FISHERIES SURVEY 1990

RIVER COLN

RIVER CHURN

AMPNEY BROOK

Key site monitoring in relation to low flow problems

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Ref: ACN90
ACU90
AAM90

CONTENTS

1. SUMMARY

1. Nine key sites were surveyed in October and November of 1990 in order to monitor any changes from the 1989 survey with particular respect to low flow problems. The four sites on the River Churn and three sites on the River Coln were sampled by electrofishing. The two sites on the Ampney Brook were surveyed by visual inspection as the watercourse was entirely dry during the survey period.

2. The River Coln survey concluded that no significant changes had occurred with one site having remained reasonable, one site having remained poor and one site having remained good. Flow regime is a key factor in determining fishery quality particularly via indirect effect on habitat factors such as siltation of spawning gravels and loss of desirable instream vegetation. No effective recruitment of brown trout was found at any of the key sites.

3. The River Churn survey concluded that two sites had shown significant deterioration, one remaining poor and one remaining satisfactory. Flow regime is a key factor in determining fishery quality by both direct and indirect effects. The drying up of the section between Siddington and 0.5km downstream of the Spine Road Bridge represents a clear case of low flows causing severe direct damage to a significant fishery. No effective recruitment of brown trout was found at any of the key sites.

4. The Ampney Brook survey concluded that the fish population had been eradicated due to it drying up for the second consecutive year. The result represents a clear case of low flow problems causing severe direct damage to a significant fishery. The events of 1990 have delayed any recovery from the disastrous deterioration observed in 1989.

5. Recommendations include continued annual monitoring of fish populations at the key sites together with relevant environmental and other factors. An investigation into the hydrology of the three watercourses concerned with particular respect to groundwater abstraction should be undertaken. A confirmed significant impact would require a further investigation of the options for alleviation of low flows. Habitat enhancement opportunities are extensive and it is this area that the Authority should target and develop in order to produce sustainable benefits to the fish population. One such project on the River Coln has been planned for 1991.

2. INTRODUCTION

In 1986 the Fisheries Department (then of Thames Water) instigated a five year rolling programme to assess the fish populations of the catchment's rivers and canals. These surveys were the first comprehensive investigations and assessed fish population quality with respect to environmental and other relevant factors including water quality, flow regime, habitat quality, fishery management etc.

Surveys of the Cotswold streams including the River Coln (Ref: ACN87), River Churn (Ref: ACU88) and Ampney Brook (Ref: AAM88) were some of the first to be undertaken and the results indicated some important areas of concern. All three survey reports concluded that habitat quality was the key factor in determining the quality of the fish populations. Furthermore, flow regime and associated habitat modification was regarded as being a key factor in determining habitat quality.

Concern over the findings of these surveys led to a key site monitoring programme being undertaken on the three watercourses above with nine sites in all investigated in 1989 (Ref. ACN89, ACU89, AAM89). The results are commented on in the relevant section of this report, however they did show deterioration at some sites and evidence that low flows were having both direct and indirect deleterious effects on the fish populations. This report represents the second year of key site monitoring in relation to low flow problems.

The conclusions of the reports were of particular importance when viewed against the background of concern against which the surveys were undertaken. A number of complaints had been received concerning low flows and fishery decline whilst the question of low flows and groundwater abstraction had and continues to be highlighted in the press and on T.V. The situation in the Cotswold streams was further highlighted by the publicity surrounding the Alleviation of Low Flows (ALF) project and the creation of the National Rivers Authority.

The reason for the concern of fishery owners and the public is clear when the distribution and size of groundwater abstraction is examined in relation to the watercourses in the west Cotswolds (Fig 2.1.1). Details of the five major groundwater pumping stations are presented below. The abstractions are from two major limestone aquifers, the Great Oolite and the deeper Inferior Oolite.

FIG. 2.1.1 UPPER THAMES CATCHMENT SHOWING LOCATIONS OF GROUNDWATER ABSTRACTIONS

Pumping Station	N.G.R.	Licence Number	Aquifer Source	Year of Licence	Abstraction Rate		
					m^3/year	Peak m^3/d	ave.m^3/d
Ashton Keynes	SU 042941	28/39/1/9	Great Oolite	*R	3182270	11593	8719
Latton	SU 080968	28/39/2/10	Great Oolite	*R	100228500	39550	28023
Baunton	SP 020048	28/39/2/10 28/29/2/63	Inferior Oolite	*R 1981	229200	21590	6280
Meysey Hampton	SP 113988	28/39/5/39	Great Oolite	1981	3327000	11370	9115
"		28/39/5/41	Inferior Oolite	1987	2909000	10140	7970
Bibury	SP 113071	28/39/6/15 28/39/6/62	Great Oolite & Inferior Oolite	*R 1967	2489000	6819	6819

*R = Licence of Right due to abstraction being established prior to the Water Resources Act 1963.

In addition, further conditions are placed on some abstractions as below.

Baunton P.S.

When the flow in the River Churn is less than 32000 m^3/d, Baunton can only abstract 6280 m^3/d .

Meysey Hampton P.S.

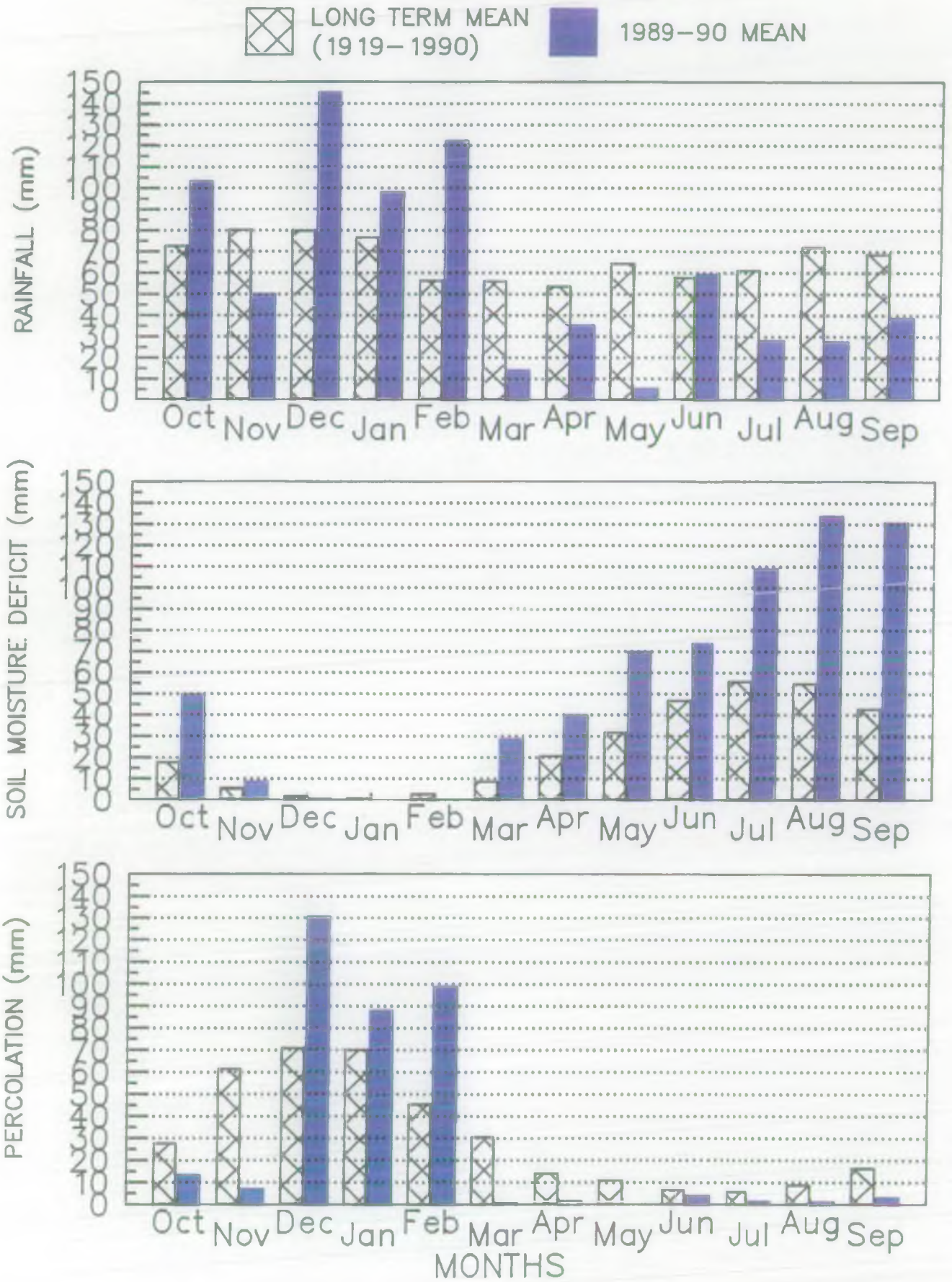
When the flow of the Coln at Bibury is below 68000 m^3/d the Great Oolite borehole must be used at Meysey Hampton. Above this flow the Inferior Oolite must be used. The annual abstraction therefore cannot exceed 3327000m^3 from the Great Oolite in a dry year and 2909000m^3 from the Inferior Oolite in a wet year.

Bibury P.S.

Additional abstraction up to 5455m^3/d is allowed to support Bibury Trout Farm springs when the spring flow falls below 5455m^3/d.

The Water Year 1989-90 (October-September) relevant to this survey was drier than average (Fig 2.1.2.) with the rainfall total in the West Cotswolds area being 91% of the long term mean. Although winter rainfall was above average, the drought summer of 1988 had produced high soil moisture deficits which delayed percolation and recharge to the aquifer until December. Below average rainfall from March throughout 1990 resulted in very high soil moisture deficits and very little surface run-off to supplement base flow. These factors culminated in low flow problems in many rivers and placed particular relevance on the key site surveys included in this report.

FIG. 2.1.2 RAINFALL, SOIL MOISTURE DEFICIT AND PERCOLATION FOR COTSWOLDS WEST AREA WATER YEAR 1989–90



The dry summer adversely affected the water supply situation and resulted in Thames Water Utilities Ltd. applying for a Drought Order under the provisions of Section 131 of the Water Act 1989 during September. The application was granted in October and covered the Cotswold, Swindon, Faringdon and Marlborough supply areas. With respect to the Cotswold area, the application included a request to abstract groundwater from the unlicensed borehole source at Kemble, Glos. (ST 9847 9764). This source abstracts from both the Great and Inferior Oolite and previous tests had suggested that a reliable yield between 3 and 4 ml/d could be obtained. Although granted, this source was not in fact used during the duration of the Drought Order.

3. AIMS AND OBJECTIVES

3.1 Overall Aims of Surveys

The National Rivers Authority (N.R.A.) has a statutory obligation to maintain, improve and develop inland fisheries. To assist in meeting this obligation, N.R.A., Thames Region fisheries staff have engaged upon a 5 year rolling programme of riverine fish population surveys to establish baseline data for each major watercourse in the Thames catchment.

3.2. Specific Aims of Surveys

The surveys included in this report represent the second year of annual monitoring at key sites on three watercourses in the Cotswold area with particular regard to low flow problems. Specific aims are as follows;

i. To monitor any changes in the fish population since the 1989 surveys with regard to environmental factors, particularly flow regimes.

ii. To provide additional baseline data in order to monitor future changes and their cause.

4. METHODS

4.1 Site Selection

Sites were selected to represent local environmental conditions within the defined water quality zone, taking into account topography, known water quality impact, flow regimes, and access considerations.

4.2 Capture & Data Acquisition

At each site, a stretch of river of at least 150m in length was enclosed by stop-nets. Catch depletion electrofishing techniques, using pulsed D.C. equipment were used. Two runs were undertaken unless catch depletion was poor and a third was required. In addition, a semi-quantitative assessment was made by a single run upstream of the survey section to assess whether the chosen site was representative of a longer section of river.

All fish captured were enumerated by species and their fork length measured to the nearest mm. Where catches were relatively low (<40 per species), all fish were weighed to the nearest gram. With larger catches, subsamples of up to 40 fish of each species were weighed. Samples of scales were not taken as growth curves had been calculated in previous surveys on these watercourses.

Minor species such as bullhead Cottus gobio, stone loach Noemocheilus barbatulus, stickleback Gasterosteus aculeatus, and minnow Phoxinus phoxinus were noted for presence and qualitative abundance. Details of the major physical characteristics of each site including weed and bankside cover, depth, substrate type and temperature were recorded.

All data acquired in the field was entered into a Husky Hunter data logger. This was later downloaded to an IBM compatible microcomputer for subsequent analysis.

4.3 Data Analysis

All data was processed on the microcomputer using the Fisheries Information System (FINS) software package developed by N.R.A., Thames Region. Graphics were generated using Freelance Plus V.3.0.

4.4 Macroinvertebrate Survey

N.R.A. Biology staff are engaged upon a biological monitoring programme of main watercourses in the Thames region. Data on macroinvertebrates from this source are presented in this report. The species composition of invertebrate communities reflect the physico-chemical variations which occur in a river and thus provides a means of monitoring the aquatic environment on a continuous basis.

A system of evaluating this data has been developed based on the Biological Monitoring Working Party (B.M.W.P.) scoring system which relates the invertebrate community to water and habitat quality. The B.M.W.P. score obtained is classified in terms of biotic quality class A-E. The score is also related to a score predicted by a computer model developed by the Freshwater Biological Association (F.B.A.). The predicted score is taken to be that expected given the environmental characteristics of the particular site with no pollution present.

The biological sampling points for each of the watercourses surveyed are detailed in the relevant sections.

4.5 Water Quality

River water quality data is collected at strategically located Reach Assessment Points (R.A.P.) by the N.R.A. Pollution Control Department. The sampling points for the watercourses surveyed are detailed in the relevant sections.

5. RIVER COLN

Ref: ACN89

5.1. INTRODUCTION

5.1.1 Description of Watercourse

A map of the River Coln and significant tributaries is presented in Fig. 5.1.1. The River Coln rises from a series of springs to the north of Brockhampton near Cheltenham (SP 035234). The river flows in a south-easterly direction to join the River Thames at Lechlade, (SU 204987) a distance of 51.6km and has a mean gradient of 1 in 430. The river has no large tributaries but those which are significant include the Spring Ditch and the Dudgrove Stream.

The catchment area is dominated by agricultural land use with no large towns being present.

5.1.2. Geology

The River Coln rises from a series of springs which correspond to the boundary of the Cotteswold Sands and Upper Lias Clay. (SP 035234). The geology of the Coln catchment is dominated by limestone and clay with the river encountering the following dominant strata in sequence from source downstream; Upper Lias Clay (source - Withington), Inferior Oolite Limestone (Withington - Fossebridge), Great Oolite Limestone (Fossebridge - Fairford), and finally alluvium on Oxford Clay (Fairford - Lechlade).

5.1.3. Hydrology

The river flow is measured at Bibury gauging station (SP 121062). The mean daily flow is approximately 1.3 cumecs (based on 25 years' data) with flood discharges in excess of 5 cumecs. Mean dry weather flows are very low being in the order of 0.5 cumecs. The hydrograph and mean monthly flow figures for Water Year 1989-90 are presented in Figs. 5.1.3.1. and 5.1.3.2. respectively. The yearly mean was just above the long term mean (102%) due to high winter rainfall and there was a particularly dry summer prior to the survey work.

5.1.4. Water Quality

5.1.4.1. River Classification

River water quality is classified according to the National Water Council (N.W.C.) River Quality Objectives (R.Q.O.) 1978 (as amended by Thames Water Authority 1987). Further details of this classification are presented in Appendices I and II.

The River Coln is classified as below:

Section	Distance(km)	R.Q.O.
Source - Bibury Trout Farm	32.3	1A
Bibury Trout Farm - Fairford Mill	10.5	1B
Fairford Mill - River Thames	8.8	1A

The only classified tributary of the River Coln is listed below.

Tributary	Section	Distance	R.Q.O.
Dudgrove Stream	Source - River Coln	7.2	1A

FIG. 5.1.1 THE RIVER COLN

FIG. 5.1.3.1 RIVER COLN HYDROGRAPH (WATER YEAR 1989–90)

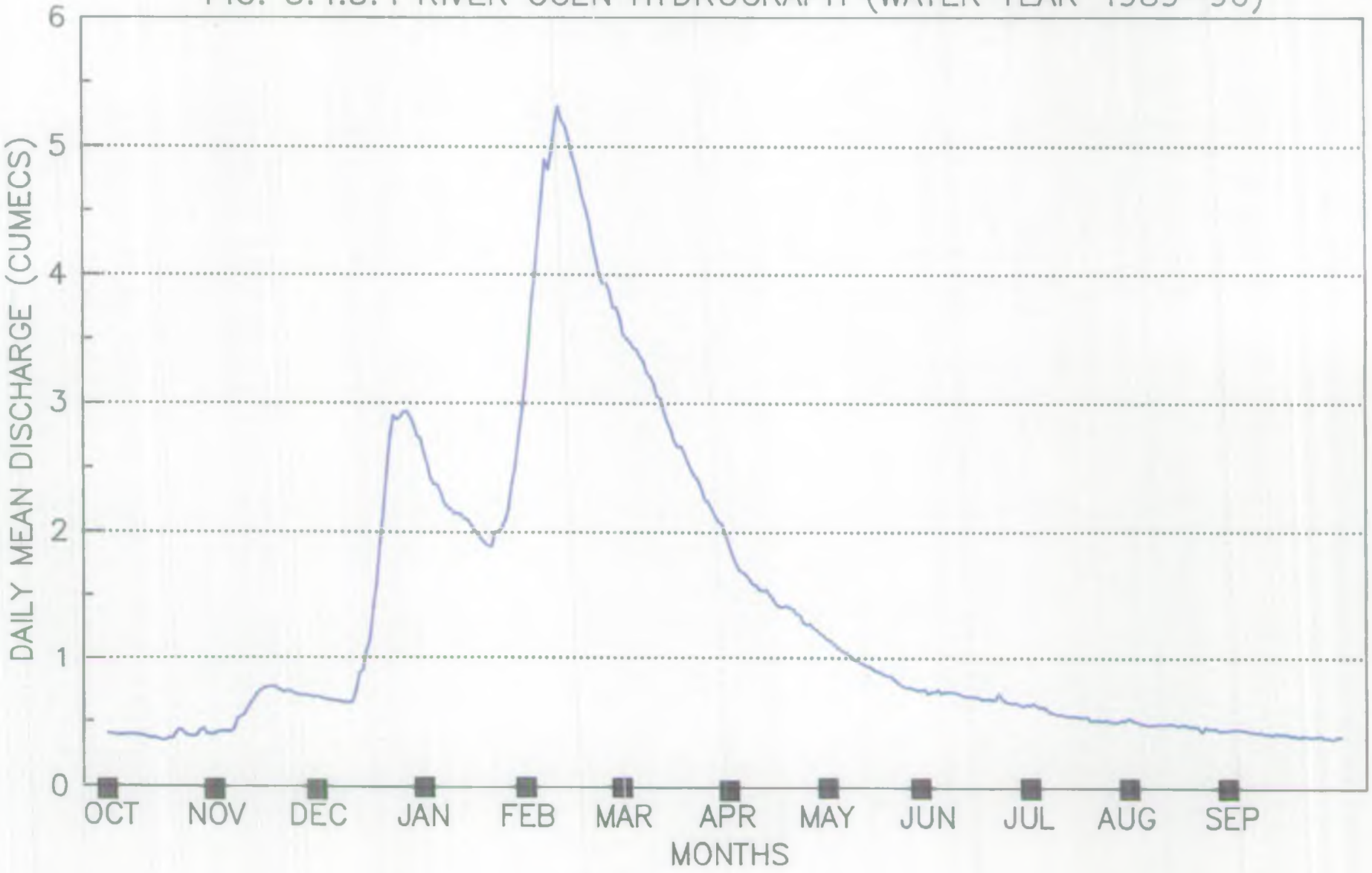
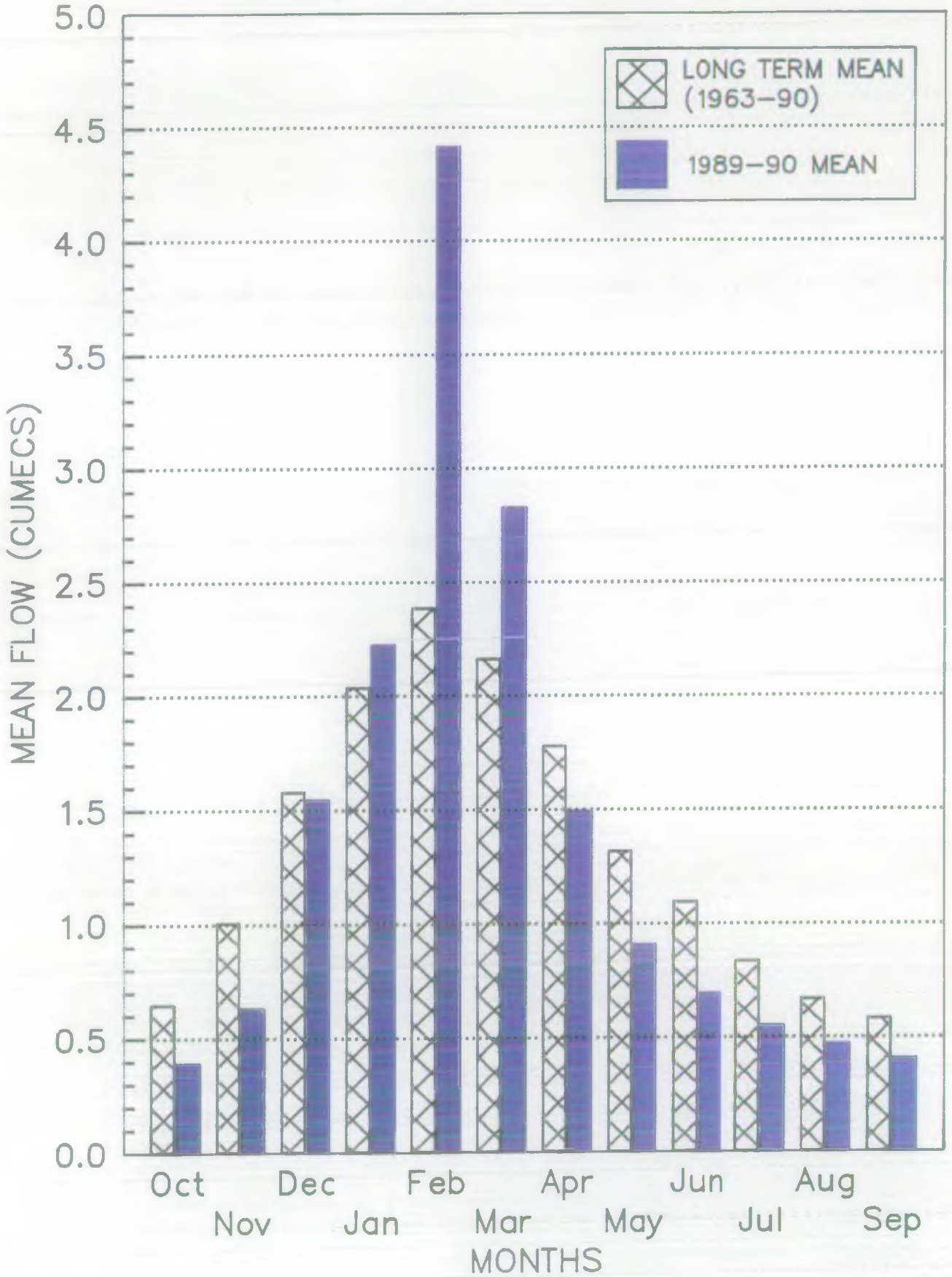


FIG. 5.1.3.2 RIVER FLOW DATA

Monthly Mean Flows at Bibury (1989–90)



5.1.4.2. Consented Discharges

The water quality survey showed that consented discharges had no significant effect on water quality. For this reason details of discharge consents are not presented.

5.1.4.3. Pollution Incidents

There were no pollution incidents resulting in a fish mortality in 1990.

5.1.5. Fishery Information

5.1.5.1. Fishery Designation

The River Coln is an E.C. designated salmonid fishery between Withington and the River Thames (38.7km), under the European Community Directive 78/659/EEC. Further details concerning water quality criteria associated with this classification are presented in Appendix III.

The National Rivers Authority, Thames Region, have set internal fish biomass targets with respect to E.C. designated fisheries, viz -

Cyprinid - $20g/m^2$
Salmonid - $15g/m^2$

The N.R.A. Thames Region have developed a site code classification system based on the River Quality Objective and the E.C. designation. A description of this is presented in Appendix IV.

5.1.5.2. Previous Fishery Surveys

Prior to 1987 no full quantitative fishery survey had been undertaken. Fishery data for this period was based on one quantitative site at Whelford (CNA7) surveyed in 1982 and the results of angling and fishery management exercises such as culling operations.

In 1987, a thirteen site electric fishing survey was undertaken (Ref. ACN87), the first comprehensive investigation of the River Coln. The conclusions were that the upper section of the river was characterised by a poor biomass of brown trout attributed to poor habitat quality. The section from Coln St. Dennis to Whelford was dominated by grayling and brown trout. Fishery quality varied considerably and was related to habitat quality. The lower section of the river, downstream of Whelford Mill, was dominated by coarse species and was affected by immigration from the River Thames. Chemical and biologically inferred water quality results showed no problems to be present. The key to fishery quality on the River Coln was habitat quality with poor populations resulting at sites which had suffered from poor land drainage practice or low flow.

A six site survey was undertaken in 1988 (Ref. ACN88) in order to provide further information on the reason for the poor results in the upper section and to monitor key sites in relation to low flow and habitat deterioration. The results confirmed the reason for poor fishery quality in the upper section to be habitat quality with isolated sites which possessed good structure supporting good fish populations. The key sites which were re-surveyed showed some significant deterioration, particularly with respect to the lack of effective recruitment in the brown trout population. This was attributed to habitat quality linked to the effects of low flow.

A key site survey was undertaken in 1989 (Ref. ACN89) with particular respect to low flow problems. This concluded that one site had shown significant deterioration, one site remained poor and one had shown an improvement. The link between habitat quality and flow regime was again stressed. There was evidence that low flows were having both direct and indirect deleterious effects on the fish population.

5.1.5.3. Fish Mortalities

There have been no reported fish mortalities in 1990.

5.1.5.4. Fisheries Management

The River Coln is intensively managed as a trout fishery downstream of Bibury. Some management work is also undertaken in restricted stretches in the upper sections.

Management practices mainly consist of the private introduction of takeable brown trout. The Authority has also been involved in stocking young trout and grayling in the lower section. The removal of grayling or coarse species is undertaken on many sections downstream of Bibury. A full list of consented fish introductions and culling operations for 1990 is provided in Appendices V and VI respectively.

5.1.5.5. Angling Interests

The River Coln represents a very important angling facility from both a recreational and commercial viewpoint, with trout fishing undertaken on all sections in the lower half of the river downstream of Bibury. Trout fishing interests are also present at several sections upstream of Bibury.

5.2 Methods

General methods are detailed in section 2 but specific details for the River Coln are given below.

5.2.1 Fishery Survey Sites

Site	Code	N.G.R.
Coln St. Dennis	CNA3	SP 087105
Downstream Bibury	CNC1	SP 132055
Upstream Whelford	CNA7	SP 167999

It was also planned to survey a fourth site at Netherton Bridge (CNC3, SP 151046), but this was not possible due to the objection of the fishery owner.

5.2.2 Macroinvertebrate Survey Sites

The following routine sites were surveyed during 1986-90 inclusive.

Site	Code	N.G.R.
Fossebridge	PUTR.0036	SP 081112
Bibury Gauging Station	PUTR.0037	SP 121062
Roundhouse, Lechlade	PUTR.0039	SU 204988

In addition, a 10 site survey (including the three above) was undertaken in 1988 at the request of the fisheries department. Details of the survey are presented in the 1988 report (ACN88).

5.2.3 Water Quality Sampling Points

Site	Code	N.G.R.
Withington	PUTR.0040	SP 031153
Fossebridge	PUTR.0036	SP 081112
Bibury Gauging Station	PUTR.0037	SP 121062
Whelford	PUTR.0038	SP 171992
Roundhouse,Lechlade	PUTR.0039	SP 204988

Data from 1990 was examined.

5.3 RESULTS

5.3.1 Fisheries Survey Results

5.3.1.1 SITE RESULTS - COLN St DENNIS (CNA3)

WATERCOURSE: River Coln

SITE NAME: Coln St Dennis

SITE CODE: CNA3

LOCATION: Long meadow opposite Pindrup Farm

N.G.R.: SP 087105

DATE FISHED: 10th October 1990

METHOD: Upstream electric fishing, wading with two anodes. 2 runs.

R.Q.O.: 1A **E.E.C. TARGET BIOMASS:** 15g/sqm.

HABITAT FEATURES

LENGTH: 142m **MEAN WIDTH:** 5.0m **AREA:** 710 sqm. **MEAN DEPTH:** 0.5m

WATER TEMPERATURE: 12 degrees C

SUBSTRATE COMPOSITION (%)

BARE: 00 **MUD & SILT:** 80 **GRAVEL:** 15 **STONE:** 05 **BOULDER:** 00

VEGETATION (% COVER)

SUBMERGED: 10 **FLOATING:** 00 **EMERGENT:** 05 **SHADE:** 30

DOMINANT PLANT SPECIES: Ranunculus, Callitriche, Sparganium, Myosotis and Carex sp.

WATER LEVEL: Low **WATER CLARITY:** Some colour

PHYSICAL STRUCTURE OF SITE: Straight section with uniform depth except one deeper pool (1m). Poor growth of Ranunculus. Solid gravel bed but overlying silt in many areas. Recent clearance of emergents on R.H.B.

ADJACENT LAND USE: L.B. Pasture
R.B. Pasture

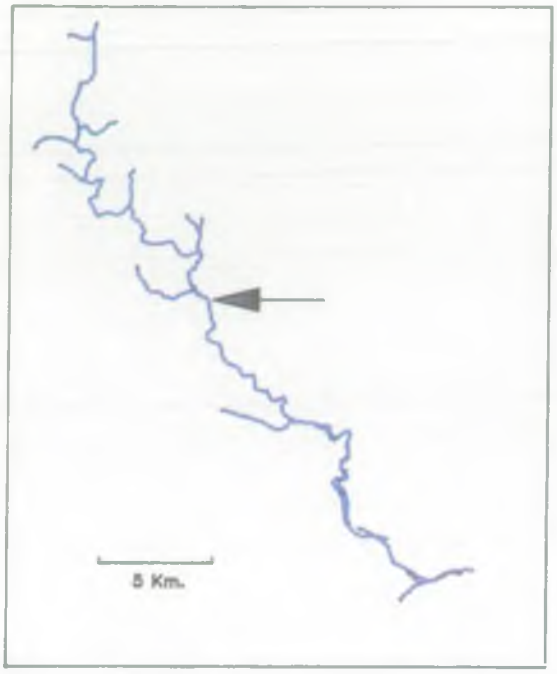
RIPARIAN OWNERS: L.B. Mr M Pratley
R.B. Mr J R Pattinson

FISHING RIGHTS: L.B. Mr M Pratley
R.B. Sir G Cox

ADDITIONAL INFORMATION: Bullhead and minnow present. An additional run upstream of the survey section (120 x 4.6m) produced 1kg. This represents a minimum biomass of 1.8g/sqm. but included 20 small brown trout (6-12cm)

COMMENTS: A good biomass achieving the site target of 15g/sqm. Brown trout are the dominant species with the age structure indicating some succesful recruitment in 1990. A poor grayling population with no effective recruitment.

Fig. 5.3.1.1a COLN St DENNIS (CNA3)
Biomass & Density

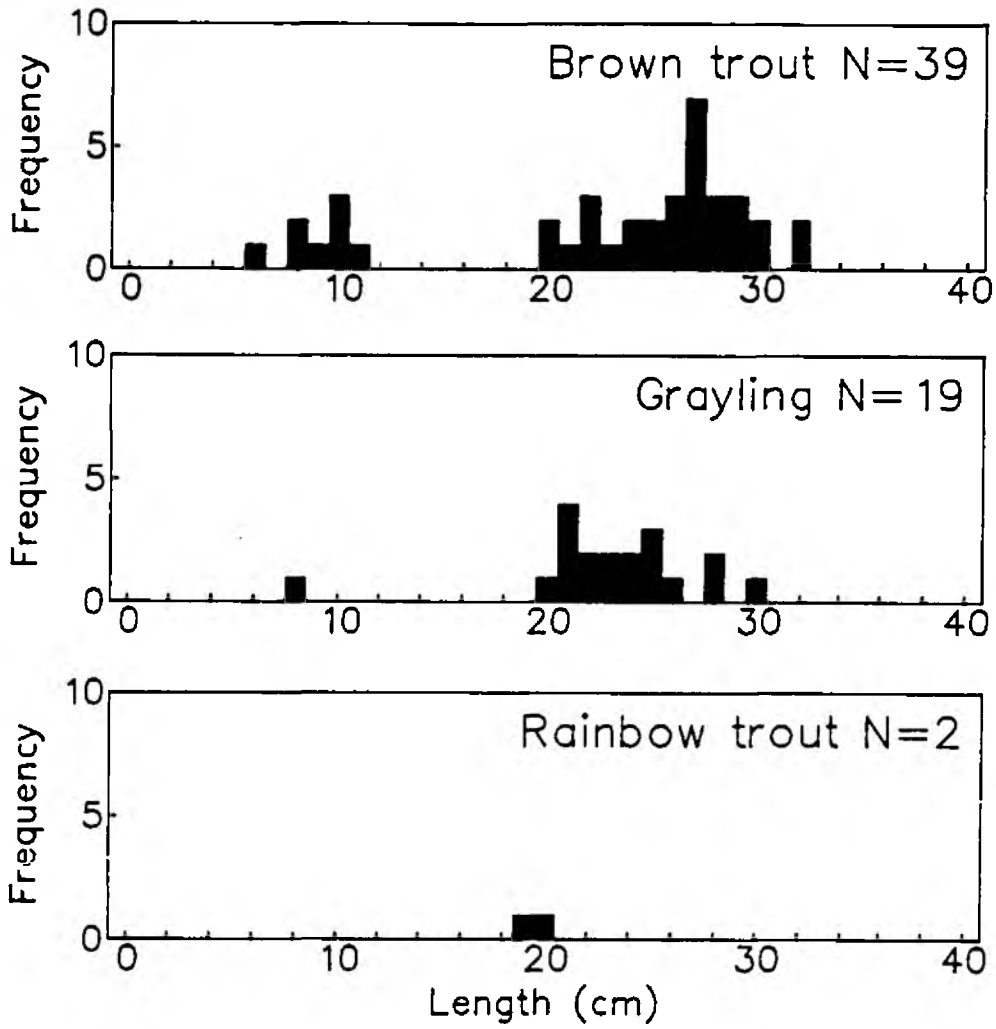


	Biomass (gm-2)	Density (nm-2)
Brown trout	10.7	0.056
Grayling	4.7	0.028
Rainbow trout	0.3	0.003
TOTAL	15.7	0.087

Biomass

Density

Fig. 5.3.1.1.b COLN St DENNIS (CNA3)
Length Frequency



5.3.1.2 SITE RESULTS - DOWNSTREAM OF BIBURY (CNC1).

WATERCOURSE: River Coln

SITE NAME: Downstream of Bibury

SITE CODE: CNC1

LOCATION: Coneygar Farm

N.G.R.: SP 132055

DATE FISHED: 10th October 1990

METHOD: Upstream electric fishing, wading with three anodes. 3 runs.

R.Q.O.: 1B E.E.C. TARGET BIOMASS: 15g/sqm.

HABITAT FEATURES

LENGTH: 138m MEAN WIDTH: 9.5m AREA: 1311 sqm. MEAN DEPTH: 0.5m

WATER TEMPERATURE: 11 degrees C

SUBSTRATE COMPOSITION (%)

BARE: 00 MUD & SILT: 80 GRAVEL: 20 STONE: 00 BOULDER: 00

VEGETATION (% COVER)

SUBMERGED: 20 FLOATING: 00 EMERGENT: 00 SHADE: 05

DOMINANT PLANT SPECIES: Potomageton pectinatus, & Sparganium,

WATER LEVEL: Low WATER CLARITY: Clear

PHYSICAL STRUCTURE OF SITE: A curving section with little bankside cover. Uniform depth with some deeper runs (0.8m). Mostly gravel substrate but overlying silt in many areas.

ADJACENT LAND USE: L.B. Pasture
R.B. Pasture

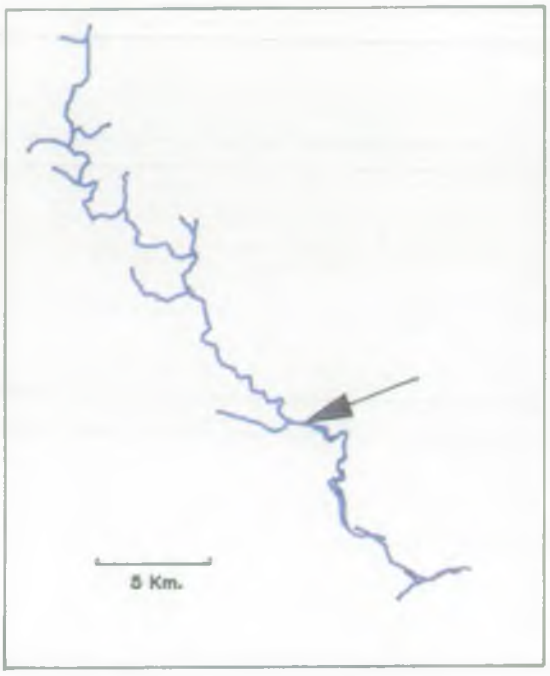
RIPARIAN OWNERS: L.B. Williamstrip Estate
R.B. As above

FISHING RIGHTS: L.B. Williamstrip Estate
R.B. As above

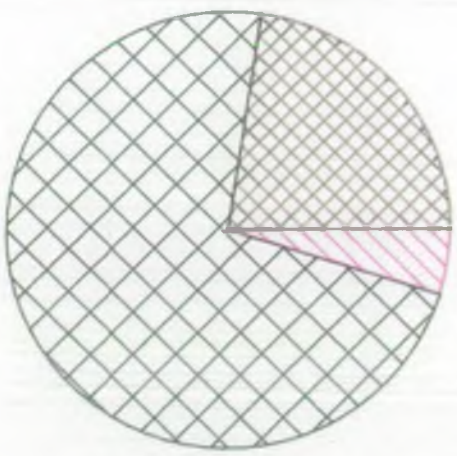
ADDITIONAL INFORMATION: Bullhead present. An additional run (90 x 8.5m) upstream of the survey section produced 6kg. This represents a minimum biomass of 7.8g/sqm.

COMMENTS: A good biomass achieving the site target of 15g/sqm. Grayling are the dominant species with the age structure indicating poor recruitment in 1990. A poor population of brown trout dominated by large fish (>30cm) probably originating from annual introductions for angling interests. Continued lack of recruitment.

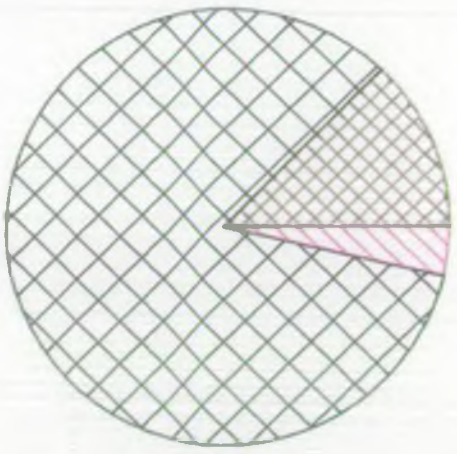
Fig. 5.3.1.2a DOWNSTREAM OF BIBURY (CNC1)
Biomass & Density



	Biomass (gm-2)	Density (nm-2)
Brown trout	4.3	0.007
Grayling	13.8	0.046
Rainbow trout	0.9	0.002
TOTAL	19.0	0.055

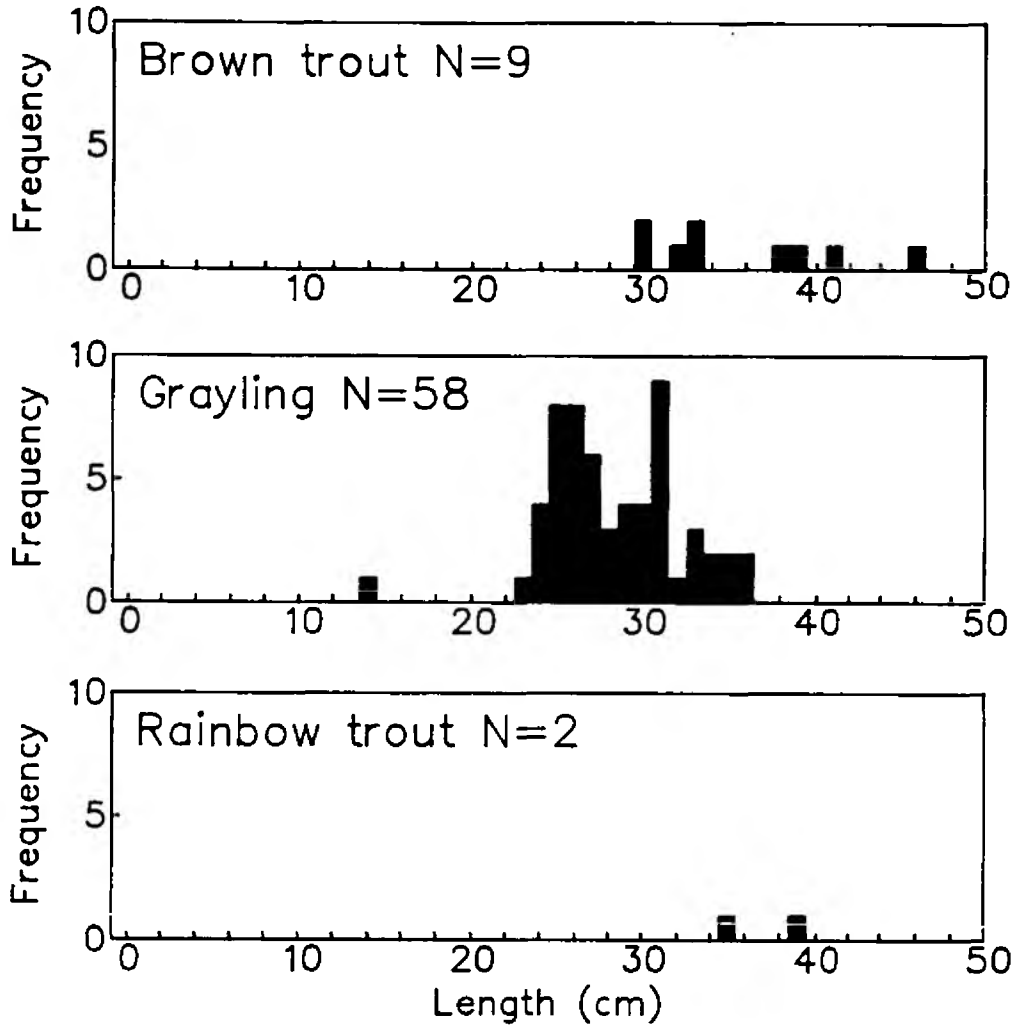


Biomass



Density

Fig. 5.3.1.2b DOWNSTREAM OF BIBURY (CNC 1)
Length Frequency



5.3.1.3 SITE RESULTS - UPSTREAM OF WHELFORD (CNA7).

WATERCOURSE: River Coln

SITE NAME: Upstream of Whelford

SITE CODE: CNA7

LOCATION: Immediately downstream of fishing hut, A.R.C. works

N.G.R.: SU 167999

DATE FISHED: 23rd October 1990

METHOD: Upstream electric fishing, wading with two anodes. 2 runs.

R.Q.O.: 1A E.E.C. TARGET BIOMASS: 15g/sqm.

HABITAT FEATURES

LENGTH: 185m MEAN WIDTH: 6.1m AREA: 1128 sqm. MEAN DEPTH: 0.5m

WATER TEMPERATURE: 14 degrees C

SUBSTRATE COMPOSITION (%)

BARE: 00 MUD & SILT: 10 GRAVEL: 90 STONE: 00 BOULDER: 00

VEGETATION (% COVER)

SUBMERGED: 30 FLOATING: 00 EMERGENT: 05 SHADE: 30

DOMINANT PLANT SPECIES: Ranunculus and Potomageton sp.

WATER LEVEL: Low WATER CLARITY: Clear

PHYSICAL STRUCTURE OF SITE: A meandering section with both riffle and deeper pools. Good stands of Potomageton and bankside cover Good gravel substrate.

ADJACENT LAND USE: L.B. Area managed as nature reserve
R.B. Pasture

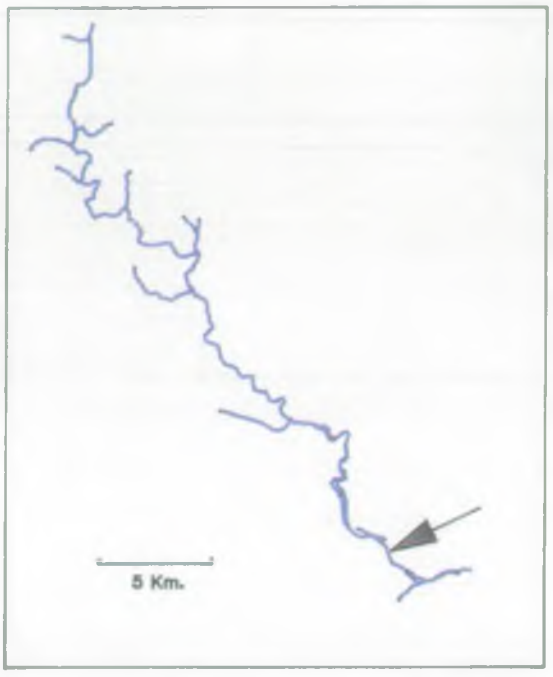
RIPARIAN OWNERS: L.B. Mr G Joyce
R.B. As above

FISHING RIGHTS: L.B. Mr G Joyce
R.B. As above

ADDITIONAL INFORMATION: Minnow, bullhead, lamprey & stoneloach present. An additional run (95 x 5.9m) upstream of the survey section produced 13kg. This represents a minimum biomass of 23.2g/sqm.

COMMENTS: A good biomass easily achieving the site target of 15g/sqm. Brown trout are dominant species with age structure showing evidence of limited natural recruitment. Grayling sub-dominant with evidence of succesful recruitment.

Fig. 5.3.1.3a UPSTREAM OF WHELFORD (CNA7)
Biomass & Density

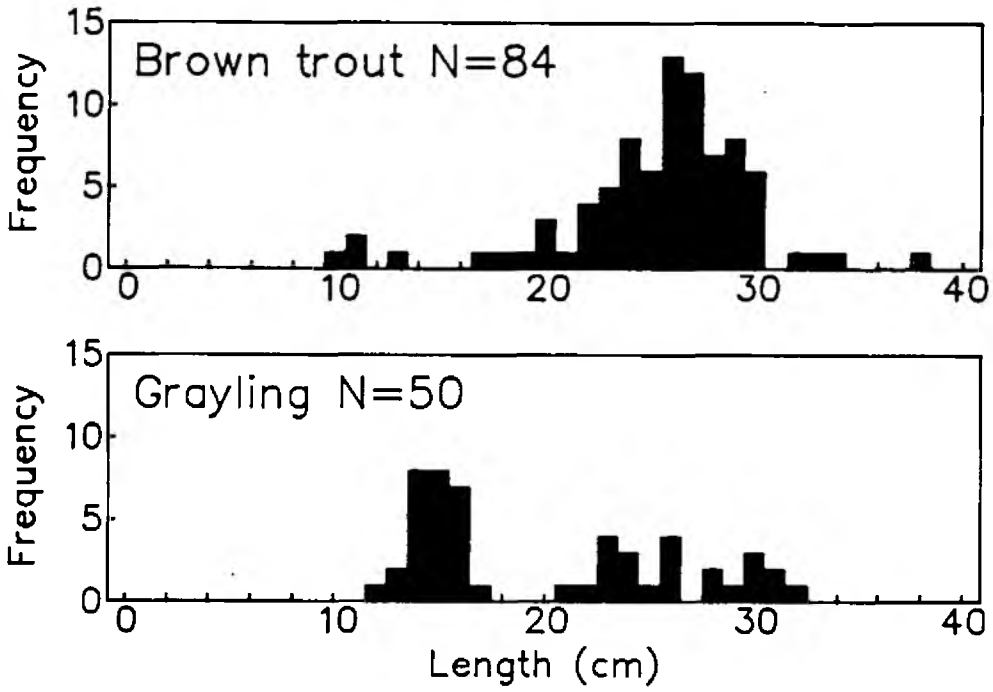


	Biomass (gm-2)	Density (nm-2)
Brown trout	17.2	0.077
Grayling	6.6	0.050
TOTAL	23.8	0.127

Biomass

Density

Fig. 5.3.1.3b UPSTREAM OF WHELFORD (CNA7)
Length Frequency



5.3.2 Water Quality Results

5.3.2.1 River Quality

The results of the water quality assessments for 1990 are summarised below.

Sampling Point	Code	R.Q.O.	Compliance
Withington	PUTR.0040	1A	Pass
Fossebridge	PUTR.0036	1A	Pass
Bibury Gauging Station	PUTR.0037	1B	Pass
Whelford	PUTR.0038	1A	Pass
Roundhouse, Lechlade	PUTR.0039	1A	Pass

5.3.2.2 Consented Discharge Quality

This was not investigated in this survey given the above full compliance with R.Q.O's.

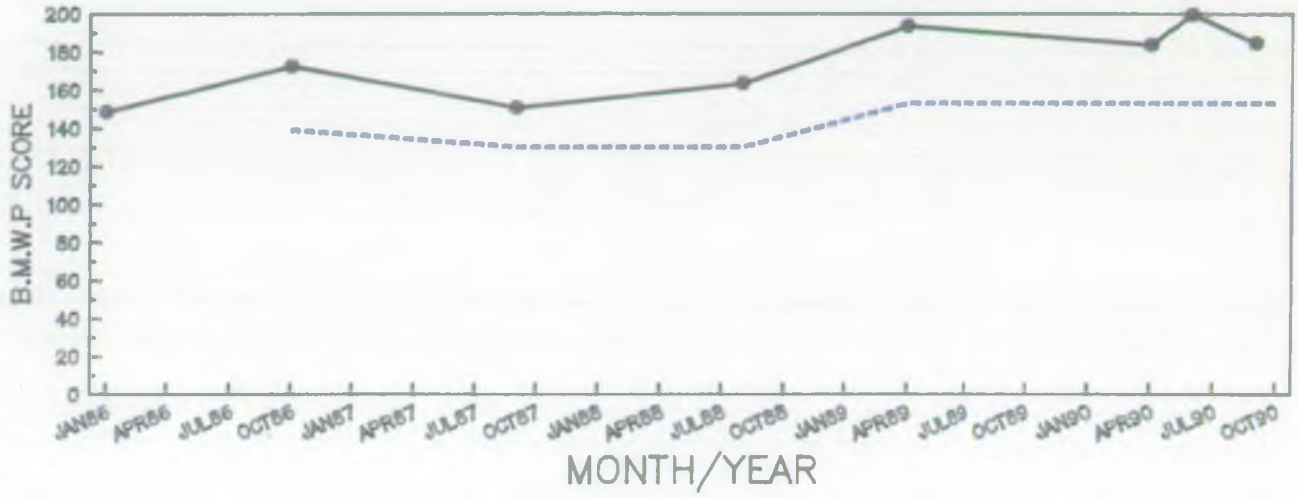
5.3.3 Macroinvertebrate Monitoring

The results of routine macroinvertebrate monitoring during 1986-90 are presented in Figs. 5.3.3 a-c.

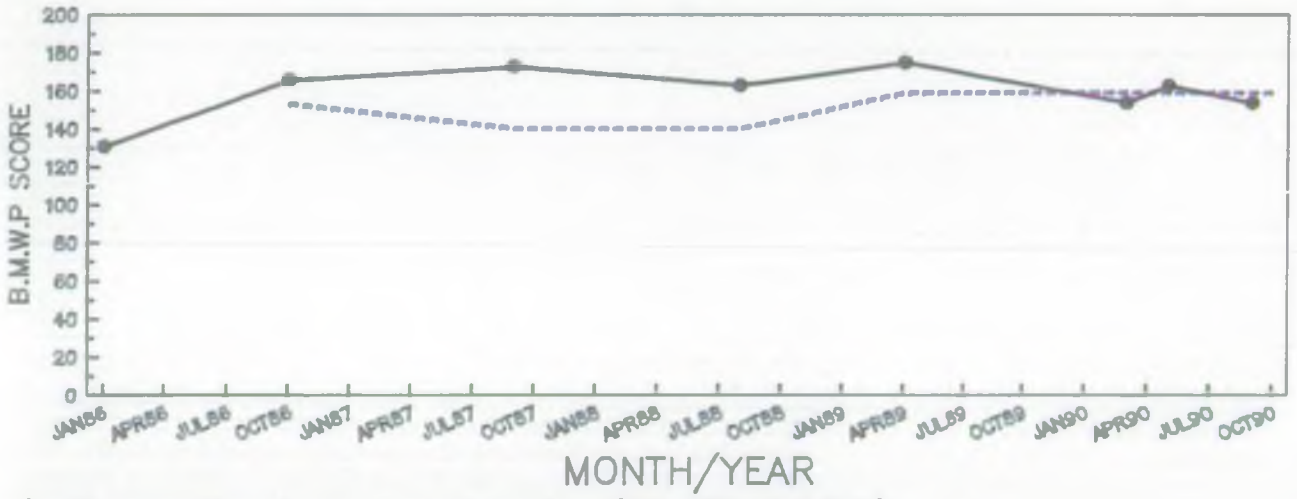
Fig.5.3.3. BIOLOGICAL MONITORING RESULTS 1986–90.

ACTUAL SCORE PREDICTED SCORE

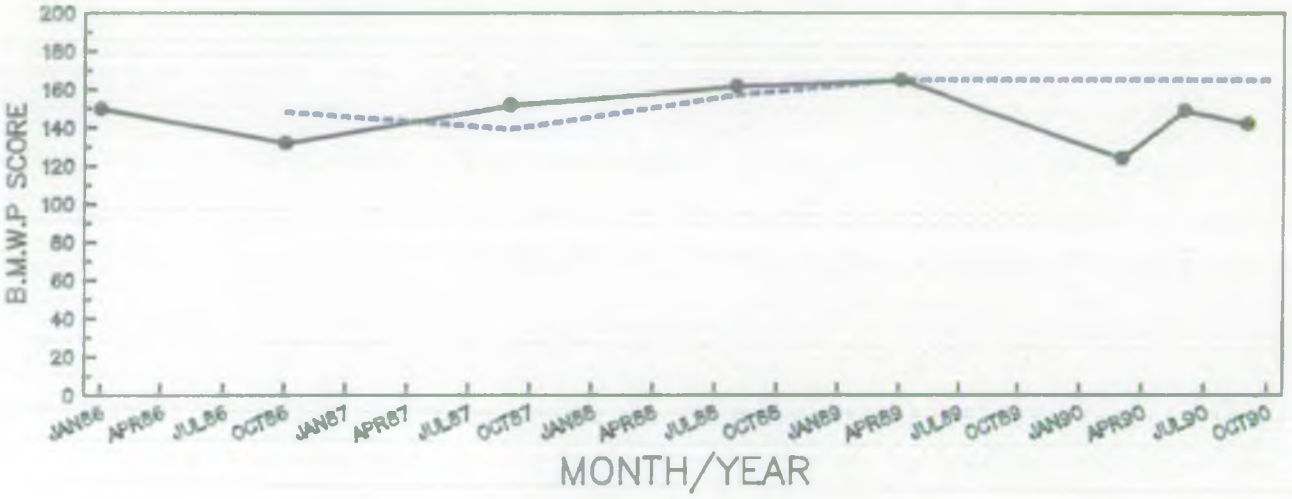
a) Fossebridge (PUTR.0036)



b) Bibury Gauging Station (PUTR.0037)



c) Roundhouse, Lechlade (PUTR.0039)



5.4 DISCUSSION

The site at Coln St. Dennis (CNA3) supports a good biomass (15.7 g/m^2) dominated by brown trout with grayling and rainbow trout present. The age structure of the brown trout population shows a lack of 1+ and 2+ year classes and a restricted number of 0+ fish. The grayling population also shows a similar lack of 0+ fish. The results indicate that 1990 has been another poor year for recruitment.

When compared to previous surveys the results are similar to those of 1989 and confirm the decline in fishery quality at the site since 1987. The modest increase in biomass in comparison to 1989 enables the site to achieve its target of $15g/m^2$ as an E.C. designated fishery. However, this increase is due to an increase in the average size of fish present rather than any overall improvement in the quality of the fish population. Of particular concern is the continued lack of effective recruitment which has now been apparent for three consecutive years (1988-90 inclusive) and is in marked contrast to the excellent results found in 1987. This is potentially very serious as effective recruitment is essential to maintain a self-sustaining population in this section of river. The cause of the decline and continued lack of recruitment is not due to water quality with both chemical and macroinvertebrate monitoring results being consistent with a R.Q.O. of 1A. As in the previous 2 years, 1990 has been characterised by low flow problems and associated habitat deterioration. The hydrograph shows that flows remained low until mid December in 1989 and may well have influenced brown trout spawning activity and hence recruitment. Summer flows in 1990 were again very low and are associated with an increased growth of blanket weed. The direct and indirect effects of low flows on trout streams were discussed in the 1989 report and are not repeated here.

The site downstream of Bibury (CNC1) supports a good biomass (19.0g/m2) dominated by grayling with brown trout and rainbow trout present. The brown trout population shows a complete absence of younger year classes indicative of a failure of recruitment. The population is dominated by larger fish (>30cm) which probably originate from annual stocking at this site. The grayling population shows no 0+ fish indicating no effective recruitment in 1990. An electrofishing operation covering 3km downstream of this site was undertaken by the owner in order to cull the grayling population shortly after the survey. This confirmed the lack of recruitment with no young brown trout being observed. This provides a clear indication of the seriousness of the situation in this section of river.

Although this site achieves its target biomass of $15g/m^2$ as an E.C. designated salmonid fishery, the result must be viewed in light of the intensive fishery management undertaken in this section. The grayling population would be larger if the culling operation were not undertaken by the owner. In addition, the brown trout population is effectively artificial and sustained solely by annual introductions for angling purposes.

In comparison to previous surveys at this site the results show a similar picture with the biomass and density being determined by the fishery management practices. The annual surveys since 1987 have shown a consistent absence of a self-sustaining brown trout population. The cause of this is poor habitat quality which has been exacerbated by the recent

low summer flows of 1988-90 inclusive. Concern over the consistent poor quality of the fish population of this section has initiated a proposed habitat enhancement project. This will be undertaken by the N.R.A. with part funding by the fishery owner. An outline of the proposed scheme which includes further discussion of the problems at this location is presented in Appendix VIII. It is hoped that the scheme will be undertaken late in 1991.

The site at Whelford (CNA7) supports a very good biomass ($23.8 g/m^2$) dominated by brown trout with grayling present. The brown trout population possesses a poor age structure. Stock fish (25-30cm) dominate the population with low numbers of young fish indicating restricted natural recruitment. It is interesting to note that no brown trout were stocked to this section during 1990 and the population remained stable, easily achieving the target biomass of $15 g/m^2$ as an E.C. designated fishery. This would imply that fish are holding in this area, unlike many other sections, and is attributable to the good habitat quality of this section. However, siltation of spawning gravels remains a problem and restricts the potential for effective recruitment of brown trout.

5.5. CONCLUSIONS

1. The survey site at Coln St. Dennis (CNA3) supports a reasonable fish population with no significant change from the result of the 1989 survey. The biomass has shown a modest increase and now achieves the target of $15g/m^2$ for this E.C. designated salmonid fishery. The results confirm the decline in fishery quality at this site since 1987. Of key concern is the continued lack of effective natural recruitment to the population. The cause of the decline is considered to be the low flow of recent years (1988-90) and associated habitat modifications.

2. The survey site downstream of Bibury (CNC1) supports a reasonable fish population and achieves its target biomass as an E.C. designated salmonid fishery. However, the result must be viewed as artificial with respect to the intensive fishery management undertaken on this section. The key parameter of the wild brown trout population is very poor with 1990 again showing the continued lack of effective recruitment. The results show no significant change from those of 1989. The cause of the continued poor result is considered to be poor habitat quality which has been exacerbated by the low flows of recent years.

3. The survey site at Whelford (CNA7) supports a very good biomass and easily achieves its target biomass as an E.C. designated fishery. The good result is partially due to the high retention of stocked fish due to the good habitat quality of this section. However, of key importance is the continued lack of effective recruitment due to some poor habitat factors which have been exacerbated by the low flows of recent years. The results show no significant change from those of 1989.

4. The general conclusion is that no significant changes have occurred since the 1989 survey. The key factor determining fishery quality is habitat quality which is closely linked to flow regime and associated habitat modifications. There is evidence that low flows are having direct and indirect deleterious effects on the fish population. Of particular concern is the continued lack of effective recruitment of brown trout at all of the key sites in 1990.

5.6. RECOMMENDATIONS

1) Continued monitoring of fish populations should be undertaken. This will be accomplished by the extension of the annual low flow survey with the 10 key sites in this report being re-surveyed in 1991.

2) Continued monitoring of flow regimes, water quality and other factors to enable interpretation of the results of the fishery surveys.

3) An investigation into the hydrology of the River Coln with particular respect to groundwater abstraction should be undertaken. A confirmed significant impact would require a further investigation of the options for alleviation of low flows.

   The planned construction of additional gauging stations at Fossebridge and Fairford will provide additional flow data and enable a more accurate assessment of the effects of flow regime on the fish population. Data is expected to be available from 1991.

4) Habitat quality has been shown to be the key factor in determining fishery quality in the River Coln. Habitat enhancement opportunities are extensive and it is this area that the Authority should target and develop in order to produce sustainable benefits to the fish population. Enhancement projects could be undertaken by continued advice and encouragement to fishery owners and angling clubs and by collaborative work with the N.R.A. One major enhancement project has already been initiated and is planned to be undertaken in late 1991.

5) Continued enforcement and consenting of fishery management practices. This is of particular importance regarding the control of culling of coarse fish and grayling populations.

6. RIVER CHURN

Ref: ACU90

6.1 Introduction

6.1.1 Description of Watercourse

A map of the River Churn is presented in Fig. 6.1.1. The River Churn rises at Seven Springs to the south-east of Cheltenham (SO 966170). The river flows in a south-easterly direction to join the River Thames at Cricklade (SU 103940) a distance of 37.3km. The river has no large tributaries and a mean gradient of 1 in 344. The catchment land use is dominated by agriculture with the large town of Cirencester located in the middle reaches. The river also runs through the Cotswold Water Park and is associated with numerous gravel pits within the river corridor.

There are three on-stream ponds at Cowley Manor and the river has been impounded by at least 12 mills. In other sections the river is split into two channels, sometimes for significant distances.

6.1.2 Geology

The River Churn rises from a series of springs at the junction of the Cotteswold Sandstone and Upper Lias Clay (SO 966170). It flows over the Inferior Oolite downstream of Rendcombe followed by Fullers Earth near Perrots Brook, and then onto the Great Oolite for 1-2km. The strata around Cirencester is Forest Marble while further downstream the river flows over Oxford Clay to the confluence with the River Thames. The river valley becomes increasingly dominated by alluvial deposits with distance downstream.

6.1.3 Hydrology

River flow is measured at two gauging stations at Cirencester (SP 020028) and Cerney Wick (SP 076963). The mean daily flow measured at Cerney Wick is approximately 0.9 cumecs (based on 20 years data) with flood discharges in excess of 4 cumecs. Mean dry weather flows are very low being in the order of 0.2 cumecs and in exeptional years this site has dried up (e.g. 1976). The hydrograph and mean monthly flow figures for water year 1989-90 are presented in Figs. 6.1.3.1 and 6.1.3.2 respectively. The yearly mean was just above the long-term mean (103%) due to high winter rainfall. However, the drought summer of 1990 had a drastic effect on river flow with the section between Siddington Mill and 0.5km downstream of the Spine Road Bridge drying up completely. In fact, it was only the dewatering of a gravel pit to the river by active pumping which sustained any flow downstream of this section. This was the first year since the drought of 1976 that this has occurred and it resulted in fish mortalities throughout this reach. Unfortunately the population was restricted to numerous pools throughout the section and no effective fish rescue operation could be undertaken. However, one limited operation was carried out at South Cerney where a reasonable number of fish had become trapped in one large pool.

6.1.4 Water Quality

6.1.4.1 River Classification

River water quality is classified according to the National Water Council (N.W.C.) River Quality Objectives (R.Q.O.) 1978 (as amended by Thames Water Authority 1987). Further details of the classification are presented in Appendices I and II. The River Churn has a R.Q.O. of 1A for its entire length.

FIG. 6.1.1 THE RIVER CHURN

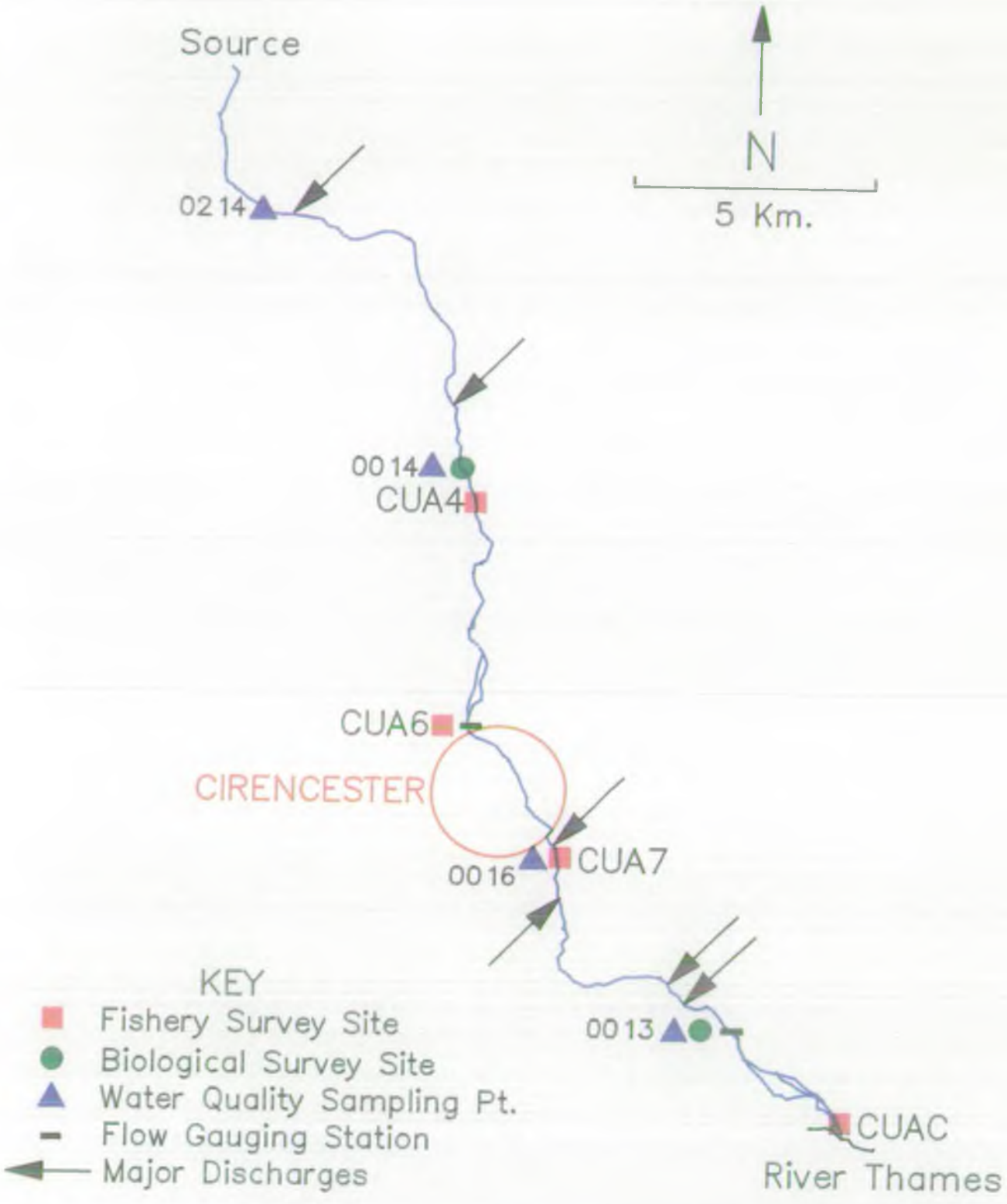


FIG. 6.1.3.1 RIVER CHURN HYDROGRAPH (WATER YEAR 1989–90)

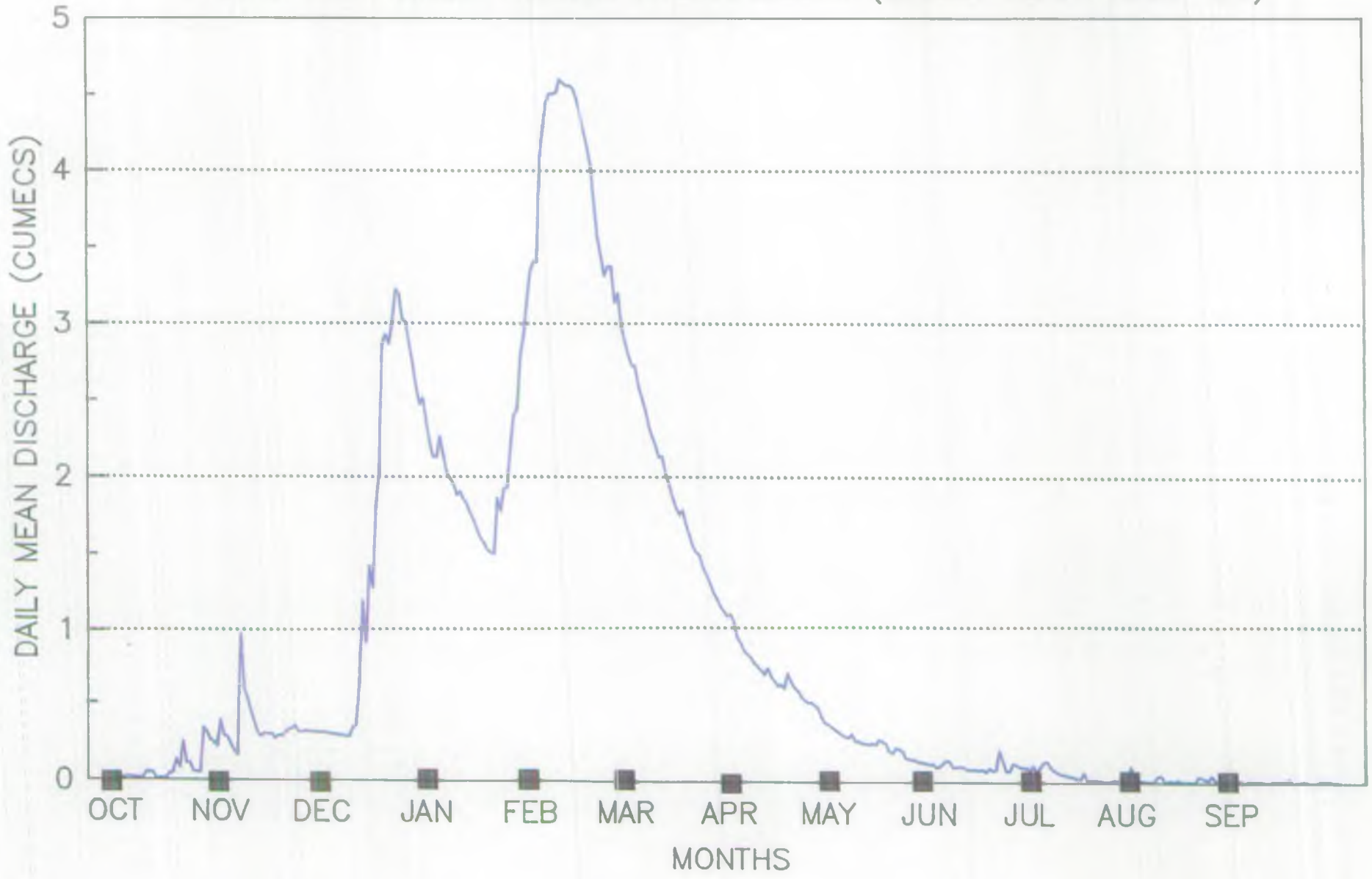
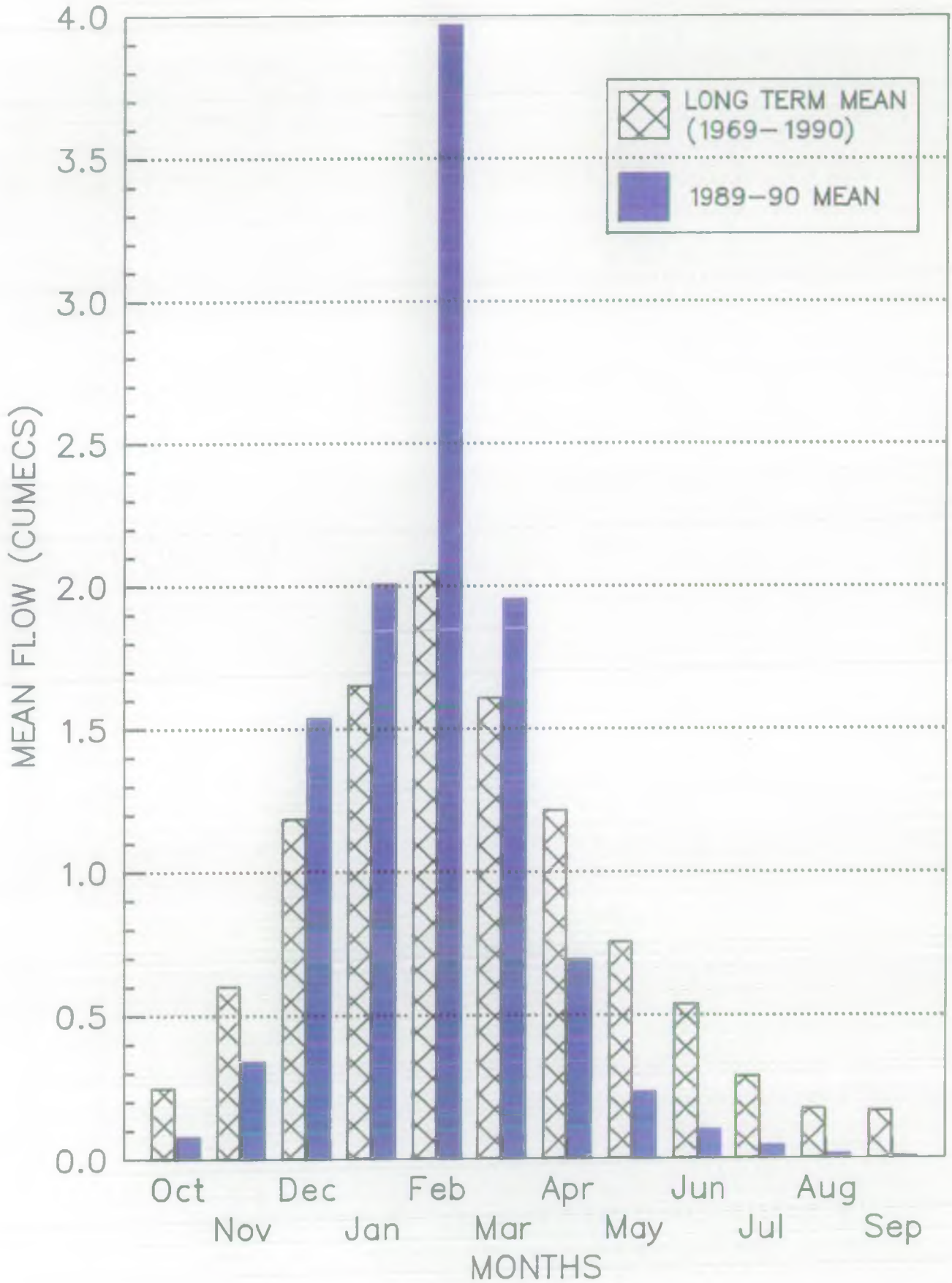


FIG. 6.1.3.2 RIVER FLOW DATA

Monthly Mean Flows at Cerney Wick (1989–90)



6.1.4.2 Consented Discharges

The water quality survey showed consented discharge to have no deleterious effect on river quality. For this reason, details are not presented.

6.1.4.3 Pollution Incidents

There were no pollution incidents which resulted in fish mortalities during 1990.

6.1.5 Fishery Information

6.1.5.1 Fishery Designation

The River Churn is an E.C. designated salmonid fishery between Cowley and the River Thames (34.5km) under the European Community Directive 78/659/EEC. Further details concerning water quality criteria associated with this classifiction are presented in Appendix III.

The National Rivers Authority, Thames Region, have set internal biomass targets with respect to E.C. designated fisheries, viz. -

Cyprinid - $20g/m^2$

Salmonid - $15g/m^2$

The N.R.A., Thames Region, have developed a site code classification system based on River Quality Objective and the E.C. designation. A description of this appears in Appendix IV.

6.1.5.2 Previous Fisheries Surveys

The first fisheries survey of the River Churn was undertaken in 1988 comprising 13 sites surveyed quantitatively by electrofishing (Ref. ACU88). The report concluded that the river upstream of the Cotswold Water Park is dominated by brown trout. All nine sites in this section failed to meet their target biomass. The top five sites covering the river to Perrots Brook support a good population of brown trout with the failures being marginal and due to low summer flows and sub-optimal habitat.

The four sites covering the middle reaches support poor populations dominated by brown trout. The problem with low summer flows are exacerbated in this lower section of the trout zone.

The river downstream of the Cotswold Water Park is dominated by coarse species with all four sites in the section supporting a healthy, diverse population and achieving their target biomass. The change in fish population is due to the change in habitat and the close proximity of the River Thames.

The overview of the main factors restricting the fish population of the River Churn are low summer flows and sub-optimal habitat in the middle and upper sections.

A key site survey was undertaken in 1989 (Ref. ACU89) monitoring four sites previously surveyed in 1988 with particular respect to low flow problems. The general conclusion of the report was that the quality of the fish population remained as it was in 1988. It was stressed that habitat quality was the factor determining fishery quality and that this is linked closely with flow regime. There was evidence that low flows were having both direct and indirect deleterious effects on the fish population.

6.1.5.3 Fish Mortalities

A total fish mortality occurred between Siddington Mill and 0.5km downstream of Spine Road Bridge. This was due to the river drying up entirely in the summer of 1990.

6.1.5.4 Fisheries Management

The River Churn is regularly stocked with brown trout at three locations for angling purposes. The details of Section 30 consent for fish introductions and Authority introductions for 1990 are presented in Appendix VII. No culling operations have been consented during the same period. Isolated habitat improvement work is being undertaken at the Perrots Brook (CUA5) and at South Cerney, with both instream and bankside work involved.

6.1.5.5 Angling Interest

The River Churn is an important recreational fishery. From source to the Cotswold Water Park, several sections are fished for trout by owners and syndicates. Downstream of the Water Park the majority of the river is leased for coarse angling by Highworth A.C. and Ashton Keynes A.C.

6.2. METHODS

General methods are detailed in section 2 but specific details for the River Churn are given below.

6.2.1 Fishery Survey Sites

Site	Code	N.G.R.
North Cerney	CUA4	SP 017084
Stratton Mill	CUA6	SP 021030
Siddington	CUA7	SP 038999
Cricklade	CUAC	SU 103941

6.2.2 Macroinvertebrate Survey Sites

The following routine sites were surveyed during 1986-90 inclusive.

Site	Code	N.G.R.
North Cerney	PUTR.0014	SP 020078
Cerney Wick G.S.	PUTR.0013	SU 076963

In addition, an eight site survey (including the two above) was undertaken at the request of the fisheries department in 1988. The details of these survey sites are presented in the 1988 report (ACU88).

6.2.3 Water Quality Sampling Points

Data for 1990 were examined for the following sites.

Site	Code	N.G.R.
U/S Cockleford Fish Farm	PUTR.0214	SO 974138
North Cerney	PUTR.0014	SP 002078
Siddington Mill	PUTR.0016	SP 039000
Cerney Wick G.S.	PUTR.0013	SU 076963

6.3 RESULTS

6.3.1 Fisheries Survey Results

6.3.1.1 SITE RESULTS - NORTH CERNEY (CUA4)

WATERCOURSE: River Churn

SITE NAME: North Cerney

SITE CODE: CUA4

LOCATION: Upstream of North Cerney

N.G.R.: SP 017084

DATE FISHED: 11th October 1990

METHOD: Upstream electric fishing, wading with two anodes. 2 runs.

R.Q.O.: 1A **E.E.C. TARGET BIOMASS:** 15g/sqm.

HABITAT FEATURES

LENGTH: 172m **MEAN WIDTH:** 2.7m **AREA:** 464 sqm. **MEAN DEPTH:** 0.2m

WATER TEMPERATURE: 14 degrees C

SUBSTRATE COMPOSITION (%)

BARE: 05 **MUD & SILT:** 45 **GRAVEL:** 45 **STONE:** 05 **BOULDER:** 00

VEGETATION (% COVER)

SUBMERGED: 25 **FLOATING:** 00 **EMERGENT:** 25 **SHADE:** 30

DOMINANT PLANT SPECIES: Ranunculus.

WATER LEVEL: Very low **WATER CLARITY:** Clear

PHYSICAL STRUCTURE OF SITE: A meandering section with shallow pool-riffle regime. Poor gravel with much silt.

ADJACENT LAND USE: L.B. Pasture
R.B. Pasture

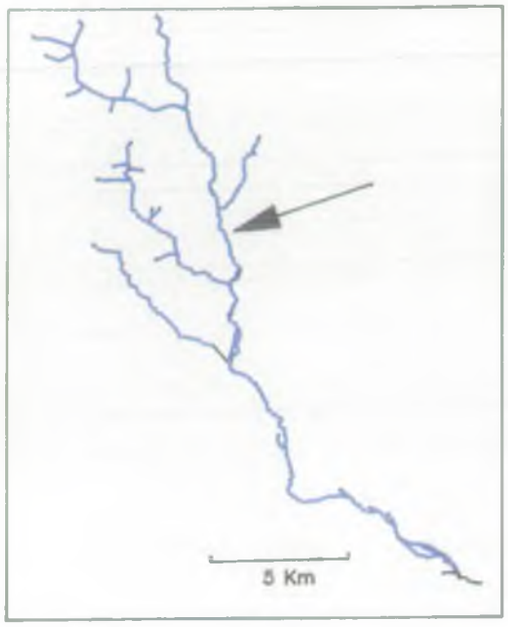
RIPARIAN OWNERS: L.B. Bathurst Estate
R.B. As above

FISHING RIGHTS: L.B. Bathurst Estate
R.B. As above

ADDITIONAL INFORMATION: Bullhead and minnow abundant. Sticklebacks and lamprey present. An additional run upstream of the survey section produced 1.5kg. This represents a minimum biomass of 5.0g/sqm.

COMMENTS: A reasonable/poor biomass failing to achieve the site target of 15g/sqm. Brown trout are the dominant species with the age structure indicating a range of year classes to be present but restricted recruitment in 1990.

Fig. 6.3.1.1a NORTH CERNEY (CUA4)
Biomass and Density

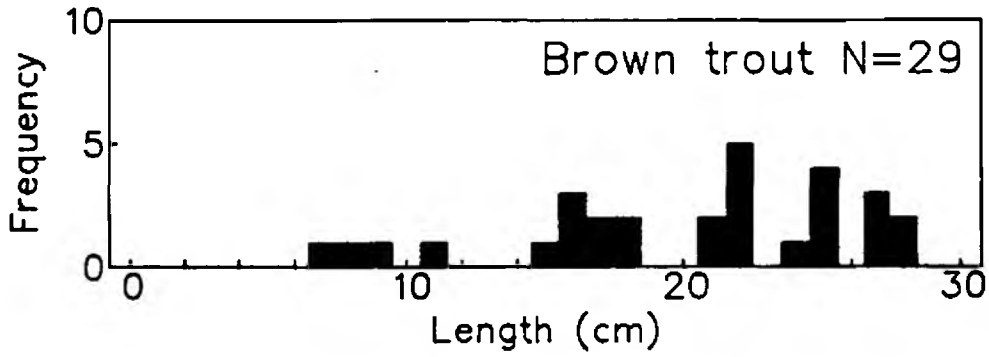


	Biomass (gm-2)	Density (nm-2)
Brown trout	8.1	0.063
Eel	0.4	0.002
TOTAL	8.5	0.065

Biomass

Density

Fig. 6.3.1.1b NORTH CERNEY (CUA4)
Length Frequency



6.3.1.2 SITE RESULTS - STRATTON MILL (CUA6)

WATERCOURSE: River Churn

SITE NAME: Stratton Mill

SITE CODE: CUA6

LOCATION: Downstream of Lower Bowling Green Farm

N.G.R.: SP 021030

DATE FISHED: 11th October 1990

METHOD: Upstream electric fishing, wading with two anodes. 2 runs.

R.Q.O.: 1A **E.E.C. TARGET BIOMASS:** 15g/sqm.

HABITAT FEATURES

LENGTH: 135m **MEAN WIDTH:** 4.1m **AREA:** 554 sqm. **MEAN DEPTH:** 0.1m

WATER TEMPERATURE: 14 degrees C

SUBSTRATE COMPOSITION (%)

BARE: 00 **MUD & SILT:** 20 **GRAVEL:** 75 **STONE:** 05 **BOULDER:** 00

VEGETATION (% COVER)

SUBMERGED: 05 **FLOATING:** 00 **EMERGENT:** 10 **SHADE:** 80

DOMINANT PLANT SPECIES: Mentha and Rorippa

WATER LEVEL: Very low **WATER CLARITY:** Clear

PHYSICAL STRUCTURE OF SITE: A meandering and shallow section. Very poor instream features with poor weed and only one good boulder riffle. Good gravel substrate and tree cover. Lack of instream features and summer flow is critical.

ADJACENT LAND USE: L.B. Pasture
R.B. Pasture

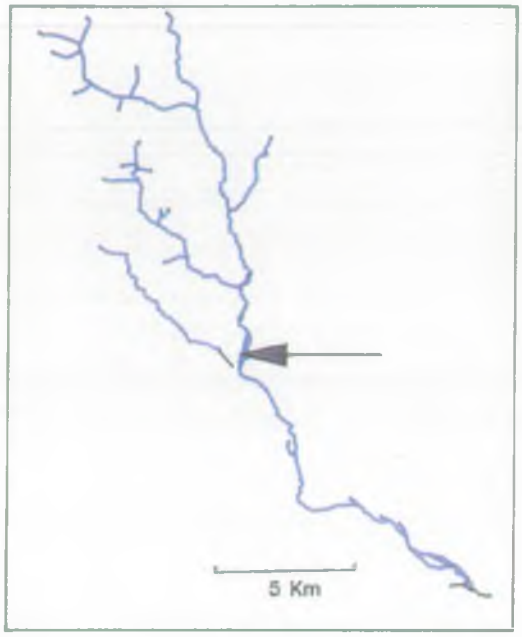
RIPARIAN OWNERS: L.B. Mr Greenaway
R.B. Mr Freeth

FISHING RIGHTS: L.B. Mr Greenaway
R.B. Mr Freeth

ADDITIONAL INFORMATION: Bullhead and minnow abundant. Stoneloach and lamprey present. No run upstream of the survey section.

COMMENTS: A very poor biomass failing to achieve the target of 15g/sqm. Brown trout are only species with the age structure showing a range of year classes and restricted recruitment.

Fig. 6.3.1.2a Stratton (CUA6) Biomass and Density

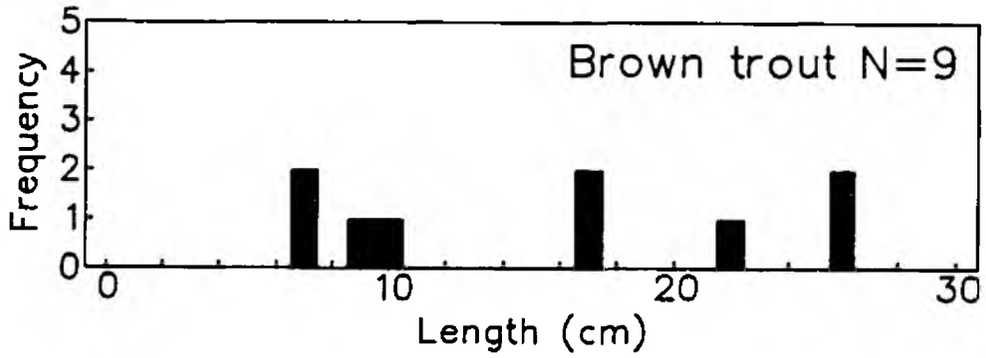


	Biomass (gm-2)	Density (nm-2)
Brown trout	1.4	0.016
TOTAL	1.4	0.016

Biomass

Density

Fig. 6.3.1.2b STRATTON (CUA6)
Length Frequency



6.3.1.3 SITE RESULTS - SIDDINGTON (CUA7)

WATERCOURSE: River Churn

SITE NAME: Siddington

SITE CODE: CUA7

LOCATION: Downstream of road bridge

N.G.R.: SP 038999

DATE FISHED: 16th October 1990

METHOD: Electric fishing in isolated pools with 1 anode.

R.Q.O.: 1A **E.E.C. TARGET BIOMASS:** 15g/sqm.

HABITAT FEATURES

LENGTH: 210m **MEAN WIDTH:** 5.1m **AREA:** 1071 sqm. **MEAN DEPTH:** 0.1m

WATER TEMPERATURE: 13 degrees C

SUBSTRATE COMPOSITION (%)

BARE: 00 **MUD & SILT:** 60 **GRAVEL:** 40 **STONE:** 00 **BOULDER:** 00

VEGETATION (% COVER)

SUBMERGED: 10 **FLOATING:** 00 **EMERGENT:** 05 **SHADE:** 10

DOMINANT PLANT SPECIES: Elodea. Myosotis and filamentous algaes

WATER LEVEL: Low **WATER CLARITY:** Clear

PHYSICAL STRUCTURE OF SITE: A meandering section with only the deep pools remaining due to severe low flow. Survey carried out in isolated pools.

ADJACENT LAND USE: L.B. Pasture
R.B. Pasture

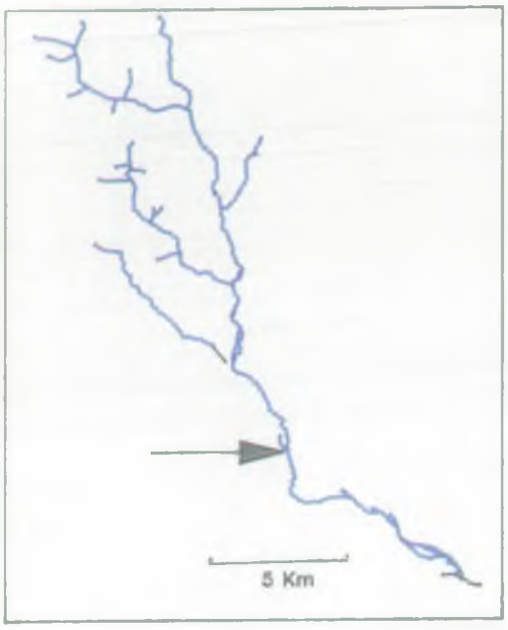
RIPARIAN OWNERS: L.B. Mr Franklin
R.B. Bathurst Estate

FISHING RIGHTS: L.B. Mr Franklin
R.B. Bathurst Estate

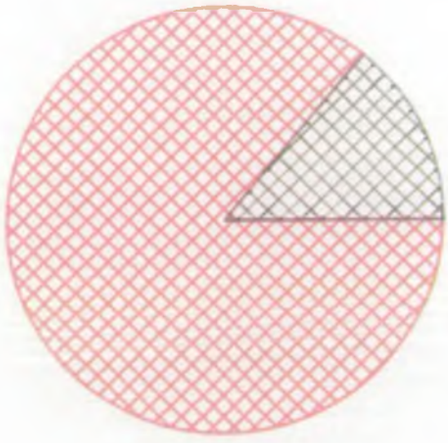
ADDITIONAL INFORMATION: Bullhead and minnow abundant. Sticklebacks and stoneloach common. Lamprey present. No upstream run.

COMMENTS: A poor biomass failing to achieve the target of 15g/sqm. Pike were the dominant species. The poor population of brown trout showed no evidence of recruitment.
The complete lack of flow had resulted in the fish being restricted to isolated pools.

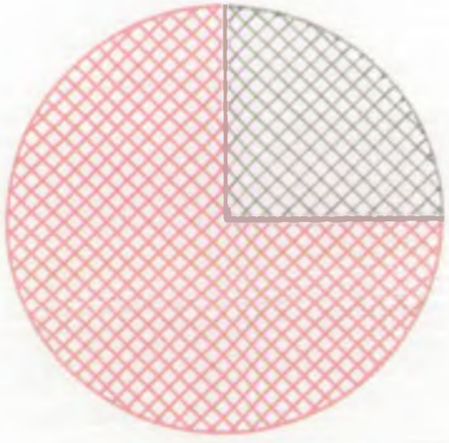
Fig. 6.3.1.3a SIDDINGTON (CUA7)
Biomass and Density



	Biomass (gm-2)	Density (nm-2)
Brown trout	0.8	0.003
Pike	5.0	0.009
TOTAL	5.8	0.012

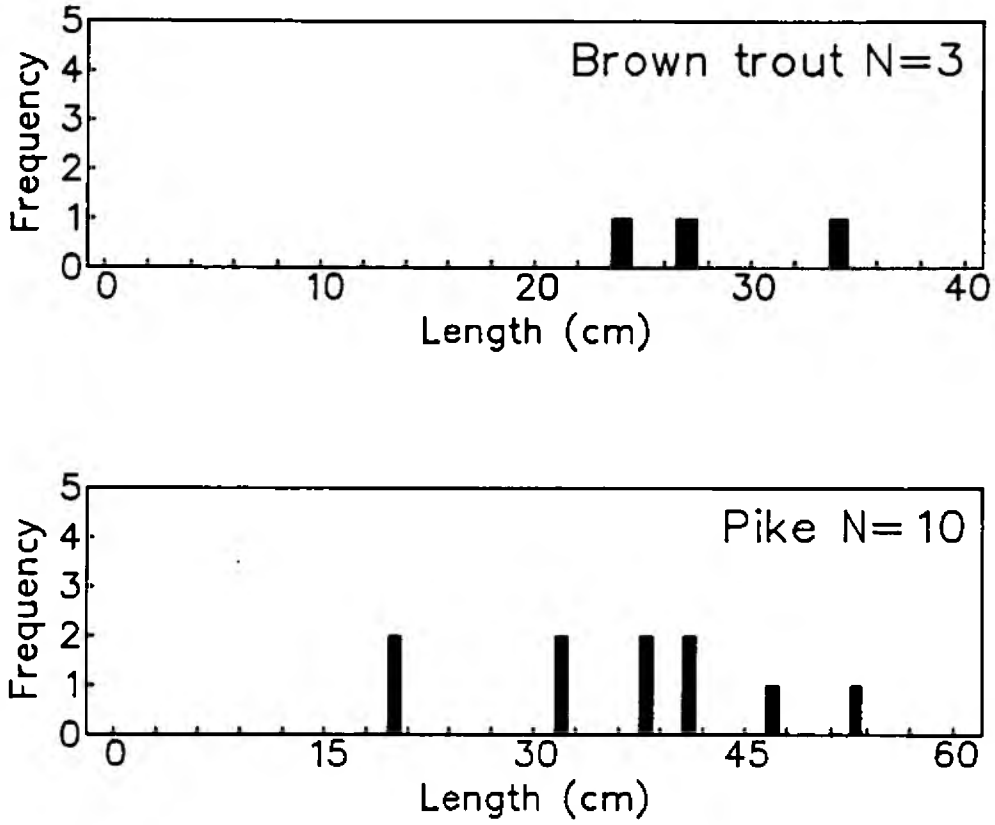


Biomass



Density

Fig. 6.3.1.3b SIDDINGTON (CUA7)
Length Frequency



6.3.1.4 SITE RESULTS - CRICKLADE (CUAC)

WATERCOURSE: River Churn

SITE NAME: Cricklade

SITE CODE: CUAC

LOCATION: 0.3km upstream of the River Thames confluence

N.G.R.: SU 103941

DATE FISHED: 15th November 1990

METHOD: Upstream electric fishing, wading with two anodes. 2 runs.

R.Q.O.: 1A **E.E.C. TARGET BIOMASS:** 15g/sqm.

HABITAT FEATURES

LENGTH: 191m **MEAN WIDTH:** 4.5m **AREA:** 860 sqm. **MEAN DEPTH:** 0.4m

WATER TEMPERATURE: 12 degrees C

SUBSTRATE COMPOSITION (%)

BARE: 00 **MUD & SILT:** 05 **GRAVEL:** 90 **STONE:** 05 **BOULDER:** 00

VEGETATION (% COVER)

SUBMERGED: 20 **FLOATING:** 00 **EMERGENT:** 30 **SHADE:** 60

DOMINANT PLANT SPECIES: Ranunculus, Potamogeton sp, Phalaris, Sparganium, Glyceria , Nuphar, Oenanthe

WATER LEVEL: Very Low **WATER CLARITY:** Clear

PHYSICAL STRUCTURE OF SITE: A meandering section with deeper runs and one riffle. Good gravel, bankside cover and undercut banks.

ADJACENT LAND USE: L.B. Pasture
R.B. Pasture

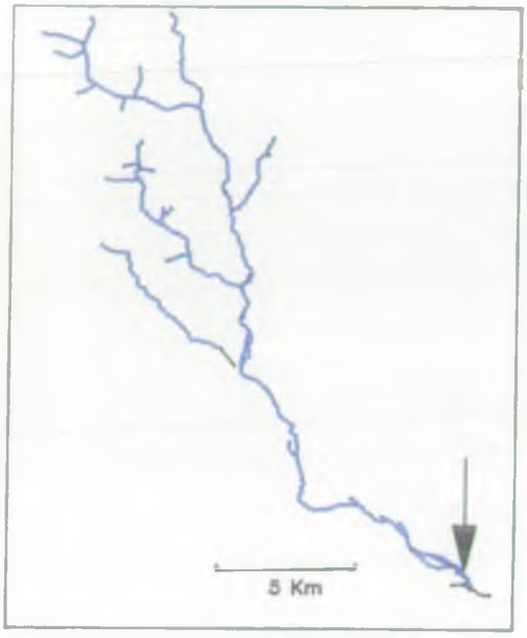
RIPARIAN OWNERS: L.B. W.H. Clark Trust
R.B. Mr Kidner

FISHING RIGHTS: L.B. Ashton Keynes A.C.
R.B. Mr Kidner

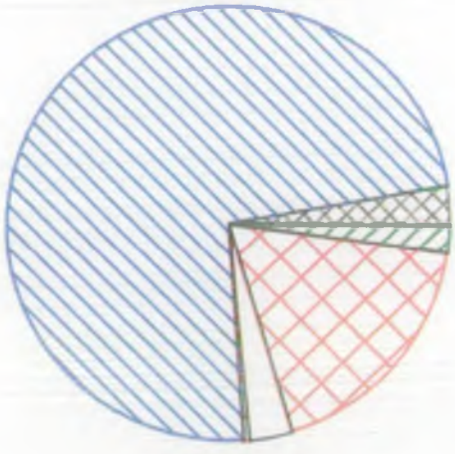
ADDITIONAL INFORMATION: Bullhead, minnow and stoneloach abundant. An additional run upstream of the survey section produced a minimum biomass of 3.1g/sqm. Cyprinid fry observed.

COMMENTS: A very good biomass easily achieving the site target. An excellent range of species with chub dominating the biomass. Only the perch population showed good recruitment. The large reduction in biomass of the upstream run is due to this section being much shallower.

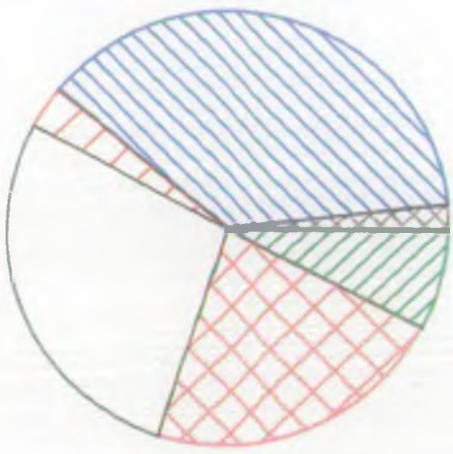
Fig. 6.3.1.4a Cricklade (CUAC) Biomass and Density



	Biomass (gm−2)	Density (nm−2)
Brown trout	2.0	0.003
Chub	50.9	0.060
Dace	0.3	0.005
Perch	2.2	0.045
Pike	12.5	0.036
Roach	1.4	0.012
TOTAL	69.3	0.161

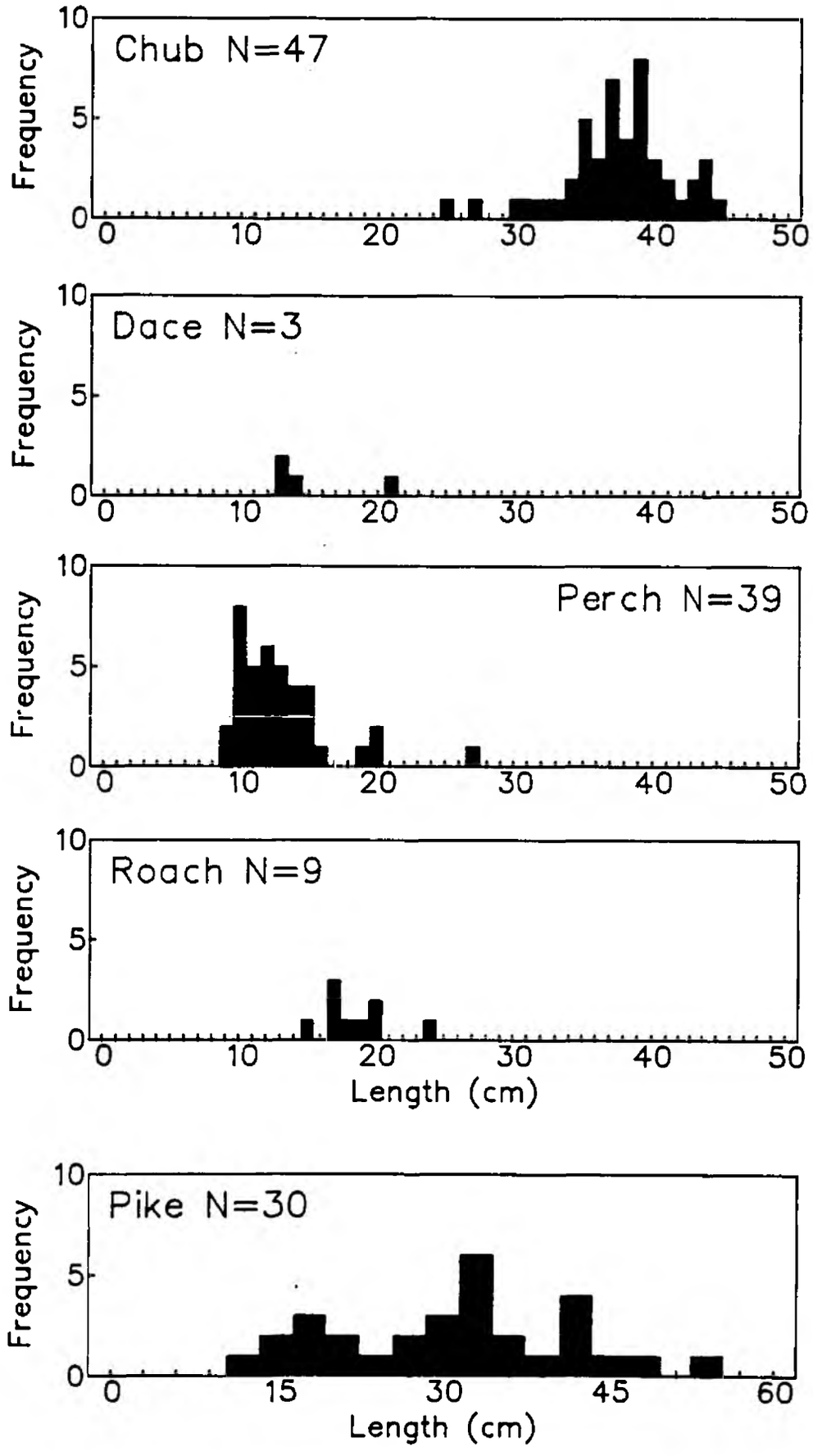


Biomass



Density

Fig. 6.3.1.4b Cricklade (CUAC)
Length Frequency



6.3.2 Water Quality Results

6.3.2.1 River Quality

The results of the water quality assessments for 1990 are summarised below.

Sampling Point	Code	R.Q.O.	Compliance
U/s Cockleford Fish Farm	PUTR.0040	1A	Pass
North Cerney	PUTR.0014	1A	Pass
Siddington Mill	PUTR.0016	1A	Pass
Cerney Wick	PUTR.0013	1A	Pass

6.3.2.2 Consented Discharge Quality

This was not investigated given the full compliance with R.Q.O.'s.

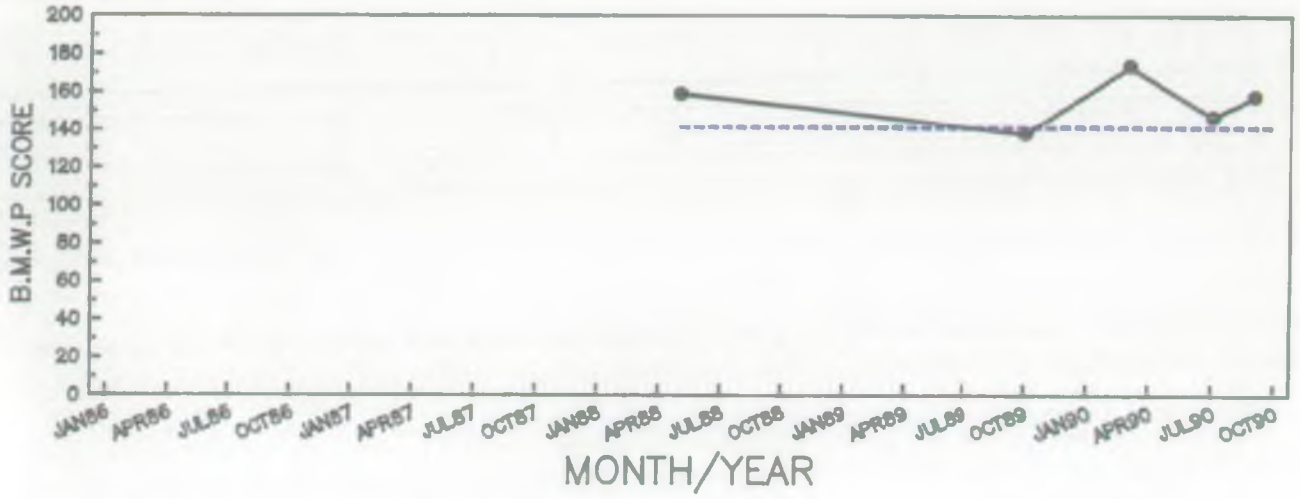
6.3.3 Macroinvertebrate Monitoring Results

The results of routine macroinvertebrate monitoring during 1986-90 are presented in Figs. 6.3.3 a-b.

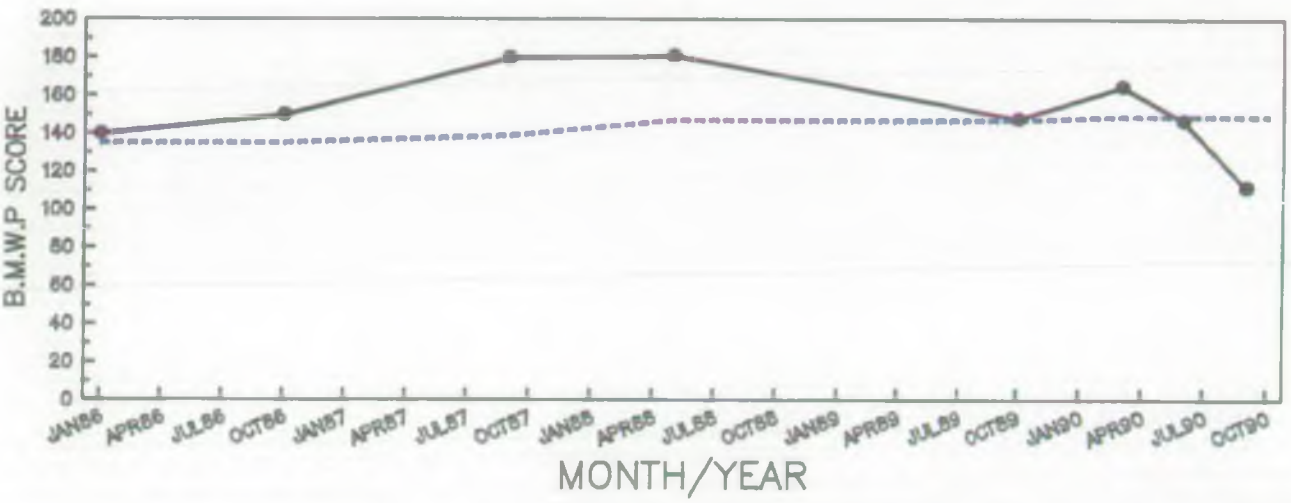
FIG. 6.3.3 BIOLOGICAL MONITORING RESULTS 1986–90

ACTUAL SCORE PREDICTED SCORE

a) North Cerney (PUTR.0014)



b) Cerney Wick (PUTR.0013)



6.4 DISCUSSION

The site at North Cerney (CUA4) supports a poor biomass (8.2 g/m^2) dominated by brown trout with eel present. The brown trout population has a range of year classes but only a restricted number of 0+ fish indicative of poor recruitment in 1990. This site fails to achieve its target biomass of 15 g/m^2 as an E.C. designated fishery.

Routine water quality remains very good with chemical and macro-invertebrate monitoring results being consistent with a R.Q.O. of 1A.

In comparison to previous surveys (1988 and 1989) the result represents a significant deterioration in biomass, density and effective recruitment. The cause of the decline is considered to be the extremely low flows of the summer of 1990 and associated habitat deterioration.

The site at Stratton Mill (CUA6) supports a very poor biomass (1.4 g/m^2) with only brown trout present. The age structure of the population shows only restricted recruitment in 1990. The site failed to achieve its biomass target as an E.C. designated salmonid fishery.

In comparison to previous surveys the result is similar but shows a decline in the level of recruitment.

Chemical and biological monitoring again show the water quality to remain very good with results consistent with the R.Q.O. of 1A.

The cause of the continued poor result is poor habitat quality. Factors include the exceptionally shallow depth exacerbated by low flows, and the lack of instream cover.

The site at Siddington (CUA7) supports a poor biomass (5.6 g/m^2) dominated by pike with brown trout present. The brown trout population is now very sparse with no evidence of recruitment.

Chemical and biological monitoring again show the water quality to remain very good being consistent with the R.Q.O. of 1A. In comparison to previous surveys, the result represents a deterioration to an already poor fish population.

The cause of the decline is due to the exceptionally low flows experienced in the summer of 1990. At the time of the survey, no flow was present and the operation was effectively a fish rescue with the fish being restricted to isolated pools. The fish were not returned to the site but transferred further downstream.

The site at Cricklade (CUAC) supports an excellent biomass (69.3 g/m^2) and density (0.161). The biomass is dominated by chub with the density comprising mainly chub, perch and pike. The age structures indicate good recruitment in perch and pike. The site easily exceeds its target of 15 g/m^2 as an E.C. designated salmonid fishery. As stated in the previous surveys it is clear that this designation is incorrect with this section of river being a coarse fish zone.

Water quality remains very good and the river achieves its R.Q.O. of 1A.

In comparison to the previous survey the result shows a substantial

deterioration. However the result of 1989 was exceptional and probably represented a temporary aggregation of fish due to immigration from the River Thames 300m downstream. This close proximity is also the reason for the variation in species composition from year to year. The fish population at the site remains very good and no significant deterioration has occurred.

The overall view of the results for 1990 is that two sites have shown deterioration, one remains very poor and one remains good. The main factor responsible for the deterioration has to be the extremely low flows experienced during the summer of 1990. This had drastic direct effects as shown at the Siddington site (CUA7) which is representative of the extensive section between Siddington and 0.5km downstream of Spine Road Bridge. The low flow problem also produced indirect effects which are considered to be the cause of the deterioration at the North Cerney site (CUA4). The results of the three upper sites (CUA4, CUA6 and CUA7) are of particular concern due to the lack of effective recruitment at survey sites in 1990. This has obvious implications for the future viability of the fish population and is similar to the result observed on the River Coln.

6.5 CONCLUSIONS

1. The survey site at North Cerney (CUA4) supports a poor fish population and fails to achieve its target biomass as an E.C. designated fishery. The result represents a significant deterioration from that of 1989 with a decline in biomass, density and recruitment. The restricted quality of the fish population is due to sub-optimal habitat which has been exacerbated by low summer flows.

2. The survey site at Stratton Mill (CUA6) supports a very poor fish population and fails to achieve its target biomass as an E.C. designated fishery. The result is similar to that of the 1989 survey. The poor quality of the fish population is due to poor habitat which may be exacerbated by low summer flows.

3. The survey site at Siddington (CUA7) supports a poor fish population and fails to achieve its target biomass as an E.C. designated fishery. The result indicates that no effective recruitment of brown trout is present and represents a significant deterioration to the already restricted fish population found in 1989. The cause of the decline is the direct effect of low summer flows with the site being reduced to a series of isolated pools during 1990.

4. The survey site at Cricklade (CUAC) supports an excellent coarse fish population and easily achieves its target biomass as an E.C. designated fishery. The result indicates a reduction in biomass and density in comparison to the 1989 survey. However, the latter result was exceptional and the current result still represents a healthy fish population.

5. The general conclusion of the survey is that two sites have shown a significant deterioration, one remains poor and one remains healthy. The key factor determining fishery quality is habitat quality which is closely linked to flow regime and associated modifications. There is evidence that low summer flows are having both direct and indirect deleterious effects on the fish population. The drying up of the section between Siddington and 0.5km downstream of Spine Road Bridge represents a clear case of severe direct damage to a significant fishery.

6.6 RECOMMENDATIONS

1) Continued monitoring of the fish population should be undertaken. This will be accomplished by the extension of the low flow survey with the 10 key sites in this report being re-surveyed in 1991.

2) Continued monitoring of flow regimes, water quality and other factors to allow interpretation of the results of the fishery surveys.

3) An investigation into the hydrology of the River Churn should be undertaken with particular reference to the cause of low flows.

   The planned construction of the additional gauging station at Perrots Brook will provide data on flows upstream of the major abstraction at Baunton. This will enable a more accurate assessment of the effects of flow regime on the fish population of the upper section. Data are expected to be available in 1991.

4) Habitat quality has been shown to be the key factor in determining fishery quality on the River Churn. Habitat enhancement opportunities are extensive and it is this area that the Authority should target in order to produce sustainable benefits to the fish population. Enhancement projects could be undertaken by continued advice and encouragement to fishery owners and angling clubs and collaborative work with the N.R.A.

7. AMPNEY BROOK
Ref: AAM90

7.1 INTRODUCTION

7.1.1 Description of Watercourse

A map of the Ampney Brook is presented in Fig. 7.1.1. The Brook rises from a series of springs at Ampney Crucis to the east of Cirencester (SP 062023) and flows in a south-easterly direction to join the River Thames near Cricklade (SU 112940), a distance of 12.6km. The brook has no large tributaries and the catchment land use is dominated by agriculture with no large urban areas being present.

7.1.2 Geology

The source of the Ampney Brook is a spring (SP 063023) within the Forest Marble formation of the clay/limestone junction. The catchment geology is dominated by limestone and clay with the brook encountering the following strata from source downstream, Forest Marble (Ampney Crucis - Ampney St. Peter), Cornbrash (Ampney St. Peter - Driffield) and Oxford Clay (Driffield - River Thames confluence).

7.1.3 Hydrology

The mean daily flow of the brook measured at Sheeppen Bridge gauging station (SU 106950) is approximately 0.75 cumecs (based on 10 yrs. data) with flood discharges in excess of 4 cumecs. Mean dry weather flows are very low being in the order of 0.1 cumecs. Flows in Water Year 1989-90 were below average. The hydrograph and mean monthly flow figures for the year are presented in Figs. 7.1.3.1 and 7.1.3.2. respectively. The yearly mean was 84% of average (based on previous 10 yrs. data) and the brook dried up along its entire length from July. This is the second consecutive year that this has occurred.

7.1.4 Water Quality

7.1.4.1. River Classification

River water quality is classified according to the National Water Council (N.W.C.) River Quality Objectives (R.Q.O.) 1978 (as amended by Thames Water Authority 1987).

Further details of the classification are presented in appendices I and II.

The Ampney Brook has an R.Q.O. of 1A for its entire length.

7.1.4.2 Consented Discharges

Previous surveys have shown these not to affect water quality. For this reason they are not presented in this report.

7.1.4.3 Pollution Incidents

No pollution incidents resulting in fish mortalities occurred during 1990.

FIG. 7.1.1 THE AMPNEY BROOK

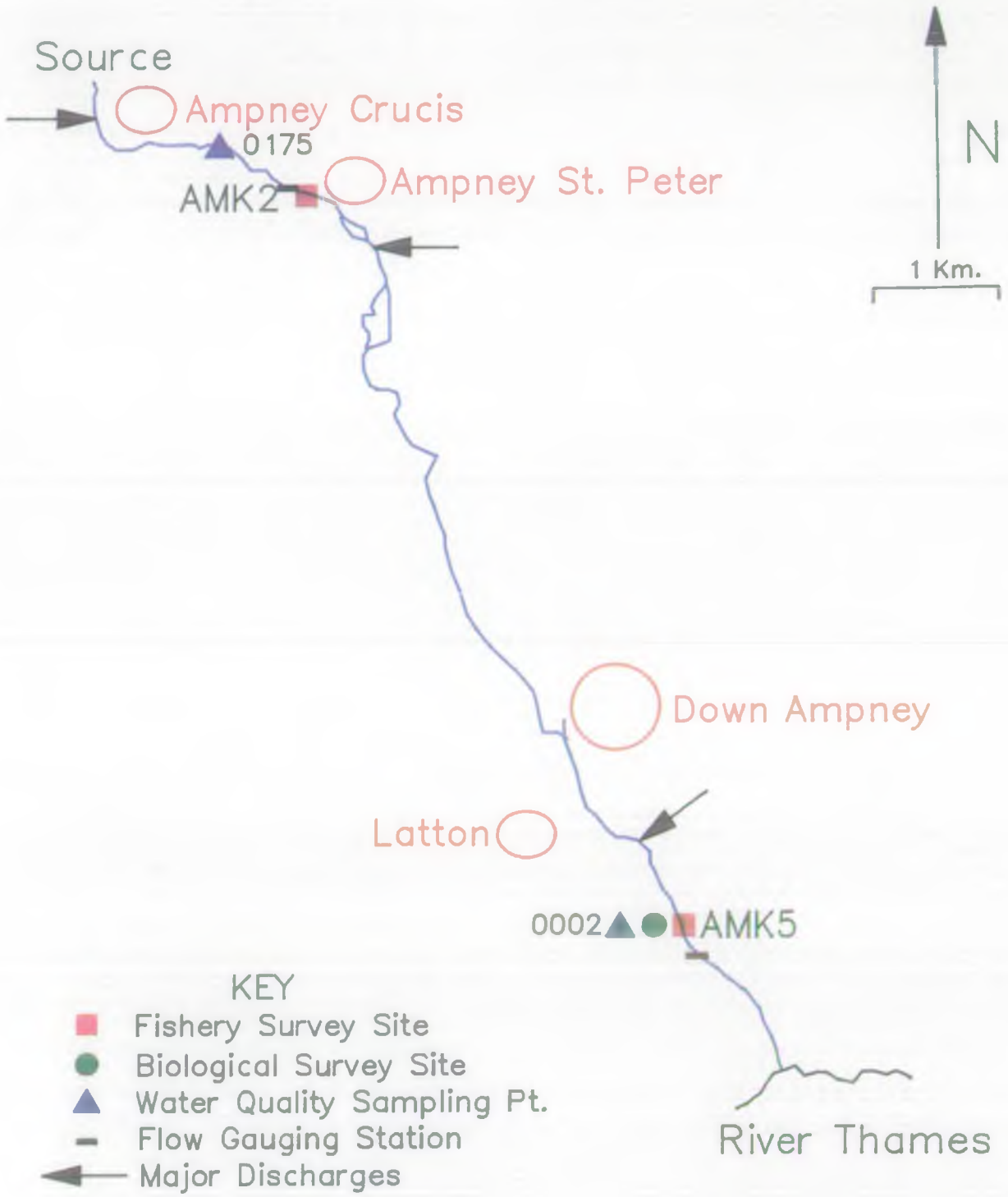


FIG. 7.1.3.1 AMPNEY BROOK HYDROGRAPH (WATER YEAR 1989–90).

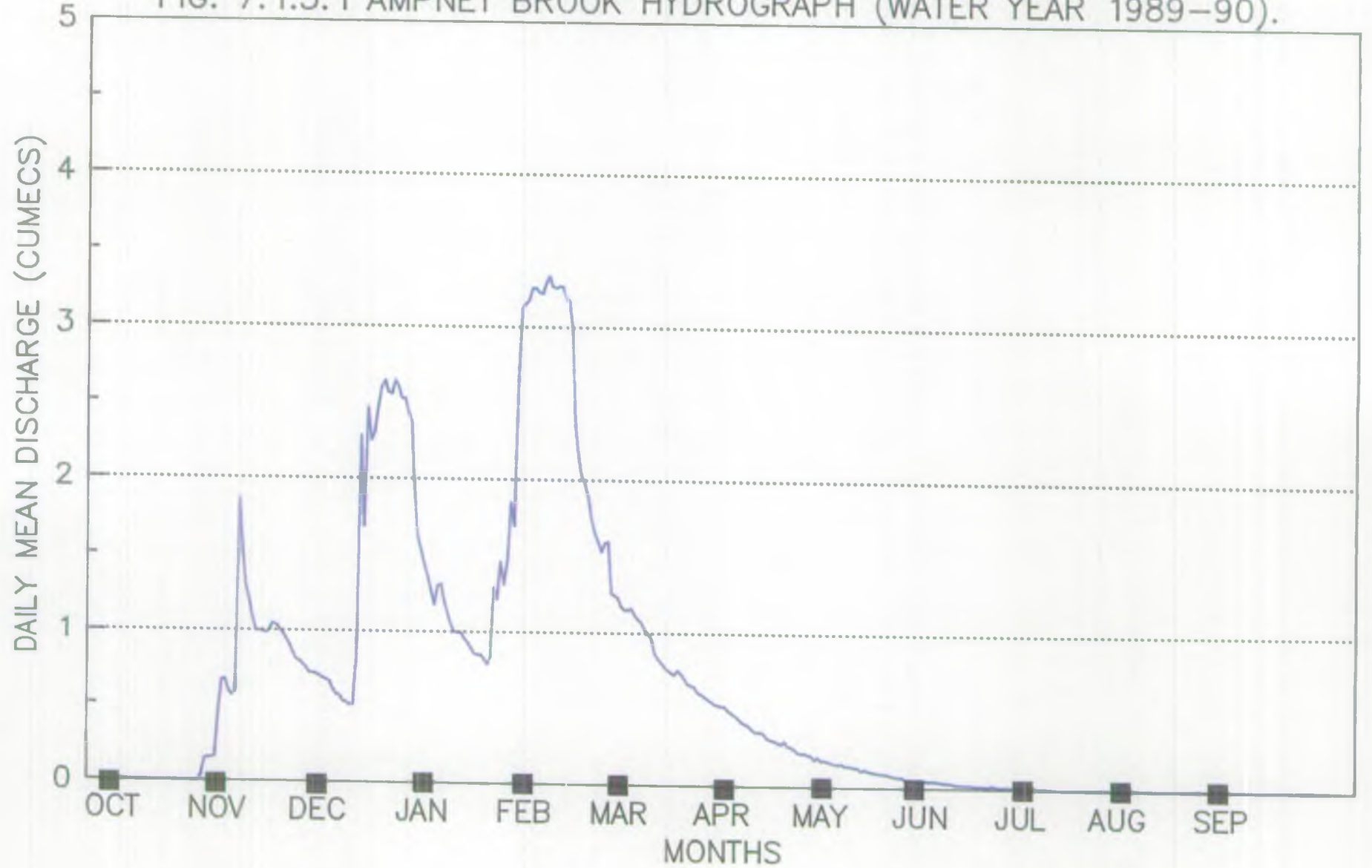
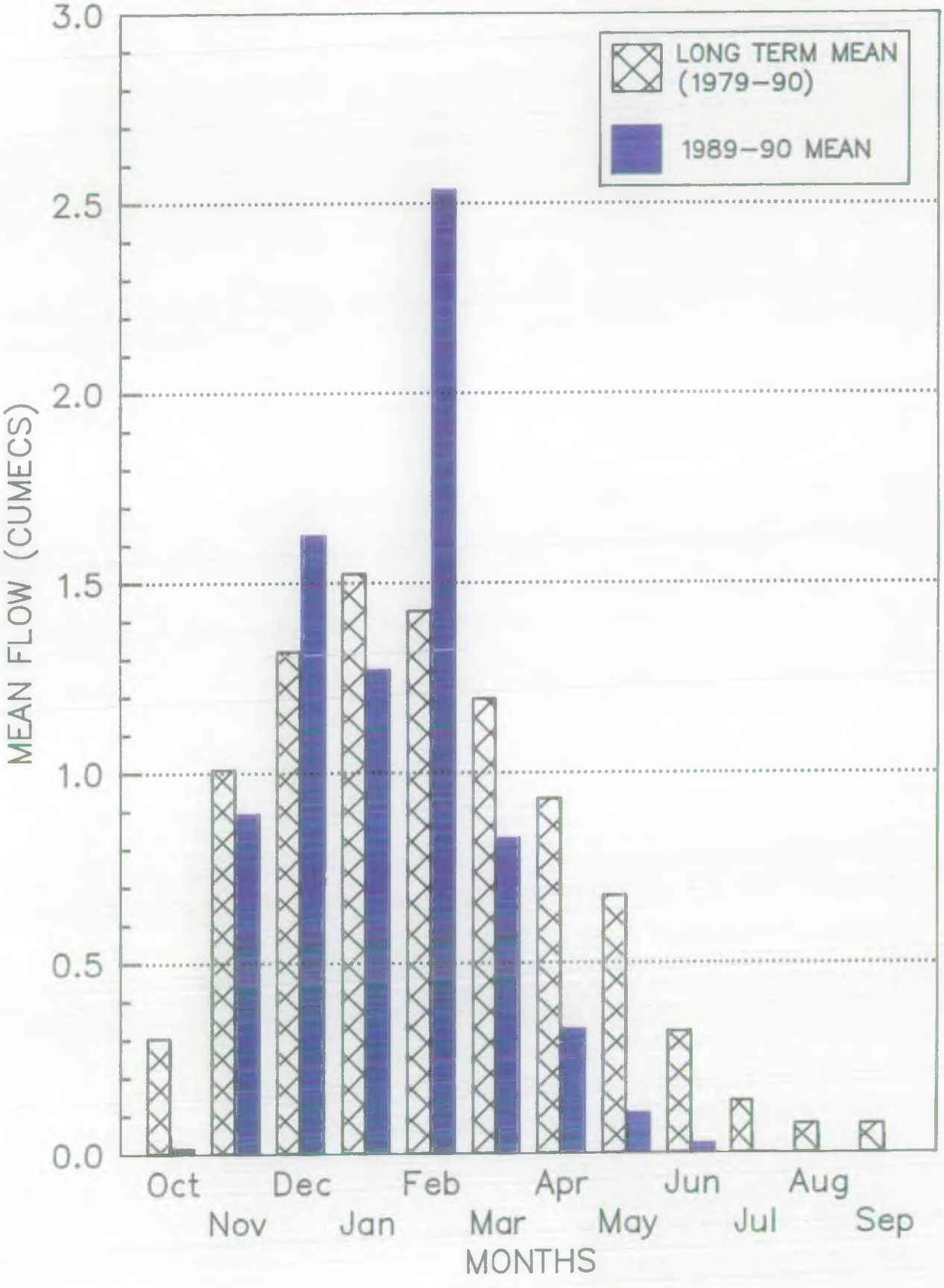


FIG. 7.1.3.2 RIVER FLOW DATA
Monthly Mean Flows at Sheeppen Bridge (1989–90).



7.1.5 Fishery Information

7.1.5.1 Fishery Designation

The Ampney Brook is not an E.C. designated fishery under the European Community Directive 78/659/EEC and therefore possesses no N.R.A. biomass target. The N.R.A. Thames Region have developed a site code classification system based on River Quality Objective and the E.C. designation. A description of this is presented in Appendix IV.

7.1.5.2 Previous Fishery Surveys

The first investigation was undertaken in 1988 comprising a six site electric fishing survey (Ref. AAM88). The survey concluded that the brook may be divided into three distinct sections on the basis of the fish population present. The upper section from source to Ampney St. Peter Sewage Treatment Works (S.T.W.) supports a restricted population of brown and rainbow trout. The brown trout population is dominated by large fish with negligible recruitment. The middle section from Ampney St. Peter S.T.W. to Down Ampney supports a reasonable fish population dominated by brown trout with low numbers of coarse species. The brown trout population is more balanced with evidence of effective recruitment. The lower section from Down Ampney to the River Thames possesses a healthy fish population dominated by chub and dace.

The major reason for the restricted fish population in the upper and middle sections was due to low summer flow. This affects the fish population directly and also via associated habitat deterioration.

A key site survey was undertaken in 1989 (Ref. AAM89). Due to the brook drying up entirely in the summer of 1989, visual inspection showed the fish population to have been eradicated.

7.1.5.3 Fish Mortalities

There were no confirmed fish mortalities in 1990. Although the brook dried up completely in 1990 no mortality was confirmed. This was due to the previous total eradication of the fish population when the brook dried up in 1989. Any fish which immigrated from the River Thames during the winter of 1989/90 appear to have emigrated as flows reduced.

7.1.5.4 Fisheries Management

The present problems associated with the brook make it impossible to develop as a permanent viable fishery. As a result, no stocking has taken place in 1988-1990. No habitat improvement work has been undertaken for the same reason.

7.1.5.5 Angling Interest

Due to the problem outlined above no section of the brook has been fished in recent years.

7.2 METHODS

General methods are detailed in section 2 but specific details for the Ampney brook are given below.

7.2.1 Fishery Survey Sites

Site	Code	N.G.R.
Ampney St. Peter	AMK2	SP 080013
Downstream Latton	AMK5	SU 104953

7.2.2 Macroinvertebrate Survey Site

Site	Code	N.G.R.
Sheeppen Bridge	PUTR.0002	SU 105952

The site at Sheeppen Bridge was the only routine site to be surveyed in 1988-90 inclusive.

7.2.3 Water Quality Sampling Sites

Site	Code	N.G.R.
Below Ampney Mill	PUTR.0175	SP 070017
Sheeppen Bridge	PUTR.0002	SU 105952

7.3 RESULTS

7.3.1.Fisheries Survey Results

7.3.1.1 SITE RESULTS - AMPNEY St. PETER (AMK2)

WATERCOURSE: Ampney Brook

SITE NAME: Ampney St. Peter

SITE CODE: AMK2

LOCATION: Immediately downstream of roadbridge.

N.G.R.: SP 080013

DATE FISHED: October 1990

METHOD: Visual Inspection

R.Q.O.: 1A **E.E.C. TARGET BIOMASS:** No

HABITAT FEATURES

LENGTH: 200m **MEAN WIDTH:** 7m **AREA:** 1400 sqm. **MEAN DEPTH:** 0m

WATER TEMPERATURE: N/A

SUBSTRATE COMPOSITION (%)

BARE:N/A **MUD & SILT:**N/A **GRAVEL:**N/A **STONE:**N/A **BOULDER:**N/A

VEGETATION (% COVER)

SUBMERGED: N/A **FLOATING:** N/A **EMERGENT:** N/A **SHADE:** N/A

DOMINANT PLANT SPECIES: N/A

WATER LEVEL: None present **WATER CLARITY:** N/A

PHYSICAL STRUCTURE OF SITE: At the time of inspection the site was completely dry as was the entire watercourse.

ADJACENT LAND USE: L.B. Pasture
R.B. Arable

RIPARIAN OWNERS: L.B. Mr J Swettenham
R.B. As above

FISHING RIGHTS: L.B. Mr J Swettenham
R.B. As above

ADDITIONAL INFORMATION: None

COMMENTS: A biomass and density of zero. The drying up of the watercourse had occurred in July. The fish population had been eradicated by a similar event in 1989.

7.3.1.2 SITE RESULTS - DOWNSTREAM OF LATTON (AMK5).

WATERCOURSE: Ampney Brook

SITE NAME: Downstream of Latton

SITE CODE: AMK5

LOCATION: Immediately upstream of Sheeppen Bridge

N.G.R.: SU 104953

DATE FISHED: October 1990

METHOD: Visual Inspection

R.Q.O.: 1A E.E.C. TARGET BIOMASS: No

HABITAT FEATURES

LENGTH: 250m MEAN WIDTH: 5m AREA: 1250 sqm. MEAN DEPTH: 0m

WATER TEMPERATURE: N/A

SUBSTRATE COMPOSITION (%)

BARE:N/A MUD & SILT:N/A GRAVEL:N/A STONE:N/A BOULDER:N/A

VEGETATION (% COVER)

SUBMERGED: N/A FLOATING: N/A EMERGENT: N/A SHADE: N/A

DOMINANT PLANT SPECIES: N/A

WATER LEVEL: None present WATER CLARITY: N/A

PHYSICAL STRUCTURE OF SITE: At the time of inspection the site was completely dry as was the entire watercourse.

ADJACENT LAND USE: L.B. Pasture
R.B. Pasture

RIPARIAN OWNERS: L.B. Co-op Estates
R.B. As above

FISHING RIGHTS: L.B. Co-op Estates
R.B. As above

ADDITIONAL INFORMATION: None

COMMENTS: A biomass and density of zero. The drying up of the watercourse had occurred in July. The fish population had been eradicted by a similar event in 1989. Evidence of restricted immigration from the River Thames 1.5km downstream had been observed during the spring of 1990. These fish would have either emigrated to the River Thames as the flow reduced or perished.

7.3.2 Water Quality Results

7.3.2.1 River Quality

The result of river quality assessment for 1990 are detailed below.

Sampling Point	Code	R.Q.O.	Compliance 1990
Below Ampney Mill	PUTR.0175	1A	Pass
Sheeppen Bridge	PUTR.0002	1A	Pass

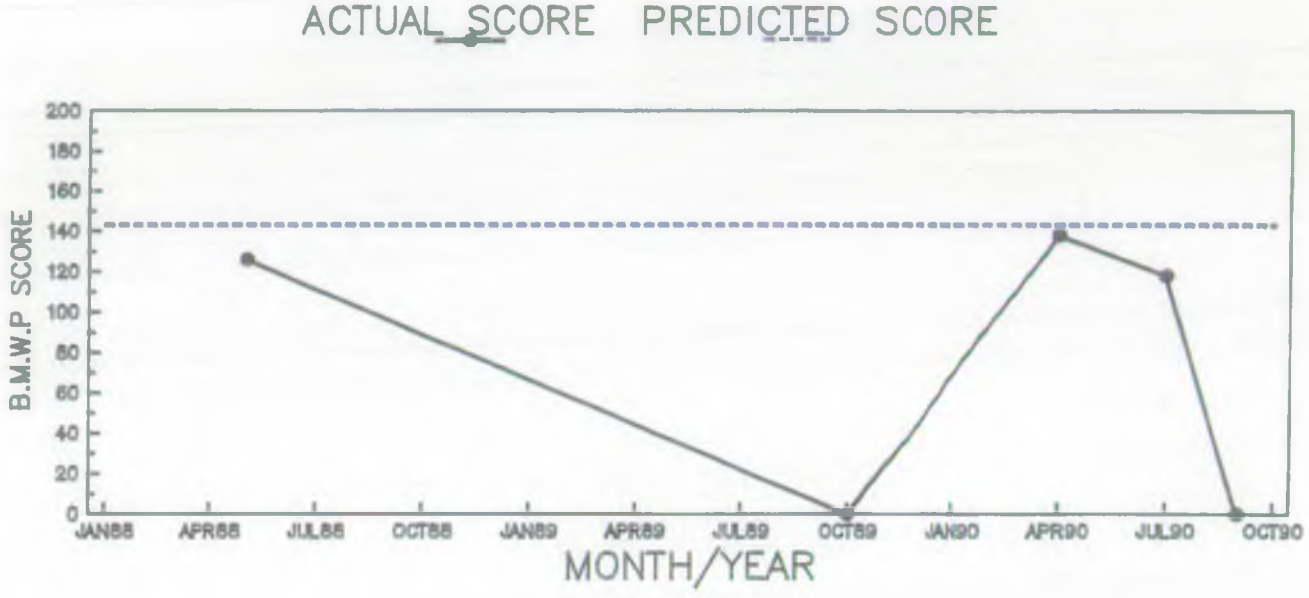
7.3.2.2 Consented Discharge Quality

This was not investigated given the full compliance with R.Q.O.'s indicated above.

7.3.3 Macroinvertebrate Monitoring Results

The results of routine monitoring at Sheeppen Bridge (PUTR.0002) for 1988-90 are presented in Fig. 7.3.3.

Fig.7.3.3. BIOLOGICAL MONITORING RESULTS 1988–90.
Sheeppen Bridge (PUTR.0002)



7.4 DISCUSSION

The total drying up of the brook in the summer of 1990 resulted in the eradication of the fish population. This was the second consecutive year that such an event has occurred. A visual inspection of the lower section of the brook (downstream of Sheeppen Bridge) in the spring of 1990 had revealed that fish had already started to recolonise the brook following it drying up the previous year. This is due to the close proximity of the River Thames and the good flows experienced by the brook over the winter period. No mortality was confirmed as the brook dried up and it is likely that the fish emigrated to the River Thames as flows reduced. It is not clear how far the fish moved up the brook, and quantitative information regarding the rate of recolonisation is not known. Given the possibility of the brook drying up in 1991, it is planned to survey the key sites in the spring to gain additional information on this point.

The events of 1990 have put back any recovery that the fish population had begun and confirm the status of this watercourse as a non-viable fishery at the present time. This is particularly distressing given the good fishery potential shown by the brook in the 1988 survey. The disastrous effect of low flow on the brook is indisputable and continues to represent the clearest case of severe damage to a significant fishery in the Upper Thames catchment.

The results of biological monitoring also indicate the large scale damage being suffered by the macroinvertebrate community. The usual biotic class B in 1988 was reduced to class X in the summers of both 1989 and 1990. However, the winter of 1989 saw a rapid rise in the scores to class B and this provided an indication of high rate of recovery which this community can make if conditions are improved.

The potential for habitat enhancement was perceived in the 1988 survey. However, it is pointless to review enhancement potential given the drastic flow problem and the rapid rate of habitat change associated with it.

7.5 CONCLUSIONS

1) The total drying up of the brook in 1990 has resulted in the eradication of the fish population. This continues to represent the clearest case of low flow problems causing severe damage to a significant fishery in the Upper Thames Catchment. The events of 1990 have delayed the recovery of the fish population following the drastic deterioration observed in 1989.

2) Observation in the spring of 1990 indicated that fish had returned to the lower section downstream of Sheeppen Bridge (approximately 1.5km). These fish appear to have emigrated downstream as flows reduced during the summer and were not observed dead when the brook dried up in July.

7.6 RECOMMENDATIONS

1) Continued monitoring of the fish populations should be undertaken. This will be accomplished by the extension of the annual low flow survey with the 10 key sites in this report being re-surveyed in 1991. The complete eradication of the fish population in 1990 does present an opportunity to monitor its recovery, particularly the immigration of coarse fish from the River Thames. Given the possibility of a further drying up of the brook in 1991 it is planned to survey the key sites by electric fishing in the spring to assess the recovery rate of this watercourse.

2) Continued monitoring of flow regimes, water quality and other factors to enable interpretation of the results of the fishery survey.

3) An investigation into the hydrology of the Ampney Brook should be undertaken. This should include an investigation of the options for alleviation of low flows.

4) Habitat enhancement opportunities do exist but assessment of these is of low priority until the immediate severe problems of low summer flows are investigated.

8. GENERAL DISCUSSION

The conclusions of the three surveys included within this report detail a variety of significant findings. The drought summer of 1990 has resulted in further direct and indirect deleterious effects on the fish populations. As in 1989, the most obvious direct effect of low flow resulted in the Ampney Brook which dried up in 1990 for the second consecutive year. Any recovery which had occurred following the events of 1989 has thus been delayed. A further important example of direct effects was on the River Churn which also dried up between Siddington and the Spine Road Bridge. This also represents a clear case of low flow causing severe damage to a significant fishery.

Indirect effects of low flow also exist and are having deleterious effects on the fish population. The most important of these is the siltation of essential spawning gravels and the loss of desirable instream vegetation. It is of great concern that no effective natural recruitment of brown trout was observed at any of the sites surveyed within this report. This has obvious implications on the future viability of a wild brown trout population in these watercourses.

It is clear that flow regime is a key factor in determining fishery quality either directly or indirectly by modifying important habitat factors. It is also clear that the low flows experienced in 1990 continue to have deleterious effects on the fish populations.

The question of reduced flows was discussed in the 1989 report but there is a need to stress the urgency of an investigation into the hydrology of these catchments.

9. REFERENCES

1. Council of the European Communities, 1978. Directive on the quality of freshwaters needing protection of improvement in order to support fish life. 78/659/EEC Official Journal of the European Communities No. L222/1.

2. National Rivers Authority, Thames Region, 1988. River Coln Fisheries Survey 1988 (Ref. ACN88). Internal Report.

3. National Rivers Authority, Thames Region, 1988. River Churn Fisheries Survey 1988 (Ref. ACU88). Internal Report.

4. National Rivers Authority, Thames Region, 1988. Ampney Brook Fisheries Survey 1988 (Ref. AAM88). Internal Report.

5. National Rivers Authority, Thames Region, 1989. Fisheries Survey 1989. Key site monitoring in relation to low flow problems. River Coln (Ref. ACN89), River Churn (Ref. ACU89) and Ampney Brook (Ref. AAM89).

6. Thames Water 1987. River Coln Fisheries Survey 1987 (Ref. ACN87). Internal Report.

10. APPENDICES

APPENDIX I N.W.C. CLASSIFICATION OF RIVER QUALITY

River Class	Quality criteria	Remarks	Current potential uses
	Class limiting criteria (95 percentile)		
1A Good Quality	(i) Dissolved oxygen saturation greater than 80% (ii) Biochemical oxygen demand not greater than 3 mg/l (iii) Ammonia not greater than 0.4 mg/l (iv) Where the water is abstracted for drinking water, it complies with requirements for A2* water (v) Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures not available)	(i) Average BOD probably not greater than 1.5 mg/l (ii) Visible evidence of pollution should be absent	(i) Water of high quality suitable for potable supply abstractions and for all other abstractions (ii) Game or other high class fisheries (iii) High amenity value
1B Good Quality	(i) DO greater than 60% saturation (ii) BOD not greater than 5 mg/l (iii) Ammonia not greater than 0.9 mg/l (iv) Where water is abstracted for drinking water, it complies with the requirements for A2* water (v) Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures not available)	(i) Average BOD probably not greater than 2 mg/l (ii) Average ammonia probably not greater than 0.5 mg/l (iii) Visible evidence of pollution should be absent (iv) Waters of high quality which cannot be placed in Class 1A because of the high proportion of high quality effluent present or because of the effect of physical factors such as canalisation, low gradient or eutrophication (v) Class 1A and Class 1B together are essentially the Class 1 of the River Pollution Survey (RPS)	Water of less high quality than Class 1A but usable for substantially the same purposes
2 Fair Quality	(i) DO greater than 40% saturation (ii) BOD not greater than 9 mg/l (iii) Where water is abstracted for drinking water it complies with the requirements for A3* water (iv) Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures not available)	(i) Average BOD probably not greater then 5 mg/l (ii) Similar to Class 2 of RPS (iii) Water not showing physical signs of pollution other than humic colouration and a little foaming below weirs	(i) Waters suitable for potable supply after advanced treatment (ii) Supporting reasonably good coarse fisheries (iii) Moderate amenity value
3 Poor Quality	(i) DO greater than 10% saturation (ii) Not likely to be anaerobic (iii) BOD not greater than 17 mg/l. This may not apply if there is a high degree of re-aeration	Similar to Class 3 of RPS	Waters which are polluted to an extent that fish are absent or only sporadically present. May be used for low grade industrial abstraction purposes. Considerable potential for further use if cleaned up
4 Bad Quality	Waters which are inferior to Class 3 in terms of dissolved oxygen and likely to be anaerobic at times	Similar to Class 4 of RPS	Waters which are grossly polluted and are likely to cause nuisance
X	DO greater than 10% saturation		Insignificant watercourses and ditches not usable, where the objective is simply to prevent nuisance developing

Notes

(a) Under extreme weather conditions (eg flood, drought, freeze-up), or when dominated by plant growth, or by aquatic plant decay, rivers usually in Class 1, 2 and 3 may have BODs and dissolved oxygen levels, or ammonia content outside the stated levels for those Classes. When this occurs the cause should be stated along with analytical results.

(b) The BOD determinations refer to 5 day carbonaceous BOD (ATU). Ammonia figures are expressed as NH_4.

(c) In most instances the chemical classification given above will be suitable. However, the basis of the classification is restricted to a finite number of chemical determinands and there may be a few cases where the presence of a chemical substance other then those used in the classification markedly reduces the quality of the water. In such cases, the quality classification of the water should be down-graded on the basis of biota actually present, and the reasons stated.

(d) EIFAC (European Inland Fisheries Advisory Commission) limits should be expressed as 95 percentile limits.

* EEC category A2 and A3 requirements are those specified in the EEC Council Directive of 16 June 1975 concerning the Quality of Surface Water Intended for Abstraction of Drinking Water in the Member State.

APPENDIX II N.R.A. - THAMES REGION. RIVER QUALITY OBJECTIVE PARAMETERS

Class 1A - High quality waters

1. Suitable for potable supply at defined abstraction points, and

2. Suitable for all other abstractions, and

3. Suitable for game or any other high class fisheries, (complying with the requirements of Directive 78/659/EEC for salmonid waters), and

4. Of high amenity value.

Class 1B - High quality waters

1. Used for the transport of high proportions of sewage effluent, trade effluent or urban run-off, and

2. Suitable for potable supply at defined abstraction points, and

3. Suitable for all other abstractions, and

4. Suitable for game or any other high class fisheries, (complying with the requirements of Directive 78/659/EEC for salmonid waters), and

5. Of high amenity value.

Class 2A - Fair quality waters

1. Suitable for potable supply after advanced treatment at defined abstraction points, and

2. Suitable for agricultural uses, and

3. Capable of supporting good coarse fisheries, (complying with the requirements of Directive 78/659/EEC for cyprinid waters), and

4. Of moderate amenity value.

Class 2B - Fair quality waters

1. Suitable for potable supply after advanced treatment at defined abstraction points, and

2. Suitable for agricultural uses, and

3. Capable of supporting reasonably good coarse fisheries, and

4. Of moderate amenity value.

Class 3 - Poor quality waters

1. Suitable for low grade industrial use, and

2. Not anaerobic or likely to cause a nuisance, and

3. Capable of supporting a restricted aquatic flora and fauna.

N.B. Not required to be capable of supporting a viable fishery.

Class 4 - Bad quality waters

1. Likely to cause a nuisance.

2. Flora and fauna absent or restricted to pollution tolerant organisms.

Class X - Insignificant watercourses

1. Watercourses, not usable, and not placed in Classes 1A to 4 above.

2. Capable of supporting a restricted flora and fauna, and

3. Not likely to cause a nuisance.

APPENDIX III E.C. WATER QUALITY CRITERIA FOR FISHERIES

LIST OF DETERMINANDS

Determinand	*Salmonid Waters*		*Cyprinid Waters*	
	G	*I*	*G*	*I*
(a) Temperature (max) (b) Temperature rise		$\leqslant$ 21.5°C $\geqslant$ 1.5°C		$\leqslant$ 28°C $\geqslant$ 3°C
Dissolved oxygen ($mg/l\ O_2$)	50% $\geqslant$ 9 100% $\geqslant$ 7	50% $\geqslant$ 9	50% $\geqslant$ 8 100% $\geqslant$ 5	50% $\geqslant$ 7
pH		6--9		6--9
Suspended solids (mg/l)	$\leqslant$ 25		$\leqslant$ 25	
B.O.D. (A.T.U.) (mg/l)	$\leqslant$ 5*		$\leqslant$ 8*	
Nitrites (mg/l)	$\leqslant$ 0.2*		$\leqslant$ 0.5*	
Non-ionized ammonia (mg/l)	$\leqslant$ 0.005	$\leqslant$ 0.025	$\leqslant$ 0.005	$\leqslant$ 0.025
Total ammonium ($mg/l\ NH_4$)	$\leqslant$ 0.04	$\leqslant$ 1	$\leqslant$ 0.2	$\leqslant$ 1
Total residual chlorine (mg/l HCIO)		$\leqslant$ 0.005		$\leqslant$ 0.005
Zinc (mg/l)		$\leqslant$ 0.3		$\leqslant$ 1
Copper (mg/l)	$\leqslant$ 0.04		$\leqslant$ 0.04	

** The revised G-values that have been set by the U.K. government*

APPENDIX IV N.R.A. FISH SURVEY SITE CODING SYSTEM

The following habitat codes are used by Thames NRA fisheries and are based on RQO and EEC legislation critera:

1. EEC Designated Watercourses

Code	Description
A	1A Salmonid
B	1A Coarse
C	1A/1B Salmonid
D	1A/1B Cyprinid
E	1B Salmonid
F	1B Coarse
G	2/1B Salmonid
H	2/1B Coarse
I	2 Salmonid
J	2 Cyprinid

2. RQO Watercourses

Code	Description
K	1A
L	1A/1B
M	1B
N	2/1B
O	2
P	3/2
Q	3
R	4/3
S	4
T	Unclassified

A 2 digit code for a watercourse is combined with the above and an individual site number to provide an unique 4 digit code for each site. Thus RAJ1 - RA=RAY, J=2 cyprinid, 1=individual site.

Appendix V. River Coln 1990 - Consented & Authority Fish Introductions

Section	Species								
	Brown Trout			Rainbow Trout			Grayling		
	No.	Size	Wt.	No.	Size	Wt.	No.	Size	Wt.
Withington	50	12"	-	-	-	-	-	-	-
Williamstrip }	275	12"	-	-	-	-	-	-	-
Estate }	200	12-14"	-	-	-	-	-	-	-
Netherton Bridge	100	Fingerlings	-	100	14"	-	-	-	-
" "	100	10"	-	-	-	-	-	-	-
Fairford Park	1000	12"	-	500	12"	-	-	-	-
Whelford - Fly Fishers	400	12-15"	-	-	-	-	-	-	-
*Whelford " "	-	-	-	-	-	-	250	12-30cm	60kg
Roundhouse	150	-	-	-	-	-	-	-	-
TOTAL	3175	-	-	600	-	-	250	-	60kg

* Authority Fish Introductions

Appendix VI River Coln 1990 - Consented Culling Operations

Date	Section	Reason	Weight Removed (Kg) Grayling	Stock Pike	Other Coarse
Oct. 90	Williamstrip Est.	Control of grayling	150	-	-
Oct. 90	Fairford Park Est.	Control of pike and grayling	50	few	-

N.B. Additional Information

Williamstrip Cull

Cull from just downstream of survey site CNC1 to Mill. An approximate biomass of removed stock was calculated at $7g/m^2$.

No small trout were observed throughout this section of approx. 3km giving an indication of the seriousness of the lack of recruitment.

Fairford Park Cull

Approximately 3km of river yielding only 50kg of mainly 1+ and 2+ grayling from cull. This represents a biomass of only approx. $3g/m^2$ and is indicative of the heavy culling of this species undertaken in recent years at this location.

Appendix VII. River Churn 1990 - Consented and Authority Fish Introductions

Section	Species	No.	Size
Perrots Brook	Brown Trout	50	12"
Siddington	Brown Trout	300	12"
TOTAL		350	

APPENDIX VIII

River Coln Habitat Improvement Scheme

1. Introduction

The River Coln rises from springs to the north of Brockhampton, near Cheltenham (SP 035 234) and flows in a south easterly direction to join the River Thames at Lechlade (SP 204 987), a total distance of 51.7km.

The river quality objective (R.Q.O.) is 1A for the length of the river with the exception of the section between Bibury Trout Farm and Fairford Mill which is 1B. These objectives are currently being achieved.

The River Coln is a designated salmonid fishery downstream of Withington (38.7km) under the European Community Directive 78/659/EEC. The National Rivers Authority - Thames Region, have set quality targets for such fisheries in the form of a biomass figure of 15g/m^2. This target forms one of the Fisheries Department's major levels of service criteria.

The river represents an important angling facility with almost every section downstream of Fossebridge being managed as a trout fishery. Historically, the Coln was a classic Cotswold trout river with records of exceptional catches of brown trout and grayling.

2. Fisheries Survey Results

The first comprehensive fishery survey of the River Coln was undertaken in 1987 (Ref: ACN87). The over-riding conclusion of the report was that the fish population quality varied considerably from poor to excellent and that the key environmental factor associated with this variation was habitat quality. Five of the eleven sites (45%) within the E.E.C. designated fishery failed to achieve their target biomass for this reason. Annual monitoring of key sites undertaken as part of the Cotswold low flow programme (Ref. ACN88, ACN89, ACN90) has confirmed these conclusions. A further important finding of the survey work is that some sections support a very low population of wild fish (i.e. non stock fish) and the key to this is lack of effective recruitment. This problem can also be attributed to poor habitat quality.

One such section is the Williamstrip Estate Water upstream of Coln St. Aldwyn. Fishery surveys have been undertaken annually since 1987 with the results showing grayling to be dominant brown trout sub-dominant and rainbow trout present. Biomass values have varied considerably between 10.5g/m^2 and 26.1g/m^2 due to two main factors.

i) The level of annual stocking of large brown trout (>30cm).
ii) The timing of the survey in relation to biannual grayling culls.

The key and consistent finding is the absence of wild brown trout and no effective recruitment. A recent grayling cull on this section in October 1990 involved the electrofishing of 3km of river showing no evidence of young brown trout.

The conclusion is that this section of river does not possess a self sustaining population of brown trout due to the lack of effective recruitment caused by poor habitat quality.

3. Habitat Quality

Good trout habitat is determined by a number of key physical and biological factors:

i) The channel structure should provide a variety of physical features including riffles, pools and deeper runs. This produces good flow diversity and creates natural holding areas for fish. This channel should also be of a size to concentrate low flows to maintain an area of reasonable flow which restricts silt deposition.

ii) The channel should possess extensive areas of clean gravel associated with a healthy flow to remain silt free. These areas are of key importance as spawning sites allowing successful recruitment of young fish to the population. These areas also provide the required habitat for a large diversity of aquatic invertebrates and important instream vegetation (e.g. Ranunculus).

iii) Extensive stands of instream weed provides excellent cover for fish and harbour a large biomass and diversity of aquatic invertebrates. Weeds such as Ranunculus require a moderate - fast flow and clean unsilted gravels in order to thrive.

iv) Good riparian cover in the form of emergent vegetation and trees/shrubs is another important factor.

The habitat quality of the Williamstrip section is poor. The river is over-wide with little riffle-pool regime. The substrate is particularly poor with a potentially good gravel bed being covered in substantial quantities of silt. The factors required for successful spawning of brown trout and subsequent survival of eggs and fry are not present. The destruction of potential spawning areas by silt deposition is widespread in this section and has been exacerbated by the extreme low summer flows experienced in recent years. The siltation problem has been associated with a severe loss of instream vegetation. As a result Ranunculus has almost disappeared and instream cover is below 10% in the majority of the section. Bankside cover is also poor in many sections.

4. Proposed Habitat Improvement

The scheme aims to undertake intensive habitat enhancement of approximately 1.5km of river on the Williamstrip Estate (SP129056 - SP142054 - see attached map).

The work will include the following:

i) Significant narrowing of channel width to concentrate flow and restrict silt deposition.

ii) The creation of meanders within the narrowing operation to increase cross-sectional flow diversity.

iii) The construction of a pool-riffle regime and the use of groynes to increase flow and habitat diversity.

iv) The construction of a spawning weir to produce ideal conditions for brown trout spawning and subsequent egg survival.

v) The introduction of instream gravel at suitable locations to increase spawning success.

vi) The replanting of instream vegetation, particularly Ranunculus, in suitable habitat to increase cover.

vii) The planting of riparian trees to improve bankside cover.

viii) The possible construction of a small stillwater within the river corridor to gain spoil required to narrow the channel.

All of the above (with the exception of iv) would also enhance the environmental value of the river and benefit wildlife in general. It is hoped to undertake the scheme during October/November 1991 before winter flow and whilst ground conditions remain good. The scheme will involve a multi-disciplinary input from the following departments: Fisheries, Conservation, Biology, Geomorphology, Flood Defence.

5) Post-Scheme Appraisal

Baseline data will be aquired to enable post scheme evaluation for the following criteria.

i) The fish population.
ii) The aquatic invertebrate community.
iii) General habitat survey including instream vegetation.
iv) In addition, the geomorphological aspects will be appraised in relation to habitat enhancement techniques, channel dynamics and stability. The scheme will serve to provide quantitative information on habitat enhancement and resulting effects on the river biota.

6) Aims/Justifications of the Scheme

i) Aim - To improve the fish population and stimulate the successful recruitment of brown trout to produce a self-sustaining population.

Justification - Target Levels of Service - to enable this E.C. designated salmonid fishery to consistently comply with its target biomass of $15g/m^2$.
- Statutory - as part of our duty to maintain improve and develop fisheries. (S.F.F.A. 1975)

ii) Aim - To enhance the river environment..
Justification - Statutory - as part of our duty to promote the conservation of wildlife dependant upon the aquatic environment (Water Act 1989).

iii) Aim - To provide quantitative data on habitat enhancement and subsequent improvement to the river environment.
Justification - to increase knowledge of this subject and allow more efficient evaluation of future enhancement opportunities.

7) Scheme Funding

The scheme will be funded mainly by the Fisheries Department but significant financial input is also being contributed by the Conservation Department in recognition of the general environmental enhancement and by the Williamstrip Estate illustrating their commitment to improving the fishery and river environment in general.

The cost of the scheme will be approximately £25,000.