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On Maturation of Acadian Redfish (*Sebastes fasciatus*) in Division 30

by

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Abstract

Results of studying of sexual maturation of Acadian redfish *Sebastes fasciatus* dwelling in Division 30 are presented by data of investigations in 2003.

Analysis of the sexual maturation rate of *Sebastes fasciatus* has shown that mature males begin to mature at the length of 19 cm and age of 4, and females – at the length of 17 cm and age of 4. Mass maturation of males (50%) happens at the length of 21 cm and age of 5. Complete maturation of males sets in at the length of 29 cm and age of 10, and that of females – at the length of 28 cm and age of 9.

Since *S. fasciatus* dominates in this area, it determines the interannual dynamics of abundance in total commercial catches of marine redfishes.

Introduction

In the period from 1960 to 2004, an international catch of redfish in Div. 30 fluctuated from 3 to 35 thousand tons. Commercial concentrations in this Division form two species of marine redfish of *Sebastes* genus: *S. mentella* (deep-sea redfish) and *S. fasciatus* (Acadian redfish). As the Russian investigations carried out in 2001-2004 by observers of NAFO onboard of fishing vessels have shown, a basis of catches (up to 85%) in Div. 30 consisted of *S. fasciatus* (Vaskov, MS 2004). Although this species is an important commercial object, the problem of its sexual maturation is poorly studied.

Analysis of sexual maturation rate of Acadian redfish is carried out in the paper.

Materials and Methods

Ichthyological material on Acadian redfish was collected in Div. 30 by PINRO and NAFO methods. Data used were from catches taken by the midwater and bottom trawls. Material for age determination (fish scale) was collected on the basis of 5-10 individuals per each centimeter class.

The main signs for species distinguishing between *S. mentella* and *S. fasciatus* were as follows:

- number of rays of the anal fin (7 rays in *S. fasciatus*),
- unity of parietal and nuchal spines (united in *S. mentella*),
- number of vertebrae (30 or less in *S. fasciatus*, 31 or more in *S. mentella*).

Individuals, which undoubtedly belonged to *S. fasciatus*, were selected to the age sample. Maturity scales developed by V. P. Sorokin (Sorokin, 1958, 1960) were used to determine sexual maturity. Mass maturation was determined as reaching of maturation by 50% of fish.

Sexual maturation rate (P) of redfish was approximated by means of the logic curve by a formula:

$$P = \frac{1}{1 + e^{a(t-t_{50})}},$$

where a – coefficient characterizing an incline of the curve;

t – age/length;

t_{50} – age/length of 50-% sexual maturation.

Results and Discussion

Sexual maturation rate. Analysis of sexual maturation rate of Acadian redfish in the Div. 3O has shown that mature males are occurred for the first time at the length of 19 cm and age of 4, and females – at the length of 17 cm and age of 4 (Tables 1 and 2). Mass maturation (50%) of males happens at the length of 21 cm and age of 5 (Fig. 1 and 2). 50-% maturation of females takes place at the length of 20 cm and age of 5. Complete maturation of males sets in at the length of 29 cm and age of 10, and that of females – at the length of 28 cm and age of 9.

By data of 2003, later sexual maturation was registered for *S. fasciatus* (Vaskov, MS 2004). However, these results were obtained during mass measurements of fish and in the process of analysis of their feeding with a probability of *S. mentella* occurrence.

Canadian researchers determine sexual maturation of redfish by maturation scales described in the paper of I-H. Ni and W. Templeman (Ni and Templeman, 1985). These scales coincide with scaled developed by V. P. Sorokin (Sorokin, 1958 and 1960). By results of investigations in Div. 3O, I-H, Ni and E. J. Sandeman noted that L_{50} for males of unseparated species *S. fasciatus* and *S. mentella* constituted 18.23 cm, for females it was 27.73 cm (Ni and Sandeman, 1984). Later Canadian investigations have shown that by results of two series of observations the average L_{50} for males constitutes 21.5 cm and for females - 27.5 cm (Power and Orr, MS 2002; Power, MS 2003). However, these data were also obtained for undistinguished species *S. fasciatus* and *S. mentella*.

Results of investigations of a number of vertebrae in marine redfishes have shown that *S. fasciatus* dominate in waters of the Nova Scotian shelf (Ni, MS 1981). By data of V. V. Barsukov and G. P. Zakharov (Barsukov and Zakharov, 1972) in Div. 4W on the Nova Scotian shelf males and females of *S. fasciatus* begin to reach sexual maturation at the length of 19 cm. More than half of males 22 cm long has already been mature (Table 3).

Thus, the obtained data on rate of sexual maturation of *S. fasciatus* in Div. 3O have more similar character with data for this species in Div. 4W.

Length composition. In accordance with data obtained from observers onboard of fishing vessels, the main portion of catches in Div. 3O in 1999-2004 consisted of redfish 22-25 cm long (Fig. 3). In spite of the increase of the catch, length frequency of redfish in 1999-2002 did not change much. Analysis of redfish length frequency in 2004 shows that since *S. fasciatus* dominates in this division just this species determines interannual dynamics of abundance.

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Table 1. Sexual maturity of Acadian redfish in NAFO Div. 3O by size groups, %

Length, cm	Males	Females
17	0.0	12.5
18	0.0	28.6
19	38.5	50.0
20	40.0	45.5
21	55.6	64.3
22	47.3	85.7
23	75.0	100.0
24	96.0	100.0
25	100.0	94.4
26	100.0	93.8
27	100.0	100.0
28	100.0	100.0
29	100.0	100.0
30	100.0	100.0
31	100.0	100.0
32	100.0	100.0
33	100.0	100.0
34	100.0	100.0
35	100.0	100.0
36	100.0	100.0
37	100.0	100.0
38	100.0	100.0
39	100.0	100.0
40	100.0	100.0
41	100.0	100.0
42	100.0	100.0
43	100.0	100.0

Table 2. Sexual maturity of Acadian redfish in NAFO Div. 3O by age groups, %.

Age	Males	Females
4	5.3	13.3
5	30.8	40.0
6	70.5	81.4
7	86.0	95.6
8	100.0	100.0
9	100.0	100.0
10	100.0	100.0
11	100.0	100.0
12	100.0	100.0
13	100.0	100.0
14	100.0	100.0
15	100.0	100.0
16	100.0	100.0
17	100.0	100.0
18	100.0	100.0

Table 3. Relative number of mature *S. fasciatus* of different length, % (Barsukov, Zakharov, 1972).

Length, cm	Div. 4W			
	Males		Females	
	n	%	n	%
16	11	-	6	-
17	14	-	9	-
18	17	-	18	-
19	24	12	25	8
20	24	33	42	21
21	37	57	36	31
22	13	62	29	55
23	8	63	29	69
24	5	100	16	88
25	2	100	21	81
26	1	100	7	100
27	-	-	6	100
28	-	-	4	100
29	-	-	6	100
30	-	-	4	100

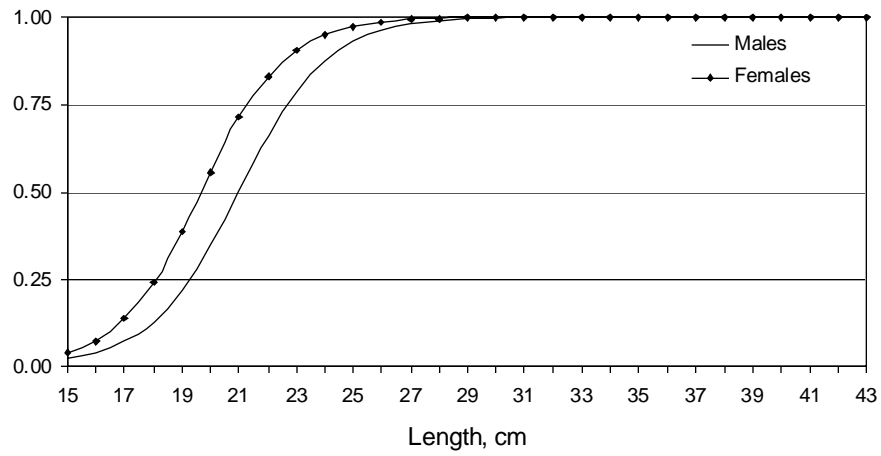


Fig. 1. Proportion of mature Acadian redfish in different length groups.

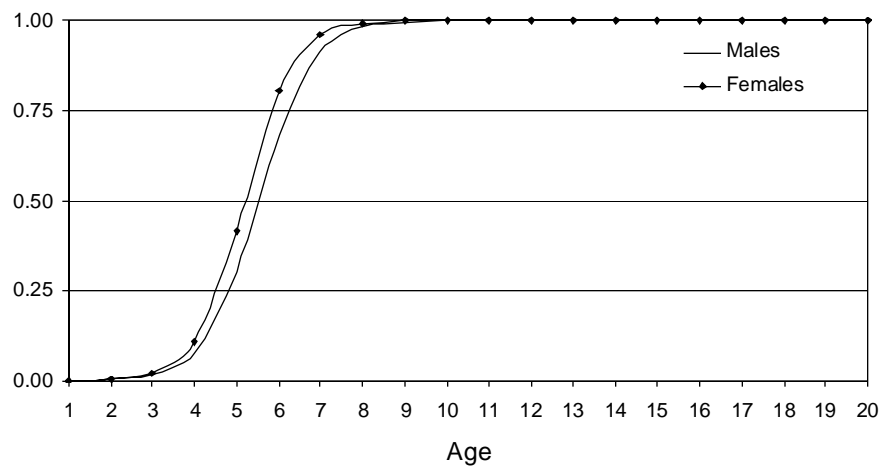


Fig. 2. Proportion of mature Acadian redfish in different age groups.

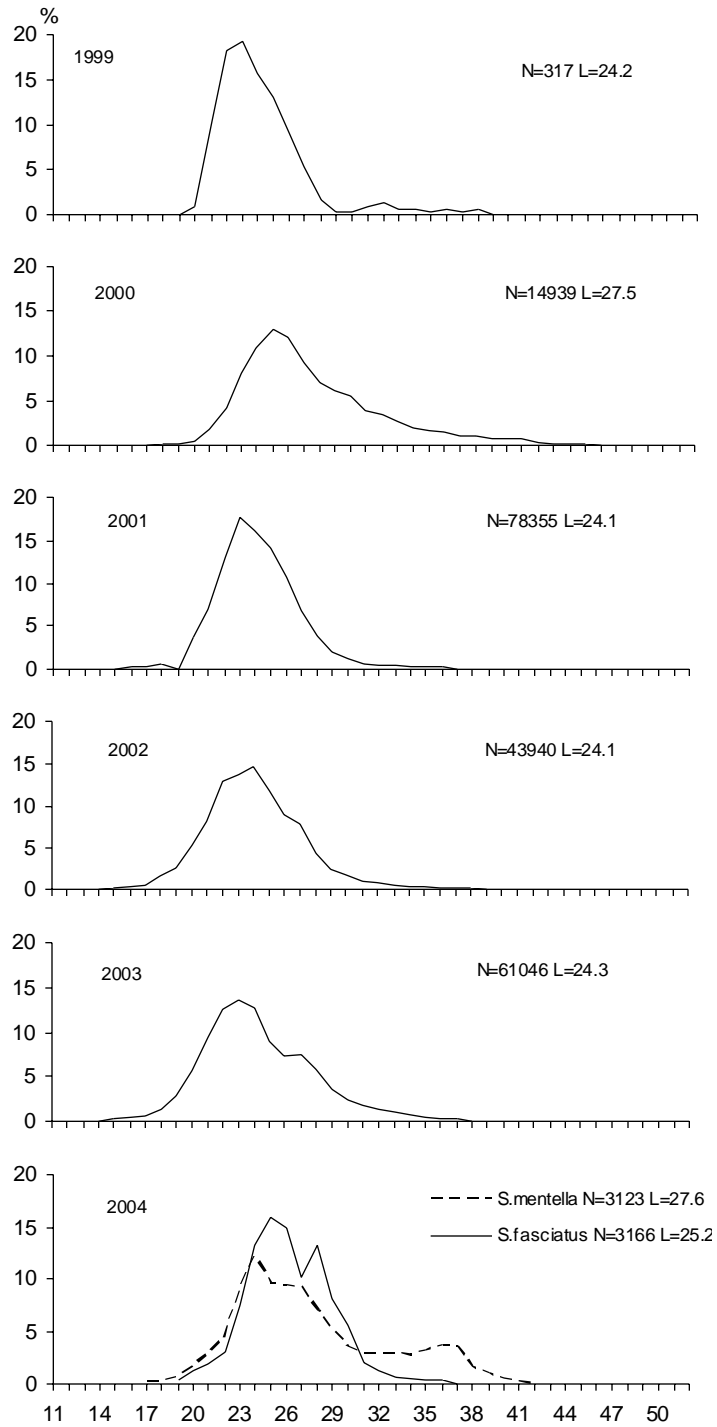


Fig. 3. Length distribution of redfish in Div. 30 in 1999-2004.