The Body-Scale Relationship of Cut-Throat Trout Caught in Gill Nets in the Fall of 1954

Scales from the cut-throat captured in the fall gill netting of 1954 were measured. This was done by projecting the scale, and then marking off the centre of the focus, the margin of the scale, and the outside edge of each annulus on a piece of cardboard.

The scale lengths (anterior radius, from the centre of focus to the margin of the scale), of all the fish in the sample and their corresponding body lengths were plotted on the graph. There were considerable variations in the scale lengths and the body lengths of the fish. A regression line, calculated from the data is also shown on the graph. This was calculated from the formula $L = a + bS$, assuming a straight line relationship between the rate of growth of the scale and the body of the fish. L represents body length, a and b are constants, and S represents the scale length. The regression formula values of a and b were calculated as $L = 16.95 + 18628$. By using the constant a in the following formula it is then possible to calculate the length of the fish at any annulus.

$$L = \frac{S_1 (L_2 - a)}{S_2} + a$$

Where L_1 = length of the fish at any annulus.

S_1 = length of scale at any corresponding annulus.

L_2 = length of fish at capture.

S_2 = length of scale (centre of focus to margin of scale).

a = constant, determined previously.

As an example, lengths of the Age III trout at the time of annulus formation can be calculated from the scales of Age III ++ fish captured in the Fall of 1954. The mean body lengths and the mean scale lengths of the Age III ++ cut-throat and the mean scale lengths of the Age III fish are calculated, and are given below.

	Age III	Age III++
Mean body length	L_1	29.2 cm.
Mean scale length	47.22 mm.	65.64 mm.

Applying these to the formula

$$L_1 = \frac{47.22\ (29.2 - 16.95}{65.64} + 16.95$$

L_1 = 25.76 cm. = length of III-year old trout at time of formation of the annulus.

The average sizes of the cut-throat of ages I to V from the brood years of 1949 to 1952 were calculated from the scales of cut-throat caught in the fall gill netting of 1954.

The calculated lengths of the trout in each age group are compared to the mean sizes of the trout caught in the gill nets in the following table.

The calculated lengths of cut-throat compared to the measured lengths of cut-throat caught in the gill nets, fall of 1954.

I	1949	1950	1951	1952	1953	1954
Calculated	19.95	19.38	19.47	19.09		
R. Cr.						
Sg-n						
L. Cr.						
Fall G-m			19.61	20.42		
W-G-n						
II						
Calculated	22.50	21.53	22.91	20.98		
R. Cr.			23.16	23.85		
Sg-n			20.22	21.09		
L. Cr.		19.75	22.42	25.00		
Fall G-m		21.41	24.63	24.14		
W-G-n						
III						
Calculated	25.58	24.82	25.76			
R. Cr.	23.50	26.89	27.45			
Sg-n		25.24	27.21			
L. Cr.	26.25	27.63	27.42			
Fall G-m	27.29	28.12	29.2			
W-G-n						
IV						
Calculated	29.73	29.07				
R. Cr.	29.35	29.30				
Sg-n	29.50	30.11				
L. Cr.	29.58	31.40				
Fall G-m	30.01	32.41				
W-G-n						

V	1949	1950	1951	1952	1953	1954
Calculated	32.38					
R. Cr.	30.20					
Sg-n	32.15					
L. Cr.	32.54					
Fall G-n	35.00					

The back calculated lengths of cut-throat of the 1949 brood year, from Age V ++ scales were consistantly higher than the actual measurements. This difference may have been due to the small number of Age V ++ trout in the sample. The back calculations of lengths based on the much larger sample of Age III ++ and IV ++ trout from the fall gill netting were consistantly more reasonable, with the exception of the one year olds in all cases.

The back calculations of the lengths break down at age one. The calculated lengths of the ones shown are probably very much higher than the actual lengths of the fish in this age class. Although the relative differences in the calculated lengths of the one year olds from year to year might be useful in indicating changes in the growth. It appears that there is a different rate of scale growth to body growth in the first year, up to a point of inflection, after which the scale body growth assumes a different rate.

The correlation coefficient for the body scale length relationship was calculated. A correlation of + 0.63 was found. This fairly low correlation may have been partly due to differences in the technique of sampling the fish for scales.

Differences in the sizes of the scales have been found to be related to the portion of the fish's body from which they were taken (Bilton, 1953). For example, scales taken posterior or anterior to an area just under the dorsal fin, have been found to be smaller than those taken below the dorsal on the same fish. Much of the variation in scale size could be reduced if scale samples were always taken from one specific area of the fish's body. This technique would probably be slower but for the purposes of back calculations it would be considerably more satisfactory.