

NATIONAL RIVERS AUTHORITY

THAMES REGION

THAMES WEST AREA

RIVER COLE
FISHERIES SURVEY
1992

COMPILED BY SIMON HUGHES

NRA-Thames 101



ENVIRONMENT AGENCY

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A KILLINGBECK (FISHERIES OFFICER)
E HOPKINS (ASSISTANT FISHERIES OFFICER)
J PERKINS (FISHERIES ASSISTANT)
B PROCTOR (FISHERIES STUDENT)

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1.0 SUMMARY.

- Nine sites were electrofished between 14/01/92 and 13/08/92. The River Cole is an EC designated 1B coarse fishery from Acorn Bridge (CLF1) to its confluence with the River Thames at Lechlade.
- Fish biomass and density results were found to be a function of fisheries habitat quality; one of several determining factors.
- The River Cole lacked suitable fisheries habitat and exhibited poor fish populations (biomass < 20 gm⁻²) at most of the sites surveyed. Habitat enhancement is a priority for much of this watercourse.
- Chub and dace populations showed poor recruitment at sites upstream from Coleshill Mill but roach showed good recruitment at the majority of sites surveyed, reflecting the different habitat and flow types in these reaches.
- From Friar's Farm (CLF3) upstream the river supported good populations of minor fish species.
- Fish stocked into the river at Coleshill did not appear in the sample at this site.
- Comparison of results between a relatively natural site and one altered in the 1975/76 land drainage works show different species dominance.
- Fish parasite loading was comparable with similar rivers in the region. A rare Microsporidian was found in dace, and *Pomphorhynchus laevis* was present in chub and dace.
- There are insufficient water quality sample analysis data available for the River Cole to discount water quality as a prime factor affecting fish populations. There is evidence to suggest that localised low DO levels (due to the effects of impoundments and low summer flows exacerbated by other factors) affect fish populations at sites between Fresden Farm (CLF4) and Roundhill Farm (CLF6).
- Measures of water quality gave conflicting results for the river upstream from Acorn Bridge. Biological results indicating reduced water quality were corroborated by the fisheries survey results at Acorn Bridge.
- Potential problems of low dissolved oxygen (DO) at CLF5 are not likely to be reflected in chemical and biological results as the water quality sampling site is situated downstream of a substantial weir and riffle.

2.0 INTRODUCTION.

Figure 2.01 shows the River Cole and major tributaries to confluence with the tail of St John's Lock and River Thames, including significant discharges, fishery survey sites, the flow gauging station, water quality sampling points, biological survey sites and major towns and villages.

2.1 Description of the Watercourse.

The source of the River Cole is situated at East Walcot, near Swindon (Wilts) at grid reference SU166851. The river flows in a northerly direction for 27 km before its confluence with the St John's Lock cut, a distributary of the Thames at Lechlade. The average gradient is 1:844 (metre:metre) which is steeper than the River Thame (1:1540) but shallower than the Oxon Ray (1:580), River Windrush (1:441) and River Churn (1:344).

The River Cole is an EC designated Coarse fishery (CEC, 1978) for 20.3 km of its length from Acom Bridge (SU216876) to its confluence with the River Thames. As such, sites falling within this reach are expected to reach a target minimum biomass of 20 gm² set by NRA Thames Region.

The catchment area is 140 km², making it one of the smallest in the Thames West area. Apart from the uppermost reaches in the town of Swindon, much of this area is rural and land use is predominantly for agriculture, particularly improved or semi-improved pasture. The development of the few larger towns and villages (Swindon, Highworth, Coleshill) in the catchment has changed land use distribution in the catchment and increased the impact of urban development on the river system.

A total of nine major tributaries join the River Cole, many of which receive discharges from sewage treatment works (STWs). These are given in order below starting with the furthest upstream:

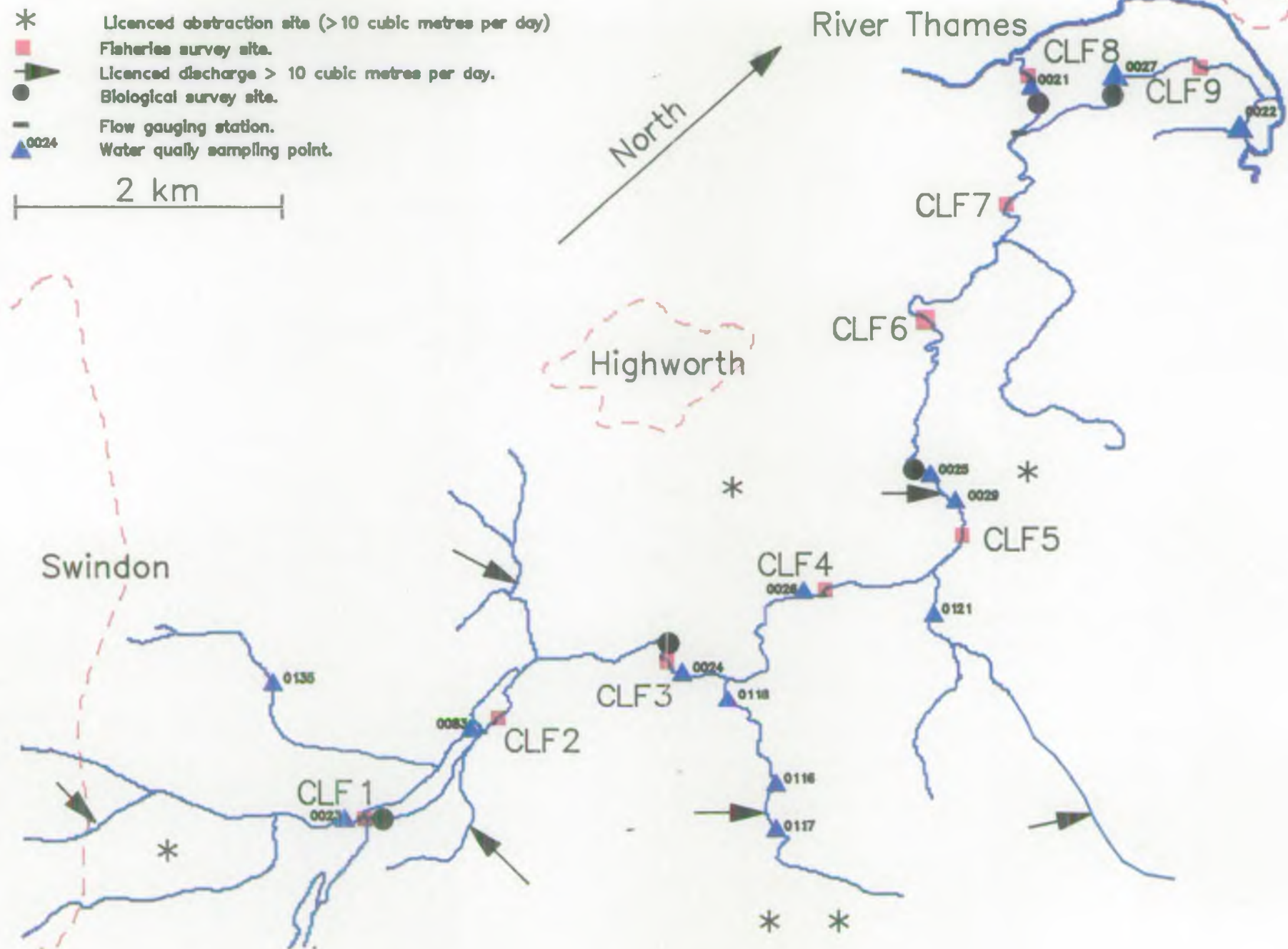
- Stratton Road Ditch.
- Dorcan Brook.
- Liden Brook.
- Lenta Brook.
- South Marston Brook.
- Cole East (distributary of Cole).
- Sevenhampton Stream.
- Tuckmill Brook.
- Waterloo Ditch.

The river is impounded at Coleshill Park by the mill which is no longer in use, and again at Inglesham where the river has been divided to form two arms, one flowing directly to the Thames and known as the Old Cole and one to the St John's Lock Cut. Flow to these arms is controlled by a three crest Crump weir allowing one third through the Old Cole and the remainder through the Barkers Brook. (See 2.7)

2.2 The Geology of the River Cole. (From Moxon, IR. 1992)

The accredited source of the River Cole is at East Walcot, Swindon (SU166851), arising from surface water run-off from the surrounding Kimmeridge Clay and urban catchment.

Fig 2.01 The River Cole.



The Cole runs north-east through Swindon, along the route of the Old Canal. The flow here will be variable, influenced greatly by the surface run-off from the surrounding impermeable clay and hardstanding areas. The quality of the stream will be influenced by anthropogenic activities, especially the surface water outfalls from the Greenbridge Industrial Estate.

The river is joined by the Dorcan Brook at SU199862. This is a tributary generated from springs associated with the Upper Greensand/Gault Clay junction to the south-west. This watercourse is also greatly influenced by surface run-off for most of its length.

The Cole flows along established alluvial deposits which widen to a maximum of 1km soon after this confluence. This is associated with the river receiving a number of inputs at this point from tributaries flowing in from the south, including the Liden Brook at SU210878.

For about 5 km downstream from Acorn Bridge the river crosses the permeable calcareous sands and limestones of the Corallian, a minor aquifer from which the river will receive a groundwater input. The river has incised a relatively steep sided valley within these harder Corallian deposits, and it receives a number of inputs in this area from spring fed tributaries.

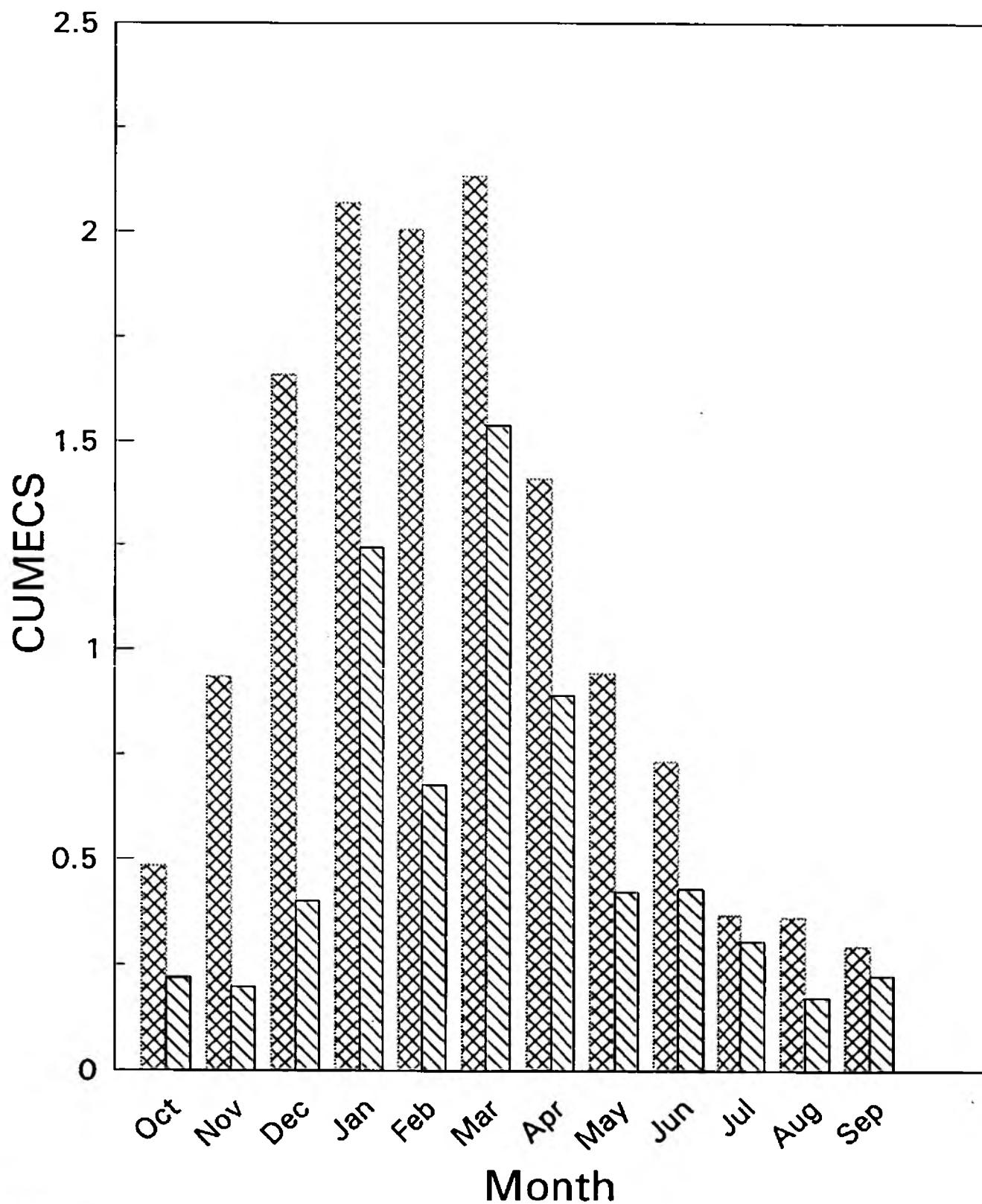
At SU233924 the river flows out of the steep sided valley onto the Oxford Clay. An increased flood plain area is indicated by the extensive alluvial deposits. The river quality in this area will once again be influenced by surface run-off from the surrounding clay catchment.

As the Cole nears its confluence with the Thames at SU201977, there is some evidence of historic Terrace gravel deposits overlying the Oxford Clay. These deposits may generate a number of minor watercourses arising from perched water tables in the gravels.

2.3 Hydrology.

Figure 2.31 shows mean monthly river flow for the long term and water year 1990/91 at Inglesham gauging station, immediately upstream of the division of the river into two channels. The annual net river flow for water year 1990/91 was significantly lower than the long term mean. Figure 2.32 shows daily flows at Inglesham for water year 1990/91, and shows the extremely flashy flow regime during this period; a characteristic of the largely impermeable clay catchment. Mean daily flow at Inglesham gauging station for the water year 1990/91 was $0.561 \text{ m}^3\text{s}^{-1}$. During this time, licensed discharges could amount to a total of $0.08 \text{ m}^3\text{s}^{-1}$ or 14% of mean daily flow. Licensed abstractions from the catchment total $0.01 \text{ m}^3\text{s}^{-1}$.

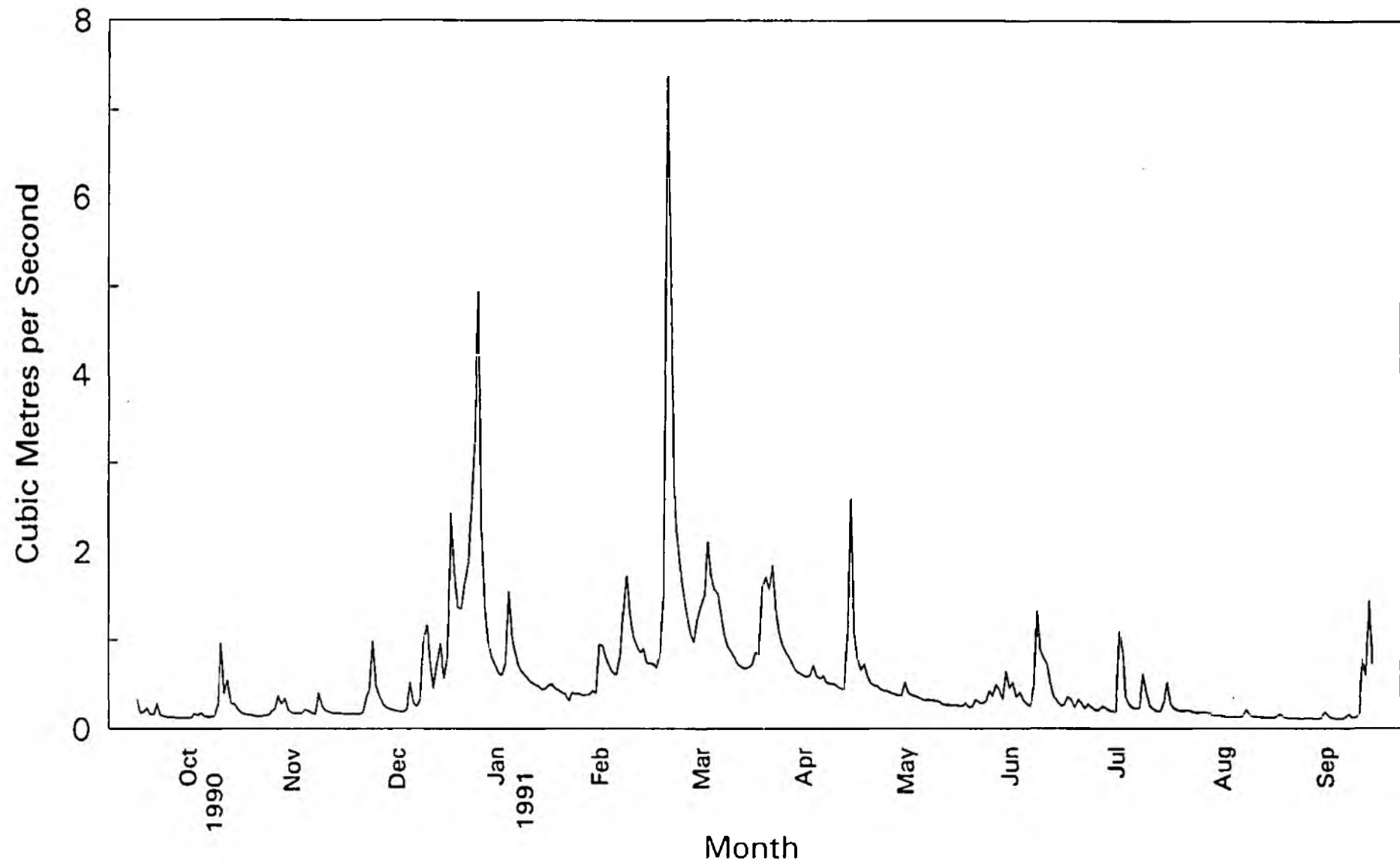
Fig 2.31 River Cole Monthly Mean River Flow At Inglesham Gauging Station (cumeecs).



Long Term Mean (1976-1992)

Water Year 1990/91

Fig 2.32 River Cole Daily Flow (CUMECS)
For Water Year 1990/91 at Inglesham



2.4 Main Discharges and Pollution Incidents.

Table 2.41 below lists pollution incidents on the River Cole and tributaries reported between 21/01/88 and 29/10/92. From a total of 96 incidents, 4 caused fish kills of between 11 and 200 fish.

Table 2.41 Pollution Incidents by Type on the River Cole and Tributaries.

Number of Incidents Reported	Incident Type
63	Oil
8	Chemical
10	Sewage
4	Natural
2	Agricultural
5	General
1	Urban Runoff
3	Not Known

Consented discharges $\geq 20\text{m}^3/\text{d}$ are listed below with discharge consent conditions and compliance as provided by NRA TR Monitoring Services.

Table 2.42 Discharges to the River Cole and Tributaries.

Watercourse	Discharge site	Consent		Conditions	
		Vol m ³ d ⁻¹	SS mg l ⁻¹	BOD mg l ⁻¹	Compliance
River Cole	Coleshill (Oxon) STW	42 DWF	45	30	Yes
Stratton Rd Ditch	Bampton Bros STW, Swindon	20 MAX	45	30	Yes
Dorcan Brook	Poplars Hotel STW, Wanborough	20 MAX	45	30	1 failure (SS & BOD) 16/9/92
Liden Brook	Wanborough STW	340 DWF	45	30	Yes
Lenta Brook	Eastbrook Farm, Bishopstone	45 DWF	30	20	Yes
	Bishopstone STW	75 DWF	45	30	4 failures of 13 samples in 1991
Lenta Brook (East)	Bourton (Oxon) STW	64 DWF	45	30	Yes
Sevenhampton Stream	Sevenhampton Village STW	23 DWF	45	30	Yes
Tuckmill Brook	Shrivenham STW	2000 DWF	45	30	Yes
Lertwell Brook	Ashbury STW	68 DWF	45	30	Yes
Waterloo Ditch	Great Coxwell STW	24 DWF	45	30	Yes

KEY: DWF - Under dry weather conditions. MAX - Maximum possible flow.

2.5 Fish Mortalities.

During the past five years, the River Cole and tributaries have only suffered two recorded fish mortalities (Appendix V) totalling 170 fish. The Dorcan Brook suffers from sporadic fish kills of minor species (Sect 4.2) in low numbers.

2.6 Fisheries Management Work.

In response to the fish kill and specific requests, over 5500 coarse fish have been stocked into the River Cole during the past five years (Appendix V). These introductions were made with the aim of improving anglers' catches by enhancing natural stocks. No other fisheries management work has been carried out on the River Cole in the past five years.

2.7 Land Drainage Scheme.

To decrease the incidence of summer and annual winter flooding of natural flood meadows and therefore release land for intensive arable culture, the former Thames Conservancy prepared a major land drainage scheme which was implemented by its successor the Thames Water Authority in 1975/6. The scheme involved regrading and re-aligning about four miles of river from Coleshill downstream to the River Thames. The result of this was to alter a natural, sinuous channel with established pool riffle sequence and excellent bankside shelter and shade bordered by established flood meadows with considerable conservation value. The finished channel was straight, wide and canalised in places and contained between steep, high banks with a bare clay substrate following the complete removal of the existing gravel (see Fig 2.7).

Figure 2.7 The River Cole Downstream of Lynt Bridge following Channel Re-profiling (March 1976)



Apart from the complete lack of environmental input to the design, fundamental errors were made in the management of the scheme, resulting in the lower section (immediately upstream of the weir at Inglesham) being dredged well below the optimum grade line, and a steep gradient was therefore required to meet with the invert of Coleshill Bridge. The result of this was to exacerbate torrential flows immediately downstream of Coleshill Bridge, and very sluggish flows upstream of Lynt Bridge. In addition to the dredging, a replacement weir was built at Lynt Bridge that diverts a maximum of two thirds of flow down the Barkers Brook and one third down the Cole, reversing the natural division of flow. (Jenkins, DG., 1980)

Results of a fisheries survey carried out immediately before and shortly after the completion of the project illustrated a 90% reduction of chub and 95% reduction of dace populations (in terms of biomass), despite significant efforts to rehabilitate this section of the river through re-stocking and habitat enhancement. (Anon 1980).

3.0 AIMS AND OBJECTIVES.

3.1 Overall Aims of Surveys.

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

3.2 River Classification.

River water quality is classified according to the National Water Council (NWC) River Quality Objectives (RQO) 1978 (as amended by the Dept of the Environment in 1987).

Under European Community Directive (78/659/EEC), river zones are designated as capable of having water quality suitable for supporting either salmonid or cyprinid fish.

Further details of the NWC classification system and the EC directive appear in Appendices I-III.

The NRA Thames Region have developed a classification system based upon the River Quality Objectives and the EC directive. A description of this system appears in Appendix IV.

Fish biomass targets apply within the NRA Thames Region with respect to EC designated fisheries, viz:

Cyprinid	20 gm ²
Salmonid	15 gm ²

3.3 Specific Aims.

This is the first exhaustive fisheries survey undertaken by the NRA Thames Region on the whole length of the River Cole, and will serve to form the datum against which future changes in fish populations in the river are compared. The aims of this survey are to provide information on fish populations, species diversity and distribution, and comment on factors that may have influenced these parameters.

4.0 METHODS

4.1 Site Selection.

Nine sites were fished between 14/1/92 and 13/08/92. Sites were selected to represent local environmental conditions within the defined water quality zones, taking into account bed topography, known water quality impacts and access considerations.

4.2 Capture and Data Acquisition.

Catch depletion electrofishing techniques using non-independently switched pulsed DC equipment were employed at each site and operated within enclosed sections of approximately 100m in length. Two or more runs were fished at each site depending on the catch efficiency. All fish captured were enumerated by species and the fork length was measured to the nearest mm. A subsample of up to 40 fish of each species at each site was weighed to the nearest gram. Scale samples from the shoulder of up to three fish of each 1cm size class were taken for age estimation.

Minor species such as stoneloach (*Noemacheilus barbatulus*), minnow (*Phoxinus phoxinus*), bullhead (*Cottus gobio*), and stickleback (*Gasterosteus aculeatus*) were noted for relative abundance.

Other relevant site details were taken and appear in the site reports.

All data acquired in the field were entered into a Husky Hunter data logger. This was later downloaded to a Novell Network file server for subsequent analysis.

Single qualitative electrofishing runs were made immediately upstream of the site where practical, with the aim of assessing the validity of results obtained in the survey section.

4.3 Data Analysis.

The data were processed on the network using the Fisheries Information System (FINS) software package. Graphics were generated using Lotus Freelance v4.0 and printed on a Hewlett Packard "Colorpro" colour plotter.

4.4 Fish Health Examination.

A representative sample of fish were examined by a fish pathologist for parasitic fauna.

4.5 Macroinvertebrate Data Collection.

NRA Biology staff are engaged upon a biological monitoring programme of the main watercourses in the region. Macroinvertebrate data from this source are presented in this report.

Invertebrate samples tend to reflect the physio-chemical variations which occur in the river and this provides a means of monitoring the aquatic environment on a continuous basis. The results were evaluated using the Biological Monitoring Working Party scoring system. Results obtained were compared to scores predicted for the site if it were unpolluted.

4.6 Water Quality.

River quality objectives (RQO) were set according to existing water quality conditions and the uses of the river. Discharge consents are determined in order to maintain water quality. NRA Pollution Officers take routine samples from consented discharges to monitor compliance with consent conditions, and from river points to assess that the RQO is being met. River and discharge samples are also taken following reports of pollution.

The samples are analysed for different parameters depending on its source. The three main parameters are Biochemical Oxygen Demand (BOD), Ammonia (expressed as mg l^{-1} N) and suspended solids. Routine sample results are held on a register available for public inspection.

4.7 Hydrology.

Data were obtained from NRA Catchment Control Department. Flow rates were measured at gauging weirs with the mean, minimum and maximum flows being recorded on a daily basis.

5.0 RESULTS.

5.10 Site Results.

Results are presented at site level with biomass, density and length frequency graphs. A brief explanatory text appears in the Remarks section of each site report. The code, name and position of each site investigated in this survey are summarised in Table 5.11 below.

Table 5.11 Summary of Survey Sites.

Site Code	Name	Grid Ref	Kilometres In Reach
CLF1	Acorn Bridge.	SU216876	6.0
CLF2	Rove's Farm.	SU217888	2.0
CLF3	Friar's Farm.	SU222906	2.5
CLF4	Fresden Farm.	SU228918	2.5
CLF5	Coleshill Park.	SU235933	2.0
CLF6	Roundhill Farm.	SU218949	2.5
CLF7	Snowswick Farm.	SU215960	2.0
CLF8	A361 Road Bridge.	SU204976	2.0
CLF9	Upstream St John's Bridge.	SU216988	3.0
		TOTAL	24.5

5.11 SITE REPORT

WATERCOURSE: River Cole.
SITE NAME: Acorn Bridge.
SITE CODE: CLF1
LOCATION: A420 road bridge, near Bourton.
NGR: SU216876
DATE FISHED: 12th May 1992.
METHOD: Pulsed DC electrofishing, wading upstream with two anodes.
EC TARGET
BIOMASS: 20 gm²

HABITAT FEATURES

LENGTH: 115 m WIDTH: 4.2 m AREA: 483 m² DEPTH: 0.7 m
WATER TEMPERATURE: 15 °C
WATER LEVEL: Normal.
WATER CLARITY: Turbid.
FLOW RATE: Normal.

SUBSTRATE COMPOSITION (%)

BARE: 30 MUD & SILT: 19 GRAVEL: 00 STONE: 50 BOULDER: 01

VEGETATION (% COVER)

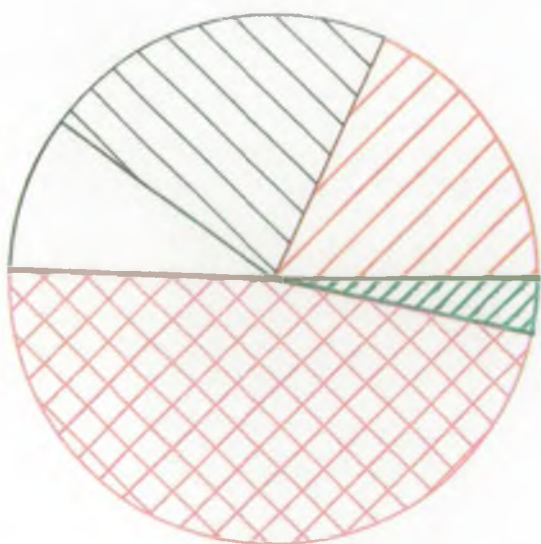
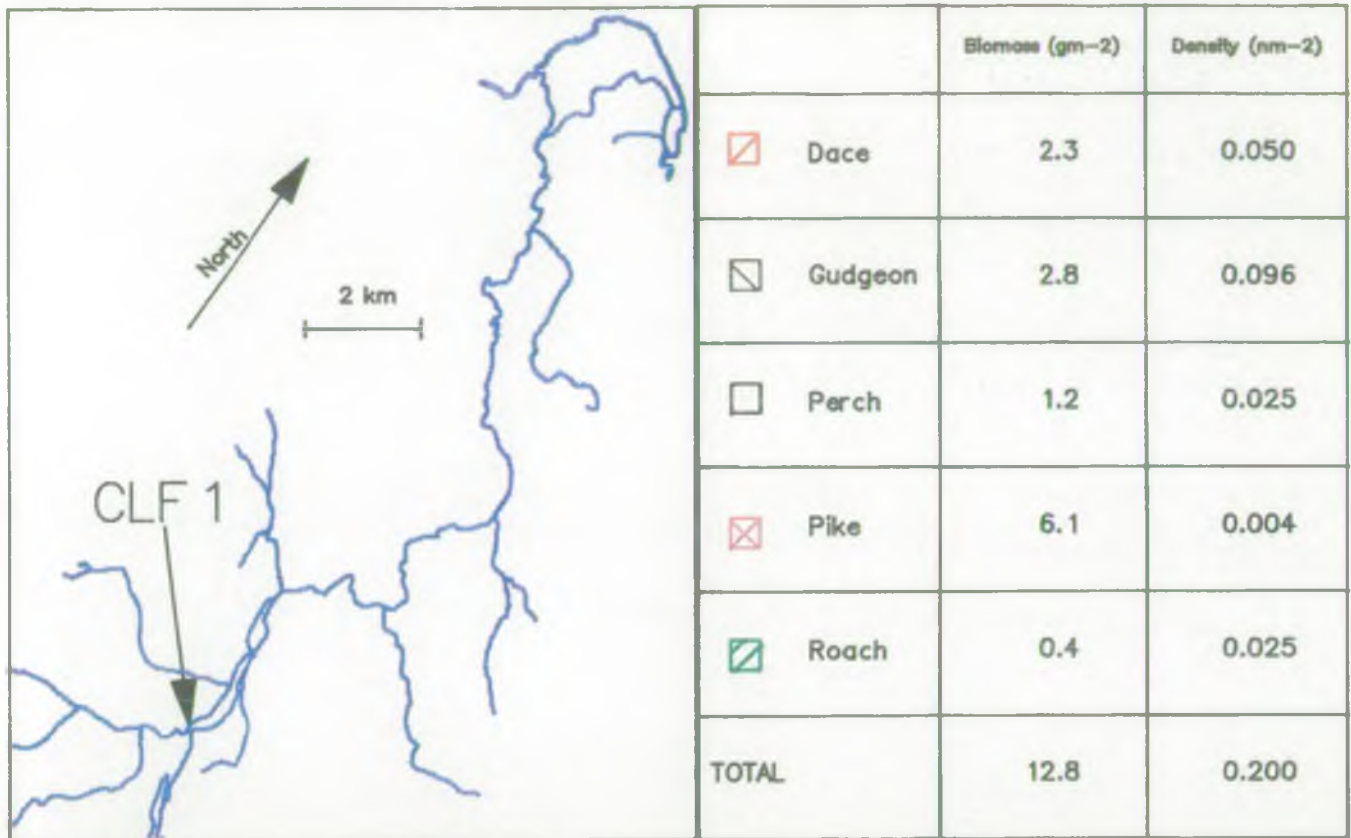
SUBMERGED: 03 FLOATING: 00 EMERGENT: 10 SHADE: 20
DOMINANT PLANT SPECIES: *Iris pseudacorus*, *Rorippa sp.*, *Ranunculus sp.*
ADJACENT LAND USE: LB Permanent pasture, RB Arable.

REMARKS

PHYSICAL STRUCTURE OF SITE: A natural channel with pool riffle sequence above a small weir, giving some variation in depth, width and flow regime. Substrate was largely bare or mud and silt except where rocks and boulders had fallen into the reach from the railway bridge. Bankside vegetation consisted of comfrey, nettles and hedge parsley. The upstream run section was more meandering with more bankside shelter and better substrate.

CATCH: This site fails to meet the NRA Thames Region target biomass for EC designated coarse fisheries and the paucity of suitable instream habitat must be a factor. Of the minor species stone loach were common and minnows, stickleback and bullhead were present. An upstream run of 105 m by 5.7 m gave a weight of 9.5 kg which equals a biomass of 15.9gm², including two chub and better quality dace. This result reflects the improved habitat present in the upstream section.

Fig 5.11 Site CLF 1 Biomass and Density.

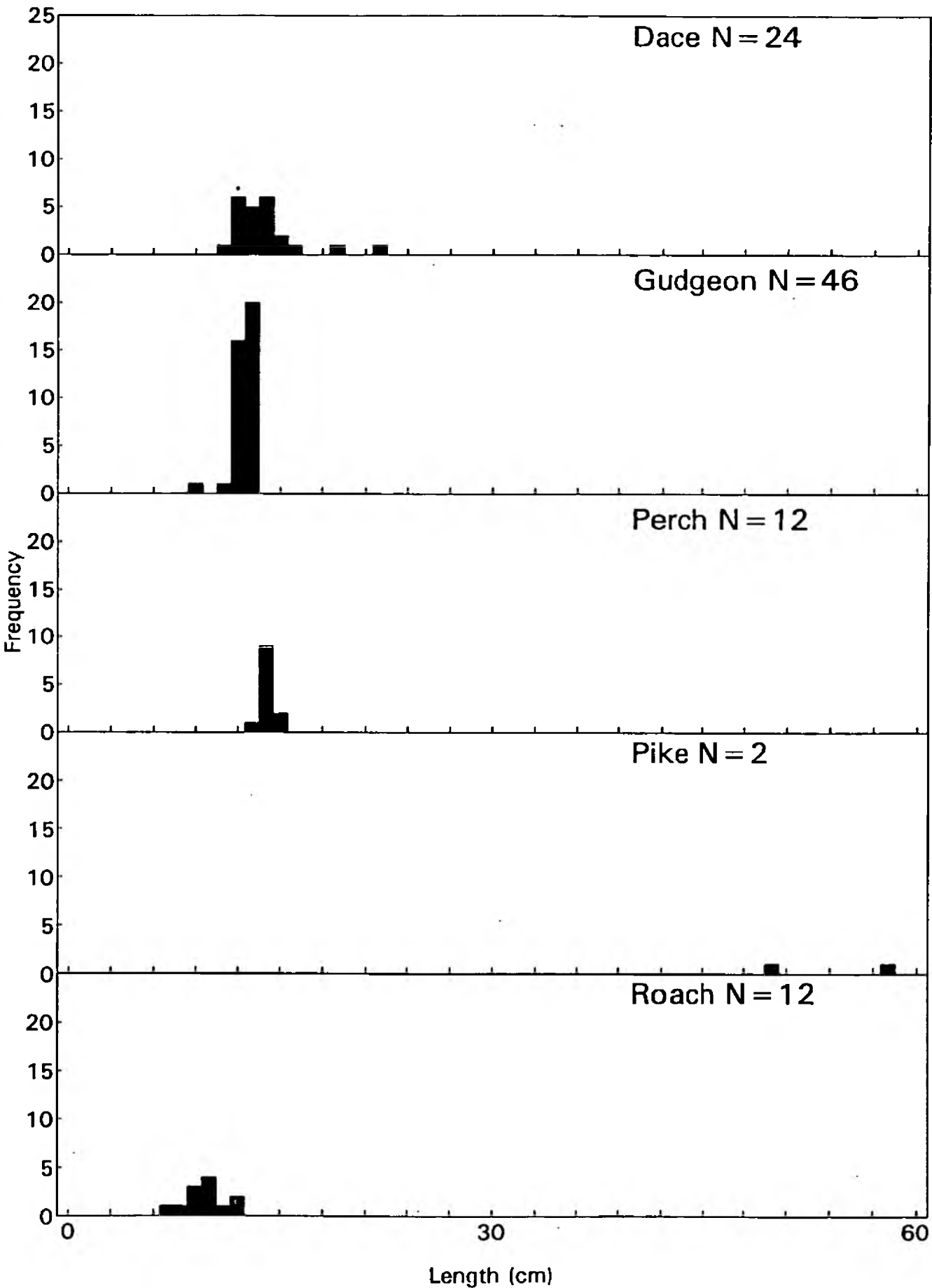


Biomass (gm-2)



Density (nm-2)

Site CLF1 Length Frequency.



5.12 SITE REPORT

WATERCOURSE: River Cole.
SITE NAME: Rove's Farm.
SITE CODE: CLF2
LOCATION: Rove's Farm, Shrivenham.
NGR: SU217888
DATE FISHED: 8th May 1992
METHOD: Pulsed DC electrofishing, wading upstream with two anodes.
EC TARGET
BIOMASS: 20 gm⁻²

HABITAT FEATURES

LENGTH: 119 m WIDTH: 4.3 m AREA: 511.7 m² DEPTH: 0.8 m
WATER TEMPERATURE: 13 °C
WATER LEVEL: Normal.
WATER CLARITY: Moderate.
FLOW RATE: Slow.

SUBSTRATE COMPOSITION (%)

BARE: 50 MUD & SILT: 15 GRAVEL: 30 STONE: 05 BOULDER: 00

VEGETATION (% COVER)

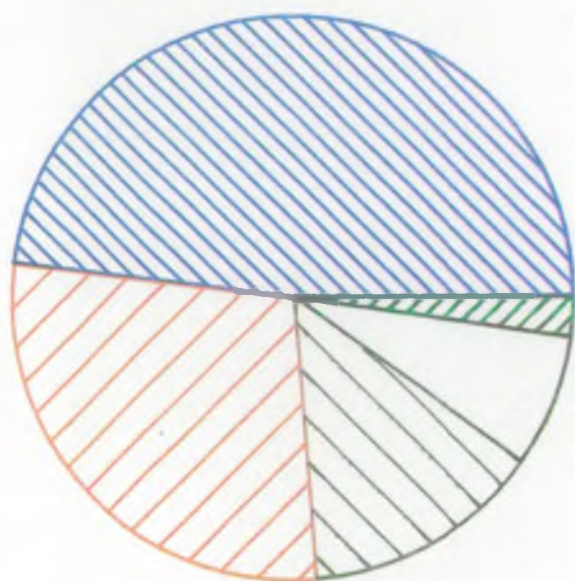
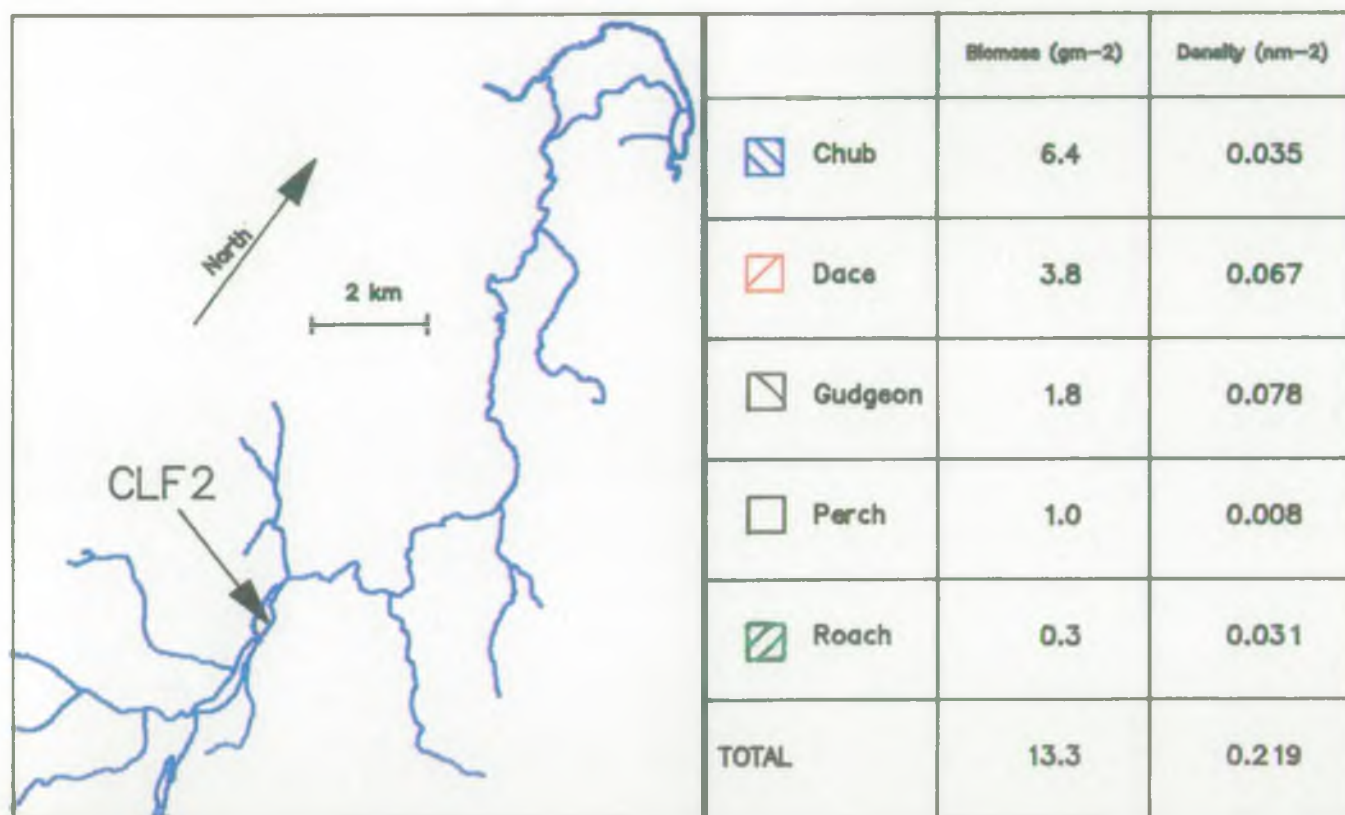
SUBMERGED: 00 FLOATING: 00 EMERGENT: 10 SHADE: 66
DOMINANT PLANT SPECIES: *Typha latifolia*.
ADJACENT LAND USE: Improved permanent pasture on both banks.

REMARKS

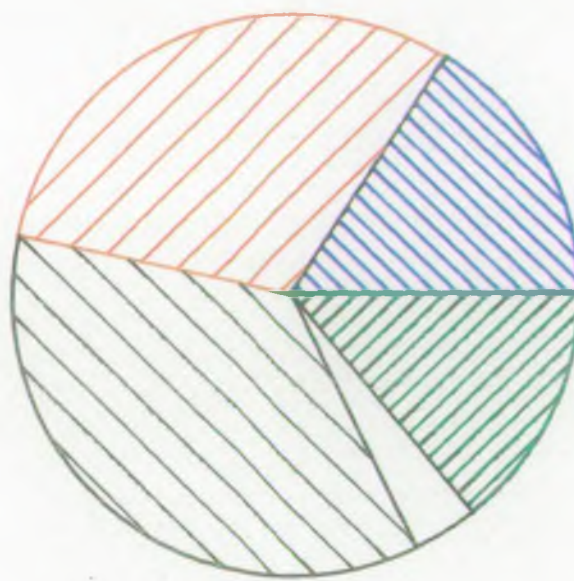
PHYSICAL STRUCTURE OF SITE: A straight section with steep high banks and very few instream features. Substrate was largely bare clay and sand with some clear gravel runs where flow had been concentrated. Some stone was present at the top of the survey section and at the top of the upstream run where an excellent pool riffle sequence had been created by the collapse of a stone bridge. Apart from this area, there was little depth, width and current variation through either section. Bankside vegetation provided excellent shelter in places (see below) and consisted of oak, hawthorn, blackthorn, dogrose and nettles.

CATCH: This site fails to meet the NRA Thames Region target biomass for EC designated coarse fisheries and the lack of suitable instream habitat must be a factor: most of the fish were found under overhanging bushes, floating debris mats, or in the limited emergent weed. Of the minor species, stone loach were very abundant, and stickleback, minnow and bullhead were abundant throughout the survey and upstream sections. The upstream run of 104 by 4.4m gave a weight of 4kg of similar species which equals a biomass of 8.7gm⁻².

Fig 5.12 Site CLF2 Biomass and Density.

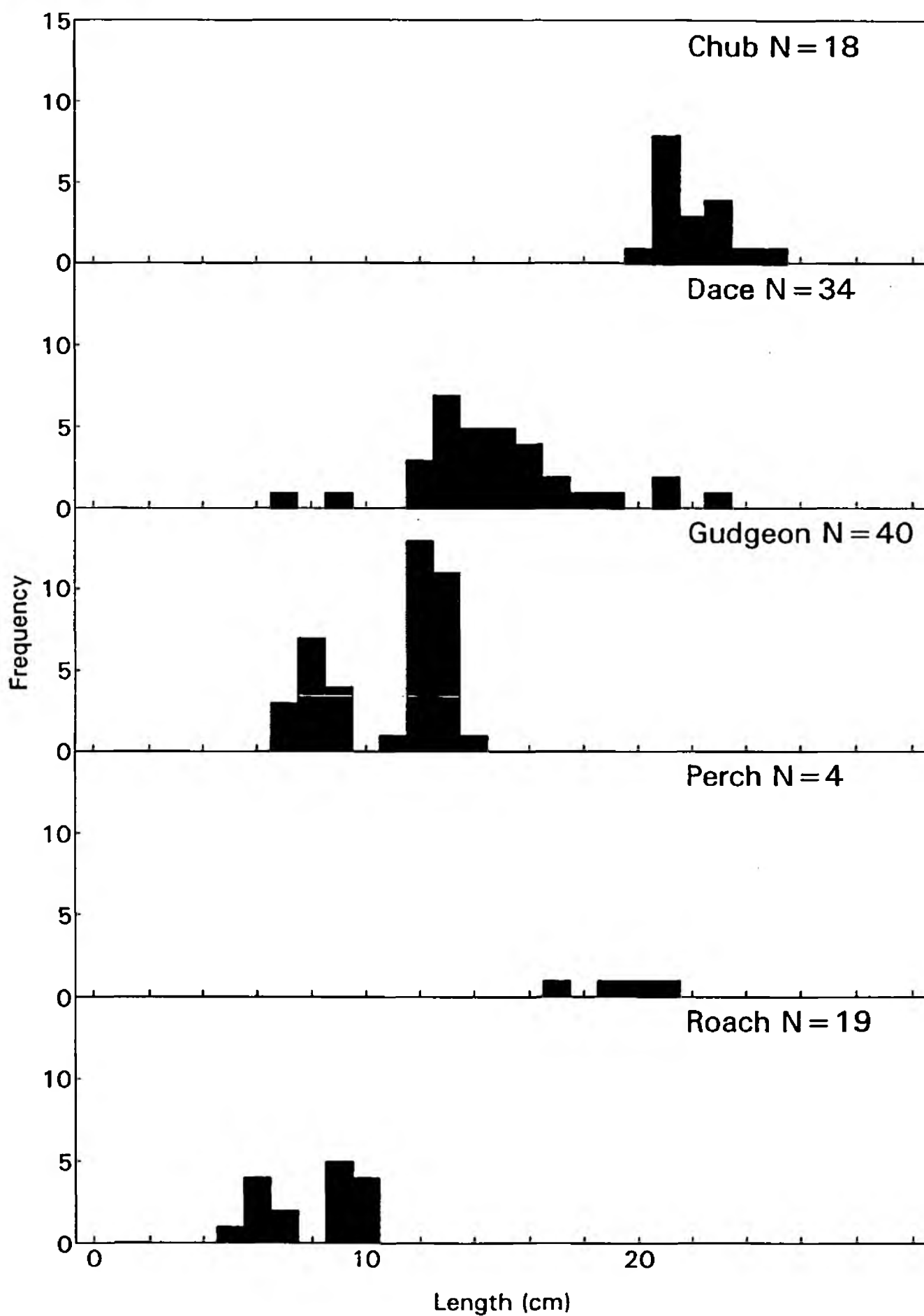


Biomass (gm-2)



Density (nm-2)

Site CLF2 Length Frequency.



5.13 SITE REPORT

WATERCOURSE: River Cole.
SITE NAME: Friar's Farm.
SITE CODE: CLF3
LOCATION: Friar's Farm near Shrivenham.
NGR: SU222906
DATE FISHED: 30th January 1992.
METHOD: Pulsed DC electrofishing, two anodes wading upstream.
EC TARGET
BIOMASS: 20 gm²

HABITAT FEATURES

LENGTH: 94 m WIDTH: 4.4 m AREA: 413.6 m² DEPTH: 0.7 m
WATER TEMPERATURE: 2 °C
WATER LEVEL: Normal.
WATER CLARITY: Good.
FLOW RATE: Moderate.

SUBSTRATE COMPOSITION (%)

BARE: 50 MUD & SILT: 35 GRAVEL: 10 STONE: 05 BOULDER: 00

VEGETATION (% COVER)

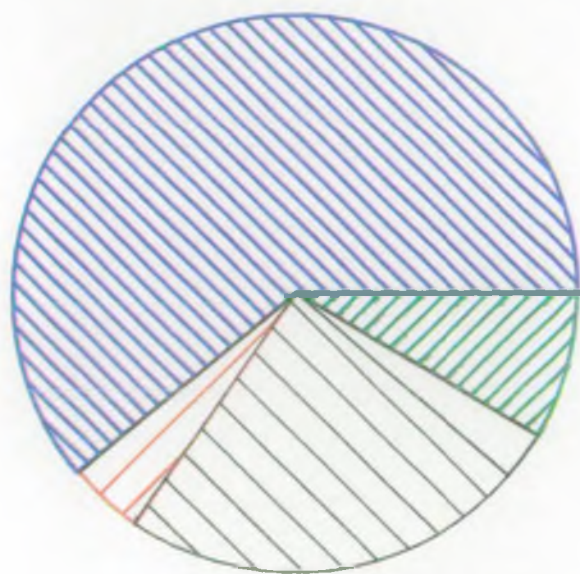
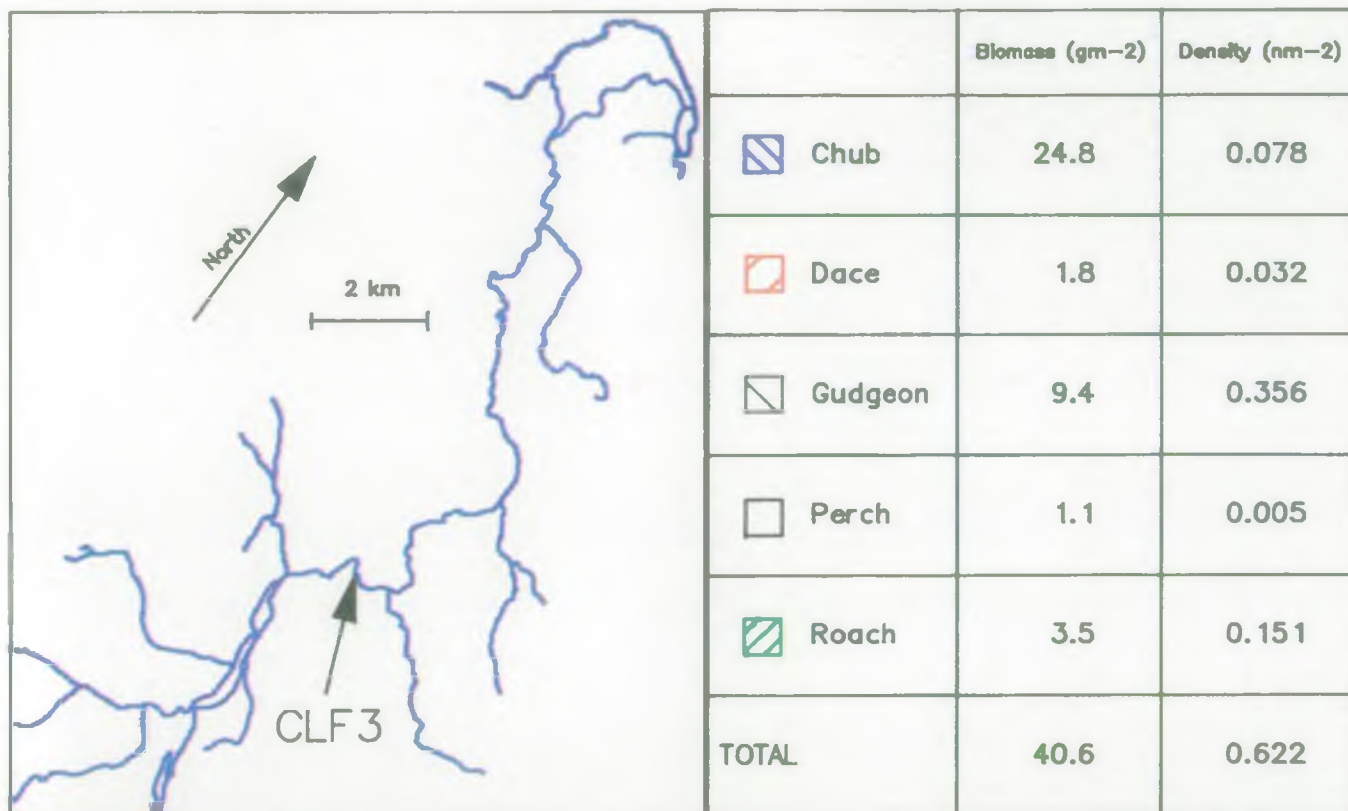
SUBMERGED: 10 FLOATING: 00 EMERGENT: 30 SHADE: 20
DOMINANT PLANT SPECIES: *Callitriche sp.*
ADJACENT LAND USE: Both banks permanent pasture.

REMARKS

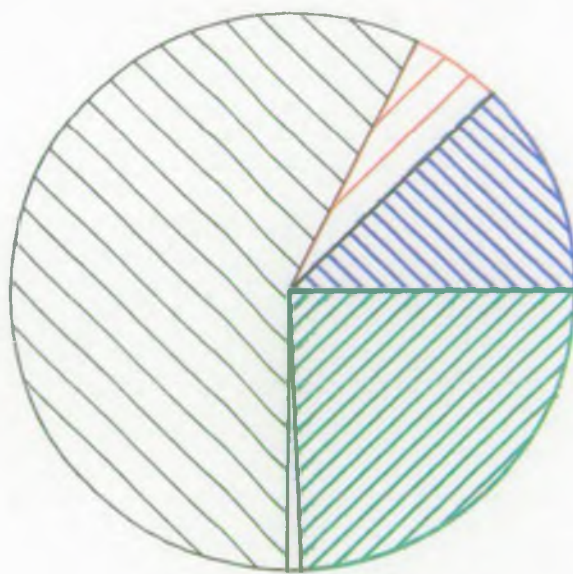
PHYSICAL STRUCTURE OF SITE: A meandering section with steep clay banks and limited pool riffle sequence that creates a variety of widths, depths and flow regimes. Substrate was largely bare clay, some sections had narrowed naturally through silt build-up creating areas of faster flow.

CATCH: An excellent biomass with good species diversity. most fish were caught around sunken trees and emergent weed. Of the minor species, stoneloach, bullhead and minnow were present. All fish appeared to be in excellent condition except for a slight *Piscicola sp.* and blackspot infestation on some roach. An upstream run of 61m by 5.8m gave a weight of 9.5 kg including one pike and several larger bream and equalling a biomass of 26.9 gm². A sample of 34 fish of 4 species was collected and sent for analysis of parasite fauna.

Fig 5.13 Site CLF3 Biomass and Density.

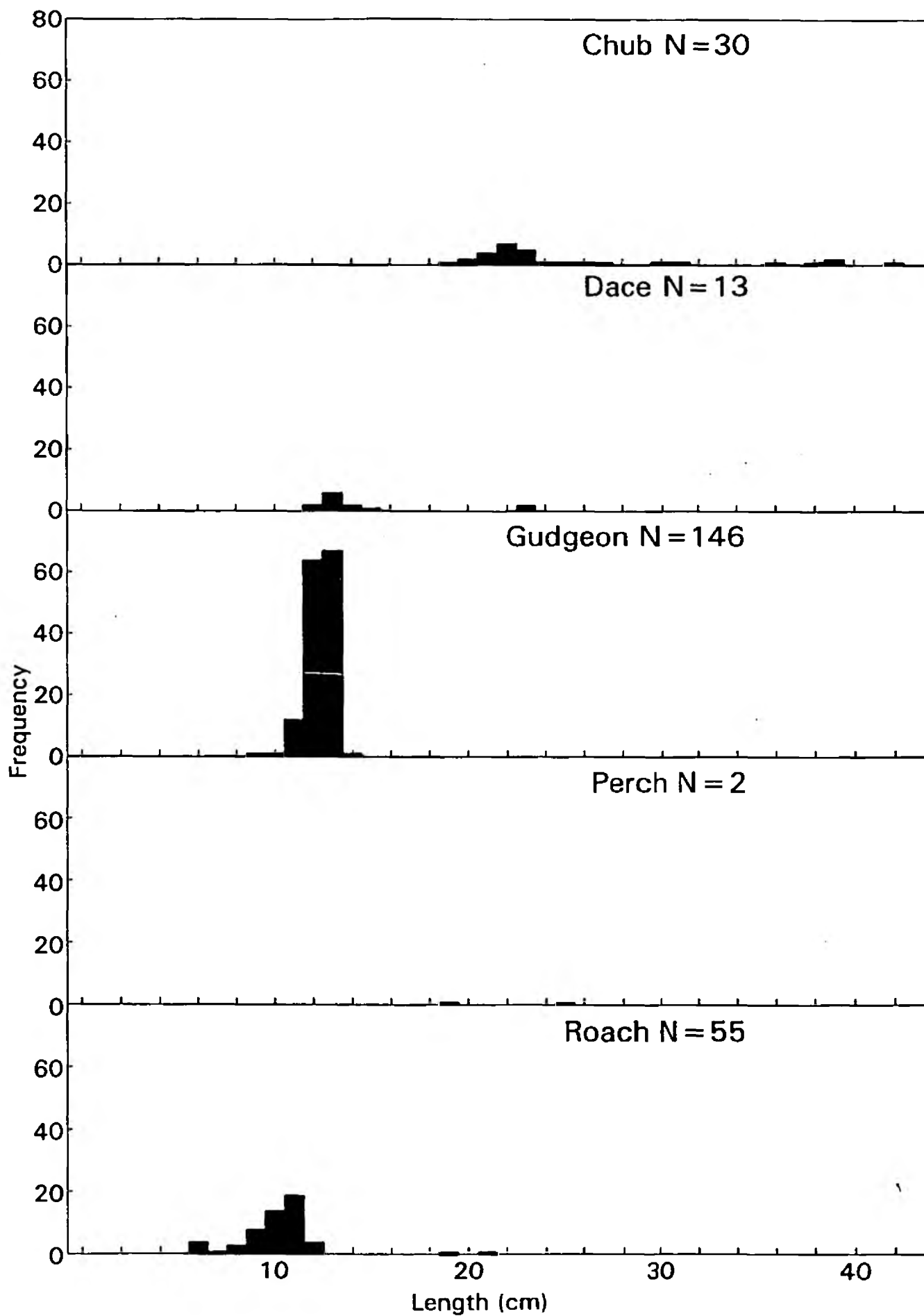


Biomass (gm-2)



Density (nm-2)

Site CLF3 Length Frequency.



5.14 SITE REPORT

WATERCOURSE: River Cole.
SITE NAME: Fresden Farm.
SITE CODE: CLF4
LOCATION: Fresden Farm, Coleshill.
NGR: SU228918
DATE FISHED: 6th February 1992.
METHOD: Pulsed DC electrofishing, two anodes wading upstream.
EC TARGET
BIOMASS: 20 gm²

HABITAT FEATURES

LENGTH: 174 m WIDTH: 7.0 m AREA: 1218 m² DEPTH: 1.0 m
WATER TEMPERATURE: 7 °C
WATER LEVEL: Normal.
WATER CLARITY: Good.
FLOW RATE: Normal.

SUBSTRATE COMPOSITION (%)

BARE: 00 MUD & SILT: 70 GRAVEL: 15 STONE: 15 BOULDER: 00

VEGETATION (% COVER)

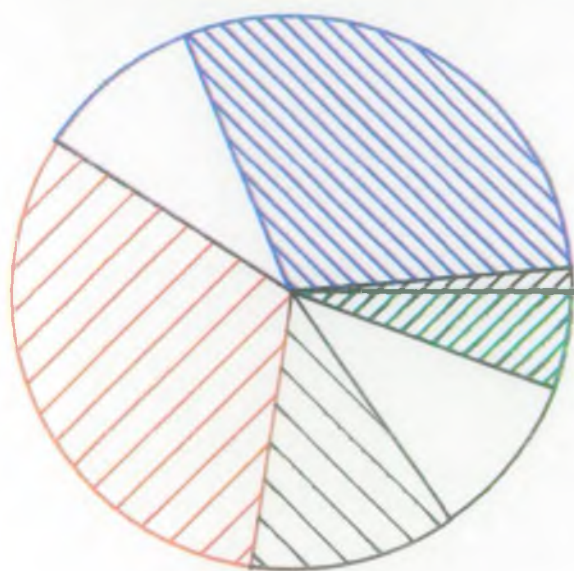
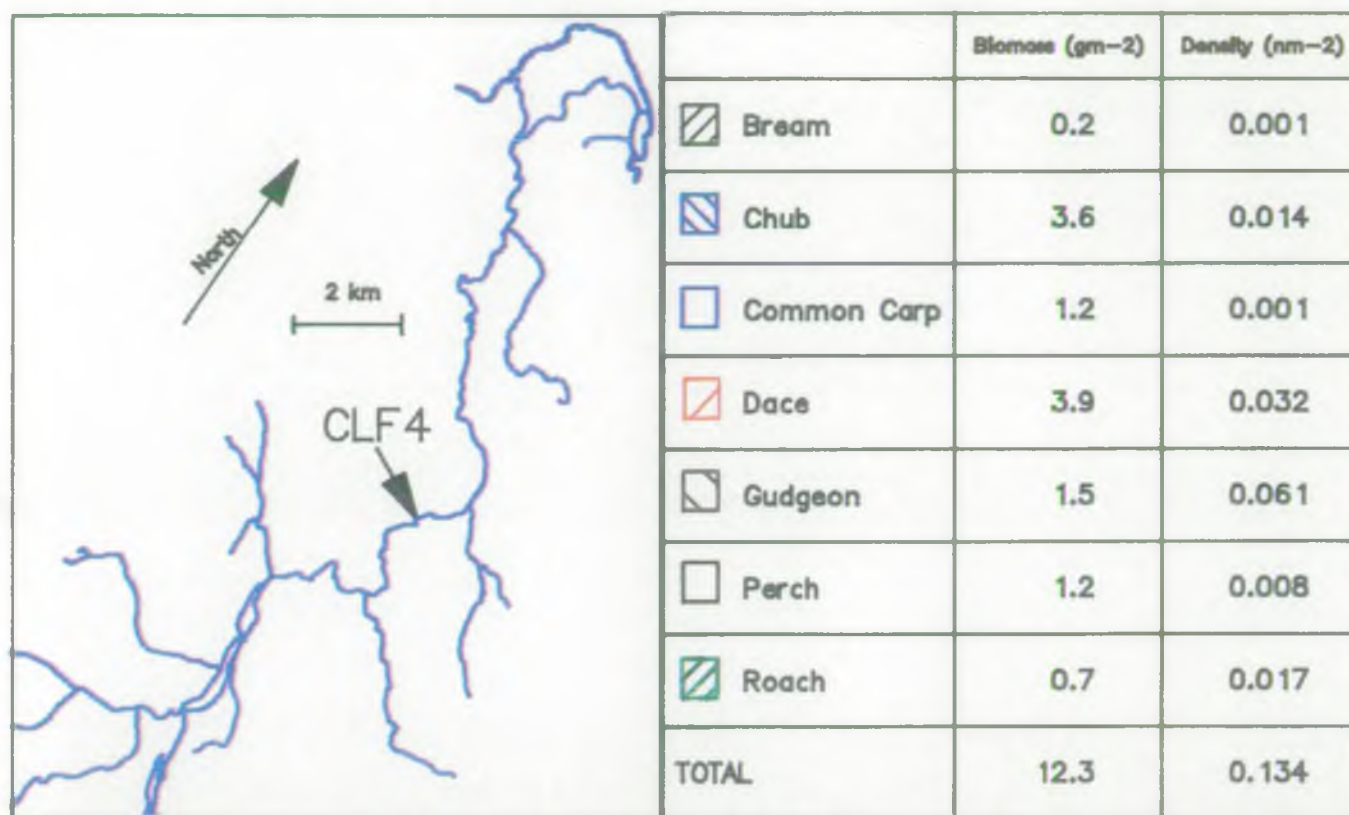
SUBMERGED: 05 FLOATING: 00 EMERGENT: 10 SHADE: 25
DOMINANT PLANT SPECIES: *Ranunculus sp.*
ADJACENT LAND USE: Left bank permanent pasture, right bank deciduous woodland.

REMARKS

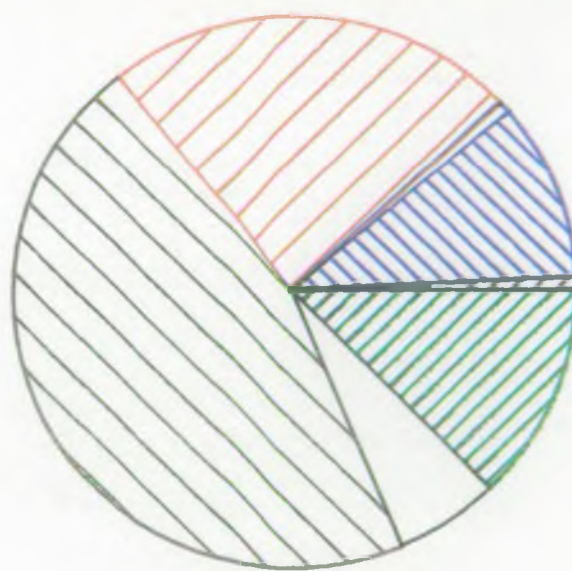
PHYSICAL STRUCTURE OF SITE: Section had steep high banks and was relatively straight with established pool riffle in the upstream third. Substrate was largely silt, mud and clay; gravel and stone was limited to short sections associated with riffles. The channel was overwide and had no significant features for much of its length, although bankside vegetation was good.

CATCH: This site failed to meet the NRA Thames Region target biomass for EC designated coarse fisheries. Most of the fish were caught in one deeper pool at the upstream extent of the survey section immediately below a riffle. Of the minor species bullhead were abundant and minnow, stoneloach and stickleback were present. No upstream run was carried out due to access problems. A sample of 30 fish of 3 species was taken for analysis of parasite fauna.

Fig 5.14 Site CLF4 Biomass and Density.

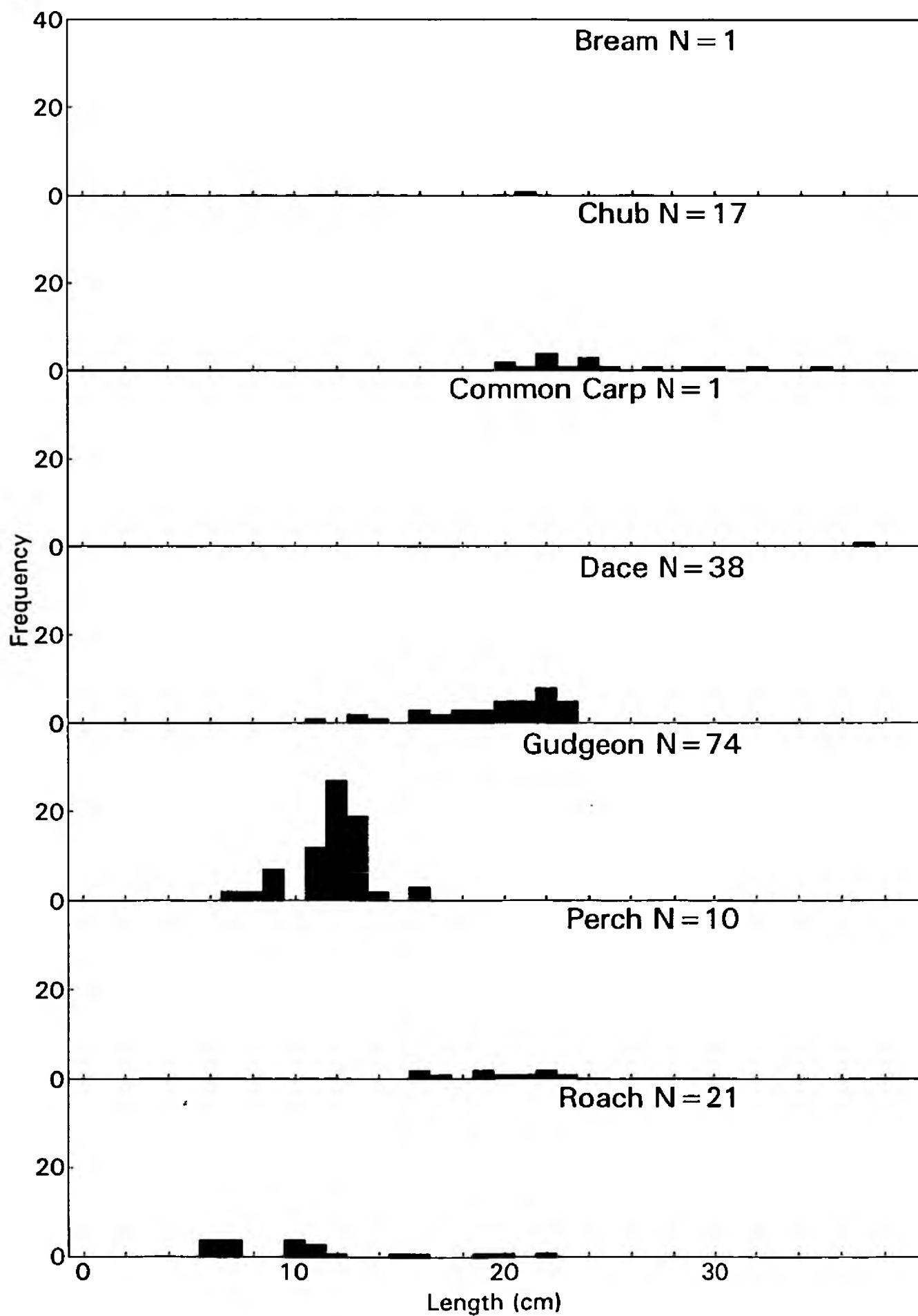


Biomass (gm-2)



Density (nm-2)

Site CLF4 Length Frequency.



5.15 SITE REPORT

WATERCOURSE: River Cole.
SITE NAME: Coleshill Park.
SITE CODE: CLF5
LOCATION: Upstream of Coleshill Mill, Coleshill.
NGR: SU235933
DATE FISHED: 7th May 1992.
METHOD: Pulsed DC electrofishing, wading upstream with three anodes.
EC TARGET
BIOMASS: 20 gm²

HABITAT FEATURES

LENGTH: 107 m WIDTH: 8.6 m AREA: 920.2 m² DEPTH: 1.2 m
WATER TEMPERATURE: 13 °C
WATER LEVEL: Normal.
WATER CLARITY: Moderate.
FLOW RATE: Slow.

SUBSTRATE COMPOSITION (%)

BARE: 10 MUD & SILT: 70 GRAVEL: 15 STONE: 05 BOULDER: 00

VEGETATION (% COVER)

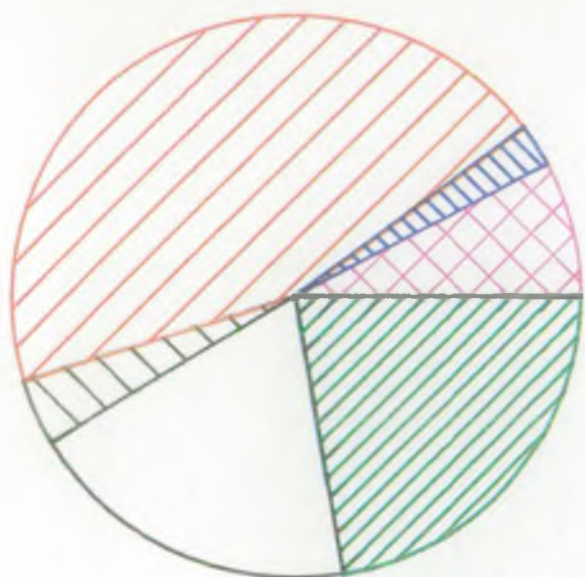
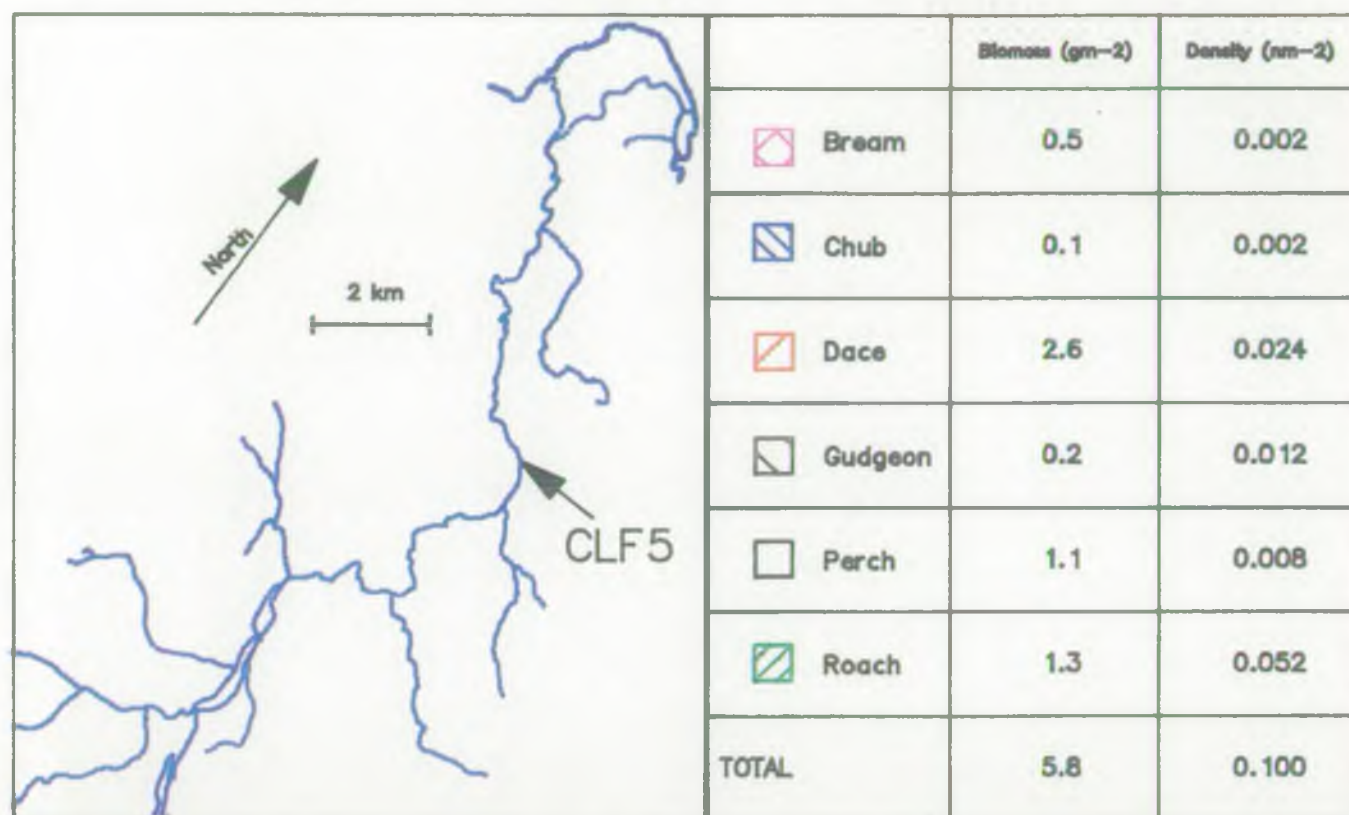
SUBMERGED: 75 FLOATING: 10 EMERGENT: 10 SHADE: 25
DOMINANT PLANT SPECIES: *Nuphar lutea*, *Schoenoplectus lacustris*, *Glyceria sp.* Also present were *Alisma sp.*, *Myosotis sp.*, *Rumex hydrolapathum*, *Eleocharis sp.*
ADJACENT LAND USE: Both banks semi-improved permanent pasture.

REMARKS

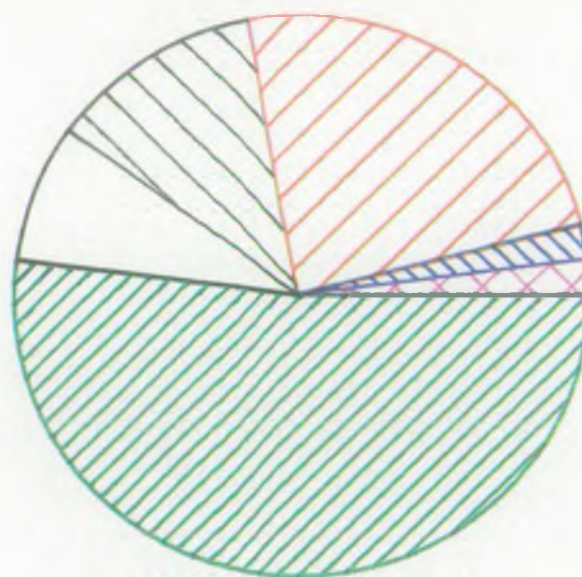
PHYSICAL STRUCTURE OF SITE: A straight canalised section, overwide and impounded by the mill sluices downstream. No natural instream features were evident in the survey and upstream run sections and there was very little depth, width or current variation. Substrate on both sections was largely mud and silt. Bankside vegetation consisted of oak, hawthorn, dogrose, bramble, nettle and Himalayan Balsam.

CATCH: This site fails to meet the NRA Thames Region target biomass for EC designated coarse fisheries; the paucity of suitable instream habitat must be a factor. Of the minor species only stone loach and stickleback were present. The upstream run of 10.5m by 180m gave a total weight of 15kg of similar species which equates to a biomass of 7.9gm².

Fig 5.15 Site CLF5 Biomass and Density.

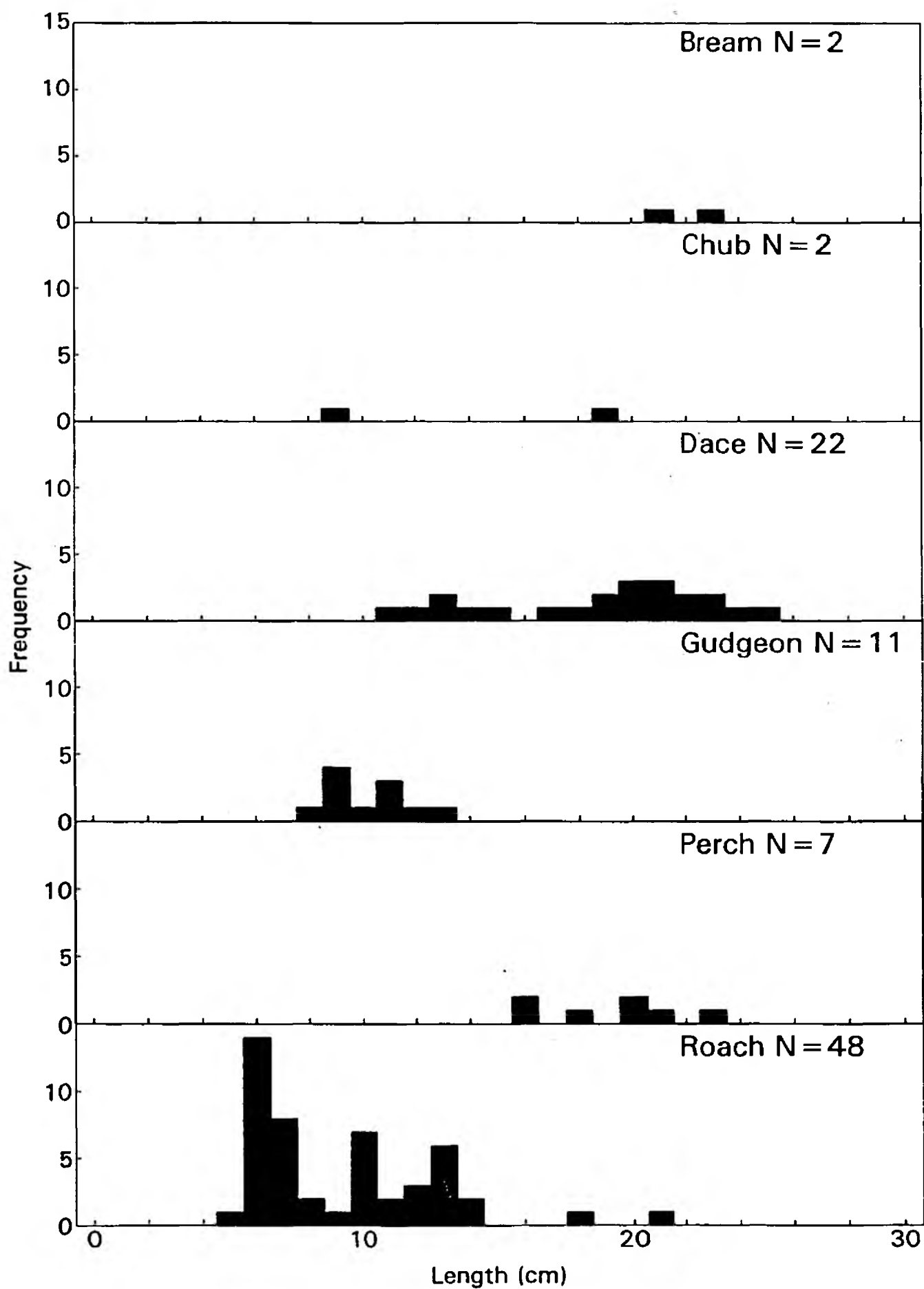


Biomass (gm-2)



Density (nm-2)

Site CLF5 Length Frequency.



5.16 SITE REPORT

WATERCOURSE: River Cole.
SITE NAME: Roundhill Farm.
SITE CODE: CLF6
LOCATION: Roundhill Farm, Highworth.
NGR: SU218949
DATE FISHED: 13th August 1992
METHOD: Pulsed DC electrofishing, two anodes wading upstream.
EC TARGET
BIOMASS: 20 gm²

HABITAT FEATURES

LENGTH: 124 m WIDTH: 7.4 m AREA: 917.6 m² DEPTH: 1.1 m
WATER TEMPERATURE: 15 °C
WATER LEVEL: High.
WATER CLARITY: Poor.
FLOW RATE: Fast.

SUBSTRATE COMPOSITION (%)

BARE: 45 MUD & SILT: 30 GRAVEL: 25 STONE: 00 BOULDER: 00

VEGETATION (% COVER)

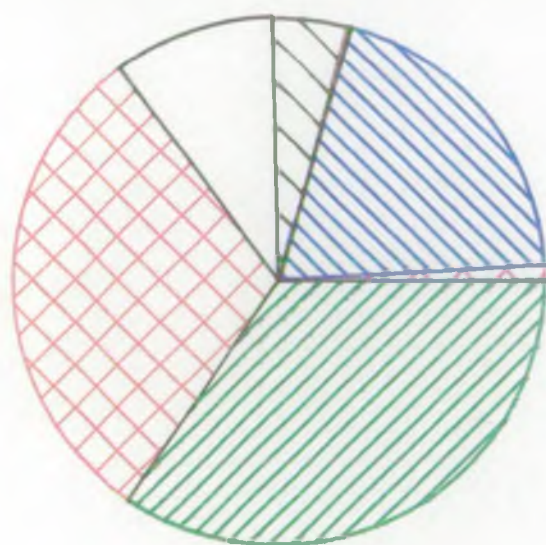
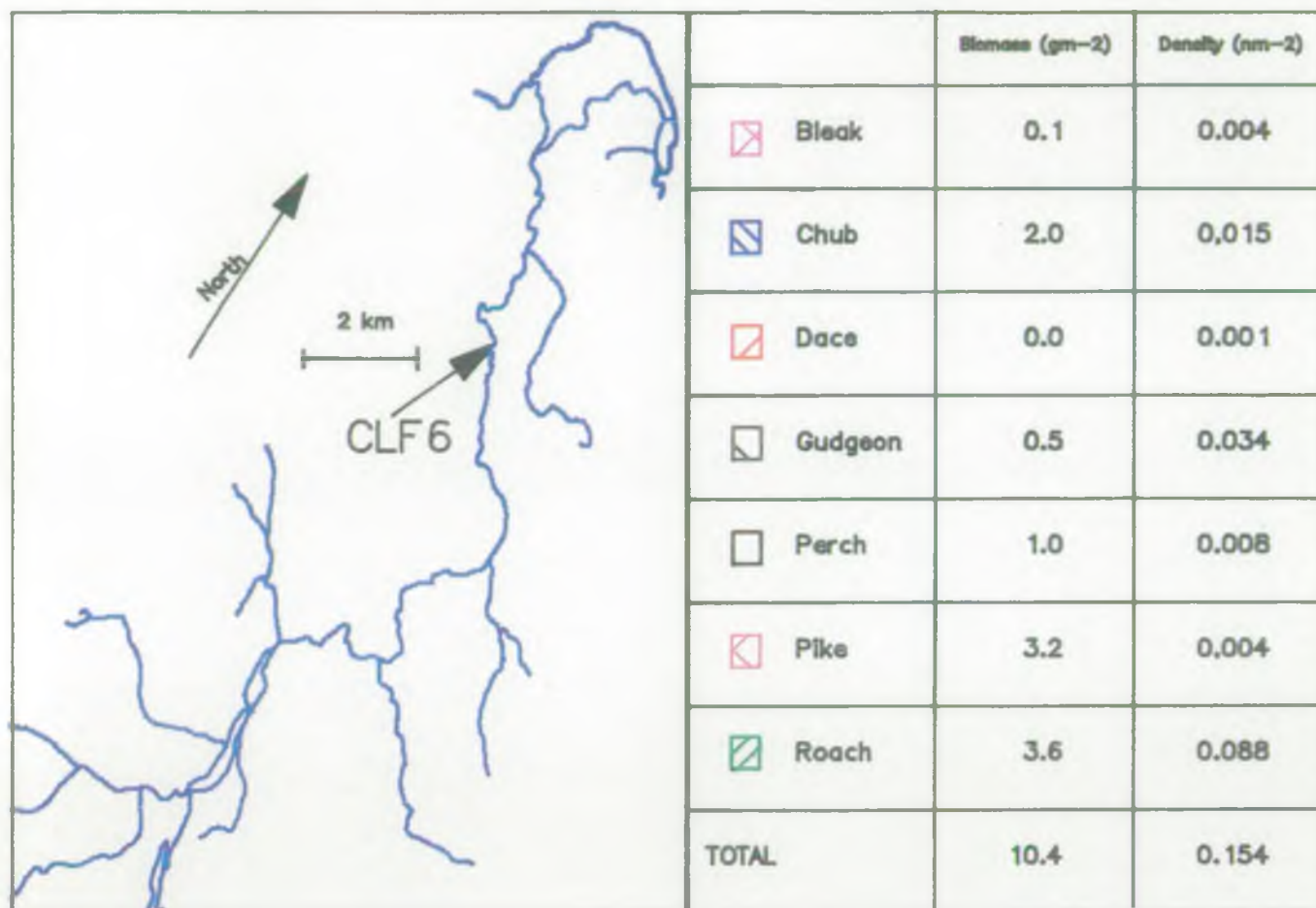
SUBMERGED: 20 FLOATING: 00 EMERGENT: 50 SHADE: 50
DOMINANT PLANT SPECIES: *Myriophyllum sp.*, *Schoenoplectus lacustris*, *Sparganium sp.*,
Nuphar lutea, *Phalaris arundinacea*.
ADJACENT LAND USE: LB Hay Meadow, RB Unimproved pasture.

REMARKS

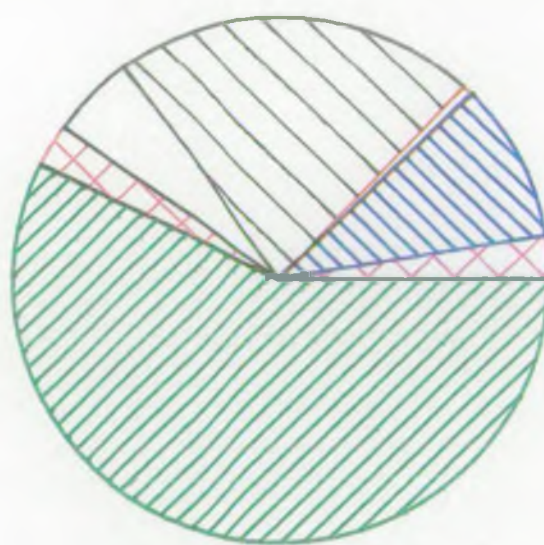
PHYSICAL STRUCTURE OF SITE: A meandering section with two pools but no riffles or other established instream features. The steep, high banks were heavily wooded with willow, alder, hawthorn and dogrose providing extensive shade to the section. Despite this the channel was choked with *Schoenoplectus sp.* growth. Constant rain prior to and during the survey had raised water levels rapidly and increased turbidity greatly. For these reasons no upstream run was carried out.

CATCH: This site fails to meet the NRA Thames Region target biomass for EC designated coarse fisheries. Of the minor species, stoneloach and bullhead were present and minnows were abundant.

Fig 5.16 Site CLF6 Biomass and Density.

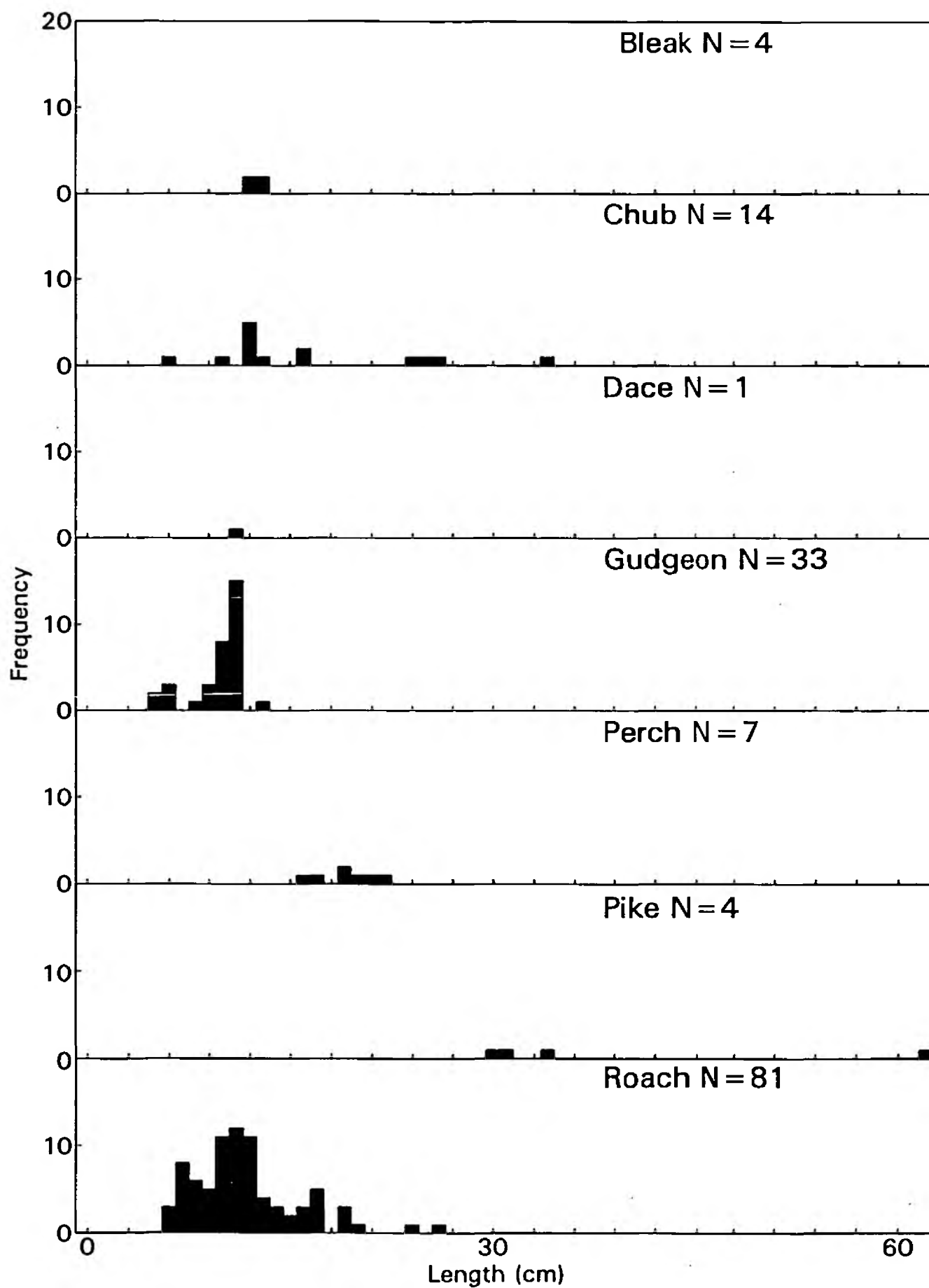


Biomass (gm-2)



Density (nm-2)

Site CLF6 Length Frequency.



5.17 SITE REPORT

WATERCOURSE: River Cole.
SITE NAME: Snowswick Farm.
SITE CODE: CLF7
LOCATION: Snowswick Farm, Coleshill.
NGR: SU215960
DATE FISHED: 14th January 1992.
METHOD: Pulsed DC electrofishing, three anodes wading upstream.
EC TARGET
BIOMASS: 20 gm²

HABITAT FEATURES

LENGTH: 167.0 m WIDTH: 7.2 m AREA: 1202.4 m² DEPTH: 1.0 m
WATER TEMPERATURE: 5 °C
WATER LEVEL: Normal.
WATER CLARITY: Moderate.
FLOW RATE: Slow.

SUBSTRATE COMPOSITION (%)

BARE: 50 MUD & SILT: 45 GRAVEL: 05 STONE: 00 BOULDER: 00

VEGETATION (% COVER)

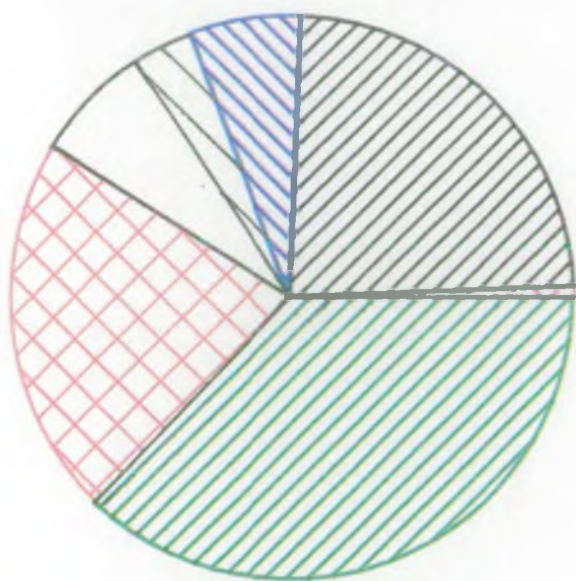
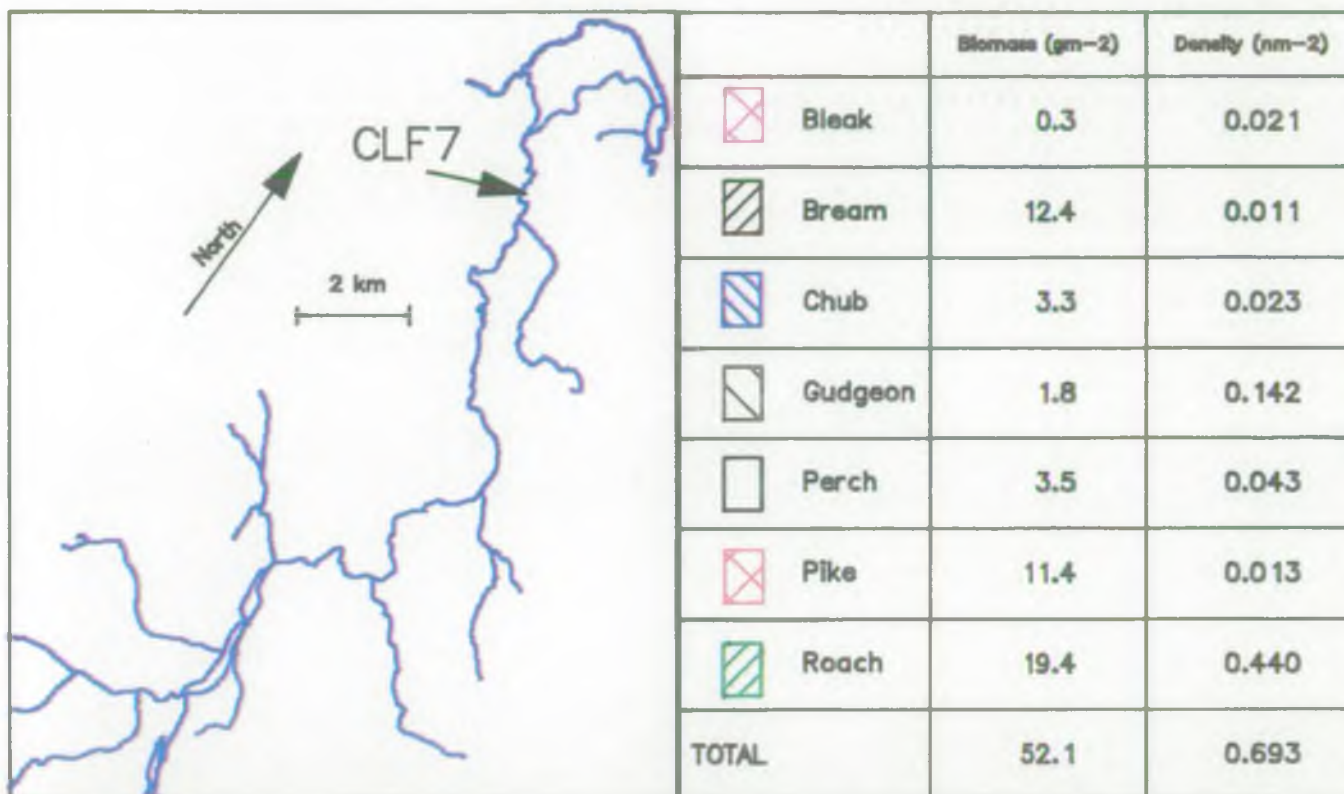
SUBMERGED: 00 FLOATING: 20 EMERGENT: 15 SHADE: 15
DOMINANT PLANT SPECIES: *Schoenoplectus lacustris*, *Typha latifolia*, *Phalaris arundinacea*.
ADJACENT LAND USE: Permanent, semi-improved pasture both banks.

REMARKS

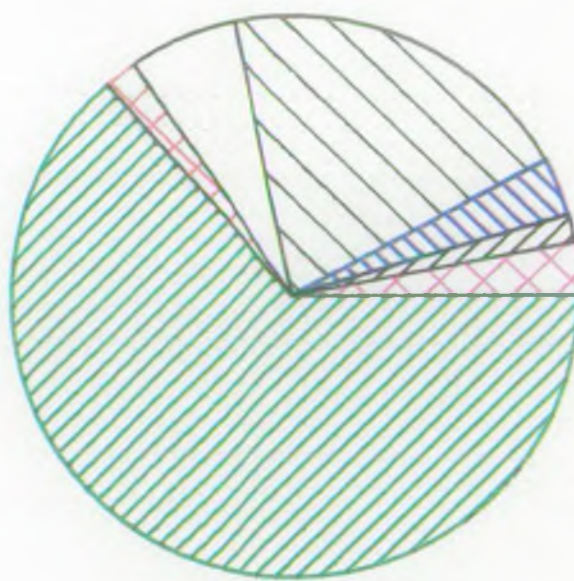
PHYSICAL STRUCTURE OF SITE: A straight uniform section with one 90° bend at the downstream limit. Survey and upstream sections were overwide with steep high banks and have been excessively dredged (In the 1975/76 land drainage scheme) which has reduced the gradient and therefore flow rates. Substrate was very poor, and largely comprised of silt overlying gravel.

CATCH: A good biomass of several species most showing successful recruitment, which is surprising considering the remarks above. Most fish were associated with the few instream features, and all appeared to be in good condition although *Piscicola sp.* was common. Of the minor species minnow, bullhead and stone loach were present. An upstream run of 117m by 6.5m gave a weight of 20 kg of a similar species mix equalling a biomass of 26.3 gm².

Fig 5.17 Site CLF7 Biomass and Density.

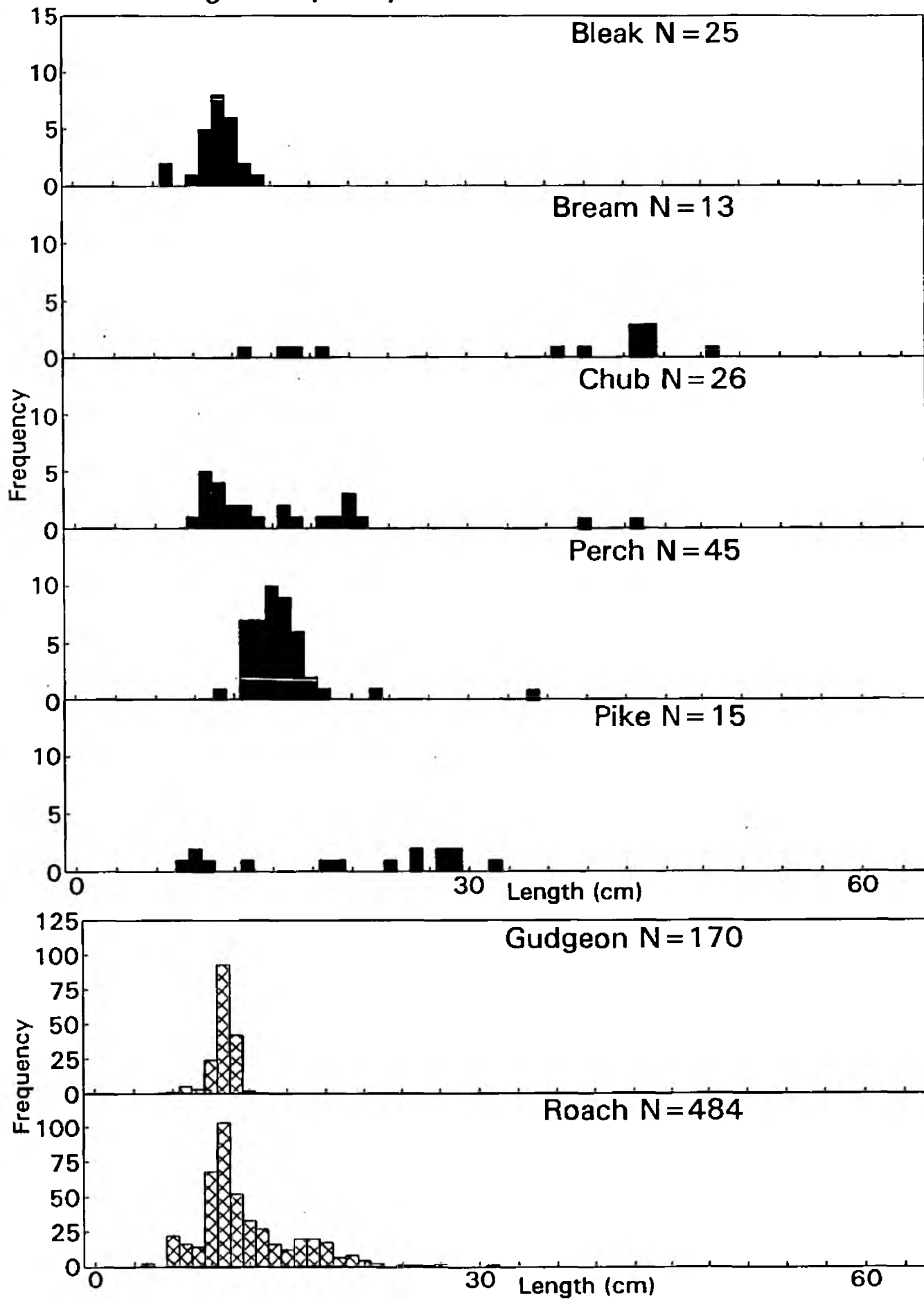


Biomass gm-2



Density nm-2

Site CLF7 Length Frequency.



5.18 SITE REPORT

WATERCOURSE: River Cole.
SITE NAME: A361 Road Bridge, Inglesham.
SITE CODE: CLF8
LOCATION: 150m downstream A361 road bridge.
NGR: SU204976
DATE FISHED: 18th June 1992
METHOD: Pulsed DC electrofishing, two anodes wading upstream.
EC TARGET
BIOMASS: 20 gm²

HABITAT FEATURES

LENGTH: 122 m WIDTH: 4.7 m AREA: 573.4 m² DEPTH: 0.4 m
WATER TEMPERATURE: 19 °C
WATER LEVEL: Low.
WATER CLARITY: Good.
FLOW RATE: Moderate.

SUBSTRATE COMPOSITION (%)

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

VEGETATION (% COVER)

SUBMERGED: 15 FLOATING: 05 EMERGENT: 20 SHADE: 15

DOMINANT PLANT SPECIES: *Ranunculus fluitans*, *Cladophora* sp., *Myosotis* sp., *Veronica beccabunga*, *Schoenoplectus lacustris*, *Nuphar lutea*, *Sparganium emersum*, *Apium nodiflorum*, *Alisma* sp.

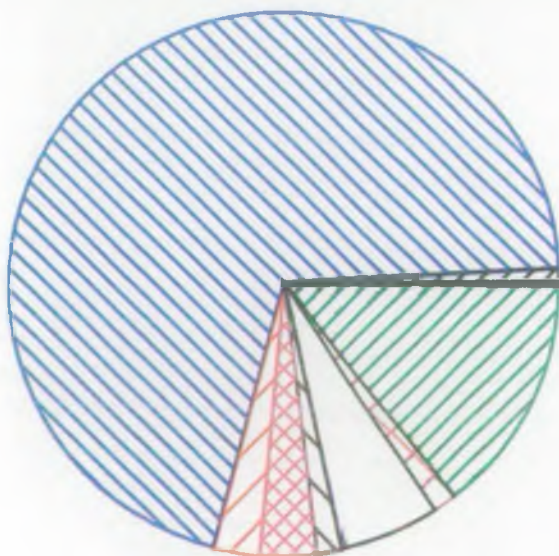
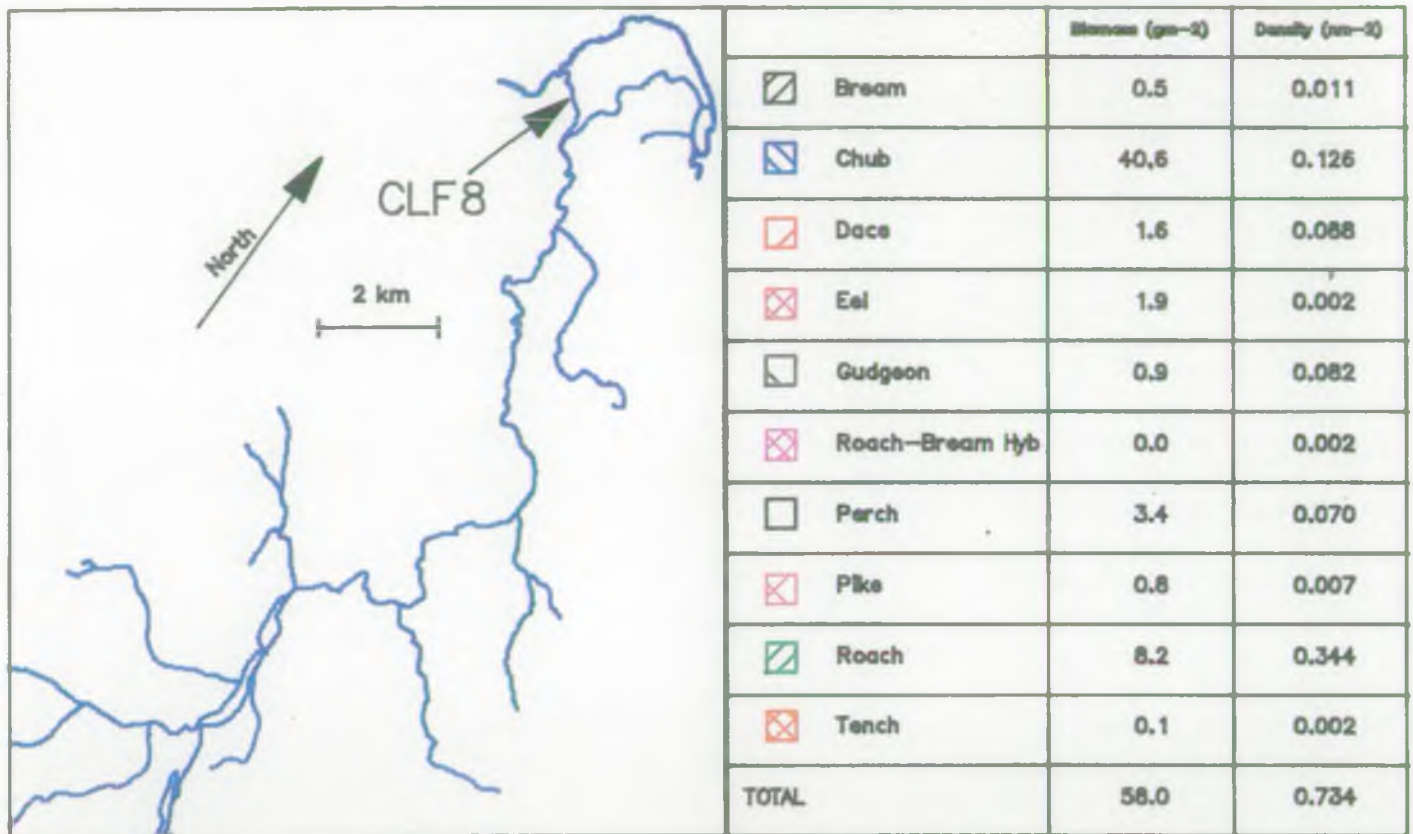
ADJACENT LAND USE: Left and right banks permanent pasture.

REMARKS

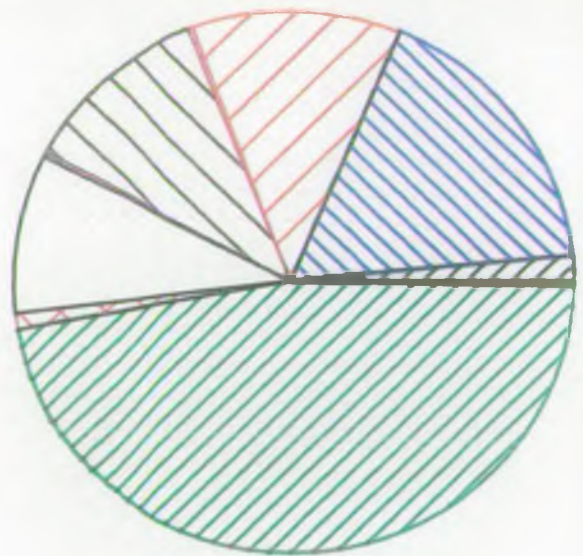
PHYSICAL STRUCTURE OF SITE: An excellent site with meandering course and established pool riffle sequence providing a range of channel profiles, flow regimes and habitat types. Substrate was largely fine gravel with some areas of silt deposition, particularly in the deepest pool. The gravel was lightly covered with fine silt and *Cladophora*, indicative of recent dry weather low flows. Emergent vegetation was confined to the pool; the limited hawthorn and dogrose bankside shelter and shade could be improved.

CATCH: This site gave an excellent biomass and density with a total of 10 major and 5 minor species present. The superior habitat provided by the site must be a significant factor and indicates the potential for the whole of this watercourse. The larger fish were taken from one large pool halfway along the site. Of the minor species, stickleback and lamprey were present, bullhead and stone loach were common and minnow were abundant in such numbers to contribute significantly to the biomass. All fish appeared to be in good condition, one *Piscicola* sp. (fish leech) and one *Argulus* sp. (fish louse) were found. No upstream run was carried out due to access restrictions.

Fig 5.18 Site CLF8 Biomass and Density.

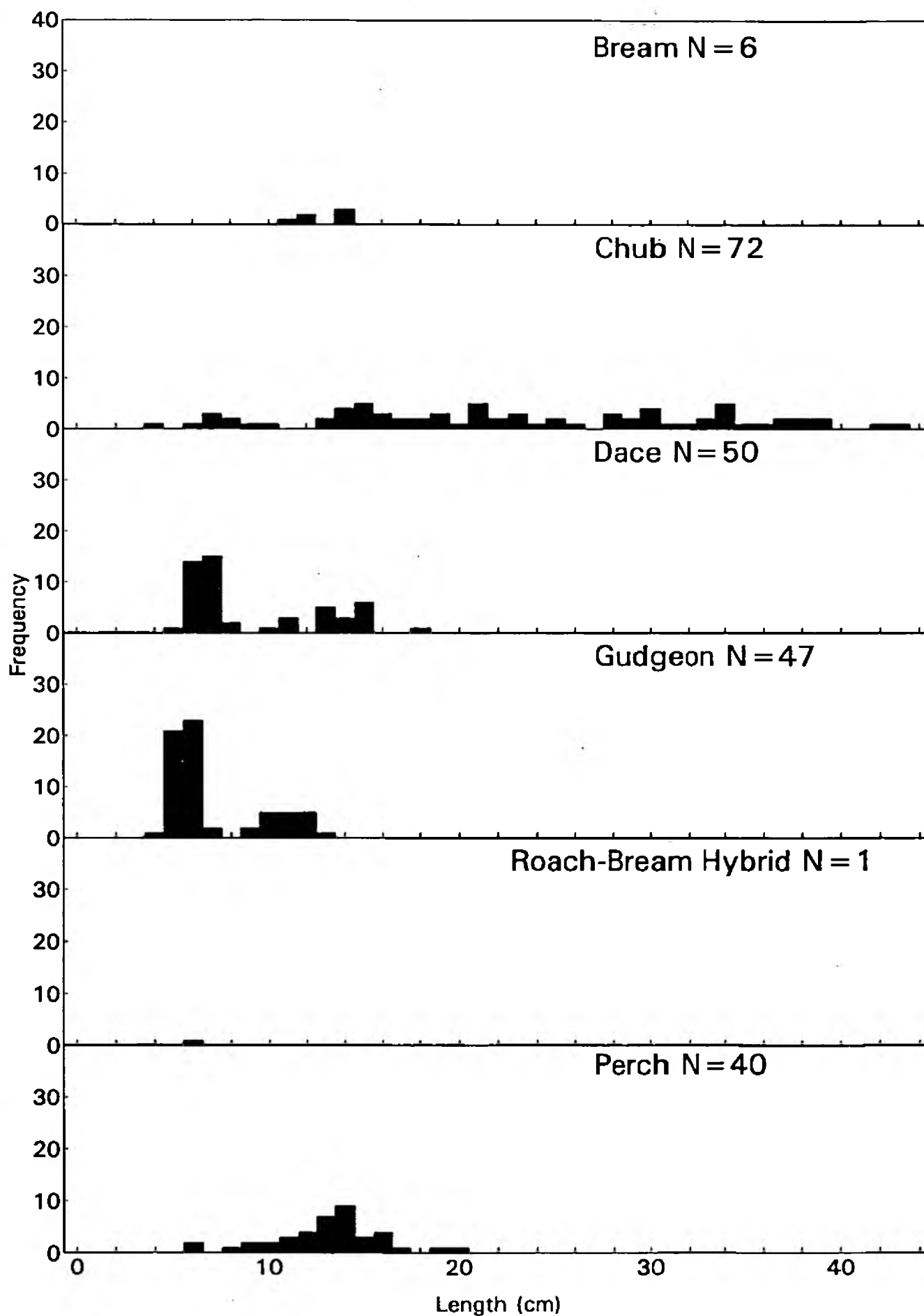


Biomass (gm-2)

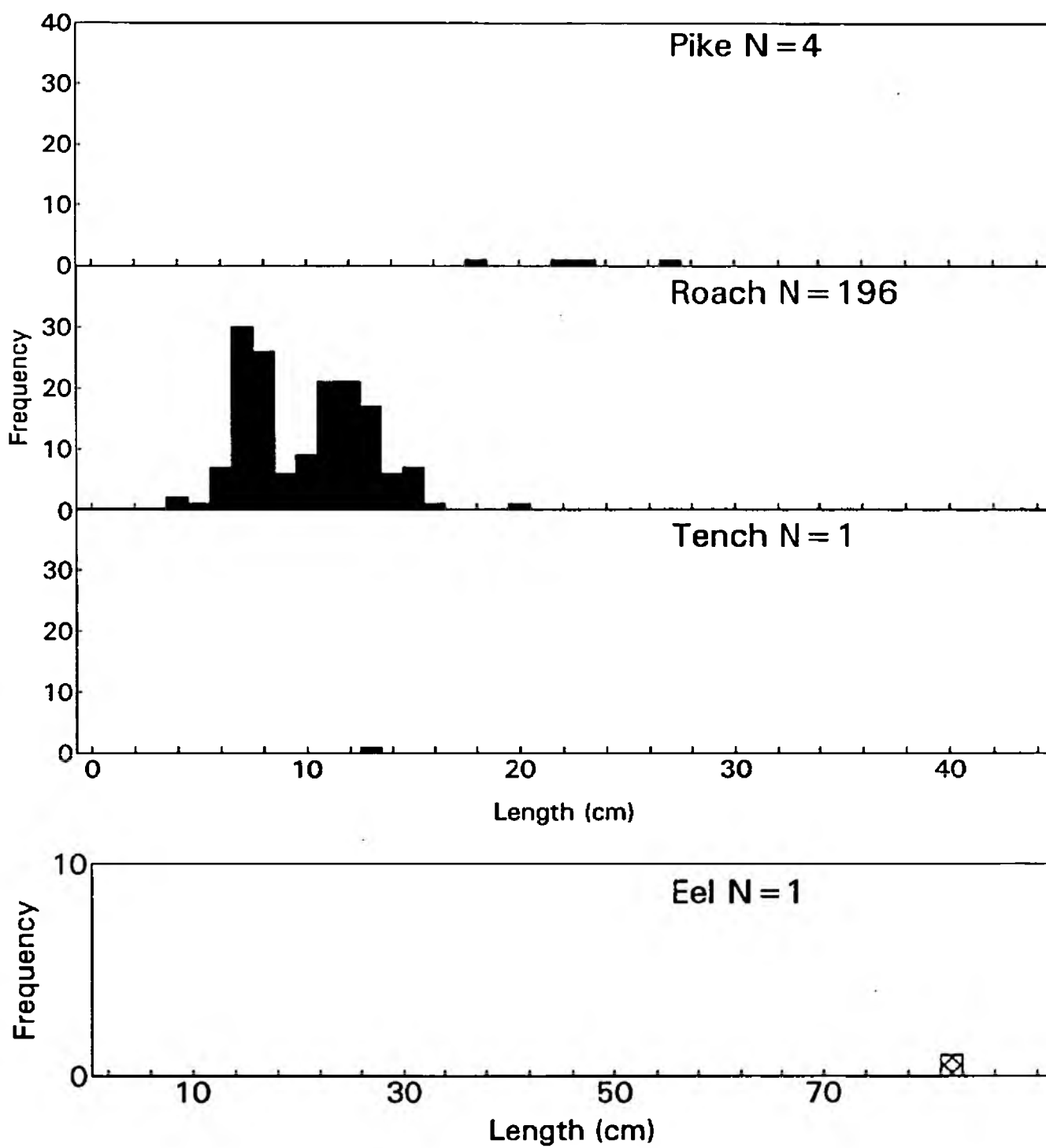


Density (nm-2)

Site CLF8 Length Frequency.



Site CLF8 Length Frequency (contd.)



5.19 SITE REPORT

WATERCOURSE: River Cole.
SITE NAME: Upstream of St John's Bridge.
SITE CODE: CLF9
LOCATION: Buscot Wick Farm.
NGR: SU216988
DATE FISHED: 15th June 1992.
METHOD: Pulsed DC electrofishing, two anodes wading upstream.
EC TARGET
BIOMASS: 20 gm²

HABITAT FEATURES

LENGTH: 127 m WIDTH: 4.9 m AREA: 622.3 m² DEPTH: 0.75 m
WATER TEMPERATURE: 21 °C
WATER LEVEL: Low.
WATER CLARITY: Good.
FLOW RATE: Slow.

SUBSTRATE COMPOSITION (%)

BARE: 05 MUD & SILT: 15 GRAVEL: 75 STONE: 05 BOULDER: 00

VEGETATION (% COVER)

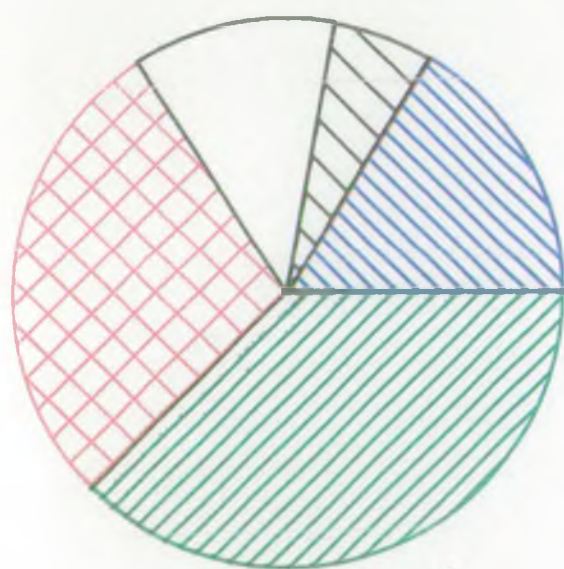
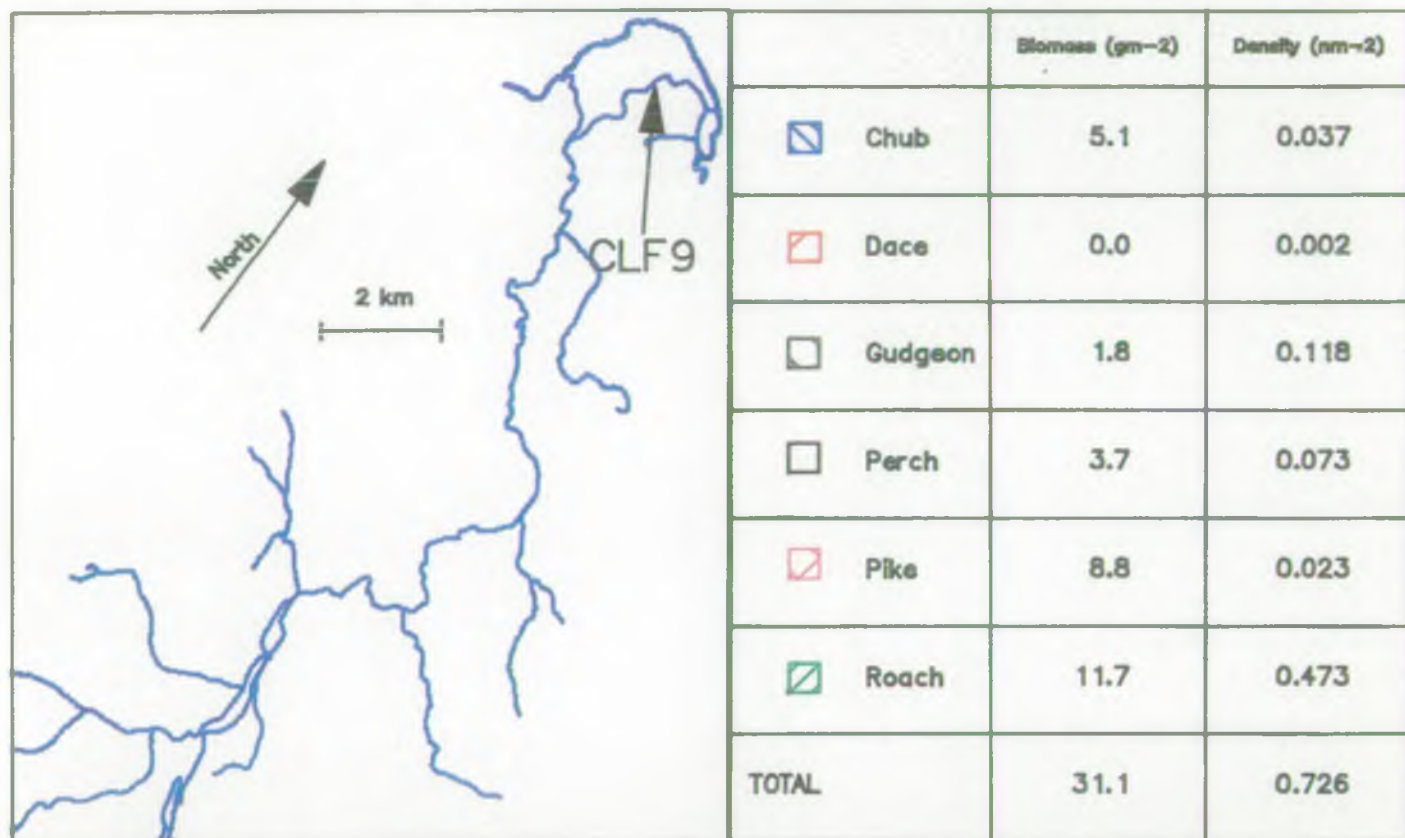
SUBMERGED: 10 FLOATING: 00 EMERGENT: 50 SHADE: 05
DOMINANT PLANT SPECIES: *Schoenoplectus lacustris*, *Phalaris arundinacea*, *Myriophyllum*
sp., *Veronica beccabunga*.
ADJACENT LAND USE: Left bank improved pasture, right bank arable.

REMARKS

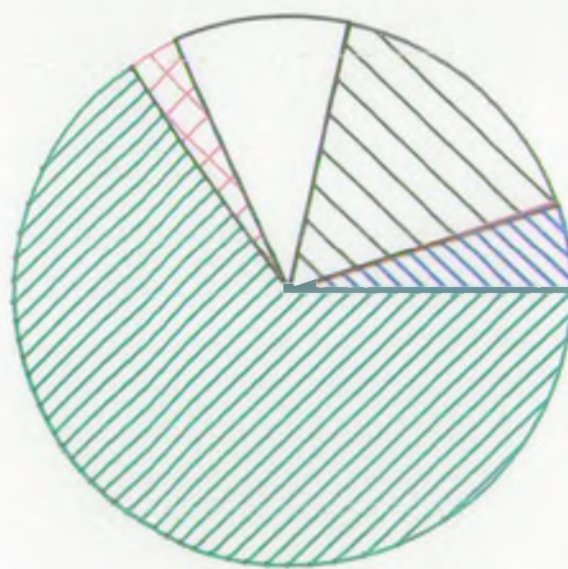
PHYSICAL STRUCTURE OF SITE: A relatively straight section with uniform profile and few instream features and no variation in flow. Substrate was largely fine gravel with some silt deposition in places which is likely to be washed away during periods of high flows. The clay banks were steep and high with very little shrub and tree cover. The channel had been overwidened in the past and has narrowed naturally by almost 75%, despite this flow was sluggish. Emergent vegetation encroached well into the channel, providing excellent shelter for small fish of many species.

CATCH: This site gave a good biomass and high density of smaller fish with a good species mix. Each species appeared to show successful recruitment and the reach is likely to be an important spawning and shelter area for fish moving up from the River Thames. Along with large quantities of cyprinid fry, stoneloach, stickleback, minnow and bullhead were present. All fish appeared to be in fair to good condition although some had slight *Piscicola sp.* infestation. No upstream run was carried out due to access difficulties, but similar shoals of small fish were observed upstream of the survey site.

Fig 5.19 Site CLF9 Biomass and Density.

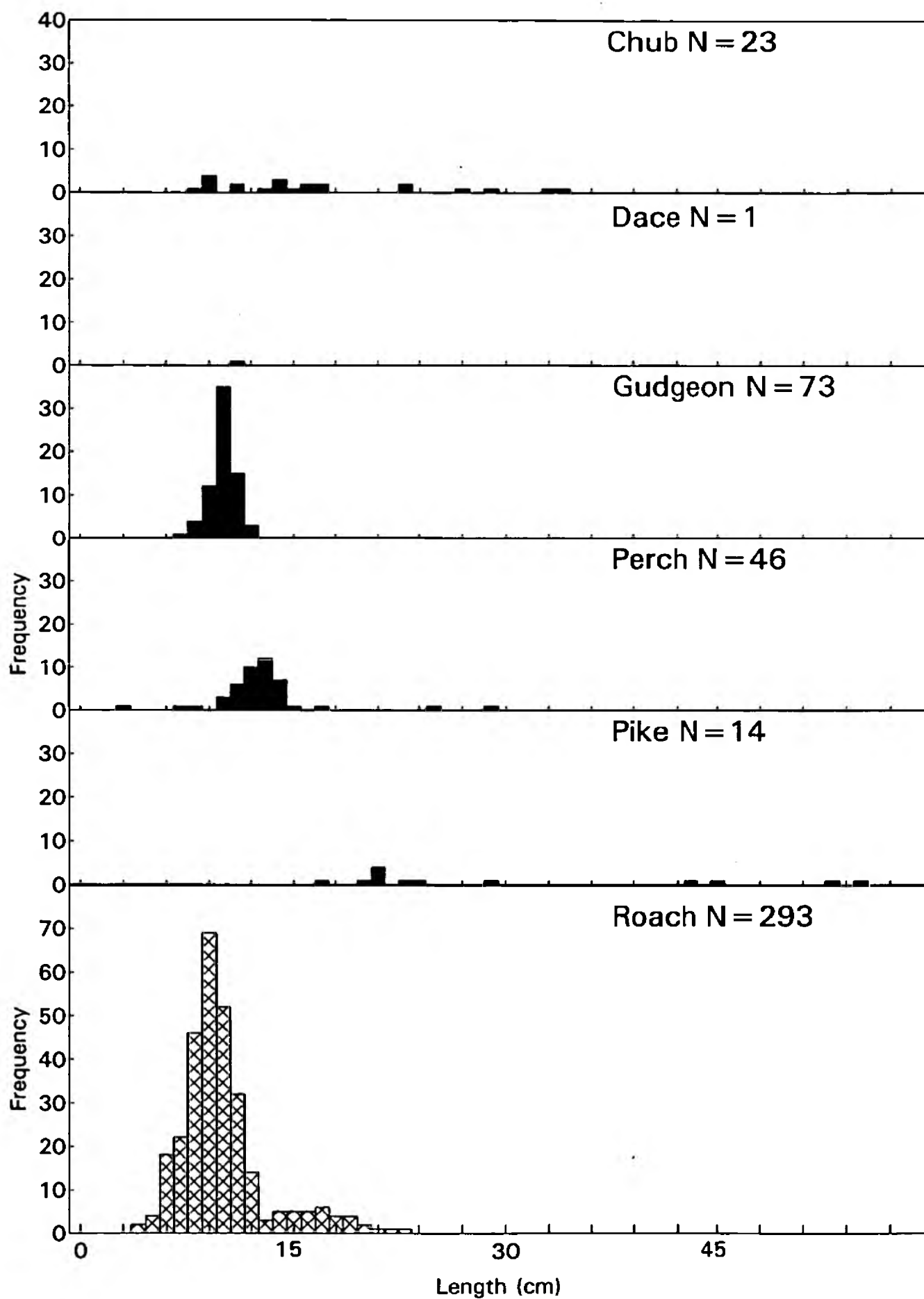


Biomass (gm-2)

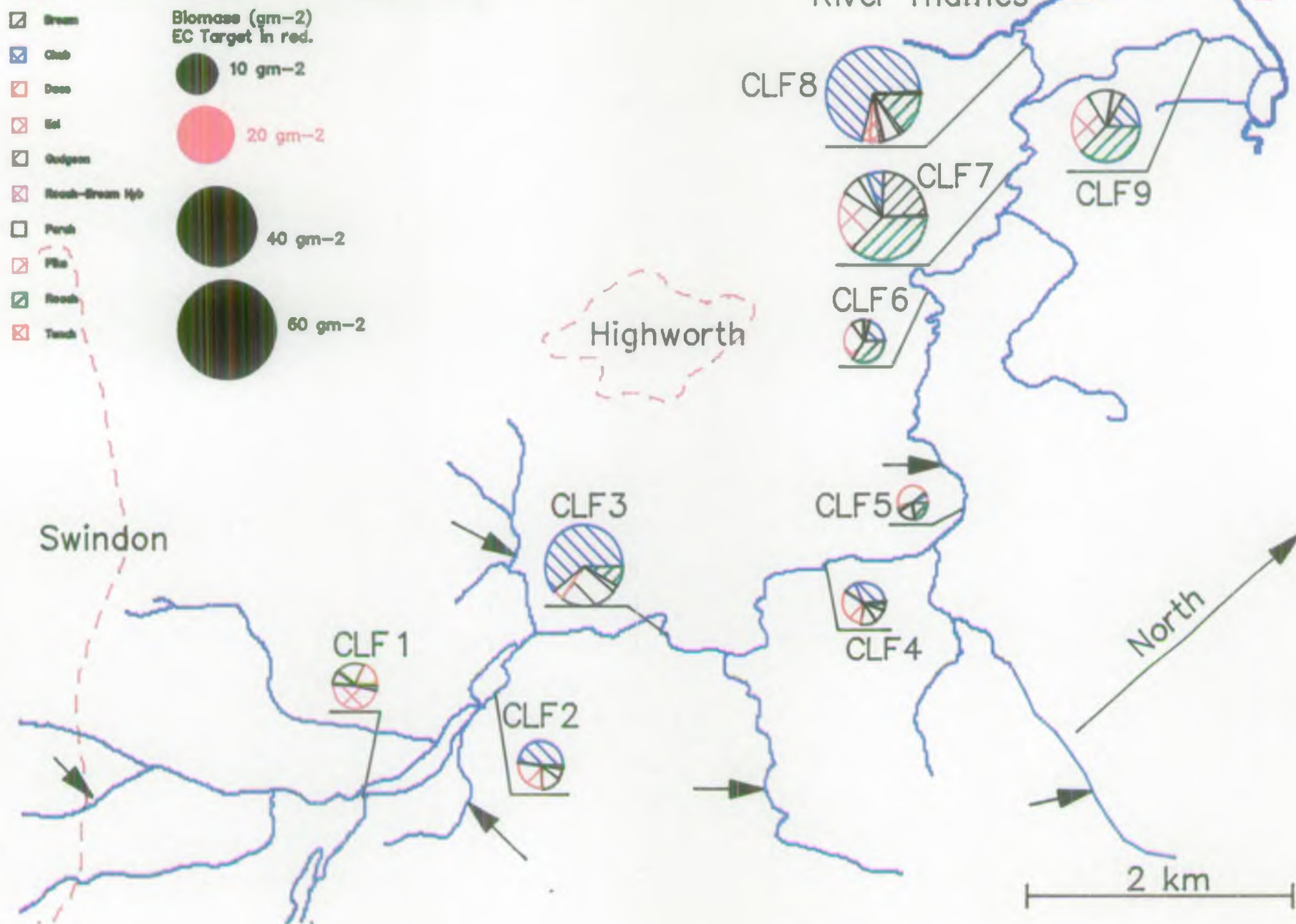


Density (nm-2)

Site CLF9 Length Frequency.



➤ **Licensed discharge > 10 cubic metres per day.**



5.2 Survey Results.

Figure 5.21 gives a summary of biomass data and species diversity at each site surveyed. Biomass values are represented by area and species by shading colour and pattern.

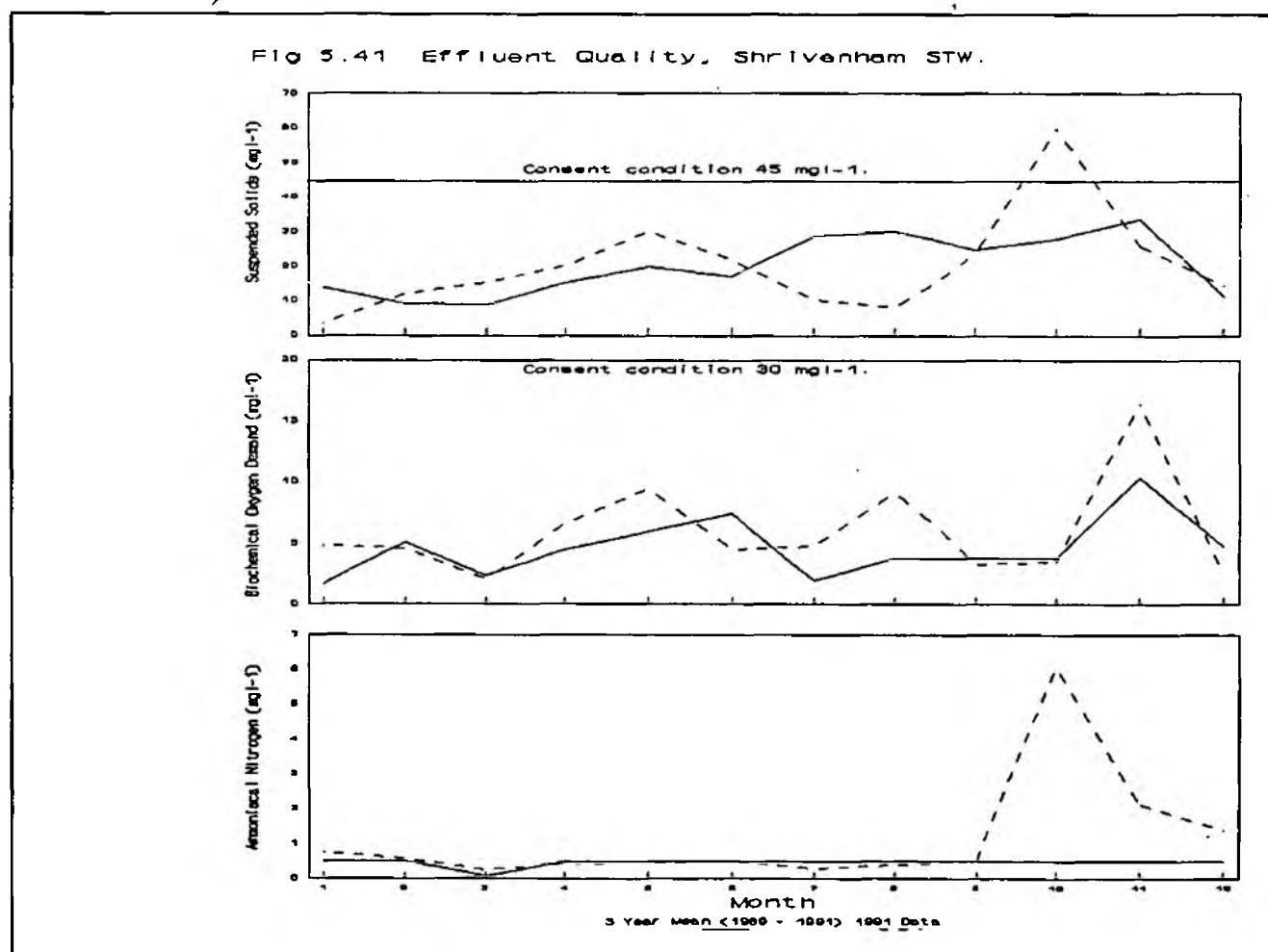
5.3 Fish Health.

A total of 65 fish collected from two sites on the river were examined for parasite loading and condition. The fish were taken from site CLF3 Friar's Farm (5 chub, 10 dace, 10 gudgeon, 10 roach) and site CLF4 Fresden Farm (10 dace, 10 gudgeon, 10 roach). Parasite fauna were found to be comparable with similar rivers in the Thames region, apart from the presence of unidentified Microsporidian on dace at CLF3. This is a rare find and is being investigated further.

The presence of *Pomphorhynchus laevis* at each site precludes the transfer of any fish from the River Cole into any other waters. Complete results of the parasitological examination are presented in Appendix VI.

5.4 Water Quality.

Figure 5.41 shows effluent quality for Shrivenham STW (The largest discharging into the River Cole catchment).



Results for compliance by other STWs within the catchment are given in Section 2.4. Table 5.41 below shows reach RQO compliance of the River Cole and tributaries.

Table 5.41 Reach RQO Compliance in the River Cole Catchment Between 1988 and June 1992.

River	Reach	Km	RQO	1988	1989	1990	1991	June 92
Cole	Walcot - Tuckmill Brook	13.1	1B	ND	1B	1B	1A	1A
Cole	Tuckmill Brook - Thames	14.5	1B	ND	1A	1A	1A	1A
Lenta Brook	Bishopstone - Cole	6.5	1A	ND	ND	1A	ND	1A
Lenta Brook East	Lenta Brook - Cole (E)	2.5	1B	ND	ND	1B	2A DO	2A DO
Lertwell Brook	Ashbury - Tuckmill Brook	2.1	1B	ND	1B	1B	1B	1B
Liden Brook	Liddington - Cole	8.2	1B	ND	ND	2A BOD	1B	2A BOD
Tuckmill Brook	Idstone - Shrivensham STW	7.1	1B	1B	2A (No info.)	1B	1B	1B
Tuckmill Brook	Shrivensham STW - Cole	2.6	2B	1B	1B	1B	1B	1B
Waterloo Ditch	Source - Cole	4.2	1B	1B	1A	1B	1A	1A

Despite the fact that the Stratton Road Ditch, Dorcan Brook and Sevenhampton Stream all received consented discharges from STWs, they are not assigned an RQO and are not routinely sampled (although discharges are sampled).

On paper, RQO compliance for the watercourses in this catchment is good, especially for the River Cole. There are, however some doubts as to whether these results are accurately reflecting the situation throughout the majority of the watercourse. The river is classified 1B from source to confluence with the Thames, yet achieved a 1A standard for its whole length in 1991 and 1992. Section 6 discusses more fully the possibility and potential impact of localised water quality problems occurring in the River Cole.

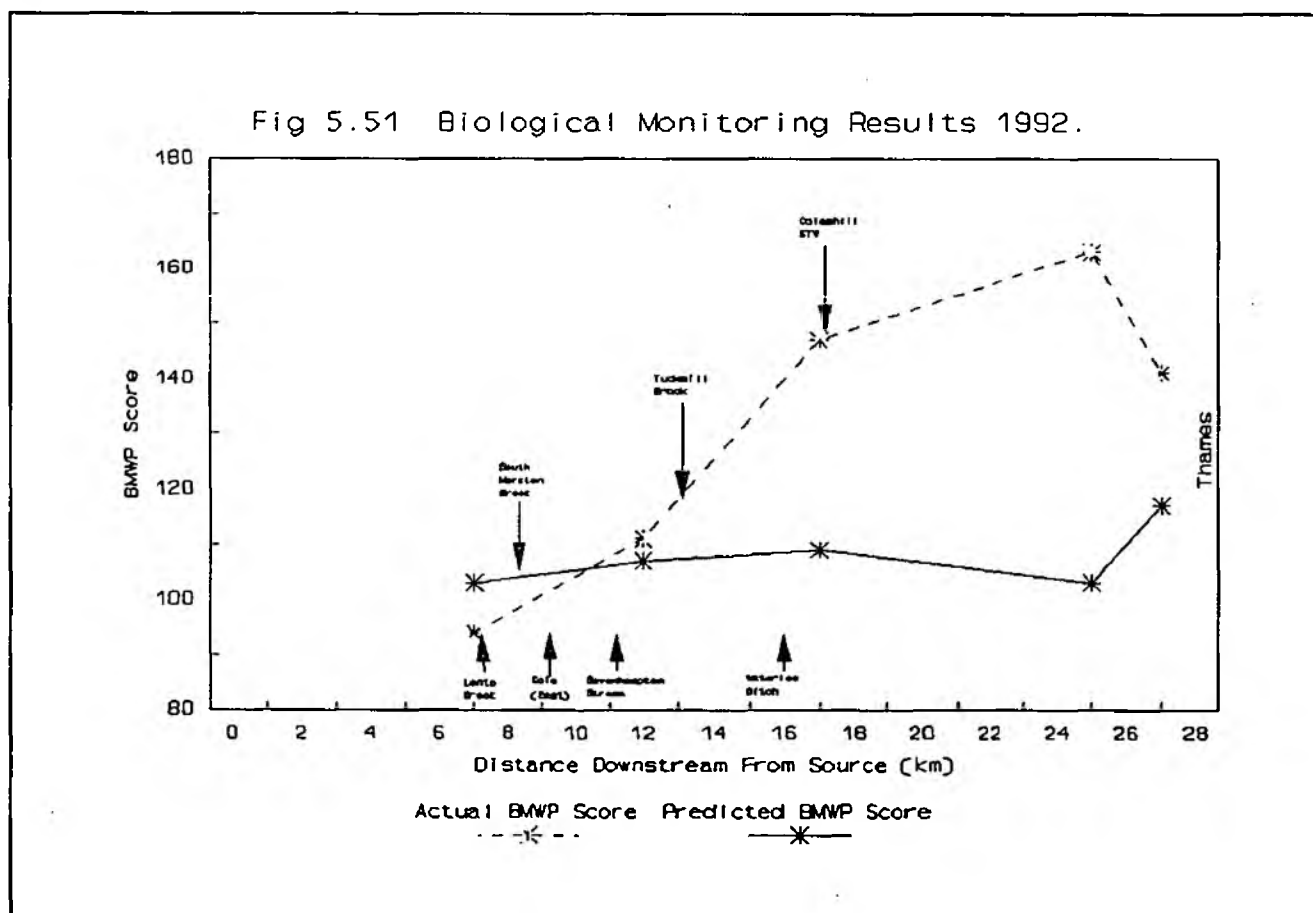
5.5 Macroinvertebrate Survey Results.

Table 5.51 shows the results of biological survey carried out on the River Cole immediately prior to this fisheries survey. These results are also presented in figure 5.51.

Table 5.51 BMWP Score, ASPT*, and RQO For Sites on the River Cole.

Site	Date	BMWP	Predicted BMWP	ASPT	Predicted ASPT	RQO
Acorn Bridge	01/04/92	94	103	4.27	4.90	1B
B4000 Sevenhampton	01/04/92	111	107	4.63	5	1B
Coleshill	01/04/92	147	109	4.90	5	1B
Lynt Bridge	01/04/92	163	103	5.26	4.90	1B
A361, Inglesham	01/04/92	141	117	5.22	5.2	1B

* Average Score Per Taxa.

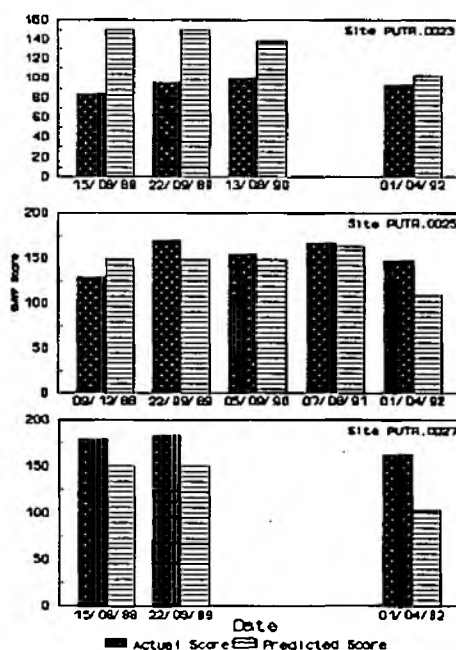


These results show that biological quality in the river is generally high, although there is evidence that the headwaters are stressed due to their urban nature. Biological sampling indicates that the river should be capable of supporting a healthy fishery, albeit restricted upstream of Coleshill. Table 5.52 below shows changes in and differences between predicted and observed BMWP scores for three sites on the River Cole. These data are also presented in figure 5.52.

Table 5.52 BMWP Score For Three Sites Over Time.

Site Code	Date	BMWP	Predicted BMWP	RQO
Acorn Bridge	15/08/88	84	150	1B
	22/09/89	96	150	1B
	13/08/90	100	138	1B
	01/04/92	94	103	1B
Coleshill	09/12/88	129	149	1B
	22/09/89	170	149	1B
	05/09/90	155	149	1B
	07/08/91	167	163	1B
	01/04/92	147	109	1B
Lynt Bridge	15/08/88	180	150	1B
	22/09/89	184	150	1B
	01/04/92	163	103	1B

Fig 5.52 BMWP Score for Three Sites Over Time.



6.0 DISCUSSION

The upper part of the River Cole from East Walcot to Acorn Bridge is a small stream, being one component of a network of tributaries that constitute the headwaters of the river. These watercourses are subject to weed encroachment, usually low summer flows with a flashy, rapid flow response to rain. Some of the small tributaries fall within the bounds of Swindon town and are increasingly subjected to problems of reduced water quality urban runoff. The size of these streams prevented the use of conventional fisheries survey techniques upstream of Acorn Bridge, however walking along the banks of the stream small shoals of minnows and sticklebacks could be clearly seen.

These streams do not suffer any angling pressure, however observations suggest that they contain a substantial number of the minor species, and may also provide nursery areas for cyprinid fry. These resident and transient populations are clearly at risk from water quality reduction associated with the urban environment and sporadic fish kills of minor species in the Dorcan Brook illustrate this risk. Given a chronic water quality problem, one would not expect to see such numbers of the minor species present both here and further downstream. Additionally, sporadic poor water quality would normally depress populations of these fish, however the minor species tend to re-colonise rapidly after environmental stress. It is therefore possible for the observed numbers of minor species to be present in a watercourse that suffers sporadic poor water quality. These problems do tend to be given lower priority when their influence is restricted to smaller ditches and streams, it is important however to note their impact on the headwaters of this river as the biological scores demonstrate (Sect. 5.5).

The site at Acorn Bridge (CLF1) marks the upstream extent of the EC fishery designation (1B cyprinid) of this river. The physical characteristics of the site were dominated by a quantity of stone spread about the river bed that had fallen from the railway line and bridge, apart from this the substrate of the survey section was mostly bare clay with mud and silt margins. Disappointing biomass (12.8 gm^{-2}) and density (0.200 nm^{-2}) results were dominated by pike (6.1 gm^{-2}) and gudgeon (0.096 nm^{-2}). A similar biomass of 15.9 gm^{-2} was found in an upstream run of 105 m. Small roach and dace in the length frequency results show that there has been successful recruitment to these species.

These results fall short of the NRA TR minimum biomass target of 20 gm^{-2} for EC designated cyprinid fisheries. Four tributaries join the River Cole upstream of this site, of these the Liden Brook and the Lenta Brook have failed their RQO in the past five years. These four tributaries receive discharges greater than $10 \text{ m}^3\text{d}^{-1}$ from five sources, two of which have failed to meet their discharge consent conditions on occasions in the past five years (Poplars Hotel STW and Bishopstone STW). The biological scores for this site corroborate the fisheries survey results that indicate a reduction in water quality, probably caused by a combination of discharges upstream and the urban nature of the headwaters discussed above. Despite these indicators, the River Cole from East Walcot to confluence of the Tuckmill Brook attained an RQO of 1A in 1991 and up to June 1992. There is no recorded history of significant fish mortalities on this part of the river, so intermittent acute pollutions seem unlikely. On the other hand, long term chronic pollution should be picked up by RQO sampling. It is possible that point sources of pollutant enter the river within the urban section (ie Greenbridge Industrial Estate) and are not subsequently detected by chemical sampling. Further investigation is necessary to clarify the water quality situation.

Site CLF2 at Rove's Farm is marked by a featureless, straight canalised channel containing no instream features with bare clay and sand substrate. The biomass (13.3 gm^{-2}) and density (0.219

nm⁻²) results are disappointing and are dominated by chub (6.4 gm⁻²) dace (0.067 nm⁻²) and gudgeon (0.078 nm⁻²). These values are matched by a minimum estimate of biomass of 8.7 gm⁻² of similar species from an upstream run of 104 m. A total of five major and four minor species were present at this site and unusually high numbers of stone loach were visible. Length frequencies show evidence of successful recruitment to the gudgeon and roach populations.

Two tributaries of the River Cole join immediately upstream of the survey site. The Lenta Brook East failed its RQO of 1B in 1991 and to June 1992; Bourton STW (which has met discharge consent conditions in the past five years) discharges to the Lenta Brook East. The South Marston Brook has an RQO of 2B and receives a total of 21 m³d⁻¹ of effluent from four licensed discharges.

The poor survey results (which do not meet the NRA TR target) are likely to be a function of the paucity of suitable instream fisheries habitat at the site, although problems with water quality cannot be ruled out. The majority of the fish were caught within a short distance of the few instream features: emergent vegetation, fallen bushes and floating debris mats. The only fish caught in the upstream run were found in a small pool at its upstream extent, and during the sampling operation only a few fish were visible moving ahead of the team. It is possible that the mixing of water of inferior quality from the Lenta Brook (East) may influence the fish population at this site.

Following the completion of fieldwork at this site in May 1992, extensive instream works have been carried out to the channel in order to re-create a pool-riffle sequence and reinstate suitable gravel spawning substrate, returning the channel to a "natural" state. This site together with an upstream control must be surveyed annually to gauge the impact of these changes on the resident and transient fish populations. In addition to this fisheries survey, results from a macroinvertebrate and river corridor surveys, together with an investigation of the impact of this scheme on water quality would be of great value to the Fisheries Section.

Site CLF3 at Friar's Farm had good fisheries habitat, a steep gradient and therefore faster river flows. The meandering section surveyed had a predominately bare clay substrate, in common with the sites upstream. The range of instream features combined to create a diversity of flow types from fast riffles to glides and eddies. Not surprisingly excellent biomass (40.6 gm⁻²) and density (0.622 nm⁻²) results were found, dominated by chub (24.8 gm⁻²) and an excellent gudgeon population (0.356 nm⁻²). An upstream run of 61 m gave a minimum estimate of biomass of 26.9 gm⁻², dominated by pike and bream. Length frequencies show some evidence of successful recruitment to the roach population, and illustrate the bias of the chub population towards larger and therefore older fish.

One tributary, the Sevenhampton Stream, enters the river immediately upstream of this site. This stream receives a discharge from Sevenhampton STW, which has complied with its discharge consent conditions in the past five years.

Compared with those upstream, the results from this site reflect the importance of suitable habitat for good fish biomass and density results. The habitat available at this site is better than found upstream, but by no means excellent. The fisheries survey results are supported by the BMWP score of 111 directly upstream of the survey site (Table 5.51) reflecting improved water quality. This improvement is likely to be a reflection of the distance downstream from the more urban headwaters and tributaries carrying effluent, combined with the aerating effect of a steeper channel gradient.

Site CLF4 at Fresden Farm was notable for the poor fisheries habitat available. The channel was

overwide, with instream features limited to a stony riffle and weir at the upstream end of the site. The remaining part of the reach was muddy and silted with steep high banks and appeared to have been extensively dredged in the past.

The Tuckmill Brook joins the river upstream of this site; it failed to meet its RQO of 1B in 1989. This brook receives a discharge from Shrivenham STW, which at a licensed discharge of 6000 m³d⁻¹ is the largest in the catchment.

The very disappointing fish biomass (12.3 gm⁻²) and density (0.134 nm⁻²) results are a stark contrast to the previous site. Of the minor species, bullhead were abundant, minnow, stone loach and stickleback were present, but none of these in sufficient numbers to substantially influence the results. A single common carp was caught, probably one of several stocked into the river in 1989 (Appendix Vb). No upstream run was carried out due to problems of access.

Fishing this site was a demonstration of the importance of habitat on fish distribution. All of the fish were caught in the upstream part of the reach around the instream features. Good water clarity allowed the fish to be seen clearly, and the survey team were confident that very few fish were driven up to this part of the sample site from further downstream. It is likely therefore that the paucity of suitable fisheries habitat has the greatest detrimental influence on fish biomass and density at this site. This site should be considered as a candidate for any fisheries habitat enhancement scheme in the future.

Site CLF5 upstream of the impoundment at Coleshill park was marked by the very poor fisheries habitat available. The channel here is very wide, straight and canalised with almost imperceptible flow except in flood conditions. There were no instream features or variations in width and depth, and the substrate was almost exclusively mud and silt. A rich submerged and emergent plant community existed in the upper part of the survey section and throughout the upstream run section, which one would expect to provide suitable habitat for roach, carp and bream, a number of which were stocked into this part of the river in 1989 (Appendix Vb).

The Waterloo ditch, which receives discharges from Great Coxwell STW enters the river upstream of this site.

The biomass (5.8 gm⁻²) and density (0.100 nm⁻²) results for this site are the worst for the whole of the River Cole, and are corroborated by an upstream run that produced a minimum estimate of biomass of 7.9 gm⁻². Length frequencies for roach show successful recruitment to this population.

This part of the river has received a considerable number of fish through the NRA restocking programme in the past five years. This particular site has been targeted with fish species that were the most likely to remain in the atypical fisheries habitat found here (Appendix Vb). Only one of these species (bream, 0.5 gm⁻²) was caught. Clearly the poor results are to some extent a function of the impoverished habitat, however there must be other factors affecting the results. Previous surveys of similar sites above impounding structures (Hughes *et al*, 1992) have given characteristically poor results. One of the most likely causes is a localised reduction in water quality, especially low dissolved oxygen (DO) during warmer months, due to the sluggish river flow. Biological and chemical measures of water quality are made at the bridge at Coleshill some 200 metres downstream of this site, and these show the water quality to be excellent. The site where these measures are routinely made is downstream of a weir and substantial riffle feature, (the only instream feature of this type upstream of site CLF8) therefore any problem of low DO in the stretch upstream of the impoundment will not be identified. The water quality sample site was not

included in the fisheries survey as it does not accurately reflect the dominant habitat type in this part of the catchment.

In addition to an investigation of the biological and chemical water quality upstream of the impoundment, options for fisheries habitat enhancement for this site must be investigated as a matter of priority.

Site CLF6 at Roundhill Farm had moderate fisheries habitat with a meandering channel containing two pools but no riffle features. The channel was contained between steep high clay banks covered with established scrub and hedge plants providing excellent shelter and shade. Despite this shade the channel was severely choked with *Schoenoplectus* growth which was proving a substantial hindrance to the river flow. Substrate was mostly bare clay or mud and silt.

The biomass (10.4 gm^{-2}) and density (0.154 nm^{-2}) results were very poor, failing to meet the NRA TR target biomass for EC designated cyprinid fisheries, despite the presence of seven major and three minor fish species. The catch was dominated by roach (3.6 gm^{-2} , 0.088 nm^{-2}) and pike (3.5 gm^{-2}), no upstream run was carried out. Length frequencies for roach and gudgeon showed successful recruitment, and the chub population exhibited a wide range of size (and therefore age) classes.

Fishing conditions were not ideal and it could be argued that the site was not sampled with great accuracy, however the fact that relatively high numbers of gudgeon, (a bottom dwelling fish that can be one of the more difficult species to catch by electrofishing)

There is no evidence to indicate why fish populations at this site were so poor. Clearly the fisheries habitat is not ideal, however one would expect to find numbers of smaller fish sheltering in the emergent vegetation, which was certainly not the case at this site. Citing water quality as a factor contradicts both chemical and biological measures that indicate excellent water quality for this part of the river. However it is possible that during recent hot and dry summers, low river flows exacerbated by the choking emergent plant growth and combined with higher water temperature had reduced water quality (particularly DO) to such an extent that fish have either migrated away or died. Figure 2.31 shows that mean monthly river flows at Inglesham gauging weir have been much lower than average during 1990-91. The site is isolated and is not fished by anglers, therefore it is unlikely that dead or dying fish would be seen and reported to the NRA. There must be further investigation of the local biological and chemical water quality to clarify the situation, and this site must be considered as a candidate for future fisheries habitat enhancement schemes.

The site CLF7 at Snowswick Farm was an overwide, slow flowing channel contained between steep high banks with one right angle bend at the downstream extent of the survey section. This site was surveyed in January, and both aquatic and bankside vegetation was therefore sparse. Substrate was largely silt over gravel. This habitat is a result of the land drainage works carried out in 1975/76 that destroyed much of the fisheries habitat in this part of the river (Sect. 2.7).

Biomass (52.1 gm^{-2}) and density (0.693 nm^{-2}) results for this site are very good and were dominated by roach (19.4 gm^{-2} , 0.440 nm^{-2}), bream (12.4 gm^{-2}) and pike (11.4 gm^{-2}). In total seven major and three minor species were present, of these length frequencies for chub, pike roach and gudgeon showed good recruitment. An upstream run of 117 metres gave a minimum estimate biomass of 26.3 gm^{-2} consisting of similar species.

In contrast with the previous site, there is no evidence to indicate why fish populations at this site

are so good. The fisheries habitat was poor, yet the roach, perch, gudgeon, pike and chub populations all appear to be stable and self sustaining. A clue is provided by results from the upstream run which are much lower than for the survey section. It is likely that an aggregation of fish was sampled at this site, which would therefore give disproportionately large density and biomass values. The fisheries results corroborate the apparently excellent results of chemical and biological measures of water quality for this part of the river.

Site CLF8 downstream of the A361 road bridge was a meandering channel providing excellent fisheries habitat in the form of gravel riffles, deep pools, a range of channel widths, depths and flow regimes. Substrate was almost exclusively gravel with some mud and silt in the margins, and river flow was low due to the lack of rain for a considerable period prior to the survey. This site was not included in the Thames Conservancy land drainage works during 1975/76 and therefore provides a key example of the natural structure of the river channel; flow through the reach has been reduced following the construction of a weir (See Sect 2.1 & 2.7). Creation of this channel and habitat type must be the goal of any future fisheries habitat enhancement on the River Cole.

The excellent biomass (58.0 gm^{-2}) and density (0.734 nm^{-2}) results are the best for this survey, and are marked by a chub population (40.6 gm^{-2}) showing a wide range of size (and therefore age) classes. Roach were the most abundant fish with 0.344 nm^{-2} , and along with chub, dace and gudgeon showed good recruitment. A total of ten major and five minor species were sampled, making this the most species diverse fish community surveyed on the River Cole. Of the minor species, minnow were so abundant that they would have contributed to biomass were they enumerated.

These results illustrate the rôle of suitable fisheries habitat in supporting good fish populations, and reveal the fisheries potential of this river where the appropriate conditions are allowed to exist. A number of the fish caught are likely to have originated from the River Thames, and this reach of the river is probably a key spawning area for gravel spawning species (chub, dace, barbel).

Site CLF9 at Buscot Wick Farm was a relatively straight section with uniform profile, few instream features and no variation in flow. The channel had been overwidened in the 1975/76 land drainage works (see Fig 2.7) but has now narrowed through natural processes by up to 75%. Substrate was largely fine gravel with some silt in places, and despite the narrow channel, river flow was sluggish. There was a rich emergent vegetation community providing excellent shelter for smaller fish.

The good biomass (31.1 gm^{-2}) and density (0.726 nm^{-2}) results were dominated by roach (11.7 gm^{-2} , 0.473 nm^{-2}) and pike (8.8 gm^{-2}). A total of six major and four minor species were caught, and a quantity of cyprinid fry were visible in the emergent vegetation. No upstream run was carried out due to problems of access, however shoals of small fish were visible swimming upstream of the survey site.

These results show a small but important difference between the previous site, namely species diversity and dominance. The dominant species at this site are roach and pike, which are recognised through past fisheries surveys to be more tolerant of environmental stress and disturbance. The previous site (CLF8) was dominated by chub, which is considered in past surveys to be an indicator of moderate to good fisheries habitat with lower environmental stress and predominantly high river flows. This reflects once more the legacy of the destructive land drainage scheme carried out in 1975/76.

The River Cole was considered to be a predominately chub and dace river (Anon. 1980), and the results of this survey reflect the important contribution of these species to fish biomass. Recruitment to the chub population appears to be reasonable, but only in sites downstream of Coleshill Mill were chub smaller than 10cm fork length found. Length frequencies for dace show poor recruitment, again mainly in the sites upstream of Coleshill Mill. The flashy nature of flow (exacerbated by straightening of the channel), which can wash fish fry rapidly downstream, combined with a paucity of spawning habitat are factors likely to contribute to this poor recruitment. Future monitoring of the habitat enhancement works at CLF2 (creation of gravel spawning habitat and wetlands) may demonstrate increased recruitment to both chub and dace populations. In addition, there may be scope for the construction of off river spawning ponds to improve fry survival.

Roach are present throughout the river, and show excellent to good recruitment at the majority of sites. They tend to dominate biomass and density results at sites where the fisheries habitat is moderate or poor and lower river flows are the norm.

7.0 CONCLUSIONS

- 1 Fish biomass and density results were found to be a function of fisheries habitat quality; one of several determining factors.
- 2 The River Cole lacked suitable fisheries habitat and exhibited poor fish populations (biomass < 20 gm²) at most of the sites surveyed. Habitat enhancement is a priority for much of this watercourse.
- 3 Chub and dace populations showed poor recruitment at sites upstream from Coleshill Mill but roach showed good recruitment at the majority of sites surveyed, reflecting the different habitat and flow types in these reaches.
- 4 From Friar's Farm upstream the river supported good populations of minor fish species.
- 5 Fish stocked into the river at Coleshill did not appear in the sample at this site.
- 6 Comparison of results between a relatively natural site and one altered in the 1975/76 land drainage works show different species dominance.
- 7 Measures of water quality gave conflicting results for the river upstream from Acorn Bridge. Fisheries survey results corroborated the biological survey indicating poorer water quality than the chemical survey.
- 8 There are insufficient water quality sample analysis data available for the River Cole to discount water quality as a prime factor affecting fish populations. There is evidence to suggest that localised low DO levels (due to the effects of impoundments and low summer flows exacerbated by other factors) affect fish populations at sites between Fresden Farm and Roundhill Farm.
- 9 Potential problems of low DO at CLF5 are not likely to be reflected in chemical and biological results as the water quality sampling site is situated downstream, below a substantial weir and riffle.

8.0 RECOMMENDATIONS

- 1) Fisheries habitat enhancement is required at the following sites or zones:
 - i) Acorn Bridge.
 - ii) Fresden Farm.
 - iii) Coleshill Park (upstream of the impoundment).
 - iv) From Roundhill Farm downstream to the gauging weir at Lynt Bridge.
- 2) Carry out an annual survey of site CLF2 at Rove's Farm and an upstream control site in order to gauge the impact of recent habitat improvement works on fish populations.
- 3) Fisheries Section would welcome the results of further investigation of biological and chemical water quality throughout the river in the light of anomalies and paucity of available data.

9.0 REFERENCES.

Moxon, I.R. (1992), "The Geology of the River Cole" NRA internal report.

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

Anon. (1980), "The Fisheries of the River Cole 1975 - 1980" Thames Water Authority internal report.

Hughes, S., Killingbeck, A., (1992), "The Oxford Structures Fisheries Survey." NRA published report.

Jenkins, DG, (1980) Internal Report.

APPENDIX I

River quality classification

River Class	Quality criteria	Remarks	Current potential uses
1A Good Quality	<p>Class limiting criteria (95 percentile)</p> <p>(i) Dissolved oxygen saturation greater than 80%</p> <p>(ii) Biochemical oxygen demand not greater than 3 mg/l</p> <p>(iii) Ammonia not greater than 0.4 mg/l</p> <p>(iv) Where the water is abstracted for drinking water, it complies with requirements for A2* water</p> <p>(v) Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures not available)</p>	<p>(i) Average BOD probably not greater than 1.5 mg/l</p> <p>(ii) Visible evidence of pollution should be absent</p>	<p>(i) Water of high quality suitable for potable supply abstractions and for all other abstractions</p> <p>(ii) Game or other high class fisheries</p> <p>(iii) High amenity value</p>
1B Good Quality	<p>(i) DO greater than 60% saturation</p> <p>(ii) BOD not greater than 5 mg/l</p> <p>(iii) Ammonia not greater than 0.9 mg/l</p> <p>(iv) Where water is abstracted for drinking water, it complies with the requirements for A2* water</p> <p>(v) Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures not available)</p>	<p>(i) Average BOD probably not greater than 2 mg/l</p> <p>(ii) Average ammonia probably not greater than 0.5 mg/l</p> <p>(iii) Visible evidence of pollution should be absent</p> <p>(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</p> <p>(v) Class 1A and Class 1B together are essentially the Class 1 of the River Pollution Survey (RPS)</p>	Water of less high quality than Class 1A but usable for substantially the same purposes
2 Fair Quality	<p>(i) DO greater than 40% saturation</p> <p>(ii) BOD not greater than 9 mg/l</p> <p>(iii) Where water is abstracted for drinking water it complies with the requirements for A3* water</p> <p>(iv) Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures not available)</p>	<p>(i) Average BOD probably not greater than 5 mg/l</p> <p>(ii) Similar to Class 2 of RPS</p> <p>(iii) Water not showing physical signs of pollution other than humic colouration and a little foaming below weirs</p>	<p>(i) Waters suitable for potable supply after advanced treatment</p> <p>(ii) Supporting reasonably good coarse fisheries</p> <p>(iii) Moderate amenity value</p>
3 Poor Quality	<p>(i) DO greater than 10% saturation</p> <p>(ii) Not likely to be anaerobic</p> <p>(iii) BOD not greater than 17 mg/l. This may not apply if there is a high degree of re-aeration</p>	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	<p>(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.</p> <p>(b) The BOD determinations refer to 5 day carbonaceous BOD (ATU). Ammonia figures are expressed as NH₄.</p> <p>(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 than 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.</p> <p>(d) EIFAC (European Inland Fisheries Advisory Commission) limits should be expressed as 95 percentile limits.</p> <p>* 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 States.</p>		

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

APPENDIX

NRA Fisheries

The following
and EC legislation

1 EC

Code

A

B

C

D

E

F

G

H

I

J

2

RQ

Code

K

L

M

N

O

P

Q

R

S

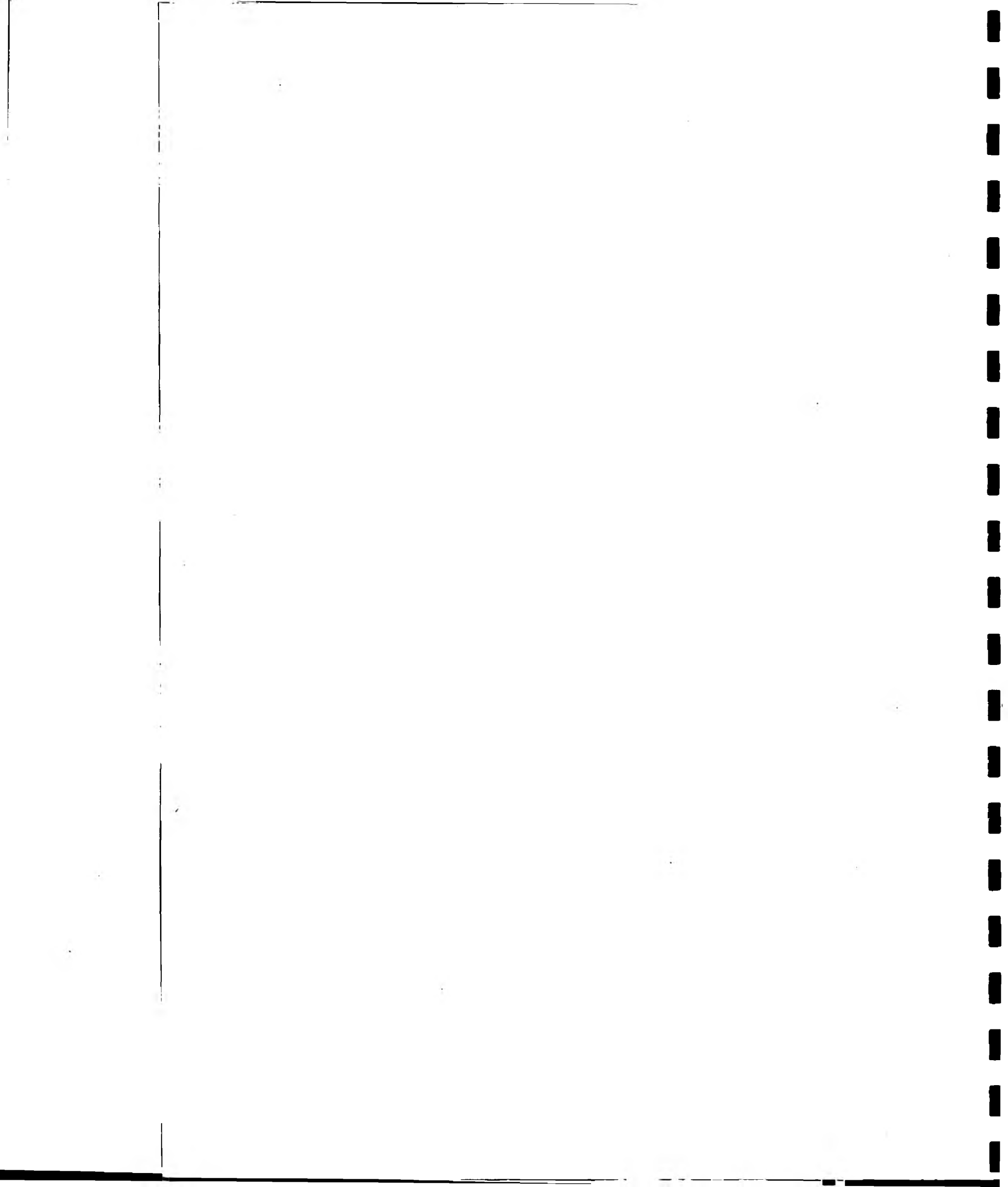
T

A 2 digit code
provide a unique
1 = Individual

LIST OF DETERMINANDS

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

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



APPENDIX Va

Fish Mortalities in the River Cole and Tributaries.

Date	Location	Losses	Cause
14/12/88	Dorcan Brook	20 Mixed Coarse	Low DO
24/08/89	R Cole, Sevenhampton	150 Mixed Coarse	Low flow & Slurry pollution

APPENDIX Vb

Fish Restocking to the River Cole and Tributaries.

Date	Location	Details
18/10/89	R Cole, Coleshill "Canal"	300 x 15-20cm Common carp.
24/10/89	R Cole, Coleshill "Canal"	90 x 10-20cm Crucian carp.
24/10/89	R Cole, Coleshill "Canal"	60 x 5-40cm mixed coarse fish.
10/11/89	R Cole, Coleshill	1000 x 8-10cm dace.
6/12/89	R Cole, Coleshill	1000 x 10cm chub.
6/12/89	R Cole, Friar's Farm	1000 x 10cm chub.
30/1/90	R Cole, Coleshill	2100 10-30 cm roach & bream.

APPENDIX VI

N.R.A. - THAMES REGION

BIOLOGY (WEST)

FISH HEALTH EXAMINATION (SUMMARY)

TO: VAUGHAN LEWIS
AREA FISHERIES OFFICER
(UPPER THAMES)

FROM: WILLIAM YEOMANS
BIOLOGIST

DATE: 28 FEBRUARY 1992

TEL: 0734 311422

CC: JOHN STEEL
AREA BIOLOGIST (WEST)

FILE

EXAMINATION REF: WYF(S30)113

DATE RECEIVED: 30 JANUARY 1992
DATE COMPLETED: 17 FEBRUARY 1992

EXAMINATION TITLE: RIVER COLE AT FRIARS FARM

NATIONAL GRID REF: SP 222 906

REASON FOR EXAMINATION: FISHERY SURVEY

GENERAL COMMENTS

Fish submitted in excellent condition.

Typical parasite fauna for all three species of fish in lowland rivers in this region (eg similar to those of the lower River Loddon).

From a parasitological point of view, the "Microsporidian" on the gills of dace was a most interesting find. To my knowledge there is no published record of a microsporidian from dace. Only one cyst was found and it was not possible to identify the spores, although they were curved or "bean-shaped". Enquiries continue.

CONCLUSION

Only the presence of *Pomphorhynchus laevis* is of concern to the future management of the fishery.

William E. Yeomans.

WILLIAM E YEOMANS
BIOLOGIST

APPENDIX VI

EXAMINATION DETAILS

EXAMINATION REF: WYF(S30)113

FISH SPECIES	LENGTH RANGE (cm)	WEIGHT RANGE (g)	AGE RANGE	SEX
Chub	21.0-23.5	112.4-151.0	All 4+	Male Female
Dace	12.2-22.7	22.9-154.1	(2+)-(4+)	Male Female
Gudgeon	12.2-13.4	21.0- 32.3	All 2+	Male Female
Roach	10.5-12.1	16.2- 25.2	All 2+	Male Female

PARASITES PRESENT:

FISH SPECIES	NO EXAMINED	PARASITE	LOCATION	PREVALENCE (PERCENTAGE INFESTATION)	INTENSITY (DEGREE OF INFESTATION)
Chub	5	<i>Myxobolus sp</i>	Encysted on Gills	80	Light
		<i>Diplostomum sp</i>	Lens	100	Light
		<i>Caryophyllaeides fennica</i>	Gut	40	Light
		<i>Pomphorhynchus laevis</i>	Gut	20	Light
Dace (2+)	9	Microsporidian	Encysted on Gills	12	Light
		<i>Myxobolus sp</i>	Encysted on Gills/in Kidney	25	Light
		<i>Diplostomum sp</i>	Lens	100	Light
		Digenean*	Gut	12	Light

APPENDIX VI

PARASITES PRESENT:

FISH SPECIES	NO EXAMINED	PARASITE	LOCATION	PREVALENCE (PERCENTAGE INFESTATION)	INTENSITY (DEGREE OF INFESTATION)
Dace (2+) Continued /...		<i>Proteocephalus torulosus</i>	Gut	12	Light
Dace (4+)	1	<i>Trypanoplasma sp</i>	Gill Squash	Present	Light
		<i>Diplostomum sp</i>	Lens	Present	Light
		Digenean*	Gut	Present	Light
		<i>Pomphorhynchus laevis</i>	Gut	Present	Light
Gudgeon	10	<i>Myxobolus sp</i>	Kidney	10	Light
		<i>Gyrodactylus sp</i>	Skin/Gills	Present	Light
		<i>Dactylogyrus sp</i>	Gills	10	Light
		<i>Diplostomum sp</i>	Lens	90	Light
Roach	10	<i>Dactylogyrus sp</i>	Gills	40	Light
		<i>Diplostomum sp</i>	Lens	40	Light
		Digenean*	Gut	30	Light

* Identification Pending

APPENDIX VI R Cole Fresden Farm.

EXAMINATION DETAILS

EXAMINATION REF: WYF(S30)115

FISH SPECIES	LENGTH RANGE (cm)	WEIGHT RANGE (g)	AGE RANGE	SEX
Dace	14.4-22.8	37.7-148.6	(1+)-(4+)	Male Female
Gudgeon	11.6-16.5	18.5- 47.8	(2+)-(4+)	Male Female
Roach	7.2-15.7	4.8- 60.6	(1+)-(3+)	Male Female

PARASITES PRESENT:

FISH SPECIES	NO EXAMINED	PARASITE	LOCATION	PREVALENCE (PERCENTAGE INFESTATION)	INTENSITY (DEGREE OF INFESTATION)
Dace	10	<i>Trypanosoma</i> sp	Gill Squash	Present	Light
		<i>Myxobolus</i> sp	Encysted on Gills	Present	Light
		<i>Diplostomum</i> sp	Lens	100	Light
		<i>Tylodelphys clavata</i>	Vitreous Humor	10	Light
		<i>Posthodiplostomum cuticola</i>	Fins	20	Light
		Digenean metacercariae	Encysted on Heart	10	Light
		Digenean*	Gut	80	Moderate/Heavy
		<i>Caryophyllaeides fennica</i>	Gut	10	Light
		<i>Proteocephalus torulosus</i>	Gut	10	Light
		Nematode	Gut	10	Light

APPENDIX VI R Cole Fresden Farm.

PARASITES PRESENT:

FISH SPECIES	NO EXAMINED	PARASITE	LOCATION	PREVALENCE (PERCENTAGE INFESTATION)	INTENSITY (DEGREE OF INFESTATION)
Dace Continued/...					
		<i>Pomphorhynchus laevis</i>	Gut	10	Light
		Glochidia larvae	Encysted on Gills	10	Light
Gudgeon	10	Microsporidian	Gill Squash	Present	Light
		<i>Trichodina sp</i>	Gill Squash	Present	Light
		<i>Gyrodactylus sp</i>	Skin/Fins	Present	Light
		<i>Diplostomum sp</i>	Lens	80	Light
		<i>Caryophyllaeides fennica</i>	Gut	20	Light
Roach	10	<i>Myxobolus sp</i>	Encysted on Gills/in Kidney	Present	Light
		<i>Gyrodactylus sp</i>	Skin	Present	Light
		<i>Dactylogyrus sp</i>	Gills	70	Light
		<i>Diplostomum sp</i>	Lens	50	Light
		<i>C. fennica</i>	Gut	10	Light

* Identification Pending

APPENDIX VII

Biological Sample Sites

Code	Name	Grid Ref
PUTR.0023	Acorn Bridge, Bourton	SU21608370
PUTR.0024	B4000 Sevenhampton	SU22209060
PUTR.0025	Coleshill	SU23409350
PUTR.0027	Lynt Bridge, Inglesham	SU21109810
PUTR.0021	Cole (old) A361, Inglesham	SU02804520
PUTR.0028	Nythe Bridge, Swindon	SU18808590
PUTR.0026	Fresden Farm, Sevenhampton	SU22209060
PUTR.0029	U/S Coleshill STW	SU23509330
PUTR.0020	1200m D/S Coleshill Bridge	SU22409390
PUTR.0022	A417 Roadbridge, Inglesham	SU22309900

APPENDIX VIII

Generic and Common Names of Aquatic Plants.

<i>Alisma</i>	Water Plantain
<i>Apium</i>	Fool's Water-cress
<i>Callitriche</i>	Water Starwort
<i>Cladophora</i>	Blanket Weed
<i>Eleocharis</i>	Spike Rush
<i>Glyceria</i>	Sweet Grass
<i>Iris pseudacorus</i>	Yellow Iris
<i>Myosotis</i>	Water Forget me not
<i>Myriophyllum</i>	Water Milfoil
<i>Nuphar</i>	Yellow Water Lily
<i>Phalaris arundinacea</i>	Reed Canary Grass
<i>Ranunculus sp.</i>	Water Crowfoot
<i>Rorippa</i>	Great Yellow Cress
<i>Rumex hydrolapathum</i>	Water Dock
<i>Sparganium sp.</i>	Bur-reed
<i>Schoenoplectus lacustris</i>	Common Club Rush
<i>Typha</i>	Bulrush
<i>Veronica</i>	Brooklime

APPENDIX IX

Survey Site Land Owners or Tenants.

Site	Owner
CLF1	Mr Burr, Rove's Fm, Sevenhampton, Wilts.
CLF2	Mr Burr, Rove's Fm, Sevenhampton, Wilts.
CLF3	Kidstone-Trigg Estates, Estate Office, Friar's Fm, Shrivenham.
CLF4	Mr Walker, Fresden Fm, Fresden, Coleshill.
CLF5	The National Trust, Estate Office, Coleshill Park, Coleshill.
CLF6	Mr Hares, Roundhill Fm, Highworth.
CLF7	Mr Hares, Roundhill Fm, Highworth.
CLF8	Mr Saunders, Highden Fm, Faringdon, Oxon.
CLF9	Buscot Wick Fm, Buscot Wick, Lechlade.