern trawler series is inherently more variable than the side trawler series.

Research Vessel Biomass Estimates

Arithmetic and geometric mean redfish biomass estimates derived from summer groundfish surveys for 1970 to 1983 are shown in Figure 5a. The arithmetic series is extremely variable with year to year fluctuations of over 200,000 t between some years. Since redfish are 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 a general sense there does appear to have been a decrease throughout the mid-1970s. This series has shown an increasing biomass of redfish since 1980 to a level of just over 166,000 t in 1983.

The geometric series does not suffer from the large year to year fluctuations of the arithmetic series yet the two demonstrate the same general trends over time. For 1983, however, the two series give contradictory results, the arithmetic series showing a 30% increase over the 1982 value and the geometric series indicating a levelling off.

To aid in the interpretation of these data three-year running means of biomass estimates were also examined (Figure 5b). These values are much less variable than the yearly values and more likely to reflect actual rates of change of biomass for this stock. This analysis indicates an increasing or stable trend since the period 1979-1981.

During 1982, the July groundfish survey, which provided the data for the above analyses, was conducted by the R.V. Lady Hammond instead of the R.V. A.T. Cameron which had been conducting these surveys since 1970. The implications of this change on estimates of biomass were discussed by Koeller and Smith (1983). Their analyses indicated that catch-per-standard tow values were, on average, 1.65 times higher for the Lady Hammond versus the A.T. Cameron. In 1983 these surveys were conducted by the R.V. Alfred Needler and R.V. Lady Hammond simultaneously. Unfortunately the Lady Hammond was not able to complete the entire survey so that the only complete data set for July 1983 is that of the Alfred Needler. The implications of this change on estimates of redfish biomass have not yet been investigated.

Annual surveys directed specifically at estimating redfish biomass below the 100 fathom contour have been conducted since 1982. These surveys cover depths to 500 fathoms and have covered the outer edge of the Scotian Shelf between the Laurentian Channel and the western border of Division 4W (Areas 4VSc and 4W). They are intended to augment the biomass estimates obtained during the July surveys since the summer surveys are conducted to a maximum depth of 200 fathoms only. They encompass several of the most heavily fished commercial grounds, where the majority of the effort is expended between 150 and 260 fathoms, and are conducted near the time the fishery is prosecuted. Abundance estimates from an area of commercial importance may more accurately reflect what is available to the fishery. During 1983 this area contributed just under 50% of the total Canadian landings of 4VWX redfish.

The biomass estimates derived from the redfish directed surveys are given in Table 4. For 1983 this survey indicates a biomass of 13,266 t for Areas 4VSc and 4W between 100 and 499 fathoms. By comparison the July survey estimated an abundance of 20,964 t for areas 4Vsw between 0 and 200 fms.

A more pertinent comparison is given in the table below which shows biomass estimates for areas 4VSc and 4W between 100 and 199 fathoms (the area of overlap for the summer and redfish directed surveys).

<u>March</u> <u>1982</u>	<u>July</u> <u>1982</u>	<u>November</u> <u>1982</u>	<u>July</u> <u>1983</u>	<u>November</u> <u>1983</u>
13124	641	5689	381	3954

The July surveys indicated less than 1000 t resident in this area in both 1982 and 1983, whereas the redfish surveys estimated between 4000 and 13,000 t for the same years. In 1983 this area (between 150 and 260 fathoms) contributed over 5000 t of the total landings for 4VWX redfish,

available redfish biomass.

The redfish directed surveys appear to give more realistic estimates of available biomass, probably as a result of more intensive coverage of the areas in which the fishery occurs and during the time the fishery is being carried out.

Research Vessel Length Frequencies

Length frequency estimates based on July research vessel surveys and combined for all of Division 4VWX redfish are presented in Figures 6 and 7. Data for 1970-1973, and 1975-1978 show a large group of fish with a modal length which gradually increases from 23 to 28 cm. Data for more recent years are rather more difficult to interpret mainly because of the smaller catches of redfish during these years. Within the time series there is evidence in 1984 of relatively strong recruitment at a modal length 17 cm and again in 1977 at a modal length 14 cm. The large mode seen at 17 cm in 1974 is almost certainly the large 1971 year-class identified by previous investigators (eg. Mayo 1980). The 14 cm mode observed in 1977 can be followed quite clearly through to 1981. The 1982 survey, in addition to giving generally higher estimates of numbers at length, presents evidence of a very strong year-class (modal length 8 cm) coming in. A breakdown of the length frequencies by Division showed that this strong year-class was mainly evident in 4Vn and to a lesser degree in 4Vs (Zwanenburg 1983). In 1983 the 8 cm mode of 1982 is very clearly evident at 11 cm. The magnitude of this mode is greater than any other mode at this length observed since 1970. This indicates that a strong year-class is in the process of moving through this population. It is interesting to note that during 1982 the large 8 cm mode was most apparent in 4Vn whereas in 1983 it shows up most clearly in 4W.

A second mode, identified in 1982 at 14-16 cm, appears at 16-18 cm during the July 1983 survey. The extremely large mode at 27 cm is mainly attributable to a single large set in 4X (Figure 7).

The redfish directed survey length frequency estimates since March 1982 (Figure 8) show the same strong year-classes moving through the population. One is evident at 7 cm in March 1982 and again at 12 cm in November 1983. The second mode (observed at 16-18 cm in July 1983) was evident at 15 cm in November 1982 and again at 18 cm in November 1983.

Summary

- * Commercial catch rates for the two major gear categories prosecuting the 4VWX redfish population give contradictory results in 1983. The side trawler catch rate series indicating increased catch rates and the stern trawler series showing a reduced catch rate. Given the demonstrably variable nature of the stern trawler catch rate series does not necessarily indicate a reversal in a generally increasing trends.

- * Annual research vessel survey abundance estimates are highly variable and difficult to interpret. The arithmetic series indicates a substantial increase in redfish biomass since 1980. The geometric series has demonstrated only a slight increase since 1980 and a stable biomass from 1982 to 1983. Analyses of these data using three-year running averages indicates an increase in redfish biomass since the period 1979-1981.
- * Research vessel length frequency estimates indicate the presence of a very strong mode at 11-12 cm in 1983. This mode may represent the strongest year-class which has entered the population since the surveys were started in 1970. A second strong mode is evident at 17-19 cm.

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- Mayo, R.K. and D.S. Miller. 1975. A Preliminary Assessment of the Redfish Sebastes marinus (L.), in ICNAF Divisions 4VWX. ICNAF Res. Doc. 75/IX/135.
- Koeller, P. and S.J. Smith. 1983. Preliminary Analysis of A.T. Cameron - Lady Hammond Comparative Fishing Experiments, 1979-81. CAFSAC Res. Doc. 83/59.
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Table 1. TAC's, quotas, allowances, and catches since 1974.

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983		
TAC	40000	30000	20000	20000	20000	20000	30000	30000	30000	30000		
Landings	32837	27983	18459	17845	16094	13154	14116	18944	16091*	12863*		
Canada:												
Quota	20000	14860	12000	13000	17500	13000	18000	18500	29000	18500	25000	27000
Landings	15739	17025	12625	14712	13576		12240		13108	17753	14366*	11987*
France:												
Quota	1000	740	250	250	250	500 ^a	500 ^a	500 ^a	500 ^a	500 ^a	500	500 ^{a,b}
Landings	420	186	279	63	121		20		21	3	1	-
Poland:												
Quota	1300	970		Subsequent catches included with "Others".								
Landings	803	230										
USSR:												
Quota	6600	4900	1000	500								
Landings	6692	4849	1021	175	Subsequent catches included with "Others".							
USA:												
Quota	10000	7430	6000	6000	1500	See "Others"	10500	0	0	-	-	
Landings	8891	5465	4446	2876	2147			885	762	1611*	810*	
Others:												
Quota	1100	1100	750	250 ^b	750 ^b	6500	1500	500	500	11000	4500	-
Landings	288	228	88	19	250		894		102	426	113*	66*

- data not yet available

^a St. Pierre vessels only

^b By-catch only

* Provisional Statistics

Landings to 1981 are from ICNAF and NAFO Statistical Bulletins.
In 1979 and 1980 quotas were amended during the year; initial and final ones are given.

Table 2. Commercial Catch Rate Indices (t per hour) for 4VWX Redfish (full year values).

Year	Side Trawlers [TONNAGE CLASS 4] (Maritimes)	Side Trawlers [TONNAGE CLASS 4] (Newfoundland)	Stern Trawlers [TONNAGE CLASS 5] (Maritimes)	Stern Trawlers [TONNAGE CLASS 5] (Newfoundland)
1958	0.48			
59	0.38			
1960	0.33			
61	0.74	0.78		
62	0.47	0.54		
63	0.43	0.60		
64	0.67	0.53		
65	0.73	0.82		
66	0.89	0.94	0.85	1.14
67	0.63	0.92	0.67	1.06
68	0.69	0.89	0.35	0.87
69	0.66	0.78	0.95	0.73
1970	0.66	0.74	0.81	0.72
71	0.67	0.78	0.68	0.46
72	0.69	0.66	0.55	0.93
73	0.57	0.58	0.30	0.62
74	0.49	0.45	0.34	0.44
75	0.51	0.56	0.52	0.62
76	0.48	0.51	0.34	0.30
77	0.47	0.41	0.58	0.78
78	0.44	0.45	0.61	0.61
79	0.43	0.36	0.78	0.44
1980	0.42	0.36	0.62	0.55
81	0.56	0.41	0.77	0.60
82	0.66	0.66	0.91	0.91
83	0.77	0.59	0.85	1.04

Table 3. Commercial Catch Rate Indices (t per hour) for 4VWX Redfish (3rd quarter values).

Year	Side Trawlers [TONNAGE CLASS 4] (Maritimes)	Side Trawlers (Newfoundland)	Stern Trawlers (Maritimes)	Stern Trawlers [TONNAGE CLASS 5] (Newfoundland)
1958	0.52			
59	0.35			
1960	0.23			
61	0.38	0.84		-
62	0.46	0.52		-
63	0.53	0.57		-
64	0.64	0.52		-
65	0.80	0.78		-
66	0.80	0.85		-
67	0.77	1.19	0.56	-
68	0.58	0.96	0.87	-
69	0.86	0.83	0.88	0.81
1970	0.75	0.74	0.91	1.32
71	0.67	0.72	0.63	-
72	0.62	0.65	0.61	-
73	0.60	0.76	0.44	0.97
74	0.49	0.54	0.32	-
75	0.47	0.55	0.54	0.36
76	0.45	0.49	0.27	-
77	0.46	0.40	0.58	0.87
78	0.41	0.42	0.55	0.71
79	0.41	0.35	0.62	0.44
1980	0.46	0.35	0.67	0.57
81	0.53	0.39	0.65	0.60
82	0.59	0.59	1.01	1.01
83	0.64	0.29*	0.84	1.10*

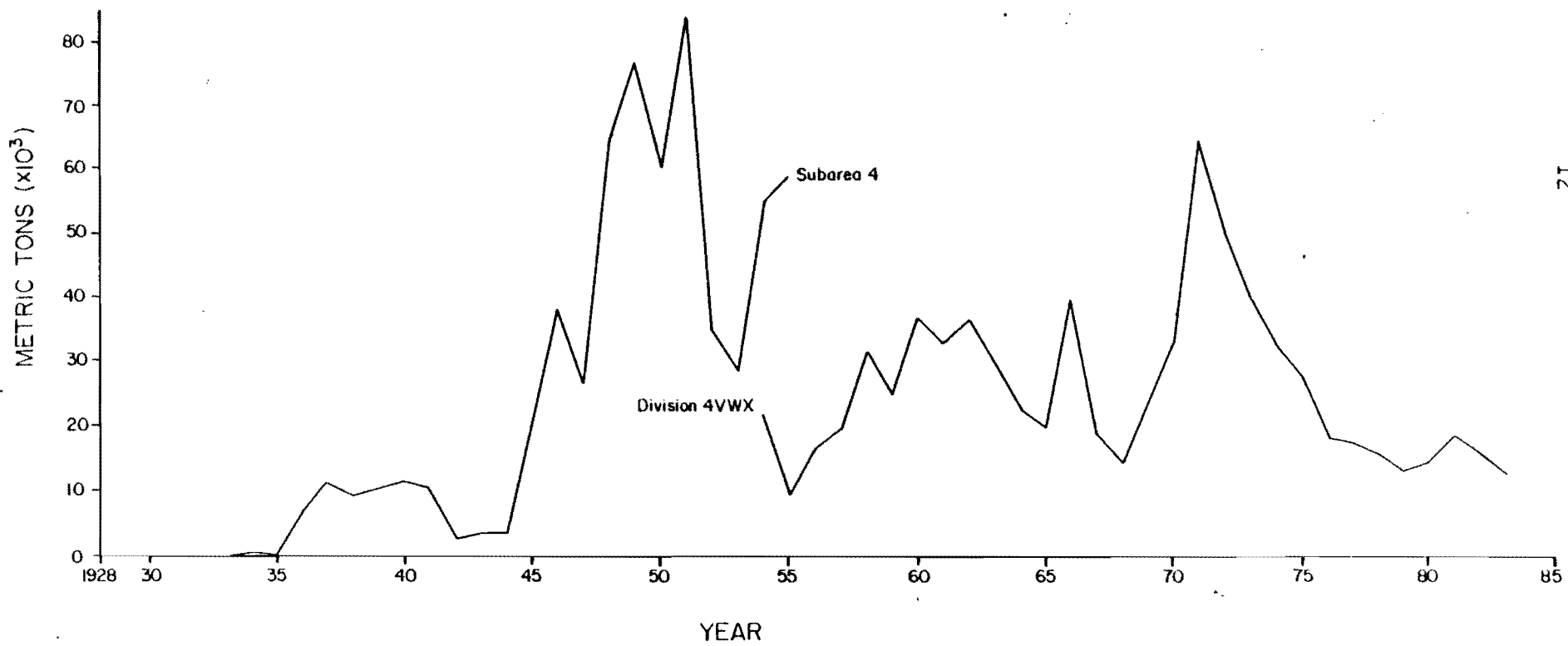
* These catch rates are based on less than 100 t of catch.

Table 4. Redfish biomass (t) by depth (fms) estimated from redfish directed surveys (4VSc and 4W only).

Depth	March 1982	November 1982	November 1983
100-199	13,124 (29)*	5,689 (28)	3,954 (25)
200-299	3,196 (24)	13,155 (26)	5,869 (22)
300-399	-	12,849 (14)	2,364 (8)
400-499	-	2,341 (11)	1,079 (15)
Total	16,320 (53)	34,034 (79)	13,266 (70)

* Numbers in brackets refer to the number of sets in each depth stratum.

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



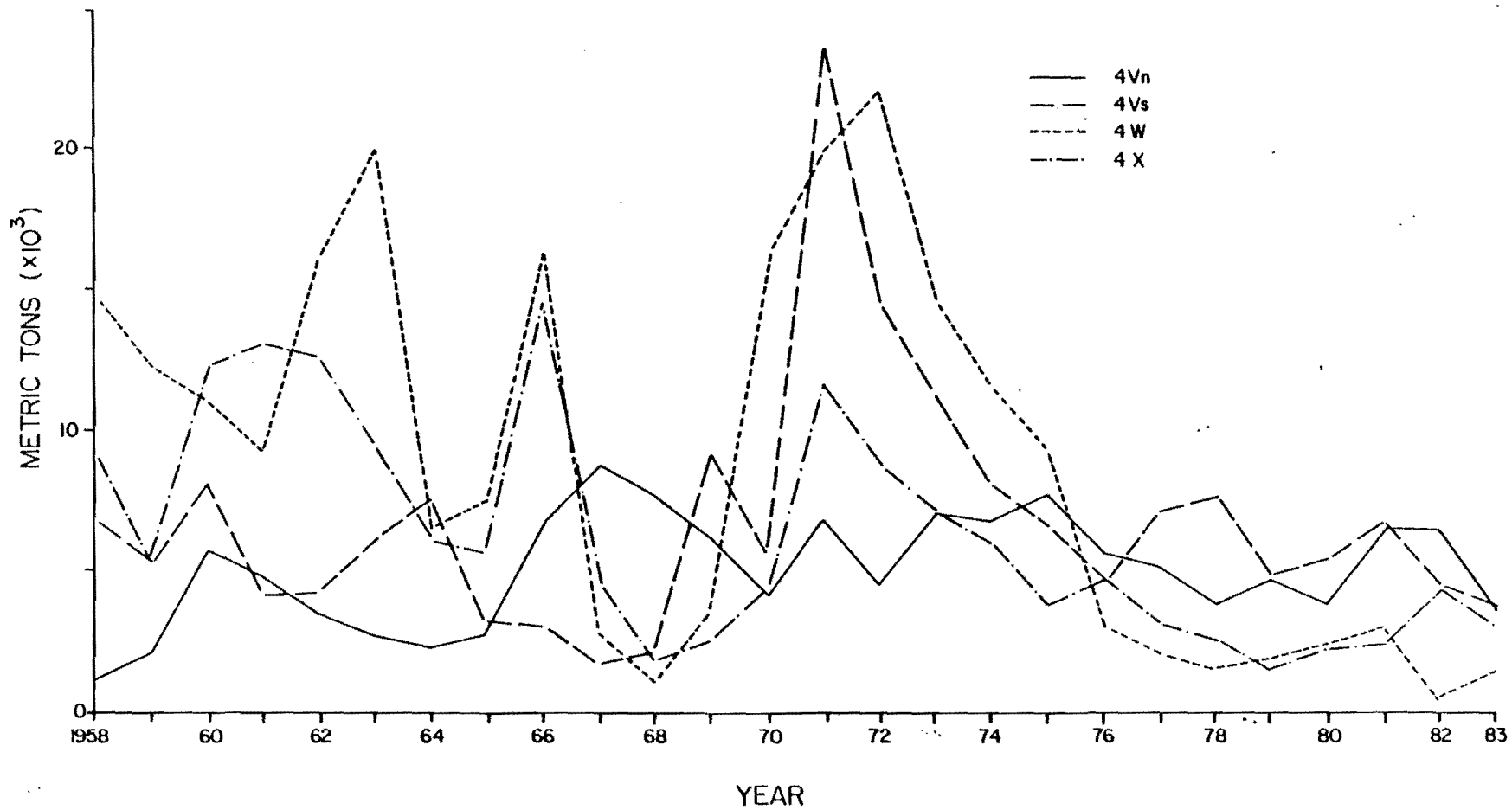


Figure 2. 4VWX redfish landings by division from 1958 to 1982.

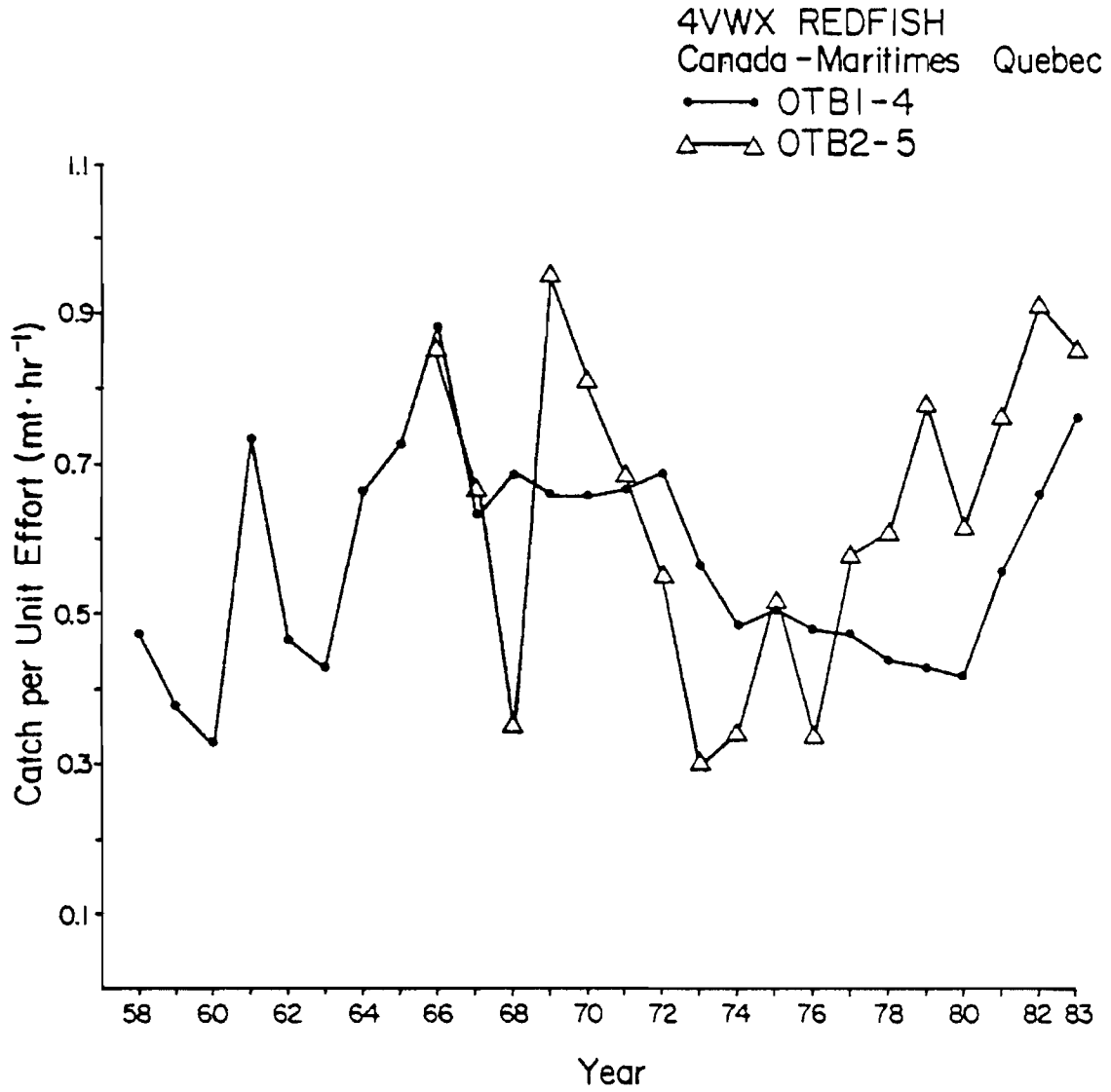


Figure 3. Catch rate series for Maritimes and Quebec based side (tonnage class 4) and stern trawlers (tonnage class 5). Catch rates were calculated from total yearly values of catch and effort for each category.

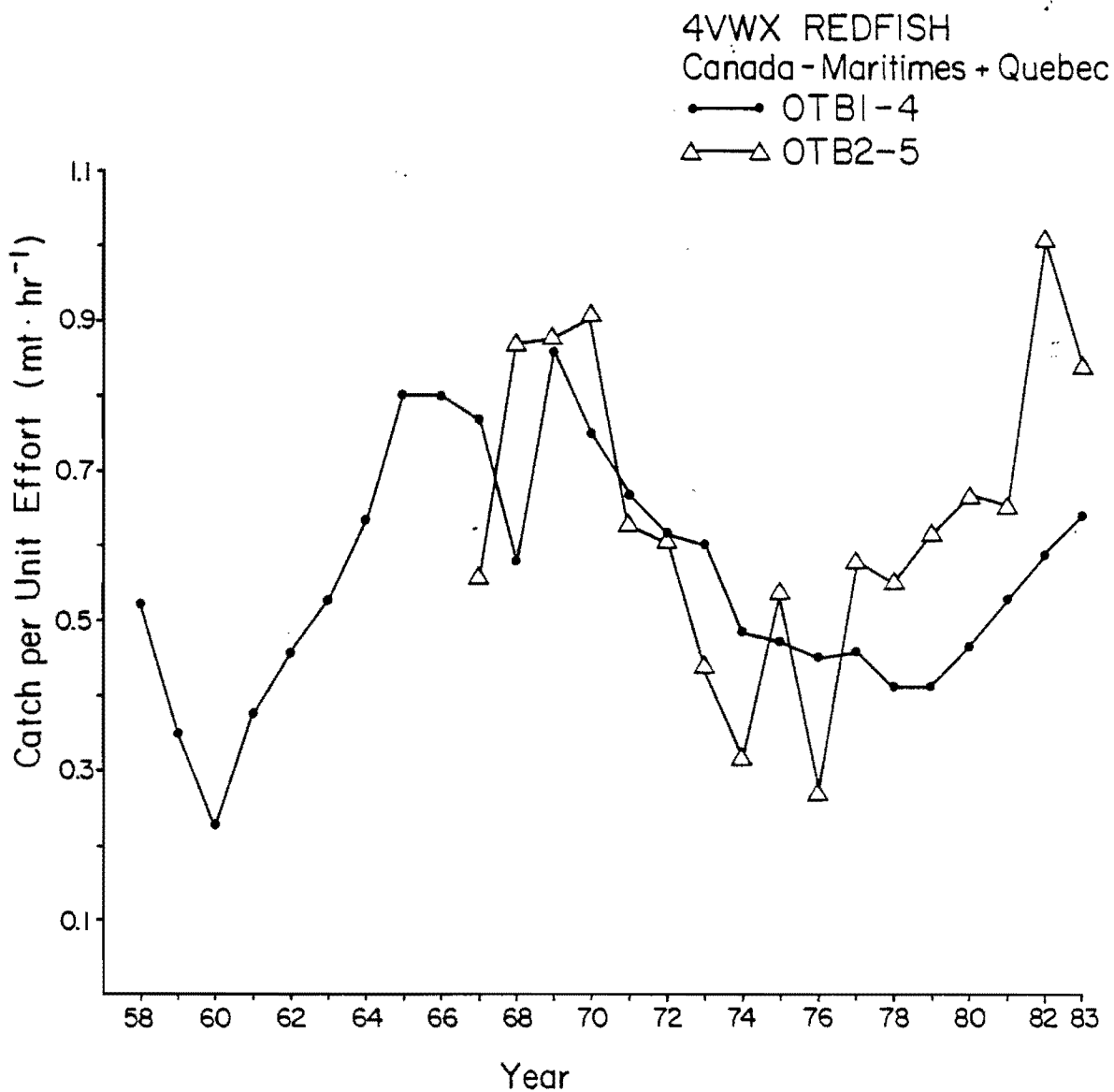


Figure 4. Catch rate series for Maritimes and Quebec based side (tonnage class 4) and stern trawlers (tonnage class 5). Catch rates were calculated from third quarterly values of catch and effort for each category.

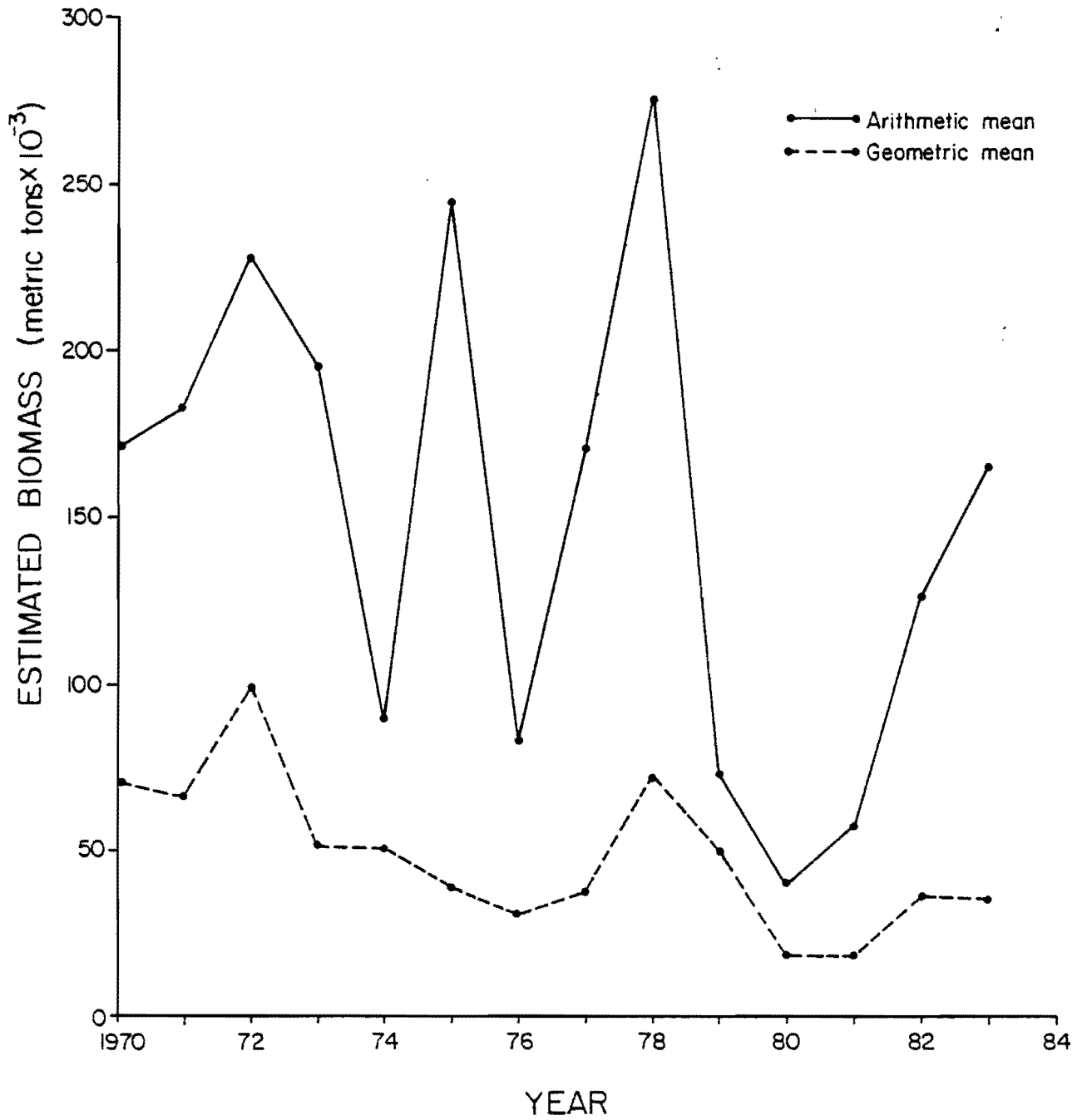


Figure 5a. Yearly estimates of total redfish biomass in Division 4VWX. These estimates were calculated from data gathered during July research surveys.

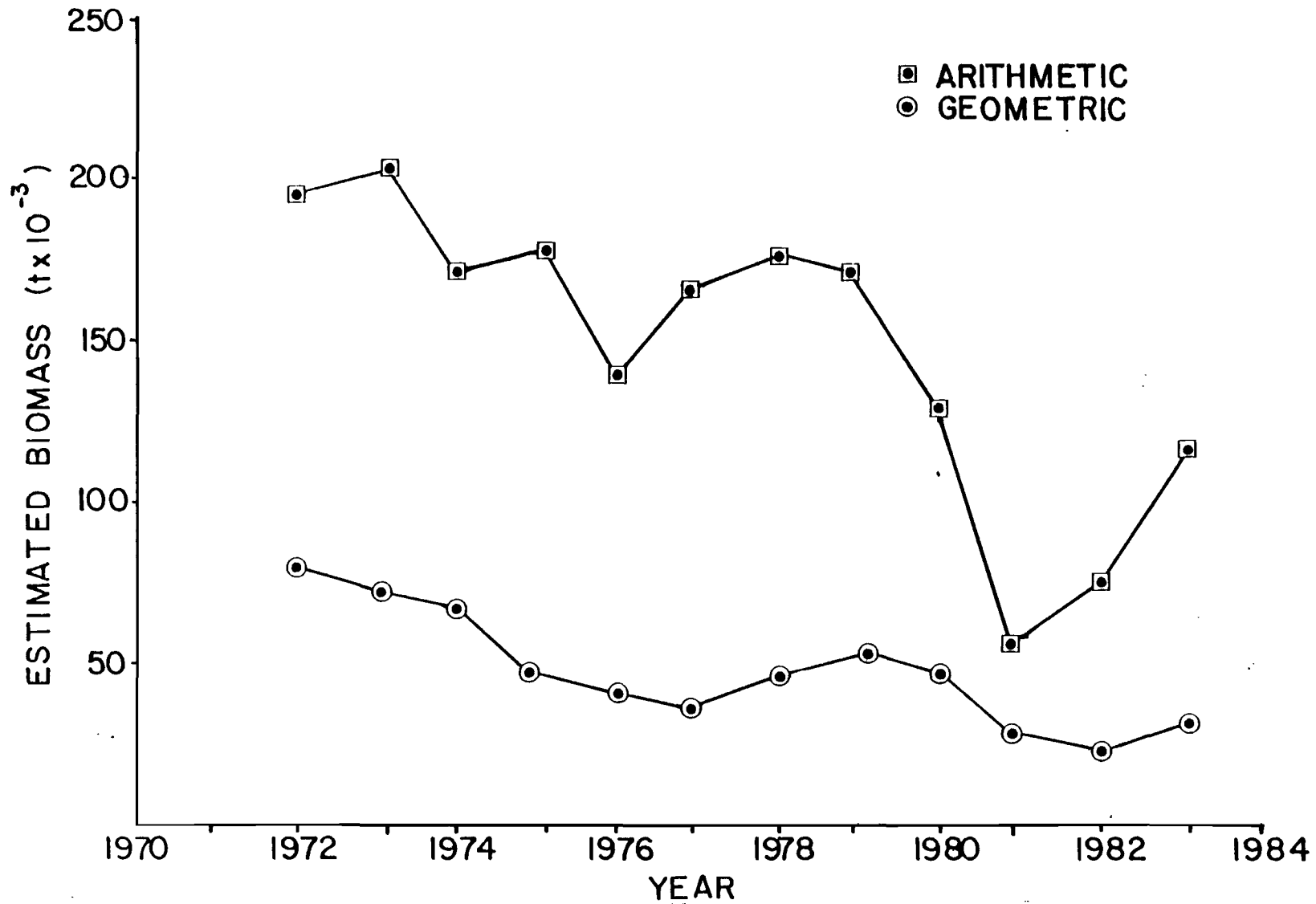
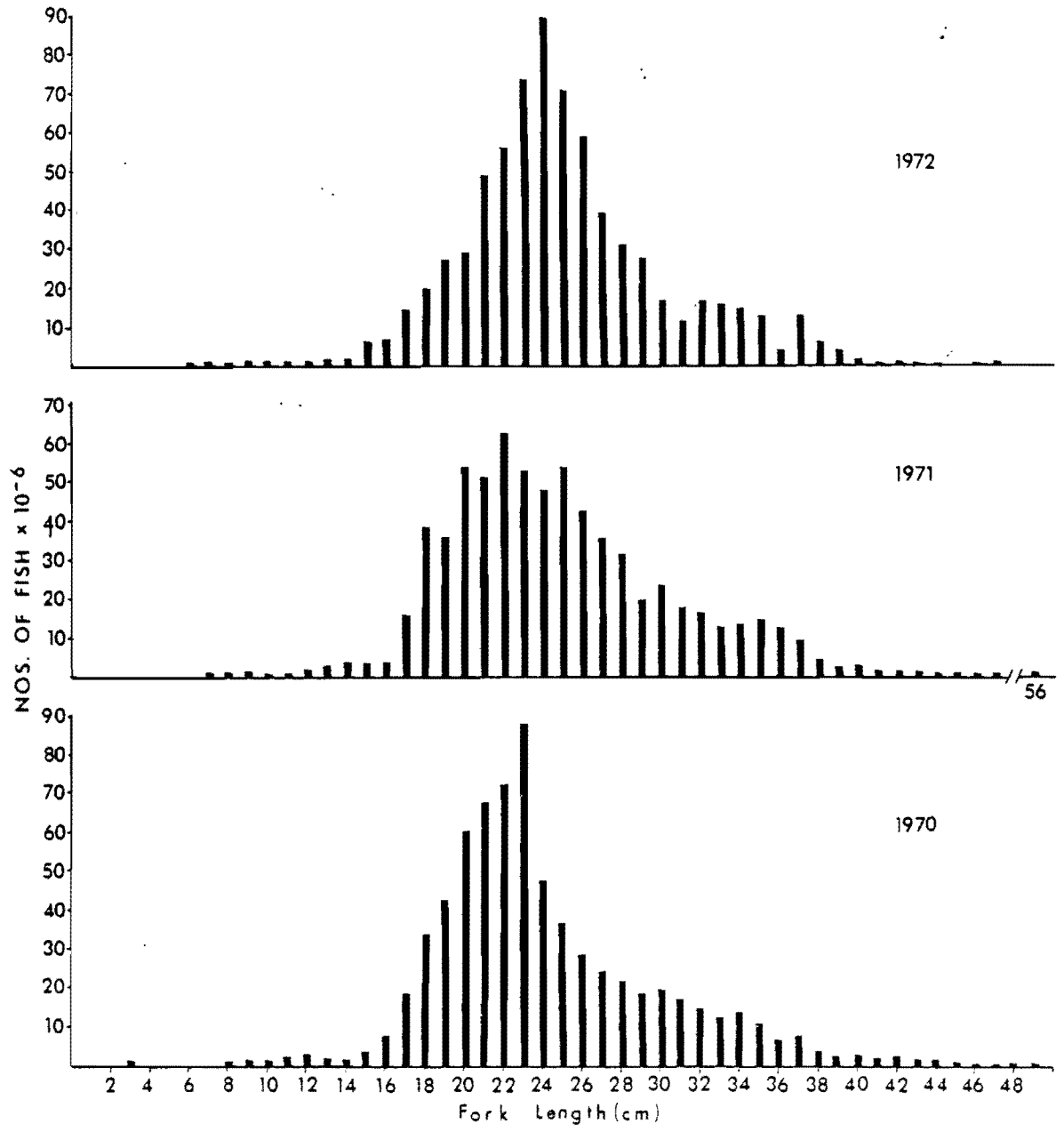
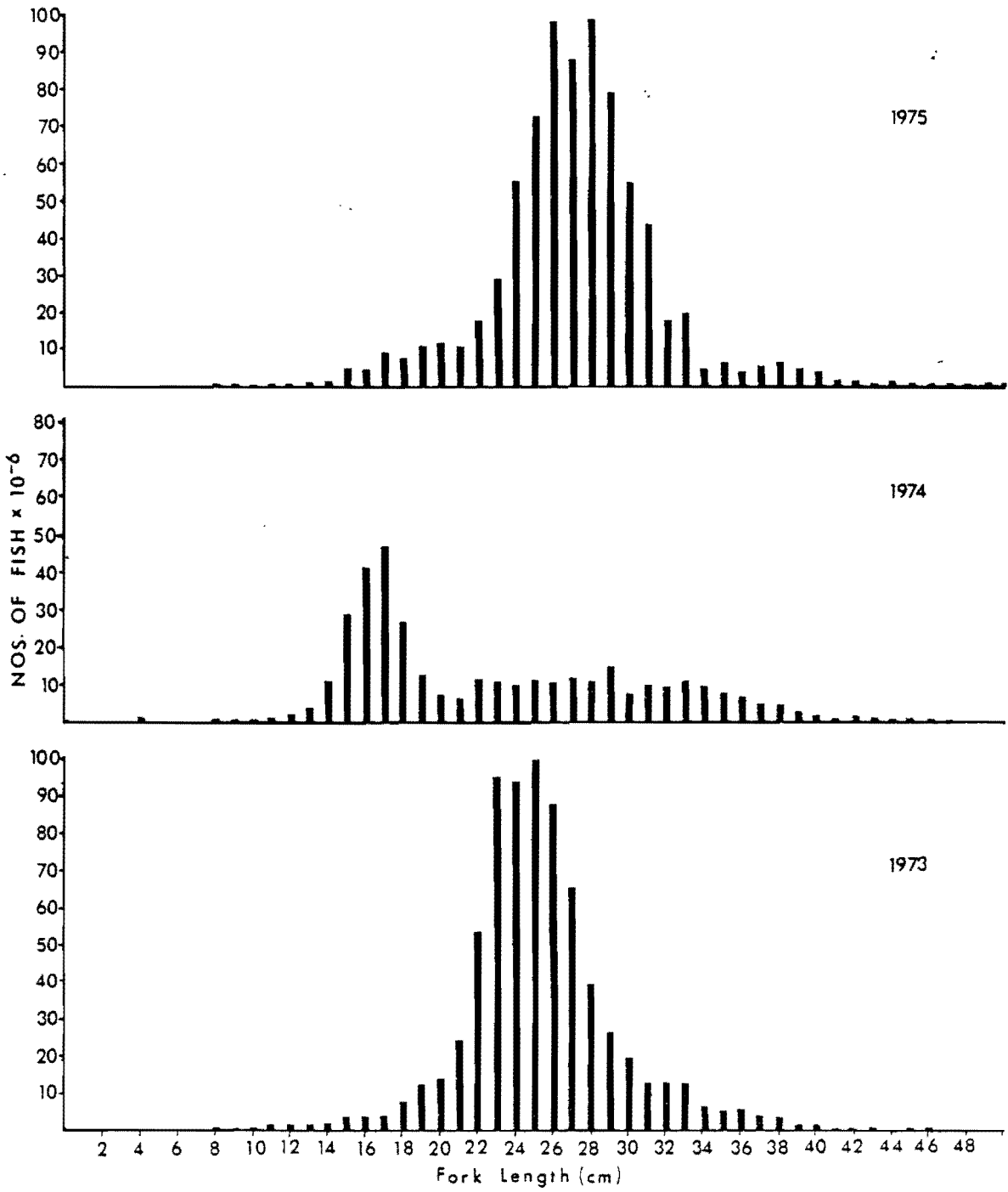


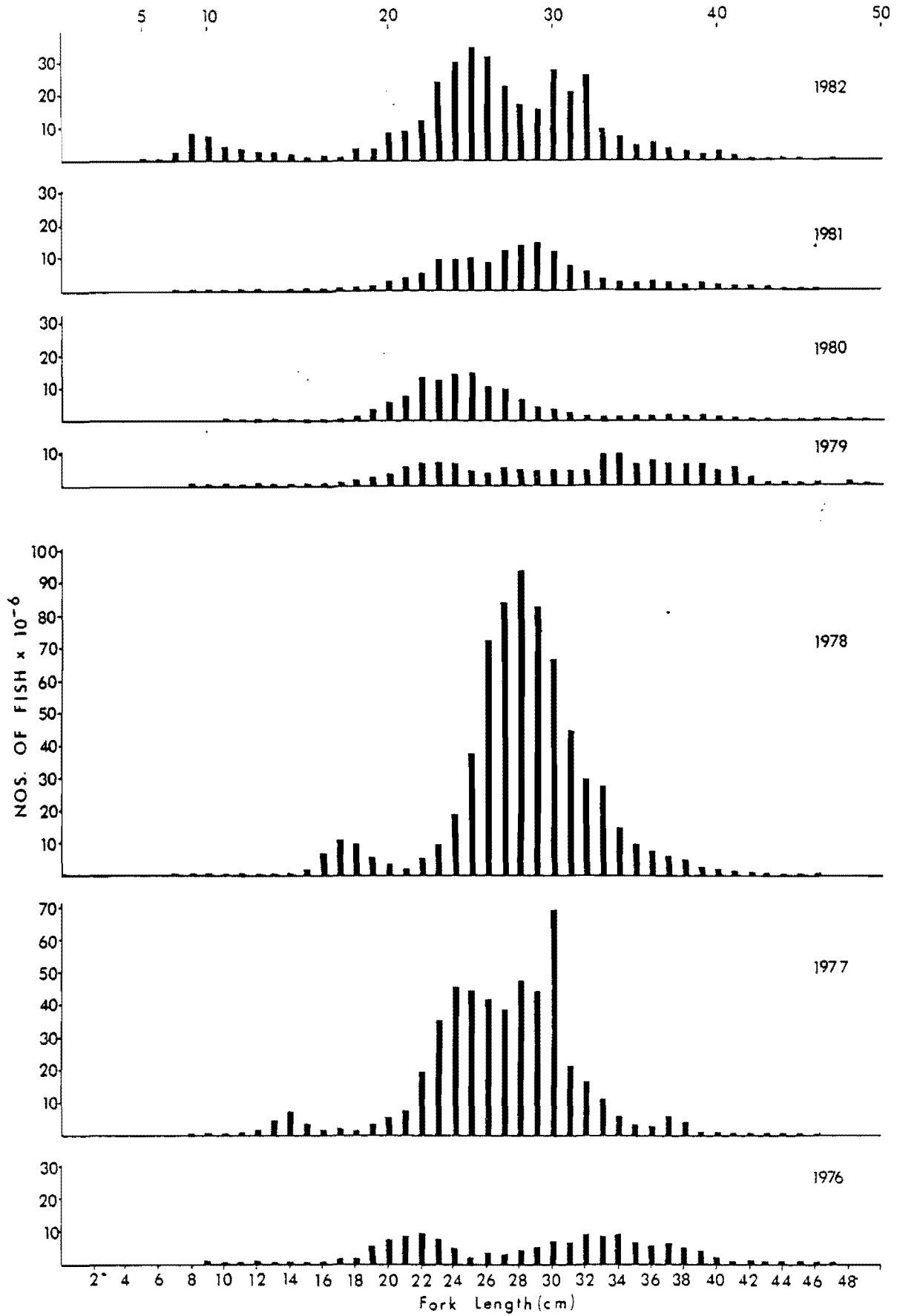
Figure 5b. Estimates of total redfish biomass in Division 4VWX. Values shown are three-year running means (ie. 1972 value if the mean of '70-'72, etc.). These values are estimated from July survey data.

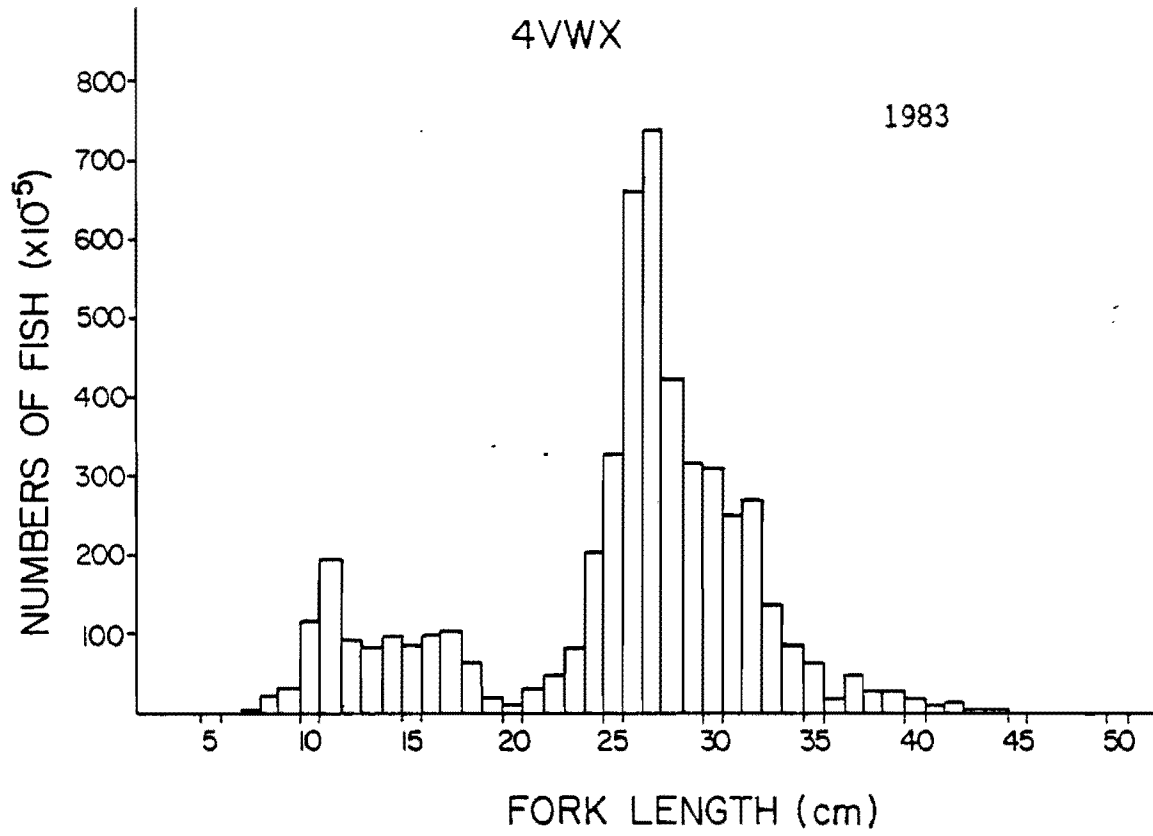
Figure 6. July survey estimates of total numbers at length for Division 4VWX redfish for the years 1970-1983. (Pages 19 to 22 inclusive).



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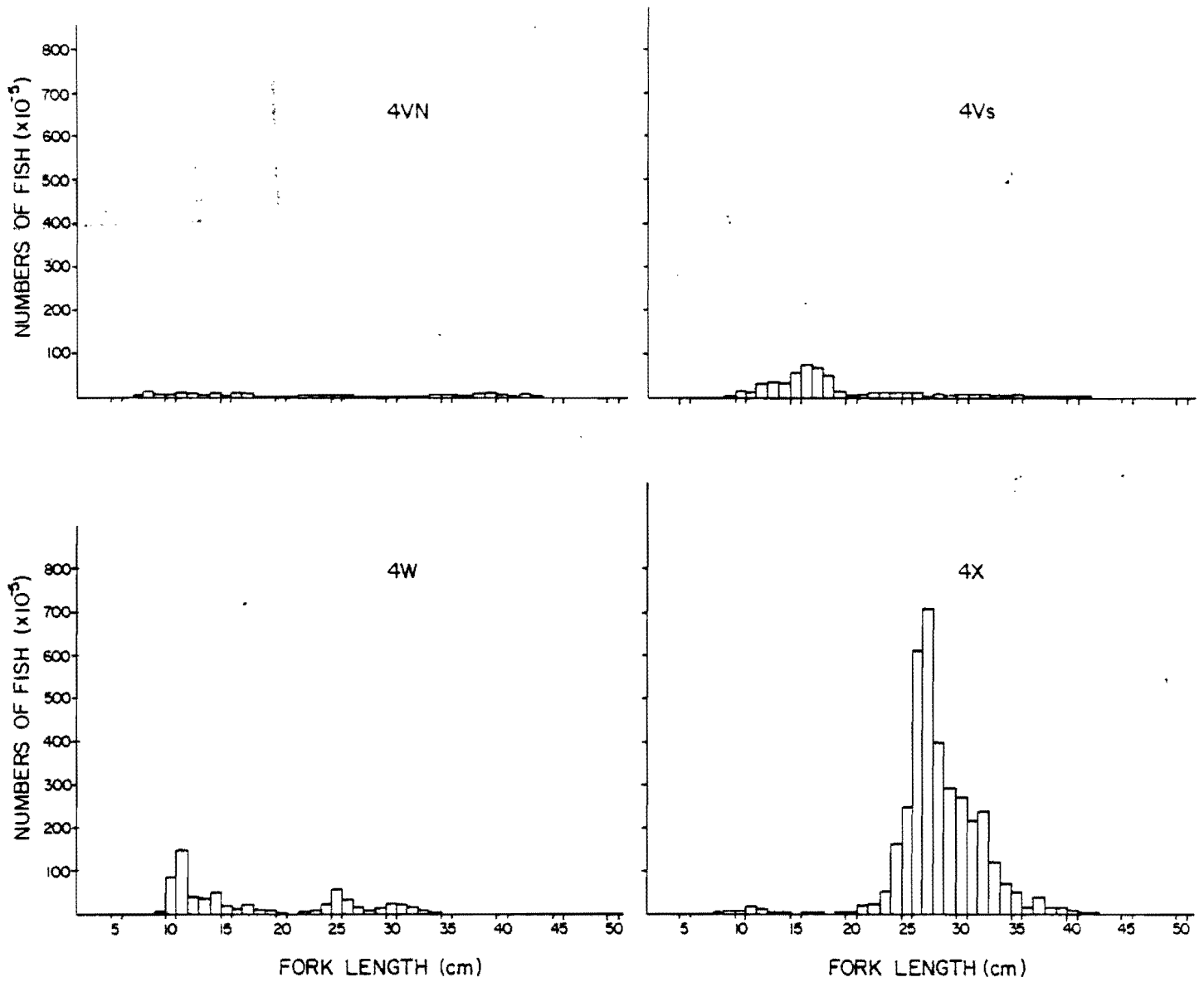


Figure 7. Numbers of redfish at length estimated from the July 1983 survey. Each division is shown separately.

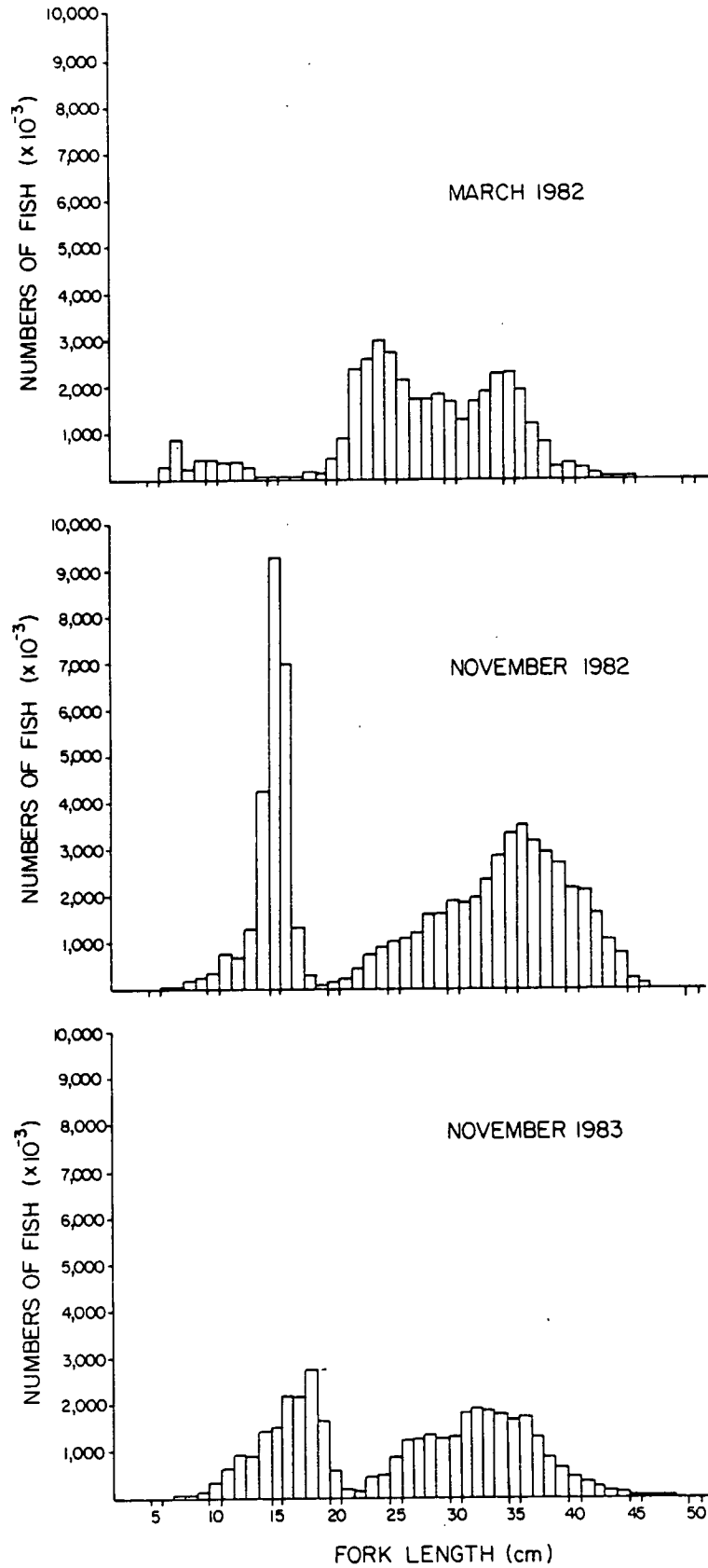


Figure 8. Numbers of redfish at length estimated From redfish directed surveys. These surveys covered only 4VSc and 4W below the 100 fathom contour.