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Interactions

SALMON RIVERS OF THE KOLA PENINSULA.
SALMON LICE (LEPEOPHTHEIRUS SALMONIS KROYER) ON
ATLANTIC SALMON (SALMO SALAR L.) FROM THE VARZUGA RIVER

by

A.B.Karasev and O.G.Kuzmin

The Knipovich Polar Research Institute of Marine Fisheries and
Oceanography (PINRO), Murmansk, Russia

B.Finstad and S.T.Nilsen

Norwegian Institute for Nature Research (NINA),
Trondheim, Norway

Abstract

Prevalence of salmon lice (*Lepeophtheirus salmonis*) on Atlantic salmon (*Salmo salar*) was studied in summer-autumn 1994. The data were collected in two posts of the mouth river reach, located at the distance of 4 and 15 km from the sea. Migrants aged 1+ in the sea prevailed in samples. Salmon lice at all developmental stages were recorded. Results showed a high prevalence of salmon lice under low parameters of index of parasite abundance. This investigation presents results of salmon lice registrations in areas which are not influenced by mariculture. The complete analysis of prevalence of *L. salmonis* of different stages in the different parts of its host body in areas with fresh and salt water is presented.

Introduction

In Norway, Ireland and Scotland - countries with developed mariculture of *Salmonidae* the problem of infestation with external parasites, called the "salmon lice" is essential (Tully et al., 1993; Birkeland et al., 1993; Anon., 1995). Special investigations have shown, that three species of parasite crustaceans - *Lepeophtheirus salmonis*, *Caligus elongatus* and *Salmincola salmoneus* (Berland & Margolis, 1983; Berland, 1993) relate to this term. The data of recent years indicate that *L. salmonis* have the worst influence of species of *Salmonidae* (see review by Costello, 1993) and concerns both the farmed fish and the wild ones.

There is little data on the infestation of the salmon from the White Sea populations with the crustacean *L. salmonis*. Some studies of the parasites of anadromous migrants both in the sea and in fresh water have been reported (Dogel & Petrushevsky, 1935; Shulman & Shulman-Albova, 1953; Malahova, 1972; Mitenev, 1984; 1993). However, these publications are insufficient to estimate the parasitological situation in the area of the Atlantic salmon, regarding the data from different regions.

This paper is aimed at obtaining the additional data on the infestation of salmon with the external parasite *L. salmonis* in the White Sea basin. Firstly, it will allow the available data to be compared and the changes in parasite-host relations within the persistent period to be recognised and, secondly, it will permit the natural conditions in the region, where there are no salmon farms, to be appreciated.

Material and methods

The prevalence of salmon lice (*Lepeophtheirus salmonis*) in salmon (*Salmo salar*) from the Varzuga River was studied in summer-autumn 1994. Samples of fish to record the parasitic crustaceans were taken at the fish accounting fences (FAF), located in the mouth river reach, in the area of strong influence of the White Sea. Tides and ebbies here are of regular and semidiurnal character. The backwater from the sea tides is observed over 20 km, however, the salty waters are noticed only in the mouth of the river (Kazakov et al. 1992). The "Koloniha" FAF is located at the distance of 15 km and the "Kitsa" one (the left affluent of the Varzuga River) - 4 km from the mouth (Fig.1).

All 143 specimens of anadromous migrants from summer and autumn biological groups were investigated for infestation with the salmon lice in July and November. The characteristic of fish in samples is given in Table 1.

The external parasites were registered immediately after the catch having been taken from the trap nets. For each fish length, weight, age and sex were recorded. A number of parasites of *L. salmonis* was counted. Stages of the crustacean was determined according to Schram (1993).

In collecting the data to identify the small specimens a magnifier was used. The typical injuries on the fish body after lice attacking were taken into account. The locuses of every *L. salmonis* specimen findings were determined by the scheme (Fig.2). When estimating the indices of infestation of salmon with the crustacean *L. salmonis* the data obtained were united into groups by the stages of parasite development, according to the methods accepted by NINA:

chalimus larvae (I-IV);
preadult and adult specimens;
adult females with eggstrings.

The indices of prevalence with 95% confidence limits, intensity and abundance index were used (Margolis et al., 1982; Roitman & Lobanov, 1985) to estimate the infestation of the Atlantic salmon with the parasitic crustacean *L. salmonis*.

Results

Table 2 presents the data on infestation of salmon with the parasite *L. salmonis* in the mouth of the Varzuga River in the river reaches with fresh (FAF "Koloniha") and salty (FAF "Kitsa") water. Besides the accounted parasites, the typical injuries, considered by us as the marks because of the crustacean *L. salmonis* invasion, were noted on the body of some fish. In July, the prevalence of fish with such injuries was the same both in the fresh water zone (8.6%) and in the salty one (8.3%). There were no such fish in the November sample. The total infestation of fish with *L. salmonis* including injuries was:

prevalence - 86.1 (72.8-95.4)%, range of intensity - 1-10 indiv., abundance index - 2.9 - in the salty water;

prevalence - 60.3 (48.4-72.8)%, range of intensity - 1-7 indiv., abundance index - 1.6 - in the fresh water.

Prevalence of *L. salmonis* specimens at the different stages of development and their distribution on the fish body are given in Table 3.

Discussion

The first data on the infestation of the White Sea salmon with the external parasite *L. salmonis* were presented by Dogel and Petrushevsky (1935). 26.6% of the autumn salmon, investigated in the area 10 km up the mouth of the Vyg River (the Karelian Coast), and 20% of kelts were infested. Shulman and Shulman-Albova (1953) studied the salmon parasites in the sea immediately. The authors noticed high infestation of fish from the autumn run with the *L. salmonis* parasite in the Gridinskaya Inlet of the Kandalakshsky Bay (prevalence - 74.7%, intensity - 2-32, on the average, 7.0 parasites per fish). Malahova (1972), investigating salmon in the Kandalakshsky Bay too, noted, that the prevalence of *L. salmonis* was at the level of 40%, intensity - from 2 to 32, the abundance index - 3.7 parasites per fish. In the rivers of the Tersky Coast of the Kola Peninsula, to which the Varzuga River relates, salmon were investigated by Mitenev (1984; 1993). Here the crustacean *L. salmonis* in salmon was recorded. Nevertheless, the special attention was paid to anadromous migrants, having entered the river. Therefore, the infestation with sea parasite was low and equalled to only 6.5% under the abundance index of 0.3 parasites per fish. There are no more data on the infestation of salmon *L. salmonis* in the White Sea basin.

Salmon investigated by Shulman and Shulman-Albova (1953) caught in the sea was considered as indices of natural infestation. At the same time it is well known, that the parasite fauna of anadromous salmon changes when entering rivers as shown firstly in the papers by Heitz (1920); Dogel & Petrushevsky (1935). The parasitic crustaceans *L. salmonis* are sensitive to fresh water. Berger (1970) and McLean et al. (1990) showed that salmon lice on the fish died after 48 hours in fresh water while Finstad et al. (1995) showed that survival time for the lice was up to 3 weeks on salmonids in fresh water. It is likely that this is the reason of the different levels of salmon infestation with *L. salmonis* in the two samples taken by us at the "Koloniha" FAF (fresh water) and at the "Kitsa" FAF (salt water) (see Table 1). However, these two samples are characterized by not only the differences in infestation. As Table 3 shows, we observed different distribution of parasites on the body. In salt water most of parasites were located on the ventral part of the body, in the area of the anal opening and the anal fin. The similar distribution of parasites on the body of the sea salmon was described by Shulman and Shulman-Albova (1953). In our sample, taken from fresh water, the parasites were distributed more regularly from head to tail, prevailing in the dorsal area of the body.

Thus, the data, obtained by us, indicate, that salmon from different biological groups (summer and autumn) are infested with the crustacean *L. salmonis* at the same level, on the whole. Nevertheless, prevalence and distribution of parasites of the different development stages on the host body changed from summer to autumn. The portion of chalimus larvae in fish from the autumn run is extremely small.

Infestation of anadromous salmon migrants from the Kandalakshsky Bay with the salmon lice *L. salmonis*, estimated by Shulman & Shulman-Albova (1953) more than half a century ago, and evaluated by us in the salty mouth river reach of the Varzuga River are characterized by the comparable values. This makes it possible to presume, that in the White Sea the parasite-host system - «salmon-*L. salmonis*» have been balanced and unaffected by serious changes within the persistent period.

Acknowledgements

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Tables

Table 1. Biological characteristic of fish in samples.

Area	"Koloniha" FAF		"Kitsa" FAF	
Date	23.07.94	14.11.94	23.07.94	
Number of fish investigated	58	49	36	
Fish length, cm:				
mean	53.3	62.5	52.3	
minimum	43.0	55.0	49.0	
maximum	62.0	80.0	59.9	
Fish weight, kg:				
mean	1.6	3.1	1.4	
minimum	0.8	1.8	1.0	
maximum	2.3	6.5	2.2	
Sex ratio (males, females)	1:0.05	1:1.3	1:0.03	
Age	3+1+ (84%)	3+1+ (86%)	3+1+ (81%)	

Table 2. Infestations of the Atlantic salmon with copepoda
L.salmonis in the Varzuga River

Groups of salmon lice development stages	Prevalence, %	Intensity		Abundance index
		min.	max.	
----- "Koloniha" (23 July 1994)				
Chalimus larvae	24,2 (13,7-35,5)	1	6	0,6
Preadult and adult	25,9 (15,2-36,5)	1	4	0,4
Adult females with eggstrings	25,9 (15,2-36,5)	1	2	0,3
All groups :	53,4 (37,9-65,6)	1	7	1,3
----- "Kitsa" (23 July 1994)				
Chalimus larvae	41,7 (26,0-58,3)	1	4	0,9
Preadult and adult	47,4 (33,6-66,4)	1	5	1,0
Adult females with eggstrings	41,7 (26,0-58,3)	1	5	0,8
All groups :	83,3 (69,3-97,3)	1	10	2,7

Table 2 continued.

Groups of salmon lice development stages	Prevalence,%	Intensity		Abundance index
		min.	max.	
"Koloniha" (14 November 1994)				
Chalimus larvae	4,1 (0,4-11,5)	1	4	0,1
Preadult and adult	30,6 (18,4-44,4)	1	2	0,5
Adult females with eggstrings	34,7 (21,9-48,7)	1	5	0,8
All groups :	53,1 (38,9-67,0)	1	6	1,4

Table 3. Distribution of *L. salmonis* on the Atlantic salmon body (% of the number of found).

Zone	Development stages*			Total
	I	II	III	

"Koloniha" (23 July 1994)				
A		9,0		9,0
B		9,0	7,5	16,5
C	30,8		1,3	32,1
D		1,3	6,4	7,7
E				
F	7,7	1,3		9,0
G		6,4	1,3	7,7
H	1,3		2,6	3,9
I	1,3	3,8		5,1
J	1,3		7,7	9,0

Sum.:	42,4	30,8	26,8	100,0

"Kitsa" (23 July 1994)				
A		1,0	2,0	3,0
B	5,1	2,0	5,1	12,2
C	5,1			5,1
D		8,2	2,0	10,2
E				
F	6,1			6,1
G			2,0	2,0
H	5,1	8,2	8,2	21,5
I	9,2	5,1	2,0	16,3
J	3,1	9,2	11,3	23,6

Sum.:	33,7	33,7	32,6	100,0

"Koloniha" (14 November 1994)				
A				
B		3,2	6,4	9,6
C				
D		3,2	3,2	6,4
E				
F		1,6		1,6
G	6,4	6,4	35,6	48,4
H		11,2	9,8	21,0
I	1,6	1,6	4,8	8,0
J			4,8	4,8

Sum.:	8,0	27,4	64,6	100,0

*Note. I - Chalimus larvae;
 II - Preadult and adult;
 III- Adult females with eggstrings.

Fig 1. Map of the investigation area with the sampling locations marked by arrows.

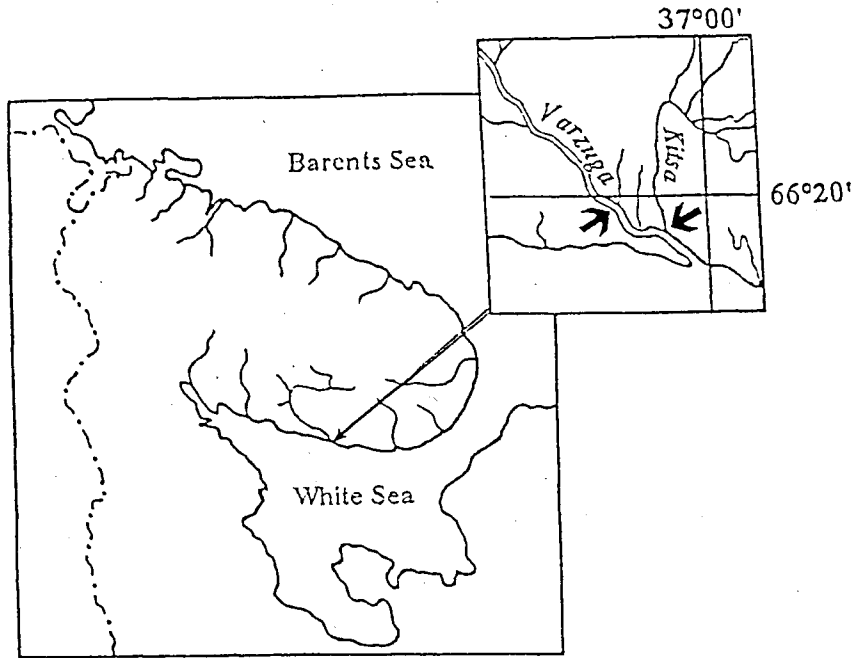
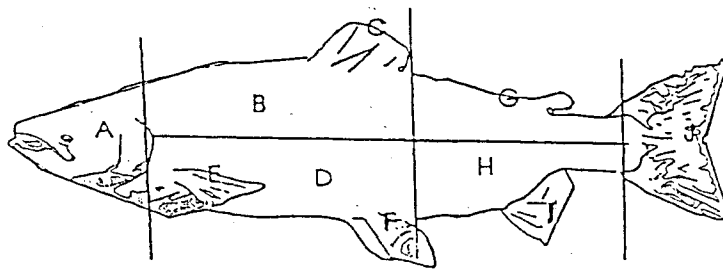


Fig 2. Scheme of copepoda *L.salmonis*. localization on the Atlantic salmon body.



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