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AN EXPERIMENT WITH MIGRATING SMOLT OF ATLANTIC SALMON (SALMO SALAR)

By

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In spring 1977 an experiment with migrating smolt was performed at the research station, Fisk og Forsøk, N-5198 Matredal. The intention was to find a simple way to separate smolt from fish that were not completely smoltified. The idea was to try to utilize the change in behaviour that enters during the process of smoltification. In this process the aggressivness of the young salmon disappears. They congregate in schools and move down stream mostly during night-time, partly passively drifting and partly actively swimming. This need to move with the current, we tried to utilize in an attempt to sort smolt from "none-smolt", i.e.fish that were not completely smoltified.

Two circular plastic tanks, A and B, were connected with a wooden channel (Fig. 1). The channel was made water-proof by placing plastic-folio on the inside. The tanks were 2 m in diameter and 1 m deep. The channel was 16 m

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long, 0,4 m wide and 0,3 m deep. The tanks and the channel were, during the whole experiment, covered with wooden lids in order to give shade and protection for the fish. Fresh water was led into tank A, through a pipe. From tank A the water was led into tank B, through the wooden channel, and from there through drain-pipes to the drainage. Sea water (about 30 °/oo) was led into the channel at five different places and in this way we got two different environments, fresh water in tank A and brackish water (about 17 °/oo) in the channel and in tank B. During the whole experiment the temperature was almost the same, $\pm$ ½° C, in tank A and B. At the beginning of the experiment the temperature was around 8° C and at the end around 13° C.

On May 3rd, 446 fishes were put into tank A, and of these 132 came from a private hatchery at the river Opo in the Hardanger fjord, 114 came from a private hatchery on the Askøy island near Bergen and 200 were raised at the research station Fisk og Forsøk. To be able to distinguish between the three groups the fish were marked by removing a fin. All fishes were hatched in spring 1976. Most of them were smolt at the start of the experiment, some were smoltifying and some would smoltify next spring at the earliest.

On May 24th, after three weeks with fresh water in the system, all the fish were anaesthetized, examined for degree of smoltification and fork length was measured. Fish that showed no sign of smoltification were classified as parr (p). Fish that had become silvery, but still had clearly visible parr marks were classified as "parr-smolt" (ps). These fish would perhaps be smolt later in the summer or autumn. The third group was classified as "parr-smolt-smolt" (pss). The fish in this group looked like smolt, but parr marks could still, though vaguely, be distinguished. The fish

that were recorded as smolt (s) were completely silvery on their sides and bellies and it was impossible to see any parr marks even when looking at the fish from different angles. After examination, the fish were put back into the same places where they were found.

The results from the first examination are shown in Fig.2. In the channel and in tank B we found almost only smolt. Of 126 fishes only 2 were "none smolt". Only 26% of the smolt from Askøy and 28% of the smolt from Opo were found in the channel and tank B. The corresponding figure for the smolt from Fisk og Forsøk was 63%. The fish that were not completely smoltified remained in tank A. There were 100 "none-smolts" and 125 smolts. A standard χ^2-test showed significant differance ($p < 0,001$) in migration between the smolt and the "none-smolts".

The tendency of the smolt from Opo and Askøy to be less migratory than the smolt from Fisk og Forsøk, might be caused by an attack of some disease during the first two weeks in tank A. Especially the fish from Askøy were hard struck, where 68% of the fish died during this period. Only 8% of the fish from Fisk og Forsøk and 10% of the fish from Opo died during the same period. The reason why the fish from Askøy were so hard struck might have been a result from stress at transportation and change to a new and most possible inferior environment. At this time there were some problems with the water quality at Fisk og Forsøk.

After the first examination, sea water was led into the channel and two weeks later, a second examination was performed. The intention was to try to keep the salinity as high as possible in tank B and at the same time only have fresh water in tank A.

Owing to the fact that the fresh water supply to tank A failed, salt water flow back into this tank. Instead of fresh water we therefore got brackish water with a salinity of

around 7°/oo for five days in this tank. During the rest of the experiment the water in tank A was kept fresh while the salinity in tank B was kept around 17 °/oo.

The results from the second examination are shown in Fig. 3. Even if more "none-smolt" were found in tank B at this examination in comparison with the first, we see that the smolt tend to stay in tank B and the "none-smolt" tend to remain in tank A. The differance between number of smolt and "none-smolt" in tank A and B was significant ($p < 0,001$).

A third examination was performed four weeks later, on July 6th, (Fig.4) and the results were then similar to the first examination, (Fig.2), with very few "none-smolt" in the channel and tank B.

The results indicate that it might be possible with relatively simple arrangements, to build a system that could be practically used for sorting smolt from "none-smolt". We think that when building such a system one must consider both the current velocity and the fresh water/salt water environment. With a better water supply system we suppose that it will be possible to keep the salinity in tank B at a higher level than we did in this experiment. We intend to continue the experiments next smolt migration season in spring 1978.

Acknowledgements

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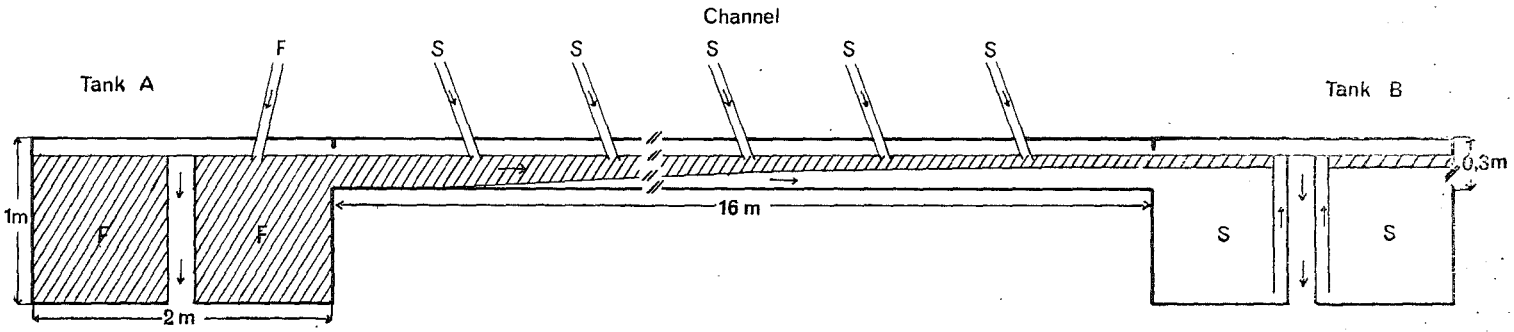

Fig. 1. Two circular plastic tanks, A and B, connected with a channel. Fresh water (F) and brackish water of around 17 °/oo (S).

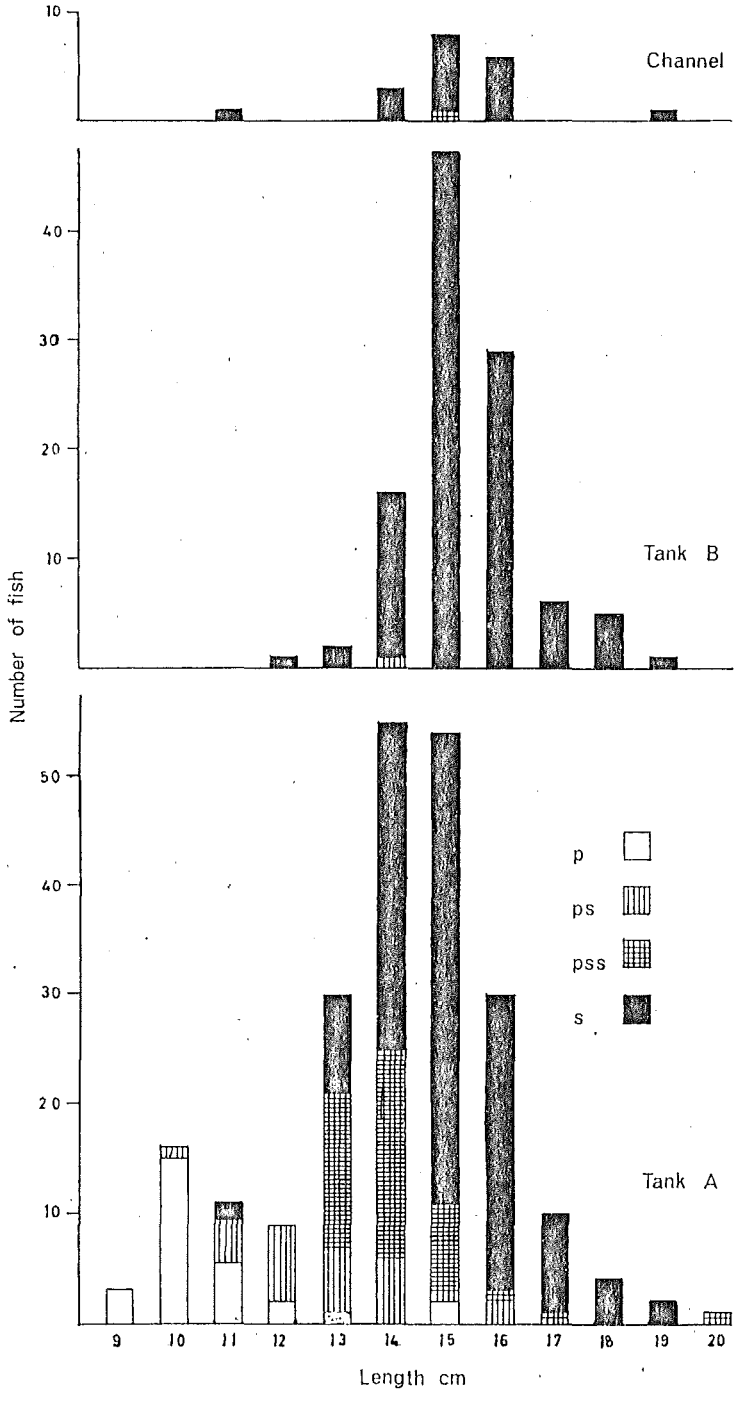

Fig. 2. Length distribution and number of fish of four groups; parr (p); parr-smolt (ps); parr-smolt-smolt (pss) and smolt (s) on May 24th.

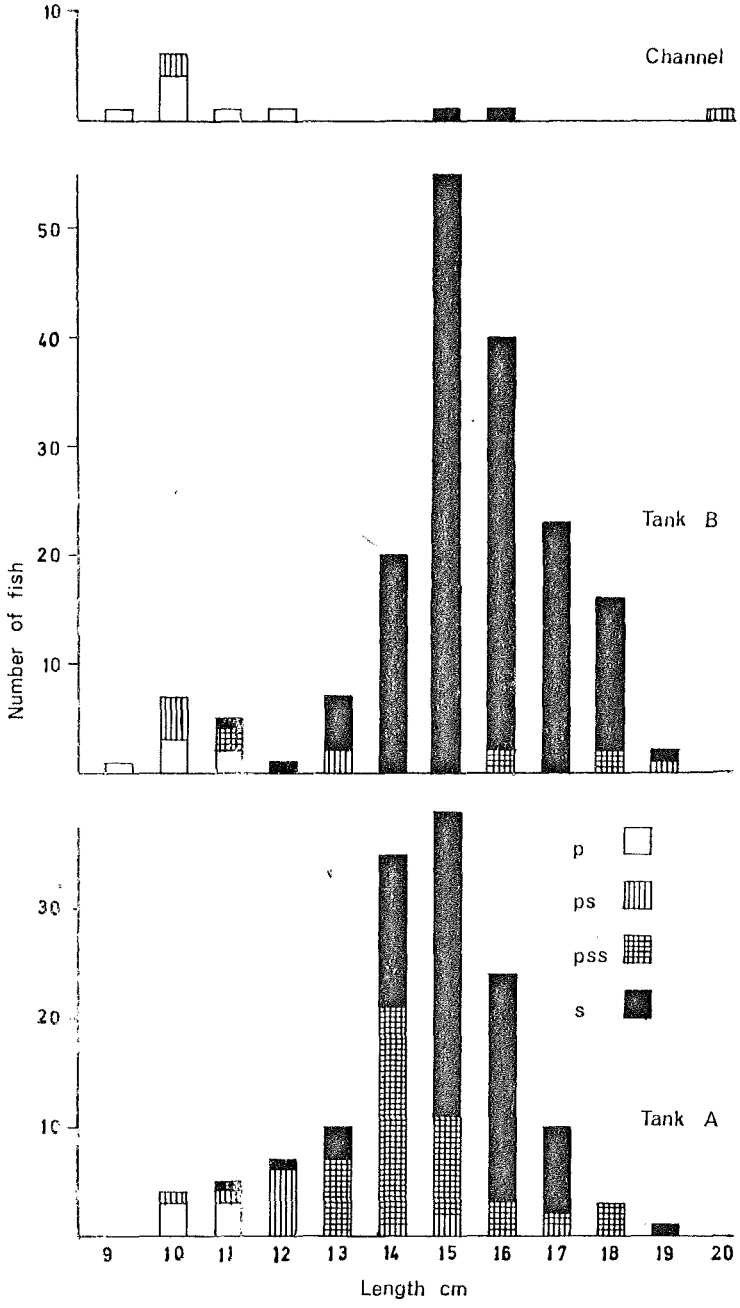

Fig. 3. Length distribution and number of fish of four groups; parr (p); parr-smolt (ps); parr-smolt-smolt (pss); and smolt (s) on June 7th.

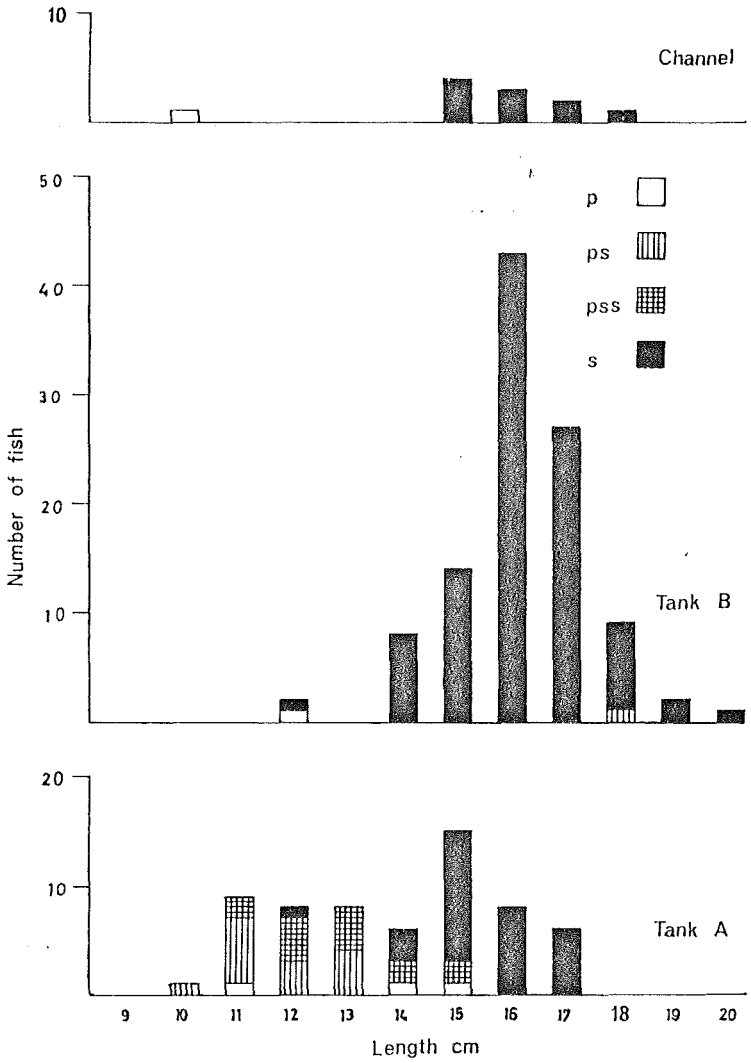

Fig. 4. Length distribution and number of fish of four groups; parr (p); parr-smolt (ps); parr-smolt-smolt (pss); and smolt (s) on July 6th.