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The Significance of the Sclerite Rings of Salmon Scales for Age-determination

by

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M. N. Lishev (1958) supposed that the number of sclerite rings constructed in fresh water was closely connected to the length of salmon. Besides he found significant differences in the sclerite numbers of salmon of various rivers and he referred these as well as the annual differences to changes in the conditions of life.

The present investigations have been based on the following questions:

1. Does the knowledge of the number of sclerite rings relieve the age-determination?
2. Is it possible to determine the individuals of a salmon catch belonging to one population or another by means of the ascertainment of the number of sclerite rings?
3. Does the composition of a smolt year-class change from year to year?

The results of the report in question proceed from age-determinations from the years 1959, 1960 and 1961. In connection with scale reading the number of sclerite rings constructed during the first year of river life is ascertained. The rings are counted from the centre oblique left or right to the edge of the scale. Most sclerites are present in these directions.

1. The relation between the number of sclerite rings and the age of salmon

In ascertaining the age of salmon, the determination of the duration of river life is most difficult. Many fishes show the first seeming winter ring soon after constructing 4-7 sclerites, i.e. at a body length of 3-5 cm (back calculation from A. Lindroth, 1960). The question (the check being a true annulus or a so-called summer-check) cannot be exactly defined before parrs or smolts, grown up under natural conditions, are investigated with regard to their variation in length and number of sclerites in the first year of life.

The connection between the sclerite number and the length of the fish is unessential as far as age determination is concerned, since the only question is the distinction between true and seeming annuli. Therefore the ascertainment of the relation between the number of sclerite rings and the duration of river life is very important. This question is pointed out by means of Figure 1. The graphical representation of the above-mentioned correlation results in a straight line, provided that a double logarithmic form is used. This means that the number of sclerites may relieve the age determination.

Table 1. The number of sclerite rings in dependence on the duration of river life (average of 1959-1961)

1	2	3	4	5
1.B	≥ 19	190	173	+9.8
2.B.	12 - 18	688	729	-5.6
3.B	7 - 11	1,508	1,488	+1.3
4.B	5 - 6	358	339	+5.6
5.B	4	12	27	-55.5

1 = age-group.

2 = arbitrarily formed sclerite-groups not overlapping themselves.

3 = number of individuals classified into the age-groups by means of the sclerite numbers without regard to the age.

4 = the number of salmon within the single age-groups ascertained by means of age-determination.

5 = differences between the numbers of column 3 and 4 in % of 4.

In this connection the present material is dealt with in Table 1. Sclerite groups are constructed under column 2 not overlapping themselves and corresponding to the age-groups (see also Figure 2). Since no gap normally exists between the sclerite numbers of the single age-groups, not all individuals ascertained by age determination are contained within the sclerite groups under column 2. If the salmon investigated is classified only by means of its sclerite numbers into the groups of column 2 and at the same time into the corresponding age-groups, we arrive at the figures under column 3. Of course, the numbers under column 3 differ also to some extent from the figures ascertained by means of scale reading (column 4). The deviations amount to 1-10%, if only the most important age-groups 1.3, 2.3, 3.3 and 4.3 are considered.

The results in question from feeding fish have to be compared with sclerite numbers of parrs or smolts since their age is easily recognisable by means of length measurements. When that comparison has been put through the present findings will prove true.

As an example the age determination would be carried out in the following way: four checks (seeming winter bands) constructed during river life are present on the scale of an A.3 salmon; supposing one of the narrow zones is not clear or only consists of a few sclerite rings, then possibly only three are true annuli and the other is a false one. Within the first annulus ten sclerite rings are present. From this and Table 1 it follows that the salmon in question is probably an individual of the 3.3 age-group.

2. Population analysis of salmon catches

M. N. Lishev (1958) is of the opinion that it is possible to determine the individuals of a definite catch to a definite population by means of the sclerite numbers. In order to put that conclusion into practice, a salmon catch from Bornholm (427 individuals) and another one form the Gdansk Deep (246 individuals) were investigated in January 1959. Both the catches showed certain differences in the age-composition. The average sclerite numbers of the 2.2 and 3.2 age-groups amount to 12.4 and 12.9, and 9.2 and 8.8 respectively (Table 2).

The probability that the small differences between the values are true is with 0.41 and 0.24 respectively far above the significance limit. Therefore the differences are probably accidental. In other words, inspite of certain distinctions in the age-composition of the catches it could not be demonstrated that the individuals of the Gdansk Deep and the Bornholm catches belong to different local populations.

Table 2. Average sclerite numbers of age-groups of salmon catches from the Gdansk Deep and the Bornholm area, January, 1959

Age-group	2.2		3.2	
Catchment area	Bornholm	Gdansk Deep	Bornholm	Gdansk Deep
No. of salmon investigated	111	46	157	90
Mean no. of sclerites in the first year of life	12.4	12.9	9.2	8.8
W (t)	0.82 = 60%		1.19 = 75%	
Significance limit 5 %	1.97		1.97	
Significance limit 1 %	2.59		2.59	

W (t) = probability of the significance test from Student

3. Annual changes in the number of sclerites

M. N. Lishev's (1958) investigations resulted in annual changes in the number of sclerite rings depending on the changed conditions of life. That also has been shown in the case of the present material.

Besides these variations the differences between the mean values of one and the same smolt year-class from year to year are of interest. In this case the significance test has been carried out for the average values of the age-groups 3.2 (1959) and 3.3 (1960) respectively, and 3.2 (1960) and 3.3 (1961) respectively (Table 3). The differences are significant and highly significant with probabilities of 0.021 and 0.002. The fact that third winter salmon show higher values than second winter individuals, whereas the reverse circumstances appear in the case of 2.2 and 3.2 age-groups of the 1957 smolt year-class, is also worth

Table 3. The annual variations of the sclerite numbers for individuals of one and the same smolt year-class (in brackets number of salmon investigated)

Age-group		1.B	2.B	3.B	4.B	5.B
Smolt year-class 1957	Jan.1959	19.0(20)	12.5(159)	9.1(227)	7.3(87)	6.9(9)
	Jan.1960	22.6(42)	13.8(128)	9.7(195)	7.8(79)	7.4(5)
Smolt year-class 1958	Jan.1960	23.5(33)	13.0(145)	9.2(294)	7.6(67)	7.0(4)
	Jan.1961	24.4(27)	12.1(74)	8.4(109)	7.9(20)	

Summary

1. Salmon with difficult readable fresh water zones on its scales may be classified into its true year-class on account of the relation between the sclerite number and the duration of river life. The values of feeding fish need a comparison with data from parrs or smolts.

2. Salmon caught in January 1959 in the Gdansk Deep and the Bornholm area showed no significant differences in their sclerite numbers.

3. Salmon of the smolt year-class 1957 as well as individuals of the smolt year-class 1958 showed various average numbers of sclerites in successive years. The differences were significant in both the cases.

References

Lindroth, A. 1960 "Body/scale relationship in Atlantic Salmon. Preliminary Report". ICES CM 1960, Salmon and Trout Ctte. No.104.

Lishev, M. N. 1958 "Difference in the structure of scales of Baltic salmon of various river populations". ICES CM 1958, Salmon and Trout Ctte. No.64.

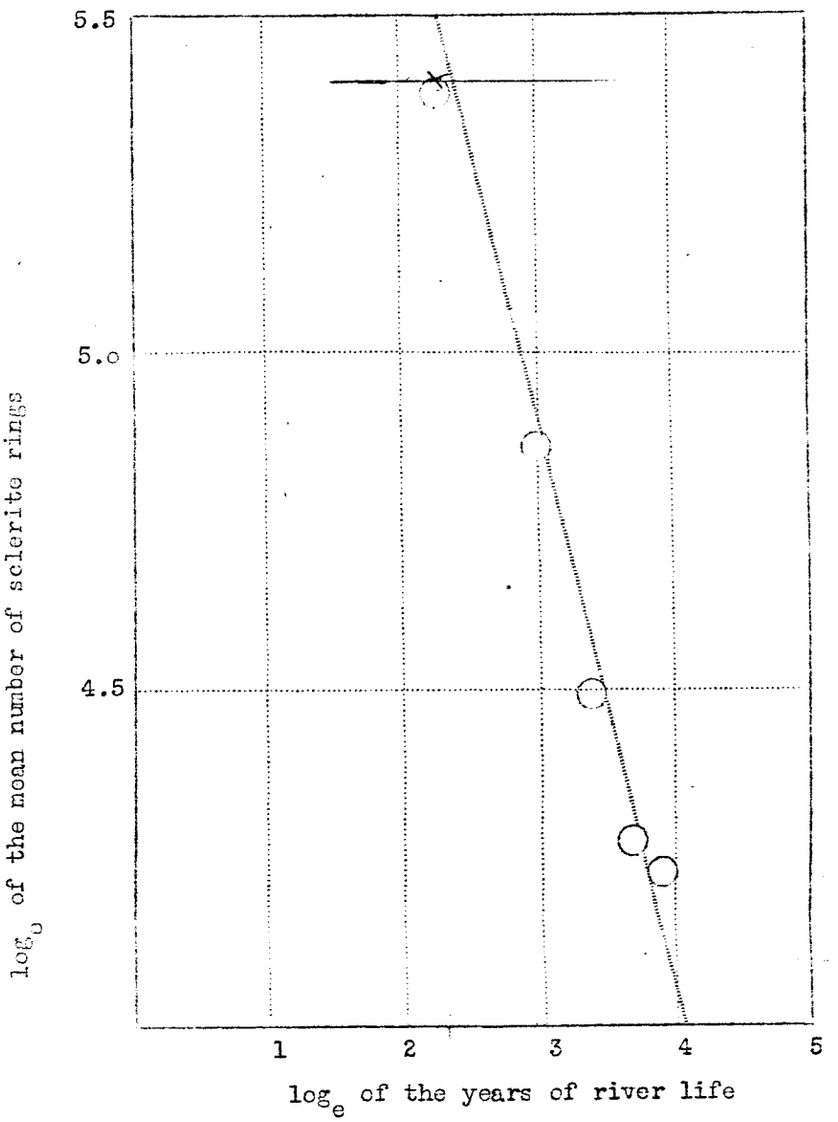

Figure 1. The relation between the number of sclerite rings formed in the first year and the duration of river life for the age-groups A.2

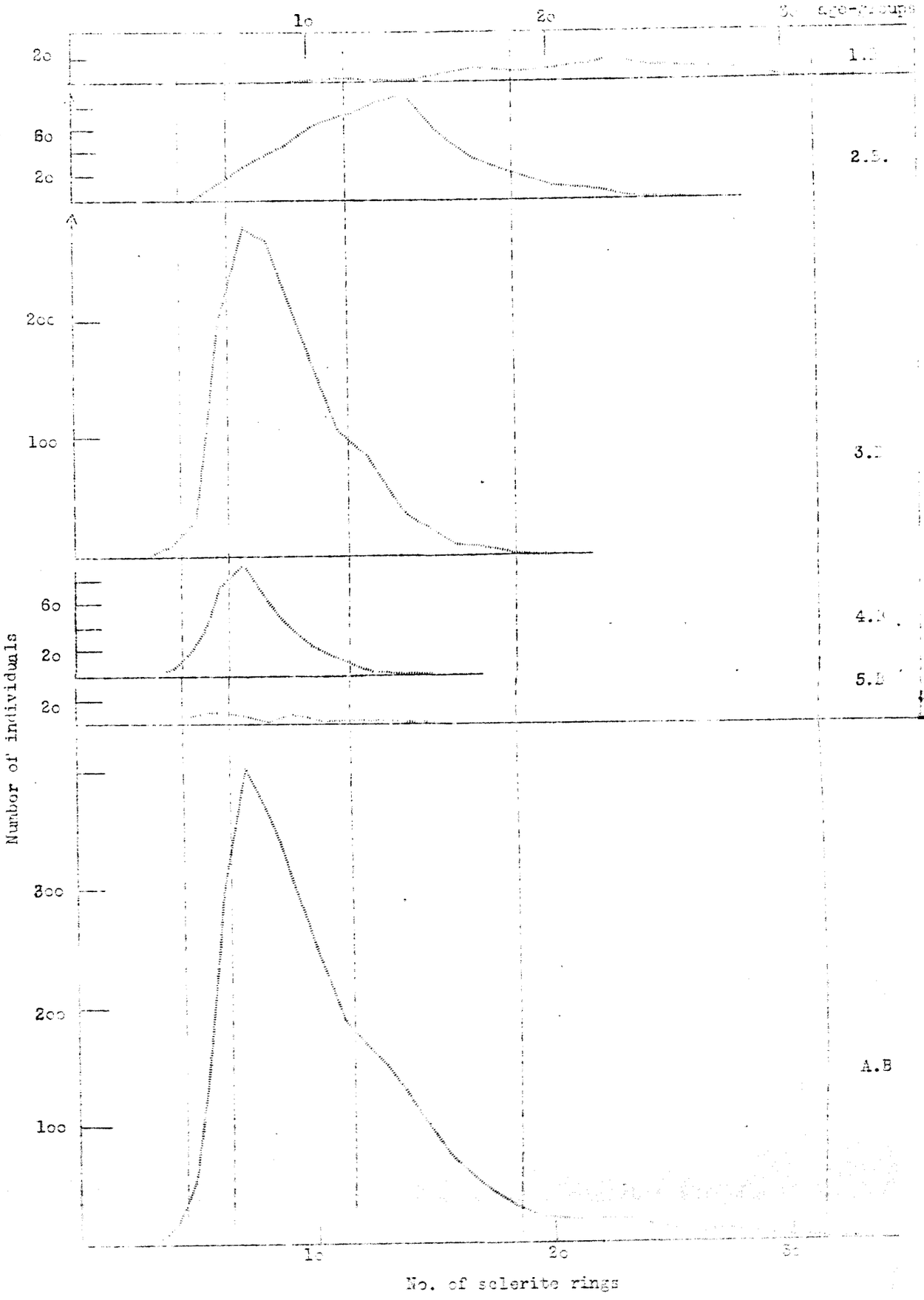

Figure 2. Number of sclerite rings constructed in the first year in dependence on the duration of river life.