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On introduction of the new measures of redfish fishery regulation in Div. 3O

by

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Introduction

This paper contains some information referring the request of the Fishery Commission to the Scientific Counsil for the new possible measures of redfish fishery regulation in Div.3O (NAFO SCS Doc.06/1). Item 8 in this request concerns the establishment of the minimal commercial redfish size, the maximal possible percentage of this fish bycatch, the closure and opening of fishery in exceeding this bycatch and possible bycatch of moratorium fish species.

Materials and methods

This paper presents the results of research on Acadian redfish *Sebastes fasciatus* caught in Div.3O in 2006. The ichthyological data on this redfish species were collected in accordance with methods used in PINRO and NAFO. Applied were the data from catches by midwater and bottom trawls with 130 mm mesh size from 200-700 m depths. Length-age composition, sex ratio, the percentage of immature and mature fish were analysed for entire fish distribution area. The age was read by the single expert in age reading. The difference in the number of fish of the certain age by scales and otoliths is explained by the fact that the age couldn't be read by some preparations since the scales were destructed.

The age group for the redfish species from the Northwestern Atlantic was taken as 1 cm. In redfish species the total length was measured. The age data were converted for the whole length series. To determine maturity the maturity scales developed by V.P. Sorokin (Sorokin, 1958, 1960) were used. Mass maturation was determined as maturity in 50% of fish. The analyzed ichthyological data are given in Table 1.

Results and discussion

Maturation rate. The analysis of *Sebastes fasciatus* maturation rate in Div.3O in 2006 showed that mature males first occurred being as long as 21 cm, aged 5, and females – with the length of 22 cm, at the age of 5 (Table 2, Figs.1,2,3). The mass maturation of males happens when they have the length of 24 cm and are 7 years old. 50 % maturation of females occurs with the length of 25 cm and at the age of 7. Males become completely mature under the length of 28 cm, at the age of 9, females – being as long as 30 cm at the age of 10. The results of observations in 2006 reminded the analogous data obtained in 2004 (Vaskov, 2004).

According to the data obtained in 2005, Acadian redfish became mature earlier (Vaskov, 2005). These results are close to the analogous data obtained by Barsukov V.V. and Zakharov G.P. in Div.4W, on the New Scotian Shelf (Barsukov, Zakharov, 1972).

According to the results of investigations, in Div.3O, I-H. Ni and E.J.Sandeman found that L_{50} for males of *Sebastes fasciatus* and *Sebastes mentella* species, which were not divided, was 18.23 cm, while in females that value amounted to 27.73 cm (Ni, Sandeman, 1984). Later Canadian research showed that according to the results of the two observation series the mean L_{50} was 21.5 cm for males and 27.5 cm for females (Power, Orr, 2002; Power, 2003). However those data were also obtained for undivided species *S.fasciatus* and *S.mentella*.

As it was mentioned before, the determination of maturity stages in redfish was especially complicated, required skills and high qualification. G.P.Zakharov noted that mature females started to differ from the immature ones since the transition of ovaries to Stage III (the start of trophoplasmatic growth of oocytes) (Zakharov, 1967). But in the field conditions some errors may be done: Stage II is registered instead of Stage III since at these stages the ovaries are almost similar in volume. Evidently this subjective error explains the fact that, in July-August, there are more females of golden redfish at Stage II (Table 3) than in the rest seasons. Therefore variations of data on sex maturation of Acadian redfish from Div.3O probably are explained by different qualification of the observers.

Undoubtedly to study the maturation rate of Acadian redfish from Div.3O further researches are needed.

Length composition. According to the data obtained, in 1999-2006, in Div.3O, redfish with 22-25 cm length made up the bulk of catches (Fig.1).

The analysis of redfish species length distribution in those years showed that the percentage of *S.fasciatus* and *S.mentella* with the length of less than 22 cm varied from 2.9 to 34.9% (Table 4). With the increase in fishing depth the percentage of these fishes decreases (Table 6, Fig.5).

Age composition. The analysis of the length distribution of commercial catches showed that, in Div.3O, the age composition of redfish species was not subjected to significant yea-to-year fluctuations. In 1999-2006, redfish aged 5-7 prevailed in catches.

Since in Div.3O the Acadian redfish predominated (about 85%) (Vaskov, 2004), Fig.6 presents the age composition of this species by the results of research in 2006. Tables 6 and 7 give the length-age keys derived when reading age by scales and otoliths. The age reading of the largest fish, i.e. the individuals from elder age groups is the most difficult. Therefore it should be noticed that the data on redfish age reading by scales and otoliths for 2006 contain more or less comparable values since the age of 7. However the results of age reading of 5- and 6-year redfish by the two methods showed, in our opinion, the evident value-added number of 6-year-old fish in determination by otoliths.

As it was mentioned before, in Div.3O, the Acadian redfish started maturing at the age of 5.

Bycatch of other fish species. The results from the directed fishery of redfish in Div.3O in 2001-2006 indicated that the bycatch of other fish species, as a rule, does not exceed 5% (Table 8). The data for 2001-2002 have been chosen and are given as, in that period, there, Russian fishery of redfish was the most intensive and the catch amounted to 10-11 x 10^3 t. Russian vessels were mainly fishing within 400-500 m depth range. At those depths, the bycatch of other bottom fish species varied from 0.2 to 4.2%. In some years, with the increase in fishing depth the rise of other species portion (of Greenland halibut in the first place) was observed. In 2002, at 200-300 m depths, Russian vessels fished white hake and, in that depth range, that species percentage was about 50%.

Conclusion

At present, in Div.3O of the NAFO Regulatory Area, the minimal commercial size of redfish has not been determined. However, in the Canadian fishing zone, the minimal commercial size being equaled to 22 cm was established (Anon., 2004). Now it is not clear which biological parameters were used to introduce that size. Therefore, in our opinion, the mechanical introduction of Canadian fishery regulations into the NAFO Regulatory

Area is not entirely motivated. To introduce the minimal commercial size of redfish the special researches and determined biological parameters based on which the commercial size may be established are needed.

Article 9 of Item 2 in the Fishery Regulations adopted for NAFO Regulatory Area determines the fishing procedure, in the cases of moratorium fish species bycatch which exceeds the allowable size, according to which a vessel should immediately leave for the distance of, as a minimum, 10 nautical miles from any site of the previous hauling and having the following hauling be at the distance of, as a minimum, 10 nautical miles from any site of the previous hauling (Conservation and Enforcement Measures, NAFO FC Doc. 07/1, Serial No. 5335). The area of Div.3O in NAFO Regulatory Area where the redfish can be fished is minor and equals to about 500 mile^2. The proposal to close the area for 10 days in the case of the extra bycatch: 1) contradicts to these regulations, 2) will not allow the vessels to fish at the large depths where the bycatch of small redfish and moratorium fish species is minor. Therefore, we think that the proposal to close the area is not absolutely correct and objective.

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TABLE 1. Ichthyological data from Div.3O analyzed in 2006.

Research	Number, fish.
Mass measurement	50683
Maturity analysis	2934
Age	317

TABLE 2. Maturation of *S. fasciatus* from Div 3O. depending on length.

Year	Maturation length					
	First maturing		50 %		100%	
	Males	Females	Males	Females	Males	Females
1974*	19	19	21	22	24	26
1984**	-	-	18	27	-	-
2002***	-	-	21	27	-	-
2004	19	23	24	25	29	31
2005	19	17	21	20	29	28
2006	21	22	24	25	28	30

* - Barsukov, Zakharov, 1972 (Div. 4W).
** - Ni, Sandeman, 1984.
*** - Power, Orr, 2002.

TABLE 3. Maturuty of golden redfish females in the area of Labrador and northern Grand Bank of Newfoundland (Div. 3K) (analysis included females larger than 34 cm) (Zakharov, 1967).

Month	Maturity stage, %							Number
	II	III	IV	VI	VII	VIII	IX	
July	25.0	57.4	0.4	-	-	0.6	16.6	812
August	23.7	44.6	-	-	-	0.3	31.4	316
September	16.5	82.6	-	-	-	-	0.9	242
October	4.1	60.4	35.5	-	-	-	-	121
November	4.9	63.0	32.1	-	-	-	-	589
December	2.3	10.3	86.0	1.4	-	-	-	485
January	1.5	8.3	31.8	58.4	-	-	-	132
February	7.5	2.1	9.7	76.4	3.1	-	-	93
March	-	-	-	9.3	72.1	14.0	4.6	43
April	2.4	0.5	0.5	4.8	8.1	81.8	1.9	210
May	14.2	0.5	3.2	3.6	7.7	15.0	26.0	585
June	19.2	6.0	2.2	-	-	4.1	68.5	269

TABLE 4. Percentage of *S.fasiatus* and *S.mentella* with the length of less than 22 cm in commercial catches in Div. 3O in 1999-2006.

Year	*S. mentella*, %	*S. fasciatus*, %	Total, %
1999	-	-	11.4
2000	-	-	2.9
2001	-	-	12.8
2002	-	-	18.3
2003	-	-	20.1
2004	5.5	6.4	5.9
2005	1.9	36.6	34.9
2006	4.7	8.4	6.9

TABLE 5. Percentage of *S.fasiatus* and *S.mentella* with the length of less than 22 cm in commercial catches depending on fishing depth in Div. 3O in 1999-2006, %.

Length, cm	Depth				
	200-299 m	300-399 m	400-499 m	500-599 m	600-699 m
19	10.20	1.93	0.64	0.73	0.19
20	13.01	4.78	1.86	1.47	0.24
21	21.69	15.61	6.98	4.88	0.91
22	**41.90**	**40.86**	**20.21**	**13.65**	**2.19**
23	62.91	68.23	40.36	27.74	6.29
24	76.64	83.47	56.86	41.51	12.30
25	87.52	93.57	72.33	56.31	22.21
26	93.17	98.07	82.60	68.42	34.37
27	96.62	99.17	89.20	77.68	45.00
28	98.41	99.54	93.58	85.26	54.91
29	99.36	99.91	96.07	89.99	64.68
30	99.81	99.91	97.68	93.46	71.54
31	99.96	99.91	98.75	95.74	78.50
32	100.00	99.91	99.31	97.25	83.41

TABLE 6. Acadian redfish age composition (ind.) in the NAFO Div. 3O in 2006. Age was read by scales.

Length, Cm	Age, years												Total	Weight g
	3	4	5	6	7	8	9	10	11	12	13	14		
14		1											1	72.0
15	2	1											3	43.3
16	3	1											4	52.8
17	3	6											9	66.4
18	1	1	2										4	78.5
19		3	1	1									5	91.0
20		1	6	2	1								10	103.9
21		2	17	4									23	117.7
22			10	10	2	1							23	138.3
23			11	9	2								22	158.6
24			3	11	5								19	177.5
25			3	11	14	4							32	203.5
26				5	6	7							18	227.6
27					3	8	3						14	243.2
28						9	7						16	284.2
29						4	7		1				12	312.5
30							3	31	4	2			24	351.2
31								8	6	1			15	374.7
32							2	1	3	3			9	423.2
33							1	2	5	4	1		13	482.5
34								2	2	3	1	1	9	520.9
35												2	2	548.0
Total	9	16	53	53	33	33	23	28	21	13	2	3	287	
Mean	16.3	17.7	21.7	23.4	24.8	26.9	29.0	30.9	31.6	32.4	33.5	34.7		25.5
Mean	58.8	76.9	133.	166.	202.	251.	316.	383.	412.	451.	488.	549.		236.2

TABLE 7. Acadian redfish age composition (ind.) in the NAFO Div. 3O in 2006. Age was read by otoliths.

Length, Cm	Age, years													Total	Weight, g
	3	4	5	6	7	8	9	10	11	12	13	14	15		
14		1												1	72.0
15	2	1												3	43.3
16	2	1												3	53.7
17	3	6												9	66.4
18	1	1	2											4	78.5
19		3	2	1										6	90.7
20			5	4	1									10	103.9
21		1	12	11	1									25	117.8
22			4	18	3	1								26	138.8
23			7	14	2									23	157.7
24			2	14	3	2								21	178.0
25			2	11	17	5	1							36	202.6
26				5	7	5	4							21	225.5
27					4	9	4							17	245.1
28					1	10	8							19	284.9
29						2	11		1					14	313.9
30							3	13	10					26	351.5
31								5	10	2				17	375.6
32								2	3	4	2			11	424.5
33								1	4	6	1	2		14	482.4
34									2	3	2	2		9	520.9
35												1	1	2	548.0
Total	8	14	36	78	39	34	31	21	30	15	5	5	1	317	
Mean	16.4	17.4	21.5	22.9	24.8	26.6	28.1	30.6	31.2	32.7	33.0	33.8	35.0		25.6
Mean	59.9	72.4	127.	157.	203.	243.	288.	369.	395.	456.	466.	532.	526.		238.2

TABLE 8. Data on catch composition in the fishery of redfish species by Russian vessels by the depth range in Div. 3O, 2001-2006.

Depth range, m	Number of hauls	Catch	
		redfishes, %	other fishes, %
		2001	
200-299	56	96.70	3.30
300-399	980	96.87	3.13
400-499	1028	97.48	2.52
500-599	175	93.82	6.18
600-699	27	90.74	9.26
		2002	
200-299	133	43.68	56.32*
300-399	604	95.24	4.76
400-499	1363	95.84	4.16
500-599	511	93.60	6.4
600-699	25	99.84	0.16
		2006	
200-299	10	98.69	1.31
300-399	27	99.51	0.49
400-499	163	99.75	0.25
500-599	69	99.22	0.78
600-699	3	98.01	1.99

* - fishing of white hake

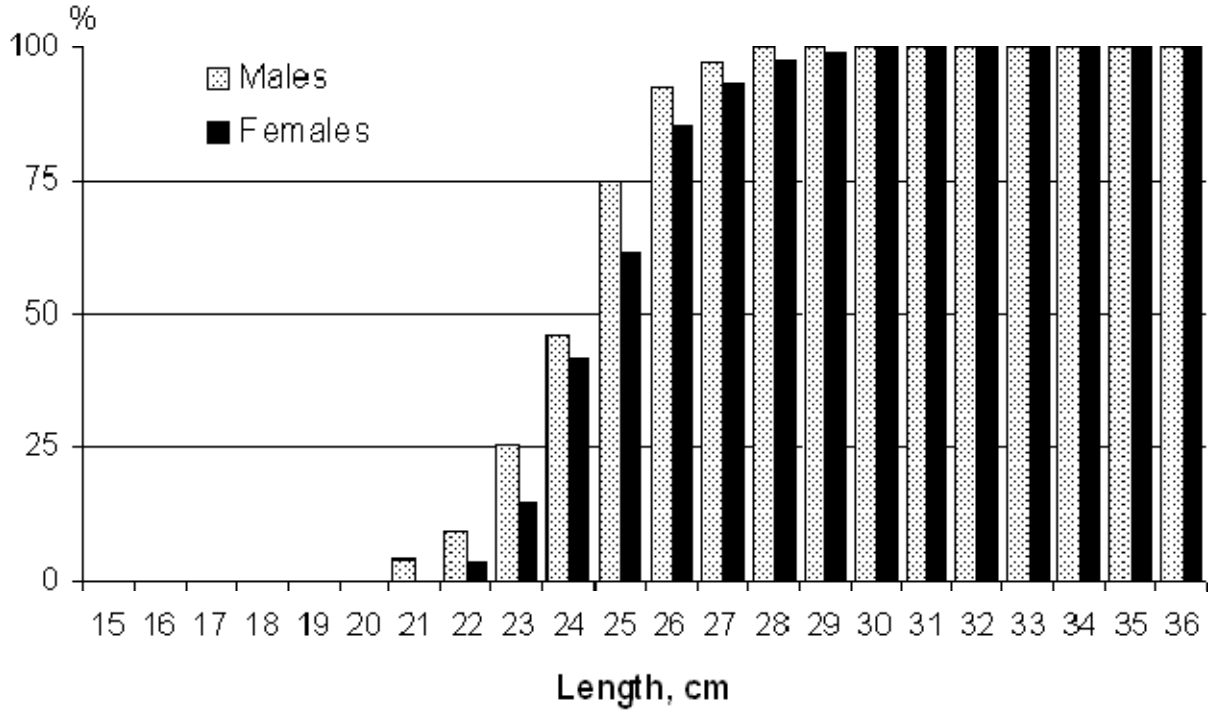

Fig. 1. Maturation of Acadian redfish in different length groups, 2006.

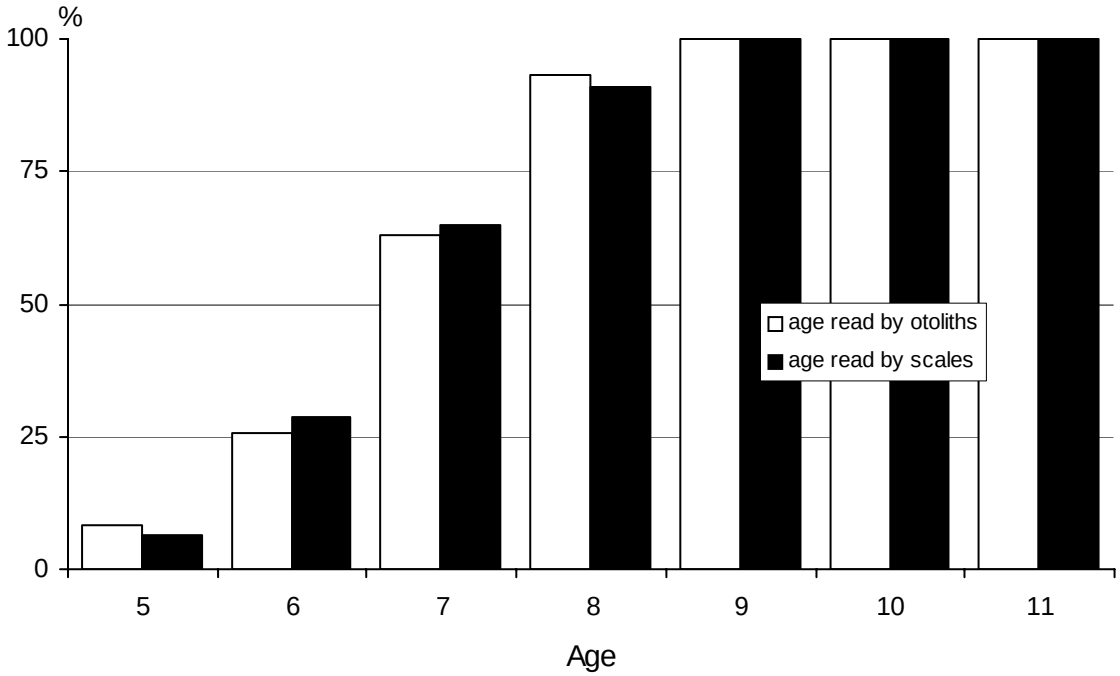

Fig. 2. Acadian redfish maturation of males in different age groups, 2006.

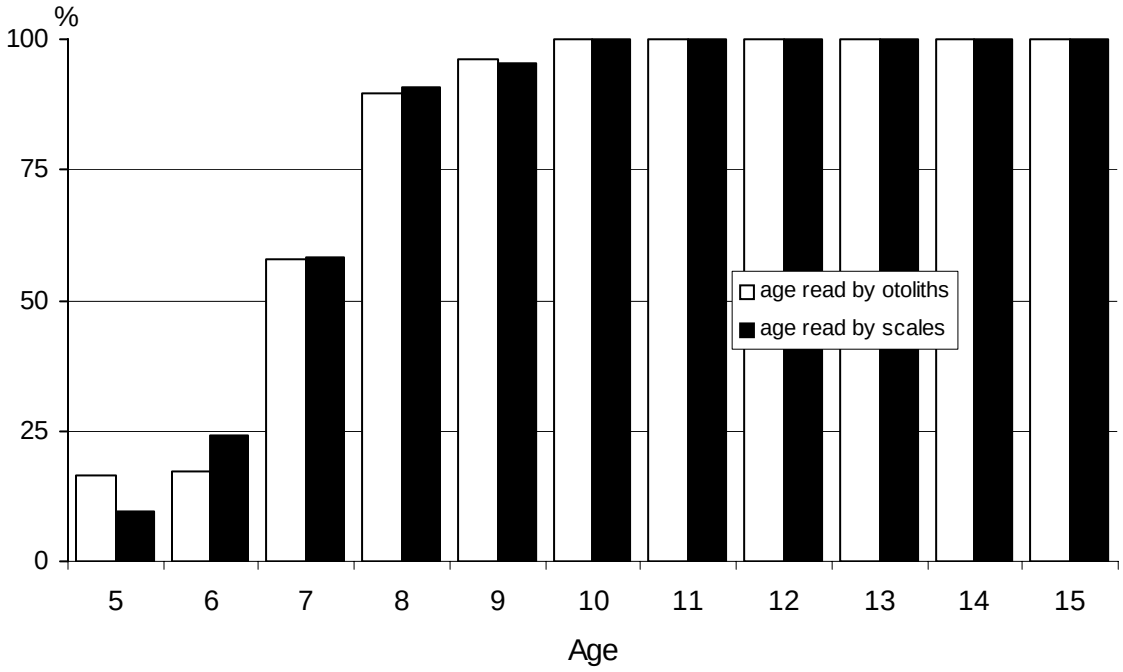

Fig. 3. Acadian redfish maturation of females in different age groups, 2006.

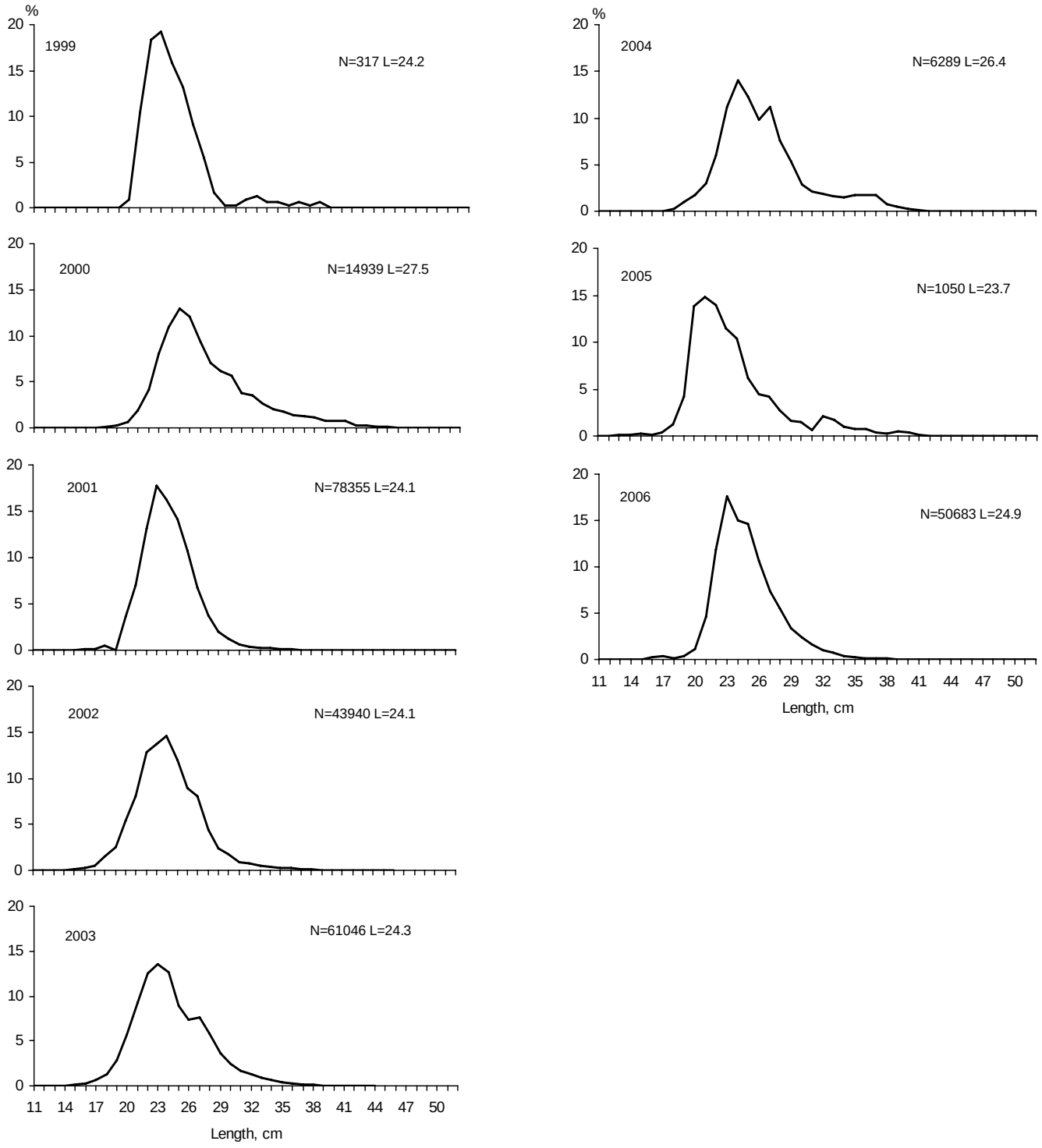

Fig. 4. Length distribution of redfish in Div. 3O in 1999-2006.

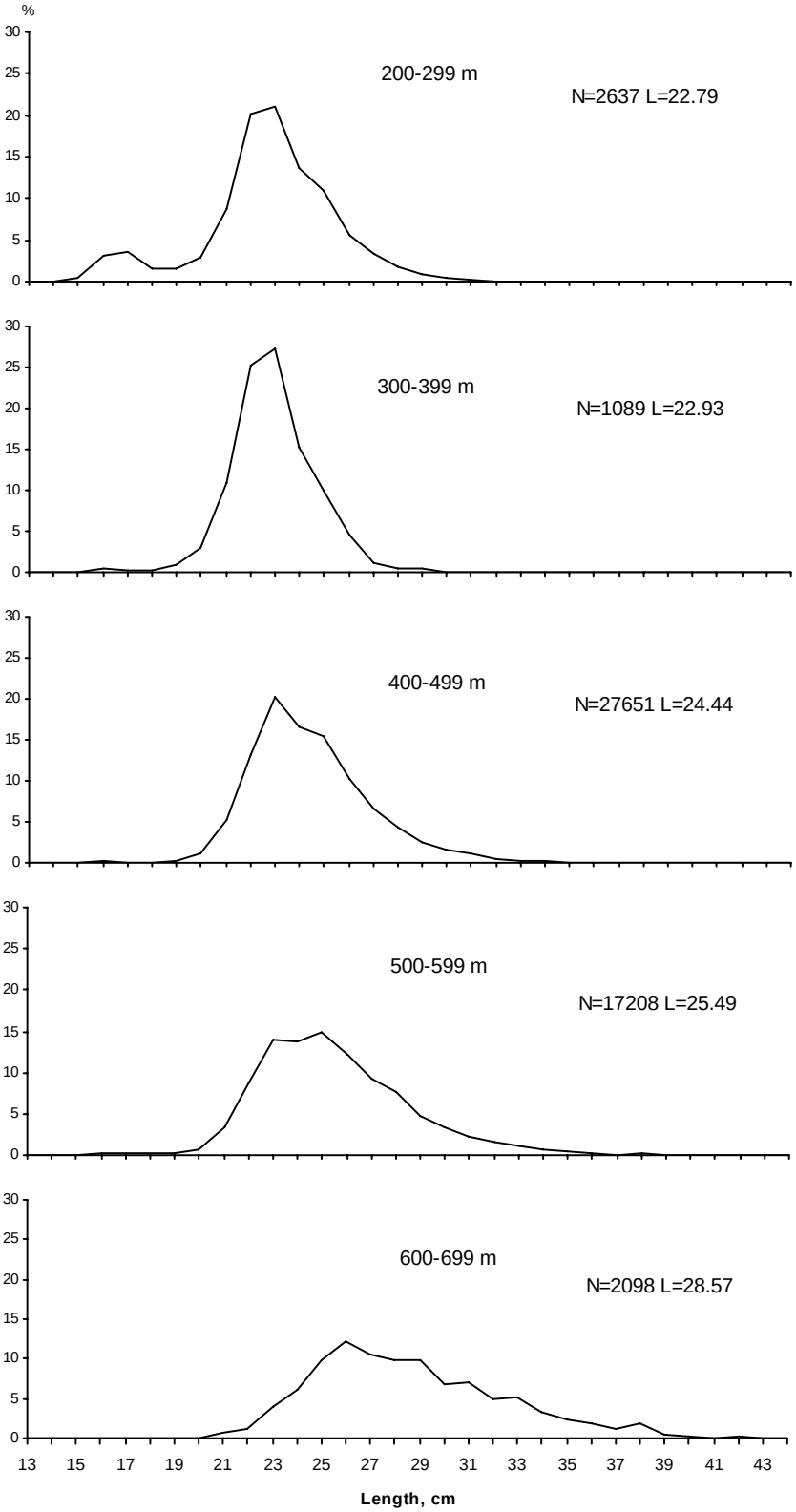

Fig. 5. Length distribution of Redfish in Div. 3O by depth in 2006.

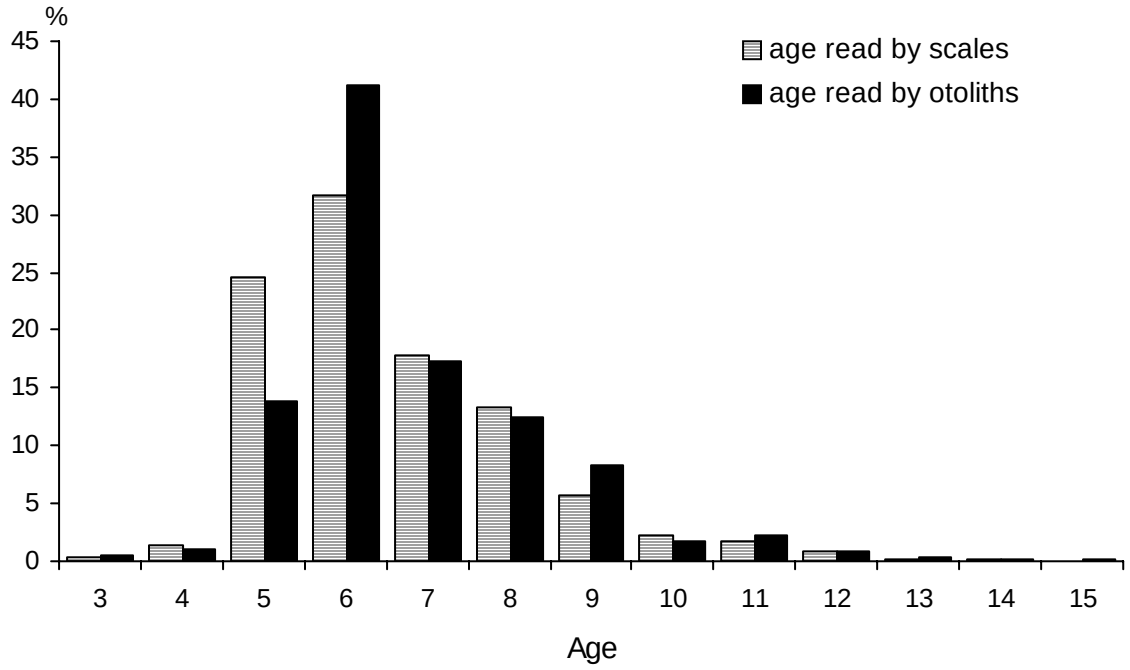

Fig. 6. Age composition of Acadian redfish in Div.3O in 2006.