

THE NATIONAL ANGUILLA CLUB

A REPORT ON THE 1967 GROWTH RATE WORK

INTRODUCTION

During the season, members collected otoliths from 95 eels. Dr. J.W. Jones and Dr. V.R.P.Sinha at Liverpool University kindly undertook to estimate ages from these otoliths, and this Report is based upon their estimates. The National Anguilla Club gratefully acknowledges this invaluable assistance.

Of the 95 sets of otoliths, 17 were broken in transit and a further 15 proved to be unreadable or doubtful. Including one additional estimate for an eel from the G.U.Canal obtained in 1966, the pattern of results was:

<u>Water</u>	<u>No. of eels</u>	<u>Broken</u>	<u>Unreadable</u>	<u>Remainder</u>
L. Helen	33	3	4	26
Butler's	23	8	2	13
Stickney	13	-	3	10
G.U.Canal, Northants. & Warwicks.	12	1	3	8
Roswell	6	4	-	2
R. Gt. Ouse, Cambs.	3	1	2	-
Kingsmead	2	-	-	2
Balderton	2	-	1	1
A Northants. dyke	1	-	-	1
"Wilson's Water"	1	-	-	1
	<u>96</u>	<u>17</u>	<u>15</u>	<u>64</u>

The reader is referred to the N.A.C. Bulletin dated December, 1966, for basic background information on the growth of eels. Briefly, it is known that there considerable differences in the growth rates of eels, between one water and another; that female eels grow more rapidly than male and undifferentiated eels; and that even eels of the same sex and in the same water show marked differences in growth rate. Measured in terms of annual increments in size, growth is relatively slow in the early years of the eels' freshwater life, gradually increases, and is more rapid in the later years; it is also generally thought that growth diminishes in rate in the older individuals, so that graphs of size against age are "sigmoid" - i.e. in the shape of a distorted S.

These facts mean that is not easy to find a generally-applicable means of representing the growth in the form of a single number or coefficient. Instead, it has to be shown in the form of a graph of age against size, in which each point should ideally be the average size of a representative number of eels in each particular age group. This would mean at least five individuals in each age group, if one is to have much confidence that their

average size is truly representative. Thus, even if no account is taken of the sex of the eels, a reliable growth rate graph covering (say) 12 years requires at least 60 successful readings: more, in practice, because one gets more specimens in the lower age groups.

It cannot be over-emphasised that no general conclusions of any angling significance can be drawn from the estimated age of one or two individual specimens from a water.

The facts also mean that, in order to strike a proper Grand Average growth rate for a number of waters, the growth in each water should be fully estimated over the number of years in question, so that each takes equal weight in the average.

Clearly, the numbers of results available in the present study do not permit a full and reliable assessment of the growth rate to be made for any one of the waters, and no truly representative Grand Average can be struck. Nonetheless, a form of Grand Average can be derived which, whilst not being truly representative, will serve as a basis for comparison; and the data can be manipulated to allow a reasonable comparison to be made for L. Helen, Butler's, Stickney and the G.U.Canal, providing the limitations indicated above are borne in mind.

In the following, ages are given in "years" i.e. years in freshwater, in accordance with the practice at Liverpool University. The age in years is one greater than the Age Group as defined in the Bulletin for December, 1966.

THE OVERALL RESULT

All 64 estimates are combined in the Table on p. 3. Lengths are in inches, weights in ounces. In compiling the Table from the original estimates, ages given as e.g. "8 or more" have been counted as "8", and ages given as e.g. "9 or 10" have been counted as "10". Mean lengths and mean weights are the arithmetic means of the lengths and weights in the age group.

Since the 64 estimates are drawn from no fewer than 10 waters, in far from equal weightings, it is not surprising that the mean lengths and weights are erratic. If plotted on a graph, they are scattered and do not lie on anything approaching a smooth curve. In this form, they do not provide a useful basis for comparison.

In order to smooth out some of the fluctuations caused by the small number of results and the erratic "mix" from different waters, geometric means are taken over successive groups of five. Thus, for example, the "smoothed weight" for age 7 years (6.0 oz.) is the geometric mean of the "mean weights" for ages 5 - 9 years inclusive.

These smoothed mean lengths and weights represent a reasonable form of Grand Average from the data. Eels of age 7 years average about 18 inches in length and about 6 oz. in weight. Eels of age 17 years average about 37 inches in length and about 3 lb. 12 oz. in weight. The smoothed lengths and weights and their ranges are plotted in Graphs I and II.

<u>Years</u>	<u>No. of eels</u>	<u>Length Range</u>	<u>Mean Length</u>	<u>Smoothed Length</u>	<u>Weight Range</u>	<u>Mean Weight</u>	<u>Smoothed Weight</u>
5	1	-	13.5		-	3.0	
6	7	15.9-22.6	18.0		4.0-10.3	6.3	
7	9	16.4-18.3	17.3	17.8	5.0- 7.0	5.4	6.0
8	8	18.1-25.0	20.2	19.3	6.5-14.5	8.7	7.2
9	6	18.8-24.5	20.9	20.6	3.0-14.5	8.9	8.6
10	4	19.3-22.8	20.6	23.0	5.5- 9.0	7.5	12.4
11	5	21.3-33.8	24.5	25.1	7.0-35.0	15.1	16.8
12	2	26.8-34.0	30.4	27.3	20.0-48.0	34.0	22.9
13	7	21.3-33.0	31.0	30.3	9.0-51.0	39.3	32.5
14	6	23.8-37.9	31.7	32.8	16.0-67.5	41.6	42.4
15	2	34.8-35.4	35.1	34.1	39.0-48.0	43.5	46.9
16	3	31.8-38.8	36.2	36.9	38.5-73.0	56.5	58.2
17	1	-	36.9	37.7	-	56.5	59.7
18	2	44.5-47.0	45.8		102.0-130.0	116.0	
19	1	-	35.3		-	47.0	

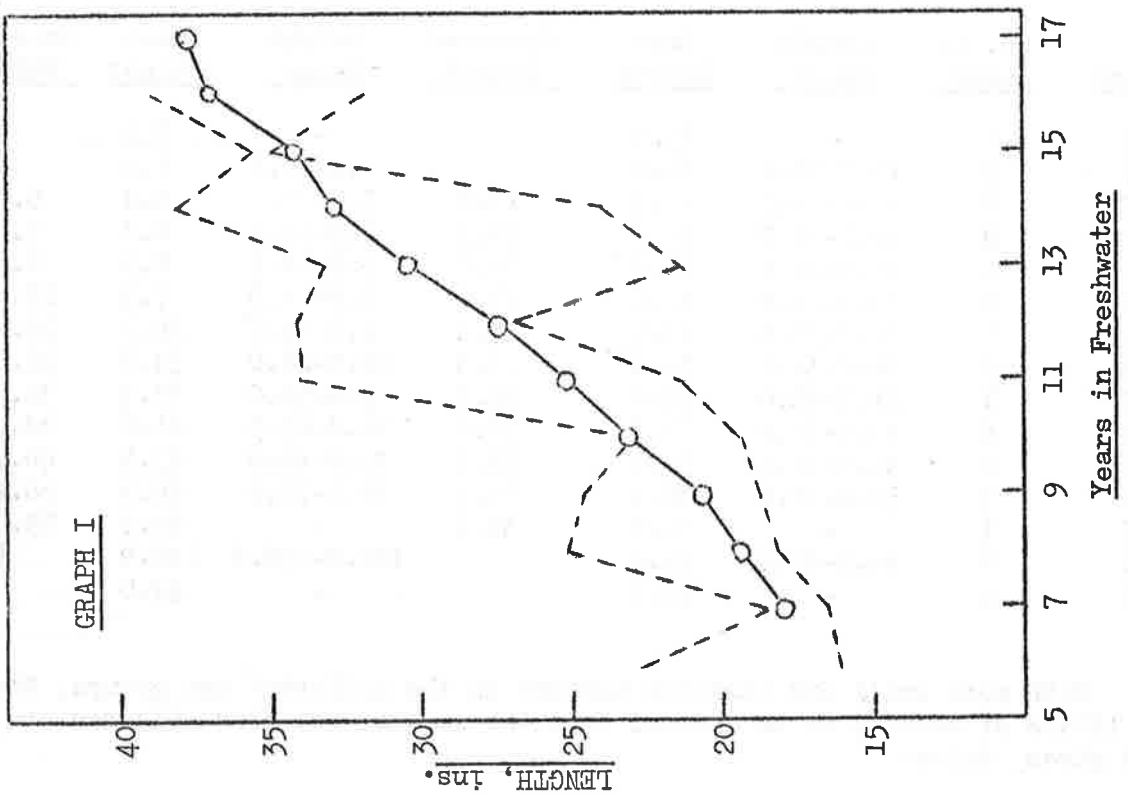
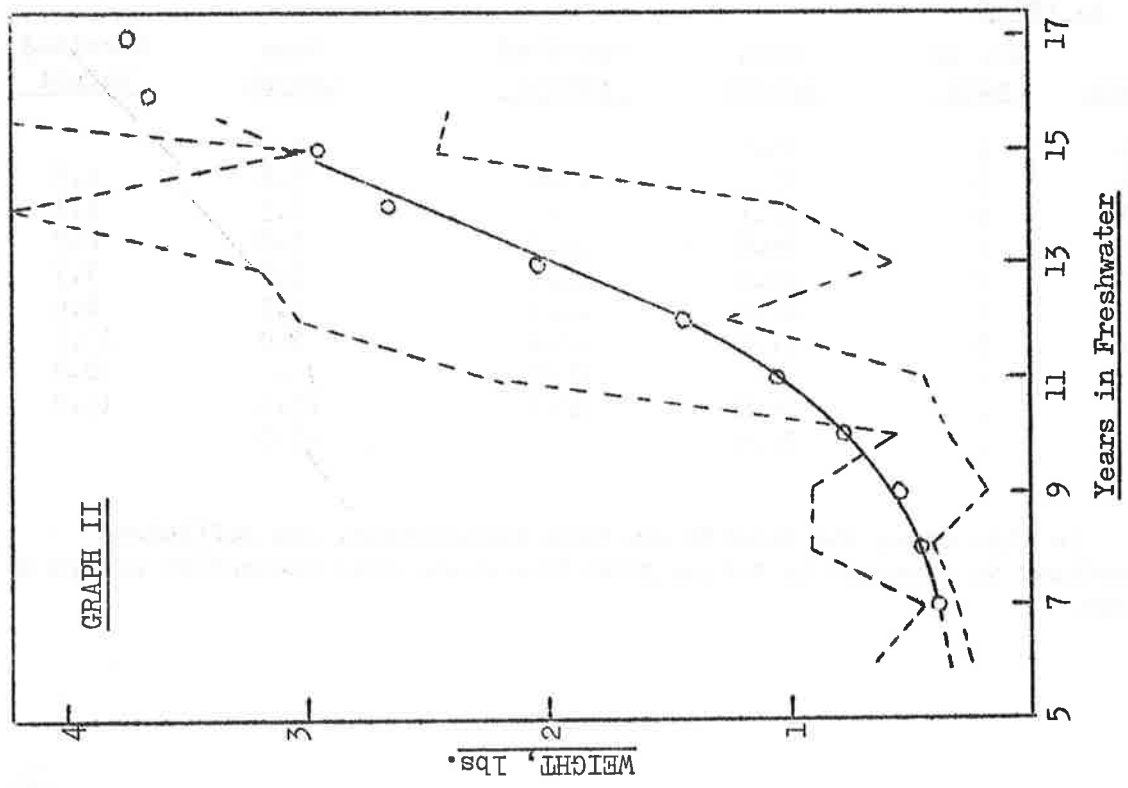
With such small and variable numbers in the different age groups, there is little or nothing to be deduced from the ranges, and these figures are not given, below.

INDIVIDUAL WATERS

1. L. Helen

<u>Years</u>	<u>No. of eels</u>	<u>Mean Length</u>	<u>Smoothed Length</u>	<u>Mean Weight</u>	<u>Smoothed Weight</u>
5	1	13.5		3.0	
6	5	17.1	15.8	5.8	4.6
7	6	17.1	17.6	5.5	6.1
8	5	18.6	18.2	7.0	6.7
9	2	19.0	20.1	7.8	7.7
10	1	22.8	21.1	8.5	8.6
11	3	21.6	22.4	9.8	10.1
12	-	-	22.8	-	12.3
13	2	24.0	26.2	15.5	19.8
14	1	32.8		41.0	

In this case, the results are more homogeneous, and sufficient smoothing is obtained by taking geometric means over successive groups of three.



2. Butler's

<u>Years</u>	<u>No. of eels</u>	<u>Mean Length</u>	<u>Smoothed Length</u>	<u>Mean Weight</u>	<u>Smoothed Weight</u>
7	1	18.3		6.0	
8	1	20.0	19.4	8.0	6.5
9	2	20.1	20.0	5.8	6.9
10	3	19.8	21.2	7.2	7.7
11	1	23.8	23.3	11.0	11.6
12	1	26.8	26.9	20.0	20.5
13	2	30.8	28.8	39.0	28.8
14	2	28.8		30.5	

Again, nothing is to be gained by applying heavier smoothing than over groups of three.

The smoothed mean weights for L. Helen and Butler's are plotted against the Grand Average smoothed mean weights in Graph III. Members with zoological interests may wish to compare smoothed lengths with the Grand Average, and also to compare weights calculated from the smoothed lengths; however, since from the angling viewpoint it is results in weight terms that matter, these comparisons are not made here.

3. Stickney

The results are too sparse to treat as above. There are two estimates in years 6 and 7, and one each in years 8, 11, 13, 15, 17 and 19. However, using similar averaging methods to those illustrated above, it is possible to obtain two individual points on the Stickney growth rate graph. These are:-

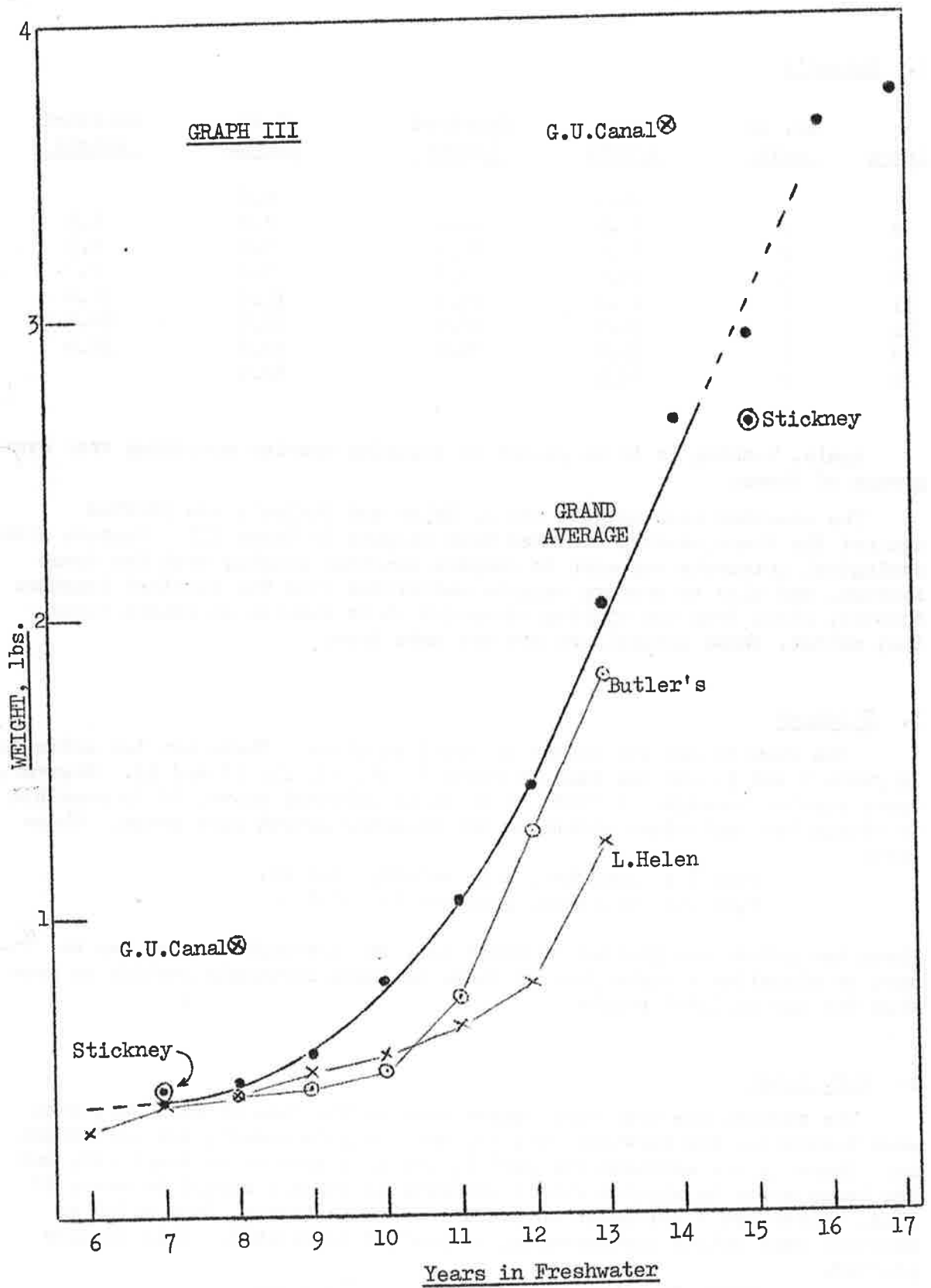
Year 7 : smoothed, mean weight, 6.7 oz.
 Year 15: smoothed, mean weight, 42.2 oz.

These two points are plotted on Graph III, and although the eye may be used to visualise a curve joining them, the data certainly justify no more than the two isolated points.

4. G.U. Canal

The results are even more sparse than in the case of Stickney, even when Northants. and Warwicks results, and the 1966 result, are all lumped in. There is one estimate for year 6, which is plotted on Graph III, and the large error to which a single estimate is subject should be borne in mind. There are 7 estimates in years 12 - 16 inclusive, from which a smoothed mean weight corresponding to year 14 is derived. This is also plotted.

Year 8: (one estimate) 14.5 oz.
 Year 14: smoothed, mean weight, 57.9 oz.



DISCUSSION

The Grand Average line in Graphs II & III is only a very rough approximation to a representative average for the 10 waters involved. Nonetheless, it is not unreasonable to compare it with the average for British eels presented in the Bulletin for December, 1966, p. 14. Considering eels of 15 years in freshwater, we have obtained an average weight of about 2 lb. 15 oz., compared with only about 13 oz. for Age Group 14 from the graph given in 1966.

The eels in Windermere, which showed the fastest growth rate amongst the waters used in the 1966 graph, reached only about 2 lb. in Group 14, whilst those in Hornyold's Worcestershire Pond - which showed the slowest growth rate - reached only about 5 oz. in Group 14.

Assuming there are no gross differences between the estimates made by the various workers who have contributed to these data, we are clearly fishing waters in which the average growth rate is a good deal faster than the average of those which contributed to the 1966 graph. This need not be particularly surprising, if we regard it as reflecting, in part, our success as anglers in selecting waters of better-than-average promise.

Of the four waters we are able to consider individually, it is clear from Graph III that L. Helen has the poorest growth rate; but even L. Helen compares favourably with Windermere over the age range covered.

The growth in Butler's starts below average and about the same as in L. Helen, but improves between years 10 and 11 and is close to average in years 12 and 13. The two points plotted for Stickney lie fairly close to the average line, too

In contrast, the two points plotted for the G.U. Canal both lie well above the average. The weight for year 14 is no less than four times the weight reached in Windermere at this age.

Bearing the limitations of the data in mind, it seems a reasonable provisional conclusion that growth rates are in the order G.U. Canal greater and Stickney and Butler's greater than L. Helen. Of course, there are many factors besides growth rate to take into account, in attempting to assess the angling potential of waters.

Terence Coulson, 2.3.68.

