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On the Relation between Egg Size in Salmon off Norway and subsequent Spawning

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Introduction

A salmon population in the sea is not only subject to fishing and natural mortality but also to losses due to spawning migration. It would be of value for assessment studies if the proportion of fish which are bound for homeward migration could be estimated. The working hypothesis put forward here is that a salmon which is to spawn in anyone year can be identified in spring of the same year from the average size of the "maturing eggs" (Vladikow,1956). Furthermore the ability of a salmon to develop sexual maturity and to spawn is thought to depend on its condition. The connection between condition factor and egg size will therefore also be analysed. During the March 1970 tagging experiment in the Norwegian Sea with R.V. "Anton Dohrn" (Thurow, 1973) 29 ovaries of Atlantic Salmon caught by longline were collected and kept in Gilson's fluid (Tab.1). When maceration of the ovarian tissue was complete 150 randomly sampled "maturing eggs" were measured by means of a binocular microscope. The ovocytes were taken from the middle of the larger ovary. They can be distinguished from "resting ovocytes" as those do not exceed a diameter of about 0,5 mm to 0,6 mm.

Results

It can be seen from Table 1, that the egg size of the salmon of age A.3 is far outside the range of the other specimens (Tab.2). If this value is omitted the distribution is found to be approximately normal (R/s-test,Sachs,1971). Old salmon are known, however, to spawn first. It is thus possible that either all salmon sampled would have spawned the same year or that the working hypothesis has to be rejected, i.e. a "spawner" cannot be identified from its egg size.

Figure 1 shows the relationship between the total length of the fish and the mean diameter of eggs. The correlation $y = 2.79\ x - 0,70$ ($r = 0.79 > r_{0.001} = 0.54$) is highly significant as is the correlation egg size versus fishweight, $y = 0.15\ x + 0.83$ ($r = 0.80 > r_{0.001} = 0.54$)(Fig.2). In contrast to these results

the relationship of the diameter of the egg and the condition factor is only significant at the 5%-level, $y = 1.46 x + 0.22$ ($r = 0.41 > r_{0.05} = 0.37$; Fig.3).

Discussion

Thurow (1966) followed the development of the ovocytes of Baltic salmon. Ovocytes of the "recruitment stock" showed only little growth. The diameter of maturing eggs increased with the length of the fish but only up to a size of about 76 cm (A.2). Thurow suggested that salmon of age A.2 will spawn in autumn of the same year if the average egg size exceeds 1.2 mm. Such a conclusion can obviously not be drawn from the material in question.

According to Dahl and Sømme (1944) the average diameter of mature salmon eggs in Norway is 6.4 mm with a range from 5 to 7 mm. These authors demonstrated a rapid growth of the ovocytes that starts in August in the rivers. They also compared results from fish caught in the sea with those caught in rivers. The egg size in rivers then ranged 4.1 - 4.5 mm whereas salmon caught in "Kile nots" revealed diameters of 1.6 - 2.5 mm in April compared to 0.6 - 2.45 mm in our off shore material of March 1970.

Two points are of importance for the final conclusion; i.e., ovocyte growth in the sea is significantly related to body growth and the main increase in egg size takes place in home rivers. With regard to the first point we have to be aware of the possibility that all fish present in the off shore fishery may be bound for homeward migration in the same year. In this case the egg size distribution is expected to be approximately normal as it appeared to be.

If, however, the population exploited by longlines consisted of juvenile as well as of maturing fish, then the method applied is not suitable to tell juvenile from maturing fish, as the ovocyte growth mainly takes place in rivers. It cannot be decided at present which one of these possibilities is more likely.

References

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Tab. 1 Catch of Salmon off Norway, March 1970

Age	Total Length (cm)	Fresh Weight (kg)	K	Average Diameter of Ovocytes (mm)
A.1	55	1,29	0,7754	0,606
"	57	1,81	0,9774	1,026
"	61	1,64	0,7225	1,102
A.2	62	1,52	0,6377	0,932
"	68	2,20	0,6997	1,209
"	68	2,40	0,7633	1,672
"	69	2,98	0,9071	1,236
"	70	2,65	0,7726	1,40
"	70	2,80	0,8163	1,25
"	71	2,80	0,7823	1,571
"	71	2,90	0,8106	1,081
"	73	2,60	0,6684	1,247
"	75	2,88	0,6826	1,357
"	75	2,96	0,7116	0,937
"	75	3,05	0,7230	1,108
"	75	3,20	0,7585	1,204
"	76	3,70	0,8429	1,769
"	76	3,92	0,8930	1,517
"	77	3,12	0,6834	1,726
"	77	3,40	0,7447	1,258
"	77	3,50	0,7666	1,489
"	80	5,00	0,9766	1,471
"	83	4,41	0,7713	1,572
"	83	4,55	0,7958	1,515
"	85	4,42	0,7197	1,476
"	85	5,56	0,9054	1,642
"	86	5,84	0,9184	1,577
"	94	7,85	0,9451	1,804
A.3	100	9,57	0,9570	2,449

Tab. 2 Frequency distribution of ovocyte diameter, Salmon off Norway, March 1970

egg diameter (mm)	n
0,60 - 0,79	1
0,80 - 0,99	2
1,00 - 1,19	4
1,20 - 1,39	7
1,40 - 1,59	9
1,60 - 1,79	4
1,80 - 1,99	1
2,00 - 2,19	
2,20 - 2,39	
2,40 - 2,59	1

n	29	28
Aver. diameter	1,39	1,35
Stand. deviation	0,35	0,29
Range	1,84	1,20
R/s	5,28	4,15
$R/s_{(5\%)}$	4,85	4,80

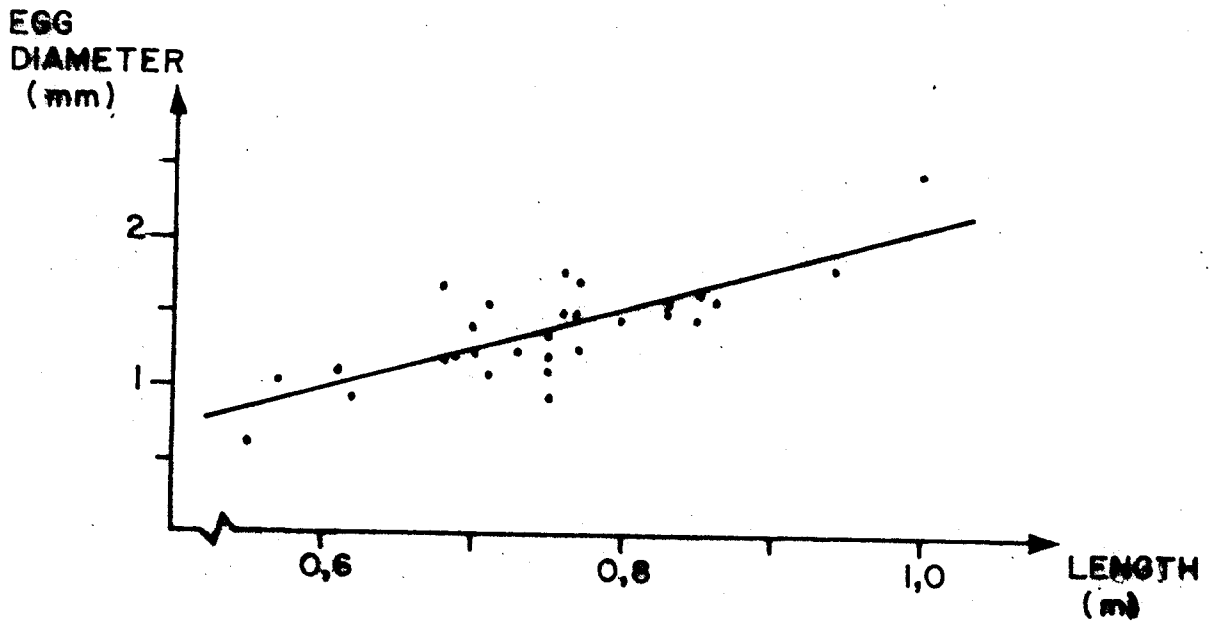

Fig. 1 Relationship between length and average diameter of ovocytes of the salmon of the Norvegian Sea

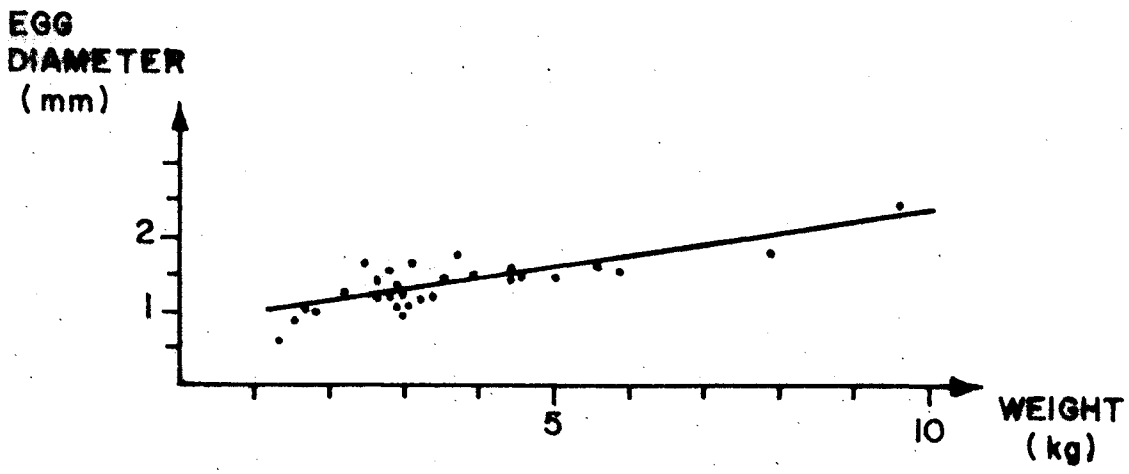

Fig. 2 Relationship between fresh weight and average diameter of ovocytes of the salmon of the Norvegian Sea

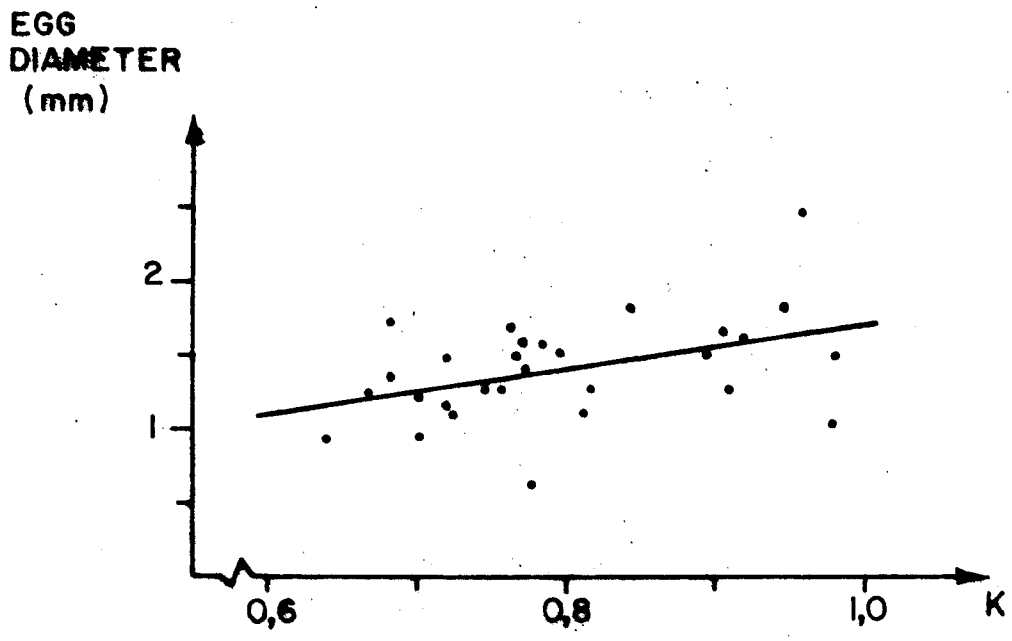

Fig. 3 Relationship between length-weight-coefficient (K) and average diameter of ovocytes of the salmon of the Norvegian Sea.