Institute of Freshwater Ecology

YEAR-CLASS STRENGTHS AND RECRUITMENT IN A GRAYLING POPULATION.

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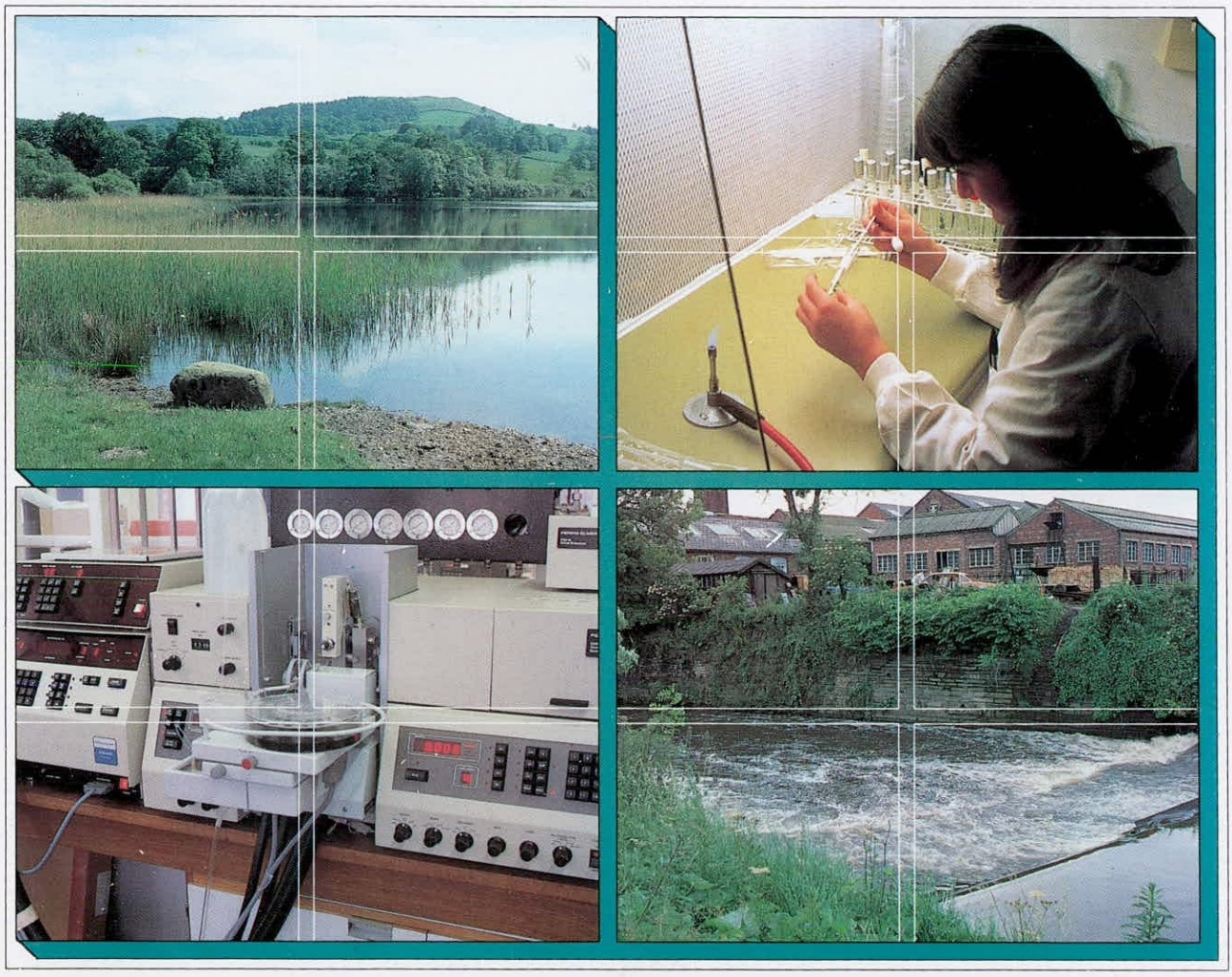

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1. Introduction

Methods for resolving water resource issues for fish have improved in recent years with the advent of a number of hydrological and habitat based models, such as PHabSim. However, these models are not designed to predict the impacts of variations in flow or other environmental factors on fish populations directly.

Most modelling of the man-made impacts on riverine fish populations in this country concerns trout *Salmo trutta* and salmon. *Salmo salar* However, grayling *Thymallus thymallus*, a comparatively understudied fish species, are numerically dominant in large areas of the middle reaches of chalk streams and other rivers. Indeed Huet's original zonation scheme of rivers, afforded a complete zone to grayling. These areas are often subject to the impacts of abstraction, impoundment and other forms of regulation, and grayling are thus a well suited species to study because they are abundant and in most cases less manipulated than trout.

In 1996 the Institute of Freshwater Ecology in collaboration with the Grayling Society Research Fund, Piscatorial Society and Environment Agency commenced a study of the grayling population at 12 sites on the River Wylye, with the following objectives.

2. Objectives

- To quantify fluctuations in recruitment and year-class strength in a grayling population.

- To develop predictive relationships between various environmental factors, including flow levels and the measured fluctuations in year-class strength.

- To model recruitment in a grayling population and to develop a conceptual model for other grayling populations.

This document reports the catches of fish from the first year sampling carried out on 14 and 15 October and makes some assessment of the potential for the current sampling methodology to complete the objectives listed above.

3. Methods

On 14 and 15 October 1996 the Piscatorial Society completed single pass electric fishing surveys on 12, 200m sections of the River Wylye between Heytesbury and Stockton (Fig. 1). All grayling were captured in nets, measured in length and a sample had scales removed for age analysis. All fish were returned to the river alive.

The following environmental measures have or are being collected:-

Local habitat features for each site including width, depth, habitat type and cover.
Measures of flow from the gauging weir at Stockton

Measures of air temperature.

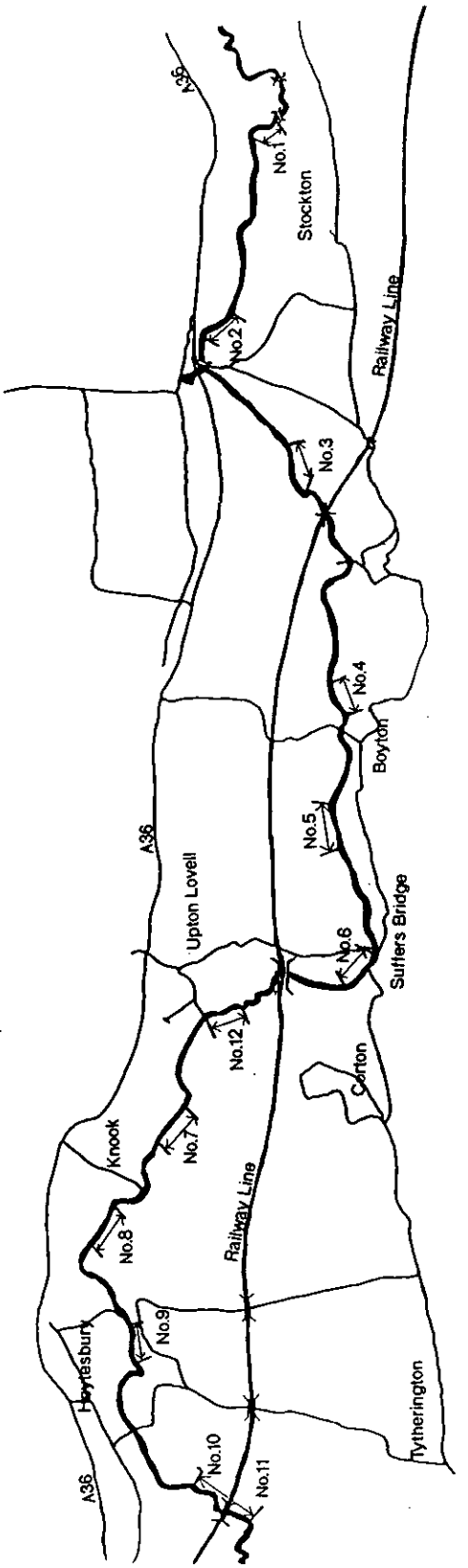

Figure 1. Map of the River Wylye identifying the 12 sites where the grayling population was sampled.

4. Results

In total 733 grayling were captured split between 6 year classes (Table 1). The most recent year-class (1996) contained the largest number of fish. Thereafter, the numbers of fish in each year-class did not decline linearly and more fish were captured from the 1994 year-class than from the 1995 year-class.

Table 1. The numbers and mean sizes of grayling in each year-class captured from 12 sites on the River Wylye in October 1996.

Yearclass	Number of grayling captured	Mean length (mm) ± S.E.
1996	282	134 ± 0.79
1995	152	238 ± 1.28
1994	206	283 ± 1.60
1993	89	330 ± 2.38
1992	2	340 ± 0.50
1991	2	370 ± 12.5
Total	733	

The 1996 year-class could be separated by size from the other year-classes, but there was considerable overlapping of size amongst the other age groups (Fig. 1).

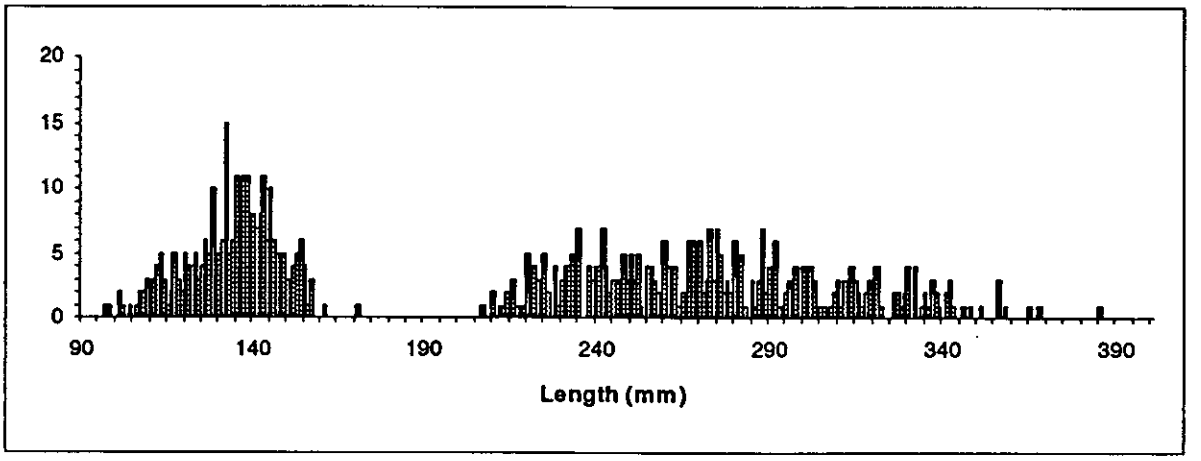

Figure 2. Length frequency histogram of grayling captured at 12 sites on the River Wylye in October 1996

The objectives of this study cannot be achieved within one year so very little analysis was performed. However, even over the small spatial scale of this study there was between site variation in the sizes of fish of the same age and a weak relationship between numbers of fish captured in each site and size was observed both for 0+ and 1+ grayling (Figs. 3 & 4).

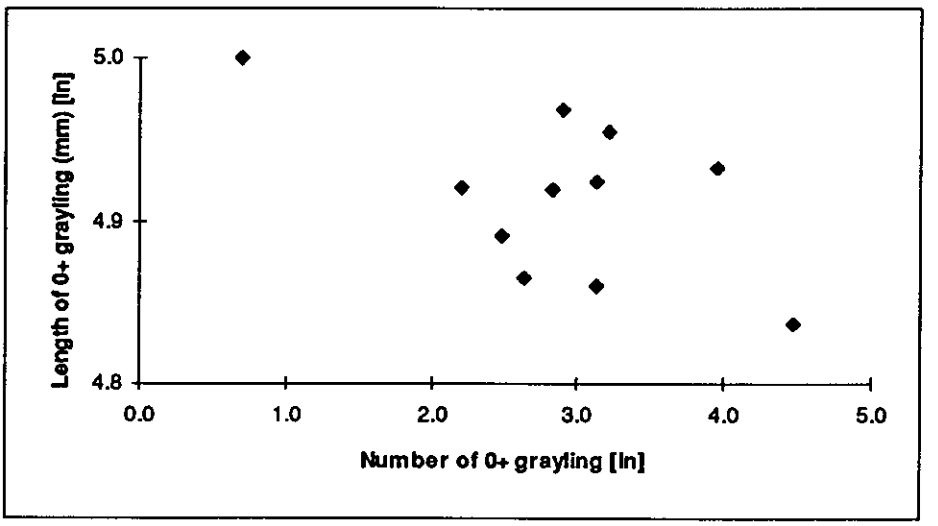

Figure 3. Numbers of 0+ grayling captured at each 200 m site and the mean length at that site (R^2 = 25.0%, p = 0.067)

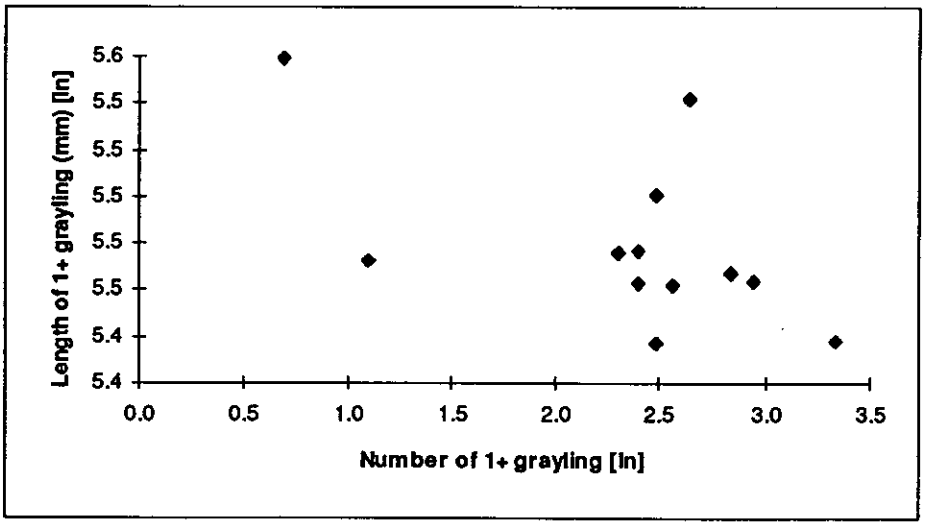

Figure 4. Numbers of 1+ grayling captured at each 200 m site and the mean length at that site (R^2 = 23.8%, p = 0.062)

5. Discussion

One of the biggest problems with sampling grayling populations by electric fishing is that the 0+ fish are often under represented. There is probably not much doubt that the efficiency of capture for these fish will be different than for the older fish but it was encouraging that such a large number were captured.

The greater number of fish in the 1994 year class captured indicates that there are differences in year-class strengths from year to year and this provides evidence that there will be something to measure (fluctuation in recruitment). Since single pass electric fishing techniques provide no estimate of absolute population size it is necessary to calculate indices of year-class strength by comparing the % numbers of fish from a particular year's hatch summed over the years they appear in the catches divided by the mean % number for each age group summed for the life-span of the grayling. In this population calculation of the index value for each year-class will only comprise data from, at best, four years for each age class, since once the fish reach 4 years of age they contribute very little to the grayling population in terms of number (Table 1). This means there is a risk that sampling error in one year will have a significant impact on the value of that index. Despite this, strong and weak classes should still be readily identifiable enabling enough information to be collected to test hypotheses relating to the cause of strong and weak year-classes.

In dace and other coarse fish species it was observed that warm years produced strong year-classes (e.g. Mills & Mann, 1985) and this was related to increased growth rates driven by temperature. However, the ability to explain 25% of the variation in mean size from the number of fish captured in this study (Fig. 3), demonstrates that density may have an important influence on growth rates. The relevance of this, to and of recruitment success will hopefully become clearer in future years.

References

Mills, C.A. & Mann, R.H.K. (1985) Environmentally induced fluctuations in year-class strength and their implications for management. *Journal of Fish Biology* **27** (Supplement A), 209-226.

APPENDIX A.

Individual lengths (mm) of all grayling captured at 12 sites on the River Wylye in October 1996.

Site 1 Glebe Farm	
144	
153	
225	
239	
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350	
351	
360	

Site 2 Stockton		
97		327
107		329
108		332
113		335
116		336
119		337
122		338
123		339
126		342
127		342
128		346
128		346
129		348
135		349
139		351
139		354
140		356
140		356
143		365
143		365
144		385
145		
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Site 3 Lower Boyton	
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276	
287	
311	
314	
338	
368	

Site 4 Lower Boyton Bridge				
101		130		267
101		130		275
102		130		276
104		131		277
106		131		280
107		132		285
109		132		288
110		132		290
110		132		290
111		133		291
111		133		292
111		134		292
112		135		301
112		136		302
113		137		310
113		138		314
113		139		314
114		140		315
114		141		316
115		141		318
117		142		319
117		144		321
117		144		322
117		145		323
118		146		327
118		146		330
119		147		332
120		148		334
120		149		341
120		152		342
120		153		342
120		153		356
120		154		
121		210		
121		220		
122		222		
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123		228		
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124		231		
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125		239		
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126		246		
127		247		
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129		265		
129		265		

Site 5 Middle Boyton The heronry			
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Site 6 Upper Boyton Sutters Bridge			
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Site 7 Lower Knook	
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Site 8 Knook Car Park		
112		270
126		273
128		274
129		275
132		279
134		281
135		281
135		285
138		287
138		288
138		288
141		289
142		292
144		300
149		300
152		303
154		308
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Site 9 Heytesbury Mill		
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Site 10 Parsonage below viaduct		
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Site 11 Parsonage above viaduct			
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Site 12 Upton Lovell				
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127		233		321
128		234		338
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131		238		
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