SOME FACTS AND THEORIES CONCERNING THE ATLANTIC SALMON

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There has probably been more written about the life history of the Atlantic salmon than about that of any other fish. Some of the writings are acknowledged fiction, some theoretical, some scientific and some which must be classed as pseudo-scientific. In this paper we shall present some data from our own observations and advance certain theories which seem to explain phases of the behavior of migrating salmon.

For a number of years we have been making observations on the Atlantic salmon in parts of Prince Edward Island, New Brunswick and Nova Scotia. Our observations, however, have been largely centered in Cumberland County, N. S. at Apple River on two streams which drain into a common estuary of the Bay of Fundy. These two streams which are known as the East and West branches of Apple River are very similar in volume of flow, temperatures and other physical characters and also in their faunas.

When we first visited these streams in 1931, we were surprised to learn that within recent years no adult salmon were known to ascend the East branch to spawn but that all the spawning salmon which entered the common estuary ascended the West branch. At that time there were no barriers to the migrating salmon on either branch but some ten years previously there had been a mill dam at the head of tide water on the East branch. A fish-way had been placed in this dam but no salmon were ever known to have passed through it. Some sixty years ago when there was no dam on this branch, many salmon ascended it to spawn, but after the dam had been out for ten years there was no run of salmon in this stream. However in the late summer and fall, many salmon would follow the tide up the estuary of this branch to the head of tide water and would go back down the estuary with the ebbing tide. This behavior is not peculiar to this stream but occurs in many small streams which the salmon ascend as well as streams which they do not ascend.

Since salmon are not known to ascend small streams to determine their suitability as spawning and rearing areas, it would seem that they are able to determine this without ascending the stream. This might be accomplished by taste or smell or some other sense. In the two branches of Apple River the main difference we found was the presence of many young salmon in the West branch and their absence in the East branch.

Is the presence of young salmon in a stream a factor which causes adult salmon to select the stream for spawning?

All male parr over one year of age and also many fry-of-the-year in these streams become sexually mature in the early fall, and since the milt from these is evidently shed into the stream, it is possible that the milt in the water is the substance which reacts on the sense organs of the adult salmon at the mouth of the stream. That this milt is unsuitable for fertilization we have demonstrated in an experiment carried out at Forbes Creek some years ago. It was found that when the milt from parr was mixed with ripe ova, a fairly high fertility was secured but 60 per cent of the resulting fry were deformed or were eyeless monsters. A check using ova from the same female but milt from a mature adult male gave normal results.

During our trout experiments at Forbes Creek, several hundred salmon parr, reared in an enclosure during the summer were liberated in the fall. The following year many of these parr were still in the region where they were liberated and that fall when the male parr were sexually mature, three adult salmon ascended the stream to this area. That was the only time during our investigations there that adult salmon were found in that area.

In accordance with our theory, we predicted that if young salmon were introduced into the East branch of Apple River, the adult salmon would enter this stream to spawn. In the summer of 1932, twenty-five thousand salmon fry were carefully planted in the lower part of this stream and there was a good survival from these. That fall, as we had predicted, a run of salmon entered the East branch. The following spring there was an abundance of salmon fry from the spawning of these salmon and in the fall of 1933 there was another good run of adult salmon.

When making the planting of salmon on this stream we distributed about three hundred fry in a very small branch stream and the spawning salmon ascended even this rivulet.

The theory that the presence of salmon parr in a stream is a factor which causes the adult salmon to select the stream, has, we believe, the following points in its favor:

(1) No better criterion of the existence of suitable spawning and rearing areas could be selected by the adult salmon than the presence of parr in the stream.

(2) It predicts a rational use for the large quantities of milt shed by the parr.

(3) If the presence of parr above a barrier could be detected in the water coming over the barrier, it would indicate to the salmon that the barrier could be surmounted.

Such a theory is not a refutation of the "parent stream theory" but may be an explanation of that theory. Our tagging operations at Apple River show that the adult salmon, returning for the second time to spawn, may not only return to their own stream but to the identical pool which they occupied the previous year. However, many salmon in the sea become strays and as the spawning time approaches these salmon endeavor to find suitable spawning streams. It is these salmon, we believe, which enter the estuaries of various streams. At Apple River, the formation of the common estuary of the two streams and the high Fundy tides rushing in and out, tend to form a maze which confuses the local migrating salmon but incidentally made unique conditions for making observations on their behavior.

In conclusion, we may state that we consider the submitting of these theories at this time as premature, since further experiments and observations are required. We are presenting them now, however, in the hope that other observers will confirm or refute them.

Discussion

Mr. Dinsmore: I have been exceedingly interested in this paper. I want to add to it an experience we had on the Pacific coast with the sockeye salmon, which demonstrates very clearly that the sockeye salmon has the same homing instincts as the author's paper shows to be true of the Atlantic salmon.

About thirty years ago we undertook to demonstrate to the fishermen on Puget Sound, who said that the sockeye salmon must reach lakes fed by ice water from the glaciers, that this was not necessary in order for them to deposit their eggs. Fish were taken from the Fraser River run at Point Roberts and towed into a fresh water lagoon at a point not far from the Canadian boundary near Blaine, Washington. The towing of the fish was almost a failure because of certain difficulties which arose in connection with the carrying out of our plans as originally arranged, but we did produce from the fish impounded there seventy-five thousand eggs. These fish were moved to a tributary stream on the Skagit River, Washington, a stream which almost never received a sockeye salmon. The eggs were hatched there and planted in this stream on the Skagit—the salmon run on the Skagit, as you who are familiar with the Pacific salmon know, is distinct from the run on the Fraser River. I am not able to say from memory just what year they came back, but at the proper return year two hundred thousand eggs were taken from salmon which entered Bradley Creek, a creek which never in the memory of the white man had had a run of sockeye salmon before.

Mr. Catt (New Brunswick): A rather interesting observation has been made on one of the streams in Albert County, New Brunswick. The mouth of the stream has been obstructed by a dam which absolutely prevents the ascent of salmon. There is no means of the fish getting past the tide, which goes up to the foot of the dam, and there is no spawning ground below. There are no young salmon up above it. I was talking this over with Dr. M'Gonigle and he suggested that possibly some of the stream inhabitants, which would include rainbow trout, might come into the picture.