International Council for the
Exploration of the Sea

C.M. 1963
Salmon and Trout Committee
No. 67 L

On the Reproduction of Pink Salmon in the Moochka River (a Tributary into Teriberka River, the Kola Peninsula)

by

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Pacific pink salmon (Onkorhynchus gorbusha Walb.) transplanted into the basins of the Barents and the White Seas migrated for spawning in the numerous rivers of the Kola Peninsula in 1960 and 1961. In connection with this, the question as to the possibility of natural reproduction of pink salmon whose feeding grounds are located in the North Atlantic area is of great interest, especially from the viewpoint of availability of an adequate progeny of this species. This report covers the results of two-year observations of the development of pink salmon eggs in the Moochka River in the East Murman area.

The Moochka is a small river of 40 km full of rapids. It is the right tributary of the Teriberka River discharging into its estuary (the Teriberka itself flows into the Barents Sea 70 km eastward from the Kola Gulf). The current velocity of the Moochka River on the spawning grounds is 0.4 - 1.1 m/per second, its depth being 0.2 - 1.0 m; the bottom is shingly with a touch of sand, the thickness of the gravel layer varying from 10 to over 50 cm. The water temperature in winter varies slightly from 0 to 0.2°C.

In 1960 the spawning of pink salmon in the Moochka River was observed from the end of the first ten-day period of September till early October, whereas in 1961 from mid-August till mid-September, i.e., one month earlier, observations were carried out on the spawning grounds located 8-9 km over the estuary of the river. After the eggs have been extruded and a spawning hillock constructed, the latter is guarded by the female which does not allow any other fish to approach it. These hillocks are 2.2 m long and 1.3 m wide. They rise up to 8 - 10 cm over the bottom level. In 1960 hillocks were somewhat smaller. In order to study the condition of eggs as well as to determine their quantity in the spawning hillocks the latter were opened with the help of a spade; eggs and embryos carried off from their nests were caught by means of a Korry net set lower the hillock down-stream. The depth at which eggs lay inside the hillocks ranges from 15 to 35 cm. During the seasons 1960-61 and 1961-62, 16 and 4 spawning hillocks respectively were opened, and the results of the opening operations are summarised in Table 1.

Table 1

Date of opening of the hillock	Total number of eggs and embryos found in hillocks	Live developping eggs and embryos	
		Nos.	%
First spawning season			
24.09.60	38	36	94.7
12.10.60	9	-	-
13.10.60	10	-	-
21.12.60	2	-	-
21.12.60	44	18	40.9
22.12.60	9	-	-
23.12.60	58	-	-
14.02.61	87	3	3.4
14.02.61	64	-	-
14.02.61	39	6	15.4
8.04.61	110	4	3.6
9.04.61	533	-	-
9.04.61	60 (4 hillocks)	1	1.7
Second spawning season			
5.04.62	292	277	94.9
16.04.62	189	1	0.5
16.04.62	298	287	96.3
17.04.62	443	398	89.8

As is seen from Table 1, only a scarce number of eggs was found in the hillocks during the first spawning season; an average number of eggs found in one hillock was about 66. But the fecundity of two females on the spawning grounds was determined as 1600 eggs, which means that only 4.2% of eggs were observed as compared with fecundity estimation. So far as the decomposition of dead eggs did almost not take place in the observed season (due to low temperatures of about 0° which occurred soon after the spawning period), it may be supposed that a considerable number of eggs was lost or left unextruded. In other rivers of the Kola Peninsula during the same season hillocks contained about 307 eggs on an average (Azbelev et al., 1960). During the next spawning season an average number of eggs contained in one hillock was larger than that in 1960 (Table 1).

In the Far East Area different investigations of hillocks gave from 7.8% to 75.5% of eggs as compared with an estimated average fecundity of females, which indicates that in the areas mentioned the losses can be quite essential. In the Ulika, one of the Far East rivers (O.V. Vasilenko, 1959) only 57 - 75 eggs were found in a nest. The reason for such a poor quantity of eggs in hillocks has not yet been discovered. The above-mentioned example testifies that the scanty quantity of eggs in the hillocks of the Moochka River in 1960/1961 can not be attributed to exceptional conditions of the new habitats of pink salmon, because a similar phenomenon has been observed also in the waters of the Far East.

In order to compare the size of eggs of pink salmon migrated in rivers of the Kola Peninsula in 1960 with that of Far East pink salmon, several series of measurements were made of eggs belonging to both species, eggs being treated in 5% formalin solution. The results of these measurements are given in the Table 2.

Table 2

Capture grounds	Number of eggs measured	Average diameter in mm
The Moochka River, spawning hillocks	47	6.58
The Moochka River, artificially inseminated eggs	105	6.26
The Kola River, artificially inseminated eggs	296	6.65
The Kamchatka Peninsula, artificially inseminated eggs	168	6.58
The Magadan District, artificially inseminated eggs	149	6.90
The Far East Area, literature data	-	6 - 6.5

Measurement of several live untreated eggs taken from the hillocks in the Moochka River gave different values of eggs, diameters ranging from 7.1 to 7.3 mm. According to the data shown in Table 2, the sizes of eggs taken from the Kola and Moochka Rivers differ slightly from those observed in Kamchatka and Magadan areas; its size is within the limits found for pink salmon of the Far East.

The intensity of corotinoid pigmentation of egg's groups shown in Table 2 is almost the same with the exception of artificially fertilized eggs in the Moochka River where it was somewhat less.

In 1960/61 the development of eggs in the spawning hillocks was extremely slow. So, late in September we found eggs at the stage of forming the axial organs of the embryo; eggs taken from the hillocks in December showed the closure of blastophore and traces of melanin pigment in the eyes of embryo; in February and in April the eye's pigmentation has not yet been completed, a network of blood vessels was developing on the yolk sac and tiny pectoral fins appeared.

While in the Far East area the extrusion of embryos usually occurs in November/ December, in the Moochka River (according to the development stages of eggs) it could be expected in March/April only or even in May.

Approximately the same slow rate of the eggs' development was observed in other rivers of the Kola Peninsula. (Azbelev et al., 1960). Such a slow rate of eggs' development may be attributed to a low water temperature which had already been registered during the spawning season. One can suppose that for the same reason a great number of eggs was not fertilized at all or died at the early stages of development. So, for instance, it was found that out of the total number of eggs - 1063 - caught during the season only 68 eggs (about 6%) were developing. The rest of the eggs stayed either non-fertilized (it was observed till April inclusive) or died. Among other factors involved the mass mortality of eggs was also caused by the freezing of the spawning hillocks during the winter season.

The young (smolts) descending a river in 1961 were observed in the lower reaches of the Moochka River by the end of June by the workers of the Fisheries Protection Service. The young were gathering in groups of 10 - 20 specimens each, mostly in places with the sluggish flow abundant in aquatic plants. Deviations from its normal structure were not observed.

The season of 1960/61 was not favourable to the development of eggs because of a low water-level in the rivers, a delayed spawning and a sharp decrease in water temperatures occurred immediately after the spawning time. In spite of all these factors, a certain part of eggs was developing, and gave rise to some quantity of smolts. The spawning season of 1961/62 was found to be most effective.

Spawning took place at the time when it usually occurs in most areas of the Far East (i.e., from the middle of August till the middle of September) and the retarded autumn was characterised by relatively high water temperatures. Both these factors ensured good conditions for the development of eggs, which grew up to the stages when the low winter temperatures did not affect them fatally. So, in the second half of September 1962 eggs containing pretty formed mobile embryos having heavily pigmented eyes were found in the hillocks.

In April 1962 when opening hillocks, a considerable quantity of the pink salmon's embryos was observed (Table 1). It is assumed that their extrusion took place in December/January. Different hillocks contained embryos at different stages of development. So, in some of the hillocks yolk sac of embryos was big enough, but the differentiation of the fins had been completed and there were faint remnants of a single fin fold and in the body cover the guanin pigment appeared. A network of blood vessels on the surface of a yolk sac still participated in the respiratory process together with the gill apparatus. Mean length of the embryos was 28 mm. The length of the embryos of certain hillocks was about 31 mm. The size of their yolk sac was considerably less, miotoms of the left and right parts almost inosculated on the ventral side (the rest of the yolk is located in the ventral cavity). The respiration of those embryos became purely gilled. These are the first stages of the larval period of development.

A certain quantity of the embryos and the larvae were kept in the aquarium after their removal from hillocks. Most of them could easily swim in mid-water avoiding a bright light. In three weeks of captivity in water with temperatures varying from 1.5 to 4.0° they reached a smolt stage. Larvae ate up intensively the plankton planted from a lake. The transplantation of larvae at this stage in the sea water with salinity of 31.6% did not cause any waste.

In 1962, the young began to move downstream the Moochka River in the last ten-day period of May when the river was already free from ice and the water temperature ranged from 3° to 4°. The smolts were descending the river more or less uniformly during 24 hours (under the conditions of the "polar day") and moved mostly along the median of the river. Mean length of the smolts was 33.8 mm, the mean weight being 201 mg. Smolts descending rivers in the Far East have approximately the same size. The feeding of the young is mixed; along with assimilation of the rests of the yolk they were eating up mainly chironomid larvae as well as of Copepoda and Cladocera. 44 of 50 examined stomachs were full of food.

From the 29th of May till the 7th of June 1962 an experimental trap caught a few number of the young, furthermore the descending became more massy (on the 11th of June the observations were stopped). According to approximate calculations, the total number of the young of pink salmon moving downstream in the Moochka River

during the whole period amounted from 4o.ooo to 8o.ooo specimens as a minimum. It was not a small amount for such a small river. The second spawning season differed from the first one by the fact that the eggs laid had the possibility here to develop during two months before the winter decrease in temperature; due to this fact the second spawning has proved to be rather efficient. The facts cited above indicate that under favourable conditions the natural reproduction may be essential for the formation of a local population of the acclimatized pink salmon.

References

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