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NATIONAL RIVERS AUTHORITY
Bristol Avon Area fishery
survey: Byde Mill Brook,
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BRISTOL AVON AREA
FISHERY SURVEY
BYDE MILL BROOK
JANUARY 1991 / SEPTEMBER 1992



FISHERY SURVEY - BYDE MILL BROOK
JANUARY 1991/SEPTEMBER 1992

SURVEY REF: BAV91
BAV92

SITE REFS BM01, BM02
BM03

1.0 INTRODUCTION

- 1.1 The Byde Mill Brook extends for a length of approximately 7Km flowing in a south east direction to join the Bristol Avon at Lacock.

The brook arises from the Great Oolite limestone passing through cornbrash and Oxford clay at its lower limits. The brook is a relatively small tributary to the Bristol Avon but has the expanding town of Corsham at its headwaters.

- 1.2 The Byde Mill Brook has not been surveyed in the past for fish.

2.0 WATER QUALITY

- 2.1 The populations of Corsham and surrounding areas have until recently been served by Corsham Sewage Treatment Works (STW) and Thingley STW. These two sewage works had final effluent discharge points within 0.5Km of each other, into the top end of the Byde Mill Brook.

Recently (1991) Wessex plc routed all effluent to Thingley STW and Corsham STW was closed. The storm overflow from the works discharges directly to the River Avon when necessary.

- 2.2 The Long Term Water Quality Objective (LTWQO) of the Byde Mill Brook is Class 3 (National Water Council Classification) in the upper and middle reaches, and Class 2b in the lower reach.

- 2.3 In the 1985 water quality survey (Department of the Environment) the Byde Mill Brook was Class 1b above Corsham and Class 3 below. The 1990 survey shows overall Class 2 which represents an improvement in the middle to lower reaches and a deterioration in the upper reach.

- 2.4 The Byde Mill Brook is not classified under the EC Freshwater Fish Directives.

- 2.5 The biological monitoring programme in 1990 sampled the brook at Courtlands, 4 Km downstream of the STW's discharge and classified this as poor (Class C). Downstream at Lacock some improvement to moderate (Class B) was recorded. These results were repeated for 1991 although a site upstream of Corsham STW which was also sampled came out as poor (Class C). The sewerage infrastructure in Corsham is known to be unsound which may account partly for this.

3.0 SURVEY SITES

- 3.1 Two sites were surveyed on the Byde Mill Brook during January 1991 and their locations are shown in Appendix 1 and 2. Further details of the sites are given in Appendix 3.
- 3.2 One site at New Farm (BM01) was surveyed again in September 1992 (BM03) following a stocking exercise.
- 3.3 Site BM01 and BM03 is located on the Byde Mill Brook at New Farm. This site is approximately 1Km downstream from the STW and 2.5Km upstream from the confluence with the main river Avon.

The survey section starts at a shallow weir and passes downstream through a fairly straight section shaded only by herbaceous vegetation. The site then begins to meander and incorporate good pool and riffle habitat. Shading from trees provides further cover to potential populations of fish.

The substrate is made up of gravel and stones and the riverside Alder trees provide instream root cover. The survey section when first surveyed extended for 190m, and on the followup survey was lengthened to 630m, extending further downstream incorporating more pool and riffle. Instream vegetation was not present at this site except as some blanket weed in the open section.

- 3.4 Site BM02 is downstream of BM01 and BM03 at Arnolds Mill. This is approximately 2.5 Km downstream from the STW and 1 Km upstream from the main Avon confluence. This survey section extended for 210m and is fairly straight and open. The brook here is twice the width (4m) of the other site. In the lower section the site incorporates a large deep pool on a bend. The substrate is mainly mud and silt and at the time of the survey instream vegetation was restricted to small amounts of reed.

4.0 SURVEY METHODS

- 4.1 At all of the survey sites 240v pulsed DC electric fishing was used. At site BM01 and BM03 wading upstream with a single hand held electrode on a 50m cable was carried out with the generator and control box on the bank. A single netsman followed in the river with a further two personnel on the bank. At site BM02 two hand held electrodes were used with a further two personnel in attendance with hand nets. Fishing was in an upstream direction with the generator and ancillary equipment following behind in an inflatable boat.
- 4.2 At site BM02 a catch depletion method of 2 fishings was carried out. At site BM01 as no fish were caught other than sticklebacks a second run was not attempted.

Site BM03 was fished as a single run as the efficiency was perceived to be high (0.8) and a longer section (630m) was fished.

- 4.3 Where appropriate each catch was retained separately in tanks on the fisheries vehicle.
- 4.4 With the exception of small species all fish were weighed and measured. Fish scales were removed from all larger species for age and growth analysis.

5.0 RESULTS

- 5.1 Details of species caught, estimated numbers and biomass are shown in Appendix 5. For these calculations all fish of less than 8cm are ignored as fish of this size are not effectively sampled by electric fishing.
- 5.2 Biomass and fish density for the three sites surveyed are shown in Figures 1 and 2.
- 5.3 Species biomass for the sites surveyed are shown in Figures 3 and 4. Figure 3 shows site BM03 (post stocking). BM01 is not shown as only sticklebacks were caught. Biomass is expressed as grams per square metre (g/m^2).
- 5.4 Species density for the sites surveyed are shown in Figures 5 and 6, similarly with the exception of site BM01. Density is expressed as numbers per hectare.
- 5.5 The population structures for each species are shown graphically site by site in the following figures:-

Chub	7
Brown trout (post stocking)	8

- 5.6 The growth rate of chub and brown trout is given in Appendix 4. As the fish were caught in January or September their ages have been promoted to the nearest whole age.
- 5.7 The only minor species to be caught at each site were sticklebacks.

6.0 DISCUSSION

- 6.1 The sites were generally well suited to the electric fishing technique used and the overall results are thought to provide a reasonably accurate assessment of the fish populations present.
- 6.2 In total only two species of fish were found to be present in the Bye Mill Brook, chub and sticklebacks. Brown trout were not found prior to stocking, although no sites above the STW's were surveyed.

The Bye Mill Brook due to its habitat and the recollections of local people undoubtedly confirm it to have once held reasonable brown trout populations, most probably prior to the 1940's before Corsham began to expand.

- 6.3 The lower site at Arnolds Mill with a biomass of chub at 5.7gm^2 and density of 250 fish per hectare is not particularly good for a river of this type.
- 6.4 The chub encountered at Arnold Mill were of two year classes (1988 and 1987) and may either be the offspring of fish that entered the Bye Mill Brook from the River Avon, or themselves an immigrant population. The growth rates of the chub are good.
- 6.5 The upper to middle reaches of the Bye Mill Brook provide good salmonid habitat being suitable for brown trout. The only species encountered in this section was sticklebacks. Sticklebacks are often the only species found in streams suffering from sporadic water quality problems and due to their life history strategies are classified by biologists as r - strategists.

These are species that rely for their persistence on the ability to colonise new habitats (or those devoid of other fish) and increase rapidly to make use of shortlived resources. The principal control factors are environmental and unpredictable.

Sticklebacks seldom live for more than 3 years and may breed several times in the same year (spring and summer). For this species (as opposed to K - strategists) marked changes in population size are an advantage in a fluctuating environment.

- 6.6 The Bye Mill Brook is classified as neither salmonid nor cyprinid and this may be due to its small size rather than its absence of fish. On habitat alone it would warrant a salmonid classification which would give any trout population legislative water quality protection.
- 6.7 Fish mortalities affecting the Bye Mill Brook are shown in Appendix 6. Interestingly roach and stoneloach turned up in the fish kills. The roach most probably originating from some of the stillwaters in the catchment, the stoneloach from an original endemic stock.

Once a fish population has been 'knocked out' then naturally no more fish mortalities are reported to highlight any problems.

- 6.8 Fish introductions to the Bye Mill Brook are detailed in Appendix 7 and list only the recent introduction by the NRA as a result of this survey.

6.9 RESTOCKING

The 1990 water quality survey has shown an improvement in the Bye Mill Brook from Class 3 to 2 from Bye Mill to Notton, and a deterioration from 1b-2 in the stretch Corsham to Bydemill. This places it in a position to support fish. Also a review of the STW consent is underway and hopefully improvement will continue.

However, during the summer months the STW constitutes the larger part of the flow in the brook so the quality of the Brook will to an extent mirror the performance of the works.

This flow apportionment is a combination of factors related to the development of Corsham. When Box railway tunnel was excavated in the 1700's by Brunel some spring lines were intercepted and routed to the By Brook catchment. Also some combined drainage in Corsham results in rainfall being directed to the STW as well as the normal importation of water to a catchment via the public water supply.

Following the initial fishery survey findings and some development in the water quality status it was decided to stock the brook with 250 small brown trout (10-15cm). These fish were partly to act as 'sentinels' in order to highlight any problems and to see if a population can be re-established. Salmonid fisheries are ideally matched to Class 1 quality watercourses, but in the Bristol Avon catchment there are often populations surviving in Class 2 stretches..

- 6.10 The fish were stocked in July 1991 and in August 1991 an incident at Thingley STW resulted in elevated ammonia levels in the brook throughout to Lacock of up to 10 mg/L and dissolved oxygen levels down to 34% saturation. No fish were found dead however.
- 6.11 The initial stock of 250 fish would equate roughly to a density of 500 fish per hectare within the restocked stretch. When the site at New Farm was resurveyed (BMO3) in September 1992, 14 months later the density was estimated at 10 fish per hectare. This represents a survival rate of 14%, which is fairly low although a margin of error exists.

The object of the stocking was also to provide breeding stock to the river. The fish had all grown very well from an initial 10cm to an average of 32.2cm.

There was no evidence that the fish had spawned in the autumn of 1991. The trout were not likely to have been mature, although they would be for the autumn of 1992 spawning season.

The eggs require incubation in the gravel for several weeks, a lifestage which is very sensitive to levels of un-ionised ammonia. If the fish move into any small tributary streams to spawn this may not pose a problem. There are good spawning gravels in much of the brook but the number of tributaries is small.

7.0 CONCLUSION

- 7.1 The Byde Mill Brook is a small tributary of the middle Bristol Avon and historically held stocks of native brown trout and coarse fish.

Two sites were surveyed which provide a reasonable indication as to the distribution of fish

- 7.2 Fish were found to be absent in the middle reaches and limited in the lower section. The fish stocks of coarse fish in the lower section probably result from access to the main River Avon.

- 7.3 The absence of fish is the direct result of water quality. Historically the sewage works serving Corsham and the surrounding area have reduced the quality of the brook eliminating the populations of fish.
- 7.4 The habitat and nature of the brook favour brown trout.
- 7.5 Following some improvement in water quality and a review of discharge consents, 250 brown trout were stocked to the river.
- 7.6 A followup fishery survey 14 months after stocking showed that the fish had grown very well, although tentatively the survival rate appears low.

8.0 SUMMARY AND RECOMMENDATIONS

- 8.1 The Byde Mill Brook historically held populations of brown trout. The expansion of Corsham put excessive pressure on the river receiving the sewage effluent and consequently the populations disappeared. The LTWQO of Class 3 in the upper to middle reaches makes no allowance for the recovery of fish populations.
- 8.2 The NRA has a statutory duty to maintain, improve and develop fisheries and therefore the impact of the STW must be reduced. One option that has been considered is routing all effluent to the main river Avon where the greater dilution available will reduce the impact.
- As the STW constitutes a lot of the flow in the brook this may cause another problem of very low flows in the Byde Mill Brook. The possibility of a compensation borehole at the top end of the brook may need to be considered.
- 8.3 Tightening of the consent on the STW is essential and if this is not sufficient to improve the brook adequately then the option of rerouting the effluent with compensation flow should be pursued.
- 8.4 The Byde Mill Brook should be resurveyed in 1993/94 to follow up the fate of the original stocking of fish. A stocking also of minor species such as bullheads, minnows and stone loach should occur to accelerate natural recolonisation which is slowed by migration barriers.

REFERENCES

1. Seber and Le Cren (1967). Estimating population parameters from catches large relative to the population, J Animal Ecol 36, 631-643.
2. Zippin (1956). An evaluation of the removal method of estimating animal populations, Biometrics 12, 163-189.
3. Carle and Stubbe (1978). A new method of estimating population size from removal data, Biometrics 34, 621-630.

FIG. 1: BYDE MILL BROOK -BIOMASS.
JAN 1991/ SEPT 1992

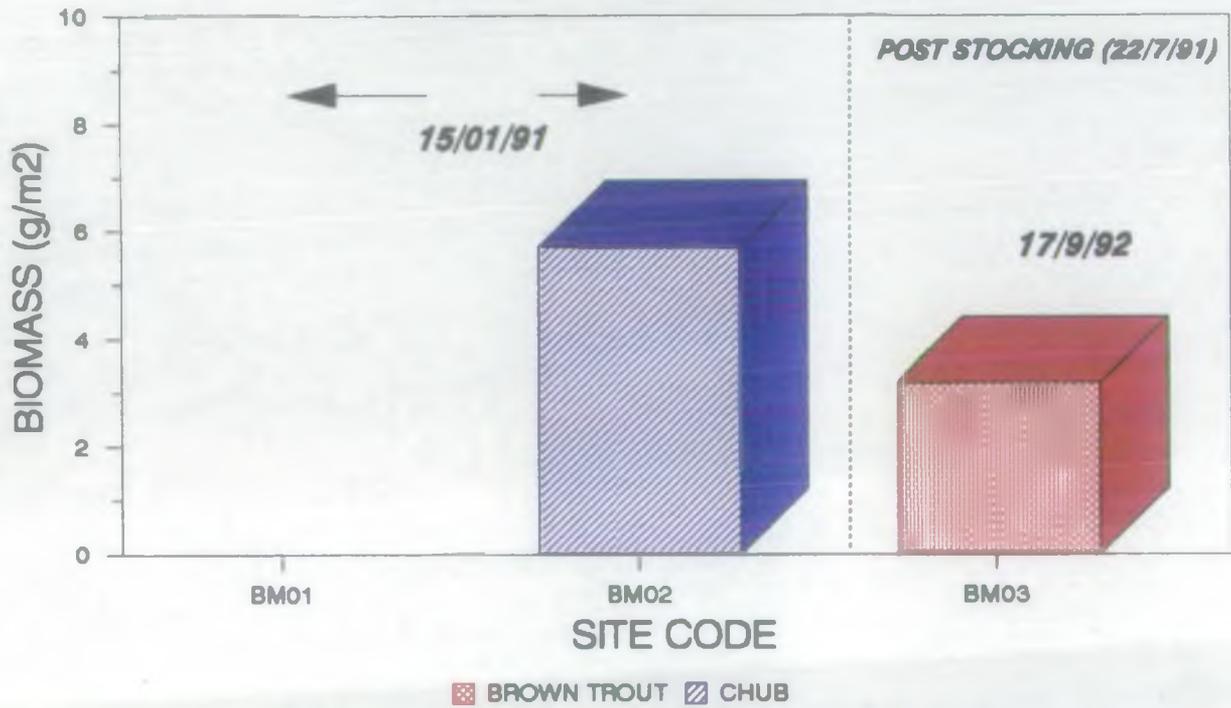


FIG. 2: BYDE MILL BROOK -DENSITY.
JAN 1991/ SEPT 1992

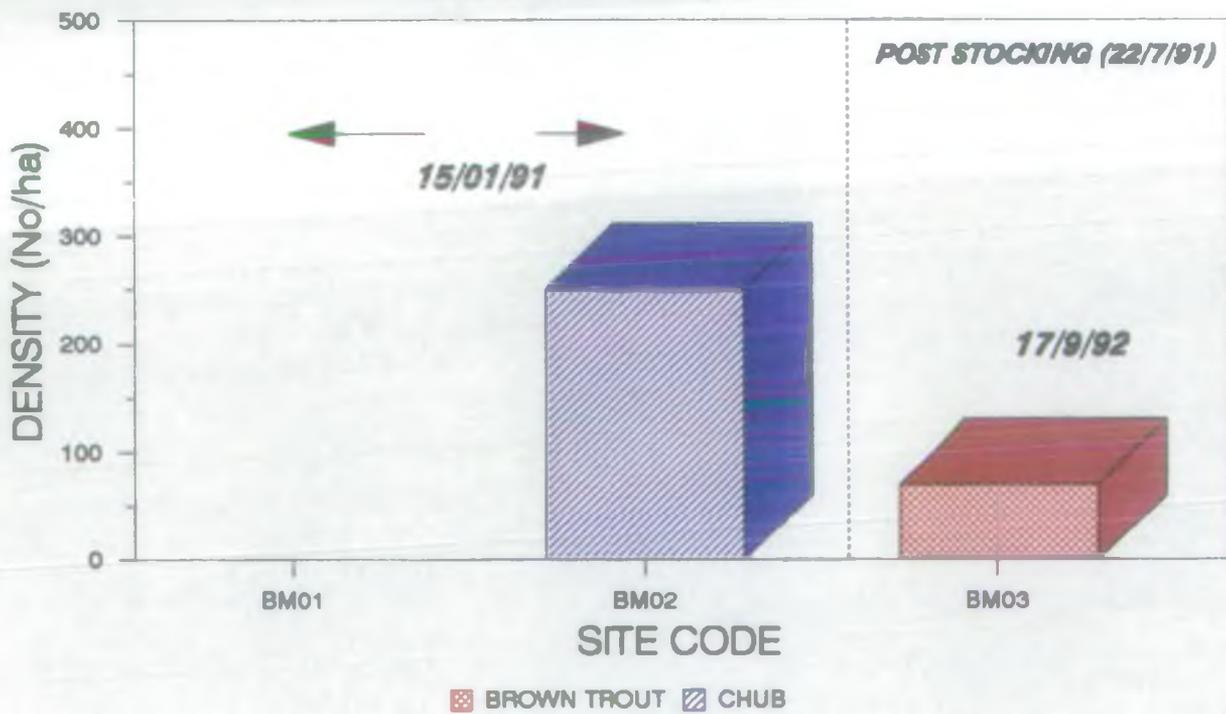


FIG. 3: BYDE MILL BROOK, ARNOLDS MILL
BIOMASS (g/m²) 15.1.91



CHUB (5.705) 100.0%

FIG. 4: BYDE MILL BROOK, NEW FARM
BIOMASS (g/m²) 17.9.92



BROWN TROUT (3.17) 100.0%

FIG.5: BYDE MILL BROOK, ARNOLDS MILL
DENSITY (No/ha) 15.1.91



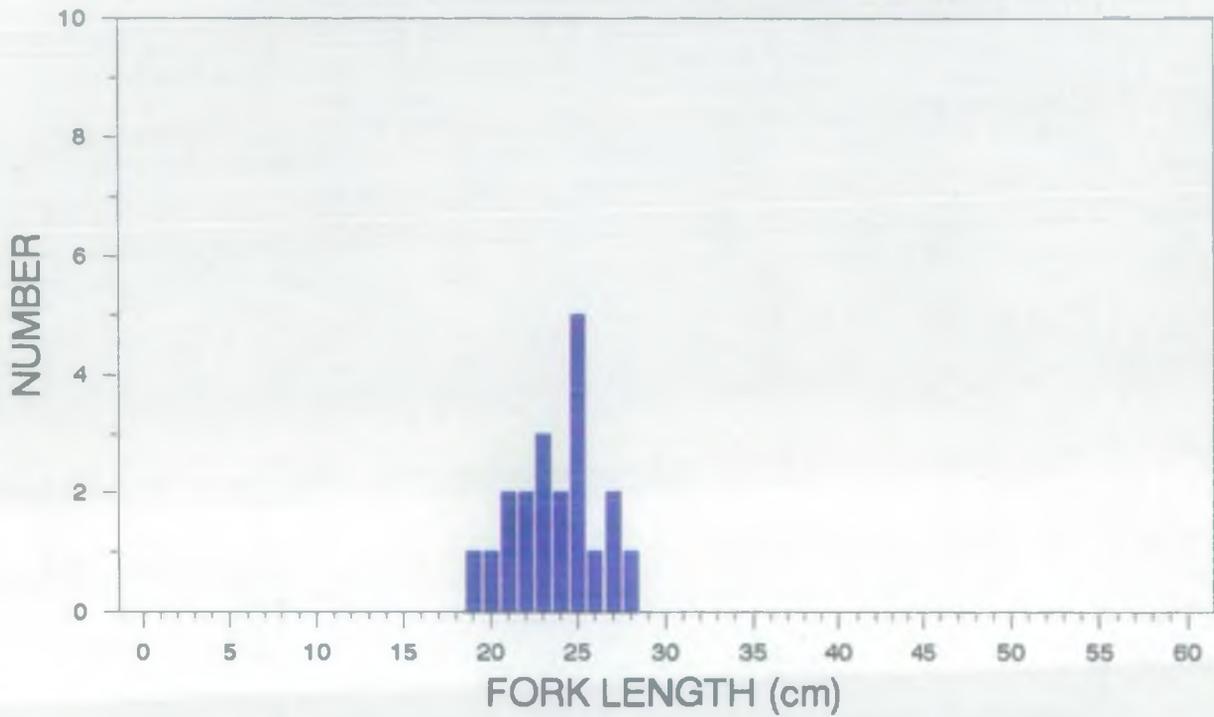
CHUB (250) 100.0%

FIG.6: BYDE MILL BROOK, NEW FARM
DENSITY (No/ha) 17.9.92

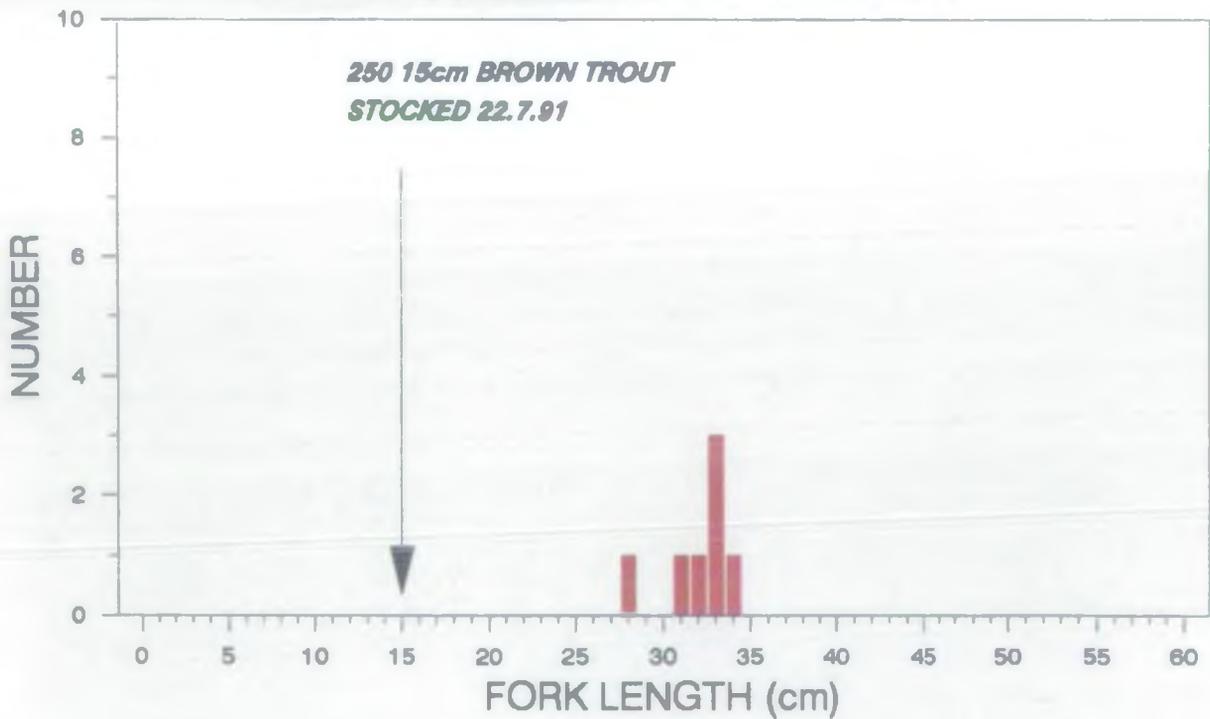


BROWN TROUT (70) 100.0%

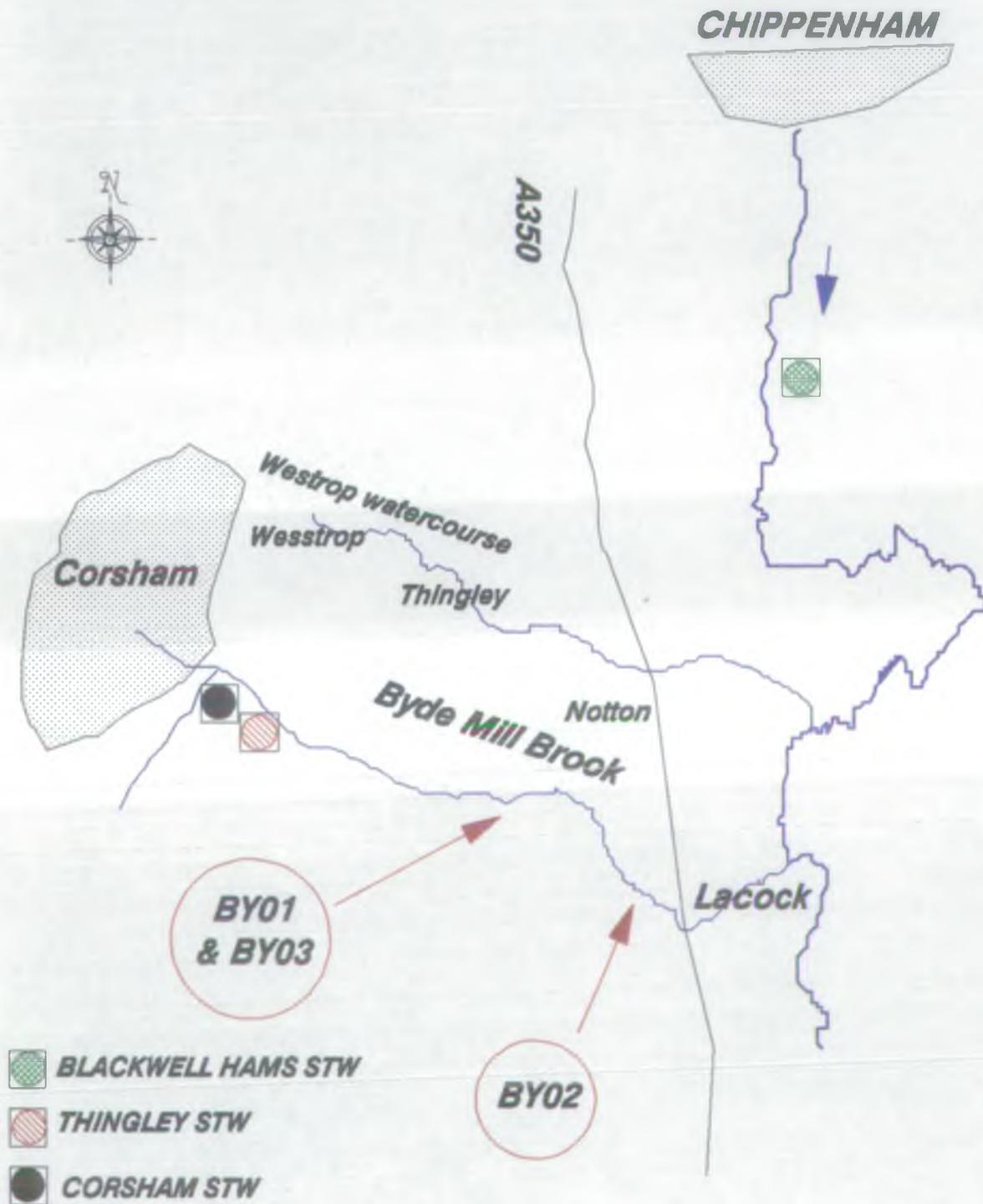
**FIG.7:CHUB, ARNOLDS MILL 15.1.91
LENGTH FREQUENCY DISTRIBUTION**



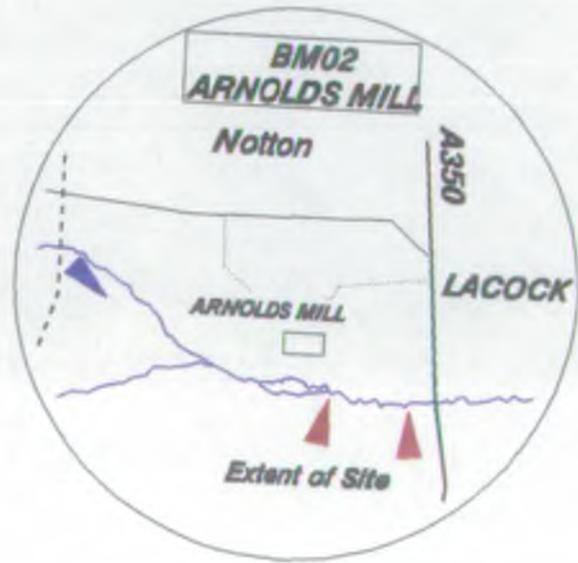
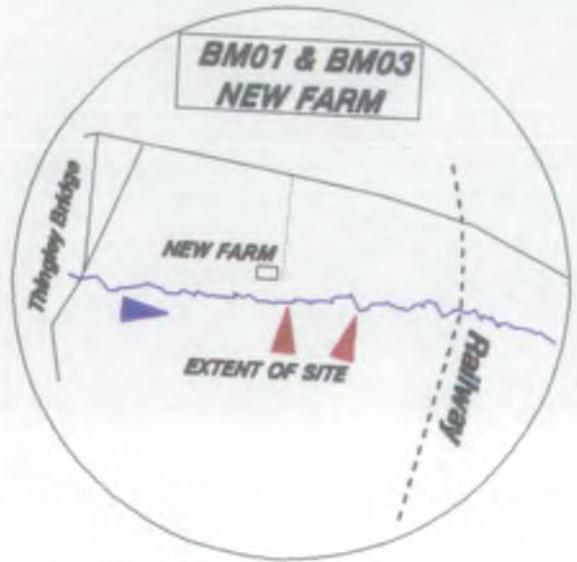
**FIG.8:BROWN TROUT, NEW FARM 17.9.92
LENGTH FREQUENCY DISTRIBUTION**



**APPENDIX.1:
FISHERY SURVEY, BYDE MILL BROOK, 1991 & 1992
SITE LOCATIONS**



**APPENDIX.2: SITE DETAIL
BYDE MILL BROOK**



APPENDIX. 3:
BYDE MILL BROOK, SURVEY SITES

SITE NAME:	NEW FARM	SITE NAME:	ARNOLDS MILL
SITE CODE:	BM01	SITE CODE:	BM02
DATE:	15.1.91	DATE:	15.1.91
WIDTH(m)	2	WIDTH(m)	4
LENGTH(m)	190	LENGTH(m)	210
AREA(ha)	0.038	AREA(ha)	0.084
MEAN DEPTH	0.3	MEAN DEPTH	0.6
WEED COVER	0	WEED COVER	3
SHADE %	50	SHADE %	30

SITE NAME:	NEW FARM
SITE CODE:	BM03
DATE:	17.9.92
WIDTH(m)	2
LENGTH(m)	630
AREA(ha)	0.1260
MEAN DEPTH	0.3
WEED COVER	0
SHADE %	60

APPENDIX. 4:
GROWTH RATES BYDE MILL BROOK

CHUB	AT ARNOLDS MILL			
AGE	YEARCLASS	No. FISH	MEAN LENGTH (cm)	STANDARD (cm)
3+	1988	3	22.0	18.64
4+	1987	15	24.3	22.58

BROWN TROUT		AT NEW FARM (POST STOCKING)		
AGE	YEARCLASS	No. FISH	MEAN LENGTH (cm)	
2+	1990	7	32.3	

APPENDIX 5: BYDE MILL BROOK, NEW FARM

SURVEY REF: BAV91

SITE REF: BM01

DATE: 15/1/91

NGR: ST898691

ESTIMATED SITE AREA 0.038 ha

SPECIES	EST TOTAL POPULATION	95% LIMITS UPPER	LOWER	*POPULATION METHOD	BIOMASS (g m ²)	DENSITY (per ha)	PROBABILITY OF CAPTURE	MEAN WT (g)	MEAN CF
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APPENDIX 5: BYDE MILL BROOK, ARNOLDS MILL

SURVEY REF: BAV91

SITE REF: BM02

DATE: 15/1/91

NGR: ST911687

ESTIMATED SITE AREA 0.084 ha

SPECIES	EST TOTAL POPULATION	95% LIMITS UPPER	LOWER	*POPULATION METHOD	BIOMASS (g m ²)	DENSITY (per ha)	PROBABILITY OF CAPTURE	MEAN WT (g)	MEAN CF
CHUB	21	23	20	1	5.705	250	0.82	228.2	1.56

APPENDIX 5: BYDE MILL BROOK, NEW FARM

SURVEY REF: BAV92

SITE REF: BM03

DATE: 17/9/92

NGR: ST898691

ESTIMATED SITE AREA 0.1260 ha

SPECIES	EST TOTAL POPULATION	95% LIMITS UPPER	LOWER	*POPULATION METHOD	BIOMASS (g m ²)	DENSITY (per ha)	PROBABILITY OF CAPTURE	MEAN WT (g)	MEAN CF
BROWN TROUT	9	0	7	5	3.1686	70	0.8	443.6	1.3

*POPULATION METHOD

CF = CONDITION FACTOR

1. SEBER & LE CREN

2. ZIPPIN

3. CARLE & STRUBBE

4. MINIMUM ESTIMATE

5. SINGLE CAPTURE

APPENDIX.6: FISH MORTALITIES, BYDE MILL BROOK

DATE	WATERCOURSE	LOCATION	SPECIES/Nos	CAUSE
12-MAY-1964	BYDE MILL BROOK	LACOCK TO THINGLEY	A FEW ROACH AND STONELOACH	OXYGEN SAG
12-APR-1968	BYDE MILL BROOK	LACOCK	A NUMBER OF SMALL ROACH	SLUDGE

APPENDIX.7:NRA FISH INTRODUCTIONS TO THE BYDE MILL BROOK

DATE	STOCKED	SPECIES	LENGTH CMS	TOTAL	REASON	SOURCE
22-JUL-1991	BYDE MILL BROOK	BROWN TROUT	10-15cm	250	FISHERY IMPROVEMENT	MIDLAND FISHERY