River Don fisheries surveys: October 1997 survey

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Institute of Freshwater Ecology

River Laboratory
East Stoke
WAREHAM Dorset
BH20 6BB

Tel: 01929 462314
Fax: 01929 462180

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A.T. Ibbotson, BSc, PhD, Grad IPM, MIFM
A. Pinder
P. Scarlett, BSc, Msc
S. Harrison, PhD
T. Wild

Project Leader:	A T Ibbotson
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Figures

1. EXECUTIVE SUMMARY

1. As a condition of drought orders imposed on several West Yorkshire rivers in 1996, eight sites on the River Don were surveyed in March and October 1996 and 1997 and an additional two sites on the River Hipper were sampled in October 1997.

2. In 1997 there appears to have been a general decline in recruitment of 0+ brown trout at most sites.

3. The decline on the River Sheaf was particularly severe and the combination of most captured trout having a fungal infection suggests that this site might be the subject of occasional episodes of acidity.

4. For the second year in a row no 0+ brown trout were captured on the River Rivelin, suggesting that the brown trout population in this river is under threat of extinction.

2. INTRODUCTION

As a condition of drought orders imposed on several West Yorkshire rivers during 1996, Yorkshire Water are obliged to carry out fishery surveys on the relevant watercourses. These surveys are intended to take place for three years from the imposition of the drought order. This report presents the results of the survey carried out in October 1997, and draws conclusions about the impacts of the drought orders using data from this survey and previous surveys. One further survey is expected to be completed in October 1998.

3. METHODS

3.1. Sampling procedures

Between 23 and 28 October 1997 the fish populations at eleven sites on the River Don catchment were surveyed (Table 3.1). The location of each site had been predetermined. Each site comprised a 50 m length of river and, with the exception of additional sites on the River Hipper and one at Hazlehead, were located in exactly the same place as previous survey sites which had been 'triple shocked' in March 1996, October 1996 and March 1997.

Each section was blocked at both ends with stop nets and electric fished three times, with 40 minute breaks between each electric fishing. All species of fish were removed to holding bins and after processing were returned to the river alive. Brown trout and grayling were measured (fork length) to the nearest mm, weighed and had scales removed for age analysis. Other species were only measured to the nearest mm (fork length).

At each site a schematic diagram was made of the site.

For direct comparison between the results of this survey and that of previous surveys data is only presented from the 'triple shock' sections at each site.

Comparison between years and for identification of impacts analysis is concentrated on the 0+ brown trout since the populations of adults are affected by stocking and angling at many of the sites.

3.2 Statistical analysis

Densities of brown trout and grayling were estimated using the exact maximum likelihood equation of the multiple catch depletion method (Carle & Strube, 1978; Seber, 1982). Where the confidence limits suggested that the population estimates were not valid, or the efficiency of capture is low, then the total number of fish caught is used as the best minimum density estimate.

Because of the requirement to present data in a form compatible with the use of HABSCORE analysis estimates of brown trout density was completed for the following three age and size groups:-

i) 0+
ii) trout older than 0+ but less than 200 mm (FL)
iii) trout greater than 200mm (FL)

Other species numbers and lengths were not analysed, since in the opinion of the authors the numbers of fish captured were so low or the efficiency of capture for those species was never sufficient to warrant meaningful further analysis, although they are presented in a separate appendix for information.

Densities of all brown trout and 0+ brown trout between the two spring surveys and between the two autumn surveys were compared using the z test (5% level of significance).

The T-test was used to compare differences in size of 0+ brown trout between years.

Table 3.1 Dates and National Grid References of sites surveyed.

Site name	Date surveyed	Site Designation	National Grid Reference
River Sheaf	28 October 1997	Unregulated Control	SK 327 823
River Don at Hazlehead Upper	26 October 1997	Regulated Control	SE 212 028
River Don at Hazlehead Lower	26 October 1997	Regulated Control	SE 213 031
River Don d/s Winscar Reservoir	25 October 1997	Regulated Control	SE 158 024
River Don at Oxspring	24 October 1997	Regulated Part-Affected	SE 278 016
Ewden Beck	28 October 1997	Regulated 50 %	SK 293 955
Little Don d/s Underbank Reservoir	23 October 1997	Regulated 66%	SK 255 992
River Loxley at Storrs Lane Bridge	24 October 1997	Regulated 66%	SK 299 895
River Rivelin at Rivelin Mill	25 October 1997	Regulated 66%	SK 289 871
River Hipper Upper	27 October 1997	Unregulated Control	SK 354 702
River Hipper Lower	27 October 1997	Unregulated Control	SK 357 703

4. RESULTS

4.1 Brown trout

4.1.1 0+ age group

With the exception of the Little Don and Hazlehead there has been an overall decline in the density of 0+ trout captured at all the River Don sites this year (Table 4.1, Fig. 4.1a). This decline was significant at the River Sheaf, Winscar Reservoir, Ewden Beck and River Loxley sites. No 0+ brown trout were captured at the River Rivelin site.

The increases at the Hazlehead Lower and Little Don sites were significant although they both represent very low densities.

Table 4.1 Mean density (n/m^2 ± 2xSE) of 0+ brown trout at each of 11 sites on four occasions on the River Don catchment.

Site name	March 1996 $n/m^2 \pm 2xSE$	March 1997 $n/m^2 \pm 2xSE$	October 1996 $n/m^2 \pm 2xSE$	October 1997 $n/m^2 \pm 2xSE$
River Sheaf	0.133 ± 0.071	0.034	0.030	0.0076
Hazlehead Upper	-	-	-	0.054 **
Hazlehead Lower	0	0.0051	0	0.0051
Winscar Reservoir	0.189 ± 0.031	0.067	0.100 ± 0.034	0.033
Oxspring	0.0123	0	0.0049 **	0.0049
Ewden Beck	0.174 ± 0.0095	0.099 ± 0.0169	0.134 ± 0.0096	0.0040
Little Don	0.030 **	0	0.0030	0.0061
River Loxley	0.066 ± 0.0197	0.063 ± 0.0085	0.201 ± 0.0191	0.069 ± 0.0083
River Rivelin	0.140 ± 0.199	0	0	0
Hipper Upper	-	-	-	0.0175
Hipper Lower	-	-	-	0.047

** represents minimum density estimate

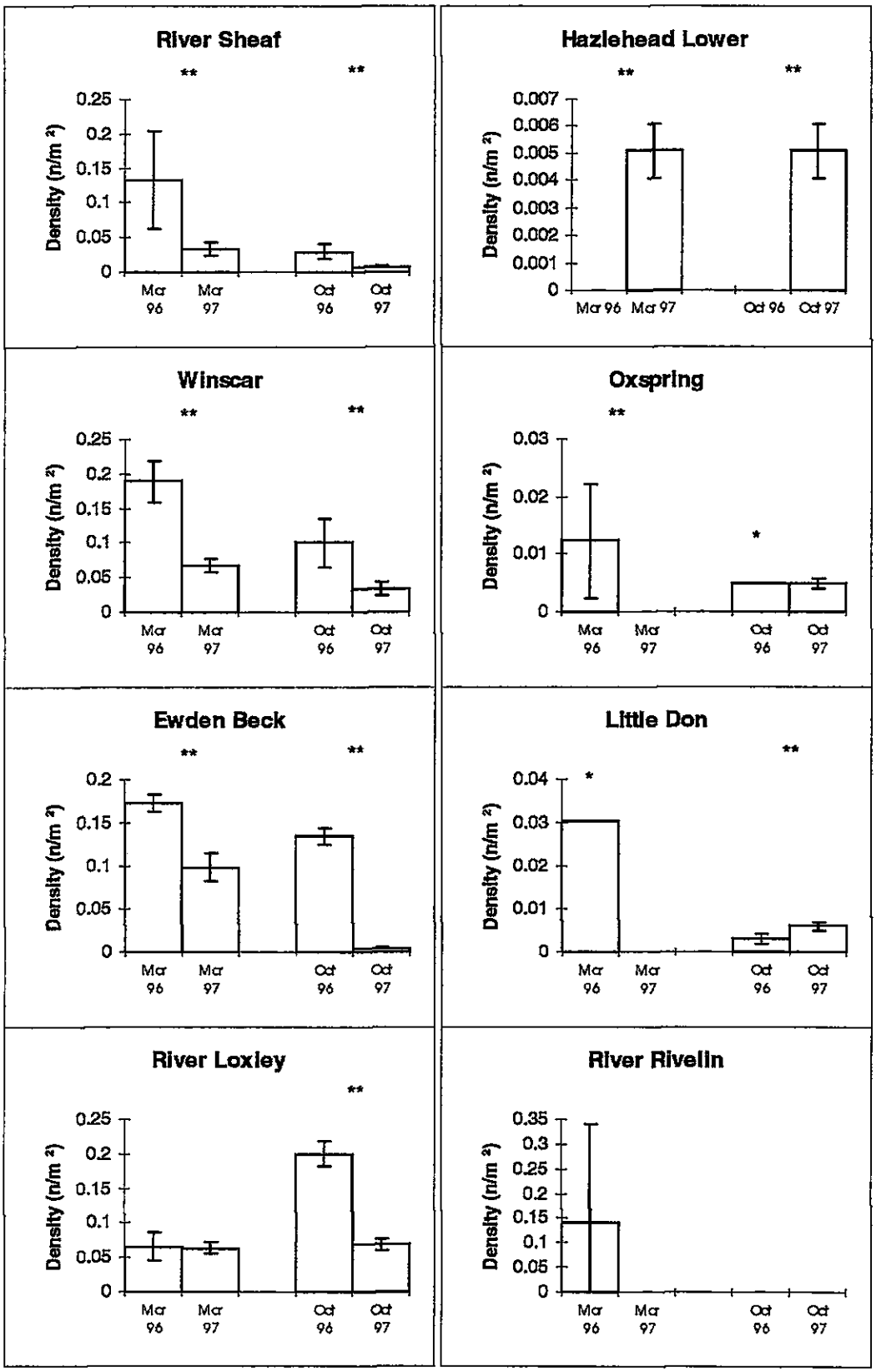


Figure 4.1a Summaries of densities (n/m^2) of 0+ brown trout (2 x standard errors) at eight sites on the River Don sampled on four occasions. * represents minimum density estimates. ** significant differences (z test, 5% level) between times.

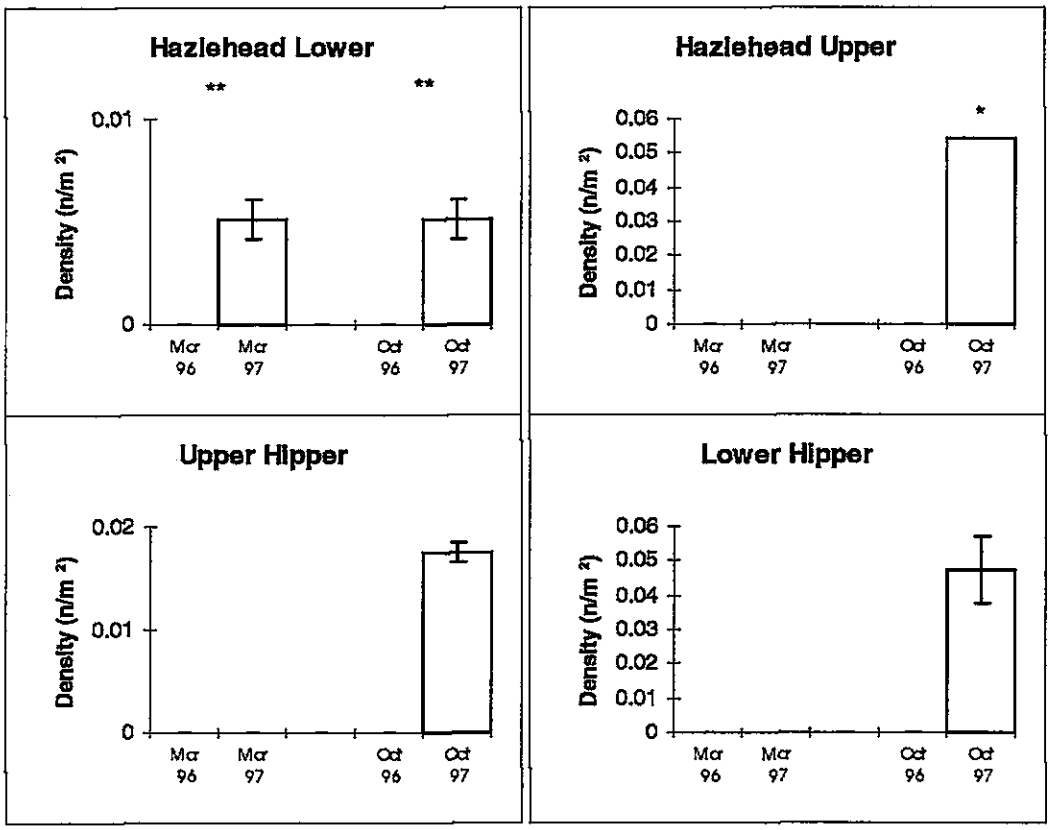


Figure 4.1b Summaries of densities (n/m^2) of 0+ brown trout (2 x standard errors) at the two Hazlehead and River Hipper sites. * represents minimum density estimates. ** significant differences (z test, 5% level) between times.

There were no significant changes in the growth rates of the 0+ brown trout in comparison with last October's survey with the exception of the River Loxley where there was a small increase in the mean size (Table 4.2, Fig. 4.2).

Table 4.2 Mean length (mm ± 95% CL) of ~~all ages of~~ brown trout at each of 11 sites on four occasions on the River Don catchment.

Site name	March 1996 mm ± 95% CL	March 1997 mm ± 95% CL	October 1996 mm ± 95% CL	October 1997 mm ± 95% CL
River Sheaf	80 ± 11.1	77 ± 7.3	66 ± 8.0	65 ± 5.0
Hazlehead	93 ± 8.7	79 ± 6.8	80 ± 8.6	86 ± 8.9
Winscar Reservoir	56 ± 9.3	75 ± 7.2	70 ± 3.3	76 ± 4.3
Oxspring	107 ± 17.0	80 ± 8.0	84 ± 14.0	79 ± 2.5
Ewden Beck	91 ± 8.1	92 ± 12.3	80 ± 10.6	90
Little Don	96 ± 13.4		85 ± 4.1	94 ± 4.5
River Loxley	79 ± 12.0	73 ± 9.8	66 ± 8.0	71 ± 8.7
River Rivelin	82 ± 9.4			
River Hipper				71 ± 5.3

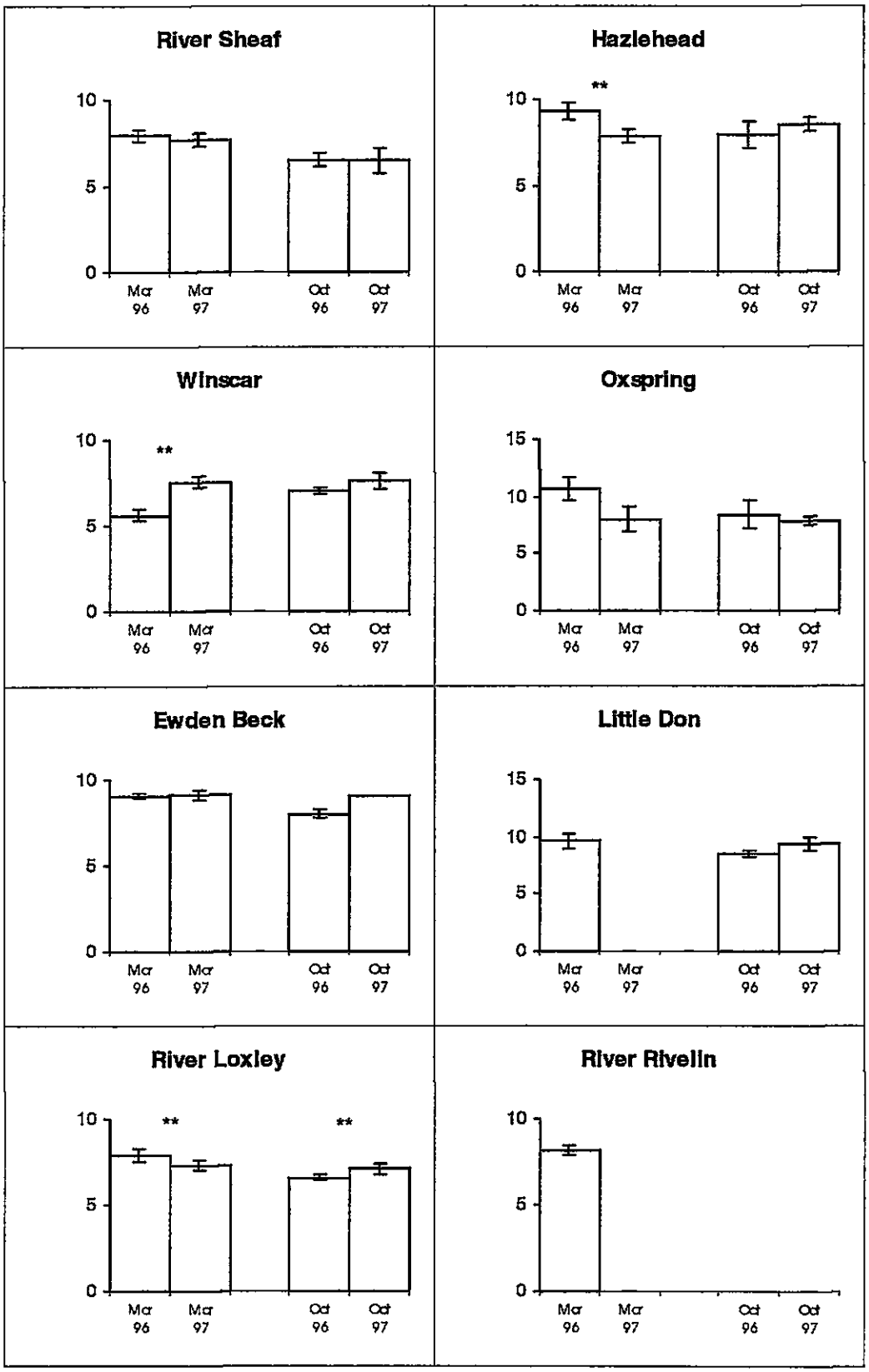


Figure 4.2 Mean lengths (error bars are 95% confidence limits) of 0+ brown trout at eight sites sampled on four occasions on the River Don. ** represents significant differences (ttest, 5% level) between times.

4.1.2 All age groups of brown trout

The general reduction in the density of 0+ brown trout is reflected in the densities of all ages of brown trout at each of the sites, with significant falls at the River Sheaf, Ewden Beck and River Loxley sites (Table 4.3, Fig. 4.3). Significant declines were also observed at the Hazlehead Lower and River Rivelin sites.

Table 4.3 Mean density ($n/m^2 \pm 2xSE$) of all ages of brown trout at each of 11 sites on four occasions on the River Don catchment.

Site name	**March 1996** $n/m^2 \pm 2xSE(D)$	**March 1997** $n/m^2 \pm 2xSE(D)$	**October 1996** $n/m^2 \pm 2xSE(D)$	**October 1997** $n/m^2 \pm 2xSE(D)$
River Sheaf	0.255 ± 0.087	0.141	0.262 ± 0.035	0.103
Hazlehead Upper	-	-	-	0.102**
Hazlehead Lower	0.0204	0.064	0.076	0.053
Winscar Reservoir	0.62 ± 0.164	0.278	0.34 ± 0.034	0.36
Oxspring	0.0270	0.042	0.071**	0.0294
Ewden Beck	0.285 ± 0.0095	0.237 ± 0.033	0.32 ± 0.0097	0.138 ± 0.0168
Little Don	0.052**	0.0030	0.0061	0.0121
River Loxley	0.37 ± 0.044	0.163 ± 0.0222	0.39 ± 0.0191	0.248 ± 0.0206
River Rivelin	0.18 ± 0.199	0.087	0.173 ± 0.0174	0.053
Hipper Upper	-	-	-	0.117
Hipper Lower	-	-	-	0.150

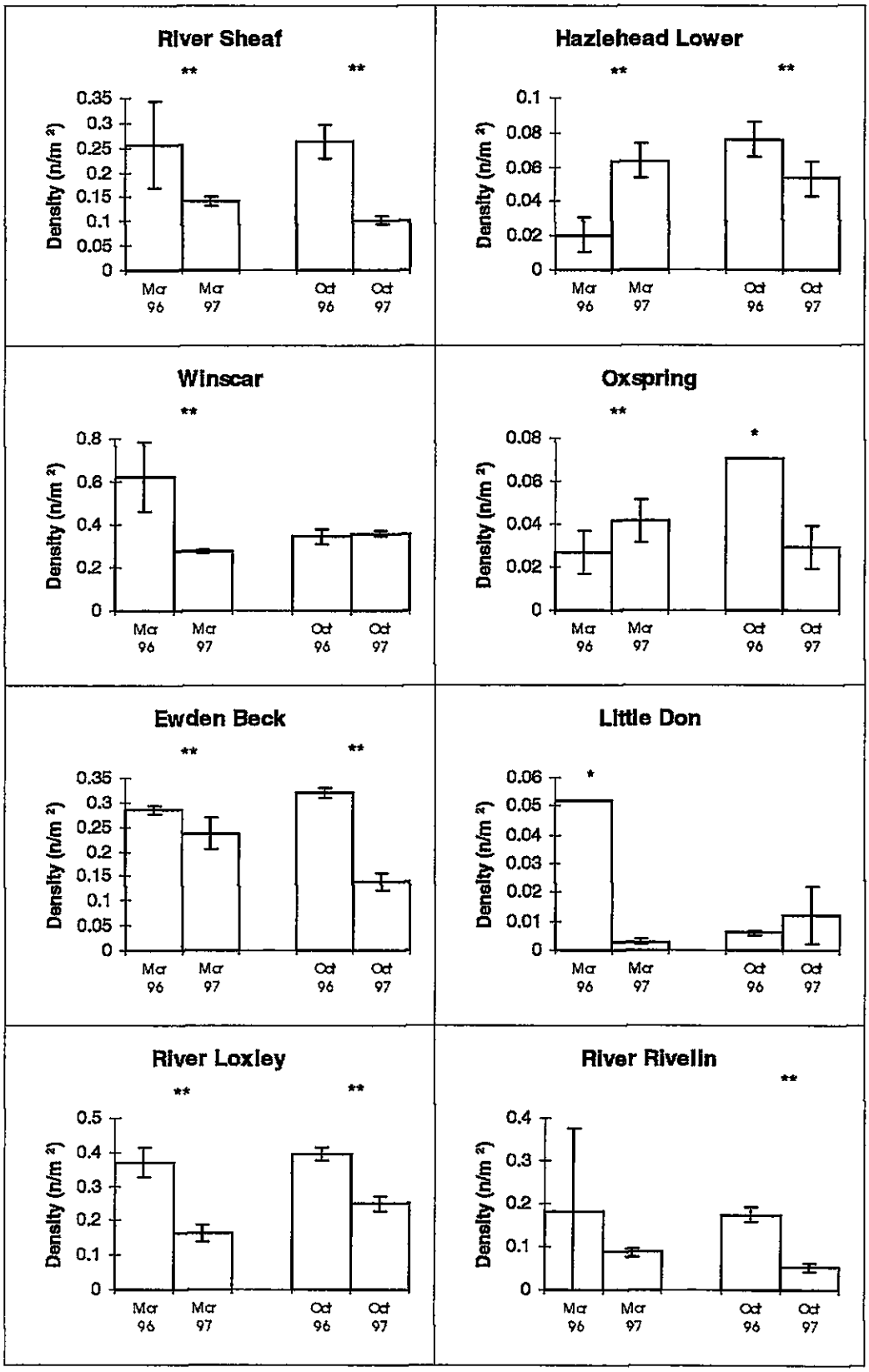


Figure 4.3a Summaries of densities (n/m^2) of all ages of brown trout (2 x standard errors) at eight sites on the River Don sampled on four occasions. * represents minimum density estimates. ** significant differences (z test, 5% level) between times.

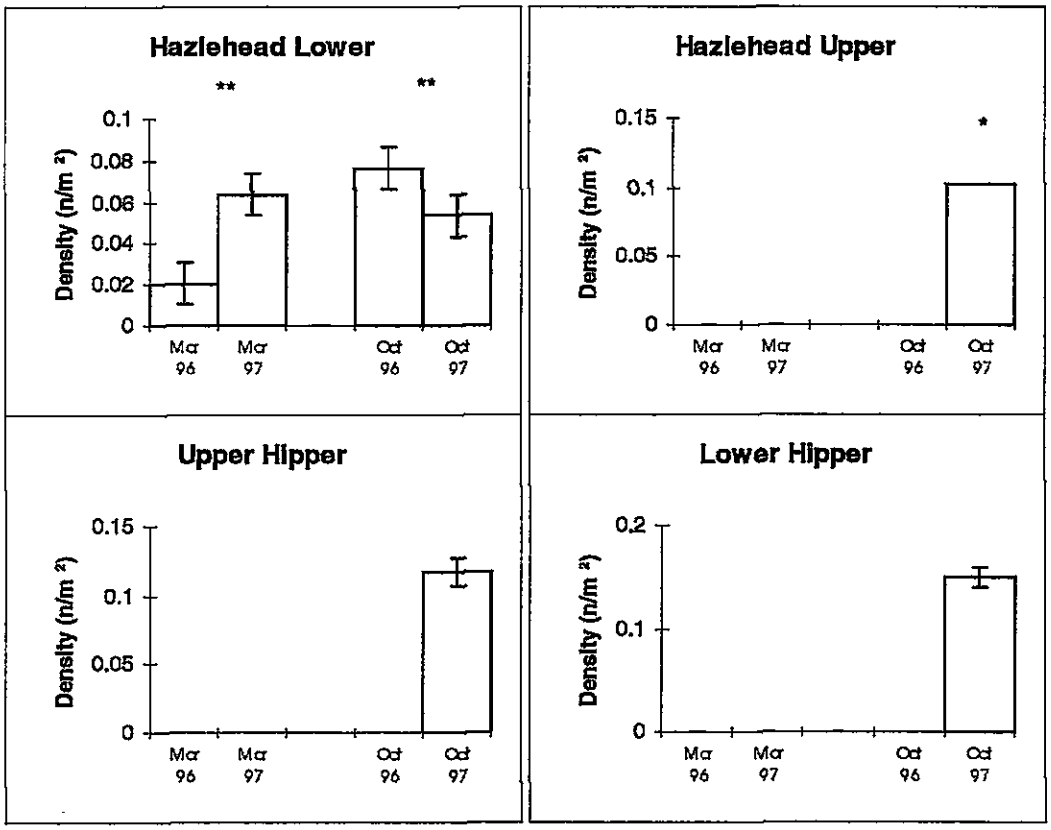


Figure 4.3b Summaries of densities (n/m^2) of all ages of brown trout (2 x standard errors) at the two Hazlehead and River Hipper sites. * represents minimum density estimates. ** significant differences (z test, 5% level) between times.

4.2 Grayling

Grayling were only captured at the Oxspring site (Table 4.4)

Table 4.4 Mean density (n/m^2) and ± 2 x SE of grayling at each of two sites on four occasions on the River Don catchment.

Site name	March 1996 n/m^2 ± 2xSE	March 1997 n/m^2 ± 2xSE	October 1996 n/m^2 ± 2xSE	October 1997 n/m^2 ± 2xSE
Oxspring	0.0172	0.052	0.071	0.0294
Hazlehead Lower	0.0051	0.041 ± 0.031	0.0229	0

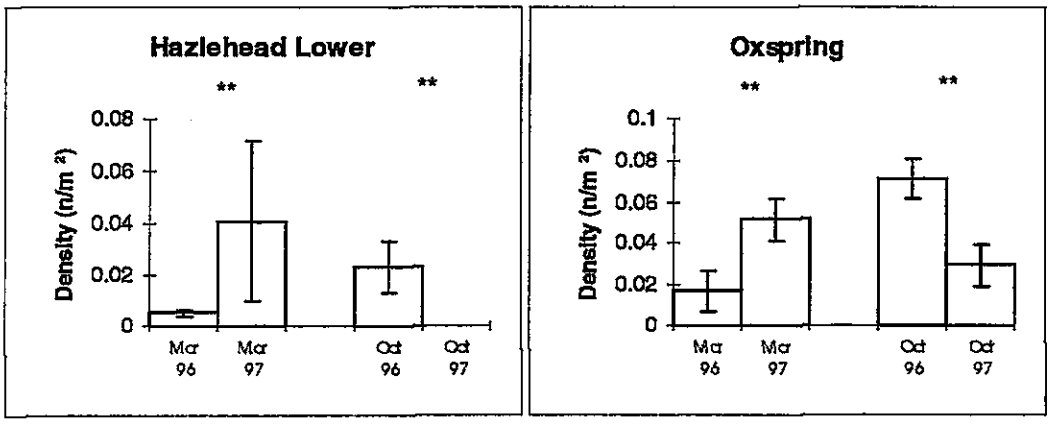


Figure 4.4 Summaries of densities (n/m^2) of all ages of grayling (2 x SE) at two sites on the River Don sampled on four occasions. * represents minimum density estimates. ** significant differences (z test, 5% level) between times.

5. DISCUSSION

5.1 Site by site

5.1.1 River Sheaf

Since the first estimate of 0+ trout abundance in March 1996 the density of these fish has fallen dramatically at this site. The reasons for this are not clear because it is a control site. There was a period in the autumn of 1996 when very large amounts of sediment were released from the reservoir upstream. There is some possibility that this may have damaged fish recruitment by silting spawning grounds and or redds if the release continued into the spawning season. However, there has been a general decline in 0+ recruitment at most sites this year and the decline here may simply be a part of that.

5.1.2 Hazlehead

The Hazlehead Lower site does not have the type of habitat that one would normally find large numbers of 0+ trout in. It is deep and slow flowing because it is backed up from the weir downstream, thus although densities of 0+ fish have increased significantly from no 0+ fish at all their numbers are still very low at this site and no importance should be read into this apparent increase. The Hazlehead Upper site, however, includes a large sized riffle and a more 0+ trout were captured here. Densities compared favourably with densities from other sites, in particular the control sites on the River Sheaf and River Hipper

No grayling were captured at Hazlehead at all, whereas in previous surveys they had been. The reason for this is not clear. It may have been partly to do with chance and partly due to the omission of one of the deeper pools from the survey.

5.1.3 Winscar Reservoir

Densities of 0+ trout here have fallen significantly from last October's survey, although the reason for this is not clear except that similar declines have been observed in other sites. The faster growth rates of these fish first observed in 1996 has continued. This was originally thought to be because of higher temperature water being released from the reservoir when the stock levles were low. The maintained growth rates may be the result of the lower density.

5.1.4 Oxspring

There was very little change in the density of 0+ trout at this site from past surveys. This site has always had low densities of these fish in comparison to the control sites and therefore it is not a veyr good place to assess changes in levels of recruitment.

Numbers of grayling captured at this site declined significantly from the October 1996 survey. This need not be a major concern since there should be some considerable variation expected from sampling a short 50 m section of river. This is particularly the case as a small artificial weir had been constructed immediately upstream from the section and such structures are well known as fish attractors. This could have had the effect of moving fish upstream towards it and hence out of the section being surveyed.

5.1.5 Ewden Beck

The greatest reduction in 0+ recruitment occurred at this site. Whilst conducting the survey it was noted that the water was very heavily peat stained. On investigation this was traced back to the release from the reservoir upstream. Many of the fish captured appeared to be covered in fungus. The reasons for the fall in recruitment and the fungus are not known, but it is possible that the peaty water was indicative of a low pH release from the reservoir and the fungus was a symptom of high levels of stress. Bearing in mind the previous unexplained observations of apparently stocked juvenile rainbow trout and absence of older fish, it is recommended that this water is checked for episodic acidic releases from the reservoir to test the hypothesis that the population of trout in this river is subject to occasional collapse from such events.

5.1.6 Little Don

There has been a small but significant increase in the recruitment of 0+ trout at this site over the previous October survey, although densities are still very low in comparison to the control sites. Undoubtedly the minewater discharge and ferrous deposits will have had a significant impact on this river.

5.1.7 River Loxley

As with the other sites with significant recruitment, there has been a large fall in the number of 0+ trout over the previous October survey, the reason for which cannot be assertained from this study. This coincided with a small but significant increase in the growth rates of these fish which could have resulted from the lower density.

5.1.8 River Rivelin

For the second year in succession there were no 0+ trout captured at this site. Confirmation of last year's failure to recruit was obtained this year when no 1+ fish were captured in the survey. The reduction of the area of water surveyed may have contributed to the failure to catvh any 0+ trout in October 1997 and therefore confirmation of the recruitment failure agsin this year may be required from the October 1998 survey. During that survey it is recommended that an additional 50 m section is added to the survey to increase the amount of habitat surveyed.

The reduction of the sampling effort at this site resulted in the section that contained grayling in previous surveys being omitted from the October 1997 survey. Thus, no grayling were captured in this survey.

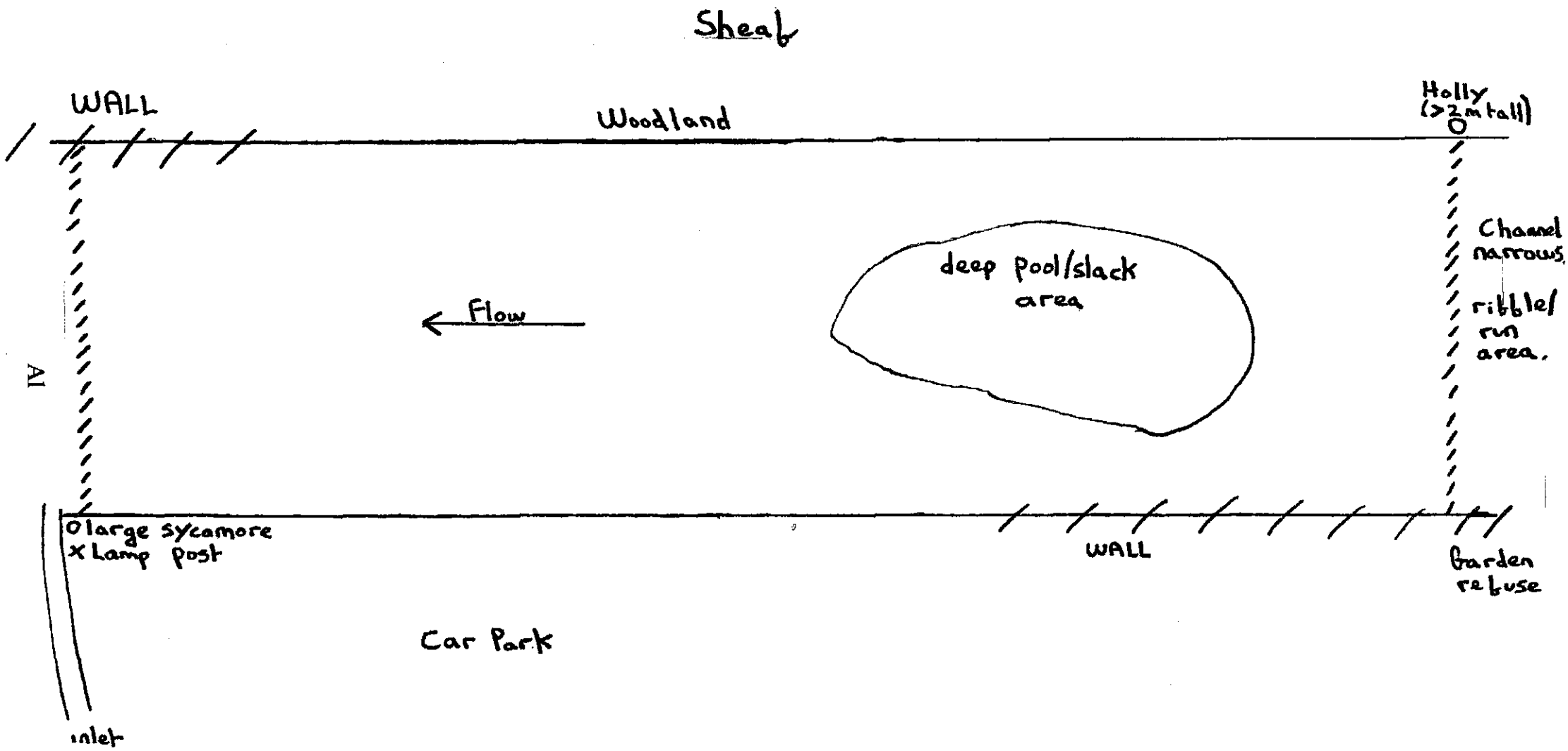
5.2 General

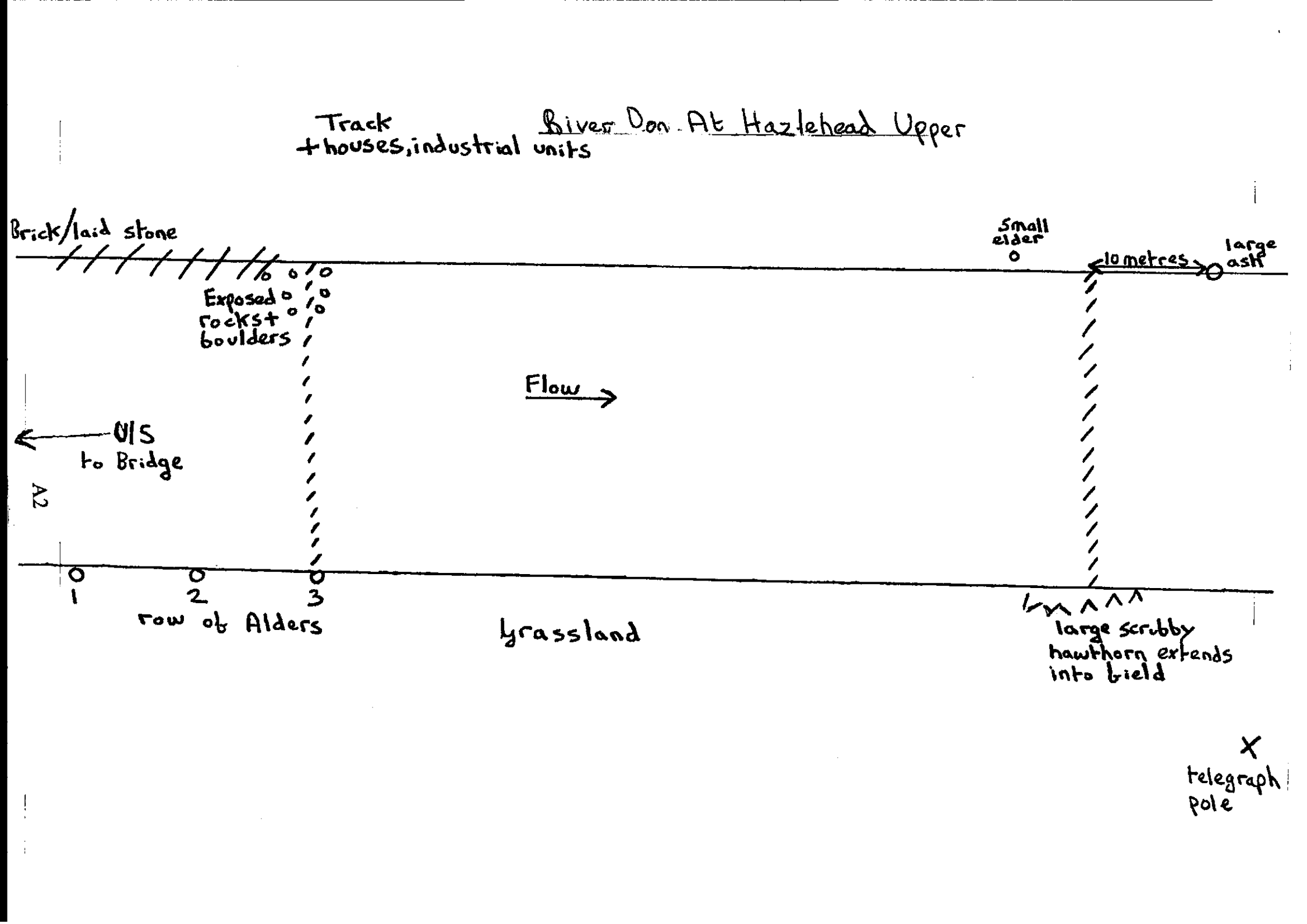
It is not possible to ascribe any impacts of the drought orders to any particular change in the trout populations. There has been a general decline in the 0+ trout populations at most sites including the control site on the River Sheaf.

The only real conclusions that can be drawn are that there has been a second year of failed recruitment on the River rivelin and although there has been some improvement in the recruitment on the Little Don, this is still at a very low level.

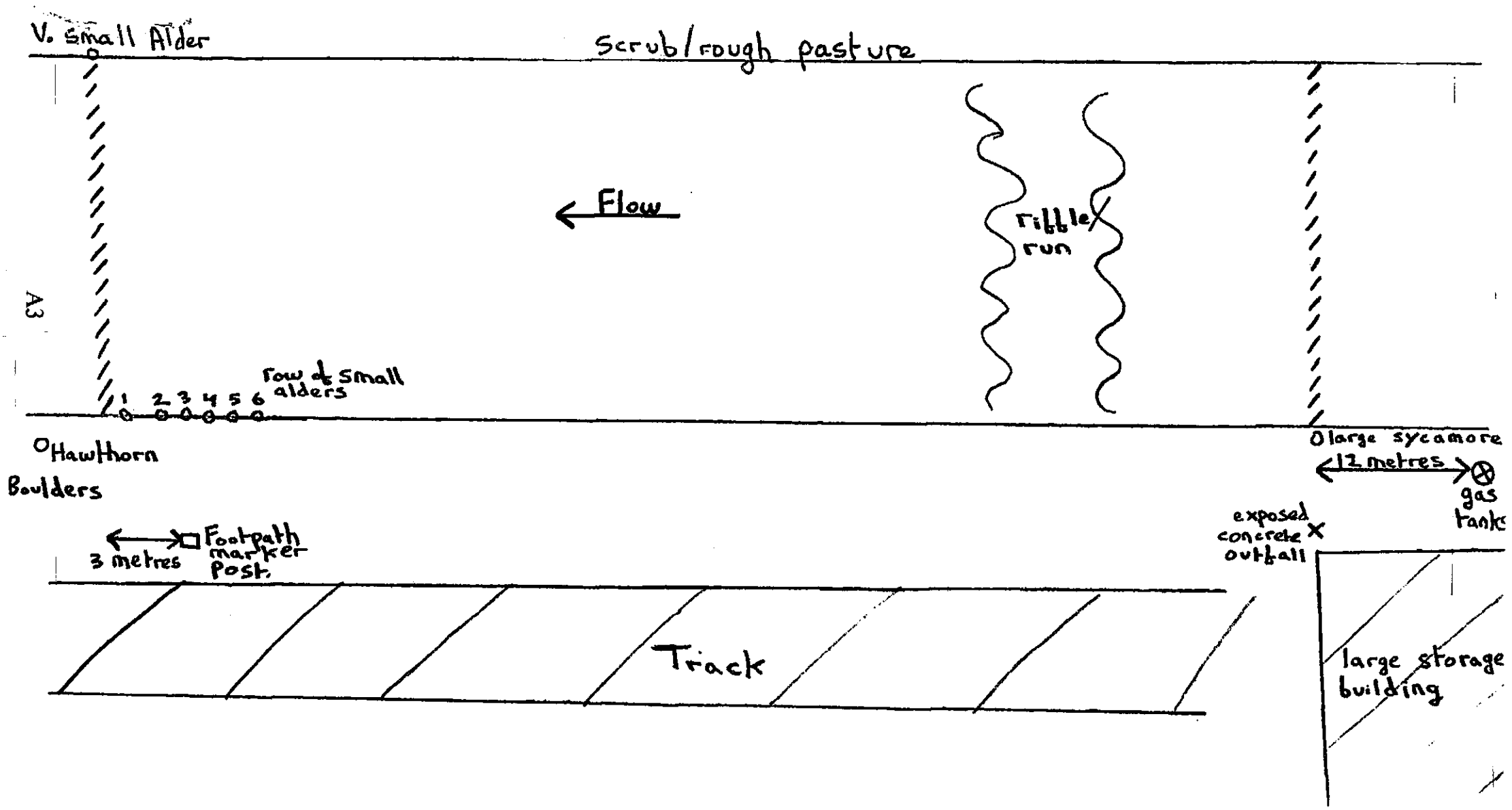
Appendix A

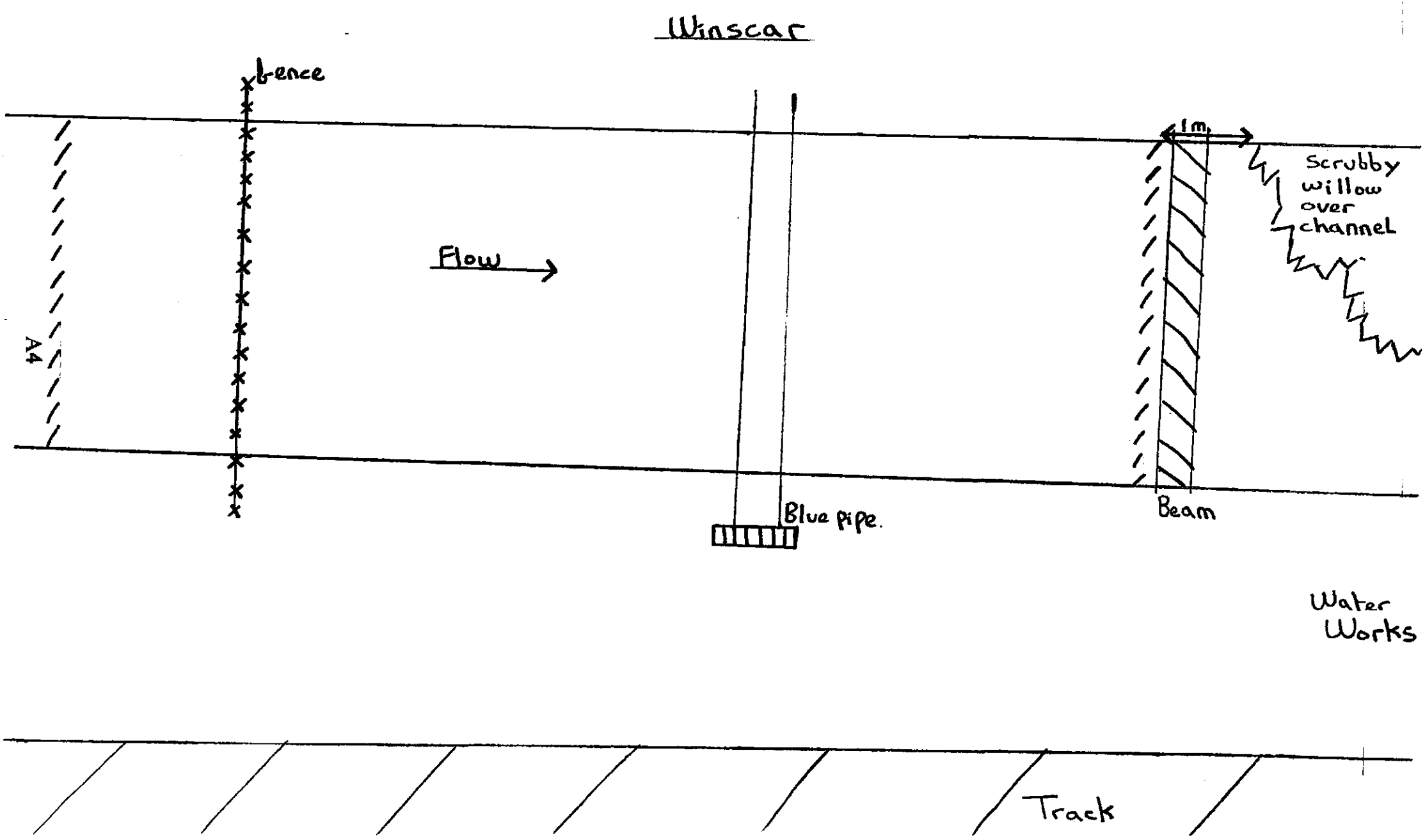
Maps of the sites surveyed

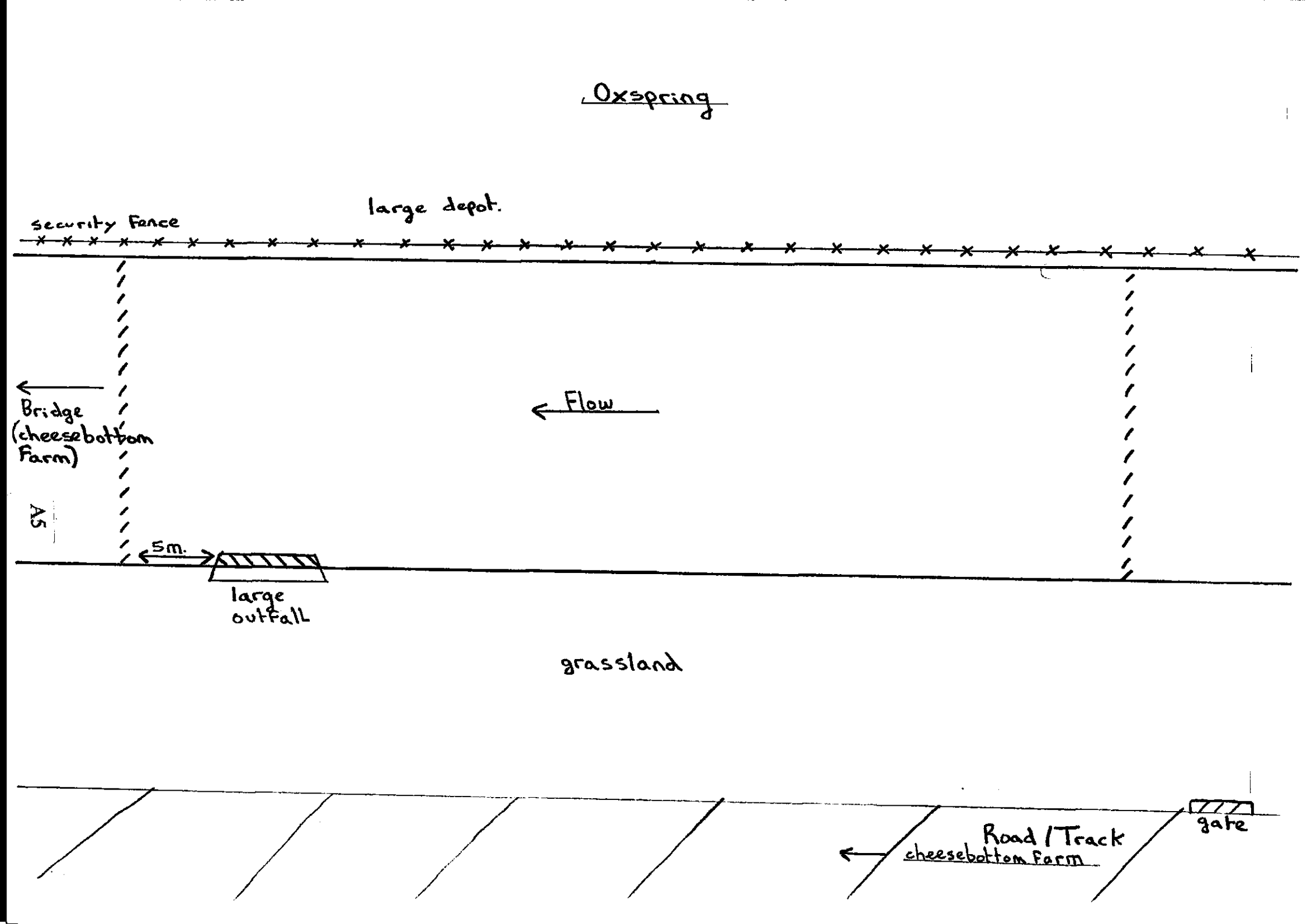

Sheaf
WALL
Woodland
Holly (>2m tall)
Channel narrows
ribble/ run area.
deep pool/slack area
Flow
A1
large sycamore
Lamp post
WALL
Garden refuse
Car Park
inlet

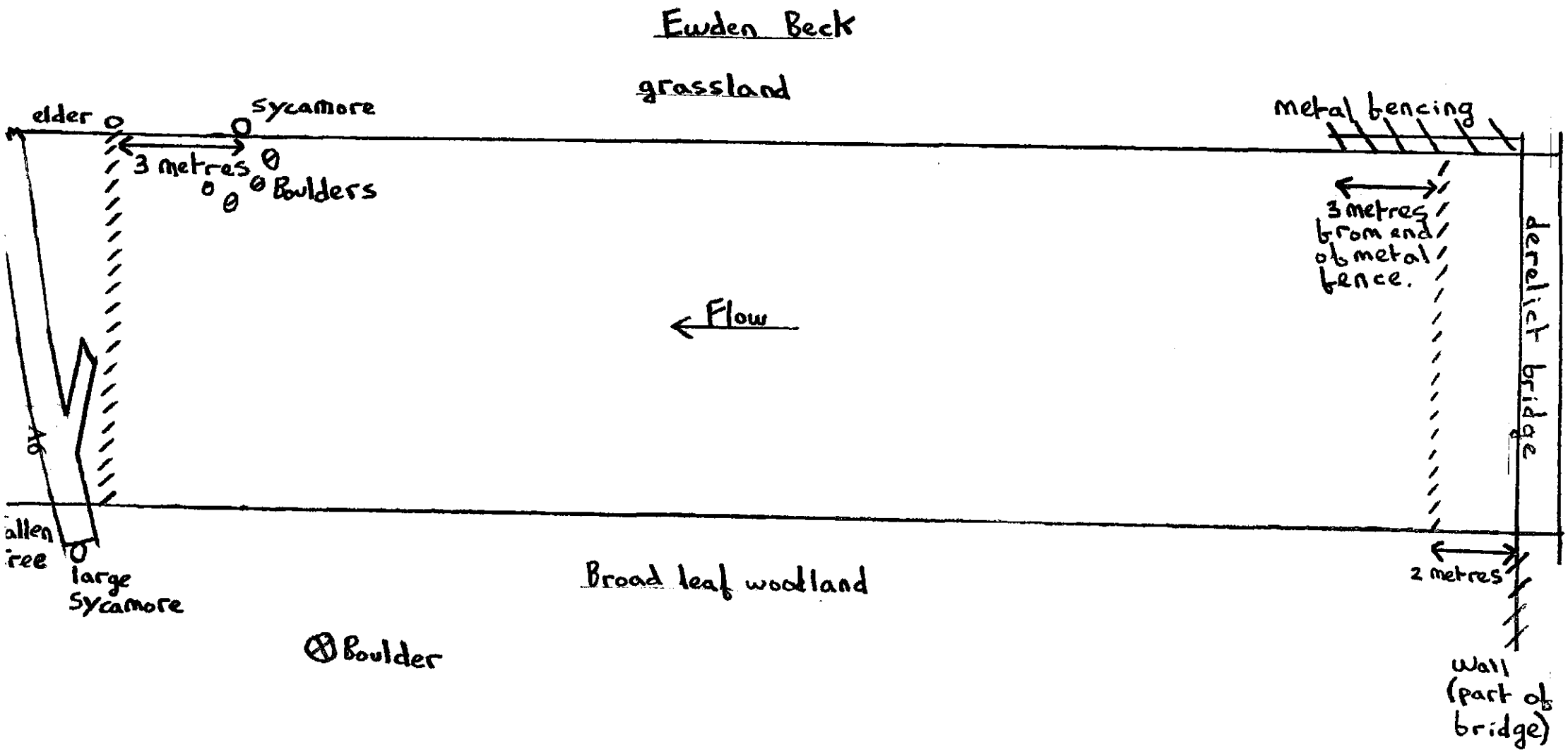

Track
+houses, industrial units
River Don At Hazlehead Upper
Brick/laid stone
Exposed rocks+ boulders
small elder
10 metres
large ash
Flow
O/S to Bridge
A2
1
2
3
row of Alders
grassland
large scrubby hawthorn extends into field
telegraph pole

River Don At Hazlehead Lower

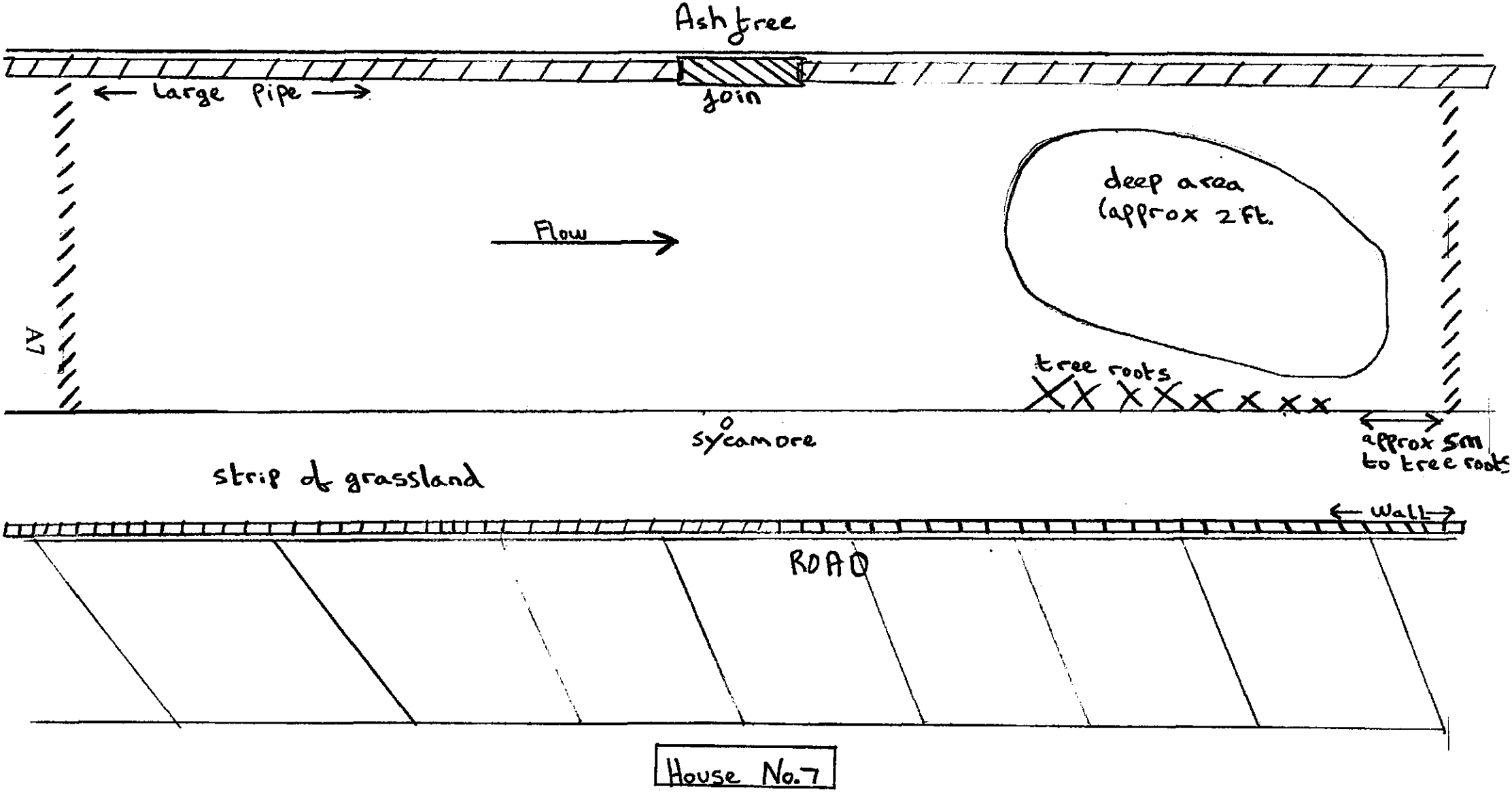


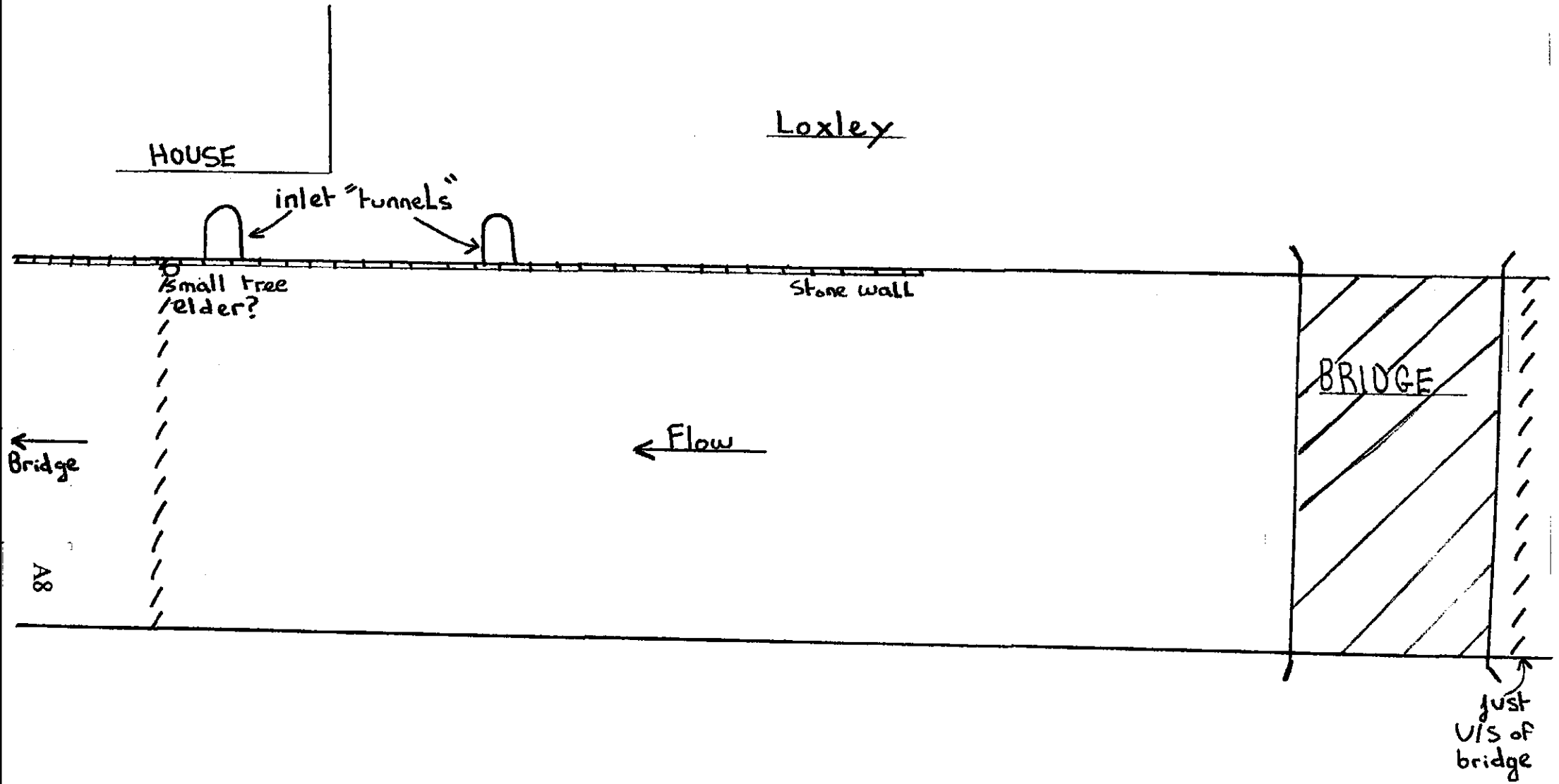

Winscar
Fence
Flow
A4
Blue pipe.
1m
Beam
Scrubby willow over channel
Water Works
Track


Oxspring
large depot.
security Fence
Bridge (cheesebottom Farm)
Flow
A5
5m.
large outfall
grassland
Road / Track
cheesebottom Farm
gate

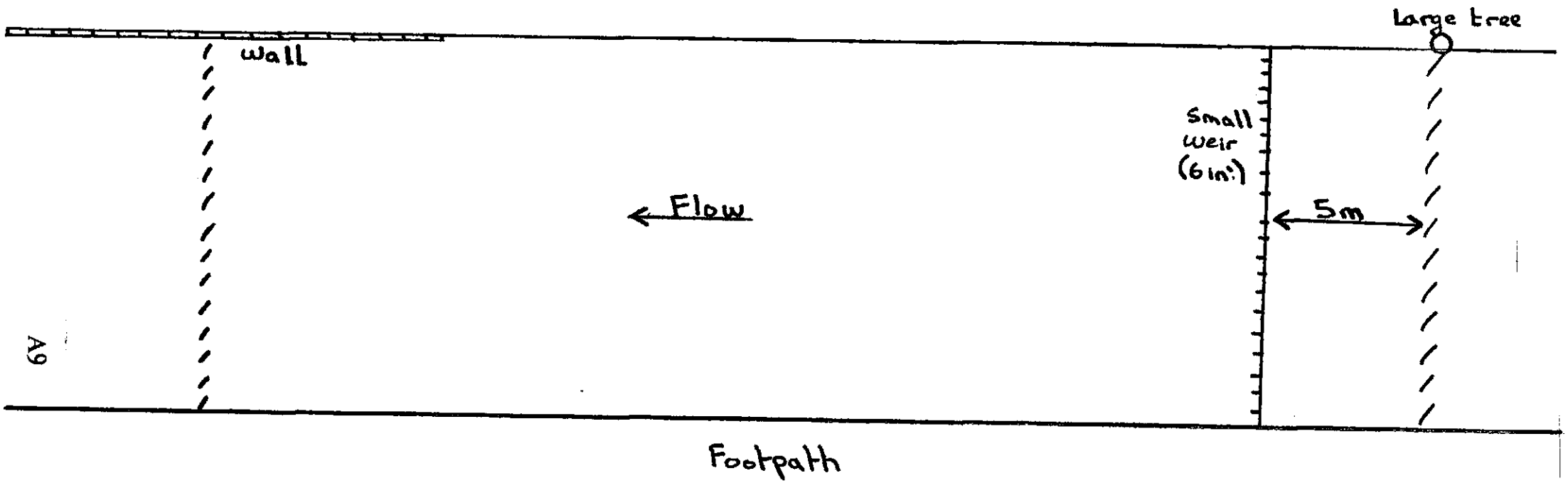

Ewden Beck
grassland
elder
sycamore
3 metres
Boulders
metal fencing
3 metres from end of metal fence.
derelict bridge
Flow
fallen tree
large Sycamore
Broad leaf woodland
2 metres
Boulder
Wall (part of bridge)

Underbank Reservoir




Loxley
HOUSE
inlet "tunnels"
small tree
/elder?
Stone wall
BRIDGE
Flow
Bridge
A8
just
U/S of
bridge

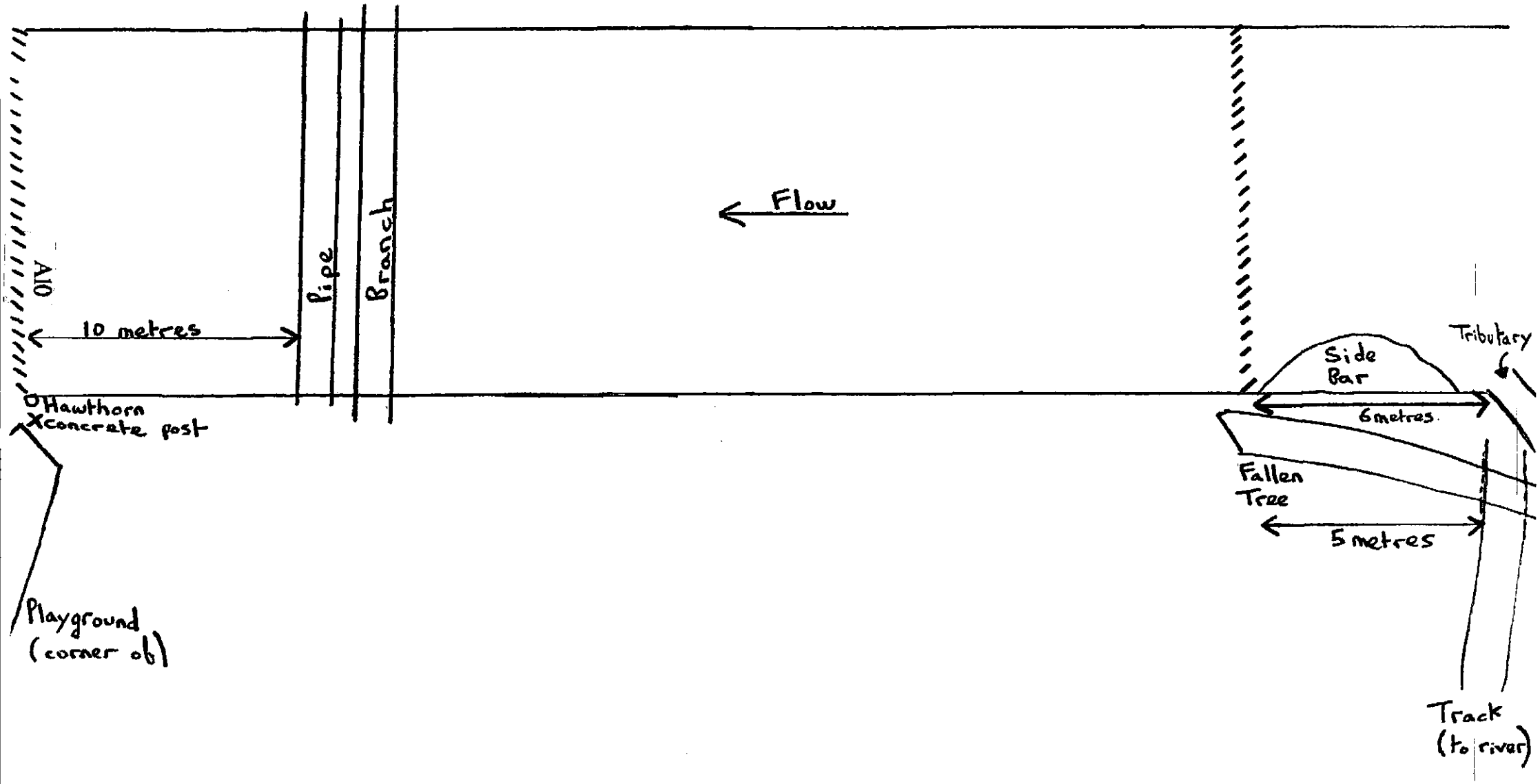
Rivelin Mill

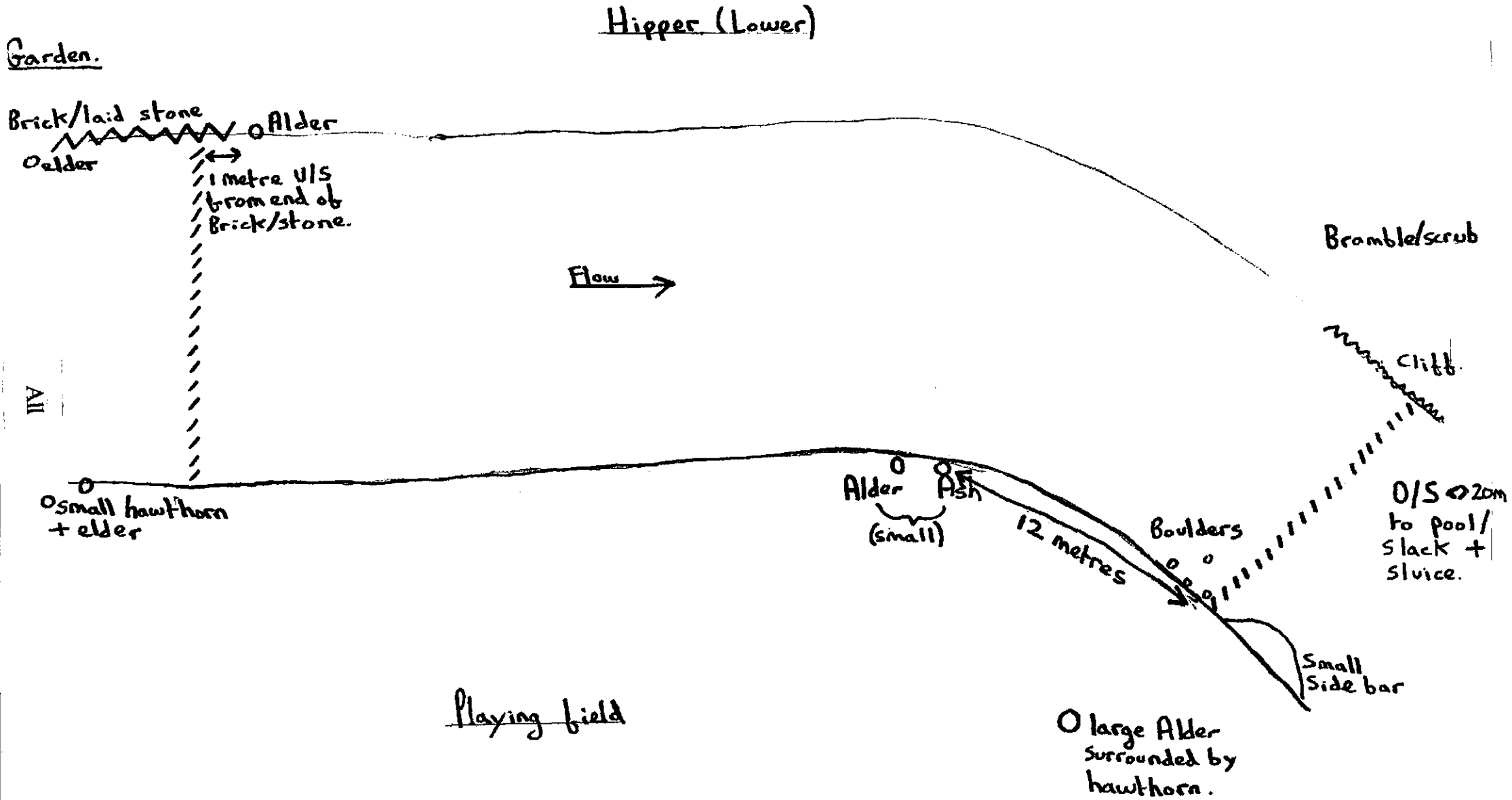


CAR PARK

POND.

Hipper (Upper)




Hipper (Lower)
Garden.
Brick/laid stone
Alder
elder
1 metre U/S from end of Brick/stone.
Flow
Bramble/scrub
Cliff
All
small hawthorn + elder
Alder
(small)
Ash
12 metres
Boulders
O/S 20m to pool/ slack + sluice.
Small Side bar
Playing field
large Alder surrounded by hawthorn.

Appendix B

The length of other fish species caught

Appendix 2.1 The length of other fish species caught on the River Sheaf

Bullhead length (cm)

Shock 1	Shock 2	Shock 3
7.8	5.9	9.5
7.8	8.2	
7.9	9	
8.4	9	
8.8	9	
9.2	9.2	
	9.8	

Perch length (cm)

Shock 1	Shock 2	Shock 3
		17.3

Appendix 2.2 The length of other fish species caught on the River Don at Hazlehead Upper

Minnow length (cm)

Shock 1	Shock 2	Shock 3
4.9	6.1	6.8
6.2	7.1	7
6.2	7.3	8.1
6.4	7.6	
6.4	7.6	
6.7		
6.7		
6.8		
7		
7		
7		
7.2		
7.8		
7.8		

Appendix 2.3 The length of other fish species caught on the River Don Hazlehead Lower

Minnow length (cm)

Shock 1	Shock 2	Shock 3
2.7	2.7	2.8
2.8	2.7	4.8
5.1	2.8	5.8
5.6	2.9	6.3
5.6	2.9	6.4
6	3	6.6
6.2	4.8	6.6
6.2	5.2	7
6.2	5.2	7
6.3	5.8	7.1
6.5	6.1	7.2
6.5	6.2	7.4
6.5	6.2	
6.5	6.5	
6.5	6.6	
6.6	6.8	
6.8	6.8	
6.8	7	
7.2	7.1	
7.2		
7.3		
7.4		
8.7		

Stickleback (cm)

Shock 1	Shock 2	Shock 3
2.3		
4.2		

Appendix 2.4 The length of other fish species caught on the River Don at Oxspring

Bullhead length (cm)

Shock 1	Shock 2	Shock 3
2.4	3.1	3.7
3.3	6.4	7
3.8	6.6	7.1
4.4	7.1	7.2
6.4	7.2	7.4
7.4	7.2	7.4
7.7	7.4	7.4
8.1	7.8	7.5
8.1	8	7.8
8.3	8.1	8.1
8.3	8.3	8.2
8.4	8.4	8.3
8.5		8.6
9.2		

Stoneloach length (cm)

Shock 1	Shock 2	Shock 3
9.6	9	
10.1		

Minnow length (cm)

Shock 1	Shock 2	Shock 3
6.3	6.6	6.5
7.1	6.6	7
7.4	6.7	7.1
8.4	6.9	7.2
	6.9	
	7	
	7	
	7.2	
	7.2	
	7.5	
	7.6	
	7.7	
	7.8	
	8	
	8	
	8	
	8.2	

Appendix 2.5 The length of other fish species caught on the Little Don d/s of Underbank Reservoir

Bullhead lengths (cm)

Shock 1	Shock 2	Shock 3
6.5	6.9	6.9
6.8	7.3	7
7.5	8.8	7.6
	10.5	8.7

Appendix 2.6 The length of other fish species caught on the River Loxley at Storrs Lane Bridge

Bullhead length (cm)

Shock 1	Shock 2	Shock 3
6.1	7.2	7.8
6.1	8.3	8.3
6.8	8.7	
7.2	9	
7.4	9.4	
8		
8.2		
8.3		
8.6		
9.3		
9.8		

Appendix 2.7 The length of other fish species caught on the River Rivelin at Rivelin Mill

Stoneloach length (cm)

Shock 1	Shock 2	Shock 3
9.4	8.9	9.6
10.3	11.2	11.2
10.7		
10.9		
11.5		

Appendix 2.8 The length of other fish species caught on the River Hipper Upper

Bullhead length (cm)

Shock 1	Shock 2	Shock 3
3.6	6.4	5.7
5.9	6.6	6.4
6.1	6.9	8.2
6.4	7.3	9
6.4	7.4	
6.6	7.5	
6.6	7.8	
6.7	8.1	
6.7	8.8	
6.9	9.7	
6.9		
7		
7.1		
7.2		
7.3		
7.4		
7.4		
7.4		
7.4		
7.4		
8.1		
9.3		

Appendix 2.9 The length of other fish species caught on the River Hipper Lower

Bullhead length (cm)

Shock 1	Shock 2	Shock 3
5.6	3.6	9.3
6.8	7.6	
7.6		
7.9		
7.9		

Minnow length (cm)

Shock 1	Shock 2	Shock 3
	6	
	6.7	

Stickleback length (cm)

Shock 1	Shock 2	Shock 3
5.2		
5.5		

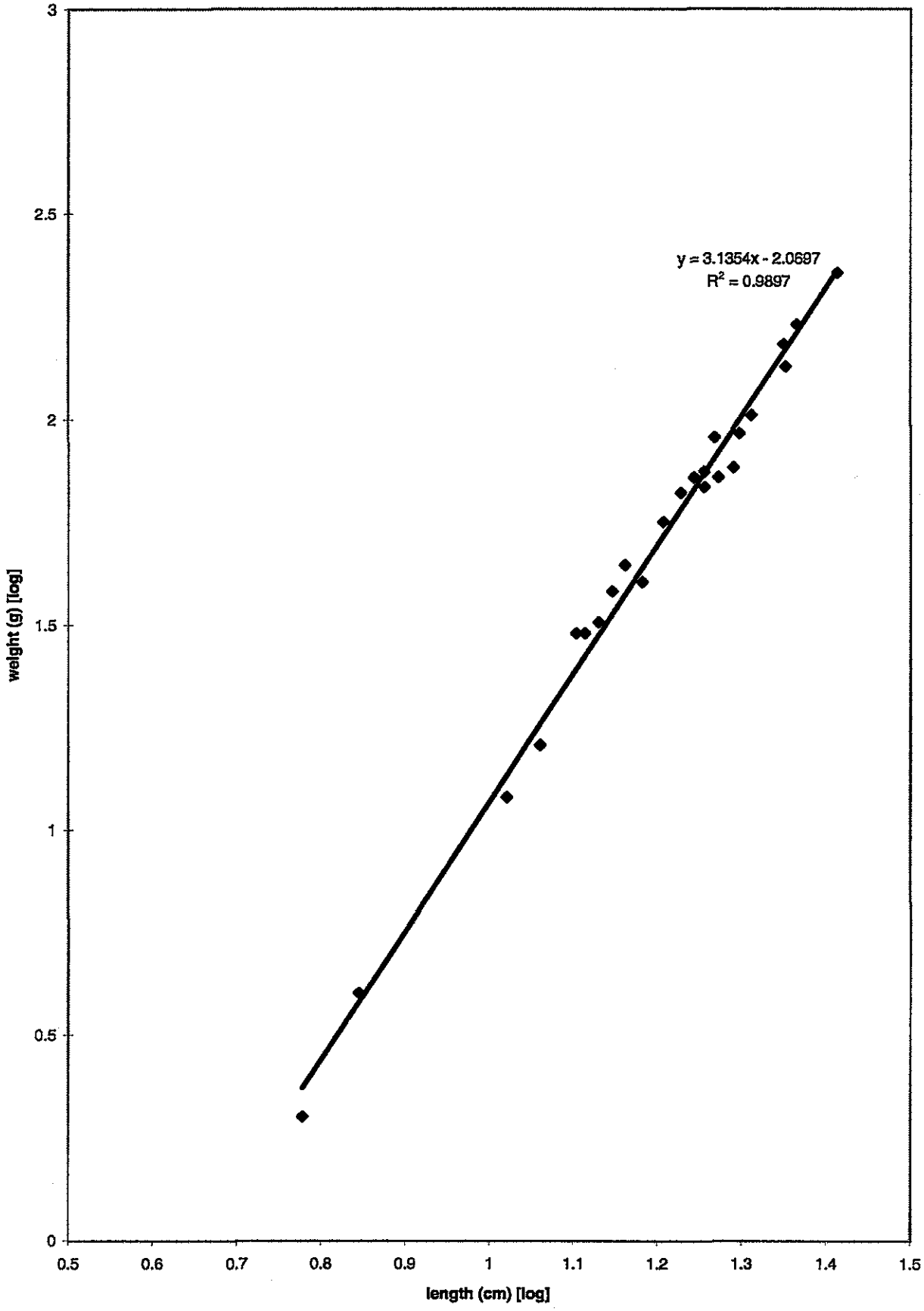
Stoneloach length (cm)

Shock 1	Shock 2	Shock 3
10.3	10.7	11.6

Appendix C

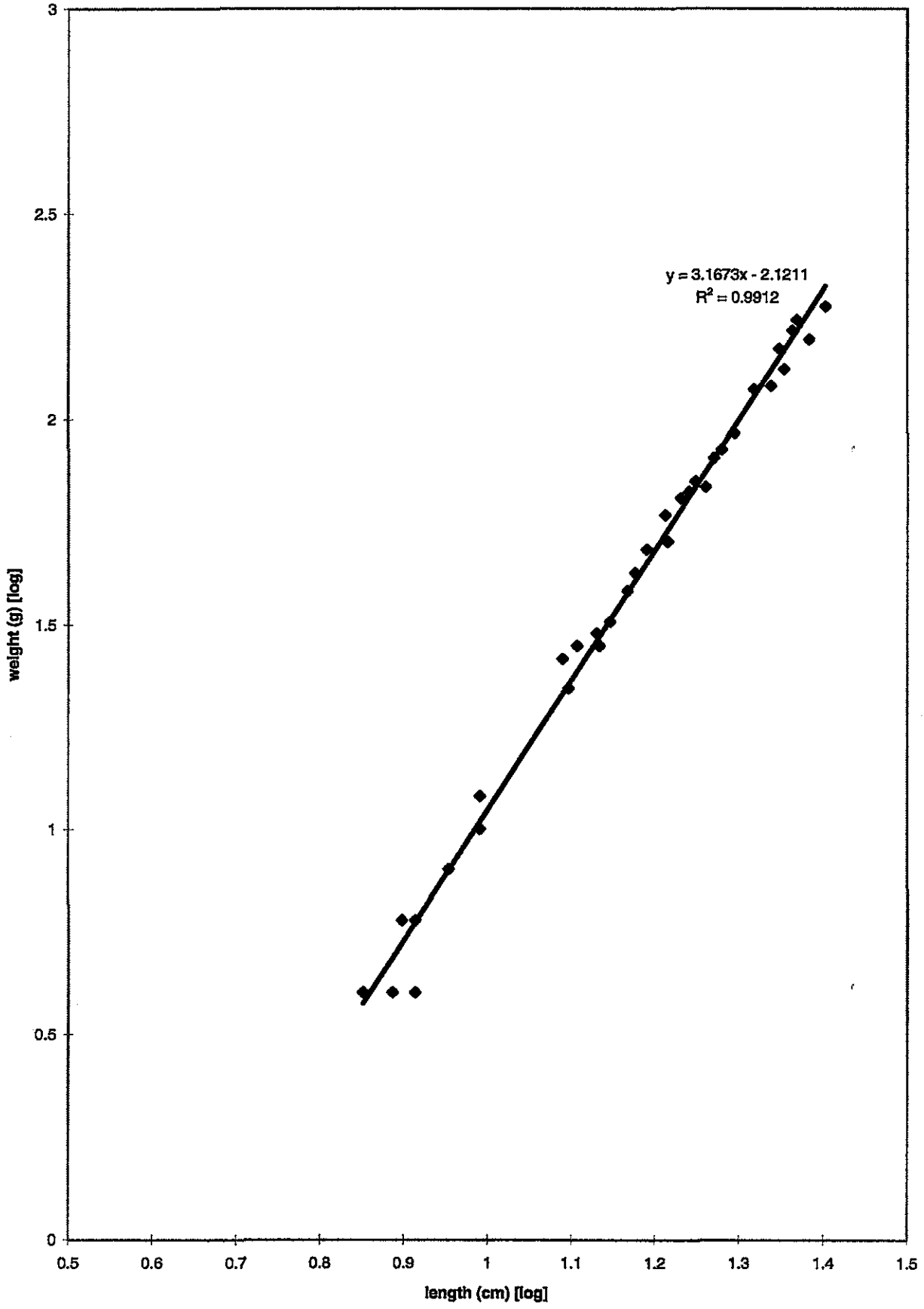
Length/weight relationship for brown trout

Appendix ~~2~~ c Length/weight relationship. ~~Length [log] and weight [log]~~ for brown trout at the River Sheaf site



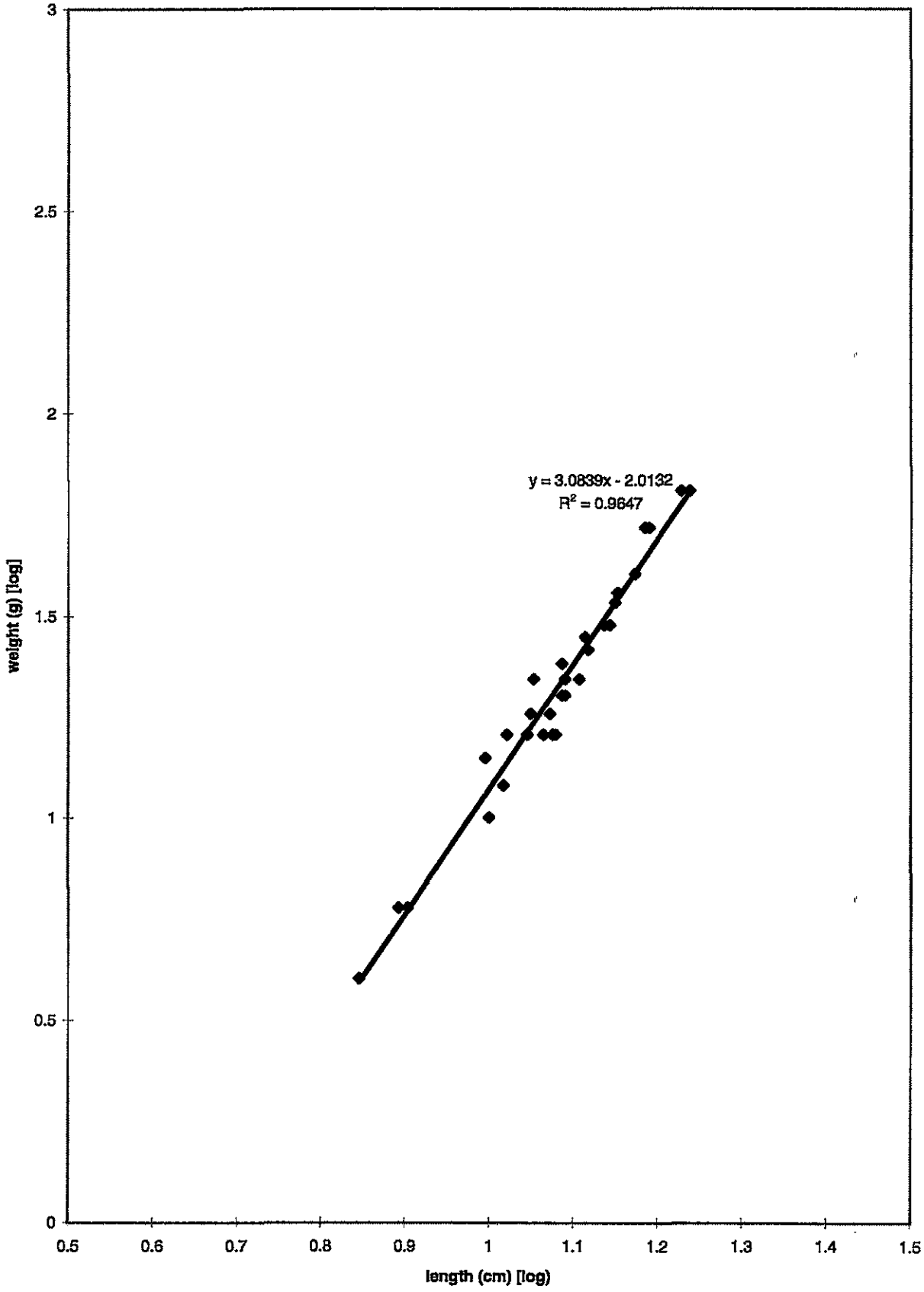
C2 Length/weight relationship

Appendix ~~3.2~~ ~~Length [log] and weight [log]~~ for brown trout at the River Don at Hazlehead upper and lower sites



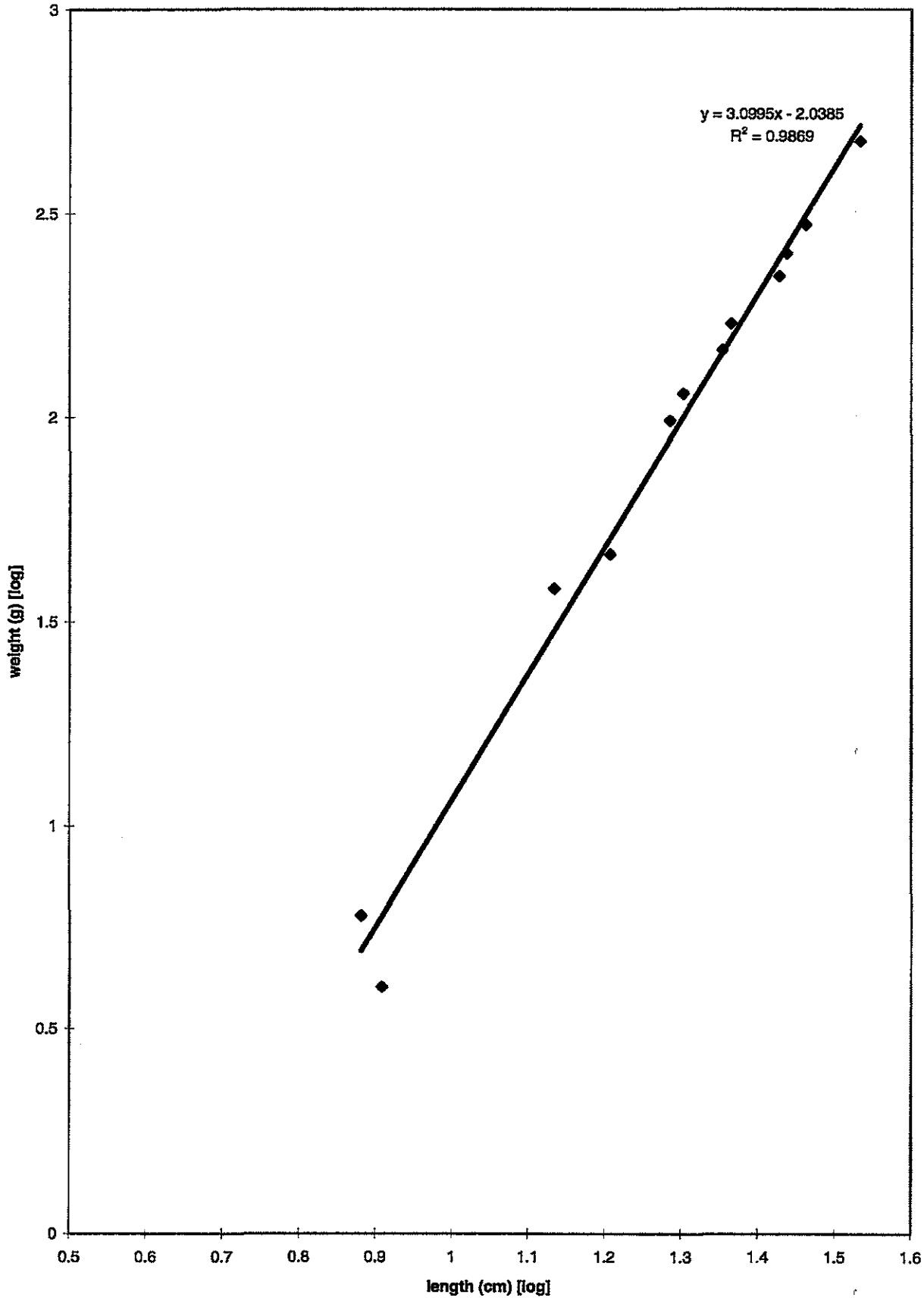
C3 Length/weight relationship

Appendix ~~3.3~~ ~~Length [log] and weight [log]~~ for brown trout at the River Don d/s Winscar Reservoir site



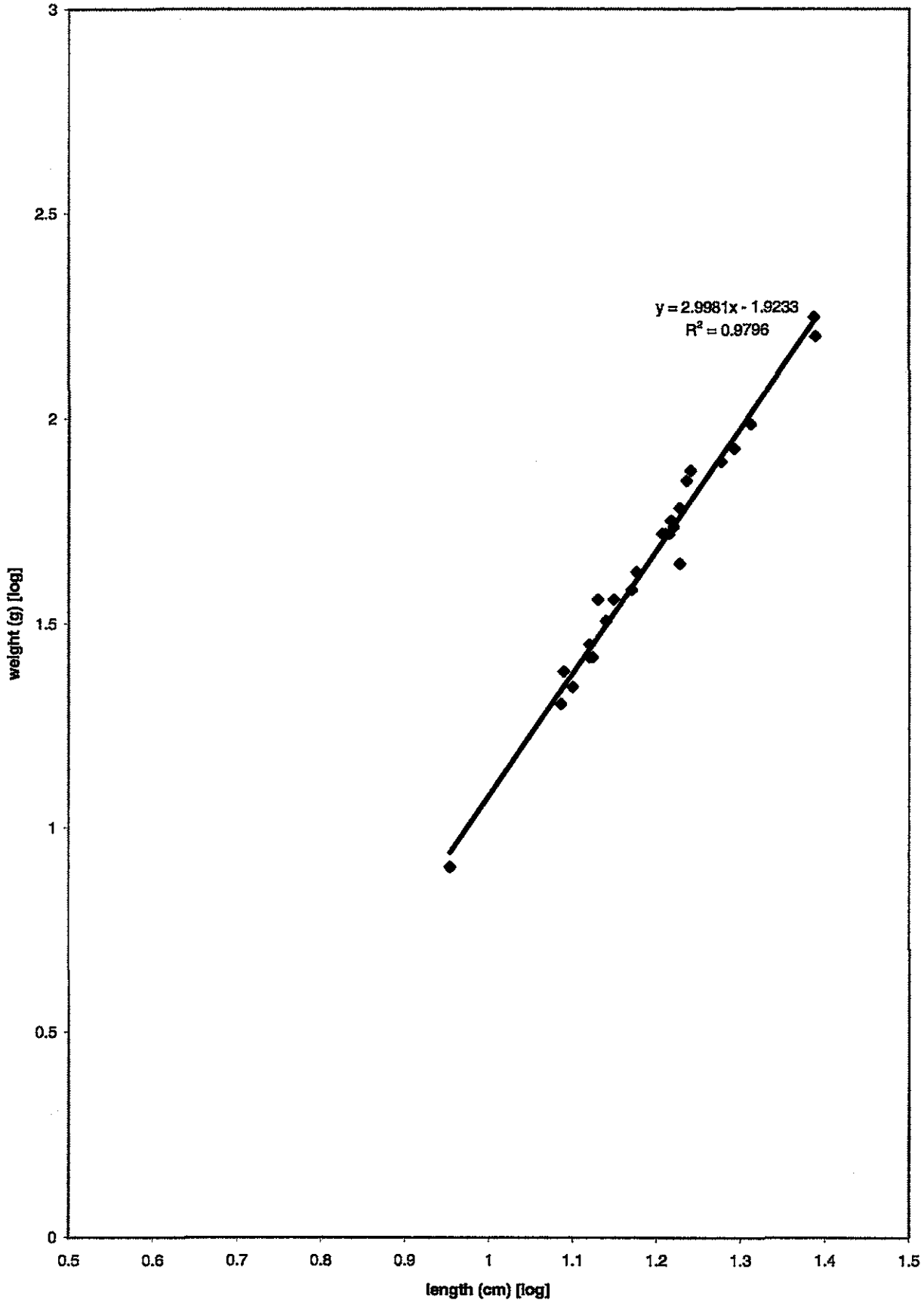
C4 Length / weight relationship

Appendix ~~3.4~~ ~~Length [log] and weight [log]~~ for brown trout at the River Don, Oxspring site



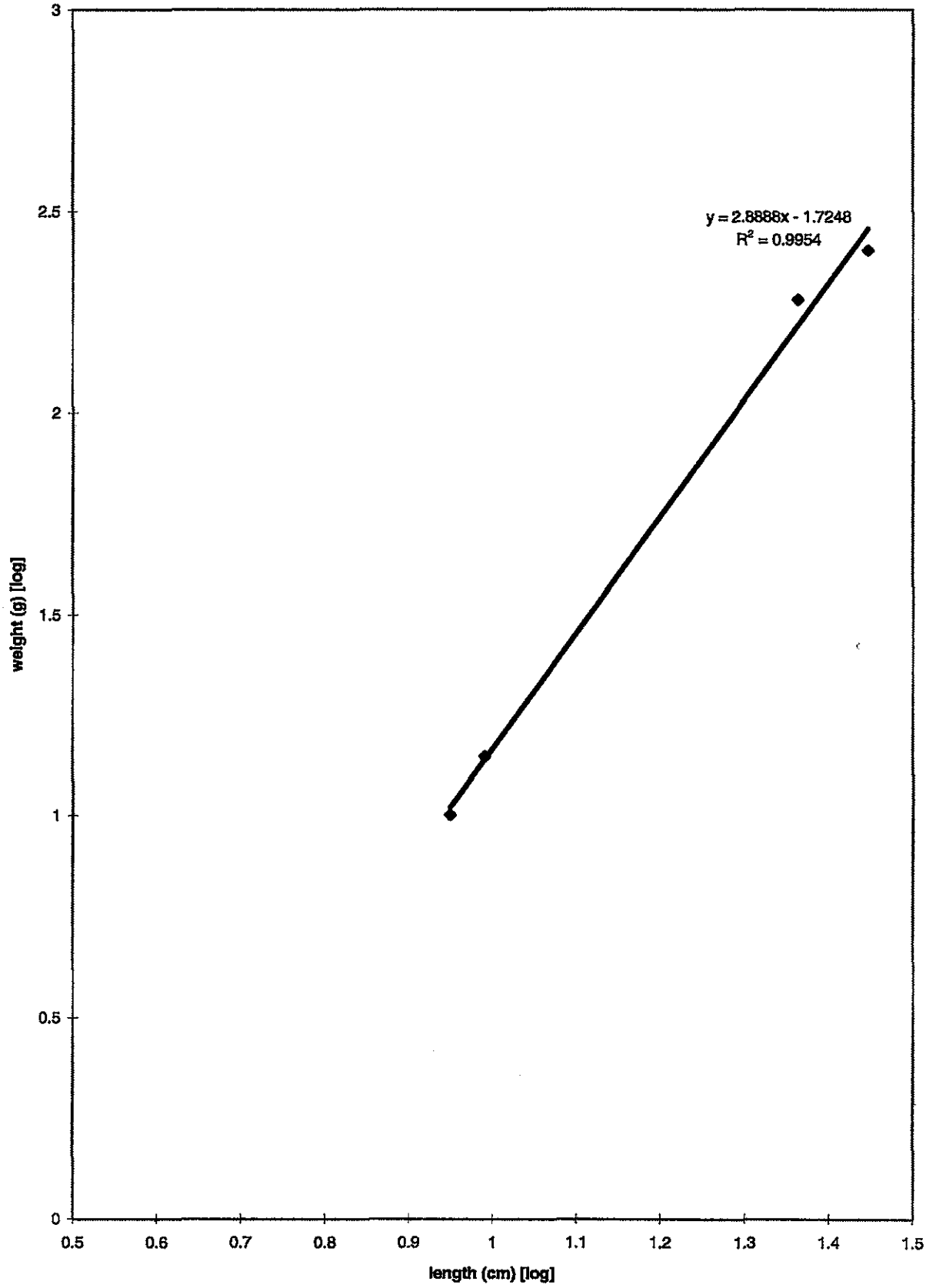
C5 Length/weight relationship

Appendix ~~2.5~~. ~~Length [log] and weight [log]~~ for brown trout at the Ewden Beck site



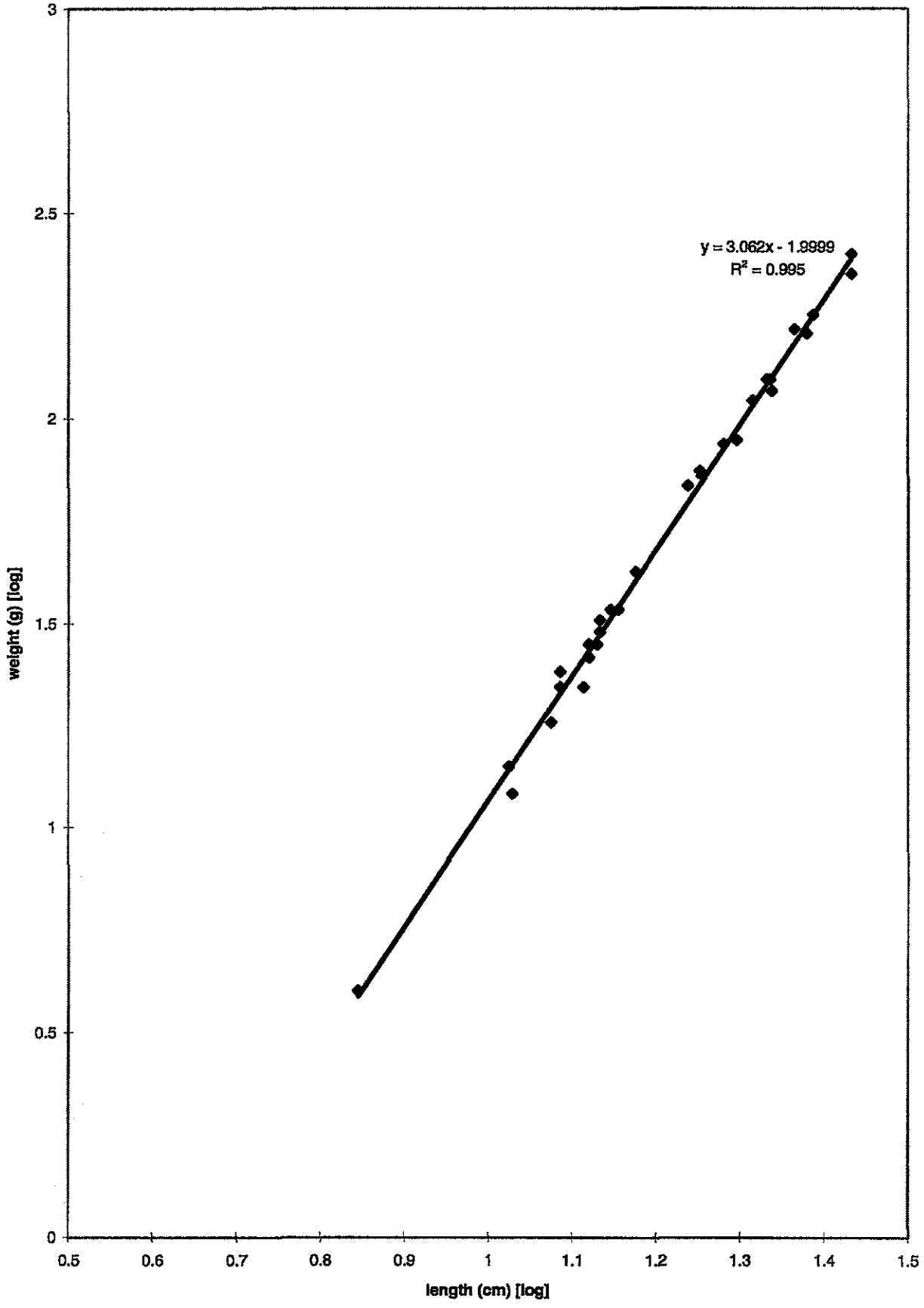
C6 Length/weight relationship

Appendix ~~3.6~~ ~~Length [log] and weight [log]~~ for brown trout at the Little Don d/s Underbank Reservoir site



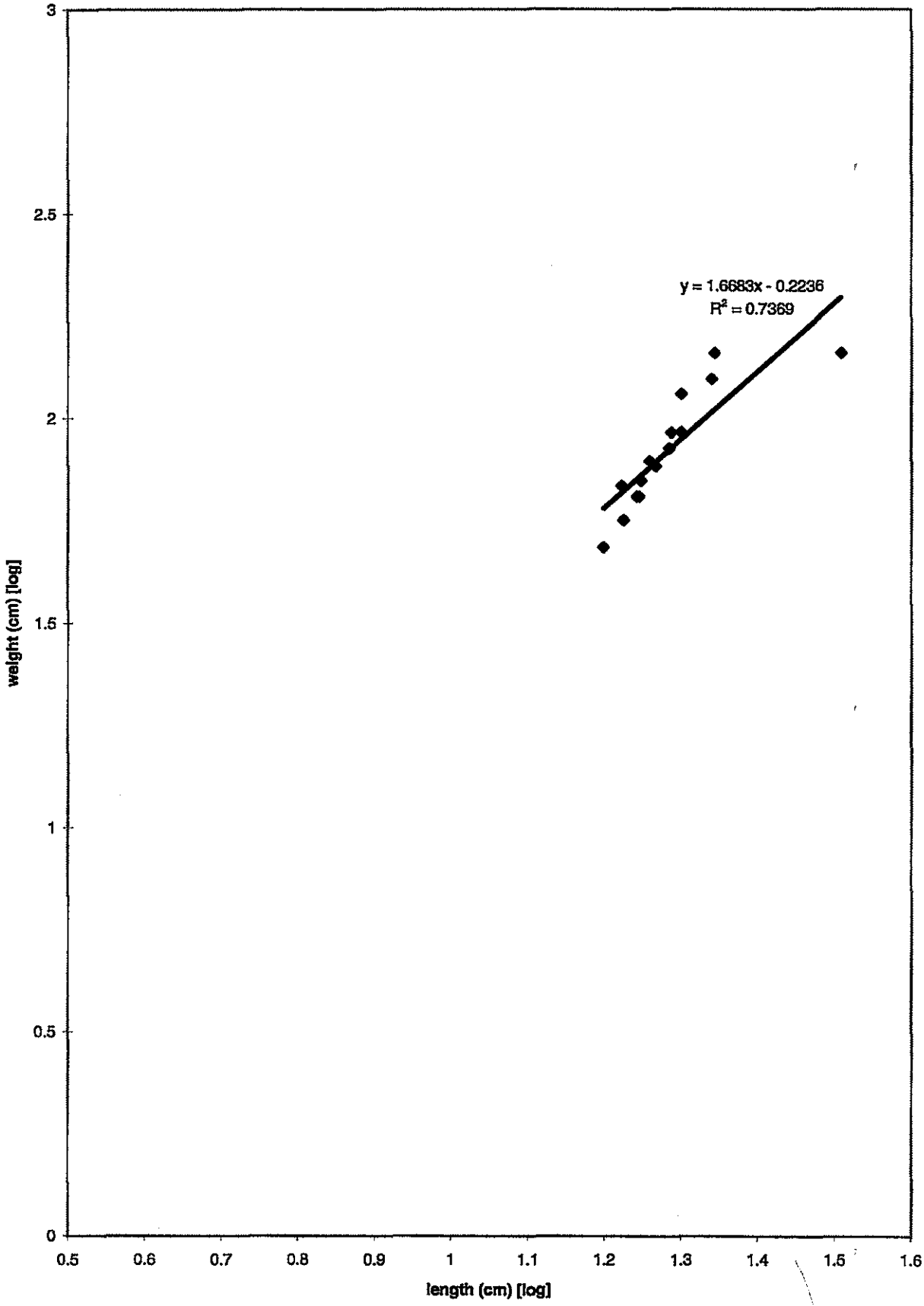
C7 Length/weight relationship

Appendix ~~3.7~~ ~~Length [log] and weight [log]~~ for brown trout at the River Loxley at Storrs Lane Bridge site



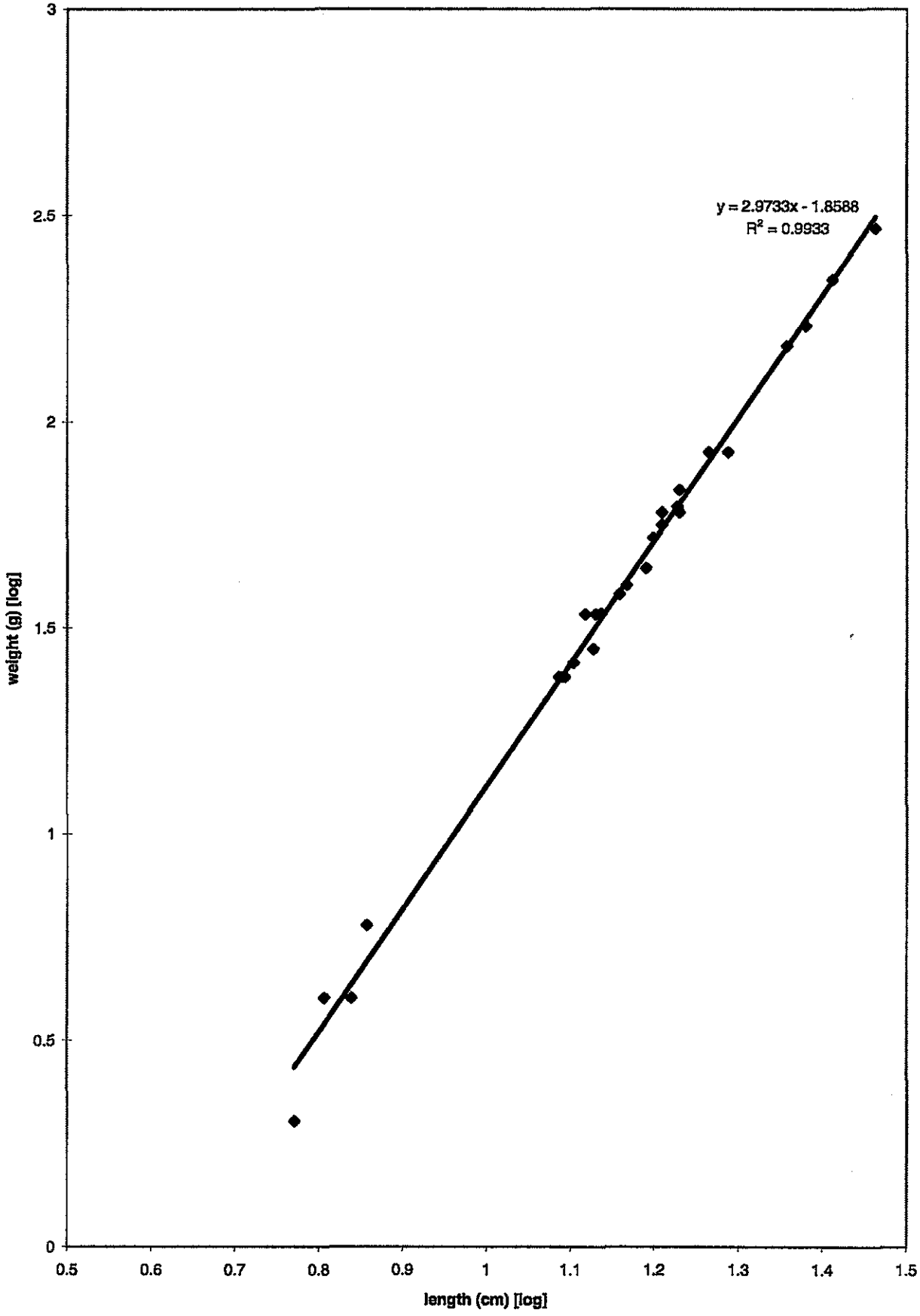
C8 Length/weight relationship

Appendix ~~3.8 Length [log] and weight [log]~~ for brown trout at the River Rivelin, Rivelin Mill site



C9 length/weight relationship

Appendix ~~3.9 Length [log] and weight [log]~~ for brown trout at the River Hipper upper and lower sites

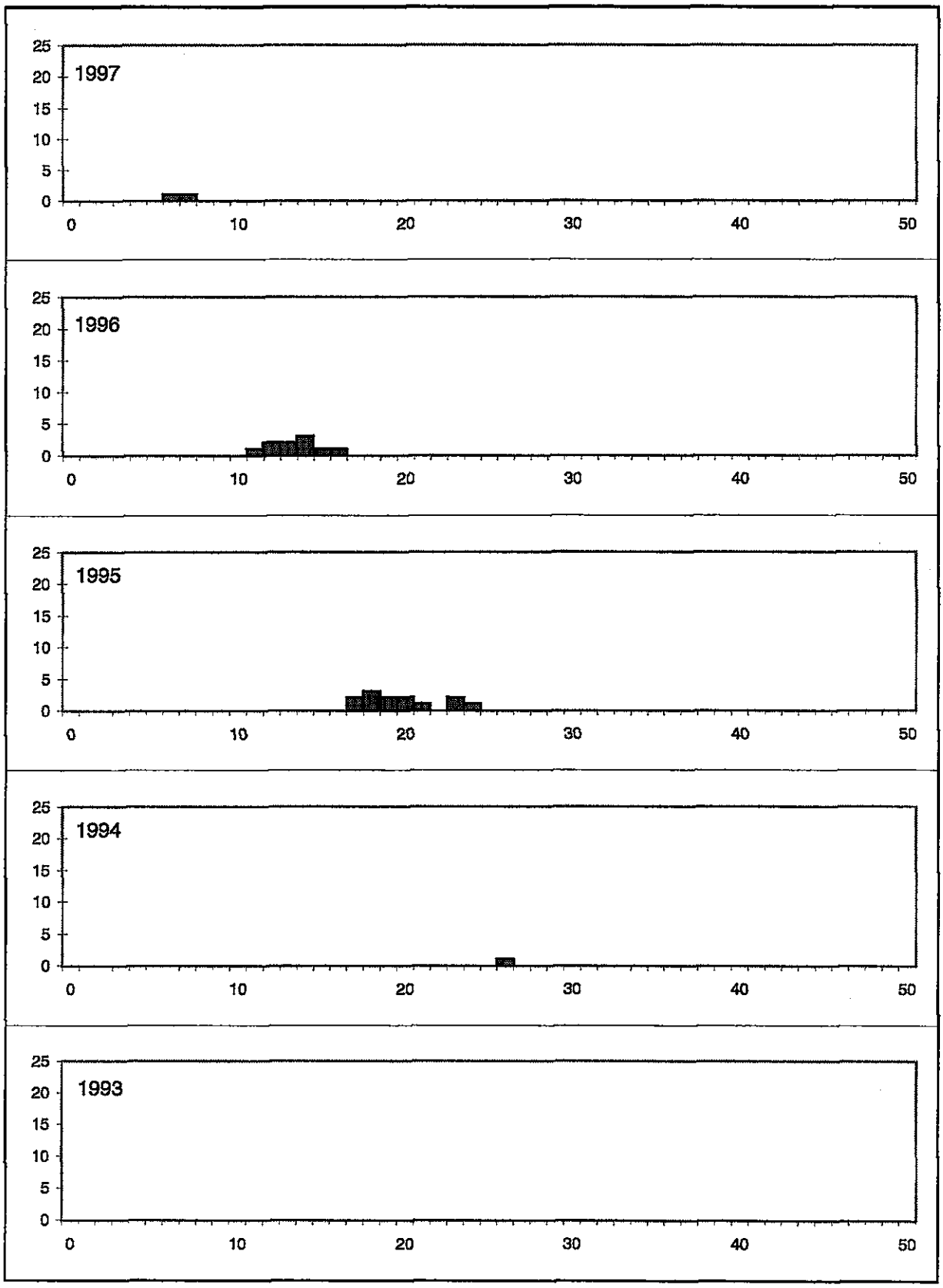


Appendix D

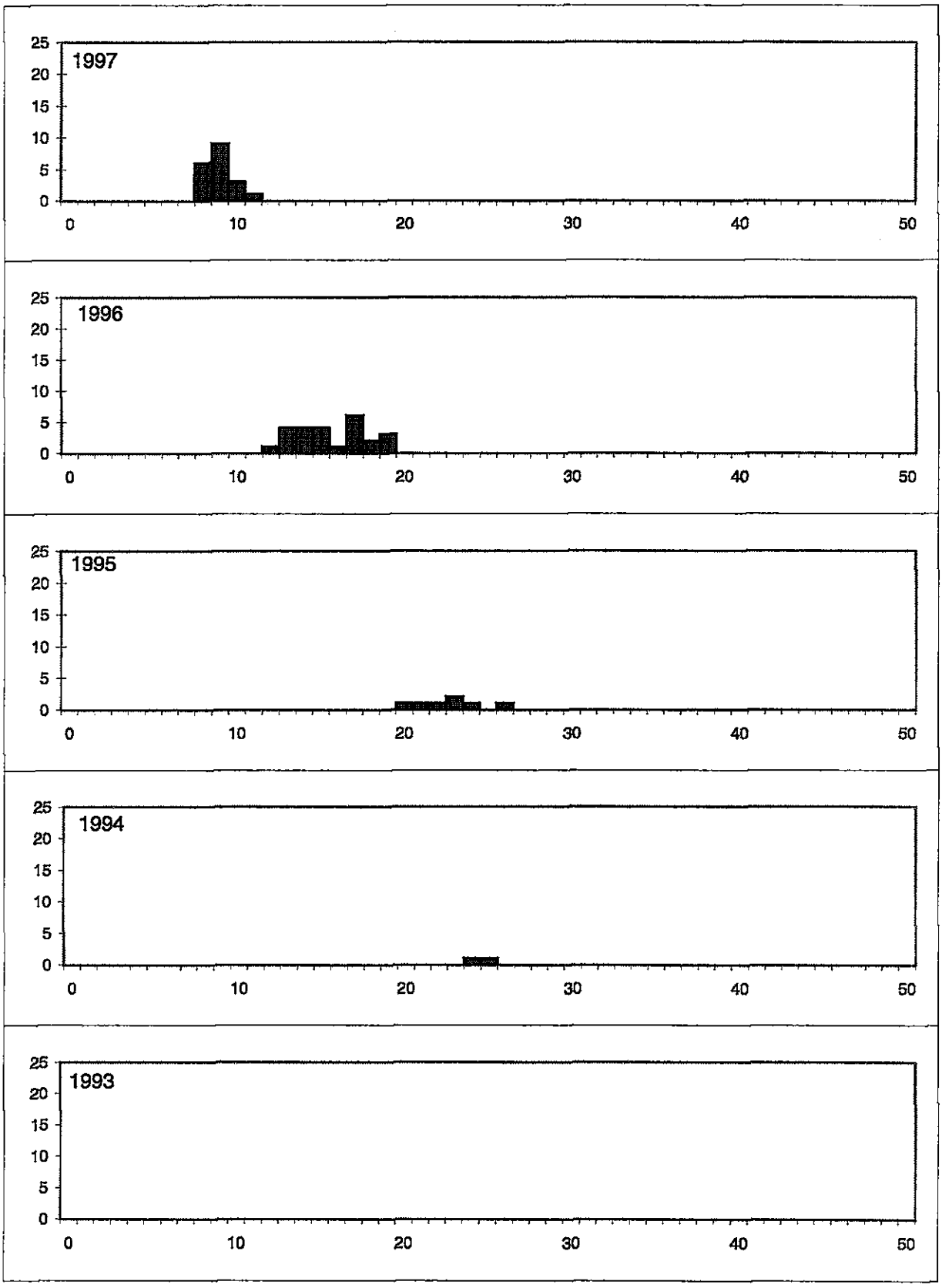
Length frequency histogram of each year class of brown trout captured

D1

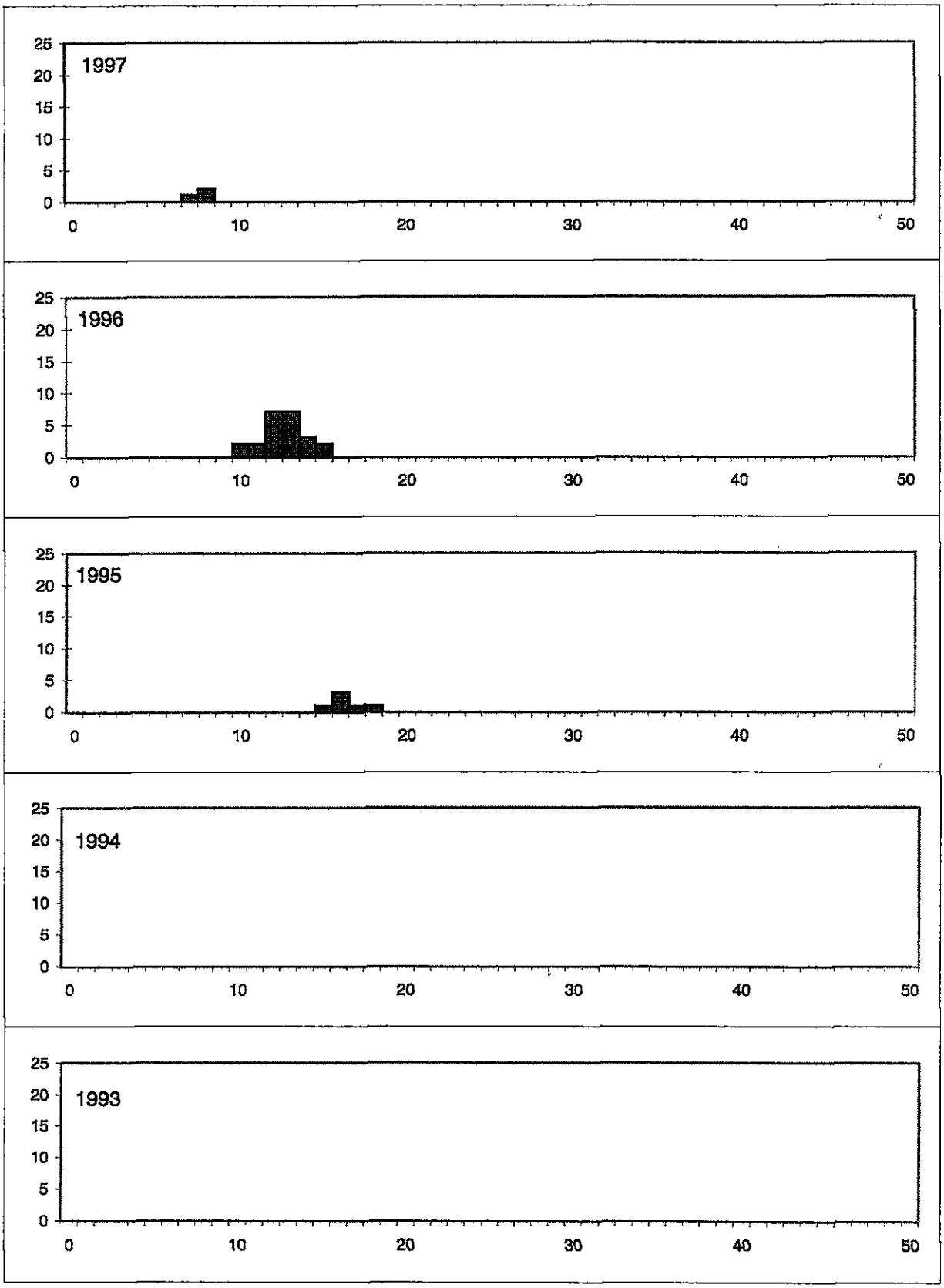
Appendix ~~3.1.1~~ Length frequency histogram of each year class of brown trout captured at the River Sheaf site



Appendix ~~3.2.1~~ D2 Length frequency histogram of brown trout captured at the River Don Hazlehead upper and lower sites

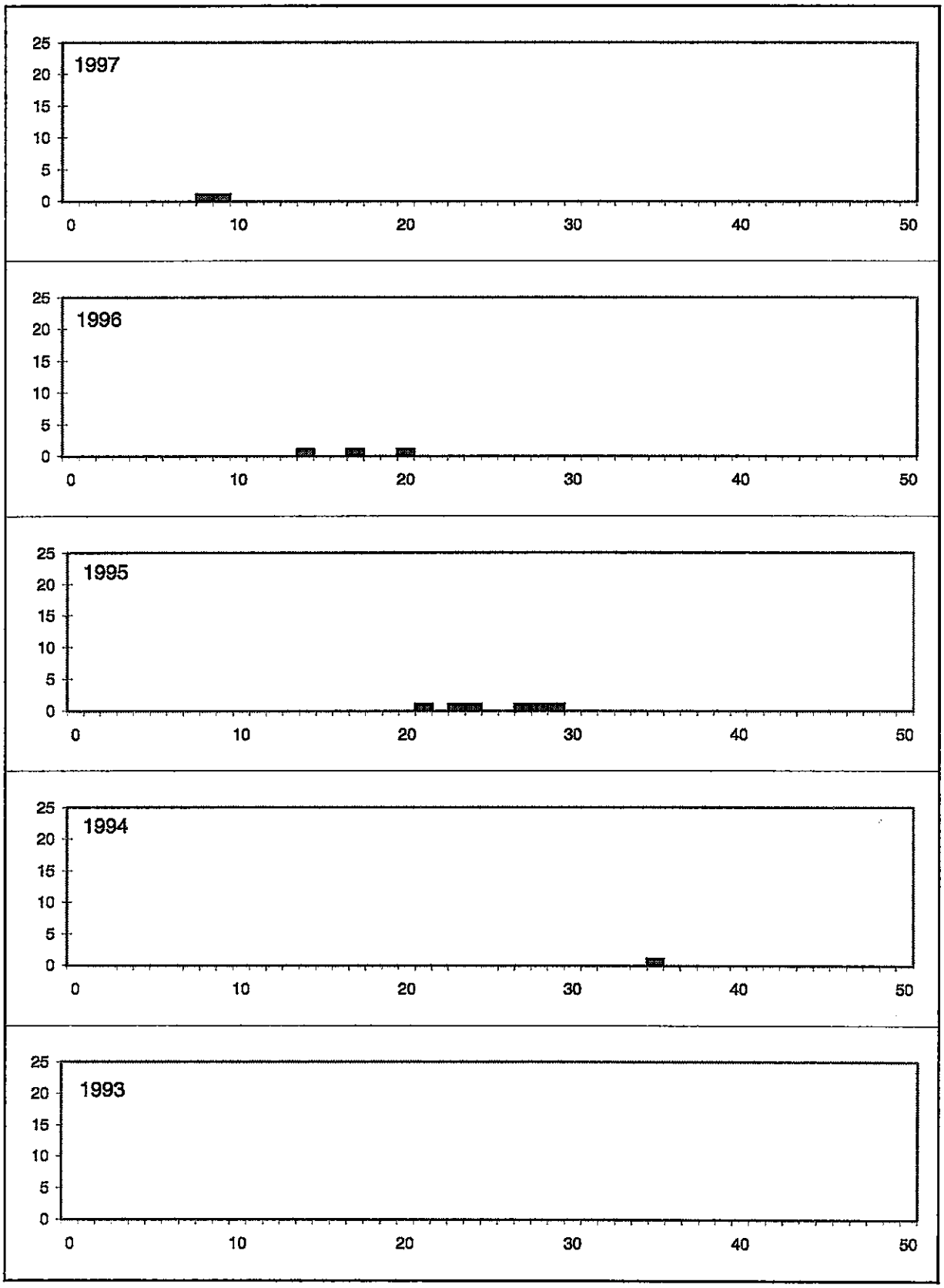


Appendix ~~3.3.1~~ D3 Length frequency histogram of each year class of brown trout captured at the River Don d/s Winscar Reservoir site

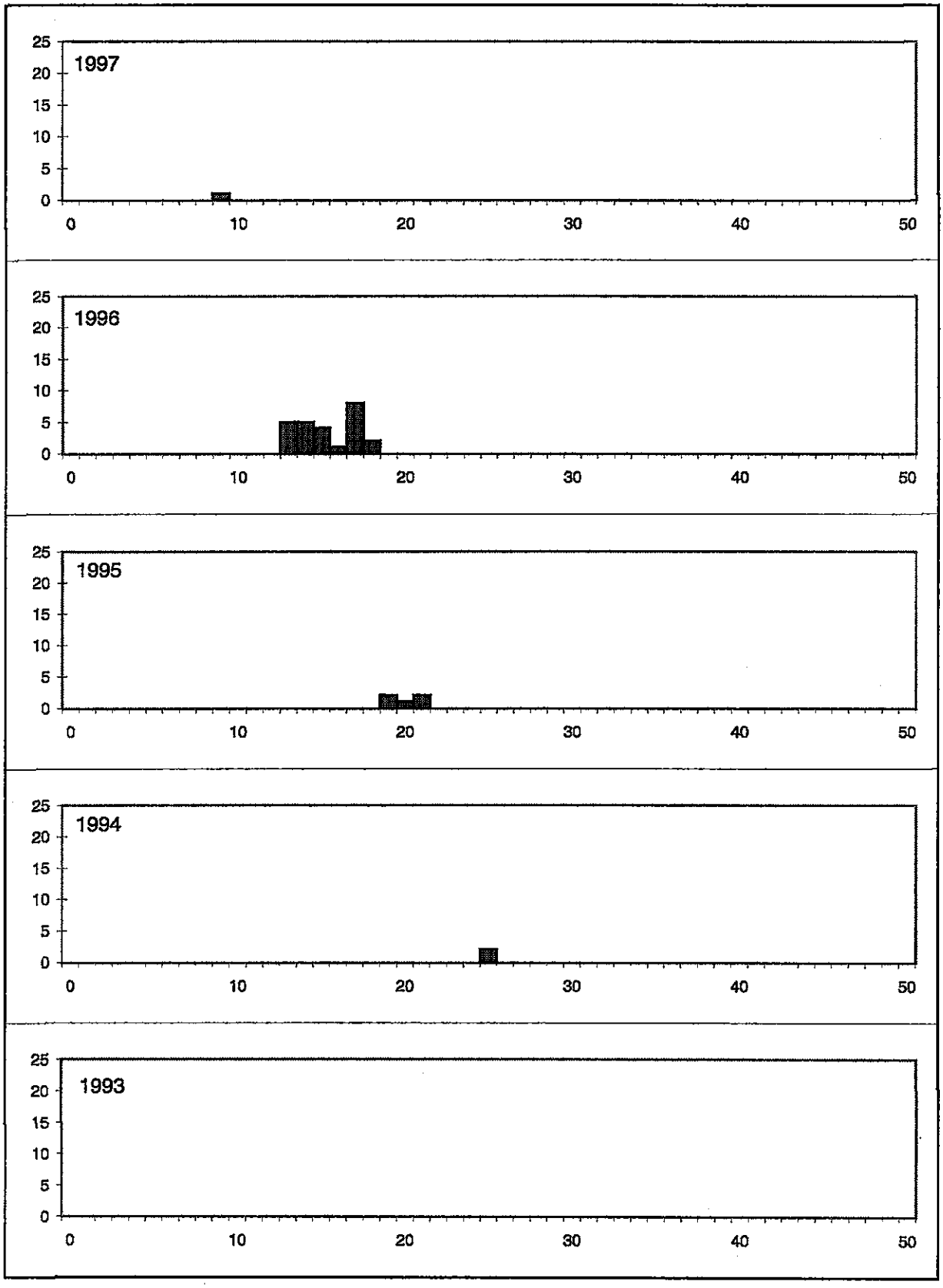


D4

Appendix ~~3.4.1~~ Length frequency histogram of each year class of brown trout captured at the River Don, Oxspring site

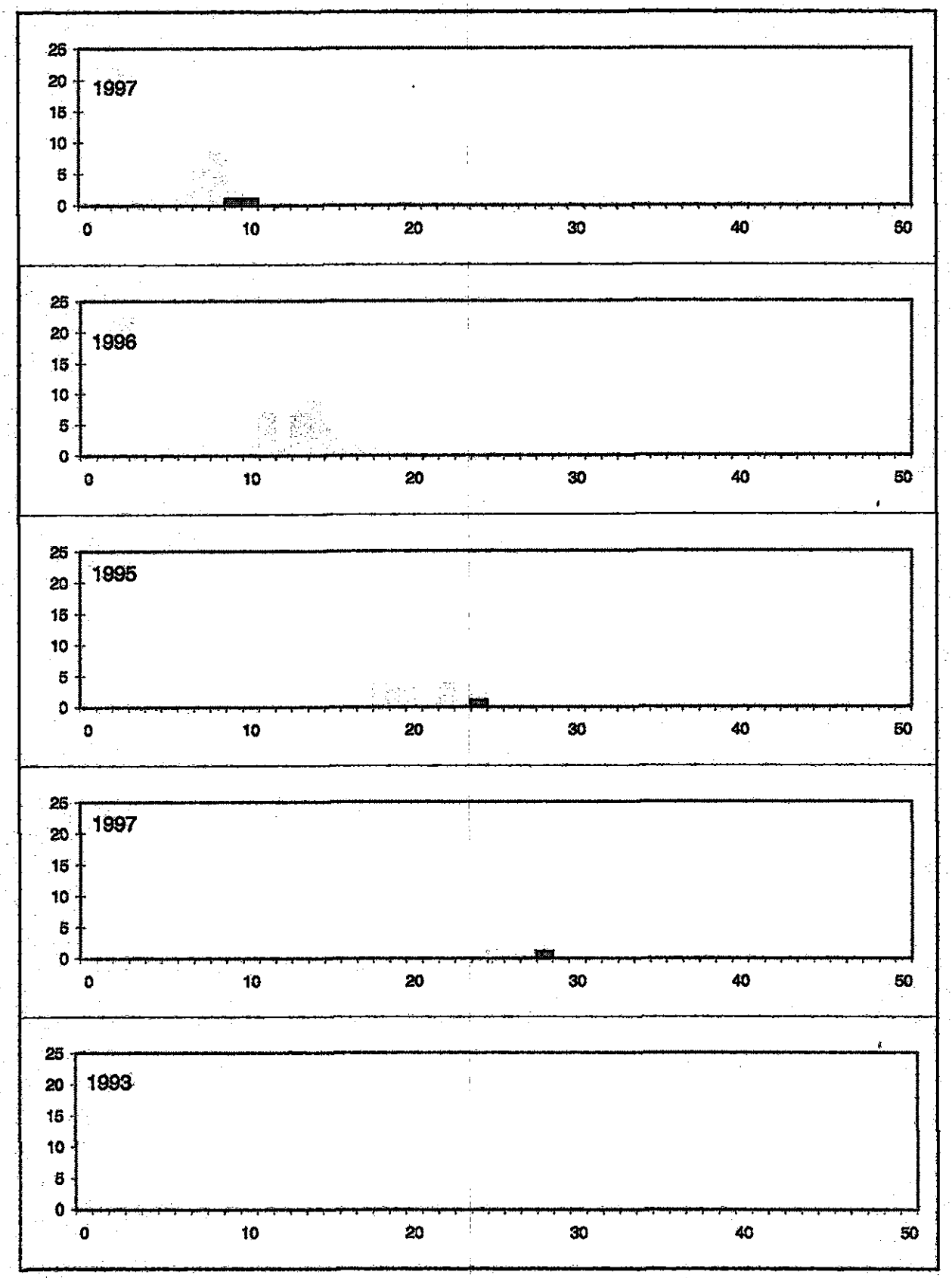


Appendix ~~3.5.1~~ D5 Length frequency of each year class of brown trout captured at the Ewden beck site



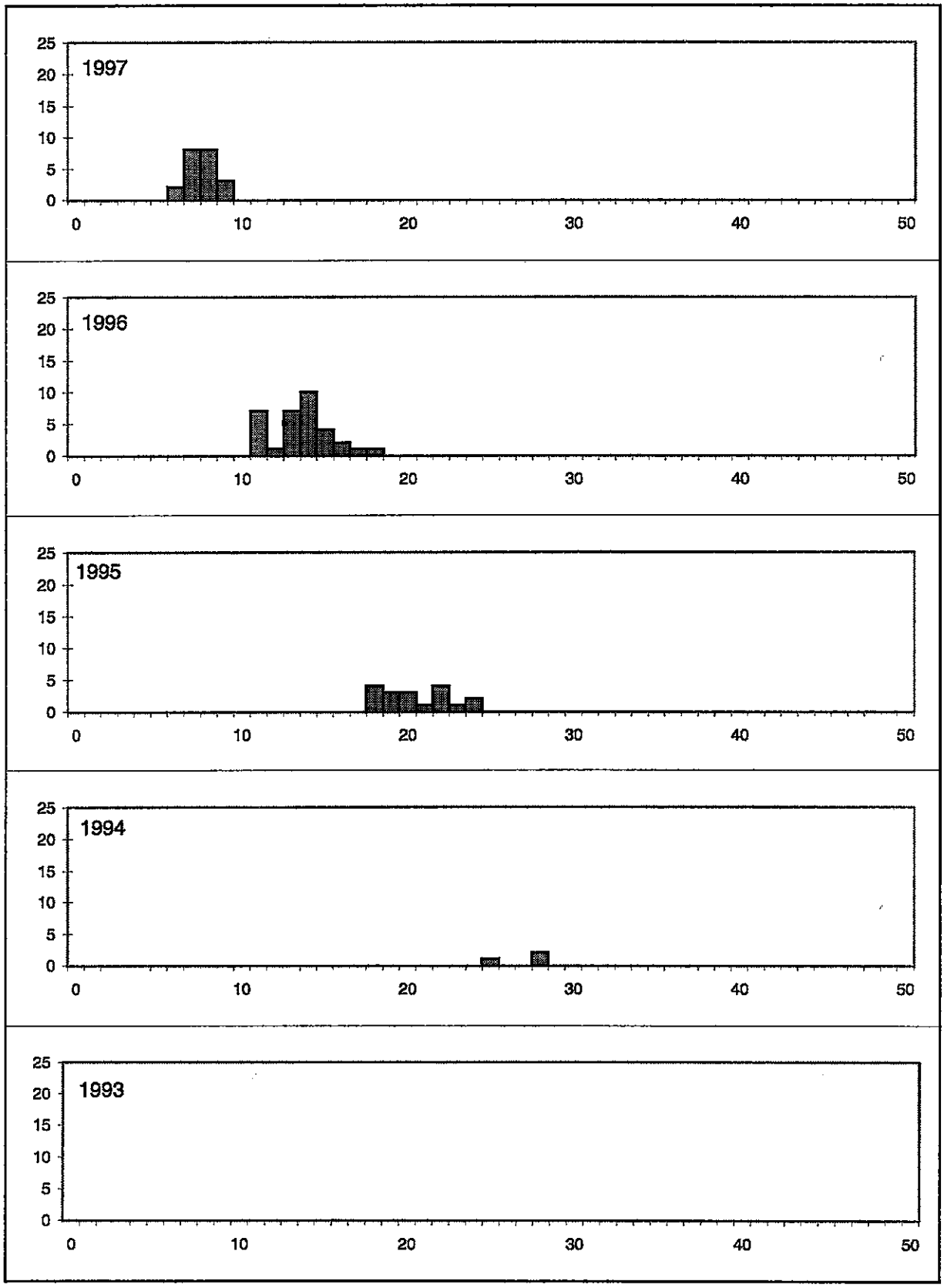
D6

Appendix ~~3.6.1~~ Length frequency histogram of brown trout captured at the Little Don d/s Underbank Reservoir site

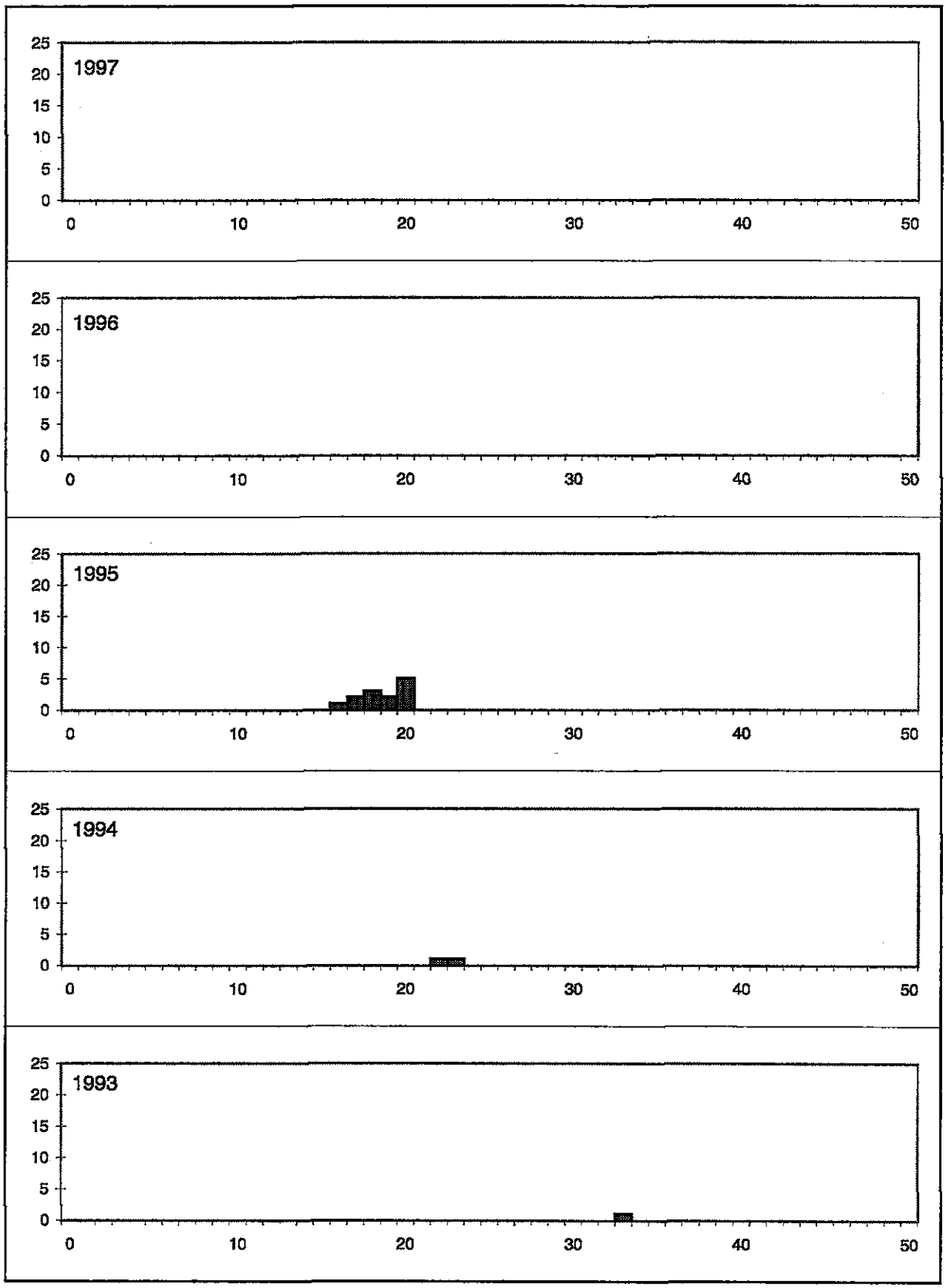


D7

Appendix ~~3.7~~.1 Length frequency histogram of each year class of brown trout captured at the River Loxley, Storrs Lane Bridge site

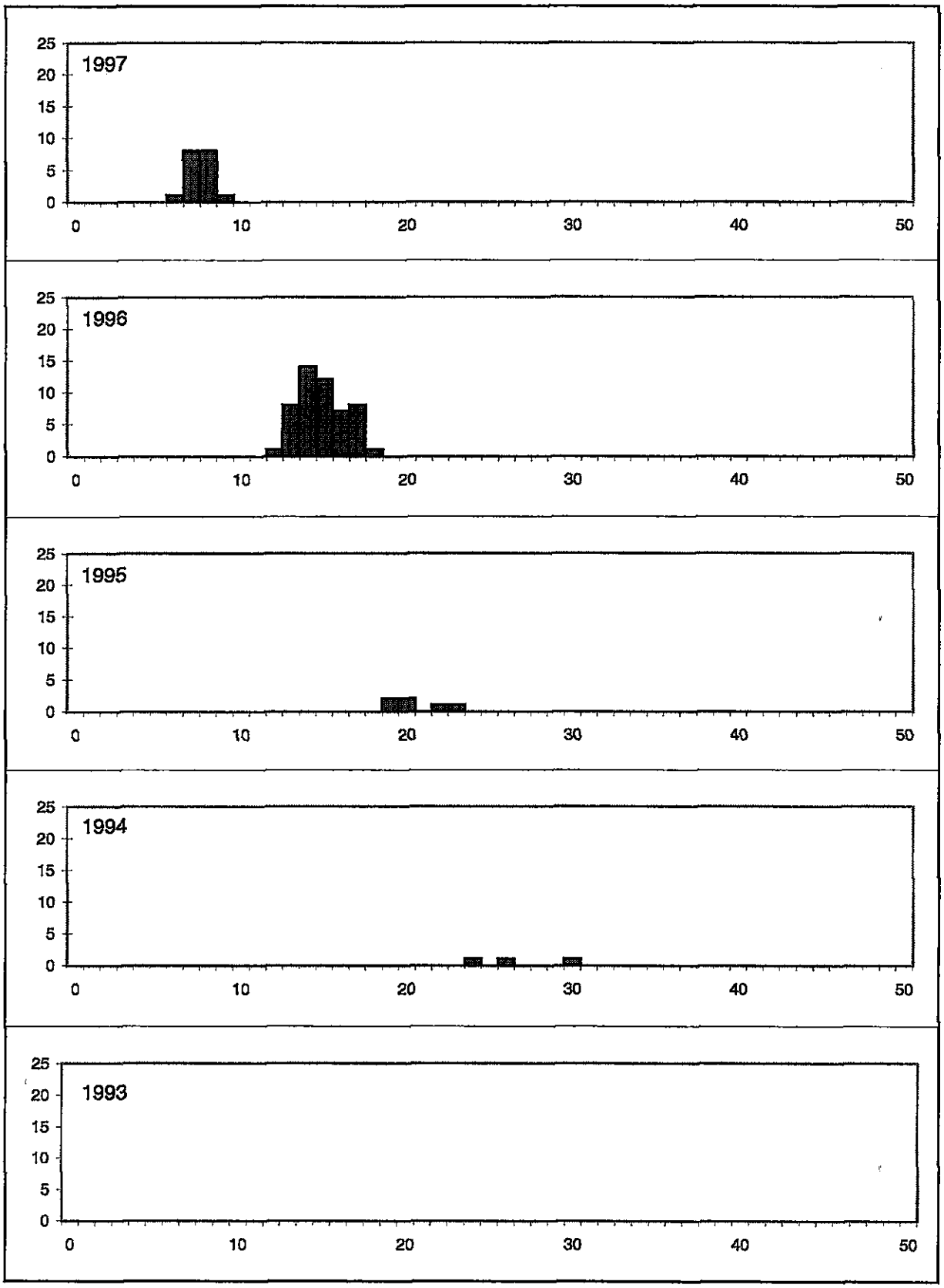


Appendix D8 ~~3.8.1~~ Length frequency histogram of each year class of brown trout captured at the River Rivelin, Rivelin Mill site



D9.

Appendix ~~3.9.1~~ Length frequency histogram of each year class of brown trout captured at the River Hipper upper and lower sites



Appendix B

HABSCORE data for each site

E

Appendix ~~4.1~~ River Sheaf

		Number of fish captured	Estimated population	Estimated density (n m^{-2})	Estimated biomass (g m^{-2})
March 1996	0+	10/10/5	35	0.156	1.19
	Trout <20cm	13/9/3	27	0.110	5.4
	Trout >20cm	5/0/0	5	0.019	3.6
October 1996	0+	5/1/2	8	0.034	0.125
	Trout <20cm	28/7/10	51	0.198	8.5
	Trout >20cm	9/0/1	10	0.038	5.6
March 1997	0+	8/1/0	9	0.034	0.26
	Trout <20cm	19/4/2	25	0.095	4.5
	Trout >20cm	2/1/0	3	0.011	1.73
October 1997	0+	1/1/0	2	0.0076	0.012
	Trout <20cm	16/3/1	20	0.076	0.193
	Trout >20cm	4/1/0	5	0.0190	0.606

Appendix ~~4.2~~ E2. River Don at Hazlehead upper

		Number of fish captured	Estimated population	Estimated density (n m^{-2})	Estimated biomass (g m^{-2})
March 1996	0+ Trout <20cm Trout >20cm	-	-	-	-
October 1996	0+ Trout <20cm Trout >20cm	-	-	-	-
March 1997	0+ Trout <20cm Trout >20cm	-	-	-	-
October 1997	0+ Trout <20cm Trout >20cm	6/4/7 5/7/0 2/0/1	17 12 3	0.05414 0.03822 0.00955	0.02297 0.12582 0.46255

- Site not surveyed before

Appendix E3 River Don Hazlehead lower

		Number of fish captured	Estimated population	Estimated density (n m^{-2})	Estimated biomass (g m^{-2})
March 1996	0+	0/0/0	0	-	-
	Trout <20cm	6/0/0	6	0.0153	0.63
	Trout >20cm	0/2/0	2	0.0051	0.71
October 1996	0+	0/0/0	0	-	-
	Trout <20cm	12/7/1	20	0.053	3.3
	Trout >20cm	7/2/1	10	0.0254	4.3
March 1997	0+	1/1/0	2	0.0051	0.029
	Trout <20cm	8/3/2	13	0.036	1.78
	Trout >20cm	7/2/1	10	0.025	3.47
October 1997	0+	1/1/0	2	0.005	0.0172
	Trout <20cm	11/3/0	14	0.0356	0.1595
	Trout >20cm	5/0/0	5	0.0127	0.5156

		Number of fish captured	Estimated population	Estimated density (n m^{-2})	Estimated biomass (g m^{-2})
March 1996	0+	8/7/1	17	0.188	0.324
	Trout <20cm	16/10/6	39	0.46	7.13
	Trout >20cm	0/0/0	0	-	-
October 1996	0+	4/2/2	9	0.20	0.88
	Trout <20cm	18/4/0	22	0.244	7.5
	Trout >20cm	0/0/0	0	-	-
March 1997	0+	4/2/0	6	0.066	0.46
	Trout <20cm	11/7/1	19	0.22	3.95
	Trout >20cm	0/0/0	0	-	-
October 1997	0+	2/1/0	3	0.0333	0.05
	Trout <20cm	20/6/3	29	0.3222	0.30
	Trout >20cm	0/0/0	0	-	-

Appendix ~~4.5~~ E5 River Don at Oxspring

		Number of fish captured	Estimated population	Estimated density (n m^{-2})	Estimated biomass (g m^{-2})
March 1996	0+	4/0/1	5	0.0123	0.154
	Trout <20cm	0/0/0	0	-	-
	Trout >20cm	4/2/0	6	0.0147	2.86
October 1996	0+	0/1/1	2	0.0049	0.040
	Trout <20cm	5/1/1	7	0.0172	1.25
	Trout >20cm	19/1/0	20	0.049	9.4
March 1997	0+	0/0/0	0	-	-
	Trout <20cm	3/1/0	4	0.0098	0.438
	Trout >20cm	13/0/0	13	0.03186	5.69
October 1997	0+	1/1/0	2	0.0049	0.013
	Trout <20cm	2/1/0	3	0.0073	0.1377
	Trout >20cm	7/0/0	7	0.0171	0.6088

Appendix ~~4.6~~ E6 Ewden Beck

		Number of fish captured	Estimated population	Estimated density (n m^{-2})	Estimated biomass (g m^{-2})
March 1996	0+	28/12/3	44	0.178	1.69
	Trout <20cm	17/5/1	23	0.091	4.5
	Trout >20cm	5/0/0	5	0.0198	1.91
October 1996	0+	19/12/2	34	0.138	0.98
	Trout <20cm	36/5/2	43	0.170	7.5
	Trout >20cm	3/0/1	4	0.0158	1.74
March 1997	0+	12/8/3	25	0.107	1.09
	Trout <20cm	16/10/3	31	0.126	5.96
	Trout >20cm	3/1/0	4	0.016	3.25
October 1997	0+	1/0/0	1	0.0039	0.034
	Trout <20cm	15/11/2	30	0.1186	0.177
	Trout >20cm	1/3/0	4	0.0158	0.539

Appendix ~~4.7~~ E7 Little Don downstream Underbank Reservoir

		Number of fish captured	Estimated population	Estimated density (n m^{-2})	Estimated biomass (g m^{-2})
March 1996	0+	4/2/4	10*	0.040	0.41
	Trout <20cm	1/2/0	3	0.0091	0.50
	Trout >20cm	3/1/0	4	0.0122	3.2
October 1996	0+	1/0/0	1	0.003	0.0229
	Trout <20cm	1/0/0	1	0.003	0.116
	Trout >20cm	0/0/0	0	-	-
March 1997	0+	0/0/0	0	-	-
	Trout <20cm	1/0/0	1	0.059	0.256
	Trout >20cm	0/0/0	0	-	-
October 1997	0+	2/0/0	2	0.006	0.03
	Trout <20cm	0/0/0	0	-	-
	Trout >20cm	2/0/0	2	0.006	0.68

Appendix E8 River Loxley at Storrs Lane Bridge

		Number of fish captured	Estimated population	Estimated density (n m^{-2})	Estimated biomass (g m^{-2})
March 1996	0+	10/3/5	21	0.075	0.41
	Trout <20cm	49/20/10	85	0.175	10.4
	Trout >20cm	11/0/1	12	0.038	4.9
October 1996	0+	38/14/8	64	0.204	0.73
	Trout <20cm	41/8/3	52	0.163	6.7
	Trout >20cm	8/2/0	10	0.031	4.8
March 1997	0+	10/8/1	20	0.06	0.304
	Trout <20cm	15/8/3	28	0.163	4.1
	Trout >20cm	1/3/0	4	0.012	1.65
October 1997	0+	12/7/2	22	0.069	0.013
	Trout <20cm	28/12/4	46	0.144	0.125
	Trout >20cm	9/2/0	11	0.034	0.493

E9

Appendix ~~4.9~~ River Rivelin at Rivelin Mill

		Number of fish captured	Estimated population	Estimated density (n m^{-2})	Estimated biomass (g m^{-2})
March 1996	0+	6/8/5	42	0.077	0.58
	Trout <20cm	6/0/3	9	0.037	1.80
	Trout >20cm	2/0/0	2	0.0067	0.76
October 1996	0+	0/0/0	0	-	-
	Trout <20cm	27/15/4	49	0.167	6.8
	Trout >20cm	2/1/0	3	0.01	1.49
March 1997	0+	0/0/0	0	-	-
	Trout <20cm	17/8/0	25	0.083	3.3
	Trout >20cm	1/0/0	1	0.0033	0.413
October 1997	0+	0/0/0	0	-	-
	Trout <20cm	11/1/1	13	0.043	0.253
	Trout >20cm	3/0/0	3	0.01	0.449

Appendix ~~4.10~~ E10 River Hipper upper

		Number of fish captured	Estimated population	Estimated density (n m^{-2})	Estimated biomass (g m^{-2})
March 1996	0+	-	-	-	-
	Trout <20cm	-	-	-	-
	Trout >20cm	-	-	-	-
October 1996	0+	-	-	-	-
	Trout <20cm	-	-	-	-
	Trout >20cm	-	-	-	-
March 1997	0+	-	-	-	-
	Trout <20cm	-	-	-	-
	Trout >20cm	-	-	-	-
October 1997	0+	4/2/0	6	0.0175	0.0166
	Trout <20cm	24/5/2	31	0.0906	0.1735
	Trout >20cm	3/0/0	3	0.0087	0.7176

- Site not surveyed before

E11

Appendix ~~4.11~~ River Hipper lower

		Number of fish captured	Estimated population	Estimated density (n m^{-2})	Estimated biomass (g m^{-2})
March 1996	0+	-	-	-	-
	Trout <20cm	-	-	-	-
	Trout >20cm	-	-	-	-
October 1996	0+	-	-	-	-
	Trout <20cm	-	-	-	-
	Trout >20cm	-	-	-	-
March 1997	0+	-	-	-	-
	Trout <20cm	-	-	-	-
	Trout >20cm	-	-	-	-
October 1997	0+	9/3/0	12	0.0474	0.0195
	Trout <20cm	21/1/0	24	0.09486	0.1625
	Trout >20cm	2/0/0	2	0.0079	0.8771

- Site not surveyed before

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