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THE INCUBATION OF EGGS AND REARING OF FRY OF SEA TROUT /Salmo trutta trutta/ IN BALTIC SEA WATER

by

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1. Introduction

The extending of, until recently applied, restocking methods and recultivating of some salmonids in the Baltic Sea is tending to be a vital problem. Basing on this necessity a complete developing cycle of diadromous fish in water of 7 - 10 ‰ salinity was conveyed. During the year 1973 an experimental incubation of roe and fry rearing of rainbow trout /Salmo gairdneri/ in brackish water was made with affirmative results. /ICES paper CM 1973/M : 16, 1973/. Simultaneously a trial was made of rearing of trout fry from the moment of hatching in brackish water. Moreover an experimental fertilisation and incubation of trout eggs in the Baltic Sea water was conveyed in the fall 1973. This contribution reviews results of these investigations.

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2. Experiments made

2.1. Fertilisation of eggs.

For the experiment eggs and spermatozoons of the wild living sea trout from the Wisła river were taken. The trout spermatozoons, different from those of rainbow trout, are attaining full mobility in water with salinity of 7 - 10 % lasting 4.5 - 5.0 min. entering the eggs and impregnating them. The trout eggs fertilised in such conditions does not develop and the roe, even after 48 hours of keeping, does not show any characteristic changes of the internal structure. The distribution of the fatt drop, the mechanical resistance against squeezing are the same like in case of eggs not fertilised. Such eggs are fertilised however, keeping during a short period of time a capacity to further development. This was proved when, after 48 hours, a quantity of such eggs was immersed in fresh water /municipal water supply/ showing - after 30 minutes - normal swelling and high degree of elasticity. These eggs put again in brackish water have developed to the stage of fissura nervosa /30 % of the whole lot/. The stage of final hatching was not attained due to the break down in the water flow system.

The roe, fertilised in fresh water and deposited in miniaturised hatching devices of californian type supplied by brackish water, developedn normally /by salinity oscillating between 7.9 - 7.6 %o and 9 - 10 %o/. The first larvae appeared after 400-450 degree days. The percentage of hatched eggs oscillated from 50 - 60 % to 80 %. It was ascertained, that salinity /in the range given before/ does not influence the cycle of hatching of fertilised eggs. Thus the percentage of eggs hatched was independent from salinity. Among the factors influencing the development of eggs the most important are the temperature of water supplied and the constructing of hatching devices, particular the size of mesh in wire nets used for filtering. The best results were obtained when using filtered water, by closed circulation and fixed temperatures 7 - 8°C ± 0.5°C, and wire netting with square meshes of side length 2.5 mm. The results obtained with circular meshes of Ø 2.0 mm were unsatisfying due to the hampered water flow.

The roe deposited in the flow of brackish water, without filtration, taken directly from the Baltic Sea /in close distance from the harbour of Gdynia/ developed worse than in filtered water. In this case the rate of eggs hatched was 50 - 60 %. The higher mortality rate was caused by a serious saprolegnia infection of fertilised eggs and repeating break downs of the water pumping system. The increase of mortality rate was observed as a rule after few days following the cleaning of the pumping system. Probably some deposits of dead moluscs /Mytilus sp/ remained in the piping what resulted in deteriorating of the quality of the water supplied.

In water without filtration a quite considerable /to 6 % / degree of premature hatching was observed also. In some events the first larvae hatched after 350 C degree days with symptoms of degeneration. This was probably the result of weakening of the egg membranes caused by activity of parasitic organisms. /fragmentary digesting of membranes/. By water temperatures characteristic for the fall - winter period of 1973/1974 the hatching of eggs, fertilised in 29th of October 1973, commenced during the turning point of December 1973 and January 1974.

Simultaneous to the trout eggs hatching in brackish water the experimental hatching in fresh water /municipal water supply/ was conveyed. This experiment, considered as a control test, failed. The failure resulted probably due to the high content of iron and the influence of chemicals added during the process of water refining for human consumption. This caused 100 % of mortality rate of fertilised eggs after 2 - 3 weeks of incubation. In only one case inconsiderable percent of eggs hatched. This sample was deposited in a seperate hatching set, in water with temperatures 15 - 16° C.

2.2 The rearing of fry.

The first purpose of experiments carried out was the inspecting of possibilities of eggs incubation in brackish water. Conditions, specific for these trials, precluded introducing of proper nourishing measures of larvae during their switching to individual feeding. Thus the results obtained can not be considered as a measure of survival of hatched larvae. The process of the yolk-sack resorbtion and the begin of active preying /feeding/ depends from the water temperature. Generally this process has a most regular course at temperatures between 4° C and 7° C. In temperatures over 10° C the resorbtion process was so much accelerated that the hatched fry was not able to feed on its own yolk supply in sufficient degree, starving due to the lack of food. At temperatures about 15° C the resorbtion of 2/3 of the yolk-sack content followed during the period of 8 - 10 days. Temperatures below 4° C caused a considerable extending of the resorbtion process. In such circumstances, after 30 days, the resorbtion of merely 1/4 - 1/3 of the yolk sack content was observed. The hatched larvae did not prey actively on the food served. They did not indicate also increased mortality rate. The most promissing results were obtained, as mentioned before, at temperatures oscillating between 4 - 7° C using non filtered sea water with salinity 7.4 - 7.8 %. This could be caused mainly by introducing of some inconsiderable amounts of natural food organisms /algae, flagellatae, protozoa/, whose presence was indicated in the water used.

By all the draw-backs menti... before, this could be of some assistance to the trout larvae in spite of the danger caused by parasites, pathogenical organisms and pollutants.

2.3 The rearing of fry after resorption of the yolk sack and of Trout Fingerlings

The rearing of fry, after resorption of the yolk sack, was observed on larvae hatched in fresh water and on larvae hatched in sea water as well. The larvae have resorbed in fresh water, before transferring to the sea water, about 2/3 of the yolk content. The brood was nourished twice a day /insufficient !/, during the morning hours and before noon, initially using beef spleen till reaching the length of about 7 - 10 cm. The nourishing rate was diminished later on to 1 time daily and as food, minced fish was used. During these two stages small amounts of living food was sporadically served also /Daphnia, Crangon crangon/. The fry was kept in tanks with capacity of 200 l and the surface plane of 0.65 m^2 till attaining the length of about 6 - 7 cm. The water temperature in the tank oscillated between 10 - 15° C, the stock density being about 100 specimen/1 m^2. After attaining the average length of 7.5 cm the fry was transferred to a more spacious tank / /1.5 m^2 and 600 l / and finally, after attaining the length of 9 - 12 cm, to an aquarium with mixed stock /4 sturgeons of 40 - 70 cm length and 6 salmons of 19 - 40 cm length/.

During the time of 14 months of rearing, periods of increasing mortality rate were reported, mainly at the stage of attaining the length of 3 - 4 cm. The deaths followed as rule due to ceasing of preying with symptoms of drastic emaciation. Up the length of 8 - 9 cm no further deaths were reported. The fry, after 12 - 13 months of rearing /eg. the turning point of April-May/ assumed the colouration characteristic for smolts, switching simultaneously from the demersal to the pelagic behaviour.

The growth rate of trout reared from the very begin in brackish water was conspiciously high in spite of malnutrition. On Fig. 1 the growth rate in weight is shown, on Fig. 2 the growth rate in length. It should be emphasised however that the growth proceeded in temperatures higher than those specific for the Baltic Sea environment during winter and below the temperatures typical for the summer. Stricking enough is the relation of length to weight by specimen of several lengths illustrated on Fig. 3. Comparing of these relations for trout reared in brackish water with average values obtained by commercial fish cultures in Poland /see suitable curves on Fig. 3/ presents, that fish reared in sea water, attains by the same lengths considerable higher weights. In solely two cases in pond culture enterprices the average values approached the minimum values obtained when rearing in brackish water.

3. Conclusions.

3.1. The complete rearing cycle of trout in water of salinity 7 - 10 % is possible except the fertilisation process and swelling stage of eggs.

3.2. The embryonic development of roe in brackish water has an adequate run in the range of C degree days specific for the species investigated. However, because of a slower cooling process of the Baltic Sea water in the fall, the hatching commences sooner than in the water taken from the river.

3.3. The fry is adapting easier to artificial nourishing in water without filtration. This follows probably due to the presence of small amounts of living food organisms.

3.4. Water of 7 - 10 % salinity exerts probably a stimulating effect on the growth rate of trout. This feature seems to be particularly evident by the faster growth rate in weight.

3.5. Developing of the method of complete rearing cycle in case of trout using brackish water might be of practical significance for output of restocking material and commercial fish culture.

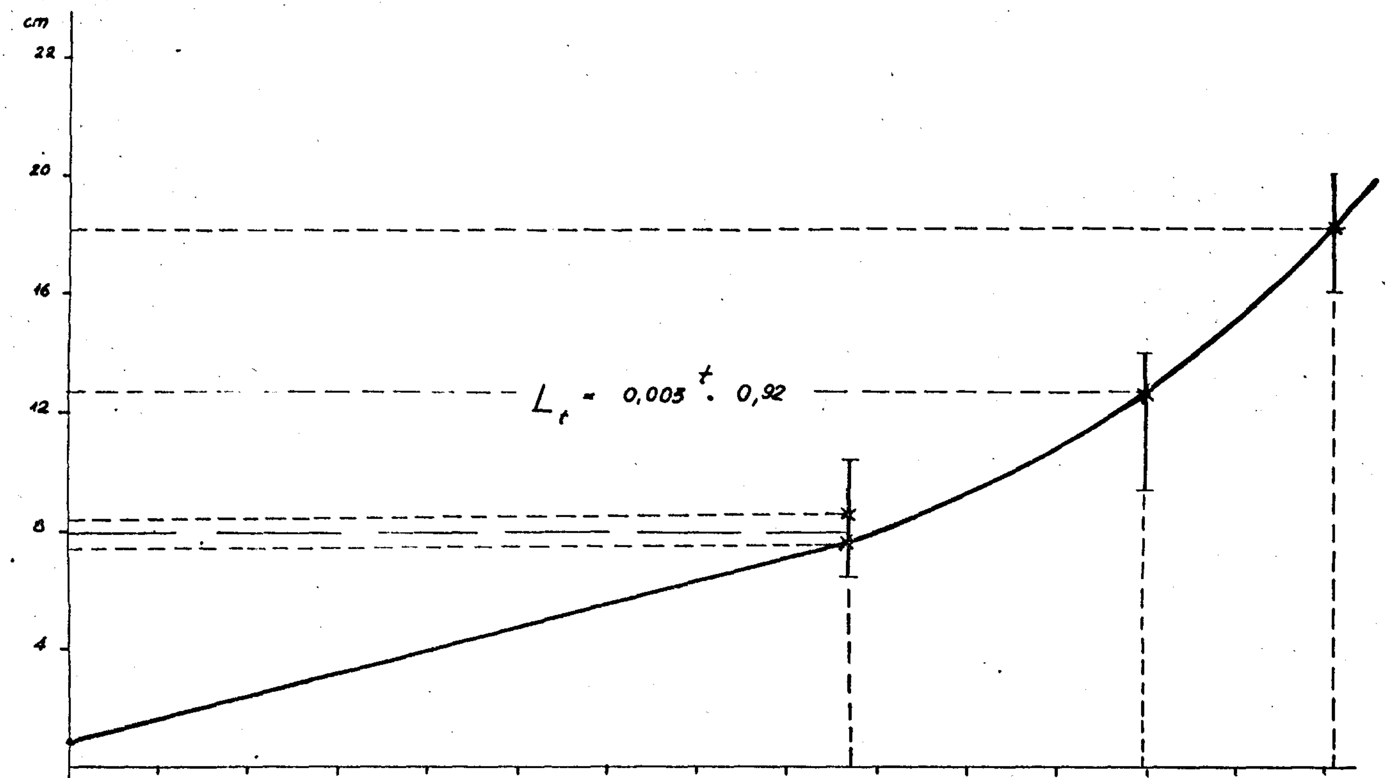

Fig. 1. The curve of growth rate in length

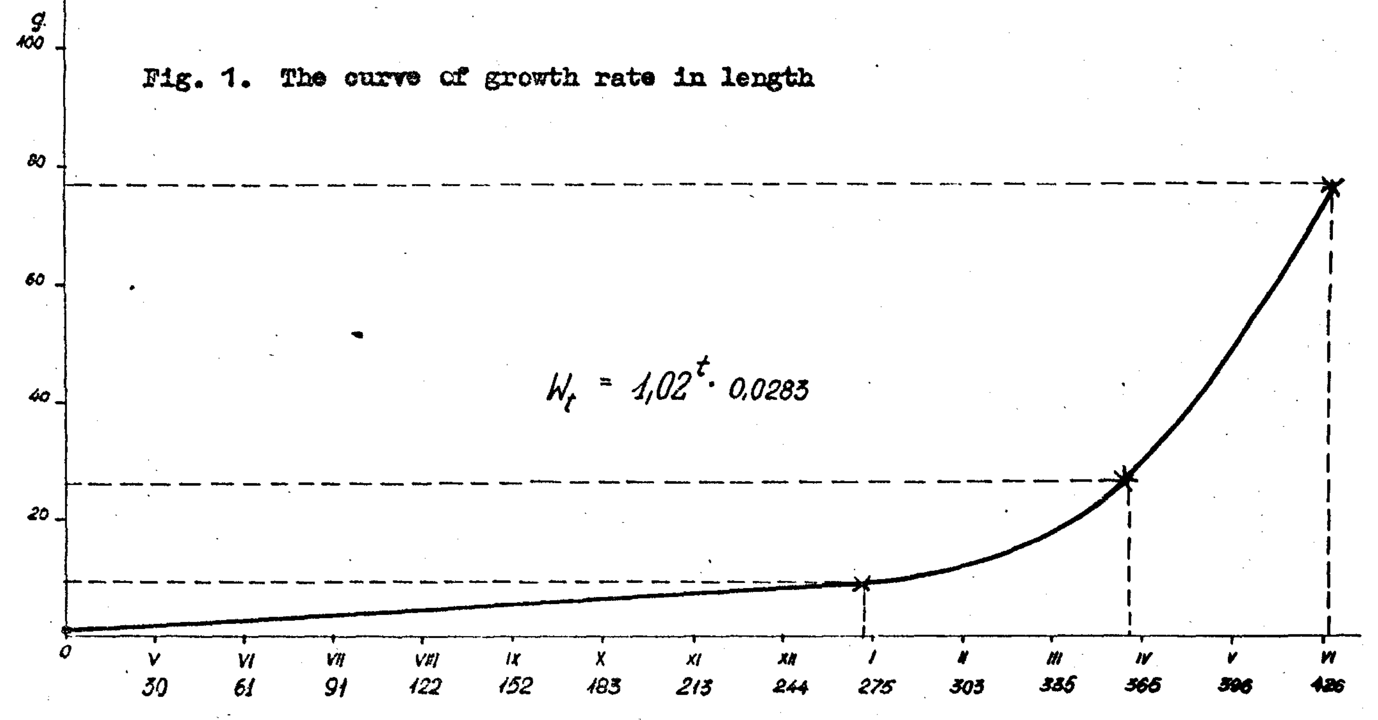

Fig. 2. The curve of growth rate in weight

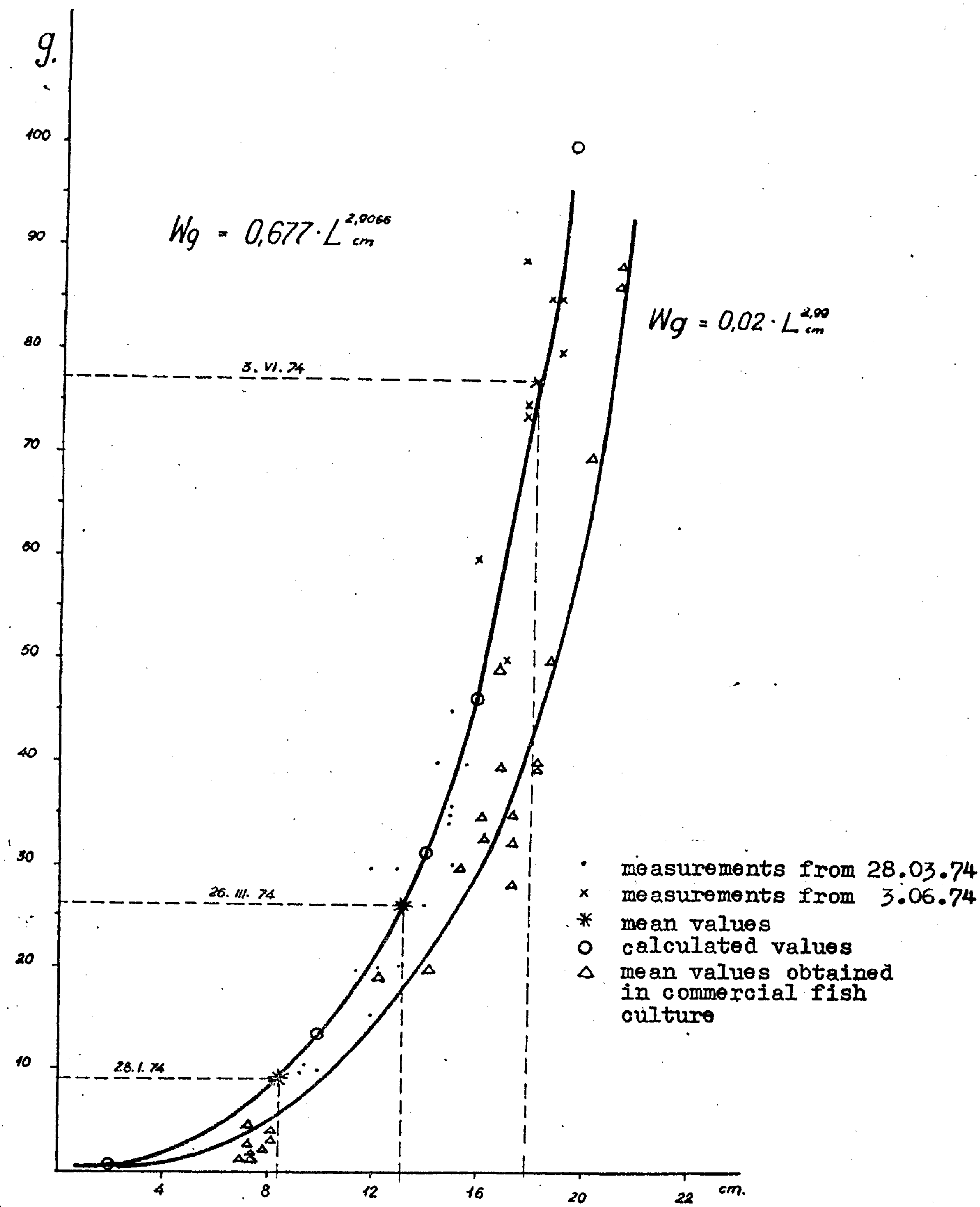

Fig. 3. Weight/length relationship