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Assessment of Redfish Stocks in Divisions 3LN and 3M from Trawl-Acoustic Survey Data, 1993

by

A.A. Vaskov

Polar Research Institute of Marine Fisheries and Oceanography
(PINRO), 6 Knipovich street, 183763, Murmansk, Russia

Abstract

This paper presents data on redfish abundance and biomass obtained from results of trawl-acoustic survey in April-July 1993. Data on age composition and distribution of redfish are also given.

According to the data from trawl-acoustic survey redfish biomass and abundance over the Flemish Cap accounted for 147.1×10^3 tons and 1062.3×10^6 fish, respectively.

Redfish stock over the Grand Bank of Newfoundland in Div.3LN estimated from the trawl-acoustic survey in 1993 was found to be 392.4×10^6 fish with biomass of 92.8×10^3 tons.

Introduction

Results presented in this paper were obtained from PINRO annual research cruises in the Northwest Atlantic. The main aim of such investigations is to get data to assess stocks of the main commercial fish species including redfish.

Redfish fishery in the Northwest Atlantic covers 3 species from the *Sebastes* genus: *S.mentella*, *S.fasciatus* and *S.marinus*. *S. mentella* and *S. fasciatus* constitute the bulk of the catches. These species are impossible to be separated during fishery because of identification difficulties. This paper gives redfish stock estimates for mixed concentrations of *S.mentella* and *S.fasciatus*. In regard with this, a lot of work has been done by Spanish researchers, who have estimated redfish stock over the Flemish Cap separately for the above 3 species since 1991 (Vazquez, 1993).

The stock was estimated from data of trawl-acoustic survey conducted by RV "Vilnius" in April-May 1993.

Materials and Methods

The trawl survey was performed using stratified-random method (Doubleday, 1981; Bulatova, Chumakov, 1986). The technique to conduct acoustic survey is described in a paper by V.S. Mamylov (Mamylov, 1988) and corresponds to previous investigations (Vaskov, Oganin, 1992).

The stock displayed as a result of echo-integration of redfish concentrations devided into two parts:

1) acoustic component from the surface to 4 m bottom layer,
2) acoustic component of 4 m layer.

Total redfish stock in the above area was estimated as the sum of pelagic component to 4 m layer and estimate obtained by bottom trawl. This method was used to get the results from all previous surveys and double summation of bottom component was excluded.

Length frequency of redfish on the Flemish Cap presented to the NAFO Meeting 1993 (Vaskov, Ivanova, 1993) was recalculated and corrected.

Div. 3L was covered partially because there was no permission to conduct trawl-acoustic survey.

In 1992 Divs. 3LNO were not covered by trawl-acoustic survey .

Results

Divs. 3LN. In the period of investigations in Div.3L redfish occurred in 184-728 m depth. Main concentrations were distributed along the continental slope at 550-750 m depth (Table 1) in 730, 732 and 734 strata. On echograms redfish were fixed as rarefied recordings in bottom layer with vertical development to 25 m with dense concentrations in close contact with ground. Vertical development of that concentrations was mainly 1.0 - 1.5 m.

Redfish 9-48 cm long (Fig. 1) with two modal groups - 22 and 26 cm occurred in catches by bottom trawl.

Distribution of redfish in 1993 in Div. 3N corresponded to their distribution in previous years. Maximum densities were observed on the southern slope, minimum along the northern one. Echorecordings were mainly displayed as rarefied bottom concentrations with vertical development to 309-40 m above ground. Like in 1992 the largest catches were taken in the stratum 728 (Table 2).

Fish 21-26 cm long were the bulk of catches in that area with 22 cm long individuals being predominant (Fig. 2).

Results from redfish stock assessment using acoustic method are presented by divisions in Table 3.

Total redfish stock over the Grand Newfoundland Bank estimated from the results of trawl-acoustic survey in 1993 accounted to 392.4×10^6 fish with biomass of 92.8×10^3tons (Table 4). Redfish biomass in the above divisions in 1993 was lower than in 1991 but higher than in the period 1989-1990.

In regard with this an increase of redfish stock in Div. 3O should be noted. From the results of trawl survey redfish abundance and biomass in 1993 in the above area was estimated to be 709.5×10^6 fish and 183.6×10^3 tons, respectively (Table 5). In 1991 total abundance of redfish constituted 175.7×10^6 fish and biomass 23.5×10^3 tons, but in 1993 these parameters were estimated as 834.0×10^6 fish and 226.1×10^3 tons, respectively. Therefore, we expected estimates of the stock in Divs.3LN to be higher because of redfish redistribution from Div.3N to Div.3O and stock underestimation in Div.3L.

We suggest that in Div.3NO dwell single stock of redfish, having complicated migrations in dependence on hydrological situation within those areas limits. This could be proved by similarity of length frequencies of redfish from Div.3O and Div.3N (Fig.2,3). In both divisions in 1988 a strong yearclass was observed to appear which became predominant in 1993. To obtain representative results for redfish stock status over the Grand Newfoundland Bank we consider it more acceptable to estimate stock in Divs.3NO and 3L.

Div.3M. In June-July redfish was observed over Flemish Cap almost in all strata (excluding 1,2,4,6) at 200-700 m depth (Table 6). The densest concentrations of redfish were observed on the southeastern and northeastern slopes.

Acoustic equipment fixed as echorecordings of different density with vertical development 10-20 m transforming to very dense concentrations with development to 5 m near the bottom.

As in 1992 young redfish (fish less than 15 cm long) were mainly distributed along northern (stratum 7) slope in 250-350 m depth range. In this part of the bank maximal catch of 980 kg (21237 fish) was taken at 310 m depth . The catch was dominated by small redfish 11-19 cm long.

Large redfish longer than 25 cm were fished mainly deeper than 500 m. Catches at those depths were negligible with maximal catch of 130 kg.

Over the whole bank fish 9-49 cm in length occurred in catches (Fig.4). Curve of length frequency has multipeak character with 16 cm and 30 cm mode.

Trawl-acoustic surveys in 1987-1992 showed reduction of redfish stock over the Flemish Cap. Considerable overfishing in 1988-1990 was the main reason for such decrease. Analysis of results obtained in 1993 indicates an increase of redfish stock in the division. According to the trawl survey results redfish biomass constituted 69.8×10^3 tons. This is the highest estimate for the period 1990-1993 (Table 7). Total redfish biomass in 1993 was estimated to be 147.1×10^3 tons that is 1.5 times as much as in 1991 and 1992. Biomass increase is connected with stock recruitment with strong 1990-1991 yearclasses.

Gradual increase of spawning stock and recruitment with abundant yearclasses allow to expect an increase of redfish stock over the Flemiash Cap to the level of 1988-1989 in the nearest years.

Conclusions

Results from trawl-acoustic survey indicate an increasing trend in redfish stock in Divs.3LN. This is related to redfish stock in Divs.3NO recruitment with abundant 1988 yearclass.

Redfish stock over the Flemish Cap is at a low level compare to 1988-1989. However, increse in redfish biomass is observed compare to 1991-1992. This is connected to recruitment of redfish stock in Div. 3NO with strong 1990-1991 yearclasses.

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Table 1. Results from the trawl survey for redfish in Div. 3L, 1993.

Stratum	Depth, m	Area, square mile	Nos of tows	Mean catch/ 1 valid tow fish	kg	Abundance, '000	Biomass, tons
386	184-274	983	3	0,7	0,2	48,5	13,7
391	-"-	282	3	0,3	0,01	7,0	0,1
387	275-365	718	3	4,7	1,3	248,2	69,6
388	-"-	361	3	1,3	0,1	35,7	1,9
392	-"-	145	3	5,0	1,0	53,7	10,3
729	366-547	90	3	33,7	6,2	224,4	41,6
731	-"-	117	3	36,3	6,9	314,9	60,1
733	-"-	312	3	21,3	6,3	493,0	145,9
730	548-728	93	3	156,0	41,0	1074,7	282,3
732	-"-	96	3	304,0	84,0	2161,8	597,6
734	-"-	160	3	180,7	49,8	2141,2	590,2
Total			33			6803,1	1813,3

Table 2. Results from the trawl survey for redfish in Div. 3N, 1993.

Stratum	Depth, m	Area, square mile	Nos of tows	Mean catch/ 1 valid tow fish	kg	Abundance, '000	Biomass, tons
358	184-274	225	5	870,2	111,9	14503,3	1865,3
378	-"-	139	3	2,7	0,8	27,5	8,3
381	-"-	182	3	0,7	0,2	9,0	2,1
357	275-365	164	4	1838,4	327,1	22337,4	3973,5
379	-"-	106	3	17,7	2,1	138,7	16,6
380	-"-	116	4	0,3	0,01	2,1	0,1
723	366-547	155	3	167,3	33,8	1921,2	387,9
725	-"-	105	3	206,7	36,0	1607,4	279,9
727	-"-	160	4	10,0	1,6	118,5	19,2
724	548-728	124	3	454,3	187,2	4173,1	1719,0
726	-"-	72	4	157,0	42,4	837,3	226,2
728	-"-	156	3	6739,3	1729,4	77876,7	19984,3
Total		42				123552,2	28482,4

Table 3.Results from stock assessment of redfish in NAFO Subarea 3 according to the 1993 acoustic survey.

Div.	Pelagic component		Bottom component		Total	
	Numbers, fish 10^{-6}	Biomass, thou.t	Numbers, fish 10^{-6}	Biomass, thou.t	Numbers, fish 10^{-6}	Biomass, thou.t
3L	134,5	33,8	74,1	17,2	208,6	51,0
3N	127,5	28,7	67,4	16,8	194,9	45,5
3LN	262,0	62,5	141,5	34,0	403,5	96,5
3O	124,5	42,5	205,1	49,2	329,6	91,7
3M	380,6	77,3	791,9	78,5	1172,5	155,8

Table 4. Estimates obtained from the trawl- acoustic survey for redfish in Divs. 3LN for 1983-1993.

Year	Trawl survey		Acoustic survey		Total	
	Numbers, fish 10^{-6}	Biomass, thou.t	Numbers, fish 10^{-6}	Biomass, thou.t	Numbers, fish 10^{-6}	Biomass, thou.t
1983	428,9	125,0				
1984	720,3	199,4				
1985	245,1	85,9				
1986	133,4	46,8				
1987	182,1	60,8				
1988	167,3	40,0	654,9	118,1	822,2	158,1
1989	44,7	10,9	100,0	18,3	145,2	29,2
1990	23,1	7,1	116,2	32,5	139,3	39,6
1991	41,8	14,5	330,7	176,4	372,5	190,9
1992	-	-	-	-	-	-
1993	130,4	30,3	262,0	62,5	392,4	92,8

Table 5. Results from the trawl survey for redfish in Div. 3O, 1993.

Stratum	Depth, m	Area, square mile	Nos of tows	Mean catch/ 1 valid tow fish	Mean catch/ 1 valid tow kg	Abundance, '000	Biomass, tons
329	93-183	1721	3	8,0	0,1	1019,8	13,5
332	-"-	1047	4	2356,8	685,4	182779,0	53153,6
337	-"-	948	3	1832,7	545,2	128693,9	38287,8
354	-"-	474	3	444,7	58,5	15612,7	2054,5
333	184-274	151	3	10424,0	1751,5	116594,4	19590,5
336	-"-	121	3	11635,7	2152,4	104290,0	19292,1
355	-"-	103	3	2267,0	349,1	17296,4	2663,2
334	275-365	92	3	29001,3	5951,9	197638,7	40561,0
335	-"-	58	3	2249,0	488,5	9662,4	2098,5
356	-"-	61	3	930,7	178,1	4205,2	804,9
717	366-547	93	3	215,7	102,4	1485,7	705,7
719	-"-	76	3	619,3	214,4	3486,6	1206,7
721	-"-	76	3	939,3	376,2	5288,1	2117,9
718	548-728	111	3	52,0	28,4	427,6	233,8
720	-"-	105	3	79,3	38,2	617,0	297,3
722	-"-	93	3	204,0	80,3	1405,3	553,4
Total			49			790502,8	183634,4

Table 6. Results from the trawl survey for redfish in Div 3M, 1993.

Stratum	Depth, m	Area, square mile	Nos of tows	Mean catch/ 1 valid tow fish	Mean catch/ 1 valid tow kg	Abundance, '000	Biomass, tons
1	127-146	342	3	-	-	-	-
2	147-183	838	4	-	-	-	-
3	184-255	628	4	7,0	0,4	325,6	18,5
4	-"-	348	3	-	-	-	-
5	-"-	703	4	3,5	0,3	182,3	13,1
6	-"-	496	3	-	-	-	-
7	256-364	822	6	6216,8	319,7	378531,0	19463,4
8	-"-	646	4	327,8	94,0	15683,4	4499,5
9	-"-	314	3	1122,3	350,4	26104,6	8148,9
10	-"-	951	3	1513,7	161,0	106629,4	11340,3
11	-"-	806	3	1352,0	119,4	80719,4	7129,7
12	365-546	670	5	192,2	65,2	9538,8	3234,1
13	-"-	249	3	662,7	266,9	12222,5	4923,7
14	-"-	602	4	324,0	59,4	14448,0	2650,6
15	-"-	666	4	621,3	110,6	30648,3	5456,4
16	547-728	634	4	23,3	12,0	1091,9	561,2
17	-"-	216	3	242,0	104,8	3872,0	1676,8
18	-"-	210	4	72,8	29,2	1131,7	454,4
19	-"-	414	4	20,0	9,1	613,3	278,4
Total			56			681742,2	69849,0

Table 7. Estimates obtained from the trawl-acoustic survey for redfish in Div. 3M for 1983-1993.

Year	Trawl survey		Acoustic survey		Total	
	Numbers, fish 10^{-6}	Biomass, thou.t	Numbers, fish 10^{-6}	Biomass, thou.t	Numbers, fish 10^{-6}	Biomass, thou.t
1983	644,0	154,9				
1984	376,7	132,3				
1985	177,3	51,9				
1986	1200,2	309,5				
1987	463,2	106,4				
1988	183,1	47,0	1632,1	332,0	1815,2	379,0
1989	283,8	83,3	1947,3	282,6	2231,1	365,9
1990	74,7	17,7	1331,4	228,7	1406,1	246,4
1991	2006,1	45,4	1850,0	62,3	3856,1	107,7
1992	119,5	18,2	149,6	81,3	269,1	99,5
1993	681,7	69,8	380,6	77,3	1062,3	147,1

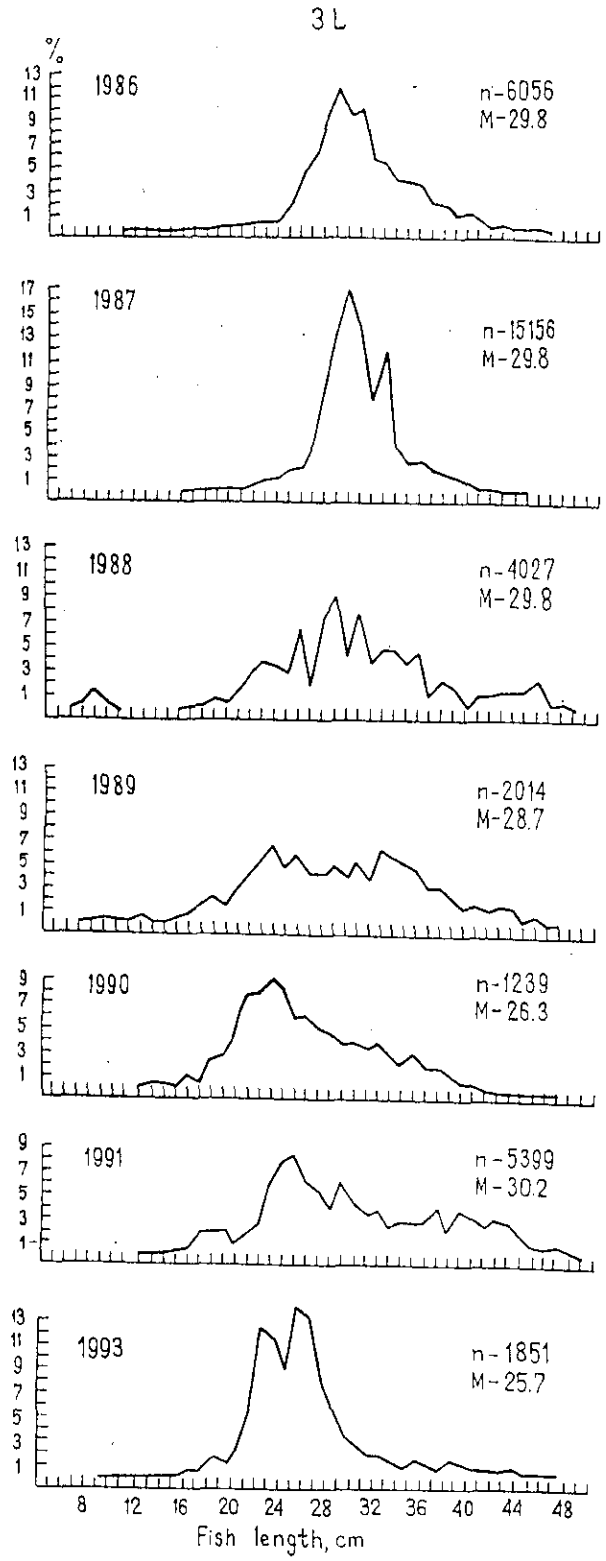

Fig.1. Size composition of redfish in catches taken by a small-meshed trawl in Div. 3L in 1986-1993.

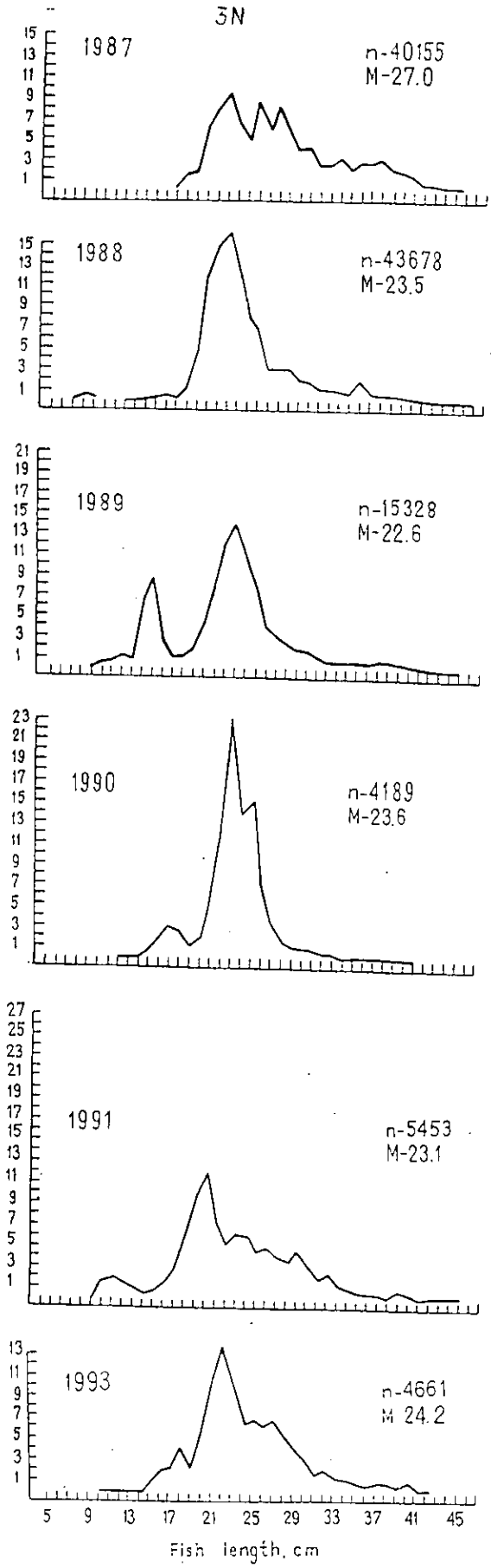

Fig. 2. Size composition of redfish in catches taken by a small-meshed trawl in Div. 3N in 1987-1993.

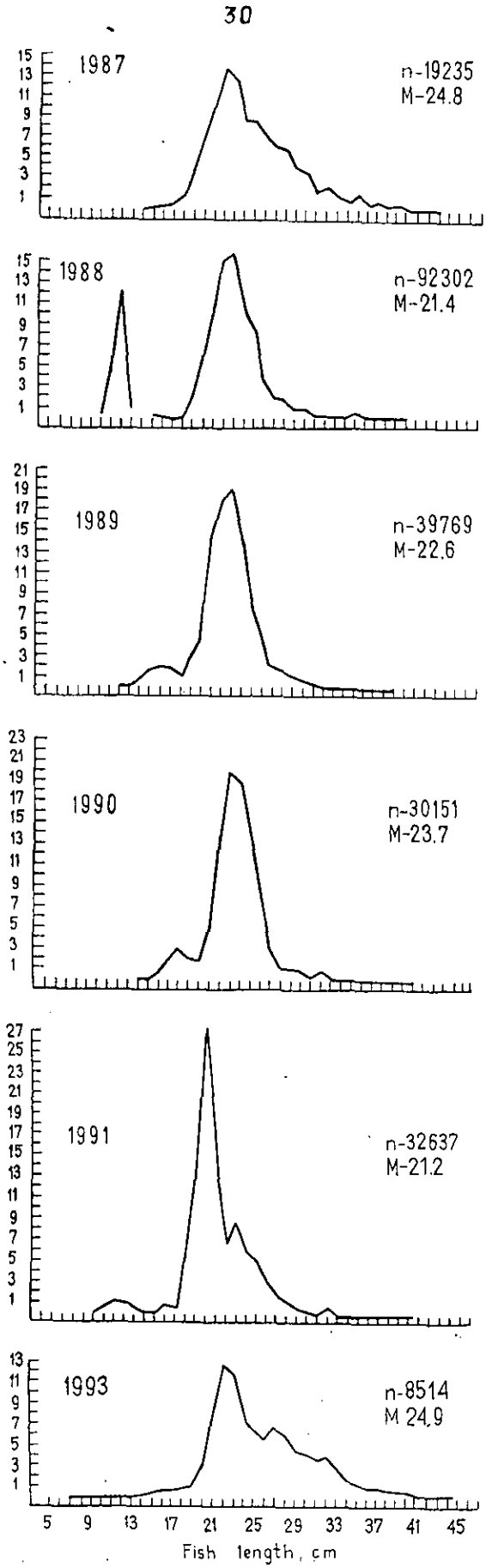

Fig.3. Size composition of redfish in catches taken by a small-meshed trawl in Div. 3O in 1987-1993.

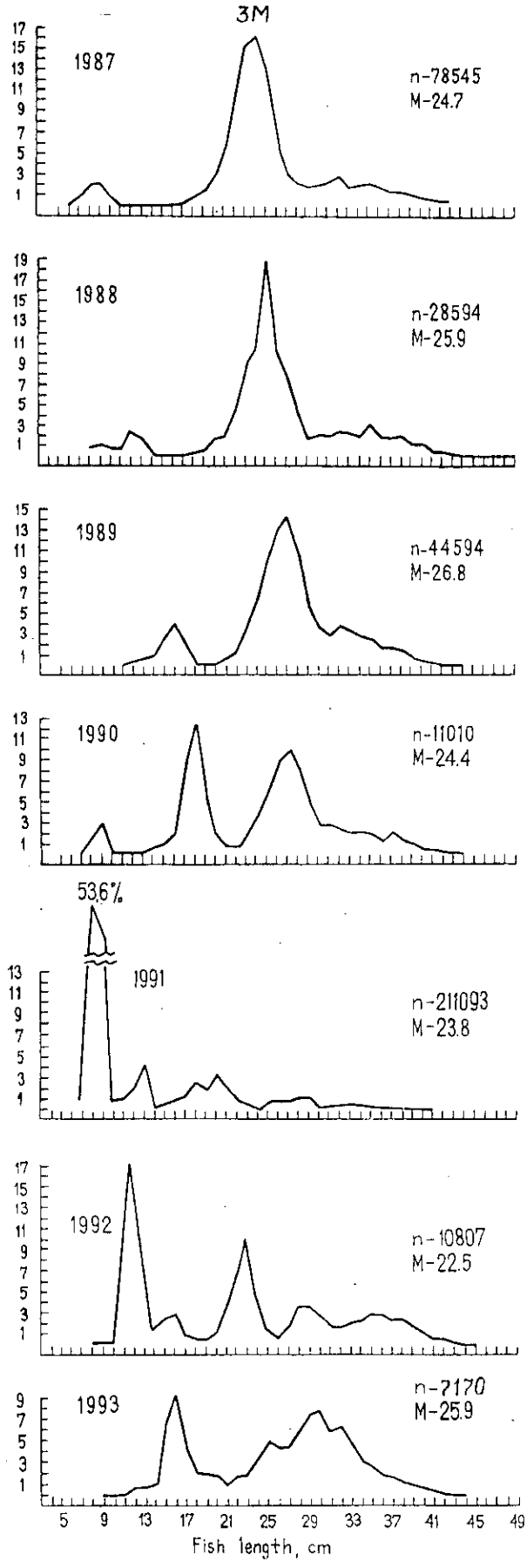

Fig.4. Size composition of redfish in catches taken by a small-meshed trawl in Div. 3M in 1987-1993.