

THE CONTRIBUTION OF SMALL STREAMS TO POTENTIAL
FISH PRODUCTION IN THE CONWY CATCHMENT

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1. INTRODUCTION

Electro-fishing surveys of rivers and streams in the Conwy River catchment have been carried out for a number of years as part of a programme to monitor fisheries impact of the Conwy A55 tunnel. Most of these electro-fishing sites are on relatively large streams (most widths greater than 3 m) and the relative importance of small streams is less well known. Very small streams (less than 1 m) may not maintain a resident trout population, but may nevertheless be important nursery areas or sources of invertebrates supporting downstream populations. This study was undertaken to estimate the total length and number of small streams in the whole Conwy catchment. In addition to setting the monitoring programme into a catchment concept, the results are of interest in establishing the relative importance of minor streams. They also highlight the need to review means of improving environmental protection of these waters, which do not normally come within standard classification or reporting schemes.

2 USE OF STREAM ORDER

Hydrographers and geographers use the concept of stream order to classify streams in a catchment. This method has been used as a preliminary classification of the Conwy catchment. Working from Ordnance Survey maps, the smallest streams marked are classified as first order rivers. Where two first order rivers come together then a second order river is formed. When two second order rivers join them a third order river results and so on. However, a first order river joining a second order does not change the order of the larger river.

This approach is influenced by map scale. Initially, a scale of 1/25000 was used but this was found to be too detailed. Many streams are shown which are merely field drains or ephemeral water courses. On the map these are not shown as being continuous from their source to the sea, and were thus difficult to classify by stream order.

Although the scale of 1/26720 may have been the most appropriate, it is available for only a limited number of areas of the country which would restrict the scope of this work. Therefore, it was decided to use maps of the scale 1/50000.

3 RESULTS AND DISCUSSION

3.1 Effect of Map Scale

As a preliminary investigation two small catchments (Gyffin and Iwrch) of the Conwy River were classified by river order at both 1/25000 and 1/50000 scales. The larger scale map shows more minor streams and thus higher order streams are found within the catchment. Most second and third order streams on the 1/25000 map appear on the 1/50000 as first and second order streams but there appears to be no relationship between river order at different map scales (Table 1).

The whole of the Conwy catchment was sub-divided into sub-catchments (Fig 1) and the total length of river of each order measured from the map (Table 2).

3.2 Distribution of stream length

To extend the investigation, six of the Conwy sub-catchments were investigated in detail. These were: Iwrch, Lledr, Llugwy, Merddwr, Nant y Goron and Roe. Each stream in each of these catchments was numbered on the attached Ordnance Survey maps and recorded for stream order and length. These results are summarised in Table 3. It can be seen that on a 1/50000 scale map first order streams form between 52% and 66% of the total stream length within a catchment and that in a large catchment containing fourth order rivers (Merddwr, Llugwy and Lledr) the highest order form less than 10% of total river length.

3.3 Distribution of stream area

An attempt was made to estimate the surface area of the lower order tributaries within the whole catchment and to estimate the contribution they make to the total river surface area.

For first order streams a limited number of field measurements were made. Ten streams were measured at their confluence and this was defined as their maximum width. At each site the stream width was measured five times at five metre intervals. It was assumed that the width of a first order stream increases linearly from its source where the width is zero to the maximum width at its confluence. Thus the mean width of first order streams was taken as half the mean of the ten sampled streams.

Second order streams were measured six times. One of these measurements was the beginning of a second order stream (i.e. the confluence of two first orders) and the remaining five were the end of a second order stream (i.e. where two second orders combine or where a second order runs into a higher order river). Due to the incomplete nature of these data a number of widths of second order rivers from electrofishing surveys have been used.

Widths of third and fourth order streams have also been taken from electrofishing surveys. Where these sites were fished in 1987 these data have been used. Otherwise the results from the very extensive survey carried out in 1985 have been used. These data are available, but are not included in this note.

Knowing the mean \bar{x} and standard deviation s of a sample of size n , 95% confidence intervals were calculated from:

$$\bar{x} \pm t_{0.025} \frac{s}{\sqrt{n}}$$

The 95% confidence limits of widths and areas lying in different stream order categories are shown in Table 4.

4 CONCLUSION

In terms of length 1st order streams are the single most important group (61%) and for riparian habitat features are therefore of great importance. Because of their small size (<1m width, Table 4) their contribution to wetted area is smaller (18-20%), but still of significance if, as may occur, salmonids selectively use small streams for egg deposition and fry production.

5 FUTURE WORK

The next phase in the investigation will be to explore actual use of these small Conwy streams. An MSc project on this is now in hand, to be completed by Autumn 1991.

TABLE 1
Comparison of stream order (lengths, km) at different map scales)

<u>STREAM</u>	<u>ORDER</u>	<u>SCALE</u>	
		<u>1/25000</u>	<u>1/50000</u>
Iwrch	1st	20.05	7.50
	2nd	13.80	6.25
	3rd	9.45	
	4th	9.40	
Gyffin	1st	17.98	8.95
	2nd	11.23	4.40
	3rd	8.78	3.65

TABLE 2
Length of rivers of each order in Conwy catchment

all river lengths are in kilometres

<u>Catchment</u>	<u>Order</u>				
	1st	2nd	3rd	4th	5th
Morfa	0.50				
*	2.35				
Gyffin	8.95	4.40	3.65		
Roe	25.95	6.20	7.30		
*	1.85				
Dulyn	13.00	5.65	8.10		
*	0.65	0.30			
Porth-llwyd	8.00	9.25			
*	0.80				
Ddu	4.60	4.10			
Crafnant	11.00	4.40			
*	7.65	0.35			
Llugwy	81.80	24.00	12.60	10.50	
*	1.95				
Lledr	84.55	26.65	15.55	14.35	
Machno	46.15	8.95	9.20	7.95	
*	19.20	4.75	2.40		
Conwy	48.00	20.20	11.75	7.70	18.10
Merddwr	37.35	16.25	8.70	4.35	
Gwrysgog	6.10	3.70			
Iwrch	7.05	6.60			
*	4.00	1.55			
Oakland	4.20	2.15			
Nant y Goron	7.85	4.30	2.15		
*	11.15	6.55			
Maenan	7.10	3.20			
*	2.10	0.35			
Hiraethlyn	17.30	7.90	5.75		
Felin	6.20	8.25	2.80		
*	5.70				
Totals	473.15	175.1	90.30	40.15	18.10

* refers to un-named catchment

TABLE 3
Distribution of stream lengths according to stream order

Catchment	River Order	No. of rivers	Total length (km)	\bar{x}	Mean (km)	Range (km)
Iwrch Total = 13.65 km	1st	5	7.05	51.6	1.41	0.60-2.35
	2nd	1	6.60	48.4	6.60	
Lledr Total = 141.1 km	1st	121	84.55	59.9	0.70	0.10-2.65
	2nd	25	26.65	18.9	1.07	0.15-3.40
	3rd	7	15.55	11.0	2.22	0.45-5.80
	4th	1	14.35	10.2	14.35	
Llugwy Total = 128.9 km	1st	96	81.80	63.5	0.85	0.10-2.85
	2nd	21	24.00	18.6	1.14	0.15-3.75
	3rd	4	12.60	9.8	3.15	1.10-5.85
	4th	1	10.50	8.1	10.50	
Merddwr Total = 66.65 km	1st	44	37.35	56.0	0.85	0.20-4.80
	2nd	13	16.25	24.4	1.25	0.20-3.10
	3rd	4	8.70	13.1	2.18	0.75-3.55
	4th	1	4.35	6.5	4.35	
Nant y Goron Total = 14.30 km	1st	8	7.85	54.9	0.98	0.25-3.25
	2nd	3	4.30	30.1	1.43	0.55-2.60
	3rd	1	2.15	15.0	2.15	
Roe Total = 39.45 km	1st	26	25.95	65.8	1.00	0.30-2.45
	2nd	6	6.20	16.7	1.03	0.40-1.55
	3rd	1	7.30	18.5	7.30	

TABLE 4: Distribution of stream area according to stream order

River Order	Sample Size (n)	Mean Width (m)	95% confidence interval (m)	measured width range (m)		Total Length		Total Area km ² (%)	
				max	min	km	%	upper limit	lower limit
1st	10	0.61	± 0.165	1.17	0.39	473.2	60.8	0.37 (19.5)	0.21 (18.4)
2nd	10	2.78	± 0.701	4.80	1.60	175.1	22.4	0.61 (32.1)	0.36 (31.6)
3rd	10	4.07	± 1.144	2.20	7.90	90.3	11.6	0.47 (24.7)	0.26 (22.8)
4th	16	9.38	± 1.769	17.50	4.90	40.2	5.2	0.45 (23.7)	0.31 (27.2)
TOTAL						778.8		1.90	11.4

Fig.1 Location of tributaries in Conwy catchment

