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The Variations in the Catches and Age Structure of Salmon (Salmo salar L.) in the Ponoy River

by
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Abstract

The variations in the catches of salmon taken in the rivers of the Kola Peninsula and Norway are compared. The age structure of salmon spawning stocks in the Ponoy River is analysed.

In sixties of the present century a sharp reduction of the catches taken in the Ponoy River (and other ones of the Kola Peninsula) took place. The age structure of spawning stocks also changed: a portion of fish with one sea year (p+1+) increased, with 2 years (p+2+) - sufficiently decreased, and the fish of age category of p+3+ occurred in the catches only by single specimens.

The main cause of abundance reduction and age structure changes of spawning stocks was the salmon fishery in the fattening grounds - in the Norwegian Sea.

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The salmon catches, mainly depending upon the spawning stocks abundance, are subjected to fluctuations. For the period of the last 48 years the catches taken in the Ponoy River (Kola Peninsula) varied from 9.3 to 121.5 tons (2 140–41 830 specimens). Parallelism was observed in the fluctuations of salmon catches taken in the Ponoy River and other ones in the USSR and also in West Europe and Canada (Berg, 1935), that was explained by natural fluctuations. However, in the last twenty years the synchronism of increase and decrease of catches was broken, that was evident while comparison of data on catches taken in the rivers of Murmansk Region and in Norway (Fig. 1).

In Fig. 1 four conventional periods in the salmon fishery are represented.

The first period covered the time, illustrated with statistical data, since XIX century up to the fifties of the present century. This period is characterized with relatively slow increasing fishery intensity and salmon catches rising both in Norway and in our rivers. The Norwegian catches in 1870–1950 varied from 400 to 1 300 tons (on the average - about 900 t) (Alm, 1928; Norges Fiskerier, 1925–1932; Rosseland, 1968, 1973). Annual catches of salmon taken in the rivers on the Kola Peninsula in 1924–1950 varied from 130 to 740 t, (on the average - about 400 t) (Azbelev, 1966; Berg, 1935; Monastyrsky, 1935), including those from Ponoy River of 9 to 100 t (on the average - about 50 t). During the first period the increase and decrease of the salmon cathces taken in the

USSR and Norway took place synchronously and were absolutely determined by natural fluctuations, which level did not reduce noticeably, because under the conditions of slow increasing fishery intensity the adapted features of reproduction function appeared (Lapin ,1971).

The second period covering 1950-1961 is characterized with sharp increase of the catches taken in Norway that can be explained only by high fishery intensity. The yield of salmon taken at sea particularly increased (Rosseland, 1968). In the rivers on the Kola Peninsula the fishery intensity was also high, nevertheless the great catches for the whole period were taken in the rivers of this peninsula only twice: in 1954 and 1960. In the rest years of the period the salmon catches variations in our rivers and in Norway were in the sharp anti-phase.

The third period is characterized with maximum catches for the whole fishery history in Norway and minimum ones in the USSR. An annual catch of salmon in Norway varied: in territorial waters - from 1 251 to 2 157 tons, in offshore waters - from 100 to 450 tons (Rosseland, 1973). Besides, the salmon fishery in the Norwegian Sea was also carried out by other countries; the total catch for 1967-1971 was equal to 78-544 t (Rosseland, 1973). As a result of intensive catching of fattening populations a sharp reduction of fish abundance in spawning stocks took place, that was evidently confirmed by catastrophic decrease of salmon catches taken in the rivers of the Kola Peninsula.

In the Ponoy River the catches in the third period varied from 10 to 47 tons (3.5 - 17 thou.spec.), and their mean value, compared to the long-term mean catch, decreased more than twice and constituted only about 20 tons (8 thou. spec.). It becomes obvious that unusual growth of catches in Norway could take place only because of intensive catching of fattening stocks, including those from the Soviet rivers. It is known that salmon from our rivers is caught both in international waters of North Atlantic and in territorial waters of Norway. The cases, when the catches of salmon tagged during their feeding in the Norwegian Sea, were taken in the rivers of Kola Peninsula, Kareliya and Arkhangelsk Region (Berg, 1935; Danilchenko, 1938; Novikov, 1953; Azbelev, 1956; Bakshtansky, 1970, 1973) and the cases of salmon catches in the North Atlantic tagged in the stage of downstream migrants and kelts in the rivers of the Kola Peninsula (Bakshtansky, Yakovenko, Nesterov, Zaguraeva, 1974) are indicative of this fact.

During last ten years the cases of occurrence of Norwegian tags on salmon migrating into the Soviet rivers were registered more often: in 1962-1972, 240 tags were observed (Bakshtansky, Nesterov, 1973), 17 specimens of these were from the Ponoy River (Table 1).

The catches reduction in Norway and slow recruitment of salmon abundance from our rivers took place in the fourth period lasted up to present time. Convention on Salmon Catch Regulations in the neutral waters adopted at the NEAFC VII Meeting caused, to some degree, the catches

reduction at sea. Except this, due to the overcatching of the feeding populations of salmon, sea fishery became less profitable and reduced. Thanks to this fact the salmon release into our rivers started to grow.

From the above given analysis of fishery and anadromous migrants determination on the fish counting fence, it should be noted that modern mean abundance of spawning salmon stock of the Ponoy River constituted only about 16 thou.spec. (fluctuations: 8-26 thou.spec.). But a sharp catches reduction, defined the spawning stocks abundance cannot be explained with natural fluctuations, but it was due to a high intensity of salmon fishery in the places of their fattening.

The influence of marine fishery upon the salmon abundance from the Ponoy River is also confirmed by variations of age structure of stocks.

The downstream migrations of salmon fry from the Ponoy River were observed for the fish at the age of two (2+) - five years (5+). The ration between the age groups of downstream migrants is the following: 2+ - 1.29%; 3+ - 60.41%; 4+ - 36.49% and 5+ - 1.81%. The changes in the distribution of age groups of downstream migrants by years and also between males and females are insignificant.

At sea the salmon from the Ponoy River fatten at the age from one (p+1+) to four years (p+4+). The age compositions of males and females are different (Table 2). As it is evident from Table 2 during salmon migration the age structure of spawning stock changed.

The relation between the age categories also varied by years (Table 3). Apparently this took place under the influence both of natural causes (thermal and trophic features of sea in the period of formation of corresponding year classes and others) and sea fishery, when the oldest age groups were fished longer. The variations in age structure of salmon under the influence of marine fishery are vividly noticeable while comparison of data, defined the modern spawning stock (Tables 2 and 3) and those characterized the age structure of stock in the previous years (in the first period of fishing).

For this purpose the data on age groups ratio of the Ponoy River salmon in 1932, that are in the paper by Svetovidova (1935) are represented (Table 4). While comparing the data from Tables 2, 3 and 4 it is possible to note that the number of fish of age category p+1 in the spawning stocks of salmon in 1966–1970 considerably increased; number of fish spent two winters at sea (p+2+) noticeably decreased, but age category p+3+ constituted 5–7% in the catches taken in 1932 has almost disappeared in the modern stocks. The main cause of the changes in the age structure of modern stock directed to their juvenation is the marine salmon fishery undoubtedly.

CONCLUSIONS

1. In sixties of the present century the salmon catches taken in the Ponoy River (and in other rivers of the Kola Peninsula) sharply decreased. The age structure of the spawning stocks also varied: the portion of fish

spent one winter at sea (p+1+) increased; but those spent two winters (p+2+) considerably decreased, and age category p+3+, constituted 5-7% in the catches in 1932, /almost completely disappeared in modern stock.

2. The increase of salmon fishery intensity in the feeding places (in the Norwegian Sea) is the cause of abundance decrease and variations of age structure of spawning stocks.

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Table I

Data on salmon specimens taken in the Ponoy River and marked with Norwegian tags

Date of catching	Tags'No.	Sex	Age	Length, cm.	Weight, kg
27.VII-1962	6220	?	+2+	75,0	4,4
I.VIII-1963	II337	?	?	?	?
7.VII-1964	II740	?	+I+	55,0	I,6
I967	I3765	?	?	?	?
23.VIII-1969	II436	♀	3+2+	7I,0	3,5
VIII-1969	I2269	?	?	?	?
8.IX-1969	I5702	♀	3+2+	7I,5	4,6
I3.VII-1970	I69I7	♀	3+2+	64,0	2,6
26.VIII-1970	I67I0	♀	3+2+	64,0	2,7
30.VIII-1970	I685I	♀	3+2+	82,0	6,3
I970	I6525	?	?	?	?
7.IX-I97I	I8366	?	+2+	?	4,7
5.IX-I97I	20229	?	+2+	?	5,2
25.VIII-1972	22804	♂	?	84,0	6,9
22.VIII-1972	2347I	♀	+2+	69,0	3,5
26.VII-1972	23483	♀	+2+	69,0	2,7
3I.VII-1972	22980	♀	+2+	67,0	3,2

Table 2

The variations in age composition (due to marine period of life) of spawning salmon stock during the run in 1966-1970 (%%)

Sex	Age categories	Months and decades											
		June	July			August			September			Oct.	
		3	I	2	3	I	2	3	I	2	3	I	
Males	+I+	72,6	89,8	90,4	9I,6	79,2	29,9	26,8	48,7	64,4	77,4	8I,0	
	+2+	27,4	9,2	9,6	8,4	20,8	68,3	72,3	50,3	33,3	22,6	I8,2	
	+3+	-	I,0	-	-	-	I,8	0,9	I,D	2,3	-	0,8	
Females	+I+	2,0	26,5	40,4	33,7	2,5	3,7	I2,3	38,4	72,0	8I,6	92,3	
	+2+	98,0	68,4	59,3	66,3	97,5	96,3	87,7	6I,4	28,0	I8,4	7,7	
	+3+	-	4,3	0,3	-	-	-	-	0,2	-	-	-	
	+4+	-	0,8	-	-	-	-	-	-	-	-	-	
Males and females	+I+	37,6	66,0	78,I	76,4	40,2	I2,3	I7,0	42,7	69,3	79,5	86,6	
	+2+	62,4	3I,4	2I,8	23,6	59,8	87,I	82,7	56,8	29,9	20,5	I3,0	
	+3+	-	2,3	0,I	-	-	0,6	0,3	0,5	0,8	-	0,4	
	+4+	-	0,3	-	-	-	-	-	-	-	-	-	

Table 3

The variations in age composition (due to marine period of life) of spawning salmon stock by years (%%)

Year of salmon run	Sex and age categories of salmon										
	Males			Females				Males and females			
	p+1+	p+2+	p+3+	p+1+	p+2+	p+3+	p+4+	p+1+	p+2+	p+3+	p+4+
I966	42,9	55,2	I,9	3,4	95,9	0,6	0,I	I9,5	79,3	I,I	0,I
I967	86,0	I3,0	I,0	28,7	7I,0	0,3	-	65,I	34,I	0,8	-
I968	78,0	2I,9	0,I	62,6	37,4	-	-	72,3	27,6	0,I	-
I969	76,7	23,3	-	4I,0	59,0	-	-	56,9	43,I	-	-
I970	70,3	29,7	-	I2,9	87,I	-	-	43,9	56,I	-	-
I960–I970	72,4	27,0	0,6	3I,6	68,I	0,2	0,I	52,4	47,I	0,4	0,I

Table 4

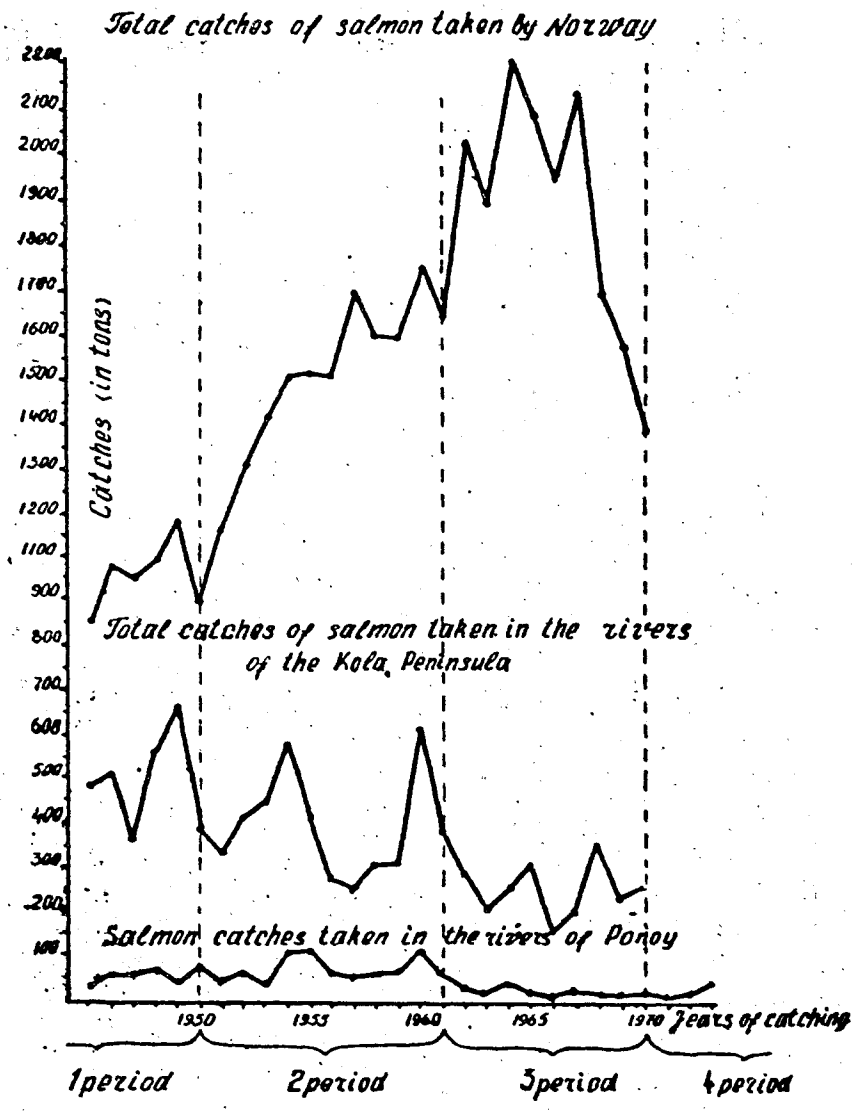
Age composition (due to marine period of life)
of spawning salmon stock from the Ponoy River
in 1932,% /according to the data by A.A.Svetovidova/

Sex	Summer salmon			Autumn salmon		
	p+1+	p+2+	p+3+	p+1+	p+2+	p+3+
Males	58	36	6	I4	79	7
Females	6,5	87	6,5	2	93	5
Total	49	45	6	4,8	90	5,2

Headings for Figures

to the paper by Grinyuk,I.N. "The Variations in the Catches and Age Structure of Salmon (Salmo salar L.) in the Ponoy River".

Fig.1 The variations in salmon catches taken in Norway and rivers of the Kola Peninsula /Data from the papers by Rosseland (1968,1973),Azbelev (1966), Il'ina,Perovsky,Rozhdestvenskaya (1971) were used for compiling the diagrams. The salmon catches from the Ponoy River are given due to the Soviet data/.



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