



SCIENTIFIC COUNCIL MEETING – JUNE 2006

Maturity of Golden Redfish *Sebastes marinus* on the Flemish Cap

by

A. Vaskov

Polar Research Institute of Marine Fisheries and Oceanography (PINRO)
6 Knipovich Street, Murmansk, 183038 Russia, e-mail:inter@pinro.ru

Abstract

According to the research in 1971-2005, the results from study of sexual maturation, annual cycle of gonad development, sex ratio and reproduction of golden redfish *Sebastes marinus* from the Flemish Cap Bank (Div. 3M) are presented.

It was found that females in catches significantly prevailed over males. The total sex ratio in the period of research was close to 1.

The results of study of the Flemish Cap redfish sexual maturation rate indicate that mature males found for the first time have the length of 19 cm and females of 23 cm. Males (over 50%) basically mature when they are as long as 34 cm, half of females having the length of 35 cm. Males completely mature with the length of 46 cm, females of 48 cm.

Based on the analysis of gonad development it was shown that the peak of larva hatching was in May.

Mass coupling takes place in October when most of mature males are at Maturity Stages V and VI.

Introduction

Despite wide distribution of golden redfish in the Atlantic Ocean its biology has been studied quite badly. There are some literature data on reproduction and sex composition of *S. marinus* in the Barents Sea, off Iceland, Greenland and Canada.

According to the results of 1991-2004 EU research surveys, in 1997 and 2003 *S. marinus* biomass exceeded 40% of total Flemish Cap redfish stock and the mean portion of this species accounted for 20% (Casas and Troncoso, 2005). However the sexual maturation and seasonal changes of gonad state and reproduction have not been considered.

The present paper analyses dynamics of golden redfish sexual maturation and reproduction. The main task is to study sexual maturation of this fish species on the Flemish Cap.

Material and Methods

This paper gives the results of the investigations into golden redfish *Sebastes marinus* caught during the directed fishery and research surveys on the Flemish Cap in 1971-2005. Ichthyological data on the golden redfish were collected in accordance with methods used in PINRO and NAFO. The data from catches by midwater and bottom

trawls were used. Length composition, sex ratio, percentage of immature and mature fish were analyzed within the whole distribution range. The total length of *S. marinus* was measured. The size group for redfish species from the Northwestern Atlantic was taken to be equal to 1 cm. In determining maturity the scales developed by V. P. Sorokin (Sorokin, 1958, 1960) were used. The maturation was determined as mass when 50% of fish became mature. Due to the lack of data, this paper does not consider the maturation rate depending on age.

Results and Discussion

Sex ratio. In the period of study on the Flemish Cap in 1971-2005, the total sex ratio was close to 1. In the majority of years, the number of females slightly exceeded that one of males and was mainly equal to 1.1:1 and, only in 2001 the sex ratio was 1.5:1 (Fig. 1).

Sex maturity rate. The analysis of the Flemish Cap *S. marinus* sexual maturation rate indicated that males having the length of 19 cm and females 23 cm in length were found as mature in catches for the first time (Table 1, Fig. 2). Mass maturation (50%) of females occurs when they are 35 cm in length and males are as long as 34 cm. Females and males completely mature under the length of 48 cm and 46 cm, respectively.

According to the data of G. P. Zakharov (1967), 50% maturation of the Flemish Cap golden redfish males and females began when they had the length of 33 cm and 39 cm, respectively (Table 2). Comparing to the Flemish Cap 50% of redfish males from the Labrador area become mature when they have the length of 31 cm. Mass maturation of females is observed when they have the length of 33 cm. Despite earlier mass maturation of fish in this area the complete maturation is observed when the length is greater. Off the West Island, half of *S. marinus* females reach maturity under greater length comparing with the Labrador area, however, 100% of fish mature under smaller length.

Annual cycle of gonad development.

The results of our observations showed that hatching of *S. marinus* larvae lasts till July. Due to the lack of observations in January-March it was not possible to register the start of hatching. Post spawning females were mainly recorded in May (Fig. 3). Some redfish couple in September, when the testes of males are at development stage V. Based on the development of gonads coupling basically occurs in October when most mature males have Stages V and VI.

According to G. P. Zakharov, hatching of golden redfish larvae begins in March and lasts till August (Table 3). The main peak of hatching is observed in May (Zakharov, 1967). Determination of golden redfish maturity stages is very complicated and requires experience and high qualification. G. P. Zakharov noticed that mature females differed from the immature ones starting since the period when ovaries transited to Stage III (the start of trophoplasmatic growth of oocytes). But in the expeditions sometimes the mistakes are made: Stage II is registered as Stage III since the ovaries at these stages almost do not differ in volume. Evidently, this subjective error explains the fact that there are more females at Stage II in July-August (Table 3) than in the other seasons.

The results of investigations indicate that when the spawning period approaches the Flemish Cap golden redfish females migrate to the depths of to 500 m forming dense concentrations (Anon., 1977). Larva hatching starts in March and lasts till May. In Div. 3KL larvae are hatched in May.

According to the data by V. I. Travin and L. N. Pechenik (1962) the hatching of golden redfish larvae takes place off the Labrador coast in late May-June, in Divs.3KL in May, and in the Flemish Cap area in late April-May.

Thus, in the Flemish Cap area, the hatching of larvae by redfish females mainly occurs in May almost in the same period as in Div. 3KL.

References

ANON. 1977. Fishery biological resources of the North Atlantic and adjacent seas of the Arctic Ocean. The group of scientists from PINRO. *M., Pishch. Prom.*, p. 61-71 (in Russian)

- CASAS J. M., and D. G. TRONCOSO. 2005. Results from the Bottom Trawl Survey on Flemish Cap of July 2004. *NAFO SCR Doc.*, No. 35, Serial No. N5121, 35 p.
- SOROKIN, V. P. 1958. On the biology of reproduction of *Sebastes marinus* L. and *Sebastes mentella* Travin in the Barents and Norwegian Seas. *Trudy soveshchaniya po fiziologii ryb.* 1958. *AS USSR Press.*, Vyp. 2. p. 158-170 (in Russian)
- SOROKIN, V. P. 1960. On the migrations of redfish *Sebastes mentella* Travin from the Bear Island-Spitsbergen stock. *In.*: Soviet fisheries research in the seas of the European North. 1960. *M.* p.291 (in Russian)
- TRAVIN, V. I., and L. N. PECHENIK. 1962. Soviet fisheries research in the Northwestern Atlantic. *In.*: Soviet fisheries research in the northwestern Atlantic Ocean. *M.* 1962. p. 36-42 (in Russian)
- ZAKHAROV, G. P. 1967. On sexual maturation of *Sebastes marinus* L. in North Atlantic. *In.*: Ecology and fishery of demersal fish in the Barents Sea and North Atlantic. *Trudy PINRO.*, Vyp. 20. p. 248-266 (in Russian).

TABLE 1. Portion of mature of golden redfish on the Flemish Cap Bank by size groups, %

Length, cm	Males	Females
13	0.00	0.00
14	0.00	0.00
15	0.00	0.00
16	0.00	0.00
17	0.00	0.00
18	0.00	0.00
19	10.00	0.00
20	0.00	0.00
21	11.11	0.00
22	11.11	0.00
23	18.75	9.09
24	6.66	21.42
25	12.00	7.14
26	31.81	6.66
27	26.66	16.66
28	48.38	34.78
29	40.74	28.57
30	43.75	31.03
31	40.90	45.83
32	46.15	46.15
33	48.14	48.14
34	54.16	46.66
35	57.14	56.75
36	71.42	63.63
37	85.71	70.83
38	81.48	78.57
39	95.83	82.75
40	95.65	86.95
41	86.95	86.36
42	94.44	90.47
43	94.44	93.75
44	95.23	93.75
45	95.00	95.23
46	100.00	98.97
47	100.00	92.59
48	100.00	100.00
49	100.00	100.00
50	100.00	100.00
51	100.00	100.00
52	100.00	100.00
53	100.00	100.00
54	100.00	100.00
55	100.00	100.00
56	100.00	100.00
57	100.00	100.00
58	100.00	100.00
59	100.00	100.00

TABLE 2. Sexual maturity of golden redfish in different areas of the North Atlantic in accord with length.

Area	Age at sexual maturity					
	First maturing		50 %		100%	
	Males	Females	Males	Females	Males	Females
Flemish Cap	19	23	34	35	46	48
Flemish Cap *	-	-	33	39	-	53
Labrador*	-	-	31	33	57	61
West Island*	-	-	35	39	53	53

* Data by G.P. Zakharov (Zakharov, 1967)

TABLE 3. Maturity 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

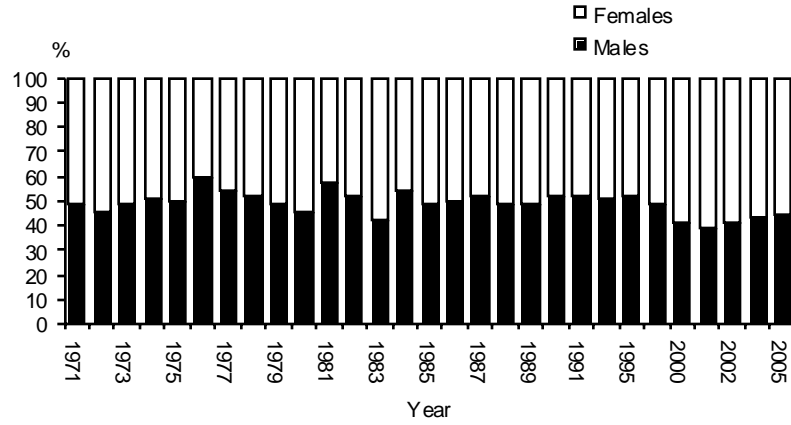


Fig. 1. Golden redfish sex ratio on the Flemish Cap in 1971-2005

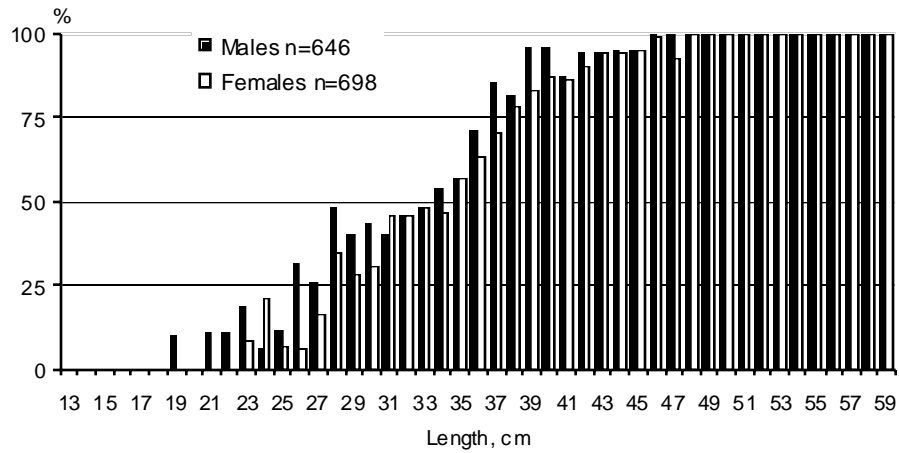


Fig. 2. Golden redfish maturation of in different size groups, 1971-2005.

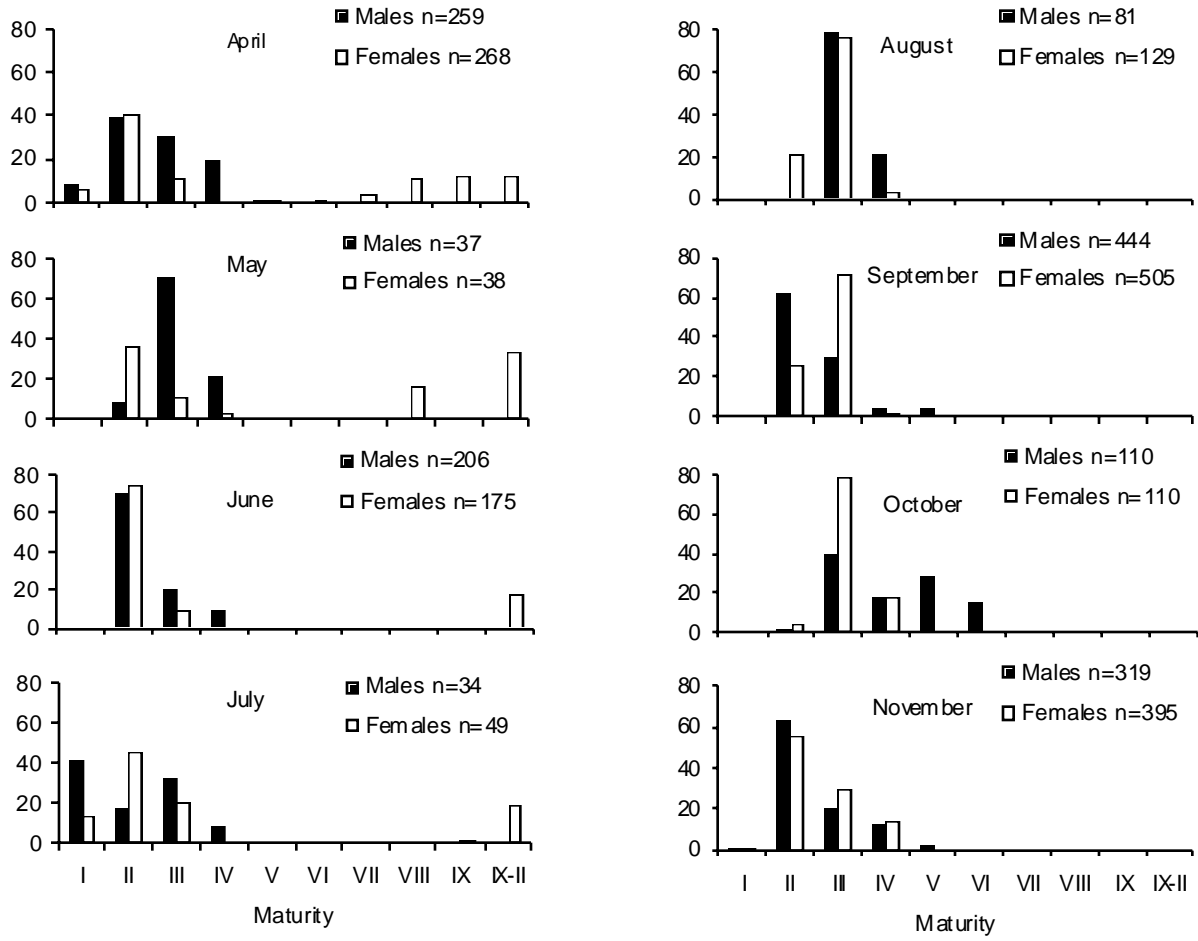


Fig. 3. Golden redfish maturity stages on the Flemish Cap by months in 1971-2005